Environment and Social Due Diligence Report

November 2015

IND: Accelerating Infrastructure Investment Facility in India
–Jaypee Infratech Limited

Prepared by

India Infrastructure Finance Company Limited for the Asian Development Bank

INDIA INFRASTRUCTURE FINANCE COMPANY LIMITED

ENVIRONMENTAL & SOCIAL SAFEGUARDS DUE DILIGENCE REPORT

UNDER

TAKE-OUT FINANCE

YAMUNA EXPRESSWAY LTD.

SUB PROJECT: **Yamuna Expressway, 6-lane (Extendable upto 8 lane) under Take-out finance Scheme from Noida to Agra on BOT Basis by Jaypee Infratech Ltd.**

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Environmental and Social Safeguards Due Diligence Report

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CONTENTS

1. PURPOSE OF THE REPORT: 5
2. SUBPROJECT TITLE 5
3. IMPORTANCE OF THE SUBPROJECT 5
4. SUBPROJECT OBJECTIVE 6
5. SCOPE OF THE SUBPROJECT 6
6. SUBPROJECT DESCRIPTION: 6
7. DECLARATION OF COD BY YEA: 8
8. TOLL PLAZA OPERATION AND MAINTENACE 8
9. PUBLIC HEARINGS 9
10. DEBT COMPONENT OF THE PROJECT: 9
11. CONCESSIONAIRE: 10
12. O & M OF THE YAMUNA EXPRESSWAY: 10
13. LENDER'S INDEPENDENT ENGINEER: 10
14. AVAILABILITY OF EIA/EMP REPORTS: 12
15. ENVIRONMENTAL SENSITIVITY AND DUE DILIGENCE: 12
16. CATEGORIZATION OF SUBPROJECT: 13
17. STATUS OF REGULATORY CLEARANCES: 13
18. STATUS OF EMP IMPLEMENTATION: 14
18.1 CONDITIONS OF TAJ TRAPEZIUM ZONE AUTHORITY: 14
18.2 MEASURES FOR CONTROL OF RIBBON DEVELOPMENT: 14
18.3 NOISE CONTROL MEASURES: 15
18.4 MEASURES TO PREVENT DAMAGE TO AGRICULTURAL LAND: 15
18.5 REDEVELOPMENT OF BORROW/DEMOBILIZATION OF CONSTRUCTION CAMP SITES: 15
18.6 PLANTATION/AFFORESTATION: 15
18.7 WATER HARVESTING SYSTEM: 16
19. ENVIRONMENTAL MONITORING/REVIEWS/INSPECTION: 16
20. SAFETY MEASURES: 17
21. CONTROL ROOM EQUIPMENT FOR TRAFFIC MANAGEMENT SYSTEM: 19
22. EXPRESSWAY/HIGHWAY TRAFFIC MANAGEMENT SYSTEM: 20

23. SITE VISIT: 22
24. PROJECT IMPLEMENTATION STRUCTURE: 23
25. ENVIRONMENTAL IMPACTS ASSOCIATED WITH 23
OPERATIONAL STAGE OF EXPRESSWAY: 23
26. CONCLUSIONS AND RECOMMENDATION: 25
27. PREFACE: 30
28. METHODOLOGY: 30
29. PUBLIC CONSULTATION: 31
30. IMPACT ON SCHEDULE TRIBE POPULATION 31
31. INFORMATION DISCLOSURE 31
32. LAND ACQUISITION IN THE PROJECT 32
33. COMPENSATION AND ENTITLEMENT: 32
34. GRIEVANCE REDRESSAL MECHANISM 33
35. RESETTLEMENT IMPACT IN THE SUB-PROJECT 33
36. IMPACT ON PROPERTIES 33
37. LOCAL EMPLOYMENT GENERATED BY THE CONCESSIONAIRE 33
38. DISCLOSURE: 33
39. SITE VISIT OBSERVATIONS 34
40. CONCLUSION 35

LIST OF TABLES

Table-1: The Salient Features of Yamuna Expressway 7
Table- 2: Environmental and Forestry Clearances Status 13
Table- 3 Ambient Air Quality during Summer, 2012 27
Table-4 Ambient Air Quality during Summer, 2015 27
Table-5 Noise Levels during Summer, 2012 27
Table- 6 Noise Levels during Summer, 2015 28
Table-7: Total Land Required for the Project 32

LIST OF APPENDICES

Appendix I EIA/EMP Report
Appendix II Environmental Clearance
Appendix III Forestry Clearance
Appendix IV Details of Public Hearings
Appendix V Organogram
Appendix VI Copies of Gazette Notification

ABBREVIATIONS

ADB	:	Asian Development Bank
AVC	:	Automatic Vehicle Classifier
BOT	:	Built Operate and Transfer
CGWA	:	Central Ground Water Authority
COD	:	Commercial Operation Date
EC	:	Environmental Clearance
EHS	:	Environment Health and Safety
EETC	:	Electronic Toll Collection
EIA	:	Environmental Impact Assessment
EMP	:	Environmental Management Plan
ESDDR	:	Environmental and Social Due Diligence Report
IIFCL	:	India Infrastructure Finance Company Limited
GoI	:	Government of India
GoUP	:	Government of Uttar Pradesh
HTMS	:	Highway Traffic Management System
JAL	:	Jaiprakash Associates Ltd.
JIL	:	Jaypee Infratech Limited
LIE	:	Lenders Independent Engineer
LSDU	:	Lane Status Display Unit
MoEF&CC	:	Ministry of Environment, Forests & Climate Change
MTP		Main Toll Plaza
NCT	:	National Capital Territory
NOC	:	No Objection Certificate
NGT	:	National Green Tribunal
MTP	:	Main Toll Plaza
MWRCGWB	:	Ministry of Water Resources Central Ground Water Board
NMS	:	Network Management System
OFC	:	Optical Fibre Cable
OHLS	:	Over Head Lane Singnal
O&M	:	Operation and Maintenance
PPP	:	Public Private Partnership
QRT	:	Quick Response Team
RFID	:	Radio Frequency Identification
RoW	:	Right of Way
SDDR	:	Social Due Diligence Report
SPV	:	Special Purpose Vehicle
SSWM	:	Slow Speed Weigh –in-Motion
TCT	:	Toll Collectors Terminal
TDP	:	Tribal Development Plan
TFS	:	Take-out Finance Scheme
TLC	:	Toll Lane Computer
TTZ	:	Taj Trapezium Zone
UFD	:	User Fare Display
VIDS	:	Video Incident Detection System
VMS	:	Variable Message Sign
YEIDA	:	Yamuna Expressway Industrial Development Authority

Project Background

1. PURPOSE OF THE REPORT:

1. This Environmental and Social Due Diligence Report (ESDDR) has been prepared by India Infrastructure Finance Company Limited (IIFCL) in consultation with the Concessionaire, M/s Jaypee Infratech Limited (JIL)-Yamuna Expressway to know the adequacy of the project with the applicable National Safeguard compliance status. The report has been prepared as per the documents/information received from the concessionaire and the site visit observations. In order to be eligible for funding from the ADB, IIFCL has prepared the Environmental and Social Due Diligence Report (ESDDR) for the sub-project on behalf of the concessionaire (JIL). The information given in the ESDDR as agreed and confirmed by the Concessionaires (JIL). Yamuna Expressway Industrial Development Authority (YEIDA), the nodal agency set up by Government of Uttar Pradesh to plan, construct, operate and maintain the Expressway.

2. This sub-project has already achieved the COD in August, 2012 and has been financed by IIFCL under takeout finance scheme.

3. The sub-project has been prepared by YEIDA as per its own funding requirement and not in anticipation to ADB's requirements.

2. SUBPROJECT TITLE

4. **The sub-project:** Six Lane Expressway between Noida and Agra with Service Roads and associated facilities on BOT basis in the State of Uttar Pradesh. The Yamuna Expressway was previously known as the Taj Expressway as it connects Greater Noida – a proximal area to the National Capital Territory of Delhi (NCT) – with the Taj Mahal in Agra. It was renamed in July 2008 by the Yamuna Expressway Industrial Development Authority (YEIDA), constituted by the UP State Government.

3. IMPORTANCE OF THE SUBPROJECT

5. Due to increasing number of tourist and devotees visiting the Agra (famous for Taj Mahal & Red Fort) and Mathura (Birth Place of Lord Krishna) cities, industrial, commercial and agricultural development in the region, the National Highway connecting Delhi to Mathura and Agra was facing incessant traffic snarls especially in the urban areas making the journey strenuous and killing the joy of travelling.

6. To ameliorate the traffic congestion between Delhi and Agra, the Yamuna Expressway has been constructed. Opened in August 2012, about 165 kilometer long, six lane (extendable up to eight lane) is India's longest motorway, creating a corridor for economic growth.

7. By dramatically reducing the travel time between these historic cities (Delhi and Agra) the Yamuna Expressway will have a lasting impact on villagers, tourists, traders and working professionals in the region when as per proposed master plan townships and industries will be developed.

8. Plane Landings can also be performed during any emergency situation, if an active airport is not available in the nearby area under certain circumstances. A Mirage 2000 fighter aircraft of the Indian Air Force was successfully landed on the Expressway near Mathura as part of trials to use it for an emergency landing. The project also has symbolic value by showcasing the availability of world-class innovative infrastructure to meet the industrial and business's transportation/travelling requirements.

4. SUBPROJECT OBJECTIVE

9. The objectives of the proposed expressway were as follows:

- To provide a fast moving corridor to minimize the travel time;
- To connect the main townships / commercial centres on the Eastern side of river Yamuna;
- To ensure development of adjoining area;
- To relieve NH-2, which was congested and runs through the urban areas like Faridabad, Ballabhgarh, Palwal, Hodal, Kosi, Mathura, Farah and Runakata.

5. SCOPE OF THE SUBPROJECT

10. For operation and maintenance of about 165 km Expressway, main scopes of the subproject are provided below :

(i) Maintenance of shoulders, toll plazas, median, tree plantation;
(ii) Undertaking major maintenance such as resurfacing of pavements, repairs to structures and refurbishment of tolling system and hardware and other equipment;
(iii) Undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, lighting and signage;
(iv) Carrying out periodic preventive maintenance to the Expressway including tolling system;
(v) Highway patrolling;
(vi) Maintenance of electrical, communication system and HTMS; and
(vii) Medical first aid.

6. SUBPROJECT DESCRIPTION:

11. Jaypee Infratech Limited (JIL), a Special Purpose Vehicle (SPV) promoted by Jaiprakash Associates Ltd. (JAL), was incorporated on April 5, 2007 to develop, construct and operate the 165 km 6-lane (extendable upto 8-lane) access controlled expressway (Yamuna Expressway) between Greater Noida and Agra in the state of Uttar Pradesh. Yamuna Expressway Industrial Development Authority, the nodal agency set up by Government of Uttar Pradesh (GoUP) to plan and construct the Expressway connecting the city of Agra with Greater Noida.

12. It provides direct access to the Yamuna Economic Zone and International Airport proposed to be constructed along the Yamuna Expressway. The Expressway also intends to ease the heavy traffic on Delhi-Agra NH-2. It was conceived to reduce the travel time between the two cities. The world famous heritage monument - Taj Mahal is said to be approximately 100 minutes from the proposed Yamuna International Airport near Greater Noida through this Expressway. The Yamuna Expressway is providing faster & uninterrupted movement to passenger and freight traffic between National Capital Delhi and Agra.

13. The Yamuna Expressway COD was achieved on August 7, 2012. The toll rates were notified by the UP Govt. and toll collection has commenced from August 16(midnight of August 15), 2012.

14. Out of 165.54 km length of Yamuna Expressway, first 40 kms is located in Gautam Budh Nagar District, passing Greater Noida, Dhankaur, Mirzapur and Jewar, followed by 20 kms in Aligarh District, passing Tappal. The following 90 kms is located in Mathura District and balance 15 kms in Agra District, with the Expressway ending near Etmadpur, a village in Agra District.

15. It has dual carriageway consisting of three 3.7 meter wide lanes in each direction. The Expressway also has a 0.7 m wide paved shoulder and a provision on the median side in order to facilitate the potential future expansion to four lanes in each direction; total width is 15.70 meters.

16. Service roads with total length of 65.51 km have been constructed to provide access of the Expressway to the local commuters.

17. Three main Toll Plazas are located near Jewar (38.84 km), Mathura (95.22 km) and near Agra (150.27 km). In addition to main Toll plazas, there are 4 Exit and 4 Entry Ramp Toll Plaza (RTP) along the expressway.

18. 6 Major Bridge including one Rail Over Bridge, 41 Minor Bridges , 70 vehicular underpasses, 75 Cart Track Underpasses / Crossing, 179 Culverts, etc. have been constructed as part of the expressway project.

19. CCTV cameras are installed at 96 location throughout the Expressway and user's call point installed at approx. every 5 kms along the Expressway for safety and accident assistance; mobile radars to monitor and regulate the compliance of minimum and maximum speed limits; upon the above 5 security vehicle, 5 ambulance, 6 patrol vehicle, 5 cranes and 5 fire fighting vehicle spread throughout the Expressway.

20. The salient features of the Yamuna Expressway are provided in **Table-1.**

Table-1: The Salient Features of Yamuna Expressway

Sl. No.	Item	Details
1.	Name of project	6 Lane Yamuna Expressway from Noida to Agra on BOT basis in the State of Uttar Pradesh
2.	Concessionaire	Jaypee Infratech Ltd. Sector – 128, Noida (UP)
3.	EPC Contractor/Toll Collection agent & O& M Contractor	Jaiprakash Associates Ltd, Sector-128, Noida (U.P)
4.	Project Advisors to YEA	RITES Ltd.
5.	Signing of Concession Agreement By Concessionaire	7th February, 2003
6.	Concession Period	36 Years (Commencing from the Commercial Operation Date)
7.	Date of Start of Construction Work	27th November, 2007
8.	COD	9th August 2012
9.	Lender's Independent Engineer (During O & M)	SMEC India Pvt. Ltd
10.	Length	165.537 km
11.	Right of Way (ROW)	100 m

12.	Number of Lanes	6 lanes extendable to 8 lanes
13.	Service road - 7.00 m wide - 5.50 m wide	35.260 km 30.255 km
14.	Design speed	120 kms per hour
15.	Type of Pavement	Rigid Pavement (PQC)
16.	Median Width	6 m
17.	Pavement width of Carriageway (One Direction)	15.70 m
18.	Earthen Shoulder Width	5.10 m

7. DECLARATION OF COD BY YEA:

21. The construction of main carriage way and three toll plazas of the Expressway was completed in March 2012. As majority of project work was completed and expressway could be safely and reliably placed into commercial operation, YEIDA issued Substantial Completion Certificate on August 7, 2012 under the provisions of Concession Agreement thereby indicating achievement of commercial operation of the project. The Yamuna Expressway was opened for public on August 9, 2012 and toll fee collection commenced from 16 August (midnight of August 15), 2012.

8. TOLL PLAZA OPERATION AND MAINTENACE

22. The Expressway has 3 Main Toll Plaza (MTP) with 32 lanes each at Jewar, Mathura and Agra. The tolls are being collected from users by cash or automatically through prepaid Smart cards and Radio Frequency Identification (RFID) Tags. The collection of toll by cash requires stopping of vehicle at toll booth and making the payment to a Toll Collector at Point of Sale. The pre-paid Smart cards and Tags for automatic collection of tolls are purchased at Toll plazas by the users. Toll Plazas has two types of lanes namely Semi-automatic and Automatic.

23. **Semi-automatic Toll Collection Lane –** this type of toll collection provides two modes of payment viz. cash and pre-paid smart card. Smart card reader is installed on booth wall near the pay-axis. The lane equipment of the toll system is operated by a Toll Collector who classifies each vehicle and the applicable toll is determined by the system. After the Toll Collector's clearance, the vehicle passes through an Automatic Vehicle Classifier (AVC) and a video image is captured by the System. The AVC based on the parameters set in the system determines the class of vehicle, independently and irrespective of the classification made by the Toll Operator. All the data relating to each individual vehicle with video image is then stored in the centralized database system for audit and future analysis.

24. **Automatic Toll Collection Lane** - in automatic lanes, the vehicles do not have to stop for toll payment as Radio Frequency Identification (RFID) technique is used for automatic collection of toll. A Transceiver is installed on the canopy and Tag is mounted inside the vehicle on the windscreen. The Transceiver and Tag make use of RFID technique for communication. The Automated Toll Collection System detects and records each and every transaction at the Toll Booth. All the vehicles are classified automatically by Automatic Vehicle Classifier (AVC) irrespective of the Toll Operator discretion and are maintained in the system for future references. In case of discrepancy in the Toll Collector's classification and AVC classification,

captured video images for the corresponding vehicle are used to resolve the discrepancy. The Electronic Toll Collection (ETC) lanes also supports cash mode of payment in case of exigencies.

25. The revenue is collected from time to time, generally at an interval of 3 hrs; after counting, cash is kept in safe vault. The cashier hand over the daily collection to Banking cashier and total collection are deposited into Escrow account maintained with nominated Bank. With the above measures, the leakage in the toll revenues is minimised.

26. The company has employed about 800 persons for toll collection and maintenance of the expressway. Out of 800 employees there are 9 doctors, 24 Nursing staff, 29 DCPO/Fireman, 62 ASO & SI/Gunman/HSG & SG/Others are employed to provide the medical facility.

27. Trauma Centre is also provided at each toll plaza having minor operation theatre, trauma ward, crash cart and advanced ventilation system, etc.

28. Each toll plaza has necessary first aid medical facilities including ambulances.

29. Doctors are also available on 24x7 basis at toll plazas.

30. Cranes and towing vehicles, vehicle repairing facilities are available at each toll plaza. Nitrogen filling facilities are also provided at each plaza.

31. Solar light facilities are provided to majority of people underpasses and vehicle underpasses.

9. PUBLIC HEARINGS

32. As reported in the EIA report, discussions were held with the stakeholders with different type of consultations such as formal, informal and group discussions and their suggestions were incorporated in mitigation measures. Based upon the public consultation and understanding the possible impacts from the consultation, the matrix of adverse environmental impacts due to the subproject and preliminary mitigation measures were prepared and implemented.

33. People view were given due concern for the selection of environmental mitigation measures in the road design aspects. Notable among them were the selection of pedestrian underpasses, road side drainages, adopting selective mechanism for tapping of only first layer of ground water, rainwater harvesting, etc.

34. Further, as part of the subproject, public hearings were also conducted on 22.01.2007, 27.01.2007, 06.02.2007 and on 15.02.2007 at Mathura, Agra, Aligarh and Gautam Budh Nagar, respectively.

10. DEBT COMPONENT OF THE PROJECT:

35. Jaypee Infratech Limited appointed IDBI bank as the sole arranger for refinancing the entire debt of Rs.6,600 crore comprising 3 tranches of varying maturities viz. Tranche A:Rs.2,000 crore (Tenor: Door to door 27 months including 22 months moratorium); Tranche B: Rs.2,600 crore (Tenor: Door to door 18 years including 5 years. Post substantial completion of the expressway, in December 2012 the company refinanced the term loans aggregating Rs.6,600 crore thereby replacing high cost debt as construction risk was over.

36. Under Takeout Finance (TFS), IIFCL had sanctioned Rs.900.00 crore to the subproject under Tranche B (Rs.600 crore) and Tranche C (Rs.300 crore) vide its letter dated 21.08.2014 for taking out of IDBI's exposure. The sanction was revalidated by IIFCL on 27.03.2015. Further

the company requested for alignment of terms of sanction with IDBI and was further modified on 12.05.2015. The Amount of Rs.900 crore was disbursed on 01.06.2015.

11. CONCESSIONAIRE:

37. Yamuna Expressway Industrial Development Authority (YEIDA) has appointed Jaiprakash Infratech Limited (JIL) as the concessionaire for this sub-project. The Concession Agreement signed on 7th February 2003. The financial closure was achieved on 18th January, 2010.

12. O & M OF THE YAMUNA EXPRESSWAY:

38. The O&M of the Yamuna Expressway Subproject is being carried out by the company. The company has implemented a computerized toll management system supplied by Efkon. The expressway has 3 Main Toll Plazas (MTP) with 32 lanes each at Jewar, Mathura and Agra.

13. LENDER'S INDEPENDENT ENGINEER:

39. M/s. SMEC India has appointed as Lender's Independent Engineer (LIE) for the project during O & M phase.

ENVIRONMENTAL SAFEGUARS

ENVIRONMENTAL SAFEGUARD DUE DILIGENCE

14. AVAILABILITY OF EIA/EMP REPORTS:

40. The Environmental Impact Assessment (EIA) study was carried out in accordance with requirements of Ministry of Environment and Forests & Climate Change (MOEF&CC), GOI, guidelines for highway projects. The proposals (presently in operation) were examined in the Ministry of Environment, Forests & Climate Change and Environmental Clearance (EC) to the project was accorded vide letter No. 5-15/2007-III dated 11th April, 2007 under Environment Impact Assessment Notification, 2006. Copy of the EIA/EMP report and environmental clearance letter are attached as **Appendix-I** and **Appendix-II**, respectively.

15. ENVIRONMENTAL SENSITIVITY AND DUE DILIGENCE:

41. The subproject site was visited by the Environmental Safeguard Specialist of IIFCL along with the concessionaire's officials on 05th October, 2015 for field verification of environmental safeguards.

- The Yamuna Expressway of 165.54 km length starts from the Greater Noida (in District Gautam Budh Nagar) and ends at Agra along left bank of river Yamuna in the State of Uttar Pradesh. It passes through Districts - Gautam Budh Nagar, Bulandshahar, Aligarh, Mahamaya Nagar (Hatras), Mathura and Agra of Uttar Pradesh. The topography of the subproject area is almost plain;

- No National Parks or Wildlife Sanctuaries exist within 10 km radius of the Expressway. Kaldeo Ghana National Park, formerly known as Bharatpur Bird Sanctuary famous for the avifauna, is the nearest National Park located at about 56 km away from Expressway in the State of Rajasthan;

- Rare and/or endangered (both flora and fauna) species have not been reported along the Expressway;

- The project Expressway does not affect any archaeological or historical monuments, protected by Archaeological Survey of India. No objection for the Yamuna Expressway (formerly known as Taj Expressway) was obtained from Archaeological Survey of India, Agra vide letter No. S/TEW/NOC-07/2794 dated 19th September, 2007;

- To avoid the incident/accident and smooth traffic flow, 6 Major Bridge including one Rail Over Bridge, 41 Minor Bridges, 70 vehicular underpasses, 75 Cart Track Underpasses / Crossing, 179 Culverts, etc. have been constructed as part of the Expressway project. Barbed Wire fencing is also provided along the Expressway for unobstructed traffic flow;

- Service roads with total length of 65.51 km have been constructed to provide access of the Expressway to the local commuters;

- Yamuna Expressway has become most preferred region for builders and developers. Many reputed builders are developing residential as well as commercial projects along the Yamuna Expressway.

- Forestry clearance and Environmental Clearance were obtained as per MOEF&CC requirements for the construction and operation of sub-project;

- Proper signage have been installed at appropriate locations for the safe traffic movement;
- Proper drainage facility is provided along the project Expressway to ensure proper drainage and avoid the water logging problem;
- The concessionaire has undertaken implementation of environment, health and safety plan as per agreed EMP during the O & M stage of the sub-project;
- Taj Trapezium issues are not involved in the sub-project;
- The subproject is in O & M phase. EMP including safety cost is being borne by the developer which also includes cost of plantation and maintenance of plantation including median plantation, amount paid to forest department for compensatory afforestation, safety measures, medical facilities and maintaining hygienic conditions, etc.
- To meet the requirements during emergency, adequate facilities have been provided. At each toll plaza, well equipped ambulance, fire tender, medical facilities with doctors and attendant on 24x7 basis are provided. First aid facilities and trauma centre are also provided at each toll plaza. Preventative measures such as rumbling, cat eye rumbling, signage, clear marking on road, zig zag barrier at accident prone area, are also provided to prevent the incident/accident.

16. CATEGORIZATION OF SUBPROJECT:

42. The subproject (Operation and Maintenance of Yamuna Expressway) has already achieved COD on 7th August 2012 and opened for traffic movement on 16th August (midnight of 15th August), 2012 financed under Take Out scheme (Amount disbursed on 01st June, 2015) by IIFCL can be classified as Category 'B' project based upon the Asian Development Bank's Safeguard Policy Statement (June, 2009). This classification is based on the site visit and review of EIA/EMP/due diligence report and other available documents provided by the Concessionaire with respect to the environmental sensitivity due to project activities. The sub-project is in operation phase, therefore, it is likely to have minimal adverse environmental impacts.

17. STATUS OF REGULATORY CLEARANCES:

43. The sub-project meets the requirements of appropriate National and State legislations by considering appropriate obligations and guidelines of Regulatory Authorities. The sub project has necessary national and local environmental clearances as well as permits and approvals for project implementation and suitable environmental management for construction as well as operation phase. Environmental Clearance and Forestry Clearance (Table-2) were obtained from the MoEF&CC. Trees cutting permission were also obtained.

Table- 2: Environmental and Forestry Clearances Status

Sl. No.	Clearances Required	Statutory Authority	Current Status of Clearance
1.	Environmental Clearance	Ministry of Environment and Forests & Climate Change, GoI, New Delhi	Environmental clearance has been accorded by MOEF&CC vide letters No. 5-15/2007-IA.III dated 11th April, 2007 **(Appendix-II)**.

	Clearance	and Forests & Climate Change, GoI, New Delhi	Forestry Clearance has been accorded by Regional Office, Lucknow of MOEF&CC No. 8B/UP/06/16/2009/ FC/ 1160 dated 20/11/2009 **(Appendix-III).**

18. STATUS OF EMP IMPLEMENTATION:

44. As part of the sub-project, EMP measures are being taken by the project proponent during O&M phase of the sub project:

- saplings plantations/replacement of dead plants/saplings are being carried out;
- Maintenance of plantations are also being carried by the project proponent;
- Adequate safety measures are being taken;
- Adequate signage are also provided and being maintained;
- Proper hygiene is being maintained;
- Proper security measures are taken for the entire stretch of the Expressway;
- Existing environment quality parameters are being monitored seasonally, except monsoon season;
- Cost of EMP (including construction of rain water harvesting system) during O & M Phase of the subproject is being borne by developer.

18.1 CONDITIONS OF TAJ TRAPEZIUM ZONE AUTHORITY:

45. The Taj Trapezium Zone, which is in the form of trapezoid was notified by the Government of India for intensifying efforts prevention and control of pollution The project proponent has confirmed that conditions stipulated by Taj Trapezium Zone Authority (TTZ) have adhered.

46. To construct the Expressway, trees felling permission for about 5000 trees, was obtained as per the requirement of TTZ. As per mandatory requirement, concessionaire applied to the Hon'ble Supreme Court for trees cutting permission.

47. Central Empowered Committee visited the site and submitted their report to Supreme Court ('The Trees Falling within the Taj Trapezium Area for the Construction of the Yamuna Expressway Project Connecting Noida to Agra.').

48. On the basis of the Central Empowered Committee's report Hon'ble Supreme Court granted approval/permission for cutting and removal of trees falling in the TTZ area.

18.2 MEASURES FOR CONTROL OF RIBBON DEVELOPMENT:

49. Because of improved connectivity and traffic flow, it is a natural tendency of people to build as near as possible to the Expressway/Highways. The building activities, therefore, expands in a natural way along the side of the Expressway/Highways and long fingers or ribbons of houses, factories, shops, etc.

50. Following measures have been taken to control the ribbon development including encroachments along the Expressway:

- Provision of service roads for traffic, which is purely local in character;

- The Right of Way (RoW) has been fenced, properly;
- The Expressway runs at a height of about 3 m above the ground level;
- Barricade has been provided to the entire stretch of the Expressway;
- Regular patrolling to prevent the new access points;
- One police station has been provided at each Toll plaza to deal with the law and order problems.

18.3 NOISE CONTROL MEASURES:

51. Noise monitoring is being carried out, seasonally, covering entire stretch of the Expressway by M/s EKO PRO Engineers Pvt Ltd, Ghaziabad, Uttar Pradesh which is a NABL accredited and UP Pollution Control Board approved Laboratory. From the analysis of monitored data, it is observed that noise levels are well below the prescribed standards.

52. If monitored noise levels are found above the applicable standards at any point of time along the expressway, adequate mitigative/control measures (including providing the acoustic barriers) will be taken to meet the applicable standards. The Concessionaire has confirmed during site visit that no complaint has been received till date.

18.4 MEASURES TO PREVENT DAMAGE TO AGRICULTURAL LAND:

53. Longitudinal toe drains have been constructed along the edge of carriageway and surrounding area being channelled towards natural drain/canal exit (culverts provided);

54. As part of the sub-project, EMP measures are being taken. Existing environmental quality parameters were measured during construction as well operation. Saplings are being planted and maintained. Cost of EMP during O & M Phase of the subproject is being borne by developer.

55. Drainage facilities are provided along the expressway to prevent the waterlogging problem. Since, there are places of high water table along the expressway, therefore, a joint survey of the entire stretch of expressway will be taken jointly by the MoEF&CC and CGWA to come to certain conclusions as regards the places where the rain water harvesting system for recharging the underground water needs to be constructed along the expressway. The entire cost of the survey and guidance design will be borne by the concessionaire.

18.5 REDEVELOPMENT OF BORROW/DEMOBILIZATION OF CONSTRUCTION CAMP SITES:

56. Based on site visit and confirmation by the project proponent borrow and pit area were developed, suitably. Camp sites demolished properly.

57. On the basis of available documents and discussions held with officials of project proponent, no material environmental and social concerns were involved in development of borrow/pit areas and demolition of camps sites. At Jewar, Mathura and Agra camp offices are being maintained to meet the requirement during operation phase of the project.

18.6 PLANTATION/AFFORESTATION:

58. During site visit, as discussed with the officials of project proponent it appeared that project proponent had taken adequate measures to carry out the plantation as per requirements of MOEF&CC.

59. The project proponent has deposited total amount towards the cost of compensatory afforestation as required by MoEF&CC while granting approval under the F.C., Act.

60. Median plantation, etc. are being carried out and maintained by the project proponent. Entire cost is being borne by the project proponent.

18.7 WATER HARVESTING SYSTEM:

61. Rain Water Harvesting system as stipulated in the Environmental Clearance conditions could not be constructed completely all along the Expressway for the reason that there are places where the water table is high and construction of rain water harvesting system would create water logging at such places.

62. Practical problem being faced in recharging the ground water table (high water table at many places) was discussed in the Hon'ble National Green Tribunal (NGT). The Hon'ble NGT Principal Bench, New Delhi had issued the following directions:

63. The MoEF (Now MoEF&CC) and CGWA shall conduct a survey of the area under the control of the Jaiprakash Associates Limited along the stretch of Yamuna Express highway keeping in view surface covered by the Expressway, water table and corresponding need to recharge the underground water for finding out the place/s where the Rain Water Harvesting System needs to be constructed for felicitating the recharge of the ground water.

64. Survey shall be carried out to identify the places for the construction of rain water harvesting systems along the expressway shall be rendered to the project proponent. The CGWA shall along that advice provide appropriate design of the Rain Water Harvesting system to the JAL.

65. To comply the order of Hon'able NGT, project proponent has initiated the process. Preliminary survey along Yamuna Expressway was conducted on 18 September, 2015 to assess the feasibility of rain water harvesting system by the Scientist of Regional Office, Ministry of Water Resources Central Ground Water Board (MWRCGWB), Lucknow.

66. In this connection some information were desired by the Board from the Project Proponent which were provided to the Board vide Letter No. JAL/NGT/15/1269 dated 10th October, 2015.

19. ENVIRONMENTAL MONITORING/REVIEWS/INSPECTION:

67. Monitoring of environmental quality during construction and operation reflects the success of implementation of the mitigation measures and it also provides a chance to review the suggested measures and improve upon the measures. The environmental monitoring was primarily the responsibility of the EPC contractor during construction phase whereas during O&M phase of the subproject it is the responsibility of concessionaire.

68. As specified in the EMP, monitoring of environmental parameters are being carried out by EKO PRO Engineers Pvt Ltd, Ghaziabad which is ISO 9001:2008 & OHSAS 18001:2007 certified and NABL accredited. It is recognised under EPA 1986 Act by MoEF&CC. It is also recognised by Uttar Pradesh Pollution Control Board, Rajasthan State Pollution Control Board and Punjab State Pollution Control Board.

69. Regular, reviews and inspections are being carried out by the Project Proponent for this sub project. Well qualified team is carrying out the review and inspection of the subproject during O & M phase. SMEC, LIE (O&M phase) of this subproject, is a professional services

firm providing high-quality consultancy services on major infrastructure projects.Team of LIE is also visiting the site periodically and submitting the report on the status of the subproject including compliance and safety measures. As per LIE (O&M phase), obtaining COD seems project complied the conditions during construction phase.

70. During O&M, LIE report covers status of applicable environmental, health & safety requirements of the subproject. Report will also suggest the mitigative measures in case of any problems are observed/reported.

20. SAFETY MEASURES:

71. At the time of site visit it was observed that Project proponent is fulfilling the EHS requirements as detailed in EIA/EMP report. Organogram is provided as **Appendix- V.** Appropriate procedures and activities are in place to achieve and maintain compliance.

- For road safety suitable measures such as installation of barricades and barbed wire fencing along both sides of the expressway, sign boards, rumble and cat eye stripes, etc. are provided;

- Fog lights have been mounted on both the leading and trailing edge of bull-nose face of all toll islands, as visual warning for drivers approaching the toll plaza, specially during inclement weather conditions;

- Overhead Lane Signals (OHLS) are Mounted at top at centre of lane axis, the signal clearly indicates to the motorists entering the plaza about the operation of toll lane (open or closed). The OHLS sign has been linked to the position of lane entry manual boom, which in closed position shall be ‘RED’ (changed to ‘GREEN’ only on lane Entry Boom opening). OHLS is mounted onto the leading edge of the Plaza Canopy;

- Manual Lane Entry Barrier: Manually operated entry boom is used to physically close a lane when the lane is not in operation. It is located on the Lane Island in front of the toll booth.

- Load Gauge Detectors are mounted on the bull-nose of each lane island which detect the over-dimensional loads on a vehicle and let out a siren/audible alarm if the extra-wide load is likely to damage the Toll Booth;

- The Touch & Go Smart Card Readers are mounted outside the booth near the window / on the driver side for easy access and use by the motorists in possession of their ‘Cash less Smart Cards / Prepaid Smart Cards’

- User Fare Display (UFD) has also been provided. The LED display is used to inform the driver of the vehicle classification entered by the toll collector and the toll to be paid. It also conveys low balance warnings, traffic safety messages, public relations and seasonal messages;

- The traffic light mounted on a pole of 1.6 m after the booth is a visual indicator for the motorist to stop (Red) for payment or proceed (Green) after payment. It is located on the lane island beyond the toll booth in a convenient position where it is readily visible to commuter

- Violation Alarm Light is provided for raising alarms in the event of violation / run through by errant drivers and gives visual indication of particular lane while siren is ringing. It is located at exit side over camera pole.

- Siren are provided which sound whenever any violation or problem occurs in lane area. These are mounted in front of the toll booths

- Incident CCTV Cameras are installed to capture the image of the vehicle in the event of any violation/incident. It is mounted on the island on exit side;

- Automatic Lane Exit Barriers are mounted on the islands on exit side to control the passage of vehicles through the lane after payment of the required toll fee. Once the transaction is processed and completed by the Toll Collector, the barrier lifts for the vehicle to proceed and exit the lane;

- Toll Lane Computer (TLC) controls all aspects of the revenue collection process and vehicle passage. The TLC also controls all communication and all peripheral equipment installed in the lane. It is mounted in the tunnel under the booth.

- Toll Collectors Terminal (TCT) Screen & Toll Collectors Keyboard, the primary input device, provided for making manual vehicle classifications as well as for processing the transactions including payment & method. These are installed on the Toll Collectors table in the booth;

- Receipt Printers are provided to print the receipt of the transaction as soon as the transaction is completed by the Toll Collector. These are installed on the Toll Collectors table in the booth;

- Bar Code Reader mounted on the Toll Collector's table in the toll booth reads daily passes (up/down trip) and the bar code encoded on the rear of the Smart Cards that are issued for monthly, exempt and regular users. It is (p) Intercom Unit: Mounted on desktop in toll booth, it allows the plaza manager or plaza controller to communicate with the toll collector from the Control Room in the plaza building;

- Booth Camera and Housing mounted on ceiling inside toll booth, it monitors the activities of Toll Collector sitting inside the toll booth;

- Manual Booth Controller as mounted on desktop in toll booth, controls the lane manually in case of malfunctioning of Toll lane computer. It controls the Traffic light, Over Head Lane Sign, Exit barrier and Siren;

- Automatic Vehicle Classification System (AVC) system has been designed to accurately count and classify each and every vehicle that passes over the AVC. It operates as a stand-alone system independent of the toll collection system to provide independent classification other than the Toll Collector's vehicle classification. It is provided with a dual data stream to transfer its data to a separate AVC Data Management System (DMS) located at the toll plaza. It classifies 2 wheelers, 3 wheelers, 4 wheelers and Multi Axle vehicles separately. It generates an Excess Axles incident. The Excess Axles incident generation shall be configurable from 4 axles and greater. This shall be a settable parameter in the AVC parameter tables;

- The Vehicle profile scanner assists the AVC located after pay-axis (centre line of Toll Collectors Window) in making a consistently accurate calculation on the class of vehicle crossing the AVC are installed;

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- ETC Antenna/RFID Readers are installed to communicate with the On Board Unit located on the vehicles windscreen when the vehicle approaches the toll lane. The Antenna is connected to the Toll Lane Computer which has all the necessary software and tables to process the vehicle transaction. It is mounted on a bracket hanged from the canopy with a height clearance of more than 5.7m.

- Plaza Camera & NVR, installed in Control Room, is used for monitoring/viewing of Lane area in Control Room. Cameras are located in the lanes and NVR;

- Slow Speed Weigh-in-Motion (SSWIM): The SSWIM Scale with control panel & display is located in the front of the toll booths (approach side) and weighs the weight / overloading slabs of moving vehicle;

- SSWIM Camera, Video grabbing system, for mass monitoring is installed in each lane in which the SSWIM scales are installed.

- The flyers / hand bills have been distributed educating motorists on road safety and safe movement on the expressway. In addition road safety measures are also announced at Plazas, where vehicle stops for paying toll tax;

- Round-the-clock patrolling on Expressway by Route Patrol and Security vehicles and police are being carried out;

- Facilities for immediate removal of breakdown/ accident vehicles to soft shoulder and securing them by safety cones and flasher lights are provided;

- Medical facilities with trauma centres, doctors (24x7 basis) and first aid facilities are provided at all toll plazas;

- Facilities to address road users to observe safety measures and follow traffic rules by route patrol teams using PA system are also provided;

- Necessary human and financial resources are being borne by the project proponent to meet environment and safety requirements;

21. CONTROL ROOM EQUIPMENT FOR TRAFFIC MANAGEMENT SYSTEM:

72. For management and monitoring of data generated in the lane area, a TMS Control Room has been established in the plaza building. Various equipment like servers and work stations for various functions are installed in the Control Room, manned by Plaza Controller & Validators:

- **Servers:** The TMS Server, AVC Data Management Server, Plaza Controller Server and SSWIM Server are installed with various toll soft wares

- **Workstations:** For controlling, monitoring and management of toll transactions and data, various workstations like LSDU (Lane Status Display Unit), Incident workstation and validation workstations are installed in the Control Room.

- **Printers:** Point of Sale (POS) Printer (to print document/receipts in POS room) and Cash Up and Control room Printer (to print documents, reports etc in cash up and control room) are installed in Control Room / POS Room.

- **Networking equipment**: All equipment installed in the long area, POS Room, Cash Up Room and Control Room are connected through networking equipment and cables for communication.

22. EXPRESSWAY/HIGHWAY TRAFFIC MANAGEMENT SYSTEM:

73. Traffic management involves the planning, monitoring and control of the traffic to aid optimum use of the Expressway. It entails monitoring of the actual traffic situation in real time and then controlling/managing the same in order to reduce congestion, deal with incidents and improve efficiency and safety. Yamuna Expressway has been provided with state-of-the-art HTMS comprising of Variable Message Sign (VMS), Speed Direction System, Video Incident Detection System, CCTV Surveillance System and Mobile Radio System. All these systems are connected to a Network Management System (NMS) through Optical Fibre Cable (OFC) for monitoring at control centres located in Main Toll Plazas. These are complimented by Traffic Safety & Management Services of Route Patrols, Ambulances, Recovery Crane and Fire Tenders. In addition, Quick Response Teams (QRTs) are also deployed for round-the-clock safety of commuters.

74. The HTMS operation and function is based on an integrated and centrally managed system in which Control Room In charge located in the HTMS control room at each Toll Plaza uses systems (including computers and communications devices) to perform the following basic functions:

- Traffic monitoring and event detection.
- System and Field device monitoring and control.
- Event response; and Information dissemination to provide a high quality of service to road users.

75. The Highway Traffic Management System provided by M/s. Efkon India Pvt. Ltd. Comprises of state-of-the-art equipment including Video Incident Detection System (VIDS) which has been used for the first time in the country at Yamuna Expressway.

76. Video Incident Detection System (VIDS), state-of-the-art system, is widely used in foreign countries, detects various activities, generates alarms / reports and also suggests various options and responses to tackle the situation. The system is integrated with the Management System to provide the following alarms on occurrence or as and when required:

- Stationary or illegally parked vehicles on the carriageway
- Left out objects on the carriageway
- Speed Detection
- Wrong Direction Traffic Identification / detection
- Lane Occupancy
- Lane Utilisation
- Vehicle Count

77. Variable Message Sign (VMS) mounted on portals / gantry have been installed at various locations of the Expressway. The VMS system is used to display messages for information of road users about the traffic advisory and weather conditions. The VMS boards are installed at

various strategic locations on the road. Various types of messages like warnings, alerts, route guidance or those related to emergencies are displayed for the guidance of road users.

78. Highway CCTV (PTZ CCTV) Surveillance System captures live videos of the covered zones along the road using the cameras & transmit the images for monitoring and analysis. The monitoring helps the Control Room in deciding the appropriate course of action for helping the road users in case of mishaps and traffic jams.

79. Speed Detection System, speed detection radars, have been installed at various locations along the Expressway to detect over-speeding and for penalizing the errant drivers. This acts as a deterrent to over-speeding which compromises the safety of other road users.

80. Radio Mobile system-For providing means of mobile communication to Route Patrol vehicles, Quick Response Teams (QRTs), Ambulance and crane services etc., Mobile Radio System has been installed. The dual frequency, semi duplex Mobile Radio communication system enables effective two way voice communication between the Highway Traffic Management System (HTMS) Operator in the Control Centre located at the toll plaza and emergency portable and mobile users such as Police, Ambulances, Cranes and other patrolling vehicles and also between these portable and mobile units

81. Network Management System (NMS) The NMS includes all the hardware and software necessary to configure, control and monitor the Ethernet connected devices. The NMS automatically layout each map network as a tree, ring or bus topology. Each map object uses a device specific or user selected icon and the object color indicates the device status.

82. HTMS Control Room Equipment: For management and monitoring of data and communication with the various components of HTMS installed along the Expressway, a separate HTMS Control Room has been established at each Main Toll Plaza, which is manned round-the-clock by a Control Room In charge.

83. Servers: The VIDS server & VMS server are installed at the Control Room, loaded with necessary software

84. Work stations: For monitoring, controlling and management of various data, various work stations are installed like VIDS work station, VMS work station, surveillance camera screen with DVR and speed monitoring work station.

85. Toll Plazas also comprising of Highway Traffic Management and other auxiliary systems of Yamuna Expressway is equipped with advance technology, many component of which commissioned for the first time in country, with objective of providing error free operation for years to come.

86. For controlling the corridor following equipment/vehicles are provided:

- Patrolling Vehicles
- Security Vehicles.
- Ambulance with Paramedics
- Recovery Vehicle 10T capacity.
- Recovery Vehicle 40T capacity
- Fire Control Vehicles
- Water Bowser
- Mechanical Broomer
- Signage Trailer with VMS facility

23. SITE VISIT:

87. A site visits were undertaken by IIFCL's Environmental and Social Safeguard Specialists along with the concessionaire's officials on 5th October and 4th November, 2015. The concessionaire has provided about 800 staffs for the operation and maintenance of the Expressway including toll collection. During the site visit it has been observed that:

- Toll charges are being collected at three toll collection plazas. All plazas are well maintained. Residential including food canteen/mess facilities are provided. Good sanitation and proper hygiene are being maintained;
- Police Stations (Chowki) are provided at all plazas to meet any untoward situation related to mainly law and order problem. 10 numbers of Patrolling vehicles are also provided to the police teams for the entire stretch of the expressway;
- At each Toll Palza, two fire fighting vehicles, two cranes and two ambulances are available to meet incident/accident requirements;
- First aid facilities and well equipped trauma centres are also provided at each trauma toll plaza. Doctors are also available at all toll plazas round-the-clock;
- Cautionary boards and other applicable sign boards are provided at regular intervals to avoid the accidents;
- About 320 Km long, 776 mm high, single W - Beam Metallic Crash Barrier on both side of Expressway at the edge of embankment have been provided for safety of the road users;
- Lane Marking, Over taking Lane Marking, Slow moving Lane Marking, Chevron Marking etc. have been provided as per IRC : 35 and MORTH Specification. Curb Stone Painting on Both Side of Median edges has been provided;
- Reflective Pavement Markers and Solar Studs are also provided;
- Road Signages as per IRC: 67 and Section 800 of MORTH Specification are provided. Visual Messaging Systems can be read from 300 m distance; are also provided which keep informing about weather condition, road condition, people working and barrier;
- Plantation in the median has been provided to reduce headlight glare from opposite traffic;
- Illumination at Interchanges and Toll Plazas. Adequate lighting facilities using solar panels are provided to the underpasses;
- Necessary barricading and safety precautions are being ensured. To prevent the incident/accident due to over speeding and drivers fatigue rumble stripes, cat eyes and speed measuring cameras are provided;
- Tow away vehicles, vehicles repair facilities; spare parts and nitrogen gas filling facility are also provided.
- Community toilets and 'dhabas' are also provided for the travellers;
- Training and awareness to the workers on potential hazard are organised time to time.

24. PROJECT IMPLEMENTATION STRUCTURE:

88. For the purpose of providing project management and carrying out routine maintenances, the company has provided a Project Management team to supervise the O & M of the Expressway. Organogram is provided as **Appendix V.**

25. ENVIRONMENTAL IMPACTS ASSOCIATED WITH OPERATIONAL STAGE OF EXPRESSWAY:

89. Transport succours economic growth, it can also impact the environment and social welfare by creating local air, noise, and visual pollution, and act as an instrument through which natural habitat and biodiversity could be adversely impacted. Further, social impact occurs due to spatial or occupational dislocation of people. The range of issues and impact cover the natural and social environment, and are often emphasized in the context of their geographical location. Yamuna Expressway subproject has achieved COD in the year 2012 and now in the O & M phase. Some of these issues are described below:

90. Air Quality changes due to air pollution caused by maintenance equipment and traffic related emissions, contributes to atmospheric pollution. Ambient air quality is being monitored in the vicinity of Expressway seasonally (Except monsoon). To see any impact on the ambient air quality data of summer seasons 2012 (Construction Phase) and 2015 (Operation Phase) have analysed. Monitored ambient air quality data for the years (summer season) 2012 and 2015 are provided in **Tables-3** and **4**, respectively. Analysis of the monitored data reveals that at some monitoring locations marginal increase, though not significant, of NOx and CO levels. However, concentrations of PM2.5 and PM10 in the ambient air are lesser during 2015 than that of 2012. Higher concentrations of PM10 and PM2.5 can be attributed to the fugitive emissions due to construction activities at the site. Concentrations of Pb, O3 and NH3 were also monitored during construction phase and are also being monitored during O&M phase of the subproject, however, their concentrations are found below detection limit. The results are compared with ambient air quality standards of Central Pollution Board Notification dated 18th November, 2009. Concentrations of all monitored parameters are found well below the prescribed standards (including ecologically sensitive area as notified by the Central Government) for the years 2009, 2010 monitored by Nuchem Ltd, Faridabad and 2011 to 2015 (summer season) monitored by EKO PRO Engineers Pvt Ltd., Ghaziabad. Therefore, no significant impact is envisaged during the O&M phase of the subproject.

91. **Noise Pollution** that affects people and animals occurs with increase in vehicular noise, friction between vehicles and the road surface, driver's behaviour, as well as maintenance activities. Noise levels are also being monitored in the near the expressway using sound level meter in thrice in a year i.e. winter, summer and post monsoon. Monitoring data collected during summer 2012 and summer 2015 are provided in **Tables-5** and **6**, respectively. However, data collected in the years 2010 to 2015 (Summer season) were also analysed to see the impact on the noise levels during construction as well as O&M phases of the subproject. Monitored noise levels are found well within the prescribed limit.

92. It is pertinent to note that all the educational institute are located beyond 125 meter from the kerb of the Expressway. Noise levels decreases with the increasing distance. Maximum recorded Leq during day time is about 55 dB(A) near road kerb, therefore, noise generated from the traffic of Expressway will reduce below prescribed limit and no significant impact on the exiting noise levels is envisaged.

93. If noise levels are reported more the prescribed limit then adequate control/mitigative measures (including acoustic barriers) will be provided to satisfy the prescribed limit.

94. **Soil Degradation** is one of the most immediate impact and occurs from loss of topsoil and decrease in the productive capacity of the soil covered by the Expressway. During O &M phase of the subproject no significant impact is expected. Proper drainage system has been provided, therefore, even during heavy rain overflow is not envisaged.

95. Sample of the soil are being collected and analysed in the laboratory to see any significant change in the soil quality in the vicinity of the Expressway. Till date no impact on the soil quality is reported due to O & M of the Expressway.

96. **Water Resources/Drainage** Modifications in the natural hydrological environment may lead to changes in surface and ground water flows, water logging and water quality degradation. Proper drainage system has been provided. Water harvesting system will also be provided to control the any water logging or over flow problem, therefore, no significant impact on the existing water quality in the vicinity of the Expressway is envisaged during O & M phase of the Expressway.

97. **Water quality** samples are being collected and analysed in the laboratory. The results of the analysed samples (Year 2009, 2010, 2012, 2013, 2014 and summer season, 2015) reveals there is no impact on the existing water quality.

98. **Biodiversity,** which is the wealth of species and ecosystems, may be directly impacted due to construction activities. Prior to cutting the trees permission approvals were obtained as statutory requirements. Trees were felled as per prescribed conditions. Reserve forest is located at about 500 m from the Expressway and between the RF and Expressway there is a village due to which no fragmentation is envisaged during O&M phase of the project, however, near that location under pass is provided.

99. No adverse impact is envisaged on the archaeological structures including Taj Mahal. Archaeological Survey of India has accorded NOC to this project.

100. A stretch of Expressway falls in the Taj Trapezium Zone (TTZ). Only issue involved was tree cutting in the TTZ during construction phase of the subproject. The project proponent obtained the tree cutting permission form the Supreme Court. Prior to granting the approval/permission Supreme Court asked the members of the Central Empowered Committee to inspect the area and submit a report. The main observations and conclusions of the Committee are provided below:

- Applicant (M/s Japee Infratech Limited) has obtained clearance under E.P. Act and F.C. Act.
- JIL has deposited Rs 3 11 550/- towards the cost of compensatory afforestation. Further, Rs. 47 38, 569/- has been deposited towards the Net Present Value of land.
- the pollution in the The Expressway in the context of the TTZ matter would help in the reduction of the traffic jams and vehicular pollution by diverting the flow of traffic away from the Taj Mahal, thereby substantially reducing area.
- The compliance of the conditions imposed while grating approval under the F C Act, particularly of the planting roadside trees in a time bound manner must be strictly ensured and monitored as the road side plantations will further help in greening and improving the environment of the area.

- Finally Committee recommended, 'This Hon'ble Court may please consider the recommendations of the CEC and may please pass appropriate orders in the matter.'

- It can, therefore, be concluded, 'the proposed project does not affect any eco-sensitive zones as declared by MOEF&CC including Taj Trapezium,

101. Socio-economic changes foreseen due to improved transportation facilities. Some of the envisaged impact are provided below:

- increase of population, migration change in will also change;
- change in economic pattern;
- increase in income levels;
- increase in overall employment and change in occupational distribution;
- increase in land value, agricultural land will be used to meet the residential, commercial and industrial land requirements;
- changes in types of housing and occupancy levels;
- changes in health and social services;
- changes in demand on educational resources;
- changes in demand on transportation system, Free flowing traffic (free from congestion) leading to reduction in fuel consumption due to idling of vehicles in the traffic jams;
- increase in tourism and recreational potential;
- Urbanization of rural area in along the Expressway will certainly help in decentralization of economic activities from NCT Delhi.

102. As indicated in Tables 3 to 6 and data analysed for the years 2009, 2010 monitored by Nuchem Ltd, Faridabad and 2012 to 2015 (summer season) monitored by EKO PRO Engineers Pvt Ltd., Ghaziabad, environmental pollution levels are well within the prescribed limits and impacts due to O & M activities on the exiting environment are minimal. Large scale commercial activities and educational facilities helps in strengthening the overall economic development of the area. Induced traffic is additional traffic that is generated when the user costs associated with a road facility decreases. Since NH2 was facing frequent traffic jams, therefore, travel & cost (Expressway) are expected to come down. Travel cost refers mainly to the vehicles operating costs and comprises two components namely distance related and time related costs.

26. CONCLUSIONS AND RECOMMENDATION:

103. Based upon the available documents and site visit, it is concluded that the concessionaire has undertaken adequate environmental safeguard measures. Managers posted at site are looking after the incident management. The conclusion for the sub-projects is given below:

- The project has been prepared by YEIDA as per its own funding requirement and not in anticipation to Asian Development Bank's operation;

- The construction works were completed satisfying the environmental safeguards requirements. The sub-project received the COD on 7th August, 2012 and opened for vehicular movement on 16th August (mid night of 15th August), 2012;

- Since there are places of high ground water table along the expressway, therefore, construction of rain water harvesting system may create water logging at that places. A joint survey of the entire stretch of Expressway is planned to be taken by the MoEF&CC and CGWA to come to certain conclusions as regards to the places where the rain water harvesting system for recharging the underground water needs to be constructed along the expressway. The entire cost of the survey and guidance design will be borne by the concessionaire;

- The concessionaire will undertake construction of rain water harvesting systems at the places indicated in the joint inspection survey (expected shortly) in accordance with the design provided by the CGWA. After completing such construction, concessionaire will place the compliance report regarding water harvesting system before the NGT and a copy of the same will be shared with IIFCL;

- The proposed project does not affect any eco-sensitive zones as declared by MoEF&CC including Taj Trapezium. Also the project does not pass through any national park or wildlife sanctuary. No historical or archaeologically important monuments are affected due to this subproject;

- For road safety suitable measures such as construction of installation of barricades and barbed wire fencing along both sides of the Expressway, sign boards, rumble and cat eye stripes, etc. are provided;

- The flyers / hand bills have been distributed educating motorists on road safety and safe movement on the expressway. In addition road safety measures are also being announced at Plazas, where vehicle stops for paying toll tax;

- Round-the-clock patrolling on Expressway by Route Patrol and Security vehicles and police are being carried out;

- Facilities for immediate removal of breakdown/ accident vehicles to soft shoulder and securing them by safety cones and flasher lights are provided;

- Medical facilities with trauma centres, doctors (24x7 basis) and first aid facilities are provided at all toll plazas;

- Facilities to address road users to observe safety measures and follow traffic rules by route patrol teams using PA system are also provided;

- Based on the due diligence findings, it can be deduced that the operation and maintenance of subproject has no environmental safeguard issues;

- The subproject, therefore, does not appear to involve any kind of reputational risk to IIFCL and the Asian Development Bank funding on environmental safeguards and is recommended for funding under the proposed head.

Table- 3 Ambient Air Quality during Summer, 2012

Sl. No.	Location	Concentration in µg/m^3, except CO (mg/m^3)				
		NO_x	SO_2	$PM_{2.5}$	PM_{10}	CO
1.	Dankaur	21.7	11.3	41.1	80.2	1.0
2.	Rabupura	19.4	11.4	41.9	89.2	1.2
3.	Jewar	25.3	15.41	47.4	93.3	0.9
4.	Tappal	22.4	12.4	37.3	85.3	0.95
5.	Seopati	29.8	16.3	48.0	85.9	1.15
6.	Sultanpur	27.5	15.2	37.6	83.0	0.8
7.	Naisthi	18.19	11.19	49.05	90.05	1.15
8.	Aura Bangar	23.25	14.22	46.19	85.12	1.05
9.	Baldev Nagar	29.3	15.1	48.0	89.1	1.2
10.	Barauli	20.3	9.4	45.2	81.1	0.95
11.	Khandauli	18.5	10.1	39.0	78.2	0.9
12.	Nadau	30.3	17.3	43.0	83.1	1.15
13.	Chaugan	23.4	14.2	34.1	78.2	1.0
14.	Etamadpur	30.95	11.07	40.06	91.12	1.2
15.	Mirzapur	22.4	13.7	45.1	82.0	1.15
Ambient Air Quality Standards for Industrial, Residential, Rural & Other Areas, Ecologically Sensitive Area(Notified by Central Government)		**80**	**80**	**60**	**100**	**04**

Table-4 Ambient Air Quality during Summer, 2015

Sl. No.	Location	Concentration in µg/m^3, except CO (mg/m^3)				
		NO_x	SO_2	$PM_{2.5}$	PM_{10}	CO
1.	Dankaur	26.2	12.6	43.5	73.8	0.82
2.	Mirzapur	34.5	16.3	47.1	84.8	1.02
3.	Nadau	25.8	11.2	44.8	75.2	0.78
4.	Sultanpur	38.4	17.2	48.0	89.5	1.09
5.	Tappal	35.9	18.2	51.6	81.3	0.89
6.	Aura Bangar	33.4	15.9	53.6	86.2	1.05
7.	Barauli Nadau	36.7	19.2	49.2	83.9	1.06
8.	Chaugan	24.8	10.2	39.6	69.8	0.92
9.	Jewar	31.4	15.2	45.6	76.8	1.12
10.	Rabupura	29.0	14.5	41.8	70.2	0.92
Ambient Air Quality Standards for Industrial, Residential, Rural & Other Areas, Ecologically Sensitive Area(Notified by Central Government)		**80**	**80**	**60**	**100**	**04**

Table-5 Noise Levels during Summer, 2012

Sl. No.	Location	Noise Levels in dB(A)		
		L_{eq}- Day Time	L_{eq}- Night Time	L_{eq}- 24 hr
1.	Jewar	52.3	43.6	48.1
2.	Dankaur	52.9	41.9	46.6
3.	Sultanpur	52.7	45.2	48.3
4.	Naisthi	53.2	42.3	47.8
5.	Tappal	53.7	43.3	47.0
6.	Seopati	52.9	43.6	46.9
7.	Aura Bangar	54.1	42.5	48.2
8.	Baldev Nagar	52.4	40.1	45.8
9.	Barauli	52.9	43.1	47.7
10.	Khandoli	52.5	42.5	47.4
11.	Nadua	53.4	42.3	47.1
12	Chaugan	53.5	43.3	48.2
13.	Etamadpur	53.1	43.8	47.2
14.	Rabupura	51.1	40.6	45.0

Table- 6 Noise Levels during Summer, 2015

Sl. No.	Location	Noise Levels in dB(A)		
		L_{eq}- Day Time	L_{eq}- Night Time	L_{eq}- 24 hr
1.	Aura Bangar	53.9	42.9	48.4
2.	Barauli	50.8	40.8	45.7
3.	Chaugan	53.4	42.9	48.1
4.	Dankaur	53.4	42.7	48.1
5.	Jewar	55.9	42.4	49.2
6.	Mirzapur	52.8	42.2	47.5
7.	Nadua	54.4	43.4	48.9
8.	Rabupura	56.7	44.5	50.6
9.	Sultanpur	51.1	43.1	47.1
10.	Tappal	54.4	44.6	49.5

SOCIAL SAFEGUARDS

SOCIAL SAFEGUARDS DUE DILIGENCE (SSDD)

27. PREFACE:

104. Jaypee Infratech Limited (JIL), a Special Purpose Vehicle (SPV) promoted by Jaiprakash Associates Ltd. (JAL), was incorporated to develop, construct and operate the 165 km 6- lane (extendable upto 8-lane) access controlled expressway (Yamuna Expressway) between Greater Noida and Agra in the state of Uttar Pradesh. Yamuna Expressway Industrial Development Authority (YEIDA), the nodal agency set up by Government of Uttar Pradesh (GoUP) to plan and construct the Expressway connecting the city of Agra with Greater Noida.

105. As assistance under Take-out Finance Scheme (TFS) is sanctioned only after minimum one year after the start of the commercial operation date (COD). IIFCL has funded this project under Take-Out finance scheme, in which the project has already achieved COD declared on 9th August 2012 and Toll collection started from midnight of 15th Aug 2012. Thus, the safeguard implementation during the construction stage as per the applicable policy provisions has been reviewed based on the available information/document in public domain to identify residual issues, if any. Thus it is expected that safeguard issues as per applicable state, national guidelines/regulations would have been addressed by that time.

106. As IIFCL's participation in Takeout Finance Scheme takes place only during the operation phase of a project, its role in social due diligence would be limited to ensuring safeguards compliance applicable to the post-COD phase. For takeout, IIFCL will conduct a social safeguards compliance study to assess social safeguards related concerns/issues applicable during operation phase. The preparation of SSDD is based on the publicly available documents, site visit, discussions with the developer, and O&M project team.

28. METHODOLOGY:

107. The Social Safeguards Due Diligence Report (SSDDR) under Take-Out Finance Scheme (TFS) for the subproject was prepared by IIFCL to understand the salient features of the project and various social issues and concerns during the operation stage of the project. This report has been prepared by IIFCL on behalf of the sub-project developer Jaypee Infratech Ltd.- Yamuna Expressway Ltd. with the limited available information and documents.

108. The methodology followed during the preparation of Social Safeguards Due Diligence Report (SSDDR) is as follows:

- Discussion with the subproject developer regarding the operation of the project, status of land acquisition and resettlement Impacts during the construction stage of the project;
- Outstanding grievances and complaints, if any;
- Review of relevant information/documents available in public domain.
- Any pending litigation cases related to land acquisition and compensation;
- Field visit observations, review of the available compliance reports/ document;
- During the preparation of SSDDR the relevant documents have been reviewed e.g. Environmental Impact Assessment (EIA) Report, Notifications for Land Acquisitions, Compensation and R&R grant payment details; Concession Agreement (CA), the project, Lenders Independent Engineers (LIE) Report July 2015 and applicable

clearances/permits/No Objection Certificates (NOCs) as applicable for the project implementation.

29. PUBLIC CONSULTATION:

109. During project planning and preparation stage, Public Consultations were carried out with the different stakeholders along the project road, villages, project affected people and the stakeholders. These consultations were conducted to take into consideration the various issues as raised by the local people and to mitigate and minimize the impact of the project by adopting necessary mitigation measure during the project finalization. During the consultations, people were generally in support of the project but have also raised concern over the acquisition of agricultural land and have demanded for adequate compensation. Which were dealt by the competent authority YEIDA.

110. Moreover, during the project planning and design stage, public hearing were also conducted at four different locations, conducted on 22.01.2007, 27.01.2007, 06.02.2007 and 15.02.2007 at Mathura, Agra, Aligarh and Gautam Budh Nagar respectively. The details of the Public Hearing related communication between State Pollution Control Board and the District Administration, minutes of meeting of the public hearing proceedings and newspaper cuttings (Notice for the general public to conduct Public Hearing was published on dated 27th December 2006, 4th January 2007 and 13th January 2007 in the daily News Paper. The public hearing notification is given in **Appendix-IV.**

30. IMPACT ON SCHEDULE TRIBE POPULATION

111. The project road is passing through the districts of Gautam Buddha Nagar, Aligarh, Mathura, Hathras and Agra Utter Pradesh, which is not a part of the notified Fifth Schedule Area1, hence, the project does not disturb any tribal settlement and does not have any adverse impact of any tribal community along the expressway. Hence no Tribal Development Plan (TDP) is required to be prepared for this sub-project.

31. INFORMATION DISCLOSURE

112. The project was disclosed to the project affected people through public consultations and hearings on 22.01.2007, 27.01.2007, 06.02.2007 and 15.02.2007 at Mathura, Agra, Aligarh and Gautam Budh Nagar respectively. Notices for the general public to conduct Public Hearing were published on 27th December 2006, 4th January 2007 and 13th January 2007 in the daily News Paper 'The Dainik Jagaran, Agra". A sample copy of the Gazette Notification is attached as **Appendix- VI.**

113. **Gazette Notifications for Land Acquisitions:-**The Gazette of Uttar Pradesh is a public journal and an authorized legal document of the Government of UP. Through the Gazette Notifications for land acquisitions, the UP Government declared its intention to acquire the land for construction of Taj Expressway (The project was known as Taj Expressway) the through Taj Expressway Industrial Development Authority.

[1] The Web link of the state wise list of "The Scheduled Areas": http://www.tribal.gov.in/Content/StatewiseListofScheduleAreasProfiles.aspx

32. LAND ACQUISITION IN THE PROJECT

114. The project road covers a total length of 165.537 Km. 6-lane (extendable up to 8 lane), access- controlled, fully concrete paved expressway connecting Noida and Agra. The right of way for the proposed expressway is 100 meter. Since this is a new road, thus the entire land is to be acquired by Yamuna Expressway Industrial Development Authority (YEIDA), under sub-section (1) of section 4 of the Land Acquisition Act 1894 (Act no. 1 of 1894). The total land acquisition for the project is approx. 2009.58 hectares (4965.79 Acres), which includes the land for Right of way, toll plaza, interchange and facilities. About 59.52 Ha. is yet to be acquired. However, this has not impacted usage of expressway by the users and Toll collection. The purpose wise detail of land acquisition is given in below **Table-7.**

115. During the site visit and discussion with the concessionaire it was told that, most of the land required for construction of the Expressway (approximately 97%) is under the possession of JIL. However, due to delay in handing over of land for the Entry / Exit Ramps and addition of new clover junction, JIL has applied for further extension of time. The proposed date for completion of balance items is 31st December 2015, provided the land is made available to the Concessionaire.

Table-7: Total Land Required for the Project

Sl. No.	Particulars	Total Land Required (Ha)	Land in Possession of JIL (Ha)	Land Yet to be transferred to JIL
Land for Expressway				
1	Right of Way	1676.41	1653.92	22.49
2	Interchange	206.38	169.59	36.79
3	Facilities	55.79	55.79	0.00
4	Toll Plaza	70.98	70.74	0.24
Total (A)		**2009.56**	**1950.04**	**59.52**

Source: PIM July 2015 & developer

116. During the discussion it was informed by the subproject developer that the land acquisition is being carried out by the Concessioning Authority i.e. YEIDA after the official Gazette Notification was published under sub-section (1) of section 4 of the Land Acquisition Act, 1894 (Act no. 1 of 1894). A sample copy of the Gazette Notification for land acquisition is attached as **Appendix- VI.**

33. COMPENSATION AND ENTITLEMENT:

117. Land acquisition is being done by YEIDA after the notifications were published both in English and vernacular language in the year 2007, 2008 and 2009. The copies of the Notifications are given in Appendix VI.

118. YEIDA has prepared this project for its own funding requirement and not in anticipation to ADB's operation, thus the land acquisition is being done by YEIDA prior to the involvement of

IIFCL/ADB and the compensation is being paid for loss of properties as determined by the Competent Authority for Land Acquisition is the respective district administration.

34. GRIEVANCE REDRESSAL MECHANISM

119. JIL has formed their own grievance sell, whenever any complaints receives in writing from any stakeholders, at first the respective toll manager will try to resolve the issue of the concern toll plaza, if not then the complaint will be forwarded to the project level for resolving the issue. If the project in-charge is unable to resolve the issue and the gravity of the issues is not within his purview, then the matter will be forwarded to JIL, if the matter required to forward to YEIDA then it may be forwarded to the Project Director to resolve the issue amicably.

35. RESETTLEMENT IMPACT IN THE SUB-PROJECT

120. During the site visit it was observed that the project corridor passes through mostly private lands on along project corridor. During the project planning and preparation stage the Concessioning Authority has taken due care and consideration not to affect any settlement areas. Moreover the project alignment has been so selected that it was totally free from any habitation. So this project does not involve any rehabilitation and resettlement. Since, midnight of 15th Aug, 2012, the Yamuna Expressway is being operational.

36. IMPACT ON PROPERTIES

121. It was observed during the site visit that the alignment has been so designed that the project road avoids cremation ground, villages, religious places, hospitals and schools. Though two numbers of Universities are located proximity of the project road but these are beyond the RoW.

122. During the site visit it was also observed that, no private structure was impacted due to the project road. Since the project road alignment is mainly passing through all along the small villages which are also far away from the project road, and no historic and culturally important structure is falling on the alignment. Only one small temple was relocated, which was now far away from the RoW.

37. LOCAL EMPLOYMENT GENERATED BY THE CONCESSIONAIRE

123. Since, midnight of 15th Aug 2012, the Yamuna Expressway is being operational and toll collection has been started in the three toll plazas. During the discussion with the concessionaire, the subproject provides employment opportunities to about 800 local people during the operation stage of the sub-project. Moreover, all the local people are employed in the Toll Plaza sites and project offices in the subproject. The local people are employed as Toll Collector, Supervisors, security guards, crain/ ambulance driver, gun man, cook, office/administrative assistants, cleaning, sweeping and maintenance, of the existing road etc.

38. DISCLOSURE:

124. The final ESDDR report will be accepted and owned by the Concessionaire and endorsed by IIFCL. After getting the No Objection Certificate (NOC) from the ADB, the report will be uploaded for public disclosure in IIFCL's website, Project developer's website as well as ADB's website.

39. SITE VISIT OBSERVATIONS

125. Site visit was undertaken by the ESMU team of IIFCL on 5th of October 2015 to understand the project and safeguard procedures adopted by the subproject developer. During the site visit it was observed that:

- As informed by the subproject developer during the site visit that more than 800 numbers of local people are engaged in the operation stage of the project;
- The local people are employed in all the three Toll Plaza sites, project offices in the subproject. The local people are employed as Toll Collector, Supervisors, security guards, crain/ ambulance driver, gun man, cook, office/administrative assistants, cleaning, sweeping and maintenance, of the existing road etc.
- The project corridor passes through mostly on plain and agricultural lands on either side of the project;
- The developer is providing medical facilities to the nearby villages as part of Community Development Activities. Three Medical van was also available in the toll plaza locations for onsite free medical services to the people;
- Enhancement , maintenance and development of 2 Km. approach road at Ch. 38.00 near Jewar Toll Plaza;
- At Ch.110.00 the subproject developer has developed a link road approx. length of 20 Km. which connects to Mathura Temple;
- Health Check-up Van available for twenty four hours at all the three toll plazas with advanced medical technology for any emergency;
- Six numbers of fire fighting vehicles, three tow away vehicles, six numbers of cranes are available for twenty four hour service at toll plazas locations;
- 15 numbers of Highway patrolling vehicle with one gunman , one assistant root patrolling officers with driver are available in each patrolling vehicle;
- Three medical trauma centres with advance lifesaving systems and trained technicians are available for emergency;
- All road patrolling vehicles are available with First Aid Box for emergency;
- During the site visit it was also informed that, with the help of local police ,five numbers of additional police vehicles are also patrolling in the expressway;
- In every two kilometres SOS (Save our Soul) telephone booths are provided which are connected to the nearest toll plaza control room;
- Ten numbers of water tankers are deployed for watering in saplings all along the project;
- As a part of emergency preparedness the subproject developer has equipped with the medical facility system by providing with Automated External Defubulators (shock therapy to revive the patient during the major accident);

40. CONCLUSION

126. The COD for the project was declared on 9th August, 2012 and Toll collection started from midnight of 15th Aug, 2012. Since, October 31, 2014, most of the land required for construction of the Expressway (approximately 97%) is under the possession of JIL. It can be understood that the project is under operation from last three years and running smoothly and toll collection is going on. Further, it can also be concluded that there is no litigation cases related to land acquisition and compensation as confirmed by the subproject developer.

127. Based upon the available documents and site visits it appears that the subproject developer has undertaken social safeguard measures for better and on time implementation of the sub-project. The key observations on due diligence on the social impacts are summarised as follows:

- The subproject has been prepared by YEIDA as per its own funding requirements and not in anticipation of ADB operation;
- As informed by the subproject developer, the major portion of land acquisition was completed (most of the land required for construction of the Expressway (approximately 97%) is under the possession of JIL.
- The land acquisition for the project has been carried out by YEIDA as per the Land Acquisition Act 1894 and the compensation has already been paid to the affected people;
- The project was disclosed to the project affected people through Gazette Notifications;
- It seems that necessary approvals required for the construction and operation of the expressway have been obtained. The project is substantially completed and has commenced commercial operation from August 2012;
- The project road is an access controlled expressway connecting Greater Noida and Agra;
- As per information provided by subproject developer no Schedule Caste/Schedule Tribe people get affected due to proposed project;
- Considering the socio-economic profile of the sub-project areas, it may be noted that the sub- project will improve the quality of life of the people;
- For benefit of the local people, concessionaire has developed a Mukti Dham (crematory ground) at Dhankaur, near International Formula Race Course;
- Expressway has been provided three workshop with free air/water and community/refreshing centres;
- To maintain the cooling effect of the tyres and to avoid the tyre burst nitrogen filling stations along the expressway has also been provided with a minimal rate;
- As a safety measures and to control the over speeding of the vehicle, rumble strips, cat eye strips, zigzag barricades and Traffic Police Enforcement Centres in each toll plazas have been provided;
- To control the overspending of the vehicles, E-challan system has been installed in all the toll plazas, guided by the speed detection cameras;

- Local people are being hired from the locality for day to day activity, for operation and maintenance of the expressway as well as for operation of the Toll Plazas. These peoples go back to their own houses in the evening after completing day's work;

- Based on the site visits observations and desk review, it seem that the sub-project have no negative significant social safeguard issue.

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Compliance with Regard to ADB Observations (Dated 26th November, 2015)		
Sl. No.	**ADB's Observations**	**Response of IIFCL**
1.	re-submission of ESDDR with the sub-project classified as of environment category B (para 42 of revised ESDDR);	The sub-project is classified as Category B. Please refer para 42 of attached **ESDDR.**
2.	continued compliance by the facility owner and the O&M contractors with the terms and conditions stipulated while according statutory environmental permissions as applicable;	Noted.
3.	regular field verification undertaken by its safeguards team to reassess and confirm compliance with the agreed environmental measures by the concessionaire, including carrying out public consultations;	Noted.
4.	the 2016 audit report for this sub-project shall provide:-	
	(a) a detailed assessment of the status of measures for control of the ribbon development;	Noted.
	(b) update on the implementation of environmental management and monitoring measures as outlined in the EIA report;	Noted.
	(c) update on the status of rainwater harvesting scheme (the case filed in the National Green Tribunal).	Noted.

Compliance Sheet-Yamuna Expressway Ltd.		
Sl. No.	**ADB's Observations**	**Response of IIFCL**
1	please attach the copy of environmental impact assessment report approved by the regulatory agencies mentioned as Appendix-I in the ESDDR (Appendix-I not attached);	A copy of EIA/EMP is attached as **Appendix I**
2	the ESDDR shall provide a detailed assessment of compliance achieved by the project proponent with the terms and conditions stipulated in the environmental clearance issued by MOEF&CC especially with regard to specific conditions under sections A.	
	(iii) All conditions stipulated by Taj Trapezium Zone Authority (TTZ) should be strictly adhered to	Adhered, as confirmed by Concessionaire. The Taj Trapezium Zone, which is in the form of trapezoid was notified by the Government of India for intensifying efforts prevention and control of pollution. To construct the Expressway, trees felling permission for about 5000 trees, was obtained as per the requirement of TTZ. As per mandatory requirement, concessionaire applied to the Hon'ble Supreme Court for trees cutting permission. Central Empowered Committee visited the site and submitted their report to Supreme Court ('The Trees Falling within the Taj Trapezium Area for the Construction of the Yamuna Expressway Project Connecting Noida to Agra.'). On the basis of the Central Empowered Committee's report Hon'ble Supreme Court granted approval/permission for cutting and removal of trees falling in the TTZ area. Details are incorporated in ESDDR under Sub-section 18.1
	(v) Details of measures for control of the ribbon development should be submitted to Ministry within 3 months from the date of receipt of this letter.	Because of improved connectivity and traffic flow, it is a natural tendency of people to build as near as possible to the Expressway/Highways. The building activities, therefore, expands in a natural way along the side of the Expressway/Highways and long fingers or ribbons of houses, factories, shops, etc. Following measures have been taken to control the ribbon

		development including encroachments along the Expressway. • Provision of service roads for traffic, which is purely local in character; • The Right of Way (RoW) has been fenced, properly; • The Expressway runs at a height of about 3 m above the ground level; • Barricade has been provided to the entire stretch of the Expressway; • Regular patrolling to prevent the new access points; • One police station has been provided at each Toll plaza to deal with the law and order problems. Details are incorporated in ESDDR under Sub-section 18.2.
	(vii) The project proponent should adhere to all the measures/actions stipulated by the TTZ Authority and also the Orders of the Hon'ble Supreme Court with regard to TIZ.	Adhered, as confirmed by the concessionaire. Details are incorporated in ESDDR under Sub-section 18.1
	(ix) Details of the acoustic barriers along the village/habitations / school/hospitals	Noise monitoring is being carried out, seasonally, covering entire stretch of the Expressway by M/s EKO PRO Engineers Pvt Ltd, Ghaziabad, Uttar Pradesh which is a NABL accredited and UP Pollution Control Board approved Laboratory. From the analysis of monitored data, it is observed that noise levels are well below the prescribed standards. If monitored noise levels are found above the applicable standards at any point of time along the expressway, adequate mitigative/control measures (including providing the acoustic barriers) will be taken to meet the applicable standards. The Concessionaire has confirmed during site visit that no complaint has been received till date. Details are incorporated in ESDDR under Sub-section 18.3
	(xiv) To prevent damage to the agricultural land, the drainage flow should be diverted to the natural course avoiding the agricultural land.	Longitudinal toe drains have been constructed along the edge of carriageway and surrounding area being channelled towards natural drain/canal exit (culverts provided) Details are incorporated in ESDDR under Sub-section 18.4
	(xvi) Suitable under passes should be provided for animal crossings along the alignment close to Reserve Forest.	Between the Expressway and Reserve Forest there are villages (inhabited), therefore, reserve forest is not opening on the Expressway. However, underpass has been provided.

	(xx) The hot mix plant should be located at least 500 m away from the habitation and on the barren land to avoid its adverse impact on the human population.	As confirmed by project proponent, 'No hot mix plant was installed for Yamuna Expressway Construction by the EPC contractor.' Construction materials were sourced from approved agencies by the EPC contractor.
	(xxii) Noise barriers will be provided at appropriate locations particularly in the areas where the alignment passes through inhabited areas schools/hospitals, so as to ensure that the noise levels do not exceed the prescribed standards	Presently, noise levels as monitored by EKO PRO Engineers Pvt Ltd., a NABL accredited and UP Pollution Control Board approved laboratory, are well below the applicable standards (for residential/sensitive/near inhabited areas/ schools /hospitals) and no complaint has been received regarding high noise levels from the public. Noise levels are being monitored at about ten locations covering entire stretch of the Expressway in three seasons. If at any point of time high noise levels are reported or compliant of high noise levels are received, adequate mitigative/control measures including (acoustic barriers) will be taken to reduce the noise levels within the applicable standards. Details are incorporated in ESDDR under Sub-section 18.3.
3	the ESDDR shall include a section elaborating the corrective actions taken/being taken by the project proponent to achieve compliance in case of any shortcomings with respect to the terms and conditions stipulated with the environmental and forest clearances obtained for the sub-project	Project proponent complied with the conditions as stipulated by the MoEF & CC, except, development of water harvesting system along the Expressway could not be completed due to report awaited from the MoEF & CC and CGWB. Ground water table is very high at many places which can be attributed to the closeness to the river Yamuna. Practical problem being faced in recharging the ground water table was discussed in the Hon'ble National Green Tribunal (NGT). The Hon'ble NGT Principal Bench, New Delhi had issued the following directions: The MoEF (Now MoEF&CC) and CGWA shall conduct a survey of the area under the control of the Jaiprakash Associates Limited along the stretch of Yamuna Express highway keeping in view surface covered by the Expressway, water table and corresponding need to recharge the underground water for finding out the place/s where the Rain Water Harvesting System needs to be constructed for felicitating the recharge of the ground water. Survey shall be carried out to identify the places for the construction of rain water harvesting systems along the expressway shall be rendered to the project proponent. The CGWA shall along that advice provide appropriate design of the Rain Water Harvesting system to the JAL with.

		To comply the order of Hon'able NGT, project proponent has initiated the process and current status is summarized below: Preliminary survey along Yamuna Expressway was conducted on 18 September, 2015 to assess the feasibility of rain water harvesting system by the Scientist of Regional Office, Ministry of Water Resources Central Ground Water Board (MWRCGWB), Lucknow. Details are incorporated in ESDDR under Sub-section 18.5
4	the ESDDR shall provide assessment in terms of the direct, indirect, induced and cumulative environmental impacts associated with the operational stage of this project, and their mitigation so far achieved by the project proponents;	During O&M phase of the Expressway minimal adverse impact is envisaged. Impact assessment during O&M phase has been summarized below: Seasonal (except monsoon), monitoring of existing environmental quality parameters are being carried out. Till date, no adverse impact during O&M phase of Expressway has been reported. Petrol pumps and local eateries are being operated near toll plazas. Operation of Expressway has improved connectivity from Greater Noida to Agra. Greater Noida is well connected with Noida/Delhi by Noida Expressway. A few townships have been planned along this link by the State Government. Greater Noida Expo Mart has immerged as meeting point for Exporters. It can also be viable alternative to the Pragati Maidan, New Delhi. Knowledge Park developed in Greater Noida . Free flowing traffic (free from congestion) leading to reduction in fuel consumption due to idling of vehicles in the traffic jams. Impact assessment details are incorporated in Section 25 of ESDDR.
5	a reference to NGT (National Green Tribunal) has been made in the ESDDR. Is there any case filed in NGT with respect to this sub-project? Please provide comprehensive details of the case or the rationale for submission of certain details to NGT as mentioned in the ESDDR	Rain Water Harvesting system as stipulated in the Environmental Clearance conditions could not be constructed completely all along the Expressway for the reason that there are places where the water table is high and construction of rain water harvesting system would create water logging at such places. Since, Rain Water Harvesting (RWH) system could not constructed completely (entire stretch of the Expressway) due to

		high water table at many places, the case was discussed in National Green Tribunal (NGT) (Kuldeep Nagar & Anr. Vs. Jaiprakash Associates Ltd. & Ors.). Finally, on July 24, 2015 (Item No. 42) NGT disposed of the case with the conditions: • MoEF&CC and CGWA shall conduct a survey of the area under the control of developer along the stretch of Yamuna Expressway, water table and corresponding need to recharge the underground water for finding out the place/s where the RWH system needs to be constructed. • Places identified for construction of RWH system along the Expressway shall be rendered to the project proponent; • CGWA shall along with that advice provide appropriate design of the RWH system to the project proponent and project proponent will undertake construction of RWH systems at the places indicted in the joint inspection survey in accordance design provided by CGWA. • The compliance report shall be placed before the tribunal by the project proponent. • The entire cost of the survey and guidance concerning design shall be borne by the project proponent. In compliance to order passed by Hon'able NGT, a preliminary survey along with Yamuna Expressway was conducted by Central Ground Water Board, Northern Region, Lucknow to assess the feasibility of rain water harvesting system to recharge the ground water. In this connection some information were desired by the Board from the Project Proponant whch were provided to the Board vide Letter No. JAL/NGT/15/1269 dated 10th October, 2015. Details are incorporated in ESDDR under Sub-section 18.7
6	please provide details of compliance with statutory environmental and forest related regulations during O&M stage for the sub-project	As per requirements, • saplings plantations/replacement of dead plants/saplings are being carried out. • Maintenance of plantations are also being carried by the project proponent. • Adequate safety measures are being taken. • Adequate signage are also provided and being maintained. • Proper hygiene is being maintained. • Proper security measures are taken for the entire stretch of the Expressway. • Existing environment quality parameters are being monitored seasonally, except monsoon season. Details are incorporated in ESDDR under Sections 18 to 22.
7	the ESDDR has stated that the	At the time of site visit it was observed that Project proponent is

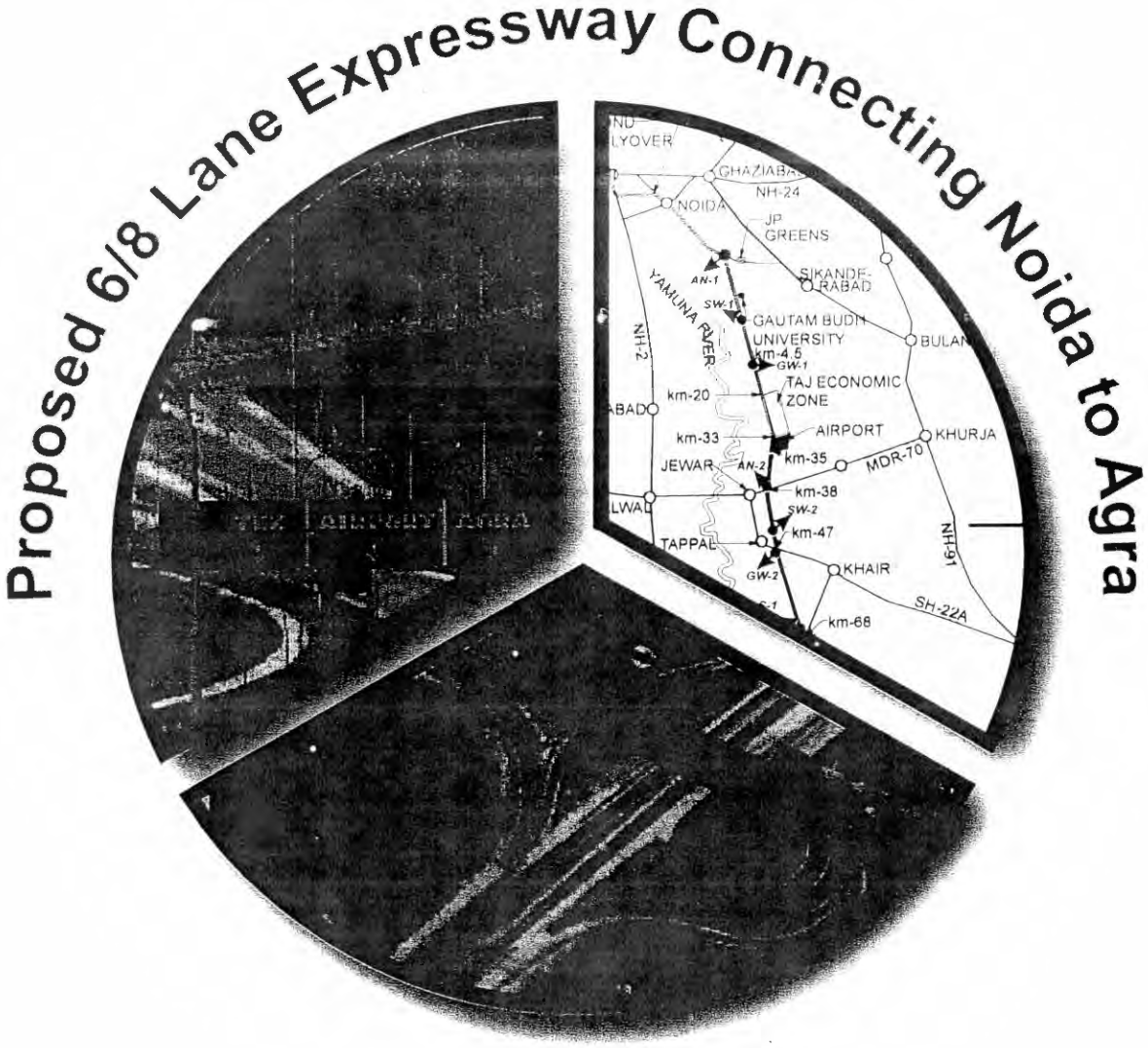
	concessionaire has undertaken implementation of environment, health and safety plan as per agreed EMP during the O & M stage of the sub-project. Please attach a copy of the EHS plan with ESDDR.	fulfilling the EHS requirements as detailed in EIA/EMP report. Organogram is provided as **Appendix-V**. For road safety suitable measures such as installation of barricades and barbed wire fencing along both sides of the expressway, sign boards, rumble and cat eye stripes, etc. are provided; • The flyers / hand bills have been distributed educating motorists on road safety and safe movement on the expressway. In addition road safety measures are also announced at Plazas, where vehicle stops for paying toll tax; • Round-the-clock patrolling on Expressway by Route Patrol and Security vehicles and police are being carried out; • Facilities for immediate removal of breakdown/ accident vehicles to soft shoulder and securing them by safety cones and flasher lights are provided; • Medical facilities with trauma centres, doctors (24x7 basis) and first aid facilities are provided at all toll plazas; • Facilities to address road users to observe safety measures and follow traffic rules by route patrol teams using PA system are also provided; • Monitoring of existing environmental parameters are being carried out by EKO PRO Engineers Ltd., Ghaziabad. Details are incorporated in ESDDR under Sections 18 to 22.
8	please add a section on the status of (i) closure and redevelopment of borrow areas and quarries, and (ii) demobilization of construction camp sites with an assessment of presence of any residual environmental impacts of construction phase, and the corrective actions thereof agreed with the project proponent. In case no residual environmental impacts were observed during site visit pertaining to construction stage as well as O&M stage until now, the ESDDR will confirm so specifically.	Based on site visit and confirmation by the project proponent borrow and pit area were developed, suitably. Camp sites demolished properly. On the basis of available documents and discussions held with officials of project proponent, no material environmental and social concerns were involved in development of borrow/pit areas and demolition of camps sites. At Jewar, Mathura and Agra camp offices are being maintained to meet the requirement during operation phase of the project. Details are incorporated in ESDDR under Sub-section 18.5.
9	please provide details of the plantation program implemented so far including the utilization of the relevant budget. Please provide assessment in terms of	During site visit, as discussed with the officials of project proponent it appeared that project proponent had taken adequate measures to carry out the plantation as per requirements of MOEF&CC.

	what was stipulated while issuing environmental and forest clearances, and what has been achieved thus far.	The project proponent has deposited total amount towards the cost of compensatory afforestation as required by MoEF&CC while granting approval under the F.C., Act. Median plantation, etc. are being carried out and maintained by the project proponent. Entire cost is being borne by the project proponent. Details are incorporated in ESDDR under Sub-sections 18.6.
10	in the ESDDR, it is mentioned that for operation and maintenance of about 165 km Expressway, the scope of works includes (i) maintenance of shoulders and toll plazas; (ii) maintenance of median, tree plantation; (iii) maintenance and repair of structures; (iv) highway patrolling; (v) maintenance of electrical, communication system and HTMS; and (vi) medical aid. Please clarify whether pavement maintenance related works including repairs, if any, are also a part of the scope. Please confirm that the construction material being sourced for these works is from statutory approved sources.	Incorporated. The scope of works includes: (i) maintenance of shoulders and toll plazas; (ii) maintenance of median, tree plantation; (iii) undertaking major maintenance such as resurfacing of pavements, repairs to structures and refurbishment of tolling system and hardware and other equipment; (iv) Undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, lighting and signage; (v) carrying out periodic preventive maintenance to the Expressway including tolling system; (vi) highway patrolling; (vii) maintenance of electrical, communication system and HTMS; and (viii) medical first aid. Incorporated in Section 5 of ESDDR.
11	please provide the analysis of the data obtained from the testing of environmental parameters such as ambient air quality, ambient noise levels, water quality and soil quality monitored since commencement of operational phase, and compare the data with the baseline data considered for the sub-project. Please include the analysis of locations used for monitoring this data vis-à-vis the baseline data locations for clarity. Please provide assessment in terms of adequacy of monitoring carried out so far.	Regular monitoring is being carried out by EKO PRO Engineers Pvt Ltd, Ghaziabad. Ambient air quality, Noise levels, Water quality (surface and ground water) and soil quality are being monitored at 11, 10, 6 (3 Surface and 3 Ground water) and 7 locations, respectively. Number of monitoring locations are more as suggested in the EIA/EMP. Number of monitoring stations/locations increased considering the environmental as well as social concerns. Monitoring of existing parameters are being carried out in each season except monsoon season. Existing environmental quality monitored data (Monitored by Nuchem Ltd. for the years 2009 and 2010; and EKO PRO Engineers Pvt Ltd for the years 2012 to summer season 2015) as provided by the project proponent have been analysed. Ambient air quality and noise levels monitored data during

		summer seasons of 2012 and 2015 are provided at Tables-3 to 6 in ESDDR. On the analysis of monitored data, no adverse impact is envisaged. Details are incorporated in ESDDR under Section 25.
12	in Para 68 of the ESDDR (social safeguards due diligence section), two universities have been reported to be just outside of the right-of-way of the sub-project. Please provide the test results, and the associated analysis of the environmental parameters monitored at these two environmentally sensitive receptors since August 2012. Please compare the data with that monitored during construction stage at these two locations, and include assessment in the ESDDR.	Existing environmental quality parameters are being monitored and the results show that the monitored parameters are well below the prescribed limit. Noise levels as monitored and calculated at universities boundaries are quite low than that of prescribed limit. Details are provided in Sl. No. 4.
13	please add a section on the adequacy of reporting on environmental safeguards by the LIE (O&M phase) in terms of the coverage of the environmental safeguards related aspects in its monthly reporting	As per LIE (O&M phase), obtaining COD seems project complied the conditions during construction phase. During O&M, LIE report covers status of applicable environmental, health & safety requirements of the subproject. Report will also suggest the mitigative measures in case of any problems are observed/reported. Details are incorporated in ESDDR under Section 19.
14	please provide details of environmental audits, reviews, inspections carried out for this sub-project by the project proponent, LIE or any other consultant since the sub-project was made operational in August 2012. This assessment shall also reflect the adequacy of such reviews with respect to direct, indirect, induced and cumulative environmental impacts associated with the operational stage of this	Regular, reviews and inspections are being carried out by the Project Proponent for this sub project. Well qualified team is carrying out the review and inspection of the subproject during O & M phase. Team of LIE is also visiting the site periodically and submitting the report on the status of the subproject including compliance and safety measures. Details are incorporated in ESDDR under Section 19.

	project, and their mitigation achieved.	
15	the ESDDR has stated that "the proposed project does not affect any eco-sensitive zones as declared by MOEF&CC including Taj Trapezium" (Para 50). The ESDDR shall provide basis and/or relevant details for arriving at this conclusion considering that about 65 km of the expressway had been reported to be falling within TTZ	Only issue involved in the subproject was tree cutting in the TTZ. The project proponent obtained the tree cutting permission form the Supreme Court. Prior to granting the approval/permission Supreme Court requested the members of the Central Empowered Committee to inspect the area and submit a report. The main observations and conclusions of the Committee are provided below: (i) Applicant (M/s Japee Infratech Limited) has obtained clearance under E.P. Act and F.C. Act. (ii) JIL has deposited Rs 3 11 550/- towards the cost of compensatory afforestation. Further, Rs. 47 38, 569/- has been deposited towards the Net Present Value of land. (iii) The Expressway in the context of the TTZ matter would help in the reduction of the traffic jams and vehicular pollution by diverting the flow of traffic away from the Taj Mahal, thereby substantially reducing the pollution in the area. (iv) The compliance of the conditions imposed while grating approval under the F C Act, particularly of the planting roadside trees in a time bound manner must be strictly ensured and monitored as the road side plantations will further help in greening and improving the environment of the area. (v) Finally Committee recommended, 'This Hon'ble Court may please consider the recommendations of the CEC and may please pass appropriate orders in the matter.' Further, it is worth to mention: 1) Expressway provides fast, safe, economical, uninterrupted connectivity to Agra unlike the existing NH-2 which is passing through congested cities like Faridabad, Ballabhgarh, Palwal, Mathura, etc. and is not fully access controlled resulting in mixing of slow and fast moving traffic leading to frequent jams and accidents; 2) Archaeological Survey of India has also accorded the NOC to this project; It can, therefore, be concluded, 'the proposed project does not affect any eco-sensitive zones as declared by MOEF&CC including Taj Trapezium. Details are incorporated in ESDDR under Section 25, Para 99 & 100..
16.	the abbreviation page needs to be corrected by deleting repeated terminologies.	Updated.

RAPID ENVIRONMENTAL IMPACT ASSESSMENT REPORT



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CONTENTS

S.No.	Description	Page No.
Foreword		
Executive Summary		
Index		
Chapter - 1	**INTRODUCTION**	**1-1**
1.0	Background	1-1
1.1	Key Findings of Initial Environmental Examination	1-2
1.2	Policy Context for Environmental Assessments in India	1-3
1.3	Policy objective of the Environmental Assessment and the Management Plan	1-3
1.4	Structure of the main EIA/ EMP Report	1-4
Chapter – 2	**PROJECT DESCRIPTION**	**2-1**
2.0	The project and its location	2-1
2.1	objectives of the project	2-1
2.2	Expected benefits of the project	2-1
2.3	Cost of the project	2-2
2.4	Phases of the project	2-2
2.5	Terrain	2-2
2.6	Forest area	2-2
2.7	Right of way	2-2
2.8	Road way and pavement	2-2
2.9	Project components	2-3
2.9.1	Bridges and Culverts	2-3
2.9.2	Raising of embankment	2-4
2.9.3	Construction of Underpasses and Overpasses	2-4
2.9.4	Provision for traffic safety features	2-4
2.9.5	Construction of wayside amenities	2-4
2.9.6	Provision for landscaping	2-5
2.9.7	Construction of Toll Plaza and ancillary structures	2-5
2.9.8	Construction of service roads, Pedestrian Crossings	2-5
2.9.9	Major River Crossings	2-5
2.9.10	Junction Improvements	2-5
2.10	Project Activities	2-5
2.10.1	Pre-Construction Stage	2-5
2.10.2	Construction Stage	2-6
2.10.3	Post Construction Stage	2-6
2.10.4	Operational Stage	2-6
Chapter – 3	**ENVIRONMENTAL REGULATORY FRAMEWORK**	**3-1**
3.0	Background	3-1
3.1	Regulatory applicability and clearances/ consents requirements	3-1
3.1.1	Exclusions:	3-1
3.1.2	Applicability	3-1
3.2	environmental legislative networks and life cycle of environmental clearance for	

CONTENTS

S.No.	Description	Page No.
	road project.	3-3
3.2.1	Legislative Network	3-3
3.2.2	Life Cycle of Environmental Clearance for Road Project.	3-4
3.3	Provision for afforestation costs, timing for plantations and environmental and safety standard norms	3-4
3.3.1	Provision for Afforestation Costs	3-4
3.3.2	Timing for Plantations	3-4
3.3.3	Environmental and Safety Standard Norms	3-4
Chapter – 4 METHODOLOGY		**4-1**
4.0	Introduction	4-1
4.1	Public consultation	4-1
4.2	Environmental survey	4-1
4.3	Testing and monitoring	4-2
4.4	Collection of secondary data	4-2
4.5	Compilation of data	4-4
4.6	Identification and assessment of valued ecosystem components	4-4
4.7	Environmental management planning	4-4
4.8	Methodology in sequence	4-4
Chapter – 5 EXISTING ENVIRONMENTAL SCENARIO		**5-1**
5.0	Introduction	5-1
5.1	Natural Environmental Setting of the Project Corridor	5-1
5.1.1	Climate	5-1
5.2	Physical Setting	5-2
5.2.1	Physiography	5-2
5.2.1.1	Drainage	5-2
5.2.1.2	Cross Drainage Structures	5-2
5.2.2	Geology	5-2
5.2.3	Soils	5-4
5.2.3.1	Location of Sampling Site	5-5
5.2.3.2	Physico-chemical Characteristics	5-5
5.2.4	Quarries and Rock Crushers	5-7
5.2.5	Borrow Pits	5-7
5.3	Land use Pattern	5-8
5.4	Water Resources	5-10
5.4.1	Surface Water Resources	5-10
5.4.1.1	National Surface Water Quality Standards	5-11
5.4.1.2	Surface Water Sampling Locations	5-12
5.4.1.3	Surface Water Quality	5-12
5.4.1.4	Aquatic Ecology	5-14
5.4.2	Ground Water	5-16
5.4.2.1	Ground Water Quality	5-17
5.5	Air Quality and Noise	5-18
5.5.1	Air Quality	5-18

CONTENTS

S.No.	Description	Page No.
5.5.1.1	Ambient Air Quality	5-18
5.5.1.1.1	Location of Ambient Air Quality Monitoring Station	5-18
5.5.1.1.2	Existing Ambient Air Quality	5-19
5.5.2	Noise Quality	5-20
5.5.2.1	Ambient Noise Quality	5-20
5.5.2.1.1	Location of Ambient Noise Quality Monitoring Stations	5-20
5.6	Flora, Fauna and Ecosystem	5-22
5.6.1	Forests	5-22
5.6.2	Fauna	5-22
5.6.3	Trees in ROW	5-23
5.7	Socio-economic Environment	5-24
5.7.1	Demographic profile along the project corridor	5-24
5.7.2	Archaeological	5-28
5.7.3	Historic and Religious Structures	5-28
5.8	Other Amenities	5-28
Chapter – 6 PUBLIC CONSULTATION		**6-1**
6.0	Public Consultation Process	6-1
Chapter – 7 IDENTIFICATION AND ASSESSMENT OF IMPACTS		**7-1**
7.0	introduction	7-1
7.1	Valuable Ecosystem Components	7-1
7.2	Potential Environmental Impacts	7-2
7.2.1	Change in Land use Pattern	7-2
7.2.2	Soil	7-2
7.2.2.1	Impact due to Loss of Soil	7-3
7.2.2.2	Land Used as Borrow Areas	7-3
7.2.3	Impact on Water Bodies along the Project Corridors	7-3
7.2.3.1	Impact on Bound Water Bodies	7-4
7.2.3.2	Alteration of Surface Drainage	7-4
7.2.3.3	Estimates on use of local water supply – sources for construction	7-4
7.2.3.4	Water Quality Degradation	7-4
7.2.4	Estimated impact on Air Quality due to the project	7-5
7.2.4.1	Ambient Air Quality on NH 2 (Delhi – Mathura Section)	7-5
7.2.4.2	Prediction of Impacts on Ambient Air Quality	7-7
7.2.5	Estimated impact on Noise Quality due to the Project	7-10
7.2.5.1	Existing Noise Quality Along NH 2 (Delhi – Mathura Section)	7-11
7.2.5.2	Prediction of Impacts on Ambient Noise Quality	7-12
7.2.6	Flora, Fauna and Ecosystems	7-14
7.2.6.1	Trees along the Roadside	7-14
7.2.7	Socio-economic Environment	7-15
7.2.7.1	Cultural Environment/Properties etc.	7-15
7.2.7.2	Other Amenities	7-15

CONTENTS

S.No.	Description	Page No.
Chapter – 8	**ANALYSIS OF ALTERNATIVES**	**8-1**
8.0	Introduction	8-1
8.1	Future Environmental Conditions – without and with the project	8-1
8.1.1	Physical Environment	8-1
8.1.2	Biological Environment	8-2
8.1.3	Socio-economic Environment	8-2
8.2	Realignments	8-2
Chapter - 9	**MITIGATION MEASURES**	**9-1**
9.0	Approach to Mitigation Measures	9-1
9.1	Expected Economic and Other Benefits of the Project	9-12
9.1.1	The Environmental Benefits	9-12
9.1.2	Costs	9-13
9.1.3	Environmental Costs versus Benefits	9-15
Chapter – 10	**MONITORING & INSTITUTIONAL STRENGTHENING**	**10-1**
10.0	Introduction	10-1
10.1	monitoring process	10-1
10.1.1	Monitoring Requirement at Different Stages	10-2
10.1.1.1	Design Stage	10-2
10.1.1.2	Construction Stage	10-2
10.1.1.3	Operation Stage	10-2
10.2	Implementation Arrangement, Training and Reporting	10-3
10.2.1	Implementation Arrangement	10-3
10.2.2	Reporting	10-5
10.2.3	Training:	10-5
Chapter - 11	**CONCLUSIONS**	**11-1**
11.0	Introduction	11-1
11.1	expected environmental improvement for this project	11-1
11.1.1	Related to Highway Design:	11-1
11.1.2	Related to Ecological Improvement:	11-1
11.1.3	Related to Air/Noise Quality Improvement:	11-1
11.1.4	Related to Improvement of Community Properties:	11-2

APPENDICES AND ANNEXURES

Appendix I	A.I – 1
Annexure 5.1: Soil Sampling and Analysis	A.5.1 – 1
Annexure 5.2: Details of Quarries	A.5.2 -1
Annexure 5.3: Borrow Areas Location Chart	A.5.3 -1
Annexure 5.4: Water Sampling and Analysis	A.5.4 -1
Annexure 5.5: Air Sampling and Analysis	A.5.5 -1
Annexure 5.6: Noise Sampling and Analysis	A.5.6 -1
Annexure 7.1: Details of flora within RoW	A.7.1 -1
Annexure 10.1: Monitoring Plan	A.10.1 -1

CONTENTS

S.No. Description	Page No.
List of Tables	
Table 3.1: Clearances/Consents required under Environmental Legislations	3-3
Table 3.2: Agencies Responsible for Clearances and Consents	3-4
Table 4.1 Summary of Secondary Data and Sources	4-3
Table 5.1: Location of Soil Sampling Sites	5-5
Table 5.2: Physico-Chemical Characteristics of Soil Along the Project Corridors	5-7
Table 5.3: Water Bodies Along The Project Corridor:	5-10
Table 5.4: List of Surface Water Sampling Locations	5-12
Table 5.5: Analytical Results of Surface Water Quality	5-13
Table 5.6: Comparison of Inland Surface water with Class E	5-14
Table 5.7: Comparison of Inland Surface water with Class D	5-14
Table 5.8: Results of Bio-monitoring conducted at the swamp	5-15
Table 5.9: Results of Primary Productivity Study	5-16
Table 5.10: List of Ground Water Sampling Locations	5-17
Table 5.11: Analytical Results of Ground Water Quality	5-17
Table 5.12: Location of Ambient Air Quality Sampling Points	5-19
Table 5.13: Analytical Results of Ambient Air Quality	5-19
Table 5.14: Location of Ambient Noise Quality Sampling Points	5-21
Table 5.15: Result of Noise Monitoring along the project corridor	5-21
Table 5.16: Economic Importance of the trees found in the study area	5-23
Table 5.17: Urban Population in 1991 and 2001	5-24
Table 5.18: Rural Population in 1991 and 2001	5-24
Table 5.19: Decennial Population 1951-1981	5-26
Table 5.20: Decennial Growth Rate (1981-2001) and Density of Population (1991-2001)	5-26
Table 5.21: The Area Irrigated by Canals, Tubewells and Other Means	5-26
Table 5.22: Important Educational Institutes along the Proposed Corridor	5-28
Table 5.23: Wells and Tubewells along the proposed alignment	5-29
Table 7.1: Earth Materials Needed for Construction	7-3
Table 7.2: Air Quality Monitoring at Sampling Site on NH-2	7-7
Table 7.3: Summarised Observed Values of CO & HC at Sampling Site on NH-2	7-7
Table 7.4: Projected Concentration of Air Pollution (CO) for	7-8
Table 7.5: WHO Emission Standard	7-8
Table 7.6: Observed Leq during Different hours of the Day on NH-2	7-11
Table 7.7: Predicted Noise level (Leq) for Both Directions	7-12
Table 7.8: Permissible limits of Noise level	7-13
Table 9.1: Type of Mitigation Measures	9-2
Table 9.2: Environmental Budget	9-14
Table 10.1: Performance Indicators at Different Project Stages	10-3
Table 10.2: Stage-wise reporting system	10-5
Table 10.3: Detailed Training Program	10-6

CONTENTS

S.No. Description	Page No.

List of Figures

Figure 5.1: Soil Profile in the Project Area 5-6
Figure 5.2: Village Types in the Area 5-25
Figure 5.3: Crop Map of the Area 5-27
Figure 5.4: Location of Sampling Points 5-34

Figure 6.1: Public Consultation at Village Sarol 6-3
Figure 6.2: Public Consultation at Village Barauli 6-3

Figure 7.1 (a) High Volume Sampler Showing Gas Collection through Impingers 7- 6
[illegible]ing Accumulation of SPM 7-6
[illegible]lyser 7-11

Figure 10.1: Proposed Organization Structure 10-4

List of Maps

Map 2.1: Location Map of Proposed 6/8 Lane Expressway connecting Noida to Agra 2-7

Map 5.1: Location of Sampling Points 5-34

List of Exhibits

Exhibit I: Modified to save Cremation Ground 8-4
Exhibit II: Mod[illegible] 8-5
Exhibit III: Modified to save fish pond 8-6
Exhibit IV: Modified to save Tappal 8-7
Exhibit V: Modified to save orchard 8-8
Exhibit VI: Modified to save houses 8-9
Exhibit VII: Modified to save Samadhi 8-10

EXECUTIVE SUMMARY

E. 1 INTRODUCTION

Taj Expressway Industrial Authority has decided to take up development of the region. This proposed Expressway will be the lifeline for other developments (Taj Economic Zone and Airport near Jewar) that are already planned. The project covers a length of 164 Km. Connecting Noida to Agra. Jaiprakash Industries Limited (JIL) is working as the Concessionaire for this project.

Govt. of India has a specific environmental regulatory frame work which all proponents must follow. The Ministry of Environment and Forest (MoEF) has overall authority for the administration and implementation of government policies, laws and regulations related to environment.

For this project JIL must seek environmental clearance from MoEF. Under the Environment (Protection) Act, 1986, for all projects, listed in Schedule I of Environment Impact Assessment Notification, Environmental Clearance from the Ministry of Environment and Forest is to be sought. Hence, there need of a full EIA study. JIL must also obtain a No Objection Certificate (NOC) from the State Pollution Control Boards as part of the regulatory process for granting environmental clearance. This project however does not fall under the provisions of The Forest (Conservation) Act, 1980, and Hazardous Waste (Management & Handling) Rules 2003 or Municipal Solid Waste (Management & Handling) Rules 2001 due to the absence of any forest or industries along the project stretch. Without these clearances, the environmental status of the project remains non-compliant.

The contractor also needs to obtain written local consents for use of water and SPCB approval for the sighting and operation of such as rock crushing, batch mixing and hot mix plant prior to the sighting and start up of any such operation.

E.1.1 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

A full EIA process is required under India's Environmental Assessment Notification. The EIA was carried out in line with India's Environmental Regulations. The EIA focused on all components of environment with specific emphasis on the identified significant environmental issues related to the proposed alignment and comparing them to the 'no-project" scenario. The EIA was carried out between April and June 2003. Under the Indian EA process this EIA was termed a "Rapid Impact Assessment', not requiring more than one season of field surveys.

E. 2 DESCRIPTION OF THE PROJECT

E.2.1 THE NEED AND OBJECTIVE

The proposed Expressway project connecting Noida to Agra, shall provide a fast travel strip between Delhi and Agra and hence minimize the travel time. It shall also connect the main existing and proposed townships / commercial centers on the eastern side of Yamuna River and relieve the traffic congestion on NH – 2, that runs through cities of Faridabad, Ballabgarh and Palwal. While, increasing traffic speed from average 30 Km/hour to 100 Km/hour, there shall also be reduction in traffic congestion, road accidents, fuel consumption and improvement in the over all environmental and aesthetic quality of the highway

E.2.2 THE ROAD STRETCHES AND COSTS

Present project covers the stretch from Noida to Agra and is entirely located in Uttar Pradesh. The road location is given in Map No. 2.1 of the EIA Report. The total project road has been divided in five sections as follows:

Section No.	Chainage (Km)	Remarks
Section 1	RD 0.00 – RD 35.00	Greater Noida to International Airport / TEZ*
Section 2	RD 35.00 – RD 47.00	Airport/TEZ to Tappal
Section 3	RD 47.00 – RD 68.00	Tappal to Nohjhil
Section 4	RD 68.00 – RD 110.00	Nohjhil to Raya
Section 5	RD 110.00 to RD 164.775	Raya to Merging of NH 2 (Etmadpur)

* *TEZ: Taj Economic Zone*

The estimated cost of the project at detailed project design stage is as follows:

Sl. No.	Financial Year	Rs. in Crores
1.	2003 – 2004	285.64
2.	2004 – 2005	482.01
3.	2005 – 2006	507.70
4.	2006 – 2007	395.03
5.	2007 – 2008	375.13
	Total	**2045.52**

E.2.3 PHASES OF THE PROJECT COMPONENTS

The proposed project has been divided into the three main phases. First phase was planning and designs stages (started in February 2003 and are expected to be completed by March 2004). The Project tendering and implementation is likely to take about five years after completion of design.

E. 3 DESCRIPTION OF THE ENVIRONMENT

The environmental conditions along the project corridor can differ widely. In the following section the project corridor's biophysical characteristics and socio-economic-cultural properties are summarized.

E.3.1 CLIMATE

The temperature in the project area varies between 44^{O}C in summer and 1.5^{O}C in winter. The south easterly monsoons contribute more than 80% of the annual rainfall. The average annual rainfall around the project area is 900 mm. However, there is a wide variation from year to year. The average rainfall along the alignment is 800 to 1000 mm per year with peak rainfall in July month. The relative humidity varies form 20% in the summer season to more than 70% in the monsoons.

E.3.2 PHYSIOGRAPHY

Of the four physiogeographic regions of Uttar Pradesh, the proposed alignment is set in the Indo-Gangetic Plain with average height, 175m above MSL The whole alignment passes through flat terrain. The RL varies from 165 m to 205 m with gentle slope from North-East to South-West.

E.3.2.1 Drainage

The Project road runs parallel to the Yamuna River and comes closer at few locations. A number of Nallahs in the catchment area of Yamuna River cross the Project Expressway. The project area is drained by a large number of canals and distributaries. The proposed highway intersects 20 Nallahs and 23 canals. The baseline survey indicated that a number of cross-drainage structure would be required to prevent hindrances to surface runoff along any stretch of the highway.

E.3.3 GEOLOGY SOILS AND MATERIALS

E.3.3.1 Geology and Soils

The majority of the area along the alignment is covered by unconsolidated sedimentary rock mainly composed of alluvium. Wherever alkaline/saline patches are developed, rch soils are also present. The vast alluvial and sandy tracts of recent to sub-recent age occupy the greater part of the Gurgaon district and south of Delhi. The quartzite is predominant hard rocks, which are trending NNE-SSW to NW-SW directions. The area of Delhi-Gurgaon is surrounded in North by Indo- Gangetic plains, in West by the Great Indian Desert.

The proposed alignment falls in Yamuna River basin comprising of newer alluvium made up of fine to medium sands, silt, gravel, clay and kankars (calcareous nodules). These deposits have high porosity and permeability, with ready water absorbing capability.

The proposed alignment passes through major part of Mathura district which is a part of the southern Gangetic plain, according the scheme of the regional division. Geologically, the Mathura district forms the part of the Indo-Gangetic alluvium, which consists of sands, clay, kankar and reh.

Along the proposed expressway, major area is covered by Hapquents (older alluvial soil).

E.3.3.1.1 Physico-chemical Characteristics of Soil along the Project Corridor

The area adjacent to proposed expressway has the distinction of having all types of soil, right from clay to sand.

To analyse the physico chemical properties of the soil along the proposed alignment, sampling of soils was done at 3 sites. In general, soils are slightly alkaline. Almost all the soils have loamy texture with the soils near the reserve forest exhibiting transitional characteristics (sandy loam). Sampled soils showed reasonable amount of organic content.

The Nitrogen content in the sampled soil is found to be low, the Potassium content is very low and that of phosphorous is moderate.

E.3.3.2 Borrow Areas, Quarries and Rock Crushers

Since either side of the proposed project has cultivable land, guidelines have been laid down to avoid borrowing of earth from the productive lands. The borrow pit shall be selected from humps above the general ground level within the road land, by excavation/enlarging of existing tanks and from mounds resulting from the digging of well and lowering of agricultural fields in vicinity of the road.

The details of the borrow areas and their locations have been furnished in **Annexure .5.3**.

E.3.3.3 Land use Pattern

Environmental Survey of the strip, along the proposed alignment as well as within the study area (i.e. 5 Km on either side of the road), shows that the land use can be categorised as:

i) Classified forest
ii) Agricultural land
iii) Settlement area
iv) Open area / fallow land; and
v) Water bodies (river, stream, canal, pond, lake, etc.)

The entire project area passes through plain terrain without much ups and downs. No forestland has been found on the proposed alignment. Nearest forestland found along the alignment is in Agra; Agra Reserve Forest (almost at a distance of 500m).

Out of the total 164.775 Km, 110.3 Km stretch of the proposed alignment passes through Agricultural lands and the rest passes through primarily settlements. Along Upper Ganga Canal, small patches of rough grazing are seen. Before Mathura along River Yamuna, uncultivable patches are also found. Almost 90% of the total area is cultivated, of which 69% area is irrigated.

Study area falling in Uttar Pradesh (i.e. Km 80 to Km 100), agricultural land and open scrub/forest are the predominant land use. However in Madhya Pradesh, forest (protected / reserved / unclassified) is the major land use; substantial area among that is protected. Analysis of the study area reveals the following landuse distribution:

Landuse Pattern Around the Project Corridor

Units (in Km^2)	Along the Project Corridor	Along the study area (5 Km on either side)
Classified Forests	-	0.59%
Agricultural Land	66.94%	90.0%
Fallow/ Open land	7.58%	0.76%
Settlement	46.50%	7.79%
Water Bodies	0.40%	0.25%

E.3.4 WATER RESOURCES

Water resources can be classified in two broad categories: Surface water and ground water. The following table gives the details of major water resources along the project corridors.

S. No.	Nallah	
	Location (Km)	Description
01.	3.80	Nallah
02.	5.85	Lohia Nallah
03.	8.75	Lohia Nallah
04.	11.52	Bhuria Nallah
05.	17.90	Nallah
06.	17.97	Nallah
07.	45.46	Nallah
08.	67.60	Patwaha Nallah
09.	68.84	Bhuria Nallah
10.	73.06	Nallah
11.	74.55	Nallah
12.	75.64	Nallah
13.	77.01	Nallah
14.	91.05	Bulandpur Drain
15.	111.00	Mahaban Drain
16.	116.68	Alipur Drain
17.	126.97	Nallah

S.No.	Canal Pattern Network	
	Location (Km)	Description
01.	21.11	Runija minor
02.	30.05	Diyantpur minor
03.	34.43	Siwara minor
04.	40.20	Gopalgarh minor
05.	55.41	Untasani minor
06.	59.54	Gairaula minor
07.	66.19	Kalana minor
08.	70.19	Parsauli minor
09.	71.94	Sikanderpur minor
10.	79.50	Surir minor
11.	85.45	Khanwal minor
12.	87.93	Jarva distributory
13.	93.49	Bhadarvan minor
14.	93.88	Mat minor
15.	98.83	Mat minor
16.	108.00	Daharwa minor
17.	109.84	Mahaban distributory

S. No.	Nallah	
	Location (Km)	Description
18.	139.42	Nallah
19.	144.84	Nallah
20.	160.82	Nadi & Nallah

S.No.	Canal Pattern Network	
	Location (Km)	Description
18.	113.62	Sihora minor
19.	123.22	Karab minor
20.	129.13	Angai minor
21.	134.14	Garsauli minor
22.	152.59	Daghela distributory
23.	155.08	Khandauli distributory

E.3.4.1 Surface Water Quality

Detailed analytical results of the water quality for all the monitored water bodies are provided in Table 5.5 of the EIA. Surface water quality testing of all the major water sources crossing the proposed alignment was carried out during September, 2003 at 5 locations (shown in Map No. 5.1 of the EIA). Apart from the physico – chemical testings, bio monitoring was also conducted for the wetland near Bhim village.

The analysis of water samples shows that the sampled water typifies the respective usage. In case of Lohia Nallah, Patwaha Nallah and the small stream, all of which represents running water bodies, the BOD and COD values have been found little higher. The water bodies crossing the proposed strip (Lohia Nallah, Patwaha Nallah, A small stream) are all meeting the applicable standard (CPCB Class E: for irrigation and fish survival) in all respect s other than the sample from the swamp. The fish pond between Sarol Village and Tappal at Km 45.60 meets CPCB Class D (Fish propagation) water quality criteria.

Bio-monitoring of the swamp water shows that it is subjected to Moderate Water Pollution. However, analysis of the primary productivity reveals a balanced ecosystem in the swamp.

E.3.4.2 Ground Water

The impact on ground water can be quantitative as well as qualitative. Since the project area belongs to regions with favourable rainfall condition, quantitative impact on ground water is not considered as an important issue.

However, the impact of the project on the groundwater quality has been assessed critically. Samples from three well distributed locations were collected and analysed and compared against standards prescribed for drinking water. It was found that the ground water quality along the project strips meet both the IS 10500:1991 and the WHO standard. By ensuring appropriate disposal of waste and since significant withdrawal of water shall not take place in the proposed project, the potential impact on surface water bodies is classified as Minor

E.3.4.3 Air / Noise Quality

In order to predict future air and noise quality as a result of the proposed highway projects, a number of air and noise quality monitoring were conducted along the project

stretch in the month of September to November, 2003 to ascertain the present Ambient Air and Noise qualities.

Since with the proposed road project, the traffic count will rise considerably (estimated to be approximately 50,000 by 2008 – Source: DPR, Traffic Projection), the total emission will also increase, leading to deterioration in air quality. Keeping this in mind, present air quality monitoring was conducted along the stretch.

E.3.4.3.1 Ambient Air Quality

Impact significance of air pollution is generally estimated against the National Ambient Air Quality Standard (NAAQS). Ambient air quality was monitored at 7 locations. The location of these sampling points has been shown in Map No. 5.1 of the EIA. Among all the parameters monitored (i.e SPM, SO_2 and NOx,), concentration of SPM (except at Khandauli Village and Agra Reserve Forest) has been found to be most critical as these have been found above NAAQS. At all the sampling locations, concentrations of SO_2 and NO_x are well below the National Ambient Air Quality Standard (NAAQS) for SO_2 (residential areas - 80 $\mu g/m^3$ and sensitive areas - 30$\mu g/m^3$) and NO_x (residential areas - 80 $\mu g/m^3$ and for sensitive areas - 30 $\mu g/m^3$) respectively.

But high concentrations of NOx has been found near the intersection of Noida – Greater Noida Expressway with the Proposed Expressway and Agra Reserve Forest without any visible activity, which may account for it. This is attributed to the high background concentrations of NOx ($\approx$ 40 – 50 $\mu g/m^3$) in the vicinity of Delhi and Agra City respectively.

E.3.4.4Noise

It is important to assess the present noise quality of an area in order to predict the potential impact of future noise level due to this project. Further, to study the effect of the noise on the ambient noise quality, noise monitoring was carried out primarily in settlements close to the project strips ad intersections. The location near Agra Reserve Forest, at Km 162 was selected as the control point.

E.3.4.4.1 Ambient Noise

Noise quality has been monitored at 7 locations distributed along the existing and proposed corridors. Monitoring results show that the noise level at all stations is mainly within the prescribed standard other than for Khandauli village and the intersection of NH2 with the proposed Expressway. This is due to their commercial and heavy traffic flow characters respectively.

E.3.5 FLORA, FAUNA AND THE ECOSYSTEM

The project area does not pass through any protected/ reserved forests. The nearest forest is nearly at a distance of 500m (Agra Reserve Forest). The main animals found in the project area are those domesticated by the inhabitants of the area.

Apart from common birds like fowl, peacock, house sparrow, pigeons, parrots, dove, cuckoo, vulture, kite, etc. other birds like bulbul, partridge, sand grouse, baya, tailor bird, kingfisher etc. are also met in various stretches of the project area. No rare or endangered species have been recorded in the project area.

E.3.5.1 Roadside Plantation

The Project corridor has very few patches of matured plantation; green tunnels are rarely found. Sample Ecological survey was conducted for 150m on either side of the proposed alignment. The main species observed are: *Acacia arabica*, Neem (*Azadirachta indica*), Mango (*Magnifera indica*), Jamun (*Eugenia ambolana*), Peepal (*Ficus religiosa*), Banyan (*Ficus benghalensis*), *Cassia siame*), *Prosopis spicigera*, *Prosopis chilensis*, Gulmohar (*Delonix regia*), *Albizzia lebbeck*, Ber (*Ziziphus jujuba*), etc. Besides these, palm and poplar trees are also seen. The total tree loss due to implementation of the project is estimated to be 473 trees on left side and 478 on right.

E.3.6 SOCIO-ECONOMIC ENVIRONMENT

In site survey, structures such as religious places, wells, hand pumps, schools, etc. situated within 150m from the centre of the road was identified and later analysed

E.3.6.1 Demographic Profile Along The Project Corridor

The project corridor is passing through the state of Uttar Pradesh only. In major portion of alignment, the density of village is low (hamleted village). Near Mathura and Agra, semi-compacted villages are also present. The density of rural population near Agra is between 300-400/km^2, near Mathura it is between 400-500/km^2 and 200–250/km^2 along Yamuna River.

Data related to the urban and rural population and decennial growth in the study area is given in Chapter 5. It is evident form the data that the population growth rate varies from about 22% to 31% in the project area. The proposed Taj Expressway is expected to serve the transportation needs of the growing population of the area

E.3.6.2 Agriculture

The economy of the area is dependent on the agriculture and the animal husbandry. Wheat and Barley are the principal crops of Rabi while Bajra, Jwar and cottons are the principle crops of Kharif. The net cultivated is about 90% of the total area of which 69% area is irrigated. Canals constitute the mains source of the irrigation in the area.

The Area Irrigated by Canals, Tubewells and Other Means

District	Irrigated area (ha)			Total Irrigated Area
	Canals	Tubewells	Others	
Aligarh	57398	316856	1118	375372
Mathura	110780	172186	947	283913
Agra	40920	184023	6195	231138

E.3.6.3 Industries

Majority of the industries in the project area are agro-based. There are a number of Rice Mills, however the closest amongst them is located at Jewar (Km 37.8, approximately at a distance of 70m from the right edge of the proposed expressway). Other industries are textile based, live-stoeks based, mineral and chemical based. There is a major oil refinery at Mathura, sugar mill at Chhata, in addition to leather industry at Mathura and Agra, and cotton prints at Mathura. There are cottage industries at Nohjhil and Mat, and miscellaneous indutries at Raya.

E.3.6.4 Archaeological

The expressway will be crossing the districts of Aligarh, Mathura and Agra, which are rich in archaeological treasure. Most noted among them is The Taj Mahal, a World Heritage Site.

However, none of the archaeological sites are falling enroute.

E.3.6.5 Historic and Religious Structure

Since the proposed alignment will be passing through small villages mainly, no historic structure is falling on the alignment.

Only one temple near Nagla Narayana Singh village (after the crossing of Jewar Distributary near Dhyanpura village) will need to be relocated, as it is located on the proposed expressway alignment.

At Jewar the road shall be passing through a Crematorium (Km 37.8) and need to be relocated.

E.3.6.6 Other Amenities

There are number of amenities and utility services located along the highway like hand pumps, wells, schools, Dhabas (hotel cum restaurant), hospitals etc. In environmental screening report it has been found that though there is no hospital along the proposed strip, few schools are located within close proximity of the proposed highway. Though none of these needs to be relocated as these are beyond the proposed ROW, however consideration should be given with respect to noise impact and safety. Screening survey reveals a number of hand pumps and wells will be adversely impacted and need to be relocated.

E. 4 PUBLIC INVOLVEMENT

Public Consultation was conducted at various stages of the project. It started at the inception stage right from the first visit to site to ensure adequate attention to public opinion and also at the preliminary environmental screening stage of the project. Consultation was done to develop the major areas of environmental problem that should be considered from the local stakeholders' point of view.

The consultation was carried out at individual level, Village level, Community leaders/Village administration level, and local/civil/forests administration level. Formal and informal methods of consultation were adopted. Some stakeholders consulted include local Residents, Shop owners, Dhaba owners, Truck drivers, Community leader or Panchayat officials.

The findings of public consultation were considered for finalization of the mitigation measures or alternatives. Details of the public consultations are given below with the issue raised, mitigation measures suggested, and action taken.

Table E. 1 : Summary of Public Consultation Program Undertaken in May and June 2003.

Stake Holders	Name of Key Participants	Date of Consultation	Issues Raised	Measures Proposed	Action Taken / Proposed
Jewar Village (Km 37)	Jaspal Singh Naveen Raja Thakur Kailash Yadav	08.09.2003	Expressed concern on the high traffic noise, deteriorate air quality and loss of agricultural land. There was a strong objection on the proposed relocation of Crematorium	Alternative alignments	The reduced road roughness and higher speed will reduce this impact. Tree plantation along the road has also been proposed. Crematorium will be saved by suitable road alignment modification
Village Sarol (Km 43)	Umesh Singh Raju Tiwari Bhagwanlal Shankar Thakur	08.09.03	Concerned for loss of agricultural land and houses and one fish pond. Since the road will be passing closely by primary school, safety of children was also a concern.	Non Specific	Road has been realigned to save the houses and fish pond. Proper safety measures will be provided near the school.
Village Barauli (Km 136)	Ganga Prasad – Ex Sarpanch Rameswar Sanjay	19.09.03	Against building of road mainly due to loss of their agricultural land.	Non Specific	Compensation will be provided as per resettlement plan
Village Bhim (Km 100)	Kamlesh Kumar Raja Ram Mahadev Sitaram	19.09.2003	Though concerned for loss of agricultural land but happy to have the road by their village	Non Specific	Care would be taken to minimise land acquisition
Village Khandauli (KM 153)	Gajan Lal Yadav Desh Kumar Hari Charan	20.09.03	Concerned over increased noise level and air pollution as the expressway will intersect the an existing highway here	Non Specific	Plantation and other barriers are proposed

Most of the output of public consultations and action proposed has been considered while carrying out alternative analysis, finalization of the alignment. and developing mitigation and management plan.

District level public hearing will also be organized through State Pollution Control Board as per the requirement of Environmental Clearance notification.

E. 5 ALTERNATIVES TO THE PROJECT

Analysis of alternatives is a key component of an Environmental Impact Assessment, particularly in projects that have sectoral impacts. This being a new road, the design was made precariously to ensure minimum adverse environmental and social impacts. However, during the public consultations, a few issues came into fore and was addressed subsequently.

With the increasing trend in population and the necessities of mankind, even without the project, the deterioration in ambient air and noise quality will take place, though at a much slower pace. The project shall bring about changes almost immediately. However, pollutant concentrations and noise levels are expected to improve during operational phase because of better road condition, vegetation cover and berms all along the project corridor. The water bodies are not found to be impacted upon significantly by the operation of the expressway. However, temporary waterlogging during the construction period is anticipated. For borrowing purposes, productive areas shall be avoided. By public consultation, it has been found that the land owners are willing to convert the borrow pits into fish pond at a later stage. Hence, it is found that with the project, the area shall benefit more than in case of a no-project scenario.

Presently, the number of standing trees along the proposed alignment is very few. About 30 times the number of trees cut is proposed to be planted. Moreover, trees and shrubs shall also be planted on the median. The choice of trees is such that while it shall serve themuch needed purpose of shade to the travelers, it shall also serve economic benefits to the local people. Hence, over time the biological environment of the project area shall improve significantly, even though the construction phase will require the felling of trees within the proposed RoW.

Those who shall need to be relocated due to this project shall be properly rehabilitated and resettlement action plan will be implemented. With the construction of the proposed expressway, providing connectivity to proposed Taj Economic Zone and International Airport, the economic growth of the project area is expected to take place at a faster rate. This will hopefully result in better quality of life for all.

The analysis has been presented for the alternatives which were found most suitable.

E.5.1 ALTERNATIVE ALIGNMENTS

Based on initial assessment of the proposed alignment and public consultation, it was found that at few of the places of environmental and social importance were negatively impacted. These are:

a) At Km 37.60, the proposed alignment would require the demolition of the cremation ground at Jewar.

b) At Km 43.40, the proposed alignment was going through village houses in village Sarol.
c) At Km 45.60, the proposed alignment was passing through a fish pond existing between Sarol Village and Tappal
d) At Km 47.50, the proposed alignment was passing through few houses in Tappal.
e) At Km 60,the proposed alignment was passing through an orchard.
f) At Km 60.3, the proposed alignment was passing through houses.
g) At Km 65.2,the proposed alignment was passing through a Samdhi.

To avoid the demolition of any of the structures mentioned above, the alignment has been changed at all the above locations:

a) At Km37.60 - Exhibit 1

b) At Km 43.40 -Exhibit 2

c) At Km 45.60- Exhibit 3

d) At Km 47.50- Exhibit 4

e) At Km 60.00- Exhibit 5

f) At Km 60.30- Exhibit 6

g) At Km 65.2- Exhibit 7

E. 6 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

E.6.1 THE ENVIRONMENTAL MANAGEMENT PLAN

Mitigation is the lessening of negative environmental impacts through a) changes in the design, construction practices, maintenance and b) additional strategies developed to protect the biophysical and safety environment which are likely to be adversely affected by the project. The approach of mitigation is dependent on the nature and severity of the impact.

Certain mitigation measures have been incorporated during the highway and pavement design itself. Mitigation measures have been incorporated with respect to project cycle. The measures given below have been developed in close coordination with design team. Inputs from environmental team were given to engineers during the project preparation stage.

Measures have been provided separately for three different phases of the proposed project. The measures proposed are given at the table below.

Environmental Issues	Remedial Measures
Design Phase	
D.1.1 Alignment The alignment was passing through the : a. Cremation ground of Jewar at 37.60km b. Houses in the Sarol village at 43.40 Km c. Fish pond at 45.60 Km d. Houses of Tappal Village at 47.50Km	Alignment has been rerouted to avoid all of these.
D.1.2 Embankment slope of the proposed highway where the sides are critical will cause **soil erosion**.	Excessive soil erosion is expected at these places owing to the steep slopes. Turfing will be done to protect the slopes. This will follow the recommended practice for treatment of embankment slopes for erosion control, IRC: 56-1974.Throughout the project corridor a conscious effort has been made to maintain a slope of 2:1
D.1.3 Road Inundation Because of increase in level, difference between the road and adjoining land, water logging may take place	The raising of the proposed pavement by 0.6 to 1.5m (depending on the requirement) from the existing level with suitable cross drainage structures e.g. culverts, in market places and areas susceptible to water logging will avoid inundation
D.2.1 Modification of Landform	Minor modifications with respect to present landuse will take place because of this project. However, against the total environmental setting this change is so less that it is insignificant and do not necessitate any special remedial measures. There is no landuse change for classified forest
D.2.2 Loss of Property: No schools or hospitals are affected by the proposed alignment. Some tubewells are however in the RoW	 The tubewells and borewells shall be relocated
D.2.3 Borrow Area: Borrow material particularly, soil and earth materials that would be used during construction. Earth borrowed from the area will modify its immediate surroundings.	Non-productive, barren lands, raised lands, riverbeds, waste lands have been recommended for borrowing earth materials; Efforts will be made to avoid agricultural lands for borrowing purposes. Rehabilitation shall be as per the owner's wish. Through community consultation with the villagers and interactions with State Department of Fisheries, low lying areas, wastelands that have a potential of being developed into fish ponds/ pisciculture have been recommended for borrow areas.
D.2.4 Quarries	• Only existing quarries with proper Environmental Clearance/ Consent, located at Sirohi and adjoining

Environmental Issues **Design Phase**	**Remedial Measures**
	areas shall be involved for the project. • No new quarries will be opened
D.3.1 Some of the **water bodies** like ponds are used as a community pond for bathing and also for fishing.	Community pond shall be protected with at least 2m high embankment, particularly on the highway side
D.3.2 Obstruction of Natural Streams a) Cross drains: Proposed widened sections are crossing number of distributaries and rivers	Provision of adequate size and no. of cross drainage structures. Overtopped sections of the corridor have been proposed to be raised suitably with the provision of suitable cross drainage structures. Adequate side drains have also been proposed. The proposed project alignment has been adequately provided with necessary engineering solution. This has been done on the basis of highest flood level data for the past 50 years, potential environmental impacts and Resettlement issues
D.4.1 Loss of **vegetation** along the proposed alignment	The loss of trees is very insignificant since the density along the existing stretch is sparse to nil. However it is compensated for by planned plantation (more than 30 times than that of the existing number of trees) along the road. Species Type: The type of species to be planted is Neem (*Azadirachta indica*), Mahua (*Madhuka Latrifolia*), Tamarind (*Tamarindus indica*), Shisham (Dalbergia sisoo), Jamun (*Eugenia jambolanii*), safed siris (*Albizia procera*)
D.4.2 Reserve / Protected Forest Areas	There is no reserved or protected forest along the proposed alignment. However, the Agra Reserve Forest which is 500m away from the proposed alignment is not expected to be impacted much owing to the roadside plantation along the proposed alignment that will act as a barrier to air and noise pollution from reaching the forest areas.
D.5.1 Poor Air Quality High levels of NOx, SOx and CO.	Appropriate pavement designs to ensure that pavement roughness is as per IRCA Certification Tree Plantation along either side of the road and on the median with shrubs of suitable species to reduce the air pollutant concentrations
D.6.1 Constructional Solid Waste	Solid Waste Disposal sites should be properly designed and must be located at least 250m away from the ROW.
D.7.1 Poor Noise Quality Existing noise levels in certain stretches are high.	Alignments have been suitably altered to ensure minimum noise quality deteoriation and impact on the nearby settlements Expected bottlenecks at the intersections will be removed and congestion shall be relieved by appropriate design.

Environmental Issues **Design Phase**	Remedial Measures
Some sensitive structures like schools, hospitals are likely to be affected because of high noise level.	In general, increasing the vegetation cover on both side of the road could cut down vehicular noise. Trees with broad leaves, evergreen species and some deciduous species will be planted on the slope of the proposed highway. Noise barriers like boundary walls along with shrubs plantation in front of them shall be provided where required.
D.8.1 Utility Lines/ Community utilities	All utilities, likely to be impacted will be relocated with prior approval of the concerned agencies. All community utilities likely to be impacted, such as sources of water, bus stands, community centers, etc. will be relocated to suitable places.
D.8.2 Cultural Properties	Alignment will be suitably routed to avoid/ minimize impact to cultural property (Public consultation has been carried out for obtaining opinion about shifting of religious structures. The alignment modification has been done keeping in view the output of public consultation)
D.9.1 Road Safety	Appropriate design measures should be taken to minimize accidents with special emphasis on the spots identified as accident prone during the assessment. Safety signages should be involved near the accident prone spots

Environmental Issues **Construction Phase**	Remedial Measures
C.1.1 Soil erosion and failure of cut and fill section	• High embankment will be provided with chutes and drains to minimize soil erosion • Stone pitching and retaining walls will be made at high embankments in critical areas • Turfing of low embankments and plantation of grasses and shrubs will be done for slope protection. • In borrow pits, the depth of the pit will be regulated so that the sides of the excavation will have a slope not steeper than 1: 4, from the edge of the final section of bank. • Soil erosion checking measures such as the formation of sediment basins, slope drains, etc, will be carried out.

Environmental Issues Construction Phase		Remedial Measures
		• Wherever earth materials will be cut for the road alignment, care should be taken in the rolling terrain where the slope grades are more than 1.5 percent so that cut side of the earth is not absolutely vertical. It should have gentle slope while cutting.
C.1.2	Loss of topsoil	Normally agricultural areas will be avoided for borrowing of materials, unless requested by the landowner for making water / fish ponds or for lowering the land for making it irrigable.
C.1.3	Compaction of soil	Construction vehicles, machinery and equipment will move, or be stationed in the designated ROW, to avoid unnecessary compaction of soil.
C.1.4	Borrowing of Earth	• No earth will be borrowed from within the ROW. • Non-productive, barren lands, raised lands, riverbeds, waste lands have been recommended for borrowing earth. • If new borrow areas are to be selected, then measures will be taken so that there will be no loss of productive soil, and all environmental considerations will be met with. • If vehicles carrying materials from borrow areas are passing through some villages, the excavation and carrying of earth will be done in such a way that it cause least inconvenience to the nearby people. • The unpaved surfaces used for the haulage of borrow materials will be maintained properly • Precautionary measures such as the covering of vehicles will be taken to avoid spillage of borrow materials during haulage. • To avoid any embankment slippage, borrow areas will not be dug continuously. • Replantation of trees in borrow areas will be carried out if required, at 1:2 basis.
C.1.5	Quarry	The quarry material will be obtained from licensed sites, which operate with proper environmental clearances, including clearances under the Air Act.
C.1.6	Contamination of soil from fuel and lubricants	Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites will be kept away from drainage channels and important water bodies.

Environmental Issues **Construction Phase**	Remedial Measures
C.1.7 Contamination of soil from construction wastes and quarry materials	Earth, if required, will be dumped in selected & approved area by the supervision consultant. All spoils will be disposed off as desired and the site will be fully cleaned before handing over. Non-bituminous wastes from construction activities will be dumped in borrow pits and covered with a layer of the conserved topsoil. Bituminous wastes will be disposed off in an identified dumping site approved by the supervision consultant
C.2.1 Water bodies	Adversely impacted water sources such as ponds etc. will be rehabilitated and compensated. Measures will be taken to prevent temporary or permanent damage to water bodies identified as per Clause D.3.1above.
C.2.2 Other Water sources	Any community water source such as wells, tube-wells, etc. lost incidentally will be replaced with alternate sources.
C.2.3 Drainage and run-off	At cross drainage structures, the earth, stone or any other construction material will be properly disposed off with the precaution that flow of water is not blocked.
C.2.4 Contamination of water from construction waste	Construction work close to the streams or other water bodies will be avoided, especially during monsoon period. All necessary precautions will be taken to construct temporary or permanent devices to prevent water pollution due to increased siltation and turbidity. All necessary measures will be taken to prevent earthworks and stone works from impeding natural flow of rivers, streams and water canals or existing drainage system. Wastes must be collected, stored and taken to approved disposal site only.
C.2.5 Contamination of water from fuel and lubricants	To avoid contamination from fuel and lubricants, the vehicles and equipment will be properly maintained and refueled. While refueling, care should be taken that no spillage of oil takes place. Oil and grease traps will be provided at fuelling locations, to prevent contamination of water. The slopes of embankment leading to water bodies will be modified and screened so that contaminants do not enter the water body. Side drains provided in the settlement areas should discharge at least through a primary settling tank

Environmental Issues **Construction Phase**	**Remedial Measures**
	Waste petroleum products will be collected, stored and disposed off to registered recyclers/refineres or at the approved disposal sites sites as per Hazardous Waste (Management and Handling) Rules, 2003. Water quality will be monitored as envisaged in the Environmental Monitoring Plan
C.2.6 Sanitation and waste disposal in construction camps	The construction camps will be located away from the habitation. The sewage system for such camps will be properly designed and built so that no water pollution takes place. Necessary septic tanks will be constructed.
C.2.7 Use of water for construction	The contractor will make arrangements for water required for construction in such a way that the water availability and supply to nearby communities remain unaffected. Since the project area do not have enough perennial surface water bodies, ground water will have to be extracted during construction in Summer Season however, over-exploitation of ground water should be avoided with implementation of proper water management techniques (water harvesting) Wastage of water during the construction shall be avoided.
C.3.1 Emission from construction vehicles and machinery	All the machinery and plants will be placed at the downwind direction with respect to human settlements. All vehicles, equipment and machinery used for construction will be regularly maintained to ensure that the pollution emission levels conform to the standards prescribed in Central Motor Vehicles Rules, 1989. Regular monitoring of air pollutant parameters during the construction period as envisaged in the Environmental Monitoring Plan. The asphalt plants, crushers and the batching plants should be sited at least 1 Km in the downwind direction from the nearest human settlement.
C.3.2 Dust Emission and Air Pollution	Remedial measures should be taken to minimise the dust generation and to keep it below the desirable level as far as practicable. All the materials that are likely to produce dust, like cement, should be delivered at site with proper cover. Exposure to dust from residential areas should be avoided. All hot mix plants, crushers and batching plants should be installed only after proper environmental clearance from the concerned authority

Environmental Issues **Construction Phase**	Remedial Measures
	All precautions to reduce the level of dust emissions from the hot mix plants, crushers and batching plants will be taken up. The hot-mix plants, crushers and batching plants will be sited at least 1 Km downwind from the nearest habitation. The hot mix plant will be fitted with dust extraction units. Water will be sprayed in the lime/cement and earth mixing sites, asphalt mixing site and temporary service and access roads. Dust suppression foam may also be used to minimize use of water. After compacting, water will be sprayed on the earthwork regularly to prevent dust. Vehicles delivering material will be covered. Mixing equipment will be well sealed and equipped as per existing standards.
C.4.1 Prevention of High Noise Level at the receptors	Avoiding the local residential area at least 300m from it. Using muffler in the equipment. Labourer should be provided with the sound plug in case of unavoidable excessive noise. Above mentioned remedial measures shall form the part of contract specification. Noise level should be maintained as per CPCB norms.
C.4.2 Noise from vehicles, asphalt plants and equipment	The plants and equipment used for construction will strictly conform to MoEF noise standards. Vehicles and equipment used will be fitted with silencer and maintained accordingly. Noise standards for industrial enterprises will be strictly enforced to protect construction workers from severe noise impacts. Workers should be provided with appropriate ear muffs/plugs Noise level will be monitored during the construction stage, as mentioned in the Environmental Monitoring Plan. Noise barriers / trees will be put at urban locations
C.4.3 Noise barriers	Construction of noise barriers in the form of sound insulating high walls and vegetation at locations with high noise levels exceeding MINAS standards shall be made.
C.5.1. Loss or damage to vegetation	Roadside trees that will be felled for the construction of the project shall be compensated for by planting shade trees and fruit trees about 70 times the number of the

Environmental Issues **Construction Phase**	**Remedial Measures**
	trees that will be felled. Apart from trees earmarked for felling, no additional tree clearing within the ROW will be carried out. Plantation of shrubs and under trees in the median.
C.5.2. Compaction of soil	Construction vehicles, machinery and equipment will move or be stationed in the designated area only (ROW or COI, as applicable), to prevent compaction of vegetation outside ROW. While operating on temporarily acquired land for traffic detours, storage, material handling or any other construction related (or incidental activities), it will be ensured that the trampling of soil and damage to naturally occurring herbs and grasses are minimum.
C.6.1. Accident risks from construction activities	To ensure safe construction in the temporary accesses during construction, lighting devices and safety signal devices will be installed. Traffic rules and regulations will be strictly adhered to. At blasting sites, the blasting time, signal and guarding will be regulated. Prior to blasting, the site will be thoroughly inspected. Blasting will not be carried out during rush hours Safety of workers undertaking various operations during construction will be ensured by providing helmets, masks, safety goggles, etc. The electrical equipment will be checked regularly At every work place, a readily available first aid unit including an adequate supply of dressing materials, a mode of transport (ambulance), nursing staff and an attending doctor will be provided. Road safety education will be imparted to drivers running construction vehicles. Adequate signage, barriers and persons with flags during construction to control traffic will be provided. Communications through newspaper/ announcements/ radio/TV etc. about the time frame of the project and the activities causing disruption to road access and the temporary arrangements made to gave relief to the public will be undertaken.
C.7.1. Health issues	Adequate drainage, sanitation and waste disposal facilities will be provided at work places Proper drainage will be maintained around the sites to avoid water logging leading to various diseases Adequate sanitation and waste disposal facilities will be

Environmental Issues **Construction Phase**	**Remedial Measures**
	provided at construction camps by means of septic tanks, soakage pits etc. At every workplace, good, and sufficient water supply will be maintained to avoid waterborne/water-related and water-based diseases and to secure the health of workers Adequate drainage, sanitation and waste disposal will be provided at workplaces. Preventive Medical care will be provided to workers. A health care system will be maintained at the construction camps for routine check up of workers and avoidance of any communicable disease.
C.8.1. Damage or loss of religious /cultural properties	Only one temple near Nagla Narayana Singh village and a crematorium at Km 37.8 shall require relocation. If any valuable or invaluable articles such as fabrics, coins, artifacts, structures, or other archaeological relics are discovered, the excavation will be stopped and Archaeology Department, Uttar Pradesh will be intimated. Construction camps, blasting sites and all allied construction activities will be located away from cultural properties so that those are not affected.
C.9.1. Roadside landscape development	Avenue plantation of foliage shade trees mixed with flowering trees, shrubs and aromatic plants as per detailed schemes prepared, will be carried out.
C.9.2. Roadside amenities	Restoration and improvement of bus shelters, bus bays and truck lay byes as per detailed design will be carried out Road furniture including footpaths, railings, traffic signs, speed zone signs, etc. will be erected as per design
C.9.3. Cultural properties	Enhancement of all cultural properties and the access roads will be completed as per design.
C.10.1 Construction camps that are likely to create negative impact due to migrant construction labourer.	Precautionary and preventive measures in the construction camp will avoid any environmental degradation. Sanitary condition of the camp should be maintained in proper hygienic condition. Drinking water quality of the campsite should be regularly maintained.

Environmental Issues **Operation Phase**	**Remedial Measures**

Environmental Issues **Operation Phase**	**Remedial Measures**
O.1 Spill Control	The spills at the accident sites will be cleared immediately The left over spills will be scrapped to small lined confined pits nearby, within the ROW
O.2 Dust Generation	Roadside tree plantations will be maintained. Afforestation will be taken up at new sites (for example, gram panchayat land, etc.) near the road.
O.3 Air Pollution	Vehicular emissions of critical pollutant parameters (SPM, RSPM, CO, SO_2, NO_x and Pb) will be monitored as per the Environmental Monitoring Plan. Roadside tree plantation will be maintained Vehicular air pollution will be managed and monitored at the proposed toll plaza locations Public awareness will be generated Regular maintenance of the road will be done to ensure good surface condition
O.4 Noise	Noise pollution will be monitored According to monitoring results, use of sound barriers / trees will be considered where warranted Signs for sensitive zones (hospitals / educational institutions etc.) will be put up where horn should not be blown or traffic speed will need to be regulated Public awareness programme will be launched.
O.5 Maintenance of Drainage systems	Maintaining the drains is important and to keep it clean. This would be essential particularly before monsoons. The drainage system will be periodically cleaned Water quality will be monitored as per the monitoring plan
O.6 Preserving and maintain natural vegetation	Efforts will be made for proper maintenance of planted trees, shrubs and grasses Efforts will be made to educate the villagers on the use of specified areas for cattle grazing
O.7 Soil	Soil quality monitoring as per monitoring plan for heavy metals shall be carried out.

O.8 Accidents involving hazardous materials	The 'rules' as defined in Environmental (Protection) Act, 1986 will be complied. For delivery of hazardous substances, three certificates issued by transportation department namely permit license, driving license and guarding license will be required. Vehicles delivering hazardous substances will be printed with appropriate signs. In case of spillage, the report to relevant departments will be made and instructions followed in taking up the contingency measures. Efforts will be made to clean the spills of oil, toxic chemicals etc. as early as possible.
O.9 Maintaining Congestion Free ROW	Traffic management plan will be developed, especially along congested locations Traffic control measures including speed limits will be enforced strictly. Growth of encroachment and squatting within the ROW will be discouraged No school or hospital will be allowed to be established within 200 m of the highway.
O.10 Safety Measures	In all the above, it is necessary that adequate safety measures in terms of access roads be given for schools, colleges and hospitals and barriers are also required to be provided for increased noise due to construction. Keeping in mind the number and nature of tankers carrying hazardous substances that will ply on these roads an Emergency Preparedness Plan will need to be drawn after consultation with the local administration, NGO and Local Police. The local people need to be made aware of the chemicals that are carried by the tankers and the consequences and first aid in case of an accident.

E. 7 ECONOMIC ASSESSMENT

E.7.1 THE ENVIRONMENTAL BENEFITS

Direct and indirect benefits from the proposed 6/8 Lane Expressway connecting Noida – Agra road and the mitigation measures required for are manifested in many ways. The important and overarching benefits are:

- Traffic speed shall be on an average more than 100 kmph which shall lead to low cost of transportation and hence reduced pollution. The air (SPM, RSPM) and noise quality along the project corridor will be significantly improved and would conform to the national standards.
- The time taken for transport shall be reduced by 20% and hence considerable amount of less fuel consumption is expected. Hence, it can be said to save nonrenewable energy resource of the country.
- The vegetation and landscape in the area will significantly improve the quality of the environment
- Provision of parking areas, toll plaza and lay-byes with all the necessary amenities will provide excellent highway user facilities.

E.7.2 COSTS

The total construction cost (does not include cost of land) of the expressway is estimated to be Rs. 20455.2 Mn. Non-recurring environmental costs during the design and construction period are estimated at Rs. 32.734 Mn. Recurring costs for 20 years life cycle of the project is estimated at Rs 5.180 Mn. Therefore, the total environmental mitigation and monitoring cost, after adding mobilization & Training and 5% contingency is estimated at 41.49 Mn. The breakup of cost estimates is in table 9.2 of Chapter 9.

E.7.3 ENVIRONMENTAL COST VERSUS BENEFITS

The EIA authors undertook an economic analysis of the overall benefits of the project. Qualitatively, the project will have tangible environmental benefit from this project in terms of overall reduction of pollution level along the corridor. The pollution reduction is in terms of Air and Noise quality. In addition it will save precious fuel savings.

The benefits gained from the recommended construction and operation-related environmental expenditures are substantial. Without such expenditures the project would generate large environmental impacts, would lack credible environmental monitoring, permitting the bio-physical environment in the project corridor to degrade and indirectly depressing the economies of local communities.

E. 8 MONITORING AND INSTITUTIONAL STRENGTHENING

For this project JIL will be responsible for completing an EIA, obtaining MOEF clearance, obtaining SPCB clearances and for securing a tree removal and replanting permit from Local authorities. It will also need to confirm that contractors have appropriate and valid permits to use local water supplies as well as to construct and operate plants such as Hot Mix Plant, batch and rock crushing facilities. In addition JIL will be responsible for implementing and monitoring all the mitigative actions during the design, construction and operational stage of the project as defined in the EMP.

An environmental officer should be appointed at the JIL corporate level who shall co-ordinate with the Project Implementation Unit (PIU). The PIU in turn should work in tandem with the Construction Supervision Consultant who will maintain liaison with contractors' people. Supervision consultants (SC), non-governmental organizations (NGOs), and contractors shall implement the project under the administrative supervision of the Project Implementation Unit (PIU) of JIL. The existing organizational structure has been studied and an additional environmental manager is recommended for PIU under project director.

To ensure the success of the proposed implementation set up there is need for training and skill upgradation. To educate and train the PIU, the personnel of the Construction Supervision Consultants and the Contractors, a training schedule has been worked. Looking into the potential requirements of each of the target groups, following trainings are suggested as part of Proposed 6/8 Lane Expressway connecting Noida – Agra.

E. 9 CONCLUSIONS

The construction of an highway may have some negative impacts, which are unavoidable, like landuse change, felling off roadside trees, which are valuable, useful and in some cases have emotional attachments with local people. Similarly, a highway project has scope for enhancing the quality of physical environment through better safety provisions, with provision of better amenities, which are important for the user and local communities. Some of these measures have been consciously and deliberately incorporated in the project itself.

Since in this project environmental considerations have been taken care of from the project design stage itself, barring a few unavoidable negative impacts as given above, no major impact is anticipated. On the other hand, a number of positive long-term environmental benefits can be derived from this project. Some of them are listed below:

Related to Highway Design:

1. There is provision of lay-byes with bus stops provided in most of semi urban settlement along the highway corridor on both the sides of the highway.
2. There is provision of service roads provided to segregate the local traffic. This is also been done with purpose improve and enhance safety of local traffic movement and to provide even non-motorised lane.
3. Highway parking places have been provided at a number of locations with vehicular parking space, space for providing restaurant, rest areas including some repair, service station along with spare parts shops. These facilities will also boost local economy.

Related to Ecological Improvement:

4. The fish pond at Km 45.60 is of ecological importance as well as used by the communities at large in the local villages. Hence the initially proposed alignment has been realigned in order to avoid any negative impact on the lake.

Related to Air/Noise Quality Improvement:

5. Certain schools and hospitals along the highway shall be subjected to high noise levels and deteoriated air quality during the construction and operation of the highway. Hence, noise barriers have been provided at strategic points that will reduce the impact of the same at these places.

Related to Improvement of Community Properties:

6. The earlier alignment of the Expressway was through village houses in Sarol and Tappal. The rerouting has been proposed for these alignments to prevent disturbance to these communities
   The earlier alignment also passed through the cremation ground of Jewar at 37.60 Km. The revised ROW avoids the cremation grounds.

Provided that the mitigative measures proposed along the proposed alignment are implemented, good-housekeeping construction practices are maintained by all contractors, and the mitigative measure put in place during construction, such as new plantings, are maintained during the operating period, the project should not lead to serious environmental degradation or loss to people and settlements near the road.

CONTENTS

S.No.	Description	Page No.
Foreword		
Executive Summary		
Index		
Chapter - 1	**INTRODUCTION**	**1-1**
1.0	Background	1-1
1.1	Key Findings of Initial Environmental Examination	1-2
1.2	Policy Context for Environmental Assessments in India	1-3
1.3	Policy objective of the Environmental Assessment and the Management Plan	1-3
1.4	Structure of the main EIA/ EMP Report	1-4
Chapter – 2	**PROJECT DESCRIPTION**	**2-1**
2.0	The project and its location	2-1
2.1	objectives of the project	2-1
2.2	Expected benefits of the project	2-1
2.3	Cost of the project	2-2
2.4	Phases of the project	2-2
2.5	Terrain	2-2
2.6	Forest area	2-2
2.7	Right of way	2-2
2.8	Road way and pavement	2-2
2.9	Project components	2-3
2.9.1	Bridges and Culverts	2-3
2.9.2	Raising of embankment	2-4
2.9.3	Construction of Underpasses and Overpasses	2-4
2.9.4	Provision for traffic safety features	2-4
2.9.5	Construction of wayside amenities	2-4
2.9.6	Provision for landscaping	2-5
2.9.7	Construction of Toll Plaza and ancillary structures	2-5
2.9.8	Construction of service roads, Pedestrian Crossings	2-5
2.9.9	Major River Crossings	2-5
2.9.10	Junction Improvements	2-5
2.10	Project Activities	2-5
2.10.1	Pre-Construction Stage	2-5
2.10.2	Construction Stage	2-6
2.10.3	Post Construction Stage	2-6
2.10.4	Operational Stage	2-6
Chapter – 3	**ENVIRONMENTAL REGULATORY FRAMEWORK**	**3-1**
3.0	Background	3-1
3.1	Regulatory applicability and clearances/ consents requirements	3-1
3.1.1	Exclusions:	3-1
3.1.2	Applicability	3-1
3.2	environmental legislative networks and life cycle of environmental clearance for	

CONTENTS

S.No.	Description	Page No.
	road project.	3-3
3.2.1	Legislative Network	3-3
3.2.2	Life Cycle of Environmental Clearance for Road Project.	3-4
3.3	Provision for afforestation costs, timing for plantations and environmental and safety standard norms	3-4
3.3.1	Provision for Afforestation Costs	3-4
3.3.2	Timing for Plantations	3-4
3.3.3	Environmental and Safety Standard Norms	3-4
Chapter – 4 METHODOLOGY		**4-1**
4.0	Introduction	4-1
4.1	Public consultation	4-1
4.2	Environmental survey	4-1
4.3	Testing and monitoring	4-2
4.4	Collection of secondary data	4-2
4.5	Compilation of data	4-4
4.6	Identification and assessment of valued ecosystem components	4-4
4.7	Environmental management planning	4-4
4.8	Methodology in sequence	4-4
Chapter – 5 EXISTING ENVIRONMENTAL SCENARIO		**5-1**
5.0	Introduction	5-1
5.1	Natural Environmental Setting of the Project Corridor	5-1
5.1.1	Climate	5-1
5.2	Physical Setting	5-2
5.2.1	Physiography	5-2
5.2.1.1	Drainage	5-2
5.2.1.2	Cross Drainage Structures	5-2
5.2.2	Geology	5-2
5.2.3	Soils	5-4
5.2.3.1	Location of Sampling Site	5-5
5.2.3.2	Physico-chemical Characteristics	5-5
5.2.4	Quarries and Rock Crushers	5-7
5.2.5	Borrow Pits	5-7
5.3	Land use Pattern	5-8
5.4	Water Resources	5-10
5.4.1	Surface Water Resources	5-10
5.4.1.1	National Surface Water Quality Standards	5-11
5.4.1.2	Surface Water Sampling Locations	5-12
5.4.1.3	Surface Water Quality	5-12
5.4.1.4	Aquatic Ecology	5-14
5.4.2	Ground Water	5-16
5.4.2.1	Ground Water Quality	5-17
5.5	Air Quality and Noise	5-18
5.5.1	Air Quality	5-18

CONTENTS

S.No.	Description	Page No.
5.5.1.1	Ambient Air Quality	5-18
5.5.1.1.1	Location of Ambient Air Quality Monitoring Station	5-18
5.5.1.1.2	Existing Ambient Air Quality	5-19
5.5.2	Noise Quality	5-20
5.5.2.1	Ambient Noise Quality	5-20
5.5.2.1.1	Location of Ambient Noise Quality Monitoring Stations	5-20
5.6	Flora, Fauna and Ecosystem	5-22
5.6.1	Forests	5-22
5.6.2	Fauna	5-22
5.6.3	Trees in ROW	5-23
5.7	Socio-economic Environment	5-24
5.7.1	Demographic profile along the project corridor	5-24
5.7.2	Archaeological	5-28
5.7.3	Historic and Religious Structures	5-28
5.8	Other Amenities	5-28
Chapter – 6	**PUBLIC CONSULTATION**	**6-1**
6.0	Public Consultation Process	6-1
Chapter – 7	**IDENTIFICATION AND ASSESSMENT OF IMPACTS**	**7-1**
7.0	introduction	7-1
7.1	Valuable Ecosystem Components	7-1
7.2	Potential Environmental Impacts	7-2
7.2.1	Change in Land use Pattern	7-2
7.2.2	Soil	7-2
7.2.2.1	Impact due to Loss of Soil	7-3
7.2.2.2	Land Used as Borrow Areas	7-3
7.2.3	Impact on Water Bodies along the Project Corridors	7-3
7.2.3.1	Impact on Bound Water Bodies	7-4
7.2.3.2	Alteration of Surface Drainage	7-4
7.2.3.3	Estimates on use of local water supply -- sources for construction	7-4
7.2.3.4	Water Quality Degradation	7-4
7.2.4	Estimated impact on Air Quality due to the project	7-5
7.2.4.1	Ambient Air Quality on NH 2 (Delhi – Mathura Section)	7-5
7.2.4.2	Prediction of Impacts on Ambient Air Quality	7-7
7.2.5	Estimated impact on Noise Quality due to the Project	7-10
7.2.5.1	Existing Noise Quality Along NH 2 (Delhi – Mathura Section)	7-11
7.2.5.2	Prediction of Impacts on Ambient Noise Quality	7-12
7.2.6	Flora, Fauna and Ecosystems	7-14
7.2.6.1	Trees along the Roadside	7-14
7.2.7	Socio-economic Environment	7-15
7.2.7.1	Cultural Environment/Properties etc.	7-15
7.2.7.2	Other Amenities	7-15

CONTENTS

S.No.	Description	Page No.
Chapter – 8	**ANALYSIS OF ALTERNATIVES**	**8-1**
8.0	Introdnction	8-1
8.1	Future Environmental Conditions – without and with the project	8-1
8.1.1	Physical Environment	8-1
8.1.2	Biological Environment	8-2
8.1.3	Socio-economic Environment	8-2
8.2	Realignments	8-2
Chapter - 9	**MITIGATION MEASURES**	**9-1**
9.0	Approach to Mitigation Measures	9-1
9.1	Expected Economic and Other Benefits of thc Project	9-12
9.1.1	The Environmental Benefits	9-12
9.1.2	Costs	9-13
9.1.3	Environmental Costs versus Benefits	9-15
Chapter – 10	**MONITORING & INSTITUTIONAL STRENGTHENING**	**10-1**
10.0	Introdnction	10-1
10.1	monitoring process	10-1
10.1.1	Monitoring Requirement at Different Stages	10-2
10.1.1.1	Design Stage	10-2
10.1.1.2	Construction Stagc	10-2
10.1.1.3	Opcration Stagc	10-2
10.2	Implementation Arrangement, Training and Reporting	10-3
10.2.1	Implementation Arrangement	10-3
10.2.2	Reporting	10-5
10.2.3	Training:	10-5
Chapter - 11	**CONCLUSIONS**	**11-1**
11.0	Introduction	11-1
11.1	expected environmental improvement for this project	11-1
11.1.1	Related to Highway Design:	11-1
11.1.2	Related to Ecological Improvement:	11-1
11.1.3	Related to Air/Noise Quality Improvement:	11-1
11.1.4	Related to Improvement of Community Properties:	11-2

APPENDICES AND ANNEXURES

Appendix I	A.I – 1
Annexure 5.1: Soil Sampling and Analysis	A.5.1 – 1
Annexure 5.2: Details of Quarries	A.5.2 -1
Annexure 5.3: Borrow Areas Location Chart	A.5.3 -1
Annexure 5.4: Water Sampling and Analysis	A.5.4 -1
Annexure 5.5: Air Sampling and Analysis	A.5.5 -1
Annexure 5.6: Noise Sampling and Analysis	A.5.6 -1
Annexure 7.1: Details of flora within RoW	A.7.1 -1
Annexure 10.1: Monitoring Plan	A.10.1 -1

CONTENTS

S.No. Description	Page No.
List of Tables	
Table 3.1: Clearances/Consents required under Environmental Legislations	3-3
Table 3.2: Agencies Responsible for Clearances and Consents	3-4
Table 4.1 Summary of Secondary Data and Sources	4-3
Table 5.1: Location of Soil Sampling Sites	5-5
Table 5.2: Physico-Chemical Characteristics of Soil Along the Project Corridors	5-7
Table 5.3: Water Bodies Along The Project Corridor:	5-10
Table 5.4: List of Surface Water Sampling Locations	5-12
Table 5.5: Analytical Results of Surface Water Quality	5-13
Table 5.6: Comparison of Inland Surface water with Class E	5-14
Table 5.7: Comparison of Inland Surface water with Class D	5-14
Table 5.8: Results of Bio-monitoring conducted at the swamp	5-15
Table 5.9: Results of Primary Productivity Study	5-16
Table 5.10: List of Ground Water Sampling Locations	5-17
Table 5.11: Analytical Results of Ground Water Quality	5-17
Table 5.12: Location of Ambient Air Quality Sampling Points	5-19
Table 5.13: Analytical Results of Ambient Air Quality	5-19
Table 5.14: Location of Ambient Noise Quality Sampling Points	5-21
Table 5.15: Result of Noise Monitoring along the project corridor	5-21
Table 5.16: Economic Importance of the trees found in the study area	5-23
Table 5.17: Urban Population in 1991 and 2001	5-24
Table 5.18: Rural Population in 1991 and 2001	5-24
Table 5.19: Decennial Population 1951-1981	5-26
Table 5.20: Decennial Growth Rate (1981-2001) and Density of Population (1991-2001)	5-26
Table 5.21: The Area Irrigated by Canals, Tubewells and Other Means	5-26
Table 5.22: Important Educational Institutes along the Proposed Corridor	5-28
Table 5.23: Wells and Tubewells along the proposed alignment	5-29
Table 7.1: Earth Materials Needed for Construction	7-3
Table 7.2: Air Quality Monitoring at Sampling Site on NH-2	7-7
Table 7.3: Summarised Observed Values of CO & HC at Sampling Site on NH-2	7-7
Table 7.4: Projected Concentration of Air Pollution (CO) for	7-8
Table 7.5: WHO Emission Standard	7-8
Table 7.6: Observed Leq during Different hours of the Day on NH-2	7-11
Table 7.7: Predicted Noise level (Leq) for Both Directions	7-12
Table 7.8: Permissible limits of Noise level	7-13
Table 9.1: Type of Mitigation Measures	9-2
Table 9.2: Environmental Budget	9-14
Table 10.1: Performance Indicators at Different Project Stages	10-3
Table 10.2: Stage-wise reporting system	10-5
Table 10.3: Detailed Training Program	10-6

CONTENTS

S.No.	Description	Page No.

List of Figures

Figure 5.1: Soil Profile in the Project Area 5-6
Figure 5.2: Village Types in the Area 5-25
Figure 5.3: Crop Map of the Area 5-27
Figure 5.4: Location of Sampling Points 5-34

Figure 6.1: Public Consultation at Village Sarol 6-3
Figure 6.2: Public Consultation at Village Barauli 6-3

Figure 7.1 (a) High Volume Sampler Showing Gas Collection through Impingers 7- 6
Figure 7.1 (b) High Volume Sampler Showing Accumulation of SPM 7-6
Figure 7.2 View of 2260 Noise Level Analyser 7-11

Figure 10.1: Proposed Organization Structure 10-4

List of Maps

Map 2.1: Location Map of Proposed 6/8 Lane Expressway connecting Noida to Agra 2-7

Map 5.1: Location of Sampling Points 5-34

List of Exhibits

Exhibit I: Modified to save Cremation Ground 8-4
Exhibit II: Modified to save Houses 8-5
Exhibit III: Modified to save fish pond 8-6
Exhibit IV: Modified to save Tappal 8-7
Exhibit V: Modified to save orchard 8-8
Exhibit VI: Modified to save houses 8-9
Exhibit VII: Modified to save Samadhi 8-10

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GREEN BELT DEVELOPMENT AND MANAGEMENT

Number of Trees Cut

The construction of the Taj Expressway extending from Delhi/ Noida – G. Noida Expressway to NH-2, near Etmadpur will result in loss of trees.

There are about 476 trees on the right hand side of the centerline and about 472 trees on the left. Since the road length is approximately 165 km, it follows that on an average a few more than 6 trees shall have to be felled per kilometer. However, in reality, most of the stretch is denuded of trees since the road is passing through agricultural lands. The trees are mainly from Km 0.0 to Km 51.0 of the proposed road. The tree numbers show a sharp decline in their numbers from there onwards and soon reaches a count of zero.

Apart from the trees that have been enumerated for the purpose of the project, there are also two avenues of trees and a mango orchard and some poplar trees that will have to be felled. Hence the total number of trees to be felled is approximated at 1100. However, as is evident the numbers of trees that shall be felled is low when considered against the length (164.775 km) and width (100m) of the proposed alignment.

The trees that shall need to be cut include trees as palm, *Acacia arabica*, Neem (*Azadirachta indica*), Mango (*Magnifera indica*), Jamun, Peepal, Banyan, (*Cassia siamea*), *Prosopis spicigera*, *Prosopis chilensis*, Gulmohar (*Delonix regia*), *Albizzia lebbeck*, Ber (*Ziziphus jujuba*).

To compensate for the trees that are cut as well as for improving the microclimate of the area, development of green belt shall be undertaken along the side of the road.

Tree Plantation Plan

It is proposed to plant trees in two rows along the roadside, one on either side and a row shall be planted in the median. **The inner row shall be of smaller trees and planted alternately with the second row.. Near villages, the density of the trees planted is being lessened to 70 trees in the i.e. 14m apart. This is done keeping in mind the suitability of plantation in populated areas. Along the median, trees are to be planted 12m apart i.e. 84 trees per km. Plantation in the median will not be taken up in stretches adding upto not more than 5 Km owing to intersections, bridges etc. In the median trees are being planted at intervals of 12m i.e. 84 trees per km.**

While care is taken in selecting the plants in terms of their suitability to the region in terms of climate, soil, water availability and nativity, aesthetic value is also given due importance.

An important objective with which trees are planted along Roads and Highways is the provision of the much desired shade, owing to the climate in the study area where the sun is unbearably hot for atleast 6 months in the year. Hence trees with moderately dense foliage have been chosen so that while there is enough shade on the road, it is not so dense as to affect visibility or inhibit free circulation of air which will other wise lead to dust clouds on the road.

Green plants form a surface capable of absorbing air pollutants and act as sink for pollutants. Hence, a green belt can act as an effective pollution sink (within the tolerance limits of constituent plants). The plants shall be selected in harmony with the right choice

of soil and climate. In the plants suggested for the green belt on the roadside, those that are indigenous have been selected. Those with economic importance have also been given importance.

Injury Symptoms and Pollutant Dose Thresholds of Tolerance by Sensitive Species of Plants

Pollutant	Threshold Dose	Plant Injury Symptoms	Remarks
Sulphur Dioxide (SO_2)	0.70 ppm (1820 $\mu g/m^3$) for 1 hr.; 0.18 ppm (468 $\mu g/m^3$) for 8 hr.; 0.008 – 0.017 ppm (21- 44 $\mu g/m^3$) for growing season	Interveinal necrotic blotches	The high Stomatal Index of *Azadirachta indica, Ficus virens* and *Prosopis* makes them susceptible to SO_2
Nitrogen Oxides (NO_X)	20 ppm (38 x 10^3 $\mu g/m^3$) for 1 hr.; 1.6 – 2.6 ppm (3000-5000 $\mu g/m^3$) for 48 hr.; 1 ppm (1900 $\mu g/m^3$) for 100 hr.	Interveinal necrotic blotches similar to those by SO_2	NOx is less damaging to plants. Large number of leguminous plants Eg. *Acacia, Pongomia* uses atmospheric nitrogen for nitrification purpose
Suspended Particulate Matter (SPM)	-	Harm leaves by blocking stomata and thus interfering with exchange of gases during photosynthesis and respiration and also cause abrasion of plant surfaces when the wind blows	Number of plants has been found to be good dust collectors Eg. *Ficus virens, Leucena leucocephala*

With all the above in mind, chainagewise plantation in terms of number of trees per km and type of trees to be planted is suggested below for each of the two rows. The two sides of the road are to be planted as per the same plan.

Chainage wise Plantation Scheme

Along the roadside				
Chainage	No of Km	No of trees per km	Total Number of trees	Species of trees
0.0 – 0.4	0.4	84	33.6	*Azadirachta indica*
0.4 – 1.4	1.0	70	70	*Mangifera indica*
1.4 – 6.4	5.0	84	420	*Mangifera indica*
6.4 - 15.8	9.4	84	790	*Azadirahta indica*
15.8 – 16.8	1.0	70	70	*Tamarindus indica*
16.8 – 18.7	1.9	84	160	*Tamarindus indica*
18.7 – 22.3	3.6	70	252	*Aegle marmelos*
22.3 – 23.8	1.5	84	126	*Aegle marmelos*
23.8 - 27	3.2	70	224	*Aegle marmelos*
27 – 29.7	2.7	84	227	*Bombax malabaricum*
29.7 – 30.7	1.0	70	70	*Bombax malabaricum*
30.7 – 31.3	0.6	84	50	*Bombax malabaricum*
31.3 – 35.5	4.2	70	294	*Mangifera indica*
35.5 – 40.8	5.3	84	445	*Mangifera indica*
40.8 – 41.8	1.0	70	70	*Mangifera indica*
41.8 – 42.7	0.9	84	76	*Terminalia arjuna*
42.7 – 43.7	1.0	70	60	*Terminalia arjuna*
43.7 – 46.6	2.9	84	243.6	*Terminalia arjuna*
46.6 – 47.8	1.2	70	84	*Aegle marmelos*
47.8 – 49.0	1.2	84	84	*Aegle marmelos*
49.0 – 51.4	2.4	70	168	*Aegle marmelos*
51.4 – 55.6	4.2	84	352.8	*Acacia auriculiformis*
55.6 – 59.4	3.8	84	319.2	*Acacia auriculiformis*
59.4 – 60.6	1.2	84	100.8	*Acacia auriculiformis*
60.6 – 61.6	1.0	70	70	*Eugenia jambolana*
61.6 – 63.1	1.5	84	126	*Eugenia jambolana*
63.1 – 65.2	2.1	70	147	*Eugenia jambolana*
65.2 – 70.3	5.1	84	428	*Eugenia jambolana*
70.3 – 71.9	1.6	70	112	*Eugenia jambolana*
71.9 – 72.7	0.8	84	67	*Dalbergia sissoo*
72.7 – 75.1	2.4	70	168	*Dalbergia sissoo*
75.1 – 95	42.2	84	3545	*Dalbergia sissoo*
95 - 117.3	19.9	70	1393	*Mangifera indica*
117.3 – 118.3	10.0	70	700	*Mangifera indica*
118.3 – 123.2	4.9	84	412	*Dalbergia sissoo*
123.2 – 124.2	1.0	70	70	*Dalbergia sissoo*
124.2 – 129.1	4.9	84	412	*Dalbergia sissoo*
129.1 – 131.1	2	70	140	*Acacia auriculiformis*
131.1 – 132.9	1.8	84	151	*Acacia auriculiformis*
132.9 – 133.9	1.0	70	70	*Acacia auriculiformis*
133.9 – 135.0	1.1	84	92	*Acacia auriculiformis*
135.0 – 136.0	1.0	70	70	*Acacia auriculiformis*

136.0 – 138.9	2.9	84	244	*Aegle marmelos*
138.9 – 139.9	1.0	70	70	*Aegle marmelos*
139.9 – 142.5	2.6	84	218	*Aegle marmelos*
142.5 – 143.5	1.0	70	70	*Aegle marmelos*
143.5 – 149.5	6	84	504	*Azadirachta indica*
149.5 – 150.5	1.0	70	70	*Azadirachta indica*
150.5 – 151.5	1.5	84	126	*Azadirachta indica*
151.1 – 152.1	1.0	70	60	*Azadirachta indica*
152.1 – 153.8	1.7	84	143	*Azadirachta indica*
153.8 – 154.8	1.0	70	70	*Eugenia jambolana*
154.8 - 155	0.2	84	16.8	*Eugenia jambolana*
155 - 156	1.0	70	70	*Eugenia jambolana*
156 – 157.1	1.1	84	92	*Eugenia jambolana*
157.1 – 158.1	1.0	70	70	*Eugenia jambolana*
158.1 – 161.8	3.7	84	311	*Tamarindus indica*
161.8 – 162.8	1.0	70	70	*Tamarindus indica*
162.8 – 163.3	0.5	84	42	*Tamarindus indica*
163.3 – 164.4	1.1	70	5390	*Tamarindus indica*
			20,598	

Median

In the median, trees such as *Delonix regia, Madhuca champaka, Melia azaderech* and *Cassia fistula* are to be planted at a distance of 12m. The trees shall be alternate with bushes of shrubs as *Nerium indica, Thevetia peruviana, Bouganvillea* and *Jatropha* to provide a sense of greenery along the level of passenger cars. This would not only enhance the aesthetic value of the corridor but would also act as an intermediate barrier for noise and gaseous pollutants. Hence 13,440 trees shall be planted on the median.

Hence a total of 34,038 trees shall be grown in the development of green area, including the median and along the road trees.

Landscaping View

It is recommended that pure lines may be planted to maintain uniformity. Often, attempts at alternate planting are unsuccessful due to death of trees inbetween. Interfillers are suggested to improve the aesthetic quality of the road, they shall be planted along the road after which there shall be a row of larger and shade bearing trees. The choice of tree types has been made with emphasis on planting fruit trees in order to benefit the local people and flowering and scented trees to provide a pleasant view to the travelers.

As a soil conservation measure, and also to render the area green at ground level, extensive turfing shall be required. The grasses suggested below are all native to the area. Widely grown grasses as *Cynodon dactylon, Dicanthium annulatum, Cymbopogon martini* and *Digitaria griffitti* may be planted.

Plantation:

Along Roadside

The standard practice for green belt development involves planting of saplings in pits of substantial dimensions i.e. 60 x 60 x 60cms for big trees and 45 x 45 x 45 for smaller trees and shrubs. The pits should then be filled with earth, sand, silt and manure in pre-determined proportions. Saplings planted in such pits are to be watered liberally. The growing plants should be nurtured for three years and should be cared and protected against any damage caused by domestic elements.

Protection Measures

Brick walls of single row plantations is recommended for protection of the trees planted. It shall be 600 x 600 x 1800mm. 300mm of it shall be below the ground.

On the Median

The surface for plantation in the median shall be smoothened and any pits filled by good soil. It shall also be cleaned of any debris in order to improve the surface smoothness. The seed of grasses need to be sown before the onset of Monsoon (May & June). A cover of 25 grams of grass per square meter of surface will be achieved. After sowing, mulch of prepared and dried out herbs are to be laid over the whole seeded area in a tin layer so that the direct sunlight and transpiration loss may not affect the grasses.

As for the shrubs along the median, these shall be planted at a spacing of 1.5metres from the inner edge of the median. The shrubs shall be planted in pits sized 45 x 45 x 45cm with 666 plants per km.

Activities Schedule for Plantation along the Highway/ Median

	Month		Activities
1st Year	Jan - March	1	Surveying & cleaning of the area
		2.	Digging of Pits
		3.	Procurement of Angles Iron and barbed wire
2nd Year	April – June	1.	Purchase of Farm Yard Manure
		2.	Brick guard for 1st Row
		3.	Plantation along the Highway
		4.	Filling up of Pits with Farm Yard manure and Soil
	July – August	1.	Transportation of Plants
		2.	Planting of Saplings
		3.	Watering
		4.	Weeding and Hoeing
	Sep – Nov	1.	Weeding and Hoeing
		2.	Watering 4 times a month

	Month		Activities
	Dec – Feb	1.	Weeding and Hoeing
		2.	Maintenance
	March	1.	Watering 4 times a month
3rd Year	**April – June**	1.	Watering 6 times a month
	July – August	1.	Casualty Replacement (20% of the total plants) - Median
		2.	Weeding
		3.	Maintenance of Mali
	Sep – Nov	1.	Watering 2 times a month
		2.	Maintenance by Mali
	Dec – Feb	1.	Maintenance by mali
	March	1.	Watering 4 times a month
		2.	Maintenance by mali
		3.	Cutting away two of three consecutive trees planted according to their growth, or their transplantation to a place where survival ratio has gone below 1:3
4th Year	**April – March**	1.	Watering
		2.	Casualty Replacement (10% of the total plants) - Median
		3.	Maintenance by Mali

CHAPTER - 1 INTRODUCTION

1.0 BACKGROUND

Taj Expressway Industrial Authority has decided to take up development of the region. This proposed Expressway will be the lifeline for the other developments (Taj Economic Zone and Airport near Jewar) already planned. Jaiprakash Industries Limited (JIL) is working as the Concessionaire for this project.

The purpose of this Rapid EIA report is to identify possible environmental impacts/problems that may be arising from the proposed 6/8 lane expressway. The Initial Environmental Examination (IEE) has been conducted in accordance with the guidelines of the Ministry of Environment and Forest (MoEF) for infrastructure projects and has served the purpose of "Scoping" for the detailed EIA.

The environment specialists for the proposed project carried out the EIA in consultation with engineers, economist, and traffic planners. It is important to note that the severity of impacts considered, the magnitudes perceived are based on ocular inspections of the project site, primary data collection through monitoring and analysis of the secondary data.

Jaiprakash Industries Limited (JIL) has entrusted ***EQMS India Pvt. Ltd. Delhi*** the task of carrying out Environmental Impact Assessment and Development of Environmental Management Plan.

The objective of this Environmental Assessment and Management Plan is to establish the technical, environmental, and social, requirements of the project with regard to rehabilitation, construction based on the highway design, pavement design, provision of service roads wherever necessary, type of intersections, rehabilitation, construction of new bridges and structures. Financial feasibility analysis is not part of the project scope.

Since road development project has various environmental impacts of varying magnitude, it is essential to identify those and integrate the mitigation measures at the design stage itself. Initial Environmental Examination has been carried out to identify the major environmental issues associated with this project.

The brief of IEE findings are given subsequently in this chapter. The finding of IEE guides the undertaking of a more focused Rapid Environmental Impact Assessment Study.

The Rapid Environmental Impact Assessment study has been carried out in line with Indian Environmental Regulatory requirements.

1.1 KEY FINDINGS OF INITIAL ENVIRONMENTAL EXAMINATION

This project poses certain negative and positive impacts. These impacts are in terms of enhancement of overall economic conditions, increase in job opportunities, better road safety, increase in quality of life, loss of plantations, effect on terrestrial ecology, increase in noise levels, loss of productive soil, impact on water quality etc. A summary of key findings is given below. Incorporating adequate remedial measures can substantially minimize the negative impacts. The overall net negative effect is far less compared to the number of positive environmental benefits of this road development project. The proposed project therefore has been found feasible and environmentally safe and sound (provided adequate measures are taken for mitigating the negative impacts). Hence the project is being recommended for implementation.

With the improvement in the road network, the economic growth of the project area is expected to take place at a faster rate. This will obviously result in better quality of life. During the construction phase, a number of employment opportunities will be generated for the local population. Therefore, the economic condition of the people living in the project area is expected to rise leading to better quality of life for them. Moreover, economic strengths also help reduce cultural backwardness.

The existing alignment does not pass through any eeologically sensitive area. However the project calls for land acquisition on a large scale as most of it passes through agricultural land. There are also a few streams running across the alignment. A few environmental concerns related to any roadways project is outlined below:

- Loss of roadside plantation is an unavoidable impact of any highway project. However, the loss of trees will be very insignificant in this project due to the immensely sparse density of vegetation along the proposed alignment.
- There are no historical, cultural and scenic spots, which may be affected due to this road project.
- The dust and noise level may increase during construction activity however the same will be temporary in nature. Adequate measures will be adopted to minimize these impacts and ensure that the noise level does not exceed the prescribed regulatory limits.
- Water is an important component for construction of roads. Due to the proximity of the River Yamuna to the proposed alignment, the impact on water environment is to be treated as an important issue even though the road is not crossing the River Yamuna at any point. Considering the favourable climatic condition of the project area with respect to rainfall, the consumption of water (surface/ground) will not be a significant issue at the time of construction.

- The land use pattern in the project area shall be significantly altered as the proposed project alignment is mainly over agricultural land. However, there are no forestland involved and hence no associated disruption of any faunal habitat. There shall also be temporary use of certain lands as borrow areas although efforts have been made to borrow lands from existing pits, highlands only. There would be few instances of high embankments, prone to soil erosion. Hence, impact on soil due to proposed project will also be an important issue and adequate protective measure have to be incorporated at the design stage.

- Once the newly constructed road is open to traffic, it is expected that an increased noise and vibration will be generated due to increased traffic during the operation stage. Adequate noise barrier would be provided at affected sensitive areas.

- Road safety measures will be provided for in the Project.

1.2 POLICY CONTEXT FOR ENVIRONMENTAL ASSESSMENTS IN INDIA

Govt. of India has elaborated environmental regulatory framework. The Ministry of Environment and Forest (MoEF) has overall authority for the administration and implementation of government policies, laws and regulations related to environment.

The MoEF provides environmental clearance for any road development project except widening with marginal land acquisition (max 20 meter). Rapid Environmental Impact Assessment (EIA) is necessary for new project having investment of more than rupees 1000 million and widening projects if the road passes through ecologically sensitive areas such as, National Parks, sanctuaries, and reserved forests area. Pubic hearing also has to be organized through State Pollution Control Board for each of the new road project. No Objection Certificate (NOC) will have to be procured from the State Pollution Control Board in order to fulfill the MoEF (Ministry of Environment & Forests) requirement for getting environmental clearance. Under Forest (Conservation) Act, 1980, forest Clearance is also required from MoEF for Reserved Forests and Protected Forest areas. It is therefore necessary to assess the applicability of environmental regulatory requirement and integrate these requirements at feasibility stage itself and take timely and appropriate actions to avoid any delay in project implementation for the want of clearance.

A detailed analysis of regulatory framework has been carried out and presented under chapter 3.

1.3 POLICY OBJECTIVE OF THE ENVIRONMENTAL ASSESSMENT AND THE MANAGEMENT PLAN

Policy objective of the environmental assessment and the management plan is to identify the positive and negative impacts of the road development project and integrate the adequate remedial measures so as to improve the capacity and the quality of the highway movement. The overall purpose of the management plan is to preserve and enhance the

quality of the natural environment, including natural habitat for wildlife, by introducing such concern based measures in design decisions as well as during construction and operational period of the proposed project.

In view of the findings of Initial Environmental Examination, regulatory requirements and need of effective management plan, the EIA scope has been finalized. The EIA/EMP focuses on some of the following key areas.

- Maintaining Sufficient Natural Drainage Flow
- Minimal land use conversion as per feasibility
- Prevention of adverse impact on Surface Water Quality
- Prevention of adverse impact on Ground Water Quality
- Minimizing impact of Air and Noise pollution including during construction
- Protection of Embankment Slopes from Erosion
- Treatment of Borrow Areas
- Road Safety

1.4 STRUCTURE OF THE MAIN EIA/EMP REPORT

Environmental Impact Assessment (EIA) part of the report consists of chapters on Introduction, Project Description, Environmental Regulatory Framework, Methodology and EMP Process, Existing Environmental/Baseline status, Public Consultation, Assessment of Potential Environmental Impacts, Analysis of Alternative and Mitigation/ Enhancement Measures, Environmental costs estimates, institutional mechanism and monitoring requirements.

The Environmental Management Plan (EMP) portion consists of Environmental Design, Environmental Management Action Plan, Monitoring, Training, budgeting and implementation arrangements.

The last Annexure part of the document contains the no of trees to be cut chainage wise, common property details chainage wise, and instruments and methodology used in sampling, borrow area details, quarry and crushers details, strip plan about environmental features along the project strip.

Chapter - 1 INTRODUCTION 1-1
1.0 BACKGROUND 1-1
1.1 KEY FINDINGS OF INITIAL ENVIRONMENTAL EXAMINATION 1-2
1.2 POLICY CONTEXT FOR ENVIRONMENTAL ASSESSMENTS IN INDIA 1-3
1.3 POLICY OBJECTIVE OF THE ENVIRONMENTAL ASSESSMENT AND THE MANAGEMENT PLAN 1-3
1.4 STRUCTURE OF THE MAIN EIA/EMP REPORT 1-4

Chapter - 2 PROJECT DESCRIPTION

2.0 THE PROJECT AND ITS LOCATION

The Proposed 6/8 Lane Expressway connecting Noida to Agra is a part of the decision taken up by Taj Expressway Industrial Authority for the development of the area. The project area is covered by longitude $77^{O}30'$ (E) to $78^{O}15'$ (E) and latitudes $27^{O}00'$ (N) to $28^{O}30'$ (N). The location map of the project road is given as Map 2.1.

For the purpose of systematic and consistent evaluation of the potential impacts, the project area has been divided in five sections (as done in DPR) as follows:

Section No.	Chainage (Km)	Remarks
Section 1	RD 0.00 – RD 35.00	Greater Noida to International Airport / TEZ*
Section 2	RD 35.00 – RD 47.00	Airport/TEZ to Tappal
Section 3	RD 47.00 – RD 68.00	Tappal to Nohjhil
Section 4	RD 68.00 – RD 110.00	Nohjhil to Raya
Section 5	RD 110.00 to RD 164.775	Raya to Merging of NH 2 (Etmadpur)

* TEZ: Taj Economic Zone

The project area is located entirely in the state of Uttar Pradesh. The various districts traversed by the project are: Goutam Buddha Nagar, Aligarh, Mathura, and Agra. Various settlements found along the project area are: Greater Noida, Jewar, Tappal, Nohjhil, Raya, and Baldev.

2.1 OBJECTIVES OF THE PROJECT

The key objectives of the project are as follows:

- To provide a fast travel strip to minimize the travel time between Delhi and Agra
- To connect the main existing and proposed townships / commercial centers on the eastern side of Yamuna River
- To relieve the traffic congestion on NH – 2, that runs through cities of Faridabad, Ballabgarh and Palwal

2.2 EXPECTED BENEFITS OF THE PROJECT

The proposed road development project is expected to and is aimed at to bring the following benefits:

- Traffic speed should increase from average 30 kmph to 100 kmph, which in turn would reduce the cost of transportation and reduce the pollution level
- The fuel consumption is estimated to reduce substantially, saving nonrenewable energy resource of the country
- Provision of parking areas, toll plaza and lay-byes with all the necessary amenities will provide better highway user facilities.
- With unidirectional flow of traffic on each side of the median the number of road accidents will be reduced

- The plantings and landscaping along the highway will significantly improve the quality of the environment as very few trees will be cut because of the project
- Overall economic benefits in terms of job opportunities, increased commercial activities through the improvement to the flow of goods and services.

2.3 COST OF THE PROJECT

The estimated cost of the project at detailed project design stage is as follows:

Sl. No.	Financial Year	Rs. in Crores
1.	2003 – 2004	285.64
2.	2004 – 2005	482.01
3.	2005 – 2006	507.70
4.	2006 – 2007	395.03
5.	2007 – 2008	375.13
	Total	**2045.52**

2.4 PHASES OF THE PROJECT

The proposed project has been divided into the three main phases. First phase was planning and designs stages (started in February 2003 and are expected to be completed by March 2004). The Project tendering and implementation is likely to take about five years after completion of design.

2.5 TERRAIN

The project area is part of the Indo - Gangetic Plain with average height, 175m above MSL. The majority of the area along the alignment is covered by unconsolidated sedimentary rock mainly composed of alluvium. The alignment passes ~~through~~ along the left bank of River Yamuna through mostly khadar land.

2.6 FOREST AREA

The proposed alignment does not cut through or even border any ecologically sensitive areas like Protected Forest, Reserve Forest or National Park.

2.7 RIGHT OF WAY

The Right of Way for the proposed project is 100m. Since this is a proposed road, entire land requirement will be met by land acquisition.

2.8 ROAD WAY AND PAVEMENT

The proposed road will generally have low embankment (2.5 m on an average except few locations where difference is more (- eg: at underpasses/ overpasses).

The proposed carriageway will be 48m wide including median. The remaining land shall be used for drainage, roadside utilities, plantation and future widening. In general, the pavement will be made of 300mm Cement Concrete (PQC), 100mm Dry Lean Concrete (DLC), 150mm Wet Mix Macadam (WMM), 150mm Granular Sub Base Coarse (GSBC), 100mm Drainage Layer (GSBC) and 500m Treated Subgrade (CBR = 7%). A 125 micron Polythene Membrane shall be placed in between PQC and DLC. There may, however be some changes in design during optimisation.

2.9 PROJECT COMPONENTS

The main components of the project is road construction along the proposed alignment as per the detailed design and off site works such as concrete/asphalt plant, borrow/quarry sites. The main components are as follows (the details of key components are given in the following paragraphs):

- Construction of new expressway
- ~~Construction of underpasses and overpasses as per requirement~~
- Construction of culverts and drainage improvement works (Pavement drainage, Cross-Drainage, Surface Water Run-off, Shoulder and slope drainage, Median drainage)
- Construction of Overpass (1 nos.) & Underpasses as per detailed engineering.
- Provision for traffic safety features (Overhead gantry signs, Reflecting road markings and signs, Safety barriers of concrete or steel or wire rope, Delineators, Traffic signs, Traffic signals) and landscaping
- Construction of wayside amenities (Restaurants, Parking, Telephone Facility, Fuelling Facility, Repair Facility, First Aid Facility, Drinking water kiosks, Wayside bus lay byes and bus stops),
- Construction of Toll Plaza and ancillary structures
- Construction of service roads as per requirements to maintain the existing connectivity of roads.

In addition to the above mentioned on-site activities, a number of other/allied activities will need to be undertaken during construction phase and, which may have a direct impact on the existing environment. The major offsite activities/works involved during project construction phase will be:

- Quarrying from nearby quarry sites
- Carriage of earth from nearby borrow areas
- Dumping/disposal of left over materials at dumping sites
- Workers/labor camps for the construction workers
- Construction of temporary access/diversion roads
- Site for location of hot mix plants and concrete batching plants; and
- Materials storage yard/warehouse

2.9.1 Bridges and Culverts

The location of bridges is very important to maintain the existing flow of natural drainage. The planning for bridges have been made in a manner that natural drainage system is not disturbed. The brief details of bridges are given below:

The proposed expressway will require 29 minor bridges to be constructed over the Nallas and Canals, and ***one major bridge at Km 160.816***. Altogether, 375 Culverts will be provided along the proposed alignment.

- **Construction of culverts and drainage improvement works**

  - Pavement drainage
  - Cross-Drainage
  - Surface Water Run-off
  - Shoulder and slope drainage
  - Median drainage

2.9.2 Raising of embankment

There are few places where the proposed alignment will be through the low lying areas of River Yamuna and its tributaries. Hence, ~~high~~ embankments ~~(≥ 10m)~~ will need to be constructed in these areas, as per design requirements.

2.9.3 Construction of Underpasses and Overpasses

The proposed expressway will cross a number of other roads (National Highways, State Highways, Major District Roads and Railway Tracks). Hence, a number of underpasses and overpasses need to be constructed. In case of other roads a conscious effort has been made to ensure that the expressway is at lower grade. Altogether 39 underpasses will be constructed. However, in case of railway tracks (at Dudadhari, Km 110) an overpass i.e. the expressway at a higher grade and the rail at the lower grade has been proposed.

2.9.4 Provision for traffic safety features

- The road signs shall confirm to IRC: 67-2001. For overhead signs, the standards prescribed in BIS / AASHTO/ASTM British standards or any other international standards in that order shall be adopted in consultation with and approved by JIL.
- Design and location of route marker signs shall be as per the IRC: 2-1968. The design of highway kilometer stones and 200 m stones shall be as per IRC: 8-1980 and IRC: 26-1967 respectively. The boundary stones shall be as per IRC: 25-1967.
- Road Delineators shall conform to IRC: 79-1981.
- All road signs shall be of retro-reflective sheet of high intensity grade with encapsulated lens fixed over aluminum substratum conforming to MORTH Specifications for R&B Works.

2.9.5 Construction of wayside amenities

- Restaurants
- Parking
- Telephone Facility
- Fuelling Facility
- Repair Facility
- First Aid Facility
- Drinking water kiosks
- Wayside bus lay byes and bus stops

2.9.6 Provision for landscaping

The project authority has kept sufficient provisions for landscaping along the proposed alignment. On an average 15m land will be available on the median and along the side of the road.

2.9.7 Construction of Toll Plaza and ancillary structures

For the above mentioned 5 sections, 4 Toll Plazas and other ancillary structures e.g. lay byes, bus stops, etc. will be constructed. Toll Plaza location details are given below:

Section No.	Chainage (Km)	Toll Plaza No.
Section 1	Km 0.00 – Km 35.00	I
Section 2	Km 35.00 – Km 47.00	II
Section 3	Km 47.00 – Km 68.00	
Section 4	Km 68.00 – Km 110.00	III
Section 5	Km 110.000 – Km 164.775	IV

2.9.8 Construction of service roads, Pedestrian Crossings

Service roads will be provided in prospective urbanized areas and in few instances, some tracks will be made for linking village tracks. Plans have been made to construct 48 Cart Track / Pedestrian Crossings.

2.9.9 Major River Crossings

Though the proposed alignment passes through the ~~low lying areas of the~~ Khader of the River Yamuna ~~Yamuna River, but~~ it ~~is~~ does not crossing the river or any of its tributaries at any place.

2.9.10 Junction Improvements

Since the proposed Taj Expressway takes off from Noida-Greater Noida Expressway, one interchange has necessarily to be provided at Km 0. Other interchanges are located in between, guided mainly by following considerations:

- Proposed Taj Economic Zone and international hub airport -located between, Km 20 and Km 33 on the proposed Expressway
- ~~Proposed International Airport near Km 35~~
- Intersection of major roads with proposed expressway

2.10 PROJECT ACTIVITIES

The activities to be implemented for the full realization of the project are presented below:

2.10.1 Pre-Construction Stage

During the pre-construction stage, following activities will be undertaken: Collection of all relevant secondary data from all concerned government offices, Topographical Survey, Traffic Survey and Forecasting and Carriageway Configuration, Geotechnical Survey/Soil/Foundation Testing, Bridge Inventory and Condition Survey, Subgrade Soil Investigation, Material Survey, Right of Way Acquisition, ~~Removal of existing structures,~~ Environmental and social screening and assessment, Detailed Engineering Design for Road Alignment, Bridges, Drainage and Culvert, Intersections and Interchanges, Pavement, ROB, Wayside Amenities, Traffic Safety Features.

2.10.2 Construction Stage

The project implementation will primarily involve the following activities: Clearing and Grubbing, ~~Demolition of structures,~~ Land acquisition, Site Development Works, Road construction, Construction of Wayside Facilities, and Implementation of Environmental Management Plan including Training

2.10.3 Post Construction Stage

The post construction activities mainly includes: Site Clearing and Restoration, Demobilization, Removal of all construction spoils to designated disposal sites, Revegetation of embankments and exposed slopes, Reforestation/aforestation , Restoration of disconnected/disrupted facilities such as irrigation canal, power lines, telecommunication

2.10.4 Operational Stage

Once the new constructed road is open to traffic regular maintenance of the expressway would need to be done. Regular maintenance works shall include the following: Maintenance of shoulders including necessary filling and dressing, Vegetation control, Drainage maintenance, Maintenance of road signs, safety installations, Routine maintenance of bridges and culverts including painting, Maintenance and operation of lighting facilities at bridges/flyovers/toll plaza/parking areas, Maintenance of road side trees, Monitoring of critical slope areas and continuous enhancement of slope protection measures, Regular environmental monitoring and Training.

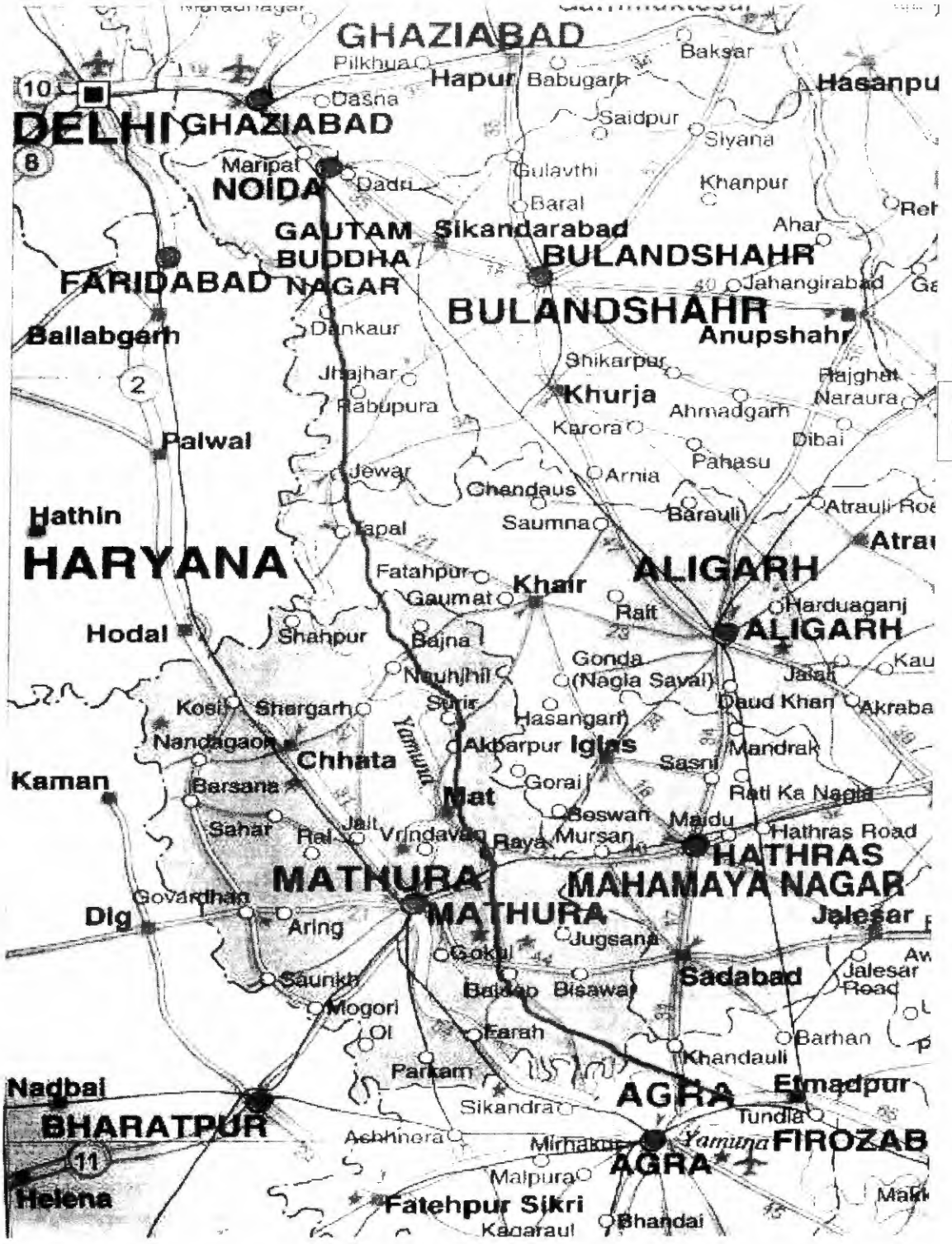


Fig. 2.1 Location Map of Proposed Taj Expressway

Chapter - 2 PROJECT DESCRIPTION 2-1
2.0 THE PROJECT AND ITS LOCATION 2-1
2.1 OBJECTIVES OF THE PROJECT 2-1
2.2 EXPECTED BENEFITS OF THE PROJECT 2-1
2.3 COST OF THE PROJECT 2-2
2.4 PHASES OF THE PROJECT 2-2
2.5 TERRAIN 2-2
2.6 FOREST AREA 2-2
2.7 RIGHT OF WAY 2-2
2.8 ROAD WAY AND PAVEMENT 2-2
2.9 PROJECT COMPONENTS 2-3
2.9.1 Bridges and Culverts 2-3
2.9.2 Raising of embankment 2-4
2.9.3 Construction of Underpasses and Overpasses 2-4
2.9.4 Provision for traffic safety features 2-4
2.9.5 Construction of wayside amenities 2-4
2.9.6 Provision for landscaping 2-5
2.9.7 Construction of Toll Plaza and ancillary structures 2-5
2.9.8 Construction of service roads, Pedestrian Crossings 2-5
2.9.9 Major River Crossings 2-5
2.9.10 Junction Improvements 2-5
2.10 PROJECT ACTIVITIES 2-5
2.10.1 Pre-Construction Stage 2-5
2.10.2 Construction Stage 2-6
2.10.3 Post Construction Stage 2-6
2.10.4 Operational Stage 2-6

Chapter - 3 ENVIRONMENTAL REGULATORY FRAMEWORK

3.0 BACKGROUND

The environmental degradation is of high concern for every one in India today. Government of India has also accorded environmental protection a high priority. It has prepared a large number of legal instruments focusing on various components of environment viz. air, water, hazardous waste, hazardous chemicals, ecology, forests and wild life etc. It has also set up administrative framework for ensuring enforcement of these regulations.

Any development project including widening/construction of new highways may affect water quality, water availability, land use pattern, air and noise quality, ecology, forest cover and wildlife well being. In view of elaborated regulatory framework and large number of environmental issues associated with a highway project, it is essential to carry out regulatory screening and incorporate the applicable legislative requirement at planning/design stage itself.

For the construction of the Taj Expressway, Jaiprakash Industries Limited, the Concessionaire for the project shall follow all applicable environmental regulatory requirements and incorporating as many mitigative measures as possible at the planning stage in order to avoid any considerable deterioration to the environment.

3.1 REGULATORY APPLICABILITY AND CLEARANCES/ CONSENTS REQUIREMENTS

The five sections viz: Section 1(RD 000, Greater Noida to RD35000, International Airport/ TEZ), Section 2 (RD 35000, Airport to RD 47000, Tappal), Section 3 (RD 47000, Tappal to RD 68000, Nohjhil), Section 4 (RD 68000, Nohjhil to RD 108000, Raya) and Section 5 (RD 108000, Raya to RD 164.775, Merging of NH-2, Etmadpur) primarily has environmental issues pertaining to noise level and air quality near sensitive locations, use of soil for construction, and air pollution during operation of construction plant/machineries and a very minor effect on the roadside trees. Various Acts/Rules addressing above environmental issues were analyzed. Some of the Acts/Rules were found not applicable. ***The major exclusions with basis are summarized below followed by Applicable Acts/Rules.***

3.1.1 Exclusions:

There are no industrial area existing along the above five packages. No waste dump found along the side of existing road or in ROW requiring waste characterization and handling. Hence notifications like Hazardous Waste (Management & Handling) Rules 2003 or Municipal Solid Waste (Management & Handling) Rules 2001 is not found applicable.

Since the proposed alignment is not passing through any Forestland the provisions of Forest Conservation Act, 1980 are not attracted.

3.1.2 Applicability

The following Acts and Rules are found applicable for the project:

- The Environment (Protection) Act, 1986
- The Environment (Protection) Rules, 1986: The Environmental Impact Assessment Notification, 1994 (amended 2002)

Applicable for construction Activity only

- The Water (Prevention and Control of Pollution) Act, 1974
- The Water (Prevention and Control of Pollution) Rules, 1975
- The Air (Prevention and Control) of Pollution Act, 1981
- The Air (Prevention and Control) of Pollution Rules, 1980/83

Clearances/consents requirements for project

Table 3.1 presents the clearance/consents requirements under above applicable environmental legislations and suggested stages for starting the process of obtaining required clearances/consents.

In addition to these, other clearances that are needed to be secured from the different department prior to actual implementation of the project are:

- Telephone Department
- Electricity Board
- ~~Groundwater Authority~~
- PWD for State and District Road Crossing
- Railways for ROB
- Other utility organizations e.g. Pipelines of IOC etc

Here, we need to keep in mind that 10,000 sq Km area around Taj Mahal has been notified (17th May, 1999) as Taj Trapezium Zone and Taj Trapezium Zone Pollution (Prevention and Control) Authority has been set up to deal with any environmental issue which is referred to it by the Central Government or the State Government of Uttar Pradesh relating to this area. The geographical limits of the Taj Trapezium Zone have been defined in the shape of a trapezoid between 26 45 N & 77 15'E to 27 45 N & 77 15 E in the West of the Taj Mahal and in the East of Taj Mahal between 27 00' N & 78 30 E to 27 30' N & 78 30 E. Since, last few kilometers of the proposed alignment falls ~~our project area falls~~ in the Taj Trapezium Zone (Area within 24.5 Km from Taj Mahal in the eastwardly direction), it may be referred to the Taj Trapezium Zone Pollution (Prevention and Control) Authority at the time of Environmental Clearance Procedure.

Table 3.1: Clearances/Consents required under Environmental Legislations

Title: Act/Rules	Clearances/Consents Required	Suggested Stage for start	Prime Responsibility
• The Environment (Protection) Act, 1986 • The Environment (Protection) Rules, 1986: The Environmental Impact Assessment Notification, 1994 (amended 2002)	Environmental Clearance Conduct and obtain summary of Public Hearing No Objection Certificate (NOC) from Uttar Pradesh State Pollution Control Board	Design Stage and on completion of Environmental Impact Assessment On Completion of Rapid EIA Report On Completion of Public hearing summary	JIL
• The Water (Prevention and Control of Pollution) Act, 1974/ Rules 1975 • The Air (Prevention and Control) of Pollution Act, 1981/Rules 1980/83	Consent to establish and operate for setting up Hot Mix plant and/ or quarries from UP State Pollution Control Board. (In case leased or hired, to be ensured that the Hot Mix Plant or the Quarries have valid consents)	Completion of DPR and Prior to start of construction	Construction Contractor
• The Explosives Act, 1984/Rules, 1983	License if possession quantity increases as per rule no 114	- DO -	
~~Central Ground Water Authority~~		- DO -	
• UP Irrigation Department	Consent for extraction of Ground water		

3.2 ENVIRONMENTAL LEGISLATIVE NETWORKS AND LIFE CYCLE OF ENVIRONMENTAL CLEARANCE FOR ROAD PROJECT.

3.2.1 Legislative Network

Govt. of India has set up a two tier structure for effective environmental management in India. Ministry of Environment and Forests (MoEF) is the nodal Agency at the Central

Level. MoEF is responsible for planning, policy formulation and according environmental clearances in certain cases of developmental projects. The state Department of Environment & Forests and State Pollution Control Board are the designated agencies to perform the executive responsibilities at state level. There are two separate wings at MoEF. One wing is responsible for environmental clearance and another for Forest clearance. Similarly state also has separate wing for Forest management under the State Department of Environment.

The Following Agencies will be responsible for according different clearances/consents:

Table 3.2: Agencies Responsible for Clearances and Consents

Authority	Clearance/Consent Responsibility
Ministry of Environment & Forests, Delhi	Environmental Clearance
U.P. State Pollution Control Board, Lucknow	Executive Summary of Public Hearings and NOC For Construction Activity only Consent to establish and operate for setting up Hot Mix plant and or a quarries if any new such facilities are created by the contractor in U.P.
Chief Controller of Explosive, Nagpur	For Construction Activity only License for possession of explosives in case quantity exceed than as specified under rule no 114 of The explosive Rules, 1983
Concerned Local/ District Authorities	Permission for cutting the trees along the proposed road

3.2.2 Life Cycle of Environmental Clearance for Road Project.

A block flow diagram for obtaining environmental clearance from conception to clearance has been presented in Fig 3.1

3.3 PROVISION FOR AFFORESTATION COSTS, TIMING FOR PLANTATIONS AND ENVIRONMENTAL AND SAFETY STANDARD NORMS

3.3.1 Provision for Afforestation Costs

Since no forestland shall need to be diverted for the purpose of the project, legislation governing Compensatory Afforestation shall not be applicable. However, to enhance the environmental quality, the project authority has decided to plant trees on either side of the proposed alignment. The detail of roadside plantation is given in Environmental Management Plan.

3.3.2 Timing for Plantations

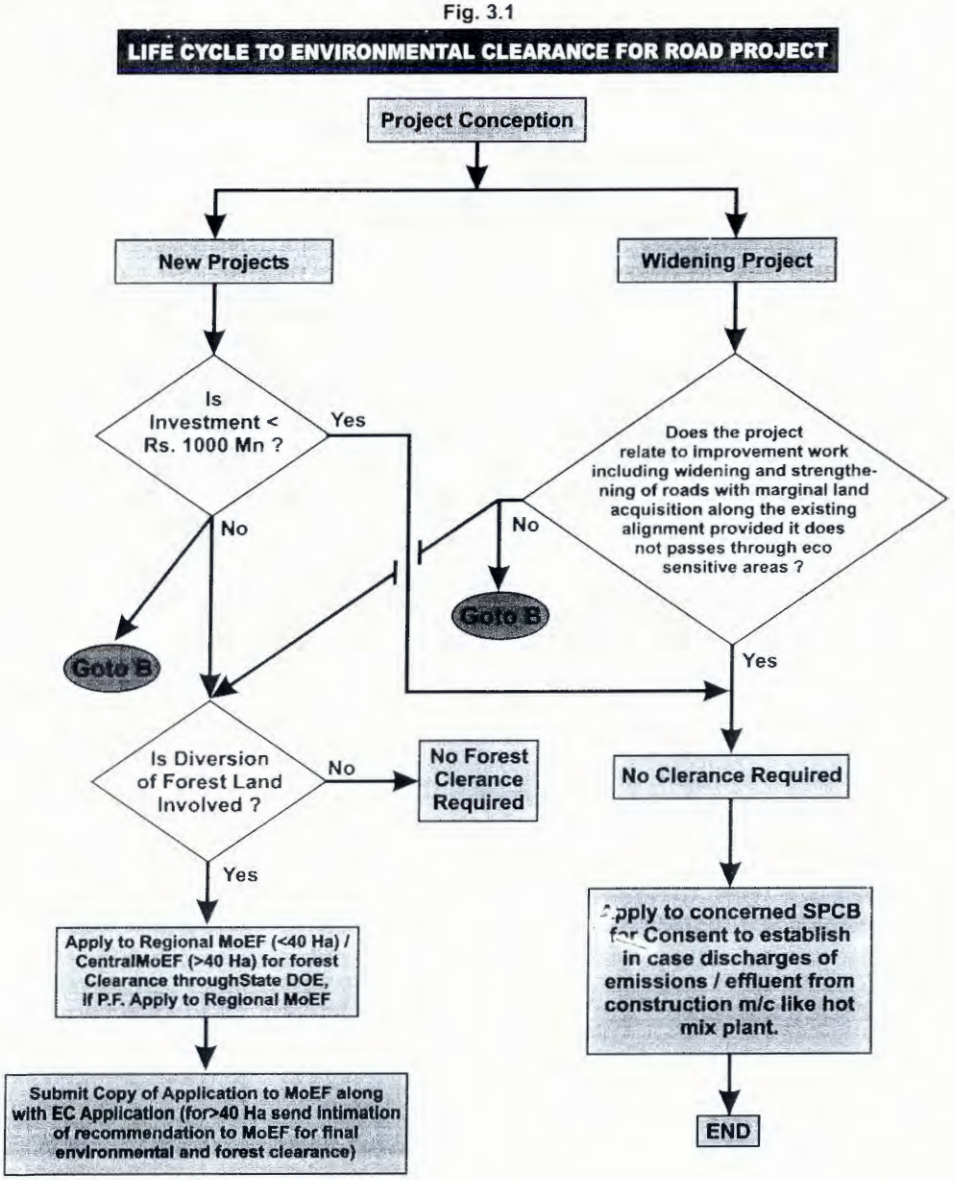
The process of plantation shall begin once the alignment is fixed and major earthworks are completed, or when the area is not required for construction activities.

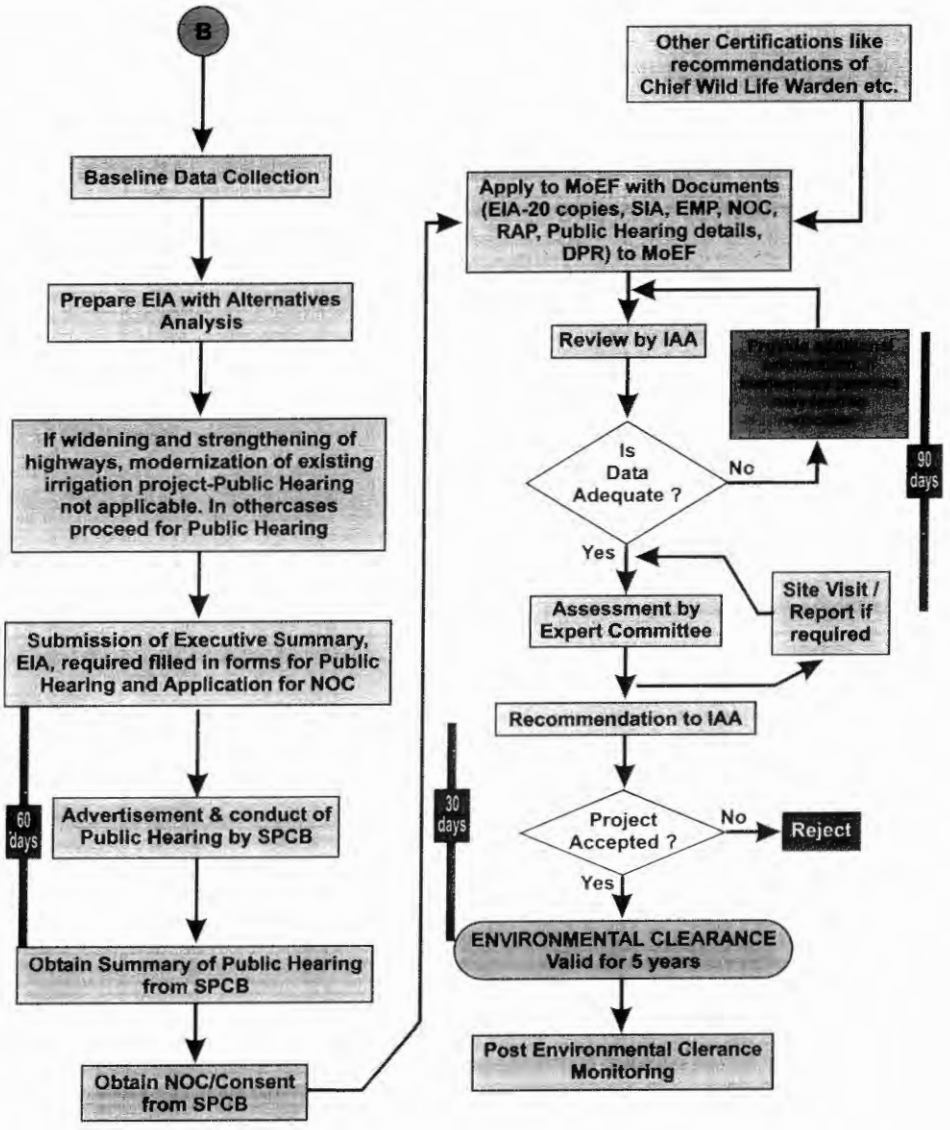
3.3.3 Environmental and Safety Standard Norms

Following road construction standards and guidelines, Indian Roads Congress (IRC) has been referred and used for bringing higher standard of road construction and safety and also integrating environment guidelines defined by IRC.

1. Guidelines for Environmental Impact Assessment of Highway Projects, IRC: 104-1988, MoEF 1989
2. Recommended Practice for Treatment of Embankment slopes for erosion control, IRC: 56-1974.
3. Highway Safety Code, IRC, specified publication no. 44.
4. Recommended Practice for Use and Upkeep of Equipment, Tools and Appliances for Bituminous Pavement Construction, IRC: 72-1978.

Fig. 3.1


LIFE CYCLE TO ENVIRONMENTAL CLEARANCE FOR ROAD PROJECT
Project Conception
New Projects
Widening Project
Is Investment < Rs. 1000 Mn ?
Yes
No
Goto B
Does the project relate to improvement work including widening and strengthe-ning of roads with marginal land acquisition along the existing alignment provided it does not passes through eco sensitive areas ?
No
Goto B
Yes
Is Diversion of Forest Land Involved ?
No
No Forest Clerance Required
Yes
No Clerance Required
Apply to Regional MoEF (<40 Ha) / CentralMoEF (>40 Ha) for forest Clearance throughState DOE, if P.F. Apply to Regional MoEF
Apply to concerned SPCB for Consent to establish in case discharges of emissions / effluent from construction m/c like hot mix plant.
Submit Copy of Application to MoEF along with EC Application (for>40 Ha send Intimation of recommendation to MoEF for final environmental and forest clearance)
END


B
Baseline Data Collection
Prepare EIA with Alternatives Analysis
If widening and strengthening of highways, modernization of existing irrigation project-Public Hearing not applicable. In othercases proceed for Public Hearing
Submission of Executive Summary, EIA, required filled in forms for Public Hearing and Application for NOC
60 days
Advertisement & conduct of Public Hearing by SPCB
Obtain Summary of Public Hearing from SPCB
Obtain NOC/Consent from SPCB
Other Certifications like recommendations of Chief Wild Life Warden etc.
Apply to MoEF with Documents (EIA-20 copies, SIA, EMP, NOC, RAP, Public Hearing details, DPR) to MoEF
Review by IAA
Is Data Adequate ?
No
90 days
Yes
Site Visit / Report if required
Assessment by Expert Committee
Recommendation to IAA
30 days
Project Accepted ?
No
Reject
Yes
ENVIRONMENTAL CLEARANCE Valid for 5 years
Post Environmental Clerance Monitoring

Chapter - 3 ENVIRONMENTAL REGULATORY FRAMEWORK 3-1
3.0 BACKGROUND 3-1
3.1 REGULATORY APPLICABILITY AND CLEARANCES/ CONSENTS REQUIREMENTS 3-1
3.1.1 Exclusions: 3-1
3.1.2 Applicability 3-23-23-1
Applicable for construction Activity only 3-2
Clearances/consents requirements for project 3-2
Table 3.1: Clearances/Consents required under Environmental Legislations 3-3
3.2 ENVIRONMENTAL LEGISLATIVE NETWORKS AND LIFE CYCLE OF ENVIRONMENTAL CLEARANCE FOR ROAD PROJECT 3-3
3.2.1 Legislative Network 3-3
Table 3.2: Agencies Responsible for Clearances and Consents 3-4
3.2.2 Life Cycle of Environmental Clearance for Road Project 3-4
3.3 PROVISION FOR AFFORESTATION COSTS, TIMING FOR PLANTATIONS AND ENVIRONMENTAL AND SAFETY STANDARD NORMS 3-4
3.3.1 Provision for Afforestation Costs 3-4
3.3.2 Timing for Plantations 3-4
3.3.3 Environmental and Safety Standard Norms 3-53-53-1

CHAPTER - 4 METHODOLOGY

4.0 INTRODUCTION

Environmental screening is undertaken in parallel with the Social, Economic and Engineering Analysis in order to determine any significant economic, social or environmental issues which would require further analysis (including the analysis of alternative alignments) to resolve such issues. The preliminary inventory of critical natural habitats (e.g. national parks, wildlife reserves, sanctuaries, sacred groves, protected areas, forests, water bodies etc.), major rivers and waterways, recorded cultural heritage sites and any other potentially sensitive areas was undertaken using data based on recent GOI census data, information from local people and site visits. The results of this analysis helped to identify any major conflicts with proposed road project. The nature and extent of such conflicts and recommendations concerning how to resolve them (including recommendation for exclusion, analysis of alternative alignment and/or mitigation) have been proposed as a precursor to preliminary engineering design. The screening exercise also identified issues requiring detailed Environmental Impact Assessment.

4.1 PUBLIC CONSULTATION

Besides consultation with local concerned authorities, public consultations were held jointly for environmental and social impacts. These public consultations were used to collect public opinions whether this project represented effective project planning and implementation. As part of the Environmental Clearance procedure, formal Public hearing shall be organized by the UP State Pollution Control Board at each Districts through which the road will be passing.

4.2 ENVIRONMENTAL SURVEY

An environmental screening survey of the proposed expressway was conducted with the help of investigators, who were selected from the field of social sciences, ecology, environmental science and technology. They worked in a team and were given specific areas of responsibility. The environmental experts carried out the supervision. The investigators used checklists and questionnaires as their tool for obtaining information from the relevant areas. Primary survey has been conducted within 50m on either side from the centerline of the proposed alignment. The secondary survey, using toposheet and other secondary data, has been conducted for a 10 Km wide strip along the proposed alignment, taking 5 Km on either side of the road.

4.3 TESTING AND MONITORING

Testing and Monitoring of Environmental parameters have been done, as per the guidelines issued by MoEF, GOI – Different Environmental parameters have been monitored as per standard methods. The sampling locations had been selected based on the location of important receptors (health care facilities, educational institutes, cultural and religious places, settlements, forests, water bodies, etc.). To understand the impact of future traffic on the air and noise quality, monitoring on existing NH 2 running parallel to the project expressway have been carried out. The details of sampling criteria have been furnished in the relevant sections of the **Chapter 5: Existing Environmental Scenario**.

4.4 COLLECTION OF SECONDARY DATA

For environmental assessment different types of data were collected from various sources. Some of the important data and possible sources for them are tabulated below:

TABLE 4.1 Summary of Secondary Data and Sources

BROAD ENV.PARAMETER	AREAS OF ENQUIRY	INFORMATION SOURCES
CULTURAL VALUE	Conservation areas if any, Archeological Building	From Archeological survey o India/discussion with loca community
FOREST legal status types density	Conservation of forest area, protection of endangered animal & any other species, including migration routes, if any	Dept. of Forest – Uttar Pradesh World Wildlife Foundation, India Discussion with local community and local Forest Chauki
SETTLEMENTS on the ROW within 50m on either side of the proposed alignment	Settlements & its population along the stretch. Its location & numbers, available community facilities, etc.	Census 1991 & 2001 Topographic sheet and detaile survey for location
DRAINAGE/ FLOODING	Existing drainage map and flooding level including its extent of water spread Identification of drainage channel and its catchment area around the project site	Toposheet/Hydrology study/River control authority in the states. State Irrigation departments Data from hydrological survey. Local peoples' experience about flood level to be obtained at field visit.
SOIL & GEOLOGY	Identification of soil type, its stability, potential for soil erosion	Geotechnical group identifyin potential of erosion on the basi of soil characteristics
AGRICULTURE/ FARM PRODUCTION	Type of crops/ its production intensity and yield changes in crop pattern	Agricultural Dept. Field survey and discussion with loca people and local expert
AIR POLLUTION	Existing traffic characteristic speed of the traffic movement in the stages	Traffic data, State Pollutio Control Board data, Fiel testing
NOISE LEVEL	Existing noise level	Traffic data/Conducting fiel test
WATER QUALITY (Surface and Ground)	Identification of water bodies/canal/drainage channels where the run off surface water will flow/due to erosion and also due to spillage of oil and other hazardous materials	Topography sheets/field study Hydrological data from the Survey Water quality test
TREES AND VEGETATION COVER	Identification of existing tree species and its location, number, CBH, abundance, local name, economic importance, etc	Forest Dept. and field survey
TRAFFIC VOLUME	Future Traffic forecast	From Traffic Engineer
SLOPES	Direction of slope Percentage of slope	Contour Survey Topographic sheet
LAND COVER AND LANDSCAPE	Landscape elements	Landscape & Land from survey

4.5 COMPILATION OF DATA

All data collected by Environmental Survey team for the project area are presented in Strip Maps of the road. These data included the location and number of trees, public utilities, commercial establishments, wetlands (ponds & tanks) and places of religious importance. Emphasis was placed on identifying all such features within the project's proposed Right of Way (RoW).

4.6 IDENTIFICATION AND ASSESSMENT OF VALUED ECOSYSTEM COMPONENTS

Assessment of impact helps decide appropriate management planning to minimize the negative environmental impacts and strengthen the positive outcomes. It also helps in selecting the alignments with minimum social and environmental disturbances.

Using the compiled information and public consultations, the Valued Ecosystem Components (VECs) of the project area have been identified.

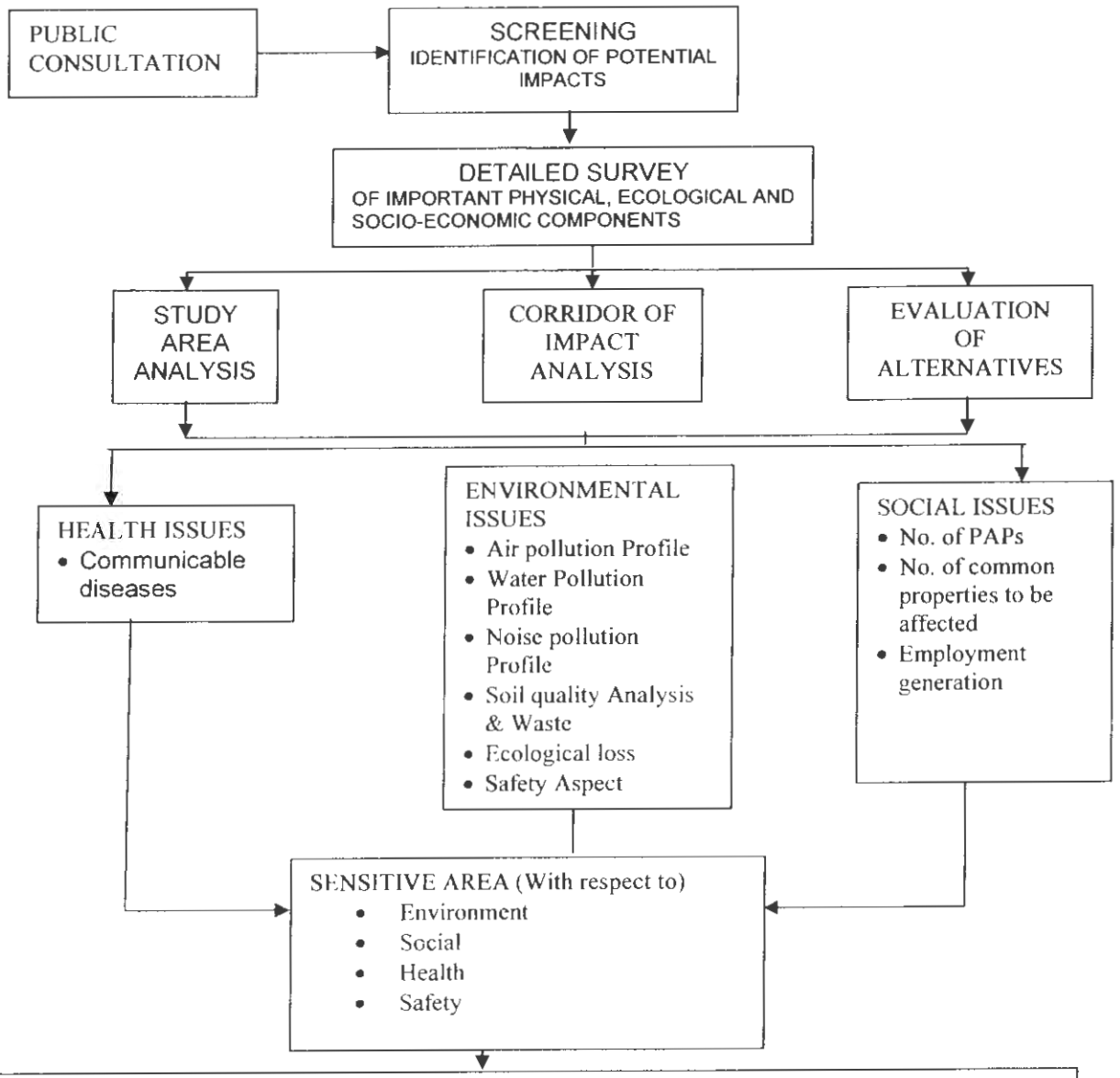
Analysis of compiled data has been carried out to assess the impact during various phases of project lifecycle on identified VECs. Qualitative prediction of future environmental conditions as a result of this project has also been done.

4.7 ENVIRONMENTAL MANAGEMENT PLANNING

The environmental management plan (EMP) includes mitigative measures to eliminate or minimize the potential negative impacts as well as measures to enhance benefits of the project. The EMP delineates measures to be taken along with responsibility, time and cost involved. In addition to mitigative measures, EMP also contains the compliance monitoring requirements to be undertaken during construction and post-construction phases of the project, as well as effects monitoring used to assess the extent and effectiveness of mitigative measures defined in the EMP. EMP also includes the requirement of institutional strengthening.

4.8 METHODOLOGY IN SEQUENCE

With the help of the following flow chart the sequence of the methodology has been depicted.



- ANALYSIS OF POTENTIAL IMPACTS
  - MAGNITUDE AND DURATION OF IMPACTS ON PHYSICAL (AIR, WATER ETC.), NATURAL AND SOCIAL ENVIRONMENT. PRIORITIZING & RANKING ON THE BASIS OF IMPORTANCE OF THE IMPACT.
- DEVELOPING AND SELECTING ALTERNATIVE
  - WITH OR WITHOUT THE PROJECT – CONSULTATIONS WITH AFFECTED PEOPLE
- SELECTION OF MOST SUITABLE ALIGNMENT
- MITIGATION MEASURES & MANAGEMENT PLAN
  - LESSENING OF NEGATIVE IMPACTS THROUGH CHANGES IN THE DESIGN, CONSTRUCTION PRACTICES MAINTENANCE AND OPERATION OF THE CORRIDOR. ANY ADDITIONAL ACTIONS REQUIRED TO PROTECT THE BIOPHYSICAL AND SOCIAL ENVIRONMENT, AS WELL AS INDIVIDUALS IMPACTED ADVERSELY BY THE PROJECT – PUBLIC INVOLVEMENT
- MONITORING AND EVALUATION
  - FOR EFFECTIVE IMPLEMENTATION IN COORDINATION WITH ENGINEERING CONSTRUCTION PRACTICES – SPECIFICATIONS OF IRC ETC.

Chapter - 4 METHODOLOGY 4-1
4.0 INTRODUCTION 4-1
4.1 PUBLIC CONSULTATION 4-1
4.2 ENVIRONMENTAL SURVEY 4-1
4.3 TESTING AND MONITORING 4-2
4.4 COLLECTION OF SECONDARY DATA 4-2
TABLE 4.1 Summary of Secondary Data and Sources 4-3
4.5 COMPILATION OF DATA 4-4
4.6 IDENTIFICATION AND ASSESSMENT OF VALUED ECOSYSTEM COMPONENTS 4-4
4.7 ENVIRONMENTAL MANAGEMENT PLANNING 4-4
4.8 METHODOLOGY IN SEQUENCE 4-4

CHAPTER - 5 EXISTING ENVIRONMENTAL SCENARIO

5.0 INTRODUCTION

The project strip is located in Uttar Pradesh, and more specifically Gautam Buddha Nagar, Aligarh, Mathura, and Agra Districts of Uttar Pradesh. The existing environmental conditions viz. climate, soil, etc. along the project strip are almost homogeneous.

Existing environmental status can be depicted with the help of following baseline condition as described below:

5.1 NATURAL ENVIRONMENTAL SETTING OF THE PROJECT STRIP

5.1.1 Climate

The temperature in the project area varies between 44^{O}C in summer and 1.5^{O}C in winter. The district wise variation with respect to temperature is furnished below:

Rainfall and Temperature in the Project Area

District	Rainfall (in mm)		Temperature (in ^{O}C)	
	Normal	*Actual ('01-'02)*	*Max.*	*Min.*
Aligarh	902	855	48.0	2.0
Mathura	820	867	45.4	1.4
Agra	951	1004	46.2	0.5

The rainfall caused by the South Easterly monsoon reaches the area in July, and extends till mid-September. During this period, the monsoon rainfall contributes more than 80% of the annual rainfall. The average annual rainfall around the project area is 900 mm. However, there is a wide variation from year to year. In some years, rainfall less than 80% of the normal has been recorded. An unusually high rainfall (211% of the average normal rainfall) has been recorded in 1971.

The average rainfall along the alignment is 800 to 1000 mm per year with peak rainfall in July month.

In summer, which is the driest part of the year, afternoon humidity in the area may be as low as 20%. The air is generally dry throughout the year, except during the monsoon seasons when the relative humidity is over 70%.

5.2 PHYSICAL SETTING

5.2.1 Physiography

The state can be divided into four physiographic regions: (1) the Himalayan region, (2) the submontane region between the Himalayas and the plains, (3) the central plains of the Ganges Rivers and its tributaries (part of the Indo-Gangetic Plain), and (4) the southern uplands.

The whole alignment passes through flat terrain. The RL varies from 165 m to 205 m with gentle slope from North-East to South-West. The project area is part of the Indo-Gangetic Plain with average height, 175m ahove MSL.

5.2.1.1 Drainage

Generally highways which cross surface drainage tracks act as long embankments and are likely to modify the natural flow of surface water. The effects are often felt beyond the immediate vicinity. The environmental assessment looked at the overall implication of the macro drainage condition of the region specifically impacted by the 165 Km long project highway. An assessment of local drainage condition along this route was completed.

The Project road runs parallel to the Yamuna River and comes closer at few locations. A number of Nallahs in the catchment area of Yamuna River cross the Project Expressway. The project area is drained by a large number of canals and distributaries. The proposed highway intersects 20 Nallahs and 23 canals.

5.2.1.2 Cross Drainage Structures

Since the vertical alignment of project strips are on an average between 1.5 to 2.0 m above grade, the existing highway would, in the absence of proper cross drainage facilities, obstruct natural surface drainage of the area. The baseline survey indicated that a number of cross-drainage structure would be required to prevent hindrances to surface runoff along any stretch of the highway.

An appropriate engineering design will resolve this problem sufficiently enough to maintain the existing level of natural flow even at a highest flood level.

5.2.2 Geology

The entire area is composed of alluvium of the Gangetic plain with small patches of Dolomite/ Alwar group of rocks. The Kanker and Nodular limestone are common along the Yamnua ravines. Water to the wells is brakish in nature with 52% salinity.

The majority of the area along the alignment is covered by unconsolidated sedimentary rock mainly composed of alluvium. Wherever alkaline/saline patches are developed, reh soils are also present. The vast alluvial and sandy tracts of recent to sub-recent age occupy the greater part of the Gurgaon district and south of Delhi. The quartzite is predominant hard rocks, which

are trending NNE-SSW to NW-SW directions. The area of Delhi-Gurgaon is surrounded in North by Indo- Gangetic plains, in West by the Great Indian Desert.

Delhi-Gurgaon region can be divided into five main geomorphic units; (i) The recent flood plains of River Yamuna., (ii) Delhi ridge, (iii) Alluvial plain west of ridge, (iv) Alluvial plain east of ridge, and (v) Alluvial basin in Chattarpur in South Delhi. The quartzite system of Delhi rocks encountered in the area is massive, compact and hard. These quartzite are intruded by Pegmatite. The alluvial sediments are known to be underlain by harder formations of Delhi system of rocks.

The proposed alignment falls in Yamuna River basin comprising of newer alluvium made up of fine to medium sands, silt, gravel, clay and kankars (calcareous nodules). These deposits have high porosity and permeability, with ready water absorbing capability. The alluvial plain in the area is almost flat and is interrupted by clusters of sand dunes and quartzite out crops. Sand dunes in the western parts are predominantly aligned in the NNE-SSW direction.

The proposed alignment passes through major part of Mathura district which is a part of the southern Gangetic plain, according the scheme of the regional division, covering an area of the 3,811 km^2. It is bound by the Aligarh in the northeast, Gurgaon (Haryana) in the northwest, Agra in the South and in the west by the Bharatpur (Rajsthan). It is more or less a plain except an imperfect crescent, the horns looking up towards the northeast. Geologically, the Mathura district forms the part of the Indo-Gangetic alluvium, which consists of sands, clay, kankar and reh. Sandstone is also available on the western border of the Govardhan.

On the basis of geology, soils, topography, climate and natural vegetation, the area falling in Aligarh, Mathura and Agra districts can be divided into three regional divisions, as below:

Nandgaon Govrdhan Plains

The region is situated in western part of the district comprising the major part of Chhata and Mathura tehsils. The eastern limit of region runs parallel to Yamuna river. The general slope of tract is from north to south. This region does not cover the proposed alignment.

Yamuna Khadar

In Aligarh district, the region is situated along the Yamuna River in a narrow strip. It is a flat plain sloping towards the south. The Yamu,na River forms its western boundary but the impact of this river on the physiography is insignificant. There are very few dry streams and shallow depressions, which retain water during the dry months also. Some traces of the left course of Yamuna may also be seen in this region. The geology of the region belongs to the Alluvium Dun Gravels (recent). Canals are absent and the villages are of comparatively larger size.

In Mathura district, it loops both side of the river Yamuna, and cover major part of the proposed alignment. The area covers Chhata, Mathura, Mat and Sadabad tehsils. The Yamuna

River is the master stream, which flows from the center of Mathura district. The slope direction and other physical features are controlled by this river. There are number of meanders, dead arms of the river, shallow depression all along the river Yamuna. Nohjhil Khadar is large natural lake located in the North. Since the physical characteristics are directly linked with Yamuna River, cultural features are not exception of this fact. The geology of the region is composed of Alluvium and Dun Gravels (recent). Gokul, Mahaban and Farah are the important places of the region. Gokul city has the religious importance.

In Agra district, the region is situated to the parallel of Yamuna River on both the sides. The average width of this tract is approximately 10 to I5krn. The slope is according to the flow direction of Yamuna River. The geology of the region belongs to the Alluvium Dun Gravels (recent).

Sadabad Plains

It is a flat plain extended from north to south in the eastern part of Mathura district. This region covers the major part of the Sadabad and half of the Mat tehsils. The slope is towards south. There is no significant stream flowing in this tract. Numbers of unsurveyed knobs are spread over in most part of the region. Its frequency is comparatively higher' in northern part than in the southern part. The Ganga canal system irrigates the region which is comparatively developed in agriculture. The geology of the region belongs to the Alluvium and Dun gravels (Recent).

Agra Plains

Agra plain, which derives its name from Agra city, is situated in the central part of Agra district. It covers the largest area (2036.51 km^2) of the district. It is a flat, plain sloping towards south east direction. Except a few rivulets, the area is completely devoid of any major stream. A few unsurveyed rocky knobs are located nearby Achhera town. An Agra canal network serves the area, which is developed in agricultural production. The geology of the region belongs to the Alluvium Dun gravels (recent).

The Expressway mainly passes through agriculture Khadar land.

5.2.3 Soils

About two-thirds of the area of Uttar Pradesh is covered by a deep layer of alluvium spread by the slow-moving rivers of the Ganges system. These extremely fertile alluvial soils range from sandy to clayey earth. The soils in the southern part of the state are generally mixed red and black or red-to-yellow. In the Himalayan and submontane regions, the soils range from gravelly to rich clayey and are mixed with fine sand and humus, producing thick growth of forests in some areas.

Soil in the Project Area:

Near Noida along the Yamuna River Udifluvents (younger alluvial soils) is present. Along the proposed expressway, major area is covered by Hapquents (older alluvial soil). There are some alkaline/saline soils observed between Yamuna and Upper Ganga Canal agricultural region. About 80% of the area is covered by older alluvial soil. The soil map of the area is shown in **Figure 2.1.**

The area adjacent to proposed expressway has the distinction of having all types of soil, right from clay to sand. They are classified in to the heavy and hard clay, clay loam, sand loam and sandy. The soil predominant along the alignment is sandy loam partly mixed with clay. The main suborder association of soils, as delineated are *Aquents-Fluvents, Ochrept -Psamments and, Ochrept - Aquept - Ustalfs.* The main soil suborder association along the proposed alignment in Aligarh district is *Aquents -Fluvent,* in Mathura district *Ochrept -Psamments, Aquents-Fluvents and Ustalfs,* and in Agra district *Aquents -Fluvent.*

5.2.3.1 Location of Sampling Site

As part of the environmental data generation for the Rapid Environmental Impact Assessment study, soil samples were collected from the study area during the month of March, 2003 to understand the physico-chemical characteristics of the soils. Samples were collected from three sites at a depth of 0 to 30 cm from the land surface. The details of the location of sampling points are given in Table 5-1 .

Table 5.1: Location of Soil Sampling Sites

Chainage	Location	Present Landuse
Km 65	Bajna	Agricultural Land
Km 153	Khandauli	Settlement Land
Km 162	Near Agra Reserve Forest	Forest Land

Though Agra Reserve Forest is at a distance of more than 500m from the proposed alignment soil sampling was conducted at this location to find out the present status. Future monitoring at this location will help establish the impact on the soil due to this project.

5.2.3.2 Physico-chemical Characteristics

The samples were analysed according to the methods described by IARI, New Delhi and Jackson (1973).

In general, soils are slightly alkaline. The pH of the sampled soils range from 6.96 to 8.58. Silt is the dominant mechanical components in the samples. Almost all the soils have loamy texture with the soils near the reserve forest exhibiting transitional characteristics (sandy loam).

Sampled soils show reasonable amount of organic content. Bulk density of the soils found in the project strip varies from 1.21 to 1.37 g/cc. Among the soil samples, the moisture content is found highest (4.95%) at the settlement area of Khandauli, while the lowest (0.26%) was at

Bajna. However, the water holding capacity was found highest (43.5%) at reserve forest and least (35.0%) at Bajna. The details of the physico-chemical characteristics are furnished below:

Figure 5.1: Soil Profile in the Project Area

Table 5.2: Physico-Chemical Characteristics of Soil Along the Project Strips

S.No.	Parameters	Bajna	Khandauli	Reserve Forest
1	Color	Brown	Brown	Brown
2	pH	6.96	8.42	8.58
3	Conductivity (µmhos/cm)	80	200	300
4	Moisture Content (%)	0.26	4.95	3.42
5	Water Holding Capacity (%)	35	42.5	43.5
6	Bulk density (gm/cm^3)	1.37	1.21	1.29
7	Chlorides (mg/kg)	50	175.2	125.1
8	Carbonates (mg/kg)	ND	ND	ND
9	Bicarbonates (mg/kg)	122	305	274.5
10	Organic Carbon (mg/kg)	5655	3803	975
11	Cation Exchange Capacity, meg/100g	43.6	34.8	38.5
12	Texture	Loamy	Loamy	Sandy Loam
13	Nitrogen (in ppm)	13	11	9
14	Potassium (in ppm)	0.05	0.03	0.01
15	Phosphorus (in ppm)	6	5	2

Standard Physico-chemical, Nutrient and Heavy Metal Status of Normal Agricultural Soil are furnished at **Annexure .5.1**. On comparison with the standard, the Nitrogen content in the sampled soil is found to be low, the Potassium content is very low and that of phosphorous is in general moderate.

Therefore, it is evident that the sampled soils are moderately fertile. However, because of moisture content and water holding capacity, this type of soil would respond favourably to soil management practices.

5.2.4 Quarries and Rock Crushers

Field visits were undertaken to study the characteristics like location, quantum of material available for mining, space availability for installation of machinery and storage, etc. Quarries that they are either operating legally and located in environmentally safe areas and are located on existing haul-roads at a minimum distance from the work sites have been selected. No quarries or crushers located within 500m of the forest area have been selected. The detailed list of sources for Stone Aggregate, identified for this project along with their location has been given in **Annexure.5.2**. The detailed raw material requirements are also furnished in the annexure.

5.2.5 Borrow Pits

The investigation was aimed at locating the potential borrow areas for sub-grade / embankment fill and granular sub-base along the strip of the project road within economic haulage distances. Reconnaissance was carried out on both sides of the project road to identify suitable locations

for borrowing earth. The area all along the project road is used for cultivation. To avoid borrowing of earth from productive lands, the following guidelines shall be followed. The following criteria have been used for deciding the amounts that can be borrowed .They are as follows:

- Borrow areas should not be located on cultivable lands. However, if it becomes necessary to borrow earth from temporarily acquired cultivated lands, their depth should not exceed 45cm. The topsoil to a depth of 15cm shall be stripped and set aside. Thereafter, soil may be dug out to a further depth not exceeding 30cm and used in forming the embankment.
- Borrow pit shall be selected from wasteland at least 500m away from the road;
  - From humps above the general ground level within the road land;
  - By excavating/enlarging existing tanks;
  - From land acquired temporarily and located at least 500m away from the road;
  - From mounds resulting from the digging of well and lowering of agricultural fields in vicinity of the road.
- In case of settlements, borrow pit shall not be selected within a distance 800m from towns or villages. If unavoidable, earth excavation shall not exceed 30cm in depth.
- The haulage distance from site should not be too far.

Since the project road strip has homogeneous soil in nature, it is proposed that at a distance of every 10km one borrow area will be selected. The details of the above borrow areas and their locations have been furnished in **Annexure .5.3**.

5.3 LAND USE PATTERN

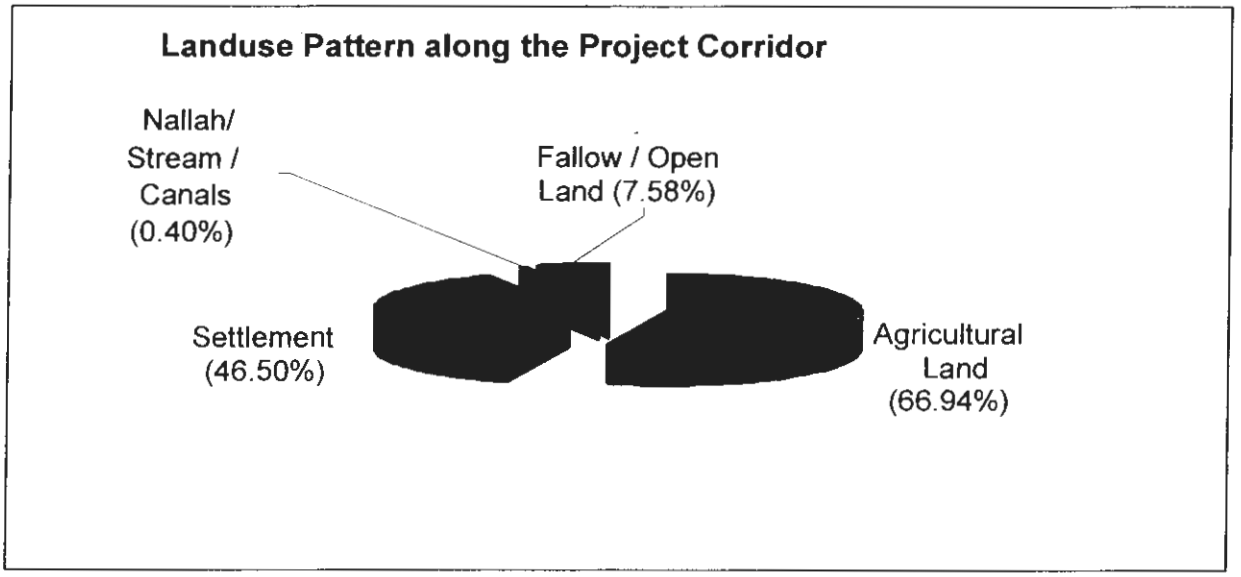
Environmental Survey of the strip, along the proposed alignment as well as within the study area (i.e. 5 Km on either side of the road), shows that the land use can be categorised as:

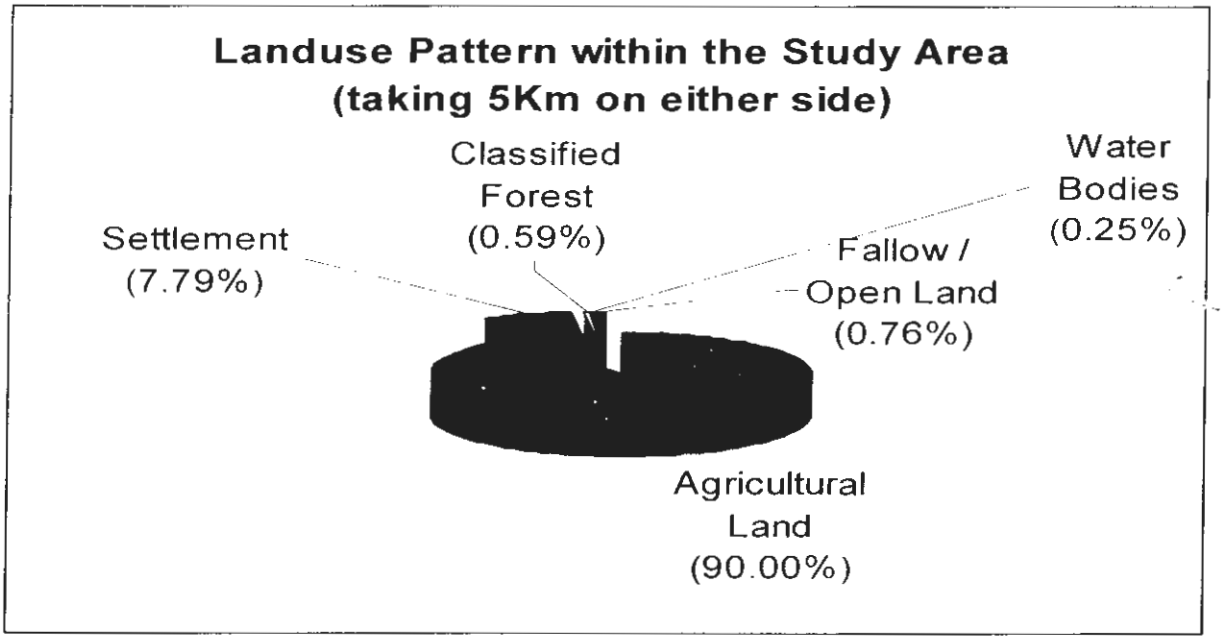
i) Classified forest
ii) Agricultural land
iii) Settlement area
iv) Open area / fallow land; and
v) Water bodies (river, stream, canal, pond, lake, etc.)

The entire project area passes through plain terrain with not much ups and downs. However, there are places like Buakpur (Km 76), where the proposed alignment is passing through the low lying areas of Yamuna and its tributaries. Ravines are also found to be present along the alignment in places like Khandera (Km 126) and Sarai Salbahan (Km 139). At Km 100 near Bhim village, the alignment is passing through a Swamp, about 500m away from the Yamuna, across Brindaban. No forestland has been found on the proposed alignment. Nearest forestland found along the alignment is in Agra; Agra Reserve Forest (almost at a distance of 500m), the other reserve forest found to be in near distance is Barauth reserve forest (Near Km 76, almost at a distance of 4 Km).

Out of the total 164.775 Km, 110.3 Km stretch of the proposed alignment passes through Agricultural lands and the rest passes through primarily settlements. Along Upper Ganga

Canal, small patches of rough grazing are seen. Before Mathura along River Yamuna, uncultivable patches are also found. Almost 90% of the total area is cultivated, of which 69% area is irrigated.





5.4 WATER RESOURCES

Water resources can be classified in two broad categories: Surface water and ground water. The following sections have elaborated on the available water resources.

5.4.1 Surface Water Resources

Uttar Pradesh

The state is well drained by a number of rivers originating in either the Himalayas to the north or the Vindhya Range to the south. The perpetual snows of the Himalayas feed the Ganges and its main tributaries the Yamuna, the Ramganga, the Gomti, the Ghaghara, and the Gandak. The Chambal, the Betwa and the Ken, originating from the Vindhya Range, drain the southwestern part of the state before joining the Yamuna. The Son, also originating in the Vindhya Range, drains the southeastern part of the state and joins the Ganges beyond the state borders in Bihar.

Project Area

The proposed Expressway runs between Yamuna River and Mat Branch (Ganga Canal). The proposed alignment is crossed by several distributaries of Yamuna River, Mat Branch and their Minors. The area has a very good drainage system. The region is effectively irrigated by surface water and ground water through wells. The drainage of the region is that of typical arid and semiarid nature. During the rainy season, the water collects in the natural depressions, particularly in the central hilly region. Very little land gets affected by water logging and is reclaimed by adopting suitable reclamation measures.

Since, the Project road runs almost parallel to the Yamuna River and comes closer at a few locations, a large number of Nallah in the catchment area of Yamuna River crosses the Project Expressway.

The study area has only few bound water bodies in the form of fish ponds. Noted amongst them is the one located at Km 45.60, between Sarol Village and Tappal.

Table 5.3: Water Bodies Along The Project Strip:
Type – Nallah

Sl. No.	Location (Km)	Description
01.	3.80	Nallah
02.	5.85	Lohia Nallah
03.	8.75	Lohia Nallah
04.	11.52	Bhuria Nallah
05.	17.90	Nallah
06.	17.97	Nallah
07.	45.46	Nallah
08.	67.60	Patwaha Nallah
09.	68.84	Bhuria Nallah
10.	73.06	Nallah
11.	74.55	Nallah
12.	75.64	Nallah
13.	77.01	Nallah
14.	91.05	Bulandpur Drain
15.	111.00	Mahaban Drain
16.	116.68	Alipur Drain
17.	126.97	Nallah
18.	139.42	Nallah
19.	144.84	Nallah
20.	160.82	Nadi & Nallah

Type – Canal Pattern Network

Sl. No.	Location (Km)	Description
01.	21.11	Runija minor
02.	30.05	Diyantpur minor
03.	34.43	Siwara minor
04.	40.20	Gopalgarh minor
05.	55.41	Untasani minor
06.	59.54	Gairaula minor
07.	66.19	Kalana minor
08.	70.19	Parsauli minor
09.	71.94	Sikanderpur minor
10.	79.50	Surir minor
11.	85.45	Khanwal minor
12.	87.93	Jarva distributory
13.	93.49	Bhadarvan minor
14.	93.88	Mat minor
15.	98.83	Mat minor
16.	108.00	Daharwa minor
17.	109.84	Mahaban distributory
18.	113.62	Sihora minor
19.	123.22	Karab minor
20.	129.13	Angai minor
21.	134.14	Garsauli minor
22.	152.59	Daghela distributory
23.	155.08	Khandauli distributory

Type – Fish Pond

Sl. No.	Location (Km)	Description
01.	Km 45.60	between Sarol Village and Tappal

Before the sampling results are presented and discussed, let's find out what are the applicable standards for the surface water resources.

5.4.1.1 National Surface Water Quality Standards

Water quality objectives for freshwaters takes into account various major uses to which the water is put like irrigation, bathing and for drinking. The water resources can be classified or zoned depending upon designated best use of the water. The Central Pollution Control Board along with the State Pollution Control Boards has classified zoning of water bodies as follows:

A. Drinking water sources without conventional treatment but after disinfecting
B. Outdoor Bathing (organized)
C. Drinking water source with conventional treatment followed by disinfecting
D. Propagation of wildlife, fisheries
E. Irrigation, industrial cooling, controlled waste disposal

The detailed standards are given in **Annexure 5.4**.

5.4.1.2 Surface Water Sampling Locations

Altogether 5 number of water samples (with 2 replications) have been collected from the project area. The sampling locations have been selected in such a way that they represent the water quality of all the major water sources found along the project highway. The criteria used in selecting sampling locations are given below:

- All the major flowing water bodies crossing the project strips
- All the major bound water bodies along the project strip that are within the proposed ROW (50m from the proposed centerline)
- Sampling points are well distributed

Table 5.4: List of Surface Water Sampling Locations

Location	Chainage (km)
Lohia Nallah	5.85
Fish Pond Between Sarol and Tappal	45.60
Patwaha Nallah	67.60
Swamp near village Bhim	100.00
A small local stream	160.82

5.4.1.3 Surface Water Quality

Water quality can be expressed in terms of physical, chemical and biological characteristics of water. Because of steady rainfall, the water bodies are generally filled. No regular monitoring has been undertaken by the concerned authorities for water quality of existing water bodies in the project.

The surface water samples have been analysed as per MoEF Guideline for indicators of organic pollution, physical, chemical and bacteriological parameters and mineral constituents. In addition to conventional water quality monitoring, biological monitoring to assess the water quality has also been conducted.

Relevant Surface Water Quality Standards are presented in **Annexure 5.4.**

Table 5.5: Analytical Results of Surface Water Quality

S.No.	Parameters	Lohia Nallah	Fish Pond	Patwaha Nallah	Water from Swamp	A small stream
1.	Color	Slightly yellow	Grayish	Slightly yellow	Slightly yellow	Slightly yellow
2.	PH	7.6	7.5	7.5	7.5	7.3
3.	Conductivity (µmhos/cm)	475	410	350	2000	330
4.	Total Hardness, mg/l as $CaCO_3$	130	100	90	280	85

S.No.	Parameters	Lohia Nallah	Fish Pond	Patwaha Nallah	Water from Swamp	A small stream
5.	Calcium, mg/l	80.3	18	32	104	28
6.	Magnesium, mg/l	27.1	13.4	24	2.4	30
7.	Chloride, mg/l as Cl	38	30	20	320	18
8.	Total Alkalinity, mg/l	185	120	150	240	140
9.	Sulphate, mg/l	48.7	11	33.3	325.9	35.7
10	Flouride, mg/l as F	0.8	0.3	0.6	0.4	0.7
11	Nitrate, mg/l as NO_3	2.6	8	3	2	2.2
12	Iron, mg/l as Fe	1.9	0.04	1.8	0.9	1.9
13	Dissolved Solids, mg/l	287	255	260	1545	238
14	Suspended solids, mg/l	30	26	38	18	21
15	Lead as Pb, mg/l	0.07	0.02	0.12	0.08	0.10
16	Arsenic, as As, mg/l	NT	NT	NT	NT	NT
17	Boron as B, mg/l	0.11	0.02	0.14	0.18	0.12
18	Total Chromium as Cr mg/l	0.22	0.01	0.13	0.06	0.09
19	Manganese as Mn, mg/l	0.46	NT	0.54	0.1	0.61
20	Phenol, mg/l	0.50	0.01	0.30	NT	0.28
21	Oil and grease, mg/l	4.8	0.4	5.8	NT	5.6
22	BOD, mg/l	34	22	38	16	41
23	COD, mg/l	82	38	65	26	70
24	Total Coliform, MPN/100ml	345	45	360	400	356
25	Faecal Coliform, MPN/100ml	26	16	28	36	31

Source: *field-test done on September, 2003*

The analysis of water samples shows that the sampled water typifies the respective usage. In case of Lohia Nallah, Patwaha Nallah and the small stream, all of which represents running water bodies, the BOD and COD values have been found little higher. The reason may be ascribed to the use of these water bodies also as conduit for waste water from nearby domestic sources.

The water bodies crossing the proposed strip are all used primarily for irrigation, however bathing and fishing activities were also observed during the site survey. Since irrigation is the most predominant usage, Class E (applicable for irrigation and fish survival) has been used for the comparison purpose.

Table 5.6: Comparison of Inland Surface water with Class E

Parameter	Tolerance Limit as per Class E	Lohia Nallah	Patwaha Nallah	Water from Swamp	A sma stream
PH	6.5 - 8.5	7.6	7.5	7.5	7.3
Electrical Conductance at 25°C, mhos, Max	1000×10^{-6}	475	350	2000	330
Sodium absorption ratio, Max	26	-	-	-	-
Boron, mg/l, Max	2	0.11	0.14	0.18	0.12
Total dissolved solids, mg/l, Max	2100	287	260	1545	238
Sulphates, mg/l, Max	1000	48.7	33.3	325.9	35.7
Chlorides, mg/l, Max	600	38	20	320	18
Percent sodium,	60	-	-	-	-
Alpha Emitters, μc/ml. Max	10^{-9}	-	-	-	-
Bita Emitters, μc/ml. Max	10^{-8}	-	-	-	-

From the above comparison it is evident that except the water from the swamp, all the other sources are meeting the standard in all respect.

There is a fish pond, between Sarol Village and Tappal at Km 45.60. It is thus, compared to Class D.

Table 5.7: Comparison of Inland Surface water with Class D

Parameters	Class D Tolerance Level	Fish Pond
Dissolved Oxygen (DO), mg/L, Min	4	4.4
Biological Oxygen Demand, BOD, mg/L, max	-	22
Total Coliform organism **, MPN/100ml, Max	-	45
pH value	6.5-8.5	7.45
Free Ammonia (as N), mg/L, Max	1.2	
Electrical Conductivity, μmhos/cm, max	-	410
Sodium absorption Ratio	-	-
Boron, mg/L, Max	-	0.02

From the above comparison it is clear that the water quality meets CPCB Class D (Fish propagation) water quality criteria.

5.4.1.4 Aquatic Ecology

Besides conventional physico-chemical analysis, aquatic ecology of the major surface water resources along the project strips was also studied. Bio-monitoring not only indicates the pollution level of the water body but also shows the impact on aquatic ecosystem. The study of the Primary Productivity was conducted to assess the level of eutrophication and ecological stability of the water bodies.

Biological Assessment

Keeping in mind the importance of swamp and such low lying area with respect to aquatic ecosystem, bio-monitoring was conducted for the swamp near the village Bhim (Km 100). Since biological diversity especially that of macro-invertebrates depends on the environmental

quality of that ecosystem, study of macro-invertebrates strengthens the true assessment of environmental quality.

For the study of bio-monitoring, the macro-invertebrates found in the sample collected are listed. The species, which are more sensitive to pollution, are given higher score. The score of all the families found during the bio monitoring are averaged to derive the Saprobic (Oxygen Availability) Score.

Diversity Score: The method involves pair wise comparison of sequentially encountered individuals and the difference of two specimens is observed upto species level. When a next observed animal is different from the previous one, a new run starts. Diversity is the ratio of the total number of runs to the total number of organisms encountered.

If the diversity score and derived Saprobic Score do not match then inference can be drawn that certain species have died due to sudden change in water quality. The details have been provided in **Annexure 5.4**

BWQC: Biological Water Quality Criteria

The animals collected from a site are scored as per pre – determined Saprobic score. Different families within the same Order may have different scores, eg: certain families from Ephemeroptera have a saprobic score of 10, some others may have 7 and still others may have 4, depending on their saprobicity. Hence, the mere presence of an organism does not indicate the water quality, but is to be assessed against all the organisms that are present. However, presence of certain species can crudely give an idea of the quality of water, e.g: the presence of Chironomidae is indicative of anaerobic and hence deteriorated water quality and the presence of species such as Sphirunidae, from Ephemeroptera and animals like prawns are indicative of good quality of water. The details have been provided in **Annexure 5.4**.

Table 5.8: Results of Bio-monitoring conducted at the swamp

Location	Name of Family/ Species found in the stream	Saprobic Score	Diversity Score	BWQC
Wetland near Bhim Village	Mollusca/ Vnionidee, Viviparidae, Physidae, Coleoptera, Dystiscidae, Hemiptera-Notonectidae, Water beetles	5.6	0.6	2 Moderate Pollution

Bio-monitoring of the swamp water shows that it is subjected to Moderate Water Pollution.

Primary Productivity

Primary productivity of an ecosystem is essential for food chain studies. The daily and seasonal carbon flow in the system forms the basis of the annual food pyramid. Primary productivity can be expressed in terms of Gross Primary Productivity (GPP) which includes organic matter used up during respiration within the measurement period and Net Primary Productivity (NPP)

includes the role of storage of organic matter in plant tissues in excess of the respiratory utilisation by the producers during the period of measurement.

Table 5.9: Results of Primary Productivity Study

Parameters	Swamp near Village Bhim
Gross photosynthesis mg oxygen/m^3/hour	541.66
Net photosynthesis mg oxygen/m^3/hour	273.33
Respiration mg oxygen/m^3/hour	271
Gross productivity mg carbon/m^3/hour	169.26
Net productivity mg carbon/m^3/hour	86.65
Photosynthesis/ Respiration P / R Ratio	1.08

The above result reveals that the swamp represents a balanced eco-system.

5.4.2 Ground Water

The ground water resources are distributed through out the strip, due to lack of variation and complexities of rock formation. Ground water is the most important source of irrigation in this area and contributes to 84% in Aligarh District, 61% in Mathura District and 80% in Agra District, of total irrigated area in these districts. In addition to irrigation, most of the rural water supply schemes are dependent on groundwater. The general ground water table is around 170 to 180m above mean sea level in the Project influence area underlain by discontinuous aquifers in porous formations. The general direction of flow of ground water is NW to SE. The potential of ground water yield varies from 1 to 10 liter/second.

Preliminary environmental survey reveals that a number of Hand Pumps and Bore wells are located within the COI, and some of them within ROW.

The impact on ground water is different from that of surface water. In case of ground water the impacts can be quantitative as well as qualitative. Since the project area belongs to region with favourable rainfall condition, quantitative impact on ground water is not an important issue. However because of prolonged rainy season and moderate soil permeability, the probability of contamination of ground water due to leaching is an issue in this region.

5.4.2.1 Ground Water Quality

Ground water is mostly used as drinking water; hence, ground water quality is assessed against standards prescribed for drinking water. The standard is given in **Annexure 5.4.**

Ground Water Sampling Locations

To assess the present ground water quality, samples have been collected along the project strip, particularly from important settlements located along the proposed road. The criteria used for selecting ground water sampling points are as follows:

- Major settlements as well as less developed areas were selected to assess the effect of excess groundwater extraction on water quality, if any.
- Sampling points are well distributed

Table 5.10: List of Ground Water Sampling Locations

Location	Chainage (km)
Dhankaur	Km 13
Tappal	Km 47
Near Agra Reserve Forest	Km 162

The locations of sampling are also marked in **Map 5.1**. The analytical results of the ground water quality are given below:

Table 5.11: Analytical Results of Ground Water Quality

S.No.	Parameters	Dhankaur Village	Tappal Village	Agra Reserve Forest
1.	Color	Colourless	Colourless	Colourless
2.	pH	7.2	7.3	7.2
3.	Conductivity (µmhos/cm)	1748	1810	1500
4.	Total Hardness, mg/l as $CaCO_3$	245	270	190
5.	Calcium, mg/l	74	80	60
6.	Magnesium, mg/l	14.7	17.1	9.7
7.	Chloride, mg/l as Cl	200	210	140
8.	Total Alkalinity, mg/l	369	330	400
9.	Sulphate, mg/l	257	274	111.1
10	Flouride, mg/l as F	0.7	0.8	0.8
11	Nitrate, mg/l as NO_3	3	2	2
12	Iron, mg/l as Fe	0.4	0.5	0.25
13	Dissolved Solids, mg/l	1320	1460	1030
14	Suspended solids, mg/l	17	16	12
15	Lead as Pb, mg/l	0.03	0.03	0.05
16	Arsenic, as As, mg/l	NT	NT	NT
17	Boron as B, mg/l	0.16	0.02	0.13
18	Total Chromium as Cr mg/l	NT	NT	NT
19	Manganese as Mn, mg/l	0.2	0.1	0.1
20	Phenol, mg/l	NT	NT	NT
21	Oil and grease, mg/l	NT	NT	NT
22	BOD, mg/l	0.2	0.1	0.1
23	COD, mg/l	8	5	6
24	Total Coliform, MPN/100ml	NT	10	NT
25	Faecal Coliform, MPN/100ml	NT	NT	NT

Source: Field Test done in September, 2003 NT – Not Traceable

It is evident from the above results that the ground water quality along the project strips meets both the IS 10500:1991 and the WHO standard. The Standards have been annexed in Annexure 5.4.

5.5 AIR QUALITY AND NOISE

In order to predict future air and noise quality as a result of the proposed highway projects, a number of air and noise quality monitoring were conducted along the project stretch in the month of September to November, 2003 to ascertain the present Ambient Air and Noise qualities.

The sampling locations were selected keeping in mind some basic guidelines of sampling i.e.

- Sampling was done at congested places with human settlement;
- Sampling sites included ecologically sensitive areas viz. Reserve Forests as well as other sensitive receptors like, schools;
- Sampling sites included intersections with other highways; and
- Sampling sites were well distributed throughout the project stretch.

5.5.1 Air Quality

Air quality and vehicular emission are very much interlinked. In cities like Delhi, Kolkata, the air quality is almost entirely governed by the vehicular emissions. Since with the proposed road project, the traffic count will rise considerably (estimated to be approximately 50,000 by 2008 – Source: DPR, Traffic Projection), the total emission will also increase, leading to deterioration in air quality[1]. Keeping this in mind, present air quality monitoring was conducted along the stretch. This will help understand the potential impact due the project. However, to understand the gravity of the impact, the ambient air quality standards need to be compared with.

5.5.1.1 Ambient Air Quality

Background level of air pollution in terms of SPM, NO_x, and SO_2 were monitored at various locations. The monitoring was carried out once for 24 hours durations at all the monitoring stations.

5.5.1.1.1 Location of Ambient Air Quality Monitoring Station

Location for Ambient Air Quality was selected based on the criteria given earlier. To assess the ambient air quality, the sampling point near Agra Reserve Forest was selected as the control point. The locations that were monitored for ambient air quality are:

[1] Road developments, while usually contributing in increased numbers of vehicles, will, at the same time help develop planned greenbelt in the form of roadside and median plantation, thus partially offsetting the deterioration in air and noise quality.

Table 5.12: Location of Ambient Air Quality Sampling Points

Location	Chainage
Near intersection of Noida – Greater Noida Expressway with the Proposed Expressway	Km 0
Jewar Village	Km 38
Near Swami Vivekananda Public School (Bajna Village)	Km 65
Bhim Village	Km 100
Khandauli Village	Km 153
Near Agra Reserve Forest	Km 162
Near Intersection of NH2 with the Proposed Expressway	Km 164.775

The locations of sampling points have been shown in Map No. 5.1

5.5.1.1.2 Existing Ambient Air Quality

The analytical results of air quality monitoring in the above locations are given below, and is compared against the National Ambient Air Quality Standards, as given in **Annexure 5.5.**

Table 5.13: Analytical Results of Ambient Air Quality

S.No.	Location	SPM ($\mu gm/^3$)	NO_x ($\mu gm/^3$)	SO_2 ($\mu gm/^3$)
1.	Near intersection of Noida – Greater Noida Expressway with the Proposed Expressway	212	28.5	6.5
2.	Jewar Village	257	5.5	5.5
3.	Near Swami Vivekanand Public School (Bajna)	350	22.8	17.1
4.	Bhim Village	455	18.1	16.4
5.	Khandauli Village	144	18.2	14.3
6.	Near Agra Reserve Forest	37	21.5	13.1
7.	Near Intersection of NH2 with the Proposed Expressway	632	22.3	20.1

Source: field-test done on Sept - Nov 2003.

Since it is a new road with no traffic or source of HC and CO, these parameters were not monitored here.

Suspended Particulate Matter (SPM)

The highest value for SPM is found Near Intersection of NH2 with the Proposed Expressway ($632\mu g/m^3$) and the lowest value is registered near the Agra Reserve Forest ($37\mu g/m^3$). The SPM concentration in most of the locations (except Khandauli Village) exceeds the National Ambient Air Quality Standard (NAAQS) for residential areas ($200\ \mu g/m^3$). However, the SPM concentration found near Agra Reserve Forest is well within the National Ambient Air Quality Standard (NAAQS) for sensitive areas ($100\ \mu g/m^3$).

The reasons for high SPM concentrations in the settlement areas may be attributed to dusty road conditions and agricultural activities (viz. thrashing). Near Intersection of NH2 with the Proposed Expressway, very high concentration of SPM is found because of emission from large number of vehicles plying on NH2. However, in case of intersection of Noida – Greater Noida Expressway with the Proposed Expressway, the SPM concentration was not so high as less number of vehicles ply on this road and the road condition is also very good.

Sulphur Dioxide (SO_2)

Jewar village is found to have the lowest SO_2 concentration (5.5 $\mu g/m^3$) while Near Intersection of NH2 with the Proposed Expressway has the highest SO_2 concentration (20.1 $\mu g/m^3$). Though because of emission from large number of vehicles plying on NH2, the SO_2 concentration was found high, at all the sampling locations, concentrations of SO_2 are well below the National Ambient Air Quality Standard (NAAQS) for SO_2 for residential areas (80 $\mu g/m^3$) and sensitive areas (30$\mu g/m^3$).

Nitrogen Oxides (NO_x)

The highest concentration of NO_x is found near intersection of Noida – Greater Noida Expressway with the Proposed Expressway (28.5 $\mu g/m^3$) and the lowest value of 5.5 $\mu g/m^3$ is registered at Jewar Village. All the sampling locations registered concentrations of NO_x well below the National Ambient Air Quality Standard (NAAQS) for NO_x for residential areas (80 $\mu g/m^3$) and for sensitive areas (30 $\mu g/m^3$).

Though except SPM concentration near Intersection of NH2 with the Proposed Expressway all the parameters are within the NAAQS limits for different landuse patterns, but the concentrations of NOx has been found high near the intersection of Noida – Greater Noida Expressway with the Proposed Expressway and Agra Reserve Forest without any visible activity, which may account for it. The reason for high NOx concentration lies in the high background concentrations of NOx ($\approx$ 40 – 50 $\mu g/m^3$) in the vicinity of Delhi and Agra City respectively. The relatively higher concentration of SO2 and NOx at Bajna may be attributed to vehicle movement along the road to Nohjhil and the running of DG sets for operation of the High Volume Sampler.

5.5.2 Noise Quality

Noise after a certain level can have a very disturbing effect on the people and animals exposed to it. In the present context, increased vehicular traffic can lead to increased levels of noise. Hence, it is important to assess the present noise quality of the area in order to predict the potential impact of future noise level due to this project

5.5.2.1 Ambient Noise Quality

It is necessary to monitor the ambient noise quality as increased vehicular traffic not only leads to increased noise level within the ROW but also contributes to the increase in ambient noise. Keeping this in mind, the monitoring stations were located primarily in settlements close to the project strips. However, to assess the ambient noise quality, a control point is always required. For this project, the location near Agra Reserve Forest, at Km 162 was selected as the control point.

5.5.2.1.1 Location of Ambient Noise Quality Monitoring Stations

The noise quality along the project strips were monitored during September to November, 2003 at the following locations:

Table 5.14: Location of Ambient Noise Quality Sampling Points

Location	Chainage
Near intersection of Noida - Greater Noida Expressway with the Proposed Expressway	Km 0
Jewar Village	Km 38
Near Swami Vivekananda Public School (Bajna Village)	Km 65
Bhim Village	Km 100
Khandauli Village	Km 153
Near Agra Reserve Forest	Km 162
Near Intersection of NH2 with the Proposed Expressway	Km 164.775

The locations of sampling points have been shown in Map No. 5.1.

Noise samples (at a distance of about 100m from the center of the proposed road) have been collected from the project area. The result of the monitoring is furnished below. The sampling locations have been selected in such a way as to represent the noise quality in major settlements (particularly with respect to sensitive receptors e.g. schools), rural areas, proposed intersection with existing roads.

Table 5.15: Result of Noise Monitoring along the project strip

S.No.	Location and landuse	Day time dB(A) Leq Value	Night time dB(A) Leq Value	Standard Leq (dBA)	
				Day	Night
1.	Near intersection of Noida – Greater Noida Expressway with the Proposed Expressway	73.7	70.1	75	70
2.	Jewar Village (residential cum commercial)	50.5	38.6	65	55
3.	Near Swami Vivekananda Public School at Bajna Village (sensitive zone)	55.2	41.6	50	40
4.	Bhim Village (residential only)	52.2	40.7	55	45
5.	Khandauli Village (residential cum commercial)	68.8	61.4	65	55
6.	Near Agra Reserve Forest (sensitive zone)	48.2	34.6	50	40
7.	Near Intersection of NH2 with the Proposed Expressway	77.6	74.8	75	70

Source: Field Test done during Sept – Nov, 2003

The results of existing noise quality found at the above locations have been compared against the national noise standard, as given in **Annexure 5.6**.

In the daytime, the highest level of ambient noise is found near Intersection of NH2 with the Proposed Expressway (77.6 dBA) and minimum near the Agra Reserve Forest, Km 162 (48.2 dBA), as predictable. The reason for high noise level near the intersection with NH2 is obvious because of large number of vehicles plying on this route. Similarly, lack of anthropogenic activities resulted in lesser noise level near Agra Reserve Forest.

In the night, the highest recorded value was again near Intersection of NH2 with the Proposed Expressway (74.8 dBA) and lowest near Agra Reserve Forest (34.6 dBA).

Besides, near Intersection of NH2 with the Proposed Expressway, the noise levels are found to exceed the standard specific to their landuse at Bajna (in front of Swami Vivekananda Public School) and Village Khandauli during day time as well as night time. The noise level near the intersection of Noida – Greater Noida Expressway with the Proposed Expressway is also on the threshold. The reason for high noise level at all the locations is the proximity to vehicular movement.

5.6 FLORA, FAUNA AND ECOSYSTEM

An ecological study has been undertaken to determine the present condition and the potential impacts due to project development activities on the existing flora and fauna of the area. This section described the ecology based on information compiled from secondary data available for the area and actual ocular inspection.

5.6.1 Forests

Uttar Pradesh

Forests are in general concentrated in the Himalayan Region, the submontane region, and the southern uplands. In the Himalayan region, common species of trees include silver fir, spruce, deodar, and pine. Tropical moist deciduous forests are found in the moist region of Terai. They grow in regions which record 100 to 150 cm. of rainfall annually, have an average temperature between 26-27^{O}C and have considerable degree of humidity. A special feature of the forests is that deciduous trees of uneven size grow on higher altitude regions. Lower regions have several species interspersed with bamboo climbers, cand and ever green shrubs. Main trees are Sal (an Indian hardwood), Ber, Gular, Jhingal, Palas, Mahua Semal, Dhak, Amla, Jamun, etc. The forests of the southern uplands consist mostly of scrub.

Project Area

The project area falls mainly under flat terrain, barring a few ravines, and do not pass through any protected / reserved forests. The nearest forest area is almost at a distance of 500m (Agra Reserve Forest).

5.6.2 Fauna

The domestic animals consist of cows, bullocks, sheep, goats, and dogs. No rare or endangered species have been recorded in the project area. Apart from common birds like fowl, peacock, house sparrow, pigeons, parrots, dove, cuckoo, vulture, kite, etc. other birds like bulbul, partridge, sand grouse, baya, tailor bird, kingfisher etc. are also met in various stretches of the project area.

5.6.3 Trees in ROW

Sample Ecological survey was conducted for 150m on either side of the proposed alignment. Any plant having "Circumference at Breast Height" (CBH) more than 30 cm has been considered as a TREE. Again depending on the CBH, the trees have been classified as i) Small – having CBH more than 30cm but less than or equal to 60cm, ii) Medium – having CBH more than 60cm but less than or equal to 90cm, and iii) Big – having CBH more than 90cm. The study reveals that the concentration of roadside tree varies significantly. The density of tree varies from more than 100 trees per km (Km 36 –Km 37) to 1 tree per km (Km 0 to Km 1). The main species observed are: *Acacia arabica*, Neem (*Azadirachta indica*), Mango (*Magnifera indica*), Jamun (*Eugenia ambolana*), Peepal (*Ficus religiosa*), Banyan (*Ficus benghalensis*), *Cassia siame*), *Prosopis spicigera*, *Prosopis chilensis*, Gulmohar (*Delonix regia*), *Albizzia lebbeck*, Ber (*Ziziphus jujuba),* etc. Besides these, palm and poplar trees are also seen. In few places, some mango orchards are located along and adjoining the proposed alignment.

Site survey along the stretch suggests that there are about 1474 trees on left side and about 1270 trees on right side of the proposed alignment witbin 150m from tbe center of the road. The total tree loss due to implementation of the project is estimated to be 473 trees on left side and 478 on right.

Many of the plant specics encountered in the study are important in various ways, some being economically important, while others mcdicinally important. Some of the trees with their economic importance are given below:

Table 5.16: Economic Importance of the trees found in the study area

S.No.	Use	Species
1.	Fuelwood	• *Acacia* spp • *Ziziphus jujuba* • *Prosopis spp*
2.	Fodder	• *Acacia spp* • *Albizzia lebbeck*
3.	Timber	• *Dalbergia sissoo* • *Albizzia lebbeck* • *Tectona grandis* • *Madhuca indica*
4.	Fruits	• *Magnifera indica* • *Diospyros melanoxylon* • *Eugenia jambolana* • *Ziziphus jujuba*
5.	Medicinal	• *Azadirachta indica* • *Justica adathoda* • *Eugenia jambolana*

5.7 SOCIO-ECONOMIC ENVIRONMENT

With settlements along the stretch of the proposed road, a number of structures such as religious places, wells, hand pumps, schools, etc. are situated within the ROW. In site survey, any such structure within 150m from the centre of the road was identified and later analysed.

5.7.1 Demographic profile along the project strip

Demography:

In any developmental project, it is necessary to study the demographic characteristics of the project area. Since the major part of the alignment falls into Aligarh, Mathura and Agra districts, population characteristics these districts were collected and studies for growth rate from 1951-2001. On the basis of growth trend, population may be projected for the future and related to the demand of their transportation needs.

In major portion of alignment, the density of village is lower (hamleted village). Near Mathura and Agra, semi-compacted villages are also present. The density of rural population near Agra is between 300-400/km^2, near Mathura it is between 400-500/km^2 and 200–250/km^2 along Yamuna River. The village type map of the area is shown in **Figure 5.2**. The population characteristics, male, female population, decennial growth rate, density of population per km^2, irrigated area etc., in three main districts along the proposed alignment are studied. Tables 5.17 and 5.18 show the urban and rural population in 1991 and 2001 respectively. Table 5.19 presents the decennial population from 1951-1981. Decennial growth rate (1981-2001) and density of population are presented in Table 5.20.

Table 5.17: Urban Population in 1991 and 2001

District	Rural (1991)			Rural (2001)		
	Male	Female	Total	Male	Female	Total
Aligarh	1,345,184	1,122,300	2,467,300	1,145,809	981,194	2,127,003
Mathura	818,745	657,130	1,475,935	809,655	677,536	1,487,191
Agra	903,464	736,471	1,639,935	1,114,971	938,985	2,053,956

Table 5.18: Rural Population in 1991 and 2001

District	Urban (1991)			Urban (2001)		
	Male	Female	Total	Male	Female	Total
Aligarh	443,696	384,802	828,498	461,413	401,972	863,385
Mathura	244,742	210,509	455,251	314,329	268,058	582,387
Agra	598,463	512,623	1,111086	834,804	722,541	1,557,345

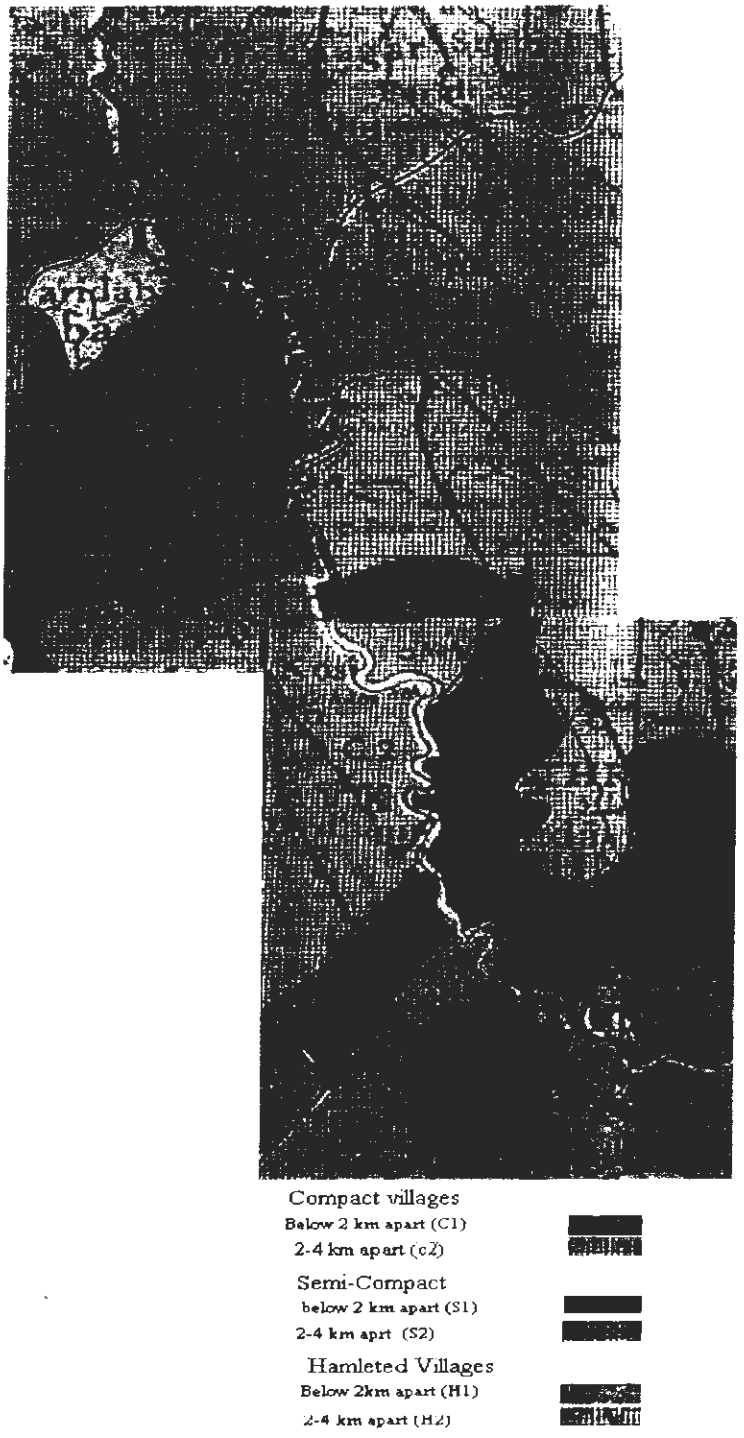


Figure 5.2: Village Types in the Area

Table 5.19: Decennial Population 1951-1981

District	Decennial Population 1951-1981			
	1951	1961	1971	1981
Aligarh	1,543,506	1,765,275	2,111,829	2,574,925
Mathura	912,264	1,071,279	1,290,307	1,560,447
Agra	1,501,391	1,862,142	2,307,638	2,248,483

Table 5.20: Decennial Growth Rate (1981-2001) and Density of Population (1991-2001)

District	Decennial Growth Rate (%)		Density (per km^2)	
	1981-1991	1991-2001	1991	2001
Aligarh	29.95	22.08	654	798
Mathura	22.69	26.95	489	621
Agra	21.90	31.27	683	897

From the above tables it is evident that the population growth rate varies from about 22% to 31% in the project area. The proposed Taj Expressway is also expected to serve the transportation needs of the growing population of the area.

Agriculture:

The agriculture is predominant economic activity in the project area. The area along the proposed expressway is mainly agricultural land. The major crops are wheat, sugarcane and maize. Small patches along upper Ganga Canal are also used for rough grazing. Before Mathura along River Yamuna, uncultivable patches are also present. Small fields of rice are also present along Upper Ganga Canal. In majority of the area, either wheat or maize crops are grown, particularly around Mathura and Agra cities.

The economy of the area is dependent on the agriculture and the animal husbandry. Wheat and Barley are the principal crops of Rabi while Bajra, Jwar and cottons are the principle crops of Kharif. The net cultivated is about 90% of the total area of which 69% area is irrigated. Canals constitute the mains source of the irrigation in the area. The crop map of the area is shown in **Figure 5.3.** The area irrigated by canals, tubewells and other means is shown in Table 5.21.

Table 5.21: The Area Irrigated by Canals, Tubewells and Other Means

District	Irrigated area (ha)			Total Irrigated Area
	Canals	Tubewells	Others	
Aligarh	57398	316856	1118	375372
Mathura	110780	172186	947	283913
Agra	40920	184023	6195	231138

Figure 5.3: Crop Map of the Area

Industry:

Majority of the industries in the project area are agro-based. There are a number of Rice Mills, however the closest amongst them is located at Jewar (Km 37.8, approximately at a distance of 70m from the right edge of the proposed expressway). Other industries are textile based, live-stocks based, mineral and chemical based. There is a major oil refinery at Mathura, sugar mill at Chhata, in addition to leather industry at Mathura and Agra, and cotton prints at Mathura. There are cottage industries at Nohjhil and Mat, and miscellaneous at Raya.

5.7.2 Archaeological

The expressway will be crossing the districts of Aligarh, Mathura and Agra, which are rich in archaeological treasure. Most noted among them is The Taj Mahal, a World Heritage Site.

However, none of the archaeological sites are falling enroute.

5.7.3 Historic and Religious Structures

Since the proposed alignment will be passing through small villages mainly, no historic structure is falling on the alignment.

Only one temple near Nagla Narayana Singh village (after the crossing of Jewar Distributary near Dhyanpura village) will need to be relocated, as it is located on the proposed expressway alignment.

At Jewar the road shall be passing through a Crematorium (Km 37.8) and need to be relocated.

5.8 OTHER AMENITIES

Schools and Hospitals

There are number of amenities and utility services located along the highway like hand pumps, wells, schools, Dhabas (hotel cum restaurant), hospitals etc. Of these schools and hospitals are important community facilities and impact on them should be looked into. In environmental screening report it has been found that though there is no hospital along the proposed strip, few schools are located within close proximity of the proposed highway. Though none of these needs to be relocated as these are beyond the proposed ROW, however consideration should be given with respect to noise impact and safety. Screening survey reveals a number of hand pumps and wells will be adversely impacted and need to be relocated.

Table 5.22: Important Educational Institutes along the Proposed Strip

LHS	Chainage	RHS	Remarks
Gautam Buddha University	Km 4.1 – 5.1		Under Construction – Approx. 60m away from the left edge of the proposed expressway
	Km 13.10	Dhankor College	Approx. 400m away from the right edge of the proposed expressway
	Km 37.80	Jewar Inter College	Approx. 120m away from the right edge of the proposed expressway
Inter College	Km 43.00		Approx. 60m away from the left edge of the proposed expressway
	Km 57.00	Secondary School	Approx. 500m away from the right edge of the proposed expressway
Swami Vivekananda Shiksha Niketan, Bajna	Km 67.10		Approx. 70m away from the left edge of the proposed expressway
	Km 67.30	Morki Inter College	Approx. 50m away from the right edge of the proposed expressway
Secondary School	Km 114.70		Approx. 100m away from the left edge of the proposed expressway

Wells and Handpumps

There are a number of handpumps, wells and borewells along the proposed alignment. The detailed account of these in terms of the side of their location from the centerline of the proposed alignment is presented below:

Table 5.23: Wells and Tubewells along the proposed alignment

RHS			CHAINAGE	LHS		
HP	WELL	BOREWELL		BOREWELL	WELL	HP
	1-I		3.8			
			4.5	1- I		
		2-O	4.9			
		2-O	5.1			
			5.2			
		1-O	5.4			
			5.5	1-O		
			5.7	2-I		
			5.8	1-O		
		1-O	6	1-O		
			6.3	2-I		
			6.5	1-O		
		1-O	6.7			
		1-O	6.8			
			6.9	1-O		
		1-O	8			
			8.1			1-I
			8.5			
		1-O	8.6			
			8.7	1-O		
			8.8	2-O		
			9.1	1-O		
			9.5	1-I		
		1-O	9.7	1-O		
			9.8	1-O		
			10.1	1-O		
			10.2	1-I		
		1-O	10.3			
		1-O	10.4			
			10.8	1-O		
			11.2	1-O		
		1-I	11.5			
1-O			12.2			
		1-O	12.8			
		1-O	13			
1-I			13.7			
		1-O	14.2			
			14.3	1-I		
1-I		1-O	14.4	2-I		
			14.9	1-I		
			15	1-I		
			15.1	1-O		
			15.4	1-O		
			15.5	1-O		

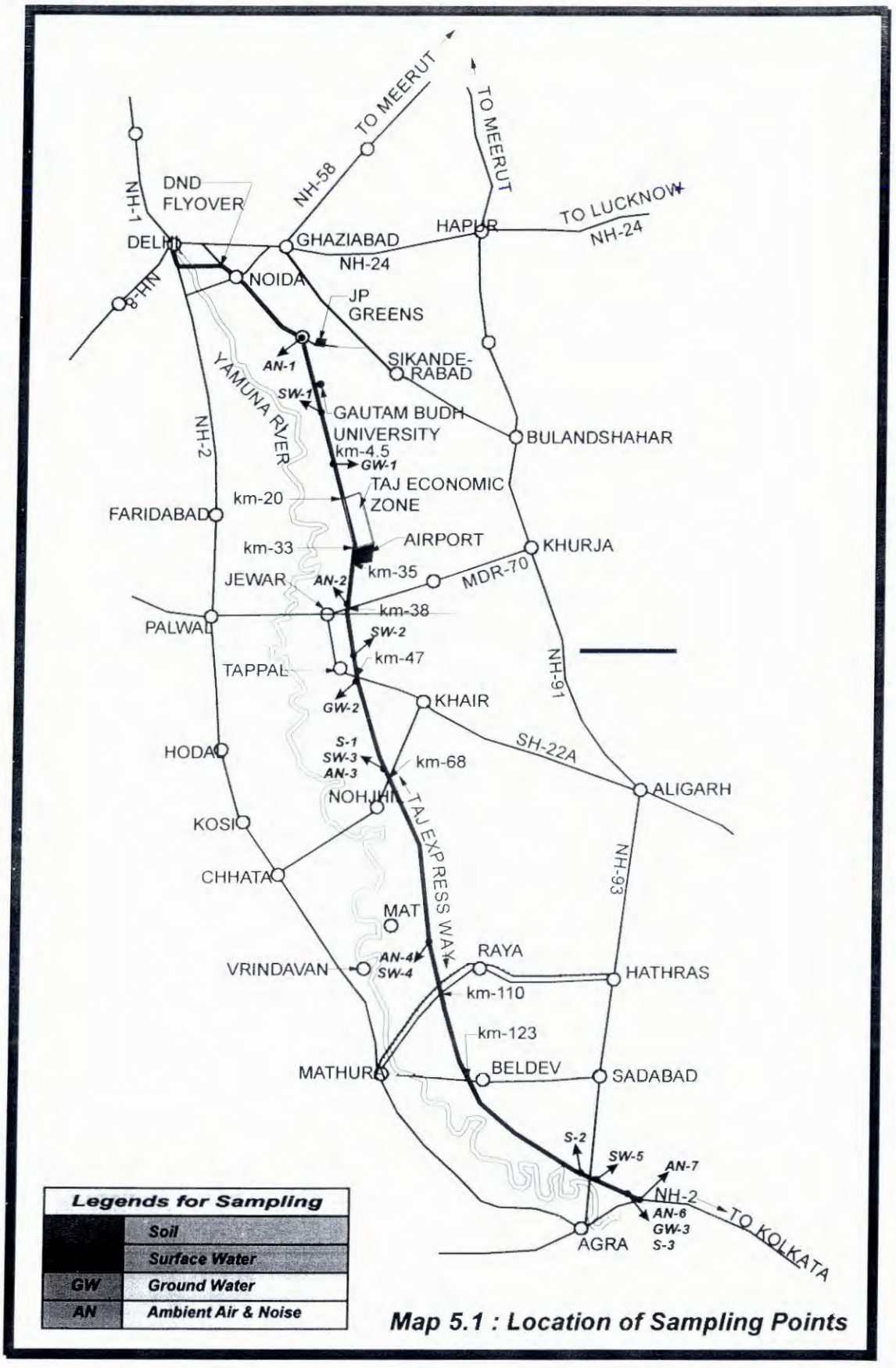
RHS			CHAINAGE	LHS		
HP	WELL	BOREWELL		BOREWELL	WELL	HP
			15.6	1-O		
		1-O	15.7	1-O		
		1-O	15.8	1-I		
		1-I	15.9			
		1-I	16			
		1-O	16.6			
		1-O	16.9			
		1-O	17			
		1-O	17.1			
		1-O	17.3			
			17.7	1-I		
			17.8	1-I,1-O		
			18	1-I,1-O		
		1-O	18.4	1-O		
			18.8			
			19.3	2-O		
			19.4	1-O		
		1-O	19.5			
			19.6	1-O		
		1-O	19.7			
		2-O	19.8	1-O		
			20	1-O		
			20.1			
		1-I	20.4			
			20.5	1-O		
		1-O	20.8			
			20.9	1-O		
			21	1-I		
			21.2	1-O		
		1-I	21.3	1-I		
1			21.6	1-O		
		1-O	21.9	1-I		
		1-O	22.1			
		1-O	22.5	1-I		
		1-O	22.6			
		1-O,1-I	22.8	1-O		
			23	1-O		
1		1-O	23.1	1-O		
		1-O	23.3			
		1-O	23.4			
		1-O	23.7			
1-O			24.3			
1-O			28.5			
			28.9			1-O
			29.5	1-O		
		1-O	30			
		1-O	30.9			

RHS			CHAINAGE	LHS		
HP	WELL	BOREWELL		BOREWELL	WELL	HP
		1-O	31			
			31.1	1-O		
1-O		1-O	31.5			
		1-O	31.6			
			31.8	1-O		
		2-O,1-I	31.9			
		1-O	32	2-O		
			32.1			1-O
1-O		1-O	32.3			
		1-O	32.4			
		2-O	32.6			
1-O			32.7			
		1-O	33.2			
			33.3	1-I		
		1-I	33.5			
		1-I	33.9			
			35	2-O		
		1-O	35.1			
		1-I	35.5			
			35.6	1-I		
		1-O	35.8			
			36	1-I		
			36.4			
			37.6	1-O		
			39			
			39.2	1-O		
			42.1	1-O		
			42.4	1-O		
		1-I	42.9			
			43	1-O		
			43.4	1-I		
		1-O	43.5	1-O		
		1-O	43.8			
			44.2	1-O		
		2-O	44.3			
		1-I	44.4			
			44.5	2-O		
			44.7	1-O		
			45.3			1-O, 1-I
			45.4			1-O
			46	1-I		
			46.1			
			46.2			
			46.3	1-O		
		1-I	46.6			
			46.7	1-O		

RHS			CHAINAGE	LHS		
HP	**WELL**	**BOREWELL**		**BOREWELL**	**WELL**	**HP**
		1-O	46.9			
			47	1-O		
	1-O	1-O	47.2			
			47.3	1-O		
			47.4			1-I
			47.5			2-I
		1-I	47.9			
			48.5	1-I		
			49	1-O		
			50.4	1-O		
		1-I	50.7			
			51.3	1-I		
		1-I	54.8			
		1-I	56.2			
			56.6	1-O		
		1-I	57.3			
			57.8			
		1-I	58.6			
			58.7	1-O		
		1-O	59			
		1-O	59.2			

Legends: O – Outside; I – Inside

There are about 9 handpumps, 1 well, 46 borewells within the RoW and 10handpumps, 1 well and 122 borewells outside the RoW. On the Right hand side there is also a government tubewell, however, it is outside the proposed RoW and there is a water tank outside the RoW on the LHS.



Map 5.1 : Location of Sampling Points

Chapter - 5 EXISTING ENVIRONMENTAL SCENARIO 5-1
5.0 introduction 5-1
5.1 Natural Environmental Setting of the Project Strip 5-1
5.1.1 Climate 5-1
5.2 Physical Setting 5-2
5.2.1 Physiography 5-2
5.2.1.1 Drainage 5-2
5.2.1.2 Cross Drainage Structures 5-2
5.2.2 Geology 5-2
5.2.3 Soils 5-4
5.2.3.1 Location of Sampling Site 5-5
Table 5.1: Location of Soil Sampling Sites 5-5
5.2.3.2 Physico-chemical Characteristics 5-5
Figure 5.1: Soil Profile in the Project Area ..... **Error! Bookmark not defined.**
Table 5.2: Physico-Chemical Characteristics of Soil Along the Project Strips 5-7
5.2.4 Quarries and Rock Crushers 5-7
5.2.5 Borrow Pits 5-7
5.3 Land use Pattern 5-8
5.4 Water Resources 5-9
5.4.1 Surface Water Resources 5-10
Table 5.3: Water Bodies Along The Project Strip: 5-10
5.4.1.1 National Surface Water Quality Standards 5-11
5.4.1.2 Surface Water Sampling Locations 5-12
Table 5.4: List of Surface Water Sampling Locations 5-12
5.4.1.3 Surface Water Quality 5-12
Table 5.5: Analytical Results of Surface Water Quality 5-12
Table 5.6: Comparison of Inland Surface water with Class E 5-14
Table 5.7: Comparison of Inland Surface water with Class D 5-14
5.4.1.4 Aquatic Ecology 5-14
Table 5.8: Results of Bio-monitoring conducted at the swamp 5-15
Table 5.9: Results of Primary Productivity Study 5-16
5.4.2 Ground Water 5-16
5.4.2.1 Ground Water Quality 5-16
Table 5.10: List of Ground Water Sampling Locations 5-17
Table 5.11: Analytical Results of Ground Water Quality 5-17
5.5 Air QualitY AND Noise 5-18
5.5.1 Air Quality 5-18
5.5.1.1 Ambient Air Quality 5-18
5.5.1.1.1 Location of Ambient Air Quality Monitoring Station 5-18
Table 5.12: Location of Ambient Air Quality Sampling Points 5-19
5.5.1.1.2 The locations of sampling points have been shown in Map No. 5.1 5-19
5.5.1.1.3 Existing Ambient Air Quality 5-19
Table 5.13: Analytical Results of Ambient Air Quality 5-19
5.5.2 Noise Quality 5-20
5.5.2.1 Ambient Noise Quality 5-20
5.5.2.1.1 Location of Ambient Noise Quality Monitoring Stations 5-21
Table 5.14: Location of Ambient Noise Quality Sampling Points 5-21
5.5.2.1.2 The locations of sampling points have been shown in Map No. 5.1 5-21
Table 5.15: Result of Noise Monitoring along the project strip 5-21

5.6 Flora, Fauna and Ecosystem 5-22
5.6.1 Forests 5-22
5.6.2 Fauna 5-22
5.6.3 Trees in ROW 5-23
Table 5.16: Economic Importance of the trees found in the study area 5-23
5.7 SOCIO-ECONOMIC ENVIRONMENT 5-24
5.7.1 Demographic profile along the project strip 5-24
Table 5.17: Urban Population in 1991 and 2001 5-24
Table 5.18: Rural Population in 1991 and 2001 5-24
Figure 5.2: Village Types in the Area 5-25
Table 5.19: Decennial Population 1951-1981 5-26
Table 5.20: Decennial Growth Rate (1981-2001) and Density of Population (1991-2001) 5-26
Table 5.21: The Area Irrigated by Canals, Tubewells and Other Means 5-26
Figure 5.3: Crop Map of the Area 5-27
5.7.2 Archaeological 5-28
5.7.3 Historic and Religious Structures 5-28
5.8 Other Amenities 5-28
Schools and Hospitals 5-28
Table 5.22: Important Educational Institutes along the Proposed Strip 5-29
Table 5.23: Wells and Tubewells along the proposed alignment 5-30

Chapter - 6 PUBLIC CONSULTATION

6.0 PUBLIC CONSULTATION PROCESS

Public Consultation was conducted at various stages of the project. It started at the inception stage right from the first visit to site to ensure adequate attention to public opinion and also at the preliminary environmental screening stage of the project. Consultation was done to develop the major areas of environmental problem that should be considered from the local stakeholders' point of view.

The consultation was carried out at individual level, Village level, Community leaders/Village administration level, and local/civil/forests administration level. Formal and informal methods of consultation were adopted. Some stakeholders consulted include local Residents, Shop owners, Dhaba owners, Truck drivers, Community leader or Panchayat officials.

The findings of public consultation were considered for finalization of the mitigation measures or alternatives. Details of the public consultations are given below with the issue raised, mitigation measures suggested, and action taken.

Stake Holders	Name of Key Participants	Date of Consultation	Issues Raised	Measures Proposed	Action Taken / Proposed
Jewar Village (Km 37)	Jaspal Singh Naveen Raja Thakur Kailash Yadav	08.09.2003	Expressed concern on the high traffic noise, deteriorate air quality and loss of agricultural land. There was a strong objection on the proposed relocation of Crematorium	Alternative alignments	The reduced road roughness and higher speed will reduce this impact. Tree plantation along the road has also been proposed. Crematorium will be saved by suitable road alignment modification
Village Sarol (Km 43)	Umesh Singh Raju Tiwari Bhagwanlal Shankar Thakur	08.09.03	Concerned for loss of agricultural land and houses and one fish pond. Since the road will be passing closely by primary school, safety of children was also a concern.	Non Specifc	Road has been realigned to save the houses and fish pond. Proper safety measures will be provided near the school.
Village Barauli (Km 136)	Ganga Prasad – Ex Sarpanch Rameswar Sanjay	19.09.03	Against building of road mainly due to loss of their agricultural land.	Non Specifc	Compensation will be provided as per resettlement plan
Village Bhim (Km 100)	Kamlesh Kumar Raja Ram Mahadev Sitaram	19.09.2003	Though concerned for loss of agricultural land but happy to have the road by their village	Non Specific	Care would be taken to minimise land acquisition
Village Khandauli (KM 153)	Gajan Lal Yadav Desh Kumar Hari Charan	20.09.03	Concerned over increased noise level and air pollution as the expressway will intersect the an existing highway here	Non Specific	Plantation and other barriers are proposed

Most of the output of public consultations and action proposed has been considered while carrying out alternative analysis, finalization of the alignment, and developing mitigation and management plan.

District level public hearing will also be organized through State Pollution Control Board as per the requirement of Environmental Clearance notification.

Figure 6.1: Public Consultation at Village Sarol

Figure 6.2: Public Consultation at Village Barauli

Chapter - 6 PUBLIC CONSULTATION 6-1
6.0 Public Consultation Process 6-1
Stake Holders 6-2
Jewar Village 6-2
Village Sarol 6-2
Village Barauli 6-2
Village Bhim 6-2
Village Khandauli (KM 153) 6-2

CHAPTER - 7 IDENTIFICATION AND ASSESSMENT OF IMPACTS

7.0 INTRODUCTION

Based on the compiled information attempts have been made to assess the present environmental status of the project area and identify Valued Ecosystem Components (VECs).

Preliminary environmental survey along the entire stretch was conducted coupled with detailed study of the available topographic maps from Survey of India, in 1:50,000 scale. During the survey, a number of discussions were held with people in the locality including those presently living along the various stretches of the project strip. Some NGOs working in the area were also contacted. Discussions were held with local government officials. The details of Public Consultation have been furnished in **Chapter 6.** This has helped in identifying the valuable ecosystem components of the region.

7.1 VALUABLE ECOSYSTEM COMPONENTS

Rapid Assessment Survey (RAS) along with public consultation was undertaken to identify the Valued Ecosystem Components (VECs) in the project corridor. The VECs identified along the project corridor are:

- Agriculture Land:
  - Consumption of valuable agricultural land
  - Loss of top soil
- Settlements:
  - Houses likely to be affected
  - Business (Commercial)
- Forest Land:
  - Accessibility to Reserve / Protected Forest
- Trees on the Right of Way (ROW):
  - Matured trees
  - Socially and culturally valuable trees
- Water:
  - Water quality Nallah/canal.
  - Fish pond
- Drainage:
  - Flooding and distribution drainage system
- Religious Structures:

- Crematorium

- Community Properties / Amenities
  - Educational Institutes
  - Hand pumps /Wells
  - Weekly Bazar places
  - Landscape and the natural scenic beauty of the place

Indicators used in selecting important issues a re:

1. Forest within 5 KM distance from the highway
2. Number of points over which the project highways cross over the nallahs, streams and drainage channels.
3. Ponds near the road within 30 m
4. Percentage of agricultural land likely to be consumed
5. Percentage of area for borrow pit from the agricultural land
6. Percentage of kilometer stretches of the road cutting through the settlements
7. Percentage of kilometer stretches of the road passing through natural habitat
8. Number of individual trees those are old, matured and traditional species and may be felled for this project.
9. Number of Community Properties (Hand Pumps / Wells) that need to be relocated
10. Number of educational institutes that may be adversely impacted

Besides the above-mentioned VECs, the issue of road safety also came up during public consultation.

7.2 POTENTIAL ENVIRONMENTAL IMPACTS

Project impacts are classified into two: impacts during construction and impacts during operation. Impacts are classified as being insignificant (IS), minor (MI), moderate (MO) and major (MA).

7.2.1 Change in Land use Pattern

The proposed project will involve changes in the existing landuse. The existing base line condition shows that the total environmental impact zone, assuming a 10km wide corridor centered over the roadway is 1647.75 km^2 (considering 164.775 Km of road length). Almost 6.69 Km^2 of the total agricultural area will be converted i.e. only 0.45% of the total agricultural area existing in the study area; no forest area will be converted into road area; however, 2.20% and 3.65% of the total settlement area and open/fallow land need to be converted respectively. The landuse conversion (i.e. land to be acquired for this project) has been calculated based on the proposed alignment and width to be acquired (approximately 100m).

Considering the total study area, only a small fragment will undergo landuse change. Hence, this impact is expected to be **MINOR**.

7.2.2 Soil

The impact on soil may be due two reasons: i) Loss of soil because of erosion, and ii) land used as borrow areas.

7.2.2.1 Impact due to Loss of Soil

Soil erosion potential of an area depends on the slope of that area and the geological structure, soil type and climatic variation. However, slope is predominant factor amongst these. Slope analysis was undertaken using the following formula known as Wenthworth Method:

$$\text{Slope in Percentage} = \frac{\text{Contour Interval}}{\text{Distance of base}} \times 100$$

Above analysis showed that except near the Agra Reserve Forest (Km160 - Km161), where the slope is little steeper, soil stability and erosion are not considered as problem for the overall project. Since no high embankment with critical slope is required (i.e. embankment height > 6m and slope > 50%), soil erosion from the embankments is also not perceived. Therefore, **significant adverse impact due to soil erosion is not anticipated**.

7.2.2.2 Land Used as Borrow Areas

Total Quantity of earth material that would be used and likely to be consumed in the proposed project is given below:

Table 7.1: Earth Materials Needed for Construction

Particulars	Unit	Main Carriage Way		Service Road Double Lane		Service Road Single Lane
		Carriage Way	Shoulder	Carriage Way	Shoulder	Carriage Way
Earthwork	Cum	18549100.73		228310.884		567029.68
Granular Sub base	Cum	685727.64	252105.75	17331.84	15165.36	31414.07

Source: Pavement Design Team.

Analysis of the baseline data reveals that tentatively 1700 ha of land have been identified for the purpose of the borrow areas. Of this only about 1110 ha (60% of the total land identified for embankment material) of land will be required for obtaining embankment material, as given above. Hence, excessive borrowing from one particular area is not likely. Moreover, efforts will be made to restrict borrowing depth within 2m in case of barren/waste lands. If any productive land need to be used for the borrow area purpose, IRC guideline shall be followed. Therefore, no significant adverse impact is expected. On the other hand, informal discussion with probable borrow area owners reveal that they are willing to provide the lands for the borrow area purposes as they want to convert those in fishponds afterwards. Hence, this is considered to be a **positive impact**.

7.2.3 Impact on Water Bodies along the Project Strip

The proposed Expressway shall intersect or touch upon a number of water bodies. However the impact on flowing water e.g. nallahs, streams, etc. is different from that of

bound water bodies e.g. fish ponds. The following sections discuss the potential impacts of the project on water bodies.

7.2.3.1 Impact on Bound Water Bodies

The proposed project corridor touches upon very few bound water bodies. Of all the bound water bodies, the one located near Km 46.60 between Sarol and Tappal is a prominent one and used as a fish pond. Hence this is a very important water body for local people. Considering the potential impact on this water body, the alignment has been shifted here to protect it. The impact on others was found to be **insignificant**.

7.2.3.2 Alteration of Surface Drainage

Although alteration of surface drainage due to this project is not envisaged but as a precautionary measure all the drainage and cross drainage channels along the project corridor has been identified. Suitable engineering design, for bridges and culverts, has been proposed so that natural flow of these drainage channels is not obstructed or modified, in any way. A comprehensive table has been provided in the baseline data section to show the pattern of drainage in and along the project area. Assuming appropriate sizing of culverts and bridges, **no significant impact** on drainage is expected.

7.2.3.3 Estimates on use of local water supply – sources for construction

Water is an essential component for any construction work. This project would not be any exception. Considerable amount of water would be required for various construction works e.g. concreting, curing, moisturizing granular base and sub-base, etc. Water would not only be required for construction purpose but it would also be needed for drinking, bathing, washing and sanitary purposes of the migrant labourers. A rough estimate shows almost 60 liters of water would be required for constructing 1 sqm of road area amounting to approximately 1500 kiloliters (KL) per Km of road whereas 50 liters/day (LD) of water would be used per person for domestic purpose, for a span of 3 years (estimated construction period of the project).

However, considering the large number of surface water bodies in the form of canals, nallahs and streams draining this region, major **ground water extraction for the project is not anticipated**.

7.2.3.4 Water Quality Degradation

Existing water quality of the roadside water sources can be degraded mainly in three ways a) by addition of pollutants (viz. debris), effluents, originated due to construction works; b) accidental spillage; c) degradation of groundwater. The probability of deterioration of water qualities due this project is very small during the operational stage. The probable causes for surface water pollution may be:

i) Accidental spillage of hazardous substances during transport

ii) Disposal of garbage (particularly plastics, condition of Yamuna River in Delhi is a live example) by the road users

However, during the construction stage deterioration of surface water can be foreseen. The probable causes could be:

i) Disposal of sanitary wastes' of construction camps

ii) Disposal of construction debris

Though the probability of deterioration of surface water quality is small but as most of these are used for irrigation, bathing and other household purposes including drinking sometimes, proper mitigation measures should be in place to prevent it during operational stage as well as construction stage. Care should be taken to prevent operational stage contamination as it would be long term in nature.

Uncontrolled dumping of wastes shall not be permitted. Therefore, contamination of ground water due to leaching of contaminants is not anticipated. Moreover, as significant withdrawal of ground water will not be required in this region, change in EH – pH state of the groundwater is not foreseen.

Considering all the aspect related with water and the prime usage, the **potential impact on surface water bodies is classified as Minor**.

7.2.4 Estimated impact on Air Quality due to the project

The significance of impact of increased traffic on air pollution is generally estimated by comparing the "with-project" conditions with the National Ambient Air Quality Standard (NAAQS: furnished in the baseline section). However, the future ambient air quality will not only depend on the project activities but also on the future landuse changes. **To predict the ambient air quality for a new road project, ambient air quality condition of an existing road of similar nature traversing through same region with similar landuse pattern would be of great help. For this reason, ambient air quality monitoring on NH 2 (Delhi – Mathura Section) was also conducted during April, 2003.**

7.2.4.1 Ambient Air Quality on NH 2 (Delhi – Mathura Section)

The air pollutants measured on NH 2 (Delhi – Mathura Section) are suspended particle matter (SPM), and gaseous pollutants like SO_2, NO_x, CO and HC. The instruments used are shown in Fig. 7.1 (a) & (b).

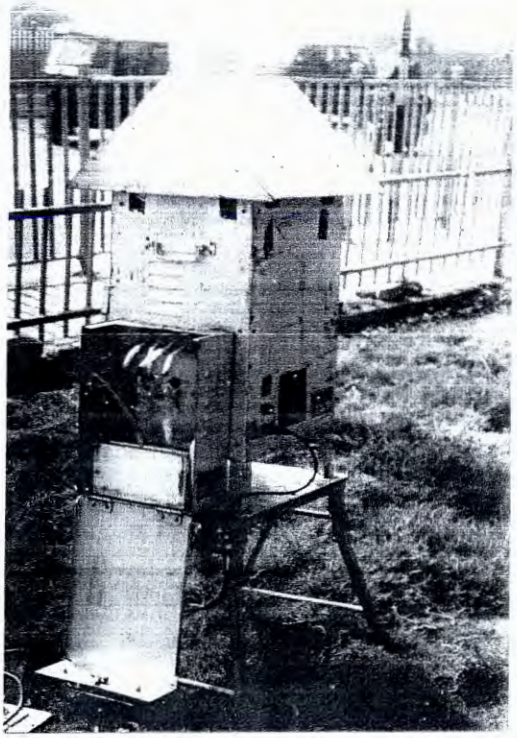


Figure 7.1 (a) High Volume Sampler Showing Gas Collection Through Impingers

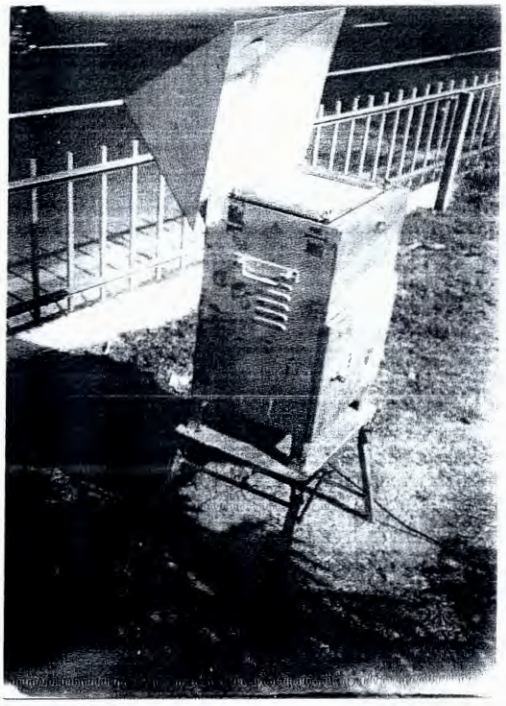


Figure 7.1 (b) High Volume Sampler Showing Accumulation of SPM

The ambient air concentration of CO and HC were monitored every hour for eight hours and concentration of NO_x, SO_2, and SPM were monitored continuously over twenty four hour time period. The summary is presented in the table below.

Table 7.2: Air Quality Monitoring at Sampling Site on NH-2

(Adjacent to Noida - Agra Expressway Corridor)

Time (hrs.)	Pollutant Concentration ($\mu g/m^3$)		
	NO_x	SO_2	SPM
9.00 AM–5.00 PM	121.29	17.3	1026.0

SPM values far exceed the permissible limit of 200 $\mu g/m^3$. The concentration of SO_2 was observed to be 17.3 $\mu g/m^3$, which is well below the permissible limit of CPCB. The concentration of NO_x observed was quite high than the prescribed limit. The observed hourly concentration of CO and HC is given in Table 7.3.

Table 7.3: Summarised Observed Values of CO & HC at Sampling Site on NH-2

Time (hrs.)	CO ($\mu g/m^3$)	HC ($\mu g/m^3$)
9.00 – 10.00	3987	620
10.00 – 11.00	4340	660
11.00 – 12.00	4271	586
12.00 – 1.00	4873	745
1.00 2.00	4651	660
2.00 – 3.00	4429	586
3.00 – 4.00	4651	624
4.00 – 5.00	5094	785

From the above results it may be concluded that the average CO concentration far exceeds the CPCB limit for general landuse, which was the case for the location monitored. In case of HC, the concentration is also high if compared against general landuse pattern; however, no standard exists for HC.

7.2.4.2 Prediction of Impacts on Ambient Air Quality

To assess the actual impact, the existing ambient air quality along NH 2 (Delhi – Mathura Section) has been used as reference and projected traffic volume along the proposed Expressway has been used as an input in the prediction model.

The California Department of Transportation (CALTRANS) has been the leader in the development of dispersion models for highways. The first line source dispersion model, CALINE was published in 1972 for predicting CO concentration. In 1975, a revised version of CALINE-2 was developed. This model could compute concentration for depressed sections and for winds parallel to the roadway. In 1979, a third version, CALINE-3 was developed. It retained the basic Gaussian dispersion methodology but used new horizontal and vertical dispersion curves modified for the effects of surfaces roughness, averaging time and vehicle induced turbulence. CALINE-4 is the latest version and the concentration of CO, NO_2 and aerosols can be predicted using this model.

Since, the concentration of carbon monoxide (CO) was the most crucial parameter found during field study, it has been predicted using the CALINE4 software. The emission factors, weighted emission factors. Meteorological data and the total hourly traffic volume data are the inputs required to run CALINE 4.The projected concentration of Carbon Monoxide (CO) for another horizon years is predicted using CALINE 4 and the results are presented in table 7.4. The traffic projection given by the traffic expert has been used for the prediction purpose.

Table 7.4: Projected Concentration of Air Pollution (CO) for Taj Expressway

Year	CO Concentration ($\mu g/m^3$)
2008	5926
2018	7024

The predicted concentration of CO is well above the prescribed limit. Though for purpose of the prediction, the inputs had been given based on the design specifications of the project road, hut the results may vary because of the actual site conditions. Moreover, the models could not predict the future concentration of SPM and RSPM, two very important parameters. Therefore, the qualitative prediction is also made based on the emission factor and barrier effects.

Experiments reveal that the ambient air quality of an area (within 300m from an existing highway) is influenced by the following factors:

I) Emission level of the vehicles:

More the emission from the vehicles worse will be the air quality. It is expected that the vehicles plying on the project corridor will conform to the pollution control norms. In order to minimize the adverse impact due to excessive vehicular emission, following emission standard must be complied with:

Pollutant Emission Standards:

The World Health Organisation (WHO) laid down the following standards for various types of vehicles. The quantities are in Kg per 1000 Km or gms/km.

Table 7.5: WHO Emission Standard

Vehicle Type	SPM	SO_2	NO_x	CO	HC
Light Duty (Petrol)	0.33	0.68	3.2	4.0	6.0
Heavy Duty (Petrol)	0.45	0.39	0.99	0.21	11.0
Heavy Duty (Diesel)	0.75	1.50	21.0	2.1	12.7
Motor Cycle	0.2	0.02	0.07	10.0	17.0

Central Pollution Control Board conducted a study on vehicular emissions. The results indicated vehicle release much higher concentration of pollutants than the vehicles in the developed communities.

The Central Motor Vehicles Rules, 1989; GSR 77 (E), dated January 31, 2000 has laid down the fonlowing mass emission standards (Bharat Stage – II) (effective from April 1, 2000):

a) ***Motor Cars with seating capacity of and upto 6 persons (including driver) and Gross Vehicle Mass (GVM) not exceeding 2500 Kg***

Vehicles with	Standard (Type Approval = COP) (gm/Km)		
	CO	(HC + NOx)	PM
Gasoline engine	2.2	0.5	-
Diesel engine	1.0	0.7	0.08

b) Four-wheeler Passenger Vehicles with GVM equal to or less than 3500 Kg and designed to carry more than 6 persons (including driver) or maximum mass of which exceeds 2500 Kg

Class	**Ref. Mass (rw) Kg**	**Limit Values for Type Approval (TA) as well as COP**				
		Mass of CO (gm/Km)		**Mass of HC + NOx (gm/Km)**		**Mass of PM (gm/Km)**
		Gasoline	**Diesel**	**Gasoline**	**Diesel**	**Diesel**
I	rw<1250	2.2	1.0	0.5	0.7	0.08
II	1250<rw<1700	4.0	1.25	0.6	1.0	0.12
III	rw>1700	5.0	1.5	0.7	1.2	0.17

c) Emission of Smoke and Vapour from Agricultural Tractors Driven by Diesel Engines for type approval as well as COP tests

Light Absorption coefficient K (l/m): 3.25:Hartridge units: 75
Mass of Oxides of Nitrogen (NOx): 18.0 gm/kwhr
Mass of Carbon Monoxide (CO): 14.0 gm/kwhr
Mass of Hydrocarbon (HC): 3.5 gm/kwhr

d) Mass Emission Standards for Compressed Natural Gas Driven Vehicles

Mass emission standards for vehicles when operating on Compressed Natural Gas shall replace Hydrocarbon by Non Methane Hydrocarbon. Non Methane Hydrocarbon (NMHC) may be estimated by an analyzer or by the following formula, namely:

NMHC = HC X (1 – K/100)
Where HC = total hydrocarbon measured
K = % methane content in natural gas fuel

II) Traffic speed:

It is a known fact that less the speed more will be emission. Considering the proposed project, where the vehicle speed is envisaged to be more than 100 Km/hour, the total emission should be less than what would have been under normal circumstances.

III) Pavement roughness

It is an established fact that greater the pavement roughness more the vehicular emission. In the proposed project, the pavement roughness is expected to be less than 2m/Km, leading to lesser vehicular emission.

IV) Anthropogenic activities

As seen from the above analysis and existing baseline condition (discussed in Chapter 5), even with other factors remaining constant, anthropogenic activities (like running of DG sets, motors, pumps, etc.) worsen the micro air quality. Hence, it is expected that during the construction period the air quality in the vicinity will deteriorate however, during operation phase, the impact on air quality will be less as minimum distance of the habitats from the centerline of the proposed road would be at least 50m. Since concentration of air pollutants is a function of distance of the receptor from the emission sources, more the distance less will be the pollution concentration.

V) Vegetation cover

Green vegetation acts as a barrier to the dispersion of air pollutants, particularly SPM and thereby reduces the pollutant concentration near the receptor. During the construction phase, the existing vegetation cover will be severely impacted. Hence, the function of vegetation as barrier to air pollutants would significantly reduce. However, in the post-construction phase a planned vegetation cover all along the project corridor will be developed and would act more effectively as a pollution barrier.

Keeping in mind the above analysis, negative impact on air environment is expected during construction phase as dust, smoke and fumes will be generated form construction machinery and due to the movement of vehicles carrying construction materials through earthen roads. During operation stage the concentration level of NO_x SO_2 and CO will increase due to vehicular emission. However, the impact is expected to reduce during the operation phase as the barrier to pollutants in the form of roadside and median plantation will be developed.

Considering the potential impact, the **adverse impact on air quality should be classified as Major** and proper management plans should be developed to minimise the impact.

7.2.5 Estimated impact on Noise Quality due to the Project

The significance of impact of increased traffic on noise pollution is generally estimated by comparing the "with-project" conditions with the Central Pollution Control Board (CPCB) prescribed Noise Quality Standard (furnished in the baseline section). To find out the likely noise quality with the project, the noise quality along NH 2 (Delhi – Mathura Section) was monitored during April, 2003.

7.2.5.1 Existing Noise Quality Along NH 2 (Delhi – Mathura Section)

A sound level meter and noise frequency analyzer shown in fig. 7.2 monitored the noise level at the site, along NH 2 (Delhi – Mathura Section).

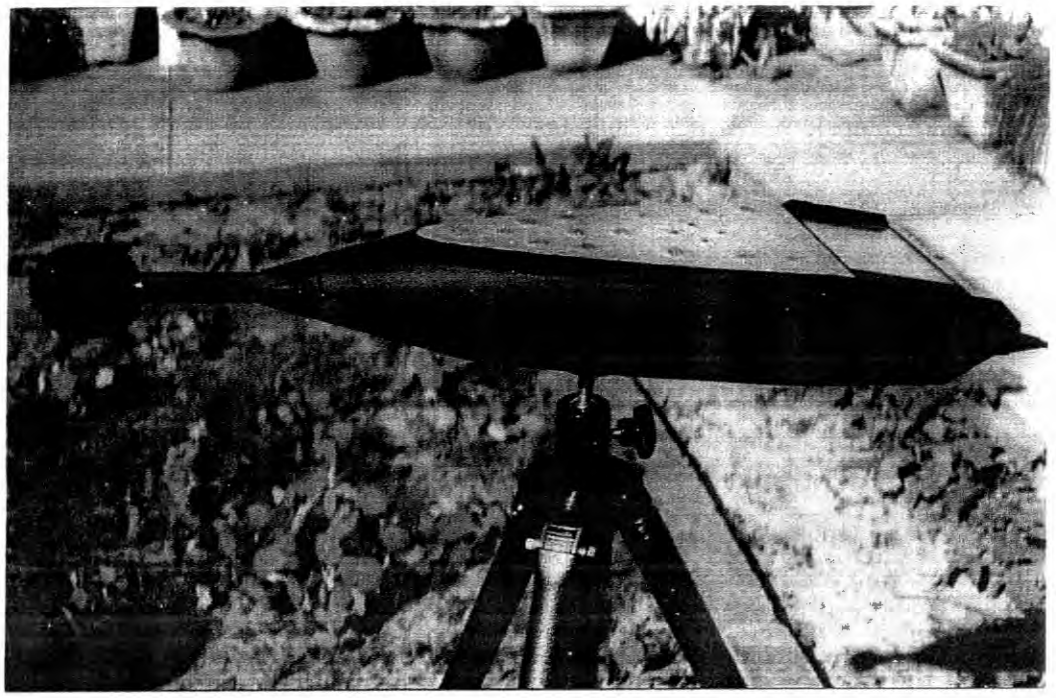


Figure 7.2 View Of 2260 Noise Level Analyser

Data was collected for duration of 24 hours. The observed hourly equivalent noise level (Leq) is summarized in the table below:

Table 7.6: Observed L_{eq} during Different hours of the Day on NH-2

Time (Hrs)	L_{eq} (dBA)	Time (Hrs.)	L_{eq} (dBA)
6.00 – 7.00	75	18.00 – 19.00	75
7.00 – 8.00	75	19.00 – 20.00	71
8.00 – 9.00	72	20.00 – 21.00	73
9.00 – 10.00	70	21.00 – 22.00	70
10.00 – 11.00	68	22.00 – 23.00	70
11.00 – 12.00	78	24.00 – 00.00	82
12.00 – 13.00	76	00.00 – 1.00	75
13.00 – 14.00	78	1.00 – 2.00	70
14.00 – 15.00	75	2.00 – 3.00	82
15.00 – 16.00	76	3.00 – 4.00	80
16.00 – 17.00	77	4.00 – 5.00	70
17.00 – 18.00	76	5.00 – 6.00	71

From the above results it is evident that the noise level exceeds the CPCB limit for most of the time. Using the above noise quality along NH 2 (Delhi – Mathura Section) as reference, noise quality for the proposed Expressway is predicted using the projected traffic volume along the Expressway over the time.

7.2.5.2 Prediction of Impacts on Ambient Noise Quality

At construction stage, noise will generate due to the operation of construction machinery and equipments. At operation stage vehicular noise due the high traffic speed will be generated. In order to assess the impact of noise, it is essential to predict the future noise level.

Over the past decade, considerable progress has been made in developing techniques for predicting noise level from road traffic. Much of early work concentrated on forecasting noise level from freely flowing traffic and the results of these studies have been used to calculate the noise emanating from highway and similar type of new road carrying traffic traveling at moderate and high speed. CORTN and FHWA are the empirical models for noise prediction.

FHWA model predicts noise level in the vicinity of roadways, on the basis of individual vehicle noise level, vehicle volume, speed, observer distance and other correlations. The Federal Highway Administration Traffic Noise model (FHWA TNM), computes a predicted noise level through a series of adjustments to a reference sound level. In the TNM, the reference level is the Vehicle Noise Emission Level, which refers to the maximum sound level emitted by a vehicle pass-by at a reference distance of 15 meters. Adjustments are then made to the emission level to account for traffic flow, distance and shielding. These factors are related by the following equation:

$$L_{Aeq\ 1h} = E_{Li} + A_{traff\,(i)} + A_d + A_s$$

Where,

E_{Li}	represents the vehicle noise emission level for the ith vehicle type.
$A_{traff(i)}$	represents the adjustment for traffic flow, the vehicle volume and speed for the ith vehicle type.
A_d	represents the adjustment for distance between the roadway and receiver and for the length of the roadway.
A_s	represents the adjustment for all shielding and ground effects between the roadway and receiver.

In order to predict future noise level on the proposed Expressway, the project traffic volume data as given by the Traffic Expert has been used. Taking into consideration this projected data and design speed of Expressway, noise level has been predicted for both the directions of Taj Expressway. The following table shows the predicted noise level.

Table 7.7: Predicted Noise level (L_{eq}) for Both Directions

Year	Noise Level (Leq)	
	Direction 1	Direction 2
2008	73	71
2018	75	73

The prediction indicates a higher noise level than the prescribed limit. However, the actual site condition may vary considerably leading to different noise level. Therefore for proper assessment of the future noise quality along the proposed Expressway the factors influencing noise quality must be identified. Experiments reveal that the noise quality of an area depends on the following factors:

i) Distance between the receptor and the source:

With the implementation of the project, the minimum distance between the centerline of the Expressway and habitat will become 50m at least. Experimental results show that, with the doubling of the distance between source and receptor, the noise level decreases by 2 – 5%, on an average.

ii) Condition of the vehicles:

It is expected that with implementation of the project, better monitoring and policing system will be put in place. If the following noise standards as prescribed in Central Motor Vehicles Rules, 1989, are enforced then noise level is expected to reduce substantially.

Table 7.8: Permissible limits of Noise level

Category of Vehicles	Maximum Permissible Noise Level
Two wheelers (Petrol driven)	80 dB(A)
All passenger cars, all petrol driven three-wheelers and diesel driven two wheelers	82 dB(A)
Passenger or Light Commercial Vehicles including three-wheelers fitted with diesel engine with gross vehicle weight upto 4000 Kgs	85 dB(A)
Passenger or Commercial Vehicles with gross vehicle weight above 4000 Kgs and upto 12000 Kgs	89 dB(A)
Passenger or Commercial Vehicles with gross vehicle weight above 12000 Kgs	91 dB(a)

iii) Anthropogenic activities and number of noise sources in the vicinity:

Usually noise impact from vehicles is compounded with presence of other noise emitting sources in the vicinity. In most of the settlements through which the road passes, a market is established. Markets itself are noisy places supplemented with mechanical noises from DG sets, motors, etc. and results in a cacophony. When vehicular noise mixes with this cacophony, standards usually go haywire. These are the facts found from the noise monitoring survey. In the proposed project, all these roadside markets will be shifted by at least 50m from the centerline. Therefore, it is expected that the resultant noise on the human populace residing by the roadside will be less impacted.

iv) Traffic Volume:

The more the number of vehicle per unit time, more will be the traffic noise. Considering the projected traffic growth along the proposed Expressway, it is evident that with time the noise level will increase.

v) Condition of road:

Experimental results show that higher pavement roughness causes more vehicular noise. In the proposed project, the pavement roughness will be less than 2m/Km. Hopefully, the honking, one of the major reasons for high noise level will substantially reduce with better awareness.

vi) Vegetation cover:

Roadside vegetation if properly planted acts as an effective noise barrier. In the project, roadside plantation will be done in such a manner that it would act as an effective noise barrier.

vii) Presence of Noise Barriers:
As part of the environmental management plan, noise barriers will be placed near sensitive receptors (e.g. schools, hospitals, etc.). Therefore, the noise level near these sensitive receptors is expected to decrease substantially.

In view of the existing condition along the project strip it is expected that during the construction phase the noise quality will deteriorate significantly as a number of heavy earth moving vehicles and other construction machineries will be operating at the same time however, with the proposed mitigation measures, it is expected that the noise quality along the project strip will improve during the operational phase

Based on the above analysis, it is evident that the **negative impact on ambient noise quality due this project will be a Major** one.

7.2.6 Flora, Fauna and Ecosystems

The existing alignment does not pass through any Reserved Forest, Protected Forest or National Park. However a few stretches of the road has thick to moderate dense trees along the roadside.

7.2.6.1 Trees along the Roadside

Roadside trees will have an important impact pertaining to this project. Once the alignment of the highway has been analysed from the environmental point of view, the number of trees with height more than 10 inch falling within the proposed alignment was counted. The corridor of alignment for this assessment included the pavement portions, median and the shoulder part of the proposed highway design.

There are about 478 trees on the right side of the centerline of the proposed alignment and 473 trees on the left within the proposed RoW. All the trees will have to be felled for the construetion of the road. On the right side, about 149 trees are small, 315 medium and 2 trees are large while on the left side, about 173 trees are small, 287 medium and 1 tree is large. There are also about 12 Palm trees on either side of the road.

The trees within the proposed RoW do not have a dense standing. On the right hand side Km 29.00 has the largest number of trees viz. 45 followed by Km 20.00, viz. 42. On the left hand side, the largest numbers of trees are at Km 21.00 viz. 42. However, after Km 52.00 there are vary few to nil number of trees within the proposed RoW. Hence the total number of trees that is getting cut is 951 trees over a stretch of 164.775 km.

The trees that shall need to be cut include trees as palm, *Acacia arabica*, Neem (*Azadirachta indica*), Mango (*Magnifera indica*), Jamun, Peepal, Banyan, (*Cassia siamea*), *Prosopis spicigera*, *Prosopis chilensis*, Gulmohar (*Delonix regia*), *Albizzia lebbeck*, Ber (*Ziziphus jujuba*).

However, this loss of ecological resources shall be compensated by new and planned plantation along the proposed alignment. **Annexure 7.1** gives the summary of the roadside trees that will have to be cut.

7.2.6.2 Impact on Fauna

The proposed project does not pose any conceivable danger to the animals which are mainly domesticated. Moreover, for safe passage across the proposed expressway, a number of underpasses are being provided.

7.2.6.3 Ecosystem

The project will entail loss of only 1100 trees along a stretch of 164.775km. Moreover, no endemic or endangered species (flora and fauna) are spotted in the project area during the baseline survey. Thus, **no eminent threat is apprehended towards the ecosystem. Hence, the impact on biological environment is anticipated to be insignificant.**

7.2.7 Socio-economic Environment

With the improvement in the road network, the economic growth of the project area is expected to take place at a faster rate. This will obviously result in better quality of life, a long term effect of all infrastructural projects. Moreover, economic strengths also help reduce cultural backwardness. Therefore, this impact is considered to be **positive and major**.

7.2.7.1 Cultural Environment/Properties etc.

The roadside temples, mosques, gurudwara etc. forms part of the cultural environment along the project corridor. Some of these religious structures are going to be affected during the implementation of this project. The potential impact of this project on these structures has been assessed on the basis of their location from the edge of the proposed pavement and whether they are within the proposed ROW or not. In the following table the potential impact on these structures is elaborated chainage wise.

There is only one temple near Nagla Narayana Singh village (after the crossing of Jewar Distributary near Dhyanpura village) that will need to be relocated. At Jewar, the road shall be passing through a Crematorium (Km 37.8) which shall also be relocated or saved through appropriate mitigation measures like route alignment

7.2.7.2 Other Amenities

Schools and other Educational Institutions

The impact on the roadside amenities such as schools, hospitals etc. are determined on the basis of the distance and sensitivity. The impact has been categorised as follows:

Schools and Hospitals come in the category of Sensitive zones and it is important that a quiet and clean air be in the surrounding to make the atmosphere conducive for learning as well as peaceful and that of resting for the patients to recover for their illness.

None of the schools or educational institutions fall in the Right of Way of the proposed alignment. However, they are at various distances from the proposed alignment. While Morki Inter college at Km 67.30, which is closest to the proposed alignment is only 50m away from the proposed alignment, others like the Secondary School Km 57.00 is 500m away. However, to ensure a safe and clean atmosphere to the students, adequate measures will be suggested subsequently.

Wells, Handpumps and Borewells

There are 9 handpumps, 46 borewells and 1 well within the RoW. These shall need to be relocated. However, the alignment has been so designed to avoid the other 10 handpumps, 122 borewells and 1 well from being disturbed which otherwise lie close to the alignment. Hence, since relocation shall be done for every impacted structure, the overall impact can be taken to be minimal to nil.

Chapter - 7 IDENTIFICATION AND ASSESSMENT OF IMPACTS 7-1
7.0 introduction 7-1
7.1 Valuable Ecosystem Components 7-1
7.2 Potential Environmental Impacts 7-2
7.2.1 Change in Land use Pattern 7-2
7.2.2 Soil 7-2
7.2.2.1 Impact due to Loss of Soil 7-3
7.2.2.2 Land Used as Borrow Areas 7-3
Table 7.1: Earth Materials Needed for Construction 7-3
7.2.3 Impact on Water Bodies along the Project Strip 7-3
7.2.3.1 Impact on Bound Water Bodies 7-4
7.2.3.2 Alteration of Surface Drainage 7-4
7.2.3.3 Estimates on use of local water supply – sources for construction 7-4
7.2.3.4 Water Quality Degradation 7-4
7.2.4 Estimated impact on Air Quality due to the project 7-5
7.2.4.1 Ambient Air Quality on NH 2 (Delhi – Mathura Section) 7-5
Table 7.2: Air Quality Monitoring at Sampling Site on NH-2 7-7
Table 7.3: Summarised Observed Values of CO & HC at Sampling Site on NH-2 7-7
7.2.4.2 Prediction of Impacts on Ambient Air Quality 7-7
Table 7.4: Projected Concentration of Air Pollution (CO) for 7-8
Table 7.5: WHO Emission Standard 7-8
7.2.5 Estimated impact on Noise Quality due to the Project 7-10
7.2.5.1 Existing Noise Quality Along NH 2 (Delhi – Mathura Section) 7-11
Table 7.6: Observed L_{eq} during Different hours of the Day on NH-2 7-11
7.2.5.2 Prediction of Impacts on Ambient Noise Quality 7-12
Table 7.7: Predicted Noise level (L_{eq}) for Both Directions 7-13
Table 7.8: Permissible limits of Noise level 7-13
7.2.6 Flora, Fauna and Ecosystems 7-14
7.2.6.1 Trees along the Roadside 7-14
7.2.7 Socio-economic Environment 7-15
7.2.7.1 Cultural Environment/Properties etc. 7-15
7.2.7.2 Other Amenities 7-16

CHAPTER - 8 ANALYSIS OF ALTERNATIVES

8.0 INTRODUCTION

Analysis of alternatives is a key component of an Environmental Impact Assessment, particularly in projects that have sectoral impacts. In case of road projects, alternative of analysis involve a thorough study of the possible future conditions in the project study area - "with the project" and "without the project" and option study of different alignments, including bypasses and realignments.

This being a new road, the design was made precariously to ensure minimum adverse environmental and social impacts. However, during the public consultations, a few issues came into fore and was addressed subsequently.

8.1 FUTURE ENVIRONMENTAL CONDITIONS – WITHOUT AND WITH THE PROJECT

8.1.1 Physical Environment

Since the future soil quality, landuse pattern and water quality conditions will not be significantly affected by the project, these three components of the environment are not discussed further. However, as a result of the project, future developmental activities may induce changes in landuse pattern.

The project is predicted to have significant impact on the air and noise quality and minor impact on surface drainage (during the construction phase only) of the project area. To address these issues, appropriate management plans have been proposed and the same shall be monitored to ensure compliance in order to minimize the impacts.

With the increasing trend in population and the necessities of mankind, even without the project, the deterioration in ambient air and noise quality will take place, though at a much slower pace. The project shall bring about changes almost immediately. The ambient quality of gaseous pollutants and noise will deteriorate to considerable extent during the 2-3 year construction period though it will be temporary and localized. However, pollutant concentrations and noise levels are expected to improve during operational phase because of better road condition, vegetation cover and berms all along the project corridor. Furthermore, proposed institutional strengthening is likely to improve the chances of implementation of mitigation measures defined in the environmental management plan.

The water bodies are not found to be impacted upon significantly by the operation of the expressway. However, at the time of construction temporary obstruction to natural

drainage is anticipated. In few of the cases, balancing / cross drainage structures may be rendered nonfunctional for short time span, leading to water logging in some areas.

Productive areas shall be avoided for borrowing purposes. By public consultation, it has been found that the land owners are willing to convert the borrow pits into fish pond at a later stage. Hence, it is found that with the project, the area will be benefiting more than in case of a no-project scenario.

8.1.2 Biological Environment

Presently, the number of standing trees along the proposed alignment is very few. In contrast, the management plan details the planting of 35,101 trees against the cutting of approximately 1100 trees along 164.775 km. With the selection of fruit trees, it has been ensured to serve the local villagers. Shade trees and scented trees have also been proposed to improve microclimatic conditions. Hence, over time the biological environment of the project area shall improve significantly, even though the construction phase will require the felling of trees within the proposed RoW.

8.1.3 Socio-economic Environment

With the construction of the proposed expressway, providing connectivity to proposed Taj Economic Zone and International Airport, the economic growth of the project area is expected to take place at a faster rate. This will hopefully result in better quality of life for all.

Though as a result of the project some persons will have to be relocated, all the project affected people will be properly rehabilitated and resettlement action plan will be implemented. However, the emotional impacts of loosing land, assets and as a worst case being relocated has always been difficult to overcome. During the construction phase a few community properties e.g. wells, schools, etc. will also be affected but as part of the project's commitment to adequate mitigation all such properties/assets will be rebuilt and improved. The present condition of these assets shall further improve with the project implementation. Hence, the overall impact of the road work on socio-economic environment is expected to be positive in the long term.

8.2 REALIGNMENTS

Based on initial assessment of the proposed alignment and public consultation, it was found that at few of the places of environmental and social importance were negatively impacted. These are:

a) At Km 37.60, the proposed alignment would require the demolition of the cremation ground at Jewar.
b) At Km 43.40, the proposed alignment was going through village houses in village Sarol.
c) At Km 45.60, the proposed alignment was passing through a fish pond existing between Sarol Village and Tappal

d) At Km 47.50, the proposed alignment was passing through few houses in Tappal.
e) At Km 60,the proposed alignment was passing through an orchard.
f) At Km 60.3, the proposed alignment was passing through houses.
g) At Km 65.2,the proposed alignment was passing through a Samdhi.

To avoid the demolition of any of the structures mentioned above, the alignment has been changed at all the above locations. The proposed alignments at these places (before and after modification) are given below:

a) At Km37.60 - Exhibit 1

b) At Km 43.40 -Exhibit 2

c) At Km 45.60- Exhibit 3

d) At Km 47.50- Exhibit 4

e) At Km 60.00- Exhibit 5

f) At Km 60.30- Exhibit 6

g) At Km 65.2- Exhibit 7

Chapter - 9 MITIGATION MEASURES

9.0 Approach to Mitigation Measures

The approach of mitigation is dependent on the nature and severity of the impact.

Remedial measures, on the basis of impact characteristics, have been approached either by avoidance and/or by mitigating the effect. Avoidance of negative environmental impacts can be realistically achieved in many cases. In certain places where the proposed alignment was passing through villages or water bodies, alternative routes have been proposed to avoid such damages to populations and environment.

Mitigation is the lessening of negative environmental impacts through a) changes in the design, construction practices, maintenance and b) additional strategies developed to protect the biophysical and safety environment which are likely to be adversely affected by the project.

Certain mitigation measures have been incorporated into the highway and pavement design itself. Mitigation measures have been incorporated with respect to project cycle. The measures given below have been developed in close coordination with design team. Inputs from environmental team were given to engineers during the project preparation stage. For example, guidelines were provided to the material engineering team for the selection of quarry sites/ borrow areas that should be environmentally suitable. This helped in providing the project with effective mitigative measures.

Impact mitigation measures have been incorporated into the highway and pavement design itself. Mitigation measures have been incorporated with respect to project cycle. The measures given below have been developed in close coordination with the design team. Inputs from environmental team were given to design team at the time of project preparation stage itself. For example, guidelines were provided to material engineering team for selection of quarry sites/ borrow areas that should be environmentally suitable. This has helped in developing an effective mitigation plan.

Measures have been provided separately for three different phases of the proposed project. The measures proposed are given at the table below.

Table 9.1: Type of Mitigation Measures

Environmental Issues **Design Phase**	**Remedial Measures**
D.1.1 Alignment The alignment was passing through the : a. Cremation ground of Jewar at 37.60km b. Houses in the Sarol village at 43.40 Km c. Fish pond at 45.60 Km d. Houses of Tappal Village at 47.50Km	Alignment has been rerouted to avoid all of these.
D.1.2 Embankment slope of the proposed highway where the sides are critical will cause **soil erosion**.	Excessive soil erosion is expected at these places owing to the steep slopes. Turfing will be done to protect the slopes. This will follow the recommended practice for treatment of embankment slopes for erosion control, IRC: 56-1974.Throughout the project corridor a conscious effort has been made to maintain a slope of 2:1
D.1.3 Road Inundation Because of increase in level, difference between the road and adjoining land, water logging may take place	The raising of the proposed pavement by 0.6 to 1.5m (depending on the requirement) from the existing level with suitable cross drainage structures e.g. culverts, in market places and areas susceptible to water logging will avoid inundation
D.2.1 Modification of Landform	Minor modifications with respect to present landuse will take place because of this project. However, against the total environmental setting this change is so less that it is insignificant and do not necessitate any special remedial measures. There is no landuse change for classified forest
D.2.2 Loss of Property: No schools or hospitals are affected by the proposed alignment. Some tubewells are however in the RoW	 The tubewells and borewells shall be relocated
D.2.3 Borrow Area: Borrow material particularly, soil and earth materials that would be used during construction. Earth borrowed from the area will modify its immediate surroundings.	Non-productive, barren lands, raised lands, riverbeds, waste lands have been recommended for borrowing earth materials; Efforts will be made to avoid agricultural lands for borrowing purposes. Rehabilitation shall be as per the owner's wish. Through community consultation with the villagers and interactions with State Department of Fisheries, low lying areas, wastelands that have a potential of being developed into fish ponds/ pisciculture have been recommended for borrow areas.
D.2.4 Quarries	• Only existing quarries with proper Environmental Clearance/ Consent, located at Sirohi and adjoining

Environmental Issues **Design Phase**	**Remedial Measures**
	areas shall be involved for the project. • No new quarries will be opened
D.3.1 Some of the **water bodies** like ponds are used as a community pond for bathing and also for fishing.	Community pond shall be protected with at least 2m high embankment, particularly on the highway side
D.3.2 Obstruction of Natural Streams a) Cross drains: Proposed widened sections are crossing number of distributaries and rivers	Provision of adequate size and no. of cross drainage structures. Overtopped sections of the corridor have been proposed to be raised suitably with the provision of suitable cross drainage structures. Adequate side drains have also been proposed. The proposed project alignment has been adequately provided with necessary engineering solution. This has been done on the basis of highest flood level data for the past 50 years, potential environmental impacts and Resettlement issues
D.4.1 Loss of **vegetation** along the proposed alignment	The loss of trees is very insignificant since the density along the existing stretch is sparse to nil. However it is compensated for by planned plantation (more than 30 times than that of the existing number of trees) along the road. Species Type: The type of species to be planted is Neem (*Azadirachta indica*), Mahua (*Madhuka Latrifolia*), Tamarind (*Tamarindus indica*), Shisham (Dalbergia sisoo), Jamun (*Eugenia jambolana*), safed siris (*Albizia procera*)
D.4.2 Reserve / Protected Forest Areas	There is no reserved or protected forest along the proposed alignment. However, the Agra Reserve Forest which is 500m away from the proposed alignment is not expected to be impacted much owing to the roadside plantation along the proposed alignment that will act as a barrier to air and noise pollution from reaching the forest areas.
D.5.1 Poor Air Quality High levels of NOx, SOx and CO.	Appropriate pavement designs to ensure that pavement roughness is as per IRCA Certification Tree Plantation along either side of the road and on the median with shrubs of suitable species to reduce the air pollutant concentrations
D.6.1 Constructional Solid Waste	Solid Waste Disposal sites should be properly designed and must be located at least 250m away from the ROW.
D.7.1 Poor Noise Quality Existing noise levels in certain stretches	Alignments have been suitably altered to ensure minimum noise quality deteoriation and impact on the nearby settlements Expected bottlenecks at the intersections will be removed

Environmental Issues Construction Phase	Remedial Measures
	be carried out. • Wherever earth materials will be cut for the road alignment, care should be taken in the rolling terrain where the slope grades are more than 1.5 percent so that cut side of the earth is not absolutely vertical. It should have gentle slope while cutting.
C.1.2 Loss of topsoil	Normally agricultural areas will be avoided for borrowing of materials, unless requested by the landowner for making water / fish ponds or for lowering the land for making it irrigable.
C.1.3 Compaction of soil	Construction vehicles, machinery and equipment will move, or be stationed in the designated ROW, to avoid unnecessary compaction of soil.
C.1.4 Borrowing of Earth	• No earth will be borrowed from within the ROW. • Non-productive, barren lands, raised lands, riverbeds, waste lands have been recommended for borrowing earth. • If new borrow areas are to be selected, then measures will be taken so that there will be no loss of productive soil, and all environmental considerations will be met with. • If vehicles carrying materials from borrow areas are passing through some villages, the excavation and carrying of earth will be done in such a way that it cause least inconvenience to the nearby people. • The unpaved surfaces used for the haulage of borrow materials will be maintained properly • Precautionary measures such as the covering of vehicles will be taken to avoid spillage of borrow materials during haulage. • To avoid any embankment slippage, borrow areas will not be dug continuously. • Replantation of trees in borrow areas will be carried out if required, at 1:2 basis.
C.1.5 Quarry	The quarry material will be obtained from licensed sites, which operate with proper environmental clearances, including clearances under the Air Act.
C.1.6 Contamination of soil from fuel and lubricants	Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites will be kept away from drainage channels and important water bodies.

Environmental Issues **Construction Phase**	**Remedial Measures**
C.1.7 Contamination of soil from construction wastes and quarry materials	Earth, if required, will be dumped in selected & approved area by the supervision consultant. All spoils will be disposed off as desired and the site will be fully cleaned before handing over. Non-bituminous wastes from construction activities will be dumped in borrow pits and covered with a layer of the conserved topsoil. Bituminous wastes will be disposed off in an identified dumping site approved by the supervision consultant
C.2.1 Water bodies	Adversely impacted water sources such as ponds etc. will be rehabilitated and compensated. Measures will be taken to prevent temporary or permanent damage to water bodies identified as per Clause D.3.1above.
C.2.2 Other Water sources	Any community water source such as wells, tube-wells, etc. lost incidentally will be replaced with alternate sources.
C.2.3 Drainage and run-off	At cross drainage structures, the earth, stone or any other construction material will be properly disposed off with the precaution that flow of water is not blocked.
C.2.4 Contamination of water from construction waste	Construction work close to the streams or other water bodies will be avoided, especially during monsoon period. All necessary precautions will be taken to construct temporary or permanent devices to prevent water pollution due to increased siltation and turbidity. All necessary measures will be taken to prevent earthworks and stone works from impeding natural flow of rivers, streams and water canals or existing drainage system. Wastes must be collected, stored and taken to approved disposal site only.
C.2.5 Contamination of water from fuel and lubricants	To avoid contamination from fuel and lubricants, the vehicles and equipment will be properly maintained and refueled. While refueling, care should be taken that no spillage of oil takes place. Oil and grease traps will be provided at fuelling locations, to prevent contamination of water. The slopes of embankment leading to water bodies will be modified and screened so that contaminants do not enter the water body. Side drains provided in the settlement areas should discharge at least through a primary settling tank

Environmental Issues **Construction Phase**	Remedial Measures
	Waste petroleum products will be collected, stored and disposed off to registered recyclers/refineres or at the approved disposal sites sites as per Hazardous Waste (Management and Handling) Rules, 2003. Water quality will be monitored as envisaged in the Environmental Monitoring Plan
C.2.6 Sanitation and waste disposal in construction camps	The construction camps will be located away from the habitation. The sewage system for such camps will be properly designed and built so that no water pollution takes place. Necessary septic tanks will be constructed.
C.2.7 Use of water for construction	The contractor will make arrangements for water required for construction in such a way that the water availability and supply to nearby communities remain unaffected. Since the project area do not have enough perennial surface water bodies, ground water will have to be extracted during construction in Summer Season however, over-exploitation of ground water should be avoided with implementation of proper water management techniques (water harvesting) Wastage of water during the construction shall be avoided.
C.3.1 Emission from construction vehicles and machinery	All the machinery and plants will be placed at the downwind direction with respect to human settlements. All vehicles, equipment and machinery used for construction will be regularly maintained to ensure that the pollution emission levels conform to the standards prescribed in Central Motor Vehicles Rules, 1989. Regular monitoring of air pollutant parameters during the construction period as envisaged in the Environmental Monitoring Plan. The asphalt plants, crushers and the batching plants should be sited at least 1 Km in the downwind direction from the nearest human settlement.
C.3.2 Dust Emission and Air Pollution	Remedial measures should be taken to minimise the dust generation and to keep it below the desirable level as far as practicable. All the materials that are likely to produce dust, like cement, should be delivered at site with proper cover. Exposure to dust from residential areas should be avoided. All hot mix plants, crushers and batching plants should be installed only after proper environmental clearance from

Environmental Issues **Construction Phase**	**Remedial Measures**
	the concerned authority All precautions to reduce the level of dust emissions from the hot mix plants, crushers and batching plants will be taken up. The hot-mix plants, crushers and batching plants will be sited at least 1 Km downwind from the nearest habitation. The hot mix plant will be fitted with dust extraction units. Water will be sprayed in the lime/cement and earth mixing sites, asphalt mixing site and temporary service and access roads. Dust suppression foam may also be used to minimize use of water. After compacting, water will be sprayed on the earthwork regularly to prevent dust. Vehicles delivering material will be covered. Mixing equipment will be well sealed and equipped as per existing standards.
C.4.1 Prevention of High Noise Level at the receptors	Avoiding the local residential area at least 300m from it. Using muffler in the equipment. Labourer should be provided with the sound plug in case of unavoidable excessive noise. Above mentioned remedial measures shall form the part of contract specification. Noise level should be maintained as per CPCB norms.
C.4.2 Noise from vehicles, asphalt plants and equipment	The plants and equipment used for construction will strictly conform to MoEF noise standards. Vehicles and equipment used will be fitted with silencer and maintained accordingly. Noise standards for industrial enterprises will be strictly enforced to protect construction workers from severe noise impacts. Workers should be provided with appropriate ear muffs/plugs Noise level will be monitored during the construction stage, as mentioned in the Environmental Monitoring Plan. Noise barriers / trees will be put at urban locations
C.4.3 Noise barriers	Construction of noise barriers in the form of sound insulating high walls and vegetation at locations with high noise levels exceeding MINAS standards shall be made.

Environmental Issues Construction Phase	Remedial Measures
C.5.1. Loss or damage to vegetation	Roadside trees that will be felled for the construction of the project shall be compensated for by planting shade trees and fruit trees about 70 times the number of the trees that will be felled. Apart from trees earmarked for felling, no additional tree clearing within the ROW will be carried out. Plantation of shrubs and under trees in the median.
C.5.2. Compaction of soil	Construction vehicles, machinery and equipment will move or be stationed in the designated area only (ROW or COI, as applicable), to prevent compaction of vegetation outside ROW. While operating on temporarily acquired land for traffic detours, storage, material handling or any other construction related (or incidental activities), it will be ensured that the trampling of soil and damage to naturally occurring herbs and grasses are minimum.
C.6.1. Accident risks from construction activities	To ensure safe construction in the temporary accesses during construction, lighting devices and safety signal devices will be installed. Traffic rules and regulations will be strictly adhered to. At blasting sites, the blasting time, signal and guarding will be regulated. Prior to blasting, the site will be thoroughly inspected. Blasting will not be carried out during rush hours Safety of workers undertaking various operations during construction will be ensured by providing helmets, masks, safety goggles, etc. The electrical equipment will be checked regularly At every work place, a readily available first aid unit including an adequate supply of dressing materials, a mode of transport (ambulance), nursing staff and an attending doctor will be provided. Road safety education will be imparted to drivers running construction vehicles. Adequate signage, barriers and persons with flags during construction to control traffic will be provided. Communications through newspaper/ announcements/ radio/TV etc. about the time frame of the project and the activities causing disruption to road access and the temporary arrangements made to gave relief to the public will be undertaken.

Environmental Issues **Construction Phase**	**Remedial Measures**
C.7.1. Health issues	Adequate drainage, sanitation and waste disposal facilities will be provided at work places Proper drainage will be maintained around the sites to avoid water logging leading to various diseases Adequate sanitation and waste disposal facilities will be provided at construction camps by means of septic tanks, soakage pits etc. At every workplace, good, and sufficient water supply will be maintained to avoid waterborne/water-related and water-based diseases and to secure the health of workers Adequate drainage, sanitation and waste disposal will be provided at workplaces. Preventive Medical care will be provided to workers. A health care system will be maintained at the construction camps for routine check up of workers and avoidance of any communicable disease.
C.8.1. Damage or loss of religious /cultural properties	Only one temple near Nagla Narayana Singh village and a crematorium at Km 37.8 shall require relocation. If any valuable or invaluable articles such as fabrics, coins, artifacts, structures, or other archaeological relics are discovered, the excavation will be stopped and Archaeology Department, Uttar Pradesh will be intimated. Construction camps, blasting sites and all allied construction activities will be located away from cultural properties so that those are no affected.
C.9.1. Roadside landscape development	Avenue plantation of foliage shade trees mixed with flowering trees, shrubs and aromatic plants as per detailed schemes prepared, will be carried out.
C.9.2. Roadside amenities	Restoration and improvement of bus shelters, bus bays and truck lay byes as per detailed design will be carried out Road furniture including footpaths, railings, traffic signs, speed zone signs, etc. will be erected as per design
C.9.3. Cultural properties	Enhancement of all cultural properties and the access roads will be completed as per design.
C.10.1 Construction camps that are likely to create negative impact due to migrant construction labourer.	Precautionary and preventive measures in the construction camp will avoid any environmental degradation. Sanitary condition of the camp should be maintained in proper hygienic condition. Drinking water quality of the campsite should be regularly maintained.

Environmental Issues Operation Phase	Remedial Measures
O.1 Spill Control	The spills at the accident sites will be cleared immediately The left over spills will be scrapped to small lined confined pits nearby, within the ROW
O.2 Dust Generation	Roadside tree plantations will be maintained. Afforestation will be taken up at new sites (for example, gram panchayat land, etc.) near the road.
O.3 Air Pollution	Vehicular emissions of critical pollutant parameters (SPM, RSPM, CO, SO_2, NO_x and Pb) will be monitored as per the Environmental Monitoring Plan. Roadside tree plantation will be maintained Vehicular air pollution will be managed and monitored at the proposed toll plaza locations Public awareness will be generated Regular maintenance of the road will be done to ensure good surface condition
O.4 Noise	Noise pollution will be monitored According to monitoring results, use of sound barriers / trees will be considered where warranted Signs for sensitive zones (hospitals / educational institutions etc.) will be put up where horn should not be blown or traffic speed will need to be regulated Public awareness programme will be launched.
O.5 Maintenance of Drainage systems	Maintaining the drains is important and to keep it clean. This would be essential particularly before monsoons. The drainage system will be periodically cleaned Water quality will be monitored as per the monitoring plan
O.6 Preserving and maintain natural vegetation	Efforts will be made for proper maintenance of planted trees, shrubs and grasses Efforts will be made to educate the villagers on the use of specified areas for cattle grazing
O.7 Soil	Soil quality monitoring as per monitoring plan for heavy metals shall be carried out.

O.8 Accidents involving hazardous materials	The 'rules' as defined in Environmental (Protection) Act, 1986 will be complied. For delivery of hazardous substances, three certificates issued by transportation department namely permit license, driving license and guarding license will be required. Vehicles delivering hazardous substances will be printed with appropriate signs. In case of spillage, the report to relevant departments will be made and instructions followed in taking up the contingency measures. Efforts will be made to clean the spills of oil, toxic chemicals etc. as early as possible.
O.9 Maintaining Congestion Free ROW	Traffic management plan will be developed, especially along congested locations Traffic control measures including speed limits will be enforced strictly. Growth of encroachment and squatting within the ROW will be discouraged No school or hospital will be allowed to be established within 200 m of the highway.
O.10 Safety Measures	In all the above, it is necessary that adequate safety measures in terms of access roads be given for schools, colleges and hospitals and barriers are also required to be provided for increased noise due to construction. Keeping in mind the number and nature of tankers carrying hazardous substances that will ply on these roads an Emergency Preparedness Plan will need to be drawn after consultation with the local administration, NGO and Local Police. The local people need to be made aware of the chemicals that are carried by the tankers and the consequences and first aid in case of an accident.

9.1 Expected Economic and Other Benefits of the Project

9.1.1 The Environmental Benefits

Direct and indirect benefits from the proposed 6/8 Lane Expressway connecting Noida – Agra road and the mitigation measures required for are manifested in many ways. The important and overarching benefits are:

- Traffic speed shall be on an average more than 100 kmph which shall lead to low cost of transportation and hence reduced pollution. The air (SPM, RSPM) and noise quality along the project corridor will be significantly improved and would conform to the national standards.

- The time taken for transport shall be reduced by 20% and hence considerable amount of less fuel consumption is expected. Hence, it can be said to save nonrenewable energy resource of the country.

- The vegetation and landscape in the area will significantly improve the quality of the environment

- Provision of parking areas, toll plaza and lay-byes with all the necessary amenities will provide excellent highway user facilities.

9.1.2 *Costs*

The total construction cost (does not include cost of land) of the expressway is estimated to be Rs. 20455.2 Mn. Non-recurring environmental costs during the design and construction period are estimated at Rs. 32.734 Mn. Recurring costs for 20 years life cycle of the project is estimated at Rs 5.180 Mn. Therefore, the total environmental mitigation and monitoring cost, after adding mobilization & Training and 5% contingency is estimated at 41.49 Mn. The breakup of cost estimates is in the following table.

Table 9.2: Environmental Budget

Component	Item	Unit	Quantity	Rate	Amount (million Rs.)
CONSTRUCTION STAGE					
Flora	• Clearing of Roadside plantation	-	1000	Rs 100 per tree	0.10
	• Compensatory afforestation	No.	34,038	Rs. 250/- per Tree	8.510
	• Landscaping/ Plantation in the median (average width 15.1m approx.)	Ha	241.6	Rs. 63,200/- per Ha (Source: ADB Study; includes cost for three years maintenance)	15.270
Slope /Embankment protection	• Turfing of embankment with grasses and herbs	Covered in engineering costs			0.000
Borrow areas	• Redevelopment of borrow areas by tree plantation and fisheries	Covered in engineering costs			0.000
Water	• Relocation of hand pumps (in addition to RAP provision)	No	9	Rs.30, 000/-	0.270
	• Relocation of village wells (in addition to RAP provision)	No	47	Rs.20, 000/-	0.940
Noise	• Sound Insulating walls for Silence zones	Meter	8 X 100	Rs.1000/- per meter	0.800
Dust Management	• Water Sprayer / Watering	Km	164	30000/- per Km (Excluding cost of watering for compaction	4.920
Environmental issues at construction sites (considering 5 Construction Packages for the entire stretch)	• Ambient air quality management	Cost as mentioned in monitoring plan **(Annexure 9.1)**			0.180
	• Noise level management				0.162
	• Water quality management				0.144
	• Maintenance cost in Soil Conservation	Km	164	Rs.7000/-	1.148
	• Sewage Disposal (Soakage Pit)	No.	16	Rs.600/- per camp / 10 Km	0.010
	• Waste disposal at service centers(Shallow Soakage well)	No.	16	Rs.5000/- each / per 10 Km	0.080
	• Accident risks in construction activity	Covered in Contract Document insurance clauses			0.000
	• Health issues	Covered in Contract Document insurance clauses			0.000
Environmental Enhancements	• Provision of pond protection work	Covered in Engineering cost			0.000
Monitoring & Supervision	Provision of consultants appointment	Lumpsum			0.200
		SUB TOTAL (CONSTRUCTION STAGE)			**32.734**
OPERATION STAGE					
Monitoring of performance indicators	• Air quality	Cost/year as mentioned in the Monitoring plan **(Annexure 9.1)**			0.045
	• Noise quality				0.024
	• Water quality				0.054
	• Vegetation				0.100
	• Soil				0.036

Component	Item	Unit	Quantity	Rate	Amount (million Rs)
		SUB TOTAL (OPERATION PHASE)			**0.259**
MOBILISATION & TRAINING					
Mobilization	• Mobilization for Pollution monitoring	Lump sum	-	-	0.100
Training	• Environmental training	Lump sum	As per training details	-	1.000
MIS		Lump sum			0.500
SUBTOTAL (MOBILIZATION & TRAINING)					**1.600**
SUBTOTAL (OPERATION PHASE) TAKEN FOR 20 YEARS PROJECT LIFE CYCLE					**5.180**
SUB TOTAL (Construction, Operation for 20 years and mobilization)					**39.514**
CONTINGENCIES @ 5 % on total Environmental Costs					**1.976**
GRAND TOTAL					**41.49**

9.1.3 *Environmental Costs versus Benefits*

The EIA authors undertook an economic analysis of the overall benefits of the project. Qualitatively, the project will have tangible environmental benefit from this project in terms of overall reduction of pollution level along the corridor. The pollution reduction is in terms of Air and Noise quality. In addition it will save precious fuel savings.

The benefits gained from the recommended construction and operation-related environmental expenditures are substantial. Without such expenditures the project would generate large environmental impacts, would lack credible environmental monitoring, permitting the bio-physical environment in the project corridor to degrade and indirectly depressing the economies of local communities.

Chapter - 8 MITIGATION MEASURES 9-1
8.0 Approach to Mitigation Measures 9-1
Table 9.1: Type of Mitigation Measures 9-2
8.1 Expected Economic and Other Benefits of the Project 9-12
8.1.1 The Environmental Benefits 9-12
8.1.2 Costs 9-13
Table 9.2: Environmental Budget 9-14
8.1.3 Environmental Costs versus Benefits 9-15

CHAPTER - 10 MONITORING & INSTITUTIONAL STRENGTHENING

10.0 INTRODUCTION

For this project JIL will be responsible for completing an EIA, obtaining MOEF clearance, obtaining SPCB clearances and for securing a tree removal and replanting permit from Local authorities. It will also need to confirm that contractors have appropriate and valid permits to use local water supplies as well as to construct and operate plants such as Hot Mix Plant, batch and rock crushing facilities. In addition JIL will be responsible for implementing and monitoring all the mitigative actions during the design, construction and operational stage of the project as defined in the EMP.

10.1 MONITORING PROCESS

JIL will coordinate with the MoEF to maintain close coordination with the members of a Multipartite Monitoring Team (MMT) which shall be organized during the pre-construction phase to monitor project compliance with the EMP, MOEF clearance conditions, NOC conditions and applicable laws and regulations. The MMT will be made up of:

- JIL (Proponent)
- Ministry of Environment and Forest
- State Pollution Control Board
- Local Non-Government Organizations

The MMT shall be organized during the pre-construction phase to monitor project compliance by the Proponent of the:

- Environmental Management Plan
- No Objection Clearance Conditions
- Applicable laws, rules and regulations

The MMT shall also:

- Gather relevant information to determine the cause of damage and public complaints/ concerns about the project;
- Prepare, integrate and disseminate monitoring status reports and submit recommendation to the MoEF.
- Undertake community information and education campaign program.

In support to the activities of the MMT, JIL will establish an Environmental Monitoring Fund covering:

- Transportation cost
- Cost of MMT Meetings
- Honoraria for the MMT members
- Cost of sampling/shipment/transport and laboratory analysis
- Cost of documentation, if any

- Cost of hiring outside experts/ subcontracting of a monitoring work to a neutral party, if required
- Cost of training of MMT, if necessary
- Cost of preparation of monitoring reports and distribution
- Cost of public information campaign and dissemination

10.1.1 Monitoring Requirement at Different Stages

The objective of monitoring is different at different stages of project cycle. An indicative list of monitoring requirements, performance indicators and associated activities is given below. The detailed monitoring plan is part of the Environment Management Plan, which is a stand alone document.

10.1.1.1 Design Stage

Develop a comprehensive monitoring plan to ensure:

- Minimum impact on roadside vegetation and nearby forests during construction
- Adherence to National Standards with respect to water quality, air and noise quality throughout the lifecycle of the project.
- Minimum impact on cultural properties and other amenities
- Hygiene at construction camps
- Safety at all times
- Regeneration of roadside plantation as per mitigation plan

10.1.1.2 Construction Stage

Implementation of the monitoring plan to ensure

- Maximum survival of roadside plantation
- Adherence to compensatory afforestation plan
- Adherence to pollution control norms with respect to emission from construction machineries and vehicles
- Adherence to pollution control measures to minimize water pollution
- Safety of project workers as well as roadside community
- Minimum impact to flora and fauna near construction camp and work site
- Hygiene at construction camps
- Minimum destruction of cultural properties and other amenities

10.1.1.3 Operation Stage

Implementation of the monitoring plan to ensure

- Prevention of deterioration of environment components of air, water, soil, noise etc.
- Restoration of borrow pits
- To improve the safety of the highway users and road side communities

Table 10.1: Performance Indicators at Different Project Stages

Performance Indicator	Project Stages		
	Design	Construction	Operation
Air quality	√	√	√
Water quality	√	√	√
Noise levels around sensitive locations.	√	√	√
Replantation success / survival rate		√	√
Soil contamination		√	
Restoration of borrow pits			√
Vital statistics on health		√	√
Accident frequency		√	√

10.2 IMPLEMENTATION ARRANGEMENT, TRAINING AND REPORTING

To supervise timely implementation of recommended mitigation measures particularly during the pre-construction and construction stages, it is essential that the JIL staff assigned to a project monitor and ensure that the construction camps and work sites should be free from any residual chemicals, debris or contaminated soil remain. With only two staff, such work is impossible. Therefore, until staffs are added, the use of consultants will continue.

10.2.1 Implementation Arrangement

An environmental officer should be appointed at the JIL corporate level who shall co-ordinate with the Project Implementation Unit (PIU). The PIU in turn should work in tandem with the Construction Supervision Consultant who will maintain liaison with contractors' people. Supervision consultants (SC), non-governmental organizations (NGOs), and contractors shall implement the project under the administrative supervision of the Project Implementation Unit (PIU) of JIL. The existing organizational structure has been studied and an additional environmental manager is recommended for PIU under project director. The proposed organizational structure is shown below:

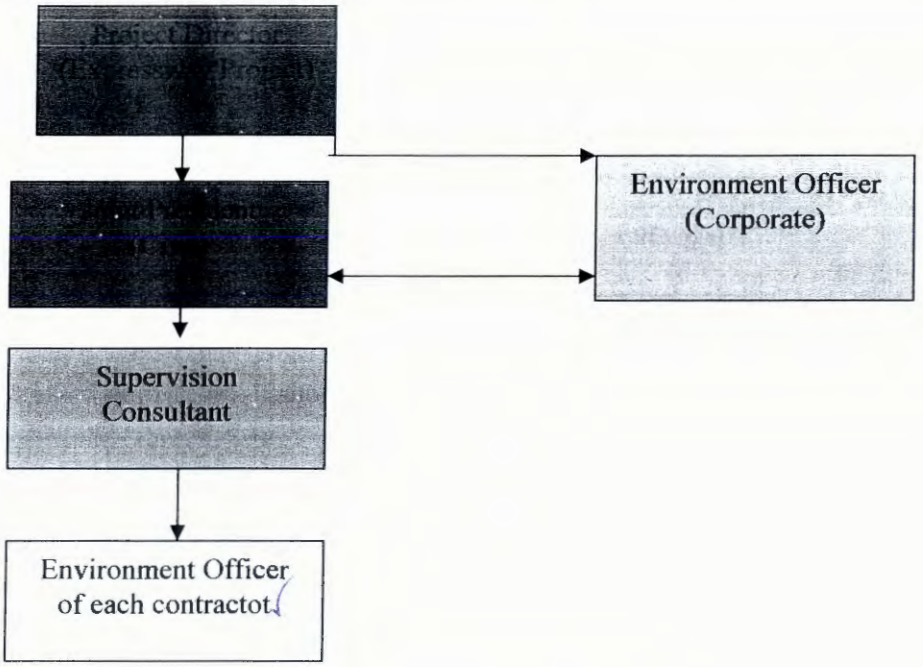


Figure 10.1: Proposed Organization Structure

10.2.2 Reporting

For effective implementation of any system / plan, reporting system is a must. The stage-wise reporting system is detailed out in the following Table:

Table 10.2: Stage-wise reporting system

Format No.	Item	Contractor	Supervision Consultant (SC)		Project Implementation Team in JIL	
		Implementation and Reporting to SC	Supervision	Reporting to PIU	Oversee/ Field Compliance Monitoring	Report to JIL (Corporate)
CONSTRUCTION						
C1	Monitoring of construction site and construction camp	Before start of work	As required	Quarterly		Half Yearly
C2	Target sheet for Pollution Monitoring	As per monitoring plan	At the time of monitoring	After Monitoring		After Monitoring
OPERATION						
O1	Target sheet for Pollution Monitoring				As per monitoring plan	After monitoring

10.2.3 Training:

To ensure the success of the proposed implementation set up there is a need for training and skill upgradation. To educate and train the PIU, the personnel of the Construction Supervision Consultants and the Contractors, a training schedule has been worked. Looking into the potential requirements of each of the target groups, following trainings are suggested as part of Proposed 6/8 Lane Expressway connecting Noida – Agra.

Table 10.3: Detailed Training Program

S. No.	Target group	Subject(s)	Method	Time Frame
1	All JIL staff, Supervision Consultants' Environmental Specialists	**Environmental Overview:** Environmental Regulations, Highway related provisions of various Acts, EIA notifications, process and methodology for EIA, EMPs and their use	Lectures	3 working days ; at l st months before the beginn of the implementatic of 6/8 Lane Expressway Connecting Noida - gra
2	All Managers (Env.) at JIL (HQ & PIU), Supervision Consultants' Environmental Specialists	**Implementation of EMPs:** Basic features of an EMP, Planning, designing and execution of environmental mitigation and enhancement measures, monitoring and evaluation of environmental conditions – during construction and operation	Workshops and Seminars	Working days; one montl before the constructi begins
3	All Managers (Env.) at JIL (HQ & PIU) Supervision Consultants' Environmental Specialists, Contractors' staff	**Environmentally Sound Construction Practices:** Clean Highway construction technology , alternatives materials and techniques for Highways, Waste Management and minimization in construction, pollution control devices and methods for construction sites and equipment, Environmental clauses in contract documents and their implications, Environmental monitoring during construction, Borrow Area and Construction Camp Management	Seminars, Lectures and Site visits	1 week; just before th construction
4	All Managers (Env.) at JIL (HQ & PIU) , Supervision Consultants' Environmental Specialists	**Monitoring Environmental Performance during Construction :** Air, Water and Noise Monitoring requirement and techniques, Evaluation and Review of results, Performance indicators and their applicability, corrective actions possible, reporting requirements and mechanisms	Lectures, Workshop and site visits	2 days During initial phas of construction
5	All Managers (Env.) at JIL (HQ & PIU)	**Long-term Environmental Issues in Highway Management :** Designing and implementing environmental surveys for ambient air , noise, biological and water quality surveys, data storage, retrieval and analysis, contract documents and environmental clauses, Risk assessment and management, contingency planning and management, Highways as assets-management and value addition and highway diseases	Workshops and seminars	3 days during implementation of 6/8 an Expressway connecting Noida - Agra

Besides the above training programme, during the construction phase training should focus on the construction labourers as they are the people whose awareness about the environment would by and large decide the protection and enhancement of environment and proper implementation of the EMP. During the operational phase, training and awareness programmes should be focused on local villagers and users of the highway. During construction phase training/ awareness programme should be organised at each construction camp twice a year. During operational phase one workshop/awareness programme should be organised at district level each year for the first 3 years.

Chapter - 10 Monitoring & Institutional Strengthening 1
10.0 Introduction 1
10.1 monitoring process 1
10.1.1 Monitoring Requirement at Different Stages 2
10.1.1.1 Design Stage 2
10.1.1.2 Construction Stage 2
10.1.1.3 Operation Stage 2
Table 10.1: Performance Indicators at Different Project Stages 3
10.2 Implementation Arrangement, Training and Reporting 3
10.2.1 Implementation Arrangement 3
Figure 10.1: Proposed Organization Structure 4
10.2.2 Reporting 5
Table 10.2: Stage-wise reporting system 5
10.2.3 Training: 5
Table 10.3: Detailed Training Program 6

CHAPTER - 11 CONCLUSIONS

11.0 INTRODUCTION

The construction of an highway may have some negative impacts, which are unavoidable, like landuse change, felling off roadside trees, which are valuable, useful and in some cases have emotional attachments with local people. Similarly, a highway project has scope for enhancing the quality of physical environment through better safety provisions, with provision of better amenities, which are important for the user and local communities. Some of these measures have been consciously and deliberately incorporated in the project itself.

11.1 EXPECTED ENVIRONMENTAL IMPROVEMENT FOR THIS PROJECT

Since in this project environmental considerations have been taken care of from the project design stage itself, barring a few unavoidable negative impacts as given above, no major impact is anticipated. On the other hand, a number of positive long-term environmental benefits can be derived from this project. Some of them are listed below:

11.1.1 Related to Highway Design:

1. There is provision of lay-byes with bus stops provided in most of semi urban settlement along the highway corridor on both the sides of the highway.
2. There is provision of service roads provided to segregate the local traffic. This is also been done with purpose improve and enhance safety of local traffic movement and to provide even non-motorised lane.
3. Highway parking places have been provided at a number of locations with vehicular parking space, space for providing restaurant, rest areas including some repair, service station along with spare parts shops. These facilities will also boost local economy.

11.1.2 Related to Ecological Improvement:

4. The fish pond at Km 45.60 is of ecological importance as well as used by the communities at large in the local villages. Hence the initially proposed alignment has been realigned in order to avoid any negative impact on the lake.

11.1.3 Related to Air/Noise Quality Improvement:

. Certain schools and hospitals along the highway shall be subjected to high noise levels and deteoriated air quality during the construction and operation of the highway. Hence, noise barriers have been provided at strategic points that will reduce the impact of the same at these places.

11.1.4 Related to Improvement of Community Properties:

5. The earlier alignment of the Expressway was through village houses in Sarol and Tappal. The rerouting has been proposed for these alignments to prevent disturbance to these communities
6. The earlier alignment also passed through the cremation ground of Jewar at 37.60 Km. The revised ROW avoids the cremation grounds.

Chapter - 11 conclusions 11-1
11.0 Introduction 11-1
11.1 expected environmental improvement for this project 11-1
11.1.1 Related to Highway Design: 11-1
11.1.2 Related to Ecological Improvement: 11-1
11.1.3 Related to Air/Noise Quality Improvement: 11-1
11.1.4 Related to Improvement of Community Properties: 11-2

Annexure 5.1

SOIL SAMPLING METHODOLOGY AND ANALYSIS

SOIL

Samples collected from the three sites at a depth of 0 to 30 cm from the land surface (Refer Table 3.4.1). The samples were analysed according to the methods described by M. L. Jackson and IARI. Some physico-chemical characteristics, nutrient and heavy metal status of Normal Agricultural Soils are given in below for comparison.

Standard Physico-chemical, Nutrient and Heavy Metal Status of Normal Agricultural Soil

Parameter	Concentration	Remarks
* EC (dSm^{-1})	0-2	Salinity effects negligible
	2-4	Yields of very sensitive crops may be restricted
* Organic Carbon (%)	<0.5	Low
	0.05-0.75	Medium
	>0.75	High
* Available - N (ppm)	<20	Low
	20 - 100	Normal
* Available - P (ppm)	<5	Low
	5-12.5	Medium
	>12.5	High
* Available - K (ppm)	<60	Low
	60-140	Medium
	>140	High
*** Extractable		
Fe	(0.7-5.5)%	
Cu	(2-100) ppm	
Mn	(100-4000) ppm	
Zn	(10-300) ppm	
Pb	(2-200) ppm	
Cd	(0.01-0.7) ppm	
Cr	(5-3000) ppm	
Co	(1-40) ppm	
Ni	(10-1000) ppm	

* Biswas, T.D. and Mukherjee, S.K. (1987): In Text Book of Soil Science, pp.314

** Review of Soil Research in India 1982. International Congress Soil Science 5, pp. 462

*** Allaway, W.H. (1968), Adv. In Agron, 20: 235.

ANNEXURE 5.2

AVAILABLE SOURCES OF STONE AGGREGATES

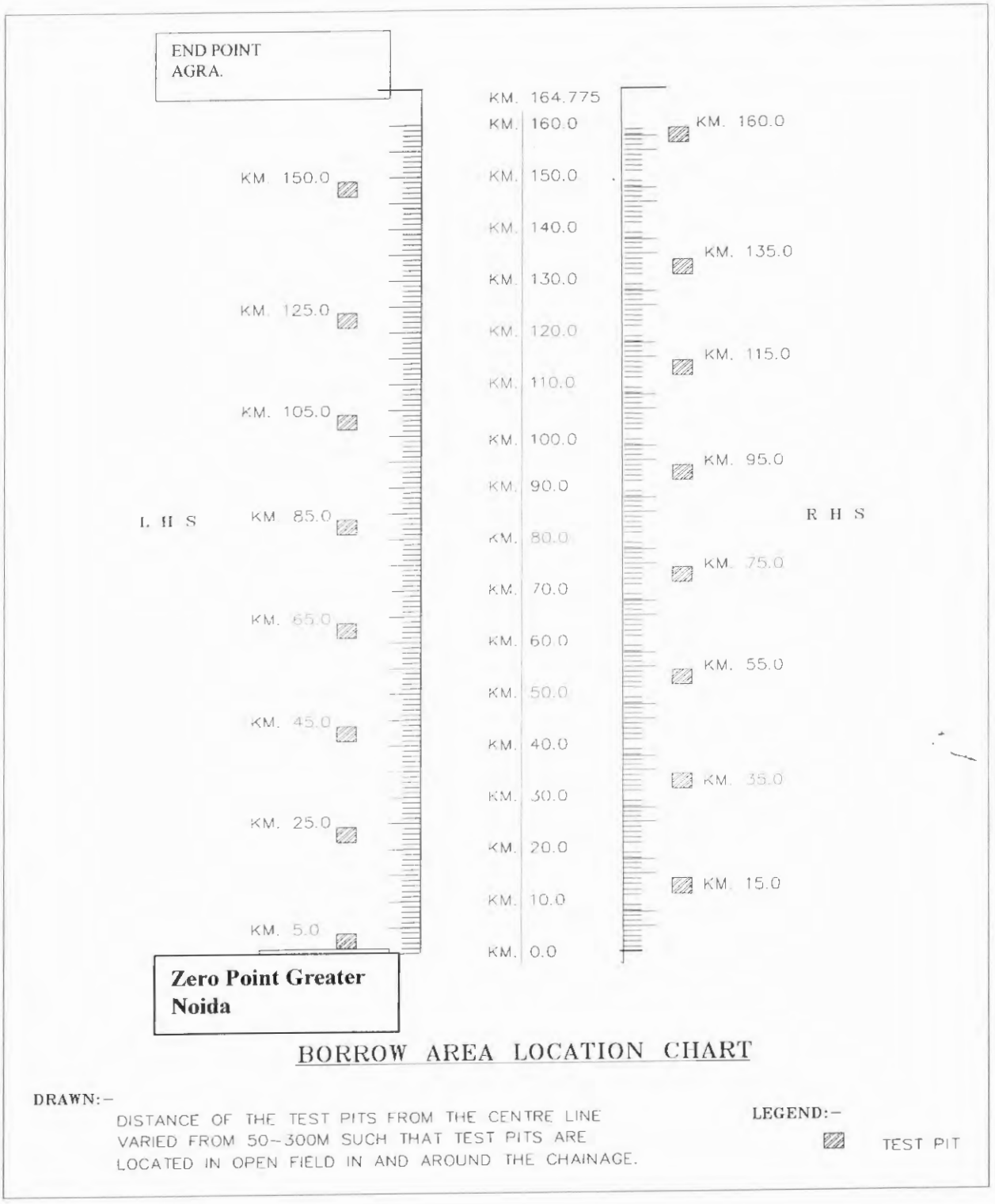
Source	Distance (Km)
Deeg, Rajasthan	100
Faridabad in Haryana	60
Kaman, Rajasthan	100
Alwar in Rajasthan	120
Near Dholpur	250
Haridwar in UP, River stone	250
Yamunagar in UP, River stone	250
Fatehpur Sikri, Dist. Agra	50
Bayana, Dist. Bharatpur	100

Enclosure-13.1 (Sheet 10/10)

SUMMARY OF QUANTITIES

S. No.	Particulars	Unit	Main Carriage Way		Service Road Double Lane		Service Road Single Lane
			Carriage Way	Shoulder	Carriage Way	Shoulder	Carriage Way
1	Earthwork	Cum	18549100.73		228310.884		567029.68
2	Pavement Qunality Concrete	Cum	1464734.41	168070.5	25275.6	6499.44	42223.22
3	Rollder Compacted Cement Concrete	Cum			21664.8	4766.26	38282.39
4	Dry Lean Concrete (M-10)	Cum	663038.12	133616.05			
5	Wet Mix Macadam	Cum	678164.47	141179.22			
6	Granular Sub base	Cum	685727.64	252105.75	17331.84	15165.36	31414.07
7	Drainage Layer	Cum	878168.36		22206.42		30400.72

ANNEXURE 5.3



BORROW AREA LOCATION CHART

DRAWN:–

DISTANCE OF THE TEST PITS FROM THE CENTRE LINE VARIED FROM 50–300M SUCH THAT TEST PITS ARE LOCATED IN OPEN FIELD IN AND AROUND THE CHAINAGE.

LEGEND:–

TEST PIT

Annexure 5.4

WATER SAMPLING METHODOLOGY AND ANALYSIS

INLAND SURFACE WATER AND RIVER WATER

Location of Sampling Stations

In order to assess the inland surface water and river water quality of the study area, five water samples were collected from the study area during the month of September, 2003. The details of the sampling location are given in Table 5.4

Quality of Inland Surface Water

Surface water samples were analysed according to the parameters listed and details of the analysis is given in Table 5.5. The quality of the surface water bodies are compared against the classification set by CPCB - Primary Water quality Criteria.

Table : Water Quality Criteria and Standards for Freshwater Classification (CPCB, 1979)

Characteristics	A	B	C	D	E
Dissolved Oxygen (DO), mg/L, Min	6	5	4	4	-
Biological Oxygen Demand, BOD, mg/L, max	2	3	3	-	-
Total Coliform organism **, MPN/100ml, Max	50	500	5000	-	-
pH value	6.5-8.5	6.5-8.5	6 – 9	6.5-8.5	6.5-8.5
Free Ammonia (as N), mg/L, Max	-	-	-	1.2	-
Electrical Conductivity, µmhos/cm, max	-	-	-	-	2250
Sodium absorption Ratio	-	-	-	-	26
Boron, mg/L, Max	-	-	-	-	2

A) Drinking water sources without conventional treatment but after disinfecting
B) Outdoor Bathing (organized)
C) Drinking water source with conventional treatment followed by disinfecting
D) Propagation of wildlife, fisheries
E) Irrigation, industrial cooling, controlled waste disposal

GROUND WATER

Location of Sampling Sites

In order to assess the ground water quality of the study area, three ground water samples were collected during the month of September, 2003 and analysis was carried out as per the procedure of APHA. The ground water samples were collected from tubewells fitted with hand pump.

Quality of Ground Water

The comparison of ground water analysis result was done against the Indian Drinking Water Standard (BIS: 10500, 1991) and WHO Standards.

Parameters	WHO (Max Permissible)
pH	6.5 – 9.2
Total Alkalinity (M)	----
Turbidity (JTU)	5-25.0
TDS	500-1500
TSS	----
Total Hardness	100-500
Calcium	75-200
Magnesium	30-150
Sulphate	200-400
Chloride	200-600
Nitrate	45-45
Boron	
Fluoride	1.0-1.5
Phenolic Compound	0.001-.002
Iron	0.1-1.0
Manganese	
Arsenic	0.05-0.05
Chromium (Total)	0.01
Lead	0.10
Total Coliform	50
Faecal Coliform	----

AQUATIC ECOLOGY

METHODOLOGY

Primary Productivity

Water samples were filtered through a phytoplankton net (mesh size 50m) with a measured bucket and collected in a PVS container. These were concentrated upto 10 ml., by centrifugation for 15 minutes using a laboratory centrifuge (2000 - 3000 rpm.). Few drops of 4% formalin was poured on the concentrated samples and stored in a refrigerator for a few days. 0.1 ml of concentrated sample was taken by capillary dropper of Haemocytomer on a counting chamber and thoroughly observed under a microscope. By repeated study using the above method representative species were identified and counted. On the basis of the counts, species diversity index were calculated using Shanon-Weaver diversity index formula. Primary productivity was calculated using Oxygen Production Method (dark and light bottle method) and multiplied by 0.375 for conversion of Carob value.

$$NPP = \frac{DO\ (Light) - DO\ (Initial)}{Duration\ Time} \qquad GPP = \frac{DO\ (Light) - DO\ (Initial)}{Duration\ Time}$$

Bio-monitoring

Benthos macro invertebrates were collected, for each water body and stored in formalin (dil). These are then drained through a no. 30US standard sieve with a pore size of 0.6mm to retain the organisms that are visible to the naked eye. The samples are then spread over a tray and sorted for benthic animals among the debris. These animals are sorted and arranged randomly in a separate tray and rated for their diversity and identified upto the family level to score for saprobity.

Biological Water Quality Criteria

Taxonomic Group	Range of Saprobic Score	Range of Diversity Score	Water Quality Characteristics	Water Quality Class	Indicator Colour
Ephemeroptera, Plecoptera, Trichoptera, Hemiptera, Diptera	7 and more	0.2 – 1	Clean	A	Blue
Ephemeroptera, Plecoptera, Trichoptera, Hemiptera, Planaria, Odonata, Diptera	6 – 7	0.5 – 1	Slight pollution	B	Light Blue
Ephemeroptera,	3 – 6	0.3 – 0.9	Moderate	C	Green

Plecoptera, Trichoptera, Hemiptera, Odonata, Crustaceae, Mollusca, Polychaeta, coleoptera, Diptera, Hirudinea, Oligochaeta			pollution		
Mollusca, Hemiptera, Coleoptera, Diptera, Oligochaeta	2 – 5	0.4 and less	Heavy Polluiton	D	Orange
Diptera, Oligochaeta, No animals	0 - 2	0 – 0.2	Severe pollution	E	Red

Annexure 5.5

AIR SAMPLING METHODOLOGY AND ANALYSIS

AMBIENT AIR QUALITY

Methodology for Sampling & Analysis of Air Pollutants

Suspended Particulate Matter (SPM), Respirable Suspended Particulate Matter (RSPM/PM_{10}), Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_x) were collected through a High Volume Air Sampler (with an attachment for RSPM sampling), manufactured by M/s. ENVIROTECH INSTRUMENTS PVT. LTD., New Delhi (model High Volume Sampler Envirotech - Cat No. APM 415-411. The sampling at seven locations for ambient air quality was done during September to November, 2003.

Analytical Methods of Measurement

The analytical methods of measurement were carried out as per IS: 11255(1985) for SPM, IS:5182 Part II(1969) for SO_2 and IS5182 Part VI(1975) and Emission Regulations Part IV by CPCB for NO_x.

Suspended Particulate Matter (SPM) & Respirable Particulate Matter (RSPM/PM_{10})

Air quality was monitored for suspended particulate matter (SPM), SO_2 and NO_2. Continuous sampling of 24 hours was carried out. Envirotech High Volume Sampler (APM 415-411) is used for sampling. Suspended particulate matter was collected on pre weighed glass fiber filter paper. Filter paper was again weighed and the difference in weight were used to calculate SPM in respective areas and expressed as $\mu gm/m^3$. The High Volume Sampler had an attachment for RSPM.

The formula used for calculation of SPM:

$$SPM\ (\mu gm/m^3) = \frac{(\text{Final weight of filter paper} - \text{Initial weight of filter paper}) \times 10^6}{\text{Volume of air sampled}}$$

Sulphur Dioxide (SO_2) & Nitrogen Oxides (NO_x)

SO_2 and NO_x were sampled by drawing air at the flow rate of 0.5 l/min, through sodium tetrachloromercurate and sodium arsenite + sodium hydroxide media respectively. SO_2 was determined by West and Gaeke Calorimetric method while the analysis of No_2 was done by modified Jacob-Hochhieiser Colorimetric Method.

SO_2 Calibration Factor = 75.0

NO_x Calibration Factor = 62.5

National Ambient Air Quality Standards

The finding as Notified on 11th April 1994 by the Central Pollution Control Board (CPCB) in exercise of its powers conferred under Section 16(2)(h) of the Air (Prevention and Control of Pollution) Act, 1981 (14 of 1981)].

Pollutant	Time-Weighted Average	Concentration µg/m³ in Ambient Air			Method of Measurement
		Industrial Area	Residential Area	Sensitive Area	
SO_2	Annual*	80	60	15	1. Improved West & Gaeke Method 2. Ultraviolet Fluo
	24 hours**	120	80	30	
NO_x	Annual*	80	60	15	1. Jacobs & Hochheiser Modified (Sodium Arsenite) Method 2. Gas phase Chemiluminescenece
	24 hours**	120	80	30	
SPM	Annual*	360	140	70	High volume sampling (average flow rate not less than 1.1 m^3/min)
	24 hours**	500	200	100	
RSPM	Annual*	120	60	50	Respirable Particulate Matter Samples
	24 hours**	150	100	75	
Lead	Annual*	1	0.75	0.5	ASS Method after sampling using EPM 2000 or equivalent filter paper
	24 hours**	1.5	1	0.75	
CO	Annual*	10000	4000	2000	Non Dispersive Infrared Spectroscopy
	24 hours**	5000	2000	1000	

OAnnual Arithmetic Mean of minimum 104 measurements in a year taken twice a week 24-hourly at uniform interval.
24-horly / 8-hourly values should be met 98% of the time in the year. However, 2% of the time, it may exceed but not on two consecutive days.

Note:

- National Ambient Air Quality Standard: The levels of air quality necessary with an adequate margin of safety, to protect the public health, vegetation and property.

- Whenever and wherever two consecutive values exceed the limit specified above for the respective category, it would be considered adequate reason to institute regular/continuous monitoring and further investigation.
- The State Government/State Board shall notify the sensitive and other areas in the respective States within a period of six months from the date of Notification of National Ambient Air Quality Standards.

Annexure 5.6

NOISE QUALITY SAMPLING METHODOLOGY AND ANALYSIS

AMBIENT NOISE QUALITY

Methodology for determining Noise levels

Noise was monitored from September, 2003 to November, 2003 at seven locations. Noise at a given location was monitored using a Noise Level Meter, Model No SL-4010. Monitoring was done in the daytime (6.00am – 6.00pm) and night (6.00pm – 6.00am) and Leq value for the daytime and night was derived from the monitored data, including the peak values.

The monitoring locations were chosen ensuring that there are no abnormal or industrial sources of noise around. The control point taken was near Agra Reserve Forest (Km 162). It was ensured that the selected sites would represent different categories of land use viz: industrial, commercial, residential and sensitive.

Standard for Noise Levels

Noise level limits prescribed under Gazelle Nalvi fiction 643 dated 26/12/1998 of Ministry of Environment & Forest, Govt. of India is given in Table below:

Table : Noise Level Limits of GoI (in L_{eq}dB(A))

Area/Class	Day Time (6:00 AM to 9:00 PM)	Night Time (9:00 PM to 6:00 am)
	Standard	Standard
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence	50	40

Annexure 7.1

DETAILS OF FLORA WITHIN THE ROW				
RHS			LHS	
Remarks	Numbers	Chainage	Numbers	Remarks
		0		
		1	1	M
		2		
2P	2	3	2	2P
4M+4P	8	4	1	M
2M+2P	4	5	5	2M+2S+1P
1S	1	6	1	1P
		7	4	3M+1S
		8	3	3S
		9	2	1P+1S
2S	2	10	3	1M+2S
5M+3S+1S	9	11	21	14S+5M+2P
		12		
4M	4	13	11	10M+1P
8M+2S	10	14	8	8M
		15	3	2S+1M
5S+1M	6	16	1	1M
2M+1S+3P	6	17	6	3S+3P
1M+3S	4	18	15	10M+5S
3M+3S	6	19	4	2M+2S
14M+28S	42	20	28	12M+16S
18M+19S	37	21	42	15M+27S
4M+2S	6	22	8	7M+1S+Mango Orchard
15M+1S+Poplar Trees	16	23	8	8M
1B+9M+4S	14	24	9	7M+2S
1M+3S	4	25	3	1M+2S
14M+2S	16	26	13	10M+3S
1B+7M+5S	13	27	8	3M+5S
12M+4S	16	28	12	11M+1S
35M+10S	45	29	26	14M+12S
10M+4S+Mango Orchard	14	30	17	13M+4S
11M+6S	17	31	16	16M
13M+11S	24	32	18	10M+8S
6M+9S	15	33	11	8M+3S
5M	5	34	13	13M
13M+2S	15	35	9	7M+2S
16M+6S	22	36	13	3M+10S+Poplar Trees+Avenue of trees+ Orchards
11M+3S	14	37	24	16M+8S+Avenue of trees
20M+1S	21	38	24	1B+10M+13S
		39	9	1M+8S

DETAILS OF FLORA WITHIN THE ROW				
RHS			**LHS**	
Remarks	**Numbers**	**Chainage**	**Numbers**	**Remarks**
		40		
		41		
1M	1	42	2	1M+1S
13M+4S	17	43	10	6M+4S
2S	2	44		
2M	2	45	1	1M
7M	7	46	9	6M+3S
5M+2S	7	47	8	4M+4S
1M	1	48	5	5M
2M	2	49	3	3M
2M	2	50	7	7M
		51	3	3M
		52		
2M	2	53		
		54		
1M	1	55		
		56		
1M	1	57	1	1M
1M	1	58		
1M	1	59	2	2M
		60		
		61	1	1M
1M	1	62	1	1M
1M	1	63	1	1M
1M	1	64	1	1M
		65		
		66		
		67		
		68		
		69		
		70		
		71	1	1M
		72		
		73		
		74		
		75	3	3M
		76		
1M	1	77	1	1M
1M	1	78	1	1M
1M	1	79	1	1M
1M	1	80	3	3M
2M	2	81		
1M	1	82	1	1M
		83		

DETAILS OF FLORA WITHIN THE ROW				
RHS			**LHS**	
Remarks	**Numbers**	**Chainage**	**Numbers**	**Remarks**
		84		
		85		
		86		
		87		
		88		
		89	1	1M
		90	1	1M
		91		
		92		
		93		
		94	1	1M
		95		
		96		
		97		
		98		
		99		
		100		
		101		
		102		
		103		
		104		
		105		
		106		
		107		
		108		
1M	1	109		
		110		
		111		
		112		
		113		
		114		
		115		
		116		
		117		
		118		
		119		
		120		
		121		
		122		
		123		
		124		
		125		
		126		
		127		

DETAILS OF FLORA WITHIN THE ROW				
RHS			**LHS**	
Remarks	**Numbers**	**Chainage**	**Numbers**	**Remarks**
		128		
		129		
		130		
		131		
		132		
		133		
		134		
		134		
		135		
		136		
		137		
		138		
		139		
		140		
		141		
		142		
		143		
		144		
		145		
		146		
		147		
		148		
		149		
		150		
		151		
		152		
		153		
		154		
		155		
		156		
		157		
		158		
		159		
		160		
		161		
		162		
		163		
		164		
12P+315M+149S+2B	**478**		**473**	**287M+12P+173S+1B**

Where, P – Palm Trees
B – Trees with girth size larger than 90cm
M – Trees with girth size greater than 60 cm but lesser than 90 cm
S – Trees with girth size greater than 30cm but lesser than 60cm

Annexure 9.1

MONITORING PLAN

The monitoring plan for the various performance indicators of the project in the construction and operation stages is summarized below.

Environmental component	Project Stage	Parameters	Location	Frequency	Standards	Approximate cost (Rs.)	Implementation	Supervision
Air Quality	Construction stage	SPM/RPM/NO_x/CO	Hot mix plant, concrete mixing plant at construction	24 hrs. continuous, 3 times in a year for 3 years	Air quality standard by CPCB	5000x3x3 =Rs.45000 / construction site (assuming 4 construction sites) Total =Rs.180000	Contractor through approved monitoring agency	PIU,JIL /SC
	Operation stage	SPM/RPM/NO_x/CO/HC/Pb/ SO_2	Greater Noida Expressway, Bajna Village, Near Ramagarhi Village, 16.36 km	24 hrs. continuous, 3 times in a year / year	Air quality standard by CPCB	5000x3X3 =Rs.45000	Contractor through approved monitoring agency	NHAI
Water Quality	Construction stage	All the parameters for inland surface water quality standard for Class-D will be tested for Ground water as per IS 10500:1991	Lohia Nallah at Km 5.85 Fish pond at Km 45.60 Small local stream at Km 160.82 and Bhim Swamp at Km 100.00(Biomonitoring only) besides 1 ground water locations at each construction package (5)	3 times a year for 3 years	Water quality standard by CPCB	9x3x2000x3 =Rs. 1,62,000	JIL	PIU,JIL/SC
	Operation stage	All the parameters for inland surface water quality standard for Class-D will be tested Ground water as per IS 10500:1991	Lohia Nallah at Km 5.85 Fish pond at Km 45.60 Small local stream at Km 160.82 and Bhim Swamp at Km 100.00(Biomonitoring only) besides 1 ground water locations at each construction package (5)	3 times a year /year	Water quality standard by CPCB	3x2000x9 =Rs.54000	Contractor through approved monitoring agency	JIL

Environmental component	Project Stage	Parameters	Location	Frequency	Standards	Approximate cost (Rs.)	Implementation	Supervision
Noise levels	Construction stage	As per National Ambient Noise Standard as per Environmental Protection Act, 1986 amended 2002	Intersection of Noida – Greater Noida Expressway with the Proposed Expressway – Km 0 Bajna Village – Km 65.00 Bhim Village – Km 100.00 Near Agra Reserve Forest – Km 162	24 hrs. continuous, 3 times a year for 3 years	Noise level standard by CPCB	4x2000x3x3 =Rs. 72,000	JIL	PIU,JIL/SC
	Operation stage	As per National Ambient Noise Standard as per Environmental Protection Act, 1986 amended 2002	Intersection of Noida – Greater Noida Expressway with the Proposed Expressway – Km 0 Bajna Village – Km 65.00 Bhim Village – Km 100.00 Near Agra Reserve Forest – Km 162	3 times in a year for 1 year	Noise level standard by CPCB	4x2000x3X1 =Rs. 24000	Contractor through approved monitoring agency	JIL
Flora	Operation stage	Maintain the species at 75% survival rate	Entire stretch	For three years after Plantation	-	Rs. 1,00,000	JIL	JIL
Soil	Operation stage	Monitoring of Pb, Cr, Cd	Congested locations (4 locations)	3 years once in a year during winters	-	4X3000X3= Rs. 36000	JIL	JIL

Total Monitoring Cost: Construction Phase = Rs. 4,14,000 and Operation Phase = Rs. 2,59,000 per Year