# WILDLIFE MITIGATION PLAN FOR BIODIVERSITY CONSERVATION

# FOR

# BEAS RIVER CONSERVATION RESERVE

# AND

# KALI BEIN CONSERVATION RESERVE

# IN PUNJAB, INDIA

## In view of construction of the Flyovers over them for New Delhi – Amritsar - Katra Expressway

**By**

**NABARD Consultancy Services Pvt.Ltd.**

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# Project Team

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(on Honorary and Voluntary Basis)

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## EXECUTIVE SUMMARY

Ministry of Road Transport & Highways, Government of India has approved Delhi - Amritsar - Katra Expressway under Bharatmala Project for implementation through its Nodal agency, the National Highways Authority of India. The construction of this 4-lane access-controlled Expressway which can be expanded to eight lanes with interchanges/ramps for providing connectivity with the other National Highways/State Highways, is to be executed through Public Private Partnership (PPP) on Build Operate and Transfer (BOT) basis, following Design, Build, Finance and Operate (DBFO) pattern.

In Punjab, total length of alignment of Delhi-Katra expressway is 361.656 Km (262.656 Km of the Punjab Section of Delhi–Katra Expressway and 99 Km of Greenfield Amritsar Connectivity) with 90 m Right of Way. The alignment in Punjab starts from Galoli village in Distt. Patiala and covers 7 Districts (Patiala, Sangrur, Ludhiana, Kapurthala, Jalandhar, Gurdaspur & Pathankot). The Project is likely to cost Rs. 30000 Crore including land acquisition and will result in savings in travel time, fuel, total transportation cost and catalyzing the economic activities. Presently, the Land Acquisition activities are under progress. The Project requires about 4400 Ha. of land in Punjab including land for Interchanges & Way Side Amenities.

The Highways play very important role for development and growth; however, they also impact environment, forests, biodiversity and other natural resources directly and indirectly besides impeding mobility and survival of both terrestrial and aquatic wildlife. Therefore, undertaking EIA of the Road projects and obtaining environmental clearance including forest and wildlife clearances have been made mandatory by Ministry of Environment, Forest and Climate Change (MOEFCC), Government of India to safeguard precious bio-resources. The proposed project is covered under schedule '7-f – Category A', based on MoEF&CC's EIA Notification (14th Sept 2006) and its subsequent amendments. The ToR for Punjab Section of Delhi-Katra Expressway was issued by MoEF&CC vide F. No. 10- 18/2020-IA.III dated 18th March, 2020.

The proposed alignment of the Expressway impacts two protected areas of Punjab. It passes through Kali Bein Conservation Reserve between Km 339+100 to Km 339+400 & Km 26+200

to Km 26+600 in Kapurthala district of Punjab and through the Beas Conservation Reserve between Km 354+474 to Km 354+962 & Km 37+500 to Km 38+900 in Kapurthala and Gurdaspur districts of Punjab. The project involves construction of bridges on Kali Bein Conservation Reserve and two flyovers on Beas Conservation Reserve at an estimated cost around Rs 600-650 crores. Both these Conservation Reserves, besides being important part of Protected Area Network in the state, are also Ramsar sites i.e. among the wetlands of international importance.

Beas Conservation Reserve is home to the only population of Indus River dolphins (*Platanista gangetica minor*) in India. The state Wildlife Dept. has also reintroduced Gharial (*Gavialis gangeticus*) in the Beas Conservation Reserve to repopulate the river with this important species after more than thirty years of their disappearance from river. The Smooth-coated Otter *(Lutrogale perspicillata)* and Hog Deer (*Axis porcinus*) are other important species which inhabit Beas Conservation Reserve. The Beas conservation reserve provides vital habitats for more than 500 species of birds and particularly is an important staging area for both summer and winter migratory water birds. The river Beas also supports seven species of freshwater turtles and around 90 species of fishes including the endangered mahseer (*Tor putitora*). Similarly, Kali Bein supports rich diversity of flora and fauna including 5 mammals, about 90 species of birds, 17 taxa of fishes and 35 taxa of invertebrates.

The proposed alignment of the Expressway will impact 2.0 Ha approx. of Kali Bein Conservation Reserve and 17.00 Ha of Beas Conservation Reserve. Therefore, preparation of a Mitigation Plan is necessary for protecting and conserving biodiversity and wildlife habitat of the impacted Conservation Reserves not only to mitigate the immediate and long-term impacts of the proposed expressway but also for obtaining the clearance of this project from the Standing Committee of the NBWL.

For preparing the Mitigation Plan, rapid surveys were conducted in the villages around the proposed sites and to the protected areas Beas and Kali Bein Conservation Reserves. The objective of these surveys was to understand the perception of the riparian communities on construction of four flyovers/ bridges near their villages and to understand biodiversity potential of the sites and over the Beas and Kali Bein Conservation Reserve. Supporting data

was also obtained from Punjab Pollution Control Board, Department of Forests and Wildlife Preservation, Punjab, Punjab State Council for Science and Technology and WWF-India.

It was observed that the construction of this expressway through protected areas will alter the present ecological conditions bifurcating natural habitats of flagship aquatic and many other species. Consequently, it may cause decline in populations of many wildlife species, influence present natural landscape patterns and alter the physical environment. The proposed expressway and bridges will also act as barriers to animal movements increasing their mortality on road, and cause other negative impacts on the biodiversity.

For local people, roads can have both positive and negative influences. On the positive side roads provide the opportunity of mobility and transport for people and goods, which will bring economic prosperity by opening the area for fast development and industrialisation. On the negative side roads occupy land resources displacing local people, form barriers to movement of people and domestic animals, and may be detrimental to health due to increased environmental pollution of all kinds, and have serious impacts on ecology, wildlife and biodiversity of the Study Area.

The mitigation strategy is proposed keeping in view the dimensions such as environment and other natural resources conservation, habitat management, biodiversity conservation, ecotourism development, sustainable resource development and livelihood improvement. The proposed plan has categorized mitigation of impacts into three categories i.e. construction phase, post- construction and operationalization phase. The mitigation plan also distributes and fixes responsibilities of Project Proponent, Wildlife and Forest authorities and other stakeholders to undertake specific mitigating measures. Measures to minimize the road-kills on the proposed expressway includes best road design and management practices to minimize road accidents, identification of important points of animal crossing including the frequency, provide safe-crossings for wild fauna through nicely designed eco-passages, provide ‘guide fencing’ on both sides of passages for safe crossing of animals, virtual fencing, install sign boards for early warning to commuters to reduce speed of vehicles.

The measures suggested for NHAI for mitigating and minimizing impacts concurrently with construction and operationalization of Expressway include implement measures to prevent roadkills, minimize impact of bifurcation of habitat and permanent barrier effect, compensate

loss of protected areas of BCR and KBCR, mitigate the effect of Pollution of various kinds, ensure that all Labour camps are established at a minimum distance of 500 meters from the boundary of Beas Conservation reserve and at least 200m from either side of KBCR to avoid any pressure on the protected areas. The labour will be made aware about wildlife laws so that they don't indulge in any poaching, fishing or any other illegal activity, etc. PP will also undertake measures to minimize noise pollution and ensure that no construction material is dumped or stored in protected area, ensure that piers of bridges are not constructed in river bed with flowing water to the extent possible so that continuity of channels and free flow of water is not obstructed or changed. Best Management Practices for construction of flyover should be adopted and efforts should be made to have Suspension Bridge based flyovers.

The mitigating measures are suggested for the Wildlife Authorities (WLA) include stationing a permanent team to work in close association with the PP for smooth execution of work of the Expressway in the protected areas consistent with plan, concurrent monitoring of project to make sure that Construction firms engaged by the PP i.e. NHAI are clear about the mitigation measures to be incorporated and implemented in letter and spirit during construction. The WLA will also ensure that eco-friendly measures are adopted by PP for storage/transportation of construction materials to minimize pollution, ensure safety of animals during construction of Expressway through continuous watch and ward of the area. This will be duty of the WLA to complete all works prescribed for amelioration in a fixed time frame to achieve the desired results are achieved. The Field team stationed at project site work with PP to ensure that those construction activities which may disturb the wildlife during breeding season and migratory season are kept at a low key. This team will be provided with all the rescue equipment viz. vehicle, boat and lifesaving equipment, tranquilizing equipment, nets, cages, etc. to ensure rescue of stranded animals in a professional manner. The loss the loss of protected area habitat coming permanently under expressway will be compensated by procuring an equivalent area for which funds will be provided by the PP under this mitigation plan. The PP and WLA will be bound to abide by any other prescriptions if made by State Wildlife Board or National Board of Wildlife while according clearance to the proposal.

The mitigation planning framework envisages ecosystem conservation for aquatic habitat improvement, biodiversity enhancement, phytoremediation, awareness, research and

monitoring to the address the adverse impacts to ecological character of Beas and Kali Bein Conservation Reserve due to the Delhi-Katra expressway are also further elaborated in the mitigation plan. A total budgetary outlay of Rupees 13.77 crore is proposed to successfully implement the activities detailed out in the mitigation plan so as to neutralise/minimise the long-term impacts from the proposed Expressway.

It is of utmost importance to act on the perceived impacts of this project on biodiversity and commensurate mitigating measures to minimize the short-term impacts and ameliorate their long-term cumulative effect on the wildlife, biodiversity and environment of the area. Suggested mitigation measures in the plan need to be implemented and brought into practice by the project proponent, by the Wildlife Authorities (WLA) or the concerned stakeholder for an overall welfare of Beas and Kali Bein Conservation Reserve.

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# Chapter 1: Introduction

## 1.1 Project Background

Ministry of Road Transport & Highways, Government of India is implementing a Bharatmala Project, namely Delhi-Amritsar-Katra Expressway. The facility is proposed to be fully access controlled with interchanges/ramps for providing connectivity with the other road network of National Highways/State Highways. Government of India had accorded the approval of Construction of 1000 Km of Expressway through Public Private Partnership (PPP) on Build Operate and Transfer (BOT) basis, following Design, Build, Finance and Operate (DBFO) pattern under National Highways Development Project (NHDP) Phase VI in the year 2006 where Delhi-Chandigarh Expressway was also identified. Later, during interaction with Stakeholder Govts., it was decided that it should be from Delhi to Katra, having spurs for providing connectivity to another road network; and should follow the shortest route from Delhi to Amritsar. Further, it was observed that the shortest route is likely to pass near the towns of Bahadurgarh-Sampla-Gohana-Kalayat-Patran-Sunam-Barnala-Jagraon-Sultanpur Lodhi- Khadoor Sahib-Amritsar-Kathua-Samba Udhampur- Katra.

After exhaustive discussions with the State Govt., the alignment in Punjab was finalized in early January, 2020. About 300 Km of the Expressway falls in Punjab. For providing connectivity to Amritsar an Expressway spur of about 100 Km is also planned from Nakodar which will connect Amritsar via Tarn Taran. The alignment is being finalized, so that further activities can be undertaken. The Project is likely to cost Rs. 30000 Crore including land acquisition.

The alignment is roughly a crow-flight alignment to allow for a near-perfect geometry with shortest distance and resulting in savings in travel time, fuel and total transportation cost, besides environmental benefits and catalysing the economic activities.

The alignment in Punjab starts from Patran Tehsil in Distt. Patiala and covers 7 Districts (namely Patiala, Sangrur, Ludhiana, Kapurthala, Jalandhar, Gurdaspur & Pathankot) before entering into Jammu & Kashmir. Presently, the Land Acquisition activities are under progress. The Project requires about 4400 Ha. of land in Punjab including land for Interchanges & Way Side Amenities. The project is 4 lanes expandable to 8 lanes with provision of service road for future.

## 1.2 Project Proponent

**National Highways Authority of India (NHAI)**

NHAI is the nodal authority / Project proponent for the Development of Punjab Section from Km 135+056 to Km 397+712 of Delhi-Katra Expressway including Greenfields Connectivity to Amritsar (starts at Km 306+000 of Delhi – Katra Expressway and ends at Amritsar – Ajnala Road NH-354 for a total length of 99 Km).

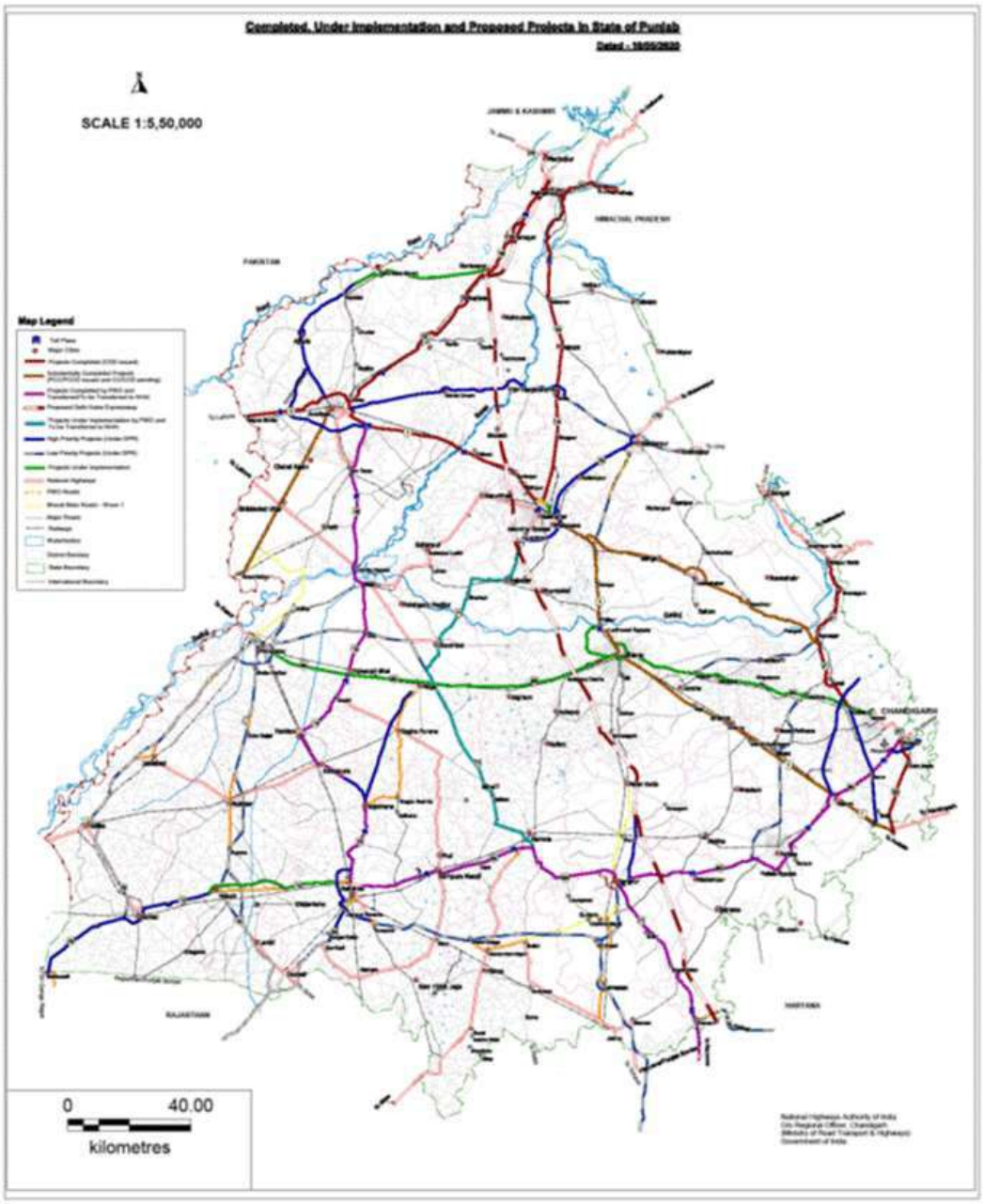
National Highways Authority of India (NHAI) is responsible for management of national highways and is the nodal agency of Ministry of Road Transport and Highways (MoRTH), Government of India. NHAI aims at provision and maintenance of national highways network to meet user expectations in the most time-bound and cost-effective manner within the strategic policy framework. In Punjab, NHAI has 31 National Highways having a total length of 3119 Km under its jurisdiction out of which it manages 1797 Km and rest are managed by State PWD. The detail is given in following Table and Map.

**Table 1: Status of National Highways length in Punjab**

| **Total No. of NHs passing through the State** | **31 (3, 5, 7, 9, 44, 52, 54, 62, 105B, 148B, 148BB, 152, 152A, 154, 154A, 205, 205A, 254, 344, 344A, 344B, 354, 354B, 354E, 503A, 503Ext, 703, 703A, 703B, 754 & 703AA)** | | |
|---|---|---|---|
| **Total Length of NH in the State of Punjab** | 3119.34 Km (plus approx. 33 km new ext.) | | |
| **Density of NHs in the State in Population (km/lakh Population)** | 11.80 against 10.90 for All India | | |
| **Density of NHs in the State in Area (km/Thousand Sq. km)** | 64.90 against 39.90 for All India | | |
| **Total Length of NH with State PWD** | 1355.46 Km | | |
| **Total Length of NH with NHAI** | 1797 Km | | |
| **Lane wise distribution of NHs** | MoRT&H (State PWD) | NHAI | Total |
| **Six Lane (m)** | - | 397 | 397 |
| **Four Lane (km)** | 297.065 | 487 | 784.065 |
| **Two Lane with Paved shoulder (km)** | 916.17 | 913 | 1829.17 |
| **Less than Two Lane (km)** | 137.22 | - | 137.22 |
| **Total Length (km)** | 1355.46 | 1797 | 3152.46 |

Source: NHAI

Figure 1: Map of existing and Proposed National Highways and Expressway in Punjab



## 1.3 Project Rationale

The Proposed Expressway Project needs and importance are as follows:

- The development of proposed Expressway will improve the connectivity between major cities of Punjab State viz. Patiala, Sangrur, Jalandhar, Ludhiana, Kapurthala, Gurdaspur, Tarn Taran and Amritsar with the National Capital Territory of Delhi.
- The proposed Expressway will overall improve connectivity from Delhi to Amritsar and Katra. The proposed expressway will act as a significant axis of entry to Delhi from major industrial hubs like Ludhiana, Kapurthala etc.
- The proposed Expressway will further enhance the connectivity of underdeveloped districts. The economic development of these regions will be strengthened as a result of access to developed markets and reduction in logistics costs.

Further, the proposed project will have multi-fold benefits for the local and regional economies as follows:

- The proposed Expressway will provide faster access for the farm produce to the developed and farther markets;
- The districts traversed by the proposed expressway are industrial districts which will significantly benefit from improved connectivity to raw material centers located in other areas and easy access to the markets;
- Tourism in the area will be benefitted from improved access and connectivity;
- Improved road safety as a result of access-control Expressway and reduced crossings.

## 1.4 Project Details

The Punjab section of Delhi - Katra Expressway starts at Ch. 135+056 (29°49'51.50"N, 76°11'00.25"E) near Galoli Village in Patiala district and ends at Ch. 397+712 (32°01'4.13"N, 75°24'5.50"E) at Gurdaspur Bypass in Gurdaspur district. The proposed Amritsar greenfield connectivity starts from Nakodar at intersection of Delhi - Katra Expressway with NH 703 (old NH 71) (Expressway Ch. 306) (31°12'8.52"N, 75°30'20.72"E) and ends on Amritsar-Ajnala Road NH 354 (near Canal) without crossing the same (31°44'32.35"N, 74°47'27.32"E).

The total length of the proposed project alignment is 361.656 Km (262.656 Km of the Punjab Section of Delhi–Katra Expressway and 99 Km of Greenfield Amritsar Connectivity). The proposed Right of Way (RoW) is 90 m. The project is planned as 4 lanes access-controlled highway expandable to 8 lanes with provision of service road for future. The proposed Expressway will improve connectivity from Delhi to Amritsar and Katra. The development will also improve the connectivity between major cities of Punjab State (viz. Patiala, Sangrur, Ludhiana, Jalandhar, Kapurthala, Tarn Taran, Amritsar and Gurdaspur) with the National Capital Territory of Delhi and other districts of Haryana and UT of Jammu and Kashmir. The

proposed expressway will act as a significant axis of entry to Delhi from major industrial hubs of Punjab like Ludhiana and Kapurthala etc. The proposed Expressway is expected to reduce the travel time between Delhi to Gurdaspur by at least 2-hour and travel distance by 70 km with respect to NH-44, and travel time reduction of four-hour with respect to NH-352.

## 1.5 Project Impact and requirement of Wildlife Clearance

It's a well-known fact that roads impact environment, forests and wildlife and other natural resources directly as well as indirectly bringing their degradation and depletion. Both terrestrial and aquatic biodiversity are significantly affected by siting as well as design of the roads, which can impede free movement of wildlife and fish movement, obstruct water flows, and degrade water quality. Consequently, undertaking EIA of the Road projects such as this Expressway and obtaining environmental clearance including forest and wildlife clearances have been made mandatory by MOEFCC, Government of India.

**Ministry of Environment, Forest and Climate Change (MOEFCC) Terms of Reference (ToR) for Expressway**

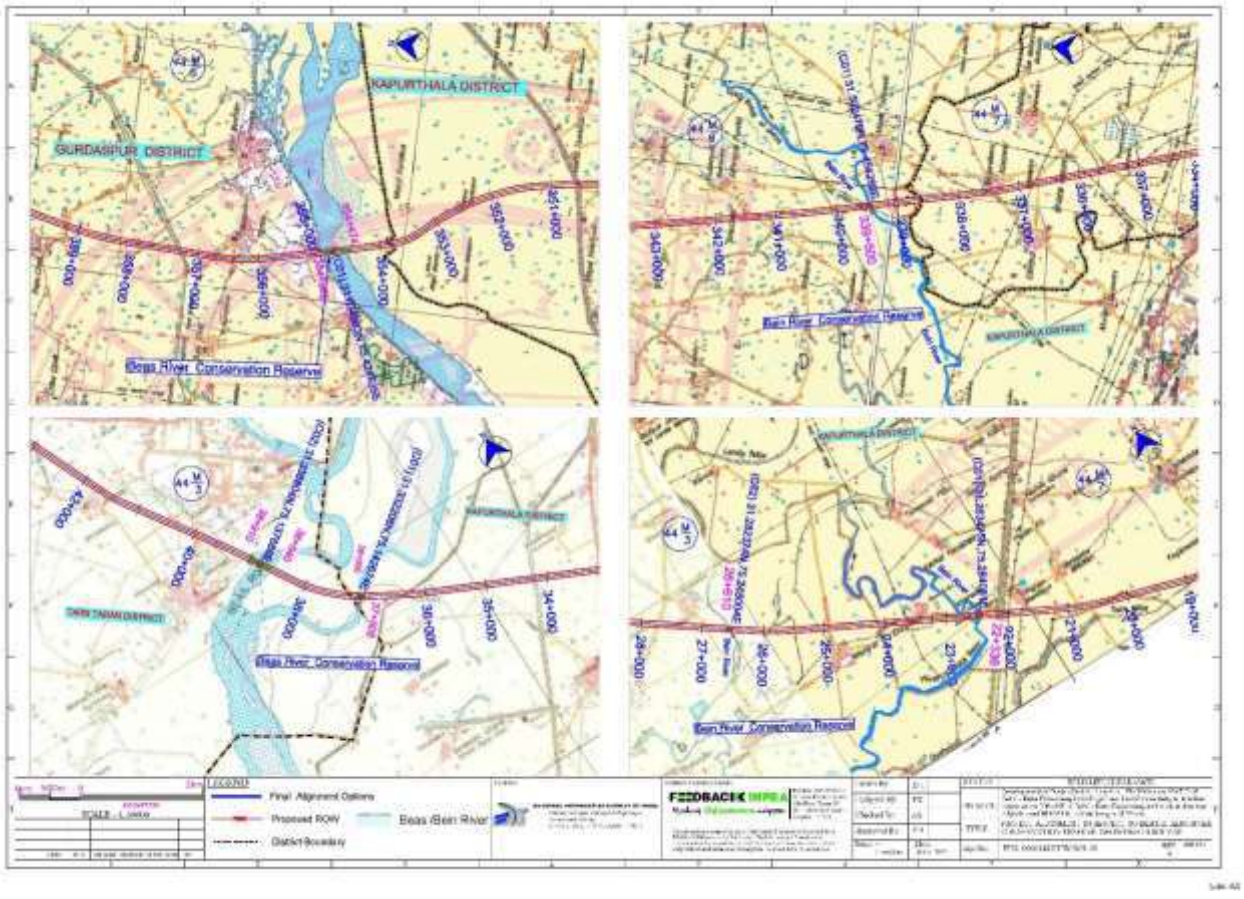
The proposed project is covered under schedule '7-f – Category A', based on MoEF&CC's EIA Notification (14th Sept 2006) and its subsequent amendments. The project involves submission of the Environmental Impact Assessment Report to Ministry of Environment, Forest and Climate Change (MoEF&CC), GOI, New Delhi as a pre-requisite to obtain Environmental Clearance.

The ToR for Punjab Section of Delhi-Katra Expressway was issued by MoEF&CC vide F. No. 10-18/2020-IA.III dated 18th March, 2020. MoEF&CC has directed NHAI to carry out following studies:

- The area is important from wildlife/biodiversity point of view as the proposed alignment passes through Beas River Conservation Reserve and the study area (10 km radius) falls within the Eco-sensitive Zones of Bir Gurdialpura (District Patiala) and Bir Aishwan (District Sangrur) Wildlife Sanctuaries. The proponent, with the help of independent ecological institution/expert of national repute, shall prepare a detailed Biodiversity Conservation Plan along with adequate mitigation measures so as to address issues related to the wildlife and biodiversity conservation in the region.
- Study in line with the recent guidelines prepared by Wildlife Institute of India for linear infrastructure with strong emphasis on animal movement and identifying crossing areas and mitigation measures to avoid wildlife mortality.
- Provide measures to avoid road kills of wildlife by the way of road kill management plan.

- A comprehensive plan for plantation of three rows of native species, as per Indian Road Congress (IRC) guidelines, shall be provided. Within the boundaries of Delhi/NCR, the project proponent has to plant 10 trees against each tree to be cut along the proposed alignment.

Figure 2: Location of the Project vis-à-vis Beas and Kali Bein Conservation Reserve



Although the proposed routes of both Punjab Section and Amritsar Connectivity have been selected after considering various parameters like acquisition of land, acquisition of ecologically protected area, length, design, project cost, etc., however, to connect Delhi from Katra and Amritsar it is inevitable to cross the Kali Bein and Beas Rivers, and consequently through Kali Bein and Beas Conservation Reserve and no other feasible routes without crossing these Wildlife Conservation Reserves are available.

The proposed alignment of Punjab Section of the Expressway passes through Kali Bein Conservation Reserve between Km 339+100 to Km 339+400, and through the Beas River Conservation Reserve between Km 354+474 to Km 354+962 in Kapurthala and Gurdaspur Districts. The proposed alignment of Amritsar Connectivity also passes through the Kali Bein Conservation Reserve between Km 26+200 to Km 26+600 and through the Beas River Conservation Reserve between Km 37+500 to Km 38+900 in Kapurthala district. The RoW for the proposed Expressway is 90 meters. The proposed project involves development of bridges at 2 locations on Kali Bein River and two locations on Beas River along the Punjab Section from Km 135+056 to Km 397+712 of Delhi - Katra Expressway including Green field Connectivity to Amritsar (starts at Km 306+000 of Delhi – Katra Expressway and ends at Amritsar – Ajnala Road NH-354 for a total length of 99 Km).

**Beas River Conservation Reserve**

'River Beas with all its water channels from 52 Head Talwara to Harike Barrage including all Government areas in River Beas' (Approx. 185 Km stretch) has been notified as Conservation Reserve by Govt. of Punjab, Dept. of Forests and Wildlife Preservation (Forest Branch) vide Notification No. 34/13/2017-Ft-5/1052756/1 Chandigarh dated 29/08/2017.

**Kali Bein Conservation Reserve**

"… The Governor of Punjab is pleased to declare the area of following villages, totalling 520.824 acre as "Kali Bein Conservation Reserve" from the date of issue of this notification…" (Govt. of Punjab, Dept. of Forests and Wildlife Preservation (Forest Branch) vide Notification No. 34/12/2019-Ft-5/1499748/1 Chandigarh dated 11/06/2019)".

**Government of India, MOEFCC's Guidelines for taking up Non-forestry activities in Wildlife Habitats**

With a view to protect the integrity of the flora and fauna of the country, as well as bring in clarity and transparency in the issue of Environmental, Forest and National Board for Wildlife (NBWL) clearances for taking up non-forestry activities in wildlife areas, Government of India, MOEFCC, vide their F. No. 6-10/2011 WL Dated:19 December 2012 issued a revised set of guidelines on the matter. The relevant paras of the guidelines for this project are reproduced as under:

“1. General Policy:

National Parks, Sanctuaries and Conservation Reserves are notified under the Wildlife Protection Act, 1972 as dedicated areas rich in, and representing the unique biodiversity of a place. Such protected areas are considered very important for conservation of biodiversity, and for ensuring the healthy populations of its floral and faunal components, for the present and future generations alike. However, the rising human population and its growing demands for socio-economic development put increasing stress on forests including protected areas both directly and indirectly. This calls for a balance that has to be struck between development and conservation implying that any activity involving use or diversion of any part of a notified protected area may be considered only under most exceptional circumstances, taking fully into account its impending impact on the biodiversity of the area, and consequently on the management of the Protected Area. A critical part of this balanced approach is to spell out the feasibility of mitigation to address the impacts without compromising the management objectives of the Protected Area. The activities to be taken up in the identified wildlife habitats also need to comply with the orders of the Hon'ble Supreme Court in addition to the statutory requirements as provided in the Wild Life (Protection) Act, 1972.

……

Activities inside Conservation Reserves:

The Ministry of Law and Justice has opined that activities to be taken up inside a Conservation Reserve can also be dealt with in the Standing Committee of NBWL. Therefore, the procedure indicated under para 4 below needs to be followed for planning and executing any activity inside Conservation Reserve also….”

In view of issues reflected in the foregoing paras, it’s clear that the proposed project impacts the area of two Wildlife Conservation reserves which attract the provisions of Wildlife (Protection) Act, 1972. Therefore, preparation of a Mitigation Plan is a necessary prerequisite for protecting and conserving the biodiversity and the wildlife habitat of the impacted Conservation Reserves and has to be submitted to the Standing Committee of the NBWL for obtaining wildlife clearance for the proposed Delhi-Katra Expressway project of NHAI. The brief technical details of the proposed project and wildlife area impacted are as under:

Table 2: Summary of technical details of the proposed project and wildlife area impacted

| S No | Subject | Details |
|---|---|---|
| **1** | Name and Nature of the Proposed Project for obtaining wildlife clearance | Development of Punjab Section of Delhi-Amritsar-Katra Expressway from Km 135+056 to Km 397+712 including Green field Connectivity to Amritsar starting at Km 306+000 of the Expressway and has a total length of 99 Km. It's a Linear project. |
| **2** | Total length of the project and area covered | 335 km of expressway covering an area of 4400 ha approx.. |
| **3** | Name of Protected Areas Impacted | Kali Bein Conservation reserve (KBCR)<br>Beas River Conservation Reserve (BCR) |
| **4** | Total Wildlife Area Impacted | 2.00 Ha approx. of KBCR<br>17.00 Ha of BCR (10.2 Ha area of water body and 6.8 Ha other area) |
| **5** | Likely Impact of the proposed project on Wildlife | The project is covered under schedule '7-f – Category A', as per MoEF&CC's EIA Notification (14th Sept 2006). Overall impact of the project on wildlife areas is described in coming chapters along with the mitigation measures to minimize the impact. |

## 1.6 Wildlife Mitigation Plan

Mitigation essentially includes any deliberate action taken to alleviate adverse effects, whether by controlling the source of impacts or the exposure of the ecological receptors to them (Treweek, 1999). Though the need for ecological mitigation is widely acknowledged it should clearly be borne in mind that ecological solution to engineered modifications of natural areas can never be complete and perfect for arresting all ecological impacts. Although, the best form of mitigation is certainly avoidance of impacts through design, this may not always be feasible under the given technological and design constraints and the limited financial resources for planning ecological mitigation. The success of mitigation measures would greatly depend on the scale of development and the nature of impacts. If the objective of mitigation is to help safeguard resources to ensure that development is compatible with conservation goals, it is important for mitigation measures to generally incorporate strategies to ensuring rescue (relocation and translocation), repair, reinstatement, restoration and compensation of ecological receptors and resources.


- Introduction
- The protected areas impacted by the project
- Study of project impacts on the protected areas
- Impact assessment of the proposed project on the study area.
- Wildlife mitigation plan for biodiversity conservation

# Chapter 2: Details of the protected areas impacted by the project

## 2.1 General Demography of Punjab

The state of Punjab derives its name from a combination of the Persian words 'Punj' (five) and 'Aab' (waters) which means Land of Five Rivers. The five rivers are the Satluj, Beas, Ravi, Chenab and Jehlum (also spelled Jhelum) with last two rivers now flowing in West Punjab, a state of Pakistan. It lies in the sub-tropical belt and is situated in the North-west of Indian subcontinent. It shares its 553 km international boundary with Pakistan in the west, and state boundaries with Jammu and Kashmir in the North, Himachal Pradesh in the North East and Haryana and Rajasthan in the south. It extends from 29.30° North to 32.32° North latitude and 73.55° East to 76.50° East longitude covering an area of 50,362 sq. km constituting 1.54 percent of the total area of the country. The density of population is quite high at 550 persons per sq. km as compared to national average of 382 persons. It is divided into 22 districts, 81 sub divisions and has 143 towns, 14 cities and 12581 inhabited villages (Punjab Economic Survey, 2012). The State capital of Punjab is Chandigarh and other big cities are Ludhiana, Jalandhar, Amritsar, Patiala, SAS Nagar, Bathinda, Ferozepur, Hoshiarpur and Gurdaspur. The state is known for its fertile land, and plenty of river water flowing through its territory. The rivers viz. the Sutlej, Beas and Ravi have been barraged with the famous multipurpose hydroelectric projects, viz., Bhakra Dam, Pong Dam and Ranjit Sagar Dam, respectively and water for irrigation to agricultural fields has been made available through a network of canals in the state, which not only serve the state of Punjab but also its neighbouring states of Rajasthan, Haryana and Delhi. About 14500 km long inter-linked canal system crosses through the state meeting about 23 percent of the irrigation water requirements of the state. The state is pioneer in bringing the Green Revolution in India and has been producing surplus food grains and contributing wheat and rice to the national food pool. The state is rightly addressed as 'food bowl' of the country and it contributes 40 to 60 percent of wheat and 30% rice to the central food reserve. Punjab has around 86.9% of its geographical area under agriculture with intense competition among different land-uses.

**Forests and Biodiversity**

The forest and tree cover of the state as per India State of Forest Report 2013 is 6.49% of its geographical area. The recorded forest area in the state is 3058 km2 which is 6.12% of the total geographical area of the state. However, the state is a good storehouse of biodiversity and 1939 Angiosperms, 48 Pteridophytes, 34 Bryophytes, 560 Fungi and 397 Algae have been reported from the wild. Also, the state is rich in avifauna (442 species) and fishes (112 species) apart from a large variety of Mammals, Reptiles, amphibians and invertebrates. Being a predominantly agricultural state, there is limited scope to increase the area under forests and trees which is only by bringing the available vacant wastelands/ degraded lands under tree cover through Agroforestry and Social Forestry. Figure 3 depicts broad land use and Land over of the State.

Figure 3: Land use/ Landcover Map of Punjab. (Source: Punjab Remote Sensing Centre)

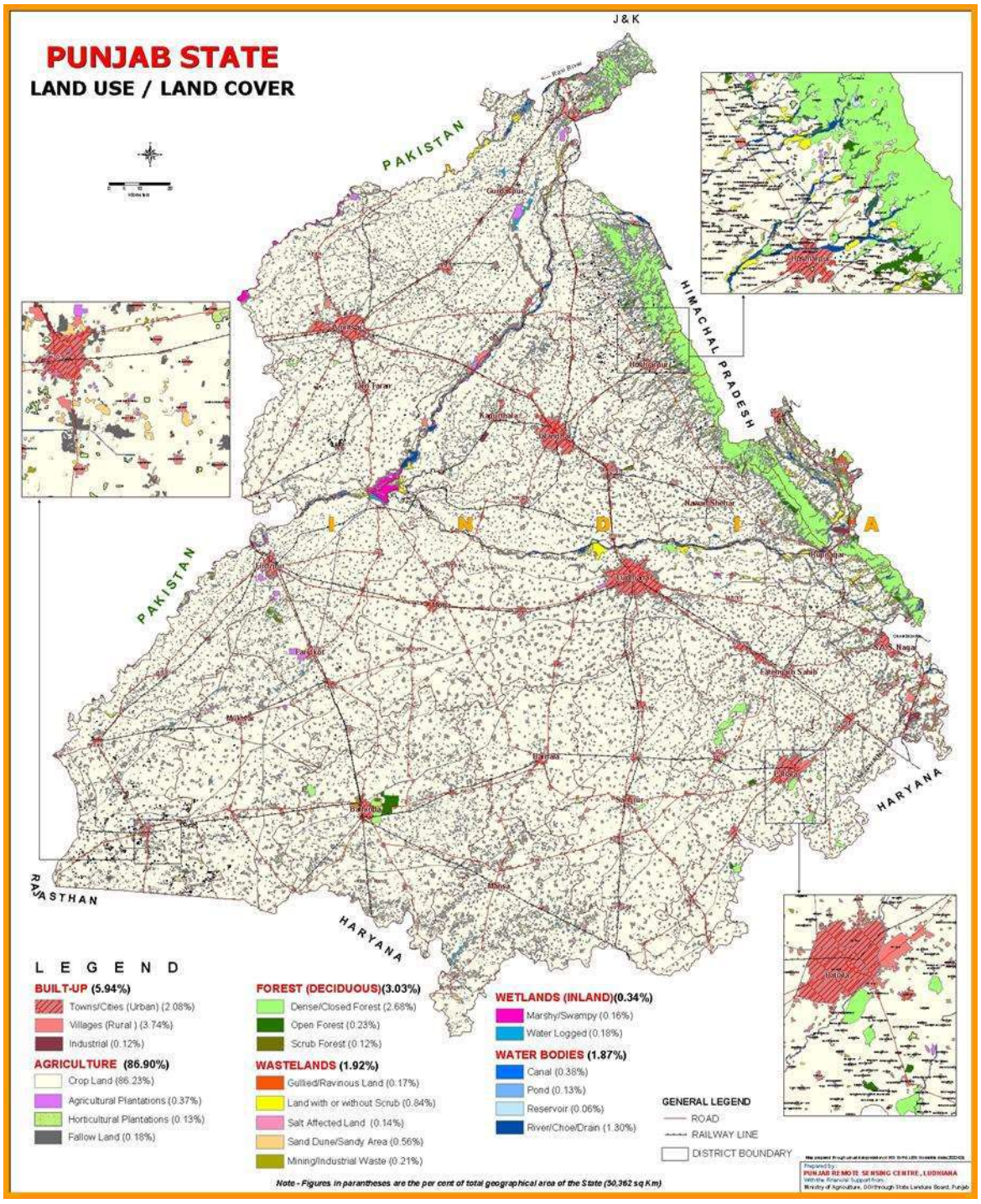
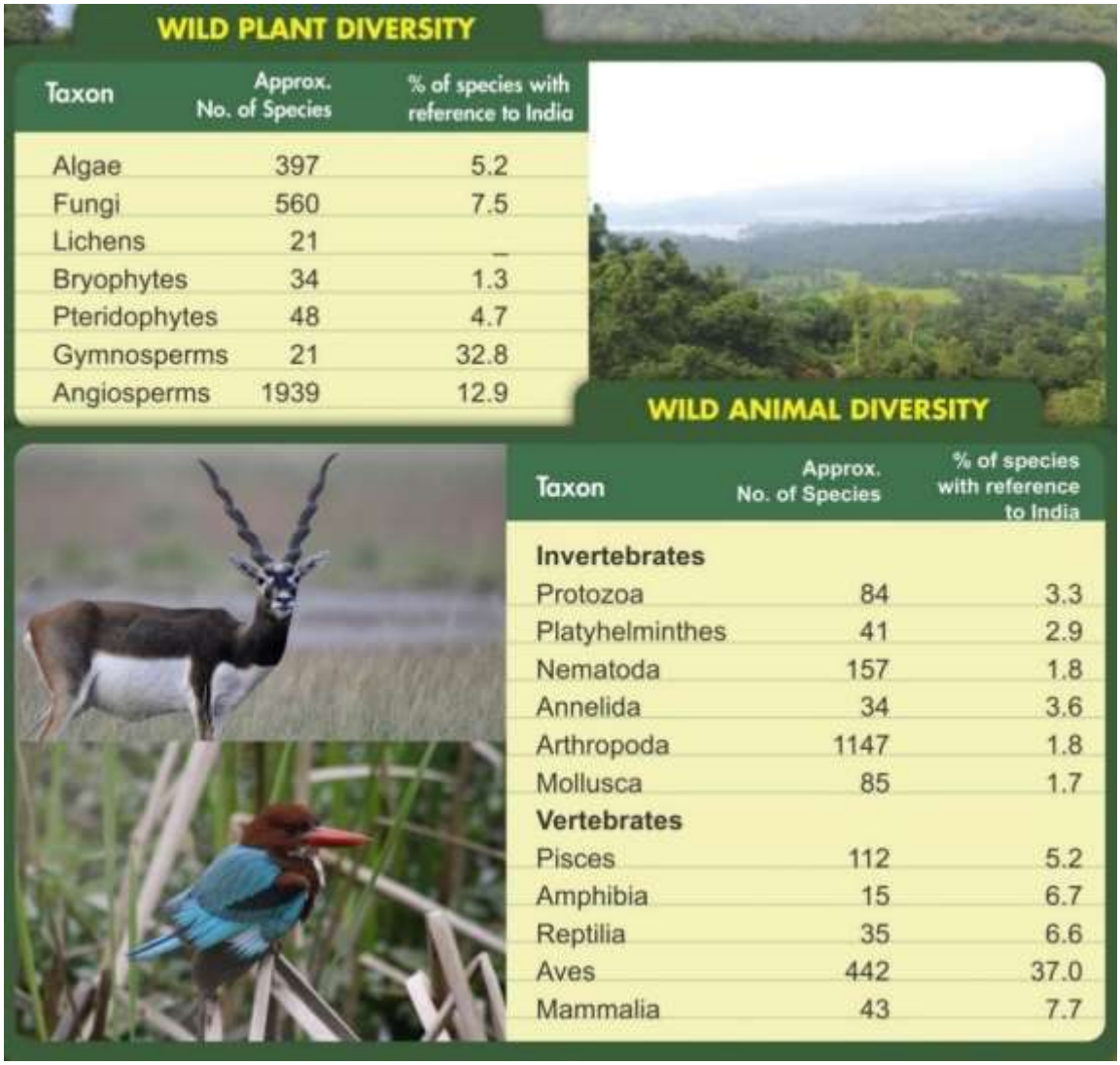


Figure 4: Wild Biodiversity (Plants and Animals) of Punjab. (Source: Punjab Biodiversity Board)




## 2.2 Wildlife and Protected Area Network of Punjab

The state of Punjab being a predominantly agricultural sate the protected area network acts as the last abode of remnant biodiversity which has been able to withstand the onslaught of humans who have indulged in clearing the forest areas for agriculture and other needs. As the importance of in situ conservation of biological diversity through the establishment and management of National Parks, Wildlife Sanctuaries, Community Reserves and Conservation Reserves has been recognized globally, the State has done well by creating a reasonable Protected Area Network (PAN) to accord protection to its wildlife and associated habitat. The state has a PAN of 13 wildlife sanctuaries, five wildlife Conservation Reserves, four Community Reserves and 6 Ramsar Sites (Table 3). The conservation efforts are supplemented by One Large zoological park and four medium or small zoos in the state, and wildlife has also been accorded protection under Wildlife (Protection) Act, 1972 in forest as well as non-forest areas of the State.

Table 3: Protected Area Network of Punjab

| Sr. No. | Name of the Protected Area | District | Area (Ha) | Date of Notification |
|---|---|---|---|---|
| **A)** | **Wildlife Sanctuaries** | | | |
| **1** | Bir Moti Bagh | Patiala | 654.00 | 28.2.1952 |
| **2** | Bir Bhunerheri | Patiala | 661.66 | 28.2.1952 |
| **3** | Bir Dosanjh | Patiala | 517.59 | 28.2.1952 |
| **4** | Bir Bhadson | Patiala | 1022.63 | 28.2.1952 |
| **5** | Bir Mehas | Patiala | 123.43 | 28.2.1952 |
| **6** | Bir Gurdialpura | Patiala | 620.53 | 27.8.2003 |
| **7** | Bir Aishwan | Sangrur | 264.40 | 28.2.1952 |
| **8** | Harike | Ferozepur | 8600.00 | 18.11.1999 |
| **9** | Abohar | Fazilka | 18650.00 | 7.9.2000 |
| **10** | Takhni-Rehmapur | Hoshiarpur | 382.00 | 8.6.1999 |
| **11** | Jhajjar-Bachauli | Ropar | 116.00 | 11.12.2003 |
| **12** | Kathlaur-Khushlian | Gurdaspur | 758.40 | 22.6.2007 |
| **13** | Nangal | Ropar | 286.33 | 10.8.2009 |
| **B)** | **Community Reserves** | | | |
| **1** | Lalwan | Hoshiarpur | 1266.80 | 22.6.2007 |
| **2** | Keshopur-Chhamb | Gurdaspur | 340.00 | 25.6.2007 |
| **3** | Panniwala-Gumjal | Fazilka | 6744.40 | 27.3.2015 |
| **4** | Siswan | S.A.S. Nagar | 1294.59 | 29.8.2017 |
| **C)** | **Conservation Reserve** | | | |
| **1** | Rakh Sarai Amanat Khan | Amritsar | 346.93 | 31.3.2010 |
| **2** | Beas River | - | - | 29.8.2017 |
| **3** | Ropar Wetland | Ropar | 210.89 | 5.9.2017 |
| **4** | Ranjit Sagar Dam | Gurdaspur | 1845.29 | 5.3.2018 |
| **5** | Kali Bein | Kapurthala | 210.77 | 11.6.2019 |
| **D)** | **Ramsar sites** | | | |
| **1** | Harike | Ferozepur | 8600.00 | 18.11.1999 |
| **2** | Kanjli | Kapurthala | 210.77 | 11.6.2019 |
| **3** | Ropar Wetland | Ropar | 210.89 | 5.9.2017 |
| **4** | Beas River | Hoshiarpur to Taran Taran | 185 Km | 29.8.2017 |
| **5** | Keshopur-Chhamb | Gurdaspur | 340.00 | 25.6.2007 |
| **6** | Nangal | Ropar | 286.33 | 10.8.2009 |

## 2.3 Beas Conservation Reserve

'*River Beas with all its water channels from 52 Head Talwara to Harike Barrage including all Government areas in River Beas*' (Approx. 185 Km stretch) has been notified as Conservation Reserve by Govt. of Punjab, Dept. of Forests and Wildlife Preservation (Forest Branch) vide Notification No. 34/13/2017-Ft-5/1052756/1 Chandigarh dated 11/06/2019. The Beas River originates from Rohtang Pass in Himachal Pradesh at an altitude of 3977 m. River Beas enters in Punjab from 52 Headworks Talwara and after travelling 185 Km it merges with River Sutlej at Harike Wildlife Sanctuary.

### 2.3.1 Wildlife Habitat and Status

The River is dotted with islands, sand bars and braided channels creating a complex environment supporting substantial biodiversity. The natural floodplains of river Beas act as ecotone of terrestrial and aquatic systems which are the most productive and diversified ecosystems on the earth (Naiman *et al.* 1993, Mitsch and Gosselink 2000).

### 2.3.2 Ecological Importance

Beas Conservation Reserve is home to the only population of Indus River dolphins (*Platanista gangetica minor*) in India. The Beas Conservation Reserve also has Gharial (*Gavialis gangeticus*) re-introduction programme to repopulate the river with Gharial after more than thirty years of their disappearance from river. Forty-seven Gharial have been reintroduced in River Beas in winter of 2017-2018 near village Gagdewal and Wazir Bhullar in Tarn Taran and Amritsar district of Punjab respectively. The Smooth-coated Otter (*Lutrogale perspicillata*) is another vulnerable and important species which is found in waters of River Beas. The terrestrial fauna of the Beas catchment in Punjab includes Hog Deer (A*xis porcinus*), Blue Bull (*Bosela phustragocamelus*) and Wild Pig (*Sus scrofa)*. The conservation reserve provides vital habitats for more than 500 species of birds (Kanwar, G., 2018) and particularly is an important staging area for both summer and winter migratory water birds. The river Beas supports seven species of freshwater turtles (Grewal, S.S., and Minhas, H.S., 1989) and around 90 species of fishes including the endangered mahsheer (*Tor putitora).*

Further, recognizing critical significance of River Beas for some key stone species, it was also included in the Ramsar List of Wetland of International Importance (Site number:2408, Area: 6,428.9 ha on 26-09-2019) with the active efforts of the Department of Forests & Wildlife Preservation, Govt of Punjab.

### 2.3.3 Social, Economic and Cultural Importance

It has tremendous values in terms of its vital support for ecology, economy and social contribution for the state. The river is referred to as 'Vipasha' in old literature by the scholars. The Beas River marks the eastern-most border of Alexander the Great's conquests in 326 BC.

River Beas is also closely associated with 8 Sikh Gurus of Punjab. The historical town of Khadur Sahib near River Beas, is known in the world as the holy town of Guru Angad Dev Ji (The Second Great Master). Sri Guru Nanak Dev Ji (The First Great Master) visited this town five times to spread his message of Sikhism. Sri Guru Angad Dev Ji spent the thirteen years period of his Guruship in this town. This fact finds mention in Sri Guru Granth Sahib Ji and in the composition of Bhai Gurdas Ji. Sri Guru Amar Das Ji, the third Great Master used to fetch a pitcher of water for the sacred bath of Sri Guru Angad Dev ji all the way from the Beas river in Goindwal Sahib to Khadur Sahib daily. The main centre of famous Radha Soami Satsang Beas (RSSB) is located on the banks of the Beas River.

### 2.3.4 Area Impacted by proposed project

The project is covered under schedule '7-f – Category A', as per MoEF&CC's EIA Notification (14th Sept 2006). 10.5 Ha wetland area and 6.8 Ha of other area of Beas Conservation Reserve will be impacted by the project.

Figure 5: Area of Beas Conservation Reserve impacted by the proposed project

Figure 6: Key faunal diversity of Beas Conservation Reserve

(a) *Platanista gangetica*

(b) *Gavialis gangeticus*

(c) *Xenochrophis piscator*

(d) *Nilssonia gangetica*

(e) *Canis lupus pallipes*

(f) *Lutrogale perspicillata*

Figure 7: Key Avifaunal diversity of Beas Conservation Reserve

(a) *Plegadis falcinellus*

(b) *Anser indicus*

(c) *Vanellus leucurus*

*(d) Dinopium benghalense*

(e) *Perdix perdix*

(f) *Milvus migrans*

(g) *Bubo bubo*

(h) *Strix occidentalis*

(i) *Accipiter badius*

# Aquatic Species of Conservation Significance

- INDUS RIVER DOLPHIN - The Indus River dolphin (*Platanista gangetica minor*) is a subspecies of the South Asian river dolphin (*Platanista gangetica*) that occurs only in the large freshwater rivers of the lower Indus basin in Pakistan and India. It was 1st discovered in 2007 near village Karmowala in Tarn Taran district of Punjab. River Beas has around 8-10 dolphins which are mostly found downstream of Beas bridge and upstream of Harike Wildlife Sanctuary.
- SMOOTH-COATED OTTER - The smooth-coated otter *(Lutrogale perspicillata)* is an otter species occurring in most of the Indian subcontinent and Southeast Asia. It is listed as Vulnerable on the IUCN Red List since 1996 and is threatened by habitat loss, pollution of wetlands and poaching for the illegal wildlife trade. River Beas and Harike Wildlife Sanctuary provide home to Smooth-coated Otter.
- GHARIAL - Gharial (*Gavialis gangeticus)* is critically endangered crocodilian species. It is locally known as sansar and was once extensively distributed in the rivers of Punjab. The Gharial reintroduction programme is an initiative by the Government of Punjab to re-establish breeding populations of the critically endangered Gharial *(Gavialis gangeticus)* in the River Beas after three decades of their disappearance from rivers in the State. Total of forty-seven juvenile Gharial (brought from the Gharial Breeding Centre in Deori, Morena, Madhya Pradesh) were re-introduced in three batches into the River Beas between December, 2017 and February, 2018.
- FRESHWATER TURTLES - Total of seven species of freshwater turtles namely Indian Softshell Turtle, Indian Flap-shell Turtle, Narrow-headed Softshell Turtle, Spotted Pond Turtle, Crowned River Turtle, Indian Roofed Turtle and Brown Roofed Turtle are found in Beas Conservation Reserve, Punjab.
- MAHSEER - *Tor putitora*, the Putitor mahseer, Himalayan mahseer, or golden mahseer, is an endangered species of cyprinid fish that is found in rapid streams, riverine pools, and lakes in the Himalayan region. Its native range is within the basins of the Indus, Ganges and Brahmaputra rivers. Mahseer uses upper stretches of Beas Conservation Reserve.

## 2.4 Kali Bein Conservation Reserve

"… The Governor of Punjab is please to declare the area of following villages, totalling 520.824 acre as "Kali Bein Conservation Reserve" from the date of issue of this notification…" (Govt. of Punjab, Dept. of Forests and Wildlife Preservation (Forest Branch) vide Notification No. 34/12/2019-Ft-5/1499748/1 Chandigarh dated 11.06.2019.

### 2.4.1 Wildlife Habitat and Status

Kali Bein is one of the important tributaries of river Beas. It has, of late, become independent of river Beas due to silting up of the Bein and westward shifting of Beas. The Bein travels a long distance of 160 Km after originating from a place near village Dhanoa a few kilometers upstream of Budho Barkat Regulator in Hoshiarpur District and feeds the Kanjli Lake and the wetland areas. It further moves towards Bakarke village, 10 kms short of Harike Pattan Regulator and joins river Beas. It is a permanent fresh water stream converted into a small reservoir at Kanjli for the purpose of irrigation supplies. Depth of water varies from 10 feet to 25 feet depending upon the season and water inflow. Catchment area is mainly under agriculture.

### 2.4.2 Ecological Importance

The rivulet has played an important role in the formation of fertile plains by bringing down large sediment loads during floods. This wetland is important for many species of plants, birds and fishes which are ecologically significant. It supports 5 mammals, about 90 species of birds, 17 taxa of fishes, 35 taxa of invertebrates. Dominant flora found in and around Kali Bein Conservation Reserve includes *Acacia arabica, Albizzia lebbeck, Azadirachta indica, Dalbergia sissoo, Eucalyptus hybrid, Ficus bengalensis, Mangifera indica, Melia azedarach, Morus alba, Prosopis juliflora, Syzygium cumini, Ziziphus mauritiana, Calotropis procera, Ipomoea crassicaulis, Tamarix dioca, Saccharum munja, S.spontaneum, Scirpus sp., Utricularia sps*.

Dominant fauna includes fish species of *Catla catla, Channa marulius, Cythus striatus, Cirrhinus mrigala, Labeo calbasu* and *L. rohita.* Birds like White eyed pochard, Wigeon, Tufted pochard, Common Teal, Large whistling teal, Pintail, Mallard, Northern Shoveller etc. The mammalian fauna seen in the Kali Bein includes Indian Civet, Mongoose, Indian porcupine, Squirrel and Common Indian hare.

### 2.4.3 Social, Economic and Cultural Importance

Kali Bein is very deeply associated with the Sikh religion as the 1st Sikh Guru, Sri Guru Nanak Dev ji spent many years of his life meditating around Kali Bein and obtained enlightenment here. Shri Guru Nanak Dev ji, the first Guru of Sikhs, came to visit his Sister Bebe Nanaki at Sultanpur Lodhi and spent here 14 years, 9 months & 13 days of his life. He used to take bath & meditate on the banks of the Kali Bein. It is said that at the age of thirty, Guru Nanak Dev ji went for his morning bath one day to the local stream called 'Kali Bein' and didn't come out, and he was presumed to have drowned in the Bein. But three days later, he resurfaced and

first words that came out from him were: "There is no Hindu, there is no Muslim". He came out with the the 'Dhur Ki Baani' from the God and pronounced the message of Ekonkar (God is One), 'Mool Mantra (First Rhyme of Sri Guru Sahib ji) & 'Sarbat Da Bhala' (Welfare of all). It was from this moment that Nanak would begin to spread the message of God or the teachings which were then became the beginning of Sikhism. So, for the whole Sikh community, Kali Bein is not just a river but a holy and sacred river. It was officially declared as Pavitar Bein (Holy Bein) in 2002.

On the Banks of Holy Kali Bein, there are two historical religious places, one is Gurdwara Ber Sahib, where Guru Nanak Dev Ji had planted a stump of Ber tree (*Zizipus Jujuba*) with his own hands on the bank of river Kali Bein which is now approximately 525 years old and is still green and healthy.

The second historical site is Gurdwara Sant Ghat Sahib, where Guru Sahib reappeared after three days from River Kali Bein and pronounced the message of Ekonkar, 'Mool Mantra & 'Sarbat Da Bhala'. These are the most important places of worship of the Sikhs.

Water of the Holy Kali Bein was contaminated/ polluted and was cleaned in three years by continuous karsewa by Sant Balbir Singh Seechewal along with volunteers. In the year 2006 & 2009, the President of India Dr. A.P.J Abdul Kalam came to pay obeisance to the Holy Kali Bein. In the year 2017 the Central Government honoured Sant Balbir Singh Seechewal with Padma Shree for cleaning the Holy Kali Bein. Punjab government declared Kali Bein as Conservation Reserve in 2019.

### 2.4.4 Area Impacted by proposed project

The project is covered under schedule '7-f – Category A', as per MoEF&CC's EIA Notification (14th Sept 2006). 2.0 Ha of Kali Bein Conservation Reserve will be impacted by the project.

Figure 8: Area of Kali Bein Conservation Reserve impacted by the proposed project

# Chapter 3: Study of project impacts on the protected areas

## 3.1 Study Area 1: Beas Conservation Reserve

There is a proposal to construct two flyovers/ bridges over the Beas River. The first bridge is located near village Balarwal (Gurdaspur) between Km 354+474 to Km 354+962 of the proposed Expressway impacting an area of 4.4 ha of the waterway. The second bridge is sited near village Dhunda (Taran Taran) between Km 37+508 to Km 38+910 of the proposed Amritsar connectivity of the proposed Expressway which impacts an area of 5.8 ha of the waterways, and also the land area of 6.8 ha between two channels totalling 12.6 ha. Considering the instability of the river bed due to the presence of very deep-water pools, the adequate protection needs to be ensured to the bridges proposed to be constructed over Beas.

## 3.2 Study Area 2: Kali Bein Conservation Reserve

There is a proposal to construct two flyovers/ bridges over the Kali Bein. The first bridge is located near village Mana Talwandi (Kapurthala) at Km 22+336 of the proposed Expressway impacting an area of 1.0 ha of the waterway. The second bridge is sited near village Malian (Kapurthala) at Km 339+500 of the proposed Amritsar connectivity of the proposed Expressway which impacts an area of 1.0 ha of the waterways totalling 2.0 ha.

## 3.3 Material and Methods

### 3.3.1 Baseline Data

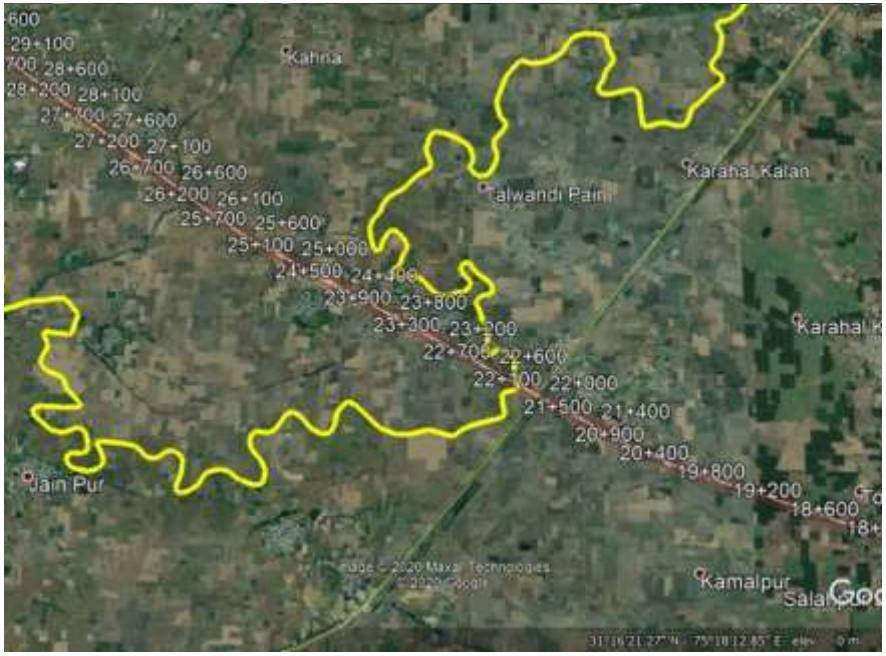
Baseline data is generated both from primary and secondary resources. Rapid surveys were conducted in the villages and to the Beas and Kali Bein Conservation Reserves. The objective of rapid surveys was to understand the biodiversity potential of the sites and perception of the riparian communities on construction of four flyovers/ bridges over the Beas and Kali Bein Conservation Reserve. Secondary data was obtained from Punjab Pollution Control Board, Department of Forests and Wildlife Preservation, Punjab, Punjab State Council for Science and Technology and WWF-India.

### 3.3.2 Topographic Maps

Topographic sheet no: 44/M/3, 44/M/6 were referred for Beas Conservation Reserve. Similarly, topographic sheet no: 44/M/3, 44/M/6, 44/M/7 were referred for Kali Bein Conservation Reserve.

### 3.3.3 Satellite Data

Figure 9: Satellite imagery of Kali Bein Conservation Reserve impacted by the proposed project




Kali Bein CR


Kali Bein CR

Figure 10: Satellite imagery of Beas Conservation Reserve impacted by the proposed project


### 3.3.4 Water Data

The water quality of river Beas is being monitored at 10 locations, starting from Beas at Talwara H/W upto Beas at Harike on monthly basis under National Water Quality Monitoring Programme (NWMP):

(i). Beas at Talwara H/W
(ii). Beas at Mirthal Bridge Gurdaspur
(iii). U/s Pathankot
(iv). D/s Pathankot
(v). Beas 1km D/S effluent discharge point at Mukerian
(vi). Beas Bridge at village Bheate Patan Tehsil Batala Distt.Gurdaspur (w.e.f July 2018)
(vii). Beas at G.T. Road, under Bridge Near Kapurthala
(viii). Beas at U/s Goindwal
(ix). Beas at D/s Goindwal
(x). Beas at Harike

The river Beas enters in Punjab at Talwara from Himachal Pradesh. The quality of river Beas at Talwara is 'B Class'. The BOD of Beas varies from 1.0 mg/l to 2.1 mg/l. The Dissolved oxygen varies from 7.3 mg/l to 8.3 mg/l for the month of December 2018. The quality of Beas at 1 km from discharge point at Mukerian upto Harike is of 'Class C' due to the pollutant Total coliforms Organism (T.Coli). The permissible limit of T.Coli MPN/100 ml for 'Class B' is 500 or less but T.Colivaries from 580 to 840 at above mentioned stretch/points of river Beas.

Thus, to improve the water quality of River Beas, there is need to identify all the outlets through which the untreated wastewater is discharged into river Beas either directly or indirectly and to install adequate arrangements to treat the wastewater of these outlets either by installing separate STPs or by diverting these outlets to the existing STPs having sufficient capacity to accommodate the additional hydraulic loading of these outlets. Also, there is need to improve upon the quality of treated wastewater of the present STPs by upgrading them.

Regarding water quality, water of Kanjli wetland belongs to category "B" & "D" as classification of Indian rivers, Estuaries and coastal rivers waters – Sweet waters. The pH varies from 7.6-7.8 with Biological Oxygen Demand varied between 1.6 – 4.0 mg/l and coliform bacteria 390-790 MPN/100 ml[1]. The water of Kanjli gets polluted by industrial effluents from towns like Jalandhar and Phillaur, domestic sewage as well as by chemical fertilizers used by farmers for their crops. But specific studies still need to be conducted and more frequently. There is need to study the biomagnifications of non-degradable pollutants by the microorganisms.

1 http://www.ppcb.gov.in/Attachments/Reports%20and%20Documents/WetlandKanjli2016-17.pdf

### 3.3.5 Wildlife Census and Surveys

**Bird Surveys**

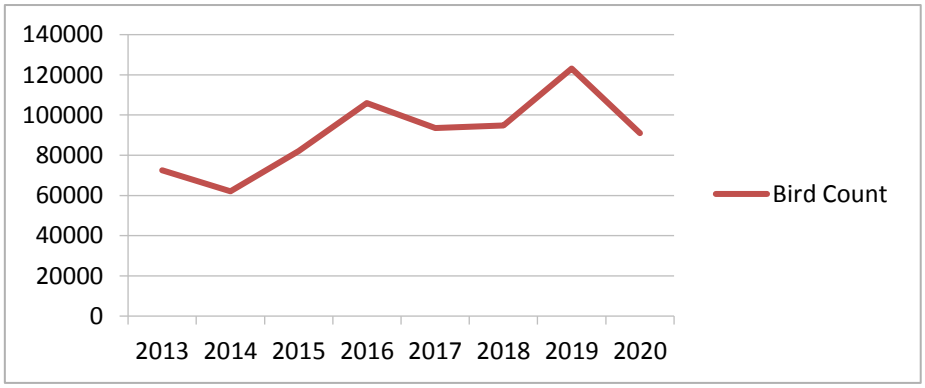
The overall avifaunal diversity of Beas and Kali Bein Conservation Reserve is excellent with the 391 species accounting for 83% of Punjab's entire avifaunal diversity (470 species). Of these 42.2 % are aquatic birds (Prakash et al, 1997). 9.4% are predominantly fish eating, 7.7% feed on deep water vegetation, aquatic invertebrates and insects and 8% comprises birds of prey including scavengers and rest are insectivorous and granivorous (Hussain S. A. 1979-84).

Every year bird census is conducted in Harike wildlife sanctuary and Beas River in the peak winter season in the month of January to estimate the count of migratory birds visiting the wetland. The details of bird census conducted at Harike Wildlife Sanctuary including part of Beas river is as given below:

Table: 4 Showing the bird count recorded during bird census from the year 2013 to 2020[2]

| Year | Bird Count |
|---|---|
| 2013 | 72488 |
| 2014 | 62065 |
| 2015 | 82100 |
| 2016 | 105890 |
| 2017 | 93488 |
| 2018 | 94771 |
| 2019 | 123128 |
| 2020 | 91025 |

Figure 11: Trend of Bird count recorded during Annual Bird Census in Harike Sanctuary




The trend of the counts of birds visiting the sanctuary over the years show an ecosystem which is conducive for the winged visitors to use this habitat as breeding, wintering and staging ground.

[2] *Kanwar, G. 2019. Short Communication on water bird census in wetlands of Punjab to Asian Water bird Count, 2019. Published by Wetland International.*

Dolphin and Gharial survey in Beas Conservation Reserve

The Indus River dolphin (*Platanista gangetica minor*), listed endangered by the IUCN redlist, is a freshwater dolphin endemic to the Indus River system. The River Beas in Punjab is home to the only population of Indus River dolphins in India. Gharial (*Gavialis gangeticus*), listed critically endangered by the IUCN redlist, were re-introduced to the Beas Conservation Reserve in 2017, more than thirty years after their disappearance from the river.

Evaluation of field data collated from joint field surveys of Department of Forests and Wildlife Preservation, Punjab and WWF-India on Indus River Dolphin since 2015 shows that dolphins primarily occur in a 75Km long stretch of the River Beas starting from Beas Bridge on NH 1 to Harike Headworks. The estimated abundance of dolphins is between 8-10 individuals in the Beas River in 2019. Gharial are using the completely 185km stretch of Beas Conservation Reserve. The direct sighting of Gharial ranges between 19-24 Gharial while surveying the complete 185km stretch of River Beas in Punjab.

### 3.3.6 Rapid Survey of the Study Area

Total of four proposed bridge locations were visited on different occasions for a rapid survey and community interaction. Beas Conservation Reserve has two proposed bridge sites and similarly Kanjli Conservation Reserve has also two proposed bridge sites. The objectives of the rapid survey were following:

- To assess biodiversity potential of the sites.
- To interact one to one with the riparian communities for understanding their perception for the proposed construction of the bridges on the Beas Conservation Reserve.

Our survey approach included surveying 5km upstream and downstream of the proposed bridge locations and interact with the riparian communities falling within the 5km upstream and downstream of the proposed bridge locations.

Following is the summary of the field visit along with the feedback from the riparian community:

Table 5: Summary of the rapid field visit along with the feedback from the riparian community

| S. No | Date of visit | Villages visited | Feedback from the riparian communities |
|---|---|---|---|
| 1 | 10.09.2020 | Amratpur Rajewal, Sri Goindwal Sahib, Dhunda, Khakh, Bhel Dhaiwala, Johal Dhaiwala in Tarn Taran district of Punjab. | • The stakeholders wanted that there should be underpasses on both side of the bridge on River Beas, to ease the movement of traffic and animals.<br>• The farmers whose land is to be acquired must be given good compensation.<br>• Local engineers and labor should be engaged/employed for the construction of the bridge and related projects e.g. toll plaza etc. according to their capability.<br>• Toll Tax should be waived for locals in the vicinity of 20 Km of the project.<br>• Medicinal and Ornamental plants should be planted near bridges.<br>• There should be a facility for Kisan Haat on the highway where farmers can sell their produce to travellers.<br>• A site should be reserved for the preservation of the forest plants and animals for the attraction of the travellers.<br>• Sh. Gurvinder Singh, Charitable Trust Nirmal Kutia Seechewal presented a letter of demand on behalf of Padma Shri Sant Balbir Singh Seechewal in which he has urged that the construction of this project should not harm the natural river bodies and a plan should be formulated for the development of the Holy Kali Bein as a historical place for the devotees passing through this highway.<br>• A passage should be kept for local villagers to cross the river.<br>• Bus stop should be constructed adjoining flyover for the village Khakh and Dhunda.<br>• A link road (3 Km) should be constructed from village Dhunda to Sri Goindwal Sahib.<br>• A metalled road (6 Km) should be constructed on Dhussi bund from village Johal Dahiwala up to Sri Goindwal Sahib.<br>• A metaled road (6 Km) be constructed from village Dhunda Flyover to Gurudwara Pataalpuri Sahib adjoining River Beas (Dhusi band). |
| 2 | 21.09.20 | Mari Bhuchian, Mari Tanda, Balarwal, | • The stakeholders said that the land of village Balarwal on Mari Tanda side gets divided into two parts on the both side of the highway. So, there should be underpasses under the highway. |

| | | | |
|---|---|---|---|
| | | Kapoora, Bhol in district Gurdaspur of Punjab. | • After every 300 meter there should be an underpass to go on the other side of the river.<br>• The earlier roads should not be disturbed.<br>• Sri Hargobindpur Sahib is a historical place so road should be constructed between Balarwal- Mari Tanda, Mari Bhuchian to connect them to Sri Hargobindpur Sahib.<br>• During rains the water gets collected in River Beas and over flows into fields therefore proper flow of water should be ensured. Divergence of direction of river need to be kept in mind.<br>• New road should be constructed between Mari Bhuchian, Mari Tanda, Balarwal, Kapoora to connect them to highway.<br>• Local engineers and labor should be engaged for the construction project and thereafter employed at Toll plaza according to their capabilities.<br>• The farmer whose land is to be acquired must be given job by Government.<br>• The farmers whose land is to be acquired must be given competitive compensation.<br>• The farmers whose land is to be acquired must be given free pass from the toll plaza within 20 kms of highway.<br>• The road from village Balarwal to River Beas should be metalled and connected to service road.<br>• There should be underpasses to ease the movement of wild animals.<br>• Trees should be planted for clean environment.<br>• Pathway should be constructed for travel of villagers and animals from Village Balarwal to Kapoora.<br>• Chain link fencing should be done around Kapoora forest to prevent the wild animals of the forest from destroying crops.<br>• Mobile towers should be installed in villages for mobile connectivity.<br>• Strengthening of Dhusi Band on River Beas by constructing spur and studs.<br>• Transportation facility should be provided for all villages.<br>• Adequate compensation should be given for Residential properties and Tube wells etc. |
| 3 | 21.09.20 | Mana Talwandi, Bamuwal, Dhirpur, Sheruwal, Kuddowal in Kapurthala district of Punjab. | • The farmers whose land is to be acquired must be given competitive compensation.<br>• The land of village gets divided into two parts on the both side of the highway. So, there should be underpasses under the highway<br>• The farmer whose land gets acquired must be given job by Government.<br>• Local Engineers and Labor should be engaged for the construction project and employed at Toll plaza according to their capability. |

| | | | |
|---|---|---|---|
| | | | • The area is prone to risk of floods; therefore, more underpasses should be made.<br>• The earlier roads should not be disturbed.<br>• Kisan Haat should be made on the expressway.<br>• The land compensation should be given all at once. |
| 4 | 24.09.20 | Talwandi Pain, Malain, Dadwindi, Karhal, Naubad, Mitha in Kapurthala district of Punjab. | • The farmers whose land is to be acquired must be given competitive compensation.<br>• The farmer whose land gets acquired must be given job by Government.<br>• There should be underpasses under the highway.<br>• Toll-Tax should be free for local public.<br>• New bridge should be constructed on the Sacred Kali Bein River<br>• A cluster of all villages should be connected to the highway.<br>• To visit Sultanpur Lodhi, Shri Goindwal Sahib, Shri Tarn Taran Sahib and Shri Amritsar Sahib the villages should be connected to the highway.<br>• Sh. Kuldip Kumar Lomis, Former Principal Chief Conservator of Forests (HOFF) and Chief Wildlife Warden (Retd.) said that River Beas is habitat for dolphins, crocodiles and smooth-coated Otter. These animals can be easily sighted in the Beas river near Shri Goindwal Sahib. Similarly, Kanjali wetland which is part of Holy Kali Bein is visitedby many migratory birds every year. With the construction of highway these birds and wild animals would take much time to understand the obstacles that would come in their way. A discussion was made on which places the bypasses are to be made and to safeguard and ensure safety of wild animals.<br>• Padma Shri Sant Balbir Singh Seechewal ji during meeting said that the youths of the area should be given some employment and Kisan Huts on the highway should be made so that they could sell their organic products and could run their business |

# Chapter 4: Impact Assessment of the proposed project on the study area

## 4.1 Impact of Proposed Project on Social and Economic Life of Inhabitants in the Study Area

### 4.1.1 Bifurcation and Division

The proposed highway and bridge construction involve expropriation of land from the current owners/users. Improvement of the road project will have significant positive impacts, but they may simultaneously also bring negative impacts on nearby communities, if proper precaution is not taken during design and implementation stage of the project. Acquisition of land may cause social disruption and economic loss for project affected persons (PAPs) and their families. A viable alignment options from social, environmentally and engineering point of view need to be implemented for the project road and bridges.

### 4.1.2 Water Pollution

Historically, the rivers have played key role for growth and sustenance of humans as almost all civilizations got established along the river sides and depended upon then for water supplies for domestic, agriculture, industrialization, recreation, transportation and other purposes. River systems, besides providing a diverse range of ecosystem services, also have inherent capacities to improve water quality and nutrient cycling because of variety of its flora, fauna and microbial inhabitants. But, despite that, there has been continuous degradation of river water quality due to overexploitation, mismanagement and contamination from disposal of human and industrial wastes. River Beas is no exception to such developments. Waste water of domestic, industrial and agricultural runoff carrying both organic and inorganic pollutants is damaging the water quality of this river also. Various towns and villages discharge their domestic waste water into this river through a number of drains/channels.

As per monitoring and assessment being carried out by Punjab Pollution Control Board from the designated sampling, the water quality of River Beas is of Class ‘B’ as per Designated Best Use classification of Central Pollution Control Board. As the rivers are lifelines of the state, the state government is making concerted efforts involving all concerned departments to maintain ecological character of river ecosystems. Towards this endeavour, the Department of Forests and Wildlife Preservation, Govt of Punjab has already declared this rive in the state as Conservation area not only to protect its ecology and habitat but also to rejuvenate its pristine glory.

### 4.1.3 Atmospheric Pollution

Air pollution level and AQI is likely to enhance many folds during execution of project work in the area. Though, no specific studies have been carried out to assess air quality of the area, but previous references show that the air quality here is on the margin. Further, movement of vehicles and their operation and maintenance, construction activities including loading and unloading of materials would also cause lot of noise pollution in the project area. Once the project gets completed, lot of traffic will start passing through which will cause lot of noise and vibrations otherwise relatively silent and calm area. This will also disturb wildlife including avifauna and reptiles to a great extent. Keeping in view the strategic importance of Beas Conservation Reserve for ecologically vulnerable and fragile species of animals and plants, it is necessary to take appropriate steps for preventing any increase in air pollution level in the area due to construction of Express Way. Suitable measures are also required to reduce air pollution including noise pollution after the projects is over. Data showing air pollution levels at Goindwal sahib and some adjoining villages for the years 2016 and 2018 is presented in following table:

Table 6: Data showing air pollution levels at Goindwal sahib and some adjoining villages for the years 2016 and 2018

| **Air pollution levels at Goindwal sahib and some adjoining villages from 2016-18.** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | **Location** | **$PM_{2.5}$ ($\mu g/m^3$)** | **$PM_{10}$ ($\mu g/m^3$)** | **$SO_2$ ($\mu g/m^3$)** | **$NO_x$ ($\mu g/m^3$)** | **CO** | **$O_3$** | **Hg ($\mu g/m^3$)** | **Source** |
| **2016** | M/s Guru Nanak Dev Superspeciality Hospital, Goindwal Tarn Taran Road | 36.14 | 106.84 | 7.92 | 13.68 | <1.5 | <5 | | 1. |
| **2017-18 (Monthly data from Oct 2017-March 2018) Average values and range.** | Goindwal Sahib | 43.60 (30-59) | 74.79 (39-98) | 19.25 (6-32) | 24.69 (10-43) | 1.27 (1-1.4) | 0 | 0 | 2. |
| | Hansawala | 42.75 (29-54) | 73.13 (42-97) | 20.08 (8-34) | 25.40 (11-49) | 1.26 (1-1.4) | 0 | 0 | |
| | Vairowal | 43.10 (32-56) | 72.27 (41-95) | 19.52 (8-32) | 24.17 (11-46) | 1.27 (1-1.4) | 0 | 0 | |
| | Mundi | 43.45 (29-56) | 72.43 (47-93) | 20.45 (7-38) | 26.0 (10-42) | 1.26 (1-1.5) | 0 | 0 | |

**Source: 1. Six Monthly Compliance Report (Period Ending 31.03.2016) for Guru Nanak Dev Super-specialty Hospital Vill Muradpura Goindwal Sahib, Tarn Taran. Project by M/s. Baba Jiwan Singh Baba Dalip Singh Educational Trust, Goindwal Sahib, Tarn Taran. Report by Eco Laboratories & Consultants Pvt Ltd. (http://nromoef.gov.in/SMPR/25102016/145.pdf,**

**2. Environmental Statement Report of GVK Power (Goindwal Sahib) Limited (2X270 MW Coal Based Thermal Power Plant) Near Goindwal Sahib, Tarn Taran, Punjab For Financial Year Ending 31st march, 2018 Submitted to Regional Office, Punjab Pollution Control Board, Amritsar. (https://gvk.com/ourbusiness/energy/Environmental%20Statement%20FY%202017-18.pdf)**

### 4.1.4 Noise Pollution

Noise pollution during construction process as well as after completion of project and its opening to fast moving vehicles will disturb wildlife to a great extent due to sound and vibrations. The use of noise barriers to attenuate sound pollution associated with road traffic has become increasingly important particularly for conservation areas. Though the unnatural noise barriers are often found effective abatement measure, but they are expensive to install and are considered unattractive. The use of vegetation, trees, shrubs and grasses are rather better and viable alternatives.

### 4.1.5 Movement Restriction of Humans and Animals

Infrastructure, such as roads, alter ecological conditions, cut through natural habitats, and consequently reduce populations of many wildlife species. Roads affect wildlife in different ways. Road construction increases fragmentation of habitats, influences landscape pattern and alters the physical environment. Roads act as barriers to animal movements, increase their mortality rates and cause other negative impacts on biodiversity.

For locals around the project sites, roads can have both positive and negative influences. On the positive side roads provide the opportunity of mobility and transport for people and goods. It will be economic boost for the local area and will open prospective for development and urban industry. On the negative side roads occupy land resources, form barriers to animals and may be detrimental for overall health due to increased pollution of all kinds.

## 4.2 Impact on Wildlife and Biodiversity of the Study Area

### 4.2.1 Likely Impact on Terrestrial Biodiversity

Roads are a widespread and increasing feature of most landscapes. We reviewed the scientific literature on the ecological effects of roads and found support for the general conclusion that they are associated with negative effects on biotic integrity in both terrestrial and aquatic ecosystems. Roads of all kinds have seven general effects: mortality from road construction, mortality from collision with vehicles, modification of animal behavior, alteration of the physical environment, alteration of the chemical environment, spread of exotics, and increased use of areas by humans. Road construction kills sessile and slow-moving organisms, injures organisms adjacent to a road, and alters physical conditions beneath a road. Vehicle collisions affect the demography of many species, both vertebrates and invertebrates; mitigation measures to reduce roadkill have been only partly successful. Roads alter animal behavior by causing changes in home ranges, movement, reproductive success, escape response, and physiological state. Roads change soil density, temperature, soil water content,

light levels, dust, surface waters, patterns of runoff, and sedimentation, as well as adding heavy metals (especially lead), salts, organic molecules, ozone, and nutrients to roadside environments. Roads promote the dispersal of exotic species by altering habitats, stressing native species, and providing movement corridors. Roads also promote increased hunting, fishing, passive harassment of animals, and landscape modifications.

### 4.2.2 Likely Impact of Aquatic Biodiversity

Roads facilitate increased use of an area by humans, who themselves often cause diverse and persistent ecological effects. New roads increase ease of access by humans into formerly remote areas. Perhaps more important, roads often increase the efficiency with which natural resources can be exported. Numerous studies have demonstrated declines in stream health associated with roads. Roads produce a pattern of aquatic habitat loss that differs from the terrestrial pattern yet nevertheless results in the ecological fragmentation of aquatic ecosystems. Not all species and ecosystems are equally affected by roads, but overall, the presence of roads is highly correlated with changes in species composition, population sizes, and hydrologic and geomorphic processes that shape aquatic and riparian systems.

### 4.2.3 Likely Impact on Avifauna

Roads are often built into areas to promote logging, agriculture, mining, and development of homes or industrial or commercial projects. Such changes in land cover and land and water use result in major and persistent adverse effects on the native flora and fauna of the area. This directly impacts the avifauna of Beas Conservation Reserve and Kali Bein Conservation Reserve which currently have rich species diversity. Avifauna using the proposed sites for foraging, roosting and nesting sites will be adversely impacted. The cultivated land around the proposed project site represents a significant feeding area for many bird species due to readily accessible food for birds and other predators; the crop or pasture plants cultivated are often eaten by birds, or attract insects which are in turn eaten by birds; during the dry season cultivated lands often are the only green or attractive food sources in an otherwise dry landscape. Potential impact through collision is anticipated to occur along the proposed sites. The water part of the river is utilized by the migratory birds especially during the winter season. In most cases the impact of collision leads to immediate death or fatal injuries.

Following is the summary of direct, indirect and long-term impacts of construction of bridges on expressway on the biodiversity of Beas and Kali Bein Conservation Reserve.

| Table 7: summary of direct, indirect and long-term impacts of construction of bridges on expressway on the biodiversity of Beas and Kali Bein Conservation Reserve | | | |
|---|---|---|---|
| **S No** | Activity | Direct Impacts | In-direct and Long-term Impacts |
| I Construction Phase Impacts | | | |
| **1** | Construction of Expressway and Approaches to the Bridges | Clearing of Vegetation and degradation of Habitat<br>Bifurcation of Land system and Barrier to free movement<br>Dust Generation and Air Pollution | Reduced use of Habitat by Wildlife<br>Reduced number of wildlife species due to movement to other places<br>Isolation of Wildlife populations leading to their unviability |
| **2** | Movement of Materials for construction | Air Pollution<br>Noise Pollution due to Loading/ Unloading Activities<br>Creation of Temporary Dumps on site | Degradation of Wildlife Habitat causing reduction in its suitability<br>Repulsion among Wild animals to use it |
| **3** | Movement of Heavy Machinery | Noise, Air and Water Pollution<br>Accidental Spillage of Oil and Lubricants | Degradation of Wildlife Habitat causing<br>Repulsion among Wild animals to use it |
| **4** | Movement of Labour and Establishment of Labour Camps | Disturbance and Stress on Wildlife Habitat<br>Indulgence by some people in Poaching, Fishing and illicit felling | Reduction in wild populations and migration of some fauna to other places<br>Loss of many species in the long-run |
| **5.** | Construction of Bridge Piers on river bed | Disturbance of Water Ways by digging Machines and Vibrations due to excavation for foundations<br>Restrictions on water Flow<br>Siltation and Debris Flow<br>Noise and Water Pollution<br>Increased Human Presence on River Bed | Degradation in water quality<br>Degradation of Aquatic ecosystem and habitat<br>Blockage of free movement of aquatic fauna leads to isolation and reduction in their population<br>Fragmentation of Habitat for some fauna |

| | | | |
|---|---|---|---|
| **6.** | Construction of Bridge slabs and surface roads above piers | Noise and Water Pollution<br>Increased Full-Time Human Presence<br>Spillage and Fall of Materials on River Bed and water Course | Disturbance leading to poor habitat quality and depletion of wildlife species richness and diversity |
| II Post-Construction and Operationalisation of Expressway Impacts | | | |
| A. | **Impact on Terrestrial Habitat** | | |
| **1.** | Continuous movement of vehicles on the Expressway | Restriction of movement of fauna<br>Mortality of terrestrial animals due to roadkill<br>Noise pollution<br>Air pollution due to smoke, dust and release of harmful gases | Permanent Barrier to movement of animals causing isolation and unviable populations and local extinctions of certain species.<br>Increased mortality leads to decline in animal population as roadkill are indiscriminate irrespective of age, sex or health status of killed animals.<br>Pollution disturbs animal population and their successful breeding in the long-run in this region. |
| **2.** | Use of Lights by Vehicles during Night | Disorientation of Nocturnal Wildlife leading to increased mortality from Roadkill<br>Disturbance to nocturnal avifauna who get disoriented and attracted towards moving lights get killed | May cause poorer and unviable populations of nocturnal fauna |
| **3.** | Night lamps on Bridges | Attraction to a large number of bird's species to eat insects gathered around Lamp posts. Many small birds get predated due to this reason. | May cause decline in small bird populations leading to their local extinction. |

| | | | |
|---|---|---|---|
| **4.** | Day and Night Human access to Wildlife Areas | Leads to increased poaching and hunting of rare wildlife species | Decline in wildlife population |
| **5.** | Waste/Garbage Dumping by people along Approaches of Highway | Cause Land and air pollution<br>Attracts wild animals who in search of food visit such dumps and may die by eating harmful materials due to ignorance. | Degradation of Wildlife Habitat causing Repulsion among Wild animals to use it<br>Decline in wildlife populations |
| **6.** | Influx of more people alongside Expressway for business and habitations | New people may not be attached to surrounding ecological heritage.<br>Increased poaching and fishing activities | Degradation of aquatic ecosystem due to more anthropogenic pressure and related legal as well as illegal activities. |
| B. | **Impact on Aquatic Habitat** | | |
| **1.** | Obstruction of Water way by Piers of the bridges | Cause barrier effect and impact free movement of aquatic life<br>Piers lead to change in flow of water and its speed which may not be conducive to many aquatic animals and fishes.<br>Aquatic animals also get hit by piers during floods and fast flow of water and die. | Degradation in water quality<br>Degradation of Aquatic ecosystem and habitat<br>Blockage of free movement of aquatic fauna leads to isolation and reduction in their population |
| **2.** | Noise, Vibration and Lights of Moving Vehicles | Continuous vibrations and noise due to movement of vehicles disturb the aquatic life forms who get repulsed from the impact zone.<br>Lights emanating from large trucks and other vehicles fall on water disturbing fishes and other aquatic animals. | Degradation of aquatic Habitat.<br>Decline in population of rare and important aquatic animals. |
| **3.** | Pollution by Garbage throwing by people from Bridges | Garbage damages the aquatic habitat<br>Also kills aquatic animals who accidently eat harmful garbage materials. | Degradation of Wildlife Habitat and reduction in its suitability to use. |

| | | | |
|---|---|---|---|
| | | | Decline in population of rare and important aquatic animals. |
| **4.** | Run-off Debris and Sedimentation | Cause strong impact on water quality and aquatic ecology | Degradation of Wildlife Habitat and its suitability for sensitive species of aquatic animals. |
| C. | **Impact on Aerial Habitat** | | |
| **1.** | Obstruction of Aerial routes of Avifauna by continuous moving vehicles | Beas river has been used as a migratory route by lacs of migratory birds coming from Siberia, Europe and high Himalayas during winters.<br>The flyovers may obstruct route of low-flying bird who may be killed by bridge hits and vehicle hit due to their lack of previous knowledge about bridges. | Disruption of aerial routes of migratory birds flying along Beas river which may cause decline in winter arrivals at Harike and Beas till the migratory birds become aware of new entities enroute.<br>Decline in population of local resident birds in Impact zone. |
| **2.** | Night Lamps on Bridges and Lights of Vehicles during Night time | Disturbance to nocturnal birds who may get attracted towards lights and get killed | Decline in nocturnal bird populations. |
| **3.** | Release of Harmful smoke and Gases by Vehicles | The continuous movement of vehicles will create a smoke and pollution belt in this hitherto clean environmental zone which may create a barrier for avifauna to cross due to poorer oxygen and larger amount of harmful gases. | Disruption of aerial routes of migratory birds flying along Beas river which may cause decline in winter arrivals at Harike and Beas till the migratory birds become aware of new entities enroute.<br>Decline in population of local resident birds in Impact zone. |
| **4.** | Increased Poaching of rare avifauna | Flyovers act as favourite spots for poachers and hunters as birds flock to bridge sides at dawn and dusk. | Increased poaching will lead to population decline of birds sought by poachers. |

# Chapter 5: Roadkill Mitigation Plan for protecting the Wildlife from mortality on roads

Wildlife suffers a lot from mortality while crossing roads commonly addressed these days as "Roadkill" which pose a serious threat to already dwindling populations of wildlife in our country. The Roadkill problem is getting compounded with time as more planned highways are under construction in India to ensure fast movement of vehicles and reduce travel time. As modern transport network based on planned roads is need of the hour to ensure fast economic development in our country, the solution lies in ensuring mitigation framework consisting of measures which can aim and minimize wild animal collisions and kills on the road. Roadkills cause deaths of animals without any consideration to age, sex or health of an animal, which has a telling effect on overall sustainability of wildlife population of that species. Therefore, a Roadkill Mitigation plan to address the problem is discussed and proposed in the context of proposed Delhi-Amritsar-Katra Expressway in following paras.

## 5.1 The problem of mortality of wildlife on roads in Punjab: Current scenario

Punjab state has a very good network of roads ranging from 6-Lane and 4-lane National/state highways to double and single width roads which ensures a rapid movement of industrial and farm produce within the state and to other destination across the country. More highways have been planned in near future which include the proposed expressway, to further strengthen the transport network in the state.

Whereas a planned and wide-spread modern road network is very desirable and important for rapid economic development of the state, it has high consequences for environment and ecology and biodiversity which can be minimized if assessed, anticipated and mitigated at the planning and construction stage of the new roads.

Punjab is primarily agricultural state where more than 80% is under agriculture and rest is under habitation, forests, waterbodies and other land uses. The wilderness areas are very few and wildlife is mainly confined to such area. However, there are a large variety of biodiversity present in non-forest areas which have made their home in places around habitations, waterbodies and in the agricultural fields. Such biodiversity includes a large number of small mammals such as cats, porcupine, mouse, hare, hedgehog and squirrel; reptiles such as many types of snakes, lizards; amphibians such as frogs and toads; and many types of birds apart from many insects, butterflies; and some very rare plants present wherever refuge areas are available. Such remnant biodiversity species have adapted and thrived well in agricultural and social settings of the state since ages but their existence has been threatened in recent decades due to change in lifestyles with improved living standards and growth in human population which has encroached upon the spaces used by them as their home since ages.

The strengthened road network with upgradation and laying of new wide roads planned for fast moving traffic and consuming wide strips of land, has created barriers to free and easy movement of wild as well as feral animals resulting in an increased incidence of roadkill in the state. The wild animals getting killed there becoming a frequent sight in the State. The Wildlife Department gets frenetic calls from the public and police on daily basis informing about road accidents involving wild animals who either get injured or die on the road. The problem gets compounded during winters when wild animals get disoriented due fog and come out of the vegetation to the roads often causing accidents or getting killed there.

Sambar deer killed in a road kill

Russell Viper killed in a road kill

Monitor lizard killed in a road kill

## 5.2 The Proposed Delhi-Amritsar-Katra Expressway

The proposed Delhi-Amritsar-Katra expressway is a totally new entity coming in open countryside where wild animals have been residing in or near agricultural fields, woodlots, water bodies enjoying barrier-free movement at present. However, the situation is going to change in near future once the upcoming highway is completed and operationalized to ensure barrier-free and signal free movement of vehicles but creating a barrier to the free movement of all other present users of the space be it humans or animals.

The proposed expressway is estimated to consume a 90 meters wide strip of land as right of way while covering about 370 km length across the state. This translates into approximately 4400 ha of land which will be consumed by the project apart from that needed for other facilities along the expressway. At present the main land use of the land proposed to be acquired is continuous agricultural ecosystem which will be bifurcated by the highway, thereby creating a barrier for all the living beings including wild creatures which were roaming across this landscape freely. Once the expressway becomes operational, the magnitude of anticipated mortality due to road kills will be very high if mitigation measures are not planned and put to place. Since this project is a greenfield project, it has an in-built component for perceiving and mitigating any likely impact in advance on environment and ecology of the area through which it will pass.

Keeping in view the points mentioned in preceding paras, following mitigating measures for the expressway and the study areas falling in two wildlife conservation reserves are recommended. Mitigation of the negative impacts generally incorporates exclusion-cum-guiding fences upto landscape connectivity structures to facilitate crossing of the road by wild creatures, commonly referred to as eco-passages these days, but there is a need to design them by understanding the needs of various wildlife species. Here, the term eco-passage has been used to broadly cover all types of underpasses which need to be planned for safe passage for wild animals and feral cattle in order to avoid road accidents and roadkills.

## 5.3 General measures to minimize the road-kills on the proposed expressway

I) Adopt Best Management Practices in road design and safety so as to minimize road accidents and associated mortality not only of wildlife but also humans and domestic cattle.

II) Identification of important points of animal crossing including the frequency along with type of animals crossing there.

III) In view of I) above, to provide safe-crossing opportunities to wild fauna, plan a type of appropriately designed eco-passages to be constructed i.e. Underpass, small underpass, culvert or other type of eco-passage which can provide

comfortable passage across the Expressway and facilitates continuity of the landscape.

Wild animal friendly underpasses

IV) Provision of chain-link fencing of appropriate height on both sides of eco-passage to guide wild creatures towards the safe passage for crossing.

V) Virtual Fencing, which is touted as next-generation mitigation, may also be considered in the Expressway project. It is an active electronic protection system that is activated by approaching headlights causing it to emit a combination of sound and light stimuli which alert and repel animals from crossing the road between dusk to dawn. It is proven to be extremely effective in preventing wildlife-vehicle collisions around the world.

VI) Animal Crossing Sign Boards should be installed at crossing points to provide early warning to commuters on the road prompting them to reduce speed of vehicles.

VII) Vehicle speed reducing strips on the highway where ever feasible and safe to establish.

VIII) Retrofitted sensors and sign boards to alert drivers of the vehicles.

IX) Electronic sensors producing noise on sensing vehicles at right angles towards crossing animals to disturb their movement towards the highway.

X) Thick vegetation barriers of suitable plant species in a proper geometric design to hamper highway sighting by animals and discouraging them to come towards road.

XI) Suitable height overhead structures for facilitating road crossing by big birds such as pea-cock to avoid roadkill.


Animal crossing sign boards

Green Barriers

## 5.4 Specific Mitigating Measures for the study areas to avoid roadkill

Both BCR and KCR are home to many rare and endangered species of wildlife. BCR harbors only population of Indus Dolphin in India, Smooth-coated Indian Otter, Gharial and some endemic species of turtles apart from a large number of fishes and avifauna. It is home a very large number of migratory bird species and has been declared a Ramsar site recently, and can be termed as a Hot-spot of Biodiversity in Punjab's context. The construction of two flyovers above it is going to create a lot of impact on wild fauna and endanger their lives as all terrestrial, aquatic and aerial faunal species have been roaming freely in the BCR for ages without any barrier. Apart from continuous vehicle movement disorienting the wildlife, lights to be installed on the Bridges (passing through Beas Conservation Reserve) and their reflections in water body may have adverse effect on animal biodiversity in this area. Also, the lights from vehicles moving on the highway may attract wildlife towards highway as a result of which they may get injured/killed.

To avoid any inconvenience to the wildlife due to road-kill, following specific mitigation measures are proposed:

I) Make provision of land underpasses alongside water courses on both sides under the bridges. The design of the suitable and conducive passages to wild animals of big size such as Blue Bull, Sambhar, other deer species, and Panthers, wild boars which frequently travel alongside water courses of Beas and Kali Bein rivers as these are their traditional tracks since ages from Shivalik hills to Harike Wildlife sanctuary. Also, the underpasses will provide free movement to Domestic cattle and villagers to access their land resources across the expressway.

II) About 3 meters high underpasses at 100 m distance from the I) on each side of the Beas river which will facilitate the crossing of disoriented animals and other small animals such as jackal, fox, cat, feral dogs, big lizards, snakes and other creatures.

III) Two small culverts on each side of Beas river at a distance of 100m from II) and from each other for very small creatures such as hare, porcupine, small snakes, hogs, mouse, frogs and other amphibians.

IV) In case of Kali Bein Bridges only one underpass and one small culvert on each side will be sufficient.

V) High wildlife friendly chain-link fencing on each side of approach to the bridge is to be provided to prevent accidental crossing by animals resulting in roadkill.

VI) Install/Use Wildlife friendly lighting on expressway/bridges passing through Conservation zone as filtered yellow-green and amber lights have been considered to have lower effects on wildlife than high-pressure sodium lamps and blue-toned lights which will affect wildlife including birds, insects, fish, turtles, etc. Also, flood lights provided on the flyovers should focus only towards the road to avoid disturbance to nocturnal wildlife.

# Chapter 6: Wildlife Mitigation Plan for Biodiversity Conservation

## 6.1 Introduction

From the preceding chapters, it is clear that Construction of Delhi-Katra Expressway and its Amritsar connectivity as well as associated flyovers crossing the Beas and Kali Bein conservation reserves, and their post-construction operationalization will have significant negative impacts such as loss of wildlife habitat and its bifurcation, barrier to the free movement of wildlife, loss of Biodiversity and degradation of wildlife habitat, various kinds of pollution of natural resources, roadkills, and increased poaching and other illegal activities violating various Laws, Acts and rules in force at present. All these impacts whether short-term or long-term, have the potential to vitiate the present undisturbed, clean wildlife habitat, and upsetting the wildlife demography, decline in numbers and migration of certain wildlife species. Therefore, it becomes necessary that immediate attention is given to the perceived impacts of this project on biodiversity and commensurate mitigating measures are taken to minimize the short-term impacts and ameliorate their long-term cumulative effect on the wildlife, biodiversity and environment of the area.

Wildlife mitigation generally refers to taking steps to minimize the anticipated negative impacts on environment and biodiversity from execution of an unavoidable project in wilderness areas whose positive impacts will be of great benefit to the human society and outweigh the negative cumulative impact.

A Wildlife mitigation strategy and plan aimed at ameliorating the negative impacts of the project and compensating, conservation, enhancement of biodiversity has been discussed and prescribed in the following sections.

## 6.2 Objectives of the Wildlife Mitigation Plan

The principal objective of the mitigation plan is maintenance of existing Ecosystem and its environs to the extent possible by adopting Best Practices during execution phase and its construction to keep it eco-friendly; and restoration of habitat post-operationalization so as to enhance its biodiversity value, develop suitable habitat which is attractive enough to the wild creatures so that these are not repulsed from the area.

Other related general objectives of the proposed plan are:

Taking cognizance of project activities which will impact the environment, natural resources and biodiversity negatively.

I. Categorization of the impacts which need to be mitigated during construction and execution phase of the project, and those which will need to be undertaken post-construction and operationalization phase.
II. Distribution and fixing of responsibilities of Project Proponent, Wildlife and Forest authorities, and other stakeholders to undertake specific mitigating measures during construction or post construction.
III. Listing of priority measures to be undertaken by the project proponent during the construction phase so as to make the project truly greenfield and environmentally friendly.
IV. Listing of the measures to be undertaken by the Wildlife Department post-construction to ameliorate the anticipated long-term impacts of the project on Biodiversity and its habitat.
V. To ensure continuous flow of ecosystem services from the Protected areas to the all sections of the society through amelioration of environment and biodiversity degradation in the area.
VI. To ensure that employment opportunities made available to the weaker sections, and the society as a whole benefit from the productivity enhancement due to implementation of Mitigation plan.
VII. To undertake steps aimed at participation of local people and other stake holders, and educate them through a proper extension activities framework.
VIII. Research and special studies to generate information and knowledge about protected areas for better decision support and management.
IX. Concurrent and post-operationalization monitoring of the Mitigation plan to steer its implementation towards achieving desired goals.
X. Adequate budgetary provisions for implementing the mitigation plan.

Based on the objectives of this plan, the Table 8 lists out the impacts which can be mitigated or minimized by planning appropriate strategies and timely interventions to achieve the desired results. For the purpose of this plan, mitigating measures have been categorized into two broad categories i.e. the actions to be taken by the Project proponent, and the measures which are to be implemented by the Wildlife Authorities of the State. Both the categories are described in following paras:

### 6.2.1 Broad Impacts and proposed Mitigation Strategies

Following are the summarized Impacts on Wildlife in Protected Areas and Vicinity due to Construction and Post-construction Operationalisation of Expressway (PP-Project Proponent, WL-Wildlife Department):

Table 8: Impacts on Wildlife in Protected Areas and Vicinity due to Construction and Post-construction Operationalisation of Expressway (PP-Project Proponent, WL-Wildlife Department)

| S No | Impact on Study Areas | Whether Avoidable | Whether Mitigable/ Duty PP or WL | Impact level on Wildlife/ Study areas | Mitigation strategy | Likely effect of Mitigation strategy |
|---|---|---|---|---|---|---|
| 1 | Bifurcation, Division and degradation of Wildlife Habitat | No | Yes, PP | High | - Maintenance of high Porosity of Expressway to ensure continuity of ecosystem and wildlife habitat. | Significant Impact reduction |
| 2 | Permanent Barrier to Movement of wildlife causing isolation and imbalance of wildlife populations | No | Yes, PP | High | -Project proponent to follow MOEFCC guidelines to make Expressway Eco-friendly and Porous as envisaged under Greenfields project objectives | Moderate Impact Reduction |
| 3 | Loss of wildlife habitat which will be permanently come under flyovers | No | Yes, PP & WL | High | -Project proponent may provide equivalent land or provide requisite funds to wildlife Department to procure similar land of low to moderate cost for developing wildlife habitat with enhanced biodiversity value. | High Impact reduction |
| 3 | Roadkill leading to decline in numbers of wild animals | No | Yes, PP | High | -Implementation of Road-Kill Protection Plan by Project proponent | High Impact reduction |

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| 4 | Increased Pollution: Air, Noise, Land and Water, causing environmental degradation of the Protected areas | No | Yes, PP & WL | High | -Vegetation Barriers along highway and flyover approaches by project proponents.<br>-Raising Massive green Belts and plantations of native fruit bearing trees useful to wildlife by the Wildlife department in and around Study areas<br>-Noise curtains on flyovers<br>-Follow Best practices of profession | Moderate to High impact reduction |
| 5 | Stress on Study areas due to increase human presence from Labour and Labour Camps | No | Yes, PP & WL | High | -Follow Best practices and site Labour camps at least 500 meters away from river banks.<br>-Educate Labour and families to make them aware about wildlife and importance | High reduction in impact |
| 6 | Degradation of wildlife habitat due to project activities and decline in its useability to many wild species | No | Yes, WL | High | -Large scale plantations in adjoining forests on the river Banks to compensate for loss of value.<br>-Increase prey base in water bodies through artificial fish-seeding<br>-Cleaning of water bodies of waste material and invasive species such as water hyacinth, ageratum and other alien and invasive species. | High Impact reduction |
| | Reduction in suitability and useability of Habitat by certain species which migrate to other places causing competition and stress on food-chain | No | Yes, WL | Medium | -Increase bio-diversity value of other areas by WL to cater to increased pressure by improving prey-base and removing weeds | High reduction in impact |
| 8 | Increased poaching and Hunting due to increased human presence | No | Yes, WL & PP | Medium | -Concurrent monitoring and Patrolling by wildlife staff to check offences.<br>-Strict control by Project proponent on its labour. | High reduction in impact |

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|---|---|---|---|---|---|---|
| **9** | Disturbance and Obstruction due to bridge piers construction leading to abdication of water habitat by fish and other species | No | Yes, PP & WL | High | -Follow best practices by working out a strict day time schedule<br>-Avoid pier erection in water courses<br>-Avoid working in breeding seasons of animals<br>-Rescue operations by WL if animals get stranded | High reduction in impact |
| **10** | Degradation of aquatic habitat and water quality due debris run-off, sedimentation and throwing of garbage and other waste material in water bodies | No | Yes, WL & PP | High | -Habitat amelioration works by Wildlife Department.<br>-Strict pollution control norms by project proponent | High reduction in impact |
| **11** | Obstruction in aerial routes of migratory as well as resident birds due to high flyovers causing bird mortalities | No | Yes, PP | High | -Provision of high noise and light curtains by Project proponent<br>-Install Sensors to alert flying birds to protect them against hitting the flyovers | High reduction in impact |
| **12** | Degradation of aerial habitat due to permanent smoke and pollution air-belt on and around flyovers disturbing wild avifaunal populations in the area. | No | Yes, WL & PP | High | -Increase habitat quality in other places to localise the avifauna for some time till they become imprinted and aware of new structures | High reduction in impact |
| **13** | Decline in nocturnal fauna due night lamps and moving lights and increased poaching of birds | No | Yes, WL | High | -Strict vigil on poachers by Wildlife staff<br>-Increase habitat quality in other places to make it suitable for such species | High reduction in impact |
| **14** | New settlements and businesses will increase anthropogenic pressure on hitherto undisturbed clean environs | No | Yes, WL | Medium | -Strict vigil on poachers by Wildlife staff<br>- Strengthen Extension infrastructure and Publicity/Extension activities to educate and involve people in wildlife conservation matters<br>-Involve school children in running wildlife awareness campaigns | High reduction in impact |

### 6.2.2 Category 1: Measures which are the responsibility of the Project Proponent

Following measures are suggested for mitigating and minimizing impacts mostly arising out of construction and operationalisation of the Expressway and keeping in view the Greenfields nature of the project, need immediate action concurrently with the construction and operationalisation by NHAI.

1. Implementation of the measures for preventing and minimising Roadkills during construction and post construction phase as listed out in Roadkill Prevention and Minimising Plan presented in Chapter 5.
2. Implement all the measures proposed for minimising the impact of Bifurcation of Habitat and Permanent barrier effect created when the expressway is operationalised post-construction.
3. To compensate for loss of protected areas of BCR and KBCR impacted permanently by construction of Expressway flyovers and their approaches by providing equivalent area or providing funds to Wildlife Departments as per minimum rates charged by the Punjab Forest department for procuring non-forest lands to compensate loss of Forest Area.
4. To undertake all the measures related to mitigate the effect of Pollution of various kinds as proposed in the plan.
5. To undertake measures with respect to Labour and Labour camps by ensuring that all the Labour camps are established at a minimum distance of 500 meters from the boundary of Beas Conservation reserve and at least 200m from either side of KBCR to avoid any pressure on the protected areas. The labour will be made aware of the wildlife laws by the project proponent and wildlife authorities so that they don't indulge any poaching, fishing or any other illegal activity; and use protected areas for any prohibited activity.
6. To undertake measures to minimise noise pollution and disturbance due to lights in night from Lamp-posts or moving vehicles by raising high permanent noise and light curtains by using materials with high rate of acoustic absorption capacities on both sides of the flyovers so that no disturbance is caused to the wild creatures during day or night.
7. To ensure that no construction material is dumped or permanently stored in protected area so that no harm is caused by such materials to the wildlife including aquatic animals by way of pollution, sedimentation due to their release in water or by any other method.
8. To ensure that the piers of the bridges are not constructed in river bed with flowing water to the extent it is possible so that continuity of channels and free flow of water is not obstructed or changed which may be harmful to the aquatic animals.

9. To ensure Best Management Practices in the field of Flyover construction. Efforts should be made to plan Suspension Bridge based flyovers which will cause least disturbance to the rivers.
10. To undertake massive plantations alongside expressway to create vegetation barriers. This is described separately under the section 'Phytoremediation'.

### 6.2.3 Category 2: Mitigation measures which are to be taken up by Wildlife Authorities (WLA)

1. WLA will station a permanent team of experienced field staff and workers who will work in close association with the PP to ensure that construction work of Expressway in the protected areas goes on smoothly to the satisfaction of all stakeholders including Wildlife present in the area.
2. Concurrent monitoring of the project during implementation phase to make sure that Construction firms engaged by the PP i.e. NHAI are clear about the mitigation measures to be incorporated during construction Phase, and to ensure that these are implemented in letter and spirit.
3. WLA will ensure that all the prescriptions to be followed by PP with regards to storage of construction materials away from protected area, their carriage by the trucks, Dumpers and other machinery in an eco-friendly manner so that pollution is minimised on the construction site crossing protected areas.
4. WLA will ensure safety of animals during construction of Expressway by ensuring continuous watch and ward of the area.
5. WLA will organise awareness camps for construction firm's staff and labour to educate them about importance of wildlife and biodiversity and need to ensure their safety, and wildlife laws which are to be complied with during construction activities in the protected areas. Similar camps will also be organised for families of the Labourers if they are housed at nearby areas of protected areas.
6. It will be ensured by WLA that dust, noise and other pollution control measures are adequately put in place and followed by the contractors of PP so that disturbance to wild animals is minimized.
7. WLA will ensure that water channels are continuously flowing and not obstructed, polluted or closed by the Construction workers.
8. WLA will make all the efforts to undertake all the works prescribed in the Mitigation plan to minimise the cumulative impacts on the protected areas in the long-term.
9. It will also be ensured by WLA that all the funds provided by the project proponent for implementing Mitigation plans are utilised for this purpose only by keeping these in a separate account in a Bank and maintaining a separate cashbook account for expenditure as per State Financial Rules.
10. WLA will ensure that all works prescribed for ameliorating the habitat degradation, enhancing biodiversity value of the protected areas, increasing prey base in the rivers, phytoremediation and massive plantations, clearing of weeds from the wildlife

habitat, and extension works including people's participation in natural resources conservation are implemented and completed in a fixed time frame and desired results are achieved.

11. WLA will work with PP to ensure that those construction activities which may disturb the wildlife during breeding season and migratory season are kept at a low key.
12. The Field team stationed at the project site will be provided with all the rescue equipment viz. vehicle, Boat and lifesaving equipment, tranquilising equipment, nets, cages etc to ensure rescue of stranded animals in a professional manner and their safe release to their habitat.
13. WLA will ensure that to compensate for the loss of protected area habitat coming permanently under expressway, the equivalent area is procured with funds provided by PP for this purpose and developed into ideal wildlife habitat.
14. WLA will be bound to abide by any other prescriptions if made by State Wildlife Board or National Boards of Wildlife while according clearance to the proposal.

### 6.2.4 Aquatic Habitat Improvement

The riparian biodiversity hugely benefits by strengthening or restoring river processes and its physical habitat. This also ensures the long-term survival of high-profile species such as the dolphins, Gharial, otter, turtles etc. For improving the aquatic habitat of Beas and Kali Bein Conservation Reserve, following measures are advised:

- Creation of the newly procured site as an ecologically strengthened site. Department of Forests and Wildlife Preservation will procure and develop new land project as a result of compensation of this expressway project.
- Procurement of weed removing machines for Harike Wildlife Sanctuary and Beas Conservation Reserve.
- Enhancing prey base for raptors with the reintroduction of suitable prey base and enhancing green cover in Harike wildlife sanctuary and Beas Conservation Reserve.

### 6.2.5 Biodiversity Enhancement

Species benefitting programmes need to be designed using sound scientific approaches that encompasses ecological, hydrological and geomorphic processes. For enhancing the biodiversity potential of Beas and Kali Bein Conservation Reserve, following measures are advised:

- Establishing in situ and ex situ facilities in Beas Conservation Reserve for conservation of freshwater turtles.
- Restocking of native freshwater fishes in both Beas and Kali Bein Conservation Reserve.
- Creation of ranches and rearing of native carnivores' fishes in Beas Conservation Reserve.
- Restoring natural grassland along the Beas and Kali Bein Conservation Reserve benefitting avifauna especially migratory birds.

### 6.2.6 Phytoremediation: Plantation of beneficial plant species

To mitigate the effects of land, air, water and/or noise pollution, phytoremediation may be counted as one of the best solution available. The plants not only produce oxygen to neutralise the effect harmful gases released by continuously running vehicles, they act as great filters for screening dust, noise and other harmful particulate matter and preventing them from falling on adjoining environs such as agricultural crops, habitations and water bodies. Therefore, raising of dense plantations on the upcoming expressway and other adjoining areas are recommended as highly desirable.

Massive Plantation works alongside Expressway by NHAI to mitigate the effects as per the Terms-of-Reference for Punjab Section of the Expressway issued by MoEF&CC vide F. No. 10-18/2020-IA.III dated 18th March, 2020, The MoEF&CC has directed NHAI to carry out following work apart from others;

"A comprehensive plan for plantation of three rows of native species, as per IRC guidelines, shall be provided. Within the boundaries of Delhi/NCR, the project proponent has to plant 10 trees against each tree to be cut along the proposed"

The total length of proposed Expressway including Amritsar connectivity and entry and exit roads on way will be approx. 400km. If flyovers and other installations on way are estimated at 20% and excluded, 350 km length will be available for raising plantations of native species of trees in three rows on each side which at a spacing of five meters translates into 4.2lac plants which is equivalent to 420 Ha plantation as per norms of 1000 plants per Ha of the State Forest Department. This can be termed as a very satisfactory effort once completed post-construction of the Highway. Apart from this a massive plantation of shrubs in the central verge is also done by NHAI which will be at close spacing and estimated to be around 5 lac plants. NHAI should avoid planting of Kaner and Lantana species as these plant species don't serve mush ecological value. The entire expenditure of this greening effort is to be borne by the NHAI.

Once raised, the NHAI plantations will serve as very good vegetation barrier for helping in mitigating the impacts of various types of pollution caused by operationalisation of the Expressway.

**Plantations by Forests and Wildlife Authorities to increase Biodiversity value of Protected areas:**

To mitigate the impacts of Expressway due its crossing the protected areas, plantation of 20 ha on protected and forest area has been proposed to be under taken by Wildlife authorities. These include 10 Ha plantation by DFO, Amritsar at Rakh Sarai Amanat Khan Wildlife Conservation Reserve (5 Ha) and Chak Gagrewal Protected Forest (5 Ha), 5 Ha plantation by DFO (Wildlife), Pathankot at Kapoora Protected Forest in Gurdaspur District, and 5 Ha

plantation by DFO Wildlife) Phillaur in Dhilwan Protected Forest adjoining Beas River in Kapurthala District. Thus, a total of 20000 native tree species will be planted keeping in view their biodiversity conservation value. These areas will be well-protected and maintained for a minimum of 5 years by the concerned officer to ensure their full success. A total layout of Rs 1.12 crores (@Rs 5.60 Lac per Ha) has been made which includes maintenance for 5 years, equipment and contingency for escalation of wage rates during this period.

**Creation of Remnant Biodiversity Refuge Areas along Expressway**

Apart from above 20 ha plantation, to promote biodiversity conservation and develop biodiversity education spots for school children and public, five areas of about 4 Ha size each within 10-15 km distance on both sides of study areas may be identified in nearby forests by the Punjab Wildlife Department and designated as Punjab Biodiversity Refuge and Conservation Parks on pilot basis. A total of 5 such refuge areas (2 each for two Beas flyovers) may be created with a special design for planting all important indigenous plant species of the area including trees, shrubs and ground flora after removing all alien and invasive species. These areas will not only cater to native small floral and faunal species of great biodiversity value, but also be used to promote day-time ecotourism. A total provision of Rs 62.5 lac (@Rs 12.5 lac per Conservation park) is made to create basic infra structure which can later be enhanced further. These areas may be located near above mentioned plantation blocks for their better care and usefulness.

**Distribution of seedlings of fruit-bearing indigenous tree species**

Distribution of seedlings of fruit-bearing indigenous tree species to local people in villages under impact zone of the project is recommended. A total 10000 number of fruit plants at a cost of Rs 15 lac (@Rs 150 per plant) is proposed.

### 6.2.7 Extension and Awareness Generation Activities

The continuous development of the nation for bettering economic and social conditions of our citizens is essential but it will always have a negative impact on our natural resources. There is a dire need of creating awareness about our natural resources including Biodiversity, wildlife, Forests and Rivers among public and solicit their involvement in protecting, conserving and safeguarding our natural resources. The school children who are our future can be involved at young age to educate them and expose them to the benefits of conserving nature. A well-planed extension network and infrastructure can be of great benefit in achieving the desired objectives on this matter.

Various measures to be undertaken under the proposed plan so that the objectives of conserving biodiversity and its enhancement in the long-run are discussed in following paras:

**i) Aquatic Biodiversity interpretation Centre and Nature Park at Dhilwan (Beas)**

To make aware the local people and from nearby Big cities such as Amritsar and Jalandhar, an Aquatic biodiversity interpretation Centre and Nature Park depicting Beas CR as theme is necessary and proposed to be setup at Dhilwan. A provision of Rs 1 crore is made for all activities including construction, furnishing, hard and soft components, creation of a medium sized Biodiversity park and plantation of native trees for educating the people. The theme of this entity will be show case of aquatic life of Beas as well as other important creatures inhabiting Riparian habitat.

**ii) Strengthening interpretation centre at Kanjli**

Kali Bein Conservation reserve is the most recent addition to protected area network of Punjab. It also includes a Ramsar site at Kanjli wetland. The earlier established Interpretation centre and other facilities are in dilapidated condition and the buildings have become unsafe. The Interpretation centre and associated infrastructure need to be fully developed for extension purposes so as to cater to the needs of visitors from outside, local people and school children of the Kapurthala District. Also, an open Butterfly Park is proposed to be developed at this place. A total outlay of Rs 40 lac for these projects is proposed which includes 25 lacs for establishing and operationalising Wildlife Interpretation centre, and Rs 15 lac for creating infrastructure for Butterfly park and its plantations.

**iii) Strengthening Wildlife interpretation centre at Harike**

Harike Wildlife Sanctuary is a Ramsar Site of International standing from wildlife perspective. It is known for winter migratory bird which flock in lacs during winter season from as far as Siberia and Europe. It is also an Internationally recognised Ramsar Site. Keeping in view its connectivity with Beas CR and number of people who visit it regularly, the extension infrastructure is not commensurate with its recognition and need further strengthening. An international standard Interpretation centre was recently created with external assistance but the soft components are to be put in place to operationalise the centre apart from furnishing it with other infrastructure. A layout of Rs 25 lacs is proposed for this purpose. Also, For strengthening Wildlife Census infrastructure at Harike WLS for hosting volunteers for regular animal census some Dormitories and toilets, and lecture hall need to be added/furnished. An outlay of 15 lacs is proposed for this purpose.

**iv) Friends of Beas/Dolphin program**

For ensuring better protection of aquatic life of Beas and Harike especially rare and endangered species such as Indus Dolphin, Gharials and Otters, Friends of Beas program was launched with support from WWF India. With the new expressway crossing BCR at two places, this program needs to be strengthened further to protect and monitor the invaluable wild animals. An outlay of Rs 12 lacs is proposed which will be implemented through WWF India.

**v) Entry point activities for Villages actively involved in Aquatic life protection**

To recognise the efforts of such villages it is recommended to make a provision of Rs 4 lac each for Village Mundapind, Karmuwal, Goindwal, Dhunda, Gagrewal, Wazir Bhullar and Sultanpur Lodhi for undertaking green developmental activities for them, with first preference to development of schools. A provision of Rs 20000 per school of other 100 villages situated on the banks of Beas and Kali Bein to designate them as Dolphin Friendly school will be made. Thus, a total provision of Rs 48 lac will be made for this purpose.

**vi) Strengthening Wildlife Census infrastructure at Harike for hosting volunteers.**

For strengthening Wildlife Census infrastructure at Harike WLS for hosting volunteers for carrying out regular animal census and other surveys, some Dormitories and toilets, and lecture hall need to be upgraded, added/furnished. An outlay of 15 lacs is proposed for this purpose.

### 6.2.8 Research and Monitoring

**i) Study of Land use change**

A GIS-based Beas Conservation Reserve Information System is proposed to be developed by Punjab Remote Sensing Centre Ludhiana. This project will use High-resolution satellite data for the project and also LIDAR data for important Spots of BCR and Harike WLS to study the land use change and its impacts on the ecological health of the riverine system of Punjab. A provision of Rs 15 lacs will be made for this project.

**ii) Species focussed special Studies**

A special study of 3-year Gharial and Dolphin monitoring program need to be conducted to understand the dispersal pattern and habitat usage of flagship aquatic species. The focus also needs to put if the minimum e-flow requirement is met for river Beas and its corelation with the habitat use of flagship aquatic species like dolphins and Gharial. These studies will be executed by WWF India in collaboration with the field officials of Punjab Wildlife Department. A Provision of Rs 30 lac for WWF has been made this project.

**iii) Monitoring of wildlife and its habitat**

Concurrent Monitoring during project implementation and post-operationalisation of the Expressway to ensure that Wildlife Act and its rules are not violated by project proponent. A Monitoring committee will be constituted under CWLW Punjab or his nominee CF (Wildlife) PPA Circle, Punjab to ensure extra protection of wildlife during project implementation phase Provision of Rs 25 lac for monitoring, POL etc.

**iv)** Some other need-based small consultancies can be given by CWLW, Punjab wherever deemed essential for better Management of Beas Conservation Reserve. A provision of Rs 5 lacs is made for this purpose.

## Chapter 7: Budget Details

The recommendations presented in the above section outlines a best management strategy to the address the adverse impacts to ecological character of Beas and Kali Bein Conservation Reserve due to the Delhi-Katra expressway. The planning framework envisages ecosystem conservation, sustainable resource development and livelihood improvement supported by institutional development; communication, education and public awareness. The mitigation strategy is proposed to address ecological conservation, water management, habitat management, biodiversity conservation, ecotourism development, improvement of quality of life of the riparian communities, sustainable resource development and livelihood improvement. A total of 13.77 crore (INR) budget is required to conduct the above-mentioned activities and projects. The 13.77 crore budget along with the physical targets is detailed in this section.

Following is the detailed physical target allocation for wildlife mitigation plan:

Table 9: Physical target allocation for wildlife mitigation plan

| Wildlife Mitigation Plan for Biodiversity Conservation - Physical targets Allocation | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| S No | **Activity** | **Target** | **Ferozepur (Wildlife)** | **Amritsar** | **Phillaur (Wildlife)** | **Hoshiarpur (Wildlife)** | **Pathankot (Wildlife)** | **CWLW SAS Nagar** | **Total** |
| **1** | Compensation for permanent Loss of Wildlife Habitat in Protected Areas | 20 Ha (50 Acres) | 35 | - | - | - | 15 | - | 50 |
| **2** | Floral Biodiversity enhancement of the Protected areas through Plantations of Indigenous trees. Removal of Invasive and Alien Species | 25 Ha | 5 | 5 | 5 | 5 | 5 | - | 25 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **3** | Distribution of seedlings of native fruit trees to Local People | 10000 | 2000 | 2000 | 2000 | 2000 | 2000 | - | 10000 |
| **4** | Remnant Biodiversity Refuge in Conservation Parks | 5 parks of 4 Ha each | 1 | 1 | 1 | 1 | 1 | - | 5 |
| **5** | Improving Aquatic vegetation food source in shallow wetlands in the vicinity of Rivers | 4 sites | 1 | 1 | - | 1 | 1 | - | 4 |
| **6** | Procurement of Motorised Aquatic weed Remover for Beas-Harike | 1 | 1 | - | - | - | - | - | 1 |
| **7** | Waste and Garbage removal from Beas and Kali Bein Rivers and their Banks through manual and Boat operations | 5 | 1 | 1 | 1 | 1 | 1 | - | 5 |
| **8** | Increasing prey base for avifauna especially raptors by restocking of small reptiles and amphibians Harike WLS and BCR and KCR | 2 | 1 | - | 1 | - | - | - | 2 |
| **9** | Establishment of Turtle Hatchery for conservation and restocking of scavenger species- (in-situ and ex-situ linkage) | 1 | 1 | - | - | - | - | - | 1 |
| **10** | Replenishment of Prey base in CR's by releasing fish seedlings of indigenous fish species for three years | 6 million fish fingerlings | 1.5 | - | 1.5 | 1.5 | 1.5 | - | 6 |
| **11** | Strengthening of Gharial reintroduction Program by restocking and conducting special studies for improving their survival in the long-Term | 1 | - | - | - | - | - | 1 | 1 |
| **12** | Extension and Awareness Generation Activities (Friends of Beas and Dolphin) | 6 locations | 1 | 1 | 1 | 1 | 1 | 1 | 6 |
| **13** | Construction of Biodiversity Interpretation Centre at Kanjli | 1 | - | - | 1 | - | - | - | 1 |
| **14** | Establishment of a Butterfly Park at Kanjli | 1 | - | - | 1 | - | - | - | 1 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **15** | Construction, Development and Operationalisation of aquatic Biodiversity Interpretation and Nature Park, Dhilwan (Beas) | 1 | - | - | 1 | - | - | - | 1 |
| **16** | Provision of infrastructure for operationalisation of newly Constructed Wildlife Interpretation Centre complex Harike | 1 | 1 | - | - | - | - | - | 1 |
| **17** | Upgradation of Extension related infrastructure viz Dormitories, Toilet Complex, Lecture Halls and Inspection Hut at Harike used for wildlife census and Nature camps for schools etc | 1 | 1 | - | - | - | - | - | 1 |
| **18** | Education-related outreach Activities including Visitor facilities, Watch towers, Bird Hides, Solid waste and Garbage Disposal, Audio-visual and publicity materials etc | Package 5 | 1 | 1 | 1 | 1 | 1 | 1 | 6 |
| **19** | Entry point activities in Wildlife friendly villages namely Karmowala, Govindwal, Mundapind, Dhunda, Gagrewal, Desal and Kanjli | 7 Villages | 1 | - | 1 | - | - | - | 2 |
| **20** | Linkage Development with rural schools around Protected areas by designating them as Wildlife Friendly School | 100 schools | 20 | 20 | 20 | 20 | 20 | - | 100 |
| **21** | Purchase of FRP Boats for monitoring and protection of BCR | 2 | 1 | - | - | 1 | - | - | 2 |
| **22** | Purchase on Multi-purpose Utility Vehicles (MPV) for Rescue operations, Monitoring and Crew Deployment etc | 3 | 1 | - | - | 1 | - | 1 | 3 |
| **23** | Procurement of need-based equipment for concurrent monitoring and rescue operations- such as Drone, Tranquilising Equipment, Trap cameras, Telescope, depth meters, range finders, safety gears, Gun nets etc | Package Lumpsum 5 No | 1 | 1 | 1 | 1 | 1 | 1 | 6 |
| **24** | Monitoring of Gharial, dolphin and prey Base on regular Intervals by WWF India | 1 | - | - | - | - | - | 1 | 1 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **25** | GIS-Based Beas Information System by Punjab remote sensing Centre, Ludhiana | 1 | - | - | - | - | - | 1 | 1 |
| **26** | Concurrent Monitoring by DFOs and Head Office | 6 | 1 | 1 | 1 | 1 | 1 | 1 | 6 |
| **27** | Other unforeseen tasks and contingency related to Mitigation Measures | Lump sum package 6 | 1 | 1 | 1 | 1 | 1 | 1 | 6 |

Table 10: Financial allocation for wildlife mitigation plan

## Wildlife Mitigation Plan for Biodiversity Conservation - Financial Allocation (In crores)

| S No | **Activity** | **Target** | **Ferozepur (Wildlife)** | **Amritsar** | **Phillaur (Wildlife)** | **Hoshiarpur (Wildlife)** | **Pathankot (Wildlife)** | **CWLW SAS Nagar** | **Amount In 3 years** | **Total Amoun** |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | Compensation for permanent Loss of Wildlife Habitat in Protected Areas | 20 Ha (50 Acres) @ Rs 13 Lac per Acre | 4.55 | - | - | - | 1.95 | - | - | 6.50 |
| **2** | Floral Biodiversity enhancement of the Protected areas through Plantations of Indigenous trees after removal of Invasive and Alien Species | 20 Ha @ Rs 5.6 Lac per acre | 0.28 | 0.28 | 0.28 | - | 0.28 | - | - | 1.12 |
| **3** | Distribution of seedlings of native fruit trees to Local People | 10000 @ Rs 150 per plant | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | 0.15 |
| **4** | Remnant Biodiversity Refuge in Conservation Parks | 5 parks of 4 Ha each @ Rs 12.5 Lac per Park | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | - | - | 0.625 |

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|---|---|---|---|---|---|---|---|---|---|---|
| **5** | Improving Aquatic vegetation food source in shallow wetlands in the vicinity of Rivers | 4 sites @ Rs 1 Lac per site | 0.01 | 0.01 | - | 0.01 | 0.01 | - | - | 0.04 |
| **6** | Procurement of Motorised Aquatic weed Remover for Beas-Harike | 1 @ Rs 50 Lac with maintenance for 5 years | 0.50 | - | - | - | - | - | - | 0.50 |
| **7** | Waste and Garbage removal from Beas and Kali Bein Rivers and their Banks through manual and Boat operations | 5 @ Rs 1.5 lac per unit for 3 years | 0.015 | 0.015 | 0.015 | 0.015 | 0.015 | - | 0.075 | 0.075 |
| **8** | Increasing prey base for avifauna especially raptors by restocking of small reptiles and amphibians Harike WLS and BCR and KCR | 2 @ Rs 1.5 lac for 3 years | 0.015 | - | 0.015 | - | - | - | 0.03 | 0.03 |
| **9** | Establishment of Turtle Hatchery for conservation and restocking of scavenger species- (in-situ and ex-situ linkage) | 1 @ Rs 10 lac for 3 years | 0.10 | - | - | - | - | - | - | 0.10 |
| **10** | Replenishment of Prey base in CR's by releasing fish seedlings of indigenous fish species for three years | 6 million fish fingerlings | 0.015 | - | 0.015 | 0.015 | 0.015 | - | 0.06 | 0.06 |
| **11** | Strengthening of Gharial reintroduction Program by restocking and conducting special studies for improving their survival in the long-Term | 1 Lumpsum package @ Rs 6 lac for 3 years | - | - | - | - | - | 0.06 | 0.18 | 0.18 |
| **12** | Extension and Awareness Generation Activities (Friends of Beas and Dolphin) | At all locations @ 2 lac per year | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | - | 0.12 |
| **13** | Construction of Biodiversity Interpretation Centre at Kanjli | 1 Lumpsum package @ Rs 25 Lacs | - | - | 0.25 | - | - | - | - | 0.25 |

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|---|---|---|---|---|---|---|---|---|---|---|
| **14** | Establishment of an open Butterfly Park at Kanjli | 1 Lumpsum Package @ Rs 15 lac for 3 years | - | - | 0.15 | - | - | - | - | 0.15 |
| **15** | Construction, Development and Operationalisation of aquatic Biodiversity Interpretation and Nature Park, Dhilwan (Beas) | 1 Lumpsum Package for 3 years @ Rs 100 Lacs | - | - | 1.0 | - | - | - | - | 1.0 |
| **16** | Provision of infrastructure for operationalisation of Newly Constructed Wildlife Interpretation Centre complex, Harike WLS | 1 Lumpsum Package for 3 years @ Rs 25 lacs | 0.25 | - | - | - | - | - | - | 0.25 |
| **17** | Upgradation of Extension related infrastructure viz Dormitories, Toilet Complex, Lecture Halls and Inspection Hut at Harike used for wildlife census and Nature camps for schools etc | 1 Lumpsum Package @ Rs 15 Lacs | 0.15 | - | - | - | - | - | - | 0.15 |
| **18** | Education-related outreach Activities including Visitor facilities, Watch towers, Bird Hides, Solid waste and Garbage Disposal, Audio-visual and publicity materials etc | Package 6 @ Rs 3 lac for 3 years | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.18 | 0.18 |
| **19** | Entry point activities in Wildlife friendly villages namely Karmowala, Govindwal, Mundapind, Dhunda, Gagrewal, Desal and Kanjli | 7 Villages @ Rs 4 lac per village | 0.20 | - | 0.08 | - | - | - | - | 0.28 |
| **20** | Linkage Development with rural schools around Protected areas by designating them as Wildlife Friendly School | 100 schools @ Rs 0.20 lac per school for 3 years | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | - | 0.20 | 0.20 |

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|---|---|---|---|---|---|---|---|---|---|---|
| **21** | Purchase of FRP Boats for monitoring and protection of BCR | 2 No @ Rs 16 Lac per Boat | 0.16 | - | - | 0.16 | - | - | - | 0.33 |
| **22** | Purchase on Multi-purpose Utility Vehicles (MPV) for Rescue operations, Monitoring and Crew Deployment etc | 3 MPV @ Rs 10 lac including maintenance for 2 years | 0.10 | - | - | 0.10 | - | 0.10 | - | 0.30 |
| **23** | Procurement of need-based Equipment for concurrent monitoring and rescue operations- such as Drone, Tranquilising Equipment, Trap cameras, Telescope, depth meters, range finders, safety gears, Gun nets etc | Package Lumpsum 5 No @ Rs 5 Lac per package | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | - | 0.30 |
| **24** | Monitoring of Gharial, dolphin and prey Base on regular intervals by WWF India | Special study @ Rs 10 lac per year for 3 years | - | - | - | - | - | 0.10 | 0.30 | 0.30 |
| **25** | GIS-Based Beas Information System by Punjab remote sensing Centre, Ludhiana | Special study @ Rs 15 lac for 3 years | - | - | - | - | - | 0.05 | 0.15 | 0.15 |
| **26** | Concurrent Monitoring by DFOs and Head Office | 6 Lumpsum package @ Rs 3 lac per DFO, and @Rs 10 lac for CWLW | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.10 | - | 0.25 |
| **27** | Other unforeseen tasks and contingency related to Mitigation Measures | Lump sum package 6 @ Rs 3 lac per package | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | - | 0.18 |
| **Grand Total** | | | **Rs 13.77 Crore** | | | | | | | |

# Chapter 8: Conclusions and Recommendations

The objective of mitigation planning is to help safeguard natural resources ensuring development is compatible with the conservation goals. Engineered modifications during road and bridge constructions for ecological solutions of natural wild habitats can never be complete and perfect for addressing all adverse ecological impacts. However, the best form of mitigation is certainly through better and eco-friendly designs, technological inclusive ecological mitigation planning.

Beas is the only living river of Punjab which has been declared as a Conservation reserve and a Ramsar site due to its unique biodiversity and ecology. It is home to the only population of Indus River dolphins *(Platanista gangetica minor)* in India and supports many other aquatic flagship species. Similarly, Kali Bein Conservation Reserve is the holy river of Punjab. It holds an immense ecological value and the riparian communities are deeply connected to the holy Kali Bein.

The proposed four bridges of the Delhi - Katra Expressway on Beas and Kali Bein Conservation Reserve will alter the current ecological conditions, cut through the natural habitats and consequently reduce populations of many wildlife species. Due to construction of expressway fragmentation of natural habitats will increase, influencing landscape patterns and altering the physical environment. In addition, the expressway will also act as barriers to animal movements, increase their mortality rates and cause other negative impacts on biodiversity. For locals around the project sites, roads can have both positive and negative influences. On the positive side roads provide the opportunity of mobility and transport for people and goods. It will be economic boost for the local area and will open prospective for development and urban industry. On the negative side roads occupy land resources, form barriers to animals and may be detrimental for overall health due to increased pollution of all kinds.

Therefore, it is of utmost importance to act on the perceived impacts (mentioned in the above mitigation plan) of this project on biodiversity and commensurate mitigating measures to minimize the short-term impacts and ameliorate their long-term cumulative effect on the wildlife, biodiversity and environment of the area. Suggested mitigation measures in the plan need to be implemented and brought into practice by the project proponent, by the Wildlife Authorities (WLA) or the concerned stakeholder for an overall welfare of Beas and Kali Bein Conservation Reserve.

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# Annexures

## Annexure 1 Picture Gallery


Biodiversity Conservation Plan (P3422) River Beas

Beas River Gagrewal - Gharial Site

Biodiversity Conservation Plan (P3422) River Beas


Biodiversity Conservation Plan (P3422) Sacred River Kali Bein

Sacred River Kali Bein at Sultanpur Lodhi.

## Annexure 2: Interaction with Stakeholders of villages along River Beas and Kali Bein Conservation Reserve

**Biodiversity Conservation Plan (P3422)**

The 1st field visit was conducted for survey on biodiversity conservation in Tarn Taran district on **10.09.2020**. The project consultants viz. Sh. Balvir Singh, Dr. Satnam Singh Ladhar, Sh. Balbir Singh Dhillon & Sh. Bhupinder Singh (Feedback Infra Pvt Ltd) visited the project area. Five villages within 5 kilometres on either side of River Beas from where bridge is proposed to be constructed for Delhi Amritsar Expressway were surveyed. Both one to one and group interactions were held with various stakeholders including villages sarpanches, numberdars and member panchayats. Villages participated in the meeting includes:

- Amratpur Rajewal
- Sri Goindwal Sahib
- Dhunda
- Khakh
- Bhel Dhaiwala
- Johal Dhaiwala

The stakeholders were informed regarding the upcoming project and its possible impacts on the flora and fauna of the area. After these discussions the stakeholders submitted their demands.

**Amratpur Rajewal village**

Meeting was held in villages Amratpur and Rajewal on 10.09.2020, in which Sarpanch Sh. Gurcharan Singh, Member Panchayat Sh. Gurcharan Singh, Sh. Gurvinder Singh, Charitable Trust Nirmal Kutia Seechewal, Ex-Sarpanch Sh. Mukhtiar Singh, Ex- Sarpanch Sh. Shinder Singh, Panch Sh. Shingara Singh, Sh. Ranbir Singh, Sh. Sandeep Singh, Sh. Santokh Singh, Sh. Harjinder Singh, Sh. Desa Singh, Sh. Balwinder Singh, Sh. Madan Singh, Sh. Jaspal Singh and other villagers participated in the discussions.

The following demands were put forward by the stakeholders: -

- The stakeholders wanted that there should be underpasses on both side of the bridge on River Beas, to ease the movement of traffic and animals.
- The farmers whose land is to be acquired must be given good compensation.
- Local engineers and labor should be engaged/employed for the construction of the bridge and related projects e.g. toll plaza etc. according to their capability.
- Toll Tax should be waived for locals in the vicinity of 20 Km of the project.
- Medicinal and Ornamental plants should be planted near bridges.
- There should be a facility for Kisan Haat on the highway where farmers can sell their produce to travellers.
- A site should be reserved for the preservation of the forest plants and animals for the attraction of the travellers.
- Sh. Gurvinder Singh, Charitable Trust Nirmal Kutia Seechewal presented a letter of demand on behalf of Padma Shri Sant Balbir Singh Seechewal in which he has urged that the construction of this project should not harm the natural river bodies and a plan should be formulated for the development of the Holy Kali Bein as a historical place for the devotees passing through this highway.
- Meeting was ended with a vote of thanks by Sarpanch Sh.Gurcharan Singh.

**Dhunda Khakh villages**

Meeting was held in villages Dhunda and Khakh on 10.09.2020, in which Ex- Sarpanch Sh. Jagtar Singh, member panchayat Sh. Balkar Singh, JE Sh. Wajir Singh, Ex- Sarpanch Sh. Narinder Singh, SCO Sh. Hari Singh, Ex Sarpanch Khakh Sh. Gurmail Singh, Ex- member Sh. Chanchal Singh, Sh. Tejinder Singh, Sh. Satbir Singh Sh. Sukhwinder Singh, Sarpanch Khakh Smt. Baljeet Kaur, Sh. Harinder Singh, Sh. Mahal Singh, Sh. Tarsem Singh Retd. Inspector, Sh. Mangal Singh Numberdar, Sh. Tehal Singh, Sh. Hardeep Singh Khakh, Sh. Inderjit Singh Khakh and several other villagers participated for the discussions.

The following demands were put forward by the stakeholders: -

- A link road (3 Km) should be constructed from village Dhunda to Sri Goindwal Sahib.
- A passage should be kept for local villagers to cross the river.
- Bus stop should be constructed adjoining flyover for the village Khakh and Dhunda.
- Underpasses should be constructed for easy movement of animals.
- A metalled road (6 Km) should be constructed on Dhussi bund up to Sri Goindwal Sahib.
- Local Engineers and Labor should be engaged/ employed for the construction of the bridge and related projects e.g. Toll plaza, according to their capability
- Meeting was ended with a vote of thanks by Ex- Sarpanch Sh. Jagtar Singh.

**Sri. Goindwal Sahib**

Meeting was held in Sri. Goindwal Sahib on 10.09.2020, in which Sarpanch Sh. Kuldeep Singh, Sh. Massa Singh, Sh. Varinder Singh Jyoti, Sh. Harbaksh Singh Johal and other villagers were present for the discussion.

The following demands were put forward by the stakeholders: -

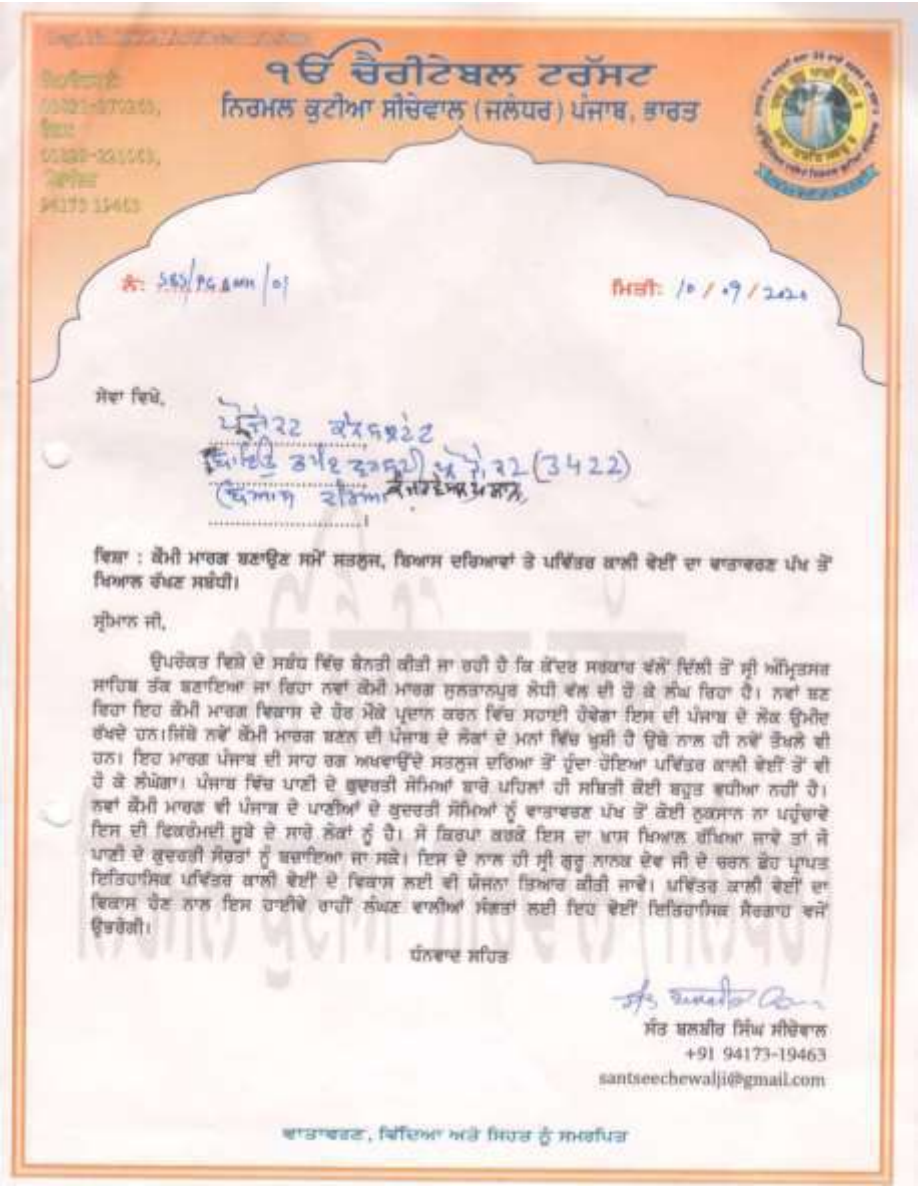
- A metaled road (6 Km) be constructed from village Dhunda Flyover to Gurudwara Pataalpuri Sahib adjoining River Beas (Dhusi band).
- Old road from Sri Goindwal Sahib to Tarn Taran should not be disturbed.
- Proper exit should be given from flyover to Sri Goindwal Sahib Gurudwara because it is visited by lot of devotees.
- Meeting was ended with a vote of thanks by Sarpanch Sh.Kuldeep Singh.

**Bhel Dhaiwala and Johal Dhaiwala villages**

Meeting was held in villages Bhel Dhaiwala and Johal Dhaiwala on 10.09.2020 in which Sarpanch Johal Dhaiwala Smt. Karamjit Kaur, PA MP Sh. Harpal Singh Johal, Sh. Gurmukh Singh Johal, Sarpanch Bhel Dhaiwala Sh. Major Singh, Member Panchayat Sh. Bageecha Singh, Sarpanch Panchayat Manak Deke, Smt. Kulwant Kaur, Sh. Harwinder Singh, Sh. Jasbir Singh, Member Panchayat Manak Deke Sh. Narinder Singh, Ex- Sarpanch Sh. Rajbir Singh, Sh. Rajvinder Singh, Member Panchayat Manak Deke Sh. Balwinder Singh and other villagers participated for the discussions.

The following demands were put forward by the stakeholders: -

- A metalled road (6 Km) should be constructed up to Sri Goindwal Sahib to link villages Bhel Dhaiwala, Johal Dhaiwala, Manak Deke and Kaler with Flyover.
- Meeting was ended with a vote of thanks by Sarpanch Bhel Dhaiwala Sh. Major Singh.



ੴ ਚੈਰੀਟੇਬਲ ਟਰੱਸਟ
ਨਿਰਮਲ ਕੁਟੀਆ ਸੀਚੇਵਾਲ (ਜਲੰਧਰ) ਪੰਜਾਬ, ਭਾਰਤ

ਮਿਤੀ: 10/9/2020

ਸੇਵਾ ਵਿਖੇ,

ਵਿਸ਼ਾ : ਕੌਮੀ ਮਾਰਗ ਬਣਾਉਣ ਸਮੇਂ ਸਤਲੁਜ, ਕਿਆਸ ਦਰਿਆਵਾਂ ਤੇ ਪਵਿੱਤਰ ਕਾਲੀ ਵੇਈਂ ਦਾ ਵਾਤਾਵਰਣ ਪੱਖ ਤੋਂ ਖਿਆਲ ਰੱਖਣ ਸਬੰਧੀ।

ਸ੍ਰੀਮਾਨ ਜੀ,

ਉਪਰੋਕਤ ਵਿਸ਼ੇ ਦੇ ਸਬੰਧ ਵਿੱਚ ਬੇਨਤੀ ਕੀਤੀ ਜਾ ਰਹੀ ਹੈ ਕਿ ਕੇਂਦਰ ਸਰਕਾਰ ਵੱਲੋਂ ਦਿੱਲੀ ਤੋਂ ਸ੍ਰੀ ਅੰਮ੍ਰਿਤਸਰ ਸਾਹਿਬ ਤੱਕ ਬਣਾਇਆ ਜਾ ਰਿਹਾ ਨਵਾਂ ਕੌਮੀ ਮਾਰਗ ਸੁਲਤਾਨਪੁਰ ਲੋਧੀ ਵੱਲ ਦੀ ਹੋ ਕੇ ਲੰਘ ਰਿਹਾ ਹੈ। ਨਵਾਂ ਬਣ ਰਿਹਾ ਇਹ ਕੌਮੀ ਮਾਰਗ ਵਿਕਾਸ ਦੇ ਹੋਰ ਮੌਕੇ ਪ੍ਰਦਾਨ ਕਰਨ ਵਿੱਚ ਸਹਾਈ ਹੋਵੇਗਾ ਇਸ ਦੀ ਪੰਜਾਬ ਦੇ ਲੋਕ ਉਮੀਦ ਰੱਖਦੇ ਹਨ।ਜਿੱਥੇ ਨਵੇਂ ਕੌਮੀ ਮਾਰਗ ਬਣਨ ਦੀ ਪੰਜਾਬ ਦੇ ਲੋਕਾਂ ਦੇ ਮਨਾਂ ਵਿੱਚ ਖੁਸ਼ੀ ਹੈ ਉਥੇ ਨਾਲ ਹੀ ਨਵੇਂ ਤੌਖਲੇ ਵੀ ਹਨ। ਇਹ ਮਾਰਗ ਪੰਜਾਬ ਦੀ ਸਾਹ ਰਗ ਅਖਵਾਉਂਦੇ ਸਤਲੁਜ ਦਰਿਆ ਤੋਂ ਪੁੰਦਾ ਹੋਇਆ ਪਵਿੱਤਰ ਕਾਲੀ ਵੇਈਂ ਤੋਂ ਵੀ ਹੋ ਕੇ ਲੰਘੇਗਾ। ਪੰਜਾਬ ਵਿੱਚ ਪਾਣੀ ਦੇ ਕੁਦਰਤੀ ਸੋਮਿਆਂ ਬਾਰੇ ਪਹਿਲਾਂ ਹੀ ਸਥਿਤੀ ਕੋਈ ਬਹੁਤ ਵਧੀਆ ਨਹੀਂ ਹੈ। ਨਵਾਂ ਕੌਮੀ ਮਾਰਗ ਵੀ ਪੰਜਾਬ ਦੇ ਪਾਣੀਆਂ ਦੇ ਕੁਦਰਤੀ ਸੋਮਿਆਂ ਨੂੰ ਵਾਤਾਵਰਣ ਪੱਖ ਤੋਂ ਕੋਈ ਨੁਕਸਾਨ ਨਾ ਪਹੁੰਚਾਵੇ ਇਸ ਦੀ ਡਿਕਰੰਮਦੀ ਸੁਬੇ ਦੇ ਸਾਰੇ ਲੋਕਾਂ ਨੂੰ ਹੈ। ਸੋ ਕਿਰਪਾ ਕਰਕੇ ਇਸ ਦਾ ਖਾਸ ਖਿਆਲ ਰੱਖਿਆ ਜਾਵੇ ਤਾਂ ਜੋ ਪਾਣੀ ਦੇ ਕੁਦਰਤੀ ਸੋਰਤਾਂ ਨੂੰ ਬਚਾਇਆ ਜਾ ਸਕੇ। ਇਸ ਦੇ ਨਾਲ ਹੀ ਸ੍ਰੀ ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਜੀ ਦੇ ਚਰਨ ਛੋਹ ਪ੍ਰਾਪਤ ਇਤਿਹਾਸਿਕ ਪਵਿੱਤਰ ਕਾਲੀ ਵੇਈਂ ਦੇ ਵਿਕਾਸ ਲਈ ਵੀ ਯੋਜਨਾ ਤਿਆਰ ਕੀਤੀ ਜਾਵੇ। ਪਵਿੱਤਰ ਕਾਲੀ ਵੇਈਂ ਦਾ ਵਿਕਾਸ ਹੋਣ ਨਾਲ ਇਸ ਹਾਈਵੇ ਰਾਹੀਂ ਲੰਘਣ ਵਾਲੀਆਂ ਸੰਗਤਾਂ ਲਈ ਇਹ ਵੇਈਂ ਇਤਿਹਾਸਿਕ ਸੈਰਗਾਹ ਵਜੋਂ ਉਭਰੇਗੀ।

ਧੰਨਵਾਦ ਸਹਿਤ

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# राष्ट्रीय मार्ग बनाते समय वेईं, सतलुज और ब्यास दरियाओं के जलचर जीवों और वनस्पति का ध्यान रखने के लिए दिया ज्ञापन

## कहा-जिन किसानों की जमीन राष्ट्रीय मार्ग के अधीन एक्वायर की जानी है, उन्हें प्रति एकड़ 1 करोड़ रुपए दिए जाएं

भास्कर न्यूज | सुल्तानपुर लोधी

केंद्र सरकार की ओर से दिल्ली से अमृतसर तक बनाए जा रहे नए राष्ट्रीय मार्ग का सर्वे करने के लिए आई टीम को पवित्र काली वेंई और सतलुज-ब्यास दरियाओं का वातावरण की दृष्टि से ध्यान रखने के लिए पर्यावरण प्रेमी संत बलबीर सिंह सीचेवाल की ओर से भेजे प्रतिनिधिमंडल ने ज्ञापन दिया। यह राष्ट्रीय मार्ग पंजाब से पवित्र काली वेंई, सतलुज और ब्यास दरियाओं से होकर गुजरना है। केंद्रीय सर्वे टीम ने शुक्रवार को ब्यास दरिया किनारे अमृतपुर-राजेवाल में किसानों, नदियों-दरियाओं किनारे फसलों, वनस्पति, जंगलात की सेवा संभाल और इसकी पुरातन शान को बरकरार रखने के सुझाव लिए। केंद्र सरकार की ओर से यह राष्ट्रीय मार्ग दिल्ली से अमृतसर तक बनाया जाना है। जालंधर के गांव कंग-साबू से इसका एक हिस्सा सुल्तानपुर लोधी में से ही होकर जाना है और एक हिस्सा वहां से करतारपुर, भुलत्थ से होता हुआ ब्यास दरिया पार कर अमृतसर जाएगा। गुरविंदर सिंह बोपाराय ने सतलुज, ब्यास और काली वेंई पर बनने वाले पुलों के दौरान नीचे दरियाओं किनारे रास्ता रखे जाने का सुझाव दिया, जिससे दरियाओं के वातावरण का ध्यान रखा जा सके। वेंई और दोनों दरियाओं किनारों पर जहां पुल बनाए जाने हैं, वहां फलदार और औषधि वाले पौधे लगाने तथा ईको टूरिज्म को विकसित करने के सुझाव दिए। वह केंद्रीय टीम के ध्यान में मामला लाए कि जिन किसानों की जमीन इस राष्ट्रीय मार्ग अधीन ली जानी है, उन्हें कम से कम 1 करोड़ प्रति एकड़ के हिसाब से मुआवजा दिया जाए। नेशनल हाईवे पर बनने वाले मोटल, पेट्रोल पंपों और मॉल के साथ-साथ किसान हट बनाने की सुविधा दी जाए, जिससे स्थानिय किसान अपनी फसल, सब्जियां और फल आए यात्रियों को बेच सके। जंगली जानवरों के रख-रखाव के लिए भी जगह निर्धारित की जाए। इस मौके पर केंद्रीय सर्वे टीम में पीएफएस प्रोजेक्ट कंसलटेंट फील्ड कोऑर्डिनेटर और सर्वे बलबीर सिंह, प्रोजेक्ट कंसलटेंट सतनाम सिंह लहड़, फील्ड अधिकारी भूपिंदर सिंह, पूर्व जंगलात अधिकारी बलबीर सिंह ढिल्लों, सेवादार गुरविंदर सिंह बोपाराय, गुरदेव सिंह फौजी, सतनाम सिंह साभो, किरपाल कार्मी सिंह दद्दूपुर, गुरचरण सिंह, मुख्तार सिंह, शिंदर सिंह मौजूद थे।

नए राष्ट्रीय मार्ग के सर्वे के लिए आई टीम से बैठक करते सेवादार गुरविंदर सिंह बोपाराय व अन्य।

**Interaction with Stakeholders from villages along River Beas (Gurdaspur District)**

**Biodiversity Conservation Plan (P3422)**

A Field visit for survey on biodiversity conservation was conducted on **21.09.2020**, by Project Consultants Sh. Balvir Singh, Sh. Satnam Singh Ladhar & Sh. Balbir Singh Dhillon, at project area within 5 Km on either side of River Beas in Gurdaspur district, where bridge is proposed to be constructed over River Beas for **Delhi – Katra Expressway**. During this visit detailed interactions were held with various stakeholders viz. Sarpanches, numberdars and member Panchayats on 21.09.2020 at Balarwal village. The stakeholders of the following villages were present for these interactions: -

- Mari Bhuchian
- Mari Tanda
- Balarwal
- Kapoora
- Bhol

The stakeholders were informed regarding the upcoming project and its possible impacts on the flora and fauna of the area. During these discussions the stakeholders submitted their demands: -

**The interaction was held at Balarwal village**

Sarpanch Sh. Ratan Singh Balarwal, Member Panchayat Sh. Sukhjinder Singh, Numberdar Sh. Balbir Singh, Hawaldar Sh. Gurdeep Singh, Sh. Joginder Singh , Master Satnam Singh village Mari Tanda, Sh. Rajinder Singh Balarwal , Sh. Sukhdev Singh Member Panchayat, Sh. Jeet Singh, Sh. Sarabjeet Singh , Sh. Malkeet Singh , Sh. Karnail Singh , Sh. Satnam Singh , Sh. Jatinder Singh , Sh. Gurjeet Singh , Sh. Chanchal Singh , Sh. Daljeet Singh, Sh. Chanan Singh , Sh. Bakshish Singh , Sh. Surinder Singh ,Sh. Rattan Singh , Sarpanch Sh. Jagdish Singh village Kapoora and about 20 more villagers were present for the discussion.

The following demands were put forward by the stakeholders: -

- The stakeholders said that the land of village Balarwal on Mari Tanda side gets divided into two parts on the both side of the highway. So, there should be underpasses under the highway.
- After every 300 meter there should be an underpass to go on the other side of the river.
- The earlier roads should not be disturbed.
- Sri Hargobindpur Sahib is a historical place so road should be constructed between Balarwal- Mari Tanda, Mari Buchian to connect them to Sri Hargobindpur Sahib.
- During rains the water gets collected in River Beas and over flows into fields therefore proper flow of water should be ensured.
- New road should be constructed between Mari Buchian, Mari Tanda, Balarwal, Kapoora to connect them to highway.
- Local engineers and labor should be engaged for the construction project and thereafter employed at Toll plaza according to their capabilities.
- The farmer whose land is to be acquired must be given job by Government.
- The farmers whose land is to be acquired must be given competitive compensation.

- The farmers whose land is to be acquired must be given free pass from the toll plaza within 20 kms of highway.
- The road from village Balarwal to River Beas should be metalled and connected to service road.
- There should be underpasses to ease the movement of wild animals.
- Trees should be planted for clean environment.
- Pathway should be constructed for travel of villagers and animals from Village Balarwal to Kapoora.
- Chain link fencing should be done around Kapoora forest to prevent the wild animals of the forest from destroying crops.
- Mobile towers should be installed in villages for mobile connectivity.
- Strengthening of Dhusi Band on River Beas by constructing spur and studs.
- Transportation facility should be provided for all villages.
- Connectivity road should be given to 5 villages.
- Adequate compensation should be given for Residential properties and Tube wells etc.
- Meeting was ended with a vote of thanks by Sarpanch Sh. Ratan Singh Balarwal.

**Biodiversity Conservation Plan (P3422)**

Interaction with Stakeholders of villages along
**Sacred River Kali Bein** (Kapurthala District)

A Field visit was conducted on **21.09.2020** at project area (Kapurthala district) in villages within 5 Km on either side of Sacred Kali Bein River where bridge is proposed to be constructed for Delhi – Katra Expressway; for survey on bio-diversity conservation and

detailed interactions with various stakeholders i.e. sarpanches, numberdars and member panchayats along with project consultants Sh. Balvir Singh, Sh. Satnam Singh Ladhar, Sh. Balbir Singh Dhillon and Sh. Bhupinder Singh (Feedback Infra Pvt Ltd) at village Mana Talwandi.

- Mana Talwandi
- Bamuwal
- Dhirpur
- Sheruwal
- Kuddowal

The stakeholders were informed regarding the upcoming project and its possible impacts. After these discussions the stakeholders submitted their requirements: -

**Mana Talwandi village**

Meeting was held in villages in which Sh. Harbhajan Singh, Sh. Makhan Singh, Sh. Mohinder Singh, Sh. Jit Singh, Sh. Gurdial Singh, Sh. Karam Singh, Sh. Gurdev Singh Fauji from Charitable Trust Nirmal Kutia Seechewal, Sh. Pritpal Singh, Sh. Karamjeet Singh, Sh. Gurdial Singh, Sh. Makhan Singh, Sh. Bhajan Singh, Sh. Lakha Singh, Sh. Parmajeet Singh, Sh. Gurbachan Singh, Sh. Gurdev Singh, Sh. Avatar Singh and about 30 more villagers participated for discussions.

The following demands were put forward by the stakeholders: -

- The farmers whose land is to be acquired must be given competitive compensation.
- The land of village gets divided into two parts on the both side of the highway. So, there should be underpasses under the highway
- The farmer whose land gets acquired must be given job by Government.
- Local Engineers and Labor should be engaged for the construction project and employed at Toll plaza according to their capability.
- The area is prone to risk of floods; therefore, more underpasses should be made.
- The earlier roads should not be disturbed.

- Kisan Haat should be made on the expressway.
- The land compensation should be given all at once.
- Meeting was ended with a vote of thanks by Sh. Gurdial Singh.

**Biodiversity Conservation Plan (P3422)**

**Interaction with Stakeholders of villages along Sacred River Kali Bein (Kapurthala District)**

A Field visit was conducted on **24.09.2020**, by Sh. Kuldip Kumar Lomis (PCCF & Chief Wildlife Punjab (Retd.), Padma Shri Sant Balbir Singh Seechewal, Project Consultants Sh Balvir Singh & Sh. Balbir Singh Dhillon; and Sh. Ranbir Singh (Wildlife Department), at project area in Kapurthala district, in the following villages, within 5 Km on either side of Sacred Kali Bein River, where bridge is proposed to be constructed over Sacred Kali Bein River for Delhi – Amritsar Expressway; for survey on biodiversity conservation. Detailed interactions were held with various stakeholders viz. Sarpanches, numberdars and member Panchayats on 24.09.2020 at Sultanpur Lodhi.

- Talwandi Pain
- Malain
- Dadwindi
- Karhal Naubad
- Mitha

The stakeholders were informed regarding the upcoming project and its possible impacts on the flora and fauna of the area. After these discussions the stakeholders submitted their requirements: -

**Sultanpur Lodhi**

Meeting of the stakeholders was held at Sultanpur Lodhi in which Sh. Ratan Singh Ex Sarpanch Mitha, S. Jarnail Singh (Talwandi Pain), Sh. Narinder Singh Press Reporter, Sh. Pal Singh Nauli, and Sh. Gurvinder Singh from Ikonkar Charitable Trust Nirmal Kutia Seechewal, Amrik Singh Mitha, Gurdeep Singh Mitha, Avtar Singh Mitha , Gurmeet Kaur Talwandi Pain , Gurmel Singh, Gurdeep Singh Sarpanch Talwandi Pain, Resham Singh, Charan Singh Kadhal Kalan, Mukhtyar Singh Talwandi pain and about 15 more villagers participated for the discussions.

The following demands were put forward by the stakeholders: -

- The farmers whose land is to be acquired must be given competitive compensation.
- The farmer whose land gets acquired must be given job by Government.

- There should be underpasses under the highway.
- Toll-Tax should be free for local public.
- New bridge should be constructed on the Sacred Kali Bein River
- A cluster of all villages should be connected to the highway.
- To visit Sultanpur Lodhi, Shri Goindwal Sahib, Shri Tarantarn Sahib and Shri Amritsar Sahib the villages should be connected to the highway.
- Sh. Kuldip Kumar Lomis, Principal Chief Conservator of Forests (WL) cum Chief Wildlife Warden (Retd.) said that River Beas is habitat for dolphins, crocodiles and smooth-coated Otter. These animals can be easily sighted in the Beas river near Shri Goindwal Sahib. Similarly, Kanjali wetland which is part of Holy Kali Bein is visited ny many migratory birds every year. With the construction of highway these birds and wild animals would take much time to understand the obstacles that would come in their way. A discussion was made on which places the bi-passes are to be made and to safeguard and ensure safety of wild animals.
- Padma Shri Sant Balbir Singh Seechewal during meeting said that the youths of the area should be given some employment and Kisan Huts on the highway should be made so that they could sell their organic products and could run their business.
- Meeting was ended with a vote of thanks by Sh. Gurvinder Singh from Ikonkar Charitable Trust Nirmal Kutia Seechewal.

## Discussion on the preservation of the dolphins in the Beas river.

on September 25, 2020

# Ex. Head of the Punjab Wild Life Warden had a meeting with Sant Seechewal Ji

Sultanpur Lodhi, 24th September

A discussion was made on the precautions to stop the affects on the aquatic animals, birds and wild animals while crossing over the natural resources of water at the time of the construction of proposed national highway from Delhi to Katra via Amritsar. A meeting between Environment Lover Sant Balbir Singh Seechewal Ji and the Ex. Chief Warden of Punjab Wild life on to stop the affects on aquatic animals of the Holy Kali Bein and in the river Beas was made, it lasted 1.5 hours. The farmers of Talwandi Pain and Mithra village also participated in the meeting as the national highway is to pass through their area. Starting from Delhi this highway is to be separated in two parts at village Kang Sabu. Both of the portions of the highway are to pass over the Beas river and the Holy Kali Bein. The chief warden of forest life Ex. Kuldip Kumar Lomis said that there are dolphins, crocodiles and udbala in the river Beas. When the water level in the river Beas is increased dolphins from Harike pattan come to the bridge of Goindwal Sahib. Same way at Kanjali wetland which is part of Holy Kali Bein the migratory birds come. With the construction of highway these birds and wild animals would take much time to understand the obstacles that would come in their way. A discussion was made on which places the bi-passes are to be made and to safeguard their lives.

Sant Balbir Singh Seechewal during meeting said that the youths of the area should be given some employment and Kisan Hutts on the highway should be made so that they could sell their organic products and could run their business. The farmers of the area told their problems and with the construction of proposed national highway the problems they are going to face. So, they asked for the crossroads under the bridges over the water resources so that they could take their crops and animals to and fro.

This team included the project advisor Balbir Singh, Balbir Singh Dhilon, forest life officer Ranbir Singh and Bhupinder Singh and other farmers were also present.

## Annexure 2: Wild Flora of Beas Conservation Reserve

| S.N. | Local Name | Scientific Name |
|---|---|---|
| 1 | Brahmi | *Bacopa Monieri* |
| 2 | Jal Kumbhi | *Eichhornia crassipes* |
| 3 | Pani da jala | *Hydrilla verticillata* |
| 4 | Brahmi booti | *Centella asiatica* |
| 5 | Duckweed | *Lemna minor* |
| 6 | Water clover | *Marsilea minuta* |
| 7 | Bushy pondweed | *Najas minor* |
| 8 | Kamal da phool | *Nelombo nucifera* |
| 9 | Kamal kakri | *Nymphaea nouchali* |
| 10 | Water lily | *Nymphaea stellata* |
| 11 | Pond weed | *Potamogenton natans* |
| 12 | Arow head | *Sagittaria trifolia* |
| 13 | Dibb bate | *Typha angustrifolia* |
| 14 | Syala | *Vallisneria spiralis* |
| 15 | Kamli saag, bel | *Ipomea aquatica* |
| 16 | Janghi, hornwort | *Ceratophyllum dermersum* |
| 17 | Kahi, Kans | *Saccharum spontaneum* |
| 18 | Arjun | *Terminalia arjuna* |
| 19 | Jamun | *Eugenia jamolana* |
| 20 | Safeda | *Eucalyptus tereticornis* |
| 21 | Kikar | *Acacia nilotica* |
| 22 | Bargad | *Ficus bengalensis* |
| 23 | Datura | *Datura stramonium* |
| 24 | Siris | *Albizzia lebbeck* |
| 25 | Amala | *Emblica officinalis* |
| 26 | Beri | *Zizyphus nummuleria* |
| 27 | Dek | *Melia azadrichta* |
| 28 | Jand | *Prosopsis juliflora* |
| 29 | Mango | *Mangifera indica* |
| 30 | Kachnar | *Bauhinia purpurea* |

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| 31 | Neem | *Azadrichata indica* |
| 32 | Amaltas | *Cassia fistuta* |
| 33 | Shisham | *Dalbergia sisso* |
| 34 | Silk cotton tree | *Bombax ceiba* |
| 35 | Kanna | *Saccharum munja* |
| 36 | Nada | *Typha latifolia* |
| 37 | Kikar | *Acacia catechu* |
| 38 | Arind | *Riccinus communis* |

## Annexure 3: Wild Fauna of Beas Conservation Reserve

| S.N. | Local Name | Scientific Name |
|---|---|---|
| 1 | Common Leopard | *Panthera pardus* |
| 2 | Indus River Dolphin | *Platanista gangetica minor* |
| 3 | Fishing Cat | *Prionailurus viverrinus* |
| 4 | Jungle Cat | *Felis chaus* |
| 5 | Small Indian Civet | *Viverricula indica* |
| 6 | Indian Porcupine | *Hystrix indica* |
| 7 | Smooth-coated Otter | *Lutrogale perspicillata* |
| 8 | Common Palm civet | *Paradoxurus hermaphroditus* |
| 9 | Grey Mongoose | *Herpestes edwardsii* |
| 10 | Small Indian Mon- goose | *Herpestes javanicus* |
| 11 | Hog Deer | *Axis porcinus* |
| 12 | Nilgai or Blue Bull | *Boselaphus tragocamelus* |
| 13 | Sambar | *Cervus unicolor* |
| 14 | Jackal | *Canis aureus* |
| 15 | Indian Wild Boar | *Sus scrofa* |
| 16 | Indian Hare | *Lepus nigricollis* |
| 17 | Rhesus Macaque | *Macaca mulatta* |

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| 18 | Indian Fox | *Vulpes benghalensis* |
| 19 | Five Striped palm Squirrel | *Funambulus pennantii* |
| 20 | House Mouse | *Mus musculus* |
| 21 | Indian Bush Rat | *Golunda ellioti* |
| 22 | Soft-furred Field Rat | *Millardia meltada* |
| 23 | Little Indian Field Mouse | *Mus booduga* |
| 24 | Common Rat | *Rattus rattus* |
| 25 | Spiny field Mouse | *Mus platythrix* |
| 26 | Brown rat | *Rattus norvegicus* |
| 27 | Lesser bandi- coot Rat | *Bandicota benhgalensis* |
| 28 | Large bandi- coot Rat | *Bandicota indica* |
| 29 | Dawn bat | *Eonycteris spelaea* |
| 30 | Flying Fox | *Pteropus giganteus* |
| 31 | Sindh Bat | *Eptesicus nasuts* |
| 32 | Lesser mouse- eared Bat | *Myotis blythi* |
| 33 | Whiskered Bat | *Myotis mystacinus* |
| 34 | Lesser Noctule | *Nyctalus leisleri* |
| 35 | Asian Bar- bastelle | *Barbastella leucomelas* |
| 36 | Great Short- nosed Fruit Bat | *Cynopterus sphinx* |
| 37 | Greater false vampire | *Megaderma lyra* |
| 38 | Hodgson Bat | *Myotis formosus* |
| 39 | Little Grebe | *Tachybaptus ruficollis* |
| 40 | Great-crested Grebe | *Podiceps cristatus* |
| 41 | Black-necked Grebe | *Podiceps nigricollis* |
| 42 | Darter | *Anhinga melanogaster* |
| 43 | Large Cormorant | *Phalacrocorax carbo sinensis* |
| 44 | Indian Cormorant | *Phalacrocorax fuscicollis* |
| 45 | Little Cormorant | *Phalacrocorax niger* |
| 46 | Grey Heron | *Ardea cinerea rectirostris* |
| 47 | Purple Heron | *Ardea purpurea manilensis* |
| 48 | Indian Pond Heron | *Ardeola grayii grayii* |
| 49 | Night Heron | *Nycticorax nycticorax* |
| 50 | Striated Heron | *Butorides striata* |
| 51 | Cattle Egret | *Babulcus ibis coromandus* |
| 52 | Little Egret | *Egretta garzetta* |

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|---|---|---|
| 53 | Intermediate Egret | *Mesophoyx intermedia* |
| 54 | Great Egret | *Ardea alba* |
| 55 | Little Bittern | *Ixobrychus Minutus* |
| 56 | Yellow Bittern | *Ixobrychus Sinensis* |
| 57 | Cinnamon Bittern | *Ixobrychus cinnamomeus* |
| 58 | Black Bittern | *Ixobrychus Flavicollis* |
| 59 | Openbill Stork | *Anastomus Oscitans* |
| 60 | Woolly-necked Stork | *Ciconia episcopus* |
| 61 | Painted Stork | *Mycteria leucocephala* |
| 62 | Spoonbill | *Platalea leucorodia major* |
| 63 | Glossy Ibis | *Pledgadis falcinellus* |
| 64 | Indian Black Ibis | *Pseudibis papillosa* |
| 65 | Black Headed Ibis | *Threskiornis melanocephalus* |
| 66 | Ferruginous Duck | *Aythya nyroca* |
| 67 | Northern Pintail | *Anas acuta* |
| 68 | Northern Shoveller | *Anas clypeata* |
| 69 | Common Teal | *Anas crecca crecca* |
| 70 | Eurasian Wigeon | *Anas penelope* |
| 71 | Mallard | *Anas platyrphynchos* |
| 72 | Spotbill Duck | *Anas poecilorhyncha* |
| 73 | Garganey | *Anas querquedula* |
| 74 | Gadwall | *Anas strepera strepera* |
| 75 | Greylag Goose | *Anser anser rubrirostris* |
| 76 | Bar-headed Goose | *Anser indicus* |
| 77 | Common Pochard | *Aythya farina* |
| 78 | Tufted Duck | *Aythya fuligula* |
| 79 | Lesser whistling teal or Tree Duck | *Dendrocygna javanica* |
| 80 | Common Merganser | *Mergus merganser* |
| 81 | Red-crested Pochard | *Netta rufina* |
| 82 | Cotton Teal or Quacky Duck | *Nettapus coromandelianus* |
| 83 | Nakta or Comb Duck | *Sarkidiornis melanotos* |
| 84 | Brahminy or Ruddy Shelduck | *Tadorna ferruginea* |
| 85 | Common Shelduck | *Tadorna Todorna* |
| 86 | Black-winged Kite | *Elanus caeruleus* |
| 87 | Oriental Honey Buzzard | *Pernis ptilorhynchus* |
| 88 | Indian Spotted Eagle | *Clanga hastata* |

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| 89 | Greater Spotted Eagle | *Clanga clanga* |
| 90 | Tawny Eagle | *Aquila rapax* |
| 91 | Steppe Eagle | *Aquila nipalensis* |
| 92 | Eastern Imperial Eagle | *Aquila heliaca* |
| 93 | Bonelli's Eagle | *Aquila fasciata* |
| 94 | Hen Harrier | *Circuscyaneus* |
| 95 | Pallid Harrier | *Circus macrourus* |
| 96 | Pied Harrier | *Circus melanoleucos* |
| 97 | Montagu's Harrier | *Circus pygargus* |
| 98 | Eurasian Sparrowhawk | *Accipiter nisus* |
| 99 | Booted Eagle | *Hieraaetus pennatus* |
| 100 | Besra | *Accipiter virgatus* |
| 101 | Brahminy Kite | *Haliastur indus* |
| 102 | White-eyed Buzzard | *Butastur teesa* |
| 103 | Long-legged Buzzard | *Buteo rufinus* |
| 104 | Indian Shikra | *Accipiter badius* |
| 105 | Marsh Harrier | *Circus aeruginosus aeruginosus* |
| 106 | Black-winged Kite | *Elanus caeruleus vociferous* |
| 107 | Pariah Kite | *Milvus migrans govinda* |
| 108 | Eastern Peregrine Falcon | *Falco peregrinus japonensis* |
| 109 | Common Kestrel | *Falco tinnunculus* |
| 110 | Red-necked Falcon | *Falco chickquera* |
| 111 | Indian Black Partridge | *Francolinus francolinus asiae* |
| 112 | North Indian Grey Partridge | *Francolinus pondicerianus interpositus* |
| 113 | Indian Red Jungle Fowl | *Gallus gallus* |
| 114 | Indian Pea Fowl | *Pavo cristatus* |
| 115 | Western Water Rail | *Rallus aquaticus* |
| 116 | Spotted Crake | *Porzana porzana* |
| 117 | Ruddy-breasted Crake | *Zapornia fusca* |
| 118 | Brown Crake | *Zapornia Akool* |
| 119 | Baillon's Crake | *Zapornia pusilla* |
| 120 | Water Cock | *Gallicrex cinerea* |
| 121 | Indian White- breasted Water Hen | *Amaurornis phoenicurus* |
| 122 | Common Coot | *Fulica atra* |

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|---|---|---|
| 123 | Indian Moorhen | *Gallinula chlorophus indica* |
| 124 | Indian Purple Moorhen | *Porphyrio poliocephalus* |
| 125 | Pheasant-tailed Jacana | *Hydrophasianus chirurgus* |
| 126 | Indian Little Ringed Plover | *Charadrius dubius jerdoni* |
| 127 | Kentish Plover | *Charadrius alexandrines* |
| 128 | Eurasian Golden Plover | *Pluvialis apricaria* |
| 129 | Black-tailed Godwit | *Limosa limosa* |
| 130 | Greater Painted Snipe | *Rostratula bengalensis* |
| 131 | Common Snipe | *Gallinago gallinago* |
| 132 | Jack Snipe | *Lymnocryptes minimus* |
| 133 | Eastern Curlew | *Numenius madagascariemsis* |
| 134 | Common Sandpiper | *Tringa hypoleucos* |
| 135 | Terek Sandpiper | *Xenus cinereus* |
| 136 | Green Sandpiper | *Tringa ochropus* |
| 137 | Wood sandpiper | *Tringa glareola* |
| 138 | Marsh Sandpiper | *Tringa stagnatilis* |
| 139 | Green Shank | *Tringa nebularia* |
| 140 | Common Redshank | *Tringa tetanus* |
| 141 | Spotted Redshank | *Tringa erythropus* |
| 142 | Ruff | *Calidris pugnax* |
| 143 | Temminck's Stint | *Calidris temminckii* |
| 144 | Little Stint | *Calidris minuta* |
| 145 | Oriental Pratincole | *Glareola maldivarum* |
| 146 | Collared Pratincole | *Glareola pratincole* |
| 147 | Small Pratincole | *Glareola lacteal* |
| 148 | Red-wattled Lapwing | *Vanellus indicus indicus* |
| 149 | White-tailed Lapwing | *Vanellus leucurus* |
| 150 | Yellow-wattled Lapwing | *Vanellus malabaricus* |
| 151 | Northern Lapwing | *Vanellus vanellus* |
| 152 | Indian Black- winged Stilt | *Himantopus himantopus* |
| 153 | Pied Avocet | *Recurvirostra avosetta* |
| 154 | Gull Billed Tern | *Gelochelidon nilotica* |
| 155 | Black bellied Tern | *Sterna acuticauda* |
| 156 | Indian River Tern | *Sterna aurantia* |
| 157 | Whiskered Tern | *Chlidonias hybrida* |
| 158 | Little Tern | *Sternula albifrons* |

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|---|---|---|
| 159 | Indian Skimmer | *Rynchops alibicollis* |
| 160 | Slender-billed Gull | *Chroicocephalus genei* |
| 161 | Brown Headed Gull | *Larus brunnicephalus* |
| 162 | Black Headed Gull | *Larus ridibundus* |
| 163 | Pallas's Gull | *Larus ichthyaetus* |
| 164 | Yellow legged Gull | *Larus cachinnans* |
| 165 | Little Gull | *Larus minutus* |
| 166 | Mew Gull | *Larus canus* |
| 167 | Caspian Gull | *Larus cachinnans* |
| 168 | Indian Spotted Dove | *Streptopelia chinensis suratensis* |
| 169 | Laughing Dove | *Streptopelia senegalensis* |
| 170 | Indian Ring Dove | *Streptopelia decaocto* |
| 171 | Rock Pigeon | *Columba livia* |
| 172 | Yellow-footed Green Pigeon | *Treron phoenicoptera* |
| 173 | Oriental Turtle- Dove | *Streptopelia oreintalis* |
| 174 | Northern Blossom headed Parakeet | *Psittacula cyanocephala benghalensis* |
| 175 | Alexandrine Parakeet | *Psittacula eupatria* |
| 176 | Northern Roseringed Parakeet | *Psittacula krameri borealis* |
| 177 | Long-tailed Minivet | *Pericrocotus Ethologus* |
| 178 | Scarlet Minivet | *Pericrocotus Flammeus* |
| 179 | Indian Golden Oriole | *Oriolus kundoo* |
| 180 | Black-naped Oriole | *Oriolus chinensis* |
| 181 | Common Crow Pheasant or Coucal | *Centropus sinensis sinesis* |
| 182 | Sirkeer Malkoha | *Taccocua leschenaultii* |
| 183 | Jacobin Cuckoo | *Clamator jacobinus* |
| 184 | Common Hawk Cuckoo | *Hierococcyx varius* |
| 185 | India Koel | *Eudynamys scolopacea* |
| 186 | Spotted Owlet | *Athene brama* |
| 187 | Brown Fish Owl | *Bubo zeylonensis leschenault* |
| 188 | Indian Barn Owl | *Tyto alba stertens* |
| 189 | Collared Scops Owl | *Otus bakkamoena* |
| 190 | Northern Long- eared Owl | *Asio otus* |
| 191 | Short-eared Owl | *Asio flammeus* |
| 192 | Eurasian Eagle Owl | *Bubo bubo* |

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|---|---|---|
| 193 | Indian Jungle or grey Nightjar | *Caprimulgus indicus* |
| 194 | Sykes's Nightjar | *Caprimulgus mahrattensis* |
| 195 | Large-tailed Nightjar | *Caprimulgus macrurus* |
| 196 | Indian House Swift or little swift | *Apus affinis* |
| 197 | Fork-tailed Swift | *Apus pacificus* |
| 198 | Alpine Swift | *Tachymarptis melba* |
| 199 | Indian Small Blue King- fisher | *Alcedo atthis benghaliensis* |
| 200 | Indian Pied King- fisher | *Ceryle rudis leucomelanura* |
| 201 | White-throated King- fisher | *Halcyon smyrnensis* |
| 202 | Green Bee- Eater | *Merops orientalis* |
| 203 | Blue-tailed Bee Eater | *Merops philippinus* |
| 204 | Northern Roller or Blue Jay | *Caracias benghalensis* |
| 205 | Indian Roller | *Merops superciliosus* |
| 206 | European Hoopoe | *Upupa epops* |
| 207 | Grey Hornbill | *Tockus birostris* |
| 208 | Crimson Breasted Barbet or Coppersmith Barbet | *Megalaima haemacephala indica* |
| 209 | Great Barbet | *Psilopogon virens* |
| 210 | Common Wood- shrike | *Tephrodornis pondicerianus* |
| 211 | Indian Crested Lark | *Galerida cristata chendoola* |
| 212 | Ashy-crowned Sparrow Lark | *Eremopterix griseus* |
| 213 | Singing Bush Lark | *Mirafra cantillans* |
| 214 | Indian Bush Lark | *Mirafra erythroptera* |
| 215 | Hume's Short- toed Lark | *Calandrella acutirostris* |
| 216 | Zitting Cisticola | *Cisticola juncidis* |
| 217 | Barn Swallow | *Hirundo rustica* |
| 218 | Plain Martin | *Riparia paludicola* |
| 219 | Sand Martin | *Riparia riparia* |
| 220 | Pale Martin | *Riparia diluta* |
| 221 | Indian Striated or Red Rumped Swallow | *Hirundo daurica erythropygia* |
| 222 | Indian Wire Tailed Swallow | *Hirundo smithii filifera* |

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|---|---|---|
| 223 | Grey or<br>Ashy Drongo | *Dicrurus leucophaeus* |
| 224 | Black Drongo | *Dicrurus macrocercus* |
| 225 | Common Starling | *Sturnus vulgaris* |
| 226 | Rosy Starling | *Pastor roseus* |
| 227 | Asian Pied Starling | *Gracupica contra* |
| 228 | Brahminy Starling | *Sturnia pagodarum* |
| 229 | Jungle Myna | *Acridotheres fuscus* |
| 230 | Bank Myna | *Acridotheres ginginianus* |
| 231 | Common Myna | *Acridotheres tristis tristis* |
| 232 | Common Raven | *Corvus corax subcorax* |
| 233 | Indian House Crow | *Corvus splendens splendens* |
| 234 | Large-billed Crow | *Corvus macrorhynchos* |
| 235 | Indian Pied Myna | *Sturnus contra contra* |
| 236 | Black Headed or Brahminy Myna | *Sturnus pagodarum* |
| 237 | Western Tree Pie | *Dendrocitta vagabunda pallida* |
| 238 | Himalayan Bulbul | *Pycnonotus leucogenys* |
| 239 | Red-vented Bulbul | *Pycnonotus cafer intermedius* |
| 240 | Red-whiskered Bulbul | *Pycnonotus jocosus* |
| 241 | White-eared Bulbul | *Pycnonotus leucotis* |
| 242 | Common Babbler | *Turdoides caudatus caudatus* |
| 243 | Jerdon's Babler | *Chrysomma altirostre* |
| 244 | Large Grey Babbler | *Turdoides malcolmi* |
| 245 | Striated Babbler | *Argya earlei* |
| 246 | Jungle Babbler | *Turdoides striata* |
| 247 | Rusty-cheeked Scimitar Babbler | *Erythrogenys erythrogenys* |
| 248 | Long-tailed Grass Babbler | *Laticilla burnesii* |
| 249 | Puff-throated Babbler | *Pellorneum ruficeps* |
| 250 | Lesser White throat | *Curruca curruca* |
| 251 | Yellow-eyed Babbler | *Chrysomma sinense* |
| 252 | Cetti's Warbler | *Cettia cetti* |
| 253 | Brooks's Leaf Warbler | *Abrornis subviridis* |
| 254 | Hume's Leaf Warbler | *Abrornis humei* |
| 255 | Sulphur-bellied Warbler | *Phylloscopus griseolus* |
| 256 | Greenish Leaf Warbler | *Seicercus trochiloides* |
| 257 | Western Crowned Leaf Warbler | *Seicercus occipitalis* |

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| 258 | Grey-hooded Leaf Warbler | *Seicercus xanthoschistos* |
| 259 | Paddyfield Warbler | *Acrocephalus agricola* |
| 260 | Booted Warbler | *Iduna caligata* |
| 261 | Moustached Warbler | *Acrocephalus melanopogon* |
| 262 | Blyth's Reed Warbler | *Acrocephalus dumetorum* |
| 263 | Clamorous Reed Warbler | *Acrocephalus stentoreus* |
| 264 | Rufous Vented Prinia | *Prinia burnesii* |
| 265 | Plain Prinia | *Prinia inornata* |
| 266 | Rufous-fronted Prinia | *Prinia buchanani* |
| 267 | Grey-breasted Prinia | *Prinia hodgsonii* |
| 268 | Graceful Prinia | *Prinia gracilis* |
| 269 | Yellow-bellied Prinia | *Prinia flaviventris* |
| 270 | Ashy Prinia | *Prinia socialis* |
| 271 | Common Tailor- bird | *Orthotomus sutorius* |
| 272 | Striated Grassbird | *Megalurus palustris* |
| 273 | Bristled Grass Warbler | *Chaetornis striata* |
| 274 | Bluethroat | *Luscinia svecica* |
| 275 | Asian Verditer Flycatcher | *Eumyias thalassinus* |
| 276 | Red-breasted Flycatcher | *Ficedula parva* |
| 277 | Ultra-marine Flycatcher | *Ficedula superciliaris* |
| 278 | Slaty-blue Fly- catcher | *Ficedula tricolor* |
| 279 | Plumbeous Water Redstart | *Rhyacornis fuliginosa* |
| 280 | White-capped Water Redstart | *Chaimarrornis leucocephalus* |
| 281 | Pied Bush Chat | *Saxicola caprata* |
| 282 | River Chat or White Capped Red Start | *Chaimarrornis leucocephalus* |
| 283 | Indian Magpie Robin | *Copsychus saularis saularis* |
| 284 | White-tailed stonechat | *Saxicola leccurus* |
| 285 | Indian Paddy Field Pipit | *Anthus novaeseelandiae rufulus* |
| 286 | Tree Pipit | *Anthus trivialis* |
| 287 | Olive-backed Pipit | *Anthus hodgsoni* |
| 288 | Red-throated Pipit | *Anthus cervinus* |
| 289 | Rosy Pipit | *Anthus roseatus* |
| 290 | Upland Pipit | *Anthus sylvanus* |
| 291 | Richard's Pipit | *Anthus richardi* |
| 292 | Long-billed Pipit | *Anthus similis* |
| 293 | Tawny Pipit | *Anthus campestris* |

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|---|---|---|
| 294 | Indian White Wagtail | *Motacilla alba dukhunensis* |
| 295 | Yellow Wagtail | *Motacilla flava* |
| 296 | Grey Wagtail | *Motacilla cinerea* |
| 297 | Citrine Wagtail | *Motacilla citreola* |
| 298 | White-browed Wagtail | *Motacilla maderaspatensis* |
| 299 | Common Chaffinch | *Fringilla coelebs* |
| 300 | Common Rosefinch | *Erythrina erythrina* |
| 301 | Indian Purple Sunbird | *Nectarinia asiatica asiatica* |
| 302 | Indian White Eye | *Zosterops palpebrosa palpebrosa* |
| 303 | Red Munia or Avadavat | *Estrilda amandava amandava* |
| 304 | Indian Silverbill | *Euodice malabarica* |
| 305 | Scaly-breasted Munia | *Lonchura punctulata* |
| 306 | Black-headed Munia | *Lonchura malacca* |
| 307 | Spanish Sparrow | *Passer hispaniolensis* |
| 308 | Indian House Sparrow | *Passer domesticus indicus* |
| 309 | Sindh Sparrow | *Passer pyrrhonotus* |
| 310 | Indian Baya or Weaver Bird | *Ploceus philipinus philipinus* |
| 311 | Streaked Weaver | *Ploceus manyar* |
| 312 | Black-breasted Weaver | *Ploceus benghalensis* |
| 313 | 'Rufous-backed' Long- tailed Shrike | *Lanius schach* |
| 314 | Isabelline Shrike | *Lanius isabellinus* |
| 315 | Great Grey Shrike | *Lanius excubitor* |
| 316 | Indian Paradise- flycatcher | *Terpsiphone paradisi* |
| 317 | Painted sand- grouse | *Pterocles indicus* |
| 318 | Chestnut-bellied Sand- grouse | *Pterocles exustus* |
| 319 | Spotted Sand- grouse | *Pterocles senegallus* |
| 320 | Eurasian Thick- knee | *Burhinus oedicnemus* |
| 321 | Great Thick- knee | *Esacus recurvirostris* |
| 322 | White-browed Fantail | *Rhipidura aureola* |
| 323 | White-throated Fantail | *Rhipidura albicollis* |
| 324 | Striolated Bunting | *Fringillaria striolata* |
| 325 | Crested Bunting | *Melophus lathami* |
| 326 | Red-headed Bunting | *Granativora bruniceps* |
| 327 | Black-headed Bunting | *Granativora melanocephala* |
| 328 | White-capped Bunting | *Emberiza stewarti* |
| 329 | Grey-headed canary- flycatcher | *Culicicapa ceylonensis* |

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|---|---|---|
| 330 | Cinereous Tit | *Parus cinereus* |
| 331 | Penduline Tit | *Remiz consobrinus* |
| 332 | Spotted pond turtle | *Geoclemys hamiltonii* |
| 333 | Indian flapshell turtle | *Lissemys punctata* |
| 334 | Soft shell Turtle | *Trionyx gangeticus* |
| 335 | Indian Tent Turtle | *Pangshura tentoria* |
| 336 | Indian Narrow- headed Turtle | *Chitra chitra* |
| 337 | Indian rock Python | *Python molurus* |
| 338 | Indian Rat Snake | *Ptyas mucosa* |
| 339 | Indian Cobra | *Naja naja* |
| 340 | Russel's Viper | *Vipera ruselli* |
| 341 | Indian Garden Lizard | *Calotes versicolor* |
| 342 | Monitor Lizard | *Varanus benghalensis* |
| 343 | Yellow monitor lizard | *Varanus flavescens* |
| 344 | Indian trinket snake | *Coelognathus helena* |
| 345 | Sand boa | *Eryx johnii* |
| 346 | Common kukri snake | *Oligodon arnensis* |
| 347 | Wolf snake | *Lycodon striatus* |
| 348 | Checkered keelback | *Xenochrophis Piscator* |
| 349 | Saw-scaled viper | *Echis carinatus* |
| 350 | Common Krait | *Bungarus caeruleus* |
| 351 | Chameleon | *Chamaeleo zeylanicus* |
| 352 | Common Asian Toad | *Bufo melanostictus* |
| 353 | Indian Bull Frog | *Hoplobatrachus tigerinus* |
| 354 | Sang-hara, Singhari | *Aorichthys seenghala* |
| 355 | Dwarf goonch, Gangetic goonch | *Bagarius bagarius* |
| 356 | Ticto barb, Ticker, chidhu | *Puntius ticto* |
| 357 | Swamp barb, Ticker, Chidhu | *Puntius sophore* |
| 358 | Golden mahaseer, mahaseer | *Tor putitora* |
| 359 | Morah, Bata, Bhangan | *Labeo bata* |
| 360 | Kalbasu, Black rohu, Dini | *Labeo calbasu* |
| 361 | Theila, Thail, Catla | *Catla catla* |
| 362 | Mrigal, Mori | *CirrhinusMrigala* |
| 363 | Reba carp, Mori, Sunni, Chunni | *Cirrhinus Reba* |
| 364 | Garua, Buchua, Chelle | *Clupisoma gaura* |
| 365 | Rohu, Dumra, Dhambra | *Labeo rohita* |

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|---|---|---|
| 366 | Sirheen, Siriha | *Labeo gonius* |
| 367 | Keongar, Kander | *Mystus bleekeri* |
| 368 | Kabakander, striped dwarf catfish | *Mystus vittatus* |
| 369 | Batoo, par, humped feather back | *Notopterus chitala* |
| 370 | Pari, Moh, Battu | *Notopterus notopterus* |
| 371 | Indian Butter Catfish, Pubta, Goong-wal | *Ompok bimaculata* |
| 372 | Pabdha catfish, pallu | *Ompok pabda* |
| 373 | Swamp barb, Ticker, Chidhu | *Puntius chola* |
| 374 | Guntia loach, Jiwal | *Lepidocephalichthys guntea* |
| 375 | Silver Carp | *Hypophthalmicthys molitrix* |
| 376 | Grass Carp | *Ctenopharyngodon idella* |
| 377 | Kaan Machli | *Xenotedon cancilla* |
| 378 | Malhi | *Wallago attu* |
| 379 | Khaga | *Rita rita* |
| 380 | Saul | *Channa marulius* |
| 381 | Indian River Shad | *Gadusia chapra* |
| 382 | Common Carp | *Cyprinus carpio* |
| 383 | Minow | *Salmophasia bacaila* |
| 384 | Dwarf Barb | *Puntius phutunio* |
| 385 | Salmo | *Salmo facia* |
| 386 | Bhrind, wasp | *Vespa orientalis* |
| 387 | Makhi | *Musca domestica* |
| 388 | Madhu makhi, honey bee | *Apis dorsata* |
| 389 | Centipede | *Scolopendra sps* |
| 390 | Milipede | *Thyrogluts sps* |
| 391 | Silver fish | *Leplma sps* |
| 392 | Locust | *Schistocerca sps* |
| 393 | Cricket | *Acheta sps* |
| 394 | Mole cticket | *Gryllotalpa brachyptera* |
| 395 | Praying Mantis | *Mantis religiosa* |
| 396 | Stick insect | *Carsuius sps* |
| 397 | Leaf insect | *Phylium sps* |
| 398 | Dragonfly | *Sympetrem sps* |
| 399 | Damselfly | *Cariageron sps* |
| 400 | Giant bug | *Ranatra sps* |

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| 401 | Water scorpion | *Nepa sps* |
| 402 | Ladybird Beetle | *Coccinella sps* |
| 403 | Yellow Wasp | *Ropalidia marginata* |
| 404 | Brown Ant | *Laius flavus* |
| 405 | Scorpion | *Palamnaeus sps* |
| 406 | Termites | *Microtermes* |
| 407 | Cockroach | *Perpnlanta americana* |
| 408 | Mosquito | *Culex fatgans* |
| 409 | Common Fruit fly | *Dropsophila melanogaster* |
| 410 | Spider | *Araneus sps.* |
| 411 | Blue Pansy | *Junonia orithya* |
| 412 | Peacock Pansy | *Junonia almana* |
| 413 | Yellow Pansy | *Junoia hierta* |
| 414 | Small grass yellow | *Eurema hecabe* |
| 415 | Chocolate pansy | *Junonia iphita* |
| 416 | Mottled emigrant | *Catopsilia pyranthe* |
| 417 | Common leopard | *Phalantha phalantha* |
| 418 | Common crow | *Euploea core* |
| 419 | Common moron | *Papilio polytes* |
| 420 | Common sailer | *Neptis hylas* |
| 421 | Grey pansy | *Junonia atlites* |
| 422 | Great eggfly | *Hippolimnas bolinia* |
| 423 | Cabbage butterfly | *Pieris brassiacae* |

## Annexure 4: Wild Flora of Kali Bein Conservation Reserve

| **S.N.** | **Local Name** | **Scientific Name** |
|---|---|---|
| 1 | Arjun | *Terminalia arjuna* |
| 2 | Jamun | *Eugenia jamolana* |
| 3 | Safeda | *Eucalyptus tereticornis* |
| 4 | Kikar | *Acacia nilotica* |
| 5 | Bargad | *Ficus bengalensis* |

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|---|---|---|
| 6 | Datura | *Datura stramonium* |
| 7 | Siris | *Albizzia lebbeck* |
| 8 | Amala | *Emblica officinalis* |
| 9 | Beri | *Zizyphus nummuleria* |
| 10 | Dek | *Melia azadrichta* |
| 11 | Jand | *Prosopsis juliflora* |
| 12 | Mango | *Mangifera indica* |
| 13 | Kachnar | *Bauhinia purpurea* |
| 14 | Neem | *Azadrichata indica* |
| 15 | Amaltas | *Cassia fistuta* |
| 16 | Shisham | *Dalbergia sisso* |
| 17 | Silk cotton tree | *Bombax ceiba* |
| 18 | Kanna | *Saccharum munja* |
| 19 | Nada | *Typha latifolia* |
| 20 | Kikar | *Acacia catechu* |
| 21 | Arind | *Riccinus communis* |

## Annexure 5: Wild Fauna of Kali Bein Conservation Reserve

| **Sr. No.** | **Local Name (or English name)** | **Scientific Name/ Order** |
|---|---|---|
| 1 | Sambar | *Rusa unicolor* |
| 2 | Neela, roz, Nilgai | *Boselaohus tragocamelus* |
| 3 | Indian hare, Khargosh | *Lepus ruficaudatus* |
| 4 | Suar, Pig | *Sus scrofa* |
| 5 | Ghalehri | *Funambulus pennanti* |
| 6 | Niola, Mongoose | *Herpestes auropunctatus* |
| 7 | Niola, Mongoose | *Herpestes edwardsi* |
| 8 | Chamgadadh, Bat | *Eptesicus nasuts* |

| Sr. No. | Local Name (or English name) | Scientific Name/ Order |
|---|---|---|
| 9 | Chamgadadh, Bat | *Myotis mystacinus* |
| 10 | Chamgadadh, Bat | *Nyctalus leisleri* |
| 11 | Chamgadadh, Bat | *Megaderma lyra* |
| 12 | Chamgadadh, Bat | *Barbastella leucomelas* |
| 13 | Chamgadadh, Bat | *Cynopterus sphinx* |
| 14 | Chamgadadh, Bat | *Myotis blythi* |
| 15 | Chamgadadh, Bat | *Myotis formosus* |
| 16 | Common Babbler | *Turdoides caudatus caudatus* |
| 17 | Large Grey Babbler | *Turdoides malcolmi* |
| 18 | Chidi, Sparrow | *Passer domesticus* |
| 19 | Kaan, Crow | *Carvus splendens* |
| 20 | Bathak, Duck | *Anas plathyrhynus* |
| 21 | Hud-Hud | *Upupa epops* |
| 22 | Koel | *Eudynamis scolopaeus* |
| 23 | Weaver Bird | *Ploceus philipinus* |
| 24 | Oriental White-Eye | *Zosterops palpebrosa* |
| 25 | Purple Sun Bird | *Nectarinia asiatica* |
| 26 | Mor, Indian Peafowl | *Pavo cristatus* |
| 27 | Kabootar, pigeon | *Cloumbia livia* |
| 28 | Magpie Robin | *Copsychus saularis* |
| 29 | Pied Bush Chat | *Saxicola sturninus* |
| 30 | Red-vented Bulbul | *Pycnonotus cafer intermedius* |
| 31 | Indian Paddy Field Pipit | *Anthus novaeseelandiae rufulus* |
| 32 | Indian White Wagtail | *Motacilla alba dukhunensis* |
| 33 | Brahminy Myna | *Sturnus pagodarum* |
| 34 | Pied Myna | *Sturnus contra* |
| 35 | Bank Myna | *Acridotheres ginginianus* |

| Sr. No. | Local Name (or English name) | Scientific Name/ Order |
|---|---|---|
| 36 | Common Myna | *Acridotheres tristis* |
| 37 | Yellow Wattled Lapwing | *Vanellus malabaricus* |
| 38 | Pariah Kite | *Milvus migrans govinda* |
| 39 | Cattle Egret | *Babulcus ibis coromandus* |
| 40 | Indian Spotted Munia | *Lonachura punctulata* |
| 41 | Grey Wagtail | *Motacilla caspica* |
| 42 | Bush Robin | *Erithacus chrysaeus* |
| 43 | Northern Rose-ringed Parakeet | *Psittacula krameri borealis* |
| 44 | Common Myna | *Acridotheres tristis tristis* |
| 45 | Black Drongo | *Dicrurus macrocercus* |
| 46 | Indian Ring Dove | *Streptopelia decaocto decaocto* |
| 47 | Indian Spotted Dove | *Streptopelia chinensis suratensis* |
| 48 | Grey Hornbill | *Tockus birostris* |
| 49 | Indian Roller | *Merops superciliosus* |
| 50 | White-breasted Kingfisher | *Halcyon smyrnensis* |
| 51 | Spotted Owl | *Athene brama* |
| 52 | Indian Koel | *Eudynamys scolopacea* |
| 53 | Punjab Raven | *Corvus corax* |
| 54 | Jungle Crow | *Corvus macrorhynchos* |
| 55 | Plain Prinia | *Prinia socialis* |
| 56 | Tailor Bird | *Orthotomus sutorius* |
| 57 | Western Treepie | *Dendrocitta vagabunda* |
| 58 | Black Drongo | *Dicrurus macrocercus* |
| 59 | Black-rumped flameback | *Dinopium benghalense* |
| 60 | Coppersmith Barbett | *Megalaima haemacephala indica* |
| 61 | Bengal green piegeon | *Treron phoenicoptera* |
| 62 | Alexandrine Parakeet | *Psittacula eupatria* |

| Sr. No. | Local Name (or English name) | Scientific Name/ Order |
|---|---|---|
| 63 | Northern blossom-headed parakeet | *Psittacula cyanocephala benghalensis* |
| 64 | Indian Shikra | *Accipiter badius* |
| 65 | Black-winged Stilt | *Himantopus himatopus* |
| 66 | Grey-headed swamphen | *Porphyrio porphyrio* |
| 67 | Common Moorhen | *Gallinula chloropus* |
| 68 | Pond Heron | *Ardeola grayii* |
| 69 | Red-watled Lapwing | *Vanellus indicus* |
| 70 | Spot-billed Duck | *Anas poecilorhyncha* |
| 71 | Common Coot | *Fulica atra* |
| 72 | Little cormorant | *Microcarbo niger* |
| 73 | Cattle Egret | *Bululcus ibis* |
| 74 | Little Egret | *Egretta garzetta* |
| 75 | Rat Snake | *Ptyas mucosa* |
| 76 | Indian Cobra | *Naja naja* |
| 77 | Common Krait | *Bungarus caeruleus* |
| 78 | Common Wolf Snake | *Lycodon aulicus* |
| 79 | Checkered Keelback | *Xenochrophis piscator* |
| 80 | Rusell's Viper | *Daboia russelii* |
| 81 | Common Cat Snake | *Boiga trigonata* |
| 82 | Buff-striped Keelback | *Amphiesma stolatum* |
| 83 | Indian Bull Frog | *Rana tigrina* |
| 84 | Frog | *Rana breviceps* |
| 85 | Frog | *Rana limnocharis* |
| 86 | House Lizard | *Hemidactylus frenatus* |
| 87 | Monitor Lizard | *Varanus benghalensis* |
| 88 | Garden Lizard | *Calotes versicolor* |

| Sr. No. | Local Name (or English name) | Scientific Name/ Order |
|---|---|---|
| 89 | Chameleon | *Chamaeleo zeylanicus* |
| 90 | Common Toad | *Bufo Bufo* |
| 91 | Toad | *Bufo andersonii* |
| 92 | Toad | *Bufo melanostictus* |
| 93 | Indian River Shad | *Gadusia chapra* |
| 94 | Mrigal Carp | *Cirrhinus cirrhousa* |
| 95 | Pool Barb | *Puntius sophore* |
| 96 | Minnow | *Salmostoma boopis* |
| 97 | Ticto Barb | *Pethia ticto* |
| 98 | Razorbelly Minnow | *Salmostoma bacaila* |
| 99 | Glassy Perchlet | *Chanda nama* |
| 100 | Garfish | *Xenentodon cancila* |
| 101 | Rohu | *Labeo rohita* |
| 102 | Fishes in aquariums | |
| 103 | Beetles in order Coleoptera | |
| 104 | Mayflies in order Ephemeroptera | |
| 105 | Tree bugs in order Hemiptera | |
| 106 | Termites in order Blatodea | |
| 107 | Dragonflies in order Odonata | |
| 108 | Damselflies in order Odonata | |
| 109 | Grasshoppers in order Orthoptera | |
| 110 | Crickets in order Orthoptera | |
| 111 | Makkhi, House fly | *Musca domestica* |
| 112 | Bhrind, wasp | *Vespa orientalis* |
| 113 | Madhu makhi, honey bee | *Apis mellifera* |
| 114 | Macchar, mosquito | *Anopheles sp.* |

| Sr. No. | Local Name (or English name) | Scientific Name/ Order |
|---|---|---|
| 115 | Makdi, spider | *Achaearanea sp.* |
| 116 | Keedi, ant | *Camponotus sp, Solenopsis sp, Dorylus sp* |
| 117 | Keedi, ant | *Monomorium sp.* |
| 118 | Cockroach | *Periplaneta americana* |
| 119 | Booklice in order Psocoptera | |
| 120 | Bed bug in order Hemiptera | |
| 121 | Wood borer in order Coleoptera | |
| 122 | Aphids in order Hemiptera | |
| 123 | Weevils in order Coleoptera | |
| 124 | Centipedes in class Chilopoda | |
| 125 | Millipedes in class Diplopoda | |
| 126 | Snails | |
| 127 | Moths in order Lepidoptera | |
| 128 | Silverfish in order Thysanura | |
| 129 | Ticks in order Parasitiformes | |
| 130 | Indian Hornets in order Hymenoptera | |
| 131 | Butterflies in order Lepidoptera | |
| 132 | Earthworms in order Megadrilacea | |

## Annexure 6: Water quality of River Beas as per monitoring under NWMP for the Months of February (Winter), June (Pre-monsoon) and October (Post-monsoon), 2017

| SLN | pH | Temp. (Air/ Water)/ $^0$C | DO mg/l | Cond µs/Cm | TDS mg/l | TFS mg/l | COD mg/l | BOD mg/l | TSS mg/l | Turb NTU | T.Alkn mg/l | p.Alkn mg/l | TH mg/l | Ca mg/l | Mg mg/l | Cl mg/l | $SO_4$ Mg/l | NO3-N mg/l | F mg/l | $PO_4^{as}$ P mg/l | Amn N mg/l | TKN mg/l | T.Coli MPN/ 100 ml | FColi MPN/ 100 ml | Na mg/l | K mg/l | B mg/l | WQI | DBU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **February, 2017** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 7.4 | 18/20 | 7.4 | 202 | 121 | 99 | BDL | BDL | 12 | 12 | 48 | BDL | 88 | 26 | 5.8 | 16 | 16 | 0.8 | BDL | BDL | BDL | BDL | 110 | 70 | 21 | 1.7 | BDL | S | B |
| 2 | 7.2 | 18/21 | 7.2 | 232 | 139 | 111 | 16 | 1.2 | 48 | 32 | 56 | BDL | 112 | 37 | 4.8 | 14 | 14 | 1.4 | 0.12 | 0.6 | 0.8 | 1.4 | 210 | 84 | 25 | 2.0 | 0.11 | S | B |
| 3 | 7.3 | 18/21 | 6.2 | 308 | 185 | 155 | 24 | 2.4 | 92 | 50 | 92 | BDL | 116 | 35 | 6.8 | 18 | 20 | 1.6 | 0.08 | 1.4 | 1.2 | 1.6 | 580 | 250 | 16 | 1.5 | 0.12 | S | C |
| 4 | 7.0 | 18/20 | 7.2 | 268 | 162 | 131 | 12 | 1.0 | 118 | 52 | 100 | BDL | 104 | 29 | 7.7 | 12 | 10 | 1.3 | 0.14 | 0.6 | BDL | BDL | 170 | 70 | 19 | 1.8 | BDL | S | B |
| 5 | 7.1 | 18/20 | 7.1 | 262 | 157 | 126 | 16 | 1.2 | 136 | 48 | 84 | BDL | 108 | 29 | 8.7 | 16 | 12 | 1.4 | 0.16 | 0.4 | 0.8 | 1.2 | 220 | 110 | 27 | 2.2 | BDL | S | B |
| 6 | 7.3 | 18/21 | 7.4 | 276 | 166 | 134 | 20 | 1.6 | 120 | 40 | 80 | BDL | 120 | 37 | 6.8 | 20 | 18 | 1.8 | 0.14 | 0.2 | 1.0 | 1.5 | 210 | 84 | 21 | 1.3 | 0.12 | S | B |
| 7 | 7.6 | 19/21 | 7.2 | 284 | 170 | 138 | 18 | 1.3 | 90 | 34 | 88 | BDL | 128 | 42 | 5.8 | 18 | 16 | 1.0 | 0.12 | 0.6 | 0.8 | 1.4 | 220 | 110 | 20 | 1.2 | 0.10 | S | B |
| 8 | 7.1 | 19/22 | 7.0 | 274 | 164 | 134 | 16 | 1.2 | 104 | 30 | 96 | BDL | 124 | 38 | 6.8 | 16 | 18 | 1.4 | 0.14 | 0.8 | 0.6 | 1.1 | 220 | 110 | 18 | 1.0 | 0.11 | S | B |
| 9 | 7.2 | 18/20 | 7.5 | 278 | 168 | 128 | 14 | 1.1 | 106 | 38 | 100 | BDL | 132 | 40 | 7.7 | 18 | 16 | 1.8 | 0.16 | 0.6 | 0.8 | 1.7 | 220 | 110 | 11 | 0.9 | BDL | S | B |
| **June, 2017** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 7.3 | 40/28 | 8.0 | 185 | 111 | 98 | 06 | BDL | 16 | 06 | 56 | BDL | 68 | 19 | 4.8 | 12 | 12 | 0.5 | BDL | BDL | BDL | BDL | 110 | 70 | 17 | 1.7 | BDL | S | B |
| 2 | 7.2 | 41/29 | 7.7 | 216 | 130 | 116 | 14 | 1.2 | 26 | 12 | 60 | BDL | 100 | 27 | 7.7 | 12 | 14 | 1.0 | 0.10 | 0.11 | BDL | BDL | 170 | 70 | 22 | 1.9 | BDL | S | B |
| 3 | 7.4 | 41/28 | 6.2 | 250 | 150 | 138 | 20 | 1.9 | 44 | 20 | 68 | BDL | 116 | 35 | 6.8 | 12 | 16 | 1.6 | 0.16 | 0.20 | 0.4 | 0.8 | 460 | 210 | 18 | 1.4 | BDL | S | B |
| 4 | 7.0 | 40/29 | 7.7 | 206 | 124 | 117 | 06 | BDL | 54 | 24 | 56 | BDL | 84 | 24 | 5.8 | 14 | 10 | 1.2 | BDL | 0.14 | BDL | BDL | 110 | 70 | 18 | 1.7 | BDL | S | B |
| 5 | 7.1 | 40/29 | 7.6 | 224 | 134 | 120 | 12 | 1.1 | 92 | 26 | 72 | BDL | 92 | 29 | 4.8 | 12 | 12 | 0.9 | 0.12 | 0.10 | BDL | BDL | 170 | 94 | 21 | 2.0 | BDL | S | B |
| 6 | 7.3 | 41/28 | 8.0 | 240 | 144 | 124 | 10 | 1.0 | 68 | 19 | 72 | BDL | 96 | 24 | 8.7 | 10 | 12 | 1.0 | 0.11 | 0.15 | BDL | BDL | 170 | 70 | 34 | 2.4 | 0.12 | S | B |
| 7 | 7.2 | 41/29 | 7.8 | 250 | 150 | 126 | 12 | 1.1 | 52 | 20 | 76 | BDL | 108 | 30 | 7.7 | 14 | 10 | 1.1 | 0.10 | 0.12 | BDL | BDL | 210 | 110 | 26 | 2.0 | 0.11 | S | B |
| 8 | 7.5 | 40/28 | 7.7 | 266 | 160 | 140 | 14 | 1.2 | 94 | 26 | 80 | BDL | 116 | 35 | 6.8 | 14 | 12 | 1.0 | 0.12 | 0.10 | BDL | BDL | 220 | 110 | 31 | 2.1 | 0.13 | S | B |
| 9 | 7.0 | 41/30 | 7.8 | 254 | 152 | 134 | 14 | 1.2 | 40 | 20 | 68 | BDL | 112 | 32 | 7.7 | 12 | 16 | 1.2 | 0.10 | 0.10 | BDL | BDL | 220 | 110 | 18 | 1.9 | 0.10 | S | B |
| **October, 2017** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 7.3 | 29/18 | 7.8 | 164 | 98 | 83 | 10 | BDL | 20 | 08 | 48 | BDL | 52 | 11 | 5.8 | 12 | 10 | 0.8 | BDL | BDL | BDL | BDL | 70 | 46 | 15 | 1.2 | BDL | S | B |
| 2 | 7.4 | 29/20 | 7.2 | 236 | 142 | 116 | 16 | 1.0 | 56 | 12 | 64 | BDL | 84 | 21 | 7.7 | 14 | 14 | 1.0 | BDL | BDL | BDL | BDL | 110 | 70 | 19 | 1.5 | BDL | S | B |
| 3 | 7.3 | 30/21 | 6.4 | 262 | 157 | 133 | 18 | 1.2 | 36 | 10 | 72 | BDL | 108 | 29 | 8.7 | 20 | 16 | 1.4 | BDL | 0.16 | 0.4 | 0.6 | 350 | 170 | 22 | 2.9 | BDL | S | B |
| 4 | 7.1 | 30/21 | 7.3 | 198 | 119 | 98 | 10 | BDL | 24 | 06 | 48 | BDL | 76 | 19 | 6.8 | 12 | 12 | 1.2 | BDL | BDL | BDL | BDL | 110 | 70 | 20 | 2.4 | BDL | S | B |
| 5 | 7.3 | 30/22 | 7.4 | 228 | 137 | 115 | 12 | BDL | 28 | 08 | 60 | BDL | 88 | 22 | 7.7 | 10 | 14 | 1.1 | 0.16 | BDL | BDL | BDL | 170 | 94 | 25 | 2.7 | BDL | S | B |
| 6 | 7.5 | 29/21 | 7.3 | 248 | 149 | 127 | 16 | 1.4 | 30 | 06 | 76 | BDL | 100 | 26 | 8.7 | 14 | 10 | 1.2 | BDL | 0.12 | BDL | BDL | 280 | 140 | 29 | 2.4 | BDL | S | B |
| 7 | 7.0 | 29/21 | 7.6 | 252 | 151 | 125 | 12 | 1.3 | 38 | 09 | 72 | BDL | 104 | 27 | 8.7 | 10 | 14 | 1.2 | 0.14 | 0.14 | BDL | BDL | 220 | 110 | 28 | 2.3 | BDL | S | B |
| 8 | 7.1 | 30/21 | 7.4 | 260 | 156 | 128 | 16 | 1.3 | 52 | 12 | 64 | BDL | 116 | 30 | 9.7 | 16 | 12 | 1.3 | 0.10 | 0.10 | BDL | BDL | 220 | 110 | 31 | 2.5 | BDL | S | B |
| 9 | 7.0 | 30/22 | 7.5 | 250 | 150 | 126 | 18 | 1.6 | 28 | 06 | 76 | BDL | 124 | 32 | 10.6 | 14 | 16 | 1.2 | 0.12 | 0.12 | BDL | BDL | 220 | 110 | 21 | 2.0 | BDL | S | B |

Note:- 1. BDL means Below Method Detection Limit., 2. WQI means Water Quality Index (S means Satisfactory, N means not Satisfactory). 3. DBU means Designated Best Use (Class A, B, C, D &E)

4. αBHC, βBHC, γBHC, 4,4' DDT, Endosulfan I, Endosulfan II, Dieldrin, Aldrin, Methyl Parathion, Delta HCH, Heptachlor, 4,4' DDD, 4,4' DDE and Endrin were BDL in all the samples.

| Sampling Location (SL) | Point of Sample Collection |
|---|---|
| 1 | River Beas at Talwara H/W |
| 2 | Beas at Mirthal Bridge Gurdaspur |
| 3 | Beas 1 Km D/S effluent discharge point at Mukerian |
| 4 | River Beas at U/S Pathankot |
| 5 | River Beas at D/S Pathankot |
| 6 | River Beas at G.T. Road, under Bridge Near Kapurthalla |
| 7 | River Beas at U/s Goindwal |
| 8 | River Beas at D/s Goindwal |
| 9 | Beas at Harike |
| 10 | River Beas at Bridge, village Bheate Patan Tehsil Batala Distt. Gurdaspur |

Annexure 7: Water quality of River Beas as per monitoring under NWMP for the Months of February (Winter), June (Pre-monsoon) and October (Post-monsoon), 2018.

| SLN | pH | Temp. (Air/ Water)/ $^0$C | DO mg/l | Cond µs/Cm | TDS mg/l | FDS mg/l | COD mg/l | BOD mg/l | TSS mg/l | Turb NTU | T.Alkn mg/l | P.Alkn mg/l | TH mg/l | Ca mg/l | Mg mg/l | Cl mg/l | $^{SO}$4 Mg/l | NO3-N mg/l | F mg/l | $^{PO}$4 $^{as}$P mg/l | Amn N mg/l | TKN mg/l | T.Coli MPN/ 100 ml | FColi MPN/ 100 ml | Na mg/l | K mg/l | B mg/l | WQI | DBU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Feb 2018** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 7.8 | 18/15 | 8.1 | 218 | 143 | 126 | 10 | BDL | 10 | 2 | 48 | BDL | 70 | 16 | 7 | 14 | 10 | 0.6 | 0.10 | BDL | BDL | BDL | 84 | 46 | 31 | 3.6 | BDL | S | B |
| 2 | 7.6 | 18/16 | 7.4 | 223 | 154 | 127 | 16 | 1.2 | 22 | 4 | 72 | BDL | 94 | 24 | 8 | 12 | 10 | 1.0 | 0.13 | BDL | BDL | BDL | 110 | 70 | 38 | 4.0 | 0.08 | S | B |
| 3 | 7.7 | 18/16 | 6.9 | 256 | 164 | 134 | 28 | 2.5 | 38 | 6 | 76 | BDL | 134 | 36 | 12 | 10 | 12 | 1.4 | 0.11 | BDL | BDL | BDL | 280 | 130 | 24 | 2.3 | 0.11 | S | B |
| 4 | 7.6 | 17/15 | 7.9 | 230 | 144 | 128 | 16 | 1.1 | 24 | 4 | 52 | BDL | 98 | 24 | 8 | 12 | 12 | 1.2 | 0.12 | BDL | BDL | BDL | 140 | 79 | 27 | 2.7 | BDL | S | B |
| 5 | 7.7 | 18/16 | 7.5 | 240 | 152 | 136 | 18 | 1.4 | 26 | 6 | 60 | BDL | 90 | 22 | 8 | 14 | 16 | 1.0 | 0.12 | BDL | BDL | BDL | 170 | 110 | 30 | 3.0 | 0.08 | S | B |
| 6 | 7.4 | 23/18 | 7.7 | 230 | 148 | 132 | 14 | 1.2 | 38 | 10 | 64 | BDL | 106 | 24 | 10 | 16 | 12 | 1.0 | 0.13 | 0.12 | BDL | BDL | 220 | 110 | 28 | 3.1 | BDL | S | B |
| 7 | 7.2 | 22/19 | 7.8 | 236 | 150 | 134 | 16 | 1.3 | 26 | 4 | 78 | BDL | 112 | 30 | 8.6 | 14 | 12 | 1.4 | 0.10 | 0.11 | BDL | BDL | 170 | 79 | 23 | 2.4 | 0.18 | S | B |
| 8 | 7.2 | 23/19 | 7.4 | 240 | 152 | 136 | 18 | 1.5 | 32 | 6 | 68 | BDL | 132 | 34 | 12.4 | 12 | 10 | 1.4 | 0.11 | 0.18 | BDL | BDL | 220 | 110 | 38 | 3.8 | 0.12 | S | B |
| 9 | 7.8 | 22/17 | 8.0 | 238 | 160 | 142 | 16 | 1.2 | 24 | 5 | 88 | BDL | 148 | 36 | 12.0 | 18 | 16 | 1.2 | 0.13 | 0.14 | BDL | BDL | 220 | 110 | 22 | 2.9 | 0.13 | S | B |

## Annexure 8: Water quality of River Beas as per monitoring under NWMP for the Months of February (Winter), June (Pre-monsoon) and October (Post-monsoon), 2019.

| SLN | pH | DO mg/l | BOD mg/l | Cond µs/Cm | T. Coli MPN/100ml | F. Coli MPN/100ml | Free Amm. mg/l | SAR | Bmg/l | COD mg/l | Turb NTU | TSS mg/l | TDS mg/l | FDS mg/l | Cl mg/l | SO4 Mg/l | TH mg/l | Ca mg/l | Mg mg/l | T.Alkn mg/l | P.Alkn mg/l | AmnN mg/l | NO3-N mg/l | TKN mg/l | PO4as P mg/l | F mg/l | Na mg/l | Water Quality as per DBU | Water Quality Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Feb 2019** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 7.6 | 9.0 | 1.0 | 207 | 70 | 33 | BDL | 0.37 | 0.13 | 8 | 9.2 | 12 | 145 | 115 | 15 | 10 | 88 | 26 | 6 | 99 | BDL | BDL | BDL | BDL | BDL | BDL | 8 | B | S |
| 2 | 7.8 | 8.9 | 1.2 | 270 | 120 | 49 | BDL | 0.53 | 0.12 | 10 | 10.4 | 12 | 176 | 148 | 16 | 12 | 97 | 29 | 6 | 127 | BDL | BDL | BDL | BDL | BDL | BDL | 12 | B | S |
| 3 | 7.9 | 8.1 | 1.8 | 310 | 790 | 490 | 0.036 | 0.55 | 0.17 | 18 | 55 | 32 | 218 | 187 | 18 | 14 | 123 | 38 | 7 | 172 | BDL | 0.8 | 1.0 | 1.4 | 0.15 | 0.12 | 14 | C | S |
| 4 | 7.9 | 8.7 | 1.3 | 237 | 220 | 110 | BDL | 0.30 | 0.10 | 12 | 49 | 34 | 160 | 136 | 17 | 10 | 122 | 32 | 6 | 120 | BDL | BDL | 0.6 | BDL | 0.12 | 0.14 | 7 | B | S |
| 5 | 8.0 | 8.4 | 1.7 | 288 | 350 | 170 | 0.040 | 0.30 | 0.12 | 18 | 64 | 36 | 200 | 154 | 16 | 12 | 135 | 40 | 9 | 160 | BDL | 0.8 | 0.8 | 1.2 | 0.14 | 0.15 | 8 | B | S |
| 6 | 7.7 | 8.6 | 1.5 | 250 | 840 | 460 | 0.024 | 0.35 | 0.22 | 18 | 74 | 36 | 166 | 144 | 16 | 14 | 102 | 32 | 5 | 128 | BDL | 0.8 | 1.0 | 1.5 | 0.15 | 0.16 | 8 | C | S |
| 7 | 7.8 | 8.8 | 1.4 | 258 | 490 | 230 | 0.025 | 0.38 | 0.12 | 14 | 50 | 32 | 172 | 146 | 14 | 12 | 105 | 33 | 6 | 138 | BDL | 0.7 | 0.8 | 1.4 | 0.14 | 0.14 | 9 | B | S |
| 8 | 7.9 | 8.1 | 1.6 | 260 | 580 | 250 | 0.036 | 0.33 | 0.15 | 14 | 48 | 36 | 174 | 130 | 13 | 14 | 108 | 34 | 6 | 118 | BDL | 0.8 | 1.2 | 1.4 | 0.13 | 0.13 | 8 | C | S |
| 9 | 8.2 | 8.2 | 1.4 | 247 | 540 | 350 | 0.064 | 0.35 | 0.09 | 12 | 68 | 34 | 170 | 150 | 14 | 10 | 100 | 33 | 4 | 142 | BDL | 0.8 | 1.0 | 1.5 | 0.12 | 0.17 | 8 | C | S |
| 10 | 7.8 | 8.5 | 1.6 | 370 | 630 | 460 | 0.032 | 0.70 | 0.14 | 16 | 58 | 30 | 234 | 205 | 19 | 16 | 140 | 47 | 5 | 160 | BDL | 0.9 | 1.2 | 1.6 | 0.16 | 0.14 | 19 | C | S |
| **June 2019** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 7.9 | 6.3 | BDL | 224 | 84 | 46 | BDL | 0.39 | 0.96 | 8 | 9.8 | BDL | 148 | 124 | 8 | 8 | 92 | 26 | 6 | 118 | BDL | BDL | BDL | BDL | BDL | BDL | 8.5 | B | S |
| 2 | 7.7 | 8.4 | BDL | 255 | 94 | 46 | 0.015 | 0.46 | 0.91 | 8 | 18 | 12 | 170 | 140 | 6 | 10 | 108 | 31 | 8 | 98 | BDL | 0.5 | BDL | 0.9 | 0.07 | 0.11 | 11 | B | S |
| 3 | 7.8 | 6.8 | 1.3 | 258 | 580 | 250 | 0.025 | 0.19 | 0.80 | 14 | 56 | 28 | 160 | 132 | 10 | 16 | 91 | 28 | 5 | 132 | BDL | 0.7 | 0.5 | 1.4 | 0.09 | 0.15 | 4.2 | C | S |
| 4 | 7.9 | 8.3 | 1.0 | 250 | 140 | 110 | 0.023 | 0.50 | 0.87 | 8 | 22 | 12 | 178 | 148 | 8 | 10 | 110 | 28 | 10 | 102 | BDL | 0.5 | BDL | 1.0 | 0.10 | 0.13 | 12 | B | S |
| 5 | 7.8 | 8.1 | 1.1 | 243 | 790 | 490 | 0.018 | 0.32 | 0.84 | 10 | 42 | 20 | 164 | 138 | 12 | 14 | 113 | 29 | 10 | 121 | BDL | 0.5 | 0.3 | 1.2 | 0.08 | 0.15 | 7.9 | C | S |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 7.6 | 8.2 | 1.0 | 264 | 220 | 170 | 0.013 | 0.33 | 0.75 | 10 | 54 | 32 | 162 | 134 | 20 | 14 | 91 | 26 | 6 | 120 | BDL | 0.5 | 0.7 | 1.4 | 0.09 | 0.13 | 7.1 | B | S |
| 7 | 7.7 | 8.0 | 1.1 | 238 | 280 | 140 | 0.021 | 0.18 | 0.71 | 12 | 48 | 30 | 149 | 118 | 16 | 12 | 91 | 26 | 6 | 112 | BDL | 0.7 | 0.6 | 1.2 | 0.08 | 0.12 | 4.0 | B | S |
| 8 | 7.7 | 7.9 | 1.2 | 240 | 310 | 170 | 0.018 | 0.18 | 0.67 | 14 | 60 | 34 | 152 | 118 | 14 | 12 | 96 | 27 | 7 | 118 | BDL | 0.6 | 0.6 | 1.0 | 0.09 | 0.12 | 4.0 | B | S |
| 9 | 7.6 | 7.6 | 1.0 | 270 | 220 | 110 | 0.015 | 0.24 | 0.63 | 10 | 68 | 36 | 172 | 140 | 14 | 18 | 106 | 27 | 9 | 133 | BDL | 0.6 | 0.9 | 1.0 | 0.08 | 0.13 | 5.7 | B | S |
| 10 | 7.4 | 7.1 | 1.2 | 314 | 280 | 170 | 0.01 | 0.41 | 0.76 | 12 | 60 | 22 | 210 | 176 | 14 | 12 | 135 | 38 | 10 | 146 | BDL | 0.6 | 0.4 | 1.2 | 0.07 | 0.14 | 11 | B | S |
| **Oct 2019** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 7.7 | 7.6 | BDL | 174 | 94 | 46 | BDL | 0.11 | 0.15 | 8 | 6 | BDL | 116 | 92 | 11 | 6 | 80 | 21 | 7 | 98 | BDL | BDL | BDL | BDL | BDL | BDL | 2.3 | B | S |
| 2 | 7.6 | 7.8 | 1.1 | 256 | 84 | 46 | BDL | 0.36 | 0.17 | 10 | 16 | 10 | 160 | 136 | 20 | 8 | 84 | 28 | 4 | 102 | BDL | BDL | BDL | BDL | BDL | BDL | 7.8 | B | S |
| 3 | 7.6 | 7.6 | 1.2 | 256 | 540 | 240 | 0.021 | 0.29 | 0.20 | 10 | 24 | 16 | 170 | 130 | 16 | 16 | 107 | 31 | 7 | 143 | BDL | 0.6 | 0.4 | 1.1 | 0.07 | 0.10 | 6.8 | C | S |
| 4 | 7.8 | 7.8 | 1.2 | 280 | 110 | 70 | BDL | 0.43 | 0.18 | 12 | 17 | 10 | 154 | 127 | 18 | 8 | 85 | 27 | 4 | 104 | BDL | BDL | BDL | BDL | BDL | BDL | 9.1 | B | S |
| 5 | 7.8 | 7.4 | 1.3 | 260 | 430 | 280 | 0.032 | 0.24 | 0.20 | 9 | 18 | 14 | 165 | 141 | 13 | 14 | 118 | 29 | 11 | 141 | BDL | 0.7 | 0.4 | 1.2 | 0.06 | 0.12 | 5.9 | B | S |
| 6 | 7.8 | 7.6 | 1.2 | 206 | 220 | 140 | 0.013 | 0.06 | 0.28 | 9 | 38 | 18 | 140 | 106 | 16 | 16 | 97 | 24 | 9 | 104 | BDL | 0.5 | 0.4 | 1.0 | 0.06 | 0.13 | 1.4 | B | S |
| 7 | 8.0 | 7.8 | 1.1 | 222 | 240 | 130 | 0.012 | 0.04 | 0.17 | 7 | 28 | 14 | 126 | 90 | 11 | 12 | 98 | 24 | 9 | 90 | BDL | 0.6 | 0.4 | 1.1 | 0.07 | 0.10 | 1.0 | B | S |
| 8 | 7.9 | 7.9 | 1.1 | 236 | 280 | 170 | 0.018 | 0.12 | 0.15 | 8 | 39 | 14 | 136 | 96 | 13 | 12 | 100 | 26 | 8 | 97 | BDL | 0.6 | 0.4 | 1.1 | 0.06 | 0.11 | 2.7 | B | S |
| 9 | 7.7 | 7.8 | 1.0 | 212 | 220 | 140 | 0.032 | 0.09 | 0.13 | 8 | 23 | 15 | 140 | 106 | 16 | 14 | 90 | 24 | 8 | 85 | BDL | 0.7 | 0.6 | 1.2 | 0.05 | 0.13 | 2.0 | B | S |
| 10 | 7.9 | 7.7 | 1.0 | 210 | 280 | 170 | 0.018 | 0.09 | 0.24 | 8 | 15 | 14 | 128 | 108 | 12 | 14 | 105 | 26 | 10 | 90 | BDL | 0.5 | 0.6 | 1.0 | 0.05 | 0.11 | 2.2 | B | S |

## Annexure 9: Water quality of River Beas as per monitoring under NWMP for the Months of February (Winter) and June (Pre-monsoon), 2020.

| SLN | pH | DO mg/l | BOD mg/l | Cond µs/Cm | T. Coli MPN/100ml | F. Coli MPN/100ml | Free Amm. mg/l | SAR | B mg/l | COD mg/l | Turb NTU | TSS mg/l | TDS mg/l | FDS mg/l | Cl mg/l | SO4 Mg/l | TH mg/l | Ca mg/l | Mg mg/l | T.Alkn mg/l | P.Alkn mg/l | AmnN mg/l | NO3-N mg/l | TKN mg/l | PO4as P mg/l | F mg/l | Na mg/l | Water Quality as per DBU | Water Quality Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Feb 2020** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 7.6 | 7.3 | 1.4 | 250 | 110 | 49 | 0.008 | 0.41 | BDL | 10 | 22 | 10 | 178 | 148 | 18 | 8 | 86 | 25 | 6 | 122 | BDL | BDL | BDL | BDL | BDL | BDL | 8.8 | B | S |
| 2 | 7.7 | 7.2 | 1.3 | 380 | 94 | 33 | 0.024 | 0.46 | 0.12 | 14 | 24 | 12 | 231 | 184 | 22 | 9 | 150 | 39 | 13 | 160 | BDL | 0.8 | 0.4 | 1.1 | 0.05 | 0.14 | 13 | B | S |
| 3 | 7.6 | 6.1 | 1.5 | 365 | 350 | 170 | 0.018 | 0.38 | 0.29 | 14 | 27 | 16 | 221 | 180 | 18 | 10 | 122 | 33 | 10 | 140 | BDL | 0.7 | 0.5 | 1.1 | 0.08 | 0.15 | 9.8 | B | S |
| 4 | 7.9 | 7.2 | 1.4 | 394 | 70 | 26 | 0.032 | 0.43 | 0.15 | 14 | 26 | 14 | 238 | 194 | 24 | BDL | 144 | 38 | 12 | 156 | BDL | 0.7 | 0.6 | 1.2 | 0.07 | 0.14 | 12 | B | S |
| 5 | 7.8 | 6.8 | 1.7 | 390 | 170 | 63 | 0.032 | 0.25 | 0.24 | 15 | 25 | 14 | 245 | 198 | 25 | 12 | 130 | 34 | 11 | 141 | BDL | 0.9 | 0.6 | 1.4 | 0.06 | 0.12 | 6.6 | B | S |
| 6 | 7.9 | 8.5 | 1.3 | 300 | 220 | 110 | 0.036 | 0.18 | 0.36 | 13 | 36 | 18 | 183 | 156 | 18 | 12 | 120 | 31 | 10 | 118 | BDL | 0.8 | 0.5 | 1.2 | 0.07 | 0.17 | 4.5 | B | S |
| 7 | 8.1 | 8.4 | 1.1 | 268 | 240 | 130 | 0.033 | 0.16 | 0.21 | 11 | 34 | 12 | 159 | 132 | 16 | BDL | 100 | 25 | 9 | 107 | BDL | 0.5 | 0.5 | 1.0 | 0.05 | 0.17 | 3.6 | B | S |
| 8 | 7.6 | 8.3 | 1.2 | 270 | 280 | 170 | 0.013 | 0.14 | 0.25 | 12 | 34 | 12 | 167 | 136 | 14 | BDL | 102 | 26 | 9 | 100 | BDL | 0.5 | 0.4 | 1.1 | 0.06 | 0.13 | 3.2 | B | S |
| 9 | 7.9 | 8.2 | 1.1 | 280 | 220 | 120 | 0.032 | 0.16 | 0.20 | 10 | 38 | 14 | 173 | 140 | 18 | 12 | 104 | 30 | 7 | 103 | BDL | 0.7 | 0.8 | 1.3 | 0.09 | 0.15 | 3.7 | B | S |
| 10 | 7.6 | 7.7 | 1.2 | 288 | 280 | 140 | 0.015 | 0.17 | 0.20 | 13 | 32 | 16 | 180 | 145 | 20 | 14 | 127 | 36 | 9 | 129 | BDL | 0.6 | 0.6 | 1.2 | 0.06 | 0.16 | 4.5 | B | S |
| **June 2020** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 7.6 | 7.6 | 1.2 | 233 | 120 | 22 | 0.013 | 0.55 | BDL | 8 | 19 | 11 | 165 | 132 | 14 | 10 | 89 | 26 | 6 | 102 | BDL | 0.5 | 0.4 | 1.0 | BDL | 0.13 | 12 | B | S |
| 2 | 8.1 | 7.2 | 1.1 | 297 | 280 | 31 | 0.039 | 0.65 | 0.11 | 13 | 18 | 10 | 192 | 154 | 16 | 11 | 132 | 41 | 7 | 155 | BDL | 0.6 | 0.6 | 1.3 | 0.07 | 0.16 | 17 | B | S |
| 3 | 7.9 | 7.0 | 1.3 | 266 | 470 | 110 | 0.041 | 0.43 | 0.25 | 13 | 32 | 13 | 176 | 138 | 16 | 12 | 124 | 35 | 9 | 134 | BDL | 0.9 | 0.8 | 1.6 | 0.09 | 0.17 | 11 | B | S |
| 4 | 7.9 | 7.5 | 1.1 | 298 | 110 | 26 | 0.027 | 0.61 | 0.16 | 13 | 21 | 11 | 205 | 165 | 16 | 12 | 146 | 41 | 11 | 160 | BDL | 0.6 | 0.5 | 1.2 | 0.08 | 0.16 | 17 | B | S |
| 5 | 8.1 | 7.1 | 1.3 | 259 | 280 | 58 | 0.052 | 0.46 | 0.20 | 14 | 27 | 12 | 182 | 145 | 18 | 14 | 127 | 34 | 10 | 137 | BDL | 0.8 | 0.8 | 1.5 | 0.08 | 0.15 | 12 | B | S |
| 6 | 7.9 | 7.8 | 1.1 | 239 | 410 | 170 | 0.032 | 0.42 | 0.16 | 13 | 36 | 14 | 165 | 136 | 18 | 16 | 132 | 36 | 10 | 110 | BDL | 0.7 | 0.5 | 1.2 | 0.09 | 0.16 | 11 | B | S |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 7.9 | 7.9 | 1.0 | 242 | 330 | 78 | 0.027 | 0.48 | 0.11 | 11 | 28 | 12 | 156 | 124 | 12 | 10 | 100 | 25 | 9 | 128 | BDL | 0.6 | 0.6 | 1.0 | 0.07 | 0.15 | 11 | B | S |
| 8 | 8.0 | 7.8 | 1.1 | 233 | 400 | 93 | 0.030 | 0.49 | 0.21 | 10 | 34 | 12 | 160 | 130 | 14 | 8 | 97 | 27 | 7 | 109 | BDL | 0.6 | 0.7 | 1.3 | 0.06 | 0.14 | 11 | B | S |
| 9 | 7.8 | 8.1 | 1.0 | 234 | 480 | 120 | 0.025 | 0.48 | 0.14 | 11 | 26 | 11 | 154 | 127 | 16 | 10 | 98 | 27 | 8 | 116 | BDL | 0.7 | 0.6 | 1.2 | 0.08 | 0.13 | 11 | B | S |
| 10 | 7.9 | 7.3 | 1.2 | 254 | 460 | 170 | 0.036 | 0.46 | 0.14 | 12 | 20 | BDL | 170 | 135 | 22 | 17 | 128 | 38 | 8 | 100 | BDL | 0.8 | 0.7 | 1.4 | 0.11 | 0.13 | 12 | B | S |

## Annexure 10: Water quality of part of Kali Bein Conservation Reserve (2016-2017)

Punjab Pollution Control Board has conducted monitoring of Kanjli wetland to study the effect on water and sediment quality due to discharge of domestic wastewater/surface run offs. The monitoring for water and sediment samples was carried out in the month of October, 2016 and April, 2017 at following locations:

1) U/s Sultanpur Lodhi (Bein on GT Road)
2) Near Barrage
3) D/s Barrage
4) Near Boat Club
5) D/s Kanjli
6) U/s Boat Club Near Vill. Badashpur
7) D/s Sultanpur Lodhi Near Sultanpur Lodhi Town

The analysis results indicate that:

**(a) Physical Parameters:**

1. pH: pH at all the monitoring locations was found to vary between 7.1 to 7.8 during October 2016 whereas pH varies from 7.4 to 7.8 in April, 2017. Wetland Kanjli 2016-17.
2. Turbidity: Turbidity is caused by a wide variety of suspended matter which ranges in sizes from colloidal to coarse dispersions depending upon the velocity of flow or upon the degree of turbulence. It varies from 19 to 25 NTU in October, 2016 & from 6 to 18 NTU during the month of April, 2017.
3. Total Dissolved Solids: The concentration of total dissolved solids varied from 160 to 228 mg/l in October, 2016 and from 174 to 264 mg/l in April, 2017.
4. Conductivity: The conductivity of an aqueous solution expresses its ability to conduct or to carry an electric current which depends largely on the presence of ions. The measurement of conductivity is thus important to establish the degree of mineralization to assess the effect of the total concentration of ions which can have an effect on the plants, animals and naturally occurring micro flora and fauna. The conductivity varied between 266 to 380 µs/cm in October, 2016 and from 290 to 440 µs/cm in April, 2017.
5. Dissolved Oxygen: Oxygen is the prime requirement of all the living organisms in one form or the other for carrying out their metabolic activities and for the production of energy essential for growth and reproduction. Oxygen depletes rapidly when the organic matter is consumed by the microorganisms naturally present in the stream. It is therefore, an indicator of organic pollution. Concentration of the dissolved oxygen

also varies with the time of the day. Dissolved Oxygen varied between 4.8 to 6.3 mg/l in October, 2016 and from 4.5 to 7.6 mg/l in April, 2017.

6. Total Coliform: Total Coliform count was found in the same range of 390 to 790 MPN/100ml in October, 2016 as well as in April, 2017. Wetland Kanjli 2016-17.

**(b) Inorganic and Non-Metallic Constituents**

1. Chloride & Sulphate: Chloride occurred naturally in rock salt. The concentration of chloride varied from 18 mg/l to 32 mg/l in October, 2016 and from 10 mg/l to 30 mg/l in April, 2017. Sulphate was found in the range of 16 mg/l to 36 mg/l in October, 2016 and in the range of 14 mg/l to 28 mg/l in April, 2017.
2. Hardness: Calcium and Magnesium exist in the form of hydroxides, carbonates and bicarbonates. Hardness of water is caused largely due to calcium and magnesium. Total Hardness varied from 120 to 160 mg/l in October, 2016 and from 116 to 156 mg/l in April, 2017.
3. Alkalinity: The Alkalinity varied from 72 to 104 mg/l in October, 2016 and from 76 to 100 mg/l in April, 2017.

**(c) Biochemical Oxygen Demand**

The organic matter which enters in the aquatic system is broken down under natural conditions to various end products by the naturally occurring micro-organisms and in this process dissolved oxygen depletion takes places resulting in an ecological imbalance affecting aquatic life and causing nuisance. Hence it becomes essential to know the amount of oxygen that would be needed by the natural micro-organisms for stabilizing a bio-degradable waste under aerobic conditions whereas BOD represents the amount of oxygen required for stabilizing waste when the waste is oxidized. Presence of BOD in water indicates that the water is polluted with organic matter. Concentration of BOD was found in the range of 1.6 to 4.0 mg/l in October, 2016 and in the range of 1.7 to 3.6 mg/l in April, 2017. Wetland Kanjli 2016-17

**(d) Study of Flora and Fauna**

The Biological study was carried out in October 2016 and April 2017. The four sampling points in and around Kanjli wetland had good plantation and Benthic fauna with Ephemerophtera, Oligochaeta Chironomids and molluscs. Saparobidty index at these points was good. The plantations in an around and the wetland provided a good

habitat to insects. The List of benthic species found at various points is given in the report3.

**(e)** Sodium and Potassium

Sodium and potassium were found in the range of 9.0 mg/l to 14.6 mg/l and 2.0 mg/l to 4.4 mg/l in October, 2016 respectively and sodium was in the range of 25 mg/l to 59 mg/l and potassium from 4.33 mg/l to 7.82 mg/l in the month of April, 2017.

**(f)** Heavy Metals

The heavy metals i.e. Zinc, Iron, Copper, Chrome, Nickel, Arsenic, Mercury, Lead & Cadmium were analyzed in the samples collected in October, 2016 and April, 2017 using Atomic Absorption Spectrophotometer. In October, 2016 the concentration of iron varied from 0.10 mg/l to 0.20 mg/l and Zn concentration was found to be 0.10 mg/l at U/S Boat Club and 0.09 mg/l at downstream Sultanpur Lodhi. In April, 2017 the concentration of iron varied between 0.12 mg/l to 0.23 mg/l and Zn was found to be 0.11 mg/l at upstream Boat Club and downstream Sultanpur Lodhi. The heavy metals were found below detection limit in the remaining samples analyzed.

**(g)** Pesticides

The pesticides i.e. 4,4-DDD, Endrin Aldehyde, 4,4-DDE, Heptachlor, Delta-BHC, Beta-BHC, Anilophos, Gama-BHC, Chloropyriphos, Endrin, Alpha-BHC, Endosulfan-ulphate, Aldrin, Methyl parathion, Dieldrin, Endo-sulphan-I, Endo-sulphan-II, 4,4-DDT, Malathion were analyzed in the samples collected in October, 2016 and the pesticides 4,4'-DDD, Endrin Aldehyde, 4,4'-DDE, Delta-HCH, Beta-HCH, Gama-HCH, Endrin, Alpha-BHC, Endosulfansulphate, Aldrin, Methyl parathion, Dieldrin, Endo-sulphan-I, Endo-sulphan-II, 4,4'-DDT were analyzed in the samples collected in April, 2017 using Gas Chromatograph–Mass Spectrophotometer. The pesticides were found below detection limit in all the samples analyzed. Wetland Kanjli 2016-17.

3 http://www.ppcb.gov.in/Attachments/Reports%20and%20Documents/WetlandKanjli2016-17.pdf

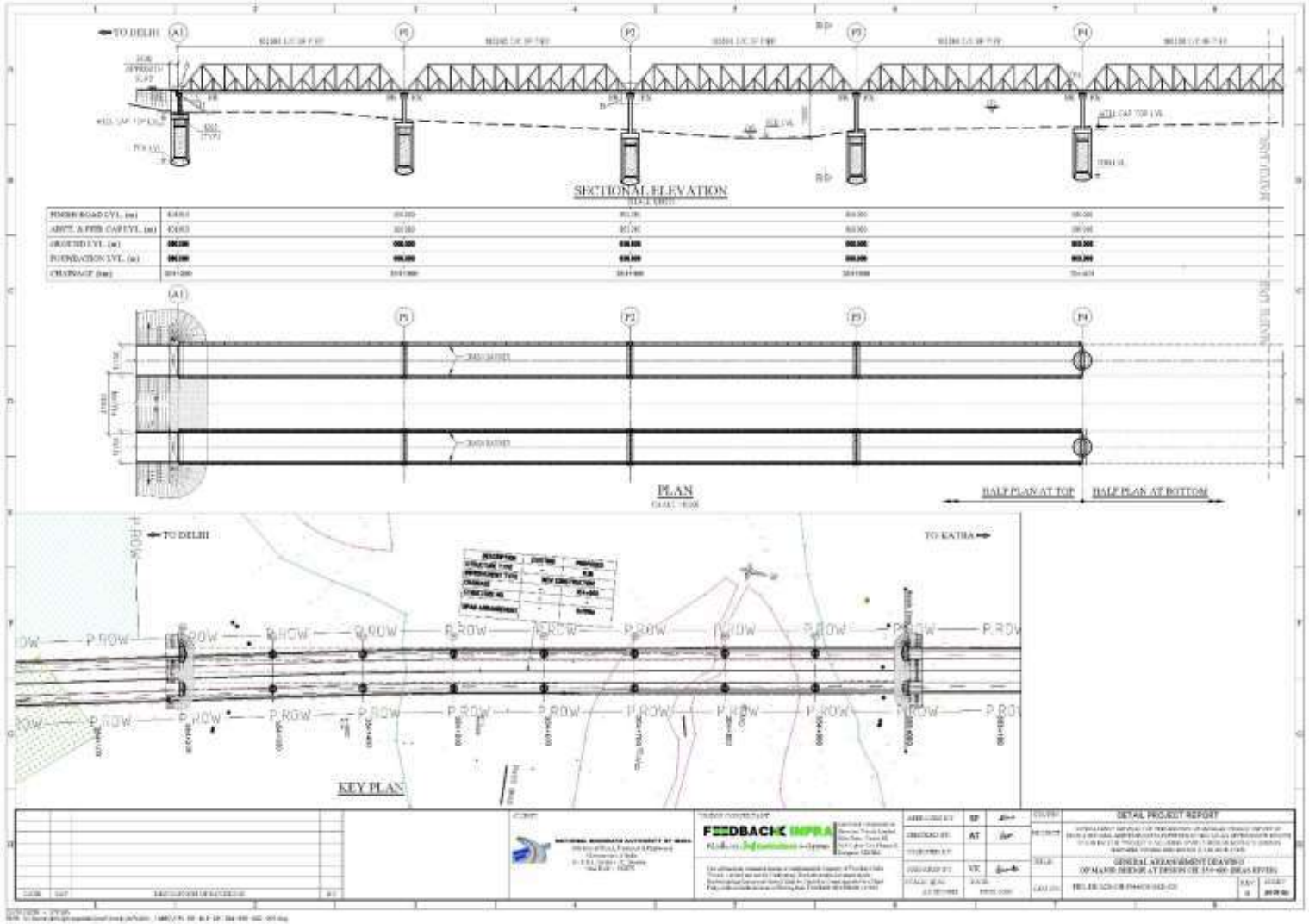
## Annexure 11: National Ambient Air Quality Standards notified by the Central Pollution Control Board (18th November, 2009)

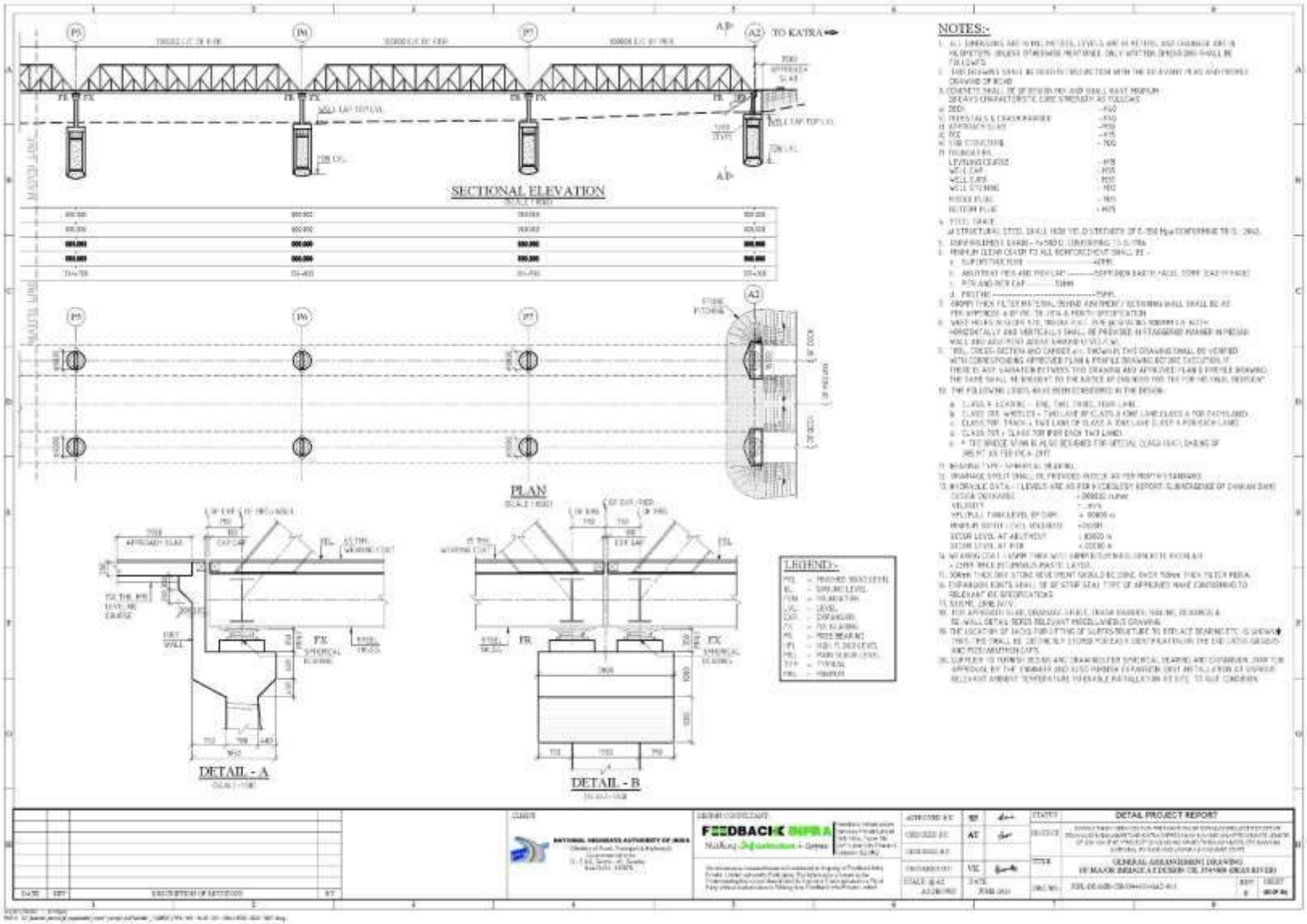
| Sr. No. | Pollutants | Time weighted average | Concentration of Ambient Air | |
|---|---|---|---|---|
| | | | Industrial, Residential, Rural and other areas | Notified Ecologically sensitive area |
| 1 | Sulphur Dioxide ($SO_2$) µg/$m^3$ | Annual | 50 | 20 |
| | | 24 hours | 80 | 80 |
| 2 | Nitrogen Dioxide ($NO_2$) µg/$m^3$ | Annual | 40 | 30 |
| | | 24 hours | 80 | 80 |
| 3 | Particulate Matter (size<10 µm) or $PM_{10}$ µg/$m^3$ | Annual | 60 | 60 |
| | | 24 hours | 100 | 100 |
| 4 | Particulate Matter (size<2.5 µm) or $PM_{2.5}$ µg/$m^3$ | Annual | 40 | 40 |
| | | 24 hours | 60 | 60 |
| 5 | Ozone ($O_3$) µg/$m^3$ | 8 hours | 100 | 100 |
| | | 1 hour | 180 | 180 |
| 6 | Lead (Pb), µg/$m^3$ | Annual | 0.50 | 0.50 |
| | | 24 hours | 1.0 | 1.0 |
| 7 | Carbon Monoxide (CO), mg/$m^3$ | 8 hours | 02 | 02 |
| | | 1 hour | 04 | 04 |
| 8 | Ammonia ($NH_3$), µg/$m^3$ | Annual | 100 | 100 |
| | | 24 hours | 400 | 400 |
| 9 | Benzene ($C_6H_6$) µg/$m^3$ | Annual | 05 | 05 |
| 10 | Benzo (a) Pyrene (BaP)-particulate phase only ng/$m^3$ | Annual | 01 | 01 |
| 11 | Arsenic (As) ng/$m^3$ | Annual | 06 | 06 |
| 12 | Nickel (Ni) ng/$m^3$ | Annual | 20 | 20 |
| | Source: https://scclmines.com/env/DOCS/NAAQS-2009.pdf | | | |

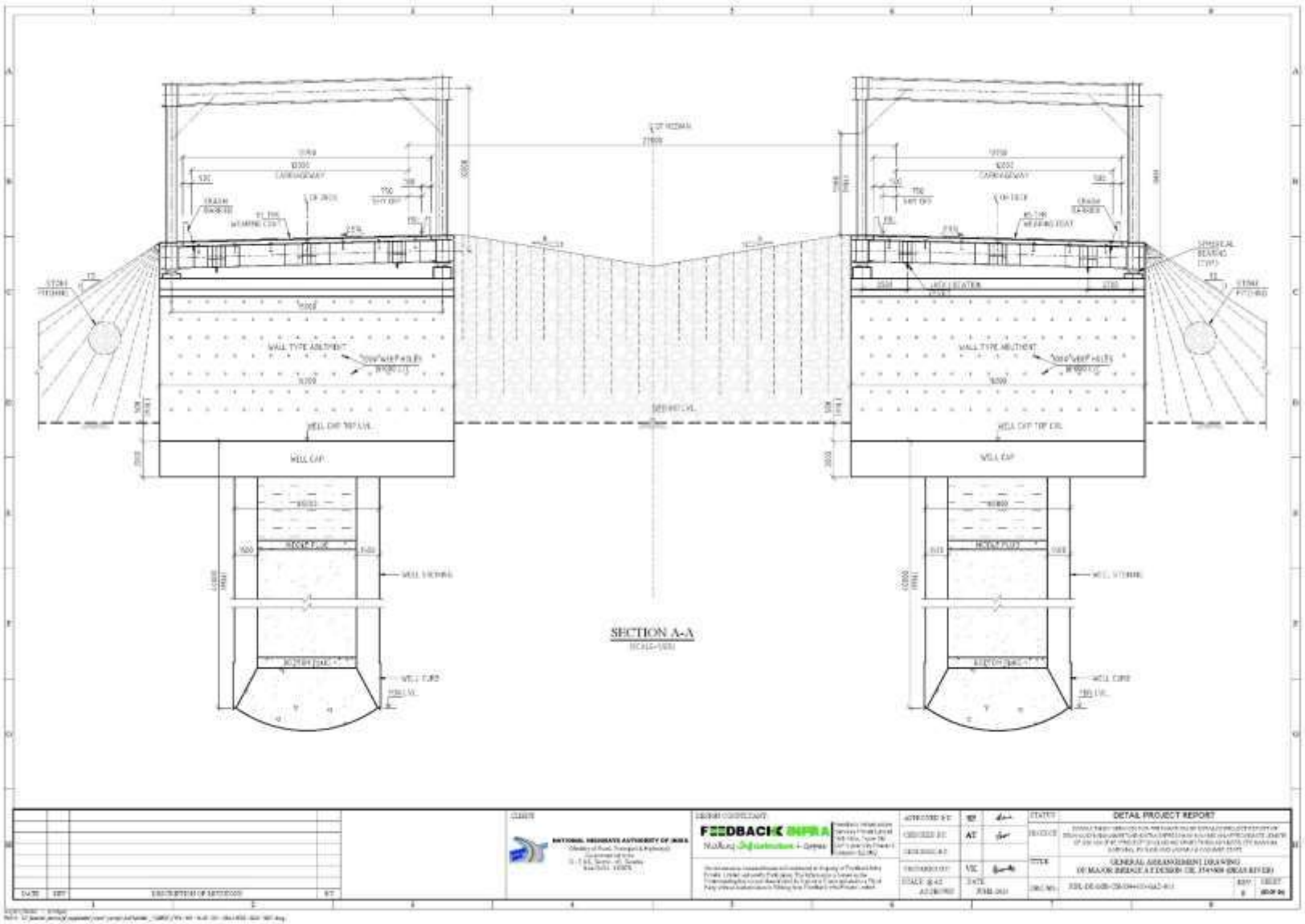
## Annexure 12: Categories of Air Quality Index (AQI) and associated health impacts.

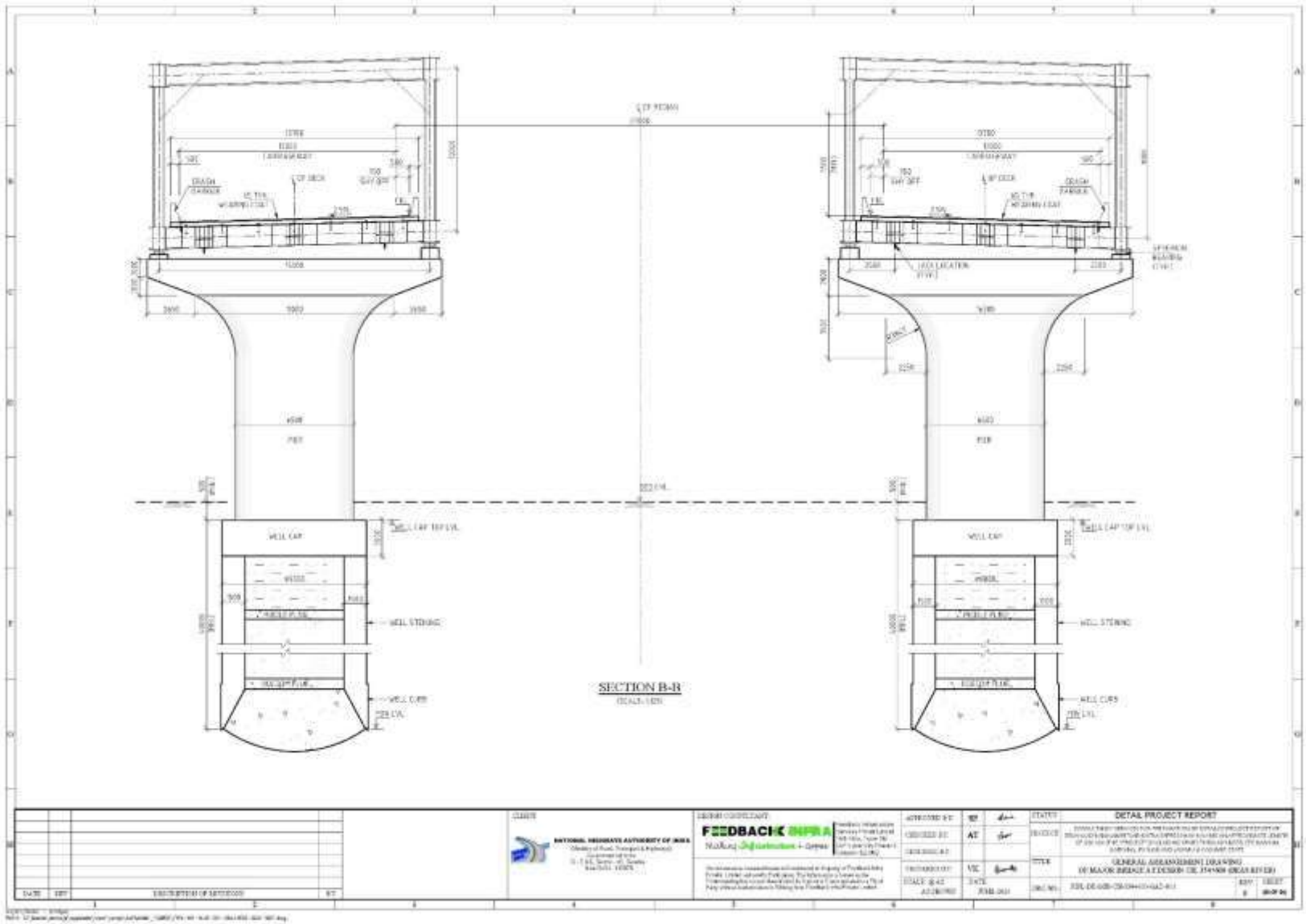
| AQI | Quality | Impact on health |
|---|---|---|
| 0-50 | Good | Minimal impact |
| 51-100 | Satisfactory | Minor breathing discomfort to sensitive people |
| 101-200 | Moderate | Breathing discomfort to people with lungs, asthma and heart diseases |
| 201-300 | Poor | Breathing discomfort to most people on prolonged exposure |
| 301-400 | Very poor | Respiratory illness on prolonged exposure |
| >401 | Severe | Affects healthy people and seriously impacts those with existing diseases. |

## Annexure 13: GAD DK Expressway




SECTIONAL ELEVATION
PLAN
DETAIL - A
DETAIL - B
NOTES:-
LEGEND:-
FEEDBACK INFRA
DETAIL PROJECT REPORT


SECTION A-A
WALL TYPE ABUTMENT
WELL CAP
WELL STEINING
WELL CURB
NATIONAL HIGHWAYS AUTHORITY OF INDIA
FEEDBACK INFRA
DETAIL PROJECT REPORT
GENERAL ARRANGEMENT DRAWING
OF MAJOR BRIDGE AT CHAINAGE 334+000 (BRAHMANI RIVER)


SECTION B-B
WELL CAP
WELL STEINING
WELL CURB
DETAIL PROJECT REPORT
GENERAL ARRANGEMENT DRAWING
OF MAJOR BRIDGE AT CHAINAGE 354+000 (KHAN RIVER)

Annexure 14: Layout of Delhi-Katra expressway along with all proposed bridges on Kali Bein and Beas Conservation Reserve