

Chapter 7. : MITIGATION MEASURES AND MANAGEMENT PLAN

7.1. Introduction

Mitigation measures includes the preventive measures which when taken can either eliminate or reduce the intensity of the impact on the CERs. These mitigation measures ensure the environmental sound implementation of the project and enhance social acceptability of the project. Mitigation plan should be prepared in early stage of the project so as the measures could be define for all the pre-construction, construction and operation phase of the project to ensure minimum damage to environment and society at all the stages of project. Effectiveness of the mitigation measures proposed should also be assessed regularly via monitoring and supervision of the monitoring indicators which defines the status of the CERs. A cell or committee should be formed by the project proponent for the purpose of implementation of these measures and supervision of effectiveness of these measures. This cell should include the environmental, social & safety experts having complete knowledge of project action on the environment and society. Approach followed for describing the mitigation measures and formation of environmental management plan is given in **Figure 7.1** below.

7.2. Review of the Mitigation Measures Proposed in EIA/SIA Study of the Jal Marg Vikas Project

Mitigation measures as proposed in EIA/SIA studies have been reviewed in detail. It has been found that mitigation measures proposed are adequate and address all major and minor issues which may have an impact on environment and society. Impacts are adequately addressed for the construction and operation of proposed civil interventions, barge operation and maintenance dredging and accordingly mitigation measures are proposed and management plans are prepared. After carrying out the CIA study and assessment of the baseline condition of the areas through which proposed NW-1 traverses and nature of developments which this area will experience after & due to development of Jal Marg Vikas Marg, it is learned that some of the proposed measures requires strengthening. Impact assessment of NW-1 and strengthening measures required to be taken are given in **Table 7.1** below

Table 7.1 : Mitigation Measures & Management Plan for Jal Marg Vikas Project & Strengthening Measures Identified to Minimize Cumulative Impacts

S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
1.	Micro-Climate	GHG emission will increase due to increase in developments in business as usual but GHG emission will cut down due to shift of freight from Road/Rail to IWT.	Will reduce GHG emissions due to shift of freight from road/rail to IWT thus positive impacts. GHG emissions may be high near terminals and jetties.	<ul style="list-style-type: none"> Compensatory plantation as per state policy Development of green belt Usage of LNG based vessels Usage of low sulphur diesel in dredgers Usage of low energy embodied material for construction of buildings Usage of low diesel sulphur in the transportation vehicles Material transportation vehicles should be regularly services and maintained and should carry PUC certificates. This can be made mandatory for all vehicles by IWA 	Y	<p>Yes</p> <ul style="list-style-type: none"> Compensatory plantation should be carried out more than the state policy so as to recover carbon sequestration loss at the earliest Minimizing dredging (use of dredgers) by using various measures like bandalling, river training methods Material transportation within all the terminal should be through mechanized system completely All the terminals should have railway connectivity (EDFC) so as most of the material to & from terminals should be taken by railways. Electronic crematorium should be constructed and people should be made aware about the benefit 	Contractor /IWA	Material Transport Agencies, ULBs
2.	Air Quality	Air Quality will deteriorate due to increased traffic, urbanization and industrial developm	Air quality will improve due to shift of freight from road/rail to IWT thus positive impacts. Air emissions may be high	<p>Terminal/Jetty Construction/River Bank Protection Works</p> <ul style="list-style-type: none"> Barricading the site to prevent dust dispersion to nearby areas Excavation and filling shall be carried out in parallel. Excavation and filling shall be carried out in phases Excavated soil shall be stored 	Y	<p>Yes</p> <ul style="list-style-type: none"> Compensatory plantation should be carried out more than the state policy so as to recover carbon sequestration loss at the earliest Minimizing dredging (use of dredgers) by using various measures like bandalling, river training methods Material transportation within all the 	Contractor IWA	Material Transport Agencies, ULBs



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
		ent in business as usual but the Air emission will cut down due to shift of freight from Road/Rail to IWT.	near terminals and jetties.	under covered conditions <ul style="list-style-type: none"> • Transport of loose and fine materials through covered vehicles. • Loading and unloading of construction materials in covered area. • Approach roads shall be paved and widened. • Water spraying on earthworks, unpaved haulage roads, other dust prone areas and construction yard. Flow of water sprinklers shall be maintained to avoid water ponding • Make Provision of PPEs like face masks to workers. • Raw materials like cement, sand and construction debris should be stored under covered conditions • Wheel wash facility shall be provided at exit points of the site • Monitoring of air quality shall be carried out on monthly basis to check the level of pollutants and effectiveness of proposed EMP • Development of green belt at the terminal & lock sites efficient for arresting the particulate matter • Thick green belt shall be developed as per the provision 		terminal should be through mechanized system completely <ul style="list-style-type: none"> • All the terminals should have railway connectivity (EDFC) so as most of the material to & from terminals should be taken by railways. • Electronic crematorium should be constructed and people should be made aware about the benefit 		



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>already made in the design and maintained all along the periphery and along the roads. The green belt shall be developed in canopy¹⁷ shape with local species of broad leaf variety.</p> <ul style="list-style-type: none">• Species selected for development of green belt shall also be tolerant to expected pollutants and shall have the ability to adsorb the pollutants. Suggested species are suitable for different areas are also listed under CPCB guidelines for green Belt development¹⁸.• LPG should be used as fuel source in construction camps instead of wood. Tree cutting shall not be allowed for fuel wood.• Mixing Plant, crushers and batching plant shall be located on downwind direction of the site fitted with adequate stack height to ensure enough dispersion of exit gases. with appropriate pollution control measures				

¹⁷Canopy shape green belt design includes three row of trees with middle tree species more in height compared to inside and outside tree species. Each of tree will have wider leaf which forms like a curtain and acts as barrier to dust spread. Dust accumulated over leaf falls down within the site boundary. Similarly external dust gets prevented from entering the terminal site. http://cpcb.nic.in/upload/Publications/Publication_513_GuidelinesForDevelopingGreenbelts.pdf

¹⁸ CPCB guidelines for green Belt development http://cpcb.nic.in/upload/Publications/Publication_513_GuidelinesForDevelopingGreenbelts.pdf



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<ul style="list-style-type: none"> Loading and unloading of construction materials shall be made at designated locations in project area with provisions of water fogging around these locations Low sulphur diesel should be used for operating DG sets, dredgers and construction equipment. Terminal/Jetty Operation <ul style="list-style-type: none"> Material shall be transported in covered vehicles Transportation vehicle shall be properly serviced and maintain and shall carry PUC certificate Thick green belt shall be developed as per the provision already made in the design and maintained all along the periphery and along the roads. The green belt shall be developed in canopy¹⁹ shape with local species of broad leaf variety. Species selected for development of green belt shall also be tolerant to expected pollutants and shall have the ability to adsorb the pollutants. 				

¹⁹ Canopy shape green belt design includes three row of trees with middle tree species more in height compared to inside and outside tree species. Each of tree will have wider leaf which forms like a curtain and acts as barrier to dust spread. Dust accumulated over leaf falls down within the site boundary. Similarly external dust gets prevented from entering the terminal site. http://cpcb.nic.in/upload/Publications/Publication_513_GuidelinesForDevelopingGreenbelts.pdf



S. No.	Cumulatively Impacted CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>Suggested species are suitable for different areas are also listed under CPCB guidelines for green Belt development²⁰.</p> <ul style="list-style-type: none"> Water sprinkling should be carried out during all loading and unloading activities and storage period. More frequent water sprinkling shall be carried out at coal yard during summer season to prevent spontaneous fire. It is recommended to provide mechanical conveying system with provision of dust collection system for loading/unloading material from barges Monitoring of air quality shall be carried out on monthly basis to check the level of pollutants and effectiveness of proposed EMP <p>Barge Movement:</p> <ul style="list-style-type: none"> Material having potential to generate the dust like coal, sand stone aggregates should be transported under covered conditions. Air emissions from the vessel should be under the prescribed limits as per MARPOL and the standards. Regular maintenance of vessels engine and 				

²⁰ CPCB guidelines for green Belt development http://cpcb.nic.in/upload/Publications/Publication_513_GuidelinesForDevelopingGreenbelts.pdf



S. No.	Cumulatively Impact ed CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>Propellers. IWA should develop the stringent norms to be followed by vessel operators and shall develop the system of penalizing based on polluters pay principle in case the standards are not met or violated</p> <ul style="list-style-type: none"> Adoption of cleaner fuels such as low sulphur bunker oil as per USEPA norms, 2000 (sulphur content is 0.25% for diesel oil and 2.7% for residual oil) or switching to LNG based vessels 				
3.	Water Resources/Flow & Drainage	Water Resources will deplete due to continued urbanization, industrial development and infrastructure development. NW-1 will not have significant impact on water resources	No impact on water resources/flow as no consumption of water is involved. Nor any water storage and diversion structure is proposed on NW-1 which can impact the water resources/flow.	<p>Terminal/Jetty Construction & River Training Works</p> <ul style="list-style-type: none"> Preference shall be given to surface water from rivers wherever feasible with due permission from authorities. Temporary rain water storage structures should be provided at the site to store rain water and this water should be used for sprinkling and construction activities No dumping of waste/wastewater in the ground. Hazardous waste or wastewater shall not be stored in unlined ponds Permission shall be obtained from irrigation department in case river water is used and from CGWA/CGWB in case 	Y	<ul style="list-style-type: none"> Any new irrigation scheme or dam construction on NW-1 and tributaries will affect the availability of water in NW-1 and water flow. Thus for any such scheme a detailed study of impact navigation in NW-1 should be carried out Intimations should also be made to IWA by industries/ULBs if any significant quantity of water withdrawal is planned from NW-1 and tributaries NW-1 should carry out detailed environmental impact assessment study of water storage structure, if any planned in future for enhancing the navigation in NW-1 	Contractor/ IWA	Irrigation Department, ULBs & Industrial Department



S. No.	Cumulatively Impact ed CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
		and flow. But coming up of new dams and irrigation schemes may impact the availability of flow in NW-1 significantly.		<p>ground water is used.</p> <p>Terminal/Jetty Operation</p> <ul style="list-style-type: none"> Regular checks shall be made for soil erosion along the banks and conditions of bank protection structures effective control. Regular visual checks and cleaning of drains shall be done along the alignment to ensure that flow of water is maintained through cross drains and other channels/streams. Drains shall be regularly cleaned and de-silted Monitoring of water borne diseases due to stagnant water bodies Storm water drains provided in parking & road areas of the terminal & lock sites, shall be provided with oil & grease traps. Arrangement shall be made to collect the roof water from the building separately into a tank so as this water can be used for horticulture activity. Storm water from other areas like storage yards, stock piles and roads shall be directed into a dump pond. Storm water shall be retained in pond so as to allow the settling of dust and suspended particles in the 				



S. No.	Cumulatively Impact ed CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>water, this water should be used for cleaning and dust suppression. Sludge from the dump pond shall be sent for disposal along with other municipal waste</p> <ul style="list-style-type: none"> Water conservation fixtures shall be installed in toilets and kitchen area. Some of the water conservation fixtures which can be installed are dual flushing cisterns, sensor taps, low water urinals etc. 				
4.	Surface /Ground Water Quality	Surface & Ground water pollution will continue to impact due to increased developmental and industrial activities in the area and religious rituals performed on Ganga by people and	Surface Water quality will be deteriorated significantly due to dredging, barge operation and terminal activities. Construction of infrastructure and related facilities of waterways may impact the natural drainage pattern at the site but the	<p>Terminal/Jetty Construction & River Training Works</p> <ul style="list-style-type: none"> Washing of vehicle and equipment shall not be carried out at river or any water body. Washing area should be provided with the storm water drains fitted with oil & grease trap. Piling of the raw materials & debris shall be avoided at the site. Storage of debris and raw material shall be carried out in paved and covered areas. This will minimize interface of run-off with raw material and debris. Site should be cleaned regularly Septic tank/soak pit shall be provided at site for disposal of sewage from the toilets at site and from the labour camps. 	Y	<ul style="list-style-type: none"> Detailed EIA study shall be carried out for each of the vessel/barge repair & maintenance facility Any River front development work being carried out in the influence area of CIA study shall establish a system of wastewater treatment and storm water management so as run-off from these sites shall not impact the water quality of river Usage of the Bio-pesticides/organic manures should be enhanced so as to minimize flow of the chemicals/pesticides into the river Any area prone to erosion in the catchment area shall be treated through plantation and other erosion prevention methods so as the water quality degradation can be minimized Any road/railway construction 	IWAI	Irrigation Departments, ULBS, Ministry of Roads & Railways



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
		burning and immersion of bones/idols in the Ganga.. Surface water pollution will be aggravated due to NW-1 project. Natural Pattern will be altered significantly due to continued road & railway development but need of development of road/rail may reduce due to shift of	impact is minimized by provision of storm water management system	<p>Adequate toilets & bathrooms shall be provided to prevent open defecation. Wherever septic tanks are not provided mobile toilets with anaerobic digestion facility shall be provided and no domestic waste shall be discharged to river.</p> <ul style="list-style-type: none"> Water use shall be minimized by using RMC, practicing curing by water sprinkling, maintaining flow of sprinklers, covering the water storage tanks to minimize water evaporation, creating awareness for water conservation and regular inspections at site to monitor the leakages in water storage area In case RMC is not used then concrete transit mixer should be washed and cleaned daily. Wash from these mixers shall be collected in block work tanks which will allow settling of concrete, removal of aggregates and allowing the waste to wastewater drain. This collected waste concrete can be dried and used for various purpose at site like construction of temporary roads at site and labour colony 		<p>should take care the maintenance of natural drainage by provision of cross drainage structures</p> <ul style="list-style-type: none"> Any bridge if constructed should carry out detail EIA study to study impact of construction of bridge piers on river flow & quality and impact of bridge construction on navigation in NW-1 Dumping of waste material in the river should be restricted & any one found dumping waste in river should be heavily penalized. Penalty should be proportional to the quantity of waste 		



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
		freight from road/rail to IWT		<ul style="list-style-type: none"> Wastewater generated from the washing/cleaning area after passing through oil & grease trap & curing area shall be re-used for water sprinkling and wheel washing Fuel shall be stored in leak proof containers and containers shall be placed on paved surface Substructure construction should be limited to the dry season and cofferdams may be constructed and utilized to lift the spoil directly out of it and carried to the riverbank for land disposal. Restoration of changes in the stream, if any, made during construction to its original level The piling work in river shall be undertaken during low flow period. Provision shall be made for collection and draining of water for the piling earth. It shall be used for embankment protection or road construction depending on its suitability. Turbidity traps/curtains should be provided or Geo-Textile synthetic sheet curtain shall be placed around piling and construction area to prevent movement of sediments and 				



S. No.	Cumulatively Impacted CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>construction waste.</p> <ul style="list-style-type: none"> Sedimentation tanks shall be provided at the site so as run-off from site shall enter the sedimentation tanks before discharging into the river. Sedimentation tanks will trap the sediments in the run-off Provision shall be made for geo Synthetic Screen for arresting silt flowing down stream. Proper collection, management and disposal of construction and municipal waste from site shall be made to prevent mixing of the waste in run-off and entering the water bodies Natural Drainage pattern of area around shall be maintained Dredged soil shall be tested for toxicity & contamination, if toxic/contaminated shall not be disposed back in water and should be send for disposal to TSDF Monitoring of water quality shall be carried out on monthly basis to check the level of pollutants and effectiveness of proposed EMP <p>Terminal/Jetty Operation</p> <ul style="list-style-type: none"> Toilets to be provided with running water facility to prevent open defecation. 				



S. No.	Cumulatively Impacted CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<ul style="list-style-type: none"> Sewage generated at site should be treated in STP if sewage generation is more than 10 KLD as in case of Varanasi, Sahibganj & Haldia terminal sites and if sewage is less than 10 KLD, sewage can be disposed through septic tanks/soak pits as in case of Farakka lock site No wastewater shall be received from vessels and vessels should not be allowed to discharge their wastewater and solid waste in river No waste/wastewater shall be discharged in river or dumped into the ground Oil/Fuel should be stored in leak proof containers and storage area should be provided with facility of collecting the oil in case of spillage. The storage facility should be so designed that spilled oil shall not enter the storm water and sewage drains or storm water storage pits Dredged soil shall be tested for toxicity, if toxic shall not be disposed back in water and should be send for disposal to TSDF. Monitoring of treated water every month 				



S. No.	Cumulatively Impacted CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<ul style="list-style-type: none"> Ship design (of capacity > 5000 DWT at Haldia site for coal transshipment) should be as per MARPOL and should be provided with double hulls/double bottoms. Speed of oil carrying vessels should be maintained to prevent accidents due to high speed. Sensors and hooters should be fitted with ships which can notify the closeness of another ship or any other potential matter which can cause accident. Immediate/quick clean-up of such spills shall be undertaken and ship owners should be liable for the same. Crew of the ships carrying the oil should be competent and experienced so as they can prevent the accidents to happen as much as possible IWAI should carry out the inspections of the vessels which are transporting the material to and from the terminal. Monitoring of surface water quality shall be carried out on a monthly basis to check the level of pollutants and effectiveness of proposed EMP <p>Barge Movement</p> <ul style="list-style-type: none"> All waste water and solid waste 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>or maintenance waste should be disposed at the designated barge maintenance facility only.</p> <ul style="list-style-type: none"> • Material having potential to generate the dust like coal, sand stone aggregates should be transported under covered conditions to minimize dust generation and its settlement on river surface. Terminals should have facility to control dust pollution during barge loading and unloading actions. • Provision of oil water interceptors with the bilge tank to separate oil prior discharge of bilge water into river. Bilge water should be discharged as per MARPOL requirements. Bilge water tank should be maintained as per MARPOL requirement. • Usage of non-toxic and non TBT containing anti-fouling paints for painting vessel • Immediate/quick clean-up of oil/other spills shall be undertaken in case of accidental release and ship owners should be liable for the same. • Crew of the vessel carrying especially oil should be competent and experienced so as they can prevent the accidents to happen as much as 				



S. No.	Cumulatively Impact ed CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>possible</p> <ul style="list-style-type: none"> • IWAI should develop the stringent norms to be followed by vessel operators and shall develop the system of penalizing based on polluters pay principle in case the standards are not met or violated • Ship design (of capacity > 5000 DWT) should be as per MARPOL and should be provided with double hulls/double bottoms. Speed of oil carrying vessels should be maintained to prevent accidents due to high speed. • Vessels should not be washed or cleaned at terminal/jetty facility and washings should not be discharge at the terminal/jetty location. <p>Maintenance Dredging</p> <ul style="list-style-type: none"> • Attempt shall be made to minimizing and optimizing the dredging requirements by effective assessment and study of the Thalweg profiles of the river. This can be achieved some of the following measures: <ul style="list-style-type: none"> ○ Increase use of bandalling which helps in diverting the flow of river towards the channel and reduces the quantity of dredging 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<ul style="list-style-type: none"> Low draft vessels should be deployed which will reduce the requirement of dredging Dredged material shall be checked for toxicity and contamination prior its disposal onshore for prevention of contamination of water and its impacts on aquatic life. Dredging should not be carried out during very low flow seasons so as to minimize the dispersion of fine sediments Usage of silt or air bubble screens/curtains should be explored to minimize the sediment release during dredging operations. Silt/air bubble screens can hang from surface floats or stands attached to the bottom and held upright by sub-surface floats (PIANC). The use of silt curtains is reported to considerably reduce the loss of suspended sediments from the dredge area, by up to 75% where current velocities are very low. However, they are generally ineffective in areas with high current velocities which exceed 0.5 m/s (UK Marine SACs Projects). To minimize the sediment dispersal during disposal of 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>dredge sediments, it should be placed as close to the bed possible preferable at a level of 1m above the bed to minimise the dispersal of sediments.</p> <ul style="list-style-type: none"> • Provision shall be made of emergency response equipment like floating blooms to deal with any emergency of oil spills or leakages. Regular servicing and maintenance of dredgers should be taken up so as to prevent any leakage of the dredged material. Leakage detection of the sediment transportation pipe shall be carried out regularly to prevent any sediment loss and water pollution at leakage location. Corrective actions should be taken immediately after detection of such leaks. • Cutter head of CSD should be selected according to material to be dredged so as to maximize the dredged material transport from dredging point to suction mouth and prevention of sediment loss and re-suspension. • Ratio of cutter revolutions and pump velocity should be adjusted to ensure that cutter advancement rate is not greater than the ability of the suction 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>pump to remove the material that is cut. This will prevent the suspension of the dredged material.</p> <ul style="list-style-type: none"> • Dredge cuts and lifts should be designed so as to prevent undercutting of material and hence a collapse of material locally at the cutter head, leading to an increase in the sediment being disturbed by dredging. • If dredge material is found contaminated at any particular location that it should be disposed off-shore. Off-shore disposal of dredged material should be carried out only at approved TSDF site such as approved TSDF site of Haldia Dock Complex at Sagar. • Dredge material if disposed on river banks or on land caution should be exercised as per the Dredging and Disposal Management Plan for NW-1 • If dredged material is disposed at land, then the care should be taken that the tail water is collected and made free from sediments prior its discharge back to surface water body. Regular monitoring of the excess water should be done in case dredged material is disposed on 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				land. This will help in assessing the efficiency of sediment trap system provided at site and controlling contamination of water by minimizing the sediments.				
5.	Noise Level & Vibrations	Noise level will increase in the area due to continued developmental and industrial activities and plying of the motorboats. But noise level along the NW-1 may reduce due to shift if freight from road/rail to IWT. Vibration will increase in area	High underground noise due to dredging, pilling and barge movement and high ambient air noise due to dredging operation. Ambient air noise generation due to dredging varies from 80-85 dB(A).	Terminal/Jetty Construction & River Training Works <ul style="list-style-type: none"> • All equipment to be timely serviced and properly maintained to minimize its operational noise. • Construction equipment and machinery to be fitted with silencers and maintained properly. • Barricading the construction site to minimize the noise level outside the site boundary • Protection devices (ear plugs or ear muffs) will be provided to the workers operating in the vicinity of high noise generating machines. • Speed control shall be enforced in habitat areas. The ambient noise level as per standard is 55 dB(A) and 45 dB(A). Current level at habitat area meets the standard • Honking shall be prohibited at the project site • Hearing test for the workers shall be undertaken before 	Y	<ul style="list-style-type: none"> • Noise monitoring should be carried out in all the urban areas within the CIA influence area by concerned pollution control boards and areas having noise levels more than permissible limits should be demarcated and special regulations for these areas should be prepared • No development of residential zone/facility should be undertaken within 500 m of the terminal/jetty • Thick green belt should be developed on all the haulage roads through which material will be transported • Vibrations due to EDFC should be managed by deployment of adequate technology 	Contractor IWAI	SPCBs, UDA, ULBs, Railways



S. No.	Cumulatively Impact ed CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
		close vicinity of railway track, i.e. near Varanasi stretch. Impact of these vibrations are analyzed during EDFC study and it is assessed that vibrations impact will dissipate within 100 m.		<p>employing them and thereafter shall be done after every six months</p> <ul style="list-style-type: none"> • Job rotations should be practiced for workers, working in high noise level areas • No noise generating activity shall be carried out between 6:00 AM to 10:00 PM. • Monitoring of Noise levels shall be carried out on monthly basis to check the level of pollutants and effectiveness of proposed EMP <p>Terminal/Jetty Operation</p> <ul style="list-style-type: none"> • Site boundary should be provided which can act as noise barrier • Earplugs should be provided to workers involved in unloading operations • Provision of thick green belt along the boundary and roads which will act as noise buffer • Timely maintenance and servicing of transportation vehicles and the machinery/pumps to be used during operation phase to reduce the noise generation due to friction and abrasion • Honking shall be prohibited at the project site • Hearing test for the workers 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>shall be undertaken before employing them and thereafter shall be done after every six months</p> <ul style="list-style-type: none"> • Job rotations should be practised for people, working in high noise level areas • No noise generating activity shall be carried out between 6:00 AM to 10:00 PM • DG sets shall be provided with acoustic enclosure • Monitoring of Noise levels shall be carried out on monthly basis to check the level of pollutants and effectiveness of proposed EMP 				
6.	Terrestrial Ecology	Terrestrial ecology will continue to be impacted due to cutting of trees for development of infrastructure and industries. However development of	May require tree cutting for development of civil interventions like cutting of 500 trees for development of Sahibganj terminals. NW-1 alignment is app. Udhawa Lake wildlife sanctuary but no significant	<p>Construction of Terminal/Lock/Jetty & River Training Structures</p> <ul style="list-style-type: none"> • Project layout design shall be in a way to minimize tree cutting • Permission shall be obtained from forest department prior tree cutting and only the identified and permitted tree shall be cut and remaining shall be maintained properly • Thick green belt shall be developed at the periphery and along the roads on the project site which will prevent spread of dust and reduce 	Y	<ul style="list-style-type: none"> • Compensatory plantation should be carried out in nearby areas to the extent possible. Plantation should be carried out as much as possible • Avenue plantations on all the approach roads of the terminal/lock/jetty should be properly maintained 	IWAI	ULBs



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
		avenue plantation, compensatory plantation, urban forests may be positive impact on the terrestrial ecology	impact is anticipated on the sanctuary. Green belt will be developed around terminals. Compensatory plantation will be carried out as per state policy to reduce the impact	<ul style="list-style-type: none"> noise propagation. Areas reserved for future development at site shall also be made green by growing grass and shrubs and herbs Caution sign shall be placed to prevent hunting of animals Provision shall be made for strict penalty for hunting/harming any animal Construction activities shall be restricted to 6:00 Am-10:00 Pm especially noise generating activities. Compensatory plantation should be carried out as per state forest policy Green belt to be developed should be mainly naturally growing native species of the area. Green belt should be developed as per the CPCB guidelines proposed above climate section. Survival rate for compensatory plantation and green belt to be developed at the site shall be monitored regularly and measures shall be taken so as to achieve minimum rate of 70% All efforts shall be made to minimize the cutting of tree through design changes. 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>Layout should be designed in a way so as to minimize the tree cutting. Only trees identified for cutting should be cut</p> <ul style="list-style-type: none"> Workers should not use any timber or firewood as fuel for any purpose. LPG should be made available to workers in construction camp. Tree cutting should be carried out only after obtaining due tree cutting permission from forest department. No hazardous material or waste shall be disposed in the other land or nearby area as it may harm the animals, if consumed accidentally Speed limit will be regulated to prevent any accidents of animals. Regular maintenance of the dumper shall be done to prevent leakage of oil so as to prevent pollution of the soil and impact on fauna and flora dependant on soil. Regular Water Sprinkling shall be carried out to minimize dust generation and settling the dust on surface of flora. Trees retained at the site (after site clearance) should not be disturbed, cut or harmed in 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>anyway. These trees should be maintained.</p> <ul style="list-style-type: none"> Adequate parking space should be provided within the site for construction vehicle and equipment so as they are not parked in other areas like road side, others agricultural field, open areas etc. to avoid any harm to flora of that area due to movement of heavy vehicles. Construction camps should not be established inside or near the forest area Construction activities and vehicle washing should not be undertaken at the river or any other water body or close to the water body Site should be barricaded to prevent entry of the animal in the site Hunting, poaching and harming any animal (wild or domestic) by any worker or project related person should be strictly prohibited and monitored Illumination at the night time should be reduced during the night time (if no activity is going on) as it may disturb the nocturnal animals 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<ul style="list-style-type: none"> Noise generating activity should not be undertaken during night time to minimize disturbance to animals. Noise levels should be maintained within the prescribed CPCBs limits to the extent possible during the day time. Workers should not use any timber or firewood as fuel for any purpose Terminal/Jetty/Lock Operation <ul style="list-style-type: none"> Planted trees, shrubs, and grasses to be properly maintained. The tree survival audit to be conducted at least once in a year to assess the effectiveness Regular watering and cleaning of the leaves to remove the accumulated dust on the leaves 				
7.	Aquatic Ecology	Impact on aquatic ecology will continue to exist and will be escalated due to NW-1 development	High impact on aquatic flora & fauna including dolphins, turtles and fishes. May directly impact the primary productivity of water body. NW-1 includes 2 wildlife	Construction of Terminal/Lock/Jetty & River Training Structures <ul style="list-style-type: none"> The area in which the construction of the Berth (jetty) is planned, advisable to carefully determine drop sites before anchor placement to ensure that Dolphin and fish communities that could locally still be present in the area are not unnecessarily damaged. Before starting piling / dredging 		<ul style="list-style-type: none"> IWAI should support the dolphin and turtle sanctuary in future also in terms of provision of aids for improving the habitat of these organisms Local bodies should ensure the maximum sewage of the cities and other areas should enter after treatment from STP. Treated water from STP should be used by local bodies for plantation purpose or can be sold to contractors of building & construction 	IWAI	ULBs, Industrial Departments



S. No.	Cumulatively Impact ed CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
			sanctuaries, i.e. Kashi Turtle Sanctuary & VGDS	<p>allow some time to aquatic fauna to displace from the piling area. Bubble curtains can be provided at the time of piling so as to displace the aquatic fauna prior start of construction activities</p> <ul style="list-style-type: none"> • The piling/dredging activities must be carried out in shortest possible timeframe as possible • All the debris shall dispose away from river course as per debris management plan of the project. • Decisions on method of construction and type of technology and equipment to be used must consider the noise and vibration levels and extent of siltation being generated. Noise and vibration levels must be far below levels that can cause injury to dolphins and other aquatic life. • Noise reducing devices like mufflers, enclosures shall be fitted with the equipment as much as feasible. Erecting barriers shall also be installed • Fish exclusion devices shall be installed in water column around the pile driving area to prevent fish access • To avoid the construction debris 		<ul style="list-style-type: none"> • All industries should install their STPs and ETPs and should discharge the waste only after tertiary treatment. Industries should achieve zero discharge system to the extent possible • No. of ships which can ply in turtle sanctuary without impacting the turtles is calculated using only noise levels generated due to barge movement. Other noisy operations are not taken care of. Thus minimum distance between two barges shall be atleast 200 m. • Dumping of waste material in the river should be restricted & any one found dumping waste in river should be heavily penalizes. Penalty should be proportional to the quantity of waste 		



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>wash or blown into the water the area shall be surrounded by silt screens, which must be placed in the water before the work starts. Geo-Textile synthetic sheet curtain can act silt screen which should be placed around pilling and construction area to prevent movement of sediments and construction waste. The screens should also be placed around storage areas, to prevent waste from blowing away and to prevent sediment run-off into the river. The storm water drain shall be connected to temporary sedimentation pit and collected water shall be used for dust suppression. Run-off from site should also pass through oil/grease traps and flow down to the same sedimentation tank before its reuse</p> <ul style="list-style-type: none"> In addition to silt screens, building guidelines of the Bonaire National Marine Park require that storage areas for sand and soil, and all work areas, must be at least 20 meters away from the high water mark and construction equipment must not be cleaned 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>or washed within 50 meters of the high water mark.</p> <ul style="list-style-type: none"> • Piling and dredging activities should be carried out rapidly. Piling should not be carried out during breeding and spawning season means during rainy season. It should be carried out in low water season, i.e. pre-monsoon • Piling/Dredging should be stopped for some time, if any dolphin/turtle/RET species is sighted in activity area • Equipment shall be maintained in good condition to prevent leaks or spills of potentially hazardous materials like hydraulic fluid, diesel, gasoline and other petroleum products • Excavation activities onshore should not be undertaken during monsoon season so as to minimize sediment load of run-off • Workers should be trained to handle the equipment and material at site so as to minimize the spillage of materials and contamination of water • No construction debris/ already accumulated solid waste at site or waste generated from labour 				



S. No.	Cumulatively Impacted CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>camp/sewage/waste water should be thrown/discharged in river or any drain</p> <ul style="list-style-type: none"> • Aquatic ecology monitoring should be carried out prior start of construction and after completion of construction so as to assess the impact of construction activities on aquatic life. • Run-off from site should pass through oil/grease traps and sedimentation tank prior discharging into the river • All construction and operation equipment shall be maintained in good condition shall be checked for oil & grease leakage • Dredged soil shall not be disposed in river or its banks especially during breeding spawning seasons of aquatic organisms <p>Terminal/Jetty Operation</p> <ul style="list-style-type: none"> • Propeller shall have net system to avoid any accident with dolphins, international practices shall be adopted. • No wastewater or waste shall be disposed in river from terminal site or from vessel into the water. Penalty shall be imposed on the vessels 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>reported of disposing waste/wastewater in the river</p> <ul style="list-style-type: none"> No contaminated run-off/sewage/effluent from terminal/jetty sites should be allowed to flow in the river Nesting grounds, breeding & spawning grounds shall be identified and project activities shall be minimized in those areas Instruction should be given to all vessels and all employee and staff that no dolphin or any other endangered species shall be harmed due to any reason Instruction shall be given to vessel operator that in case any accident with dolphin occurs that should be reported immediately to terminal authority Time schedule and the quantity of material allowed shall be strictly checked and monitored for each ship. This will prevent overcrowding of the vessels at terminal site and thus no obstruction will be there on movement of the aquatic organisms due to ships. Waiting time of vessels shall be reduced at the terminal/lock sites by providing the adequate 				



S. No.	Cumulatively Impacted CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>loading and unloading equipment and vehicles.</p> <ul style="list-style-type: none"> No developments shall be brought up on other bank of river opposite to terminal/jetty site so as to provide the ground to aquatic organisms for their activities Dust suppressors shall be used at site and at barge while loading & unloading of material to suppress the dust level and minimize its settling in the river Quick clean-up operations shall be carried out in case of accidents. Vessel owner shall be responsible for paying the clean-up expenses in case of the accidents and pollution of river water quality <p>Barge Movement:</p> <ul style="list-style-type: none"> Vessels shall be instructed for not using sharp lights and sounds all the time as they may disturb aquatic organisms Vessel speed shall be restricted to 2.7 knots in VSDS and Kashi turtle sanctuary areas to reduce the noise generation from propeller. Hooting should also be prohibited in sanctuary areas. Vessel shall be fitted with the dolphin reflectors Usage of non-toxic and non TBT 				



S. No.	Cumulatively Impacted CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				containing anti-fouling paints for painting vessel <ul style="list-style-type: none"> • Provision of propeller guards with vessel to minimize injury to the aquatic fauna • Barge/vessel movement will be restricted to the designate route only over the Sanctuary area to minimize noise disturbance of Aquatic life. • If any aquatic mammal spotted, then the measures should be taken to push it away through sirens/signals and creating noise signals. • If any accident of aquatic mammal occurs, then that should be reported to IWAI for rescue action through wild life or forests departments. • All vessels should follow MARPOL for managing their liquid and solid waste. No vessel should discharge the liquid and solid waste in the river. All waste shall be discharged at vessel repair facility only. IWAI should develop the stringent norms to be followed by vessel operators and shall develop the system of penalizing based on polluters pay principle in case the standards are not met or violated • Material having potential to 				



S. No.	Cumulatively Impact ed CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>generate the dust like coal, sand stone aggregates should be transported under covered conditions to minimize dust generation and its settlement on river surface.</p> <ul style="list-style-type: none"> • Provision of oil water interceptors with the bilge tank to separate oil prior discharge of bilge water into river. Bilge water should be discharged as per MARPOL requirements. Bilge water tank should be maintained as per MARPOL requirement. • Immediate/quick clean-up of oil/other spills to prevent damage on aquatic organisms shall be undertaken and ship owners should be liable for the same. Facilities should be made to ensure quick rescue and clean-up operations in case of accidents • Crew of the vessel carrying especially oil should be competent and experienced so as they can prevent the accidents to happen as much as possible • Regular maintenance of vessels engine and Propellers. • River training works should be carried out at the bank locations which are prone to erosion to 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>minimize sedimentation & impact on water quality & aquatic organisms</p> <ul style="list-style-type: none"> • Adequate depth to be maintained to prevent grounding under low flow conditions. Information on available depths should be conveyed to the navigators through online systems by IWAI. River Information System being developed by IWAI will serve this purpose. • Maintaining flood plains & riparian corridors wherever possible and limit potential damage to the navigation channel. Restricting the project activities in breeding and spawning ground of the fisheries which are majorly the bends in the meandering river. • Design measures like bandalling and design of groin should be considered which can reduce the dredging requirement and help in meeting depth, width and steerage needs and reduces dredging requirement • Modern design vessels having low draught say 2 m instead of 2.5 m for equal payload should be procured by IWAI for transportation. Modern vessel- 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>better technology vessels or with retrofits with quieting techniques to reduce further the noise emissions (specifically cavitation noise).</p> <ul style="list-style-type: none"> Regular patrol and inspections should be carried out to monitor the activities in waterway. Also regular monitoring of environmental attributes as proposed in environment planning plan of this should be carried out for the waterway to keep track of the condition of the environmental attributes Enhancement Measures: Support for promoting fish productivity through setting up or supporting existing fish nurseries. Also providing training and awareness support through reputed institutes or experts like CIFRI for better fishing techniques. Provision of supporting Studies for conservation of Dolphin and other sensitive studies shall be made. <p>Maintenance Dredging</p> <ul style="list-style-type: none"> Dredging plan including timeframe should be prepared for each stretch prior initiating dredging activity. No dredging should be undertaken within 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>VGDS, Turtle sanctuary. No dredging shall be carried out in winter season (November to February) along Mokama Taal to minimize impact on aquatic species and avifauna.</p> <ul style="list-style-type: none"> Dredging operations should not be carried out during the breeding and spawning season of the valued aquatic species which is from June to August (Monsoon season). Dredging if required to be taken at critical stretches (Turtle and Dolphin Sanctuaries) as mention above then dredgers should be provided with turtle and Dolphin deflectors. This would prevent the sucking of the animals (fish or turtle) swimming nearby. But such dredgers are inefficient and costly. Measures like provision of bubble curtains or creation of agitation in water should be carried out prior carrying out dredging operations so as to provide avoidance time and let the species move away from dredging point. and to prevent any injury/mortality. Dredging operations should be halted in case of sighting of aquatic mammal in adjoin locations. 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<ul style="list-style-type: none"> Contractors should submit SOPs and action time chart with risk management plan prior to any dredging work. Dredging sub-contractor should follow the defined safety procedures to avoid accidents and spills, and IWAI should ensure that other vessel users are provided with adequate information and instruction to avoid conflict with the dredgers. 				
8.	Avifauna	Avifauna will continue to be impacted due to loss of habitat. Impact will increase due to NW-1 and other upcoming developments in the area	NW-1 traverses through 5 important bird areas. Dredging operations in these areas may impact the avifauna. Development of civil interventions may involve tree cutting which is habitat of avifauna thus again disturbing the avifauna. Compensatory	Maintenance Dredging <ul style="list-style-type: none"> Dredging operations should be restricted to day time only, i.e. 6:00 Am-10:00 Pm only to minimize noise impacts on the avifauna near Important Bird Areas Dredgers should be equipped with the noise reduction/masking equipment to reduce the noise generation inside and outside water. Noise from dredgers can be reduced at source (dredger) by isolation of exhaust system, by keeping engine room doors shut and by shielding. 	Y	Yes <ul style="list-style-type: none"> Bird areas along the NW-1 stretch should be protected against the poaching & hunting of these birds Some artificial wetland/ponds can be developed for these birds in these areas which can also act as tourist spots 	IWAI	Wildlife Department, ULBs



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
			plantation and green belt development may reduce the impact.					
9.	Soil & River Bed Sediment Quality	Soil quality, & fertility will continue to deteriorate due to upcoming developments in the area and will also be impacted due to Jal Marg Vikas Project. River bed sediments will further pollute due to continued use of fertilizers and pesticides	Loss of productive top soil for development of terminals or jetties but impact will be very less. Soil may be required for development of embankment on carrying out other bank protection work. This soil can be sourced from agriculture fields. Spillage of materials at site may contaminate the soil in the area. River bed sediments are disturbed due to	Construction of Terminal/Jetty/Lock & River Training Structure <ul style="list-style-type: none"> Excavation and filling operation should be carried out in parallel so as to minimize the soil erosion. Unusable debris material should be suitably disposed at pre designated disposal locations, with approval of the concerned authority. Compaction of soil shall be undertaken by sprinkling the water to minimize the surface runoff and erosion. Remaining excavated soil should be reused at site for filling/levelling/ road construction/railway construction/construction activities in nearby areas/restoration of mine pits (Sahibganj) as possible. Remaining excavated soil should be send for the disposal at designated location or to debris disposal site as approved by IWAI 	Y	None	IWAI	--



S. No.	Cumulatively Impact ed CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
			dredging & piling. At present river bed sediments are not contaminated in the entire stretch except Ghazipur, Varanasi & Allahabad where pesticides were found in traces but they are below the level as per US standard for off-shore disposal. Cadmium levels are found higher in Allahabad, Varanasi & Ghazipur but concentration is below the toxicity level for fishes.	<ul style="list-style-type: none"> Fuel shall be stored in HDPE containers on paved surfaces with provision of catchment pit to prevent soil contamination from oil spillages. Municipal waste likely to be generated at site shall be collected in segregated manner with the use of two bin system at site. It shall be segregated into biodegradable and non-biodegradable waste. Provision of bio composter shall be made at site. The biodegradable material shall be decomposed for production of compost for use at site. The non-biodegradable waste shall be disposed to predefined land fill site nearby. The land fill site shall have provision of liners to prevent leachate to ground. Septic tank or mobile toilets fitted with anaerobic treatment facility shall be provided at construction camp Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be obtained by DBOT contractor and submitted to IWAI. 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<ul style="list-style-type: none"> Geometric adjustment shall be made if required and technically safe to minimize cutting of the tree. Provision shall be made for additional tree plantation as feasible along the road while finalizing the road alignment and rail alignment as proposed (Access road to be constructed at Sahibganj terminal & Varanasi terminal, realignment of road required at Farakka lock site and at Haldia terminal and Railway link to be provided at Sahibganj terminal site). Hazardous waste like used oil from DG sets shall be stored in HDPE containers and shall be stored on paved surfaces in isolated location to prevent its spillage and contamination of soil. Used oil shall be disposed through authorized vendors only. Movement of construction vehicles shall be restricted to the designated haulage roads only Wash-off from concrete mixing tanks and wash from washing area shall not be allowed to enter the soil. This wash shall be collected through drains into tanks and concrete shall be 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>settled, collected, dried and re-used in the site again.</p> <p>Terminal/Jetty Operation</p> <ul style="list-style-type: none"> Fuel shall be stored in HDPE containers on paved surfaces only to prevent spillage of fuels on the soil and thus soil contamination Dustbins shall be provided at all the required locations at the site for collection of recyclable and non-recyclable waste. Recyclable waste shall be sold to authorized vendors and non-recyclable waste shall be disposed through authorized agencies and shall not be dumped in open. Used oil from DG sets and other equipment shall be stored in HDPE containers in isolated location on paved surfaces and shall be disposed through authorized vendors only and shall not be dumped in open. Room shall be provided for storage of E-waste at site and this waste shall be sold to authorized vendors periodically and shall not be dumped in open. Bio- medical waste likely to be generated at first aid centre shall be disposed of following 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>the bio medical waste disposal rules</p> <ul style="list-style-type: none"> - Dredged soil shall be tested for toxicity prior disposal, if toxic it shall not be disposed back in water and should be send for disposal to TSDF. Dredged soil shall not be dumped onto the terminal site or in open. 				
10.	Soil/Bank Erosion	Soil erosion will increase in the influence area due to NW-1 and other identified development	Construction of terminals/jetties may lead to bank/soil erosion and bed scouring in upstream and downstream of the developed structure. But shore/bank protection measures & bed scouring protection measures are being taken by IWAI already. Erosion is expected in narrow stretches like feeder canal	<p>Construction of Jetty/Terminal/Lock and River Training Structures</p> <ul style="list-style-type: none"> • The earth stockpiles to be provided with gentle slopes to prevent soil erosion. • Sedimentation tanks shall be provided with storm water drain to arrest the sediments and these sediments shall be removed and stored with remaining excavated soil • Provision of cross drainage structure like culverts shall be made in the access road if required to maintain the natural drainage pattern and prevent soil erosion. • Provision of side drain shall be made in access road if required to prevent water logging. • Shore protection works like stone pitching, and geo-textile matting along the bank and construction of stone apron in 	Y	<ul style="list-style-type: none"> • Bank protection measures shall be taken all along the feeder canal and other narrow stretches where erosion can happen due to barge movement 	IWAI	--



S. No.	Cumulatively Impacted CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>the river to prevent the scouring of banks shall be undertaken as required to prevent erosions and scour (bank protection required in case of Sahibganj & Varanasi terminal in u/s & d/s of the terminal site and scour protection is required in case of Sahibganj site)</p> <ul style="list-style-type: none"> Bio-turfing of embankments shall be made enhance the slop stabilization <p>Terminal/Jetty Operation</p> <ul style="list-style-type: none"> Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc. Necessary measures to be followed wherever there are failures <p>Barge Movement</p> <ul style="list-style-type: none"> Restricting the ship speed in the stretches where river is narrow and in feeder canal to prevent impact on the river banks. Regularizing the barge speed to 7-8 knots in bending areas so as bank erosion can be reduced River bank protection works should be carried out at the bank locations which are prone to erosion. Opt for the bank protection measures in feeder 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				canal to maintain the speed of the barges. • Provision of cautionary signage at the navigational hazard locations				
11.	Social Aspects (Quality of life, pressure on existing resources, development of new infrastructure, health & safety, Religious Value, Livelihood & Traffic)	Quality of life and infrastructure in the area is likely to improve with new upcoming developments. However pressure on existing resources will increase. Developmental activities poses threat to health & safety of the population involved with	Increased employment, new infrastructure development, reduction of pressure on existing road and railway, Reduction of traffic, may increase air and noise pollution in close vicinity of terminals/jetties	Construction of Terminal/Jetty/Lock and River Training Works • Separate SIA is being carried out and RAP and other social measures should be proposed under SIA and same should be followed. • R & R issues to be settled prior start of construction at site. People have sentiments associated with River Ganga so relocation as required in case of Sahibganj terminal site should also be given to people near River only • Skill training and assistance should be given to people so as they can get other jobs or get into other business. NGOs should be hired for this purpose. Employment should be given to both women & men and preferably to local people • Small loans should be given to the farmers losing the land and wishing to start new business (Sahibganj terminal site) • Infrastructure development in	Y	None	IWAI	--



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
		development during construction & operation phase		<p>form of small school, hospital, and library can be undertaken in the village as compensation to the disturbance caused</p> <ul style="list-style-type: none"> Any common property resources, if removed should be relocated to the other location (should be a private land) as soon as it is removed and location should be acceptable to the local people Site should be barricaded and should have entry guarded by security guard. Register should be maintained for entry of outsiders. No unauthorized person should be allowed to enter the site especially village children A board should be displayed at entrance of site displaying name of project, area and hazards associated with the site on entrance and activities prohibited within and near site area in local language Non-productive lands, barren lands, raised lands; wastelands should be used for setting up labour camps, plant sites and debris disposal site. Agricultural land should be avoided. Land should be used for establishment of construction 				



S. No.	Cumulatively Impacted CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>camps, debris disposal site and plant site only after obtaining consent from land owner.</p> <ul style="list-style-type: none"> • Consultations to be done with fishermen prior start of any activity at bank/ in river to avoid any conflicts. Fishermen should be consulted prior restricting fishing activity in the activity area • Care should be taken that fishing gears and the equipment should not be impacted due to construction activities at site • Necessary permits should be obtained from concerned authorities in case any batching plant, and hot mix plant. is set up at site. • All these facilities shall be installed at proposed project site itself if possible. In case these are to be set up away from site than these shall be located at minimum distance of 500 m from habitation, water bodies and 1000 m from forest areas. • Management, rehabilitation and closure of these sites should be as per the Management plans proposed for these sites. Records for starting, maintaining and closure should be maintained and should be approved by site engineers 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<ul style="list-style-type: none"> • Implementation of EMP adequately so as to prevent environmental pollution and its impact on socio-economy due to project development • Adequate illumination should be provided at site during evening and night time till the work is being carried out • Rest area should be provided at site in which workers can rest after the lunch hours • Workers should wear the personal protective equipment like helmet, gum boots, safety shoes, safety jackets, ear plugs, gloves etc. while working • Noise level in the work zone should be maintained and followed as per OSHAS norms • Contractors should adopt and maintain safe working practices. SOPs should be prepared for each and every activity and all activities should be undertaken as per SOPs under supervision of site engineer • Training should be given to workers to handle the heavy equipment so as to prevent accidents • Training should be given to workers to handle emergency situation like fire, earth quake 				



S. No.	Cumulatively Impacted CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>and flood</p> <ul style="list-style-type: none"> • Emergency preparedness plan should be available at the site all the time and mock drills for workers should be conducted from time to time • Complete medical check-up should be done for workers prior to joining and after six months of joining • First aid facilities, first aid room, first aid trained personnel and ambulance should be provided at the site 24 X 7. Also tie-ups with local hospital should be done to handle emergency case, if any • List of emergency nos., hospital contacts, ambulance contacts and doctors contacts should be displayed in first aid room, rest area and at all required location • Working hours of labour should not exceed than standard norms as per state factory law • Labour camps should be located at neat and clean location with no water logging issues and should be well ventilated with adequate illumination, kitchen and safe drinking water facility • Construction labour camps and site should be properly cleaned 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>and hygiene should be maintained</p> <ul style="list-style-type: none"> • Proper sanitation facility like toilet and bathing facility should be provided at site and labour camps. Wastewater generated from these facilities should be disposed through septic tanks and soak pit • LPG should be provided as fuel for cooking to workers and open burning of fuel should not be allowed • Wastewater from construction site should not be allowed to accumulate at site as standing water may lead to breeding of mosquitoes. Septic tanks/soak pits should be provided for its disposal • Temporary storm water drainage system should also be provided at camp site and construction site so as to drain the storm water and prevent accumulation of storm water at site and thus breeding of mosquitoes/flies • Safety officers should be appointed at site so as to ensure all safety measures are taken at the site • All construction workers should be provided with personal 				



S. No.	Cumulatively Impacted CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>protective equipment like helmet, gloves, gumboots, safety jackets etc. and fines should be imposed if found not wearing</p> <ul style="list-style-type: none"> • Job rotation should be carried out for workers exposed to high noise and dust areas • Activity like smoking and consuming liquor should be prohibited at the site • Awareness on AIDS should be spread among the workers • Traffic manager should be present at the site all the time to manage incoming and outgoing traffic to prevent accidents • Crèche facility should be provided for kids if female workers are employed • Regular inspection for hygiene and safety in labour camps should be done • Provision of cautionary and guiding signage in local and English language indicating the hazard associated with the site & activities. Usage of fluorescent signage, in local language at the construction sites • Speed limit of vehicles should be restricted at site and on haulage roads to prevent any 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>accidents and fines should be imposed on vehicles if same is not maintained. All construction vehicles should follow the designated routes & timings only.</p> <ul style="list-style-type: none"> • Construction vehicle movement should be restricted to non-peak hours, i.e. late evening (7-12:00 pm) only. Villagers should also be given intimation of these timings. • Noise level in the work zone should be maintained and followed as per OSHA norm • Employment should be provided preferable to local & affected people • Dustbins should be provided at labour camps for collection of waste and waste should be regularly disposed through the concerned agency • Arrangement of fire-fighting should be made at site and workers should be trained to use the system in case of fire • Site should be barricaded and should have entry guarded by security guard. Register should be maintained for entry of outsiders. No unauthorized person should be allowed to enter the site especially village 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>children</p> <ul style="list-style-type: none"> • A board should be displayed at entrance of site displaying name of project, area and hazards associated with the site on entrance and activities prohibited within and near site area in local language • All construction vehicles should be regularly serviced and maintained and carry pollution under control certificate • All proposed environmental pollution measures should be taken during construction of phase of terminal to minimize the harm to existing environmental quality of the area, which is being enjoyed by the residents of that area • Maintenance and repair of the village road should be carried out both before and end of construction by contractor. • Sprinkling of water should be carried out in village road also, so as to minimize dust generation due to movement of construction vehicles. • Any CPR, if removed shall be relocated at the earliest with consent of the villagers and the Gram Panchayat to suitable location in consent with the 				



S. No.	Cumulatively Impacted CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>villagers (preferably private land). A community temple would be required to be relocated in case of Sahibganj terminal site</p> <p>Terminal/Jetty/Lock Operation</p> <ul style="list-style-type: none"> • Efforts shall be made to make shoulder of approach road to terminal/lock sites completely clear of vegetation. • Regular maintenance of plantation along the roadside • No invasive plantation near the road. • Traffic control measures, including speed limits should be forced strictly. • Further encroachment of squatters within the ROW will be prevented. • Monitor/ensure that all safety provisions included in design and construction phase are properly maintained • Movement of traffic shall be restricted to designate hours and routes • Adequate illumination should be provided at the site during evening • Existence of spill prevention and control and emergency responsive system with the vessel operators & jetty 				



S. No.	Cumulatively Impacted CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>authority</p> <ul style="list-style-type: none"> • Emergency plan for vehicles carrying hazardous material • Implementation of the environment management plan as proposed to prevent the environmental pollution during operation phase • Safety norms should be followed for all operational phase activities at terminal • Development activities should be carried out in the village and nearby areas of proposed terminal/lock sites for development of area • Fishing activity should not be restricted in the river. Alternate provision for fishermen should be given in case fishing activity is restricted. • Safety training should be given to the terminal staff for managing the floods, earthquake, fire, ship accidents like situation. Emergency collection area should be designated at the site which is safe. All workers should be directed to collect at this area in case of emergency. • Firefighting facility should be provided at site and trained personnel should be available 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>at site who can operate the fire extinguishers and other fire-fighting equipment.</p> <p>Barge Movement</p> <ul style="list-style-type: none"> • Vessel movement shall be restricted or regularise during the identified major festival period as listed under description of Environment chapter 4. • No waste in form shall be discharged by vessel in the river. • Enhancement Measures • Support for establishment of small enclosed areas dedicated for female bathing in every village along the NW-1 to allow female maintain their privacy. • Support for improving cleanliness and at existing Ghats at Varanasi and other locations • Provision for improving select Ghats as per the demand raised during public consultation. • Barge/vessel movement will be restricted to the designate navigation route only. Maintenance of buoys, beacons, signs, gauges to mark the navigation channel • Crew of the vessel carrying especially oil should be 				



S. No.	Cumulatively Impacted CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>competent and experienced so as they can prevent the damage to fishing gears and boats.</p> <ul style="list-style-type: none"> • Marking of navigation channel through beacons and communicating information about the navigation channel monthly to fishermen and the expected timing or frequency of barges to fishing community so as they can be pre-informed and the damage to their boats and gears can be reduced. Barge movement schedule should be prepared in advance and should be shared with the fishermen • Regularizing the barge speed to 7-8 knots in bending areas so as bank erosion can be reduced due to barge movement resulting in lesser turbidity, enhanced planktonic growth and thus increased fish yield. • River training works should be carried out at the bank locations which are prone to erosion to reduce the turbidity in shallow areas and its impact on fish yield. • All measures to reduce the water quality pollution & to prevent damage to ecology due to barge movement as 				



S. No.	Cumulatively Impacted CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>proposed above should be adequately addressed and implemented so as to minimise impact on fish yield due to the project.</p> <ul style="list-style-type: none"> • In case of damage of fishing nets, fishing crafts and other gears of fishers, arising due to barge operation, appropriate and quick compensations may be given to the aggrieved fishers. • The barges may be fitted with powerful searchlight and may sound horn so that fishermen can realize arrival of barge at least from 500 m-1 km away to prevent damage to fishing nets • Regular consultations to be carried out with the fishing communities to get their feedback on the impact due to barge movement on fishing and problems they are facing • Enhancement Measures • Support shall be extended in terms of supporting setting up fish nurseries for improving fish productivity and training awareness of fishermen for better fishing techniques through institute of repute like CIFRI. <p>Maintenance Dredging</p>				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<ul style="list-style-type: none"> Dredging operations should be restricted to day time only, i.e. 6:00 Am-10:00 Pm only to minimize noise impacts on the residents of nearby settlements. Dredgers should be equipped with the noise reduction/masking equipment to reduce the noise generation Dredgers should be placed in consultation with the fishermen so as to minimize the impact on their equipment/gears and their fishing activities Dredging should not be carried out in the areas close to Ghats in Varanasi and buffer of 2 km should be maintained for dredging during time of religious gatherings during Chat and Kumbh festivals. In case contaminated dredged material is disposed on land, then it should be disposed at approved TSDF sites to prevent any harm to community residing in nearby areas. One of such approved TSDF site is located Sagar (Haldia Dock Complex site) Material to be disposed on land may create nuisance odour due to exposure of anaerobic sediments with air. Thus if land 				



S. No.	Cumulatively Impacted CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>disposal is involved than disposal site should not be in upwind direction of any settlement area or sensitive locations like hospitals, schools etc.</p> <ul style="list-style-type: none"> Log book should be maintained for recording the accidents at site/mortality of the any marine mammal should be maintained. Analysis shall be carried out to assess the reason for the accident/mortality and measures should be taken to prevent repetition of the event. Contractors having experience of dredging and well trained staff should only be allowed to carry out dredging. This will help in prevention of spillage of dredged material or any accidents during the dredging operations Dredging plan should be prepared by contractor and submitted to IWAI for approval prior to carrying out dredging operations. Dredging plan should be reviewed considering its location w.r.t environmental sensitive locations/archaeological locations/cultural festival/pollution influx in the area/dredged material quality & 				



S. No.	Cumulatively Impacted CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				<p>texture/available depth etc. as given in this EIA report and through local sources and past experience.</p> <ul style="list-style-type: none"> Contractors should submit method statement & risk assessment plan prior to carrying out any dredging work. Dredger should follow the defined safety procedures to avoid accidents and spills, and IWAI should ensure that other vessel users are provided with adequate information and instruction to avoid conflict with the dredgers. Post-dredging monitoring of the sediment nature, rate of sedimentation shall be made part of contractor's job as best dredging practise. This will provide information which can be taken into consideration before the next maintenance dredge is carried out. Re-use of dredged material should be explored if dredged material is not contaminated. Economically and environmentally feasible options can be adopted to minimize the dredge spoil burdens. Some of such measures include Dredged sediment can be used 				



S. No.	Cumulatively Impacted CERs	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
				for beach nourishment/development of artificial beach/deposition on shoal & thus enrichment of habitat <ul style="list-style-type: none"> ○ Dredged material can be explored for its usage for coast/bank protection purpose/flood protection ○ Use of dredged material can be explored for land filling, as construction material for road foundations, dikes, mounds, noise/wind barriers. 				
12.	Land Use	More change of land use. Diversion of more agricultural and forest land for other uses	Land may be required to be acquired for construction of various proposed civil interventions which will lead to change in land use.	Construction of Terminals/Jetties/Locks & River Training Works <ul style="list-style-type: none"> • Agricultural land shall not be selected for setting up project, construction camps, borrow area (if any), plant site or any other construction purpose • 15 cm of top soil layer shall be stripped off prior to excavation and shall be stored separately in covered condition and used for landscaping purpose or shall be given to farmers in nearby areas, if required by them 	Y	None	IWAI	--
13.	Archaeological Sites	Impacts on Archaeological Sites	No intervention planned close	Construction of Terminals/Jetties/Locks <ul style="list-style-type: none"> • No construction or any 	Y	<ul style="list-style-type: none"> • ASI should carry out regular inspection and maintenance of the sites located within the 300 m of the 	IWAI	--

S. No.	Cumulatively Impact ed CERS	Cumulative Impacts Anticipated (Refer Table 6.4)	Impact of NW-1	Mitigation Measures	Whether addressed in EIA Reports (Y/N)	Enhancement Required (If Yes)	Authorities Responsible	
							Direct	Indirect
		gical sites may continue to occur due to developm ents and the impact may increase if any developm ent related to NW-1 will be undertake n within 300 m of such site	to archaeological sites at present thus minimal impact but may have impact if any activity is undertaken in future	intervention to be done within 300 m of the identified archaeological sites along NW-1 <ul style="list-style-type: none"> • Permission should be obtained from ASI/INTACH, if any such development is to be undertaken 		NW-1		

7.3. Mitigation Measures for Proposed / Planned & Anticipated Developments within Influence Area

Developments within the influence area are being identified and also the impacts due to each of such development are identified. Mitigation measures which are to be taken up by the concerned departments for these developments is prepared so as the cumulative impact in the influence zone can be minimized. These mitigation plans should be shared by IWAI with the concerned departments so as they include these measures in their environment management plan. Mitigation measures are detailed in **Table 7.2** below.

Table 7.2 : Mitigation measures for anticipated developments



S. No.	Proposed / Planned / Anticipated Developments	Mitigation Measures	Environment Management Plan	Authorities Responsible	Monitoring Authorities /Agencies	Role of IWAI
1	EDFC development/IR development & expansion	<ul style="list-style-type: none"> Essentially to carry out environment impact assessment study to assess the impacts of the project on the existing infrastructure and environmental quality during both construction & operation phase To obtain all the environment and safety related approval as per applicability from concerned authorities Site selected should be free from National Parks, Wildlife sanctuary, Reserve forests, Migratory Route of birds etc, if any permission should be taken from NBWL Public consultations should essentially be undertaken Connectivity should be provided to each of the IWAI terminals <p>Mitigation Measures for Management of Land Use, Soil Quality, Soil Erosion & People</p> <ul style="list-style-type: none"> Selection of borrow areas, plant site, construction labour camps and debris disposal site should be carried out carefully so as to avoid agricultural land and distance from habitation and sensitive location should be minimum 1000 m. Closure of borrow area, debris disposal site, plant site and construction labour camp site should be done so as to restore its original state by filling, relaying top soil and carrying out plantation Any land acquired or used should be with consent of land owner and appropriate compensations should be paid to the land owners as per law of land. Shifting of utilities, if any should be done immediately after removal Workers must be trained and made aware to avoid wastage of resources by mishandling, conserve 	<ul style="list-style-type: none"> Environment Management Plan <ul style="list-style-type: none"> Air Quality Management Plan Water Resources Management Plan Noise Level Management Plan Soil Quality & erosion Management Plan Bio-diversity Management Plan Quarry management plan Plant Site/Labour camp Management Plan Borrow Area Management Plan Landscaping Plan Disaster Management Plan Occupational Health & Safety Management Plan Traffic Safety Management Plan 	DFCCIL & Indian Railways, Forest Department	MoEF/SEI AA, State Pollution Control Boards, Forest Department	IWAI should share this plan with the DFCCIL. EDFC within influence zone of CIA near Varanasi section



S. No.	Proposed / Planned / Anticipated Developments	Mitigation Measures	Environment Management Plan	Authorities Responsible	Monitoring Authorities /Agencies	Role of IWAI
		<p>energy by following best practices, handle emergency situations</p> <ul style="list-style-type: none"> • Cautionary and guiding signage should be displayed at site in local language at all required locations like fuel storage area, raw material storage, plant site and entry should be restricted to trained and authorized personnel in risk prone areas • Stone pitching should be carried out in embankments close to water body • Top soil removed should be stored separately and should be re-used for landscaping purpose or should be relayed on the same location after completion of activity • Personal protective equipment should be provided to workers • Safety officer must be deputed to ensure safety of all personnel at the site all the time. Traffic managers should also be deputed to manage the traffic & minimize the accident hazards • First aid facilities including ambulance should be provided at the site. Also tie-ups with local hospital should be done to handle emergency case, if any • Labour camps should be provided with all facilities like drinking water, sanitation, kitchen facility (LPG fuel). Open burning of fuel should be prohibited. Six monthly health check up should be arranged for all workers <p>Mitigation Measures for Air Quality Management</p> <ul style="list-style-type: none"> • Construction material should be sourced from licensed quarry & authorized dealers, nearest to project site • Piling of material and debris at site should be avoided to prevent wastage and air, water and soil pollution 	<ul style="list-style-type: none"> • Environment Monitoring Plan 			



S. No.	Proposed / Planned / Anticipated Developments	Mitigation Measures	Environment Management Plan	Authorities Responsible	Monitoring Authorities /Agencies	Role of IWAI
		<ul style="list-style-type: none"> Dust emissions from the site should be managed by sprinkling water and low sulphur diesel should be used in construction vehicles, equipment & DG sets to minimize the emissions Wheel washing facility should be provided at exit point of construction to minimize the emissions Material Transportation Vehicles should be covered <p>Mitigation Measures for Water Resources & Drainage Management</p> <ul style="list-style-type: none"> Construction site should be kept clean and debris should be removed regularly from the site Storm water from construction site should be managed by providing garland drains, sediment traps etc. to protect the surface water bodies from pollution Cross drainage structures like balancing culverts should be provided to maintain natural drainage patter. Stone pitching should be provided for slope stabilization near water bodies Waste management should be carried out at site. Different color bins should be provided to collect different type of waste. Recyclable waste should be sold off to authorized dealers and the remaining waste should be sent for land filling to sites identified by Municipal Corporation or to the site identified & approved by client for debris disposal. No waste should be disposed off in any water body Any hazardous waste, if generated should be stored and disposed off as per Hazardous Waste (Management, handling & Trans-boundary) Rules, 2008 Wastewater from site should be managed by providing the septic tanks & soak pits. Construction wastewater should be collected and should be re- 				



S. No.	Proposed / Planned / Anticipated Developments	Mitigation Measures	Environment Management Plan	Authorities Responsible	Monitoring Authorities /Agencies	Role of IWAI
		<p>used for curing purpose & wheel washing</p> <ul style="list-style-type: none"> • Curing should be carried out by spraying to conserve water. • Fuel storage and hazardous waste storage area should be located in isolated location and on paved surfaces • Oil interceptor will be provided for accidental spill of oil and diesel • All washing and maintenance effluent from the workshop area of vehicle maintenance area should drain to separate collection areas fitted with oil and grease trap and de- siltation chamber. The treated water shall be used for dust suppression and green belt development. This water shall not be discharged to river at all. <p>Mitigation Measures for Noise Level & Vibration Management</p> <ul style="list-style-type: none"> • Temporary noise barriers should be provided at the locations where high levels of noise may generate. Construction activities should not be carried out during night time • Construction machinery should comply with standards prescribed by CPCB and should be regularly maintained and serviced. • Construction equipment & DG sets should be enclosed in acoustic enclosure • Noise barrier should be provided in the locations close to sensitive receptors like school & hospital during operation phase • Vibrations should be regulated by incorporating adequate design measures <p>Mitigation Measures for Bio-Diversity Management</p> <ul style="list-style-type: none"> • Alignment should be such selected to minimize the tree cutting 				



S. No.	Proposed / Planned / Anticipated Developments	Mitigation Measures	Environment Management Plan	Authorities Responsible	Monitoring Authorities /Agencies	Role of IWAI
		<ul style="list-style-type: none"> Compensatory plantation should be carried out in ratio of 1:2 minimum with assistance of forest area. 				
2	Road Development	<ul style="list-style-type: none"> Essentially to carry out environment impact assessment study to assess the impacts of the project on the existing infrastructure and environmental quality during both construction & operation phase To obtain all the environment and safety related approval as per applicability from concerned authorities Site selected should be free from National Parks, Wildlife sanctuary, Reserve forests, Migratory Route of birds etc, if any necessary permission from NBWL to be taken as per rules Analysis of alternative alignment should be carried out to minimize impact on environment & society Public consultations should essentially be undertaken Road connectivity should be provided to all the terminal/jetty locations <p>Mitigation Measures for Management of Land Use, Soil Quality, Soil Erosion & People</p> <ul style="list-style-type: none"> Selection of borrow areas, plant site, construction labour camps and debris disposal site should be carried out carefully so as to avoid agricultural land and distance from habitation and sensitive location should be minimum 1000 m. Closure of borrow area, debris disposal site, plant site and construction labour camp site should be done so as to restore its original state by filling, relaying top soil and carrying out plantation Any land acquired or used should be with consent of land owner and appropriate compensations should be paid to the land owners as per law of land. 	<ul style="list-style-type: none"> Environment Management Plan <ul style="list-style-type: none"> Air Quality Management Plan Water Resources Management Plan Noise Level Management Plan Soil Quality & erosion Management Plan Bio-diversity Management Plan Quarry management plan Plant Site/Labour camp Management Plan Borrow Area Management Plan Landscaping Plan Disaster Management Plan Occupational Health & Safety Management Plan 	National Highways Authority of India / Central Public Works Department / MoEF, State Public Works Department , Forest Department	MoEF/SEI AA/Department of Environment, State Pollution Control Boards, Forest Department	IWAI should share this plan with the Road development authorities. IWAI should consult with road development authorities for expansion and maintenance of approach and haulage road time to time.



S. No.	Proposed / Planned / Anticipated Developments	Mitigation Measures	Environment Management Plan	Authorities Responsible	Monitoring Authorities /Agencies	Role of IWAI
		<ul style="list-style-type: none"> Shifting of utilities, if any should be done immediately after removal Workers must be trained and made aware to avoid wastage of resources by mishandling, conserve energy by following best practices, handle emergency situations Cautionary and guiding signage should be displayed at site in local language at all required locations like fuel storage area, raw material storage, plant site and entry should be restricted to trained and authorized personnel in risk prone areas Stone pitching should be carried out in embankments close to water body Top soil removed should be stored separately and should be re-used for landscaping purpose or should be relayed on the same location after completion of activity Personal protective equipment should be provided to workers Safety officer must be deputed to ensure safety of all personnel at the site all the time. Traffic managers should also be deputed to manage the traffic & minimize the accident hazards First aid facilities including ambulance should be provided at the site. Also tie-ups with local hospital should be done to handle emergency case, if any Labour camps should be provided with all facilities like drinking water, sanitation, kitchen facility (LPG fuel). Open burning of fuel should be prohibited. Six monthly health check up should be arranged for all workers <p>Mitigation Measures for Air Quality Management</p> <ul style="list-style-type: none"> Construction material should be sourced from licensed quarry & authorized dealers, nearest to 	<ul style="list-style-type: none"> Traffic Safety Management Plan Environment Monitoring Plan 			



S. No.	Proposed / Planned / Anticipated Developments	Mitigation Measures	Environment Management Plan	Authorities Responsible	Monitoring Authorities /Agencies	Role of IWAI
		<p>project site</p> <ul style="list-style-type: none"> • Piling of material and debris at site should be avoided to prevent wastage and air, water and soil pollution • Dust emissions from the site should be managed by sprinkling water and low sulphur diesel should be used in construction vehicles, equipment & DG sets to minimize the emissions • Wheel washing facility should be provided at exit point of construction to minimize the emissions • Material Transportation Vehicles should be covered <p>Mitigation Measures for Water Resources & Drainage Management</p> <ul style="list-style-type: none"> • Construction site should be kept clean and debris should be removed regularly from the site • Storm water from construction site should be managed by providing garland drains, sediment traps etc. to protect the surface water bodies from pollution • Cross drainage structures like balancing culverts should be provided to maintain natural drainage patter. Stone pitching should be provided for slope stabilization near water bodies • Waste management should be carried out at site. Different color bins should be provided to collect different type of waste. Recyclable waste should be sold off to authorized dealers and the remaining waste should be sent for landfilling to sites identified by Municipal Corporation or to the site identified & approved by client for debris disposal. No waste should be disposed off in any water body • Any hazardous waste, if generated should be stored and disposed off as per Hazardous Waste (Management, handling & Trans-boundary) Rules, 				



S. No.	Proposed / Planned / Anticipated Developments	Mitigation Measures	Environment Management Plan	Authorities Responsible	Monitoring Authorities /Agencies	Role of IWAI
		<p>2008</p> <ul style="list-style-type: none"> Wastewater from site should be managed by providing the septic tanks & soak pits. Construction wastewater should be collected and should be re-used for curing purpose & wheel washing Curing should be carried out by spraying to conserve water. Fuel storage and hazardous waste storage area should be located in isolated location and on paved surfaces Oil interceptor will be provided for accidental spill of oil and diesel All washing and maintenance effluent from the workshop area of vehicle maintenance area should drain to separate collection areas fitted with oil and grease trap and de- siltation chamber. The treated water shall be used for dust suppression and green belt development. This water shall not be discharged to river at all. <p>Mitigation Measures for Noise Level Management</p> <ul style="list-style-type: none"> Temporary noise barriers should be provided at the locations where high levels of noise may generate. Construction activities should not be carried out during night time Construction machinery should comply with standards prescribed by CPCB and should be regularly maintained and serviced. Construction equipment & DG sets should be enclosed in acoustic enclosure Noise barrier should be provided in the locations close to sensitive receptors like school & hospital during operation phase <p>Mitigation Measures for Bio-Diversity Management</p> <ul style="list-style-type: none"> Alignment should be such selected to minimize the 				



S. No.	Proposed / Planned / Anticipated Developments	Mitigation Measures	Environment Management Plan	Authorities Responsible	Monitoring Authorities /Agencies	Role of IWAI
		tree cutting <ul style="list-style-type: none"> Compensatory plantation should be carried out in ratio of 1:2 minimum with assistance of forest area. Avenue plantation should be carried out in the Haulage roads and roads to the terminal 				
3	Industrial Area/SEZ/Growth Centers/Focal Points Development	<ul style="list-style-type: none"> Environmental impacts of the project should assess in detail and environment clearance should be obtained, if applicable To obtain all the environment and safety related approval as per applicability from concerned authorities Structural approval for the buildings should be obtained as applied in NBC, 2005 Site selected should be free from National Parks, Wildlife sanctuary, Reserve forests, Migratory Route of birds etc, if any necessary permission from NBWL to be taken as per rules Analysis of alternative alignment should be carried out to minimize impact on environment & society Public consultations should essentially be undertaken <p>Mitigation Measures for Management of Land Use, Soil Quality, Soil Erosion & People</p> <ul style="list-style-type: none"> All industries should taken CLU, if required a Any land acquired or used should be with consent of land owner and appropriate compensations should be paid to the land owners as per law of land. Shifting of utilities, if any should be done immediately after removal Workers must be trained and made aware to avoid wastage of resources by mishandling, conserve energy by following best practices, handle emergency situations 	<ul style="list-style-type: none"> Environment Management Plan <ul style="list-style-type: none"> Air Quality Management Plan Water Resources Management Plan Noise Level Management Plan Soil Quality & erosion Management Plan Bio-diversity Management Plan Plant Site/Labour camp Management Plan Landscaping Plan Disaster Management Plan Occupational Health & Safety Management Plan Traffic Safety 	Ministry of Commerce & Industry, State Industrial Development Corporation , Forest Department	MoEF, SEIAA, State Pollution Control Boards, Forest Department	IWAI should share this plan with the Industrial Departments and should recommend industrial departments to make these conditions bindings for the major industries which will come up within the influence area of CIA



S. No.	Proposed / Planned / Anticipated Developments	Mitigation Measures	Environment Management Plan	Authorities Responsible	Monitoring Authorities /Agencies	Role of IWAI
		<ul style="list-style-type: none"> Cautionary and guiding signage should be displayed at site in local language at all required locations like fuel storage area, raw material storage, plant site and entry should be restricted to trained and authorized personnel in risk prone areas Top soil removed should be stored separately and should be re-used for landscaping purpose or should be relayed on the same location after completion of activity Personal protective equipment should be provided to workers Safety officer must be deputed to ensure safety of all personnel at the site all the time. Traffic managers should also be deputed to manage the traffic & minimize the accident hazards First aid facilities including ambulance should be provided at the site. Also tie-ups with local hospital should be done to handle emergency case, if any Labour camps should be provided with all facilities like drinking water, sanitation, kitchen facility (LPG fuel). Open burning of fuel should be prohibited. Six monthly health check up should be arranged for all workers <p>Mitigation Measures for Air Quality Management</p> <ul style="list-style-type: none"> Construction material should be sourced from licensed quarry & authorized dealers, nearest to project site Piling of material and debris at site should be avoided to prevent wastage and air, water and soil pollution Dust emissions from the site should be managed by sprinkling water and low sulphur diesel should be used in construction vehicles, equipment & DG sets to minimize the emissions 	<p>Management Plan</p> <ul style="list-style-type: none"> Environment Monitoring Plan 			



S. No.	Proposed / Planned / Anticipated Developments	Mitigation Measures	Environment Management Plan	Authorities Responsible	Monitoring Authorities /Agencies	Role of IWAI
		<ul style="list-style-type: none"> Wheel washing facility should be provided at exit point of construction to minimize the emissions Material Transportation Vehicles should be covered <p>All industries coming up in influence area should manage their emission levels</p> <p>Mitigation Measures for Water Resources & Drainage Management</p> <ul style="list-style-type: none"> Construction site should be kept clean and debris should be removed regularly from the site Storm water from construction site should be managed by providing garland drains, sediment traps etc. to protect the surface water bodies from pollution Cross drainage structures like balancing culverts should be provided to maintain natural drainage patter. Stone pitching should be provided for slope stabilization near water bodies Waste management should be carried out at site. Different color bins should be provided to collect different type of waste. Recyclable waste should be sold off to authorized dealers; compostable waste should be composted within the site. Reacted waste will go for landfilling Any hazardous waste, if generated should be stored and disposed off as per Hazardous Waste (Management, handling & Trans-boundary) Rules, 2008 Wastewater from site should be managed by providing the septic tanks & soak pits. Construction wastewater should be collected and should be re-used for curing purpose & wheel washing Curing should be carried out by spraying to conserve water. Fuel storage and hazardous waste storage area 				



S. No.	Proposed / Planned / Anticipated Developments	Mitigation Measures	Environment Management Plan	Authorities Responsible	Monitoring Authorities /Agencies	Role of IWAI
		<p>should be located in isolated location and on paved surfaces</p> <ul style="list-style-type: none"> Oil interceptor will be provided for accidental spill of oil and diesel All washing and maintenance effluent from the workshop area of vehicle maintenance area should drain to separate collection areas fitted with oil and grease trap and de- siltation chamber. The treated water shall be used for dust suppression and green belt development. This water shall not be discharged to river at all. <p>All industries shall install their own STP & ETP to treat effluent generated.</p> <p>Mitigation Measures for Noise Level Management</p> <ul style="list-style-type: none"> Temporary noise barriers should be provided at the locations where high levels of noise may generate. Construction activities should not be carried out during night time Construction machinery should comply with standards prescribed by CPCB and should be regularly maintained and serviced. Construction equipment & DG sets should be enclosed in acoustic enclosure Noise barrier should be provided in the locations close to sensitive receptors like school & hospital during operation phase All industries should manage the noise levels from their units as per CPCB standards <p>Mitigation Measures for Bio-Diversity Management</p> <ul style="list-style-type: none"> Alignment should be such selected to minimize the tree cutting Compensatory plantation should be carried out in ration of 1:2 minimum with assistance of forest area, if any tree cutting involve. 				



S. No.	Proposed / Planned / Anticipated Developments	Mitigation Measures	Environment Management Plan	Authorities Responsible	Monitoring Authorities / Agencies	Role of IWAI
4	Urbanization/Urban Agglomeration/Mega Projects/Townships/River Front Development Projects	<ul style="list-style-type: none"> Environmental impacts of the project should assess in detail and environment clearance should be obtained, if applicable To obtain all the environment and safety related approval as per applicability from concerned authorities Structural approval for the buildings should be obtained as applied in NBC, 2005 Site selected should be free from National Parks, Wildlife sanctuary, Reserve forests, Migratory Route of birds etc, if any necessary permission from NBWL to be taken as per rules Analysis of alternative alignment should be carried out to minimize impact on environment & society Public consultations should essentially be undertaken <p>Mitigation Measures for Management of Land Use, Soil Quality, Soil Erosion & People</p> <ul style="list-style-type: none"> Any land acquired or used should be with consent of land owner and appropriate compensations should be paid to the land owners as per law of land. Shifting of utilities, if any should be done immediately after removal Workers must be trained and made aware to avoid wastage of resources by mishandling, conserve energy by following best practices, handle emergency situations Cautionary and guiding signage should be displayed at site in local language at all required locations like fuel storage area, raw material storage, plant site and entry should be restricted to trained and authorized personnel in risk prone areas Stone pitching should be carried out in embankments close to water body 	<ul style="list-style-type: none"> Environment Management Plan <ul style="list-style-type: none"> Air Quality Management Plan Water Resources Management Plan Noise Level Management Plan Soil Quality & erosion Management Plan Bio-diversity Management Plan Plant Site/Labour camp Management Plan Landscaping Plan Disaster Management Plan Occupational Health & Safety Management Plan Traffic Safety Management Plan Environment Monitoring Plan 	Ministry of Urban Developments / Municipal Corporations / Municipality / State Urban Development Authorities /	MoEF, SEIAA, State Pollution Control Boards, Forest Department	IWAI should share these plan with all concerned departments



S. No.	Proposed / Planned / Anticipated Developments	Mitigation Measures	Environment Management Plan	Authorities Responsible	Monitoring Authorities /Agencies	Role of IWAI
		<ul style="list-style-type: none"> Top soil removed should be stored separately and should be re-used for landscaping purpose or should be relayed on the same location after completion of activity Personal protective equipment should be provided to workers Safety officer must be deputed to ensure safety of all personnel at the site all the time. Traffic managers should also be deputed to manage the traffic & minimize the accident hazards First aid facilities including ambulance should be provided at the site. Also tie-ups with local hospital should be done to handle emergency case, if any Labour camps should be provided with all facilities like drinking water, sanitation, kitchen facility (LPG fuel). Open burning of fuel should be prohibited. Six monthly health check up should be arranged for all workers <p>Mitigation Measures for Air Quality Management</p> <ul style="list-style-type: none"> Construction material should be sourced from licensed quarry & authorized dealers, nearest to project site Piling of material and debris at site should be avoided to prevent wastage and air, water and soil pollution Dust emissions from the site should be managed by sprinkling water and low sulphur diesel should be used in construction vehicles, equipment & DG sets to minimize the emissions Wheel washing facility should be provided at exit point of construction to minimize the emissions Material Transportation Vehicles should be covered <p>Mitigation Measures for Water Resources & Drainage Management</p>				



S. No.	Proposed / Planned / Anticipated Developments	Mitigation Measures	Environment Management Plan	Authorities Responsible	Monitoring Authorities /Agencies	Role of IWAI
		<ul style="list-style-type: none"> Construction site should be kept clean and debris should be removed regularly from the site Storm water from construction site should be managed by providing garland drains, sediment traps etc. to protect the surface water bodies from pollution. Storm water during operation should be harvested and re-used/recharged to ground Cross drainage structures like balancing culverts should be provided to maintain natural drainage patter. Stone pitching should be provided for slope stabilization near water bodies Waste management should be carried out at site. Different color bins should be provided to collect different type of waste. Recyclable waste should be sold off to authorized dealers; compostable waste should be composted within the site. Reacted waste will go for landfilling Any hazardous waste, if generated should be stored and disposed off as per Hazardous Waste (Management, handling & Trans-boundary) Rules, 2008 Wastewater from site should be managed by providing the septic tanks & soak pits. Construction wastewater should be collected and should be re-used for curing purpose & wheel washing Curing should be carried out by spraying to conserve water. Fuel storage and hazardous waste storage area should be located in isolated location and on paved surfaces Oil interceptor will be provided for accidental spill of oil and diesel All washing and maintenance effluent from the workshop area of vehicle maintenance area should 				



S. No.	Proposed / Planned / Anticipated Developments	Mitigation Measures	Environment Management Plan	Authorities Responsible	Monitoring Authorities /Agencies	Role of IWAI
		<p>drain to separate collection areas fitted with oil and grease trap and de- siltation chamber. The treated water shall be used for dust suppression and green belt development. This water shall not be discharged to river at all.</p> <p>Mitigation Measures for Noise Level Management</p> <ul style="list-style-type: none"> • Temporary noise barriers should be provided at the locations where high levels of noise may generate. Construction activities should not be carried out during night time • Construction machinery should comply with standards prescribed by CPCB and should be regularly maintained and serviced. • Construction equipment & DG sets should be enclosed in acoustic enclosure • Noise barrier should be provided in the locations close to sensitive receptors like school & hospital during operation phase <p>Mitigation Measures for Bio-Diversity Management</p> <ul style="list-style-type: none"> • Alignment should be such selected to minimize the tree cutting • Compensatory plantation should be carried out in ratio of 1:2 minimum with assistance of forest area, if any tree cutting involve. 				
5	Irrigation Schemes/Dams	<ul style="list-style-type: none"> • Carry out detailed environmental impact assessment study, biological assessment study and obtain environmental clearance form the concerned departments • Structures used for withdrawal of water should not pose threat to navigation <p>Mitigation Measures for Management of Land Use, Soil Quality, Soil Erosion & People</p> <ul style="list-style-type: none"> • Soil quality in the area should be managed by restricting usage of chemical based fertilizers and 	<ul style="list-style-type: none"> • Water Resources/Flow Management Plan • Water Quality Management Plan • Soil Quality Management Plan 	Irrigation Department and Water Resources Department	MoEF, SEIAA, State Pollution Control Boards, Forest Department	IWAI should share these plan with all concerned departments. Any such scheme may have impact on available water flow in the area. Existing



S. No.	Proposed / Planned / Anticipated Developments	Mitigation Measures	Environment Management Plan	Authorities Responsible	Monitoring Authorities /Agencies	Role of IWAI
		<p>pesticides</p> <ul style="list-style-type: none"> • Soil erosion prevention measures should be taken in the area to prevent loss of productive top soil <p>Mitigation Measures for Water Resources & Drainage Management</p> <ul style="list-style-type: none"> • Drip irrigation/sprinkle irrigation measures should be taken up or irrigation and conservation of water • Drainage in area should be maintained by provision of adequate cross drainage structure • Water logging should be prevented by provision of injection wells or drainage of logged water • Surface & ground water pollution should be prevented by preventing usage of chemical fertilizers or pesticides <p>Mitigation Measures for Noise Level Management</p> <ul style="list-style-type: none"> • Pumps used should be provided with noise mufflers and vibration dampeners 				Bhagmari siphon is one of the navigational hazard in NW-1

7.4. Environment Management Plan

As per suggestions made in Table 7.1, IWAI should incorporate suggestive enhancement measures in their EMPs and should ensure all these suggestive measures are being complied with. The report should be uploaded on IWAI website so as any new developer or state authorities can know the status of the CERs in the influence area and can plan the development accordingly. As per suggestion made in Table 7.2, environment management plan should be prepared for each development by respective responsible authority. Suggested environment management plans given above will help the agencies to include the cumulative impact in their mind while finalizing the mitigation plans

7.5. Environment Monitoring Plan

Environmental monitoring is essential component of environment management plan as it provides the status of the CERs which helps in assessing the effectiveness of the EMPs proposed. Environment management plan for assessing the quality of CERs along the NW-1 stretch is given in **Table 7.3** below. In addition to this CERs are being monitored continuously by other departments like Pollution Control Boards, Census Department, Industrial Departments, forest Departments and status of the CERs is available in their respective websites

Table 7.3 : Monitoring plan

S. No	Aspect	Parameters to be monitored	No of sampling locations & frequency	Standard methods for sampling and analysis	Role & Responsibility	
					Implementation	Supervision
Construction Period						
1.	Air Quality (Ambient & Stack)-terminal, lock & jetty sites	PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , CO	Three Locations up wind and downwind direction including project site. Once in 3 months	<ul style="list-style-type: none">• Fine Particulate Samplers for PM_{2.5}• Respirable Dust Sampler for PM₁₀fitted with Gaseous sampling arrangements for SO₂ and NO_x,• CO analyser;	Contractor	IWAI & PMC
2.	Surface Water Quality-terminal, lock & jetty sites	Physical, chemical and biological	River u/s & d/s of the proposed facility Once a month	Grab sampling and analysis by using standard methods	Contractor	IWAI & PMC
3.	Drinking water Quality-terminal,	Physical, chemical and biological	Drinking water for labour camps	Grab sampling and analysis by using standard methods	Contractor	IWAI & PMC



S. No.	Aspect	Parameters to be monitored	No of sampling locations & frequency	Standard methods for sampling and analysis	Role & Responsibility	
					Implementation	Supervision
	lock & jetty sites		Once a month			
4.	Noise Level-terminal, lock & jetty sites	Day time and night time noise level (max, min & Leq levels)	Construction labour camp, construction site and nearest habitation Once a month	Noise meter	Contractor	IWAI & PMC
5.	Soil Quality - terminal, lock & jetty sites	Soil texture, type, Electrical conductivity, pH, infiltration, porosity, etc.,	Construction site, labour camps and debris disposal site Once in 6 months	Collection and analysis of samples as per IS 2720	Contractor	IWAI & PMC
6.	River Bed Sediment-terminal, lock, jetty sites	Texture, type, Electrical conductivity, pH, infiltration, porosity, etc., and biological compounds	River bed near sites of terminals/locks/jetty Once in 6 months	Collection and analysis of samples as per IS 2720	Contractor	IWAI & PMC
7.	Green Belt-terminal & lock site (jetty site if green belt developed)	Plantation survival rate	Green belt area at site-periphery of site and along roads Once in year	Survey, counting, recording & reporting	Contractor	IWAI & PMC
8.	Soil Erosion-terminal/lock & jetty site, site for river bed and bank protection and sites of river training structures development	---	Upstream & downstream of civil intervention sites and sites of river bank protection/river training works Six monthly	Survey & observation; Extent and degree of erosion; Structures for controlling soil erosion	Contractor	IWAI & PMC



S. No.	Aspect	Parameters to be monitored	No of sampling locations & frequency	Standard methods for sampling and analysis	Role & Responsibility	
					Implementation	Supervision
9.	Aquatic ecology-terminal/lock & jetty site, site for river bed and bank protection and sites of river training structures development	Phytoplankton, Zooplankton and species diversity index	U/s and d/s of the civil intervention sites and location of river training works/bank protection works Six monthly	Plankton net of diameter of 0.35 m, No.25 mesh size 63 and analysis by using standard methods.	Contractor	IWAI & PMC
10.	Integrity of embankment-locations of existing & newly constructed embankments along NW-1	---	locations of existing & sites of proposed sites for embankments construction along NW-1	Survey & observation; Extent and degree of erosion; Structures for controlling soil erosion	Contractor	IWAI & PMC
Operation Phase						
1.	Air Quality (Ambient & Stack)-terminal, lock & jetty sites	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ , HC and CO	Three Locations up wind and downwind direction including project site. Once in 6 months	<ul style="list-style-type: none"> Fine Particulate Samplers for PM_{2.5} Respirable Dust Sampler for PM₁₀ fitted with Gaseous sampling arrangements for SO₂ and NO_x CO analyser 	NABL accredited Lab to be contracted by IWAI	IWAI
2.	Surface Water Quality-terminal, lock & jetty sites	Physical, chemical and biological	River u/s & d/s of the proposed facility Once in quarter	Grab sampling and analysis by using standard methods	NABL accredited Lab to be contracted by IWAI	IWAI
3.	Drinking water Quality-	Physical, chemical and biological	Drinking water for staff	Grab sampling and analysis by using standard	NABL accredited Lab to	IWAI



S. No.	Aspect	Parameters to be monitored	No of sampling locations & frequency	Standard methods for sampling and analysis	Role & Responsibility	
					Implementation	Supervision
	terminal, lock & jetty site		Once a quarter	methods	be contracted by IWAI	
4.	Noise Level-terminal, lock & jetty sites	Day time and night time noise level (max, min & Leq levels)	Two locations: Project site & nearest habitation - Once in quarter	Noise meter	NABL accredited Lab to be contracted by IWAI	IWAI
5.	Wastewater Management - terminals	Physical, chemical and biological of sewage and STP treated water	Terminal site, testing of sewage and STP treated water Once in quarter	--	NABL accredited Lab to be contracted by IWAI	IWAI
6.	Plantation-terminal & lock site (jetty site if green belt developed)	Plantation survival rate of 70%	Maintenance and survival loss of existing - Once in year	Survey, counting, recording & reporting	IWAI	IWAI
7.	Soil Erosion-terminal/lock & jetty site, site for river bed and bank protection and sites of river training structures development	---	Upstream & downstream of civil intervention sites and sites of river bank protection/river training works Six monthly	Survey & observation; Extent and degree of erosion; Structures for controlling soil erosion	IWAI	IWAI
8.	Aquatic ecology-terminal/lock & jetty site, site for river bed and bank protection and sites of	Phytoplankton, Zooplankton and species diversity	U/s and d/s of the civil intervention sites and location of river training works/bank protection works	Plankton net of diameter of 0.35 m, No.25 mesh size 63 and analysis by using standard methods.	IWAI	IWAI

S. No.	Aspect	Parameters to be monitored	No of sampling locations & frequency	Standard methods for sampling and analysis	Role & Responsibility	
					Implementation	Supervision
	river training structures development		Six monthly			
9.	River Bed Sediments-terminal, lock, jetty sites	Physio-Chemical Parameters	River bed near sites of terminals/locks/jetty Once in 6 months	Depth Sampler	IWAI	IWAI
10.	Integrity of embankment-locations of existing & newly constructed embankments along NW-1	---	locations of existing & newly constructed embankments along NW-1	Survey & observation; Extent and degree of erosion; Structures for controlling soil erosion	IWAI	IWAI

7.6. Organizational Framework

For effective implementation of the proposed environmental management plan, it is necessary to have permanent organizational set up charged with the task of ensuring effective implementation of EMP and to monitor the implementation efficiency. IWAI has set up a project management unit which is staffed with environmental and social specialists. These specialists would work as an environment and social cell (ESC) within PMU. It is proposed that each field unit will have one designated officer responsible for environment and social aspects who will also coordinate with ESC. Also this cell will keep track of the developments happening within the influence area by maintaining regular contact with the above identified developmental authorities in the area. Regular contact can be maintained through meetings, workshops, seminars and brochure distribution. The major responsibilities of IWAI and of ESC would be:

- To implement the environmental management plan
- To assure regulatory compliance with all relevant rules and regulations
- To ensure regular operation and maintenance of pollution control devices
- To minimize environmental impacts of operations as by strict adherence to the EMP
- To initiate environmental monitoring as per approved schedule
- Review and interpretation of monitoring as per approved schedule
- Review and interpretation of monitoring results and corrective measures in case monitored results are above the specified limit

- Maintain documentation of good environmental practices and applicable environmental laws as ready reference
- Maintain environmental related records
- Coordination with regulatory agencies, external consultant, monitoring laboratories
- Maintain log of public complain and the action taken
- Efforts shall be made for setting up of common conservation cell consisting of one marine biologist, and ecologist, a sociologist and a fishery expert
- To communicate and share this environment management plan with all the identified stakeholders within the influence zone of the CIA through meetings, workshops, seminar, brochures etc

The ESC should have all basic record keeping facilities such as hard ware/software facilities, adequate space, vehicle (transport) and basic furniture and all simple instruments such as GPS, Digital camera, Hand held noise metre etc. The cell should have all basic environmental management data of the project that includes but not limited to the following:

- Environmental Impact Assessment Report (both well preserved soft and hard copy) and Environmental Management Plan
- All valid and up to date regulatory permits and consent papers
- All latest Environmental legislations, policies, codes and manuals for ready references
- A list of consultants on environmental management need to be kept with yearly revision of the list. This will help to receive proper advice in case of an emergency or are requirement and also to implement day to day environmental management activities.

Over a period of time a system to understand and absorb the new revisions and changes in the environmental requirements and practices are to be established. This can only be achieved by regular training and genuine capacity building initiatives. IWAI shall also ensure availability of adequate resources. Institutional framework for the project is given in **Figure 7.1**.

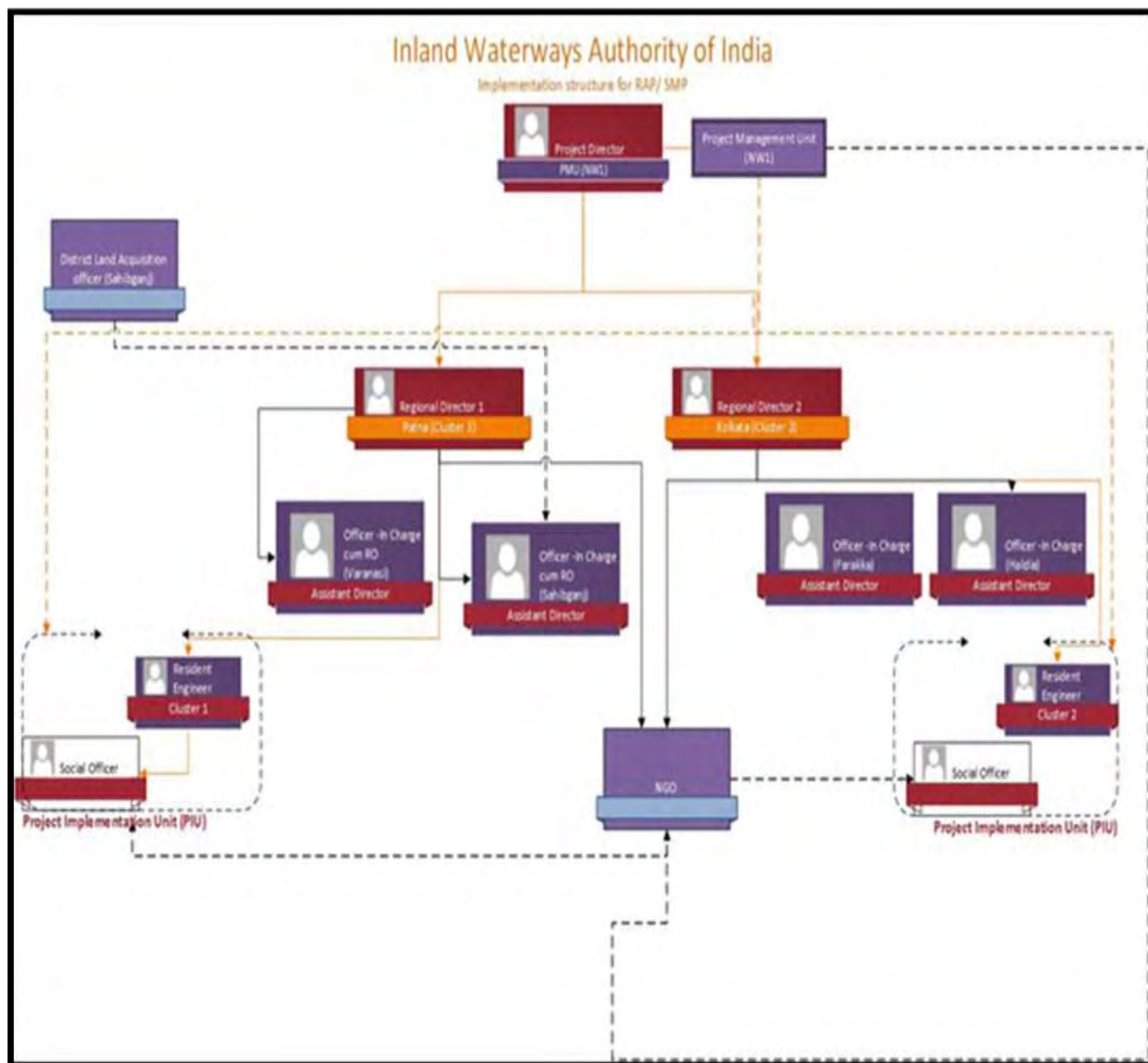


Figure 7.1 : Institutional Framework of IWAI

7.7. Environmental Health & Safety Policy and EHS Management System

An effective environmental health and safety policy is essentially required to be prepared for the project and it should be communicated to the workforce through displaying posters/bill boards/posters/glow boards and campaigning around the work site. Posters should be in Hindi, English & Regional language so as it can be understood by the workforce. Verbal communication through campaigning also should be carried out. Some of the important days such as Environment Day (June 5), Red Cross Month (March), Emergency Preparedness Week (May 1-7), National safety day (4th April), National Health Day (7th April), Fire safety

day (14th April), 20th April (Earth day) can be planned for spreading the awareness for Environment Protection, Cleanliness and safety among work force through campaigning.

For effective and systematic implementation of the project, it is desirable that IWAI (The EA) develops its Environmental and Social management systems which are auditable and effectively enforceable. Parallel can be drawn from the experience of National Highway Authority of India or Delhi Metro Rail Corporation and adopt EHS system on the similar lines. Each contractor should be contractually bound to follow such system and must have EHS management system in line with EA's management system. IWAI should also develop its standard technical guidelines for Environmental Assessment, Management and Reporting

7.8. Mechanism for Feedback and Adjustments

As part of the feedback mechanism, the ESC of PMU shall monitor project compliance based on monitoring reports, audit and inspection reports with respect EMP, EMoP and applicable laws, rules and regulations. ESC will report to PD quarterly. In case, any deviation from the contract requirements with respect to proposed EMP is observed, the same shall be corrected within a fortnight through contractor and PMC and records maintained for the same. ESC will also verify the facts reports through periodic site visits.

Public involvement shall be encouraged and ensured throughout the lifecycle of the project. The ESC shall gather and maintain information on any damage or public concern that may be raised by the local people, NGOs and local authorities. While immediate solutions are to be worked out with the help of contractor, a detailed report will be submitted to the PMU and PD for information or detailed consideration, as the case may be. The PMC and ESC will be responsible to bring it to the notice of the PMU and PD. Resulting decisions shall be communicated back to PMC and contractor for correction and future implementation.

7.9. Grievance Redress Mechanism

The concern/grievances from local/affected people/developmental authorities/pollution control boards/other identified agencies in above sections of the chapter may come up related to inappropriate implementation of various components of EMP. These issues required to be addressed through acknowledgement, evaluation and corrective action and response approach. To resolve grievance from public and other concerned departments a grievance redressal cell is required to be formulated. The cell should be headed by the PMU/Director concerned. Firstly, it should be assessed if the grievances are genuine or suggestion is acceptable through site visits, surveys and consultations immediately after the receipt of grievance. Accordingly, response should be given within 15-30 days by the PMU in consultation with PMC and Director concerned. In case the PMU is unable to resolve the issue, the matter should be forwarded to Project Director at Head Quarter. The corrective action should be started as per the response or action plan indicated to the stakeholder. The outcome shall also form part of quarterly report to World Bank (**Figure 7.2**). Six monthly meetings with the public and other concerned agencies can also facilitate in identification of grievance and other environmental and social issues within the influence zone.

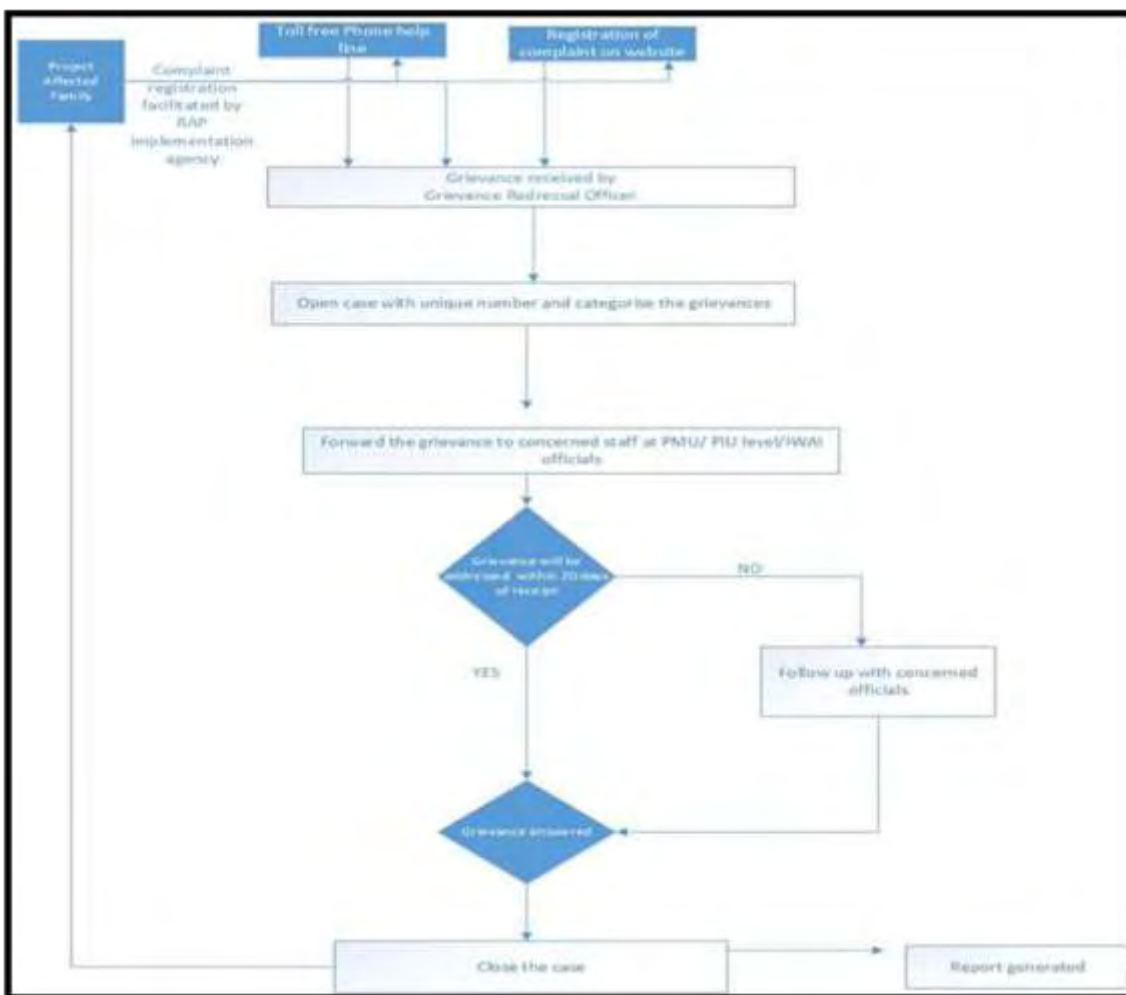


Figure 7.2 : Grievance Redressal Cell

7.10. Conclusion & Recommendations

Environment management plan is prepared for the identified cumulative impacts. IWAI can take up the mitigation measures and remediation measures for controlling the impact on CERs in influence area, however an extended role of IWAI is suggested in this plan so as to manage the cumulative impacts in the influence area. IWAI has an operational and effective institutional framework which will implement the environment management plan as suggested for Jal Marg Vikas Project during all the stages. It is recommended through this plan that IWAI should additionally take up the task of interaction with the ULBs, DAs, PCBs, Industrial Departments, EDFC, Road Development Authorities, NHA and other concerned department six monthly so as to know their developmental plans, to assess effect of their plans on NW-1 and sharing the suggestive environment management and impact mitigation plan for respective development prepared in this document. This practise can regulate the cumulative impacts to some extent and may help in mitigation of the impacts.



Annexures

Annexure 4.1: List of the stakeholders invited for the consultation meeting at Farakka Lock and Sahibganj Terminal

List of Stakeholders for Farakka Lock

S. No.	Name	Designation	Department	Mobile No.
1	Mrs. Moonmoon Roy	Panchayat Pradhan	Bewa Gram Panchayat	8820194794
2	Mr. Jaihid Hussain	Director	Farakka Welfare Society(NGO)	9732807273
3	Santunu Dutta	Land revenue inspector	Farakka LRO	9851970202
4	Kesang Dhendup Bhutia	BDO & Block Executive Officer	BDO, Farakka	9434770026
5	Mr. Prasun K Dhara	BLRO	Farakka BLRO	9474308250
6	Mr. Santosh Mujherjee	Executive Officer	TINI(NGO)	8906689465
7	Mr. Subhra Khan	Executive Engr.	PWD, Farakka Circle	9433956762
8	Mr. Arnab Chakraborty	Journalist (Malda & Farakka Division)	Journalist from Uttarbanga Sangbad	9609442670
9	Mr. A.K.Paul	Executive Engr.	FBP Welfare Department	7074957614
10	Nikhil Sinha	Executive Engr.	FBP Anti-Erosion Dept	8348886678
11	Prof. Sutapa Dutta	Prof dept. Of Social Science	S. Nurul Hasan College	9434183507
12	Ashesh Deyashi	Asst. Director	WB Agriculture Dept. (Farakka Circle)	9563273466
13	--	Officers	MRSW, NGO, Farakka	--

List of Stakeholders for Sahibganj Terminal

S. No.	Name	Designation	Department	Mobile No.
1	Shri Umesh Prasad Singh	Deputy Commissioner	Office of the Deputy Commissioner	06436-222100
2	Shri K.K. Tiwari	Divisional Forest Officer	Divisional Forest Office, Sahibganj	--
3	Mr. Sushil Soren	District Forest Officer	DFO, Van Pramandal Awas, Sakrogarh, Sahibganj	--
4	Sh. Faiku Ram	District Mining Officer	District Mining Department	--
5	Shri Vinay Kumar Mishra	District Land Acquisition Officer	Distt. Land acquisition Department	9934096667
6	Er. Ras Bihari Singh	Executive Engineer	Public Health Engineering Department	9934884808
7	Er. Vishal Chandra Toppo	Executive Engineer	Jharkhand Rajya Vidhut Vitran Nigam Ltd.	9431135857
8	Er. Santosh Kumar Tiwari	Superintending Engineer	Irrigation Circle, Sahibganj	9135308972
9	Er. Abhadesh	Executive Engineer	Ganga Pump Nahar	9431194614



S. No.	Name	Designation	Department	Mobile No.
	Kumar		Pariyojna (Irrigation)	
10	Dr. Bhagwat Marandi	CMO	Health Department	9334776755
11	Shri Mithlesh Kumar Singh	Executive Officer cum BDO	Nagar Parishad	9955229279
12	Er. Shushil Kumar	Executive Engineer	Public Works Department	9431366639
13	Shri Marshal Khalko	District Agriculture Officer	Agriculture Department	9431193417
14	Smt. Munni Gaund	Mukhiya (Samda Nala, Samadaasi Aasharam, SakariBajar)	Gram Panchayat Head	7808789116
15	Smt. Usha Khalko	Mukhiya (HaathiGarhi)	Gram Panchayat Head	9801018326
16	Local People Villages Rampur & Samdha Nalla	--	--	--
17	Shri Niranjan Kumar	A.D.C	DC Office, Sahibganj	--
18	----	District Fisheries Officer	District Fisheries Office, Sahibganj	--
19	Mr. Ram Dayal Ravidas	Assistant Engineer	Drinking Water and Sanitation Department, Sahibganj	--
20	Mr. Vidya Nand Singh	Executive Engineer	Small Irrigation Department, Sahibganj	--
21	---	Additional Principal Chief Conservator of Forest (W/L)	Environment & Forest Department, Sinchai Bhawan, Patna	--
22	--	Conservator of Forest	Bhagalpur, Bihar	--
23	--	District Forest Officer	Bhagalpur, Bihar	--
24	---	Director Ecology	Environment & Forest Department, Sinchai Bhawan, Patna	--
25	--	Principal Chief Conservator of Forest (HOFF)	Environment & Forest Department, Sinchai Bhawan, Patna	--
26	Prof. Subhasis Dey	Professor	Vikramshila Bio-diversity Research and Education Centre, TM Bhagalpur University, Bhagalpur	--
27	Prof. Sunil Chaudhary	Professor	Vikramshila Bio-diversity Research and Education Centre, TM Bhagalpur University, Bhagalpur	--
28	---	Member Secretary	JPCB, Nagar Prashasan Bhawan, HEC, Dhurva, Ranchi, Jharkhand	--
29	--	PCCF Wildlife & CWLW	Department of Forest & Environment, van Bhawan, Doranda, Ranchi	--
30	--	Principal Chief	Department of Forest &	--



S. No.	Name	Designation	Department	Mobile No.
		Conservator of Forest (HOFF)	Environment, van Bhawan, Doranda, Ranchi	
31	--	Officers	Talijari Matsya Jeev Samiti	--
32	--	Officers	Jan Kalyan Abhiyan	--

Annexure 4.2: Copy of Invitation Letter Sent to Stakeholder

Invitation Letter Sent to Government Dept. and NGO's



EQMS INDIA PVT. LTD.

304-305, III Floor, Rashabh Tower, Plot No. 16
Community Centre, Karkardooma, Delhi - 110 092
Phone : (011) 3800 3200 - 30003210
Fax : (011) 2237 4775
E-mail : eqms@eqmsindia.org
Url : www.eqmsindia.com
CIN : U85199DL1988PTC094954

Date: 13.10.2015

To,
Mr. Vidya Nand Singh
Executive Engineer
Small Irrigation Department
C/O Shankar Jha, Chaudhary Colony
Sahibganj, Jharkhand

Subject: Request for Support & Participation in Public Consultation Meetings at Sahibganj to be Organized by EQMS India Pvt. Ltd. along with JV Partners AIAID & IRGSSA for upcoming Project of IWAI "Capacity Augmentation of Navigational Infrastructure of National Waterway-1, i.e. Haldia to Allahabad"

Dear Sir,

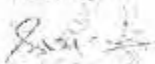
Inland Waterways Authority of India (IWAI) has undertaken above mentioned project to enhance the freight movement along the NW-1. In this regard IWAI has appointed Environmental & Social Consultants to study the associated Environmental & Social Sensitivities of the project. Consultants are carrying out socio-economic survey at Sahibganj at present and have organized a formal public consultation meeting on 16th October, 2015. Details of Venue and Time for meeting is given below

Venue: Ashram, Village Samdha Ghat, Sahibganj

Time: 11:00 AM

We thus request you to kindly attend the meeting to provide the inputs and suggestions for the project.

We look forward to kind cooperation
Thanking you



Sanjay Kumar Jain
Director, Technical
EQMS India Pvt. Ltd.

14/10/15
14/10/15
14/10/15

Annexure 4.3: Proceedings of Informal Consultations for NW-1

Proceedings of Informal Consultation

Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
Informal Consultation in Varanasi				
1.	IWAI, Varanasi & Date:20.06.2015	A.K.Mishra, Deputy Director, IWAI, Varanasi	1	According to him site location is suitable for development of terminal from HFL prospective. Other points he added are 1. Economic Feasibility 2. Reduced Air and noise pollution, 3. Increased Employment
2.	Varanasi & Date: 21-6-2015	Group Discussion with Locals, Fishermen and Boatmen, Baluaghat, Varanasi 1. Suresh Saki 2. Hariyan 3. Savajeet Sahni 4. Kashim Nishad 5. Rambabu Nishad 6. Syambabu nishad 7. Sidhunishad 8. Jaikishan 9. Bholusankar 10. Vishunnishad 11. Dablu Sahni 12. Takkan majhi 13. Ramnath Majhi 14. Gopal Nishad 15. Sidhu Sahni 16. Kashi 17. Dakhhi 18. Somnath 19. Hiralal	52	1. People consulted involved local resident of the area, fishermen and boatmen and squatters at Balua Ghat 2. People affected here are indirectly 3. Most of them are educated till higher secondary level. All of them are well aware about the project. 4. Some of them wants this project because more job opportunity will create in the area. 5. Some of the fishermen showed concern the development of project may lead to fish kill and in turn will affect the fishing businesses. They expect some allowances from the Government in lieu of their affected income.



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
		20. Shankar 21. Ramnahe 22. Visnu 23. Syambabu 24. Banarsilal 25. Seva lal 26. Manish 27. Gopal ji 28. Manish kumar 29. Vivek Chorasiya 30. Sankar Sahni 31. Bittu 32. Ramesh 33. Banarsi 34. Gaurisankar 35. Ranku Sahni 36. Pancham Mallah 37. Dilesh Sahni 38. Mirtu Kumari 39. Dhobelal 40. Bichanu 41. Sumeru 42. Bablu kumar 43. Chedi Sahni 44. Raju Sahni 45. Rajesh 46. Mohit 47. Anans Sahni 48. Mote Nath 49. Banarsi lal 50. Chote lal 51. Sri Ram 52. Gopal Ji		
3.	PWD, Varanasi &	M.P Singh (Administrative	1	1. PWD officials are not aware about the project development



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
	Date: 21-6-2015	Office)		<ol style="list-style-type: none"> When the details were shared with him about the project, he presented a favourable view towards the project He stated that development of waterways will reduce the freight load from highways, will reduce the air and noise pollution in area and will make transportation of goods cheaper. However he suggested that the nearby roads to the terminal facility should be strengthened and widened, as there may be substantial increase in traffic movement in the roads connecting the terminal site after development of terminal. Thus IWAI should carry out traffic assessment due to project development and should coordinate with PWD in this regard.
4.	UPSIDC, Varanasi & Date-22-6-2015	Sushash Tripathi Ph-9935757014	1	<ol style="list-style-type: none"> Development of terminal site may generate necessity of development of industrial zone near the terminal site as industries will be willing to find a location close to terminal site. Development of terminal will facilitate low cost transportation of goods which will enable industries to produce goods at low cost, however no such industry exist in the industrial area at present in the nearby industrial area which may avail the facility of raw material movement by waterways.
5.	Kashi Van Mandal, Kacchua sanctuary, Varanasi & Date: 23.06.2015	Ajay roy, DFO, Kashi Van Mandal, Kacchua sanctuary Varanasi	1	<p>Discussion was carried out to identify environmental issues may associate with Turtle Sanctuary. Following are the main concerns of the officer:</p> <ol style="list-style-type: none"> There turtle will get impacted due to regular movement of ships and vessels in river. Because the Turtle is very shy in nature the noise generated from the waterway transport will affect them. Siltation during the construction period will create a problem to aquatic fauna. Chance of oil spillage from the ships will contaminate the Ganga water quality. Solid waste generation management shall be done in scientific manner.
6.	District Industry Centre (DIC), Varanasi & Date:	Umesh Kumar Singh (Joint Commissioner, Industry)- 09838467078	1	<ol style="list-style-type: none"> They were not aware about the project development. When project information was shared with them they said that there are 2 industrial areas in Chandauli District. These



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
	23-6-2015			industries are generally agro based, small scale and non-polluting types. However, development of terminal may interest industrialist to develop industries in nearby areas. 3. He suggested waterways are cost effective and environment friendly mode of transportation. However, water pollution may occur, if wastewater is discharged by ships and terminal facility into river. This may also affect the aquatic life of the river and fishing activity.
7.	Banaras Hindu University & Date: 24.06.2015	Dr.B.D. Tripathi, UGC-BSR, BHU, Ganga pollution Research, NMCGA	1	Discussion was carried out with him regarding this project. Following are the main concerns of Dr. Tripathi was: 1. Ganga River has anti bacterial quality on itself. Execution of this project, Ganga will lose its anti bacterial property. 2. Aquatic flora and fauna will disturbs 3. Religious point of view he was not satisfied. 4. Overall he is not in favour of this project.
8.	Irrigation Department, Varanasi & Date: 24.06.2015	E.S.P. Srivastava, Sacchiv, Jal Nigam Irrigation Department, Varanasi	1	1. He is concerned about the vibration generated due to heavy traffic movement can disturb the strata of pump wells located in Ganga River for drinking water purposes.
9.	Ganga Pollution Unit at Varanasi & Date: 24-6-2015	Er. J.B Rai, General Manager	1	1. He was aware about the project development 2. He does not have any favour and opposition for the project development
10.	Public Health department (PHD), Varanasi & Date: 26.06.2015	Dr. M.P.Chaurasiya, (C.M.O), Public Health Department, Varanasi.	1	1. They are not aware about the project 2. They do not have any existing and upcoming health schemes in the area near to the site development. 3. They suggested IWAI should contact them for development of health.
11.	Vikas Bhawan at Varanasi & Date: 26.06.2015	R.k.sharma (DESTRO), Contact:941525214 C.M.srivastava:9451890977, Statics Deptment	2	1. They are not aware about the project 2. They do not have any upcoming development scheme in the area near to site. 3. They did not have any say about the project development.
12.	USPCB, Varanasi & Date:	Dr. Mohd. Sikandar R.O, UPPCB	1	1. He was aware about the project development. 2. He was concerned regarding the water quality issues which may



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
	27.06.2015	Contact:7800006344		be there due to construction of terminal facility and operation of cargos, spillage in case of accidents, discharge of waste and sewage, oil leakage and other related activities. 3. He suggested environment management plan should be prepared for the construction and operation phase and that should be strictly followed by IWAI and cargo operators to ensure no pollution to occur due to them. 4. In case of accidents, cargo operator should be responsible to clean the spills.
13.	Ralhupur, Village, Varanasi & Date- 8-7-2015	Project Affected Families: 1. Dinesh Singh 2. Ashok Singh 3. Santosh Kumar Singh 4. Alok Kumar Singh 5. Gopal Singh 6. NarenderBahadur Singh 7. Laxami Prased Rai and Family.	7	1. People are aware about the project development 2. Discussion was carried out with Farmers, students and PAF regarding the impact of this project. People are well aware about the project. The main issues of the villagers are: <ul style="list-style-type: none">▪ Most of them want this project because more job opportunity will create in the area.▪ People were expecting permanent job in this project.▪ Majority of people have positive attitude towards the project.▪ People also expect infrastructure development such as good roads, water supply, power supply in their area after coming up of proposed terminal.▪ People expects that the upcoming project is of less polluting industries so as no pollution related problems will observed in the area.▪ They wished and expect from authority that their compensation should be on current market price.▪ They got notification from government before acquisition of their land.▪ As per villagers, officers from block/anchal never talked to them regarding compensation and land acquisition.▪ They have been growing crops like Jau, Pulse, Arhar, Masoor for a long time on their land but now they have been gradually losing their irrigation land.



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
				<ul style="list-style-type: none"> Villagers are requesting that compensation of their land should be as per prevailing market rate, if it is not feasible at least compensation should be disbursed to them on circle rate. <p>3. Some Project affected families have filed petitions in the court for higher compensation.</p>
14.	Balwa Ghat Ramnagar Date:9.7.2015	Fishermen, Boatmen and Squatters at Ghat and local community. 1. Jaikishan 2. Ramlal 3. Kamlu 4. Roshan Lal 5. Majhi Lal 6. Kamlulal 7. Sankar 8. Ramnahe 9. Vivek 10. Aman 11. Banarsi 12. Kamlesh	12	1. Yes, Supporting project 2. Fishermen, Boatmen Squatters at Ghat and local community were happy from the NW-1 3. The main concern of the local community is to provide them the livelihood based activities in the project works. 4. Second concern is to provide them skill based training which can help them to provide employment
15.	Land Owner (Local People), Dated-23.8.2015	Vieswar Dravin, Land owner for proposed access road to Terminal	1(The land belongs to one family of three brothers)	1. Mr. Vieswar has some issues. Total land to be acquired as per the Government notification dated 19 th March 2015 is 0.592 ha. The land belongs to one family of three brothers. The owner of the land opined that the valuation of land is being done based on the circle rates and is not justified. He is requesting for the revision of the land value 2. Compensation amount and circle rates for the proposed land should be revised with the consent of the affected families in the meeting before finalization of the circle rates. 3. Loss of this land will lead to loss of livelihood to the family.
Informal Consultation in Sahibganj				



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
16.	Samda Nala Ghat, Near Project site, Sahibganj & Date: 16-09- 2015	General Public and Fisherman 1. Shiv ji maldar 2. Chanchal kumar yadav 3. Jawahar yadav 4. Rmaan 5. Narayan yadav 6. Shiv Shankar yadav 7. Rupan Mandal 8. Shivshankar yadav 9. Sudeshan Yadav 10. Sushila devi 11. Mahendra yadav 12. Kanhayia yadav 13. Bal Krishna Yadav	13	Participants included farmers, students, affected people, fishermen, Boatmen and females. Most of the people in the area are farmers and depend on agriculture for livelihood. Villagers are aware about the IWAI planning for construction of terminal. Following issues/concerns were raised by the participants. 1. Land owners are highly concerned as they depend on the agriculture and mango plantation for their livelihood 2. Students however see the project as positive development in the area in terms of infrastructure, power, roads and water supply facilities and employment generation 3. Fishermen stated that fish catch will reduce in the area after construction of terminal due to increase in water pollution and killing due to barge movement. 4. Farmer practice river terrace cultivation in the river bed area and they are worried that they will not be allowed to practice the same after construction of terminal due to restrictions by authority.
17.	Ashram, Samda Nala Village & Date: 9 th -10-2015	Villagers from Rampur & SamdaNala village	10	Participants included farmers, students and females. Following issues/concerns were raised by the participants. 1. Loss of livelihood is major concern due to loss of agriculture land 2. Land owners were demanding compensation should be as per prevailing market rates 3. Local people only should be considered for provision of employment 4. Proper R & R should be done before displacement of affected people. Affected people/land owners are worried about the loss of houses and place of relocation 5. Religious sentiments of locals are associated with River Ganga so they want place near to River Ganga for relocation 6. Employment and home should be provided to affected people before displacement/land acquisition and loss of livelihood 7. Project development will lead to increase in pollution in area and water. Water pollution may significantly impact the fish catch.



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
18.	Ashram, Samda Nala Village & Date: 9 th -10-2015	Villagers from Rampur, Ashram, Samda Nala Village (8 Participants)	8	Participants included farmers, fishermen & students. Following issues/concerns were raised by the participants. <ol style="list-style-type: none"> 1. Land owners categorically said that land will be given only, if they will get appropriate compensation 2. Also they require employment, if complete land will be taken away from them 3. They mentioned large nos. of trees are planted in the land which is under planning to be acquired, cutting of large no. of trees will affect the environment of village thus equal nos. of trees should be planted before cutting the trees in nearby land areas 4. They said some dolphins are seen in the water, operation of barges may be danger to life of dolphin. 5. They are scared as they think fishing will be banned in the area after development of terminal which is major livelihood source of most of the people.
19.	Ashram, Samda Nala Village & Date: 9 th -10-2015	Ashram, Village Rampur	15	Participants included farmers, fishermen & students. Following issues/concerns were raised by the participants. <ol style="list-style-type: none"> 1. Land owners are expecting appropriate compensation for their land and also assistance in alternative livelihood of their land will be acquired 2. They demanded job for them and their children and they mentioned they should be given skill generation training for job offered as they have practised only agriculture throughout their life 3. They insisted that they worship River Ganga and they will not bear addition of pollutants and waste in the River 4. They want to get assurance about that they can continue fishing activity in the river after construction of terminal. 5. They wanted to ask what other developments will be taken up by IWAI in village for betterment of villagers
20.	Naya Tola & Samda Nala	Villagers from Naya Tola & Samdha Nala	10	Participants included farmers, students and females. Following issues/concerns were raised by the participants.



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
	Village & Date:5 th -11-2015			<ol style="list-style-type: none"> 1. Farmers whose land will be acquired are worried due to loss of land and loss of livelihood as they are practising agriculture since generation 2. Land owners demanded alternate housing facility and employment prior to land acquisition and displacement 3. Fishing activity will be hampered in the river due to development of terminal and plying of large nos. of cargos 4. Cutting of large nos. of trees within the project site will impact the climate of the area 5. Local people should be considered for providing employment. 6. Community facility in the area, if any to be disturbed should be relocated at the accessible and appropriate location
21.	Asharam Ashram, Naya Tola & Samda Nala Village & Date:8 th November, 2015	Villagers from Naya Tola & Samdha Nala	20	<p>Participants included farmers, students and females. People are aware about the project. Following issues/concerns were raised by the participants.</p> <ol style="list-style-type: none"> 1. Land owners are worried about the compensation rates and the loss of livelihood 2. They demanded provision of employment for the affected people. Authority committed for provision of employment to locals after coming up of project 3. Locals demanded compensation should be given as per market rates 4. Displaced population want the relocation near or inside the village only 5. Assistance should be given for alternate livelihood for affected people 6. Water quality can be affected due to project development, this will affect the aquatic life in the area. 7. Air pollution in the area will increase due to increased movement of vehicles in the area.
22.	Department of Environment and	Dr. D K Shukla Designation: Principal Chief	1	<ol style="list-style-type: none"> 1. Dr. D.K. Shukla gave idea on extent of the dolphin sanctuary. VGDS boundary starts from Sultangunj block boundary and ends



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
	Forest, Aranya Bhawan, Shahid Pir Ali Khan Path (Riding Road), Shekhpura, Patna-14 & Date: 15 th September 2015	Conservator of Forest (PCCF) Phone: 0612-2545074 Department of Environment and Forest.		at Kahalgaon subdivision boundary. He also advised to meet Chief Wildlife Warden, Bihar for more information on VGDS. He raised the following concern 2. Dolphins will be impacted with barge & cargo movement especially the baby dolphins. 3. Development of terminal may increase the water pollution which will significantly affect the aquatic life 4. Strict norms and measures are required to be followed and taken towards the protection of habitat of the dolphins, if this project is being developed. 5. Discharge of waste in the river should be strictly prohibited by anybody (terminal/vessels/barges). Waste management facilities should be developed at site and waste should be treated and disposed off at other safe locations. 6. Mechanical movement of barges will impact the dolphins thus the speed of the cargos movement in these water should be regularized
23.	Department of Environment and Forest, Aranya Bhawan, Shahid Pir Ali Khan Path (Riding Road), Shekhpura, Patna-14 & Date: 15 th -09- 2015	Shri S S Chaudhary Designation: Additional Principal Chief Conservator of Forest (PCCF) and Chief Wildlife Warden, Bihar Phone: 09430919565	1	1. Shri S.S. Chaudhary was aware about the project development. He gave more information about the extent of VGDS. He told that river stretch between Sultanganj and Kahalgaon Pahar (50 kms) is declared as VGDS. Copy of notification for declaration of VGDS as Dolphin Sanctuary was provided by him. He raised the following concerns: 2. Project may have significant impact on dolphin thus proper measures should be taken during operation phase to minimize this impact. 3. It may be required to obtain Wildlife clearance for the project 4. Interference in this zone should be minimized to the extent possible. 5. Minimal disturbance to the dolphin should be done as they are sensitive. 6. Waste management is key requirement. Waste disposal, disposal of coal ash and contaminated run-off to the river may pollute the river water quality significantly which in turn may affect the aquatic



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
24.	Gangetic Plains Regional Centre, Zoological Survey of India, 11-D Rajendra Nagar, Patna - 800 016, 0612-2360054 & Date: 15 th -09-2015	Dr. Gopal Sharma Designation: Scientist D and Officer-In-Charge at Gangetic Plains Regional Centre Phone: 09431221918	1	life. 1. Dr. Gopal Sharma was aware about the IWAI Project. He opined that the project will have impact on Dolphins. He told that VGDS extends about 60-65 kms. Coordinates for starting and end points are as follows: <ul style="list-style-type: none"> ▪ Sultanganj (Ajgaivinath Temple) N 28°15.247' and E 86°44.758' ▪ Kahalgaon (3 hillocks in river) N 25°15.402' and E 87°13.246' 2. He told that this stretch is preferred habitat of the dolphin due to availability of confluence points, meandering locations and deep pools of river. About 127 dolphins have been recorded in VGDS. Other aquatic fauna of VGDS include Otter, gharial, turtle, etc. VGDS provides breeding ground of such species. He raised the following concerns: <ul style="list-style-type: none"> ▪ VGDS is rich in bio-diversity thus care should be taken that minimal or no disturbance should be caused to aquatic life ▪ Dredged material may contain toxic compounds so should not be dumped on river bank as river banks are habitat for otter, birds feeding on aquatic organisms and other species ▪ Dolphins are affected by the vibrations. Plying vessels create ripples which causes energy losses in dolphin for its movement and carrying out other functions. ▪ At present dolphins are distracted by vessels plying in NW-1. Mitigation measure for propellers to avoid dolphin getting hit should be considered, e.g. propeller guard. ▪ This leads to entanglement of dolphins in fishing nets in Ganga causing mortality. ▪ In the current situation, plying vessels get stuck in lean season. In the event of larger vessels plying in NW-1, the situation will be aggravated. 3. Also there are various sites of socio-cultural importance like

Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
				Ajgaivinath temple, Sultangunj, which should not be impacted due to project development.
25.	Department of Fisheries, Sahibganj & Date: 16 th September 2015	Shri Jayant Ranjan, Designation: District Fisheries officer Phone: 09835031630 Email: jayant.ranjan21@gmail.com	1	<p>1. During the consultation, Mr. Jayant Ranjan made the following comments</p> <ul style="list-style-type: none"> He appreciated the efforts to engage with local communities through public consultation. He said app. 5000 fishermen are dependent on fisheries for livelihood in this stretch and their livelihood may get impacted due to development of project Some of the commercial fisheries in the area are Indian Major carps, singhi, shrimps, Mystus sp. Catfishes & tengra The river banks at Bejligar, Maharajpur, Mahadevganj, etc in Sahibganj are known as breeding and spawning grounds. Fish breeding takes place in shallow water. Fish seedlings are collected by fishermen in this region. During lean season, siltation is high and water current is low. Thus dredging will be required to carry out which will significantly impact the water quality Dredging may have significant impact on breeding and spawning season Impacts which may result due to project development are oil spills from barge vessels, cargo spillage, ballast water, anti-fouling paints etc Dredged material should not be disposed off on the bank of river as they are breeding and spawning grounds of fishes In Jharkhand District, decline in Rohu fish is recorded. Project will open up the opportunity for movement of frozen fish in Sahibganj and will open up opportunity for livelihood of local communities <p>2. There is potential for growth of commercial fisheries including cage culture fisheries, which is being promoted in Jharkhand.</p>
26.	District Forest officer, Bhagalpur, Patna & Date:	Mr. S.K.Sinha, Designation: DFO, Bhagalpur Phone: 09835031630	1	<p>1. Mr. S. K. Sinha made the following comments and suggestion</p> <ul style="list-style-type: none"> He discussed that it may require to clear large nos. of trees for development of project



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
	16 th -09- 2015			<ul style="list-style-type: none"> ▪ He suggested permission should be taken from forest department before cutting any tree ▪ He also suggested that compensatory aforestation should be carried out in lieu of trees cut ▪ He suggested to consider impacts on aquatic life and terrestrial flora & fauna while designing the project and to include mitigation measures in environment management plan ▪ He suggested a thick green belt should be developed all around the boundary of the terminal site <p>2. He also suggested that terminal boundary should be high enough to prevent entry of cattle/animals</p>
27.	Gram Panchayat, Samda Nala and Rampur village & Date: 9 th -09- 2015	Mrs. Munni Gaud Designation: Gram Panchayat Head Phone: 07808789116, 7070603324 Gram Panchayat, Samda Nala and Rampur village	1	<p>1. Mrs. Munni Gaud is aware about the project and she opined the following:</p> <ul style="list-style-type: none"> ▪ She said the project will bring development in the area and will have positive socio-economic impact on large scale. However people who are losing land will lose their livelihood and their housing ▪ People are expecting employment generation from the project and also the infrastructure development ▪ Traffic may increase in the village and nearby area which will pollute the air so mitigation measures should be taken to minimize air pollution ▪ Villagers have emotional values attached with the River Ganga, thus terminal project should not cause water pollution else there will be opposition from the villagers ▪ Adequate compensation should be given provided to the people. <p>2. Alternate employment options should be suggested for people who are completely losing their land.</p>
28.	Gram Panchayat, Hathigarhi & Date: 9 th -09-2015	Mrs. Usha Khalkoo Designation: Gram Panchayat Head, Gram Panchayat, Hathigarhi	1	<p>1. Mrs. Usha Khalkoo is aware about the project and she told the following:</p> <ul style="list-style-type: none"> ▪ Land owners are worried as some are losing their complete land and they will lose their livelihood, if land will



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
		Phone:9801018326, 9801352024		<p>be taken away from them</p> <ul style="list-style-type: none"> Adequate compensation and assistance should be provided to land owners to find new livelihood options. Employment should be provided to local people preferably Tree cutting should be minimized and compensation should be provided to owners for all their assets as per law River water will be polluted due to construction of terminal and villagers may have concerns about this as they worship River Ganga <p>2. Traffic may increase in the area which may increase chances of accidents.</p>
29.	District Collector Office Sahibganj, Jharkhand & Date: 7 th -09-2015	Mr Niranjan Kumar Designation: Additional Deputy Collector + Land Acquisition officer, Sahibganj Phone: 09431306331, District Collector Office Sahibganj, Jharkhand	1	Meeting was held in the Collectorate office regarding the proposed terminal activities. In the meeting Mr Niranjan kumar ADC Sahibganj told that their office is carrying out the land acquisition which is in progress and it may take some more time to finalize the final individual award list. After completion of the work they can provide the final award list and land details to the IWAI. He also suggested to carry out the SIA activities and they can provide security for survey team as necessary.
Informal consultation in Farakka:				
30.	Bewa village—cognitive interview & Date:5/10/2015	Villagers of Bewa Panchayat 1. Ajay Mondal 2. Arun Ghosh 3. Ashoke Ghosh 4. Banu Ghosh 5. Bapan Ghosh 6. Binoy Ghosh 7. Bharat Ghosh 8. Bikash Ghosh 9. Biren Ghosh 10. Dukhu Sekh 11. Abddul Mannan 12. Barqat Sekh	21	<p>Participants included farmers, indirectly affected local persons and community members. Following issues/concerns were raised by the participants.</p> <p>People were aware about the project.</p> <ol style="list-style-type: none"> Some of them were doing agriculture on Farakka Barrage project land without any agreement and lease navigational lock to be constructed. They had already given their land to FBP during Farakka barrage project installation in 1965 Most of them were disagree with the compensation provided by FBP.



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
		13. Gani Sekh 14. Aftab Sekh 15. Hamsad Sekh 16. Ahmad Sekh 17. Tufani Sekh 18. Sarju Sekh 19. Gaju Sekh 20. Siraj Sekh 21. Abdul Sekh		4. Erosion occurs along the bank of feeder canal and that is creating problem. Ship movement has further enhanced erosion.
31.	Near Primary school Ghoraipada village & Date:6/10/2015	Villagers of Ghoraipada village 1. Nikil ghosh 2. Pawan ghosh 3. Pappu ghosh 4. Ravi ghosh 5. Rakesh ghosh 6. Ram Chandra ghosh 7. Ratan Ghosh 8. Sadan Ghosh 9. Sanjay Ghosh.	9	Participants included farmer and small traders. Following issues/concerns were raised by the participants. 1. They demanded job for them and their children and they mentioned they should be given skill generation training for job offered as they have practiced only agriculture throughout their life 2. Most of them were disagree with the compensation provided by FBP. 3. They need compensation for damage of fishing nets and other accessories due to barge movement and project development (if any) 4. They need employment during construction and operation phase of the proposed navigation lock.



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
32.	Central Inland Fisheries Research Institute, Barrackpore, 700120, West Bengal & Date:1.07.2015	Director, Central Inland Fisheries Research Institute, Barrackpore,	1	They are aware about the project development. 1. They suggested project will have significant impact on aquatic life and sensitive species like dolphins and turtles 2. Water quality is already polluted and will be affected further due to project development. 3. Dredging activity have significant impact on the aquatic life 4. This will lead to disturbance of the sediments which may contain hazardous material, increase in turbidity which may impact the visibility and gills of the aquatic organisms etc. 5. Mechanical movement of barges will impact the fish and other aquatic animals thus the speed of the cargos movement in these water should be regularized.
33.	Department of Environment, Government of West Bengal & Date-31.06.2015	Mr. Siddhartha Roy, IFS, Senior Environment Officer, Government of West Bengal, Kolkata	1	He was aware about the project and they were highly concerned about the environment issues related with the project development. 1. Clearances and NOCs should be obtained as applicable for the project as per the laws and Acts of Govt. of India 2. Project will significantly reduce air emission, noise level & traffic loads from highways but may add to water pollution 3. Surface water quality may be degraded due to discharge of waste/sewage from ships and lock gate facility, increased human activities near river, accidental spillage, leakage of oils etc. 4. Ground water may also get polluted as this surface water seeps into ground water aquifers.
34.	State Warehousing	Mr. A.K. Sinh, Executive Secretary, WBSWC &	2	The officials were aware about the project and added the following:



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
	Corporation, WB & Date -30.06. 2015	Mr. Kaushik Mukherjee, Dy. Commercial Manager, WBSWC		<ol style="list-style-type: none"> 1. They have expressed positive attitude towards project development 2. Project will boost the freight movement, cheap raw material transportation and thus the industrial sector 3. With boost in freight transportation and industrial activity, need of warehouses will increase with time 4. Thus some projects may come near to lock gate sites. 5. Cost effective, energy efficient and environment friendly mode of transportation.
35.	Farakka Block Development Office, Farakka, Murshidabad & Date:8 th October 2015	Mr Niranjan Kumar, Kesang Dhendup Bhutia, BDO & Block Executive Office Ph-9434770026 <u>E-mail-</u> bdo.farakka@gmail.com	1	<p>BDO, Farakka was aware and happy with the project development and assured his and local administration cooperation for the project implementation.</p> <ol style="list-style-type: none"> 1. He was also invited for public consultation meeting. 2. Any kind of toxic pollution by the vessel like oil spillage and chemicals in the river water, transport emissions, needs to be considered.
36.	Divisional Forest Office, Nadia & Murshidabad Range & Date:15 th October 2015	Mr. Rana Dutta, IFS, DFO PH: 9434053965 <u>E-mail:</u> dfomnd@rediffmail.com	1	<p>He was aware about the project. He says that there is no reserve and protected forest in the area and also added that there is no sensitive ecosystem present in the area. He was highly concerned about river bank erosion.</p>
37.	Coal India, Kolkata.	Mr. Niranjan Das, CGM (Env.), Coal India, Kolkata.	1	<p>He was aware about the project he further added that the project is highly beneficial. Insufficient transportation facility available at present.</p> <ol style="list-style-type: none"> 1. Project development will increase the transportation of coal to user agencies, especially NTPC thus enhancing the power generation capacity 2. IWT is environment friendly mode of transportation 3. Transportation of coal should be carried out only in covered cargo 4. However, project can impact the aquatic life by disturbing its habitat. 5. Environment management plan should be prepared and for all the



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
				stages of project and should be implemented as suggested to minimize environmental impacts of the project.
38.	Community members of local Villages at PCM	Community members of local Villages at PCM	50	<ol style="list-style-type: none"> 1. The villagers also informed that there is no forest area. Further, they did not anticipate any adverse impacts on their livelihood due to construction works. 2. They further opined that there would be positive impacts on the sources of livelihood due to increased economic opportunities which will provide good earning sources to the local families due to the project implementation. It was also informed that there is no Schedule Tribe (ST) population in the project area. 3. Representatives from Beoa Panchayat extended their support during the construction and operational phase of the proposed project. -They also suggested that public consultation meetings should be held at different places for awareness of the people and Grievance Redressal Committee should be active with timely conflict resolution.
39.	Patna Aranya Bhawan, Shahid Pir Ali Khan Path (Riding Road), Shekhpura, Patna-14 Phone: 0612-2545074 Date: October 15, 2015	Dr. D K Shukla, Principal Chief Conservator of Forest (PCCF), Department of Environment and Forest	1	Wildlife Protection Act, 1972 will be applicable if the project intervention is within the boundary of Vikramshila Gangetic Dolphin Sanctuary (VGDS)
Informal Consultation in Haldia				
42.	Tamluk, East Medinipur & Date: September 21, 2015,	Mr. S K Chakraborty, DFO, East Medinipur Division	1	DFO sought directions from Headquarters of Department of Environment and Forest for providing relevant data.
43.	Tamluk, East	Mr. Satikanta Bairagi,	1	Provided information on Nayachar and Nutanchar Islands in the



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
	Medinipur & Date: September 21, 2015	Assistant Director of Fisheries (ADF) in Directorate of Fisheries and Fish Farmers Development Agency		project area of proposed Haldia Terminal.
44.	Tamluk, East Medinipur & Date: September 22, 2015,	Mr. Jay Sengupta, Director (Technical) and Mr. B D Saha, Manager (Process)	2	The officials of Sanjana Cryogenic Storages Ltd. were aware of the proposed terminal at Haldia in the neighbourhood of Sanjana Cryogenic Storages Ltd. The issue of over ground pipeline was raised which runs along the proposed site
45.	Kolkata, September 23, 2015,	Dr R P Saini, Special Additional PCCF and Chief Conservator of Forests (HQ) Department of Environment and Forests	1	Instructions were issued to DFOs in Nadia and East Medinipur Division for collection of relevant data
46.	Haldia Municipality, Haldia, Purba Medinipur & Date: 25th September, 2015	Mr. Deboprasad Mondal Chairman of Haldia Municipality Cell No. 9434940619 Email: haldmuni@yahoo.com	1	Support the project. The main issues are: 1. Hooghly River which is very much close to the proposed terminal 2. Any kind of toxic pollution by the vessel like oil spillage and chemicals in the river water, transport emissions, needs to be considered. 3. He appealed to the authority that they should provide jobs to the local unemployed youth based on their skill and should give business opportunities to the local people. 4. As part of social development the local immersion Ghat at Durgachak (near project site) should be expanded by the project sponsors to overcome the current congestion especially during the local festival. 5. The access road needs to be carpeted as present road is not in good condition. 6. Our request is to develop the road as it will be needed for the proposed terminal access movement also. 7. He requested to make provisions for appropriate parking facilities inside the proposed terminal for better management of container carrying vehicles.



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
				8. Finally he gave the assurances that local government (ULB) will give all help for smooth operation of the project activities.
47.	Haldia, P Haldia Development Authority(HDA), Haldia, Purba Medinipur. Date: 28th September 2015	Mr. Purnendu S. Naskar, WBCS Ph: 03224-255927 , Email: ceo.hda@gmail.com	1	Support the project, The main issues discussed are: 1. The project sponsors should consider the fact that the vessel navigation should be planned appropriately as there could be an impact to the river bank which is adjacent to the proposed terminal. 2. Due to increased river cargo traffic management of incoming and outgoing vessels in terms of loading and unloading will have to be planned and executed appropriately. 3. During dry and winter season the river water depth is low, this will create issue of cargo movement from and to the terminal. Measures should be taken to address this problem either by ensuring minimum water flow in the river or provide appropriate warehousing facilities for storing the cargo material during the lean period. 4. Oil from vessel may flow into the river and pollute the water. This pollution will affect the terrestrial flora and fauna. Their needs strict control to be imposed by the project sponsors. 5. The IWAI authority have to be prepared for any kind of accidents occurring with maximum preparedness like – having a rescue team on call, good communication with the civil volunteers, fire services and local administration contacts.
48.	Haldia Municipality, Haldia, Purba Medinipur & Date: 25th September, 2015	Mr. Gopal Chandra Das, Vice Chairman, Haldia Municipality Ph:09475038119 , Email: haldiamunicipality@gmail.com	1	Support the project, The main issues discussed are: 1. The interviewee raised concerns about the existing high particulate matter concentration in the area and recommended that the proposed project should ensure that no further particulate matter is created by the proposed project. Concerns about oil spillage was raised and hoped that proper emergency response to tackle any accidental spillage would be in place. 2. The access road needs to be widened and upgraded to ensure smooth traffic movement. A traffic management plan needs to be



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
				in place. 3. The interviewee suggested that the project should employ local people in the proposed terminal on a priority basis provided they have the required skills.
49.	Haldia Block Development office, Brajlalchak, Haldia Purba Medinipur & Date: 23 rd September 2015	Mr. Suman Kumar Sahoo, Fisheries Extension officer PH:-9434506729	1	Support the project, The main issues discussed are: 1. There is no fish sanctuary around the port site. Fish existence is found for three months during the rainy season. During the dry season the water quality is degraded and blackish which is not suitable for the fish. Thus production of fish reduces. 2. Turbulence and wave from plying vessel movement can be a cause of fish resource sheltering in safer waters. This is problem that is difficult to resolve as the waterway fish may migrate. 3. Considering terrestrial flora and fauna, the authority can prepare habitat by tree plantation. 4. There are some fishermen depending on the fishing activity in the Hooghly River for 3-4 months of the year; the authority can support them through livelihood restoration programmes. 5. The authority can prohibit the discharge of oily water into the river during fish breeding period April- May. 6. IWAI authority can invest in fish breeding in the river or nearby water bodies and employ the fishermen who are without a livelihood for nine months in a year.
50.	Sanjana Cryogenic Storages Ltd., Durgachak, Haldia, Purba Medinipur. Cell No: 09332311334, Email: sanjana_haldia@rediffmail.com &	Mr. Joy Sengupta, Director Technical, Sanjana Cryogenic Storages Ltd	1	Support the project, The main issues discussed are: 1. The terminal will be a new addition for carrying the container and goods by the river at lower rate. Once the terminal is in operation they will use it to vessel their export goods which will be cheaper by road transport that they are currently using. <ul style="list-style-type: none"> ▪ Export import business will be improved for terminal installation. ▪ Employment opportunity will be increase. ▪ The only source of pollution from proposed terminal will be sound pollution. The project implementing agency needs



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
	<u>Date: 21st September 2015</u>			<p>to take steps to abate the noise pollution.</p> <ol style="list-style-type: none"> Our factory is close to the proposed terminal therefore, we will help IWAI authority to operate the terminal smoothly in term of existing pipe line shifting, etc. Need to work in close cooperation with the IWAI to ensure that no water logging takes place due to the project by integrating the drainage systems in the area. Fire team should be available on call to attend to and avoid any kind of disaster situations.
51.	Durgachak, Haldia, Purba Medinipur. Ph No.- 03224-253180, Date: 27 th September 2015	Haldia Vigyan Parishad (NGO's, Ph No.- 03224-253180)	3	<ol style="list-style-type: none"> Support the project, The main issues discussed are: <ul style="list-style-type: none"> Meaningful community development for the people in the affected areas was demanded Oil water from vessel washes may pollute the river water which will affect the terrestrial flora and fauna. There needs to be strict control measures to be imposed by the project authority. The proper environment management plan should be prepared before the project operation phase.
52.	Community members living within 1.5km radius of the project location at Durgachawak & Date: 27 th September 2015	<p>Community members living within 1.5km radius of the project location at Durgachawak.</p> <ol style="list-style-type: none"> Sanjay Kumar Maji Arindam Pramanik Sadhan Sardar Sibsankar Patra Pralay Kr. Hazra Atanu Bera Prabir Pusti Biswajit Rana Arjun Metya Kamal Jana 	10	<ol style="list-style-type: none"> Interviewees highlighted that the consultation – adapting the company's operations to reflect the views heard – is typically missing. They underlined that if companies wish to conduct meaningful consultation, they should be willing to revise the project terms in response to the feedback received from the community. They noted that they view the objective of the consultation not as merely explaining the project, but revising it as needed to satisfy the affected communities. Consider providing access to alternative methods of gaining adequate livelihoods, such as offering vocational training for specific jobs, in addition to providing monetary compensation for affected structure. Compensation for affected structure payments should be transferred directly to the recipients through community-based organizations. The funds should not be transferred through local authorities, land registries or other entities that could be prone to



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
				corruption. 4. Put in place grievance mechanisms so that community members have a place to go to voice concerns and resolve the issue.
53.	Durgachak, Haldia, Purba Medinipur & Date - 28 th -06-2015	Santanu Ghosh, Local Auto Rickshaw Drivers at Durgachak, Haldia, Purba Medinipur	1	1. We are driving our vehicle in this road from dawn to dusk. 2. We earned and derive our 6-member family by this. 3. If traffic congestion becomes severe than our income will be reduced and will have to divert our profession. 4. We expect the authority will take measures.
54.	Fisherman group at Durgachak & Date: 29 th -06, 2015	Sanatan Dinda and other fishermen	1	1. According to the team leader Md. Sanatan Dinda-we are fishing here only 3 to 4 month. 2. Another time we work in the brickfield and some of us pulling rickshaw and van. There are 7-8 people in our team, every day we get 2500 to 3000 rupees by fishing. 3. September is the peak time for high income. Our concern is that if the vessel comes during this time the fishing may be affected which will hamper our livelihood.
Informal Consultations for Barge Movement in Buxar & Patna				
55.	People gathered for Ganga bath & Date: 10 th February 2016	Ram Rekha ghat, Buxar	10	1. People were given brief about the project and to be increased frequency of barge movement and large size barges movement in the stretch of River 2. People welcome the project and were interested to know about the employment generation potential for locals due to project 3. No objection was raised to project. 4. People said that if project will lead to congestion then infrastructure should be enhanced accordingly so as local people



Sr. No	Date and place of consultation	Name and designation of person with organization name	No of people participated in the consultation	Major outcome: specifically : Have they supported the project or not. Major concern raised.
				do not suffer.
56.	Local People gathered for bath in Ganga (Ganga Snan) & Date: 11 th February 2016	Adi Nath Ghat, Buxar	6	<ol style="list-style-type: none"> 1. People were not aware about the project and thus brief was given to people about the augmentation of entire NW-1 to enhance the navigation 2. People were told about the increased barge movement in the area 3. People raised their concerns regarding their day to day activity in the river. 4. They inquired if the barge movement will enhance the pollution. They asked for pollution free Ganga 5. They also expect that employment generation should be there due to project development in their area also
57.	Local people gathered for idol emersion. & Date: 14 th February 2016	Gai Ghat, Patna	8	<ol style="list-style-type: none"> 1. People were aware about the project as IWAI is nearby 2. Brief was given to people again about the augmentation of entire NW-1 to enhance the navigation 3. People were told about the increased barge movement in the area. 4. People were worried about the enhanced pollution in the river due to project

Annexure 4.4: Attendance sheet for the PCM at Sahibganj

Formal Consultation

सांख्यिक पत्रादेशाचे वैधता स्थान - आत्मन सभेसाठी साट दिनांक 16-10-2015			
क्रमांक	नाम	पिनांग	हस्ताक्षर
1.	रवि कान्त	भाषीय अन्तर्देशीय जलमार्ग शास्त्रज्ञ	विनायक
2.	जयंत-रंजन	जि. मल्लय पदा, साहेबगंज	Ry
3.	विनयकुमार प्रिय	जिला मज - अर्जुन पदा, साहेबगंज	RO -
4.	प्रशांत कुमार	भाषीय अन्तर्देशीय जलमार्ग प्रमुख - पु	
5.	अमोड कुंठर	भाषीय अन्तर्देशीय जलमार्ग	अमोड
6.	Rohini R. Mohu	IWA	RW
7.	अमोड सिंगल जेडी	WB (consultant)	अमोड
8.	MRIDULA	WORLD BANK	MR
9.	Dr. A. Yashwanth	Health (Cano)	Dr. A. Yashwanth
10.	Ashwini Kumar	KC - (D.L.A.O)	Ashwini
11.	अमोड साहे	सहाय्यक प्रमुख, अमोड	अमोड
12.	Shankar. A. Mohu	D.L.A. Officer	Shankar
13.	Rajendra Singh	D.L.A. Officer	Rajendra
14.	रवि कुमार	जि. मल्लय पदा, साहेबगंज	रवि कुमार
15.	अमोड साहे	जिला मज - अर्जुन पदा, साहेबगंज	अमोड
16.	Kuldeep Kumar	IRSSA / EOMC JV	Kuldeep
17.	Dr. Jyoti	DSVV, Haridwar	Dr. Jyoti
18.	विनायक	IWA	विनायक
19.	Ravi Ranjan	IWA	R. R. Ranjan
20.	Sayajy Singh	K.R.D. (Ganga pur)	Sayajy
21.	Kaushal Singh	CRADLE - Ramn	Kaushal

लोक परामर्श बैठक		
क्रमांक	नाम	हस्ताक्षर
1	पारस पादव	पारस पादव
2	Rajendra Samda Sir	Rajendra Samda
3	विष्णु पादव	विष्णु पादव
4	मोहन पादव	मोहन पादव
5	पुष्प पादव	पुष्प पादव
6	गोविंद पादव	गोविंद पादव
7	जयपाल पादव	
8	आशु पादव	
9	दिनेश पादव	दिनेश पादव
10	शोभा पादव	
11	शशिकांत पादव	
12	सिद्धेश्वर पादव	
13	आरती पादव	
14	गोविंद पादव	
15	गोविंद पादव	

क्रमांक	नाम	गांव	हफ्ता
16	शिवजी महलदा - रामपुर		
17	मंजुलक्ष्मी मादव - रामपुर		
18	जवाहर महल मादव - रामपुर		
19	महेश मादव - रामपुर		
20	महेश मादव - रामपुर		
21	रामचंद्र महल - रामपुर		
22	रामचंद्र महल - रामपुर		
23	रामचंद्र महल मादव - रामपुर		
24	रामचंद्र महल मादव - रामपुर		
25	शिवशंकर मादव - रामपुर		
26	रुद्रेश मादव - रामपुर		
27	रुद्रेश मादव - रामपुर		
28	महेश मादव - रामपुर		
29	कन्हैया मादव - रामपुर		
30	बालू वृद्धा मादव - रामपुर		

Annexure 4.5: Photographs of Informal Public Consultation

	
<p>Session 1: Consultation with Boatmen and Fishing community</p>	<p>Session 2: Consultation with Boatmen, Sqatters and Fishing community</p>
	
<p>Session 3: Consultation with Boatmen and Fishing community</p>	<p>Photograph of Baluva Ghat</p>
	
<p>FGD at Gharaipara Village with local villagers.</p>	<p>Socio-economic survey carried out by AIAID representative</p>



**Consultation with villagers in Ashram,
Rampur and Samdhanala**



**Consultation with villagers in Ashram,
Samdhanala**



**Consultation with villagers in Samdha nala,
Naya Tola Asram**



Consultation with fishermen in Sahibganj



Consultation at Samda Nalla Ghat



Consultation in Village Rampur



Consultation with fishery Department



Consultation with Villagers in Rampur



Consultation with Villagers in Village Area & Ashram in Rampur Village



<p>Stakeholder Consultation with Mr. Purnendu S. Naskar at HDA office Haldia</p>	<p>SC with Haldia Municipality Chairman Office at Haldia.</p>
	
<p>FGD with local residential at Durgachak,Haldia</p>	<p>SC with Haldia Block Development Officials at Haldia</p>
	
<p>KII with local fishermen at Durgachak,Haldia</p>	<p>Photo from project location at Durgachak,Haldia</p>
	
<p>BisarjaniGhat at Durgachak which located in nearby proposed project site.</p>	<p>Consultation with fisherman</p>

	
<p>Consultation with Fisher man</p>	<p>Consultation with boat man near Pathakali ghat</p>
	
<p>Consultation with locals at Ram Rekha Ghat, Buxar</p>	<p>Consultation with locals at Adi Nath Ghat, Buxar</p>
	
<p>Consultation with locals at Gai Ghat, Patna</p>	<p>Consultation with WII, IWAI Officials and DFO, Kashi</p>

Photographs of Formal Consultation at Samda Nala Village, Sahibganj



Photographs of Formal Consultation Meeting at Farakka



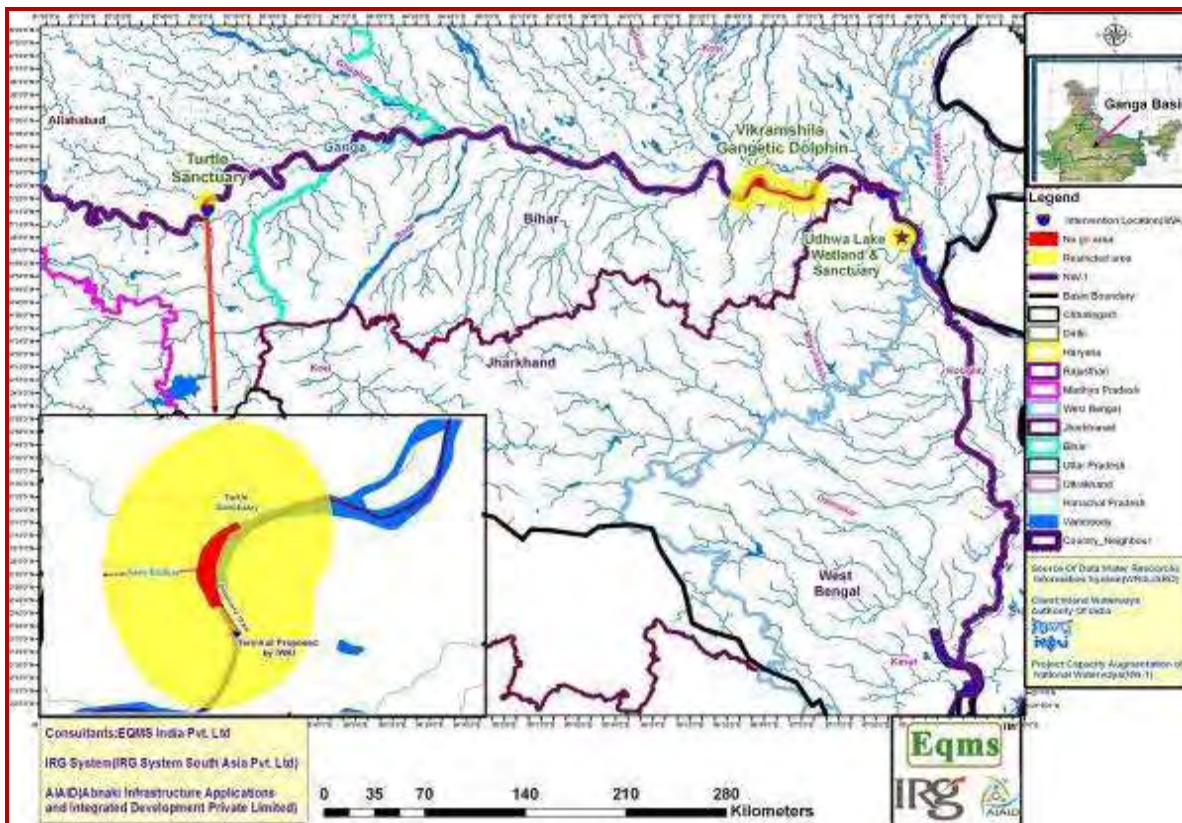
Photographs of Formal Second Stage Consultation Meeting at Patna



Annexure 5.1: List of Sanctuary

A. Kashi Turtle Sanctuary (KTS), Varanasi, UP

The area of the midsection of the Ganga River, between Ramnagar Fort to Malviya Rail/Road Bridge (Raj Ghat Bridge) measuring around 7-km area is declared as the Turtle Wild Life Sanctuary under the State Administration Forests Act, Section-3, Part -4170/14-3-62 dated 21-12-1989. Along with the turtles, incidentally the other species of aquatic bio-diversity inhabiting this stretch is also protected. The Sanctuary also forms the part of Ganga Action Plan. Location of Kashi Turtle sanctuary in NW-1 is shown at **Figure below**.



Location of Kashi Turtle Sanctuary in NW-1

Throughout the sanctuary many religious Ghats are located on the banks of Ganga River which are used for bathing, boating and cremation purposes. Fishing activity in sanctuary area is completely prohibited. Sand mining in the sanctuary area is also prohibited. Biological resource of the sanctuary comprises of Turtle and fishes.

Gangetic Dolphin, Ganges Soft shelled turtle wintering birds, etc are reported in Kachua varyajeev Vihar (Turtle WLS), Varanasi²¹. TWS, a notified protected area under Wildlife protected area is located about 2.27 km in north direction, downstream from the proposed Ramnagar terminal in NW-1. Stretches of Varanasi downstream which was not surveyed in 2012 recorded 269 Gangetic Dolphins²².

21 *State of Environment Report- 2010, Uttar Pradesh, p.105, Directorate of Uttar Pradesh.*

[22http://www.wmfindia.org/?14681/The-Ganga-Dolphin-Census-and-My-Ganga-My-Dolphin-campaign-2015-come-to-a-close-with-a-heartening-1263-in-the-surveied-3350-km-stretch](http://www.wmfindia.org/?14681/The-Ganga-Dolphin-Census-and-My-Ganga-My-Dolphin-campaign-2015-come-to-a-close-with-a-heartening-1263-in-the-surveied-3350-km-stretch)

As reported in literature freshwater turtles are major biodiversity components of the aquatic ecosystem, often serve as keystone species benefiting other animals and plants. They participate in the web of interacting and co-dependent species that constitute a healthy functioning of ecosystem. In Kashi Turtle Sanctuary mainly *Aspideretes gangetica* (self-shell turtles), *Geoclemys hamiltonii*, *Chitra indica* and *Lissemys punctata* which are carnivorous species and hard shelled herbivorous turtle - Pechra Kachhua, Sundri Kachhua, Tentoria Kachhua, and Tongoka are in abundance. The list of Turtle species with their IUCN's Threatened status is provided in following **Table**. A turtle breeding centre is also set up at Sarnath to propagate its population where turtle (both herbivorous and carnivorous) are hatched, reared for one to two year and then released into Kashi Turtle sanctuary.

Turtle species in Sanctuary Area

Sl. No.	Common name	Species	IUCN Classification
1	Self-shell turtle	<i>Aspideretes gangeticus</i>	Vulnerable
2	Indian flap shell turtle	<i>Lissemys punctata</i>	Low risk
3	Narrow headed soft shell turtle	<i>Chitra indica</i>	Endangered
4	Spotted pond turtle	<i>Geoclemys hamiltonii</i>	Vulnerable
5	Crowned river turtle	<i>Hardella thurjii</i>	Vulnerable
6	Indian roofed turtle	<i>Pangshura tecta</i>	Lower risk
7	Indian tent turtle	<i>Pangshura tentoria</i>	Lower risk
8	Tongoka	<i>Batagur dhongoka</i>	Endangered

The right bank of the turtle sanctuary provides a perfect habitat for turtle to breed. However, during the site visit as well as literature records no such nesting and breeding sites were observed in KTS as well as in Varanasi area.

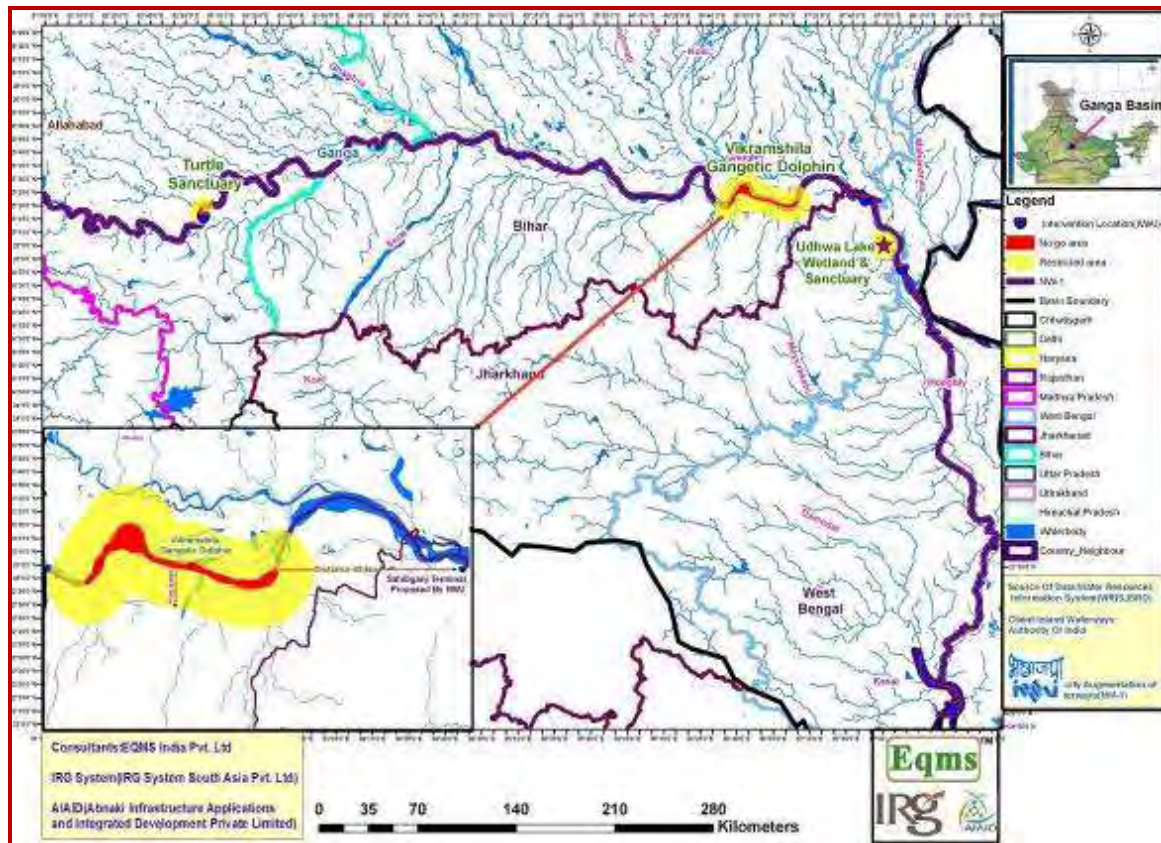
Fishes: In sanctuary area major carps like, Rohu (*Labeo rohita*) mrigal (*Cirrhinus mrigala*), katla (*Catla catla*), kalbasu (*Labeo calbasu*) and cat fishes like padhan (*Wallago attu*) tengras (*Mystus tengara*) and Magur (*Clarias batrachus*), Singhi (*Heteropneustes fossilis*), Tilapia (*Oreochromis sp.*), Kawai (*Anabas testudineus*) and Mahfish (*Barbus sp.*) are present.

B. Vikramshila Dolphin Sanctuary, Bihar

Vikramshila Gangetic Dolphin Sanctuary (VGDS) has been notified on 7th August, 1991 as Wildlife Sanctuary under Wildlife Protection Act, 1972 for the protection of Dolphin²³, which is categorized as endangered species on the IUCN Red List. VGDS is the only riverine protected area for conservation of Gangetic Dolphin in the eastern Gangetic Plain. The sanctuary includes middle of Ganges between Sultanganj and Kahalgaon Hills (25.254°N to 25.282°N²⁴ and 86.738°E to 87.229°E)- in Bhagalpur district-. 10 kms area around VGDS is the default Eco Sensitive Zone at present. The proposed nearest Terminal at Sahibganj is located about 48 kms from VGDS. The location of VGDS in NW-1 and proposed terminal at Sahibganj is shown in **Figure below**.

²³This species has been included in Schedule- I of the Indian Wildlife (Protection) Act 1972, Appendix I of the Convention on International Trade in Endangered Species (CITES), Appendix II of the Convention on Migratory Species (CMS) and IUCN red list as endangered species.

²⁴ The coordinates printed in the notification of the Sanctuary falls outside the Ganga River. Coordinates shown here are as per report published by WWF and corresponding to actual situation on ground. However starting and ending locations name are as per the notification.



Location of VGDS in NW-1

Various aquatic species of flora and fauna are found in Vikramshila Gangetic Dolphin Sanctuary. Besides Dolphins, other species of freshwater shrimps, fish and crustaceans can be observed. The area of the sanctuary is also an important bird area and the species such as the Greater Adjutant (*Leptoptilos dubius*) and Lesser Adjutant (*L. javanicus*) are present. Other storks present are the Ciconia nigra, Black-necked stork (*Ephippiorhynchus asiaticus*), White-necked (*Ciconia episcopus*), and the Asian Openbill (*Anastomus oscitans*). The Sanctuary is rich in waders. Common Crane (*Grus grus*), Eurasian Spoonbill (*Platalea leucorodia*) and various ducks are also seen here. The major carps like, Rohu (*Labeo rohita*) mrigal (*Cirrhinus mrigala*), katla (*Catla catla*), kalbasu (*Labeo calbasu*) and cat fishes like padhan (*Wallago attu*), tengras (*Mystus tengara*) and Magur (*Clarias batrachus*), Singhi (*Heteropneustes fossilis*), Tilapia (*Oreochromis sp.*), Kawai (*Anabas testudineus*), Mahfish (*Barbus sp.*) etc. are present in the sanctuary area.

C. Hilsa Sanctuary

Hilsa (*Tenualosa ilisha*) is assessed as Least Concern species as per IUCN's threatened category (version 3.1) but its population is declining due to over fishing and fragmentation of migratory routes along Farakka barrage. This sanctuary is notified²⁵ mainly with objective of enhancing Hilsa production. In order to facilitate spawning, all types of fish catching are banned in the Hilsa Sanctuaries during June to August and October to December every year in Hilsa Sanctuary areas (Refer **Table below** and **Figure below**). Fishing of Hilsa is prohibited within 5 square kilometre of the Farakka Barrage (the notified

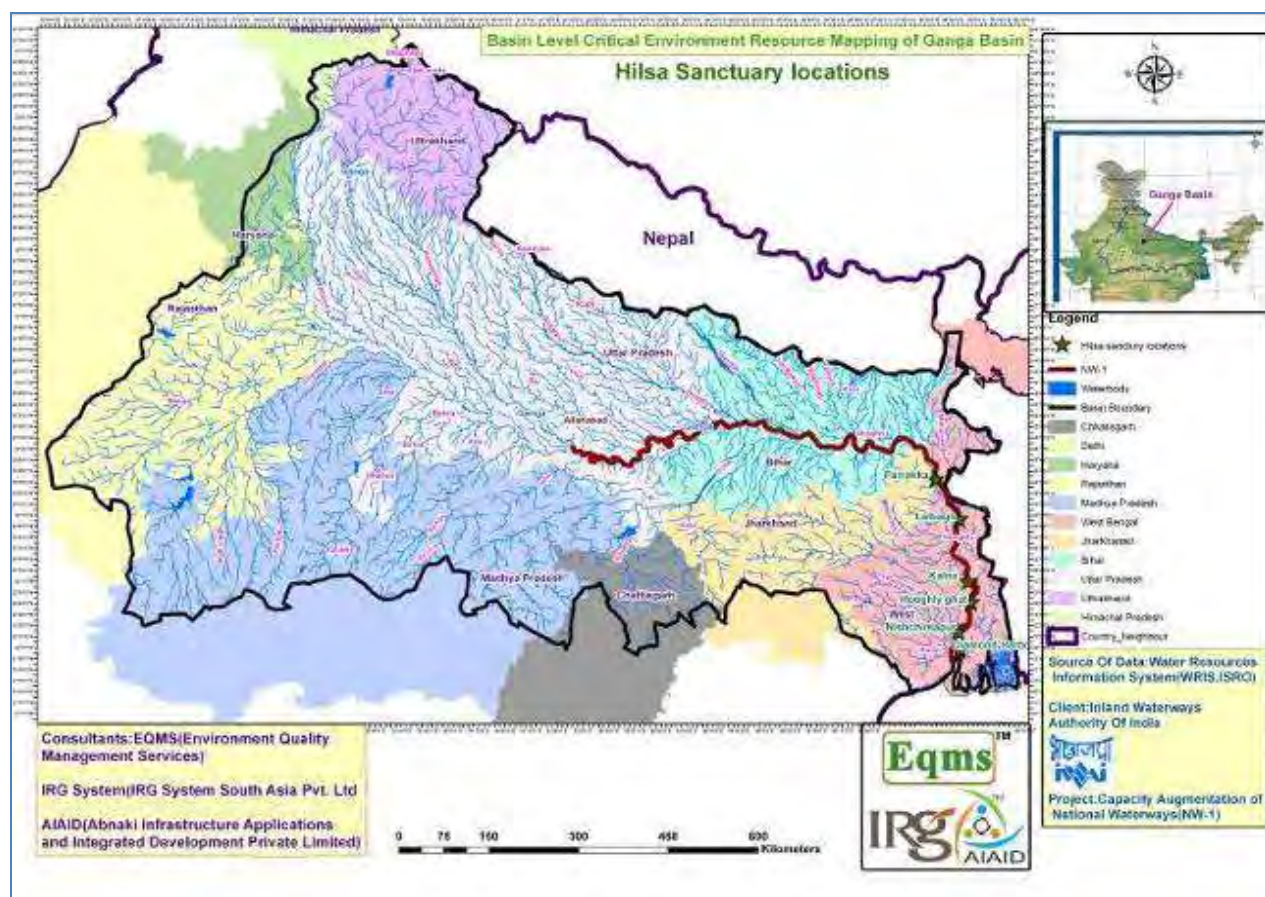
²⁵Notification of Fisheries Department, Government of West Bengal dated Tuesday, April 09, 2013 published in *The Kolkata Gazette*. The Hilsa Sanctuary Is not notified under Wild Life (Protection) Act and as such does not attract any provision of this act.

sanctuary area) round the year to protect the hilsa species and facilitate breeding and spawning in this area.

Location of the Hilsa Sanctuary and their stretch

Sr. No.	Location of the Hilsa Sanctuaries and their stretches
1	Diamond Harbour to Nishchintapur Godakhali
2	Katwa to Hooghly Ghat, part of Burdwan and Hooghly District)
3	Between Lalbagh in Farakka, Murshidabad district
4	5 square kilometres area around Farakka Barrage

Salinity is a critical chemical factor in governing the faunal distribution in this zone. The important families are Catla, Labeo rohita, L. calbasu, L. bata, Cirrhinus mrigala, C. reba, Puntius ticto, P. conchonus, P. sarana, P. sophore, Salmostoma bacaila, Danio devario, Brachygobius nusus, Glossogobius giuris, Pseudapocryptus lanceolatus, Stigmatogobius sadanundio, Periophthalmodon schlosseri, Boleophthalmus dussumieri, Gobioptrus chuno, Bathygobius orbicularis, Tenulosa ilisha, Hilsa kelee, Coilia dussumieri, C. ramcorti, C. reynaldi, Setipinna phasa, S. taty, Liza parsia, L. tade, L. macrolepis, Mugil cephalus, Ailia coila and Eutropiichthys vacha.



Location of Hilsa Sanctuaries in NW-1

Annexure 5.2: Morphology of River (NW-1) in different reached

S. No.	Reach/Stretch	Chainage	Morphology
1.	Sagar Road – Haldia	(0-35)	Split channel with central islands
2.	Haldia – Diamond Sand	(35-60)	Split channel with central islands
3.	Diamon Sand –Howrah Bridge	(60-145)	Sinuuous channel
4.	Howrah Bridge -Tribeni	(145-193)	Irregular meandering channel with some sporadic central bars
5.	Tribeni-Balagarh	(193-221)	Irregular meandering channel with split channels and bars. Oxbow lakes and cut-offs visible
6.	Balagarh-Kalna	(221-245)	Tortuous meandering channel showing split channels at bends. Oxbow lakes and cut-offs visible
7.	Kalna-Samudragarh	(245-263)	Irregular meandering channel showing some degree of split at a few locations. Oxbow lakes and cut-offs visible
8.	Samudragarh-nabadweep	(263-280)	Tortuous meandering channel with bars at the near the inner bank of bends
9.	Nabadweep-Patuli	(280-322)	Tortuous meandering channel with chutes at bends and several split channels. Oxbow lakes and cut-offs visible
10.	Patuli-Katwa	(322-345)	Tortuous meandering channel with localised bars and chutes at bends and some degree of split channels. Oxbow lakes and cut-offs visible
11.	Katwa-Palassey	(345-371)	Meandering single channel, wider at bends with some chutes. Cut-offs visible
12.	Palassey-Chaurigacha	(371-400)	Irregular meandering channel showing chutes at bends and split of channels at particular locations. Oxbow lakes and cutoffs visible
13.	Chaurigacha-berhampur	(400-421)	Sinuuous channel except for the approximately last 5 km of the reach. In that area the channel shows tortuous meanders and oxbow lakes. Cut-offs also visible
14.	Berhampur-mohammadpur	(421-449)	Irregular meandering single channel. Oxbow lakes visible
15.	Mohammadpur-nasirpur	(449-479)	Tortuous meandering single channel with central bars at certain locations. Oxbow lakes and abandoned meander channels visible
16.	Nasirpur-Jangipur Lock	(479-505)	Tortuous meandering single channel. Cut-off and abandoned meander channels visible
17.	Jangipur Lock-Farraka Lock	(505-544)	Artificial channel
18.	Farakka Lock Rajmahal	(544-583)	Composite river with one main sinuous channel with bars and islands and several sinuous secondary channels. Several oxbow lakes can be seen
19.	Rajmahal-Manihari	(583-633)	Composite river with one main channel with bars and islands and several sinuous side channels
20.	Manihari-Karagola	(633-660)	Split river with sinuous channels with a certain degree of braiding that converts in a single main sinuous channel with several side channels
21.	Karagola-Kahalgaon	(660-690)	Split river with sinuous channels with a certain degree of braiding
22.	Kahalgaon-Bhagalpur	(690-715)	Sinuuous channel with a certain degree of braiding showing bars and islands
23.	Bhagalpur-sultanganj	(715-746)	Sinuuous channel that shows some degree of braiding. The area shows clear oxbow lakes
24.	Sultanganj-Munger	(746-793)	Sinuuous channel that shows some degree of braiding in a stretch of a few kilometres. It is a clear cut-off with the old bendy channel still showing some activity
25.	Munger-Mahendrapur	(793-820)	Anabranched river with channels with a certain degree of braiding showing bars, islands and side channels
26.	Mahendrapur-Semaria	(820-853)	Anabranched river with channels with a certain degree of braiding showing bars, islands and side channels



S. No.	Reach/Stretch	Chainage	Morphology
27.	Semaria-Barh	(853-891)	Anabranched river with channels with a certain degree of braiding showing bars, islands and side channels
28.	Barh-Mehnar	(891-925)	Anabranched river with channels with a certain degree of braiding showing bars, islands and side channels
29.	Mehnar-Patna	(925-955)	Anabranched river with channels with a certain degree of braiding showing bars and islands
30.	Patna-Doriganj	(955-1000)	Split sinuous channels with a high degree of anabranching
31.	Doriganj-Ballia	(1000-1063)	Meandering single channel, wider at bends with some chutes and several subparallel anabranches
32.	Ballia-Buxar	(1063-1124)	Sinuous single channel, wider at bends with some chutes and a sinuous side channel and certain degree of braiding
33.	Buxar-Ghazipur	(1124-1178)	Sinuous single channel, wider at bends with some chutes and a sinuous side channel
34.	Ghazipur-Saidpur	(1178-1254)	Sinuous channel that shows some degree of braiding in a stretch of around 10 kilometres
35.	Saidpur-Varanasi	(1254-1311)	Meandering single channel, wider at bends with some chutes and a side channel
36.	Varanasi-Chunar	(1311-1344)	Meandering single channel, wider at bends with some chutes and a side channel
37.	Chunar-Mirzapur	(1344-1398)	Meandering single channel, wider at bends with several chutes
38.	Mirzapur-Rampur Ghat	(1398-1419)	Sinuous channel that shows some degree of braiding in a stretch of a few kilometres
39.	Rampur Ghat-Sirsa	(1419-1506)	Meandering single channel, wider at bends with some chutes and a sinuous side channel; stretches of few kilometres with split of channels less than 200 m wide
40.	Sirsa-Allahabad	(1506-1547)	Meandering single channel, wider at bends with some chutes and a sinuous side ch

Source: HOWE Engineering Projects (India) Pvt. Ltd. (Design Consultant)

Annexure 5.3: Primary data analysis and observation on water quality

Flow Discharges

The South Asian monsoon system largely defines the climate and hydrology of the Ganga River. The monsoon brings heavy rains three months a year therefore, the Ganga River is characterised by high flows during the monsoon season, approximately from July until October, and low flows during the rest of the year. April and May are in general, the lowest flow months with negligible rainfall and a low base flow into the system. Due to the climate variability the timing of the onset of the monsoon period is uncertain. Climate change predictions suggest that for the River Ganga the monsoon discharges will increase in the future (ref).

Figure 1 and **Figure 2** show the rapid increase and fall of discharges during July and September-October at two locations: Varanasi (chainage 1311) and Farakka (chainage 583). The average values during the low flow season can be of the order of 1 per cent of the discharge during the high flow season.

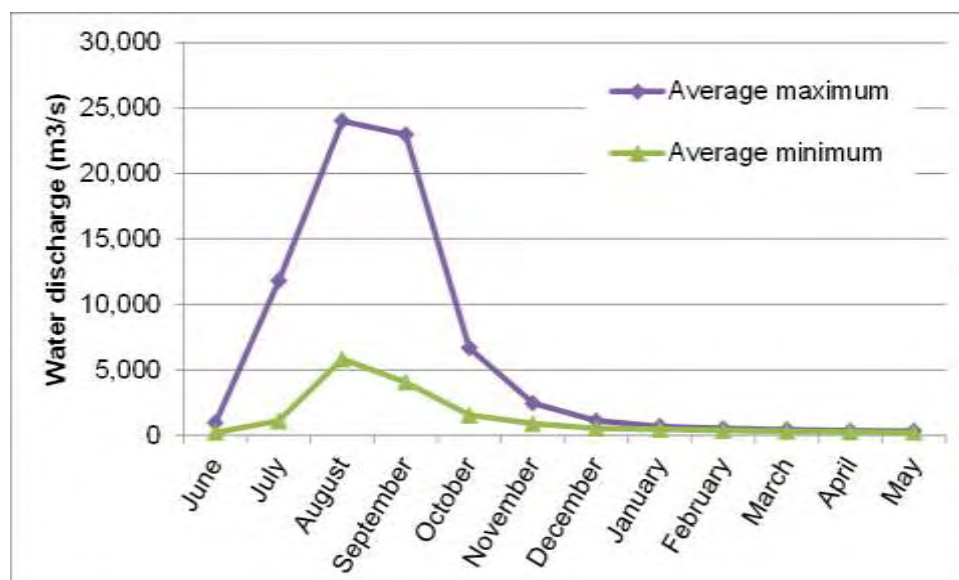


Figure 1: Average of maximum and minimum monthly discharges at Varanasi (chainage 1311)

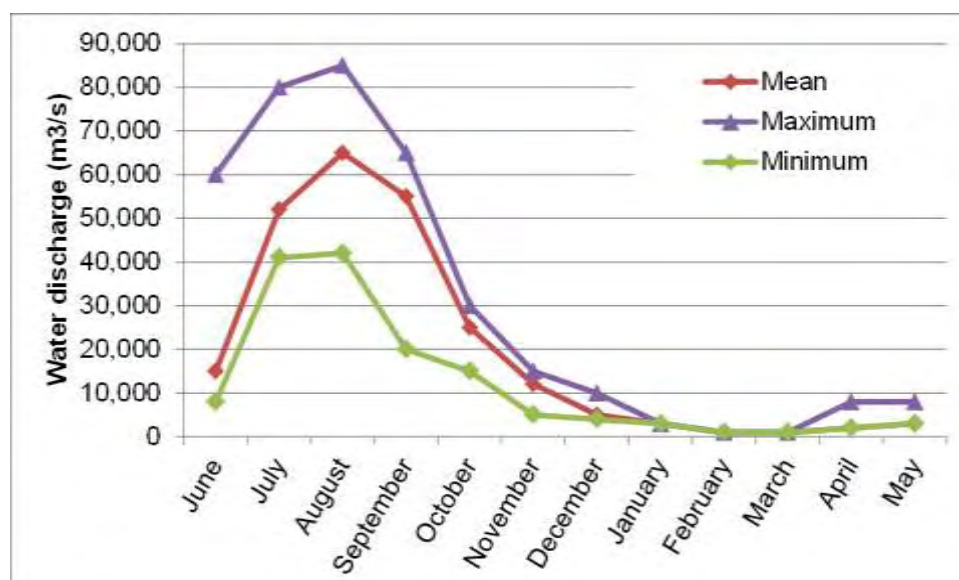


Figure 2: Mean, maximum and minimum monthly discharges at Farakka, chainage 583 (extracted from Jeuland et al, 2013)

Maximum and minimum discharges were provided by IWAI for different years at 3 locations: Allahabad (chainage 1547), Mirzapur (chainage 1398) and Varanasi (chainage 1311). Average monthly discharges for a range of years were provided at Buxar (chainage 1124) and Patna (chainage 955). When comparing this information it is clear (see **Figure 3**) that average discharges increase downstream during the high season (July to November).

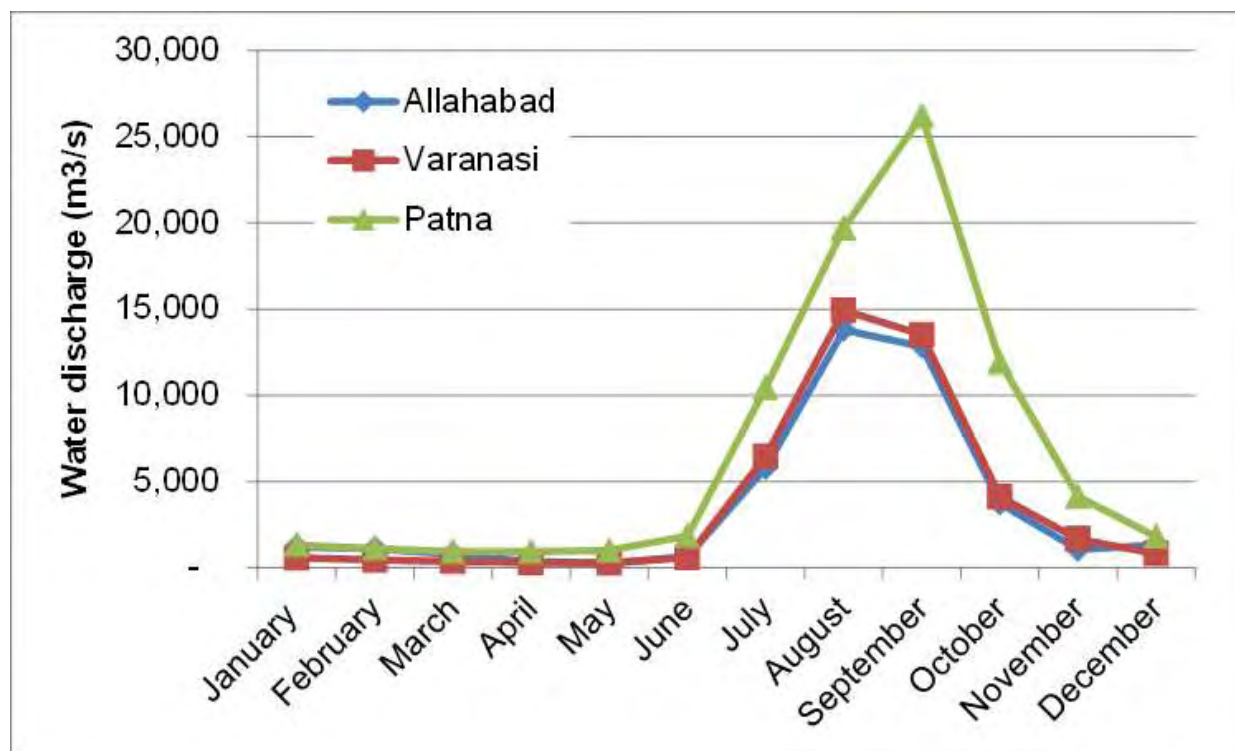


Figure 3: Monthly average discharges over the year at Allahabad, Varanasi and Patna

In addition to the significant seasonal variation within years, there is also a great variability between years. With the time series available at the three upstream gauging sections it is possible to perform a statistical analysis of the lowest flows. **Figure 4** shows, as an example, the extreme analysis performed at Allahabad considering the Generalized Extreme Value (GEV) distribution.

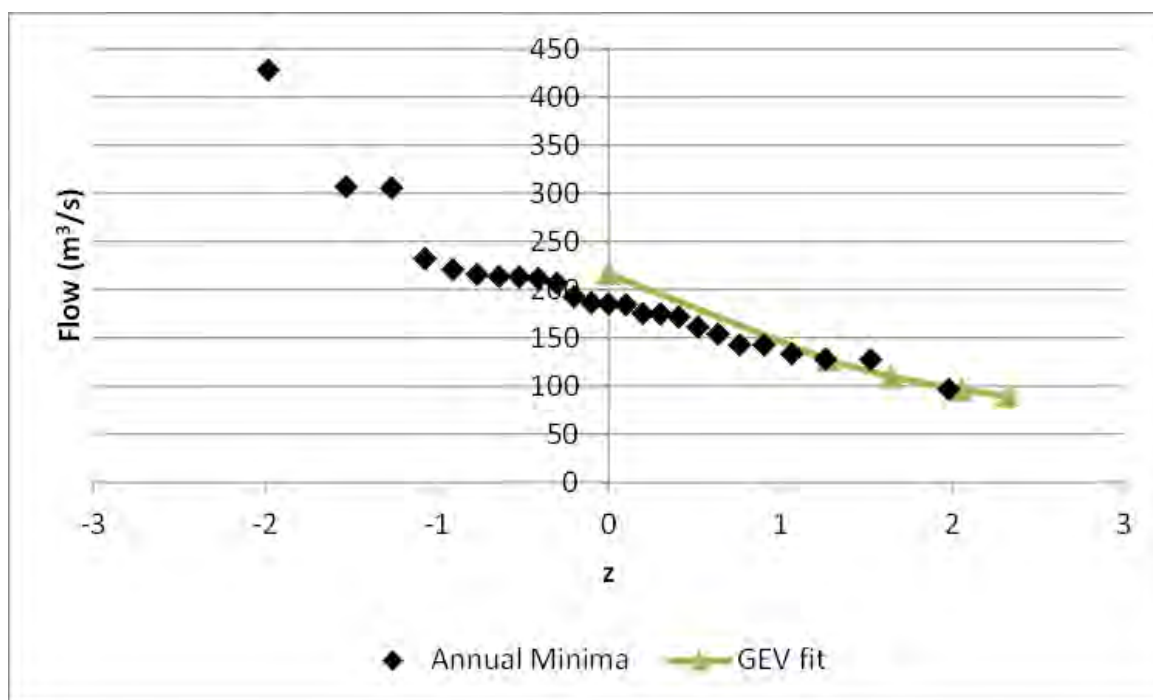


Figure 4: Extremes analysis on the annual minimum flow at Allahabad

The results of the statistical analysis are summarised in the following **Table 1**.

Table 1: Annual minimum discharges obtained from statistical analysis

Discharge (m ³ /s) Parameter	Allahabad	Mirzapur	Varanasi
Minimum recorded flow (m ³ /s)	96	122	117
1 in 2 year minimum flow (50% annual probability)	188	167	185
1 in 10 year minimum flow (10% annual probability)	117	128	130
1 in 100 year minimum flow (1% annual probability)	90	119	110

Despite data constraint at Buxar & Patna, the available data shows that the lowest flow recorded at Buxar was 225 m³/s and the lowest flow recorded at Patna was 689 m³/s. These flows are considerably lower than the averages for the dry season.

The report “Status on River Ganga: State of the Environment and Water Quality” from the National River Conservation Directorate (2009) provides useful information in terms of understanding water discharges along the upstream reaches of NW-1. The report presents water discharges with a probability of exceedance of 50%, 10% and 90% at 6 stations: Allahabad, Mirzapur, Varanasi, Buxar, Patna and Azamabad during the low flow season. It also presents average post-monsoon flows (in October-November), average flows in December-February and in March-May periods. These values are summarised in Table 16. They are generally higher than the values presented in **Table 2** obtained from the statistical (extremes) analysis of available data at the three gauging stations.

Table 2: Characteristic discharges obtained from the National River Conservation Directorate (2009) report

Flow regime Discharge (m ³ /s)	Allahabad	Mizarpur	Varanasi	Buxar	Patna	Azamabad
Q50 (flow with 50% probability of exceedance) during low season	300	300	300	450	1050	1400
Q90 (flow with 90% probability of exceedance) during low season	175	175	175	250	600	1050

Q10 (flow with 10% probability of exceedance) during low season	450	450	450	600	1600	2000
Average in October-November	2000	2200	2400	3100	5500	9500
Average in December-February	500	500	500	750	1300	2200
Average in March-May	400	400	400	500	1000	1500

Source: The National River Conservation Directorate, Ministry of Environment and Forests, Government of India (2009)

Farakka Barrage, with a length of 2.2 km and about 15 km from the border with Bangladesh, regulates the flow of the River Ganga diverting some of the water into the 42 km long Feeder Canal linking with the Bhagirathi River downstream towards Kolkata. The design discharge for this channel is around 1,100 m³/s. The navigation lock at Farakka, as well as the Feeder Canal, are part of the Farakka Barrage Project and become the link between the Bhagirathi-Hugli system and the main River Ganga upstream of the Farakka Barrage.

The existing agreement between India and Bangladesh, includes specific water allocation rules during the low flow season. The treaty establishes that during the period January – May 35,000 cusecs (or approximately 425 m³/s) are shared alternatively through the Farakka Barrage on a 10 day cycle in each month by both countries.

Data extracted from Jeuland et al (2013) shows the historical flows at Farakka for the period 1969-2001 (Figure 5).

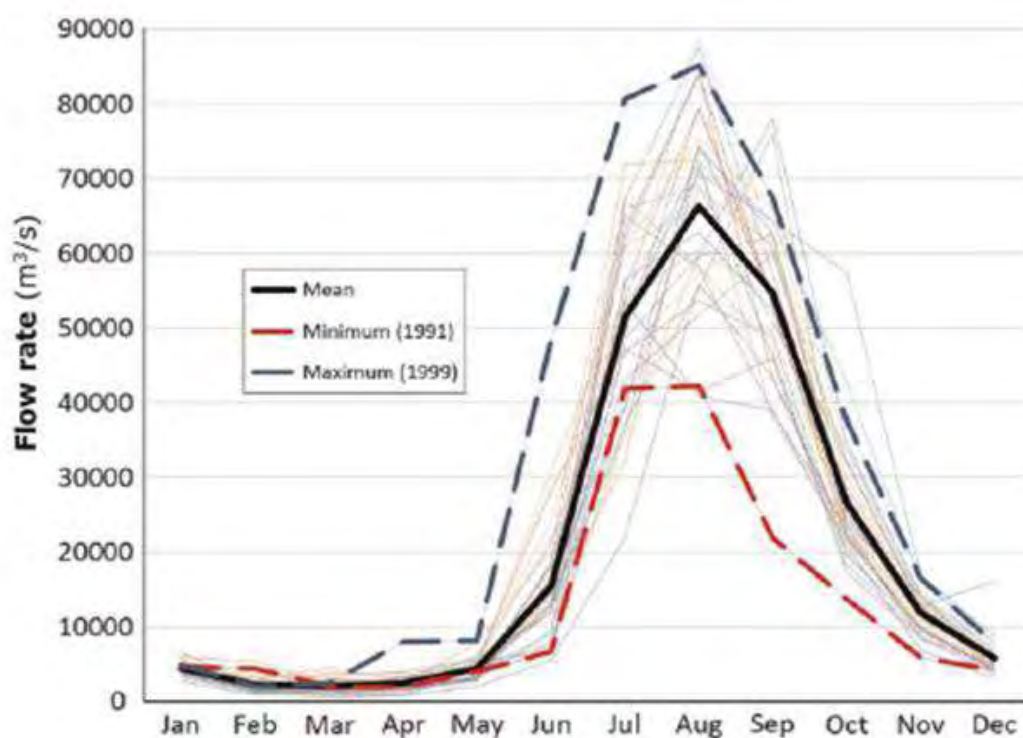


Figure 5: Historical flows at Farakka for the period 1969-2001 (extracted from Jeuland et al, 2013)

Water Levels

Temporal series of water levels have been provided for a number of locations along the waterway between Allahabad and Farakka. The following figures show the variability of monthly water levels, which can be of the order of 10 m during the high season. In general, water levels are at their highest in August-September

and sharply decrease in October-November. In general, they continue to decrease during the whole low flow season, from December to May, and start to raise again in June-July. The variability of water levels during the dry season is lower than during the high season, with variations of the order of 2-3m. The following figures show the maximum and minimum monthly values with the black block representing where 50% of the values concentrate.

The period of the year in which the minimum water level can occur varies with location along the river. In the upstream reaches from Allahabad to Ghazipur the minimum water levels occur from April to July (**Figure 6** and **Figure 7**). Downstream of the three major tributaries, Ghagra, Son and Gandak that join the river near Patna, the minimum water levels can occur between February and June as a result of the influence of snow melt (**Figure 8** and **Figure 9**).

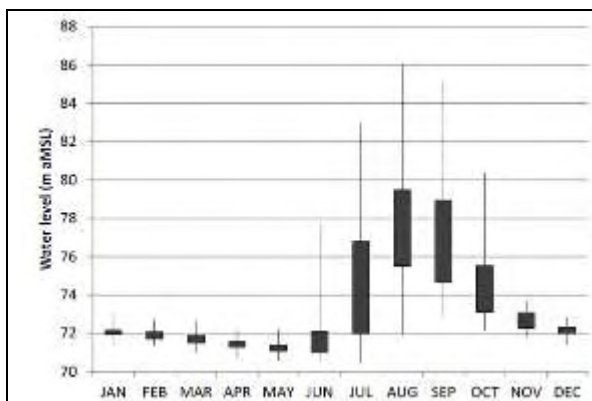


Figure 6: Monthly water levels at Allahabad (chainage 1,547)

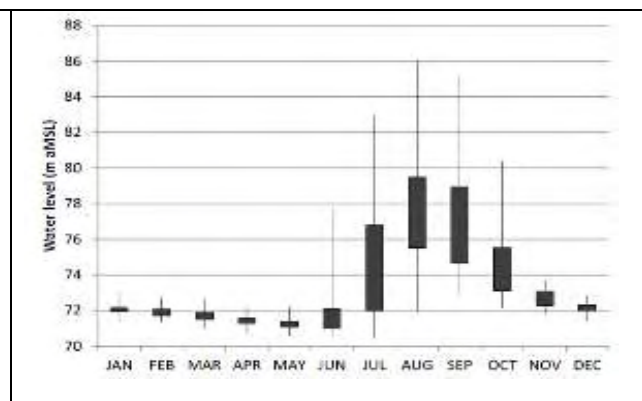


Figure 7: Monthly water levels at Ghazipur (chainage 1,178)

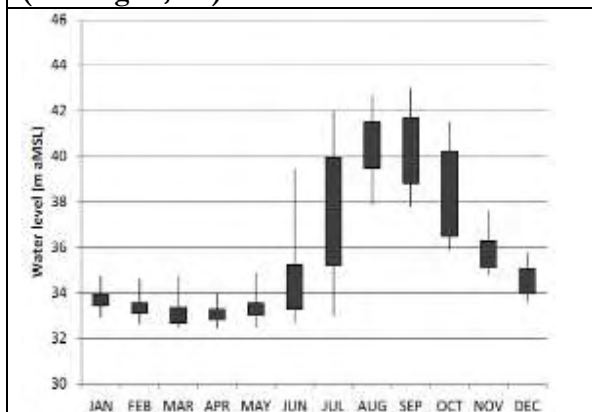


Figure 8: Monthly water levels at Hathida (chainage 850)

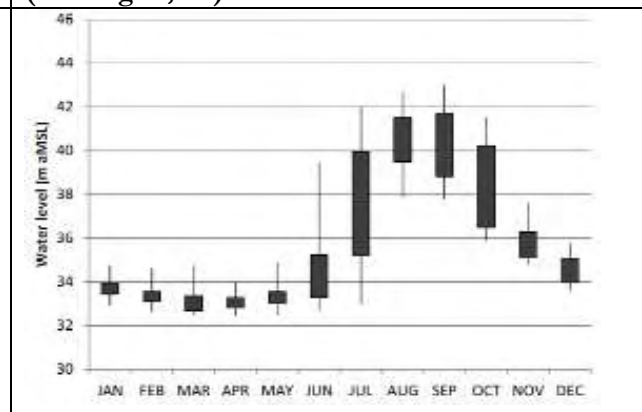


Figure 9: Monthly water levels at Kahalgaon (chainage 690)

Statistical analysis has been performed on the annual minimum and maximum water levels at 7 gauging stations between Allahabad and Farakka. These water levels at each location are given for 3 annual probabilities of occurrence (see **Table 3** and **Table 4**).

Table 3: Minimum water levels for a range of annual probabilities

Location	Minimum water level (m)		
	50%	10%	1%
Allahabad	71.45	70.72	70.38
Mirzapur	63.10	62.58	62.37
Varanasi	58.59	57.91	57.27
Ghazipur	52.45	51.69	51.27
Patna	40.88	40.27	39.56
Hathida	33.28	32.59	32.18
Kahalgaon	23.64	22.96	22.57

Table 4: Maximum water levels for a range of annual probabilities

Location	Maximum water level (m)		
	50%	10%	1%
Allahabad	82.36	85.67	87.22
Mirzapur	75.65	78.77	79.89
Varanasi	70.00	72.48	73.37
Ghazipur	62.88	64.78	65.18
Patna	49.36	50.44	50.91
Hathida	41.78	42.85	43.01
Kahalgaon	30.99	32.70	32.90

Analysis of LAD

Least Available Data (LAD) available from Tribeni to Allahabad was analysed to get an understanding of the variations of water depths in NW-1. Data for the period April 2002 to June 2015 was used to build probability curves of LAD. As an example, two of them are shown in **Figure 10**.

The curves show the probability of having a LAD value lower than the value shown in the graph. For example, in IWAI Reach 20 the probability of having a value less than 6.30 m in August is 90% and the probability of having a value less than 3.60 m is only 10%. As a reference, horizontal lines at 3, 2.5 and 2.2 metres are also shown on the Figures. The graph corresponding to the IWAI Reach 32, Varanasi – Chunar, clearly shows that, based on the existing data, the probability of having depths less than 2.2 m for the period January-May and November-December is 90% or more.

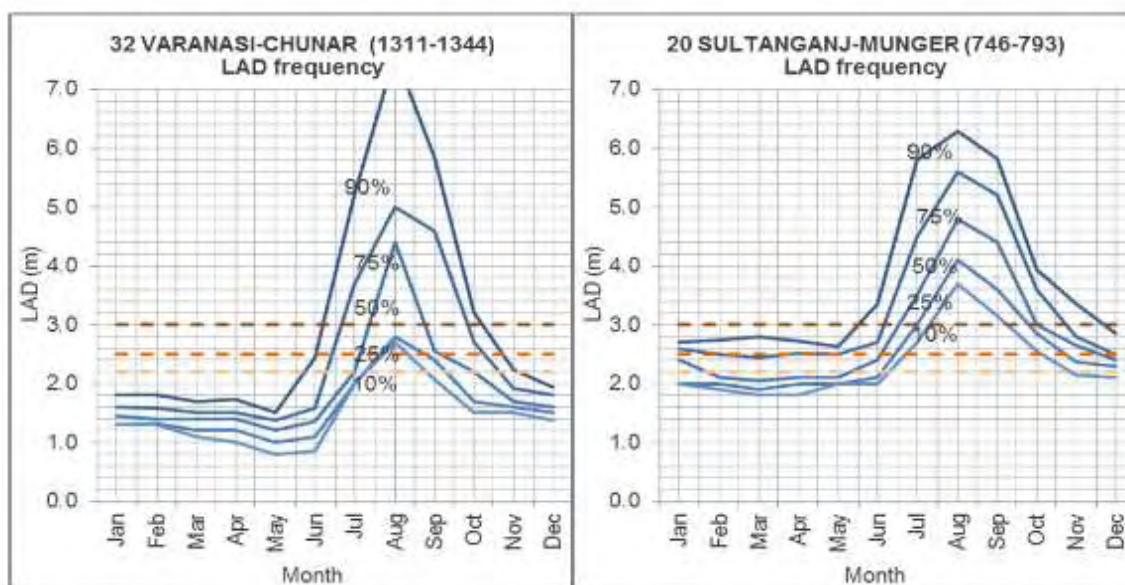


Figure 10: Probability curves of LAD for two different reaches

This statistical information has also been analysed to show the periods when available water depths have a 50% probability to be lower than a certain value (3m, 2.5m and 2.2m). The information is presented in **Table 5** below. It should be analysed in conjunction with other information presented in this report about the length and number of shoals to provide a full picture of the sedimentation processes occurring.

Table 5: LAD with 50% probability (in metres)

Sr. No	Name	Chainage (km)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Tribeni – Balagarh	193-221	3.00	3.10	3.00	3.00	3.30	3.40	3.80	4.20	3.80	3.60	3.10	3.00

Sr. No	Name	Chainage (km)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	Balagarh – Kalna	221-245	3.00	2.90	2.80	2.90	3.00	3.30	3.50	3.95	3.90	3.60	3.05	3.05
3	Kalna - Samudragarh	245-263	3.00	2.80	2.75	2.80	2.90	3.20	3.60	4.00	3.80	3.50	3.20	3.10
4	Samudragarh - Nabadweep	263-280	3.00	2.90	2.80	2.80	2.95	3.25	3.40	4.20	4.20	3.70	3.20	3.10
5	Nabadweep – Patuli	280-322	2.80	2.85	2.85	2.75	2.80	3.10	3.30	3.50	3.70	3.50	3.10	3.00
6	Patuli – Katwa	322-345	3.10	2.90	2.90	2.85	2.90	3.10	3.20	3.40	3.50	3.30	3.00	3.05
7	Katwa – Palassey	345-371	2.80	2.65	2.50	2.50	2.70	3.00	3.00	3.50	3.40	3.10	2.80	2.80
8	Palassey - Chaurigacha	371-400	2.90	2.95	2.80	2.90	3.00	3.10	3.10	3.40	3.40	3.20	3.05	3.00
9	Chaurigacha - Berhampur	400-421	3.40	3.20	3.00	3.05	3.20	3.40	3.70	3.70	3.80	3.55	3.50	3.50
10	Berhampur – Mohammadpur	421-449	3.20	3.00	3.00	3.00	3.10	3.45	3.60	3.95	3.70	3.60	3.40	3.30
11	Mohammadpur - Nasirpur	449-479	3.30	3.20	3.15	3.00	3.20	3.50	3.70	3.80	3.50	3.70	3.50	3.50
12	Nasirpur – Jangipur Lock	479-505	3.75	3.50	3.30	3.40	3.50	4.15	4.30	4.50	4.20	3.95	4.00	4.00
13	Jangipur Lock – Farrakka Lock	505-544	2.70	2.50	2.50	2.30	2.50	2.85	2.80	2.80	2.70	2.75	3.00	2.80
14	Farrakka Lock - Rajmahal	544-583	2.00	2.00	2.00	2.05	2.10	2.20	2.35	2.20	2.10	1.95	2.00	2.00
15	Rajmahal – Manihari	583-633	2.60	2.30	2.35	2.20	2.40	2.65	3.50	4.20	3.90	3.00	2.80	2.85
16	Manihari – Karagola	633-660	2.60	2.40	2.20	2.20	2.45	2.80	3.90	4.60	3.70	3.20	2.95	2.85
17	Karagola - Kahalgaon	660-690	2.20	2.15	2.00	2.00	2.30	2.60	3.95	4.20	4.20	3.00	2.60	2.50
18	Kahalgaon - Bhagalpur	690-715	2.45	2.40	2.20	2.20	2.30	2.50	4.00	4.70	4.10	3.00	2.85	2.70
19	Bhagalpur - Sultanganj	715-746	2.35	2.10	2.10	2.10	2.15	2.50	3.50	4.60	4.10	2.90	2.50	2.35
20	Sultanganj - Munger	746-793	2.40	2.10	2.05	2.10	2.10	2.40	3.50	4.80	4.40	3.00	2.65	2.40
21	Munger - Mahendrapur	793-820	2.20	2.10	2.10	2.15	2.25	2.40	3.70	4.70	3.60	3.10	2.60	2.50
22	Mahendrapur - Semaria	820-853	2.20	2.10	2.10	2.15	2.20	2.45	3.50	5.20	3.90	2.90	2.40	2.30
23	Semaria – Barh	853-891	2.10	2.10	2.00	2.00	2.10	2.30	3.30	4.60	3.40	2.80	2.35	2.20
24	Barh – Mehnar	891-925	2.05	2.00	2.00	2.00	2.00	2.30	3.40	4.50	3.50	2.80	2.40	2.10
25	Mehnar – Patna	925-955	2.00	2.00	2.00	2.00	2.00	2.25	3.40	4.50	3.40	2.70	2.30	2.00
26	Patna – Doriganj	955-1000	2.00	2.00	1.95	1.90	2.00	2.10	3.20	4.30	4.20	2.40	2.10	2.00
27	Doriganj – Ballia	1000-1063	1.60	1.70	1.70	1.70	1.80	1.75	3.00	4.00	3.60	2.30	2.05	1.75
28	Ballia – Buxar	1063-1124	1.70	1.70	1.60	1.60	1.50	1.50	3.00	4.10	3.60	2.40	2.00	1.70
29	Buxar – Ghazipur	1124-1178	1.55	1.60	1.60	1.50	1.30	1.50	2.70	4.40	4.10	2.25	1.80	1.70
30	Ghazipur – Saidpur	1178-1254	1.40	1.30	1.25	1.30	1.10	1.15	2.10	4.40	3.35	2.00	1.65	1.40
31	Saidpur – Varanasi	1254-1311	1.50	1.50	1.30	1.30	1.10	1.20	2.20	4.30	3.10	2.20	1.75	1.45
32	Varanasi – Chunar	1311-1344	1.45	1.40	1.40	1.40	1.20	1.35	2.20	4.40	2.55	2.20	1.70	1.60
33	Chunar – Mirzapur	1344-1398	1.40	1.30	1.20	1.05	0.95	1.00	2.10	3.10	2.75	2.15	1.60	1.40
34	Mirzapur – Rampur Ghat	1398-1419	1.40	1.40	1.30	1.30	1.00	1.10	2.10	3.10	2.70	2.10	1.80	1.40
35	Rampur Ghat - Sirsa	1419-1506	1.50	1.50	1.30	1.40	1.10	1.30	2.10	3.10	3.25	2.05	1.90	1.50
36	Sirsa – Allahabad	1506-1547	1.20	1.10	1.00	0.90	0.80	0.90	2.00	2.80	2.75	1.95	1.50	1.30

Key:

3.0m =< LAD	2.5m =< LAD < 3.0m	2.2m =< LAD < 2.5m	LAD < 2.2m
-------------	--------------------	--------------------	------------

The different colours in Table 19 show the range of minimum depths available. Green corresponds to the months when available depths are larger than 3 m. The table clearly shows the different behaviour of water depths upstream of Farakka Barrage, where the waterway is not regulated and downstream of Farakka Barrage, where water discharges are regulated by the releases from the Barrage into the Hugli River.

Figure 11 summarises the information provided by the table for the dry season (November to June). It shows the available dry season LAD along the waterway.

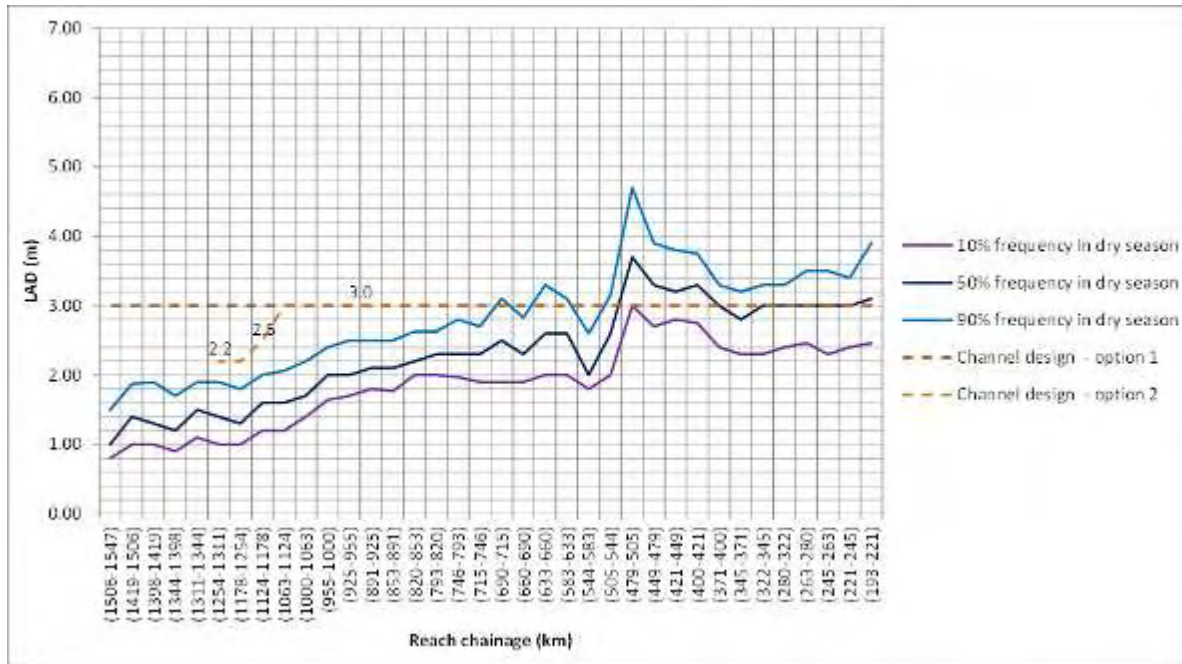


Figure 11: LAD along the waterway for the 10, 50 and 90 per cent frequency values

Annexure 5.4: The details of sampling locations of surface water and analysis results

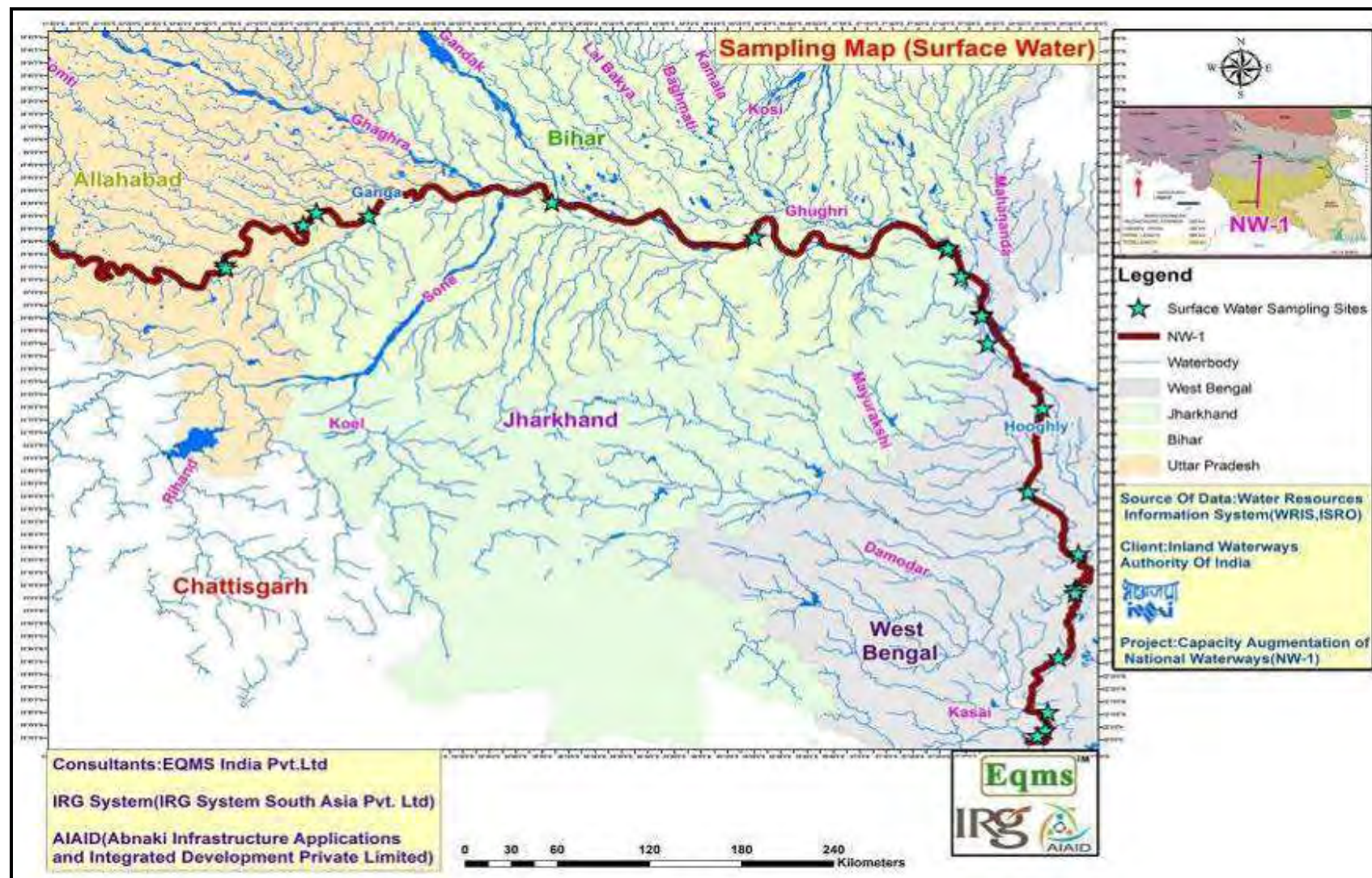
Primary Data

Surface water sample were collected²⁶ from the upstream and downstream of the proposed and planned terminals/ lock locations and environmental sensitive receptors present all along the NW-1. One sample each were also collected from existing ro-ro/jetty/floating terminals. The water samples were examined for physico-chemical parameters as well as for bacteriological parameters. Samples were analysed for various parameters using the CPCB's BDU Criteria. The name of water sampling locations is given at **Table 4.19** and shown at **Figure 4.19**. The analysis results of surface water are presented in **Table 4.20** to **4.22**. Photograph of water sampling is provided in **Figure 4.20** and **4.21**.

Name of Surface Water Sampling Locations

Sl. No.	Terminal Location	Surface water sampling Location	Location Code	Source
Proposed and Planned Terminals				
1	Haldia Terminal, West Bengal	Hoogly River Upstream of Terminal Site and Green Belt Canal	SW-1	Hooghly River
		Hoogly River downstream of Terminal Site and Green Belt Canal	SW-2	Hooghly River
2	Tribeni Terminal, West Bengal	Ganga River Upstream of proposed Tribeni Terminal Site	SW-3	Ganga River
		Ganga River downstream of proposed Tribeni Terminal Site near Shibpurghat	SW-4	Ganga River
	Farakka Lock, West Bengal	Ganga River Upstream of existing Farakka lock site	SW-5	Ganga River
		Ganga River downstream of existing Farakka lock site	SW-6	Ganga River
	Sahibganj Terminal, Kharkhand	Ganga River Upstream of Terminal site near Samda village	SW-7	Ganga River
		Ganga River Downstream of Terminal site near Samda village	SW-8	Ganga River
	Gazipur Terminal, Uttar Pradesh	Ganga River Upstream of proposed Terminal site at Ghazipur	SW-9	Ganga River
		Ganga River Downstream of proposed Terminal site at Ghazipur	SW-10	Ganga River
	Varanasi Terminal, Uttar Pradesh	Ganga River upstream of Gurha Nala and proposed Terminal site	SW-11	Ganga River
		Ganga River downstream of Gurha Nala and proposed Terminal site	SW-12	Ganga River
Existing Ro/Ro/Jetty/Floating Terminals along NW-1				
1	West Bengal	Diamond Harbour	SW-13	Ganga River
2	West Bengal	Howrah	SW-14	Ganga River
3	West Bengal	Shantipur	SW-15	Ganga River
4	West Bengal	Katwa	SW-16	Ganga River
5	West Bengal	Hazardwari	SW-17	Ganga River
6	West Bengal	Pakur	SW-18	Ganga River
7	Jharkhand	Magalhal	SW-19	Ganga River
8	Uttar Pradesh	Buxar	SW-20	Ganga River
9	Uttar Pradesh	Munger	SW-21	Ganga River
10	Uttar Pradesh	Patna	SW-22	Ganga River
Sensitive Locations (Turtle, Vikramshila Dolphin and Hilsa Sanctuaries)				
1	Near Sanctuary Areas	Three locations per Sanctuary areas	-	Ganga River

²⁶Samples were collected as per the standard protocol. The samples for bacteriological analyses were collected in sterilized bottles.



Surface Water Sampling Locations
Ganga Water Quality NW-1 (near proposed and planned Terminal Site location)

Sl.No.	Parameters	Haldia West Bengal		Tribeni West Bengal		Farakka, West Bengal		Sahibganj Jharkhand		Ghazipur Uttar Pradesh		Varanasi Uttar Pradesh	
		SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-10	SW-11	SW-12
1	pH	7.12	7.52	7.22	7.19	6.68	6.54	7.04	6.98	7.8	7.4	7.46	7.45
2	Temperature 0C	24.1	24.6	23.8	24.2	26.2	25.9	25.4	25.8	25.1	25.3	-	-
3	Conductivity, μ mhos/cm	858	880	304	335	288	298	340	354	258	262	509	499
4	Turbidity (NTU)	2.1	3.2	3.1	2.5	1.8	1.9	1.6	1.5	1.2	1.8	-	-
5	Total Dissolved solids	484	497	189	208	192	198	208	214	170	178	339	355
6	Total Suspended solids	8	18	12	10	6	8	8	9	12	10	-	-
7	Dissolved Oxygen (mg/litre)	6.9	6.2	7.0	7.6	7.1	6.9	6.9	7.2	7.6	7.4	6.0	6.2
8	BOD, (for 3 days at 270C) (mg/litre)	4.1	2.6	3.6	3.9	2.2	2.3	2.4	2.1	4.8	4.3	7.43	6.85
9	Chemical Oxygen Demand, (mg/litre)	13.2	8.6	12.1	13.0	8.4	8.2	8.6	8.2	15.7	16.2	-	-
10	Total Hardness, mg/l	219	268	180	192	123	116	123	128	114	116	-	-
11	Oil & grease, mg/l	0.2	0.6	0.5	0.4	0.2	0.2	0.4	0.3	0.5	0.3	-	-
12	Chloride, mg. l	172	168	28	26	14	16	14	16	14		-	-
13	Nitrates as NO ₃ , mg/l	1.9	2.4	0.86	0.88	0.16	0.14	0.21	0.20	0.30	0.28	-	-
14	Iron as Fe, mg/l	0.13	0.19	0.42	0.49	0.31	0.33	0.28	0.25	0.41	0.36	-	-
15	Zinc as Zn, mg/l	0.2	0.6	2.2	2.3	2.9	2.8	3.4	3.5	2.9	2.8	-	-
16	Calcium as Ca, mg/l	72	79	37	38	24	22	26	28	22	26	-	-
17	Magnesium as Mg, mg/l	18	19	21	24	15	14.4	14	13	14	12	-	-
18	Cadmium as Cd, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
19	Copper as Cu, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
20	Nickel as Ni, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
21	Lead as Pb, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
22	Mercury as Hg, mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
23	Total Chromium (Total as Cr), mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
24	Arsenic as As, mg/l	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	-	-
25	Silica, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
26	Fecal coliform MPN/100ml	3920	4370	5462	4370	3890	3940	3429	3390	8756	9472	12300	15400
27	Total coliform MPN/100ml	10234	11343	12300	11343	12324	12574	11489	11206	14520	16120	-	-
28	Pesticides (Present /Absence)	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	-	-

Source: Data sampling & Analysis by JV and NABL accredited Lab

Ganga Water Quality Along NW-1 (near Existing Ro-Ro/Jetty/Floating Terminal sites)

Sl.No.	Parameters	West Bengal						Jharkhand	Bihar		
		SW-13	SW-14	SW-15	SW-16	SW-17	SW-18	SW-19	SW-20	SW-21	SW-22
1	pH	7.20	8.1	7.45	7.80	7.65	7.54	7.31	8.1	7.7	8.2
2	Temperature 0C	25.0	26.0	25	24.8	23.8	25.0	24.8	23.8	23.8	24.0
3	Conductivity, μ mhos/cm	1230	320	315	405	345	319	327	305	318	290
4	Turbidity (NTU)	2.4	4.2	3.5	4.7	3.1	3.1	2.7	2.5	2.1	4.8
5	Total Dissolved solids	840	201	195	260	204	198	204	196	204	188
6	Total Suspended solids	14	6	5	11	9	11	9	8	10	13
7	Dissolved Oxygen (mg/litre)	5.8	6.5	7.6	6.5	7.2	7.8	7.1	7.8	6.7	8.1
8	BOD, (for 3 days at 270C) (mg/litre)	2.6	5.4	3.5	2.6	2.0	2.4	2.8	2.1	2.3	2.8
9	Chemical Oxygen Demand, (mg/l)	9.4	19	10.6	9.3	7.8	8.9	10	7	8.4	10.4
10	Total Hardness, mg/l	322	168	164	214	168	160	168	156	158	152
11	Oil & grease, mg/l	0.2	1.1	0.3	0.7	0.4	0.4	0.1	0.2	0.4	0.6
12	Chloride, mg. l	212	26	24	34	28	24	26	22	26	22
13	Nitrates as NO ₃ , mg/l	1.6	2.45	2.68	1.87	1.90	2.91	1.68	1.28	1.14	1.10
14	Iron as Fe, mg/l	0.14	1.45	1.28	0.56	0.98	2.21	2.31	1.20	1.08	1.34
15	Zinc as Zn, mg/l	0.22	0.87	0.25	0.45	0.40	0.29	0.45	0.50	0.34	0.67
16	Calcium as Ca, mg/l	92	34	32	38	34	32	34	28	30	31
17	Magnesium as Mg, mg/l	22	20	20	29	20	19	20	21	20	18
18	Cadmium as Cd, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
19	Copper as Cu, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
20	Nickel as Ni, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
21	Lead as Pb, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
22	Mercury as Hg, mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
23	Total Chromium (Total as Cr), mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
24	Arsenic as As, mg/l	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
25	Silica, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
26	Fecal coliform MPN/100ml	6120	18456	6450	8760	7890	4580	3890	2340	2460	3890
27	Total coliform MPN/100ml	11720	45680	12400	12988	11340	9890	8790	5430	5980	8790
28	Pesticides (Present /Absence)	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent

Source: Data sampling & Analysis by JV and NABL accredited Lab



Ganga Water Quality near sensitive locations along NW-1

Sl.No.	Parameters	Hilsa Sanctuary Area			Dolphin Sanctuary			Kashi Turtle Sanctuary		
		Farakka Barrage	Near Diamond Harbour	Near Katua	Sultanganj Ghat	Near Vikramshila setu, Bhagalpur	Ganga ghat near Kahalgaon	Near Dashashwamegh ghat	Near Tulsi Ghat	Near AssiGhat
1	pH	7.10	6.95	7.67	6.85	7.43	6.47	7.65	7.23	7.72
2	Temperature 0C	25.4	24.8	24.5	25.2	24.6	24.8	23.6	24.2	24.3
3	Conductivity, μ mhos/cm	304	838	400	335	436	368	545	486	532
4	Turbidity (NTU)	2.1	3.0	3.8	1.2	3.8	1.8	6.7	7.2	8.0
5	Total Dissolved solids	200	465	254	208	275	222	368	328	352
6	Total Suspended solids	8	10	9	11	4	6	12	8	14
7	Dissolved Oxygen (mg/litre)	6.7	7.5	7.0	7.8	6.9	7.9	7.3	7.8	7.0
8	BOD, (for 3 days at 270C) (mg/litre)	2.8	3.1	2.8	2.2	2.0	3.1	6.8	5.2	7.2
9	Chemical Oxygen Demand, (mg/l)	9.0	11.3	10.8	6.4	5.8	11.8	19.8	17.2	23.0
10	Total Hardness, mg/l	130	210	208	176	192	170	234	208	222
11	Oil & grease, mg/l	0.4	0.2	0.4	0.1	0.5	0.2	2.1	1.6	2.4
12	Chloride, mg. l	16	158	32	28	48	30	48	32	40
13	Nitrates as NO ₃ , mg/l	0.23	2.3	1.98	0.89	3.82	0.88	0.89	0.67	1.10
14	Iron as Fe, mg/l	0.45	0.67	0.58	2.31	2.50	1.25	1.20	0.98	1.16
15	Zinc as Zn, mg/l	2.45	1.23	0.68	1.06	0.78	1.28	1.10	1.12	1.21
16	Calcium as Ca, mg/l	28	68	34	35	38	36	58	46	48
17	Magnesium as Mg, mg/l	15	10	30	22	24	19	22	23	25
18	Cadmium as Cd, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
19	Copper as Cu, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
20	Nickel as Ni, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
21	Lead as Pb, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
22	Mercury as Hg, mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
23	Total Chromium (Total as Cr), mg/l	<0.05	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
24	Arsenic as As, mg/l	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
25	Silica, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
26	Fecal coliform MPN/100ml	3100	4560	4560	2340	2200	2980	8670	5680	7988
27	Total coliform MPN/100ml	11876	13467	24356	10120	12340	12650	14790	13210	14218
28	Pesticides (Present /Absence)	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent

Source: Data sampling & Analysis by JV and NABL accredited Lab

Ground Water Use pattern

Groundwater is the water present beneath Earth's surface in soilpore spaces and in the fractures of rock formations. It is stored in and moves slowly through geologic formations of soil, sand and rocks called aquifers. The major land use type around the NW-1 is agriculture. The NW-1 area has a vast reservoir of groundwater, replenished every year at a very high rate. The conjunctive use of groundwater for irrigation, even within the canal command areas, not only ensures steady supply to the cultivated fields on time but also helps reduce water logging and salinization due to consequent downward movement of subsurface moisture.

The groundwater usage pattern in the states traversed by NW-1 is given in **Table 4.12**-. The extent of groundwater utilization for irrigation is highest in Uttar Pradesh (45.36 BCM per year), followed by West Bengal (10.84 BCM per year), Bihar (9.39 BCM per year) and Jharkhand (0.7 BCM per year).

Overview of Ground water uses Pattern in States Traversed by NW-1

S. No.	State	Annual Groundwater Draft (BCM per year)			Net annual Groundwater availability (BCM/year)	Projected Demand for Domestic and Industrial uses up to 2025 (BCM per Year)
		irrigation	Domestic and Industrial uses	Total		
2	Uttar Pradesh	45.36	3.42	48.78	70.18	5.30
4	Bihar	9.39	1.37	10.77	27.42	2.14
5	Jharkhand	0.7	0.38	1.06	5.25	0.56
6	West Bengal	10.84	0.81	11.65	27.46	1.24

(Source: Central Groundwater Board, 2008 and Central water commission 2008)

Apart from irrigation, groundwater resources are also being heavily tapped for industrial and domestic activities in urban as well as in rural areas. Throughout the alluvial area of the NW-1, most of the urban water supply schemes are dependent upon groundwater resources. Similarly, a large number of industries also withdraw significant amounts of groundwater, especially from the easily accessible aquifers in the alluvial zone. State wise ground water resources in NW-1 state is given in **Table 4.13**.

State wise Ground water resources in NW-1 (2008)

S. No.	State	Annual Replenishable Groundwater (BCM per Year)	Annual Groundwater Draft (BCM per Year)	Balance available (BCM per year)	Stage of Groundwater Development (%)
2	Uttar Pradesh	76.35	48.78	27.57	70
4	Bihar	29.19	10.77	18.42	39
5	Jharkhand	5.58	1.06	4.52	20
6	West Bengal	30.36	11.65	18.71	42

Source: CWC 2008

Ground Water Quality

Ground water samples were collected from intervention locations and stretches close to populated zones all along the NW-1²⁷. The water samples were examined for physico-chemical parameters as well

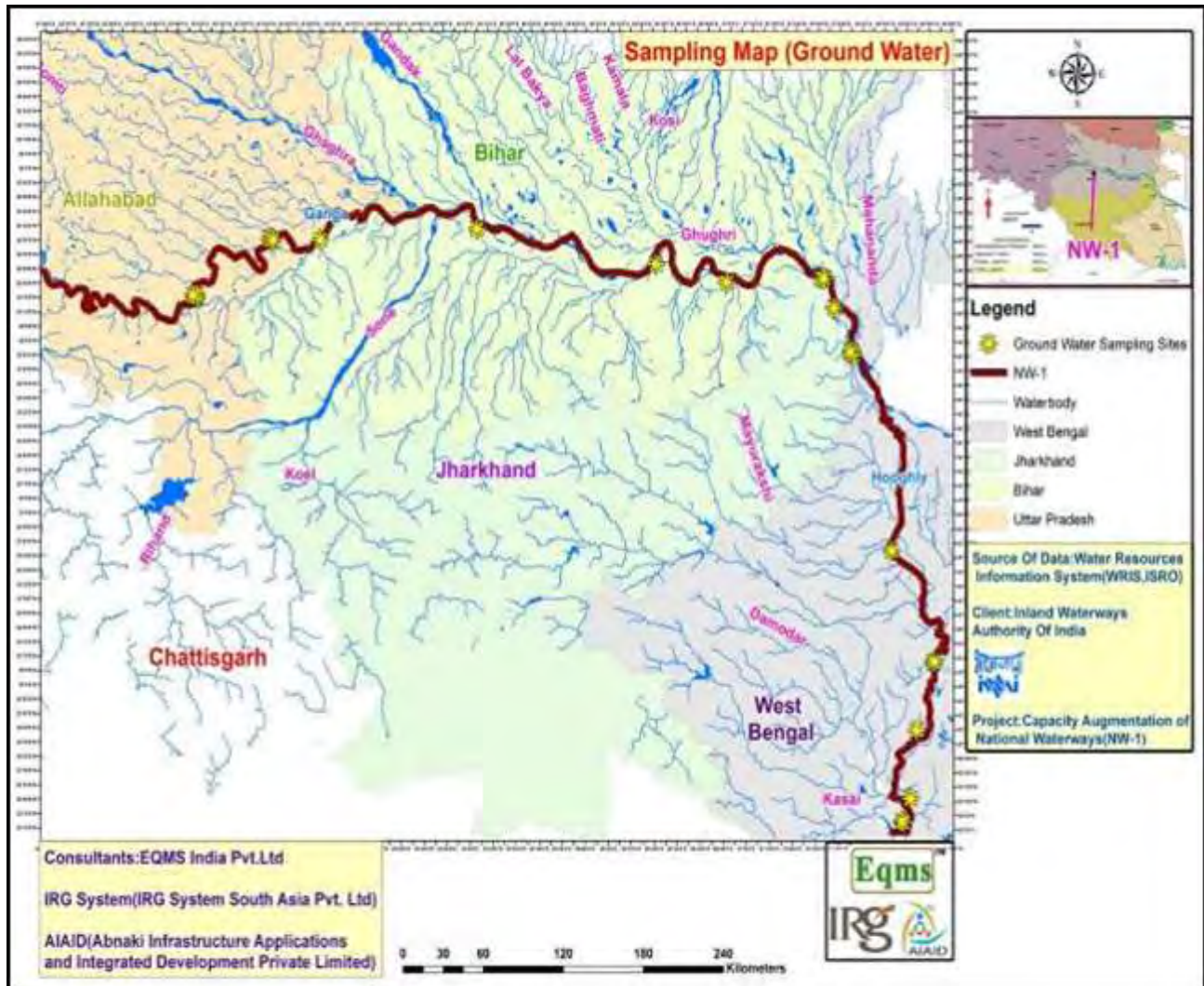
²⁷Samples for chemical analyses and bacteriological analyses were collected in polyethylene carboys and in sterilized bottles (APHA Method) respectively.



as for bacteriological parameters. The details of sampling locations are presented in **Table 4.14** and **Figure 4.16**. The Analysis results are presented in **Table 4.15** and **Table 4.16**.

Ground Water Sampling Locations along NW-1

Sl. No.	Terminal Location	Ground water sampling Location	Location Code	Source
Proposed and Planned Terminals				
1	Haldia Terminal, WB	Patikhali	GW-1	Hand pump
		Near terminal site	GW-2	Borewell
		Durgachak	GW-3	Borewell
2	Tribeni Terminal, WB	Near Terminal site, Tap water	GW-4	Borewell
		Tribeni, Tap Market	GW-5	Tap water
	Farakka Lock, WB	Near Farakka lock site	GW-6	Borewell
		Goraipara Village	GW-7	Hand pump
		Farakka Town	GW-8	Hand pump
	Sahibganj Terminal, Kharkhand	Samda Nala Village	GW-9	Hand pump
		Rampur Village	GW-10	Hand pump
		Sakrigali	GW-11	Hand pump
	Gazipur Terminal, Uttar Pradesh	Tarighat, Ghazipur	GW-12	Hand pump
			GW-13	Handpump
		Kalupur	GW-14	Handpump
	Varanasi Terminal, Uttar Pradesh	Terminal Site	GW-15	Borewell
		Milkipur	GW-16	Hand pump
		Ralhupur	GW-17	Hand pump
		Tahirpur	GW-18	Hand pump
		Bhitti	GW-19	Hand pump
		Madarwa	GW-20	Hand pump
Populated areas along NW-1				
1	West Bengal	Diamond Harbour	GW-21	Hand pump
2	West Bengal	Howrah	GW-22	Hand pump
3	West Bengal	Katwa	GW-23	Hand pump
4	Jharkhand	Magalhat	GW-24	Hand pump
5	Bihar	Bhagalpur	GW-25	Hand pump
6	Bihar	Buxar	GW-26	Hand pump
7	Bihar	Munger,	GW-27	Hand pump
8	Bihar	Patna	GW-28	Hand pump



Ground Water Sampling Locations

Ground Water Quality at Proposed Terminals/Lock area

S.N.	Parameters	Desirable Limit IS: 10500	Permissible Limit IS: 10500	Haldia Terminal (WB)			Triveni Terminal		Farakka Lock (WB)			Sahibganj Terminal		
				GW-1	GW-2	GW-3	GW4	GW5	GW-6	GW-7	GW-8	GW-9	GW-10	GW-11
1	pH	6.5-8.5	No relaxation	7.24	8.04	7.67	7.38	7.31	6.79	6.96	6.71	7.1	6.85	6.91
2	Temp. °C	-	-	24	24	24	27.4	26.5	24.6	25	24.8	27	26	27
3	Conductivity, mmhos/cm	-	-	950	1982	1164	474	314	551	549	558	316	632	1303
4	Turbidity, NTU	5	10	0.1	0.1	0.2	0.1	0.4	0.1	0.1	0.2	0.1	0.2	0.2
5	TDS, mg/l	500	2000	612	1372	744	299	201	356	369	377	212	429	886
6	TSS, mg/l	-	-	2	1	1	Nil	Nil	1	2	2	2	1	4
7	T Hardness as CaCO ₃ , mg/l	300	600	268	345	279	264	152	244	252	264	132	225	756
8	Chloride as Cl, mg/l	250	1000	236	456	276	26	16	18	20	26	18	39	171
9	Alkalinity, mg/l	200	600	186	268	226	95	75	112	126	116	126	167	133
10	Sulphates as, SO ₄ , mg/l	200	400	8.2	3.98	3.34	15	5	6	9	11	8	13	75
11	Nitrates as NO ₃ , mg/l	45	100	2.9	0.06	0.08	0.9	0.6	0.6	0.8	0.9	0.9	1.2	1.48
12	Fluoride as F, mg/l	1	1.5	0.38	0.46	0.49	0.28	0.22	0.4	0.5	0.23	0.3	0.24	0.19
13	Iron as Fe, mg/l	0.3	1	0.46	0.35	0.32	0.56	0.41	0.22	0.34	0.44	0.12	0.44	0.32
14	Zinc as Zn, mg/l	5	15	0.08	0.7	0.9	1.1	1.0	0.6	0.9	0.9	0.8	1	0.9
15	Calcium as Ca	75	200	72	114	68	53	30	50	51	53	27	70	152
16	Magnesium as Mg	30	100	21	14	28	32	19	29	30	32	16	11	91
17	Cadmium as Cd, mg/l	0.01	No relaxation	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
18	Copper as Cu, mg/l	0.05	1.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
19	Nickel as Ni, mg/l	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
20	Lead as Pb, mg/l	0.05	No relaxation	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
21	Mercury as Hg, mg/l	0.001	No relaxation	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
22	Chromium (Total as Cr, mg/l	0.05	No relaxation	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
23	Arsenic as As, mg/l	0.05	No relaxation	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
24	Phenolic compound	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
25	Total coliform MPN/100ml	-	-	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
26	Fecal Coliform, MPN/100ml	-	-	Nil	Nil	NI	Nil	Nil	Nil	Nil	NI	Nil	Nil	NI

Source: Data sampling & Analysis by JV and NABL accredited Lab

Ground Water Quality at Proposed Terminals/Lock areas (cont..)

		Desirable Limit IS: 10500	Permissible Limit IS: 10500	Ghazipur Terminal				Varanasi Terminal					
S.N.	Parameters			GW-12	GW-13	GW-14	GW-15	GW-16	GW-17	GW-18	GW-19	GW-20	
1	pH	6.5-8.5	No relaxation	7.11	7.11	7.34	7.4	7.14	1.17	7.25	7.5	7.4	
2	Temp. 0C	-	-	24.6	25.2	25.0	-	-	-	-	-	-	
3	Conductivity, mmhos/cm	-	-	749	648	472	462	490	575	887	493	711	
4	Turbidity,NTU	5	10	0.1	0.2	0.3	0.5	0.5	0.6	0.8	1.8	1.6	
5	TDS, mg/l	500	2000	472	428	320	318	253	274	501	316	440	
6	TSS, mg/l	-	-	2	4	1	2	3	4	4	4	4	
7	T Hardness as CaCO3, mg/l	300	600	392	310	168	272	212	220	284	172	312	
8	Chloride asCl, mg/l	250	1000	30	28	14	14	7	10	50	16	68	
9	Alkalinity, mg/l	200	600	143	124	110	NA	NA	NA	NA	NA	NA	
10	Sulphates as, SO4, mg/l	200	400	17	15	8.7	15	13	29	35	5	46	
11	Nitrates as NO3, mg/l	45	100	0.84	0.78	1.23	0.95	0.07	0.08	0.75	0.7	0.6	
12	Fluoride as F, mg/l	1	1.5	0.46	0.38	0.34	0.4	0.03	0.31	0.64	0.34	0.13	
13	Iron as Fe, mg/l	0.3	1	0.48	0.38	0.60	0.12	0.02	0.11	0.012	0.12	0.12	
14	Zinc as Zn, mg/l	5	15	1.21	1.21	0.87	1	1	0.9	1.1	0.9	0.8	
15	Calcium as Ca	75	200	78	62	32	32	39	35	37	44	50	
16	Magnesium as Mg	30	100	48	45	21	47	27	32	47	12.2	46	
17	Cadmium as Cd, mg/l	0.01	No relaxation	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
18	Copper as Cu, mg/l	0.05	1.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
19	Nickel as Ni, mg/l	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
20	Lead as Pb, mg/l	0.05	No relaxation	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
21	Mercury as Hg, mg/l	0.001	No relaxation	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
22	Chromium (Total as Cr, mg/l	0.05	No relaxation	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
23	Arsenic as As, mg/l	0.05	No relaxation	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	
24	Phenolic compound	0.001	0.002	<0.001	<0.001	<0.001	-	-	-	-	-	-	
25	Total coliform MPN/100ml	-	-	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	
26	Fecal Coliform, MPN/100ml	-	-	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	

Source: Data sampling & Analysis by JV and NABL accredited Lab

Ground Water Quality at Major Habitation area along NW-1

S.N.	Parameters	Desirable Limit IS: 10500	Permissible Limit IS: 10500	Daimond Harbour	Hoorah	Katwa	Mangalhat	Bhagalpur	Buxer	Munger	Patna
1	pH			7.50	7.36	7.29	7.67	7.56	7.34	6.94	7.23
2	Temp. 0C	-	-	24.0	24.2	24.5	24.8	24.8	23.6	23.8	25.1
3	Conductivity, mmhos/cm	-	-	1148	1240	322	626	637	342	862	674
4	Turbidity, NTU	5	10	1.0	2	1	Nil	2	1	3	1
5	TDS, mg/l	500	2000	754	794	232	420	408	220	646	425
6	TSS, mg/l	-	-	1.1	0.5	0.7	0.8	Nil	0.4	1.2	Nil
7	T Hardness as CaCO ₃ , mg/l	300	600	258	304	100	220	376	138	288	348
8	Chloride as Cl, mg/l	250	1000	270	230	12	38	64	20	42	50
9	Alkalinity, mg/l	200	600	236	252	90	164	180	118	160	187
10	Sulphates as, SO ₄ , mg/l	200	400	2.86	1.87	15	18	24	12	16.8	28
11	Nitrates as NO ₃ , mg/l	45	100	2.1	4.2	7.8	1.8	1.13	1.22	11.2	8.4
12	Fluoride as F, mg/l	1	1.5	0.50	0.48	0.53	0.45	0.35	0.43	0.56	0.81
13	Iron as Fe, mg/l	0.3	1	1.20	0.89	0.46	0.87	0.61	0.92	0.046	0.51
14	Zinc as Zn, mg/l	5	15	1.10	0.92	0.74	1.34	1.23	1.10	1.26	1.29
15	Calcium as Ca	75	200	74	102	24	64	75	32	48	70
16	Magnesium as Mg	30	100	18	20.3	9.7	14	46	14	41	42
17	Cadmium as Cd, mg/l	0.01	No relaxation	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
18	Copper as Cu, mg/l	0.05	1.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
19	Nickel as Ni, mg/l	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
20	Lead as Pb, mg/l	0.05	No relaxation	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
21	Mercury as Hg, mg/l	0.001	No relaxation	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
22	Chromium (Total as Cr, mg/l)	0.05	No relaxation	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
23	Arsenic as As, mg/l	0.05	No relaxation	<0.025	<0.025	<0.025	<0.025	0.03	<0.025	0.04	<0.025
24	Phenolic compound	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001
25	Total coliform MPN/100ml	-	-	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
26	Fecal Coliform, MPN/100ml	-	-	NI	NI	NI	Nil	NI	Nil	Nil	Nil

Source: Data sampling & Analysis by JV and NABL accredited Lab

Observation on Ground Water Quality

The Physico-chemical characteristics of the ground water samples were assessed with respect to prescribed drinking water standard IS: 10500. Few parameters namely TDS, total hardness and chloride values are marginally above the desirable limits at Haldia and Sahibganj, Howrah and Kolkata but all were within the permissible limits as per prescribed Standard (IS: 10500) except Fe which exceeds the prescribed limits at certain locations. Other heavy metal were either present in traces or below prescribed standards. The arsenic content in ground water sample of Bhagalpur and Munger were found present but lower than the permissible limit.

Annexure 5.5: River bed sediment samples

River Sediment Analysis

This section describes the baseline conditions of riverbed sediment with respect to requirement of dredging to maintain least available depth in stretches between Allahabad to Haldia in NW-1, estimated dredging quantities, the locations of river bed sampling so as to understand the values of selected parameters, their characteristics and analysis of river bed sediment quality.

Presently the IWAI undertakes a programme of dredging with their in-house dredging fleet to assist in providing depth in the waterway. The IWAI currently undertakes about 0.8 Mm³ of dredging each year. On average each of the dredging plant is reported to achieve production of about 135,000 m³ during the dredging season which spans from October to June. Other interventions such as bandalling are also undertaken in certain areas²⁸.

The quantities for dredging have been estimated based on required least available depth in various stretches from Allahabad to Haldia²⁹ as given in below.

Dredging Quantities – Allahabad to Haldia

Stretch	Stretch Length (km)	Average Annual Dredge Volumes (m ³)		
		Present day 2013/14	Option 1 3m LAD	Option 2 3m to Barh 2.5 to Buxar 2.2m to Varanasi
Haldia to Farakka	544	-	1,662,592	1,662,592
Farakka to Barh	347	370,000	5,618,132	5,618,132
Barh to Patna	64	330,000	3,189,534	2,287,099
Patna to Buxar	169		4,999,253	3,262,123
Buxar to Varanasi	187		5,793,355	2,930,650
Varanasi to Allahabad	236		9,816,710	n/a
Total	1547	700,000	31,079,576	15,760,596

In the context of India and NW-1, dumping in landfill and sea (particularly relevant for Haldia) may be suitable. Criteria for Harmful Bottom Sediments of Japan and Criteria for Off-Shore Dumping of Dredged Material in USA and Canada (for offshore dumping of dredged material) may be adopted as given in below.

Criteria for Disposal of Harmful Bottom Sediments: No specific standards are defined in India for disposal of dredged material. If dredged material is toxic/ harmful then these sediments should either be disposed off in landfill or in Sea. Criteria followed in Japan³⁰ is given in the below.

Criteria for Harmful Bottom Sediments, Japan (unit: mg/l)

Contaminated Material	Dumping in Landfills (mg/l)	Dumping at sea (mg/l)
Alkylmercuric compounds	Not detectable	Not detectable
Mercury and its compounds	0.005	0.005

²⁸ Detailed Feasibility Study for Capacity Augmentation of NW-1 and Detailed Engineering for its Ancillary Works and Processes between Haldia to Allahabad (Jal Marg Vikas Project), Detailed Feasibility Report, March 2016

²⁹ Detailed Feasibility Study for Capacity Augmentation of NW-1 and Detailed Engineering for its Ancillary Works and Processes between Haldia to Allahabad (Jal Marg Vikas Project), Detailed Feasibility Report, March 2016

³⁰ Assessment of the Environment Impact of Port Development, United Nations, New York, 1992

Cadmium and its compounds	0.1	0.1
Lead and its compounds	1	1
Organophosphorus compounds	1	1
Chromium (VI) compounds	0.5	0.5
Arsenic and its compounds	0.5	0.5
Cyanogen compounds	1	1
PCB	0.003	0.003
Copper and its compounds	-	3
Zinc and its compounds	-	5
Fluoride	-	15

Note: Criteria are based on the examination of dissolution of contaminated materials

Criteria for Off-shore dumping of Dredged material: No criteria is defined for off-shore disposal of dredged material in India, thus reference to the UN standards³¹ can be made and is given in **Table below**.

Criteria for Off-Shore Dumping of Dredged Material (unit: ppm or ppb)

Substance	Canada	USA
PCB (ppb)	100	380
Hg (ppm)	0.5	0.15
Cd (ppm)	0.60	0.7
Zn (ppm)	169	105
Cu (ppm)	45	68
As (ppm)	(5 – 25)	12.5
Pb (ppm)	45	33
Organochlorine pesticide (ppb)	10 for any compound	5.0 Sum of DDT, DDE and DDD
Polyaromatic hydrocarbon (ppb)	(1,000) Sum of 16 compounds	680 Sum of six low mol. Wt. compounds 2,690 Sum of 10 high mol. Wt. compounds

Methodology

Sampling of River bed sediment was carried out in February- March 2016 (pre monsoon) in selected stretches of NW-1. Samples of river bed sediments were collected at three levels of depth viz. 0.0 to 1.0, 1.1 to 2.0 and 2.1 to 3.0 in 2 boreholes. Sampling of River bed sediments was conducted in 21 locations given in **Tables below**.

20 parameters (physical, chemical, Pesticides/Insecticides) selected for assessment of river bed sediments and their unit is given in **Table below**.

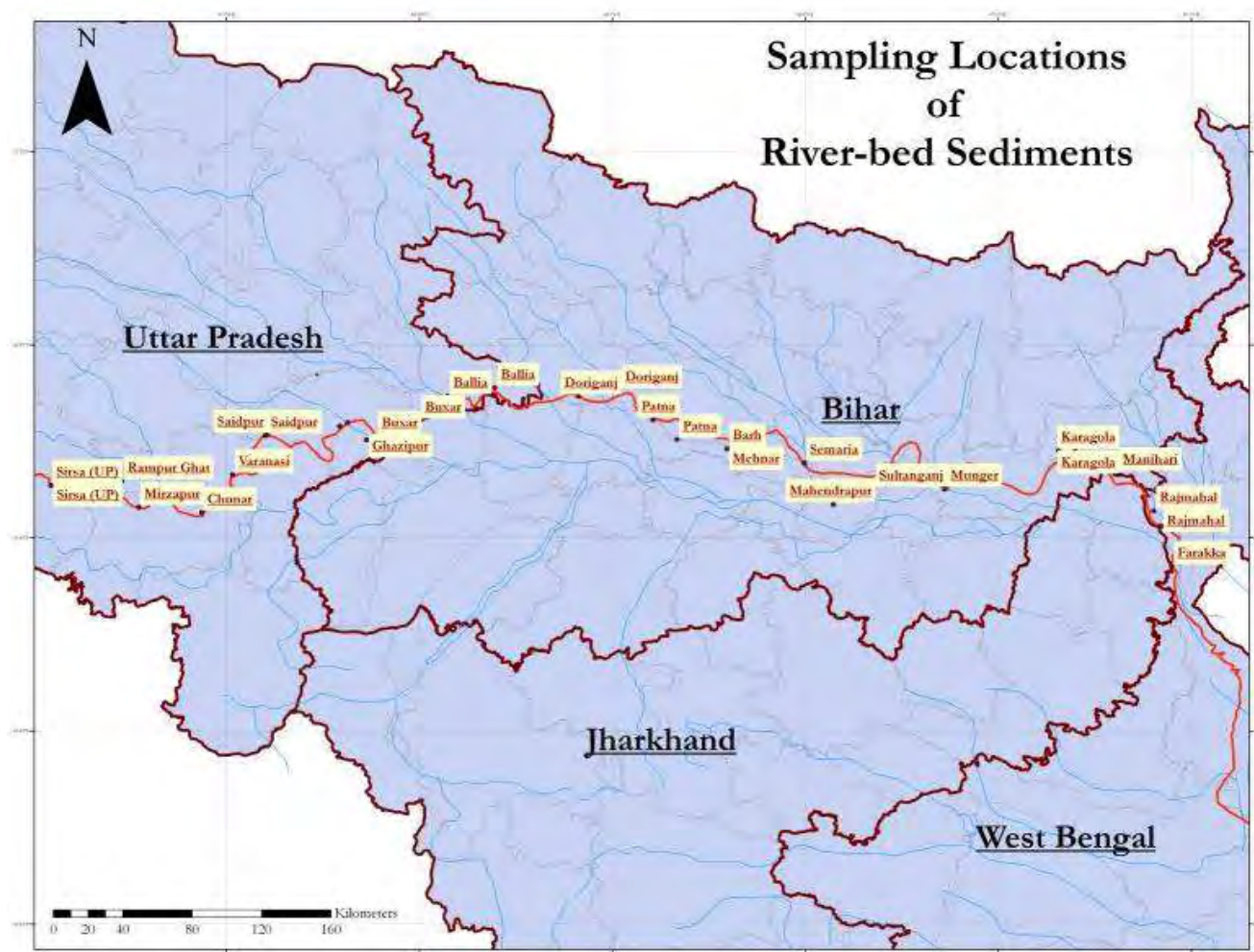
Parameters (physical, chemical, Pesticides/Insecticides) selected for assessment of river bed sediments

Sl. No.	Parameters	Unit
	Physical Parameters	
1	Texture	-

³¹ *Assessment of the Environment Impact of Port Development, United Nations, New York, 1992*

Sl. No.	Parameters	Unit
2	Bulk Density	gm/cc
	Chemical Parameters	
3	pH	-
4	Conductivity	µmhos/cm
5	Cation Exchange Capacity (CEC)	meq/100gm
6	Organic Matter	%
7	Chromium (as Cr)	ppm
8	Arsenic (as As)	ppm
9	Mercury (as Hg)	ppm
10	Lead (as Pb)	ppm
11	Iron (as Fe)	ppm
12	Cadmium (as Cd)	ppm
13	Nickel (as Ni)	ppm
14	Zinc (as Zn)	ppm
15	Copper (as Cu)	ppm
	Pesticides/Insecticides	
16	α Endosulphan	ppb
17	β Endosulphan	ppb
18	γ Endosulphan	ppb
19	Methyl Parathion	ppb
20	Lindane	ppb

Sampling locations of river bed sediments are shown in **Figure below**.



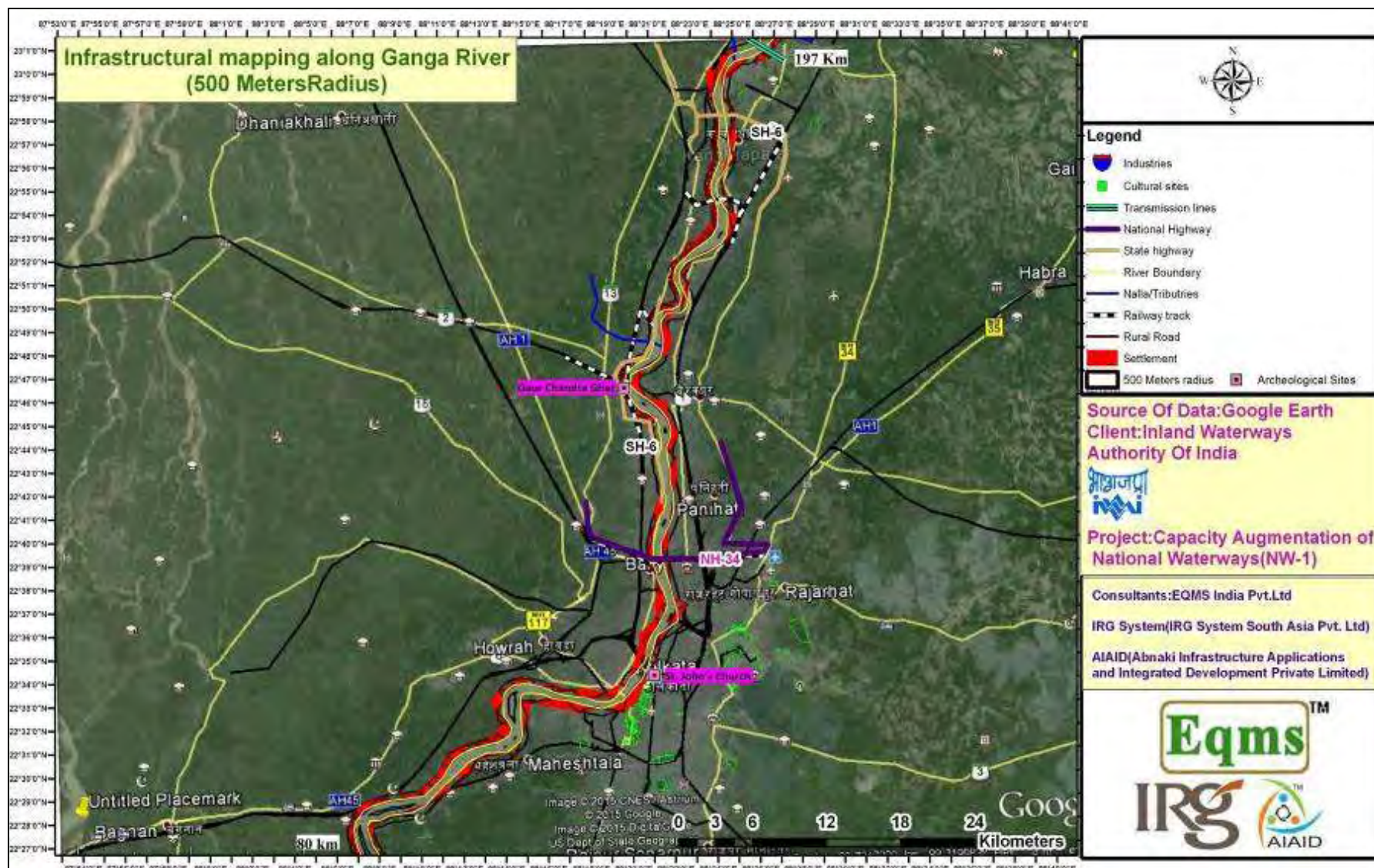
Sampling locations of river bed sediments

Annexure 5.6: Infrastructural mapping along Ganga River

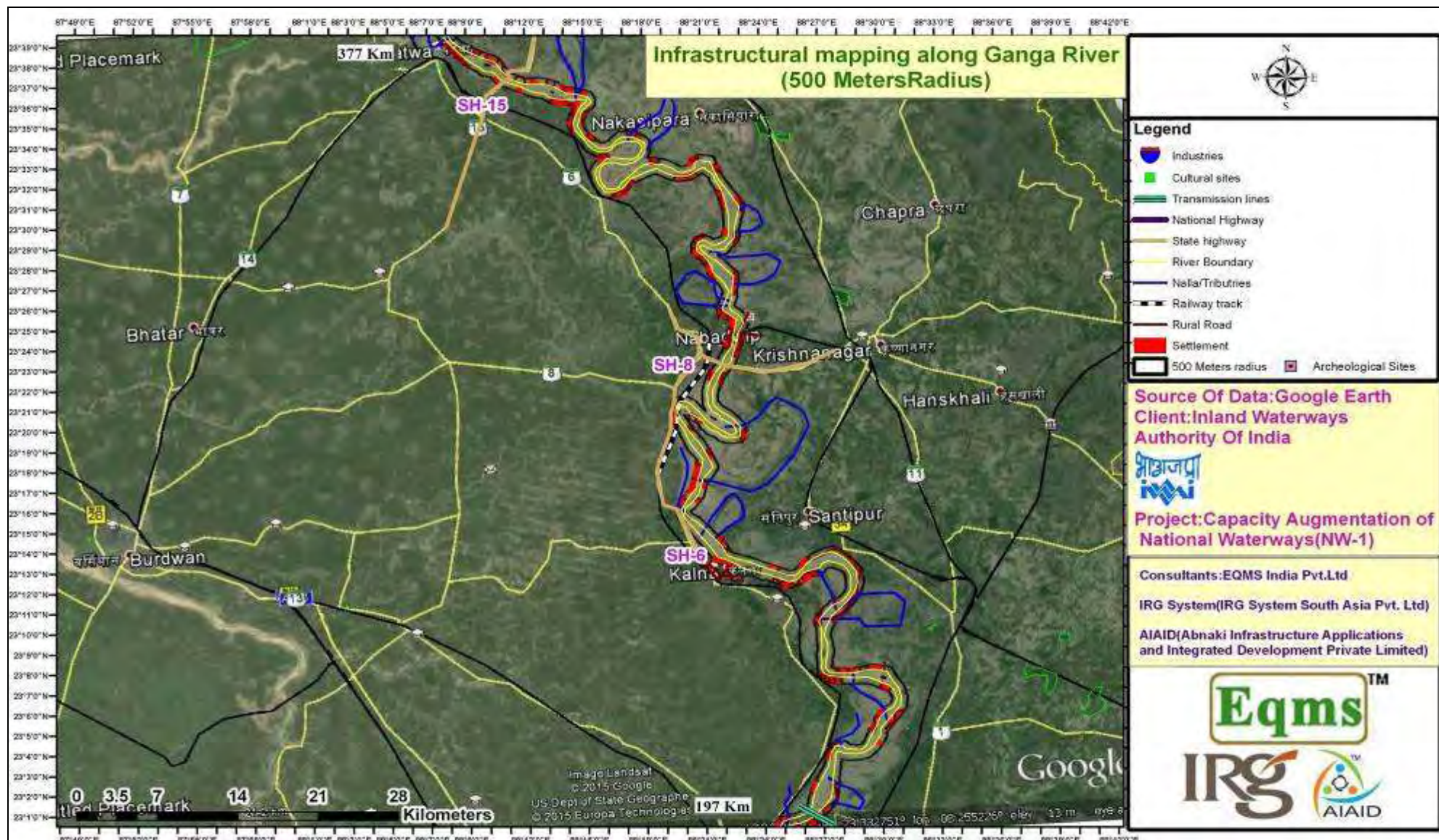
Infrastructural Mapping



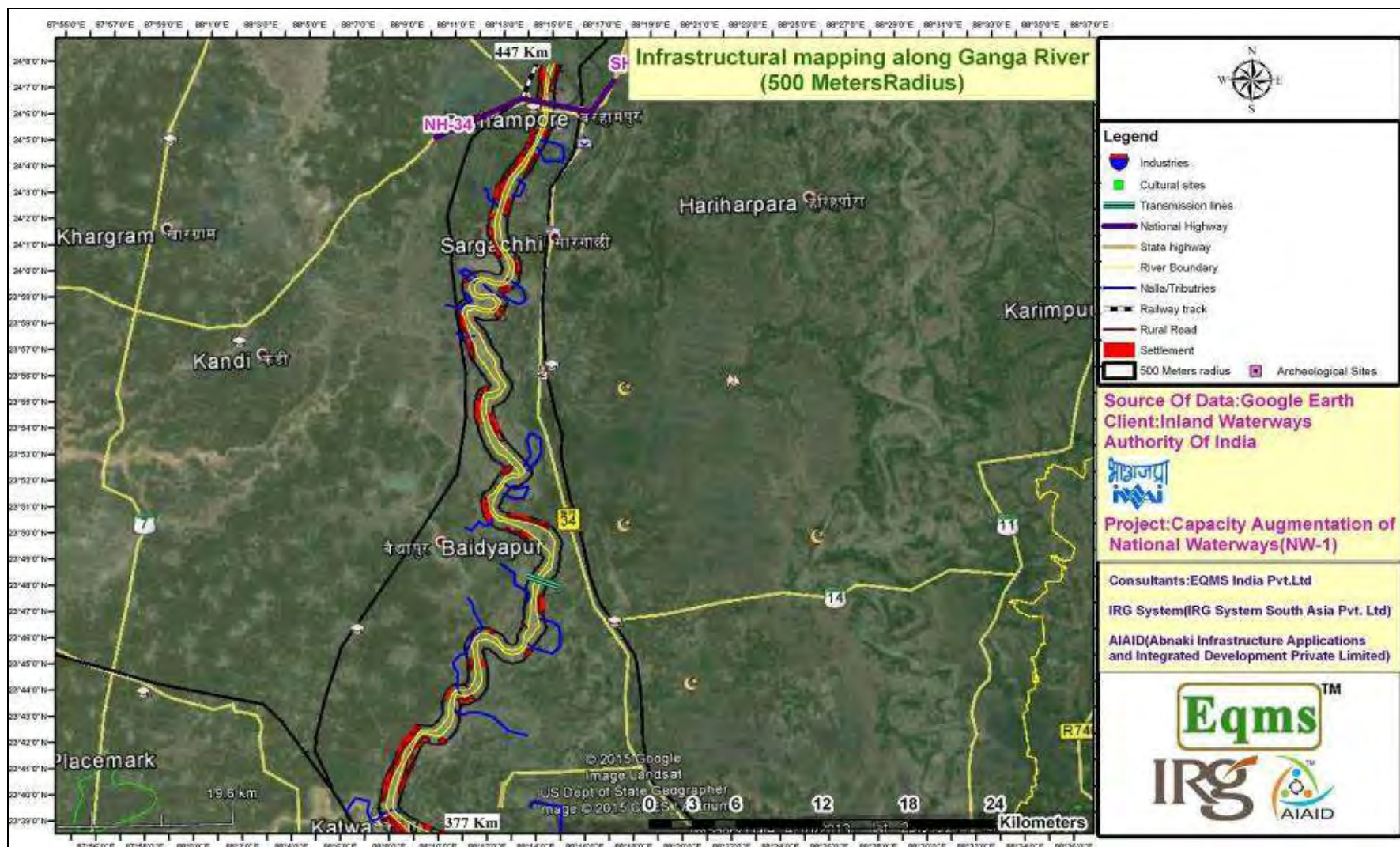
Infrastructural Mapping along 500 m area of NW-1 (Chainage 0-80 km)



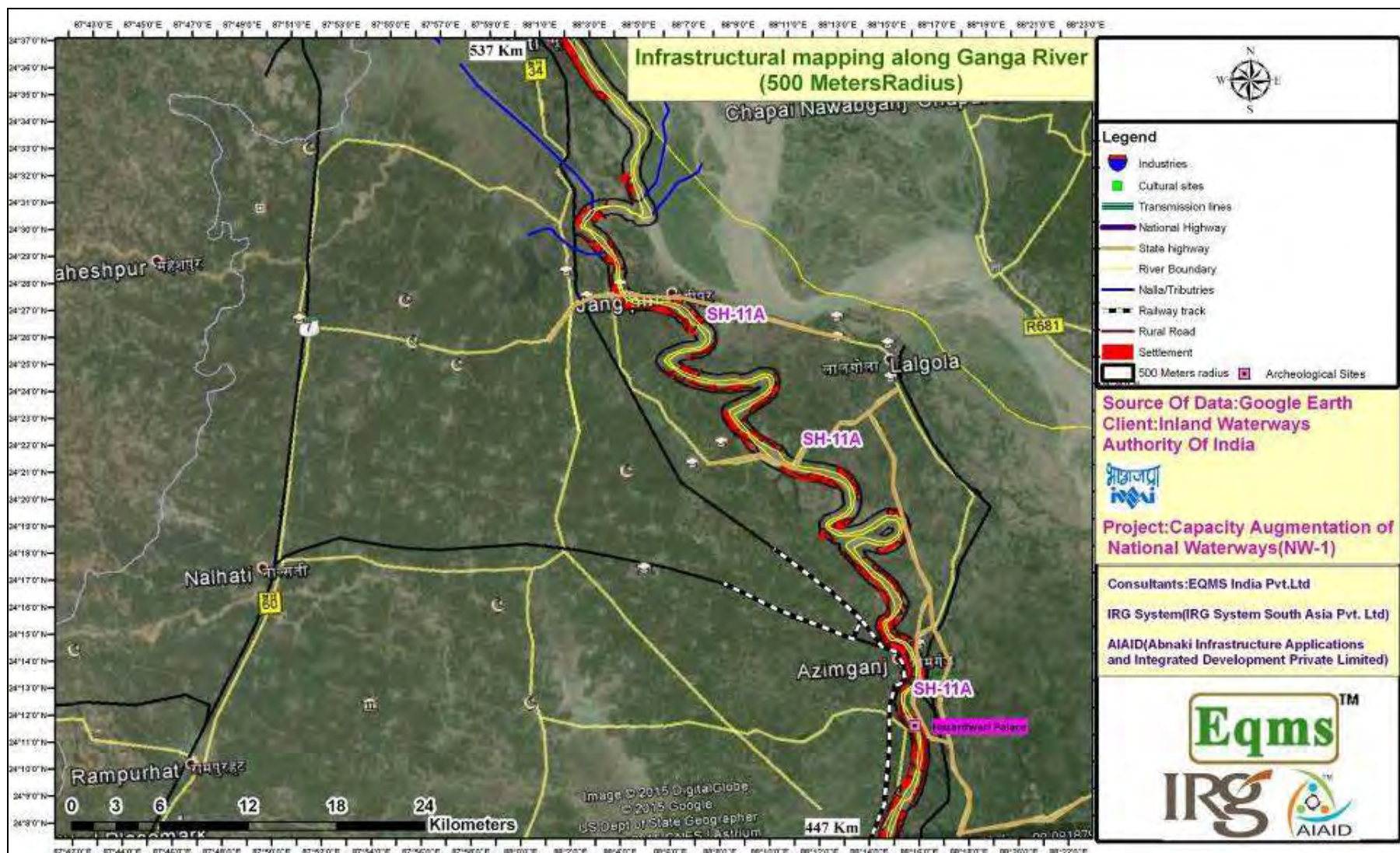
Infrastructural Mapping along 500 m area of NW-1 (Chainage 80-197 km)



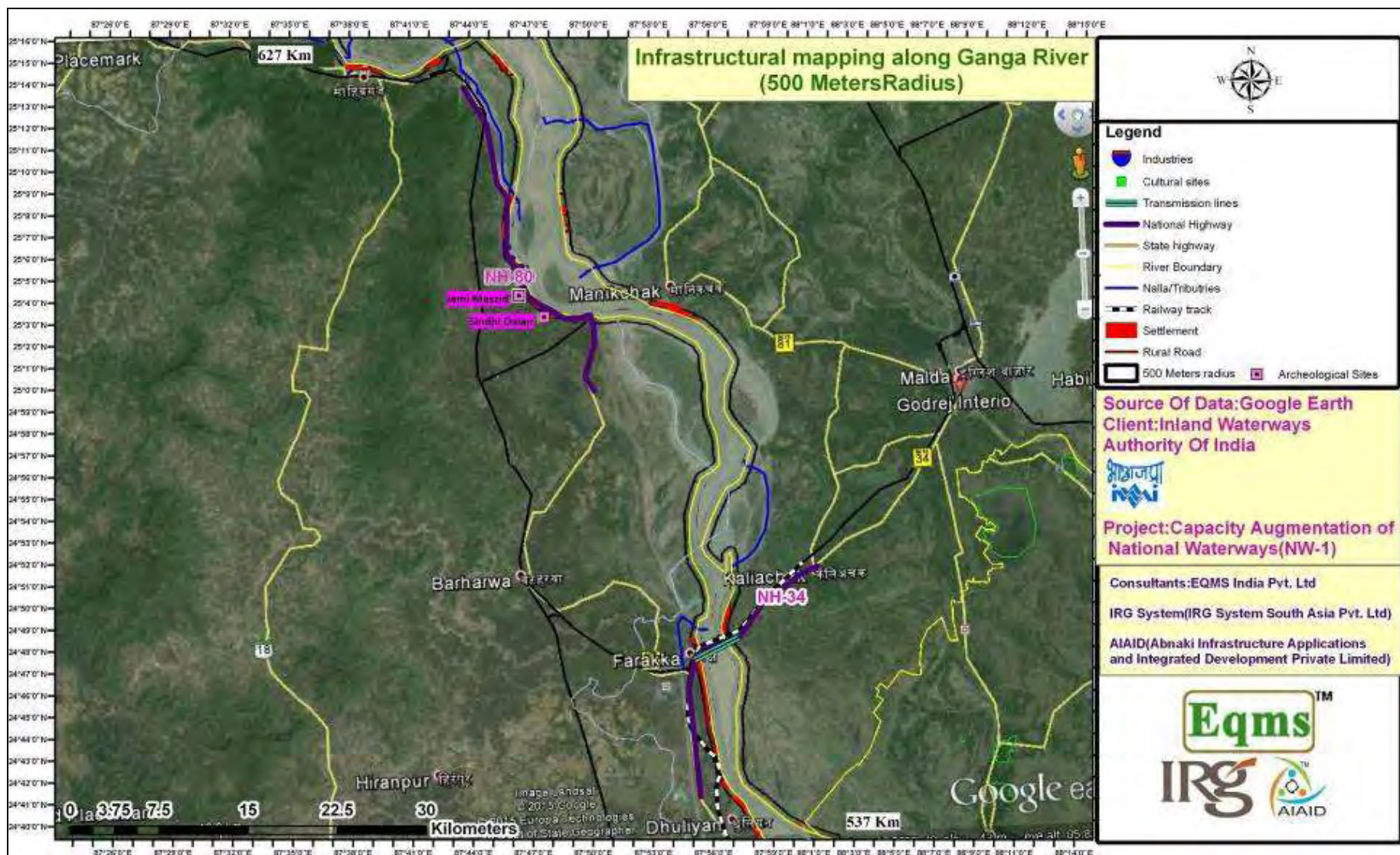
Infrastructural Mapping along 500 m area of NW-1 (Chainage 197-377 km)



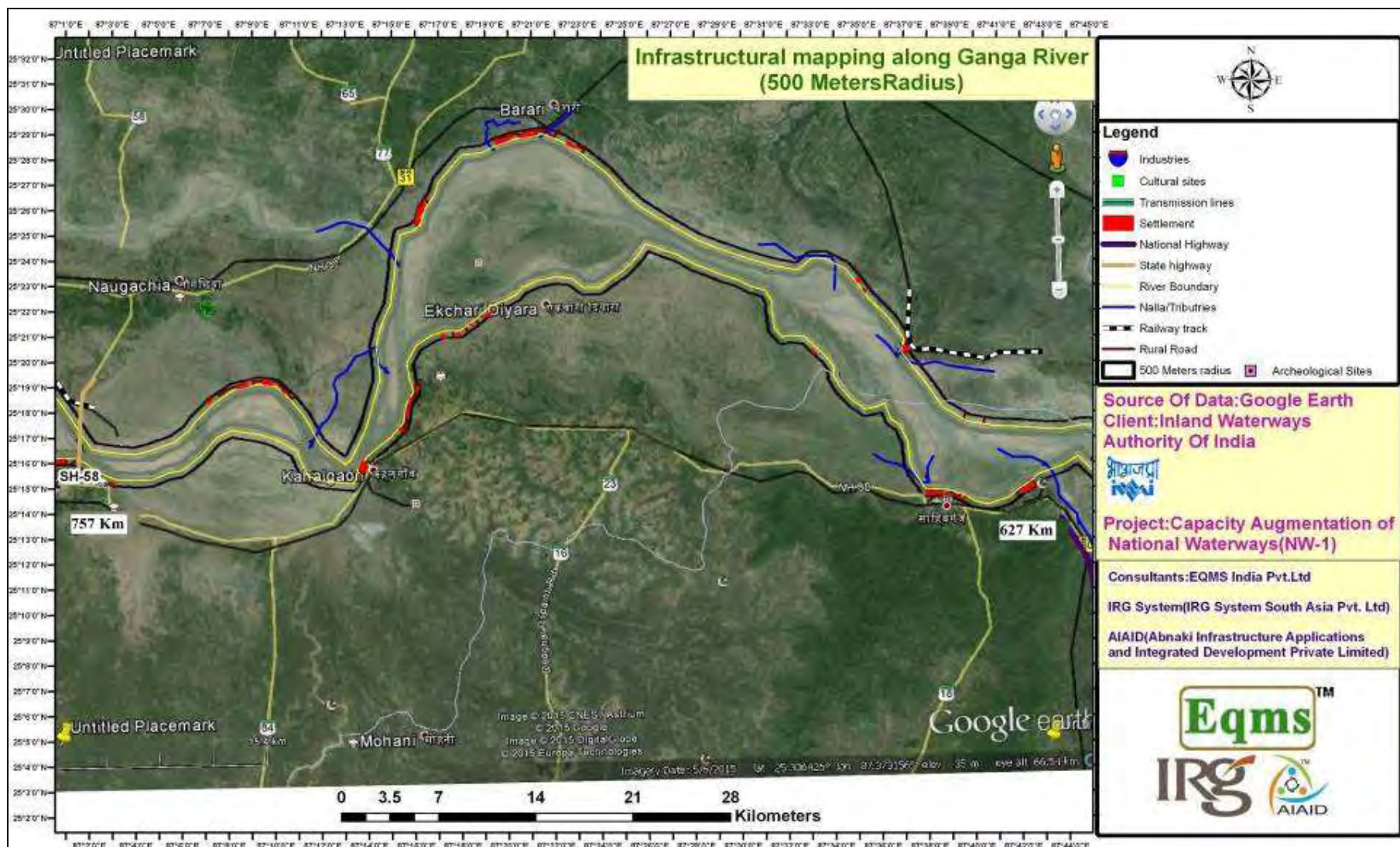
Infrastructural Mapping along 500 m area of NW-1 (Chainage 377- 447 km)



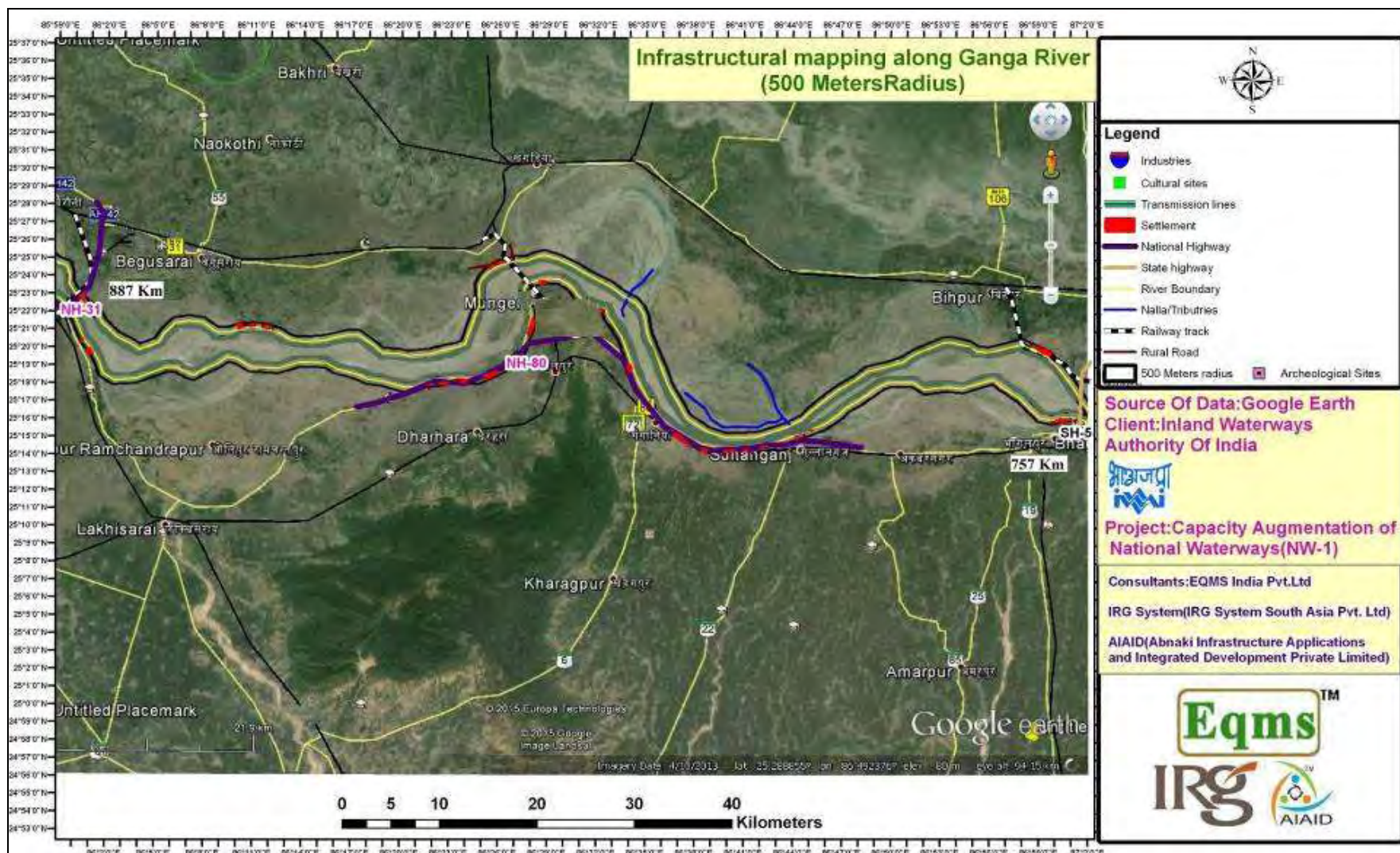
Infrastructural Mapping along 500 m area of NW-1 (Chainage 447-553 km)



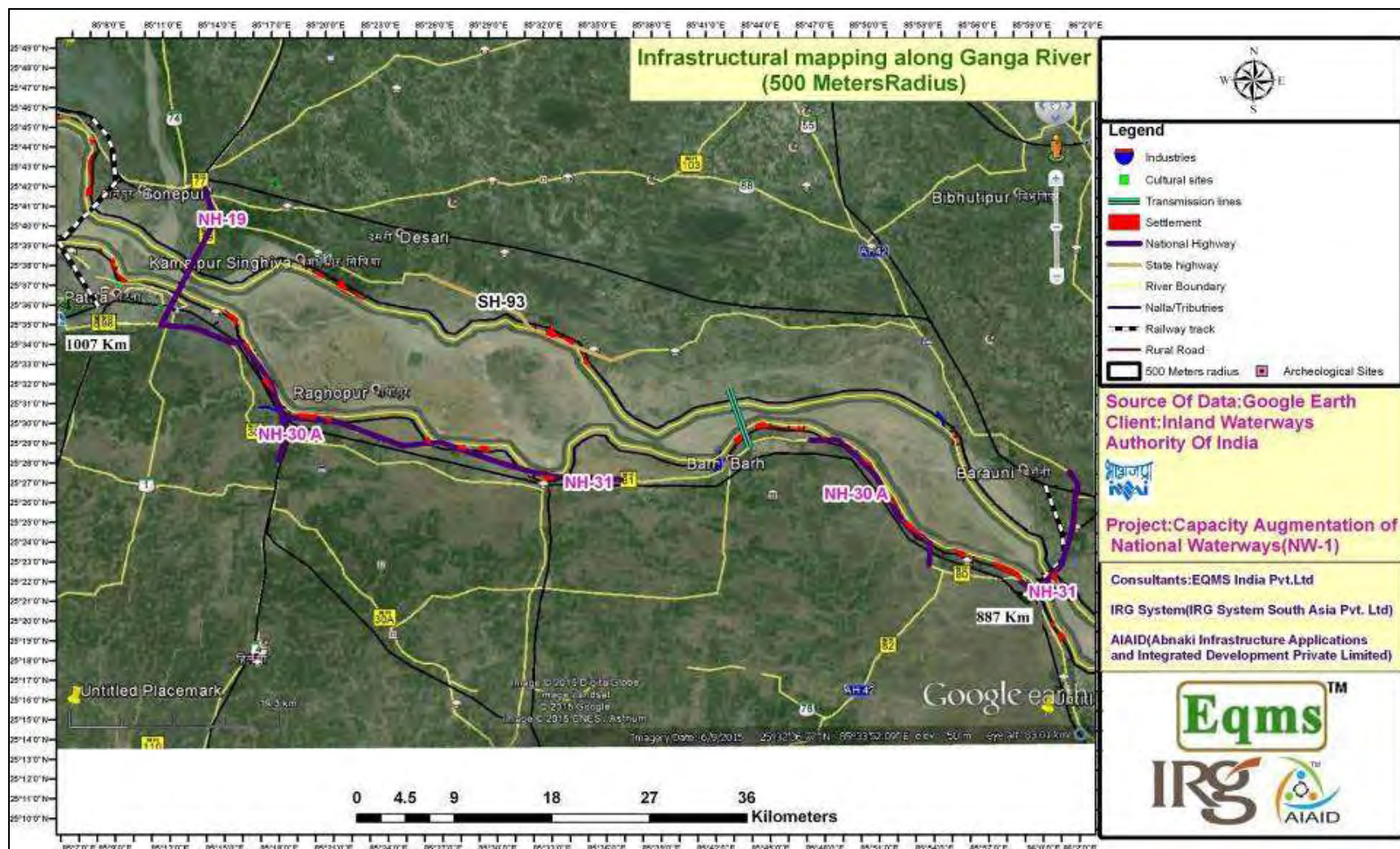
Infrastructural Mapping along 500 m area of NW-1 (Chainage 553-627 km)



Infrastructural Mapping along 500 m area of NW-1 (Chainage 627-750 km)



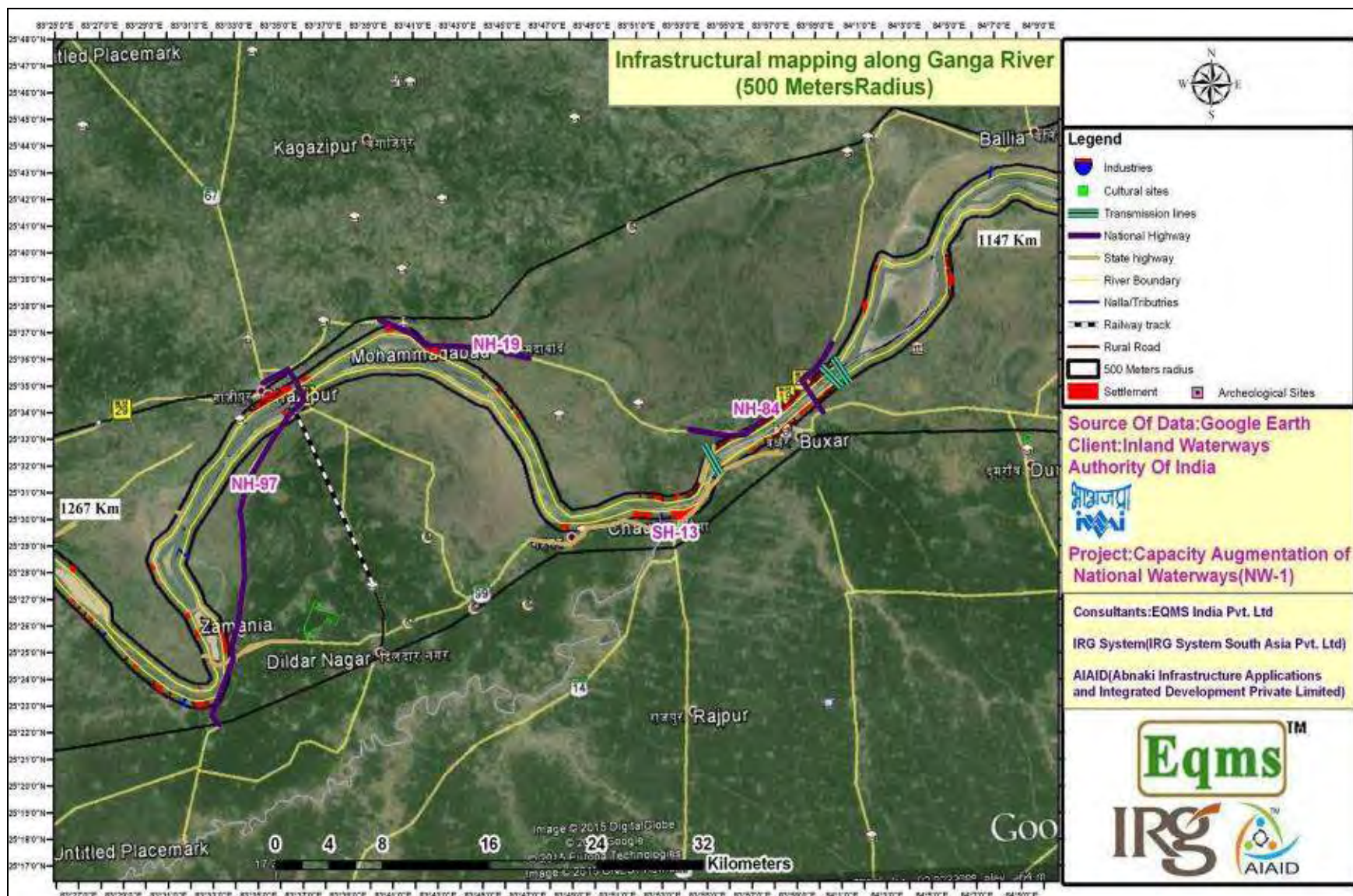
Infrastructural Mapping along 500 m area of NW-1 (Chainage 750-887 km)



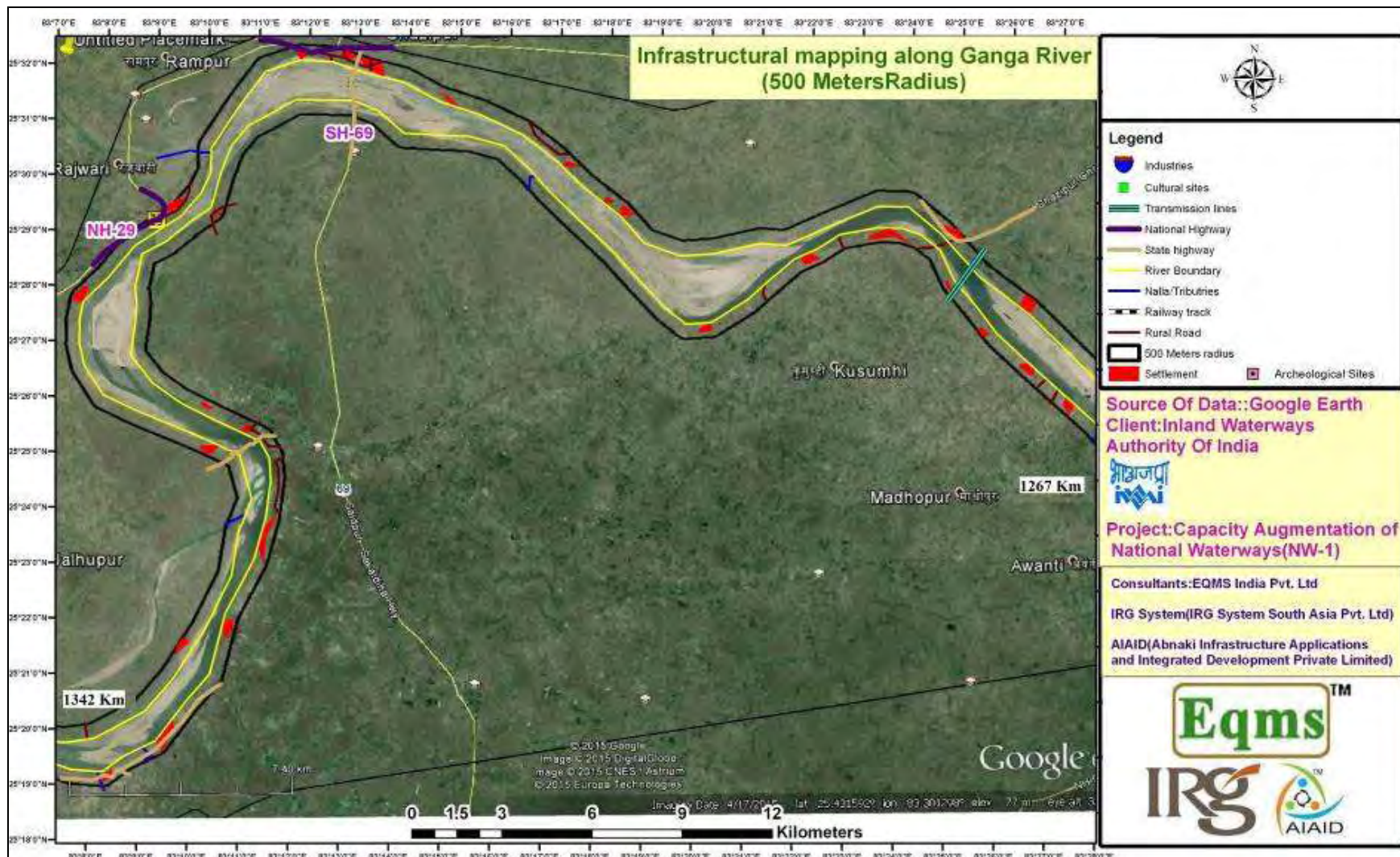
Infrastructural Mapping along 500 m area of NW-1 (Chainage 887-1007 km)

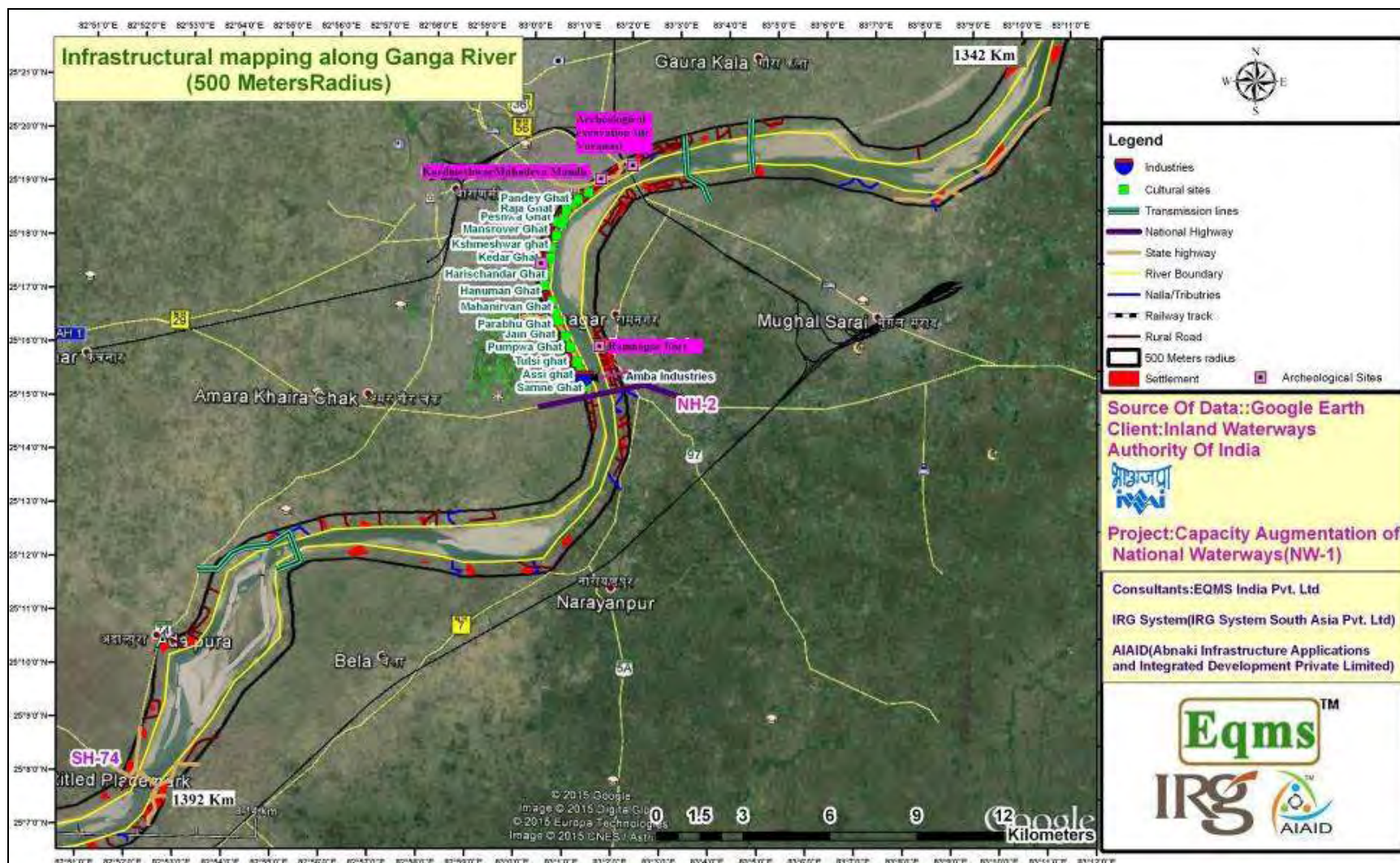


Infrastructural Mapping along 500 m area of NW-1 (Chainage 1007-1147 km)

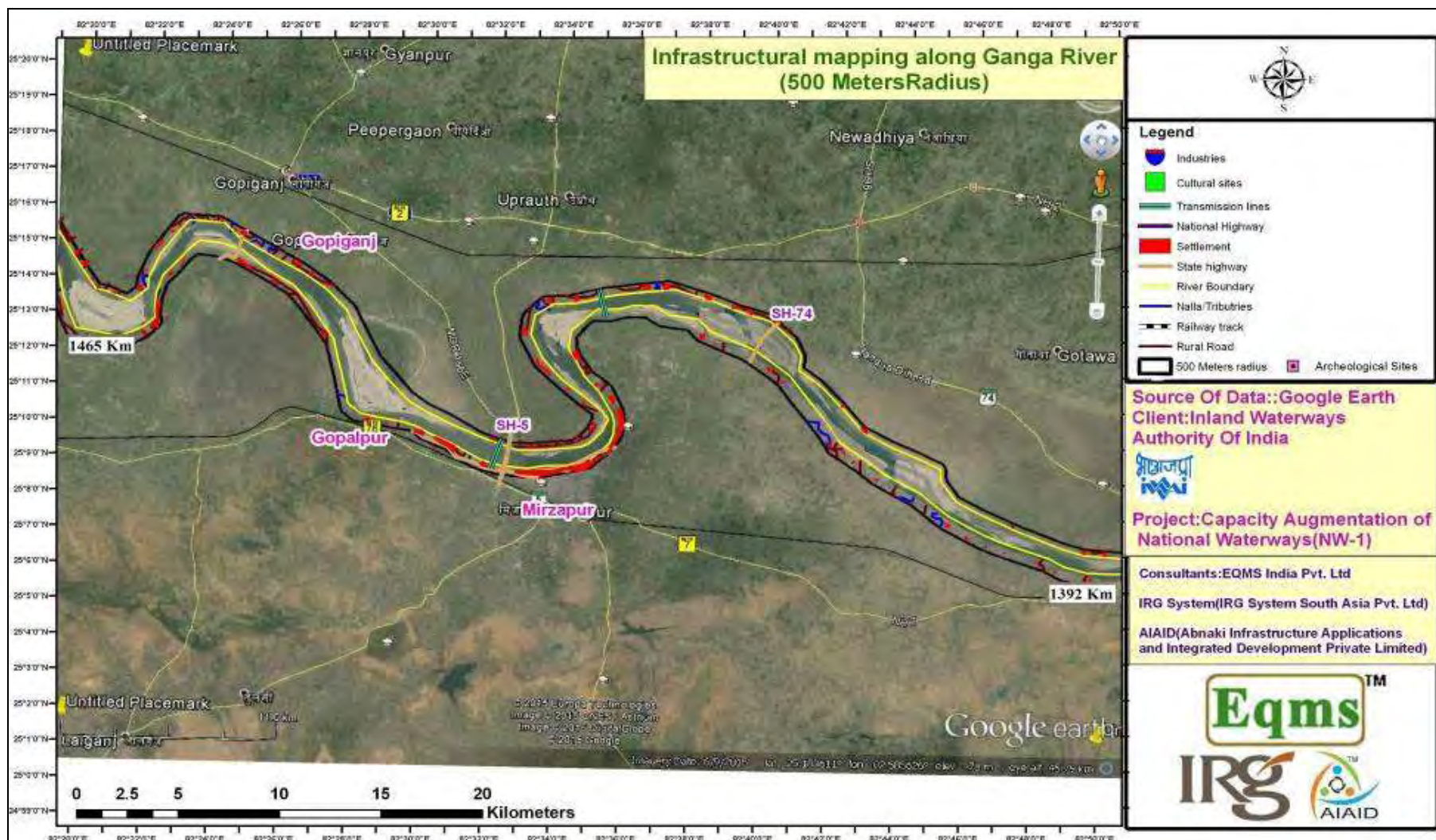


Infrastructural Mapping along 500 m area of NW-1 (Chainage 1147-1267 km)

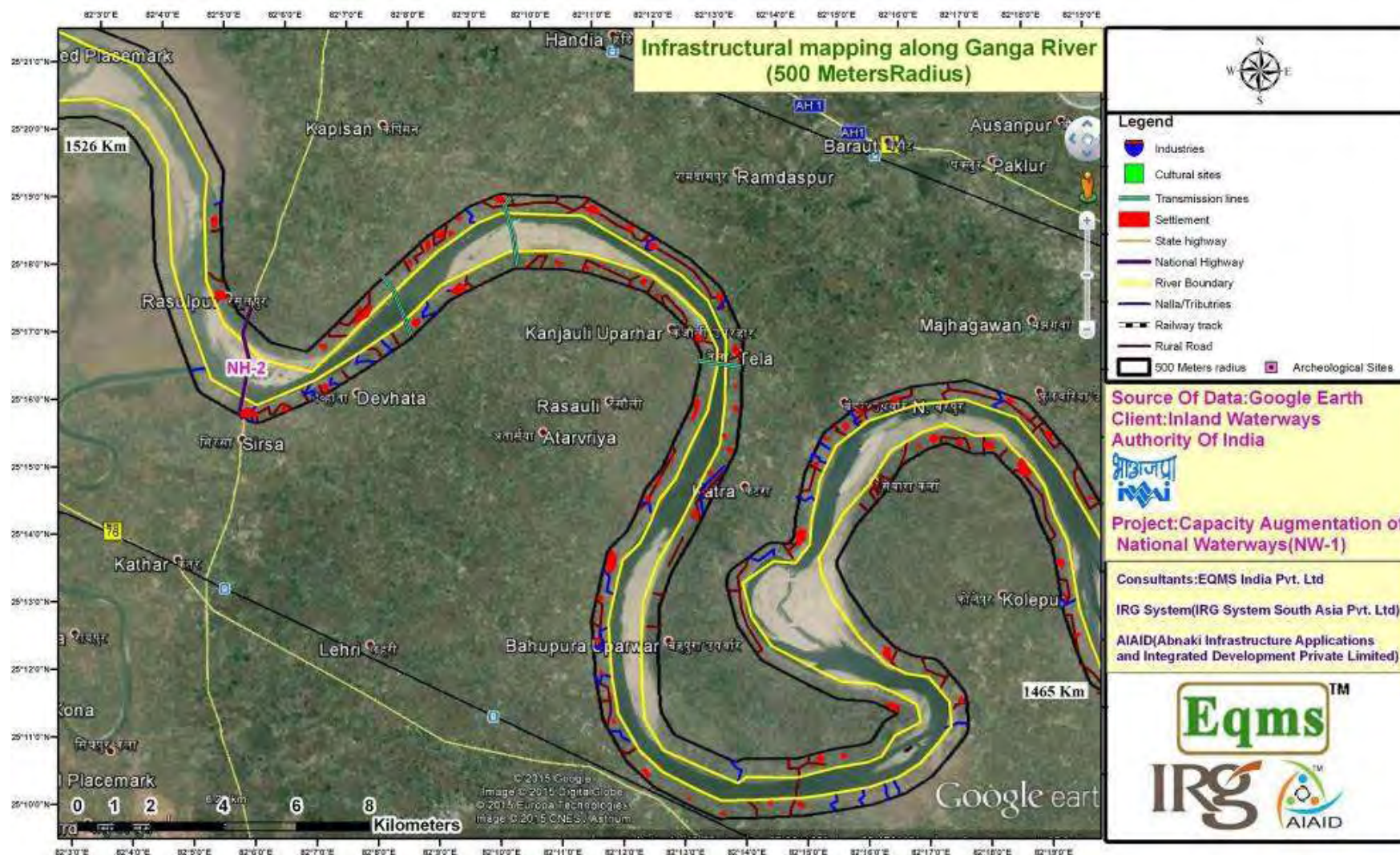




Infrastructural Mapping along 500 m area of NW-1 (Chainage 1342-1392 km)



Infrastructural Mapping along 500 m area of NW-1 (Chainage 1392-1465 km)





Annexure 6.1: GHG emission for transportation of freight

GHG Emissions for Transportation of Freight through IWT, Rail & Road mode Planned to be Transported through Phase I of IWT

Any transport system viz rail, road and IWT has emission of GHG. It is also well established that different mode of transport has different intensity of GHG emission. The analysis given below present the GHG emission levels in all the three mode of transport for similar quantity of cargo movement for transportation between Haldia to Varanasi. This analysis also presents the possibility and benefit of transport model shift from Rail, road to IWT. CO₂ is the main GHG gas which contributes maximum to the warming of atmosphere and increased CO₂ concentration is one of the major driver of climate change. Fuel burning also emit the CO₂. GHG emission from IWT is assessed in the form of CO₂ emissions. CO₂ emissions are calculated based on reported emission factor under various studies. The likely emission level of CO₂ is presented at **Table 1**.

Table 1: Comparative assessment of GHG (CO₂) emissions from Various Modes of Transport

Mode	CO ₂ emissions (gCO ₂ /NTKM)	Avg. Cargo transportation between Haldia and Varanasi in Phase I (tonnes/day)	Distance Considered to be travelled (Haldia to Varanasi)	Net CO ₂ emissions (Tonne/day)	Net CO ₂ emissions (Tonne/yr)	%Ranking
Road 32	38.1	19000	1065	770.95	281396.75	IV
Railways (Diesel) ³³	11.9		1037	234.46	85579.98	III
Railway (Electric)	11.22		1037	220.67	80545.86	II
Inland vessels of 1900 DWT and dimension - 110X11.434	6.4		1311	159.41	58187.42	I

³²Promoting Low Carbon Transport in India, UNEP, "Infrastructure for Low Carbon Transport in India: A case study of the Delhi-Mumbai Dedicated Freight Corridor, IIM Ahmadabad

³³Promoting Low Carbon Transport in India, UNEP, "Infrastructure for Low Carbon Transport in India: A case study of the Delhi-Mumbai Dedicated Freight Corridor, IIM Ahmadabad

³⁴Workshop Inland Navigation CO₂ emissions "Energy efficiency of inland water ships-and how to improve it", DST, Germany

Note: The emissions calculated are only for the section where material transportation will be taken through IWT, i.e. Haldia to Varanasi. Emissions from source of material to the initial point³⁵ are not considered in any of the mode. These emissions will be common in all the road, railway & IWT mode.

In addition to above calculations GHG emissions, which will be generated due to material transportation within the terminal site, is presented at **Table 2**.

Table 2: GHG (CO₂) emission generation within terminal due to material transportation

S. No.	Terminal Facility	Capacity of Terminals in Phase I (Million metric tonnes)	No. of trucks (15 MT) required to carry the material-2 way movement	Distance to be travelled by trucks within terminal site for material transportation (km)	Standard for CO ₂ emission by trucks post 2000 of 6000 cc engine capacity (g.km)	GHG Emissions (tonnes/day)	GHG Emissions (tonnes/yr)
1	Varanasi	0.5	92	184	762.3936	0.07	25.67
2	Haldia	1.57	544	0.45		0.19	68.09
3	Sahibganj	2.24	818	0.7		0.44	159.39
Total GHG (CO ₂) Emissions						0.7	253.15
GHG Emissions by IWT estimated in Table 5.10						159.41	58187.42
Total GHG Emissions through IWT Mode						160.11	58440.57

The GHG emission from IWT is estimated to be 58440.57 tonnes per annum which is the least amongst all the other mode of transport. These emissions can be further reduced by design and operational measures. The anticipated model shift will also help in reducing the GHG from RAIL and Road transportation system.

Mitigation Measures

- Adoption of modern designed vessels to be operated having more load carrying capacity and less draught requirement.
- Operating the freight vessels at slow speeds to increase the fuel efficiency and reducing the emissions.
- Adoption and strictly adhering to the standards as prescribed by MARPOL for managing the emissions.

³⁵Initial point is referred to as start point of each mode, i.e. Road, railway & IWT in section from Haldia to Varanasi.

³⁶Air Quality Monitoring Research Association of India “Air Quality Monitoring Project-India Clean Air Programme (ICAP), CPCB/MoEF & EPA emission factors for rail locomotives, commercial.



- Switching to LNG based vessels. LNG is not only cleaner but have comparatively higher calorific value than gasoline and diesel.

Table 3: Reduction in GHG Emissions Due to Shift of Freight from Road/Rail to IWT

Reduction in GHG due to shift of freight from Road to IWT	222956.18 Tonnes/yr
Reduction in GHG due to shift of freight from Rail to IWT	27139.41 Tonnes/yr

Annexure 6.2: List of Thermal Power Plants

SL. No.	Coal Projects	Latitude			Longitude		
		Degree	Min.	Sec.	Degree	Min.	Sec.
1	Kolaghat Thermal Power Station	22	25	5.56	87	52	19.78
2	Budge Budge	22	27	53.58	88	1	6.03
3	Bandel TPP	22	59	39.37	88	24	10.24
4	Sagardighi TPP	24	22	0.93	88	6	8.33
5	Farakka STPS	24	46	21.32	87	53	40.32
6	Kahalgaon STPS	25	14	26.98	87	16	0.77
7	Barauni TPP	25	23	54.58	86	1	12.05
8	Kanti TPS	26	11	49.36	85	18	5.36
9	Anpara TPS	24	12	12.11	82	47	17.36
10	Obra TPS	24	26	42.29	82	58	51.72
11	Haldia Energy Power Station Phase 1	22	6	8.93	88	10	46.04
12	Barh STPS	25	29	15.3	85	45	9.22
13	Banka Power Plant	24	33	11.62	86	43	44.89
14	Pirpainti TPS	25	20	5.06	87	24	55.95
15	Buxar Thermal power Station	25	33	5.56	83	57	24.46
16	Nabinagar SPTP	24	35	52.02	84	7	24.74
17	Nabinagar TPS	24	36	36.64	84	7	1.93
18	Lakhisarai TPS	25	12	1.64	86	10	49.74
19	Bhagalpur Power Project	25	14	25.48	87	16	0.3
20	Pirpainti Power Station CESC	25	23	56.47	87	27	10.83
21	Pirpainti TPS Ganga Power	25	24	3.15	87	27	15.13
22	Indragachi PS	22	14	8.92	88	15	2.76
23	Balagarh PS	23	7	32.59	88	28	13.6
24	Welspun Energy Mirzapur PS	25	8	12.08	82	33	43.72

Annexure 6.3: Air emissions for transportation of freight

Air Emissions for Transportation of Freight through IWT, Rail & Road mode Planned to be Transported through Phase I of IWT

Exhaust gases from vessel are source of air pollution and GHG gases. However, vessels emit least emissions compared to the air, road and railway modes. The impact on air quality due to vessel movement is anticipated insignificant considering the emission levels and projected vessel traffic. However, an estimation is carried out to arrive at the total emission load from the movement of vessels and corresponding load for transportation of similar amount of cargo by rail and road. Emission levels are calculated for transportation of cargo for about 19000 metric tonnes cargo movement per day for phase I of NW-1 between Haldia to Varanasi³⁷. Assessment has been carried out based on emission factors and emissions associated with different mode of transportation for pollutants NO_x, SO₂, CO, PM & HC. The comparative analysis is shown at Table 1. The analysis indicates that IWT transport while will have least emission load (air pollution) amongst all the three mode of transport and will rather have positive impact in the nearby areas due to modal shift and corresponding reduction in emission load (air pollution) of rail or road transport.

Table 1: Comparative Analysis of Air Pollution Levels between Rail, Road and IWT

A. Emission Comparisons for NO _x , SO ₂ , and CO						
Mode of Transportation	Emission Factor for NO _x (g/tonne km)	Emission Load per day for NO _x (Tonne/day)	Emission Factor for SO ₂ (g/tonne km)	Emission Load per day for SO ₂ (Tonne/day)	Emission Factor for CO (g/tonne km)	Emission Load per day for CO (Tonne/day)
Railway (Diesel Engines) ^{38,39}	0.4	7.78	0.18	3.50	0.15	2.91
Road ⁴⁰	1.37	27.38	0.18	3.59	0.54	10.79
IWT (For inland vessels) ⁴¹	0.26	6.39	0.04	0.98	0.11	2.70

³⁷The average of phase I cargo movement in NW-1 between Varanasi to Haldia is about 19000 MT. For calculation purposes and considering worst case scenario, it is assumed that 19000 MT cargo will travel full length of NW-1 between Varanasi to Haldia. The length considered between Varanasi to Haldia will vary from one mode to another mode of transport. The length is considered as 1311 Km, 1037 Km, 1065 Km for IWT, Rail and Road respectively.

³⁸ Table 14: Rail Air Pollution Emission, in g/tonne-km (sources: Kurer, 1993-Table 5), The Environmental Effects of Freight, Organization for Economic Co-operation and Development, Paris

³⁹Air Quality Monitoring Research Association of India "Air Quality Monitoring Project-India Clean Air Programme (ICAP), CPCB/MoEF & EPA emission factors for rail locomotives, commercial.

⁴⁰ Table 9: Truck Air Pollution Emission, in g/tonne-km (sources: Kurer, 1993, Table 5), The Environmental Effects of Freight, Organization for Economic Co-operation and Development, Paris

⁴¹ Table 7: Emissions from vessels Travelling on Inland Waterways (sources: Dutch data from the Centraal Bureau voor de Statistiek, Shoemaker and Bouman, P. 57 US data from US EPA (September 1985), p. II-3.2), The Environmental Effects of Freight, Organization for Economic Co-operation and Development, Paris

B. Emission Comparisons for PM and HC						
Mode of Transportation	Emission Factor for PM (g/tonne km)	Emission Load per day for PM (Tonnes /day)	Emission Factor for HC (g/tonne km)	Emission Load per day for HC (Tonne /day)		
Railway (Diesel Engines)	0.07	1.36	0.07	1.36		
Road	0.22	4.40	0.38	7.59		
IWT (For inland vessels)	0.02	0.49	0.05	1.23		

Material to be transported through NW-1 includes building construction materials like sand, stone aggregates, coal, textiles, fertilizers etc. Some of these commodities have potential to generate the dust majorly sand, stone aggregates, coal etc. This dust is required to be managed to prevent air quality degradation during transportation and high wind conditions.

Table 2: Reduction in Air Emission Due to Shift of Freight from Road/Rail to IWT

S. No.	Reduction in SO₂	Reduction in NO_x	Reduction in CO	Reduction in PM	Reduction in HC
	(Tonnes/Yr)				
Shift from Road to IWT	2.61	20.99	8.09	3.91	6.36
Shift from Rail to IWT	2.52	1.39	0.21	0.87	0.13

Annexure 6.4: Water demand

Table 1: Water Demand

S. No.	District	Number of Urban Households	Total Urban Population	Water Consumption	Effluent Discharge / Pollution Load	Number of Household Covered by Sewer Systems	% of Households Covered by Sewer Systems
1	Varanasi	253,184	1,597,051	30382080	24305664	167152	66.02
2	Ghazipur	41,569	274,360	4988280	3990624	3201	7.70
3	Mirzapur	55,602	3,47,567	6672240	2003006	16692	30.02
4	Buxar	26,483	164,499	3177960	2542368	1046	3.95
5	Munger	71,010	380,120	8521200	6816960	3188	4.49
6	Patna	429,424	2,514,590	51530880	41224704	72873	16.97
7	Lakhisarai	24,107	143,011	2892840	2314272	926	3.84
8	Bhagalpur	106,303	602,532	12756360	10205088	5868	5.52
9	Saran	55,873	353,202	6704760	5363808	2095	3.75
10	Katihar	53,564	273,822	6427680	5142144	2244	4.19
11	Sahibganj	30,967	159,666	3716040	2972832	511	1.65
12	Murshidabad	284,559	1,400,692	34147080	27317664	11212	3.94
13	Bardhaman	659,366	3,078,299	79123920	63299136	78267	11.87
14	Nadia	348,972	1,438,873	41876640	33501312	21566	6.18
15	Hugli	505,943	2,128,499	60713160	48570528	41791	8.26
16	Howrah	669,902	3,074,144	80388240	64310592	42874	6.40
17	North 24 Pgs	1,355,449	5,732,162	162653880	130123104	148286	10.94
18	South 24 Pgs	482962	2087773	57955440	46364352	21878	4.53
19	Purba Medinipur	125386	592714	15046320	12037056	6545	5.22



Annexure 6.5: List of Dams in Ganga basin and its tributaries

Dams in Ganga basin and its tributaries

Sl. No.	Dam Name	Completion Year	River	Nearest City	Basin	District	Type	Height (m)	Length (m)	Purpose	Status
WEST BENGAL											
1	Bakreshwar Dam			Siuri	Ganga	Birbhum					
3	Bandhu Dam		Bandhu	Puruliya	Ganga	Puruliya	TE	16	1605	Irrigation	Completed
4	Bara Mandira Dam	1977	Baramandira	Asansol	Ganga	Bardhaman	TE	17	853	Irrigation	Completed
5	Barabhum Dam	1991	Nagasai, Barabhum	Puruliya	Ganga	Puruliya	TE	11	1529	Irrigation	Completed
6	Beko Dam	1990		Puruliya	Ganga	Puruliya	TE	16	914	Irrigation	Completed
7	Dangrajhore Dam	1982		Puruliya	Ganga	Puruliya	TE	10	580	Irrigation	
9	Futary Dam			Puruliya	Ganga	Puruliya	TE	13.7	768	Irrigation	Completed
10	Golamarajore Dam	1989	Golamarajore	Puruliya	Ganga	Puruliya	TE	13		Irrigation	Completed
11	Hanumata Dam	2007	Hanumata	Puruliya	Ganga	Puruliya	TE	19	984.62	Irrigation	Completed
12	Hinglow Irrigation Scheme Dam	1976		Siuri	Ganga	Birbhum	TE	12	1158	Irrigation	Completed
13	Kangsabati Kumari Dam	1965	Kasai	Bankura	Ganga	Bankura		41	10400	Irrigation	Completed
14	Kanjan Dam			Bankura	Ganga	Bankura					
17	Kumari Dam	1984		Puruliya	Ganga	Puruliya	TE + PG	15	1068	Irrigation	Completed
18	Lipania Dam			Puruliya	Ganga	Puruliya	TE	15	750	Irrigation	Completed
20	Moutorejore Dam	1990		Puruliya	Ganga	Puruliya	TE + PG	14	1151	Irrigation	Completed
21	Muruguma Dam	1982		Puruliya	Ganga	Puruliya	TE	19	328	Irrigation	Completed
22	Nachan Irri. Scheme Dam	1977		Durgapur	Ganga	Bardhaman	TE	14	853	Irrigation	Completed
23	Paraga Irri. Scheme Dam	1979		Puruliya	Ganga	Puruliya	TE	16	737	Irrigation	Completed
24	Patloi Dam	2012	Patloi	Puruliya	Ganga	Puruliya	TE	14	952.4	Irrigation	Completed



*Draft Cumulative Impact Assessment
Report of National Waterways-1*

25	Ramchandrapur Dam	1991	Machkandajore	Puruliya	Ganga	Puruliya	TE	15	899	Irrigation	Completed
27	Saharajore Irri. Scheme Dam	1978		Bankura	Ganga	Bankura	TE	16	2682	Irrigation	Completed
28	Sali Dam	1985	Sali	Bankura	Ganga	Bankura	TE	12	1494	Irrigation	Completed
29	Taragonia Irri. Scheme Dam	1987		Puruliya	Ganga	Puruliya	TE	12	716	Irrigation	Completed
30	Tatko Dam	2013	Tatko	Puruliya	Ganga	Puruliya	TE	15	1468	Irrigation	Completed
JHARKHAND											
1	Amanat Dam		Amanat	Daltenganj	Ganga	Palamu	TE	41	869	Irrigation	Under Construction
2	Anjanwa Dam	1981	Anjanwa	Hazaribag	Ganga	Hazaribagh	TE	16.25	1341.46	Irrigation	Completed
3	Anraj Dam		Arraj	Garhwa	Ganga	Garhwa	TE	27.74	731.52	Irrigation	
4	Babhani Khand Dam		Banki	Garhwa	Ganga	Garhwa	TE	13.1	822.96	Irrigation	
5	Baranadi Dam	1967		Dumka	Ganga	Dumka	TE	19.51	220.98	Irrigation	Completed
6	Barhi Dam	1981	Mahuaghat	Hazaribag	Ganga	Hazaribagh	TE	12.8	1057.66	Irrigation	Completed
8	Batane Dam	1990	Batane	Daltenganj	Ganga	Palamu	TE	24.08	2011.68	Irrigation	Completed
9	Batre Dam	1954	Batare	Daltenganj	Ganga	Palamu	TE	19.33	748.48	Irrigation	Completed
10	Bhairwa Dam		Bhera	Hazaribag	Ganga	Ramgarh	TE	29.57	2469.5	Irrigation	Under Construction
11	Boudha Dam	1978	Agrawa/Konar	Hazaribag	Ganga	Hazaribagh	TE	15.85	609.26	Irrigation	Completed
12	Bucha Opa Dam	1957	Buchaopa Nala	Ranchi	Brahmani and Baitarni	Ranchi	TE	14.02	1067	Irrigation	Completed
13	Buksa Dam	1982	Baksa	Chatra	Ganga	Chatra	TE	18.78	2667.67	Irrigation	Completed
14	Burhai Dam		Pathro	Devghar	Ganga	Deoghar	TE	29.23	5760	Irrigation	
15	Butanduba Dam	1985		Daltenganj	Ganga	Palamu	TE	22.56	365.85	Irrigation	Completed



*Draft Cumulative Impact Assessment
Report of National Waterways-1*

17	Chatania Ghat Dam	1980	Kuljhiri Nala	Garhwa	Ganga	Garhwa	TE	19.81	365.76	Irrigation	Completed
19	Chirka Dam	1985	Dhengura	Garhwa	Ganga	Garhwa	TE	22.13	1046.07	Irrigation	Completed
20	Danro Dam	1985	Danro	Garhwa	Ganga	Garhwa	TE	22.37	1371.6	Irrigation	Completed
21	Dhankai Dam	1979	Dhankai Nala	Daltenganj	Ganga	Palamu	TE	10.55	810.77	Irrigation	Completed
23	Diggalpahari Dam	1975	Ashabani River/Reshma Nala	Dumka	Ganga	Dumka	TE	10.37	426.72	Irrigation	
24	Dulaki Dam	1971	Lilajan	Chatra	Ganga	Chatra	TE	16.76	1067	Irrigation	Completed
26	Getalsud Dam	1971	Subarnarekha	Ranchi	Subarnarekha	Ranchi	TE	36.1	3800	Hydroelectric, Irrigation, Water Storage	
27	Ghaghra Dam	1957	Ghaghra	Hazaribag	Ganga	Hazaribagh	TE + PG	19.82	94.51	Irrigation	Completed
28	Gonda Dam	1954	Gonda	Hazaribag	Ganga	Hazaribagh	TE	13.41	1006.09	Irrigation	Completed
29	Hatia Dam	1963	Subarnarekha	Ranchi	Subarnarekha	Ranchi	TE	24	4525	Irrigation	Completed
30	Hiru Dam	1982	Hiroo	Chatra	Ganga	Chatra	TE	18.3	970.788	Irrigation	Completed
33	Jamunia Dam	1954	Jamunia	Hazaribag	Ganga	Hazaribagh	TE	17.38	1067.1	Irrigation	Completed
38	Karawani Dam	1967	Dararika	Dumka	Ganga	Dumka	TE	18.59	295.66	Irrigation	Completed
40	Kesho Dam		Kesho	Kodarma	Ganga	Kodarma	TE	14.57	2052	Irrigation	Under Construction
41	Khudia Dam	1971	Khudia River	Baghmara	Ganga	Dhanbad	TE		1227.12	Irrigation	
42	Konar Dam	1955	Konar	Hazaribag	Ganga	Hazaribagh	TE + PG	48.77	3806.65	Irrigation	Completed
45	Left Banki Dam	1980	Left Banki	Garhwa	Ganga	Garhwa	TE	14.32	1499.42	Irrigation	Completed
47	Lotia Dam	1978	Chondhi	Hazaribag	Ganga	Hazaribagh	TE	19.74	762.2	Irrigation	Completed



*Draft Cumulative Impact Assessment
Report of National Waterways-1*

48	Maithon Dam	1957	Barakar	Asansol	Ganga		TE	56.08	4426	Hydroelectric, Water Storage	Completed
49	Malay Dam	1985	North Koel	Daltenganj	Ganga	Palamu	TE	28.8	1684.15	Irrigation	Completed
50	Masanjor JH Dam	1955	Mayurakshi or Mor	Dumka	Ganga	Dumka	TE	36.9	630	Hydroelectric, Irrigation	Completed
54	Nalkari Dam	1968	Nalkari	Hazaribag	Ganga	Ramgarh	TE	36	3074	Irrigation	Completed
56	North Koel Dam		North Koel	Garhwa	Ganga	Garhwa	TE	67.86	343	Hydroelectric, Irrigation	Under Construction
58	Panchat Hill Dam	1959	Damodar	Dhanbad	Ganga	Dhanbad	TE + PG	48	6777	Hydroelectric, Irrigation, Water Storage	Completed
59	Panchkhero Dam		Panchkhero	Giridih	Ganga	Giridih	TE	19.33	2182	Irrigation	Under Construction
60	Pandarwa Dam	1983	Pandarwa	Garhwa	Ganga	Garhwa	TE	21.8	193.55	Irrigation	Completed
62	Punasi Dam		Ajoy	Devghar	Ganga	Deoghar	TE	21.54	2133.6	Irrigation	Under Construction
65	Salaiya Dam		Barsoti	Kodarma	Ganga	Hazaribagh	TE	18.6	990	Irrigation	Under Construction
69	Sudhari Nala Dam		Sudhari nala	Chatra	Ganga	Chatra	TE	16.46	396.34	Irrigation	Under Construction
70	Sugathan Dam			Godda	Ganga	Godda	TE	21.12	2040	Irrigation	Under Construction
72	Sunder Dam	1976	Sunder	Godda	Ganga	Godda	TE	35.67	1554.48	Irrigation	Completed
74	Suryodi Dam	1974	Surjudi Nala	Pakaur	Ganga	Pakur	TE + PG	12.5	487.68	Irrigation	Completed
75	Tahlay Dam		Tahlay	Daltenganj	Ganga	Palamu	TE	15		Irrigation	Under Construction
78	Temrain Dam	1973		Daltenganj	Ganga	Palamu	TE	12.8	503.05	Irrigation	Completed
79	Tenughat Dam	1978	Damodar	Bermo	Ganga	Bokaro	TE	50.61	6492.24	Hydroelectric, Irrigation	Completed
80	Tilaiya Dam	1953	Barakar	Hazaribag	Ganga	Kodarma	PG	29.7	366	Hydroelectric, Irrigation	Completed
81	Torai Dam		Torai	Pakaur	Ganga	Pakur	TE	24.4	647.	Irrigation	Under



									7		Construction
BIHAR											
1	Ajan Dam	1989	Ajan	Jamui	Ganga	Jamui	TE	39.02	518.3	Irrigation	Completed
2	Amrity Dam	1965		Jamui	Ganga	Jamui	TE	16.65	166.16	Irrigation	Completed
3	Badua Dam	1965	Badua	Banka	Ganga	Banka	TE	56.66	457.32	Irrigation	Completed
4	Barnar Dam			Jamui	Ganga	Jamui	PG	76.75	282.7	Irrigation	Under Construction
5	Baskund Dam	1984	Baskund	Lakhisarai	Ganga	Lakhisarai	TE	17.68	67.07	Irrigation	Completed
6	Belharna Dam	1987	Belharna	Banka	Ganga	Banka	TE	30.1	411.58	Irrigation	Completed
7	Bilasi Dam	2001	Bilasi	Banka	Ganga	Banka	TE	19.9797003	169.8	Irrigation	Completed
8	Chandan Dam	1968	Chandan	Banka	Ganga	Banka	TE	40.4	1555	Irrigation	Completed
9	Durgawati Dam		Durgawati	Bhabhua	Ganga	Kaimur (bhabua)	TE	46.3	1615.4	Irrigation	Under Construction
10	Gaighat Dam		Baghara	Munger	Ganga	Munger					Proposed
11	Jalkund Dam	1968	Jalkund	Munger	Ganga	Munger	TE	15.99	631.1	Irrigation	Completed
12	Job Dam	1977	JOB	Nawada	Ganga	Nawada	TE	18.9	1616	Irrigation	Completed
13	Kailash Ghati Dam	1980	Kailash Ghati	Jamui	Ganga	Jamui	TE	25.9	183	Irrigation	Completed
14	Khargpur Lake Dam	1876	Man	Munger	Ganga	Munger	TE	26.53	221.04	Irrigation	Completed
15	Kohira Dam	1962	Kohira	Bhabhua	Ganga	Kaimur (bhabua)	TE + PG	16	265.24	Irrigation	Completed
16	Kolmahadeo Dam	1966	Kolmahadev(bhusari)	Nawada	Ganga	Nawada	TE	19.2	157	Irrigation	Completed
17	Morwy Dam	1960	Morwe	Lakhisarai	Ganga	Lakhisarai	TE	25.56	533.53	Irrigation	Completed
18	Nagi Dam	1958	Nagi	Jamui	Ganga	Jamui	TE	113.5	1884	Irrigation	Completed
19	Nakti (Bihar) Dam	1980	Nakti	Jamui	Ganga	Jamui	TE	23.61	990.85	Irrigation	Completed
20	Orhni Dam	2000	Orni	Banka	Ganga	Banka	TE	23.774	686	Irrigation	Completed
21	Phulwaria Dam	1988	Tilaiya	Nawada	Ganga	Nawada	TE	25.66	1135	Irrigation	Completed
22	Sindhwarni Dam		Man	Munger	Ganga	Munger	TE	21.34	125.76	Irrigation	Under Construction
23	Srikhandi Dam	1965	Srikhandi	Jamui	Ganga	Jamui	TE	16.65	205.8	Irrigation	Completed
24	Upper Kiul Dam	2004	Kiul	Jamui	Ganga	Jamui	TE	30.48	3673	Irrigation	Completed



UTTAR PRADESH											
1	Adwa Dam	1978	Adwa	Mirzapur	Ganga	Mirzapur	TE	20.48	7906	Irrigation	Completed
2	Afzalgarh Dam			Bijnore	Ganga		TE			Irrigation	
3	Ahraura Dam	1955	GARAI	Chunar	Ganga	Mirzapur	TE	22.87	1219.5	Irrigation	Completed
4	Arjun Dam	1957	ARJUN River	Kulpahar	Ganga	Mahoba	TE	25.88	5200	Irrigation	Completed
5	Aunjhar Dam	1930	AUNJHAR	Mau	Ganga	Chitrakoot	PG	17.6	1056	Irrigation	Completed
6	Bachara Dam	1980		Meja	Ganga	Allahabad	TE	15	660	Irrigation	Completed
7	Baghel Khand Dam	1957	Jamunahwa	Balrampur	Ganga	Balrampur	TE	15.46	3200	Irrigation	Completed
8	Balui Dam		LOCAL	Robertsganj	Ganga	Sonbhadra	TE	14.1	2900	Irrigation	Under Construction
9	Banjari Kalan Dam		LOCAL	Mirzapur	Ganga	Mirzapur	TE	14.1	1470	Irrigation	Under Construction
10	Barkachha Dam	1975	LOCAL	Mirzapur	Ganga	Mirzapur	TE	19	570	Irrigation	Completed
11	Barwa Dam	1967		Jhansi	Ganga	Jhansi	TE	21.03	2815	Irrigation	Completed
12	Barwa Sagar Dam		Barwa Nala	Karwi	Ganga	Chitrakoot	TE	21.03	1067	Irrigation	Completed
13	Barwar Dam	1923	BORANALA	Garautha	Ganga	Jhansi	TE	20.4	2233	Irrigation	Completed
14	Barwatola Dam	1957		Dudhi	Ganga	Sonbhadra	TE	16.77	1050	Irrigation	Completed
15	Bhagwan Pur Dam	1965		Balrampur	Ganga	Balrampur	TE	11.28	4400		Completed
16	Bhainsora Dam	1926	Marhwa Nala	Chakia	Ganga	Chandauli	TE	11.26	1850.61	Irrigation	Completed
17	Bhonka Dam	1951	BHONKA	Mirzapur	Ganga	Mirzapur	TE	15.3	2012	Irrigation	Completed
18	Chandra Prabha Dam	1966	Chandraprabha	Chakia	Ganga	Chandauli	TE	22.25	1600	Irrigation	Completed
19	Chandrawal Dam	1973	Chandrawal	Charkhari	Ganga	Mahoba	TE	10	5765	Irrigation	Completed
20	Chittaurgarh Dam	1985		Balrampur	Ganga	Balrampur	TE	15.3	11000	Irrigation	Completed
21	Deori Dam	1978	LOCAL	Robertsganj	Ganga	Sonbhadra	TE	21	930	Irrigation	Completed
22	Dhandhraul Dam	1917		ROBERTSGANJ	Ganga		TE	21	7305	Irrigation	Completed
23	Dhenkwan Dam	1985		Chunar	Ganga	Mirzapur	TE	20.85	1700	Irrigation	Completed
24	Dongia Dam	1918	GARAI	Robertsganj	Ganga	Sonbhadra	TE	15.3	2012	Irrigation	Completed
25	Dongri Dam	1986	PAHUJ	Jhansi	Ganga	Jhansi	TE	15.3	2760	Irrigation	Completed
26	Ganeshpur Dam			Balrampur	Ganga	Balrampur					
27	Garhwa Dam	1975	GARHW	Mau	Ganga	Chitrakoot	TE	13	980	Irrigation	Completed



*Draft Cumulative Impact Assessment
Report of National Waterways-1*

			A								
28	Ghaghar Dam			Robertsganj	Ganga	Sonbhadra					
29	Ghooga Dam		LOCAL	Bahraich	Ganga	Shrawasti	TE	16	520	Irrigation	
30	Ghori Dam	1915		Mirzapur	Ganga	Mirzapur	TE	13.87	1584	Irrigation	Completed
31	Girgity Dam	1966		Balrampur	Ganga	Balrampur	TE	15.18	4800	Irrigation	Completed
32	Gointha Dam	1992	LOCAL	Ghazipur	Ganga	Ghazipur	TE	13.55	500	Irrigation	Completed
33	Govind Sagar Dam	1953	Shahzad River	Lalitpur	Ganga	Lalitpur	TE	18.29	3606	Irrigation	Completed
34	Gularia Dam	1966	GULARI A STREAM	Meja	Ganga	Allahabad	TE	11	3200	Irrigation	Completed
35	Gunta Dam	2003	GUNTA NALA (YAMUN A)	Karwi	Ganga	Chitrakoot	TE	29.5	5200	Irrigation	Completed
36	Hinauti Dam	1964	COL NALA	Mirzapur	Ganga	Mirzapur	TE	10.67	995	Irrigation	Completed
37	Jaiwanti Dam	1928		Mau	Ganga	Chitrakoot	TE	15	3352	Irrigation	Completed
38	Jamini Dam	1973	Jamni	Mahrauni	Ganga	Lalitpur	TE	26.22	6400	Irrigation	Completed
39	Jirgo Dam	1958	JIRGO	Chunar	Ganga	Mirzapur		29.88	6704	Irrigation	Completed
40	Jogendra Dam	1970	JOGEND RA	Mirzapur	Ganga	Mirzapur	TE	10.04	1313	Irrigation	Completed
41	Kabrai Dam	1955		Mahoba	Ganga	Mahoba	TE	18.24	2300 .2	Irrigation	Completed
42	Kachnoda Dam	2012		Lalitpur	Ganga	Lalitpur	TE	18.9	4100	Irrigation	Completed
43	Kargara Dam	1978	LOCAL	Robertsganj	Ganga	Sonbhadra	TE	16.84	1410	Irrigation	Completed
44	Keolari Dam	1966		Kulpahar	Ganga	Mahoba	TE	11.73	2836 .58	Irrigation	Completed
45	Khairman Dam	1958	HENGA NALA	Balrampur	Ganga	Balrampur	TE	10.6	3020	Irrigation	Completed
46	Khandeha Dam	1929	DASRAT H NALA	Mau	Ganga	Chitrakoot	TE	19.9	1200	Irrigation	Completed
47	Khapatia Dam	1916	BORERA	Mau	Ganga	Chitrakoot	TE	16	806	Irrigation	Completed
48	Khirihata Dam	1992	LOCAL	Dudhi	Ganga	Sonbhadra	TE	10.77	178	Irrigation	Completed
49	Kohar Gaddi Dam	1930		Balrampur	Ganga	Balrampur	TE	10.5	2820	Irrigation	Completed
50	Kota Dam	1960	LOCAL	Robertsganj	Ganga	Sonbhadra	TE	14.63	549	Irrigation	Completed
51	Kotra Khambha Dam	1915		Mau	Ganga	Chitrakoot	TE	18	806	Irrigation	Completed
52	Kuba Khurd Dam	1988	LOCAL	Chunar	Ganga	Mirzapur	TE	10.33	1675	Irrigation	Completed
53	Lachura Dam	1910		Mau Ranipur	Ganga	Jhansi	TE + PG	14.94	542. 3	Irrigation	Completed



*Draft Cumulative Impact Assessment
Report of National Waterways-1*

54	Lower Khajuri Dam	1949		Mirzapur	Ganga	Mirzapur	TE + PG	18	640	Irrigation	Completed
55	Majhgawan Dam	1917	GUNCHI NALA	Kulpahar	Ganga	Mahoba	TE	19.43	1402	Irrigation	Completed
56	Matatila Dam	1958		Lalitpur	Ganga	Lalitpur	TE	45.72	6300	Hydroelectric, Irrigation	Completed
57	Maudaha (Swami Brahmanand) Dam	2003		Rath	Ganga	Hamirpur	TE	32.6	3480	Irrigation	Completed
58	Meja Dam	1987	Belan	Mirzapur	Ganga	Mirzapur	TE	40	2000	Irrigation	Completed
59	Moosakhand Dam	1967	KARMN ASA	Chakia	Ganga	Chandauli	TE	33.53	2967	Irrigation	Completed
60	Muirpur Dam	1992	LOCAL	Dudhi	Ganga	Sonbhadra	TE	15.3	581	Irrigation	Completed
61	Murtia Dam	1977	LOCAL	Robertsganj	Ganga	Sonbhadra	TE	18.26	1135	Irrigation	Completed
62	Nagwa Dam	1950	KARMA NALA RIVER	Robertsganj	Ganga	Sonbhadra	TE	20.31	2810.19	Irrigation	Completed
63	Nanauti Dam	1963	LOCAL	Chunar	Ganga	Mirzapur	TE	13.71	1400	Irrigation	Completed
64	Narson Dam	1988	NARSON	Robertsganj	Ganga	Sonbhadra	TE	14.33	2340	Irrigation	Completed
65	Naugarh Dam	1956	KARMN ASA	Chakia	Ganga	Chandauli	TE	18.9	5975	Irrigation	Completed
66	Newari Dam		LOCAL	Robertsganj	Ganga	Sonbhadra	TE	15.44	1218	Irrigation	Under Construction
67	Obra Dam	1970	RIHAND	Robertsganj	Ganga	Sonbhadra	TE + PG	29	2000	Hydroelectric, Irrigation	Completed
68	Ohen Dam	1961	Ohan	Karwi	Ganga	Chitrakoot	TE + PG	24.08	2527	Irrigation	Completed
69	Pachwara Lake Dam	1694	LOCAL	Mau Ranipur	Ganga	Jhansi	TE + PG	13.72	208	Irrigation	Completed
70	Pahari Dam	1912	Local Nalla	Mau Ranipur	Ganga	Jhansi	TE + PG	10	580.95	Irrigation	Completed
71	Pahuj Dam	1909	PAHUJ	Jhansi	Ganga	Jhansi	TE + PG	10.67	2040	Irrigation	Completed
72	Parichha Dam	1886	BETWA	Jhansi	Ganga	Jhansi	TE + PG	16.77	1174.59	Irrigation	Completed



*Draft Cumulative Impact Assessment
Report of National Waterways-1*

			PATHARI AND SUKHNA I (TRIBUT ARY OF DHASAN)								
73	Patharai Dam	2002		Mau Ranipur	Ganga	Jhansi	TE	18	3800	Irrigation	Completed
74	Pili Dam	1968	Pili	Nagina	Ganga	Bijnor	TE	19	1540	Irrigation	Completed
75	Ragura Dam	1976	Local	Tikamgarh	Ganga		PG	12.05	1189	Irrigation	Completed
76	Raipura Dam	1930		Mahoba	Ganga	Mahoba	TE	13	3509	Irrigation	Completed
77	Rajghat Dam	2000	Betwa	Lalitpur	Ganga	Lalitpur	TE + PG	43.5	1120 0	Hydroele ctric,Irrig ation,Wat er Storage	Completed
78	Rajkhar Dam	1957	LOCAL STREAM	Dudhi	Ganga	Sonbhadra	TE	14.94	970	Irrigation	Completed
79	Rampur Dam	1958	GOINGH AWA NALA	Bahraich	Ganga	Shrawasti	TE	10.5	3820	Irrigation	Completed
80	Rampur Kalyangarh Dam	1925	LOCAL	Karwi	Ganga	Chitrakoot	TE	13	1000	Irrigation	Completed
81	Rampur Pindaria Dam	1974	LOCAL	Mirzapur	Ganga	Mirzapur	TE	10.3	1260	Irrigation	Completed
82	Rihand Dam	1962	Rihand	Dudhi	Ganga	Sonbhadra	PG	91.46	932	Hydroele ctric,Irrig ation	Completed
83	Rohini Dam	1983	ROHINI	Mahrauni	Ganga	Lalitpur	TE	17.82	1647	Irrigation	Completed
84	Sajnam Dam	1990		Mahrauni	Ganga	Lalitpur	TE	22.34	4524	Irrigation	Completed
85	Saktesh Garh Dam	1989	LOCAL	Chunar	Ganga	Mirzapur	TE	15.66	880	Irrigation	Completed
86	Salarpur Dam	1960	KARDIA	Mahoba	Ganga	Mahoba	TE	11	2975	Irrigation	Completed
87	Saprar Dam	1952		JHANSI	Ganga		TE	16.76	3000	Irrigation	Completed
88	Sarai Garh Dam	1970	LOCAL	Robertsganj	Ganga	Sonbhadra	TE	10.82	735	Irrigation	Completed
89	Sarda Sagar Dam	1962	Sharda	Puranpur	Ganga	Pilibhit	TE	16.15	2220	Irrigation	Completed
90	Semri Dam	1989	LOCAL	Chunar	Ganga	Mirzapur	TE	14.8	666	Irrigation	Completed
91	Shahjad Dam	1992		Lalitpur	Ganga	Lalitpur	TE	18	4160	Irrigation	Completed
92	Siori Lake Dam	1911	Siori	Mau Ranipur	Ganga	Jhansi	TE	13.94	2306	Irrigation	Completed
93	Sirsi Dam	1958	Bakhar Nala	Mirzapur	Ganga	Mirzapur	TE	21.34	3808	Irrigation	Completed
94	Sukhra Dam	1909	SUKHAR A NALA	Mirzapur	Ganga	Mirzapur	TE	12.2	1158	Irrigation	Completed
95	Suswar Dam		LOCAL	Mirzapur	Ganga	Mirzapur	TE	14.03	1400	Irrigation	Under



											Construction
96	Upper Khajuri Dam	1958	Chandauli and Shibati	Mirzapur	Ganga	Mirzapur	TE	24.88	2313	Irrigation	Completed
97	Urmil Dam	1994	Urmil	Mahoba	Ganga	Mahoba	TE	25.56	4799	Irrigation	Completed
98	Vijaipur Dam	1983	LOCAL	Mirzapur	Ganga	Mirzapur	TE	14.3	570	Irrigation	Completed

(Source: [India-WRIS WebGIS](#))



Barrages in Ganga basin and its tributaries

Sl. No.	BWA Name	Completion Year	River	Nearest city	Basin	District	Height (m)	Length (m)	Purpose	Status
WEST BENGAL										
1	Bakreswar Barrage	1950		Siuri	Ganga	Birbhum		91		Completed
2	Brahmani Barrage		Brahmani	Rampur Hat	Ganga	Birbhum		126		Completed
3	Dauk Barrage	1988		Islampur	Ganga	Uttar Dinajpur		68		Completed
4	Durgapur Barrage	1955	Damodar	Bankura	Ganga	Bankura	12	692.2		Completed
5	Dwaraka Barrage	1953	Dwaraka	Siuri	Ganga	Birbhum		83.82		Completed
6	Farakka Barrage	1975	Ganga	Jangipur	Ganga	Murshidabad		2240		Completed
9	Kopai Barrage	1955	Kopai	Siuri	Ganga	Birbhum		66		Completed
10	Mahananda Barrage	1986	Mahananda	Siliguri	Ganga	Darjiling		182.88		Completed
11	Sali Weir		Damodar	Bankura	Ganga	Bankura				Completed
12	Tarafeni Barrage	1972		Jhargram	Ganga	Pashchim Medinipur				Completed
14	Tilpara Barrage	1949	Mayurakhi	Siuri	Ganga	Birbhum		309		Completed
JHARKHAND										
1	Ajoy Barrage	2004	Ajoy/Ajay	Devghar	Ganga	Deoghar		275		Completed
2	Amanat Barrage				Ganga					
3	Anraj Weir		Arraj	Garhwa	Ganga	Garhwa				Completed
5	Batane Pick-up Barrage		Batane	Daltenganj	Ganga	Palamu		95.12		Completed
6	Batre Weir		Batre	Daltenganj	Ganga	Palamu		32.004		Completed
7	Bhora Weir	1974	Jhamarlahal	Rajmahal	Ganga	Sahibganj		22.86		Completed



9	Birha Weir		Shankh	Latehar	Ga nga	Latehar	3.05	48.77		Complete d
10	Bishunpur Weir	1967	Phuljhar	Gumla	Ga nga	Gumla	0.91 4	23.77		Complete d
12	Chako Weir		Chako	Chatra	Ga nga	Chatra		115.8 2		Complete d
13	Chordana Weir				Ga nga					
14	Daruwa Weir		Darhwa	Devghar	Ga nga	Deoghara		60.96		Complete d
16	Ghaghari Weir		Ghaghari	Latehar	Ga nga	Latehar	0.46	40.84		Complete d
17	Gobai Barrage	1983		Baghmara	Ga nga	Bokaro		93.27		Complete d
18	Golai Weir	1968		Chatra	Ga nga	Chatra	1.21 92	73.76		Complete d
19	Gumani Barrage		Gumani	Rajmahal	Ga nga	Sahibganj		79.55		Complete d
20	Harhi Weir		Harhi	Dalten ganj	Ga nga	Palamu				Complete d
21	Harna North Weir		Harna	Godd a	Ga nga	Godda		43.28		Complete d
22	Harna South Weir		Harna	Godd a	Ga nga	Godda		38.1		Complete d
23	Jinjoy Weir		Jinjoy	Dalten ganj	Ga nga	Palamu		60.96		Complete d
24	Jugra Weir	1952	Pakwa Nala	Hazaribag	Ga nga	Hazaribagh	1.18 6	106.6 8		Complete d
25	Kajhia Weir		Kajhia	Godd a	Ga nga	Godda		164.6		Complete d
27	Karantola Weir		Domani	Rajmahal	Ga nga	Sahibganj		24.38		Complete d
28	Kawaldag Weir		Panda	Garhwa	Ga nga	Garhwa	1.22	57.91		Complete d
31	Khudia Weir	1971	Khudia River	Dhanbad	Ga nga	Dhanbad		54.9		Complete d
34	Kutipisi Weir	1963	Tributor y of Kewta	Hazaribag	Ga nga	Hazaribagh	4.57	46.65		Complete d



			Nadi							
3 6	Left Banki Weir		Banki	Garh wa	Ga nga	Garhwa	2.44	72.54		Complete d
3 7	Lilajan Weir	1958	Lilajan	Chatra	Ga nga	Chatra		367.2 85108		Complete d
3 8	Lower Kararbar Weir		Kararwa r	Dalten ganj	Ga nga	Palamu		25.91		Complete d
3 9	Mohamadganj Barrage		North Koel	Garh wa	Ga nga	Garhwa		814.7 5		Complete d
4 0	Nakti Nala Weir		Nakti Nallah	Latcha r	Ga nga	Latehar	1.52	25.6		Complete d
4 1	Pagla Weir	1974	Pagla	Pakaur	Ga nga	Pakur	1.62	79.25		Complete d
4 3	Phulwariya Weir		Phulwari a	Garh wa	Ga nga	Garhwa	1.52	25.6		Complete d
4 4	Piri Weir		Piri Nala	Dalten ganj	Ga nga	Palamu		51.21		Complete d
4 7	Ramghat Weir		North Koel	Latcha r	Ga nga	Latehar	1.83	45.72		Complete d
4 9	Sadabah Weir		Jinjoy	Dalten ganj	Ga nga	Palamu	1.52	70.1		Complete d
5 0	Sarswatia Weir		Sarswati a	Garh wa	Ga nga	Garhwa		35.05		Complete d
5 2	Sonepur Weir				Ga nga					
5 3	Sonre Weir		Sonre	Dalten ganj	Ga nga	Palamu		51.82		Complete d
5 7	Triveni / Tribeni Weir	1961		Godd a	Ga nga	Godda	0.7	121.9 2		Complete d
5 8	Upper Kararbar Weir		Kararwa r	Dalten ganj	Ga nga	Palamu				Complete d
5 9	Usri Weir	1968	Usri	Giridi h	Ga nga	Giridih	1.51	40		Complete d



60	Uttmahi Weir		Sarswati a	Garh wa	Ga nga	Garhwa		39.62		Complete d
61	Yamuna Weir		Satbahin i	Dalten ganj	Ga nga	Palamu				Complete d
BIHAR										
1	Adri Weir		Adri	Auran gabad	Ga nga	Aurang abad				Complete d
2	Bagara Weir		Baghara	Mung er	Ga nga	Munger		43		Complete d
3	Batane Weir		Batane	Auran gabad	Ga nga	Aurang abad				Complete d
4	Belharna Weir		Belharna		Ga nga					Complete d
5	Chanken Weir			Mung er	Ga nga	Munger				Proposed
6	Chhariyari Weir		Yamune River	Jahana bad	Ga nga	Jehanab ad		30.48 0092		Complete d
7	Dakai Weir			Banka	Ga nga	Banka				Complete d
8	Dhadhar Barrage	2004	Dhadhar	Gaya	Ga nga	Gaya	2.43 4	138		Complete d
9	Dhawa Weir		Dhawa	Auran gabad	Ga nga	Aurang abad				Complete d
10	Durgawati Weir (Kudra)		Durgaw ati	Bhabh ua	Ga nga	Kaimur (bhabua)				Complete d
11	Gandak Barrage	1968	Gandak	Bettia h	Ga nga	Pashchi m Champ aran		739		Complete d
12	Ghogha Weir		Chandan	Banka	Ga nga	Banka		312.4		Complete d
13	Gidheshwar Weir		Kiul	Jamui	Ga nga	Jamui		396.2 4		Complete d
14	Gokhula Weir	1975	Gokhula	Gaya	Ga nga	Gaya				Complete d
15	Ikorla Weir		Chandan	Banka	Ga nga	Banka		244		Complete d
16	Kamla Weir		Kamla	Madh ubani	Ga nga	Madhu bani	1.52	292.5 3		Complete d
17	Kanakbigha Weir		Yamune River	Jahana bad	Ga nga	Jehanab ad		49.98 7351		Complete d
18	Karihari Weir		Karihari	Nawa da	Ga nga	Nawada				Complete d
19	Kohira Weir		Kohira	Bhabh ua	Ga nga	Kaimur (bhabua)		26.22		Complete d
20	Kosi Barrage Bihar	1963	Kosi	Bhimn agar	Ga nga	Bhimna gar		1149		Complete d
21	Kulthi Weir			Bihar Sharif	Ga nga	Naland a				Complete d
22	Kundghat Weir		Bahuar	Jamui	Ga nga	Jamui		34.7		Complete d
23	Libari / Bharthuanandan Weir		Bhutahi	Hilsa	Ga nga	Naland a		54.86 4		Proposed



2			Lokain(Ga	Naland		73.15		Complete
4	Lokain Weir	1964	Falgu)	Hilsa	nga	a		2221		d
2				Lakhis	Ga					Complete
5	Lower Kiul Weir	1965	Kiul	arai	nga	Jamui		202.5		d
2					Ga			289.5		Complete
6	Lower Morhar Weir	1962	Morhar	Gaya	nga	Gaya		60873		d
2				Jahana	Ga	Jehanab				Undercon
7	Mandai Weir		Falgu	bad	nga	ad		305		struction
2				Lakhis	Ga	Lakhisa				Complete
8	Morwe Weir		Morwe	arai	nga	rai				d
2				Jhanjh	Ga	Madhu				Complete
9	Munahra Weir	2007	Balan	arpur	nga	bani	2	114		d
3					Ga	Naland				Complete
0	Paimar Barrage		Paimar	Hilsa	nga	a				d
3			Panchan	Bihar	Ga	Naland				Complete
1	Panchane Weir		a	Sharif	nga	a	1.21	230		d
3				Nawa	Ga					Complete
2	Paura Weir (Sakri)		Sakri	da	nga	Nawada				d
3				Auran	Ga	Aurang				Undercon
3	Punpun Barrage		Punpun	gabad	nga	abad		178		struction
3			Sasara		Ga					Complete
4	Sone Barrage	1968	sone	m	nga	Rohtas		1407		d
3					Ga					Complete
5	Sukhnia Weir		Sukhnia	Banka	nga	Banka				d
3				Bhabh	Ga	Kaimur				Complete
6	Surara Weir		Suar	ua	nga	(bhabua)				d
3				Jahana	Ga	Jehanab				Complete
7	Uderasthan Weir		Falgu	bad	nga	ad	1	336		d
3					Ga					Complete
8	Upper Jamuna /Yamuna Weir	1959	Yamune River	Gaya	nga	Gaya				d
3					Ga					Complete
9	Upper Morhar Diversion Weir	1961	Morhar	Gaya	nga	Gaya		195.0		d
								7		
UTTAR PRADESH										
1	Adwa Barrage	1978		Mirza pur	Ga	Mirzapur		113.5		Complete
					nga					Complete
2	Banganga Barrage	1956	Banganga	Naugarh	Ga	Siddharth Nagar	0.92	116		d
3	Dakpatthar Barrage	1965	Yamuna	Paonta	Ga	Dehradun	18.3	516.9		Complete
					nga		8	2		d
4	Dhukwan Weir	1905	BETWA	Lalitpur	Ga	Lalitpur	18.6	1171.		Complete
					nga		7	9		d
5	Duni Barrage	1925		Pilibhit	Ga	Pilibhit		157.2		Complete
					nga			6		d
				Rober tsganj and Sonbh adra	Ga					Complete
6	Ghaghar Barrage		SONE		nga					d
7	Girija Barrage	1976	GHAG HRA	Nanpara	Ga	Bahraich		716		Complete
					nga					d
8	Gokul Barrage	2001		Mathura	Ga	Mathura		555		Complete
					nga					d



9	Gomti Barrage	1979	GOMTI	Lucknow	Ganga	Lucknow		202.5		Completed
10	Hindan Barrage	1979		Dadri	Ganga	Gautam Buddha Nagar		162		Completed
11	Husainpur Weir		GARAI	Chunar	Ganga	Mirzapur				Completed
12	Kho Barrage	1975		Dhampur	Ganga	Bijnor		203		Completed
13	Lakhani Devi Diversion Weir				Ganga					Completed
14	Latifshah Weir		KARMANASA RIVER	Chakia	Ganga	Chandauli	14.33	217.68		Completed
15	Lower Khajuri Weir				Ganga					Completed
16	Lower Sarda Barrage	1974	SHARDA	Nighasan	Ganga	Kheri		408		Completed
17	Madhya Ganga Barrage (Chaudhary Charan Singh)			Jansath	Ganga	Muzaffarnagar		621		Completed
18	Nagwa silhati Weir				Ganga					Completed
19	Narora Barrage	1966	GANGA	Anupshahr	Ganga	Bulandshahr		922.43		Completed
20	New Okhla Barrage		YAMUNA	Dadri	Ganga	Gautam Buddha Nagar		743.11		Completed
21	Parichha Weir	1886	BETWA	Moth	Ganga	Jhansi	16.77	1171.3		Completed
22	Ramganga Barrage	1975	RAMGANGA	Nagina	Ganga	Bijnor		408		Completed
23	Rapti Barrage		Rapti	Bahraich	Ganga	Shrawasti		284.5		Completed
24	Saryu Barrage			Nanpara	Ganga	Bahraich		243.5		Completed
25	Tons Weir			Meja	Ganga	Allahabad		500		Completed



Annexure 6.6: Major medium irrigation projects in Ganga basin and its tributaries

Major medium irrigation projects in Ganga basin and its tributaries

Sl. No.	Project Name		River	Basin	Purpose	Status
	WEST BENGAL					
1	Bandhu Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Completed
2	Barabhum Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Completed
3	Barrage And Irrigation System Of DVC		Damodar	Ganga	Irrigation	Completed
4	Beko Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Completed
5	Berai Canal Medium Irrigation Project		Dwarkeswar	Ganga	Irrigation	Completed
6	Dimu Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Completed
7	Futuary Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Ongoing
8	Golamarajore Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Ongoing
9	Hanumata Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Ongoing
10	Hinglow Medium Irrigation Project		Ajoy	Ganga	Irrigation	Completed
11	Kangsabati Major Irrigation Project		Subernarekha	Ganga	Irrigation	Completed
12	Karatowa Medium Irrigation Project		Teesta	Brahmaputra	Irrigation	Completed
13	Karrior Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Completed
14	Khairabera Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Completed
15	Kumari Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Completed
16	Lipaniajore Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Completed
17	Mayurakshi Major Irrigation Project West Bengal			Ganga	Irrigation	Completed
18	Midnapur Canal Major Irrigation Project		Kangsabati	Ganga	Irrigation	Completed
19	Moutorejore Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Ongoing
20	Parga Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Completed
21	Patloi Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Ongoing
22	Ramchandrapur Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Completed
23	Ranichak Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Ongoing
24	Saharajore Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Completed
25	Sali Medium Irrigation Project		Damodar	Ganga	Irrigation	Completed
26	Sali Reservoir Medium Irrigation Project		Damodar	Ganga	Irrigation	Completed



27	Subernarekha Barrage Major Irrigation Project			Ganga	Irrigation	Ongoing
28	Subernarekha Multipurpose Project West Bengal		Subernarekha	Subarnarekha	Irrigation	Ongoing
29	Suvankar Dangra Medium Irrigation Project		Damodar	Ganga	Irrigation	Completed
30	Taragonia Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Completed
31	Tatko Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Ongoing
32	Teesta Barrage, Phase -I, St.I, Sub Stage I		Teesta	Ganga, Brahmaputra	Irrigation	Ongoing
33	Turga Medium Irrigation Project		Kangsabati	Ganga	Irrigation	Completed
	JHARKHAND					
1	Ajoy Barrage (Siktia) Major Irrigation Project		Ajoy	Ganga	Irrigation	Completed
2	Amanat Reservoir Project		Amanat	Ganga	Irrigation	Completed
3	Anjanwa Reservoir Medium Irrigation Project		Anjanwa	Ganga	Irrigation	Completed
4	Anraj Medium Irrigation Project		Arraj	Ganga	Irrigation	Completed
5	Aradih Weir Medium Irrigation Project			Subarnarekha	Irrigation	Completed
6	Auranga Major Irrigation Project		Auranga	Ganga	Irrigation	Ongoing
7	Babhanikhand Medium Irrigation Project		Banki	Ganga	Irrigation	Completed
8	Baranadi Medium Irrigation Project		Baranadi	Ganga	Irrigation	Completed
9	Barhi Medium Irrigation Project		Mahuaghat	Ganga	Irrigation	Completed
10	Basuki Medium Irrigation Project		South Koel	Subarnarekha	Irrigation	Proposed
11	Batane Major Irrigation Project Jharkhand		Batane	Ganga	Irrigation	Ongoing
12	Bateshwarsthan Pump Canal Major Irrigation		Ganga	Ganga	Irrigation	Ongoing
13	Batre Medium Irrigation Project Jharkhand		Batare	Ganga	Irrigation	Completed
14	Baudha Medium Irrigation Project		Agrawa/ Konar	Ganga	Irrigation	Completed
15	Bhairawa Medium Irrigation Project			Ganga	Irrigation	Ongoing
16	Bhoura Bandh Medium Irrigation Project		Jhamarla	Ganga	Irrigation	Completed
17	Birha Medium Irrigation Project			Brahmani and Baitarni	Irrigation	Completed
18	Bishunpur Medium Irrigation Project		Phuljhar	Ganga	Irrigation	Completed
19	Bishunpur Medium Irrigation Project			Ganga	Irrigation	Completed
20	Brahmani Medium Irrigation Project		Bamni	Subarnarekha	Irrigation	Completed
21	Buchaopa Medium Irrigation Project			Brahmani and Baitarni	Irrigation	Completed



22	Buksa Medium Irrigation Project		Baksa	Ganga	Irrigation	Completed
23	Butanduba Medium Irrigation Project			Ganga	Irrigation	Completed
24	Chako Medium Irrigation Project		Chako	Ganga	Irrigation	Completed
25	Chandan Major Irrigation Project Jharkhand		Chandan\ Tribeni\ Harna	Ganga	Irrigation	Completed
26	Chataniyaghat Medium Irrigation Project			Ganga	Irrigation	Completed
27	Chinda Medium Irrigation Project		Chhinda	Brahmani and Baitarni	Irrigation	Completed
28	Chirka Medium Irrigation Project		Dhengura	Ganga	Irrigation	Completed
29	Chordanda Medium Irrigation Project		Surhar	Ganga	Irrigation	Completed
30	Danro Medium Irrigation Project		Danro	Ganga	Irrigation	Completed
31	Daruwa Medium Irrigation Project		Darhwa	Ganga	Irrigation	Completed
32	Desh Bandh Medium Irrigation Project			Subarnarekha	Irrigation	Completed
33	Dhankai Medium Irrigation Project			Ganga	Irrigation	Completed
34	Dhansinghtoli Medium Irrigation Project			Brahmani and Baitarni	Irrigation	Completed
35	Dhauajore Medium Irrigation Project			Ganga	Irrigation	Completed
36	Diggalpahari Medium Irrigation Project			Ganga	Irrigation	Completed
37	Dulki Medium Irrigation Project			Ganga	Irrigation	Completed
38	Garhi Medium Irrigation Project		Garhi (Damodar)	Ganga	Irrigation	Ongoing
39	Ghaghari Medium Irrigation Project			Ganga	Irrigation	Completed
40	Ghaghra Medium Irrigation Project		Ghaghra	Ganga	Irrigation	Completed
41	Gobai Barrage Medium Irrigation Project		Gabai / Gowai	Ganga	Irrigation	Completed
42	Golai Medium Irrigation Project			Ganga	Irrigation	Completed
43	Gonda Medium Irrigation Project		Gonda	Ganga	Irrigation	Completed
44	Gumani Barrage Major Irrigation Project			Ganga	Irrigation	Ongoing
45	Harhi Medium Irrigation Project			Ganga	Irrigation	Completed
46	Harna Medium Irrigation Project		Harna	Ganga	Irrigation	Completed
47	Hiru Medium Irrigation Project		Hiru	Ganga	Irrigation	Completed
48	Jaipur Medium Irrigation Project		Nakti Nallah	Brahmani and Baitarni	Irrigation	Completed
49	Jamunia Medium Irrigation Project			Ganga	Irrigation	Completed
50	Jenasai Medium Irrigation Project		Karala	Subarnarekha	Irrigation	Completed
51	Jharjhara Medium Irrigation Project		Bamini Nalla	Subarnarekha	Irrigation	Ongoing
52	Jinjoy Weir Scheme Medium Irrigation Project		Jinjoy	Ganga	Irrigation	Completed



53	Jugra Medium Irrigation Project		Pakwa Nala	Ganga	Irrigation	Completed
54	Kajhia Medium Irrigation Project		Kajhia	Ganga	Irrigation	Completed
55	Kanchi Major Irrigation Project		Kanchi	Subarnarekha	Irrigation	Completed
56	Kans Medium Irrigation Project			Subarnarekha	Irrigation	Ongoing
57	Kansjore Medium Irrigation Project			Brahmani and Baitarni	Irrigation	Completed
58	Karantola Medium Irrigation Project			Ganga	Irrigation	Completed
59	Karawani Medium Irrigation Project		Dwarika	Brahmani and Baitarni	Irrigation	Completed
60	Katri Medium Irrigation Project		South Koel	Brahmani and Baitarni	Irrigation	Ongoing
61	Kawaldag Medium Irrigation Project		Panda	Ganga	Irrigation	Completed
62	Kesho Medium Irrigation Project		Kesho	Ganga	Irrigation	Ongoing
63	Khatwa Medium Irrigation Project			Brahmani and Baitarni	Irrigation	Completed
64	Khudia Irrigation Scheme Medium Irrigation		Khudia River	Ganga	Irrigation	Completed
65	Kita Medium Irrigation Project		Urangarha	Subarnarekha	Irrigation	Completed
66	Kitanala Medium Irrigation Project		Kita Nala	Subarnarekha	Irrigation	Completed
67	Kokro Irrigation Scheme Medium Irrigation Project		Raru	Subarnarekha	Irrigation	Completed
68	Konar Major Irrigation Project		Konar	Ganga	Irrigation	Ongoing
69	Kutipisi Medium Irrigation Project			Ganga	Irrigation	Completed
70	Lapasias Medium Irrigation Project			Subarnarekha	Irrigation	Completed
71	Larwa Medium Irrigation Project		Deo	Brahmani and Baitarni	Irrigation	Completed
72	Latratu Medium Irrigation Project		North Karo	Brahmani and Baitarni	Irrigation	Completed
73	Left Banki Weir Irrigation Project		Left Banki	Ganga	Irrigation	Completed
74	Left banki Reservoir Irrigation Project		Left Banki	Ganga	Irrigation	Completed
75	Lorgara Medium Irrigation Project		Kharkhai	Subarnarekha	Irrigation	Completed
76	Lotia Medium Irrigation Project		Chondhi	Ganga	Irrigation	Completed
77	Lower Karrabar Medium Irrigation Project		Kararbar	Ganga	Irrigation	Completed
78	Malay Medium Irrigation Project		North Koel	Ganga	Irrigation	Completed
79	Masaria Medium Irrigation Project			Brahmani and Baitarni	Irrigation	Completed
80	Mayurakshi LBC Jharkhand		Mayurarakshi/ Mor	Ganga	Irrigation	Completed
81	Murahir Reservoir Scheme Medium Irrigation		Lokjheria Nala	Subarnarekha	Irrigation	Completed
82	Murumsona Irrigation Scheme Medium Irrigation		Sana	Subarnarekha	Irrigation	Completed
83	Nakti Medium Irrigation Project		Bijay	Subarnarekha	Irrigation	Ongoing



84	Nakti Nala Weir Scheme Medium Irrigation Project			Subarnarekha	Irrigation	Completed
85	Nandini Medium Irrigation Project		Nandini	Brahmani and Baitarni	Irrigation	Completed
86	North Koel Major Irrigation Project Jharkhand		North Koel	Ganga	Irrigation	Ongoing
87	Pagla Medium Irrigation Project		Pagla	Ganga	Irrigation	Completed
88	Palna Medium Irrigation Project		Ranka Jhuria	Subarnarekha	Irrigation	Completed
89	Panch Khero Medium Irrigation Project			Ganga	Irrigation	Ongoing
90	Pandarwa Medium Irrigation Project		Pandarwa	Ganga	Irrigation	Completed
91	Paras Medium Irrigation Project		Paras	Brahmani and Baitarni	Irrigation	Completed
92	Phuljhar Medium Irrigation Project		Phuljhar	Brahmani and Baitarni	Irrigation	Completed
93	Phulwaria Medium Irrigation Project		Phulwaria	Ganga	Irrigation	Completed
94	Piri Medium Irrigation Project		Piri Nala	Ganga	Irrigation	Completed
95	Punasi Major Irrigation Project		Ajoy	Ganga	Irrigation	Ongoing
96	Putunggara Medium Irrigation Project			Brahmani and Baitarni	Irrigation	Completed
97	Raisa Medium Irrigation Project		Kanchi	Subarnarekha	Irrigation	Completed
98	Rajbhandh Medium Irrigation Project			Subarnarekha	Irrigation	Completed
99	Ramghat Medium Irrigation Project			Ganga	Irrigation	Completed
100	Ramrekha Medium Irrigation Project		Utial Nala	Brahmani and Baitarni	Irrigation	Ongoing
101	Roro Medium Irrigation Project		Roro Gara	Subarnarekha	Irrigation	Completed
102	Sadabah Medium Irrigation Project			Ganga	Irrigation	Completed
103	Sakrigali Pump Canal Medium Irrigation Project			Ganga	Irrigation	Completed
104	Salaiya Medium Irrigation Project			Ganga	Irrigation	Ongoing
105	Saraswatia Medium Irrigation Project			Ganga	Irrigation	Completed
106	Satpotka Medium Irrigation Project		Brahmani	Brahmani and Baitarni	Irrigation	Ongoing
107	Sona Medium Irrigation Project			Subarnarekha	Irrigation	Completed
108	Sonepur Medium Irrigation Project		Dhaulia	Ganga	Irrigation	Completed
109	Sonre Medium Irrigation Project			Ganga	Irrigation	Completed
110	Sonua Medium Irrigation Project			Subarnarekha	Irrigation	Ongoing
111	Sonua Medium Irrigation Project		Sanjay	Subarnarekha	Irrigation	Completed
112	Subarnarekha Multipurpose Project Jharkhand		Subarnarekha	Subarnarekha	Irrigation	Ongoing
113	Sunder Medium Irrigation Project		Sunder	Ganga	Irrigation	Completed
114	Surangi Medium Irrigation Project		Surangi Nala\ Karkari	Subarnarekha	Irrigation	Ongoing



115	Suru Medium Irrigation Project			Brahmani and Baitarni	Irrigation	Ongoing
116	Suryodi Medium Irrigation Project			Ganga	Irrigation	Completed
117	Tajna Barrage Medium Irrigation Project		Tajna	Subarnarekha	Irrigation	Completed
118	Tapkara Medium Irrigation Project		Kukurdoba	Brahmani and Baitarni	Irrigation	Completed
119	Temrain Medium Irrigation Project			Ganga	Irrigation	Completed
120	Tenughat Medium Irrigation Project		Damodar	Ganga	Irrigation	Completed
121	Torlow Medium Irrigation Project		Torlow	Subarnarekha	Irrigation	Completed
122	Triveni Medium Irrigation Project		Triveni	Ganga	Irrigation	Completed
123	Upper Sankh Medium Irrigation Project		Shankh	Brahmani and Baitarni	Irrigation	Ongoing
124	Upri Karabar Medium Irrigation Project		Kakarbar	Ganga	Irrigation	Completed
125	Usri Medium Irrigation Project		Usri	Ganga	Irrigation	Completed
126	Uttmahi Medium Irrigation Project			Ganga	Irrigation	Completed
127	Vijay Medium Irrigation Project			Subarnarekha	Irrigation	Completed
128	Yamuna Medium Irrigation Project			Ganga	Irrigation	Completed
BIHAR						
1	Adri Canal Medium Irrigation Project		Adri	Ganga	Irrigation	Completed
2	Ajan (Kukurjhap) Medium Irrigation Project		Ajan	Ganga	Irrigation	Completed
3	Badua Major Irrigation Project		Badua	Ganga	Irrigation	Completed
4	Bansagar Dam Major Irrigation Project Bihar		Sone	Ganga	Irrigation	Completed
5	Barnar Major Irrigation Project		Barnar	Ganga	Irrigation	Ongoing
6	Batane Canal Medium Irrigation Project		Batane	Ganga	Irrigation	Completed
7	Batane Major Irrigation Project Bihar		Batane	Ganga	Irrigation	Ongoing
8	Bateshwarasthan Pump Ph-I Major Irrigation		Ganga	Ganga	Irrigation	Ongoing
9	Belharna Medium Irrigation Project		Belharna	Ganga	Irrigation	Completed
10	Bharthu Nandna Medium Irrigation Project		River Bhutahi (Old Course Of Falgu)	Ganga	Irrigation	Ongoing
11	Bilasi Medium Irrigation Project		Bilasi	Ganga	Irrigation	Completed
12	Chandan Major Irrigation Project Bihar		Chandan	Ganga	Irrigation	Completed
13	Chausa Pump Canal Medium Irrigation Project		Ganga	Ganga	Irrigation	Completed
14	Chhariyari Medium Irrigation Project		Yamune River	Ganga	Irrigation	Completed
15	Dhakranalla Pump Ph - I Medium Project Medium		Dhakranalla	Ganga	Irrigation	OnGoing



16	Dhakranalla Pump Ph - II Medium Project Medium		Dhakranalla	Ganga	Irrigation	OnGoing
17	Dhuwa /Dhawa Medium Project Medium Irrigation		Dhawa	Ganga	Irrigation	Completed
18	Durgavati Major Irrigation Project		Durgawati	Ganga	Irrigation	Ongoing
19	Gandak Major Irrigation Project Bihar		Gandak	Ganga	Irrigation	Completed
20	Gokhula Medium Irrigation Project		Gokhula	Ganga	Irrigation	Completed
21	Job Medium Irrigation Project		JOB	Ganga	Irrigation	Completed
22	Kamla Major Irrigation Project		Kamla	Ganga	Irrigation	Completed
23	Kanak Bigha Medium Irrigation Project		Yamune River	Ganga	Irrigation	Completed
24	Karihari Medium Irrigation Project		Karihari	Ganga	Irrigation	Completed
25	Kohira Dam Major Irrigation Project		Kohira	Ganga	Irrigation	Completed
26	Kolmahadeo Medium Irrigation Project		Kolmahadev(bhusari)	Ganga	Irrigation	Completed
27	Kosi Barrage and Eastern Canal Major Irrigation		Kosi	Ganga	Irrigation	Completed
28	Kulthi Weir Medium Irrigation Project			Ganga	Irrigation	Completed
29	Kundghat Medium Irrigation Project		Bahuar	Ganga	Irrigation	Ongoing
30	Lilajan Major Irrigation Project		Lilajan	Ganga	Irrigation	Completed
31	Lokine Medium Irrigation Project		Lokain(Falgu)	Ganga	Irrigation	Completed
32	Lower Kiul Valley Major Irrigation Project		Kiul	Ganga	Irrigation	Completed
33	Lower Morhar Major Irrigation Project		Morhar	Ganga	Irrigation	Completed
34	Mahabodhi Medium Irrigation Project		Lilajan	Ganga	Irrigation	Completed
35	Mandai Medium Irrigation Project		Falgu	Ganga	Irrigation	Ongoing
36	Morwa Medium Irrigation Project		Morwe	Ganga	Irrigation	Completed
37	Munhara Barrage Medium Irrigation Project		Balan	Ganga	Irrigation	Ongoing
38	Musakhand Dam (Karmanasa Irrigation Project)		KARMANASA RIVER	Ganga	Irrigation	Completed
39	Nagi Medium Irrigation Project		Nagi	Ganga	Irrigation	Completed
40	North Koel Major Irrigation Project Bihar		North Koel	Ganga	Irrigation	Ongoing
41	Orni Medium Irrigation Project		Orni	Ganga	Irrigation	Completed
42	Paimar Barrage Medium Irrigation Project		Paimar	Ganga	Irrigation	Completed
43	Panchane Medium Irrigation Project		Panchana	Ganga	Irrigation	Completed
44	Phulwaria Medium Irrigation Project		Tilaiya	Ganga	Irrigation	Completed
45	Punpun Barrage Major Irrigation		Punpun	Ganga	Irrigation	Ongoing



	Project					
46	Sakri Lower Valley Major Irrigation Project		Sakri	Ganga	Irrigation	Completed
47	Sindhwarni Medium Irrigation Project		Man	Ganga	Irrigation	Ongoing
48	Sone Canals Major Irrigation Project		Sone	Ganga	Irrigation	Completed
49	Sone High Level Canal Major Irrigation Project		Sone	Ganga	Irrigation	Completed
50	Suara Canal Medium Irrigation Project		Suar	Ganga	Irrigation	Completed
51	Surajgarh Pump Canal Medium Irrigation Project		Harohar	Ganga	Irrigation	Completed
52	Tilaiya - Dhadhar Major Irrigation Project		Dhadhar	Ganga	Irrigation	Ongoing
53	Uderasthan Major Irrigation Project		Falgu	Ganga	Irrigation	Completed
54	Upper Jamuna/Yamuna Medium Irrigation Project		Yamune River	Ganga	Irrigation	Completed
55	Upper Kiul Major Irrigation Project		Kiul	Ganga	Irrigation	Completed
56	Upper Morhar Major Irrigation Project		Morhar	Ganga	Irrigation	Completed
57	Western Kosi Canal Major Irrigation Project		Kosi	Ganga	Irrigation	Ongoing
58	Zamania Pump Scheme (Larma) Medium Irrigation		Karamnasa	Ganga	Irrigation	Ongoing
	UTTAR PRADESH					
1	Adwa Dam Project Major Irrigation Project		ADWA	Ganga	Irrigation	Completed
2	Afzalgarh Medium Irrigation Project			Ganga	Irrigation	Completed
3	Agra Canal Major Irrigation Project Uttar Pradesh		YAMUNA	Ganga	Irrigation	Completed
4	Ahaura Dam Medium Irrigation Project			Ganga	Irrigation	Completed
5	Aliganj Major Irrigation Project			Ganga	Irrigation	Completed
6	Arjun Dam Medium Irrigation Project		Arjuna	Ganga	Irrigation	Completed
7	Augasi Pump Canal Major Irrigation Project		YAMUNA RIVER	Ganga	Irrigation	Completed
8	Badaun Major Irrigation Project		RAMGANGA	Ganga	Irrigation	Ongoing
9	Bakhar Marihan Feeder Medium Irrigation Project			Ganga	Irrigation	Completed
10	Balmiki (Ohen) Sarovar Medium Irrigation Project			Ganga	Irrigation	Completed
11	Banganga Canal Major Irrigation Project			Ganga	Irrigation	Completed
12	Bansagar Canal (UP) Irrigation		Sone	Ganga	Irrigation	Ongoing



	Project					
13	Bansagar Dam Major Irrigation Project Uttar			Ganga	Irrigation	Completed
14	Barwa Dam Medium Irrigation Project		BORA NALA	Ganga	Irrigation	Completed
15	Baur Medium Irrigation Project Uttar Pradesh			Ganga	Irrigation	Completed
16	Beewer Feeder Canal Medium Irrigation Project			Ganga	Irrigation	Completed
17	Belan - Tons Canal Major Irrigation Project		BELAN	Ganga	Irrigation	Completed
18	Belan Bhakhar Medium Irrigation Project		BELAN	Ganga	Irrigation	Completed
19	Bevar Feeder Canal Major Irrigation Project			Ganga	Irrigation	Completed
20	Bhaunrat Dam Medium Irrigation Project			Ganga	Irrigation	Ongoing
21	Bhopauli Pump Canal Major Irrigation Project			Ganga	Irrigation	Completed
22	Bijnore Canal Major Irrigation Project			Ganga	Irrigation	Completed
23	Chambal Lift Irrigation Project			Ganga	Irrigation	Completed
24	Chandra Prabha Dam Medium Irrigation Project			Ganga	Irrigation	Completed
25	Chandrawal Dam Medium Irrigation Project			Ganga	Irrigation	Completed
26	Chillimal Pump Canal Medium Irrigation Project		Yamuna	Ganga	Irrigation	Completed
27	Chittaurgarh Reservoir Major Irrigation Project			Ganga	Irrigation	Completed
28	Dalmau Pump Canal Stage - I and Stage - II Major			Ganga	Irrigation	Completed
29	Denkwa Dam Major Irrigation Project			Ganga	Irrigation	Completed
30	Deokali Pump Canal Stage - I Major Irrigation			Ganga	Irrigation	Completed
31	Dhasan Canal Major Irrigation Project			Ganga	Irrigation	Completed
32	Dhoba Pump Canal Medium Irrigation Project			Ganga	Irrigation	Completed
33	Dohrighat Pump Canal Major Irrigation Project			Ganga	Irrigation	Completed
34	Dohrighat Sahyak Major Irrigation Project			Ganga	Irrigation	Completed
35	Dongri Medium Irrigation Project			Ganga	Irrigation	Completed
36	East Baigul Major Irrigation Project			Ganga	Irrigation	Completed



	Uttar					
37	Eastern Ganga Canal Major Irrigation Project		Ganga	Ganga	Irrigation	Completed
38	Eastern Yamuna Canal Major Irrigation Project			Ganga	Irrigation	Completed
39	Gandak Canal Major Irrigation Project Uttar		Gandak	Ganga	Irrigation	Completed
40	Ghaggar Canal Project		GHAGGAR	Ganga	Irrigation	Completed
41	Gularia Dam Medium Irrigation Project			Ganga	Irrigation	Completed
42	Gunta Nalla Medium Irrigation Project			Ganga	Irrigation	Completed
43	Gyanpur Pump Canal Major Irrigation Project			Ganga	Irrigation	Completed
44	Haripur Major Irrigation Project Uttar Pradesh			Ganga	Irrigation	Completed
45	Jahangirganj Branch Medium Irrigation Project			Ganga	Irrigation	Completed
46	Jamni Dam Medium Irrigation Project Uttar Pradesh		JAMINI RIVER	Ganga	Irrigation	Completed
47	Jamrani Multipurpose project Uttar Pradesh			Ganga	Irrigation	Ongoing
48	Jarauli Pump Canal Major Irrigation Project			Ganga	Irrigation	Completed
49	Jirgo Medium Irrigation Project			Ganga	Irrigation	Completed
50	Kabrai Lake Medium Irrigation Project		Arjun	Ganga	Irrigation	Completed
51	Kachnoda Dam Major Irrigation Project		Sajnam	Ganga	Irrigation	Completed
52	Kanhar Major Irrigation Project		PAGAN	Ganga	Irrigation	Ongoing
53	Ken Canal Major Irrigation Project		KEN	Ganga	Irrigation	Completed
54	Keolari Medium Irrigation Project			Ganga	Irrigation	Completed
55	Khara Canal Medium Irrigation Project		YAMUNA RIVER	Ganga	Irrigation	Completed
56	Kishanpur Pump Canal Major Irrigation Project			Ganga	Irrigation	Completed
57	Kosi Irrigation Medium Irrigation Project Uttar			Ganga	Irrigation	Completed
58	Lakhwar Multipurpose Project Uttar Pradesh		YAMUNA RIVER	Ganga	Irrigation	Ongoing
59	Lalitpur Dam Medium Irrigation Project Uttar			Ganga	Irrigation	Completed
60	Lower Ganga Canal Major Irrigation Project		Gnaga	Ganga	Irrigation	Completed
61	Madho Tanda Major Irrigation Project			Ganga	Irrigation	Completed



62	Madhya Ganga Canal Phase - II Major Irrigation		Ganga	Ganga	Irrigation	Completed
63	Madhya Ganga Canal Stage - I Major Irrigation		Ganga	Ganga	Irrigation	Completed
64	Matatila Dam Major Irrigation Project (including		BETWA RIVER	Ganga	Irrigation	Completed
65	Maudaha Dam Major Irrigation Project		BIRMA	Ganga	Irrigation	Completed
66	Meja Dam Major Irrigation Project			Ganga	Irrigation	Completed
67	Moosakhanda Dam Major Irrigation Project Uttar		KARMANSA	Ganga	Irrigation	Completed
68	Nagwa Dam Major Irrigation Project		KARNASSA	Ganga	Irrigation	Completed
69	Nanak Sagar Major Irrigation Project Uttar		SARDA	Ganga	Irrigation	Completed
70	Narainpur Pump Canal Major Irrigation Project			Ganga	Irrigation	Completed
71	Naugarh Dam Major Irrigation Project		KARMANASA RIVER	Ganga	Irrigation	Completed
72	Parallel Lower Ganga Canal Major Irrigation			Ganga	Irrigation	Completed
73	Pathrai Dam Medium Irrigation Project		PATHRAI AND SUKHNAI	Ganga	Irrigation	Completed
74	Pili Dam Medium Irrigation Project Uttar Pradesh		Pili	Ganga	Irrigation	Completed
75	Providing Kharif Channel in Hindon Krishi Doab			Ganga	Irrigation	Completed
76	Rajghat Canal Major Irrigation Project		BETWA	Ganga	Irrigation	Completed
77	Rajghat Dam Irrigation Project Uttar Pradesh		Betwa	Ganga	Irrigation	Completed
78	Ramganga Major Irrigation Project		Ramganga	Ganga	Irrigation	Completed
79	Rampur Canal Major Irrigation Project			Ganga	Irrigation	Completed
80	Rangwan Dam Project Uttar Pradesh Major		Banne Nala	Ganga	Irrigation	Completed
81	Rohilkhand Canal Major Irrigation Project			Ganga	Irrigation	Completed
82	Rohini Project Medium Irrigation Project			Ganga	Irrigation	Completed
83	Sajnam Dam Medium Irrigation Project		SAJNAM	Ganga	Irrigation	Completed
84	Saprar Medium Irrigation Project			Ganga	Irrigation	Completed
85	Sarda Canal Major Irrigation Project Uttar			Ganga	Irrigation	Completed
86	Sarda Sagar Stage I Major Irrigation Project		SARDA	Ganga	Irrigation	Completed



87	Sarda Sagar Stage II Major Irrigation Project		SARDA	Ganga	Irrigation	Completed
88	Sarju Pump Canal Major Irrigation Project			Ganga	Irrigation	Completed
89	Saryu Nahar Pariyojana Major Irrigation Project		SARYU	Ganga	Irrigation	Completed
90	Shahganj Medium Irrigation Project			Ganga	Irrigation	Completed
91	Shahzad Major Irrigation Project			Ganga	Irrigation	Completed
92	Sharda Sahayak Major Irrigation Project		SHARDA	Ganga	Irrigation	Completed
93	Sirsi Barundha Feeder Medium Irrigation Project			Ganga	Irrigation	Completed
94	Sone Pump Canal Major Irrigation Project		Sone	Ganga	Irrigation	Completed
95	Suheli Major Irrigation Project			Ganga	Irrigation	Completed
96	Tanda Pump Canal Major Irrigation Project			Ganga	Irrigation	Completed
97	Tehri Dam (Irrigation Share) Irrigation Project		Bhagirathi	Ganga	Irrigation	Completed
98	Tons Pump Canal Major Irrigation Project			Ganga	Irrigation	Completed
99	Trans- Kalyani Medium Irrigation Project			Ganga	Irrigation	Completed
100	Tumaria Reservoir Medium Irrigation Project Uttar			Ganga	Irrigation	Completed
101	Umarahat Pump Canal Phase - I Medium Irrigation			Ganga	Irrigation	Completed
102	Upper Ganga Canal Major Irrigation Project		Ganga	Ganga	Irrigation	Completed
103	Upper Khajuri Medium Irrigation Project		Chandauli and Shibati	Ganga	Irrigation	Completed
104	Urmil Dam Major Irrigation Project Uttar Pradesh		KEN	Ganga	Irrigation	Completed
105	Yamuna Pump Canal Major Irrigation Project			Ganga	Irrigation	Completed
106	Zamania Pump Canal Major Irrigation Project			Ganga	Irrigation	Completed

(Source: [India-WRIS WebGIS](#))