Initial Environmental Examination

January 2017

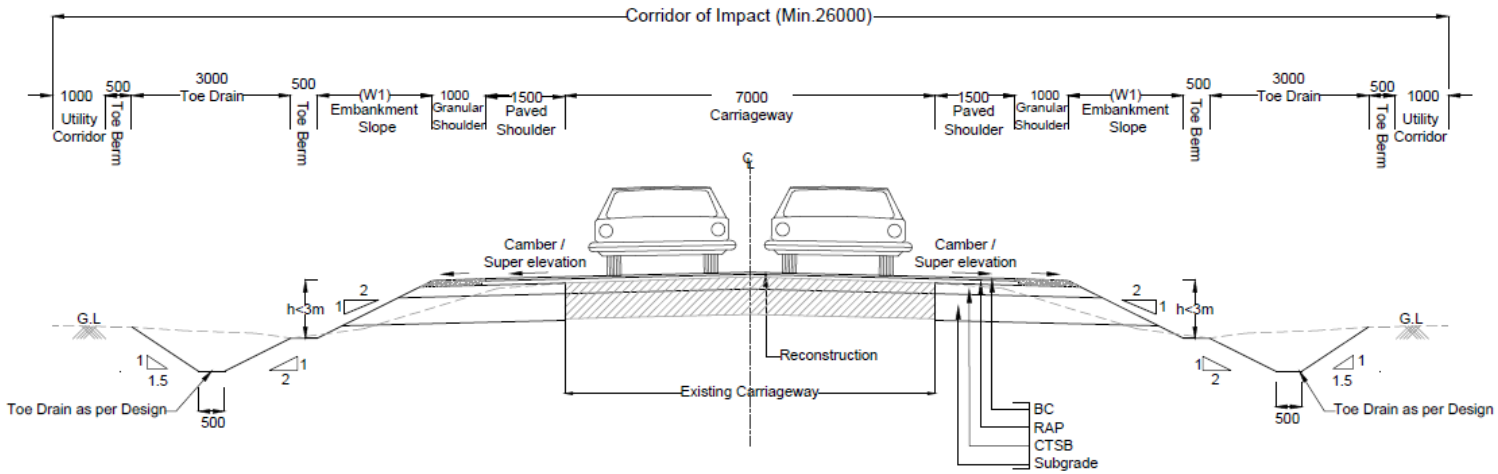
IND: Karnataka State Highways Improvement Project III

Magadi to Somwarpet (Annexures)

Prepared by Project Implementation Unit, KSHIP, Government of Karnataka for the Asian Development Bank

TABLE OF CONTENTS

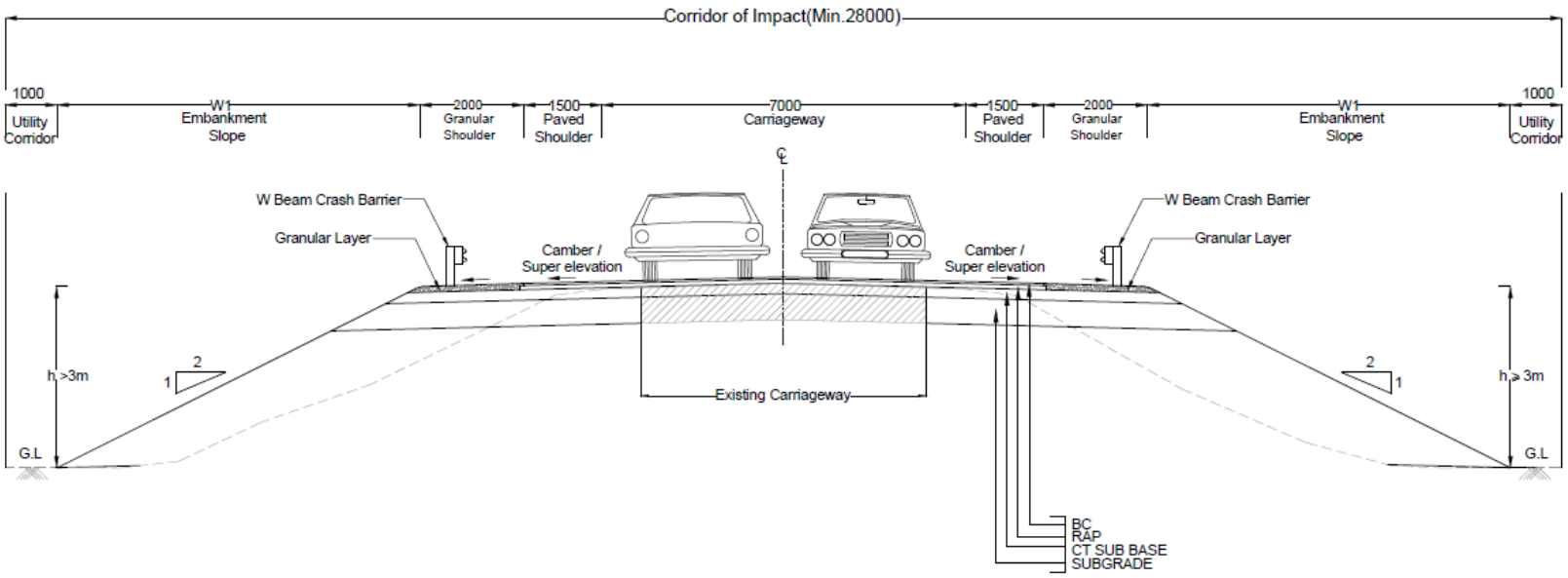
ANNEX 2.1 TYPICAL CROSS SECTIONS



TYPICAL CROSS SECTION FOR 2-LANE WITH PAVED SHOULDER (OPEN COUNTRY)
TCS - 1 - CONCENTRIC WIDENING

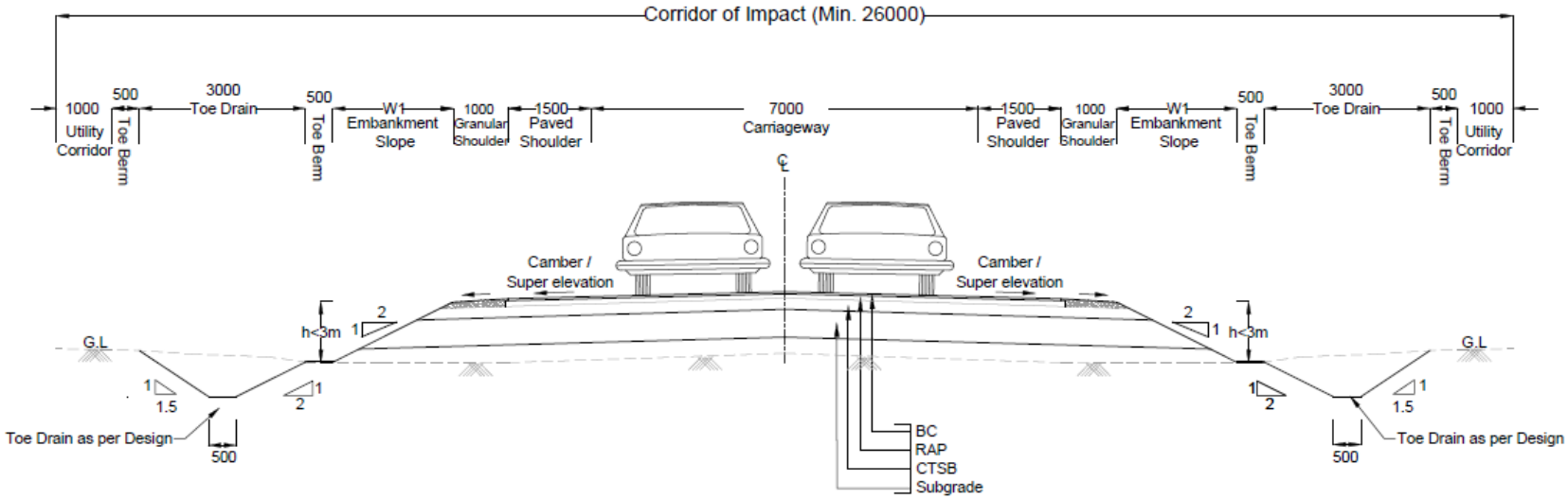
Note:-
1. All dimensions are in mm unless otherwise specified.
2. Existing Bituminous Layer to be scarified and reconstruction start from CTSB, treating Existing Granular Layer as Subgrade.

2 Annex 2.1



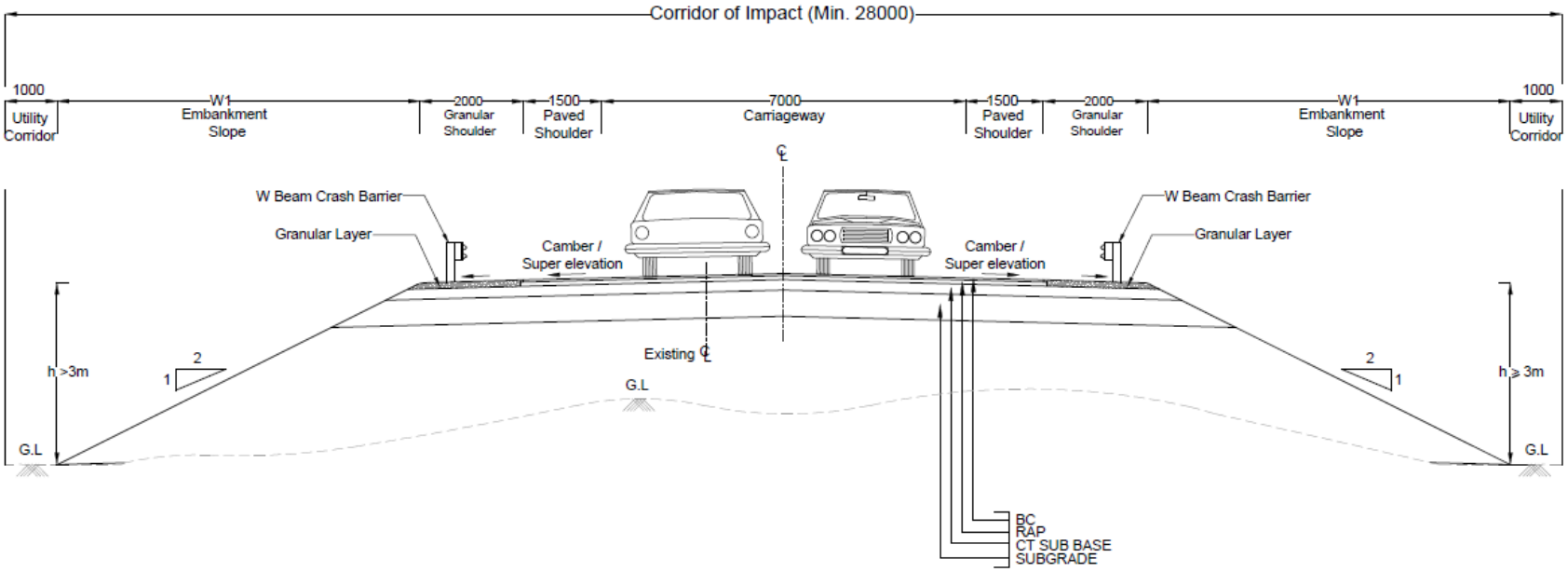
TYPICAL CROSS SECTION FOR 2-LANE WITH PAVED SHOULDER (OPEN COUNTRY)
TCS - 1A - CONCENTRIC WIDENING (EMBANKMENT HEIGHT ≥3M)

Note:-
1. All dimensions are in mm unless otherwise specified.
2. Existing Bituminous Layer to be scarified and reconstruction start from CTSB, treating Existing Granular Layer as Subgrade.



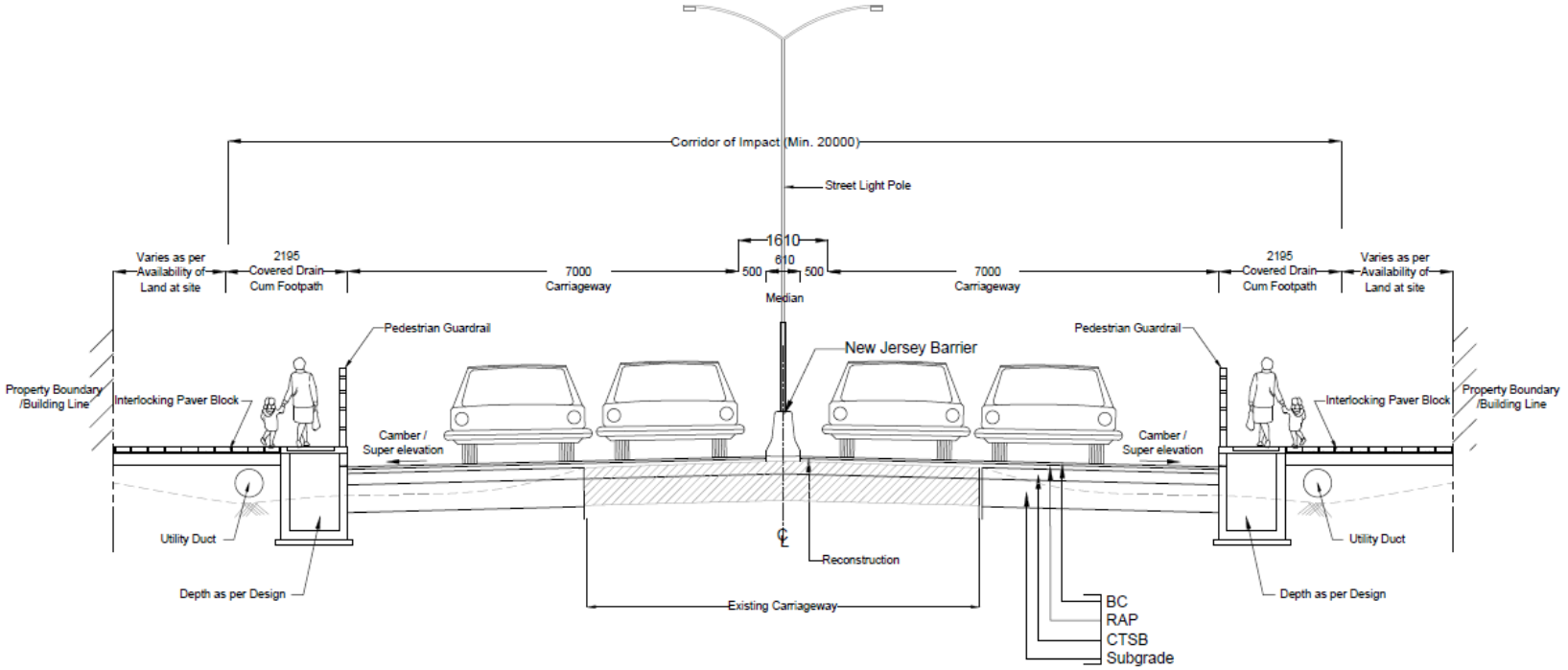
TYPICAL CROSS SECTION FOR 2-LANE WITH PAVED SHOULDER (OPEN COUNTRY)
TCS - 2 - REALIGNMENT/NEW CONSTRUCTION/BYPASS

Note:-
1. All dimensions are in mm unless otherwise specified.



TYPICAL CROSS SECTION FOR 2-LANE WITH PAVED SHOULDER (OPEN COUNTRY)
TCS - 2A - REALIGNMENT/NEW CONSTRUCTION/BYPASS (EMBANKMENT HEIGHT ≥ 3M)

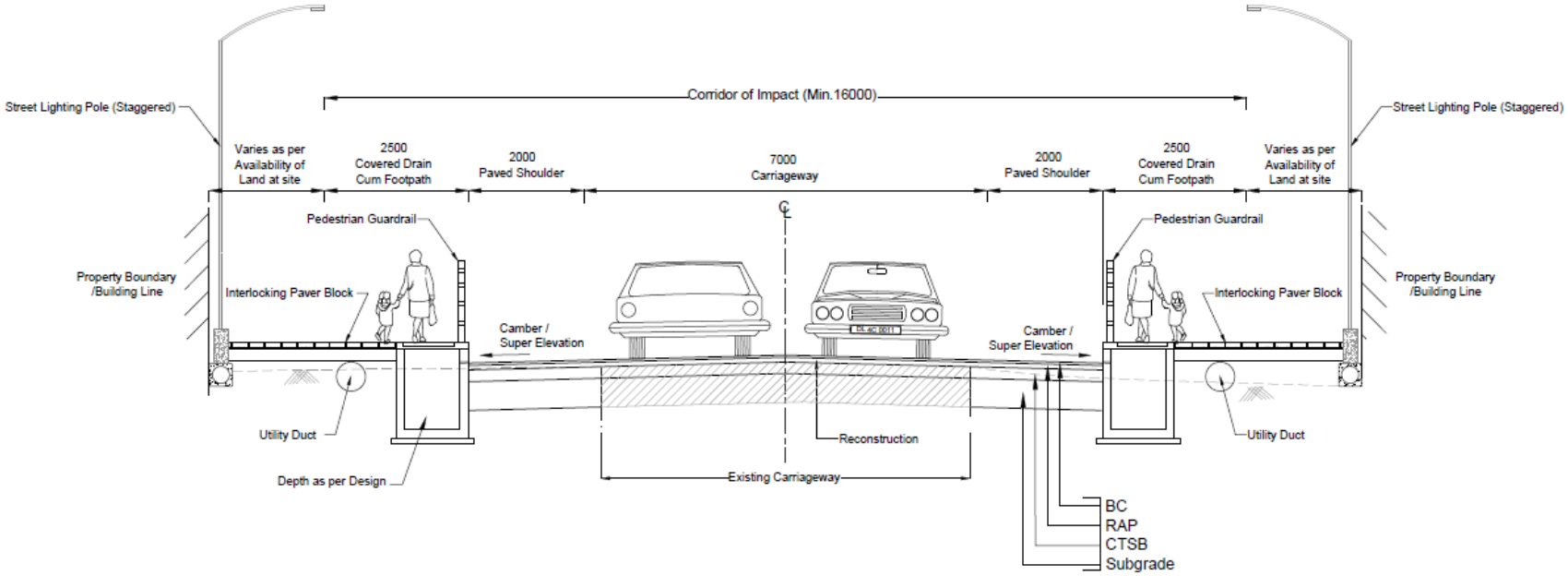
Note:-
1. All dimensions are in mm unless otherwise specified.



TYPICAL CROSS SECTION FOR 4-LANE DIVIDED CARRIAGEWAY (URBAN SECTION)
TCS - 3 - CONCENTRIC WIDENING - BUILT-UP SECTION

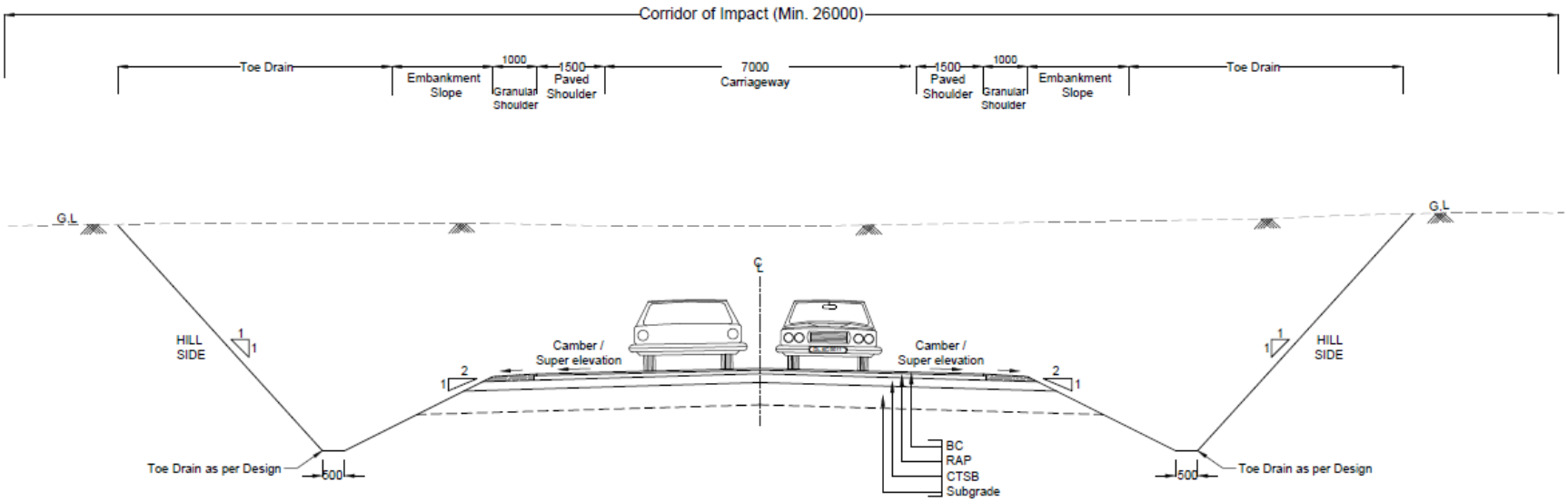
Note:-
1. All dimensions are in mm unless otherwise specified.
2. Existing Bituminous Layer to be scarified and reconstruction start from CTSB, treating Existing Granular Layer as Subgrade.

6 Annex 2.1



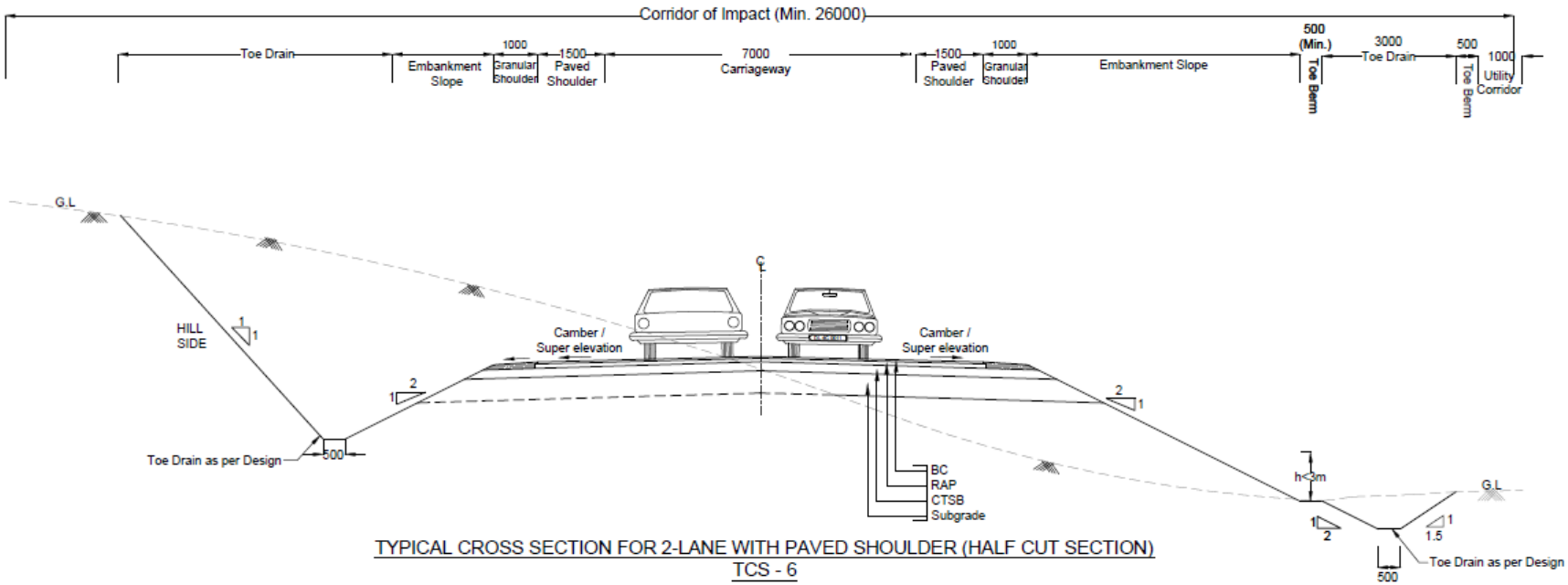
TYPICAL CROSS SECTION FOR 2-LANE WITH PAVED SHOULDER (URBAN SECTION)
TCS - 4 - CONCENTRIC WIDENING - BUILT UP SECTION

Note:-
1. All dimensions are in mm unless otherwise specified.
2. Existing Bituminous Layer to be scarified and reconstruction start from CTSB, treating Existing Granular Layer as Subgrade.



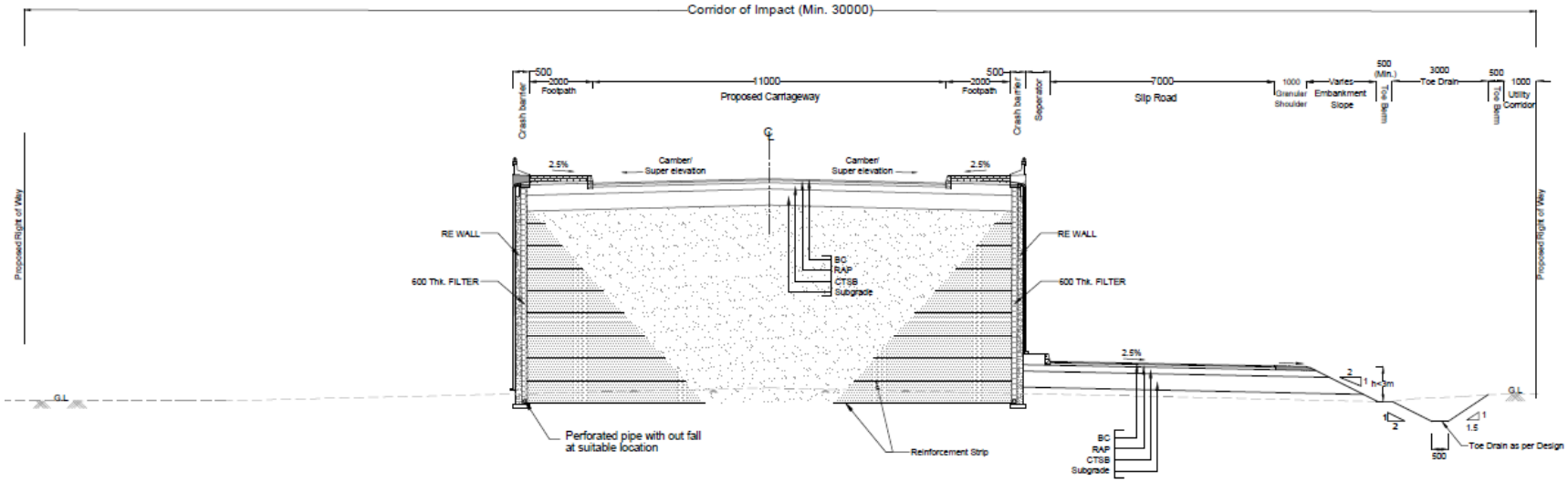
TYPICAL CROSS SECTION FOR 2-LANE WITH PAVED SHOULDER (CUT SECTION)
TCS - 5

Note:-
1. All dimensions are in mm unless otherwise specified.



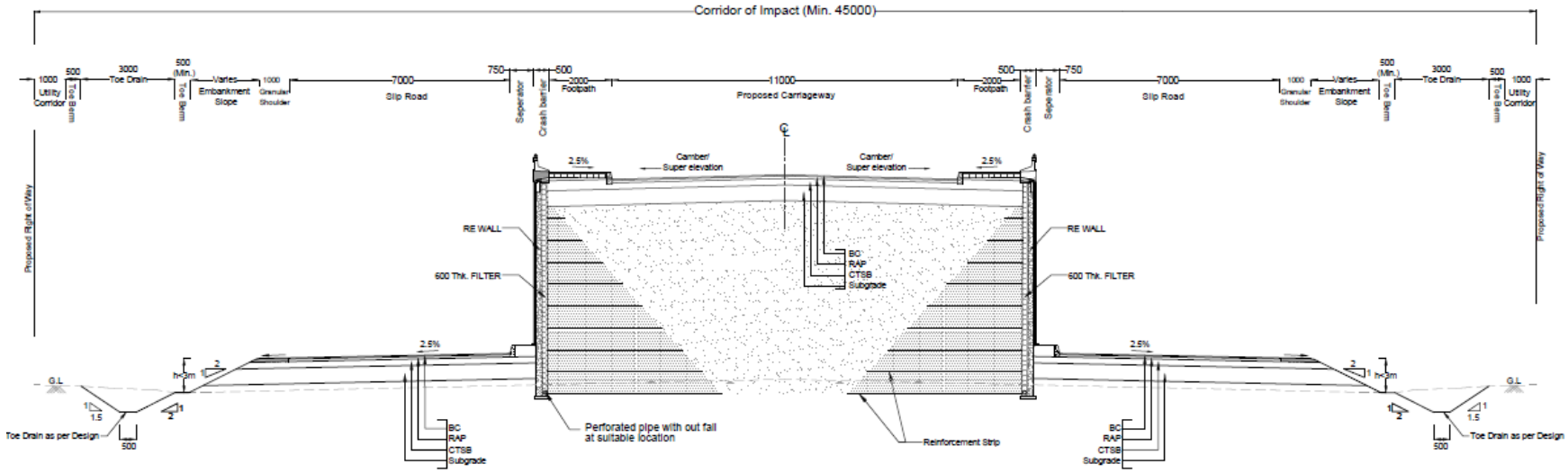
TYPICAL CROSS SECTION FOR 2-LANE WITH PAVED SHOULDER (HALF CUT SECTION)
TCS - 6

Note:-
1. All dimensions are in mm unless otherwise specified.



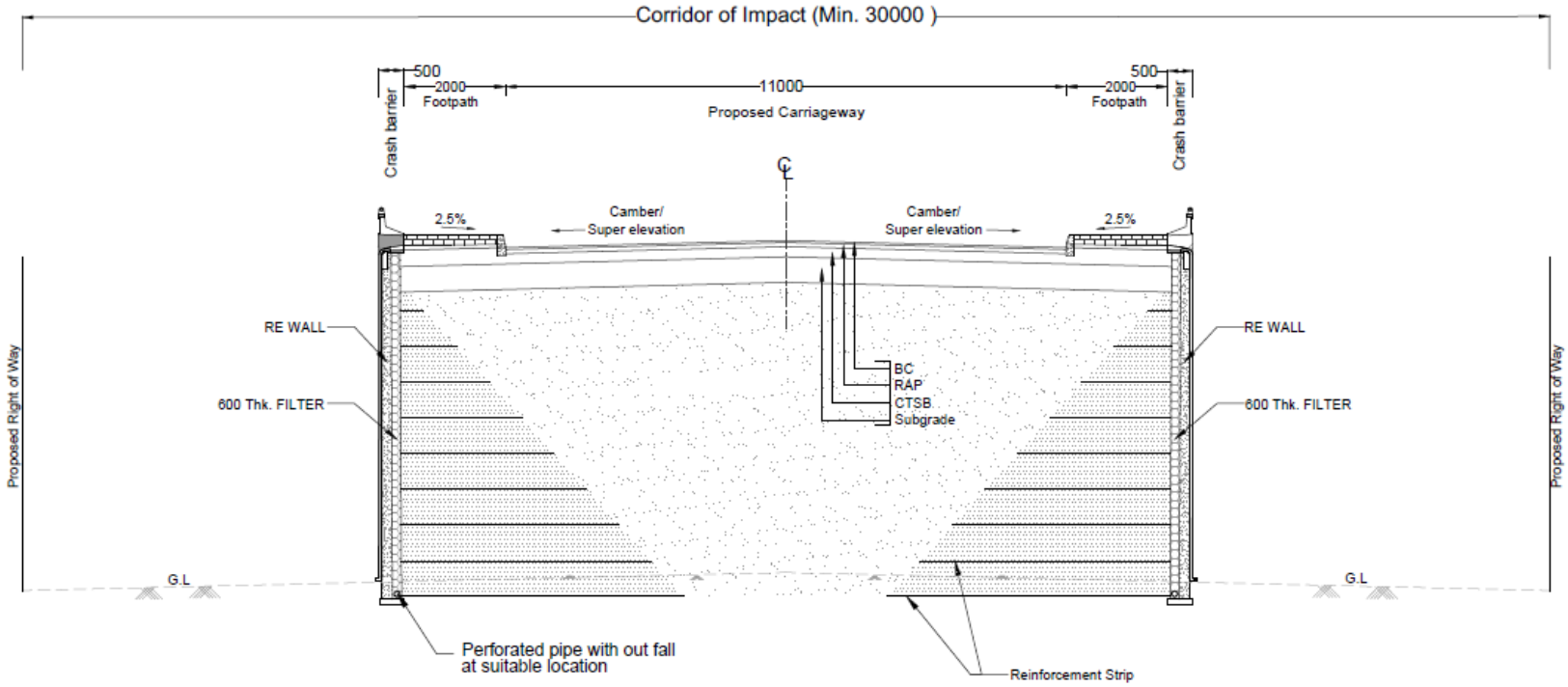
TYPICAL CROSS SECTION FOR APPROACHES TO ROB
WITH ONE SIDE SLIP ROAD (OPEN COUNTRY)
TCS - 7

Note:-
1. All dimensions are in mm unless otherwise specified.



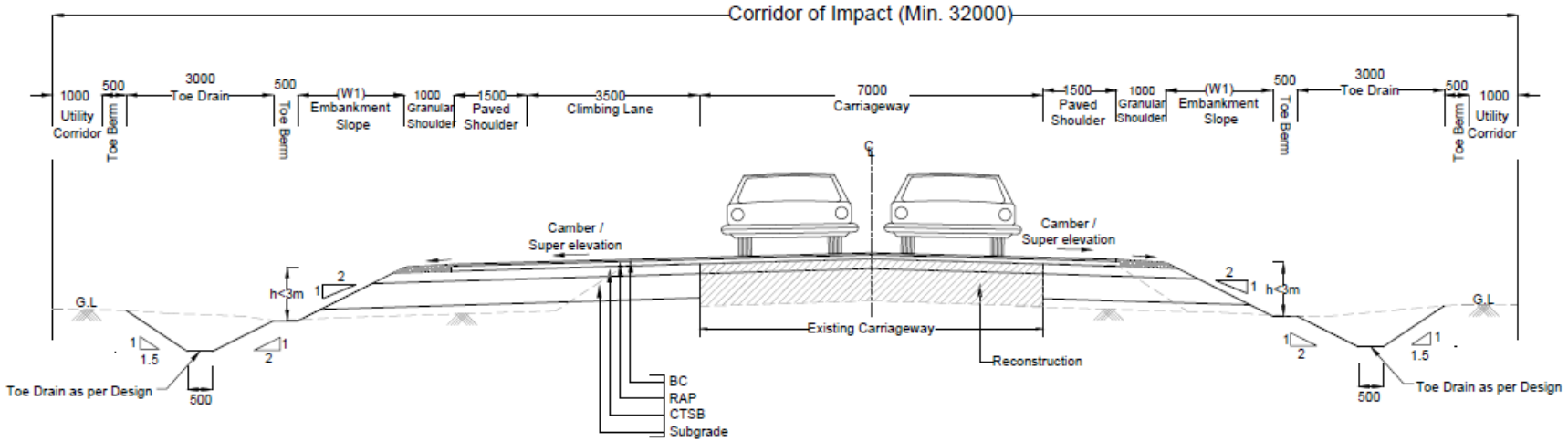
TYPICAL CROSS SECTION FOR APPROACHES TO ROB
WITH BOTH SIDE SLIP ROAD (OPEN COUNTRY)
TCS - 8

Note:-
1. All dimensions are in mm unless otherwise specified.



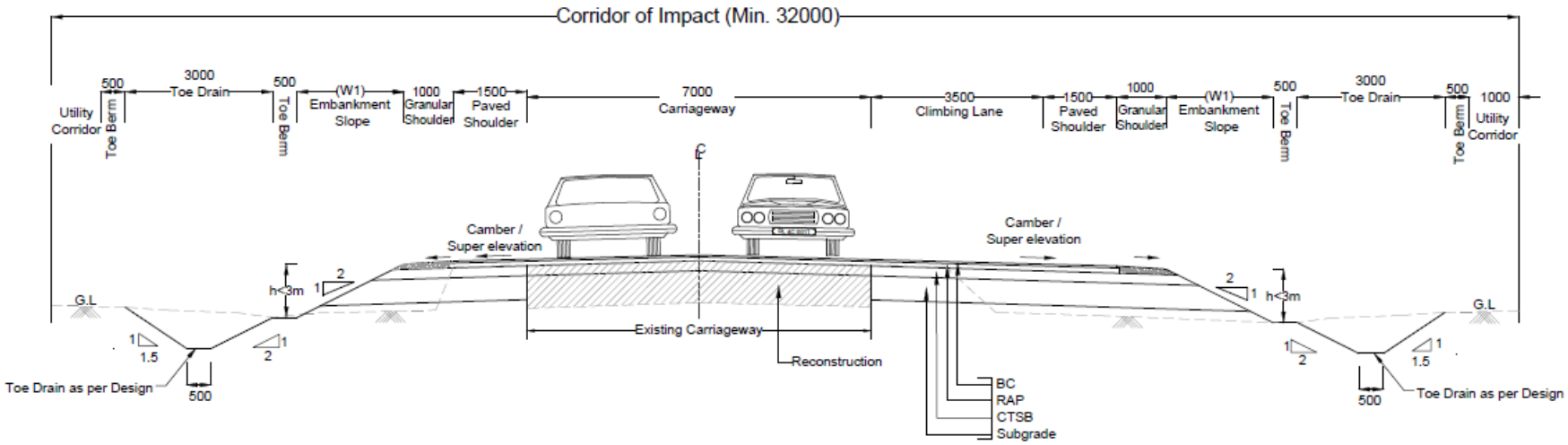
TYPICAL CROSS SECTION FOR APPROACHES TO ROB
WITHOUT SLIP ROAD (OPEN COUNTRY)
TCS - 9

Note:-
1. All dimensions are in mm unless otherwise specified.



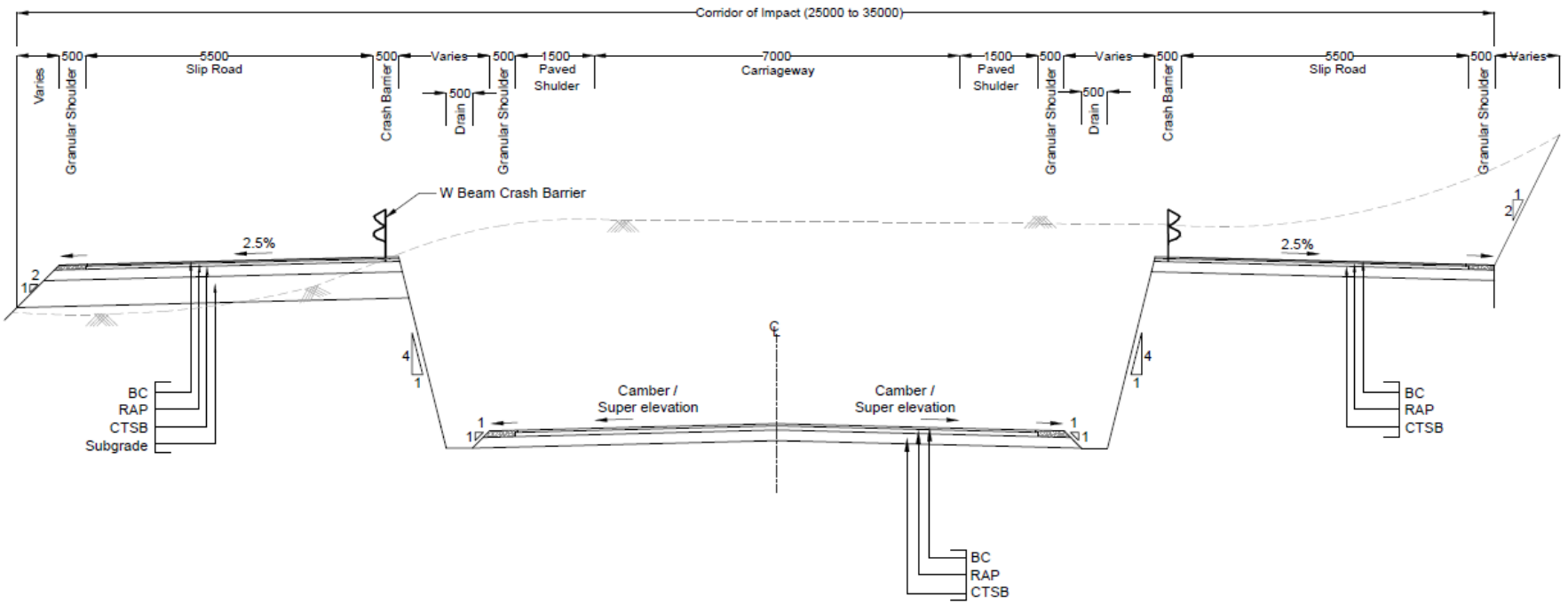
TYPICAL CROSS SECTION FOR 2-LANE WITH PAVED SHOULDER (OPEN COUNTRY)
TCS - 10 - CLIMBING LANE - LEFT

Note:-
1. All dimensions are in mm unless otherwise specified.
2. Existing Bituminous Layer to be scarified and reconstruction start from CTSB, treating Existing Granular Layer as Subgrade.



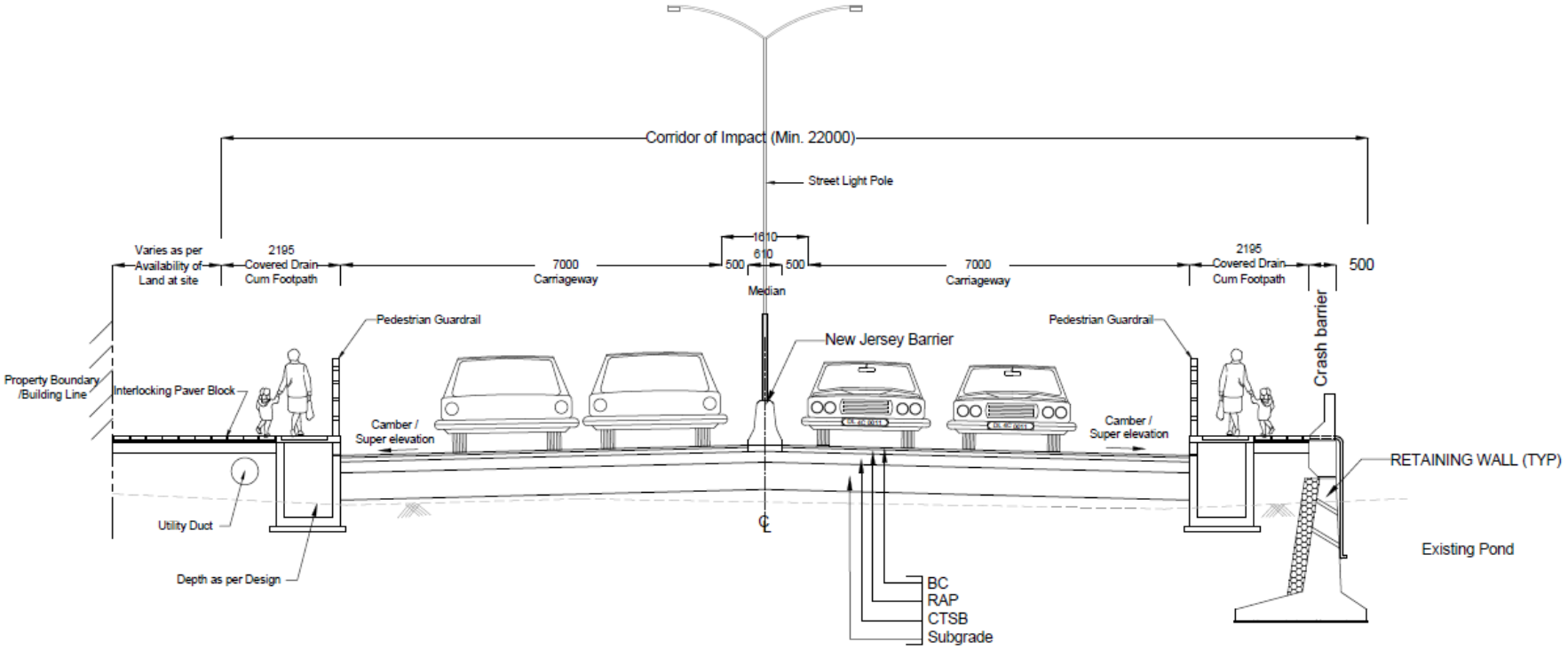
TYPICAL CROSS SECTION FOR 2-LANE WITH PAVED SHOULDER (OPEN COUNTRY)
TCS - 11 - CLIMBING LANE - RIGHT

Note:-
1. All dimensions are in mm unless otherwise specified.
2. Existing Bituminous Layer to be scarified and reconstruction start from CTSB, treating Existing Granular Layer as Subgrade.



TYPICAL CROSS SECTION FOR 2 LANE PAVED SHOULDER WITH BOTH SIDE SLIP ROAD (CUT SECTION)
TCS - 12

Note:-
1. All dimensions are in mm unless otherwise specified.



TYPICAL CROSS SECTION FOR 4-LANE DIVIDED CARRIAGEWAY WITH RETAINING WALL ON RIGHT SIDE (URBAN SECTION)

TCS - 13

Note:-
1. All dimensions are in mm unless otherwise specified.

ANNEX 3.1 RELEVANT INDIAN STANDARDS

Table-A.3.1.1 National Ambient Air Quality Standards

[as per Environment (Protection) Rules, 1986]

Sl. No.	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other area	Ecologically Sensitive Area (notified by Central Govt.)	Methods of Measurements
1.	Sulphur Dioxide (SO_2) µg/m^3	Annual *	50	20	- Improved West & Gaeke
		24 hours**	80	80	- Ultraviolet fluorescence
2.	Nitrogen Dioxide (NO_2) µg/m^3	Annual *	40	30	- Modified Jacob & Hochheiser (Na-Arsenite)
		24 hours **	80	80	- Chemiluminescence
3.	Particulate Matter (size less than 10µm) or PM_{10} µg/m^3	Annual *	60	60	- Gravimetric - TOEM
		24 hours **	100	100	- Beta attenuation
4.	Particulate Matter (size less than 2.5µm) or $PM_{2.5}$ µg/m^3	Annual *	40	40	- Gravimetric - TOEM
		24 hours **	60	60	- Beta attenuation
5.	Carbon Monoxide(CO) mg/m^3	8 hours**	02	02	- Non Dispersive Infra Red (NDIR) Spectroscopy
		1 hour**	04	04	

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24-hourly at uniform interval.

** 24-hourly or 8-hourly or 01 hourly monitored values as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Note: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.

Table-A.3.1.2 World Bank Guideline Values for Ambient Air Quality

Ambient Air Quality Parameter	Averaging Period	WB Guideline Value	
Sulfur dioxide (ug/m3)	24-hr	125	(Interim target)
		50	(Interim target)
		20	(guideline)
	10 min	500	(guideline)
	Annual	None	
Nitrogen dioxide	1 Year	40	(guideline)
	24 Hour	None	
	1 Hour	200	(guideline)
PM10	1 Year	70	(Interim target)
		50	(Interim target)
		30	(Interim target)
		20	(guideline)
	24-hr	150	(Interim target)
		100	(Interim target)
		75	(Interim target)
		50	(guideline)
PM2.5 (ug/m3)	1 year	35	(Interim target)
		25	(Interim target)
		15	(Interim target)

Ambient Air Quality Parameter	Averaging Period	WB Guideline Value	
		10	(guideline)
	24-Hour	75	(Interim target)
		50	(Interim target)
		37.5	(Interim target)
		25	(guideline)
Ozone (ug/m3)	8-hr daily max	160	(Interim target)
		100	(guideline)
Lead (Pb) (ug/m3)	Annual		
	24 hours		
Carbon Monoxide (CP) mg/m3	8 hours		
	1 Hour		
Ammonia (NH3) (ug/m3)	Annual		
	24 hours		

Table-A.3.1.3 Ambient Air Quality Standards in respect of Noise

[as per Noise Pollution (Regulation and Control) Rules, 2000]

Area Code	Category of Area	Limits in dB(A) L_{eq}*	
		Day Time	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

Notes:

1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night time shall mean from 10.00 p.m. to 6.00 a.m.
3. Silence zone is defined as an area comprising not less than 100 metres around hospitals, educational institutions and courts. The silence zones are zones which are declared as such by the competent authority.
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

* dB(A) L_{eq} denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

Table-A.3.1.4 World Bank Noise Guide Values

Receptor	World Bank	
	Day Time	Night Time
	7:00-22:00	22:00-7:00
Residential	55	45
Institutional; educational		
Industrial	70	70
Commercial		
Silence Zone	None	None

Table-A.3.1.5 Tolerance Limits for Inland Surface Waters (as per IS:2296)

SN	Parameter and Unit	Class-A	Class-B	Class-C	Class-D	Class-E
1.	Colour (Hazen Units)	10	300	300	-	-
2.	Odour	Unobject	-	-	-	-
3.	Taste	Tasteless	-	-	-	-
4.	pH (max) (min:6.5)	8.5	8.5	8.5	8.5	8.5
5.	Conductivity (25^{o}C) (μmhos/cm)	-	-	-	1000	2250
6.	DO (mg/L)(min)	6	5	4	4	-
7.	BOD (3 days at 27^{o}C) (mg/L)	2	3	3	-	-
8.	Total Coliforms (MPN/100 mL)	50	500	5000	-	-

SN	Parameter and Unit	Class-A	Class-B	Class-C	Class-D	Class-E
9.	TDS (mg/L)	500	-	1500	-	2100
10.	Oil and Grease (mg/L)	-	-	0.1	0.1	-
11.	Mineral Oil (mg/L)	0.01	-	-	-	-
12.	Free Carbon Dioxide (mg/L CO_2)	-	-	-	6	-
13.	Free Ammonia (mg/L as N)	-	-	-	1.2	-
14.	Cyanide (mg/L as CN)	0.05	0.05	0.05	-	-
15.	Phenol (mg/L C_6H_5OH)	0.002	0.005	0.005	-	-
16.	Total Hardness (mg/L as $CaCO_3$)	300	-	-	-	-
17.	Chloride (mg/L as Cl)	250	-	600	-	600
18.	Sulphate (mg/L as SO_4)	400	-	400	-	1000
19.	Nitrate (mg/L as NO_3)	20	-	50	-	-
20.	Fluoride (mg/L as F)	1.5	1.5	1.5	-	-
21.	Calcium (mg/L as Ca)	80	-	-	-	-
22.	Magnesium (mg/L as Mg)	24.4	-	-	-	-
23.	Copper (mg/L as Cu)	1.5	-	1.5	-	-
24.	Iron (mg/L as Fe)	0.3	-	50	-	-
25.	Manganese (mg/L as Mn)	0.5	-	-	-	-
26.	Zinc (mg/L as Zn)	15	-	15	-	-
27.	Boron (mg/L as B)	-	-	-	-	2
28.	Barium (mg/L as Ba)	1	-	-	-	-
29.	Silver (mg/L as Ag)	0.05	-	-	-	-
30.	Arsenic (mg/L as As)	0.05	0.2	0.2	-	-
31.	Mercury (mg/L as Hg)	0.001	-	-	-	-
32.	Lead (mg/L as Pb)	0.1	-	0.1	-	-
33.	Cadmium (mg/L as Cd)	0.01	-	0.01	-	-
34.	Chromium (VI) (mg/L as Cr)	0.05	0.05	0.05	-	-
35.	Selenium (mg/L as Se)	0.01	-	0.05	-	-
36.	Anionic Detergents (mg/L MBAS)	0.2	1	1	-	-
37.	PAH (mg/L)	0.2	-	-	-	-
38.	Pesticides (μg/L)	Absent	-	-	-	-
39.	Insecticides (mg/L)	-	-	Absent	-	-
40.	Alpha Emitters (10^{-6}μc/mL)	0.001	0.001	0.001	0.001	0.001
41.	Beta Emitters (10^{-6}μc/mL)	0.01	0.01	0.01	0.01	0.01
42.	Percent Sodium (%)	-	-	-	-	60
43.	Sodium Absorption Ratio	-	-	-	-	26

Class-A: Drinking water source without conventional treatment but after disinfection.
Class-B: Outdoor bathing.
Class-C: Drinking water source with conventional treatment followed by disinfection.
Class-D: Fish culture and wild life propagation.
Class-E: Irrigation, industrial cooling and controlled waste disposal.

Table-A.3.1.6 Drinking Water Quality Standards (as per IS 10500:2012)

Sl. No.	Parameter and Unit	Acceptable Limit	Permissible Limit in Absence of Alternate Source
1.	pH	6.5-8.5	No relaxation
2.	Turbidity (NTU)	1	5
3.	TDS (mg/L)	500	2000
4.	Total Hardness (mg/L as $CaCO_3$)	200	600
5.	Total Alkalinity (mg/L as $CaCO_3$)	200	600
6.	Calcium (mg/L as Ca)	75	200
7.	Chloride (mg/L as Cl)	250	1000
8.	Fluoride (mg/L as F)	1	1.5
9.	Iron (mg/L as Fe)	0.3	No relaxation
10.	Magnesium (mg/L as Mg)	30	100
11.	Manganese (mg/L as Mn)	0.1	0.3
12.	Boron (mg/L as B)	0.5	1.0
13.	Nitrate (mg/L as NO_3)	45	No relaxation
14.	Sulphate (mg/L as SO_4)	200	400
15.	Zinc (mg/L as Zn)	5	15
16.	Cadmium (mg/L as Cd)	0.003	No relaxation
17.	Lead (mg/L as Pb)	0.01	No relaxation
18.	Mercury (mg/L as Hg)	0.001	No relaxation
19.	Copper (mg/L as Cu)	0.05	1.5
20.	Total Arsenic (mg/L as As)	0.01	0.05
21.	Total Chromium (mg/L as Cr)	0.05	No relaxation
22.	Total Coliforms (MPN/100 mL)	Nil	-

Table-A.3.1.7 General Standards for Discharge of Effluents

[as per Environment (Protection) Rules, 1986]

Sl. No.	Parameter and Unit	Inland Surface Water	Public Sewers	Land for Irrigation	Marine Coastal Water
1.	Temperature (^oC)	#	-	-	#
2.	Colour and Odour	$	-	$	$
3.	pH	5.5-9.0	5.5-9.0	5.5-9.0	5.5-9.0
4.	BOD (3 days at 27^oC) (mg/L)	30	350	100	100
5.	COD (mg/L)	250	-	-	250
6.	Bio-assey (% 96-hrs Survival)	@	@	@	@
7.	TSS (mg/L)	100	600	200	100*
8.	SS Particlesize(pass IS Sieve)	850	-	-	&
9.	Oil and Grease (mg/L)	10	20	10	20
10.	Total Residual Chlorine (mg/L)	1	-	-	1
11.	Nitrate Nitrogen (mg/L as N)	10	-	-	20
12.	Ammonia Nitrogen (mg/L N)	50	50	-	50
13.	Kjeldahl Nitrogen (mg/L as N)	100	-	-	100
14.	Free Ammonia (mg/L as N)	5	-	-	5
15.	Cyanide (mg/L as CN)	0.2	2	0.2	0.2
16.	Phenol (mg/L C_6H_5OH)	1	5	-	5
17.	Fluoride (mg/L as F)	2	15	-	15
18.	Sulphide (mg/L as S)	2	-	-	5
19.	Dissolved Phosphate (mg/L P)	5	-	-	-
20.	Copper (mg/L as Cu)	3	3	-	3

Sl. No.	Parameter and Unit	Inland Surface Water	Public Sewers	Land for Irrigation	Marine Coastal Water
21.	Iron (mg/L as Fe)	3	3	-	3
22.	Manganese (mg/L as Mn)	2	2	-	2
23.	Zinc (mg/L as Zn)	5	15	-	15
24.	Nickel (mg/L as Ni)	3	3	-	5
25.	Vanadium (mg/L as V)	0.2	0.2	-	0.2
26.	Arsenic (mg/L as As)	0.2	0.2	0.2	0.2
27.	Mercury (mg/L as Hg)	0.01	0.01	-	0.01
28.	Lead (mg/L as Pb)	0.1	1	-	1
29.	Cadmium (mg/L as Cd)	2	1	-	2
30.	Chromium (VI) (mg/L as Cr)	0.1	2	-	1
31.	Chromium (Total) (mg/L as Cr)	2	2	-	2
32.	Selenium (mg/L as Se)	0.05	0.05	-	0.05
33.	Alpha Emitters (10^{-6}μc/mL)	0.1	0.1	0.01	0.1
34.	Beta Emitters (10^{-6}μc/mL)	1	1	0.1	1

\# Shall not exceed 5°C above the receiving water temperature.
$ All efforts should be made to remove colour and unpleasant odour as far as practicable.
@ 90% survival of fish after 96 hours in 100% effluent.
* For cooling water effluent 10% above TSS of influent.
& (a) Floatable solids 3 mm, (b) Settleable solids 850 micron.

Table-A.3.1.8 Side-by-Side Comparison of GoI and WHO Drinking Water Standards and Guide Values

S. No.	Parameters	GoI Prescribed limits		Probable effects	World Health Organization Guide Values (2011)
		Desirable	Permissible		
1	COLOUR (HAZEN UNIT)	5	25	Aesthetically undesirable.	No Guideline
2	ODOUR	Essentially free		Aesthetically undesirable.	No Guideline
3	TASTE	Agreeable		Aesthetically undesirable.	No Guideline
4	TURBIDITY (NTU)	5	10	Indicates pollution/ contamination.	No Guideline
5	pH	6.5	8.5	Affects taste, corrodes supply system.	No Guideline
6	HARDNESS, as CaCO3, mg/l	300	600	Causes scaling, excessive soap consumption, calcification of arteries.	No Guideline
7	IRON, as Fe , mg/l	0.3	1	Causes staining of laundry and porcelain. In traces it is essential for nutrition.	No Guideline
8	CHLORIDE, as Cl , mg/l	250	1000	May be injurious to heart or kidney patients. Taste, indigestion, corrosion and palatability are affected.	No Guideline
9	RESIDUAL CHLORINE, only when Water is chlorinated	0.2	-	Excessive chlorination causes asthma, colitis and eczema	0.2
10	TOTAL	500	2000	May cause gastro-	No Guideline

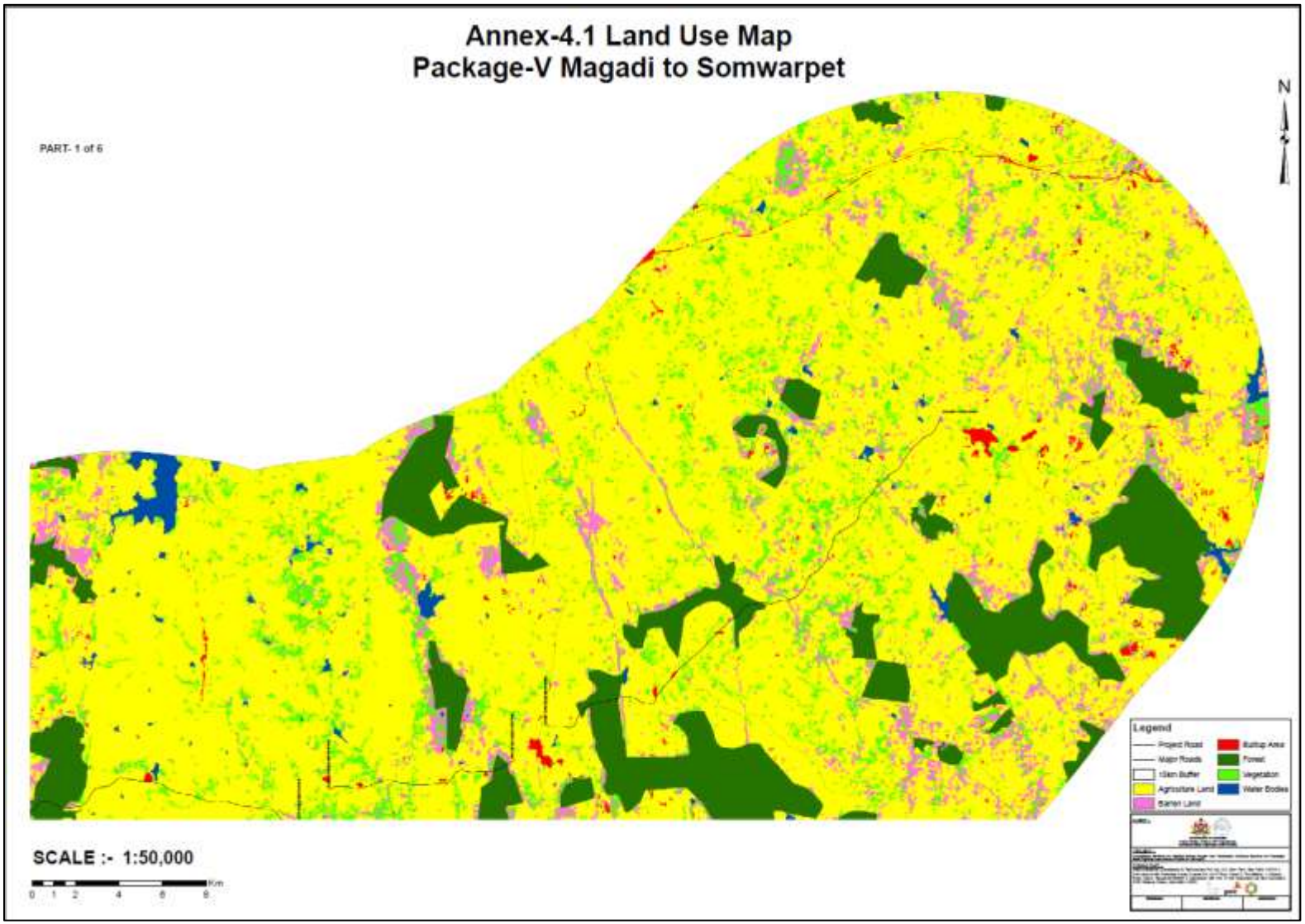
S. No.	Parameters	GoI Prescribed limits		Probable effects	World Health Organization Guide Values (2011)
		Desirable	Permissible		
	DISSOLVED SOLIDS, mg/l			intestinal irritation, corrosion and laxative effect to new users.	
11	CALCIUM, as Ca, mg/l	75	200	Excessive Cause incrustation, deficiency causes rickets, essential for nervous, muscular, cardiac functions and in coagulation of blood.	No Guideline
12	MAGNESIUM, as Mg, mg/l	30	100	Its salts are cathartics and diuretic. Excessive may cause laxative effect; deficiency causes structural and functional changes. It is activator of many enzyme systems.	No Guideline
13	COPPER, as Cu, mg/l	0.05	1.5	Beneficial in human metabolism, deficiency results in nutritional anaemia in infants. Large amounts may result in liver damage, causes central nervous system irritation and depression. Enhances corrosion of Al in water supply systems.	2
14	SULPHATE, as SO4, mg/l	200	400	Causes gastro-intestinal irritation. Along with Mg or Na can have a cathartic effect. Concentration more than 750 mg/l may have laxative effect.	No Guideline
15	NITRATE, as N, mg/l	45	100	Causes infant methaemoglobinaemia, at very high concentration causes gastric cancer and effects central nervous and cardiovascular system.	As NO3 = 50 mg/l; as NO2=3mg/l
16	FLUORIDE, as F, mg/l	1	1.5	Reduces dental carries, very high concentration may cause crippling skeletal fluorosis.	1.5
17	CADMIUM, as Cd, mg/l	0.01	No relaxation	Acute toxicity may be associated with renal, arterial hypertension, itai-itai (bone disease). Cd salts cause cramps, nausea, vomiting and diarrhoea.	0.003
18	LEAD, as Pb,	0.05	No	Burning in mouth, severe	0.01

S. No.	Parameters	GoI Prescribed limits		Probable effects	World Health Organization Guide Values (2011)
		Desirable	Permissible		
	mg/l		relaxation	inflammation of gastro-intestinal tract with vomiting and diarrhoea. Chronic toxicity produces nausea, severe abdominal pain, paralysis, mental confusion, visual disturbances, and anaemia etc.	
19	ZINC, as Zn , mg/l	5	15	Essential and beneficial in human metabolism. Imparts astringent taste to water.	No Guideline
20	CHROMIUM, as Cr, mg/l	0.05	No relaxation	Cr6+ produces lung tumours, coetaneous and nasal mucous membrane ulcers and dermatitis.	0.05
21	ARSENIC, as As, mg/l	0.05	No relaxation	Causes skin damage, circulatory problems, and increased risk of skin cancer.	0.01
22	ANTIMONY, as Sb, mg/l	0.006	No relaxation	Raises blood cholesterol, lowers blood sugar.	0.02
23	ALUMINIUM, as Al, mg/l	0.03	0.2	Leads to neurological disorders.	0.9
24	BARIUM, as Ba, mg/l	2	No relaxation	Increases blood pressure.	0.7
25	BERYLLIUM, as Be, mg/l	nil	0.0002	Is carcinogenic	No Guideline
26	CYANIDE, as CN, mg/l	0.05	No relaxation	Causes nerve damage, thyroid problem.	No Guideline
27	MERCURY, as Hg, mg/l	0.001	No relaxation	Neurological and renal disturbances. Excess causes gonadotoxic and mutagenic effects and disturbs the cholesterol metabolism.	0.006
28	MANGANESE, as Mn, mg/l	0.1	0.3	Essential as a cofactor in enzyme systems and metabolism processes. Excessive causes change in appetite and reduction in metabolism of iron to form haemoglobin. Imparts undesirable taste and stains plumbing fixtures and laundry.	No Guideline
29	SELENIUM, as Se, mg/l	0.01	No relaxation	Leads to hair, finger loss, and numbness in fingers or toes, circulatory problems.	0.04

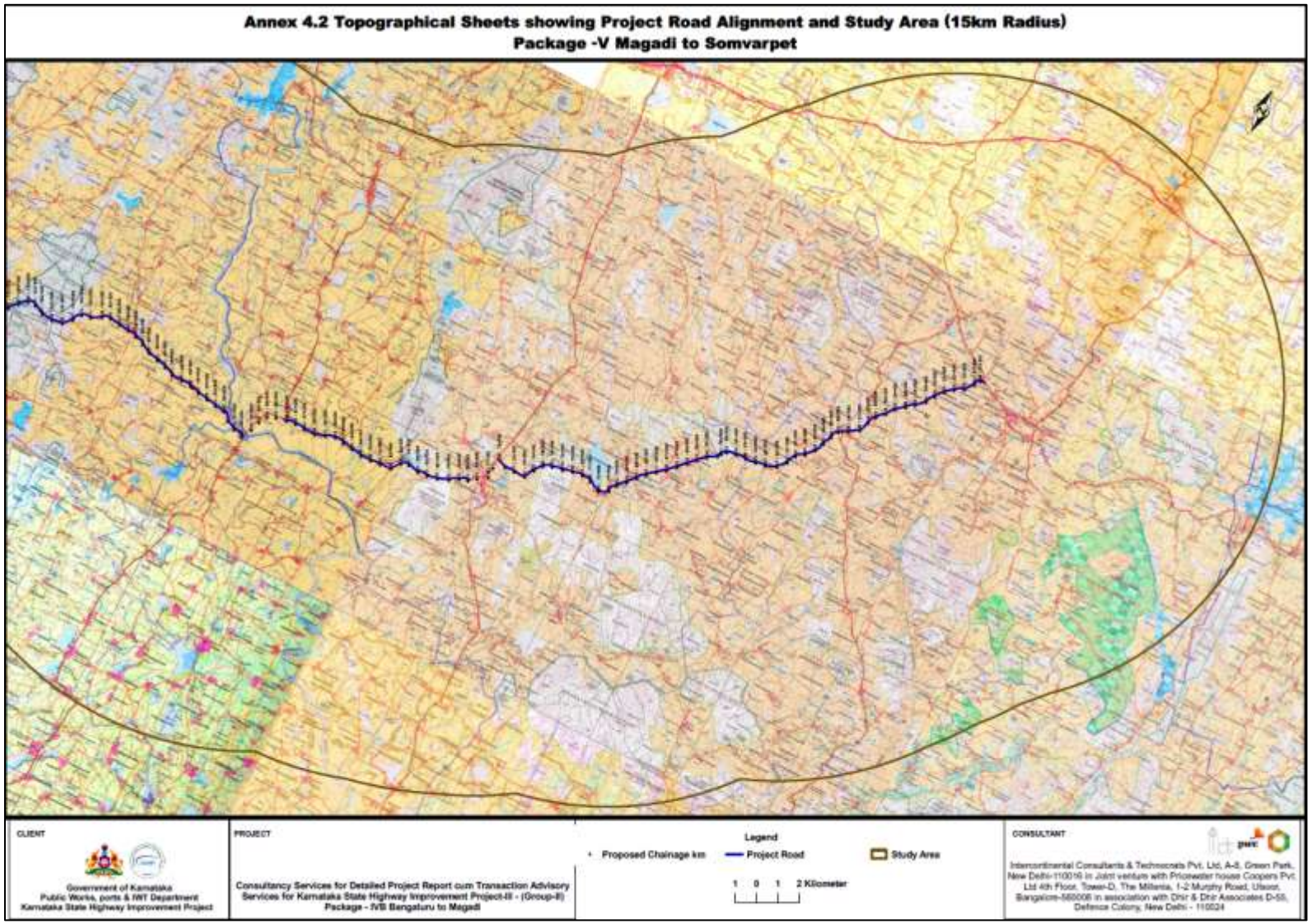
S. No.	Parameters	GoI Prescribed limits		Probable effects	World Health Organization Guide Values (2011)
		Desirable	Permissible		
30	BORON, as B, mg/l	1	5	Affects central nervous system, salts may cause nausea, cramps, convulsions, coma, etc.	2.4
31	ALKALINITY, as CaCO3, mg/l	200	600	Imparts unpleasant taste, deleterious to humans in presence of high pH, hardness and TDS.	No Guideline
32	PESTICIDES, ug/l	nil	0.001	Imparts toxicity, accumulates in different organs of body, and affects immune and nervous systems. Carcinogenic.	Alachlor 0.02; Aldicarb 0.01; Aldrin and dieldrin 0.000 03; Atrazine and its chloro-striazine metabolites 0.1; Carbofuran 0.007; Chlordane 0.000 2; Chlorotoluron 0.03; Chlorpyrifos 0.03; Cyanazine 0.000 6; 2,4-Db 0.03; 2,4-DBc 0.09; 1,2-Dibromo-3-chloropropane 0.001; 1,2-Dibromoethane 0.4a 0.000 4; 1,2-Dichloropropane 0.04; 1,3-Dichloropropene 0.02; Dichlorprop 0.1; Dimethoate 0.006; Endrin 0.000 6; Fenoprop 0.009; Hydroxyatrazine 0.2; Atrazine metabolite Isoproturon 0.009; Lindane 0.002; MCPAd 0.002; Mecoprop 0.01; Methoxychlor 0.02; Metolachlor 0.01
33	PHOSPHATE, as PO4, mg/l	No guideline		High concentration causes vomiting and diarrhoea stimulates secondary hyperthyroidism and bone loss.	No Guideline
34	SODIUM, as Na, mg/l	No guideline		Harmful to persons suffering from cardiac, renal and circulatory diseases.	No Guideline
35	POTASSIUM, as K, mg/l	No guideline		Essential nutrition element but excessive amounts are cathartic.	No Guideline
36	NICKEL, as Ni , mg/l	No guideline		Non-toxic element but may be carcinogenic in animals, can react with	0.07

S. No.	Parameters	GoI Prescribed limits		Probable effects	World Health Organization Guide Values (2011)
		Desirable	Permissible		
				DNA resulting in DNA damage in animals.	
37	PATHOGENS	1	10	Causes water borne diseases like coliform jaundice; Typhoid, Cholera etc. produces infections involving skin mucous membrane of eyes, ears and throat.	E. coli no detection in any 100 ml sample
	a)TOTAL COLIFORM No/dl				
	b)FAECAL COLIFORM No/dl				
38	RADIOACTIVITY:			Increases risk of cancer.	Gross alpha activity > 0.5 Bq/li and gross beta activitry > 0.1 Bq/li concentrations of individual nucleotides should be determined and compared to below: Uranium-238, 10; Uranium-234 1; Thorium-230, 1; Radium-226, 1; Lead-210, 0.1; Polonium-210, 0.1; Thorium-232, 1; Radium-228, 0.1; Thorium-228, 1; Caesium-134d, 10; Caesium-137d 1.3 × 10−8 10; Strontium-90d, 10; Iodine-131d,e, 10; Tritiume 1.8, 10 000; Carbon-14, 100; Plutonium-239d, 1; Americium-241d, 1;
	-BETA PARTICLES	0-4 milligram/year			
	-ALPHA PARTICLES	0-15 picocuries/year			
	-RADIUM	0-05 picocuries/year			

ANNEX 4.1 LAND USE MAP



ANNEX 4.2 TOPOGRAPHICAL SHEET SHOWING PROJECT ROAD ALIGNMENT AND STUDY AREA



ANNEX 4.3 ON-SITE METEOROLOGICAL MONITORING RESULTS

Date & Time DD/MM/YYYY HH:MM	Air Temperature (°C)	RH (%)	Wind Speed (m/sec)	Wind Direction (°)	Rainfall (mm)
9/12/ 2015 - 14:00	21.60	83.20	1.70	165	0
09/12/ 2015 - 15:00	21.40	81.20	1.80	156	0
09/12/ 2015 - 16:00	21.00	80.40	1.70	124	0
09/12/ 2015 - 17:00	21.50	80.30	3.30	124	0
09/12/ 2015 - 18:00	22.30	79.60	3.70	155	0
09/12/ 2015 - 19:00	23.50	77.40	3.00	162	0
09/12/ 2015 - 20:00	24.30	71.00	2.20	161	2
09/12/ 2015 - 21:00	25.30	77.00	2.90	160	0
09/12/ 2015 - 22:00	25.70	80.00	2.90	158	0
09/12/ 2015 - 23:00	26.50	86.30	2.90	156	0
10/12/ 2015 - 00:00	27.30	89.00	1.80	154	0
10/12/2015 - 01:00	27.90	90.00	4.10	148	0
10/12/2015 - 02:00	28.60	91.00	1.70	174	0
10/12/2015 - 03:00	27.50	92.00	1.60	167	0
10/12/2015 - 04:00	26.50	93.00	2.10	165	0
10/12/2015 - 05:00	25.30	93.40	0.90	174	0
10/12/2015 - 06:00	24.30	89.60	0.60	196	0
10/12/2015 - 07:00	23.10	87.60	4.60	201	0
10/12/2015 - 08:00	22.60	88.60	1.30	204	0
10/12/2015 - 09:00	21.30	85.30	2.10	201	0
10/12/2015 - 10:00	20.60	80.30	1.40	205	0
10/12/2015 - 11:00	19.30	78.40	2.10	206	0
10/12/2015 - 12:00	19.10	80.30	1.80	121	0
10/12/2015 - 13:00	18.20	80.40	2.10	124	0
10/12/2015 - 14:00	18.00	68.10	2.40	124	0
10/12/2015 - 15:00	17.60	78.30	1.50	179	0
10/12/2015 - 16:00	18.60	71.30	1.00	189	0
10/12/2015 - 17:00	19.30	68.30	0.60	171	0
10/12/2015 - 18:00	20.10	67.60	0.70	182	0
10/12/2015 - 19:00	21.50	66.10	1.20	202	0
10/12/2015 - 20:00	20.60	73.00	1.10	248	0
10/12/2015 - 21:00	22.30	79.00	1.00	220	0
10/12/2015 - 22:00	23.60	83.00	1.20	172	0
10/12/2015 - 23:00	24.50	88.00	1.50	173	0
11/12/2015 - 00:00	25.70	89.00	1.90	172	0
11/12/2015 - 01:00	26.50	90.00	2.40	172	0
11/12/2015 - 02:00	27.50	92.00	1.90	150	0
11/12/2015 - 03:00	28.36	93.30	2.30	155	0
11/12/2015 - 04:00	27.60	92.00	1.40	146	0
11/12/2015 - 05:00	26.10	92.00	1.10	123	0
11/12/2015 - 06:00	25.30	93.00	1.40	175	0
11/12/2015 - 07:00	23.30	94.00	2.10	159	0
11/12/2015 - 08:00	21.00	94.00	1.20	175	0
11/12/2015 - 09:00	19.30	94.00	2.30	132	0
11/12/2015 - 10:00	18.30	93.00	2.30	261	0
11/12/2015 - 11:00	17.20	89.40	2.30	118	0
11/12/2015 - 12:00	16.30	85.00	2.30	126	0
11/12/2015 - 13:00	15.30	81.00	3.00	189	0

Date & Time DD/MM/YYYY HH:MM	Air Temperature (°C)	RH (%)	Wind Speed (m/sec)	Wind Direction (°)	Rainfall (mm)
11/12/2015 - 14:00	17.30	81.00	3.20	139	0
11/12/2015 - 15:00	18.60	81.00	3.00	139	0
11/12/2015 - 16:00	19.20	80.00	2.60	272	0
11/12/2015 - 17:00	20.30	81.00	1.00	316	0
11/12/2015 - 18:00	21.30	83.40	1.30	288	0
11/12/2015 - 19:00	22.30	86.00	2.60	190	0
11/12/2015 - 20:00	23.60	88.40	1.30	225	0
11/12/2015 - 21:00	24.30	90.00	2.50	220	0
11/12/2015 - 22:00	25.80	91.70	2.70	175	0
11/12/2015 - 23:00	26.40	93.00	3.20	161	0
12/12/2015 - 00:00	25.60	94.00	1.10	244	0
12/12/2015 - 01:00	26.40	95.00	3.20	190	0
12/12/2015 - 02:00	27.30	96.00	3.00	208	0
12/12/2015 - 03:00	26.30	97.00	0.90	156	0
12/12/2015 - 04:00	24.30	97.00	1.00	157	0
12/12/2015 - 05:00	23.60	97.00	2.00	124	0
12/12/2015 - 06:00	22.50	97.00	3.10	287	0
12/12/2015 - 07:00	22.80	96.00	3.20	179	0
12/12/2015 - 08:00	21.30	96.00	3.30	156	0
12/12/2015 - 09:00	19.20	94.00	2.90	345	0
12/12/2015 - 10:00	20.30	85.60	4.60	121	0
12/12/2015 - 11:00	18.30	70.00	3.50	146	0
12/12/2015 - 12:00	18.60	56.00	3.40	159	0
12/12/2015 - 13:00	17.30	53.00	2.80	169	0
12/12/2015 - 14:00	16.30	52.50	2.40	163	0
12/12/2015 - 15:00	17.10	54.00	1.30	159	0
12/12/2015 - 16:00	18.30	52.00	1.30	150	0
12/12/2015 - 17:00	19.30	52.00	1.60	139	0
12/12/2015 - 18:00	20.30	61.00	1.60	150	0
12/12/2015 - 19:00	21.30	69.90	0.80	153	0
12/12/2015 - 20:00	21.60	78.00	1.50	164	0
12/12/2015 - 21:00	22.30	82.00	1.40	156	0
12/12/2015 - 22:00	25.30	87.00	2.30	155	0
12/12/2015 - 23:00	26.30	91.00	2.90	147	0
13/12/ 2015 - 00:00	27.30	93.50	2.50	157	0
13/12/ 2015 - 01:00	28.30	95.00	2.30	212	0
13/12/ 2015 - 02:00	28.30	96.00	0.50	151	0
13/12/ 2015 - 03:00	27.90	97.00	1.40	181	0
13/12/ 2015 - 04:00	26.30	97.00	1.40	189	0
13/12/ 2015 - 05:00	25.40	98.00	1.30	181	0
13/12/ 2015 - 06:00	24.30	99.00	1.40	168	0
13/12/ 2015 - 07:00	23.60	99.00	1.30	178	0
13/12/ 2015 - 08:00	22.30	99.00	2.50	159	0
13/12/ 2015 - 09:00	21.30	98.00	2.80	145	0
13/12/ 2015 - 10:00	20.30	90.00	2.30	155	0
13/12/ 2015 - 11:00	19.30	75.60	1.70	155	0
13/12/ 2015 - 12:00	18.00	58.10	2.20	154	0
13/12/ 2015 - 13:00	17.30	53.00	2.20	160	0
13/12/ 2015 - 14:00	17.20	53.00	2.20	178	0
13/12/ 2015 - 15:00	17.60	47.00	1.40	168	0

Date & Time DD/MM/YYYY HH:MM	Air Temperature (°C)	RH (%)	Wind Speed (m/sec)	Wind Direction (°)	Rainfall (mm)
13/12/ 2015 - 16:00	17.80	45.00	3.10	179	0
13/12/ 2015 - 17:00	18.20	45.00	0.90	178	0
13/12/ 2015 - 18:00	18.30	54.40	1.10	185	0
13/12/ 2015 - 19:00	18.60	67.00	0.40	189	0
13/12/ 2015 - 20:00	18.90	77.00	0.70	249	0
13/12/ 2015 - 21:00	19.20	82.00	0.30	208	0
13/12/ 2015 - 22:00	19.60	85.10	0.80	155	0
13/12/ 2015 - 23:00	20.30	89.00	0.50	151	0
14/12/ 2015 - 00:00	20.60	92.00	0.50	153	0
14/12/ 2015 - 01:00	20.50	94.00	2.50	171	0
14/12/ 2015 - 02:00	21.30	95.00	2.90	160	0
14/12/ 2015 - 03:00	21.90	96.00	1.60	159	0
14/12/ 2015 - 04:00	22.60	97.00	1.30	146	0
14/12/ 2015 - 05:00	21.30	98.00	0.60	134	0
14/12/ 2015 - 06:00	21.10	99.00	1.10	134	0
14/12/ 2015 - 07:00	21.00	99.00	2.80	159	0
14/12/ 2015 - 08:00	20.80	99.00	2.30	166	0
14/12/ 2015 - 09:00	20.70	98.00	2.10	165	0
14/12/ 2015 - 10:00	20.50	90.30	2.10	142	0
14/12/ 2015 - 11:00	19.30	75.00	1.70	145	0
14/12/ 2015 - 12:00	19.50	56.60	1.90	161	0
14/12/ 2015 - 13:00	19.10	53.00	2.40	162	0
14/12/ 2015 - 14:00	18.30	52.00	1.60	169	0
14/12/ 2015 - 15:00	18.20	49.00	1.40	167	0
14/12/ 2015 - 16:00	18.20	46.60	5.10	174	0
14/12/ 2015 - 17:00	19.20	49.00	1.90	196	0
14/12/ 2015 - 18:00	19.20	55.30	1.70	198	0
14/12/ 2015 - 19:00	19.70	67.60	1.70	197	0
14/12/ 2015 - 20:00	20.30	75.60	1.60	183	0
14/12/ 2015 - 21:00	20.40	81.00	2.10	181	0
14/12/ 2015 - 22:00	20.80	86.00	0.90	148	0
14/12/ 2015 - 23:00	21.20	90.00	0.60	166	0
15/12/ 2015 - 00:00	21.50	92.00	0.40	165	0
15/12/ 2015 - 01:00	21.60	93.00	0.40	169	0
15/12/ 2015 - 02:00	23.60	94.00	0.70	154	0
15/12/ 2015 - 03:00	23.50	95.00	0.40	146	0
15/12/ 2015 - 04:00	23.80	96.00	0.30	147	0
15/12/ 2015 - 05:00	22.60	96.00	0.60	148	0
15/12/ 2015 - 06:00	22.60	96.60	1.10	211	0
15/12/ 2015 - 07:00	22.40	97.00	1.90	161	0
15/12/ 2015 - 08:00	21.60	97.00	2.10	161	0
15/12/ 2015 - 09:00	21.50	95.00	2.20	153	0
15/12/ 2015 - 10:00	20.30	85.00	2.30	141	0
15/12/ 2015 - 11:00	21.60	70.80	2.00	133	0
15/12/ 2015 - 12:00	19.60	54.00	1.90	157	0
15/12/ 2015 - 13:00	19.80	51.00	2.10	156	0
15/12/ 2015 - 14:00	19.70	51.00	2.70	148	0
15/12/ 2015 - 15:00	18.50	49.80	4.70	148	0
15/12/ 2015 - 16:00	18.60	49.00	2.30	182	0
15/12/ 2015 - 17:00	18.20	50.00	1.40	178	0

Date & Time DD/MM/YYYY HH:MM	Air Temperature (°C)	RH (%)	Wind Speed (m/sec)	Wind Direction (°)	Rainfall (mm)
15/12/ 2015 - 18:00	19.36	55.70	1.60	179	0
15/12/ 2015 - 19:00	19.40	68.10	1.40	190	0
15/12/ 2015 - 20:00	20.30	77.40	2.50	216	0
15/12/ 2015 - 21:00	20.10	82.00	1.20	181	0
15/12/ 2015 - 22:00	20.60	85.00	1.10	161	0
15/12/ 2015 - 23:00	21.30	89.00	1.10	179	0
16/12/ 2015 - 00:00	21.00	91.00	2.00	159	0
16/12/ 2015 - 01:00	22.60	93.00	3.40	161	0
16/12/ 2015 - 02:00	23.60	94.00	2.90	156	0
16/12/ 2015 - 03:00	24.50	95.00	1.80	165	0
16/12/ 2015 - 04:00	24.60	96.00	2.40	164	0
16/12/ 2015 - 05:00	24.50	94.50	2.10	166	0
16/12/ 2015 - 06:00	23.60	94.00	2.90	189	0
16/12/ 2015 - 07:00	23.60	94.00	3.70	213	0
16/12/ 2015 - 08:00	23.50	95.00	3.60	168	0
16/12/ 2015 - 09:00	22.10	94.00	2.10	111	0
16/12/ 2015 - 10:00	22.50	85.30	3.40	116	0
16/12/ 2015 - 11:00	22.60	69.00	3.10	143	0
16/12/ 2015 - 12:00	20.30	56.00	3.20	16	0
16/12/ 2015 - 13:00	20.30	52.00	4.10	172	0
16/12/ 2015 - 14:00	20.80	51.00	3.00	17	0
16/12/ 2015 - 15:00	21.00	50.00	2.30	177	0
16/12/ 2015 - 16:00	21.60	51.30	1.00	160	0
16/12/ 2015 - 17:00	21.60	55.00	1.60	187	0
16/12/ 2015 - 18:00	22.60	62.10	2.00	186	0
16/12/ 2015 - 19:00	22.90	72.00	2.30	186	0
16/12/ 2015 - 20:00	23.50	77.00	2.50	181	0
16/12/ 2015 - 21:00	23.50	81.00	2.40	180	0
16/12/ 2015 - 22:00	23.50	85.00	1.30	175	0
16/12/ 2015 - 23:00	24.60	88.40	1.30	180	0
17/12/ 2015 - 00:00	24.50	91.30	1.30	135	0
17/12/ 2015 - 01:00	24.70	94.30	1.50	140	0
17/12/ 2015 - 02:00	26.30	96.00	1.50	142	0
17/12/ 2015 - 03:00	26.35	98.00	0.90	155	0
17/12/ 2015 - 04:00	25.40	99.00	0.90	164	0
17/12/ 2015 - 05:00	25.80	99.00	1.50	163	0
17/12/ 2015 - 06:00	25.90	99.00	1.50	154	0
17/12/ 2015 - 07:00	24.30	99.00	1.20	215	0
17/12/ 2015 - 08:00	24.60	99.00	1.20	254	0
17/12/ 2015 - 09:00	24.50	99.00	1.60	181	0
17/12/ 2015 - 10:00	24.10	97.60	1.00	142	0
17/12/ 2015 - 11:00	23.20	95.00	2.00	231	0
17/12/ 2015 - 12:00	23.10	93.00	2.10	248	0
17/12/ 2015 - 13:00	21.30	89.00	2.10	253	0
17/12/ 2015 - 14:00	21.50	80.50	2.30	295	0
17/12/ 2015 - 15:00	21.60	69.80	2.40	325	0
17/12/ 2015 - 16:00	22.30	66.00	2.50	283	0
17/12/ 2015 - 17:00	22.50	66.60	2.50	277	0
17/12/ 2015 - 18:00	22.60	72.10	2.50	229	0
17/12/ 2015 - 19:00	22.90	80.60	2.60	208	0

Date & Time DD/MM/YYYY HH:MM	Air Temperature (°C)	RH (%)	Wind Speed (m/sec)	Wind Direction (°)	Rainfall (mm)
17/12/ 2015 - 20:00	24.30	87.00	2.60	194	0
17/12/ 2015 - 21:00	24.30	92.00	2.10	256	0
17/12/ 2015 - 22:00	24.60	95.00	2.10	202	0
17/12/ 2015 - 23:00	25.60	96.00	2.30	226	0
18/12/ 2015 - 00:00	25.90	98.00	2.00	198	0
18/12/ 2015 - 01:00	26.30	99.00	2.00	200	0
18/12/ 2015 - 02:00	25.60	99.00	2.00	196	0
18/12/ 2015 - 03:00	25.30	99.00	2.10	304	0
18/12/ 2015 - 04:00	24.30	99.00	1.90	297	0
18/12/ 2015 - 05:00	24.30	99.00	1.90	289	0
18/12/ 2015 - 06:00	24.30	99.00	1.80	275	0
18/12/ 2015 - 07:00	22.30	99.00	1.80	198	0
18/12/ 2015 - 08:00	22.60	99.00	1.70	191	0
18/12/ 2015 - 09:00	22.10	99.00	2.50	244	0
18/12/ 2015 - 10:00	19.30	99.00	2.30	294	0
18/12/ 2015 - 11:00	19.50	99.00	2.30	276	0
18/12/ 2015 - 12:00	19.40	99.00	2.30	242	0
18/12/ 2015 - 13:00	18.30	95.00	2.40	221	0
18/12/ 2015 - 14:00	18.60	86.20	2.30	312	0
18/12/ 2015 - 15:00	18.30	73.30	2.30	322	0
18/12/ 2015 - 16:00	19.30	64.00	2.00	313	0
18/12/ 2015 - 17:00	20.00	64.00	2.20	303	0
18/12/ 2015 - 18:00	20.30	67.40	2.10	209	0
18/12/ 2015 - 19:00	20.30	76.40	2.10	244	0
18/12/ 2015 - 20:00	20.40	85.00	2.10	229	0
18/12/ 2015 - 21:00	21.30	90.00	2.20	209	0
18/12/ 2015 - 22:00	21.30	93.00	2.20	194	0
18/12/ 2015 - 23:00	21.50	95.00	2.20	221	0
19/12/ 2015 - 00:00	22.60	96.30	2.30	180	0
19/12/ 2015 - 01:00	22.60	98.00	2.30	209	0
19/12/ 2015 - 02:00	22.50	99.00	2.30	149	0
19/12/ 2015 - 03:00	22.90	99.00	2.30	151	0
19/12/ 2015 - 04:00	21.30	99.00	2.00	147	0
19/12/ 2015 - 05:00	21.30	99.00	1.80	164	0
19/12/ 2015 - 06:00	19.30	99.00	1.60	131	0
19/12/ 2015 - 07:00	19.50	99.00	1.60	148	0
19/12/ 2015 - 08:00	19.00	99.00	1.60	154	0
19/12/ 2015 - 09:00	19.30	99.00	1.60	171	0
19/12/ 2015 - 10:00	18.20	97.70	2.10	160	0
19/12/ 2015 - 11:00	18.30	90.40	2.10	147	0
19/12/ 2015 - 12:00	18.30	74.60	2.10	173	0
19/12/ 2015 - 13:00	18.00	57.60	2.50	201	0
19/12/ 2015 - 14:00	18.00	55.00	2.50	212	0
19/12/ 2015 - 15:00	18.20	52.00	2.50	190	0
19/12/ 2015 - 16:00	19.30	50.00	2.60	170	0
19/12/ 2015 - 17:00	19.30	52.00	2.60	181	0
19/12/ 2015 - 18:00	19.50	56.70	2.00	177	0
19/12/ 2015 - 19:00	19.25	69.30	2.50	174	0
19/12/ 2015 - 20:00	20.30	79.10	2.50	162	0
19/12/ 2015 - 21:00	20.60	85.00	2.50	244	0

Date & Time DD/MM/YYYY HH:MM	Air Temperature (°C)	RH (%)	Wind Speed (m/sec)	Wind Direction (°)	Rainfall (mm)
19/12/ 2015 - 22:00	20.60	90.00	2.40	210	0
19/12/ 2015 - 23:00	20.40	93.00	2.40	167	0
20/12/ 2015 - 00:00	21.60	95.00	2.30	167	0
20/12/ 2015 - 01:00	21.50	97.00	2.30	152	0
20/12/ 2015 - 02:00	21.00	97.60	2.60	147	0
20/12/ 2015 - 03:00	23.60	98.00	2.60	114	0
20/12/ 2015 - 04:00	23.60	99.00	2.60	150	0
20/12/ 2015 - 05:00	23.60	99.00	2.60	127	0
20/12/ 2015 - 06:00	21.30	99.00	2.50	345	0
20/12/ 2015 - 07:00	21.50	99.00	2.50	154	0
20/12/ 2015 - 08:00	21.60	99.00	2.30	160	0
20/12/ 2015 - 09:00	20.10	99.00	2.00	179	0
20/12/ 2015 - 10:00	19.30	979.00	2.30	114	0
20/12/ 2015 - 11:00	19.30	90.40	2.30	152	0
20/12/ 2015 - 12:00	19.20	76.40	2.10	145	0
20/12/ 2015 - 13:00	17.50	60.90	2.10	150	0
20/12/ 2015 - 14:00	17.20	59.00	2.00	160	0
20/12/ 2015 - 15:00	17.60	59.00	2.00	190	0
20/12/ 2015 - 16:00	17.80	60.00	2.00	180	0
20/12/ 2015 - 17:00	18.20	57.00	2.30	185	0
20/12/ 2015 - 18:00	18.30	59.00	2.20	180	0
20/12/ 2015 - 19:00	18.60	71.00	2.20	180	0
20/12/ 2015 - 20:00	18.90	79.00	2.80	179	0
20/12/ 2015 - 21:00	19.20	84.00	2.80	232	0
20/12/ 2015 - 22:00	19.60	88.00	2.80	180	0
20/12/ 2015 - 23:00	20.30	91.00	2.80	177	0
21/12/ 2015 - 00:00	20.60	94.00	2.80	171	0
21/12/ 2015 - 01:00	20.50	96.00	2.80	169	0
21/12/ 2015 - 02:00	21.30	97.00	2.80	214	0
21/12/ 2015 - 03:00	21.90	98.00	2.60	25	0
21/12/ 2015 - 04:00	22.60	99.00	2.60	134	0
21/12/ 2015 - 05:00	21.30	99.00	2.60	147	0
21/12/ 2015 - 06:00	21.10	99.00	2.10	206	0
21/12/ 2015 - 07:00	21.00	99.00	2.10	216	0
21/12/ 2015 - 08:00	20.80	99.00	1.60	258	0
21/12/ 2015 - 09:00	20.70	99.00	1.60	234	0
21/12/ 2015 - 10:00	20.50	99.00	1.60	138	0
21/12/ 2015 - 11:00	19.30	99.00	1.30	177	0
21/12/ 2015 - 12:00	19.50	97.00	1.30	241	0
21/12/ 2015 - 13:00	19.10	89.20	1.30	297	0
21/12/ 2015 - 14:00	18.30	73.30	1.50	195	0
21/12/ 2015 - 15:00	18.20	60.00	1.50	194	0
21/12/ 2015 - 16:00	18.20	58.00	0.90	217	0
21/12/ 2015 - 17:00	19.20	59.00	0.90	199	0
21/12/ 2015 - 18:00	19.20	63.60	1.50	199	0
21/12/ 2015 - 19:00	19.70	75.90	1.50	208	0
21/12/ 2015 - 20:00	20.30	85.00	1.20	230	0
21/12/ 2015 - 21:00	20.40	90.50	1.20	209	0
21/12/ 2015 - 22:00	20.80	94.00	1.60	183	0
21/12/ 2015 - 23:00	21.20	96.00	1.00	197	0

Date & Time DD/MM/YYYY HH:MM	Air Temperature (°C)	RH (%)	Wind Speed (m/sec)	Wind Direction (°)	Rainfall (mm)
22/12/ 2015 - 00:00	21.50	98.00	2.00	200	0
22/12/ 2015 - 01:00	21.60	99.00	2.10	222	0
22/12/ 2015 - 02:00	23.60	99.00	2.10	186	0
22/12/ 2015 - 03:00	23.50	99.00	2.30	136	0
22/12/ 2015 - 04:00	23.80	99.00	2.40	227	0
22/12/ 2015 - 05:00	22.60	99.00	2.50	208	0
22/12/ 2015 - 06:00	22.60	99.00	2.50	245	0
22/12/ 2015 - 07:00	22.40	99.00	2.50	176	0
22/12/ 2015 - 08:00	21.60	99.00	2.60	167	0
22/12/ 2015 - 09:00	21.50	99.00	2.60	111	0
22/12/ 2015 - 10:00	20.30	99.00	2.10	154	0
22/12/ 2015 - 11:00	21.60	99.00	2.10	161	0
22/12/ 2015 - 12:00	19.60	98.50	2.30	162	0
22/12/ 2015 - 13:00	19.80	90.40	2.00	180	0
22/12/ 2015 - 14:00	19.30	79.30	2.00	203	0
22/12/ 2015 - 15:00	20.10	71.00	2.00	186	0
22/12/ 2015 - 16:00	20.30	69.00	2.10	186	0
22/12/ 2015 - 17:00	20.60	69.50	1.90	259	0
22/12/ 2015 - 18:00	21.60	75.30	1.90	278	0
22/12/ 2015 - 19:00	21.50	82.20	1.80	195	0
22/12/ 2015 - 20:00	21.30	88.10	1.80	175	0
22/12/ 2015 - 21:00	22.30	92.00	1.70	238	0
22/12/ 2015 - 22:00	22.60	95.00	2.50	203	0
22/12/ 2015 - 23:00	22.90	96.70	2.30	205	0
23/12/ 2015 - 00:00	23.60	98.00	2.30	197	0
23/12/ 2015 - 01:00	23.70	99.00	2.30	229	0
23/12/ 2015 - 02:00	23.90	99.00	2.40	281	0
23/12/ 2015 - 03:00	24.50	99.00	2.30	286	0
23/12/ 2015 - 04:00	24.60	99.00	2.30	251	0
23/12/ 2015 - 05:00	23.60	99.00	2.00	267	0
23/12/ 2015 - 06:00	23.30	99.00	2.20	204	0
23/12/ 2015 - 07:00	22.40	99.00	2.10	264	0
23/12/ 2015 - 08:00	22.10	99.00	2.10	194	0
23/12/ 2015 - 09:00	22.00	99.00	2.10	129	0
23/12/ 2015 - 10:00	19.80	99.00	2.20	167	0
23/12/ 2015 - 11:00	19.40	99.00	2.20	133	0
23/12/ 2015 - 12:00	19.20	99.00	2.20	176	0
23/12/ 2015 - 13:00	18.20	99.00	2.30	220	0
23/12/ 2015 - 14:00	18.10	98.00	2.30	274	0
23/12/ 2015 - 15:00	18.00	90.00	2.30	314	0
23/12/ 2015 - 16:00	19.30	75.40	2.30	299	0
23/12/ 2015 - 17:00	19.40	71.90	2.00	303	0
23/12/ 2015 - 18:00	19.50	76.20	1.80	208	0
23/12/ 2015 - 19:00	20.30	84.00	1.60	197	0
23/12/ 2015 - 20:00	20.60	90.10	1.60	226	0
23/12/ 2015 - 21:00	20.60	94.00	1.60	212	0
23/12/ 2015 - 22:00	21.50	97.00	1.60	248	0
23/12/ 2015 - 23:00	21.60	98.50	2.10	232	0
24/12/ 2015 - 00:00	21.90	99.00	2.10	260	0
24/12/ 2015 - 01:00	23.60	99.00	2.10	263	0

Date & Time DD/MM/YYYY HH:MM	Air Temperature (°C)	RH (%)	Wind Speed (m/sec)	Wind Direction (°)	Rainfall (mm)
24/12/ 2015 - 02:00	23.80	99.00	2.50	212	0
24/12/ 2015 - 03:00	23.90	99.00	2.50	194	0
24/12/ 2015 - 04:00	22.30	99.00	2.50	207	0
24/12/ 2015 - 05:00	22.60	99.00	2.60	237	0
24/12/ 2015 - 06:00	21.70	99.00	2.60	218	0
24/12/ 2015 - 07:00	21.60	99.00	2.00	166	0
24/12/ 2015 - 08:00	21.30	99.00	2.50	236	0
24/12/ 2015 - 09:00	21.20	99.00	2.50	195	0
24/12/ 2015 - 10:00	20.30	99.00	2.50	202	0
24/12/ 2015 - 11:00	20.20	99.00	2.40	162	0
24/12/ 2015 - 12:00	20.00	97.00	2.40	206	0
24/12/ 2015 - 13:00	19.60	88.40	2.30	263	0
24/12/ 2015 - 14:00	19.50	71.80	2.30	223	0
24/12/ 2015 - 15:00	19.20	62.70	2.60	232	0
24/12/ 2015 - 16:00	20.60	60.00	2.60	279	0
24/12/ 2015 - 17:00	20.50	60.00	2.60	313	0
24/12/ 2015 - 18:00	20.10	66.20	2.60	202	0
24/12/ 2015 - 19:00	21.80	78.20	2.50	183	0
24/12/ 2015 - 20:00	21.50	86.40	2.50	169	0
24/12/ 2015 - 21:00	21.60	91.40	2.30	165	0
24/12/ 2015 - 22:00	22.30	95.00	2.00	175	0
24/12/ 2015 - 23:00	22.60	97.00	2.30	277	0
25/12/ 2015 - 00:00	22.40	98.00	2.30	312	0
25/12/ 2015 - 01:00	23.50	99.00	2.10	281	0
25/12/ 2015 - 02:00	23.60	99.00	2.10	255	0
25/12/ 2015 - 03:00	23.70	99.00	2.00	230	0
25/12/ 2015 - 04:00	24.50	99.00	2.00	210	0
25/12/ 2015 - 05:00	24.50	99.00	2.00	278	0
25/12/ 2015 - 06:00	24.20	99.00	2.30	274	0
25/12/ 2015 - 07:00	23.80	99.00	2.20	208	0
25/12/ 2015 - 08:00	23.70	99.00	2.20	213	0
25/12/ 2015 - 09:00	23.40	99.00	2.80	161	0
25/12/ 2015 - 10:00	22.60	99.00	2.80	161	0
25/12/ 2015 - 11:00	22.50	98.80	2.80	106	0
25/12/ 2015 - 12:00	22.40	90.90	2.80	276	0
25/12/ 2015 - 13:00	22.30	75.80	2.80	190	0
25/12/ 2015 - 14:00	21.30	63.00	2.80	154	0
25/12/ 2015 - 15:00	21.20	56.60	2.80	189	0
25/12/ 2015 - 16:00	21.20	53.40	2.60	190	0
25/12/ 2015 - 17:00	22.30	56.00	2.60	172	0
25/12/ 2015 - 18:00	22.60	58.10	2.60	187	0
25/12/ 2015 - 19:00	22.60	66.70	2.10	182	0
25/12/ 2015 - 20:00	22.80	77.00	2.10	188	0
25/12/ 2015 - 21:00	23.50	84.00	1.60	173	0
25/12/ 2015 - 22:00	23.50	88.40	1.60	198	0
25/12/ 2015 - 23:00	24.60	91.00	1.60	188	0
26/12/ 2015 - 00:00	24.50	94.00	1.30	269	0
26/12/ 2015 - 01:00	24.30	95.30	1.30	273	0
26/12/ 2015 - 02:00	25.30	97.00	1.30	254	0
26/12/ 2015 - 03:00	25.10	98.00	1.50	307	0

Date & Time DD/MM/YYYY HH:MM	Air Temperature (°C)	RH (%)	Wind Speed (m/sec)	Wind Direction (°)	Rainfall (mm)
26/12/ 2015 - 04:00	25.00	99.00	1.50	255	0
26/12/ 2015 - 05:00	24.80	99.00	0.90	223	0
26/12/ 2015 - 06:00	24.60	99.00	0.90	260	0
26/12/ 2015 - 07:00	24.30	99.00	1.50	208	0
26/12/ 2015 - 08:00	23.30	99.00	1.50	114	0
26/12/ 2015 - 09:00	22.10	99.00	1.20	161	0
26/12/ 2015 - 10:00	22.00	98.60	1.20	173	0
26/12/ 2015 - 11:00	21.60	98.70	1.60	226	0
26/12/ 2015 - 12:00	21.30	97.60	1.00	152	0
26/12/ 2015 - 13:00	19.30	96.40	2.00	152	0
26/12/ 2015 - 14:00	19.20	95.60	2.10	164	0
26/12/ 2015 - 15:00	19.10	89.10	2.10	194	0
26/12/ 2015 - 16:00	20.70	87.60	2.30	145	0
26/12/ 2015 - 17:00	20.60	85.60	2.40	136	0
26/12/ 2015 - 18:00	20.50	82.30	2.50	148	0
26/12/ 2015 - 19:00	21.40	80.30	2.50	151	0
26/12/ 2015 - 20:00	21.50	81.40	2.50	218	0
26/12/ 2015 - 21:00	22.40	79.00	2.60	219	0
26/12/ 2015 - 22:00	22.50	86.00	2.60	237	0
26/12/ 2015 - 23:00	22.60	91.00	2.10	224	0
27/12/ 2015 - 00:00	23.40	94.00	2.10	177	0
27/12/ 2015 - 01:00	23.50	96.00	2.30	142	0
27/12/ 2015 - 02:00	25.30	98.00	2.00	215	0
27/12/ 2015 - 03:00	25.20	99.00	2.00	175	0
27/12/ 2015 - 04:00	25.10	99.00	2.00	210	0
27/12/ 2015 - 05:00	24.30	99.00	2.10	44	0
27/12/ 2015 - 06:00	23.50	99.00	1.90	173	0
27/12/ 2015 - 07:00	23.60	99.00	1.90	209	0
27/12/ 2015 - 08:00	22.10	99.00	1.80	188	0
27/12/ 2015 - 09:00	22.00	99.00	1.80	141	0
27/12/ 2015 - 10:00	22.00	99.00	1.70	133	0
27/12/ 2015 - 11:00	20.60	99.00	2.50	143	0
27/12/ 2015 - 12:00	19.60	92.20	2.30	136	0
27/12/ 2015 - 13:00	19.60	72.50	2.30	156	0
27/12/ 2015 - 14:00	18.50	53.70	2.30	137	0
27/12/ 2015 - 15:00	18.60	48.60	2.40	172	0
27/12/ 2015 - 16:00	19.60	46.60	2.30	159	0
27/12/ 2015 - 17:00	19.70	46.00	2.30	179	0
27/12/ 2015 - 18:00	19.40	55.00	2.00	175	0
27/12/ 2015 - 19:00	20.30	67.50	2.20	202	0
27/12/ 2015 - 20:00	20.20	78.20	2.10	234	0
27/12/ 2015 - 21:00	20.00	84.00	2.10	196	0
27/12/ 2015 - 22:00	21.50	89.40	2.10	247	0
27/12/ 2015 - 23:00	21.60	93.00	2.20	324	0
28/12/ 2015 - 00:00	21.60	95.00	2.20	142	0
28/12/ 2015 - 01:00	22.30	97.00	2.20	221	0
28/12/ 2015 - 02:00	22.30	98.00	2.30	254	0
28/12/ 2015 - 03:00	23.50	99.00	2.30	120	0
28/12/ 2015 - 04:00	23.60	99.00	2.30	154	0
28/12/ 2015 - 05:00	23.40	99.00	2.30	170	0

Date & Time DD/MM/YYYY HH:MM	Air Temperature (°C)	RH (%)	Wind Speed (m/sec)	Wind Direction (°)	Rainfall (mm)
28/12/ 2015 - 06:00	22.70	99.00	2.00	146	0
28/12/ 2015 - 07:00	22.60	99.00	1.80	180	0
28/12/ 2015 - 08:00	22.30	99.00	1.60	151	0
28/12/ 2015 - 09:00	22.20	99.00	1.60	182	0
28/12/ 2015 - 10:00	21.50	99.00	1.60	203	0
28/12/ 2015 - 11:00	20.30	99.00	1.60	189	0
28/12/ 2015 - 12:00	20.50	93.60	2.10	164	0
28/12/ 2015 - 13:00	19.40	84.50	2.10	227	0
28/12/ 2015 - 14:00	19.30	70.00	2.10	223	0
28/12/ 2015 - 15:00	19.10	63.20	2.50	135	0
28/12/ 2015 - 16:00	18.80	62.00	2.50	187	0
28/12/ 2015 - 17:00	19.60	63.00	2.50	200	0
28/12/ 2015 - 18:00	20.40	68.30	2.60	223	0
28/12/ 2015 - 19:00	20.50	77.70	2.60	222	0
28/12/ 2015 - 20:00	20.60	85.00	2.00	205	0
28/12/ 2015 - 21:00	21.70	90.20	2.50	219	0
28/12/ 2015 - 22:00	21.50	93.00	2.50	219	0
28/12/ 2015 - 23:00	22.60	96.00	2.50	259	0
29/12/ 2015 - 00:00	22.10	97.00	2.40	250	0
29/12/ 2015 - 01:00	23.50	98.00	2.40	223	0
29/12/ 2015 - 02:00	23.60	99.00	2.30	248	0
29/12/ 2015 - 03:00	24.10	99.00	2.30	255	0
29/12/ 2015 - 04:00	24.00	99.00	2.60	191	0
29/12/ 2015 - 05:00	23.00	99.00	2.60	283	0
29/12/ 2015 - 06:00	22.40	99.00	2.60	226	0
29/12/ 2015 - 07:00	22.50	99.00	2.60	244	0
29/12/ 2015 - 08:00	21.30	99.00	2.50	196	0
29/12/ 2015 - 09:00	21.10	99.00	2.50	224	0
29/12/ 2015 - 10:00	19.50	99.00	2.30	171	0
29/12/ 2015 - 11:00	19.20	99.00	2.00	165	0
29/12/ 2015 - 12:00	18.50	94.10	2.30	257	0
29/12/ 2015 - 13:00	18.20	85.10	2.30	274	0
29/12/ 2015 - 14:00	17.20	68.30	2.10	246	0
29/12/ 2015 - 15:00	17.60	61.00	2.10	310	0
29/12/ 2015 - 16:00	17.80	59.00	2.00	291	0
29/12/ 2015 - 17:00	18.20	60.00	2.00	266	0
29/12/ 2015 - 18:00	18.30	67.20	2.00	215	0
29/12/ 2015 - 19:00	18.60	78.10	2.30	193	0
29/12/ 2015 - 20:00	18.90	86.20	2.20	186	0
29/12/ 2015 - 21:00	19.20	91.30	2.20	185	0
29/12/ 2015 - 22:00	19.60	94.30	2.80	200	0
29/12/ 2015 - 23:00	20.30	97.00	2.80	193	0
30/12/ 2015 - 00:00	20.60	98.00	2.80	184	0
30/12/ 2015 - 01:00	20.50	99.00	2.80	285	0
30/12/ 2015 - 02:00	21.30	99.00	2.80	254	0
30/12/ 2015 - 03:00	21.90	99.00	2.80	224	0
30/12/ 2015 - 04:00	22.60	99.00	2.80	219	0
30/12/ 2015 - 05:00	21.30	99.00	2.60	232	0
30/12/ 2015 - 06:00	21.10	99.00	2.60	215	0
30/12/ 2015 - 07:00	21.00	99.00	2.60	259	0

Date & Time DD/MM/YYYY HH:MM	Air Temperature (°C)	RH (%)	Wind Speed (m/sec)	Wind Direction (°)	Rainfall (mm)
30/12/ 2015 - 08:00	20.80	99.00	2.10	114	0
30/12/ 2015 - 09:00	20.70	99.00	2.10	213	0
30/12/ 2015 - 10:00	20.50	99.00	1.60	236	0
30/12/ 2015 - 11:00	19.30	96.20	1.60	195	0
30/12/ 2015 - 12:00	19.50	87.60	1.60	271	0
30/12/ 2015 - 13:00	19.10	66.20	1.30	274	0
30/12/ 2015 - 14:00	18.30	66.80	1.30	339	0
30/12/ 2015 - 15:00	18.20	54.00	1.30	269	0
30/12/ 2015 - 16:00	18.20	53.00	1.50	329	0
30/12/ 2015 - 17:00	19.20	56.90	1.50	318	0
30/12/ 2015 - 18:00	19.20	65.30	0.90	192	0
30/12/ 2015 - 19:00	19.70	73.80	0.90	179	0
30/12/ 2015 - 20:00	20.30	83.20	1.50	192	0
30/12/ 2015 - 21:00	20.40	90.00	1.50	192	0
30/12/ 2015 - 22:00	20.80	93.00	1.20	156	0
30/12/ 2015 - 23:00	21.20	96.00	1.20	191	0
31/12/ 2015 - 00:00	21.50	98.00	1.60	235	0
31/12/ 2015 - 01:00	21.60	99.00	1.00	278	0
31/12/ 2015 - 02:00	23.60	99.00	2.00	269	0
31/12/ 2015 - 03:00	23.50	99.00	2.10	316	0
31/12/ 2015 - 04:00	23.80	99.00	2.10	225	0
31/12/ 2015 - 05:00	22.60	99.00	2.30	206	0
31/12/ 2015 - 06:00	22.60	99.00	2.40	198	0
31/12/ 2015 - 07:00	22.40	99.00	2.50	170	0
31/12/ 2015 - 08:00	21.60	99.00	2.50	187	0
31/12/ 2015 - 09:00	21.50	99.00	2.50	180	0
31/12/ 2015 - 10:00	20.30	99.00	2.60	165	0
31/12/ 2015 - 11:00	21.60	96.80	2.60	193	0
31/12/ 2015 - 12:00	19.60	88.30	2.10	155	0
31/12/ 2015 - 13:00	19.80	74.20	2.10	250	0
31/12/ 2015 - 14:00	19.60	66.00	2.30	251	0
31/12/ 2015 - 15:00	19.20	63.50	2.00	286	0
31/12/ 2015 - 16:00	19.10	61.00	2.00	10	0
31/12/ 2015 - 17:00	20.60	63.00	2.00	309	0
31/12/ 2015 - 18:00	20.50	67.10	2.10	296	0
31/12/ 2015 - 19:00	20.40	74.00	1.90	223	0
31/12/ 2015 - 20:00	20.30	81.50	1.90	172	0
31/12/ 2015 - 21:00	21.40	88.00	1.80	240	0
31/12/ 2015 - 22:00	21.50	78.40	1.80	184	0
31/12/ 2015 - 23:00	21.60	78.90	1.70	234	0
01/01/ 2016 - 00:00	22.30	77.50	2.50	229	0
01/01/ 2016 - 01:00	22.30	76.10	2.30	301	0
01/01/ 2016 - 02:00	24.50	76.80	2.30	270	0
01/01/ 2016 - 03:00	24.60	75.10	2.30	282	0
01/01/ 2016 - 04:00	23.50	75.80	2.40	314	0
01/01/ 2016 - 05:00	23.40	74.80	2.30	210	0
01/01/ 2016 - 06:00	23.20	73.20	2.30	218	0
01/01/ 2016 - 07:00	23.10	74.50	2.00	192	0
01/01/ 2016 - 08:00	22.60	72.10	2.20	161	0
01/01/ 2016 - 09:00	22.50	72.60	2.10	126	0

Date & Time DD/MM/YYYY HH:MM	Air Temperature (°C)	RH (%)	Wind Speed (m/sec)	Wind Direction (°)	Rainfall (mm)
01/01/ 2016 - 10:00	22.30	72.90	2.10	112	0
01/01/ 2016 - 11:00	21.50	71.30	2.10	155	0
01/01/ 2016 - 12:00	20.60	71.80	2.20	126	0
01/01/ 2016 - 13:00	20.50	70.50	2.20	168	0
01/01/ 2016 - 14:00	19.70	69.30	2.20	182	0
01/01/ 2016 - 15:00	18.70	68.40	2.30	184	0
01/01/ 2016 - 16:00	18.60	68.70	2.30	168	0
01/01/ 2016 - 17:00	18.50	67.30	2.30	167	0
01/01/ 2016 - 18:00	18.40	66.20	2.30	162	0
01/01/ 2016 - 19:00	18.90	66.00	2.00	190	0
01/01/ 2016 - 20:00	19.70	65.70	1.80	220	0
01/01/ 2016 - 21:00	19.80	67.30	1.60	222	0
01/01/ 2016 - 22:00	20.40	68.10	1.60	221	0
01/01/ 2016 - 23:00	20.50	68.40	1.60	248	0
02/01/ 2016 - 00:00	20.60	69.40	1.60	220	0
02/01/ 2016 - 01:00	21.30	69.80	2.10	174	0
02/01/ 2016 - 02:00	22.60	70.10	2.10	173	0
02/01/ 2016 - 03:00	22.30	71.60	2.10	173	0
02/01/ 2016 - 04:00	22.10	84.50	2.50	172	0
02/01/ 2016 - 05:00	21.60	70.00	2.50	150	0
02/01/ 2016 - 06:00	21.50	63.20	2.50	156	0
02/01/ 2016 - 07:00	21.40	62.00	2.60	146	0
02/01/ 2016 - 08:00	20.80	63.00	2.60	123	0
02/01/ 2016 - 09:00	20.70	68.30	2.00	163	0
02/01/ 2016 - 10:00	20.40	77.70	2.50	159	0
02/01/ 2016 - 11:00	19.60	78.40	2.50	155	0
02/01/ 2016 - 12:00	19.50	78.20	1.20	132	0
02/01/ 2016 - 13:00	19.40	79.30	1.20	114	0
02/01/ 2016 - 14:00	18.20	79.50	2.40	118	0
02/01/ 2016 - 15:00	18.10	80.30	1.90	126	0
02/01/ 2016 - 16:00	18.30	80.90	3.20	101	0
02/01/ 2016 - 17:00	19.60	81.30	2.10	139	0
02/01/ 2016 - 18:00	19.70	81.60	3.60	137	0
02/01/ 2016 - 19:00	20.40	82.40	3.40	219	0
02/01/ 2016 - 20:00	20.30	81.70	2.80	244	0
02/01/ 2016 - 21:00	20.10	80.30	3.90	264	0
02/01/ 2016 - 22:00	21.60	79.40	4.20	202	0
02/01/ 2016 - 23:00	21.70	79.80	3.90	210	0
03/01/ 2016 - 00:00	22.40	78.10	4.10	167	0
03/01/ 2016 - 01:00	22.30	77.60	4.90	149	0
03/01/ 2016 - 02:00	24.50	76.40	4.60	169	0
03/01/ 2016 - 03:00	24.60	77.60	5.30	160	0
03/01/ 2016 - 04:00	24.50	76.60	3.80	152	0
03/01/ 2016 - 05:00	23.60	77.90	3.10	147	0
03/01/ 2016 - 06:00	23.50	78.10	2.50	161	0
03/01/ 2016 - 07:00	23.10	79.10	1.40	150	0
03/01/ 2016 - 08:00	22.30	80.20	5.30	146	0
03/01/ 2016 - 09:00	22.10	81.30	2.20	173	0
03/01/ 2016 - 10:00	22.00	82.10	2.20	176	0
03/01/ 2016 - 11:00	21.70	79.10	2.80	176	0

Date & Time DD/MM/YYYY HH:MM	Air Temperature (°C)	RH (%)	Wind Speed (m/sec)	Wind Direction (°)	Rainfall (mm)
03/01/ 2016 - 12:00	20.50	79.40	2.80	173	0
03/01/ 2016 - 13:00	20.40	79.60	2.80	183	0
03/01/ 2016 - 14:00	19.50	79.40	2.80	187	0
03/01/ 2016 - 15:00	19.60	78.10	2.80	172	0
03/01/ 2016 - 16:00	19.90	77.60	2.80	169	0
03/01/ 2016 - 17:00	20.50	76.20	2.80	178	0
03/01/ 2016 - 18:00	20.30	79.60	2.60	191	0
03/01/ 2016 - 19:00	20.10	77.30	2.60	192	0
03/01/ 2016 - 20:00	21.50	80.30	2.60	121	0
03/01/ 2016 - 21:00	21.50	80.90	2.10	147	0
03/01/ 2016 - 22:00	23.60	79.40	2.10	156	0
03/01/ 2016 - 23:00	23.50	78.60	1.60	163	0
04/01/ 2016 - 00:00	23.10	77.80	1.60	169	0
04/01/ 2016 - 01:00	24.50	76.10	1.60	158	0
04/01/ 2016 - 02:00	24.90	75.10	1.30	155	0
04/01/ 2016 - 03:00	25.30	74.30	1.30	133	0
04/01/ 2016 - 04:00	24.80	73.10	1.30	134	0
04/01/ 2016 - 05:00	24.80	74.60	1.50	156	0
04/01/ 2016 - 06:00	23.60	78.40	1.50	157	0
04/01/ 2016 - 07:00	23.40	78.90	0.90	153	0
04/01/ 2016 - 08:00	23.20	76.40	0.90	192	0
04/01/ 2016 - 09:00	21.00	76.20	1.50	197	0
04/01/ 2016 - 10:00	19.30	76.10	1.50	194	0
04/01/ 2016 - 11:00	19.30	75.10	1.20	258	0
04/01/ 2016 - 12:00	19.20	74.80	1.20	259	0
04/01/ 2016 - 13:00	18.50	73.50	1.60	226	0
04/01/ 2016 - 14:00	17.20	73.20	1.00	229	0
04/01/ 2016 - 15:00	17.60	74.50	2.00	302	0
04/01/ 2016 - 16:00	17.80	72.60	2.10	289	0
04/01/ 2016 - 17:00	18.20	71.80	2.10	244	0
04/01/ 2016 - 18:00	18.30	72.90	2.30	228	0
04/01/ 2016 - 19:00	18.60	71.60	2.40	245	0
04/01/ 2016 - 20:00	18.90	69.80	2.50	250	0
04/01/ 2016 - 21:00	19.20	70.60	2.50	197	0
04/01/ 2016 - 22:00	19.60	69.10	2.50	141	0
04/01/ 2016 - 23:00	20.30	68.40	2.60	170	0
05/01/ 2016 - 00:00	20.60	68.40	2.60	166	0
05/01/ 2016 - 01:00	20.50	67.30	2.10	157	0
05/01/ 2016 - 02:00	21.30	66.40	2.10	145	0
05/01/ 2016 - 03:00	21.90	68.50	2.30	148	0
05/01/ 2016 - 04:00	22.60	65.90	2.00	150	0
05/01/ 2016 - 05:00	21.30	67.40	2.00	155	0
05/01/ 2016 - 06:00	21.10	68.70	2.00	149	0
05/01/ 2016 - 07:00	21.00	68.40	2.10	157	0
05/01/ 2016 - 08:00	20.80	80.30	1.90	158	0
05/01/ 2016 - 09:00	20.70	79.60	1.90	156	0
05/01/ 2016 - 10:00	20.50	77.40	1.80	164	0
05/01/ 2016 - 11:00	19.30	71.00	1.80	164	0
05/01/ 2016 - 12:00	19.50	77.00	1.70	167	0
05/01/ 2016 - 13:00	19.10	80.00	2.50	212	0

Date & Time DD/MM/YYYY HH:MM	Air Temperature (°C)	RH (%)	Wind Speed (m/sec)	Wind Direction (°)	Rainfall (mm)
05/01/ 2016 - 14:00	18.30	86.30	2.30	275	0
05/01/ 2016 - 15:00	18.20	89.00	2.30	302	0
05/01/ 2016 - 16:00	18.20	90.00	2.30	114	0
05/01/ 2016 - 17:00	19.20	91.00	2.40	307	0
05/01/ 2016 - 18:00	19.20	92.00	2.30	193	0
05/01/ 2016 - 19:00	19.70	93.00	2.30	197	0
05/01/ 2016 - 20:00	20.30	93.40	2.00	194	0
05/01/ 2016 - 21:00	20.40	89.60	2.20	186	0
05/01/ 2016 - 22:00	20.80	87.60	2.10	170	0
05/01/ 2016 - 23:00	21.20	88.60	2.10	197	0
06/01/ 2016 - 00:00	21.50	85.30	2.10	191	0
06/01/ 2016 - 01:00	21.60	80.30	2.20	156	0
06/01/ 2016 - 02:00	23.60	78.40	2.20	170	0
06/01/ 2016 - 03:00	23.50	80.30	2.20	164	0
06/01/ 2016 - 04:00	23.80	80.40	2.30	183	0
06/01/ 2016 - 05:00	22.60	68.10	2.30	179	0
06/01/ 2016 - 06:00	22.60	78.30	2.30	126	0
06/01/ 2016 - 07:00	22.40	71.30	2.30	147	0
06/01/ 2016 - 08:00	21.60	68.30	2.00	159	0
06/01/ 2016 - 09:00	21.50	67.60	1.80	153	0
06/01/ 2016 - 10:00	20.30	66.10	1.60	147	0
06/01/ 2016 - 11:00	21.60	73.00	1.60	184	0
06/01/ 2016 - 12:00	19.60	79.00	1.60	176	0
06/01/ 2016 - 13:00	19.80	79.40	1.60	211	0
06/01/ 2016 - 14:00	17.20	80.10	3.40	192	0
06/01/ 2016 - 15:00	17.60	81.60	1.70	294	0
06/01/ 2016 - 16:00	17.80	81.70	3.30	238	0
06/01/ 2016 - 17:00	18.20	82.60	3.50	247	0
06/01/ 2016 - 18:00	18.30	82.10	4.20	232	0
06/01/ 2016 - 19:00	18.60	79.40	1.40	216	0
06/01/ 2016 - 20:00	18.90	78.60	4.20	192	0
06/01/ 2016 - 21:00	19.20	77.50	3.90	167	0
06/01/ 2016 - 22:00	19.60	76.10	1.20	171	0
06/01/ 2016 - 23:00	20.30	76.50	1.30	147	0
07/01/ 2016 - 00:00	20.60	77.45	2.60	216	0
07/01/ 2016 - 01:00	20.50	78.40	4.10	192	0
07/01/ 2016 - 02:00	21.30	79.00	4.20	155	0
07/01/ 2016 - 03:00	21.90	80.60	4.30	159	0
07/01/ 2016 - 04:00	22.60	81.20	3.80	147	0
07/01/ 2016 - 05:00	21.30	82.10	6.00	162	0
07/01/ 2016 - 06:00	21.10	80.60	4.60	159	0
07/01/ 2016 - 07:00	21.00	79.40	4.40	129	0
07/01/ 2016 - 08:00	20.80	78.60	3.70	155	0
07/01/ 2016 - 09:00	20.70	78.50	3.10	155	0
07/01/ 2016 - 10:00	20.50	77.40	1.70	159	0
07/01/ 2016 - 11:00	19.30	76.80	2.50	147	0
07/01/ 2016 - 12:00	19.50	75.40	2.30	200	0
07/01/ 2016 - 13:00	19.10	74.30	2.00	159	0
07/01/ 2016 - 14:00	18.30	76.40	2.30	129	0
07/01/ 2016 - 15:00	18.20	78.60	2.30	155	0

Date & Time DD/MM/YYYY HH:MM	Air Temperature (°C)	RH (%)	Wind Speed (m/sec)	Wind Direction (°)	Rainfall (mm)
07/01/ 2016 - 16:00	18.20	75.60	2.10	337	0
07/01/ 2016 - 17:00	19.20	74.90	2.10	197	0
07/01/ 2016 - 18:00	19.20	75.20	2.00	228	0
07/01/ 2016 - 19:00	19.70	75.70	2.00	182	0
07/01/ 2016 - 20:00	20.30	76.40	2.00	284	0
07/01/ 2016 - 21:00	20.40	75.60	2.30	76	0
07/01/ 2016 - 22:00	20.80	74.30	2.20	337	0
07/01/ 2016 - 23:00	21.20	72.80	2.20	197	0
08/01/ 2016 - 00:00	21.50	73.00	2.80	196	0
08/01/ 2016 - 01:00	21.60	73.60	2.80	196	0
08/01/ 2016 - 02:00	23.60	74.60	2.80	193	0
08/01/ 2016 - 03:00	23.50	75.60	2.80	192	0
08/01/ 2016 - 04:00	23.80	76.10	2.80	189	0
08/01/ 2016 - 05:00	22.60	76.20	2.80	189	0
08/01/ 2016 - 06:00	22.60	77.80	2.80	200	0
08/01/ 2016 - 07:00	22.40	79.40	2.60	192	0
08/01/ 2016 - 08:00	21.60	80.30	2.60	182	0
08/01/ 2016 - 09:00	21.50	81.10	2.60	181	0
08/01/ 2016 - 10:00	20.30	81.60	2.10	180	0
08/01/ 2016 - 11:00	21.60	82.30	2.10	202	0
08/01/ 2016 - 12:00	19.60	82.60	1.60	212	0
08/01/ 2016 - 13:00	19.80	84.60	1.20	269	0
08/01/ 2016 - 14:00	13.40	61.73	0.90	233	0
08/01/ 2016 - 15:00	12.40	63.87	0.60	253	0
08/01/ 2016 - 16:00	12.60	71.11	0.50	257	0
08/01/ 2016 - 17:00	13.50	76.66	0.80	193	0
08/01/ 2016 - 18:00	15.40	78.21	0.30	186	0
08/01/ 2016 - 19:00	16.50	83.55	0.20	172	0
08/01/ 2016 - 20:00	18.40	82.11	0.70	156	0
08/01/ 2016 - 21:00	19.40	95.99	0.90	144	0
08/01/ 2016 - 22:00	20.40	96.66	1.00	142	0
08/01/ 2016 - 23:00	23.50	96.95	1.10	140	0
09/01/ 2016 - 00:00	26.10	97.27	0.90	138	0
09/01/ 2016 - 01:00	28.90	96.49	0.30	137	0
09/01/ 2016 - 02:00	30.10	96.4	0.80	137	0
09/01/ 2016 - 03:00	33.40	95.85	0.40	143	0
09/01/ 2016 - 04:00	31.50	91.46	0.60	147	0
09/01/ 2016 - 05:00	29.60	85.91	0.50	135	0
09/01/ 2016 - 06:00	27.60	72.15	0.50	134	0
09/01/ 2016 - 07:00	24.10	68.68	0.80	152	0
09/01/ 2016 - 08:00	18.30	59.37	0.90	164	0
09/01/ 2016 - 09:00	17.40	52.69	0.70	126	0
09/01/ 2016 - 10:00	16.50	53.12	1.20	142	0
09/01/ 2016 - 11:00	15.30	43.81	1.30	142	0
09/01/ 2016 - 12:00	14.20	51.26	1.20	151	0
09/01/ 2016 - 13:00	14.50	52.30	1.40	159	0
09/01/ 2016 - 14:00	13.20	64.57	1.30	161	0

ANNEX 4.4 ON SITE AIR QUALITY MONITORING RESULTS

Table-A.4.4.1 On-Site Ambient Air Quality Monitoring Results

SN	Date	AAQMS Code	Location	PM10 ($\mu g/m^3$)	PM2.5 ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	CO (mg/m^3)
1.	02.01.2015	AQ1	Kenkere	16	56	7.6	20	0.60
2.	12.12.2015	AQ1	Kenkere	12	60	9.8	15	0.65
3.	15.12.2015	AQ1	Kenkere	17	66	6.5	18	0.70
4.	19.12.2015	AQ1	Kenkere	15	58	10.2	14	0.66
5.	22.12.2015	AQ2	Devalapura	15	60	15.4	22	0.38
6.	26.12.2015	AQ2	Devalapura	16.4	66	12.2	28	0.45
7.	29.12.2015	AQ2	Devalapura	11.6	58	10.9	24	0.44
8.	02.01.2015	AQ2	Devalapura	14.2	56	10.6	30	0.37
9.	10.12.2015	AQ3	Nagamangala	20	66	8.8	24	0.53
10.	13.12.2015	AQ3	Nagamangala	16	72	11.6	30	0.64
11.	17.12.2015	AQ3	Nagamangala	13	68	9.4	26	0.61
12.	20.12.2015	AQ3	Nagamangala	18	80	10.7	22	0.68
13.	24.12.2015	AQ3	Nagamangala	22	66	12.2	28	0.62
14.	27.12.2015	AQ3	Nagamangala	12	77	11.6	26	0.57
15.	31.12.2015	AQ3	Nagamangala	17	70	12.5	32	0.63
16.	03.01.2016	AQ3	Nagamangala	15	78	13.8	24	0.59
17.	08.12.2015	AQ4	Kommenahalli	14	48	8.6	22	0.36
18.	12.12.2015	AQ4	Kommenahalli	12	42	11.3	26	0.42
19.	15.12.2015	AQ4	Kommenahalli	16	55	9.4	32	0.38
20.	19.12.2015	AQ4	Kommenahalli	13	50	8.8	24	0.32
21.	22.12.2015	AQ4	Kommenahalli	15	56	10.6	30	0.37
22.	26.12.2015	AQ4	Kommenahalli	18	60	8.2	27	0.35
23.	29.12.2015	AQ4	Kommenahalli	14	54	12.6	25	0.45
24.	02.01.2016	AQ4	Kommenahalli	12	46	11.2	28	0.41
25.	10.12.2015	AQ5	Ramanathapura	12	54	8.6	20	0.44
26.	13.12.2015	AQ5	Ramanathapura	11	48	7.4	16	0.32
27.	17.12.2015	AQ5	Ramanathapura	13	50	9.2	12	0.36
28.	20.12.2015	AQ5	Ramanathapura	16	56	11.8	22	0.46
29.	24.12.2015	AQ6	Bheriya	12	46	6	18	0.42
30.	27.12.2015	AQ6	Bheriya	10	40	6.5	20	0.39
31.	31.12.2015	AQ6	Bheriya	9.5	38	7.2	24	0.41
32.	03.01.2016	AQ6	Bheriya	14	44	8.5	16	0.44
33.	08.12.2015	AQ7	Siddapura	14	60	9	22	0.33
34.	12.12.2015	AQ7	Siddapura	10	46	6.2	19	0.40
35.	15.12.2015	AQ7	Siddapura	17	54	9.8	16	0.39
36.	19.12.2015	AQ7	Siddapura	11	40	6.5	12	0.34
37.	22.12.2015	AQ8	Konanur	13	36	10.6	14	0.37
38.	26.12.2015	AQ8	Konanur	18	50	8.2	20	0.35
39.	29.12.2015	AQ8	Konanur	14	42	11.4	12	0.31
40.	02.01.2016	AQ8	Konanur	11	48	9.8	18	0.39

ANNEX 4.5 CHAINAGE WISE DETAILS OF EXISTING TREES

Table - A.4.5.1 Chainage wise Number of Existing Trees on LHS

Table - A.4.5.1 Chainage wise Number of Existing Trees on LHS

Chainage		Side	No of Trees in Girth Class (in cm)					Total	Predominant Species Observed
From	To		<30	31-59	60-119	120-180	>180		
52+000	53+000	LHS	12	17	9	3	11	52	Arjin, Banyan, Silver Oak
53+000	54+000	LHS	11	11	6	5	10	43	Banyan, Silver Oak, Sisham Neem
54+000	55+000	LHS	11	16	9	5	22	63	Arjun, Gulmohar, Jamun, Pipal
55+000	56+000	LHS	27	15	10	3	18	73	Gulmohar, Silver Oak, Banyan, Pipal, Neem
56+000	57+000	LHS	14	5	8	9	12	48	Gulmohar, Silver Oak, Banyan, Pipal, Arjun
57+000	58+000	LHS	24	19	13	2	3	61	Arjun, Gulmohar, Jamun, Pipal, Neem
58+000	59+000	LHS	13	6	10	3	4	36	Gulmohar, Ashok, Banyan, Neem
59+000	60+000	LHS	11	3	4	1	1	20	Pipal, Banyan, Neem
60+000	61+000	LHS	21	4	2	4	9	40	Pipal, Banyan, Silver Oak
61+000	62+000	LHS	11	5	4	0	5	25	Karanj, Neem, Tamarind
62+000	63+000	LHS	6	3	4	1	4	18	Karanj, Cherry, Mango
63+000	64+000	LHS	49	13	2	0	2	66	Karanj, Cherry, Banyan, Tamarind
64+000	65+000	LHS	102	80	14	0	0	196	Mango, Neem, Silver Oak, Cherry
65+000	66+000	LHS	1	7	7	0	1	16	Neem, Banyan, Mango
66+000	67+000	LHS	7	11	3	0	3	24	Jamun, Pipal
67+000	68+000	LHS	2	3	3	2	5	15	Pipal, Banyan, Mango. Karanj
68+000	69+000	LHS	5	10	8	0	3	26	Gulmohar, Jamun, Mango, Neem
69+000	70+000	LHS	9	2	9	4	2	26	Banyan, Jamun, Gulmohar, Arjun
70+000	71+000	LHS	12	7	9	3	4	35	Karanj, Neem, Gulmohar
71+000	72+000	LHS	1	0	0	0	1	2	Pipal
72+000	73+000	LHS	5	16	12	4	1	38	Pipal, Gulmohar, Neem
73+000	74+000	LHS	38	42	17	19	3	119	Gulmohar, Karanj, Arjun, Neem
74+000	75+000	LHS	21	35	17	14	0	87	Neem
75+000	76+000	LHS	15	14	13	7	4	53	Banyan
76+000	77+000	LHS	1	4	1	1	1	8	Banyan, Eucalyptus
77+000	78+000	LHS	0	0	0	0	0	0	
78+000	78+770	LHS	2	5	1	1	0	9	Karanj, Gulmohar, Pipal
80+820	81+000	LHS	0	2	3	3	0	8	Gulmohar, Neem, Pipal
81+000	82+000	LHS	17	12	13	12	5	59	Neem, Arjun, Gulmohar
82+000	83+000	LHS	7	8	7	2	0	24	Karanj, Arjun
83+000	84+000	LHS	4	4	1	0	0	9	Gulmohar, Arjun, Neem, Tamarind
84+000	85+000	LHS	2	2	2	2	1	9	Pipal, Arjun, Karanj,
85+000	86+000	LHS	2	1	0	0	1	4	Pipal, Honge
86+000	87+000	LHS	2	8	2	0	0	12	Pipal, Honge, Gulmohar
87+000	88+000	LHS	2	0	0	1	0	3	Neem, Gulmohar
88+000	89+000	LHS	0	0	0	0	0	0	

Chainage		Side	No of Trees in Girth Class (in cm)					Total	Predominant Species Observed
From	To		<30	31-59	60-119	120-180	>180		
89+000	90+000	LHS	0	0	0	0	0	0	
90+000	90+900	LHS	0	1	0	0	0	1	Gulmohar
93+300	94+000	LHS	5	7	10	2	1	25	Arjun, Pipal, Honge
94+000	95+000	LHS	0	0	0	0	0	0	
95+000	96+000	LHS	0	1	3	0	0	4	Arjun
96+000	97+000	LHS	1	1	1	2	3	8	Pipal, Babool
97+000	98+000	LHS	0	0	1	0	0	1	Pipal
98+000	99+000	LHS	0	1	0	1	1	3	Shisham
99+000	100+000	LHS	1	14	3	2	2	22	Banyan, Shisham, Babool
100+000	101+000	LHS	24	43	19	0	0	86	Eucalyptus
101+000	102+000	LHS	55	58	15	0	0	128	Eucalyptus
102+000	103+000	LHS	48	40	4	5	0	97	Eucalyptus
103+000	104+000	LHS	150	44	3	0	0	197	Eucalyptus
104+000	105+000	LHS	66	62	28	8	2	166	Eucalyptus
105+000	106+000	LHS	42	62	28	18	5	155	Eucalyptus
106+000	107+000	LHS	55	73	20	12	1	161	Eucalyptus
107+000	108+000	LHS	67	57	50	7	0	181	Eucalyptus
108+000	109+000	LHS	54	37	26	7	2	126	Eucalyptus
109+000	110+000	LHS	0	0	0	1	8	9	Honge, Arjun, Pipal, Babool
110+000	111+000	LHS	0	0	0	0	0	0	
111+000	112+000	LHS	0	0	0	4	14	18	Gulmohar
112+000	113+000	LHS	0	6	5	2	1	14	Gulmohar, Honge, Arjun, Babool
113+000	114+000	LHS	0	2	1	2	5	10	Arjun, Gulmohar
114+000	115+000	LHS	0	0	1	1		2	Eucalyptus
115+000	115+080	LHS	0	0	0	0	0	0	Honge
116+380	117+000	LHS	0	1	0	2	0	3	Banyan
117+000	118+000	LHS	1	2	1	0	1	5	Pipal, Gulmohar
118+000	119+000	LHS	1	0	1	0	0	2	Neem
119+000	120+000	LHS	2	2	1	0	0	5	Pipal, Arjun
120+000	121+000	LHS	4	1	0	0	1	6	Mango, Honge
121+000	122+000	LHS	2	0	0	0	0	2	Neem
122+000	123+000	LHS	1	5	1	3	1	11	Arjun, Pipal, Honge
123+000	124+000	LHS	1	0	0	0	2	3	Mango, Neem
124+000	125+000	LHS	6	2	3	6	14	31	Banyan, Tamrind, Honge, Arjun
125+000	126+000	LHS	1	6	5	3	2	17	Shisham, Gulmohar
126+000	127+000	LHS	6	3	4	7	7	27	Mango, Neem, Banyan, Arjun
127+000	128+000	LHS	6	0	2	1	9	18	Pipal, Honge, Mango
128+000	129+000	LHS	32	1	3	2	5	43	Pipal, Mango, Eucalyptus
129+000	130+000	LHS	12	3	0	4	16	35	Neem, Eucalyptus, Mango
130+000	131+000	LHS	3	1	1	9	25	39	Banyan, Arjun, Mango
131+000	132+000	LHS	24	15	6	6	9	60	Eucalyptus, Arjun
132+000	133+000	LHS	20	29	6	4	5	64	Eucalyptus, Honge, Mango
133+000	134+000	LHS	2	6	2	7	13	30	Banyan, Mango
134+000	135+000	LHS	2	1	2	1	7	13	Banyan, Arjun, Honge
135+000	136+000	LHS	7	2	2	0	15	26	Shisham, Banyan
136+000	137+000	LHS	5	3	2	3	10	23	Banyan, Arjun, Neem
137+000	138+000	LHS	9	5	4	1	12	31	Banyan, Arjun, Neem
138+000	139+000	LHS	12	5	6	0	13	36	Janun, Banyan, Arjun
139+000	140+000	LHS	1	0	0	0	3	4	Pipal, Arjun

Chainage		Side	No of Trees in Girth Class (in cm)					Total	Predominant Species Observed
From	To		<30	31-59	60-119	120-180	>180		
140+000	141+000	LHS	1	6	1	0	1	9	Arjun, Pipal
141+000	142+000	LHS	2	0	2	1		5	Gulmohar, Honge
142+000	143+000	LHS	4	3	2	0	0	9	Pipal, Arjun
143+000	144+000	LHS	0	1	2	2	2	7	Pipal
144+000	145+000	LHS	0	0	0	0	2	2	Banyan
145+000	146+000	LHS	3	5	3	2	7	20	Pipal, Mango, Arjun
146+000	147+000	LHS	5	6	7	9	8	35	Tamrind, Arjun, Pipal, Shisham
147+000	148+000	LHS	1	0	4	0	2	7	Pipal
148+000	149+000	LHS	0	0	1	0	0	1	Pipal
149+000	150+000	LHS	0	0	0	0	4	4	Gulmohar
150+000	151+000	LHS	0	0	0	0	0	0	
151+000	152+000	LHS	0	1	2	1	5	9	Pipal, Arjun
152+000	153+000	LHS	0	0	0	0	2	2	Pipal
153+000	154+000	LHS	0	0	1	2	10	13	Pipal, Honge, Neem
154+000	155+000	LHS	3	5	0	1	4	13	Honge
155+000	156+000	LHS	1	2	2	6	8	19	Shisham
156+000	157+000	LHS	3	6	8	4	4	25	Neem, Banyan, Shisham
157+000	158+000	LHS	0	5	1	2	2	10	Sgisgam, Neem
158+000	159+000	LHS	6	7	4	0	11	28	Babool, Pipal, Honge
159+000	160+000	LHS	1	0	0	0	3	4	Pipal
160+000	161+000	LHS	3	1	1	0	0	5	Babool, Shisham
161+000	162+000	LHS	1	2	4	3	9	19	Pipal, Banyan, Babool
162+000	163+000	LHS	0	0	1	0	0	1	Pipal
163+000	164+000	LHS	0	0	0	0	0	0	
164+000	165+000	LHS	4	3	2	4	3	16	Janum, Arjun
165+000	166+000	LHS	2	0	0	0	7	9	Tamarind, Arjun
166+000	167+000	LHS	0	0	1	0	1	2	Arjun
167+000	168+000	LHS	0	1	0	0	0	1	Neem
168+000	169+000	LHS	2	0	0	0	0	2	Pipal
169+000	170+000	LHS	1	0	0	0	0	1	Honge
170+000	171+000	LHS	0	0	0	0	0	0	
171+000	172+000	LHS	0	0	0	0	0	0	
172+000	173+000	LHS	0	1	2	0	1	4	Neem
173+000	174+000	LHS	0	0	0	0	0	0	
174+000	175+000	LHS	0	0	1	0	0	1	Pipal
175+000	176+000	LHS	0	0	1	1	3	5	Pipal
176+000	177+000	LHS	0	0	0	0	6	6	Banyan
177+000	178+000	LHS	3	0	1	0	0	4	Cherry
178+000	179+000	LHS	0	0	0	0	0	0	
179+000	180+000	LHS	1	2	0	0	0	3	Cherry
180+000	181+000	LHS	0	0	0	1	1	2	Pipal
181+000	182+000	LHS	0	1	0	0	0	1	Cherry
182+000	183+000	LHS	10	5	0	0	0	15	Eucalyptus
183+000	184+000	LHS	0	0	0	0	5	5	Banyan, Arjun
184+000	185+000	LHS	0	0	0	0	0	0	
185+000	186+000	LHS	0	0	0	0	0	0	
186+000	187+000	LHS	0	0	0	0	1	1	Banyan
187+000	188+000	LHS	0	0	0	0	1	1	Banyan
188+000	189+000	LHS	3	0	0	0	0	3	Cherry
189+000	190+000	LHS	0	0	0	0	1	1	Banyan
190+000	191+000	LHS	0	0	2	0	0	2	Banyan

Chainage		Side	No of Trees in Girth Class (in cm)					Total	Predominant Species Observed
From	To		<30	31-59	60-119	120-180	>180		
191+000	192+000	LHS	3	0	2	1	1	7	Gulmohar
192+000	193+000	LHS	6	0	0	1	6	13	Arjun, Gulmohar
193+000	194+000	LHS	0	0	0	0	2	2	Banyan
194+000	195+000	LHS	0	0	0	0	1	1	Arjun
195+000	196+000	LHS	1	3	0	0	2	6	Arjun, Pipal
196+000	197+000	LHS	0	0	0	0	5	5	Arjun, Banyan
197+000	198+000	LHS	0	0	0	0	3	3	Arjun, Pipal
198+000	199+000	LHS	0	1	0	0	4	5	Banyan, Pipal
199+000	200+000	LHS	0	0	0	0	3	3	Tamarind, Arjun
200+000	201+000	LHS	0	0	2	1	2	5	Gulmohar
201+000	202+000	LHS	0	0	0	0	12	12	Arjun, Banyan
202+000	203+000	LHS	0	1	2	1	17	21	Arjun, Banyan
203+000	204+000	LHS	0	0	2	2	6	10	Banyan
204+000	205+000	LHS	0	3	0	1	6	10	Arjun, Shisham
205+000	206+000	LHS	0	1	0	3	22	26	Arjun, Banyan,
206+000	207+000	LHS	0	0	0	1	11	12	Arjun
207+000	208+000	LHS	0	0	1	0	8	9	Banyan, Mango
208+000	209+000	LHS	0	2	1	0	13	16	Banyan, Shisham, Gulmohar
209+000	210+000	LHS	0	0	2	0	3	5	Mango, Banyan
210+000	211+000	LHS	0	0	0	1	8	9	Arjun, Pipal, Shisham
211+000	212+000	LHS	0	0	0	0	0	0	
212+000	213+000	LHS	0	0	0	0	3	3	Mango
213+000	214+000	LHS	0	0	0	0	0	0	
214+000	215+000	LHS	0	0	0	0	1	1	Tamarind
215+000	216+000	LHS	0	1	0	0	0	1	Eucalyaptus
216+000	217+000	LHS	0	0	0	0	0	0	
217+000	218+000	LHS	0	0	0	0	1	1	Tamarind
218+000	219+000	LHS	0	0	0	0	3	3	Banyan, Arjun
219+000	220+000	LHS	0	0	0	0	0	0	
220+000	221+000	LHS	0	0	0	0	1	1	Gulmohar
			1,265	**1,067**	**561**	**295**	**609**	**3,797**	

Table - A.4.5.2 Chainage wise Chainage wise Number of Existing Trees on RHS

Chainage		Side	No of Trees in Girth Class (in cm)					Total	Predominant Species Observed
From	To		<30	31-59	60-119	120-180	>180		
52+000	53+000	RHS	6	21	12	8	0	47	Honge, Silver Oak, Mango, Pipal
53+000	54+000	RHS	4	7	15	5	4	35	Honge, Silver Oak, Mango, Pipal
54+000	55+000	RHS	9	8	12	14	5	48	Honge, Silver Oak, Mango, Pipal
55+000	56+000	RHS	5	17	9	11	9	51	Arjun, Gulmohar, Eucalyptus
56+000	57+000	RHS	14	14	24	9	3	64	Arjun, Gulmohar, Eucalyptus, Pipal
57+000	58+000	RHS	9	30	18	8	0	65	Arjun, Gulmohar, Eucalyptus, Pipal
58+000	59+000	RHS	4	14	6	2	0	26	Pipal, Gulmohar
59+000	60+000	RHS	14	3	6	2	0	25	Eucalyptus, Pipal
60+000	61+000	RHS	25	4	3	2	0	34	Eucalyptus, Pipal
61+000	62+000	RHS	11	11	5	5	0	32	Pipal, Honge, Eucalyptus

Chainage		Side	No of Trees in Girth Class (in cm)					Total	Predominant Species Observed
From	To		<30	31-59	60-119	120-180	>180		
62+000	63+000	RHS	6	14	16	10	1	47	Pipal, Honge, Eucalyptus
63+000	64+000	RHS	33	9	5	2	0	49	Pipal, Honge, Eucalyptus
64+000	65+000	RHS	1	37	29	2	0	69	Neem, Arjun
65+000	66+000	RHS	3	11	6	5	0	25	Neem, Gulmohar, Eucalyptus
66+000	67+000	RHS	3	0	2	0	0	5	Arjun
67+000	68+000	RHS	0	7	6	2	1	16	Gulmohar, Pipal
68+000	69+000	RHS	3	5	9	9	0	26	Gulmohar, Tamarind, Cherry
69+000	70+000	RHS	3	10	11	2	0	26	Gulmohar, Tamarind, Cherry
70+000	71+000	RHS	0	0	10	3	1	14	Pipal, Honge
71+000	72+000	RHS	0	3	2	1	0	6	Pipal, Jamun
72+000	73+000	RHS	4	25	18	4	0	51	Neem, Gulmohar, Honge
73+000	74+000	RHS	0	31	29	9	0	69	Neem, Gulmohar, Honge
74+000	75+000	RHS	3	32	17	6	0	58	Neem, Gulmohar, Pipal
75+000	76+000	RHS	2	17	26	6	0	51	Silver Oak, Gulmohar, Neem
76+000	77+000	RHS	2	7	4	2	0	15	Silver Oak, Gulmohar, Eucalyptus
77+000	78+000	RHS	0	0	0	0	0	0	
78+000	79+000	RHS	3	14	10	0	0	27	Neem, Gulmohar
79+000	80+000	RHS	4	37	6	5	3	55	Banyan, Pipal, Shisham
80+000	81+000	RHS	4	9	21	10	0	44	Banyan, Pipal
81+000	82+000	RHS	2	13	10	0	0	25	Arjun, Pipal
82+000	83+000	RHS	0	2	5	0	0	7	Pipal, Shisham
83+000	84+000	RHS	11	12	6	0	0	29	Neem, Pipal
84+000	85+000	RHS	4	10	3	0	0	17	Gulmohar
85+000	86+000	RHS	7	7	8	0	0	22	Pipal, Neem
86+000	87+000	RHS	4	8	5	0	0	17	Pipal, Honge, Gulmohar
87+000	88+000	RHS	2	6	3	0	0	11	Neem, Gulmohar
88+000	89+000	RHS	0	0	0	0	0	0	
89+000	90+000	RHS	0	0	0	0	0	0	
90+000	91+000	RHS	2	4	1	0	0	7	Gulmohar
91+000	92+000	RHS	0	1	9	1	0	11	Gulmohar, Babool
92+000	93+000	RHS	1	7	3	0	0	11	Gulmohar, Jamun
93+000	94+000	RHS	2	43	10	0	0	55	Arjun, Pipal, Honge
94+000	95+000	RHS	0	0	1	0	0	1	Gulmohar
95+000	96+000	RHS	1	2	10	0	0	13	Arjun
96+000	97+000	RHS	0	4	2	0	0	6	Pipal, Babool
97+000	98+000	RHS	0	0	3	0	0	3	Pipal
98+000	99+000	RHS	1	0	3	0	0	4	Shisham
99+000	100+000	RHS	0	0	5	7	4	16	Banyan, Shisham, Babool
100+000	101+000	RHS	10	52	31	0	0	93	Eucalyptus
101+000	102+000	RHS	15	48	20	0	0	83	Eucalyptus
102+000	103+000	RHS	16	76	11	0	0	103	Eucalyptus
103+000	104+000	RHS	12	41	89	20	0	162	Eucalyptus
104+000	105+000	RHS	22	77	30	0	0	129	Eucalyptus
105+000	106+000	RHS	15	72	43	4	3	137	Eucalyptus
106+000	107+000	RHS	42	43	48	0	0	133	Eucalyptus
107+000	108+000	RHS	25	45	43	0	0	113	Eucalyptus
108+000	109+000	RHS	21	46	35	0	0	102	Eucalyptus
109+000	110+000	RHS	0	2	25	1	0	28	Gulmohar, Pipal
110+000	111+000	RHS	0	0	3	1	0	4	Neem
111+000	112+000	RHS	0	4	26	11	6	47	Gulmohar, Copper Pod
112+000	113+000	RHS	0	0	4	1	0	5	Gulmohar, Cherry

Chainage		Side	No of Trees in Girth Class (in cm)					Total	Predominant Species Observed
From	To		<30	31-59	60-119	120-180	>180		
113+000	114+000	RHS	0	4	4	3	0	11	Arjun, Gulmohar
114+000	115+000	RHS	0	5	8	1	0	14	Eucalyptus
115+000	116+000	RHS	9	7	0	0	0	16	Honge
116+000	117+000	RHS	1	3	8	1	0	13	Honge, Banyan
117+000	118+000	RHS	0	5	1	2	0	8	Pipal, Gulmohar
118+000	119+000	RHS	2	12	4	1	0	19	Neem
119+000	120+000	RHS	5	5	2	1	0	13	Pipal, Arjun
120+000	121+000	RHS	1	0	2	1	0	4	Neem
121+000	122+000	RHS	0	1	1	0	2	4	Banyan
122+000	123+000	RHS	1	5	0	1	1	8	Gulmohar, Cherry, Pipal
123+000	124+000	RHS	0	2	1	2	0	5	Pipal, Arjun
124+000	125+000	RHS	0	5	7	5	3	20	Banyan, Tamrind, Honge, Arjun
125+000	126+000	RHS	1	3	11	1	0	16	Shisham, Gulmohar
126+000	127+000	RHS	2	6	5	9	6	28	Mango, Neem, Banyan, Arjun
127+000	128+000	RHS	6	2	3	4	6	21	Pipal, Honge, Mango
128+000	129+000	RHS	37	5	4	1	1	48	Pipal, Mango, Eucalyptus
129+000	130+000	RHS	8	13	8	9	4	42	Neem, Eucalyptus, Mango
130+000	131+000	RHS	3	2	6	10	10	31	Banyan, Arjun, Mango
131+000	132+000	RHS	1	7	9	11	10	38	Eucalyptus, Arjun
132+000	133+000	RHS	31	35	9	6	0	81	Eucalyptus, Honge, Mango
133+000	134+000	RHS	4	7	12	5	2	30	Banyan, Mango
134+000	135+000	RHS	1	0	8	2	1	12	Banyan, Arjun, Honge
135+000	136+000	RHS	0	10	6	3	2	6	Arjun, Banyan
136+000	137+000	RHS	0	3	4	0	8	15	Banyan, Arjun, Neem
137+000	138+000	RHS	7	5	4	5	3	24	Banyan, Arjun, Neem
138+000	139+000	RHS	1	2	3	7	5	18	Janun, Banyan, Arjun
139+000	140+000	RHS	0	1	2	1	1	5	Pipal, Arjun
140+000	141+000	RHS	3	6	5	1	1	16	Arjun, Pipal
141+000	142+000	RHS	5	0	3	0	0	8	Gulmohar, Honge
142+000	143+000	RHS	0	5	0	0	1	6	Pipal, Arjun
143+000	144+000	RHS	1	5	5	0	0	11	Pipal
144+000	145+000	RHS	1	1	3	0	3	8	Banyan
145+000	146+000	RHS	3	3	11	1	0	18	Pipal, Mango, Arjun
146+000	147+000	RHS	1	4	13	3	1	22	Tamrind, Arjun, Pipal, Shisham
147+000	148+000	RHS	1	5	8	3	0	17	Pipal
148+000	149+000	RHS	1	0	1	0	4	6	Gulmohar
149+000	150+000	RHS	0	1	0	2	0	3	Gulmohar
150+000	151+000	RHS	0	0	0	0	0	0	
151+000	152+000	RHS	3	0	0	1	0	4	Tamarind, Gulmohar
152+000	153+000	RHS	0	0	0	1	1	2	Pipal
153+000	154+000	RHS	0	2	7	13	1	23	Pipal, Honge, Neem
154+000	155+000	RHS	3	3	10	3	0	19	Honge
155+000	156+000	RHS	0	2	7	1	0	10	Shisham
156+000	157+000	RHS	2	3	6	1	0	12	Neem, Banyan, Shisham
157+000	158+000	RHS	6	1	0	2	1	10	Sgisgam, Neem
158+000	159+000	RHS	4	9	8	7	1	29	Babool, Pipal, Honge
159+000	160+000	RHS	0	6	3	3	0	12	Pipal
160+000	161+000	RHS	0	2	0	0	0	2	Babool, Shisham
161+000	162+000	RHS	6	6	8	2	0	22	Pipal, Banyan, Babool
162+000	163+000	RHS	2	7	2	1	0	12	Pipal

Chainage		Side	No of Trees in Girth Class (in cm)					Total	Predominant Species Observed
From	To		<30	31-59	60-119	120-180	>180		
163+000	164+000	RHS	0	0	1	0	0	1	Gulmohar
164+000	165+000	RHS	2	4	11	5	4	26	Janum, Arjun
165+000	166+000	RHS	1	4	4	2	5	16	Tamarind, Arjun
166+000	167+000	RHS	0	0	1	1	0	2	Arjun
167+000	168+000	RHS	1	2	3	0	0	6	Neem
168+000	169+000	RHS	1	0	1	0	0	2	Pipal
169+000	170+000	RHS	2	4	0	0	0	6	Honge
170+000	171+000	RHS	0	2	5	1	0	8	Gulmohar, Neem
171+000	172+000	RHS	0	1	1	0	0	2	Babool
172+000	173+000	RHS	1	11	16	0	0	28	Gulmohar, Pipal
173+000	174+000	RHS	0	0	0	3	0	3	Pipal
174+000	175+000	RHS	0	0	2	0	0	2	Pipal
175+000	176+000	RHS	0	1	1	5	0	7	Pipal
176+000	177+000	RHS	0	0	1	2	0	3	Banyan
177+000	178+000	RHS	0	2	1	0	0	3	Cherry
178+000	179+000	RHS	0	10	2	1	0	13	Gulmohar, Pipal
179+000	180+000	RHS	3	0	0	0	0	3	Honge
180+000	181+000	RHS	0	0	1	0	0	1	Gulmohar
181+000	182+000	RHS	1	0	0	0	0	1	Cherry
182+000	183+000	RHS	1	5	2	0	0	8	Eucalyptus
183+000	184+000	RHS	0	0	0	1	2	3	Banyan
184+000	185+000	RHS	0	8	0	0	1	9	Gulmohar, Banyan
185+000	186+000	RHS	0	0	1	2	0	3	Gulmohar
186+000	187+000	RHS	0	0	0	1	0	1	Banyan
187+000	188+000	RHS	0	0	0	0	0	0	
188+000	189+000	RHS	0	0	2	1	1	4	Banyan
189+000	190+000	RHS	0	0	0	0	0	0	
190+000	191+000	RHS	0	1	3	1	0	5	Tamarind
191+000	192+000	RHS	3	0	1	2	3	9	Gulmohar
192+000	193+000	RHS	0	0	1	3	2	6	Arjun, Gulmohar
193+000	194+000	RHS	0	0	0	1	0	1	Banyan
194+000	195+000	RHS	2	0	2	0	1	5	Arjun, Gulmohar
195+000	196+000	RHS	0	2	1	1	0	4	Arjun, Pipal
196+000	197+000	RHS	0	1	2	5	1	9	Arjun, Banyan
197+000	198+000	RHS	0	0	1	3	2	6	Arjun, Pipal
198+000	199+000	RHS	0	0	2	3	7	12	Banyan, Pipal
199+000	200+000	RHS	0	0	0	0	0	0	
200+000	201+000	RHS	0	4	1	3	0	8	Gulmohar
201+000	202+000	RHS	0	0	1	3	9	13	Arjun, Gulmohar
202+000	203+000	RHS	1	0	0	1	3	5	Arjun, Banyan
203+000	204+000	RHS	0	3	4	12	9	28	Banyan, Arjun, Tamarind,
204+000	205+000	RHS	1	2	1	4	0	8	Neem, Mango
205+000	206+000	RHS	0	0	1	8	17	26	Arjun, Pipal,
206+000	207+000	RHS	0	0	0	7	9	16	Arjun, Tamarind, Mango
207+000	208+000	RHS	0	3	0	0	1	4	Mango
208+000	209+000	RHS	0	0	0	5	6	11	Pipal, Banyan, Neem, Mango
209+000	210+000	RHS	0	1	4	6	7	18	Pipal, Banyan, Neem, Mango
210+000	211+000	RHS	0	0	1	4	9	14	Pipal, Banyan, Neem, Mango
211+000	212+000	RHS	0	0	0	0	0	0	
212+000	213+000	RHS	0	0	0	2	0	2	Banyan
213+000	214+000	RHS	0	0	0	1	0	1	Honge

Chainage		Side	No of Trees in Girth Class (in cm)					Total	Predominant Species Observed
From	To		<30	31-59	60-119	120-180	>180		
214+000	215+000	RHS	0	0	0	0	0	0	
215+000	216+000	RHS	0	0	0	0	0	0	
216+000	217+000	RHS	0	0	0	0	0	0	
217+000	218+000	RHS	0	0	0	1	0	1	Tamarind
218+000	219+000	RHS	0	0	2	0	4	6	Tamarind, Gulmohar
219+000	220+000	RHS	0	0	0	0	0	0	
220+000	221+000	RHS	0	0	1	0	0	1	Tamarind
			573	**1319**	**1149**	**428**	**222**	**3676**	

Table - A.4.5.3 Total Number of Existing Trees

Side	No of Trees in Girth Class (in cm)					Total
	<30	31-59	60-119	120-180	>180	
RHS	573	1319	1149	428	222	**3,691**
LHS	1265	1067	561	295	609	**3,797**
	1,838	**2,386**	**1,710**	**723**	**831**	**7,488**

Table-A.4.5.4 List of Giant Tree along Magadi to Somwarpet Road

Sl. No.	Design Chainage	Side	Distance of Existing Centre line (m)	Species	Girth size (m)
1	52+050	RHS	6.3	Banyan	5.5
2	52+110	LHS	4.8	Banyan	6.8
3	51+250	LHS	7	Mango	3.5
4	52+440	RHS	10	Jamun	3.2
5	52+450	RHS	10.4	Jamun	3.5
6	52+510	RHS	10.1	Mango	4.9
7	52+540	RHS	10.2	Mango	4.6
8	52+590	LHS	6.1	Jamun	5.1
9	52+630	LHS	7.5	Jamun	4.5
10	52+680	LHS	8.1	Jamun	3.7
11	52+750	RHS	8.4	Mango	3.3
12	53+360	LHS	7	Banyan	3.8
13	53+430	LHS	9.2	Jamun	3.4
14	53+620	RHS	9.2	Jamun	3.5
15	53+690	RHS	8.5	Jamun	3.4
16	53+810	LHS	10.3	Mango	3.6
17	53+920	RHS	10.5	Mango	4.7
18	53+960	RHS	8.5	Mango	6.5
19	53+990	RHS	10.2	Jamun	3.5
20	54+010	RHS	10.5	Mango	4.5
21	54+070	LHS	9.8	Jamun	3.1
22	54+100	RHS	10.3	Jamun	4.4
23	54+290	RHS	6.9	Mango	3.8
24	54+305	LHS	6.6	Mango	3.3
25	54+400	RHS	7.2	Mango	4.2
26	54+390	LHS	6.1	Jamun	3.3
27	54+410	RHS	7.4	Mango	3.3
28	54+435	RHS	6.8	Mango	7.3
29	54+550	LHS	6.3	Mango	3.4
30	54+460	RHS	7.8	Mango	3.5
31	54+480	RHS	7.5	Mango	3.2
32	54+520	LHS	7	Banyan	4.8

Sl. No.	Design Chainage	Side	Distance of Existing Centre line (m)	Species	Girth size (m)
33	54+570	LHS	9.2	Mango	3.4
34	54+790	RHS	5.6	Mango	3.2
35	54+810	RHS	4.3	Mango	4.0
36	55+100	RHS	4.5	Mango	3.2
37	55+180	RHS	8.6	Mango	4.1
38	55+220	RHS	7.9	Mango	3.3
39	55+250	RHS	8.8	Mango	3.2
40	55+280	RHS	8.6	Mango	3.4
41	55+290	RHS	8.7	Mango	3.2
42	55+320	RHS	6.1	Mango	3.8
43	55+480	LHS	5.2	Mango	3.4
44	55+500	LHS	5.1	Mango	3.8
45	55+520	LHS	4	Jamun	4.5
46	55+565	LHS	3.7	Mango	4.0
47	55+590	RHS	7.6	Jamun	3.7
48	55+610	LHS	6.2	Jamun	4.4
49	55+625	RHS	7.4	Mango	3.8
50	55+600	RHS	6.7	Banyan	8.0
51	55+710	RHS	6.9	Mango	3.4
52	55+715	LHS	9.3	Mango	3.4
53	55+725	LHS	8.1	Banyan	10.0
54	55+800	LHS	8.6	Mango	3.8
55	55+810	RHS	9.5	Mango	3.4
56	55+830	RHS	10.2	Mango	3.9
57	55+940	LHS	3.4	Mango	4.2
58	55+950	LHS	6.8	Jamun	3.8
59	56+000	LHS	7.5	Mango	3.6
60	56+080	RHS	7.3	Jamun	3.6
61	56+180	RHS	6.5	Jamun	8.5
62	56+170	RHS	6.7	Neem	5.5
63	56+190	LHS	5.4	Jamun	6.0
64	56+200	RHS	5.5	Jamun	4.0
65	56+205	RHS	6.5	Mango	4.6
66	56+250	RHS	6.7	Mango	4.2
67	56+260	RHS	8.4	Jamun	3.8
68	56+390	RHS	6.8	Mango	3.5
69	56+395	LHS	9.2	Jamun	4.0
70	56+410	RHS	7	Mango	6.7
71	56+415	RHS	8.4	Mango	3.2
72	56+460	RHS	8.6	Jamun	3.6
73	56+490	LHS	9.5	Banyan	5.3
74	56+510	LHS	10.6	Banyan	4.2
75	56+620	LHS	7	Peepal	4.0
76	57+300	RHS	9.5	Banyan	3.5
77	57+580	LHS	9.3	Banyan	4.8
78	57+820	RHS	8.2	Jamun	4.2
79	58+390	RHS	8.6	Gulmohar	3.8
80	59+100	LHS	7	Banyan	4.6
81	59+350	RHS	7.8	Banyan	4.2
82	60+220	LHS	9	Banyan	4.1
83	60+280	RHS	10.1	Banyan	3.4
84	60+460	LHS	9.4	Peepal	4.2

Sl. No.	Design Chainage	Side	Distance of Existing Centre line (m)	Species	Girth size (m)
85	60+640	RHS	6.3	Banyan	3.4
86	60+780	LHS	7.4	Banyan	6.4
87	60+820	LHS	9.8	Banyan	4.6
88	60+880	RHS	9.3	Banyan	9.5
89	60+910	RHS	8.2	Banyan	9.7
90	60+915	LHS	9.8	Banyan	10.6
91	60+980	RHS	9.4	Banyan	10.2
92	61+050	RHS	9.2	Banyan	4.6
93	61+280	LHS	9.8	Banyan	5.6
94	61+750	LHS	6.8	Banyan	6.5
95	61+835	LHS	7.7	Banyan	5.5
96	62+160	RHS	7.8	Shirish	4.1
97	62+190	RHS	8.3	Banyan	3.6
98	62+240	RHS	9.5	Banyan	3.8
99	62+400	LHS	6.5	Banyan	6.7
100	62+980	RHS	8.6	Banyan	3.8
101	63+240	LHS	7.6	Peepal	3.6
102	63+860	RHS	6.1	Banyan	3.7
103	66+200	LHS	5.7	Peepal	4.2
104	66+220	LHS	5	Gulmohar	4.6
105	67+700	RHS	7.8	Peepal	5.6
106	68+620	LHS	5.5	Mango	3.1
107	68+630	LHS	5.7	Banyan	5.2
108	68+910	RHS	6.3	Shirish	3.2
109	68+930	RHS	6	Shirish	3.4
110	68+950	LHS	5.5	Mango	3.2
111	69+120	LHS	6.4	Peepal	7.7
112	70+280	RHS	7	Shirish	3.3
113	70+300	LHS	6	Shirish	3.2
114	70+320	RHS	9.5	Mango	3.6
115	70+325	LHS	7.2	Shirish	3.3
116	70+400	RHS	5.2	Peepal	4.1
117	71+280	LHS	5.9	Mango	3.2
118	71+340	RHS	6.4	Banyan	8.5
119	72+450	LHS	7.6	Jaali	3.5
120	72+580	RHS	6.5	Tarmarind	3.2
121	73+100	RHS	7.5	Honge	3.1
122	73+480	RHS	6.9	Banyan	9.6
123	76+430	LHS	4.8	Shirish	3.8
124	76+435	RHS	5.6	Shirish	4.0
125	99+350	LHS	5.8	Shirish	3.3
126	99+450	LHS	6.3	Banyan	3.6
127	105+050	RHS	6	Banyan	3.4
128	105+090	RHS	4.5	Banyan	4.6
129	105+710	RHS	5.8	Banyan	3.2
130	105+890	LHS	6.2	Banyan	3.3
131	109+620	RHS	4.5	Peepal	3.2
132	109+680	LHS	6	Arjun	3.8
133	109+850	RHS	5.4	Peepal	3.1
134	109+840	LHS	6.2	Peepal	4.2
135	110+890	RHS	9.6	Shirish	3.2
136	110+975	LHS	5.7	Shirish	3.8

Sl. No.	Design Chainage	Side	Distance of Existing Centre line (m)	Species	Girth size (m)
137	110+980	LHS	5.5	Shirish	3.5
138	111+000	RHS	7.6	Shirish	3.6
139	111+100	LHS	4	Shirish	3.4
140	111+175	RHS	6.5	Shirish	3.9
141	111+195	LHS	5.6	Shirish	3.0
142	111+225	LHS	5.7	Shirish	3.5
143	111+250	LHS	6.9	Shirish	3.4
144	111+250	RHS	6.8	Shirish	3.6
145	111+300	RHS	6.6	Shirish	3.5
146	112+600	RHS	6.2	Petrofarm	3.5
147	112+800	RHS	6.6	Shirish	3.3
148	112+950	RHS	6.4	Mango	3.5
149	112+970	LHS	7.2	Mango	3.7
150	113+120	RHS	7.6	Mango	3.7
151	113+145	RHS	6.9	Mango	3.1
152	113+160	RHS	6.3	Banyan	4.0
153	117+640	RHS	7.2	Peepal	3.9
154	119+950	RHS	8.6	Banyan	4.2
155	120+270	LHS	5.3	Mango	3.1
156	120+300	RHS	7	Banyan	3.4
157	121+760	RHS	6.4	Banyan	4.5
158	121+940	LHS	6.7	Jamun	3.2
159	122+970	LHS	6.3	Jamun	4.6
160	123+460	RHS	6.8	Jamun	4.4
161	123+460	LHS	6.4	Mango	6.6
162	123+520	RHS	7.5	Banyan	3.8
163	123+640	LHS	7.6	Banyan	5.4
164	124+160	LHS	8.1	Tarmarind	3.6
165	124+220	RHS	7.4	Mango	4.3
166	124+270	RHS	6.2	Shirish	4.3
167	124+840	RHS	7.3	Mango	5.3
168	124+860	RHS	7	Mango	4.5
169	125+900	RHS	6.3	Jamun	3.7
170	125+910	RHS	5.4	Mango	4.8
171	126+490	RHS	9.3	Banyan	3.4
172	126+640	LHS	10.5	Mango	4.0
173	126+645	RHS	9.5	Mango	3.6
174	126+650	RHS	9.7	Mango	3.5
175	126+820	LHS	7.25	Jamun	3.5
176	126+920	RHS	7.14	Jamun	3.3
177	127+070	LHS	6.7	Mango	3.9
178	127+100	RHS	6.4	Mango	3.5
179	127+160	RHS	3.2	Mango	4.0
180	127+300	LHS	7	Mango	3.2
181	127+310	LHS	8	Mango	3.7
182	127+315	RHS	9	Mango	3.2
183	127+375	LHS	5	Banyan	4.1
184	127+610	LHS	6.9	Jamun	3.8
185	127+635	RHS	7.5	Jamun	3.2
186	127+640	LHS	7.3	Mango	3.1
187	128+400	LHS	11	Mango	3.6
188	128+680	RHS	6.2	Mango	3.5

Sl. No.	Design Chainage	Side	Distance of Existing Centre line (m)	Species	Girth size (m)
189	129+455	RHS	9.3	Mango	3.6
190	129+460	LHS	7.2	Mango	3.4
191	129+530	RHS	9.5	Mango	3.2
192	129+550	RHS	8.6	Mango	3.5
193	129+690	RHS	3.6	Mango	3.3
194	129+720	LHS	8.6	Jamun	4.0
195	129+730	RHS	7.8	Mango	4.3
196	129+735	LHS	9.3	Jamun	3.3
197	129+790	RHS	10.4	Jamun	3.8
198	129+960	RHS	10.1	Mango	3.2
199	130+000	LHS	10.9	Jamun	3.3
200	130+020	LHS	11.2	Mango	3.1
201	130+050	RHS	7.3	Mango	3.3
202	130+055	LHS	10.2	Jamun	3.1
203	130+060	RHS	7.4	Banyan	3.4
204	130+090	LHS	10.5	Jamun	3.3
205	130+140	LHS	9.6	Jamun	3.5
206	130+325	RHS	9.3	Banyan	3.8
207	130+490	LHS	8.6	Banyan	4.4
208	130+520	RHS	10.1	Mango	4.1
209	130+560	RHS	6.5	Mango	4.0
210	130+561	LHS	7.4	Mango	3.2
211	130+640	LHS	7.6	Jamun	3.4
212	130+660	LHS	7.2	Jamun	3.4
213	130+670	RHS	7	Mango	3.3
214	130+790	RHS	6	Mango	3.6
215	130+890	RHS	6.5	Mango	3.2
216	130+915	RHS	7.5	Mango	5.5
217	130+920	RHS	7.3	Mango	3.9
218	130+950	LHS	7.4	Mango	3.2
219	130+955	RHS	8.5	Mango	3.3
220	130+956	RHS	8	Mango	3.1
221	131+120	LHS	8	Mango	3.1
222	131+135	RHS	5.9	Mango	3.1
223	131+140	RHS	8	Banyan	4.0
224	131+147	LHS	8	Banyan	5.8
225	131+147	RHS	3.8	Jamun	4.0
226	131+790	LHS	8.5	Banyan	3.2
227	131+800	LHS	8	Mango	3.4
228	131+855	RHS	5.5	Mango	3.8
229	131+860	RHS	5.8	Mango	3.7
230	131+865	LHS	6	Mango	3.8
231	133+350	LHS	6.8	Banyan	4.0
232	133+560	LHS	6.7	Banyan	4.2
233	133+565	LHS	7.5	Banyan	3.4
234	133+790	RHS	7.7	Banyan	4.5
235	133+880	RHS	7.5	Banyan	3.9
236	133+990	LHS	7.8	Banyan	12.0
237	134+190	RHS	5.4	Banyan	8.6
238	134+210	LHS	5.8	Banyan	4.5
239	134+900	LHS	7.5	Banyan	4.0
240	135+500	RHS	5.5	Banyan	4.1

Sl. No.	Design Chainage	Side	Distance of Existing Centre line (m)	Species	Girth size (m)
241	135+740	LHS	4.2	Banyan	4.5
242	135+750	RHS	7.6	Banyan	4.7
243	135+755	LHS	6.8	Jamun	3.5
244	135+760	LHS	5.9	Jamun	3.8
245	135+800	LHS	4.5	Jamun	4.2
246	135+820	LHS	4.55	Mango	4.1
247	135+830	RHS	6	Jamun	3.4
248	135+835	LHS	5	Mango	3.2
249	135+836	RHS	6	Mango	3.2
250	135+890	LHS	4.3	Mango	3.1
251	135+895	RHS	6.5	Mango	3.8
252	135+900	LHS	5	Mango	3.9
253	135+910	LHS	4.8	Banyan	3.6
254	136+050	LHS	9.5	Banyan	5.2
255	136+055	LHS	3.8	Banyan	5.0
256	136+110	RHS	5.2	Peepal	4.8
257	136+115	RHS	5	Peepal	4.3
258	136+120	RHS	4.85	Banyan	3.8
259	136+800	RHS	4.7	Banyan	3.6
260	136+870	RHS	6.2	Banyan	7.5
261	136+910	LHS	6.4	Banyan	8.0
262	136+915	LHS	6.1	Banyan	4.2
263	136+920	RHS	6.6	Banyan	3.4
264	137+000	LHS	6.3	Banyan	5.0
265	137+070	RHS	5.5	Banyan	3.4
266	137+100	RHS	5	Banyan	4.5
267	137+200	LHS	4.8	Banyan	3.8
268	137+205	RHS	5.9	Banyan	3.6
269	137+350	RHS	4	Banyan	6.7
270	137+490	LHS	7.1	Mango	3.1
271	137+770	LHS	7.3	Banyan	3.2
272	137+820	RHS	10.5	Banyan	3.3
273	137+840	LHS	4.6	Mango	3.3
274	137+890	RHS	6.3	Banyan	3.2
275	137+920	LHS	6.5	Banyan	3.4
276	137+925	RHS	7.8	Banyan	3.8
277	137+930	RHS	5.7	Banyan	3.5
278	138+150	LHS	6.7	Banyan	3.5
279	138+160	RHS	8.6	Banyan	8.8
280	138+165	LHS	5.5	Banyan	5.0
281	138+180	LHS	5.6	Banyan	4.2
282	138+230	LHS	5.3	Banyan	3.8
283	138+185	LHS	5.8	Banyan	5.0
284	138+220	LHS	4.5	Banyan	4.5
285	138+250	LHS	5.4	Banyan	4.5
286	138+460	LHS	5.5	Banyan	7.4
287	138+500	RHS	7.8	Banyan	5.0
288	138+590	LHS	5.8	Banyan	4.3
289	138+605	RHS	8.5	Banyan	3.3
290	138+610	RHS	8	Banyan	5.0
291	138+850	LHS	6	Banyan	5.0
292	139+605	LHS	6.1	Banyan	3.8

Sl. No.	Design Chainage	Side	Distance of Existing Centre line (m)	Species	Girth size (m)
293	139+900	RHS	9	Banyan	4.9
294	140+470	RHS	7.1	Banyan	3.1
295	144+200	RHS	6.5	Banyan	6.0
296	144+250	RHS	6.2	Banyan	4.0
297	145+300	RHS	5.6	Banyan	5.0
298	145+370	LHS	5.75	Banyan	6.0
299	145+460	LHS	5.5	Mango	4.5
300	145+550	LHS	5.4	Mango	3.1
301	145+650	RHS	5.6	Mango	3.2
302	155+100	RHS	5.1	Banyan	5.7
303	155+400	LHS	5.5	Banyan	8.0
304	157+060	LHS	7.1	Shirish	3.5
305	157+200	RHS	10.3	Peepal	4.0
306	157+860	RHS	6.8	Shirish	3.2
307	158+950	RHS	6.6	Shirish	3.4
308	158+990	LHS	6.4	Peepal	4.5
309	159+300	LHS	8.9	Peepal	4.2
310	161+640	LHS	4.2	Banyan	3.9
311	161+645	LHS	4.5	Banyan	4.0
312	161+690	LHS	4	Banyan	3.8
313	161+760	LHS	4	Banyan	5.0
314	164+400	RHS	11.7	Banyan	3.8
315	164+440	RHS	11.5	Jamun	3.2
316	164+640	RHS	12	Banyan	3.6
317	165+540	RHS	4.2	Jamun	3.5
318	165+545	RHS	4	Jamun	3.9
319	165+260	RHS	4.5	Jamun	3.4
320	165+390	RHS	4.1	Banyan	4.7
321	165+500	RHS	7	Jamun	5.2
322	165+590	LHS	4	Banyan	3.1
323	165+640	RHS	3.7	Jamun	4.2
324	165+650	RHS	3.9	Jamun	4.3
325	165+670	RHS	4	Jamun	5.6
326	165+820	LHS	5.1	Jamun	3.4
327	165+825	LHS	5.6	Jamun	5.9
328	166+050	LHS	6.1	Tarmarind	4.3
329	166+060	LHS	3.9	Tarmarind	6.7
330	166+340	LHS	4.1	Jamun	3.4
331	172+950	LHS	8.4	Peepal	3.2
332	175+750	RHS	8.9	Jamun	3.4
333	176+090	RHS	6.5	Banyan	4.5
334	176+095	RHS	8	Banyan	3.6
335	176+240	LHS	3.7	Banyan	5.4
336	177+090	RHS	5.1	Banyan	3.8
337	177+095	LHS	4.3	Banyan	4.4
338	177+130	LHS	5.5	Banyan	4.5
339	180+790	LHS	5.2	Banyan	3.3
340	180+800	LHS	5.1	Banyan	5.0
341	183+270	LHS	5.4	Banyan	5.2
342	183+370	LHS	5.3	Banyan	3.6
343	183+490	LHS	5.2	Banyan	3.8
344	184+150	RHS	4	Banyan	5.4

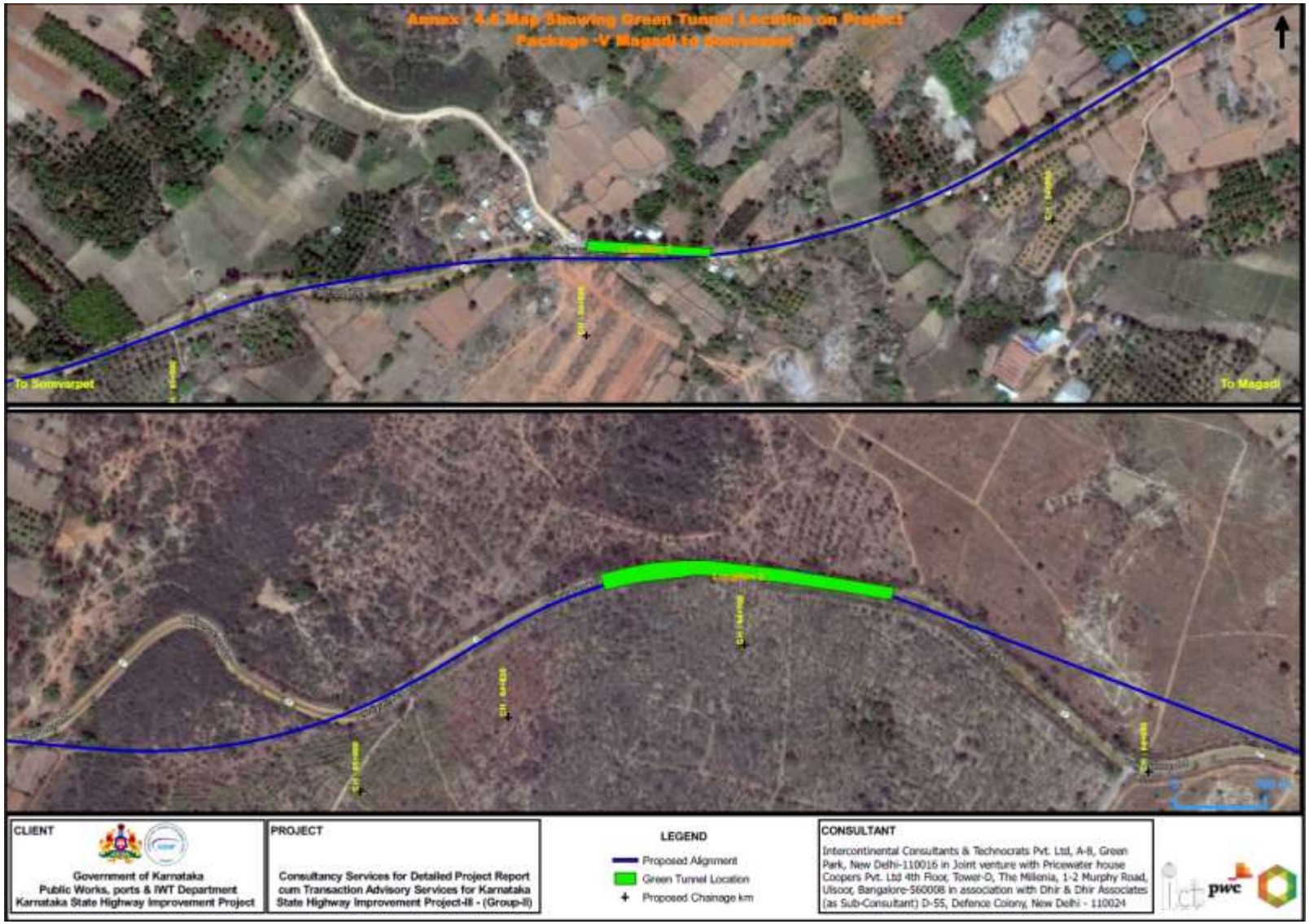
Sl. No.	Design Chainage	Side	Distance of Existing Centre line (m)	Species	Girth size (m)
345	184+200	LHS	4.1	Banyan	6.5
346	184+350	LHS	7.6	Banyan	3.4
347	184+390	LHS	9.3	Arjun	4.2
348	187+190	LHS	4.9	Banyan	4.8
349	189+160	RHS	6.1	Peepal	4.5
350	190+090	LHS	4.8	Banyan	7.0
351	191+820	RHS	4.4	Peepal	6.7
352	191+200	RHS	4	Peepal	3.6
353	191+300	RHS	4.3	Banyan	4.5
354	192+150	LHS	8.5	Mango	6.2
355	192+450	LHS	9.2	Peepal	5.2
356	192+920	RHS	4.2	Peepal	3.8
357	193+130	LHS	5	Banyan	4.5
358	193+100	RHS	5.2	Banyan	3.2
359	193+170	LHS	4.2	Banyan	5.5
360	193+620	LHS	6.6	Banyan	5.2
361	194+450	RHS	6.1	Banyan	4.5
362	196+230	RHS	5.8	Peepal	3.3
363	196+820	LHS	5.3	Banyan	6.8
364	196+850	RHS	6.7	Arjun	3.7
365	196+930	LHS	5.2	Arjun	4.8
366	196+940	LHS	5.3	Arjun	3.7
367	196+990	RHS	5.1	Arjun	3.6
368	197+030	RHS	5	Banyan	3.2
369	197+040	LHS	5.9	Arjun	3.4
370	197+050	RHS	6.4	Arjun	4.6
371	197+630	RHS	6.3	Arjun	3.4
372	197+635	LHS	4.6	Arjun	3.1
373	197+670	RHS	5.6	Banyan	3.4
374	197+965	LHS	4	Peepal	7.8
375	197+970	RHS	4.7	Peepal	7.8
376	198+380	RHS	6.5	Banyan	3.8
377	198+460	RHS	4.3	Banyan	8.7
378	198+700	RHS	4.6	Banyan	8.0
379	198+705	LHS	4	Arjun	3.2
380	198+760	RHS	5	Banyan	6.6
381	199+070	LHS	4.3	Banyan	3.6
382	199+140	RHS	4.6	Banyan	7.2
383	199+145	RHS	4.4	Banyan	6.4
384	199+150	RHS	4.2	Banyan	8.0
385	199+155	RHS	3.7	Banyan	8.0
386	199+440	LHS	6.1	Tarmarind	3.2
387	199+650	LHS	8.4	Tarmarind	6.8
388	200+770	LHS	4.4	Banyan	4.5
389	201+150	RHS	5.4	Banyan	3.2
390	201+250	RHS	6.1	Arjun	4.8
391	201+260	RHS	4.9	Arjun	5.9
392	201+360	LHS	5.5	Banyan	7.8
393	201+365	RHS	4.8	Arjun	4.7
394	201+450	RHS	4.5	Arjun	4.2
395	201+460	LHS	4	Banyan	5.1
396	201+490	LHS	3.9	Mango	3.9

Sl. No.	Design Chainage	Side	Distance of Existing Centre line (m)	Species	Girth size (m)
397	201+505	RHS	4.5	Arjun	3.3
398	201+600	RHS	4.8	Peepal	3.7
399	201+660	LHS	4	Banyan	5.8
400	201+800	LHS	6	Banyan	6.4
401	201+805	RHS	6.7	Banyan	12.0
402	201+905	LHS	5.9	Arjun	3.7
403	201+990	LHS	6.4	Arjun	3.8
404	202+000	LHS	6.6	Arjun	4.6
405	202+100	LHS	8	Arjun	4.1
406	202+400	LHS	7.5	Banyan	4.2
407	202+420	LHS	7.3	Banyan	6.7
408	202+450	LHS	7.4	Banyan	4.6
409	202+550	LHS	6.1	Arjun	4.2
410	202+570	LHS	8.9	Arjun	4.5
411	202+605	LHS	8.2	Arjun	4.2
412	202+640	RHS	8.8	Arjun	5.2
413	202+760	LHS	7.6	Banyan	4.8
414	202+850	RHS	6.4	Banyan	4.8
415	203+050	LHS	4.2	Arjun	3.4
416	203+350	LHS	5.5	Arjun	5.2
417	203+390	RHS	5.5	Shirish	3.4
418	203+470	LHS	3.2	Peepal	6.5
419	203+640	RHS	6	Mango	4.8
420	203+645	RHS	5.9	Mango	4.1
421	203+800	RHS	7.4	Tarmarind	5.5
422	204+340	LHS	7.2	Shirish	6.4
423	204+550	RHS	7.7	Shirish	6.8
424	204+670	RHS	7.7	Shirish	6.3
425	204+675	RHS	7.1	Shirish	5.8
426	204+830	LHS	9.7	Mango	4.8
427	204+835	LHS	9.3	Mango	3.4
428	205+050	RHS	8.3	Mango	4.8
429	205+400	LHS	7.2	Arjun	5.5
430	205+630	LHS	7	Arjun	6.4
431	205+635	RHS	9.2	Mango	6.8
432	205+650	LHS	6.8	Mango	3.2
433	205+655	LHS	6.3	Mango	4.9
434	205+750	LHS	10.4	Mango	3.7
435	205+850	LHS	7.6	Mango	3.6
436	205+950	RHS	9.5	Mango	4.5
437	205+970	RHS	9.8	Mango	3.5
438	205+975	LHS	5	Mango	5.5
439	205+980	RHS	9.9	Jamun	3.8
440	206+050	LHS	6.4	Mango	3.7
441	206+025	RHS	9.5	Mango	4.1
442	206+050	LHS	7.1	Arjun	5.5
443	206+050	RHS	9.5	Arjun	6.1
444	206+585	RHS	8.5	Arjun	5.2
445	206+585	LHS	10	Shirish	3.4
446	206+100	RHS	9.5	Arjun	3.2
447	206+115	LHS	7.5	Mango	3.8
448	206+115	RHS	9.2	Mango	4.2

Sl. No.	Design Chainage	Side	Distance of Existing Centre line (m)	Species	Girth size (m)
449	206+140	RHS	9.7	Mango	7.1
450	206+170	RHS	9.1	Banyan	5.4
451	206+170	LHS	7.2	Mango	4.8
452	206+180	RHS	8.8	Arjun	5.4
453	206+200	RHS	9.2	Arjun	4.8
454	206+220	RHS	8.5	Arjun	5.4
455	206+260	RHS	9.1	Mango	4.2
456	206+280	RHS	9	Mango	5.5
457	206+285	RHS	9.3	Banyan	5.7
458	206+300	RHS	9.8	Arjun	10.5
459	206+280	RHS	9.2	Arjun	4.2
460	206+320	RHS	9.5	Arjun	3.2
461	206+180	LHS	7.5	Mango	5.4
462	206+200	LHS	7.3	Arjun	3.4
463	206+300	LHS	6.7	Arjun	5.5
464	206+380	LHS	5.3	Banyan	3.6
465	206+550	LHS	5.9	Arjun	6.1
466	206+680	LHS	6.1	Mango	3.8
467	207+690	LHS	5.2	Arjun	4.2
468	207+200	RHS	8	Mango	5.9
469	207+190	LHS	6.3	Mango	5.5
470	207+320	RHS	9	Arjun	6.8
471	207+520	RHS	8.3	Banyan	7.8
472	207+620	LHS	6.4	Banyan	6.5
473	207+600	RHS	9.1	Mango	3.3
474	207+650	LHS	7.5	Mango	5.2
475	207+695	RHS	9.7	Tarmarind	3.8
476	207+950	LHS	6.5	Arjun	8.0
477	208+000	RHS	9.9	Arjun	5.7
478	208+020	LHS	6.2	Arjun	4.8
479	208+020	RHS	7.2	Mango	7.0
480	208+180	LHS	4.5	Banyan	3.6
481	208+250	RHS	6.2	Peepal	6.9
482	208+360	LHS	8.5	Arjun	3.5
483	208+380	RHS	10.1	Mango	6.8
484	208+400	RHS	9.8	Arjun	5.4
485	208+570	LHS	8.7	Arjun	4.0
486	208+600	LHS	8.5	Shirish	3.0
487	208+630	RHS	6.8	Shirish	3.2
488	208+695	LHS	6.5	Shirish	3.3
489	208+800	LHS	5.9	Shirish	3.8
490	208+830	LHS	6.1	Shirish	3.2
491	208+880	LHS	4.5	Shirish	4.2
492	208+905	LHS	5.5	Shirish	3.4
493	208+910	RHS	4.8	Peepal	4.5
494	209+250	RHS	8.5	Shirish	3.4
495	209+260	RHS	3.1	Shirish	4.2
496	209+270	LHS	5.8	Shirish	3.2
497	209+280	LHS	4.2	Shirish	3.3
498	209+320	RHS	4.5	Shirish	3.8
499	209+380	RHS	4.7	Shirish	3.6
500	209+420	RHS	4	Peepal	6.5

Sl. No.	Design Chainage	Side	Distance of Existing Centre line (m)	Species	Girth size (m)
501	209+590	RHS	5.6	Mango	4.9
502	209+600	RHS	5.5	Mango	3.2
503	209+610	LHS	5.4	Banyan	4.6
504	209+300	RHS	5.7	Mango	3.0
505	209+800	RHS	7.1	Banyan	6.5
506	209+900	RHS	6	Arjun	3.4
507	210+100	RHS	7.6	Arjun	6.1
508	210+735	LHS	7.3	Peepal	4.8
509	210+740	LHS	7	Arjun	3.5
510	211+030	LHS	7.5	Arjun	4.8
511	211+050	RHS	6.6	Mango	4.6
512	212+950	RHS	8.8	Arjun	4.5
513	214+485	LHS	4.5	Tarmarind	3.2
514	218+280	LHS	4	Tarmarind	4.8
515	218+480	LHS	3	Banyan	7.8
516	218+795	RHS	5	Tarmarind	3.4
517	218+790	RHS	5.5	Tarmarind	3.8
518	218+850	RHS	8	Tarmarind	4.2
519	218+880	RHS	6.2	Tarmarind	4.6
520	220+800	RHS	4.1	Arjun	6.1

ANNEX 4.6 GREEN TUNNEL LOCATIONS ALONG PROJECT ROAD



ANNEX 4.7 RESULTS OF BIODIVERSITY STUDY

Table-4.7.1 Relative Frequency (RF), Relative Density (Rd), important Value Index (IVI) and Species Abundance for Trees Species

Sl. No.	Species Name	RF	Rd	IVI	Abundance
1	*Pongamia pinnata*	6.96	7.59	14.54	3.50
2	*Cassia siamea*	4.35	5.96	10.31	4.40
3	*Leucaena leucocephala*	3.48	5.96	9.44	5.50
4	*Grevillea robusta*	3.48	5.42	8.90	5.00
5	*Ficus benghalensis*	4.35	4.07	8.41	3.00
6	*Azadirachta indica*	4.35	3.52	7.87	2.60
7	*Eucalyptus tereticornis*	3.48	4.34	7.81	4.00
8	*Wrightia tinctoria*	3.48	4.07	7.54	3.75
9	*Butea monosperma*	4.35	2.98	7.33	2.20
10	*Annona squamosa*	3.48	3.52	7.00	3.25
11	*Psidium guajava*	3.48	3.52	7.00	3.25
12	*Acacia nilotica*	3.48	3.25	6.73	3.00
13	*Dalbergia sissoo*	3.48	3.25	6.73	3.00
14	*Syzygium cumini*	2.61	4.07	6.67	5.00
15	*Diospyros melanoxylon*	3.48	2.98	6.46	2.75
16	*Peltophorum pterocarpum*	3.48	2.98	6.46	2.75
17	*Acacia catechu*	2.61	3.79	6.40	4.67
18	*Albizia lebbeck*	3.48	2.71	6.19	2.50
19	*Delonix regia*	3.48	2.71	6.19	2.50
20	*Acacia auriculiformis*	3.48	2.44	5.92	2.25
21	*Tamarindus indica*	3.48	1.90	5.38	1.75
22	*Cassia fistula*	2.61	2.44	5.05	3.00
23	*Samanea saman*	2.61	2.44	5.05	3.00
24	*Morinda tinctoria*	2.61	1.90	4.51	2.33
25	*Vitex altisima*	2.61	1.90	4.51	2.33
26	*Terminalia chebula*	1.74	2.71	4.45	5.00
27	*Bauhinia parpurea*	2.61	1.63	4.23	2.00
28	*Ficus religiosa*	2.61	1.36	3.96	1.67
29	*Phoenix sylvestris*	1.74	1.63	3.37	3.00
30	*Ficus amplissima*	1.74	1.08	2.82	2.00
31	*Albizia amara*	0.87	1.90	2.77	7.00

Table-4.7.2 Relative Frequency (RF), Relative Density (Rd), Important Value Index (IVI) and Species Abundance for Shrub Species

Sl. No.	Species Name	RF	Rd	IVI	Abundance
1	*Chromolaena odorata*	4.55	9.88	14.43	19.50
2	*Stachytarpheta indica*	6.06	7.52	13.58	11.13
3	*Lantana camara*	5.30	7.77	13.07	13.14
4	*Sida acuta*	4.55	5.91	10.46	11.67
5	*Dodonaea viscosa*	5.30	4.81	10.12	8.14
6	*Tephrosia purpurea*	3.79	5.07	8.86	12.00
7	*Sida rhombifolia*	3.79	4.22	8.01	10.00
8	*Pterolobium hexapetalum*	3.79	4.14	7.93	9.80
9	*Vicoa indica*	3.79	4.14	7.93	9.80

Sl. No.	Species Name	RF	Rd	IVI	Abundance
10	*Cassia tora*	3.03	4.81	7.84	14.25
11	*Jatropha curcas*	3.79	3.13	6.91	7.40
12	*Agave americana*	4.55	2.36	6.91	4.67
13	*Securinega virosa*	3.03	3.72	6.75	11.00
14	*Canthium parviflorum*	3.79	2.79	6.58	6.60
15	*Sida cordifolia*	3.03	3.21	6.24	9.50
16	*Stylosanthes fruticosa*	3.03	3.04	6.07	9.00
17	*Acacia concinna*	3.79	1.94	5.73	4.60
18	*Argyriea cuniata*	3.79	1.94	5.73	4.60
19	*Solanum indicum*	3.03	2.45	5.48	7.25
20	*Opuntia dillenii*	3.03	2.11	5.14	6.25
21	*Ziziphus oenoploea*	3.03	2.11	5.14	6.25
22	*Waltheria indica*	2.27	2.62	4.89	10.33
23	*Jasminum ritchiei*	3.03	1.77	4.80	5.25
24	*Cassia auriculata*	3.03	1.52	4.55	4.50
25	*Rhus mysorensis*	2.27	1.86	4.13	7.33
26	*Calotropis procera*	3.03	1.01	4.04	3.00
27	*Tarenna asiatica*	1.52	1.86	3.37	11.00
28	*Erythroxylum monogynum*	1.52	1.18	2.70	7.00
29	*Toddalia asiatica*	1.52	1.10	2.61	6.50

Table-4.7.3 Relative Frequency (RF), Relative Density (Rd), Important Value Index (IVI) and Species Abundance for Herb Species

Sl. No.	Species Name	RF	Rd	IVI	Abundance
1	*Mimosa pudica*	7.32	12.20	19.51	15.11
2	*Parthenium hysterophorus*	6.50	10.40	16.91	14.50
3	*Hybanthus enneaspermus*	5.69	8.79	14.48	14.00
4	*Cynodon dactylon*	4.88	9.06	13.94	16.83
5	*Leucas aspera*	6.50	5.56	12.06	7.75
6	*Spilanthes acmella*	5.69	6.10	11.79	9.71
7	*Achyranthes aspera*	4.88	6.37	11.25	11.83
8	*Hemidesmus indicus*	5.69	5.47	11.16	8.71
9	*Tridax procumbens*	4.07	5.65	9.72	12.60
10	*Dolichos falcatus*	4.07	3.95	8.01	8.80
11	*Evolvulus alsinoides*	4.07	3.32	7.38	7.40
12	*Desmodium triflorum*	4.07	3.23	7.29	7.20
13	*Commelina benghalensis*	4.88	2.15	7.03	4.00
14	*Tylophora asthmatica*	4.88	2.15	7.03	4.00
15	*Orthosyphon diffuse*	4.07	2.87	6.93	6.40
16	*Ocimum americanum*	3.25	3.05	6.30	8.50
17	*Vernonia cinerea*	4.07	1.97	6.04	4.40
18	*Phyllanthus urinaria*	3.25	2.78	6.03	7.75
19	*Tinospora cardifolia*	4.07	1.52	5.59	3.40
20	*Mitracarpus verticillata*	3.25	1.88	5.14	5.25
21	*Asparagus racemosus*	3.25	1.35	4.60	3.75
22	*Ichnocarpus frutescens*	1.63	0.18	1.81	1.00

Table-4.7.4 Relative Frequency (RF), Relative Density (Rd), Important Value Index (IVI) and Species Abundance for Faunal Species

Sl. No.	Scientific Name	Kind	RF	Rd	IVI	Abundance
1	*Eurema brigitta*	Insect	4.57	10.08	14.66	10.50
2	*Apis dorsata*	Insect	2.86	10.56	13.42	17.60
3	*Catopsilia pomona*	Insect	2.86	6.24	9.10	10.40
4	*Psuedocoladenia dan*	Insect	1.71	6.72	8.44	18.67
5	*Zizeeria karsandra*	Insect	3.43	4.20	7.63	5.83
6	*Acridotheres tristis*	Bird	2.86	3.24	6.10	5.40
7	*Cypsiurus balasiensis*	Bird	2.29	3.72	6.01	7.75
8	*Psittacula krameri*	Bird	2.86	3.00	5.86	5.00
9	*Lonchura punctulata*	Bird	1.71	3.96	5.68	11.00
10	*Streptopelia chinensis*	Bird	2.86	2.40	5.26	4.00
11	*Apis cerana*	Insect	1.14	3.96	5.10	16.50
12	*Calotes versicolor*	Reptile	4.00	1.08	5.08	1.29
13	*Sympetrum flavolum*	Insect	1.71	3.00	4.72	8.33
14	*Atrophaneura hector*	Insect	2.86	1.68	4.54	2.80
15	*Dicaeum agile*	Bird	2.29	1.56	3.85	3.25
16	*Euploea core*	Insect	2.29	1.56	3.85	3.25
17	*Hirundo rustica*	Bird	1.71	2.04	3.76	5.67
18	*Turdoides striatus*	Bird	1.14	2.28	3.42	9.50
19	*Ariadne merione*	Insect	1.71	1.44	3.15	4.00
20	*Chorthippus brunneus*	Insect	1.71	1.44	3.15	4.00
21	*Merops orientallis*	Bird	1.71	1.32	3.03	3.67
22	*Megalaima viridis*	Bird	1.71	1.20	2.91	3.33
23	*Xylocopa Violacea*	Insect	2.29	0.60	2.89	1.25
24	*Papillio polytes*	Insect	1.71	1.08	2.79	3.00
25	*Pycnonotus jocosus*	Bird	1.71	0.96	2.67	2.67
26	*Pseudibis papillosa*	Bird	1.71	0.84	2.55	2.33
27	*Egretta garzetta*	Bird	1.14	1.32	2.46	5.50
28	*Junonia iphita*	Insect	1.71	0.60	2.31	1.67
29	*Lampropholis guichenoti*	Reptile	1.71	0.60	2.31	1.67
30	*Halcyon smyrnensis*	Bird	1.71	0.48	2.19	1.33
31	*Anser indicus*	Bird	0.57	1.44	2.01	12.00
32	*Fulica atra*	Bird	1.14	0.84	1.98	3.50
33	*Atrophaneura aristolochiae*	Insect	1.14	0.72	1.86	3.00
34	*Bubulcus ibis*	Bird	1.14	0.72	1.86	3.00
35	*Mycteria leucocephala*	Bird	0.57	1.08	1.65	9.00
36	*Ardeola grayii*	Bird	1.14	0.48	1.62	2.00
37	*Ariadne ariadne*	Insect	1.14	0.48	1.62	2.00
38	*Mirafra contillans*	Bird	1.14	0.48	1.62	2.00
39	*Oriolus oriolus*	Bird	1.14	0.48	1.62	2.00
40	*Saxicola caprata*	Bird	1.14	0.48	1.62	2.00
41	*Saxicoloides fulicata*	Bird	1.14	0.48	1.62	2.00

Sl. No.	Scientific Name	Kind	RF	Rd	IVI	Abundance
42	*Delias eucharis*	Insect	1.14	0.36	1.50	1.50
43	*Vanellus indicus*	Bird	1.14	0.36	1.50	1.50
44	*Phalacrocorax carbo*	Bird	0.57	0.84	1.41	7.00
45	*Ictinaetus malayensis*	Bird	1.14	0.24	1.38	1.00
46	*Pavo cristatus*	Bird	1.14	0.24	1.38	1.00
47	*Nectarinia zeylonica*	Bird	0.57	0.72	1.29	6.00
48	*Dicrurus macrocercus*	Bird	0.57	0.48	1.05	4.00
49	*Streptopelia senegalensis*	Bird	0.57	0.48	1.05	4.00
50	*Actitis hypoleucos*	Bird	0.57	0.36	0.93	3.00
51	*Corvus splendens*	Bird	0.57	0.36	0.93	3.00
52	*Eurema hecabe*	Insect	0.57	0.36	0.93	3.00
53	*Muscicapa dauurica*	Bird	0.57	0.36	0.93	3.00
54	*Phalanta phalanta*	Insect	0.57	0.36	0.93	3.00
55	*Anthus rufulus*	Bird	0.57	0.24	0.81	2.00
56	*Dicrurus leucophaeus*	Bird	0.57	0.24	0.81	2.00
57	*Haliaster indus*	Bird	0.57	0.24	0.81	2.00
58	*Hypolimnas misippus*	Insect	0.57	0.24	0.81	2.00
59	*Neptis hylas*	Insect	0.57	0.24	0.81	2.00
60	*Turnix suscitator*	Bird	0.57	0.24	0.81	2.00
61	*Ypthima huebneri*	Insect	0.57	0.24	0.81	2.00
62	*Accipiter badius*	Bird	0.57	0.12	0.69	1.00
63	*Acraea violae*	Insect	0.57	0.12	0.69	1.00
64	*Amphiesma stolatum*	Reptile	0.57	0.12	0.69	1.00
65	*Castalius rosimon*	Insect	0.57	0.12	0.69	1.00
66	*Coracias benghalensis*	Bird	0.57	0.12	0.69	1.00
67	*Cuculus micropterus*	Bird	0.57	0.12	0.69	1.00
68	*Danaus chrysippus*	Insect	0.57	0.12	0.69	1.00
69	*Gallus sonneratii*	Bird	0.57	0.12	0.69	1.00
70	*Ischnura hecterostica*	Insect	0.57	0.12	0.69	1.00
71	*Junonia atlites*	Insect	0.57	0.12	0.69	1.00
72	*Lanius meridionalis*	Bird	0.57	0.12	0.69	1.00
73	*Lepus nigricollis*	Mammal	0.57	0.12	0.69	1.00
74	*Ocyceros birostris*	Bird	0.57	0.12	0.69	1.00
75	*Threskiornis melanocephalus*	Bird	0.57	0.12	0.69	1.00
76	*Tirumala septentrionis*	Insect	0.57	0.12	0.69	1.00
77	*Vespula vulgaris*	Insect	0.57	0.12	0.69	1.00

ANNEX 4.8 SECONDARY FROM STATE FOREST DEPARTMENT

Table-4.8.1 List of Flora found in Natural Forests of Magadi to Somwarpet

Sl.No	Botanical Names	Local / Common
1.	*Aagyrei cuneata*	Kallanamele
2.	*Abrus precatorius*	Gurugunji
3.	*Abutilon indicum*	Shirmudhre Gida
4.	*Acacia auriculiformis*	Earleaf Acacia
5.	*Acacia catechu*	Cachu , Kaggali
6.	*Acacia chundra*	-
7.	*Acacia concinna*	Seege.
8.	*Acacia ferruginea*	Banni
9.	*Acacia intsia*	Kaduseege
10.	*Acacia leucophloea*	Bilijai, Thoppale, Thumbemara
11.	*Acacia nilotica*	Gobli, Karijali
12.	*Acacia polycantha*	-
13.	*Achras zapota*	-
14.	*Achyranthus aspera*	Uthrane
15.	*Actinodaphne hookeri*	Kagodgimara
16.	*Adathoda vasica*	-
17.	*Adenanthera pavonina*	Aadusoge
18.	*Adina cordifolia*	Aadusoge
19.	*Aegle marmelos*	Bilpathre
20.	*Aeschynomene indica*	-
21.	*Agave sissalana*	Kathale (Sissal)
22.	*Ailanthus excelsa*	Hemmara, Hiremara
23.	*Ailanthus tryphysa*	Guggula Dhupa
24.	*Alangium lamarckii*	Ankola, Anesorali
25.	*Albizia odoratissima*	Bilwara, Bachari
26.	*Albizia amara*	Chagali, Sujjalu /Tuggali, Tugi
27.	*Albizia lebbeck*	Hombage, Shirish
28.	*Albizia odoratissima*	Bilwara
29.	*Albizia procera*	Bellate, Salubage
30.	*Alstonia scholaris*	Banthale, Maddale, Kodale
31.	*Anacardium occidentale*	Godambi, Kaju,Jidi,
32.	*Andropogon serratus*	-
33.	*Annona squamosa*	Seethaphala, Amruthaphala
34.	*Anogeissus latifolia*	Dindiga, Dindal, Bejjalu
35.	*Antiaris toxicaria*	Arunje, Bairi, Jaguri, Ajjanapatte
36.	*Antidesma menasu*	-
37.	*Aporosa lindleyana*	Saroli,
38.	*Arenga wightii*	Dadsalu
39.	*Aristolochia indica*	Iswaree beru balli
40.	*Artocarpus hirsuta*	Hebbalasu, Kabbalasu,K aduhalasu,
41.	*Artocarpus integrifolia*	Halasu, Phanasa
42.	*Artocarpus lakoocha*	Watehuli, Vantimara, Vatemara
43.	*Asparagus racemosus*	Satawari
44.	*Azadirachta indica*	Bevu, Ollebevu
45.	*Azima tetracantha*	Uppagachi
46.	*Bambusa arundinacea*	Hebbidiru
47.	*Bauhinia malabarica*	Basavanapada, Mandhara
48.	*Bauhinia purpurea*	Kaadu mandhara
49.	*Bauhinia racemosa*	Vanasampige, Achalu

Sl.No	Botanical Names	Local / Common
50.	*Bauhinia vahlii*	Arise
51.	*Bombax ceiba*	Buruga
52.	*Bombax malabaricum*	Buruga, Kempuburuga,
53.	*Boswellia serrata*	Maddi,Dhupa, Maddimara
54.	*Bridelia retusa*	Goje, Gurige,Gowrige, Hasana
55.	*Buchanania angustifolia*	Maradi, Murkali, Charoli
56.	*Buchanania latifolia*	Morave, Dhanushchata
57.	*Butea monosperma*	Muthuga, Phalasa,
58.	*Caesalpinia bonduc*	Gajjuga,
59.	*Caesalpinia mimosoides*	Kenjaga
60.	*Caesearia tomentosa*	Hesara
61.	*Calophyllum elatum*	Srihonne
62.	*Calophyllum inophyllum*	Surahonne, Sudabu, Hoohonne
63.	*Calotropis gigantia*	Ekka
64.	*Calotropis procera*	Ekka
65.	*Canarium strictum*	Kaidhupa, Raladhupa, Karidhupa
66.	*Canthium parviflorum*	Kare, Gandukakorla
67.	*Canthium spp.*	Heddarare
68.	*Capparis horrida*	Kathrihambu
69.	*Capparis stylosa*	Hunsadlimullu
70.	*Cardiospermum halicacabum*	Agniballi
71.	*Careya arborea*	Kavalu, Kaval,Gonji
72.	*Carissa carandas*	Karonda
73.	*Caryota urens*	Bagani, Paine, Baine
74.	*Cassia auriculata*	Avarike,, Honnavari,Thangadi
75.	*Cassia fistula*	Kakke,Swaranapushpa, Bava
76.	*Cassia siamea*	Seemathangadi,Hirethangadi
77.	*Cassia tora*	Chagache,Chagate
78.	*Casuarina equisetifolia*	Survey, Galimara,Casuarina
79.	*Celastrus montana.*	Kadugandha
80.	*Celastrus paniculata*	Gengungeballi
81.	*Ceropegia tuberosa*	Bachachamanda,Bithrige
82.	*Chloroxylon swietenia*	Hurugalu, Maasi, Mashavala
83.	*Cinnamomum tamala*	Tejpat
84.	*Cinnamomum wightii*	Kadudalchinni,Lavangapathre
85.	*Cipadessa baccifera*	Chittundi
86.	*Clematis gouriana*	Arakanambu
87.	*Cochlospermum gossypium*	Arashinaburuga
88.	*Cochlospermum gossypium*	Bettadavare
89.	*Cordia macleodii*	Hadage
90.	*Cordia myxa*	Challe, Chadlu,Kendal, Solle, Botte
91.	*Crotalaria retusa*	Dhingala
92.	*Croton bonplandianus*	-
93.	*Cryptolepis buchanani*	Halubatti
94.	*Curculigo orchioides*	Nela Thaale
95.	*Curcuma longa*	-
96.	*Cymbopogon citrates*	Lemon grass
97.	*Cynodon dactylon*	Garike hullu
98.	*Cynoglossum denticulatum*	-
99.	*Daemia extensa*	Kuntigena gida
100.	*Dalbergia citrates*	Beete
101.	*Dalbergia latifolia*	Beete

Sl.No	Botanical Names	Local / Common
102.	*Dalbergia paniculata*	Pachali, Belaga
103.	*Dalbergia sissoides*	Sissoo, Shisso,Bindi, Sheesham
104.	*Datura metel*	Dhathuri gida
105.	*Delonix regia*	Gulmohar
106.	*Dendrocalamus strictus*	Kiribidiru
107.	*Desmodium heterocarpon*	-
108.	*Desmodum pulchellum*	Kaadulthi
109.	*Digitaria longiflora*	-
110.	*Dioscorea pentaphylla*	-
111.	*Diospyros melanoxylon*	Tupra, Bidiele
112.	*Diospyros montana*	Jagalaganti, Bilkunika,Kalnandi
113.	*Diospyros tupru*	Tupra, Bidiele, Tubare
114.	*Dipterocarpus indicus*	Dhuma, Challane, Kalpain
115.	*Dodonaea viscosa*	Kanagalu
116.	*Dregea volubilis*	Akeseppu
117.	*Dregea volubilis*	Akeseppu
118.	*Elaeocarpus tuberculatus*	Dandlamara,Kungemara
119.	*Elaeodendron glaucum*	Mukarthi, Kannire,Hakkeralu
120.	*Eleocharis retroflexa*	
121.	*Embelia tsjeriam-cottom*	Amti,Choladhangna
122.	*Emblica officinalis*	Nelli, Amla, Bettanelli, Amlaka
123.	*Emblica officinalis*	Nelli
124.	*Entada scandens*	Ganapeballi
125.	*Entada scandens*	Ganapeballi
126.	*Erythrina stricta*	-
127.	*Erythroxylon monogynum*	Devadari, Gandagiri, Adavi
128.	*Eucalyptus hybrid*	Neelagiri
129.	*Eucalyptus teriticormis*	Forest red gum
130.	*Euphorbia antiquorum*	-
131.	*Euphorbia hirta*	-
132.	*Euphorbia tirukalli*	Kalli
133.	*Evolvulus alsinoides*	Vishnukranthi
134.	*Ficus asperrima*	Gargathi, Khargasa
135.	*Ficus benghalensis*	Ala, Vada,Vatavruksha
136.	*Ficus benjamina*	-
137.	*Ficus glomerata*	Atti, Rumadi,Gulara
138.	*Ficus hispida*	-
139.	*Ficus infectoria*	Basari(Kappu)
140.	*Ficus lacor*	Kari Basari, Kela
141.	*Ficus mysorensis*	Goni
142.	*Ficus racemosa*	-
143.	*Ficus religosa*	Arali
144.	*Ficus tsjahela*	-
145.	*Fimbristylis dichotoma*	--
146.	*Flacourtia indica*	-
147.	*Flacourtia ramontchi*	Sannagejjalikey
148.	*Flacourtia sepiaria*	Miradi, Mindi
149.	*Flemingia strobilifera*	-
150.	*Fluggea leucopyrus*	Hukigida
151.	*Fluggea microcarpa*	Haggajalikey
152.	*Gardenia gummifera*	Bikke, Kambimena, Dikamali
153.	*Gardenia latifolia*	Kambimara, Khalkambi, Adavibikke

Sl.No	Botanical Names	Local / Common
154.	*Girardinia zeylanica*	Thurike gida
155.	*Givotia rotteriformis*	Bilitale, Buditale,Pulike
156.	*Glochidion malabaricum*	-
157.	*Glochidion zeylanicum*	-
158.	*Gloriosa superba*	Gouri gadde,Koli juttu
159.	*Glossocardia bosvallea*	-
160.	*Glycosmis pentaphylla*	-
161.	*Glyricidia maculata*	-
162.	*Gmelina asiatica*	Roboli,Heggulla
163.	*Gnetum scandens*	Kambali balli
164.	*Grevillea robusta*	Silver oak
165.	*Grewia arborea*	Shivane, Gamara, Kashmiri mara
166.	*Grewia arborea*	Sivanae
167.	*Grewia hirsuta*	-
168.	*Grewia retuse*	Jane
169.	*Grewia tiliaefolia*	Tadasalu, Dhaman, Kendalasu
170.	*Gymnema sylvestre*	Madhu naashini
171.	*Gymnosporia montana*	Thandarasi
172.	*Habenaria roxburghii*	-
173.	*Hardwickia binata*	Kamra, Kamara,Karachi
174.	*Hardwickia binata*	Kamara,Karachi
175.	*Hardwickia pinnata*	Yennemara
176.	*Helicteres isora*	Kowry, Edamuri,Kadukalnaru, Kavaragi
177.	*Hemidesmus indicus*	Segadeberu
178.	*Hibiscus furcatus*	Bettadha bende
179.	*Hibiscus rosa sinensis*	Dhasavala
180.	*Holarrhena antidysenterica*	Kodasiga, Kodachaga, Kurji,
181.	*Holoptelea intergrifolia*	Thapasi, Rasabeeja, Kaladhri, Berabilva
182.	*Hymenodictyon excelsum*	Doddathoppe, Dhoddimara, Bindarimara,
183.	*Ichnocarpus wightiana*	Narihambu
184.	*Imperata arundinacea*	-
185.	*Indigofera pulchella*	Neeli
186.	*Indigofera tinctoria*	Nellisoppu
187.	*Indigofera wightii*	-
188.	*Ixora nigricans*	-
189.	*Ixora parviflora*	Goravi,Kissara, Gorije,Heddarani
190.	*Jacaranda mimosaefolia*	Jacaranda
191.	*Jasminum arborescens*	Mallige
192.	*Jasminum pubescens*	Kaadu Mallige
193.	*Jasminum sambac*	Jasmine
194.	*Jatropha curcas*	Turkkuharalu, Bettaharalu, Kaduharalu
195.	*Jatropha gossipyfolia*	-
196.	*Justicia betonica*	-
197.	*Justicia simplex*	-
198.	*Knema attenuata*	Rikta, Wild Nutmeg
199.	*Lagasca mollis*	-
200.	*Lagerstroemia flosreginae*	Holedasavala, Challa, Chella
201.	*Lagerstroemia lanceolata*	Nandi, Belmatti, Nana, Bolandaru
202.	*Lagerstroemia microcarpa*	Nandi
203.	*Lagerstroemia parviflora*	Channangi, Lendi
204.	*Lantana camara*	Lantana
205.	*Leucas aspera*	Thumbe

Sl.No	Botanical Names	Local / Common
206.	*Leucas linifolia*	Thumbe
207.	*Limonia acidissima*	Naibela, Thondarasi
208.	*Loranthus indica*	Badanike,Bandanike
209.	*Ludwigia parviflora*	-
210.	*Macaranga indica*	Uppale
211.	*Macaranga peltata*	Batlachandrice,Upplige, Chandrakala
212.	*Madhuca indica*	Ippe,Helippe
213.	*Madhuca longifolia*	Kadippe
214.	*Mallotus philippensis*	Kumkumadamara, Hulibendu, Urabatti
215.	*Mangifera indica*	Mavu
216.	*Martynia diandra*	-
217.	*Melia composita*	Maddi
218.	*Memecylon edule*	Bulichappe,Archeti
219.	*Michelia champaca*	Sampige
220.	*Michelia nilagirica*	Kadusampige
221.	*Miliusa tomentosa*	Wumb, Kari hessare
222.	*Mimosa pudica*	Naachige mullu gida
223.	*Mimusops elengi*	Ranja, Kesara,Pagademara
224.	*Mitragyna parviflora*	Kadambolu
225.	*Morinda tomentosa*	Maddi mara
226.	*Moringa oleifera*	Nugge
227.	*Mucuna pruriens*	Nayisonanguballi
228.	*Mundulea sericea*	Betta hurali
229.	*Murdannia nudiflora*	Doveweed
230.	*Myristica magnifica*	Ramaadike,
231.	*Myristica malabarica*	Rampathre, Kanaagi
232.	*Nephelium longana*	Charkotte
233.	*Nerium oleander*	Nerium
234.	*Nervavelia zeylanica*	Yethi balli
235.	*Ocimum americanum*	Janagali Tulasi
236.	*Ocimum sanctum*	Tulasi
237.	*Olea dioica*	Hekkarakalu, madle
238.	*Opuntia dillenii*	Papaskalli
239.	*Opuntia dillenii*	Papaskalli
240.	*Oxalis corniculata*	Huli soppu
241.	*Palaquium ellipticum*	Pale,Maddale
242.	*Parthenium hysterophorus*	Congress grass
243.	*Passiflora foetida*	Kukkiballi
244.	*Pavetta indica*	Pavatte
245.	*Pavonia zeylanica*	Shivana kadle
246.	*Peltophorum pterocarpum*	Copper pod
247.	*Pennisetum pedicellatum*	Grass
248.	*Peristrophe bicalyculata*	Chibira gida
249.	*Perotis indicus*	Narimisai-hullu, Comet Grass
250.	*Phoenix humilis*	Kirichalu
251.	*Phoenix sylvestris*	Eachalu
252.	*Phyllanthus amarus*	Kirunelli
253.	*Phyllanthus maderaspatensis*	Madaraas nelli
254.	*Phyllanthus simplex*	-
255.	*Phyllanthus virgatus*	Virgate leaf-flower
256.	*Plumbago zeylanica*	Bili chitramoola
257.	*Plumeria alba*	Kaadu sampige

Sl.No	Botanical Names	Local / Common
258.	*Poeciloneuron indicum*	Baligi, Kirbilli,Kiraballi
259.	*Polyalthia longifolia*	Ashok
260.	*Pongamia pinnata*	Honge, Karanja, Huligili
261.	*Premna tomentosa*	Narabe, Ejimara, Narale
262.	*Prosopis juliflora*	Ballarijali
263.	*Prosopis spicigera*	Banki
264.	*Protium caudatum*	Kondamaavu, Mukul
265.	*Psidium guajava*	Guava
266.	*Pterocarpus marsupium*	Honne, Hane, Bijasala
267.	*Pterolobium hexapetalum*	-
268.	*Randia dumetorum*	Mangarekai, Mangare, Maggare,
269.	*Rhinacanthus communis*	Naagamallige
270.	*Salix tetrasperma*	Neeravanji, Neeranje, Holebosi
271.	*Samanea saman*	Rain tree
272.	*Santalum album*	Shrigandha
273.	*Sapindus emarginatus*	Antuval, Norekai, Kugatemara
274.	*Schleichera trijuga*	Kusum, Sagade, Kendala
275.	*Schreberas swietenoidies*	Gante, Kalante, Goki
276.	*Scilla hyacinthina*	-
277.	*Scolopia crenata*	Kodalimara, Doddajapalajappe
278.	*Scutia indica*	Kurudi
279.	*Semecarpus anacardium*	Geru, Karigeru,Kadugeru
280.	*Sesabania bispinosa*	Dhaincha, Mullu jeenangi
281.	*Shorea roxburghii*	Ragina Mara, Bile Bovu, Jaalari
282.	*Shorea talura*	Jalari, Jaalada
283.	*Sida acuta*	Blue okra
284.	*Sida cordifolia*	Bala Panchang
285.	*Sida glutinosa*	Mysore Sida
286.	*Sida veronicifolia*	Bekkinathale Gida
287.	*Smilax zeylanica*	-
288.	*Smithia bigemina*	Double Paired Smithia
289.	*Smithia conferta*	Elakanni
290.	*Solanum erianthum*	Kadusonde, Kallarthi, Savudangi
291.	*Solanum ferox*	Gull bane
292.	*Solanum indicum*	Sonde
293.	*Solanum torvum*	Sundekkayi
294.	*Solanum xanthocarpum*	
295.	*Sophubia delphinifolia*	Dudhali
296.	*Soymida fabrifuga*	Somemara, Swamymara,Kemmara
297.	*Spatholobus roxburhii*	Ujjina balli
298.	*Spondias pinnata*	Ambate
299.	*Stachytarpheta indica*	Kaadu Uttarani
300.	*Sterculia guttata*	Happusavaya,Hulithond
301.	*Sterculia urens*	-
302.	*Stereospermum sauveolens*	Billa,Bilipadri,Huppalave
303.	*Streblus asper*	Mitlimara
304.	*Strychnos potatorum*	Chilla
305.	*Symplocos laurina*	Chunga,Buthagari
306.	*Syzygium cumini*	Nerale, Jambunerale
307.	*Syzygium gardneri*	Bilitupra
308.	*Tabebuia argentia*	-
309.	*Tagetas erecta*	Marygold

Sl.No	Botanical Names	Local / Common
310.	*Tamarindus indica*	Hunse
311.	*Tecoma stans*	-
312.	*Tectona grandis*	Sagavani, Tega
313.	*Tephrosia pulcherrima*	Yellow bell flower
314.	*Tephrosia purpurea*	Sarapunkha
315.	*Tephrosia villosa*	-
316.	*Terminalia arjuna*	Tore Matti, Belimatti, Holematti
317.	*Terminalia bellerica*	Shantimara, Tare, Gotinga
318.	*Terminalia chebula*	Alale
319.	*Terminalia paniculata*	Hunal, Kindal, Huluve
320.	*Terminalia tomentosa*	Matti
321.	*Terminalia tremula*	-
322.	*Thespesia populnea*	Paras Pipal
323.	*Thevetia nerifolia*	Yellow oleander
324.	*Toddalia aculeata*	Forest pepper
325.	*Tragia involucrata*	-
326.	*Tragus roxburghii*	-
327.	*Trebulus terestris*	-
328.	*Trema orientalis*	-
329.	*Triumfetta rhomboidea*	-
330.	*Triumfetta pilosa*	-
331.	*Tylophora asthmatica*	Indian Ipecac
332.	*Vateria indica*	Saldupa, Dupadamara,Bilidamar
333.	*Ventilago madraspatana*	Pappuli, Popli, Kabbilu
334.	*Vernonia anthelmintica*	-
335.	*Vernonia cinerea*	Ash colored fleabane
336.	*Viscum monoicum*	-
337.	*Vitex altissima*	Naviladi, Myrole, Nevuladi
338.	*Vitex negundo*	Lakkili, Lakkigida,Nekki,
339.	*Wendlandia exserta*	Kansurgi
340.	*Withania somnifera*	Ashwagandha
341.	*Wrightia tinctoria*	Hale
342.	*Wrightia tomentosa*	Indrajao
343.	*Xanthophyllum flavescens*	Kariuokki, chalapr
344.	*Xylia xylocarpa*	Jambe
345.	*Zizyphus jujuba*	Bore, Yelachi
346.	*Zizyphus oenoplia*	Soorimullu
347.	*Zizyphus rugosa*	Wild jujube
348.	*Zizyphus xylopyrus*	-
349.	*Zizypus glabrata*	Karukuttemara

Source: Forest Working Plan of, Bengaluru Rural, Mandya, Hassan, Madikeri Division

Table-4.8.2 List of Wild Animals dwelling in Forest Area

S.No	***Scientific Name***	***Common Name***
Mammals		
1.	*Axis axis*	*Spotted deer*
2.	*Bos gaurus*	*Gaur*
3.	*Canis aureus*	*Jackal*
4.	*Cervus unicolor*	*Sambar*
5.	*Cuon alpinus*	*Wild dog*
6.	*Elephas maximus*	*Elephant*

S.No	Scientific Name	Common Name
7.	Felis chaus	Jungle cat
8.	Herpestes edwardsii	Common Mongoose
9.	Helurecus ursinus	Sloth bear
10.	Hystrix Indica	Indian porcupine
11.	Lepus nigricollis	Indian hare
12.	Loris tardigrandus	Loris
13.	Macaca radiata	Bonnet Macaque
14.	Manis crassicaudata	Pangolin
15.	Melursus ursinus	Sloth bear
16.	Muntiacus muntjak	Barking deer
17.	Panthera pardus	Leopard
18.	Panthera tigris	Tiger
19.	Petaurista petaurista	Giant Squirrel
20.	Presbytis entellus	Common langur
21.	Pragulus meminna	Mouse deer
22.	Pteropus giganteus	Flying fox
23.	Ratufa indica	Indian giant squirrel
24.	Sus scrofa	Indian wild boar
25.	Tragulus meminna	Mouse deer
26.	Viverricula indica	Small Indian coivet
27.	Viverra megaspila	Malabar Civet
Reptiles		
28.	Typhlina diardi	Blind Snake
29.	Python molurus	Indian rock python
30.	Lycodon aulicus	Wolf Snake
31.	Macropisthodon plumbicolor	Green Keel back
32.	Ptyas mucosus	Rat Snake
33.	Ahaetulla nasutus	Vine Snake
34.	Bungarus caeruleus	Common Krait
35.	Naja naja	Indian Cobra
36.	Viper russellii	Russells Viper
37.	Trimeresurus gramineus	Bamboo pit viper
38.	Hemidactylus trenatus	House Gecko
39.	Calotes versicolor	Garden lizard
40.	Calotes calotes	Green calotes
41.	Chamaelon zeylanicus	Indian chamelon
42.	Riopa punctuata	Skink
43.	Varanus bengalensis	Common Indian monitor

Source: Forest Working Plan of Bangalore Rural, Mandya, Hassan, Madikerri , Kodagu

ANNEX 6.1 ADB RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

Rapid Environmental Assessment (REA) Checklist - Roads and Highways

Rapid Environmental Assessment (REA) Checklist - **Roads and Highways**

Screening questions	Yes	No	Remarks
A. Project Sitting - Is the Project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site	Yes		▪ Shri Rameshwara Temple ▪ Shri Lakshmaneshwara Temple ▪ Sri Agasthyeshwaraswamy Temple
▪ Protected Area	Yes		▪ Reserved Forest and State Forests
▪ Wetland		No	
▪ Mangrove		No	
▪ Estuarine		No	
▪ Buffer zone of protected area	No		
▪ Special area for protecting biodiversity		No	
B. Potential Environmental Impacts - Will the Project cause…			
Encroachment on historical / cultural areas; disfiguration of landscape by road embankments, cuts, fills and quarries?		No	
Encroachment on precious ecology		No	
Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?	Yes		No major changes in surface water hydrology of Waterways crossed by the road is envisaged as construction of cross drainage structures will be taken up during lean stream flow periods (summer) to avoid diversion of stream flow, soil erosion and flooding in the adjacent areas. All existing cross drainages will be reviewed for impact on surface water hydrology; reconstruction and replacement of distressed cross drainage structures along with new structures will minimize the impact on the surface water hydrology.
Deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?	Yes		▪ Adequate mitigation measures will be suggested to minimize the silt runoff from construction sites, ▪ Construction camps will be away from the surface water bodies; ▪ Silt trap trenches across the natural drains will be provided, ▪ Toilets will be provided with Septic tanks and sullage water will be connected to soak pits, ▪ Paved platform will be provided for vehicle service area, ▪ Chemicals and oil spills will be collected in oil interceptors and stored separately for recycling

Screening questions	Yes	No	Remarks
Increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?		No	Impacts on air quality during construction stage are transitory in nature and can be limited by mitigating measures. Crushing units, hot mix plant and wet mix plants will be located away from the human settlements and sensitive ecosystems. SPCB consents will be obtained and conditions laid there will be complied by the Contractor for establishing and operating these plants.
Noise and vibration due to blasting and other civil works?		No	Not envisaged
Dislocation or involuntary resettlement of people	Yes		
Other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?		No	
Hazardous driving conditions where construction interferes with pre-existing roads?		No	Site specific Traffic Management Plan will be prepared. Assistance from local police will be taken. Temporary diversions will be provided by maintaining adequate carriage way for diversion traffic. Barricades, Traffic Safety Signs, Caution Boards, Markings, Flags, Lights and Flagmen as may be required will be provided to avoid interference to the flow of traffic at preexisting roads.
Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases from workers to local populations?		No	Construction camps will be provided with sanitary latrines and urinals. The sewage system will be operated properly to avoid health hazards, ground water and soil contamination. Compost pits will be constructed for the disposal of the garbage and other Bio-degradable wastes generated from the camps. Proper collection, transportation and disposal of the wastes will be ensured. Construction and labour camps will be sited away from human settlements to avoid possible transmission of communicable diseases from workers to local populations
Creation of temporary breeding habitats for mosquito vectors of disease?		No	Better sanitation will be provided in construction and labour camps. Open pits near settlements will be filled with construction debris and covered with soil.
Dislocation and compulsory resettlement of people living in right-of-way?	Yes		
Accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials and loss of life?		No	Not envisaged However, if any accidental spill occurs, emergency spill procedure such as stopping the flow; removing ignition source; initiating emergency response;

Screening questions	Yes	No	Remarks
			cleanup and safe disposal will be followed.
Increased noise and air pollution resulting from traffic volume?	Yes		Short-term impact; Mitigation measures will be suggested After the completion of project, there will be reduction in noise and air pollution due to smooth and uniform flow of traffic. Further, proposed avenue and median plantation along the road sides and in medians shall help to control dust, fugitive emissions and noise from reaching the receptors.
Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?	Yes		▪ There may be negligible risk of water pollution from small quantities of oil, grease and fuel spills and other materials from vehicles using the road. ▪ Oil interceptors will be proposed for all the construction camps. ▪ Emergency Services will be engaged for the containment, cleanup and disposal of contamination release into the environment.

ANNEX 7.1 PCM QUESTIONNAIRE

Karnataka Public Works Department

KSHIP

ಕರ್ನಾಟಕ ರಾಜ್ಯ ಹೆದ್ದಾರಿ ಸುಧಾರಣೆ ಯೋಜನೆ – ಹಂತ II

ಪರಿಸರದ ಬಗ್ಗೆ ಹೂಡಿಕೆದಾರರ ಪ್ರತಿಕ್ರಿಯೆ

ಸ್ಥಳ	ಸ್ಪರ್ಧಿಯ ವಿವರಗಳು
1 ಸ್ಥಳ	4 ಹೆಸರು
2 ದಿನಾಂಕ	5 ಹಳ್ಳಿ
3 ರಸ್ತೆ	6 ದೂರವಾಣಿ ಸಂಖ್ಯೆ :

ಸೂಕ್ತವಾದುದನ್ನು ಆಯ್ಕೆ ಮಾಡಿ (✓)

ಶಬ್ದ ಮಾಲಿನ್ಯ

1 ನಿಮಗೆ ಸಂಚಾರದ ಶಬ್ದದಿಂದ ತೊಂದರೆಯಾಗುತ್ತದೆ ಎಂದು ಅನಿಸುತ್ತದೆಯೆ	ಹೌದು ☐				ಇಲ್ಲ ☐
ಹೌದು ಎನ್ನುವುದಾದರೆ, ನಂತರ ಪರಿಣಾಮದ ಪ್ರಮಾಣ ➢	ಉತ್ತಮ	ಮಧ್ಯಮ	ಕಡಿಮೆ	ಅತ್ಯಲ್ಪ	ಹೇಳಲು ಸಾಧ್ಯವಿಲ್ಲ
ಪ್ರಸ್ತುತ ಸಂಚಾರದ ಶಬ್ದದಿಂದ ತೊಂದರೆಯೇ					
ಪ್ರಸ್ತುತ ಸಂಚಾರದ ಹಾರ್ನ್ ಶಬ್ದದಿಂದ ತೊಂದರೆಯೇ					
2 ಯೋಜನೆಯ ಅನುಷ್ಠಾನದ ನಂತರ ಸಂಚಾರದ ಪರಿಮಾಣವನ್ನು ಹೆಚ್ಚಿಸುವುದು					

3 ನೀವು ಯೋಜನೆಯ ಕಾರಣ ಶಬ್ದ ಮಟ್ಟದಲ್ಲಿ ಯಾವುದೇ ಬದಲಾವಣೆ ನಿರೀಕ್ಷಿಸುತ್ತೀರ	ಹೆಚ್ಚಿಸುವುದು ☐		ಇಳಿಸುವುದು ☐		ಬದಲಾವಣೆ ಇಲ್ಲ ☐
ನಿರೀಕ್ಷಣೆಯ ಹೆಚ್ಚಾದರೆ, ನಂತರ ಪರಿಣಾಮದ ಪ್ರಮಾಣ ➢	ಉತ್ತಮ	ಮಧ್ಯಮ	ಕಡಿಮೆ	ಅತ್ಯಲ್ಪ	ಹೇಳಲು ಸಾಧ್ಯವಿಲ್ಲ
ಯೋಜನೆಯ ಅನುಷ್ಠಾನದ ನಂತರ ಶಬ್ದವನ್ನು ಹೆಚ್ಚಿಸುವುದು					
ಯೋಜನೆಯ ಅನುಷ್ಠಾನದ ನಂತರ ಹಾರ್ನ್ ಹೆಚ್ಚಿಸುವುದು					
ಯಂತ್ರಗಳು ಮತ್ತು ನಿರ್ಮಾಣ ವಾಹನಗಳಿಂದ ತೊಂದರೆಯೇ					
4 ಯಾವುದಾದರು ಸಲಹೆಗಳು ಶಬ್ದ ಮಾಲಿನ್ಯವನ್ನು ತಗ್ಗಿಸಲು :					

ಸೂಕ್ತವಾದುದನ್ನು ಆಯ್ಕೆ ಮಾಡಿ (✓)

ವಾಯು ಮಾಲಿನ್ಯ

5 ನಿಮಗೆ ವಾಯು ಮಾಲಿನ್ಯದಿಂದ ತೊಂದರೆಯಾಗುತ್ತದೆ ಅನಿಸುತ್ತದೆಯೆ	ಹೌದು ☐				ಇಲ್ಲ ☐
ಹೌದು ಎನ್ನುವುದಾದರೆ, ನಂತರ ಪರಿಣಾಮದ ಪ್ರಮಾಣ ➢	ಉತ್ತಮ	ಮಧ್ಯಮ	ಕಡಿಮೆ	ಅತ್ಯಲ್ಪ	ಹೇಳಲು ಸಾಧ್ಯವಿಲ್ಲ
ಪ್ರಸ್ತುತ ಸಂಚಾರದ ಗಾಳಿ ಹೊರಸೂಸುವಿಕೆಯಿಂದ ತೊಂದರೆಯೇ					
ಪ್ರಸ್ತುತ ಸಂಚಾರದ ಧೂಳಿನಿಂದ ತೊಂದರೆಯೇ					
6 ಸಂಚಾರ ಹೊರತುಪಡಿಸಿ ಬೇರೆ ಯಾವುದಾದರೂ ವಾಯು ಮಾಲಿನ್ಯದ ಮೂಲಗಳಿವೆಯೇ? ಇದ್ದರೆ, ಆ ಮೂಲಗಳನ್ನು ಹೆಸರಿಸಿ:					

7 ನೀವು ಯೋಜನೆಯ ಕಾರಣದಿಂದ ವಾತಾವರಣದ ಗುಣಮಟ್ಟದಲ್ಲಿ ಯಾವ ನಿರೀಕ್ಷಣೆಯಿದೆ	ಹೆಚ್ಚಿಸುವುದು ☐		ಇಳಿಸುವುದು ☐		ಬದಲಾವಣೆ ಇಲ್ಲ ☐
ನಿರೀಕ್ಷಣೆಯು ಹೆಚ್ಚಾದರೆ, ನಂತರ ಪರಿಣಾಮದ ಪ್ರಮಾಣ ➢	ಉತ್ತಮ	ಮಧ್ಯಮ	ಕಡಿಮೆ	ಅತ್ಯಲ್ಪ	ಯಾವುದೇ ಬೇಕೆಗಳಿಲ್ಲ
ಸಂಚಾರದ ಹಾವಳಿಯಿಂದ ವಾಯು ಮಾಲಿನ್ಯ ಹೆಚ್ಚಾಗಿದೆಯೇ					
ಸಂಚಾರದ ಹಾವಳಿಯಿಂದ ಧೂಳು ಹೆಚ್ಚಾಗಿದೆಯೇ					
8 ನಿರ್ಮಾಣದ ಕಾರ್ಯಗಳಿಂದ ಧೂಳು ಹೆಚ್ಚಾಗಿದೆಯೇ					
ಯಾವುದಾದರು ಸಲಹೆಗಳು ವಾಯು ಮಾಲಿನ್ಯವನ್ನು ತಗ್ಗಿಸಲು :					

ಕರ್ನಾಟಕ ಲಂಬ ಹೆದ್ದಾರಿ ಸುಧಾರಣೆ ಯೋಜನೆ – ಹಂತ II

KSHIP

ಪರಿಸರದ ಬಗ್ಗೆ ಹೂಡಿಕೆದಾರರ ಪ್ರತಿಕ್ರಿಯೆ

ಸೂಕ್ತವಾದುದನ್ನು ಆಯ್ಕೆ ಮಾಡಿ (✓)

ರಸ್ತೆ ಸುರಕ್ಷತೆ

9 ರಸ್ತೆ ಅಪಘಾತವು ಪೀಡಿತವೇ ?	ಹೌದು ☐				ಇಲ್ಲ ☐
ಹೌದು ಎನ್ನುವುದಾದರೆ, ನಂತರ ಪರಿಣಾಮದ ಪ್ರಮಾಣ ➢	ಉತ್ತಮ	ಮಧ್ಯಮ	ಕಡಿಮೆ	ಅತ್ಯಲ್ಪ	ಯಾವುದೇ ಟೀಕೆಗಳಿಲ್ಲ
ಸಣ್ಣ ಅಪಘಾತದ ಅವವರ್ತನ					
ಮಾರಣಾಂತಿಕ ಅಪಘಾತದ ಅವವರ್ತನ					

10 ನೀವು ಅಪಘಾತದ ಅವವರ್ತನದಲ್ಲಿ ಯೋಜನೆಯಿಂದ ಯಾವುದಾದರೂ ಬದಲಾವಣೆಯನ್ನು ನಿರೀಕ್ಷಿಸುತ್ತೀರ?	ಹೆಚ್ಚಿಸುವುದು ☐		ಇಳಿಸುವುದು ☐		ಬದಲಾವಣೆ ಇಲ್ಲ ☐
ನಿರೀಕ್ಷಣೆಯ ಹೆಚ್ಚಾದರೆ, ನಂತರ ಪರಿಣಾಮದ ಪ್ರಮಾಣ ➢	ಉತ್ತಮ	ಮಧ್ಯಮ	ಕಡಿಮೆ	ಅತ್ಯಲ್ಪ	ಯಾವುದೇ ಟೀಕೆಗಳಿಲ್ಲ
ನಿರ್ಮಾಣದ ಹಂತದಲ್ಲಿ ಅಪಘಾತ ಹೆಚ್ಚಾಗಿದೆಯೇ					
ಕಾರ್ಯಾಚರಣೆ ಹಂತದಲ್ಲಿ ಅಪಘಾತ ಹೆಚ್ಚಾಗಿದೆಯೇ					
11 ರಸ್ತೆ ಅಪಘಾತ ಕಡಿಮೆ ಮಾಡಲು ರಸ್ತೆ ಸುರಕ್ಷತಾ ಕ್ರಮಗಳನ್ನು ಆಯ್ಕೆ ಮಾಡಿ					
ವೇಗದ ಬ್ರೇಕ್/ ರೋಡ್ ಹಂಪ್					
ಪಾದಚಾರಿಗಳು ದಾಟುವ ಸ್ಥಳ					
ರಸ್ತೆ ರುಜುಗಳು					
ಸುಧಾರಿತ ತುರ್ತು ಸೇವೆಗಳು					
ಪೊಲೀಸ್ ಪೆಟ್ರೋಲ್					
ವೇಗದ ಕ್ಯಾಮೆರ					
ರಸ್ತೆ ಸುರಕ್ಷತಾ ಶಿಕ್ಷಣ ಕ್ಯಾಂಪ್					
ಬಾಲಕ ಜಾಗೃತಿ ಕಾರ್ಯಕ್ರಮಗಳು					
ಇತರೆ ಕ್ರಮಗಳನ್ನು (ಸಲಹೆ ನೀಡಿ)					

12 ಇತರೆ ಯಾವುದೇ ಸಲಹೆಗಳು :

ಆಸಕ್ತಿ ಜೀವವೈವಿಧ್ಯ

13 ಈಯು ಪ್ರಾಣಿಗಳು ಸುತ್ತಮುತ್ತಲಿನ ಪ್ರದೇಶಗಳಲ್ಲಿ ಗುರುತಿಸಲ್ಪಡುತ್ತದೆಯೇ?	ಹೌದು ☐				ಇಲ್ಲ ☐
ಹೌದು ಎನ್ನುವುದಾದರೆ, ನಂತರ ಪರಿಣಾಮದ ಪ್ರಮಾಣ ➢	ಉತ್ತಮ	ಮಧ್ಯಮ	ಕಡಿಮೆ	ಅತ್ಯಲ್ಪ	ಯಾವುದೇ ಟೀಕೆಗಳಿಲ್ಲ
ಕಾಡು ಪ್ರಾಣಿಗಳ ದೃಶ್ಯದ ಅವವರ್ತನ					
ಕಾಡು ಪ್ರಾಣಿಗಳು, ಬೆಳೆ / ಆಸ್ತಿಗಳಿಗೆ ಹಾನಿ ಮಾಡಿದ ಘಟನೆ					
ವನ್ಯಜೀವಿ ಒಳಗೊಂಡ ಅಪಘಾತ					
ಮನುಷ್ಯ ವನ್ಯಜೀವಿ ಭಿನ್ನಾಭಿಪ್ರಾಯದ ಘಟನೆ					
ಹತ್ತಿರದ ಪ್ರದೇಶದಲ್ಲಿ ಅಕ್ರಮಣಕಾರಿಂದ ವನ್ಯಜೀವಿ ಕಳ್ಳಸಾಗಣೆ ಘಟನೆ					

14ದಯವಿಟ್ಟು ನೀವು ಆಗಾಗ್ಗೆ ನೋಡುವ ವನ್ಯಜೀವಿಗಳ ಹೆಸರು ತಿಳಿಸಿ	15ನೀವು ಯಾವುದೇ ಕಿರು ಅರಣ್ಯ ಉತ್ಪನ್ನವನ್ನು ಬಳಸುತ್ತೀರಾ? ಬಳಸುವಿದಾದರೆ ಅವುಗಳ ಹೆಸರು :
16 ದಯವಿಟ್ಟು ಯಾವುದಾದರೂ ಆಗಾಗ್ಗೆ ಆಗುವ ವನ್ಯಜೀವಿ ಅಪಘಾತ ತಾಣಗಳ ಹೆಸರು ತಿಳಿಸಿ	17ಸಾಮಾನ್ಯವಾಗಿ ನಿಮ್ಮ ಪ್ರದೇಶದಲ್ಲಿರುವ ಔಷಧೀಯ ಸಸ್ಯಗಳು ಯಾವುವು ?
18 ನಿಮ್ಮ ಇಷ್ಟದ ಯವ ಜಾತಿಯ ಮರಗಳನ್ನು ಕೃಷಿ ಭೂಮಿಯಲ್ಲಿ ಅಥವಾ ಗಡಿಗಳಲ್ಲಿ ಹಾಕಬಹುದು	19 ರಸ್ತೆ ಬದಿಯಲ್ಲಿ ನೆಡಲು ನಿಮ್ಮ ಇಷ್ಟವಾದ ಕಳೆಯ ಹೆಸರುಗಳು?

20 ಬೇರೆಯಾವುದಾದರೂ ಸಲಹೆಗಳು ಜೀವವೈವಿಧ್ಯ ಮತ್ತು ಪರಿಸರದ ಬಗ್ಗೆ

ANNEX 7.2 REGISTRATION OF PARTICIPANTS IN PCM

MS-I

Karnataka State Highways Improvement Project (KSHIP-III)
Public Consultation for EIA Studies

Name of the Project Road	Magadi to Somwarpet
Place of Public Consultation	Govt. Higher Primary School Ramnathpura
Date of Public Consultation	10/12/2015 at 12:00 PM

S. N.	Name of the Participant	Village	Mobile No.	Signature
1	Shivaramegowda	Kotavalu	9964292374	
2.	Arun kumar KN	— " —	9964272236	
3.	[illegible]	[illegible]	9008857234	
4	ಆನಂದ.	[illegible]	8970498983	
5	A. [illegible]	R. N. [illegible]	9008882074	
6	[illegible]	[illegible]	9164722314	
7	[illegible]	[illegible]	8792269974	
8	[illegible]	[illegible]	9008268806	
9	[illegible]	[illegible]	9632239166	
10	[illegible]	[illegible]	9743918461	
11	[illegible]	[illegible]	9591431216	
12	S.T. [illegible]	[illegible]	8197455568	
13	T.P. [illegible]	[illegible]	9008881295	
14	Girija - R.I.V.	[illegible]	8105475721	
15	[illegible]		8861080371	
16	[illegible]		9945440217	
17	[illegible]	[illegible]	8546873217	
18	[illegible]	[illegible]		

Karnataka State Highways Improvement Project (KSHIP-III)
Public Consultation for EIA Studies

Name of the Project Road	Magadi to Somwarpet
Place of Public Consultation	Govt Higher Primary School Ramnathpura
Date of Public Consultation	10/2/2015 at 12.00 PM

S. N.	Name of the Participant	Village	Mobile No.	Signature
20	[illegible]	[illegible]	9632432995	[illegible]
21	Chethana	[illegible]	9980373597	Chethana
22	[illegible]	[illegible]	9164897691	Roopa
23	[illegible]	[illegible]	9945817745	[illegible]
24	M. Shaista Jabassum	R.N. Pura	9901080266	[illegible]
25	[illegible]	R.N. Pura	9649398888	[illegible]
26	[illegible]	R N Pura	99033365[illegible]	[illegible]
27	Rateshwari	R N Pura	9760187243	Rateshwari
28	[illegible]	[illegible]	—	Leelavathi [illegible]
29	Lakshminarasimha.RK	Ramanthapura	8762329635	[illegible]
30	Sreedevi	Ramanathapura	9900814353	Sreedevi
31	pushpa	Ramanathapura	9743939218	[illegible]
32	Tirthankar Banerjee	ICT, Delhi	9599233384	[illegible]
33	Veeresh. H	ICT Delhi	9538590801	[illegible]
34	VIKAS SHARMA	ICT N. Delhi	9414055229	[illegible]
35	B. Sridhar. K	ICT Banglore	9611104051	[illegible]
36	Manoj Kumar M	ICT Banglore	9916659919	[illegible]

MS-II

Karnataka State Highways Improvement Project (KSHIP-III)
Public Consultation for EIA Studies

Name of the Project Road	Maggadi to Somwarpet
Place of Public Consultation	Govt. High School Haradanahally
Date of Public Consultation	10/12/2015 at 1:30 pm

S. N.	Name of the Participant	Village	Mobile No.	Signature
1	[illegible]	ಹರದನಹಳ್ಳಿ	9916[illegible]1555	
2	[illegible]	ಹರದನಹಳ್ಳಿ		
3	[illegible]	— " —	8884396583	
4	[illegible]	— " —	9740647465	
5	[illegible]	— " —	9900593866	
6	[illegible]	— " —	9845268856	
7	[illegible]	— " —	9900857362	
8	[illegible]	— " —	—	
9	[illegible]	— " —	8105971808	
10	[illegible]	— " —	8105353580	
11	[illegible]	— " —	9900944097	
12	[illegible]	— " —	9632983287	
13	[illegible]	— " —	9901251508	
14	[illegible]	— " —	9900872896	
15	[illegible]	— " —	9741914138	
16	[illegible]	— " —	8892239694	
17	[illegible]	— " —	8105353492	
18	[illegible]	— " —	9845069892	

Karnataka State Highways Improvement Project (KSHIP-III)
Public Consultation for EIA Studies

Name of the Project Road	Magadi to Somwarpet
Place of Public Consultation	Govt. High School, Haradanahally
Date of Public Consultation	10/11/2015 at 1:30 PM

S. N.	Name of the Participant	Village	Mobile No.	Signature
19	Husenbasha. M.A.	Haradanahally	9916431339	
20	[illegible]	[illegible]	—	[illegible]
21	[illegible]	—"—	9880038534	
22	[illegible]	—"—	9731137448	[illegible]
23	[illegible]	—"—	9945314680	[illegible]
24	[illegible]	—"—	7760252135	[illegible]
25	[illegible]	—"—	9008539S1	[illegible]
26	[illegible]	—"—	8105093359	[illegible]
27	[illegible]	—"—	9880[illegible]7288	[illegible]
28	Tirthankar Banerjee	ICT, Delhi	9873351727	
29	Veeresh.H	ICT. Delhi	9538590[illegible]	
30	Vikas Sharma	ICT N. Delhi	9414055624	
31	Sridhar. K	ICT. Banglore	9611014091	
32	Manoj Kumar M	ICT. Banglore	9916659919	

MS-III

Karnataka State Highways Improvement Project (KSHIP-III)
Public Consultation for EIA Studies

Name of the Project Road	Magadi to Somwarpet
Place of Public Consultation	Govt. Girls High School, K.R. Pet
Date of Public Consultation	14/12/15 10:30 Am

S. N.	Name of the Participant	Village	Mobile No.	Signature
	Subochana			
1	Subochana	ಕೆ.ಆರ್ ಪೇಟೆ	9686029?6	Subochana
2	[illegible]	[illegible]	7760440778	[illegible]
3	[illegible]	K.R.Pat	7406692046	[illegible]
4	Naseerath	K.R.Pat	8861169642	Naseerath
5	[illegible]	K R Pat	8694912422	[illegible]
6.	H.R. [illegible]	K.R Path	9844406516	H.R. [illegible]
7)	Rehana Begum	K.R. Path	99459987??	Rehana Begum
8)	Jabeen Taj	K.R. Pat	9902617382	Jabeen Taj
9)	[illegible]	ಕೆ. ಆರ್ ಪೇಟೆ	8453149961	[illegible]
10)	M. Bhagyamma	K.R.pet	9972433782	M. Bhagyamma
11)	Parvathi	K.R.pet	9008943774	[illegible]
12)	Nathravathi	K.R.pet		
13)	Bharathi N.Y	K.R. pet	9964102737	Bharathi N.Y
14)	[illegible]	ಕೆ.ಆರ್. ಪೇಟೆ	9980240080	[illegible]
15	Savitha H.V.	Marigomanhalli	8453787747	Savitha H.V.
16	ರಾಧ	[illegible]	......	ರಾಧ
17	[illegible]	[illegible]		[illegible]
18	[illegible]	[illegible]		[illegible]
19	Mamatha [illegible]	[illegible]		Mamatha
20.	Manoj Kumar M	ICT Bengaluru	9916659919	[signature]

1

Karnataka State Highways Improvement Project (KSHIP-III)

Public Consultation for EIA Studies

Name of the Project Road	Magadi to Somwarpet
Place of Public Consultation	Govt. Girls High School, K.R. Pet
Date of Public Consultation	14/12/15 10:30 Am

S. N.	Name of the Participant	Village	Mobile No.	Signature
01	Chikke Gowda	Aredoppanahalli	9902351957	[illegible]
02	A. ಮಂಜೇಗೌಡ	[illegible]	9901717815	[illegible]
03	M.d. Samalle.	K.R. Pet	9980181924	Md. Samalle
04	Athik Kumar Kumar	K.R. Pet	9902900506	BUSHRA ANJUM
05	Nagaiah	K.R. Pet	9141107647	[illegible]
06	KUMARA M.D	Manikuppe	7259389248	[illegible]
07	Mallesh. B.	Bullekere	8970499637	[illegible]
08	[illegible]	[illegible]	9964225559	[illegible]
09	Gopal Krishna	K.R. pet	9964711369	[illegible]
10	[illegible]	KRPET	8970235762	[illegible]
11	J.S. [illegible]	[illegible]	8970433406	J.S. Ramesh
12	[illegible]	[illegible]	8105517609	[illegible]
13	[illegible]	[illegible]	8453875905	[illegible]
14	[illegible]	[illegible]	9902957462	[illegible]
15	HG ಕುಮಾರ	[illegible]	9632397553	HC ಕುಮಾರ್
16	[illegible]	[illegible]	9945911583	[illegible]
17	[illegible]	[illegible]	9068592465	[illegible]
18	[illegible]	[illegible]	9686426116	[illegible]
19	[illegible]	[illegible]	9964490594	[illegible]

MS-IV

Karnataka State Highways Improvement Project (KSHIP-III)
Public Consultation for EIA Studies

Name of the Project Road	Magadi - Somwarpet
Place of Public Consultation	Kanthapura
Date of Public Consultation	12/01/2016 10:30 AM

S. N.	Name of the Participant	Village	Mobile No.	Signature
1	CL Varadharaju	Kanthapura	9945097329	CL. Varadharaju
2	Siddegowda	— " —	9980219151	ಸಿದ್ದೇಗೌಡ
3	Ningegowda	— " —	9483544562	K. Ningegowda
4	Shivakumar	— " —	9483939353	Shivakumar
5	ashoka	— " —	9483839354	Ashoka K.M.
6	Dastagirkhan	— " —	9936592887	Dastagir
7	Krishnegowda	— " —		ಕೃಷ್ಣೇಗೌಡ
8	Paraniswami	— " —	9480336332	ಪರಮೇಶ್ವರಿ
9	Ranugowda	— " —	9431250009	ರಂಗೇಗೌಡ
10	Jayarama	— " —	8105234529	ಜಯರಾಮ
11	Subhoshchandra	— " —	9448996473	Subhash
12	Shabarinathreddy	— " —	8453790926	Shabarinathreddy
13	A.T. Shanthana	— " —	9902809747	A.T. Shanthana
14	Geetha C.V.	— " —	9880310943	Geetha C.V.
15	Manjula N.M.	— " —	9663443625	Manjula
16	Mangkumar M	ICT, Bangalore	9916699919	Mangkumar
17	Chandragiri Reddy Sekhar	ICT Bangalore	8150962831	Sekhar
18	Sivaram			Sivaram
19	Tirthankar	ICT Delhi	9873351727	Tirthankar

MS. V

Karnataka State Highways Improvement Project (KSHIP-III)
Public Consultation for EIA Studies

Name of the Project Road	Magadi to somwarpet
Place of Public Consultation	Bommanahalli
Date of Public Consultation	12/01/2016, 3.00 pm

S. N.	Name of the Participant	Village	Mobile No.	Signature
1	Santosh	Bommenahalli	9743164530	ಸಂತೋಷ
2	Yogha	Bommenahalli	8105630441	[illegible]
3	Mingegowda	-"-	9632840691	
4	shivegowda	-"-	8970291306	ಶಿವೇಗೌಡ
5	Ramesha	-"-	9632339942	ರಮೇಶ
6	Nagmani	-"-		
7	Manjula devaraja	-"-	9535773335	ಮಂಜುಳ
8	Geetha shankar	-"-		ಗೀತ
9	Subramanyachari	-"-	9663861192	Subramanyachari
10	Kalegowda	-"-		
11	Jayarama	-"-	8722529146	ಜಯರಾಮ
12	Chandranayaka	-"-	9741209703	ಚಂದ್ರನಾಯಕ
13	Muthuraj	-"-	7090962959	MUTHURAJU.
14	ashoka BK	-"-	9844546773	Ashok B.K
15	Hariprasad	-"-	9739131701	BN Hariprasad.
16	Rahul	-"-	8546087889	Rahul, B.R
17	Nagaraju	-"-	9449978001	Nagaraju
18	Ramegowda T	-"-	99007[illegible]	T-Raghu

Karnataka State Highways Improvement Project (KSHIP-III)
Public Consultation for EIA Studies

Name of the Project Road	Nagadi Sommanpet (SH-85)
Place of Public Consultation	BOmmanahali
Date of Public Consultation	12/01/2016 3 PM

S. N.	Name of the Participant	Village	Mobile No.	Signature
19	Thimmegowda	Bommenahalli	8861670470	
20	Jayaramachari	— 11 —	9632996234	
21	Mariyayya	— 11 —	9008738682	
22	Kumaranayaka	— 11 —	9741208754	
23	Manjegowda	— 11 —	9964368681	
24	Venkatesh	— 11 —	9880074346	
25	Komalamma	— 11 —		
26	Jayalakshmi	— 11 —		
27	B manju	— 11 —	8197265668	
28	Basavlagowda	— 1 —		
29	Kumaru	— 1 —	9164874860	
30	Ananda	— 11 —	9731359327	
31.	BhereGowda.	— 1 —	9008258989	
32	VilleK.M.	— 11 —	7026933298	
33	Kenche Gowda.	— 1 —		
34.	Some Gowda.	— 1 —		
35.	Manju.	1 — 1	9164758004.	
36	B N Ramkrishnagowda ++	←	7353332750	

Karnataka State Highways Improvement Project (KSHIP-III)
Public Consultation for EIA Studies

Name of the Project Road	Magadi to Somwarpet
Place of Public Consultation	Bommanahalli
Date of Public Consultation	12/01/2016 3.00 pm

S. N.	Name of the Participant	Village	Mobile No.	Signature
37	B.N. Karigowda	Bommanahalli	9980797751	BN Karigowda
38	BasaveGowda	—"—	8548981064	Kumara.B.B.
39	Mahadeva.B.S	—"—	9880807553	Mahadeva
40	chandregowda	—"—	9632625279	chandregowda
41	Yogegowda	—"—	8970654149	yoge gowda.B.S.
42	ManojKumar.M	ICT, Bengaluru	9916659969	[illegible]
43.	Chandragiri Reddy Sekhar	ICT Bangalore	8150962831	[illegible]
44	Tirthankar Banerjee	ICT Delhi	9873351727	Tirthankar

MS-VI

Karnataka State Highways Improvement Project (KSHIP-III)
Public Consultation for EIA Studies

Name of the Project Road	Magadi to Somwarpet
Place of Public Consultation	Yele Muddana halli,
Date of Public Consultation	13/1/2016 10:30 A.M

S. N.	Name of the Participant	Village	Mobile No.	Signature
1.	[illegible]	[illegible]	9845103087	[illegible]
2.	Prasannavenkatesh	-11-	9945309169	[illegible]
3.	Satisha	-11-	9902820378	[illegible]
4.	[illegible]	-11-	8970653866	[illegible]
5.	Madeva	-11-	-	
6.	Dasaiah	-11-	-	
7.	Nagaiah	-11-	-	
8.	Kariyappa	-11-	-	
9.	[illegible]	-11-	9901612366	[illegible]
10.	M.S chandrappa	-11-	9480994093	[illegible]
11.	Jayanna	-11-	-	[illegible]
12.	Nandini	-11-		[illegible]
13.	M.V.LINGAPPA	-11-	9945428[illegible]	[illegible]
14.	Ningamma	-11-	-	[illegible]
15.	Ramya	-11-	9008164696	[illegible]
16.	Mahadeva	-11-	9663662677	[illegible]
17.	channigarshetty	-11-	9740229660	[illegible]
18.	Kempamma	-11-		

Karnataka State Highways Improvement Project (KSHIP-III)
Public Consultation for EIA Studies

Name of the Project Road	Magadi to Somwarpet
Place of Public Consultation	Yelemuddanahalli
Date of Public Consultation	13/01/2016 10.30 Am

S. N.	Name of the Participant	Village	Mobile No.	Signature
19	M.B. Prasanna	Yelemuddanalli	9900807046	
20	Nageshe	-11-	-	
21	Chanbasappa	-11-	-	
22	THEERTHA PRABHU. M.T	-e-	9880371377	
23	Ratnamma	-11-		
24	Jayanthi	-11-	8494857889	
25	Sannigamma	-11-	-	
26	Veerayya	-e-		
27	Lokesha	-11-	9740126260	
28	Madesha	-11-	9900856279	
29	Prashantha	-11-	9036837002	
30	Ningegowda	-11-	-	
31	Veeregowda	-e-	9686685029	
32	M.V Chandrashekhar	-e-	8970978415	
33	Manjkumar. M	ICT, Benzalur	9916659919	
34	Chandragiri Reddy	ICT Bengaluru	8150962831	
35	Tirthankar Banerjee	ICT Delhi	9873351727	

MS- VII

Karnataka State Highways Improvement Project (KSHIP-III)
Public Consultation for EIA Studies

Name of the Project Road	Magadi to Somwarpet
Place of Public Consultation	Keralapura
Date of Public Consultation	13/01/2016 1.00 pm

S. N.	Name of the Participant	Village	Mobile No.	Signature
1.	Bhagya	Keralapura	9663133507	Bhagya
2.	H.R. aradhi	—"—	9008761680	H.R Aradhi
3.	Jayaram K.R	—"—	9008761680	K.R Jayaram
4.	K H Venkatesh	—"—	7259458269	K.H.Venkatesh
5.	Kumar	—"—	9740506836	Kumar
6.	Padma	—"—		Padma
7.	Krishna	—"—	9964480386	Krishna
8.	K. Mahesh	—"—	9731504351	K. Mahesh
9.	Leelavathi M.V	—"—	8151859264	M.V. Leelavathi
10.	Lokesh	—"—	9611796233	Lokesh
11.	Mahesh	—"—	8105524373	Mahesh
12.	Hemanth	—"—	7760067371	Hemanth
13.	Malathi K.M	—"—	9902140837	K.M Malathi
14.	Lokesh	—"—	9880192616	Lokesh
15.	Vijaya H.R	—"—	9902240663	Vijaya
16.	Maheshwari	—"—	9743919980	Maheshwari
17.	Jayalakshmi	—"—	9980317410	Jayalakshmi
18.	Ramaprasad	—"—	9916436238	

Karnataka State Highways Improvement Project (KSHIP-III)
Public Consultation for EIA Studies

Name of the Project Road	Magadi to Somwarpet
Place of Public Consultation	Kerlapura
Date of Public Consultation	13/01/2016 1.00 pm

S. N.	Name of the Participant	Village	Mobile No.	Signature
19.	Krishnegowda	Kerlapura		[signature]
20.	Ragho	-11-	8722498542	[signature]
21.	Feleitas Sequeira	-11-	9845074297	[signature]
22.	Yogahanna	-11-	9611852721	[signature]
23.	B.D Devrajegowda	-11-	9591484574	[signature]
24.	Vasu	-11-	9741203251	[signature]
25	S. Nagaraju.	-11-	9481964773	[signature]
26.	Shashi Kalla	-11-	9632707523	[signature]
27.	Malathi B.N	-11-	9945900403	[signature]
28.	Leelawati. N	-11-	–	[signature]
29.	Manoj Kumar.M	CIIECT Bengaluru	9916659919	[signature]
30	Chandragiri Reddy Sekhar	ICT Bengaluru	8150962837	[signature]
31	Tirthankar Banerjee	ICT Delhi	9873351727	[signature]

MS-VIII

Karnataka State Highways Improvement Project (KSHIP-III)
Public Consultation for EIA Studies

Name of the Project Road	Magadi to Somwarpet
Place of Public Consultation	GPBS, Basavapatna
Date of Public Consultation	13/1/2016 : 3:00 p.m

S. N.	Name of the Participant	Village	Mobile No.	Signature
1.	JAYAKUMAR	Basavapatna	9964590109	[signature]
2.	B.A. Ningegowda.	Basavapatna	9900809797	[signature]
3.	Devarajegowda	Basavapatna	9902257129	[signature]
4.	[illegible]	-"-	9535725401	[signature]
5.	[illegible]	BasavaPatna	9740232937	[signature]
6.	[illegible]	[illegible]	9448919928	[signature]
7.	B. [illegible]	[illegible]	9880355864	[signature]
8.	vishalakshi K.S.	Basavapatna	9964284388	[signature]
9.	K.N. pushpamala	Basavapatna	9481430084	[signature]
10.	Vidya mallya	-"-	9900852080	VM
11.	T.S. [illegible]	Thoreyanapatna	8970999863	[signature]
12.	B.R. Srinivasa	Basavapatna	7829573435	B.R. Srinivasa
13.	B.V. Anupama	Basavapatna	9900810429	[signature]
14.	Sri. Basavaiyya	Ramthapur	9663290489	[signature]
15.	K.M. Rajeshwari	keralapura	9743588804	K.M. Rajeshwari
16.	S. Gurunath	BasavaPatna	9980715245	S. Gurunath
17.	yogeshwari	Basavapatna	9741437840	yogeshwari
18.	M.N. [illegible]	[illegible]	8971898222	M.N. [signature]

1

Karnataka State Highways Improvement Project (KSHIP-III)
Public Consultation for EIA Studies

Name of the Project Road	Magadi to Somwarpet
Place of Public Consultation	GPBS, Basavapatna
Date of Public Consultation	13/1/2016; 3.00pm

S. N.	Name of the Participant	Village	Mobile No.	Signature
19	[illegible]	Basavapatna	9686711571 9	[illegible]
20	[illegible]	— 11 —	9980830795	[illegible]
21	B.R.Govindareddy	— 11 —	9845982817	B.R.Govindareddy
22	Nagayya	— 11 —		[illegible]
23	Kenchegowda	— 11 —	9989706492	Kenchegowda
24	S.V.[illegible]	— 11 —	8453802871	S.V.[illegible]
25	Manojkumar.M	ICT Banglore	9916659919	[illegible]
26	Chandragiri Reddy Secretary	ICT Bangalore	8150962831	[illegible]
27	Tirthankar Banerjee	ICT, Delhi.	9873351727	[illegible]

2

MS-IX

Karnataka State Highways Improvement Project (KSHIP-III)
Public Consultation for EIA Studies

Name of the Project Road	Magadi to Somwarpet
Place of Public Consultation	GLPS Kotagahalli
Date of Public Consultation	14/1/16 12 PM

S. N.	Name of the Participant	Village	Mobile No.	Signature
01	YOGESWARA P.G.	Kotagahally	8277095777	
02	Nagalakshmi	Kotagahally	7760254716	
03	Manjegowda K.	K — " —	7259114440	
4.	Girijamma	— " —	— " —	
5	Manju	— " —	9483402113	
6	Shoradamma	— " —	— " —	
7	Shwetha	— " —	— " —	
8	Mahesh	— " —	9480595521	
9	Narasimhegowda	— " —	9901799756	
10	Narayana	— " —	8277159403	
11	[illegible]	— " —	9483407988	
12	Nagegowda	— " —	8971371184	
13	Kumar	— " —	9901024182	
14	Akash K. S	— " —	8497884640	
15	Ganesh	— " —	9980995900	
16	Ekesh	— " —	8761023189	
17	Parvathamma	— " —	—	
18	[illegible]		9482408	

Karnataka State Highways Improvement Project (KSHIP-III)
Public Consultation for EIA Studies

Name of the Project Road	Magadi to Somwarpet
Place of Public Consultation	
Date of Public Consultation	14/01/2016 12.00 pm

S. N.	Name of the Participant	Village	Mobile No.	Signature
19	Dileep KN	--------	9686259427	DILIP
20	Kamalamma		————	ಕಮಲಮ್ಮ
21	Lakshmidevi		————	ಲಕ್ಷ್ಮಿದೇವಿ
22	manjunath		9482146401	ಮಂಜುನಾಥ
23	Ramakrishna			ರಾಮಕೃಷ್ಣ
24	dhananjayo		9060606326	KR ಧನಂಜಯ
25	yogesha			ಯೋಗೇಶ.
26	Manju			ಮಂಜು
27	Lokesh		9731660912	ಲೋಕೇಶ KN
28	madhu K.P		9535289517	Madhu KP
29	Manoj Kumar M	ICT, Banglore	9916659919	[signature]
30	Chandragiri Reddy Sekhar	ICT Pvt Ltd Bangalore	8150962831	CR Sekhar
31	Tirthankar Banerjee	ICT Delhi	9873351727	Tirthankar

ANNEX 8.1 GUIDELINES FOR TOP SOIL CONSERVATION AND REUSE

1. The top soil from all sites including road side widening and working area, cutting areas, quarry sites, borrow areas, construction camps, haul roads in agricultural fields (if any) and areas to be permanently covered shall be stripped to a specified depth of 15 cm and stored in stock piles for reuse.

2. At least 10% of the temporary acquired area for construction purposes shall be earmarked for stockpiling of fertile top soil

3. The locations for stacking will be pre-identified in consultation and with approval of Environmental Specialist of the Independent Engineer.

4. The following precautionary measures will be taken by the contractor to preserve the stock piles till they are re-used:

- Slop of the stockpiles should not exceed 1:2 (vertical to horizontal), and height is restricted to 2m to retain soil and allow percolation of H2O.
- The edges of pile should be protected by silt fencing and allow percolation of water, which will help to retain soil
- Multiple handling kept to a minimum to ensure that no compaction occurs.
- Stockpiles shall be covered with empty gunny bags or will be planted with grasses to prevent the loss during rains.

5. Such stockpiled topsoil will be utilized for

- Covering reclamation sites or other disturbed areas including borrow areas (not those in barren areas).
- Top dressing and raising turfs in embankment slopes
- Filling up of tree pits
- For developing median plantation
- In the agricultural fields of farmers, acquired temporarily that needs to be restored.

6. Residual top soil, if there is any, shall be utilized for the plantations works along the road corridor. The utilization as far as possible shall be in the same area from where top soil was removed. The stripping, preservation and reuse shall be carefully inspected, closely supervised and properly recorded by the Environmental Specialist of the Independent Engineer.

ANNEX 8.2 GUIDELINES FOR SITING AND LAYOUT OF CONSTRUCTION CAMP

A. Siting

1. The following guidelines shall be followed while siting the construction camps:

- The construction camps shall be located at least 500 m away from habitation. The living accommodation and ancillary facilities for labour shall be erected and maintained to approved standards and scales.
- Non-agricultural land should be used, as for as possible
- Not within 1,000 m of either side of locations of Forest areas.
- All sites used for camps must be adequately drained. They must not be subject to periodic flooding, nor located within 300 feet of pools, sink holes or other surface collections of water unless such water surface can be subjected to mosquito control measures.
- The camps must be located such that the drainage from and through the camps shall not endanger any domestic or public water supply.
- All sites must be graded, ditched and rendered free from depressions such that water may get stagnant and become a nuisance.

B. Layout

2. Contractor shall follow all relevant provisions of the Factories Act, 1948 and the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for development and maintenance of construction camp. A conceptual layout of a typical construction site has been presented in **Figure-A.** The contractor during the progress of work shall provide, erect and maintain necessary (temporary) living accommodation and ancillary facilities for labor to standards and scales approved by the Engineer of IE. The site must be graded and rendered free from depressions such that water does not get stagnant anywhere. The entire boundary of the site should be fenced all around with barbed wire so as to prevent the trespassing of humans and animals. All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. Safe drinking water should be provided to the dwellers of the construction camps. Adequate washing and bathing places shall be provided and kept in clean and drained condition. Construction camps are to be sited away from vulnerable people and adequate health care is to be provided for the work force. Vehicle parking area is to be made impervious using 75 mm thick P.C.C. bed over 150 mm thick rammed brick bats. The ground will be uniformly slopped towards to adjacent edges towards the road. A drain will take all the spilled material to the oil interceptor.

C. Drinking Water

3. The contractor should provide potable water within the precincts of every workplace in a cool and shaded area, which is easily accessible. All potable water storage facilities must be on a safely raised platform that is at least 1m above the surrounding ground level. Such facilities shall be regularly maintained from health and hygiene point of view. If necessary, water purifier units shall be installed for providing potable water. As far as possible, shallow wells should not be used as potable source of water. However, if water is drawn from any existing well, irrespective of its location from any polluting sources, regular disinfection of the water source (which may include application of lime, bleaching power and potassium permanganate solution)

has to be ensured at weekly/fort nightly interval. All open wells will be entirely covered and will be provided with a trap door to prevent accidental fall and contamination from dust, litter etc. The trap door will be kept locked and opened only for cleaning or inspection, which will be done at least once in a month. A reliable pump will be fitted to each covered well. A drain shall be constructed around the well to prevent flow of contaminated water into the well from road, camp or other sources.

4. Contractor's vehicles shall not be allowed to wash in the river / stream / pond. This is toavoid potential pollution from oil residues.

D. Sanitation Facilities

5. Construction camps shall be provided sanitary latrines and urinals. Adequate number of toilets shall be provided separately for men and women depending on their strength. Sewerage drains should be provided for the flow of used water outside the camp. Drains and ditches should be treated with bleaching powder on a regular basis. The sewage system for the camp must be properly designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place. Compliance with the relevant legislation must be strictly adhered to. Garbage bins must be provided in the camp and be regularly emptied at designated disposal place in a hygienic manner.

6. Portable toilets may be brought to use and the night soil from such units has to be disposed through designated septic tanks so as to prevent pollution of the surrounding areas. All these facilities shall be inspected on a weekly basis to check the hygiene standards.

E. Shelter at Workplace

7. At every workplace, there shall be provided free of cost, four suitable shelter, two for meals and two others for rest, separately for use of men and women laborers. The height of shelter shall not be less than 3 m from floor level to lowest part of the roof. Sheds shall be kept clean and space provided shall be the basis of at least 0.5 m2 per head.

F. Canteen Facilities

8. A cooked food canteen on a reasonable scale shall be provided for the benefit of workers wherever it is considered necessary and should generally conform to sanitary requirements of local medical, health and municipal authorities including such precautionary measures as necessary to prevent soil pollution of the site.

G. First Aid Facilities

9. At every workplace, a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances shall be provided as per the Factory Rules. Workplaces in remote location and far away from regular hospital shall have indoor health units with one bed for every 250 workers. Suitable transport shall be provided to facilitate taking injured and ill persons to the nearest hospital. At every work place an ambulance room containing the prescribed equipment and nursing staff shall be provided.

H. Health Care Facilities

10. Health problems of the workers should be taken care of by providing basic health care facilities through health centres temporarily set up for the construction camp. The health centre should have at least a doctor, nurses, duty staffs, medicines and minimum medical facilities to tackle first aid requirements or minor accidental cases, linkage with nearest higher order hospital to refer patients of major illnesses or critical cases.

11. The health centre should have MCW (Mother & Child Welfare) units for treating mothers and children in the camp. Apart from this, the health centre should provide with regular vaccinations required for children.

I. Day Care Facilities

12. At every construction site, provision of a day care shall be worked out so as to enable women to leave behind their children. At construction sites where 20 or more women are ordinarily employed, there shall be provided at least a hut for use of children under the age of 6 years belonging to such women. Huts shall not be constructed to a standard lower than that of thatched roof, mud walls and floor with wooden planks spread over mud floor and covered with matting. Hut shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate provisions of sweepers to keep the places clean. There shall be two maid servants (or aayas) in the satisfaction of local medical, health, municipal or cantonment authorities. Where the number of women workers is more than 25 but less than 50, at least one hut and one maid servant should be provided to look after the children of women workers. Size of cares shall vary according to the number of women workers employed.

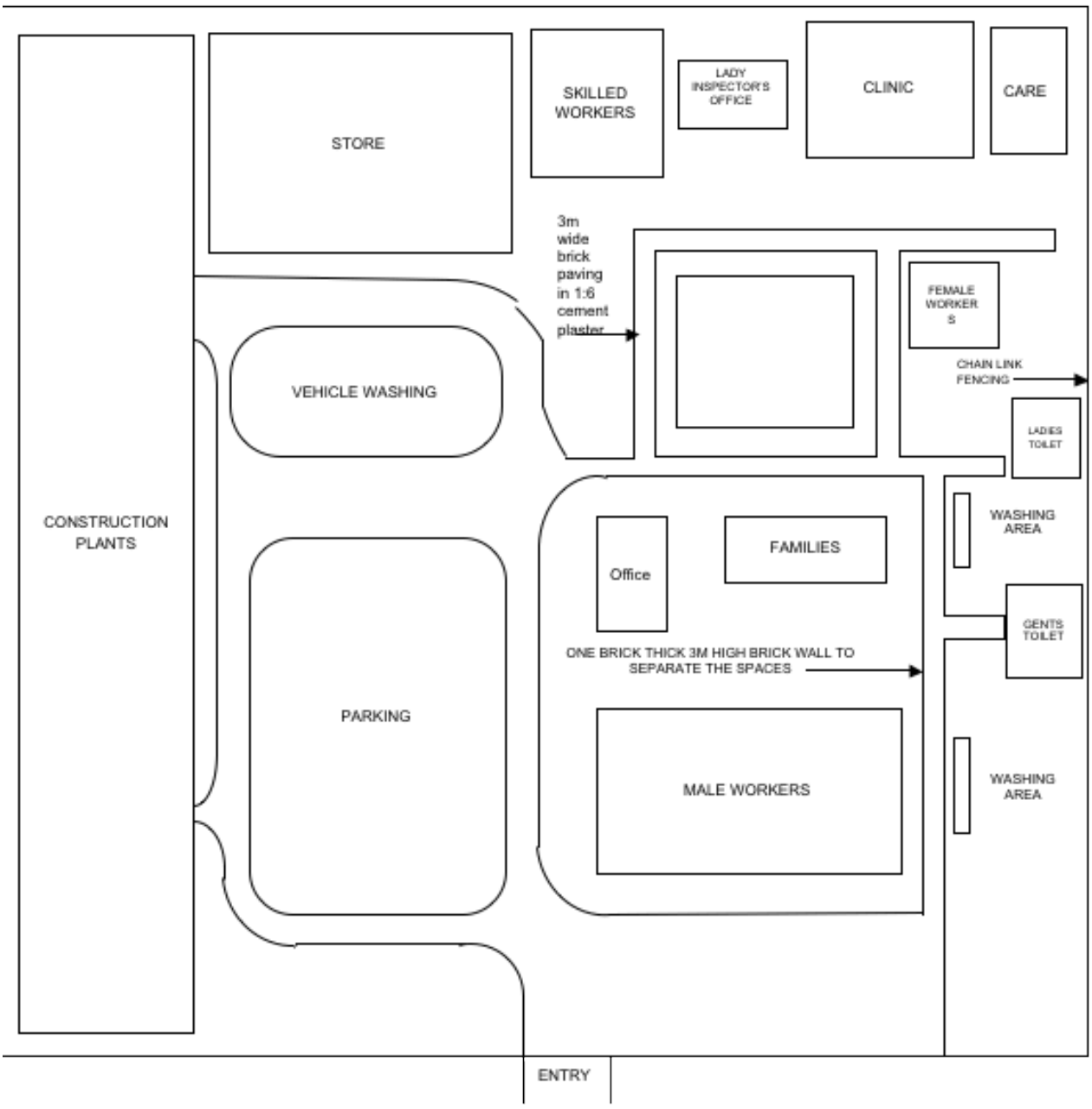


Figure-A Typical Layout of Construction Camp

ANNEX 8.3A GUIDELINES ON SLOPE STABILIZATION

A. Introduction

1. Erosion Control on roads is fundamental for the protection of water quality. Soil stabilization and erosion control practices are needed and should be used in areas where soil is exposed. Bare ground should be covered, typically with grass seed and some form of matting or mulch. This will help prevent erosion and subsequent movement of sediment into river, streams, lakes and ponds. This movement of sediment can occur during and after road construction. Erosion control measures need to be implemented immediately following construction and every time an area is disturbed.

B. Soil Erosion Control

2. Soil erosion is the process of detachment and transportation of soil particles by wind, water principally. Normally non-cohesive soil particles are blown away by wind erosion. The kinetic energy of falling rain drops causes detachment of soil particles and subsequently carried away by surface run-off. Erodibility co-efficient of soil and impact of rain drops are determinant factors in the process. This is guided by the nature of soil (clay content), particle size distribution and soil condition like saturation, density, permeability, plasticity etc. Dislodged soil particles flow down the slope with the overland flow, eroding and destabilizing the soil-body. When the intensity of rainfall increases surface run-off velocity accelerates and facilitates carriage of subsequent particles and ultimately results in disorders in the form of rill to gully and finally to erosion ditches. These disorders will impair slope stability worst if not controlled with proper protective measures.

3. Ground cover is considered as the most suitable solution for erosion protection. Tress, grass and other plant species are natural soil-binders and provide the best natural solution against erosion. In bio-engineering, plants have mainly two functions viz. hydrological and mechanical. Hydrological effects of plants are many such as interception (rain drops strike the leaves first before striking the ground soil), storage (leaves and stems hold water for some time before it eventually reaches the ground), infiltration (stems and shoots roughen and loosen the ground, enabling water to infiltrate more easily) etc. Mechanical function of plant is to reinforce the soil by binding the loose soil particles with its fibrous root system.

4. Bio-engineering is the technique of utilizing vegetation in addressing geotechnical problems. Environmental uncertainties are prompting engineers to favour bioengineering measures. Vegetation as an aid to artificial methods in controlling surficial soil erosion is gaining larger acceptability among engineers all over the world. Growth of appropriate vegetation on exposed soil surface is facilitated by use of natural geotextiles such as Coir Geotextiles. Properly designed Coir Geotextiles laid on slopes or any other exposed soil surface provides a cover over exposed soil lessening the probability of soil detachment and at the same time reduces the velocity of surface runoff, the main agent of soil dissociation. Natural geotextiles bios-degrade quicker than man-made counterpart, but facilitate growth of vegetation quicker and better due to its inherent characteristics. Road slope stabilization can range from allowing native grass (Vetiver grass) to re-establish on a disturbed slope to building an engineered wall.

C. Role of Coir Geotextile in Slope Stabilization

5. Coir is a biodegradable organic fibre material which is coarse, rigid and strong. The constituents of coir have been found to be mostly cellulose and lignin. Coir fibre is weather resistant and resistant to fungal and bacterial decomposition. The rate of decomposition of coir is much less than any other natural fibre. These characteristics are attributed due to the high lignin content in the fibre. Coir in the form of woven mesh mattings or non-woven stitch bonded blankets are used in engineering applications in the geotechnical field. Due to growing awareness to preserve environment, use of biodegradable natural material has gained popularity. The natural fibre, coir, which has been used in geotextiles for the past 20 years, has already proved its worth.

6. Coir geotextiles are made from coconut fibre extracted from the husk of coconut. Like other polymeric counterparts, coir geotextiles are developed for specific application in civil engineering like erosion control, ground improvement, filtration, drainage, river bank protection, road pavements, slope stability etc. This biodegradable and environment friendly material is virtually irreplaceable by any of the modern synthetic substitutes.

Coir geo-textiles specifications: Grade I- 400g/m^2

Advantages of Coir Geotextile

- The high tensile strength of coir fiber protect steep surface from heavy flows and debris movement
- It can withstand considerable pedestrian movement and vehicular traffic without deterioration
- Easy to install and huge contour of the soil surface due to its heavy weight and ability to absorb water
- Totally Biodegradable, 100% natural
- Water absorbent, thus act as mulch on the surface and as a wick in the soil mantle
- Environmental friendly and aesthetically pleasing and nonpolluting
- Provides excellent microclimate for plant establishment and healthy growth
- The thick and protruding fibers from the yarn render an extra protection against soil erosion and Provide roughness to the surface floor and hold the soil particles in place.
- The coir geo textile gives the grass plenty of room to grow and at the same time provides large number of "CHECK DAMS" per square meter of soil media
- During the manufacturing process of coir yarn, non-chemicals are used
- Holds the seeds and saplings in place
- Allows sunlight to pass through

7. Coir Geotextile is laid on the shoulder and slope surface helped retain the soil particles and prevented detachment of soil particles from the prepared slope. Establishment of vegetation ensured stabilization of the soil on the slope surface. It is a bio-degradable natural geotextile, can conveniently be used for controlling surface soil erosion and help growth of vegetation as a bio-engineering measure. After biodegradation coalesces with the soil and adds nutrient to the soil and fosters growth of vegetation.

Coir Mesh 400 gsm

Coir Geo-textile laid on the Embankment

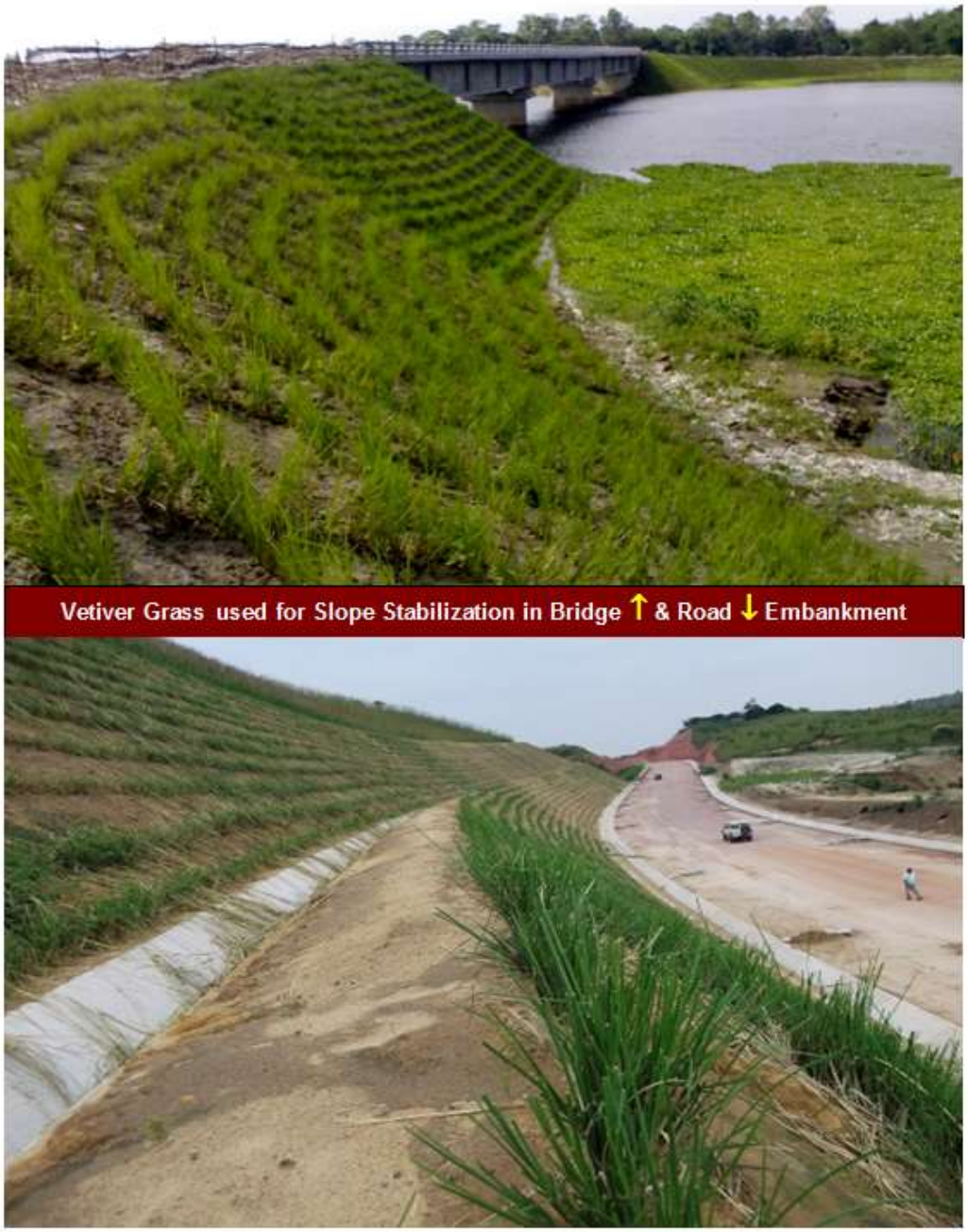
D. Role of Vetiver Grass in Slope Stabilization

8. Vetiver grass (Chrysopogon zizanioides) **is native to India.** It has been has been shown to be a simple and economical method to conserve soil by slowing the velocity of water and trapping sediment, filtering out nutrients, and stabilizing steep slopes. In western and northern India, it is popularly known as khus. Several aspects of Vetiver make it an excellent erosion control plant in warmer climates:

- Vetiver grass does not have stolons or rhizomes. It's massive finely structured root system that can grow very fast; in some applications rooting depth can reach 3 to 4m in the first year. This deep root system makes Vetiver plant extremely drought tolerant and difficult to dislodge by strong current.
- Stiff and erect stems, which can stand up to relatively deep water flow
- Highly resistance to pests, diseases and fire
- A dense hedge is formed when planted close together acting as a very effective sediment filter and water spreader
- New roots grow from nodes when buried by trapped sediment. Vetiver will continue to grow up with the deposited silt eventually forming terraces, if trapped sediment is not removed.
- Tolerance to extreme climatic variation such as prolonged drought, flood, submergence and extreme temperature from -14°C to +55°C
- Tolerance to wide range of soil pH from 3.3 to 12.5 without soil amendment
- High level of tolerance to herbicides and pesticides
- Highly efficient in absorbing dissolved nutrients such as N and P and heavy metals in polluted water.
- Highly tolerant to growing medium high in acidity, alkalinity, salinity and

magnesium

- Highly tolerant to Al, Mn and heavy metals such as As, Cd, Cr, Ni, Pb, Hg, Se and Zn in the soils
- As typical tropical grass, Vetiver is intolerant to shading. Shading will reduce its growth and in extreme cases, may even eliminate Vetiver in the long term. Therefore Vetiver grows best in the open and weed free environment, weed control may be needed during establishment phase. On erodible or unstable ground Vetiver first reduces erosion, stabilizes the erodible ground (particularly steep slopes), then because of nutrient and moisture conservation, improves its microenvironment so other volunteered or sown plants can establish later. Because of these characteristics Vetiver can be considered as a nurse plant on disturbed lands



Vetiver Grass used for Slope Stabilization in Bridge ↑ & Road ↓ Embankment

- Vetiver is useful to treat pollution due to its capacity to quickly absorb nutrients and heavy metals, and its tolerance to elevated levels of these elements. Although the concentrations of these elements in Vetiver plants is often not as high as those of hyper-accumulators, it's very fast growth and high yield allows Vetiver to remove a much higher volume of nutrients and heavy metals from contaminated lands than most hyper-accumulators.

- When planted closely together, Vetiver plants form dense hedges that reduce flow velocity, spread and divert runoff water and create a very effective filter that controls erosion. The hedges slow down the flow and spreads it out, allowing more time for water to soak into the ground.
- Acting as a very effective filter, Vetiver hedges help to reduce the turbidity of surface run-off. Since new roots develop from nodes when buried by trapped

sediment, Vetiver continues to rise with the new ground level. Terraces form at the face of the hedges, this sediment should never be removed. The fertile sediment typically contains seeds of local plants, which facilitates their re-establishment.

E. Cost Analysis

9. Cost of slope stabilization using Coir Geo-textile and Vetiver Grass is **Rs. 450/- per square meter**, which includes coir geo-textiles (erosion control blanket) 600 to 700 GSM woven or non-woven type (inclusive of transportation to site), GI hooks of 4 mm diameter U-Shaped point sharp edges of 300 mm length, installation charges, coir mat spreading, cutting, seeds mix broadcasting, over lapping, watering for 7-9 days twice per day and after complete installation of work get the quality certification from the authorized technical agency.

F. Where to Approach

The Karnataka State Coir Co-operative Federation Ltd. (Govt. of Karnataka Enterprise)
#953/A, 2nd Main, 4th Block, Rajajinagar, Bangalore - 560 010
Phone No: 080 – 23154220; Fax No. 080 - 23154231

10. Karnataka State Coir Co-Operative Federation an Enterprise of Government of Karnataka was established in the year 1961 with the main objective of developing coir industry through co-operative movement in Karnataka state.

ANNEX 8.3B BITUMINOUS PAVEMENT RECYCLING

A. Introduction

1. The bituminous pavement rehabilitation alternatives are mainly overlaying, recycling and construction. In the recycling process the material from deteriorated pavement, known as Reclaimed Asphalt Pavement (RAP), is partially or fully reused in fresh construction. Some of the advantages associated with pavement recycling are:

- Preservation of environment
- Reduction in greenhouse gases emission
- Conservation of energy
- Conservation of fresh aggregates and binder
- Minimization of health hazards
- Minimization of cost of construction
- Preservation of existing pavement geometrics etc.

2. It is also reported that recycled mix has higher resistance to shearing and scuffing, which in turn increase the rutting resistance. Chances of reflective cracking are found to be less with recycled mix.

3. The RAP is a deteriorated bituminous mix that contains aged bitumen and aggregates. Hence its performance is poor when compared to the fresh mix. The purpose of the bituminous recycling is to regain the properties of the RAP, such that it tends to perform as good as fresh mix. Thus, the process of bituminous recycling involves mixing of the RAP, fresh bitumen, rejuvenators and new aggregates in suitable proportions. Rejuvenators are low viscosity oily substance, which helps to bring down the high viscosity of aged bitumen.

B. Recycling Methods

4. Based on the process adopted in recycling the bituminous mix, it can be broadly classified as central plant recycling and in-situ recycling. If the RAP is modified at a plant, away from construction site then the process is known as Central Plant Recycling. In-situ recycling process the RAP modified in place, where from it is available. Further, the RAP could be heated to condition is. If heat is applied then the process is known as Hot Mix Recycling. In case of cold mix recycling, old materials are conditioned using recycling agent (like low viscosity emulsion) without application of heat.

5. Another way of classification could be based on the depth of the old pavement removed. If the top layers of pavement fail, then the upper layers are removed and laid again. This process is known as surface recycling. However, if base failure occurs then the pavement layers up to base layer is removed and constructed again. This process is known as full depth reclamation.

6. The following paragraphs elaborate further the various recycling processes:

1) Hot In-place Recycling

7. Initially the pavement intended to be recycled is heated to a higher temperature using suitable heating arrangement. After heating, the pavement surface is scarified to the required depth. Further, depending on the requirement fresh aggregate and binder are added. The material is mixed well and compacted to the required thickness. As this process consumes less time, least disruption to traffic is caused. Also the transportation cost is less as materials need not be taken away. Machinery required for this purpose being bulky in nature, sufficient RoW is required. This becomes an important consideration for in-place recycling within the city area.

2) Cold In-place Recycling

8. In cold in-place recycling process, first, the pavement is scarified with a scarifier. The scarified material is crushed to the required gradation. Then the required amount of fresh aggregates and binder in cold form (emulsion or cutback) is added. It is compacted and left for aeration. During this process additives like cement, quick lime, fly ash may be used. The cold mix recycling takes care of local geometric correction, correction of pavement distresses like surface cracks. Being an in-situ process the hauling cost is considerably low. The air quality related problems during construction is almost negligible as compared to hot mix process. Similar to hot in-place recycling process the machinery required being bulky, sufficient maneuvering space should be available for operating the equipment. Also, the lane needs to be closed for certain time so that sufficient time is available for cutting of freshly laid course. Moisture content (when bitumen emulsion is used) needs to be given importance as it influences gradation control, mixing and workability of recycled mix to a large extent.

3) Hot Central Plant Recycling

9. In this process, RAP is combined with required quantity of bituminous binder and fresh aggregates in a hot mix plant. The resultant mix is heated to an elevated temperature and mixed thoroughly. The hot mix is transported to paving site, placed and compacted to the required compaction level. The main advantage of this process is that the mix properties and performance is comparable to that of virgin mix. It is noted that the quality control in this process is better when compared to hot in-place recycling. As RAP is susceptible to moisture, care needs to be taken while storing it. Less workplace is required for laying the recycled mix, hence this is suitable for the roads where the ROW is restricted. The RAP should not be exposed to extremely high temperature as it causes pollution due to smoke emission.

4) Cold Central Plant Recycling

10. This is the similar process as it the hot central plant mixing, except it does not involve any heating and therefore emulsion bitumen is used binder in most of the cases. Precise control on the mixing time is important, over-mixing may cause premature breaking of emulsified bitumen, under-mixing results in insufficient coating of aggregates.

ANNEX 8.4 GUIDELINES FOR SITING, OPERATION AND RE-DEVELOPMENT OF BORROW AREAS

A. Introduction

1. Potential sources of earth (borrow areas) for the construction of embankment and subgrade were identified on either side of project road. The details of proposed borrow areas investigated with their respective locations; corresponding chainages and lead from nearest point to project road are tabulated below:

Location of Proposed Borrow Areas

S. No.	Chainage of Nearest Point on Project Road (km)	Side	Location / Village Name	Lead From Nearest Point on Project Road (km)	Type of Land	Present Land Use
1.	3+500	RHS	Mujkande Danda	3.0	Government	Barren
2.	6+300	LHS	Kelodih	7.0	Private	Barren
3.	9+250	RHS	Sulikeri	1.5	Government	Barren
4.	14+400	LHS	Kathgere	2.0	Government	Barren
5.	15+800	LHS	Hangargi	3.0	Government	Barren
6.	23+00	RHS	Hallkurki	2.0	Private	Barren
7.	25+200	RHS	Heremuchhada Gogga	2.0	Private	Barren
8.	29+400	LHS	Adagall	0.10	Private	Barren
9.	30+00	LHS	Adagall	0.3	Government	Barren
10.	34+200	RHS	Badami	5.0	Government	Barren
11.	37.600	RHS	near Badmi	7.0	Private	Barren
12.	47+100	LHS	Belur	3.3	Government	Barren
13.	53+900	RHS	Hirayad	0.2	Private	Barren
14.	58+350	RHS	Kothbad	1.0	Private	Barren
15.	62.500	RHS	Khorahatti	3.0	Private	Barren
16.	65.200	LHS	Rona	2.5	Private	Barren
17.	72.000	RHS	Hirenanor	5.5	Private	Barren
18.	76.400	LHS	Savadi	2.5	Private	Barren
19.	80+000	RHS	Savadi	0.2	Private	Barren
20.	91+000	LHS	Huilagar	0.1	Private	Barren
21.	92+000	RHS	Kiritigeri	2.0	Government	Barren
22.	100+500	LHS	Chikapa	7.0	Private	Barren

2. However, borrow areas for the project will be finalized by the Contractor. All provisions stipulated in this guideline shall be strictly adhered to. The finalization of all such locations will depend on the approval given by the Sr. Environmental Specialist of the Independent Engineer (IE) on technical and environmental grounds. This includes on-site verification by the IE to cross-check the correctness of details provided by the Contractor in the prescribed format. Only after receipt of the written approval from the IE, the Contractor shall enter into a formal agreement with landowner.

B. Siting

3. The selection of borrow areas shall be based on environmental considerations apart from civil engineering considerations. Environmental considerations dictate that:

- Borrow areas should be located away from human habitation (1 km away) to avoid breeding of mosquitos and other organisms during monsoon when the borrow areas are flooded.
- Borrow areas should be at a distance of about 1.5 km from ecologically sensitive area i.e. Reserve Forest, Protected Forest, Sanctuary, National Park and any archaeological sites
- Borrow areas should be generally on degraded land unsuitable for any productive purpose. Government or community land should be preferred to private land. Productive agricultural land should not as far as possible, be used for borrowing earth and where it is used, the productive top soil must be stored and reuse.
- Borrow areas should not, as far as possible, obstruct the natural drainage of the ground and bunds and/or boundary drains should be created on their periphery to restore the flow of natural run off.
- Borrow areas should not be selected near sensitive locations such as banks or beds of rivers or channels, which can adversely affect the river hydrology and hydraulics, or along the road or rail embankment, which, apart from threatening the embankment may enhance the severity of accidents if these happen, or close to public structures such as transmission towers whose foundation can be endangered.
- Borrow area sites must be authorized sites. If located on private land, there should be written consent of the owner in the form of lease agreement permitting the use of the land for borrowing earth. If located on government or community land, the permission should be of the appropriate authority.

4. Avoid locating borrow area close to any road (maintain at least 30m distance from ROW and 10 m from toe of embankment, whichever is higher);

C. Borrow Area Operations

- Excavation in the areas should be planned keeping in view the end use of the borrow area land the shape and dimensions of the area to be excavated from (length, breadth and depth) should be accordingly decided. Generally the depth of excavation should not be deeper than 2 m from the consideration of safely of the humans or animals against accidental fell into the ditch.
- The eventual slope of the excavation should be 2 (H):1(V) from the consideration of safety of the slopes as well as humans.
- There should be safe access to the earth moving equipment and transport vehicles into the borrow areas
- The approach to the borrow areas from the public or private haul roads should have a reasonable design to withstand the movement of transport vehicles.
- Dust palliation measures should be taken to minimise dust pollution on the approach roads (e.g. watering, spraying of lime or cement slurry or bitumen emulsion, etc.)
- Spillage of materials under transit on to the haul roads or main roads through gaps in the transport vehicles should be guarded against buy plugging such

gaps. Similarly, Wind blowing of the materials in transit should be checked by suitable covers.

- Where productive agricultural land is used for borrow areas, the top soil in 150 mm thickness should be scrapped, stock piled and re-used for rehabilitation of borrow areas. At least 10% of the temporary land should be earmarked for stockpiling. The top soil should be seeded and mulched to cover the slopes, or any degraded area in thickness between 75 -150 mm.

D. Borrow Area Rehabilitation Plan

5. The borrow area must be rehabilitated after completion of the work and rehabilitation plan should be prepared in advance in consultation with the community. The area shall be restored to a safe and secure area usable to the public enabling safe access and entry to the restored site vy filling the borrow pit floor to approximately the access road level. Some indicative rehabilitation measures could be community water storage facility, pisciculture ponds, recreational spots, landscape enhancement, or rehabilitation by re-vegetation of the borrow area. Where re-vegetation is done, it should be ensured that:

- Vegetative cover is established on all affected land
- Topsoil is placed, seeded and mulched within 30 days of final grading if it is within a current growing season or within 30 days of the start of the next growing season.
- Vegetative materials to be used are grasses, legumes, herbaceous or woody plants or a mixture thereof
- Plant material must be planted during the first growing season following the reclamation phase
- Selection and use of vegetative cover should take into account soil and site characteristics such as drainage, pH, nutrient availability and climate to ensure permanent growth. Choice of plant species for the planting program shall be made in consultation with ecological consultant and local forest department.
- The planning of trees and shrubs results in a permanent stand or regeneration and succession rate, sufficient to assure a 75% survival rate
- The planning results in 90% ground coverage
- The site should be inspected when the planting is completed and again at one year to ensure compliance whit the reclamation plan

E. Borrow Area Documentation

6. Location reference and potential yield: The information as per the table below should be contained in the documentation:

Sample No.	Name of Village	Material Type	Site identification		
			Nearest Chainage (Km)	Left / Right	Offset from nearest Chainage (m)
1	2	3	4	5	6

Approximate Quantity (Cum)				Available land / Terrain	Surrounding Land / Terrain	Remarks
Length (m)	Breadth (m)	Depth (m)	Total (cum)			
7	8	9	10	11	12	13

7. Land use and vegetative cover (exiting)

- Existing land use (agricultural/barren/scrub/grazing/any other type)
- Vegetation /trees to be removed
- Erosion /degradation potential
- Distance and name of the nearest settlement
- Distance from the nearest surface water body
- Drainage pattern of the area
- Distance of the nearest reserve forest / eco-sensitive area (if any)
- Distance of the nearest sacred tree (if any)
- Distance from the nearest school/hospital/primary health center
- Daily / occasional or avenues for generation of income for adjoining community

8. Borrow area and community features

- Area (in Sq. m)
- Type of Access / width / kutcha / pucca etc. from carriageway
- Soil type
- Slope / drainage characteristics
- Water Table of the area or identify from nearest well etc. /ask people
- Land-use type such as barren / agricultural / gazing land
- Social features of settlement / community and its proximity to
- Present use of the borrow area by the community
- Identification of any other community facility in the vicinity of the borrow pit

9. Plans and photographs

- Borrow area site plans showing the land use, habitation, drainage pattern and structures and other physical features such as access roads, haul roads, existing community facilities (roads, schools, play grounds, community facilities, religious places etc.)
- Before and after photographs of the borrow areas.

ANNEX 8.5 GUIDELINES FOR SITING, OPERATION AND RE-DEVELOPMENT OF QUARRYING AND STONE CRUSHING OPERATIONS

A. Introduction

1. **Stone / Coarse Aggregate Material:** Six stone quarries were identified along the project road section and samples were collected and tested. The sampling locations, name of quarry /village and approximate lead distances from project site are given in **Table-A.8.5.1.**

Table-A.8.5.1 Location of Stone / Coarse Aggregate Material

S. No.	Chainage of Nearest Point on Project Road (km)	Side	Location / Village Name	Lead From Nearest Point on Project Road (km)	Approx. Quantity
1	0+000	RHS	K.G.N. Stone Crusher, Kolhar	42.0	16,00,000 cum
2	23+150	LHS	Basaveer Stone Crusher, Narenur	20.0	6,00,000 cum
3	106+550	RHS	Shri devi Stone Crusher, Parsjapur	37.0	Huge
4	106+550	RHS	Kalmeshwar Stone Crusher, Annigeri	26.0	Huge
5	106+550	RHS	S.M.K Stone Crusher, Bardur	35.0	Huge
6	106+550	RHS	Kalmeshwar Stone Crusher, Chilchili	32.0	Huge

2. **Fine Aggregate Material:** Local enquiry suggests that extraction / mining of natural sand is banned in Karnataka state. It is therefore suggested to use manufactured sand which can be obtained by crushing the stone at crusher plant itself, in the pavement construction as well as concreting of the structures. During field investigation four sources of stone dust and three sources of River sand were identified and presented in **Table- A.8.5.2** and **Table- A.8.5.3** respectively.

Table-A.8.5.2 Location of Fine Aggregate Material (Stone Dust)

S. No.	Chainage of Nearest Point on Project Road (km)	Side	Location / Village Name	Lead From Nearest Point on Project Road (km)
1	106+550	RHS	Kalmeshwar Stone Crusher, Annigeri	26.0
2	106+550	RHS	S.M.K Stone Crusher, Bardur	35.0
3	106+550	RHS	Kalmeshwar Stone Crusher, Chilchili	32.0
4	106+550	RHS	Shri devi Stone Crusher, Parsjapur	37.0

Table-A.8.5.3 Location of Fine Aggregate Material (River Sand)

S. No.	Location / Chainage (Km)	Side	Source	Lead From Nearest Point on Project Road (km)
1	52+200	LHS	Halla River	2.0
2	80+000	LHS	Savadi River	4.0
3	106+550	LHS	Kolahali River	55.0

B. Overview

3. A quarry is a type of open-pit mine from which rock or minerals are extracted for building materials, such as dimension stone, construction aggregate, riprap, sand, and gravel. Quarrying causes environmental damages like air and noise pollution, water logging etc. and requires permission from regulatory authorities like mining department, state pollution control board etc. It requires a careful approach in the site selection process, scientific method of quarrying and appropriate measures to redevelop it.

C. Criteria for Locating the Site/s

4. The selection of a quarry is sole responsibility of the contractor and should be undertaken in adherence to the rules & regulations of the authorities. Following criteria should be followed while selecting a quarry site:

- To the extent possible barren land or waste lands shall be preferred during site selection and fertile land and agricultural land shall be avoided.
- There shall be no quarrying of sand in any river bed or adjoining area or any other area which is located within 500 meters radial distance from the location of any bridge, water supply system, infiltration well or pumping installation of any of the local bodies or Central or State Government
- Department or any area identified for locating water supply schemes by any of the Government Department or other bodies.
- Quarry site shall be located at a minimum distance of 1km from any human settlements and 100 meters from any surface water body / natural drainage channel.
- Locate the quarry and crusher at a min. distance of 1.5 km away from forests / wildlife habitats / ecologically sensitive areas
- Access roads to quarry sites must be wide enough for heavy vehicle movement without inconvenience to local traffic.
- After identification of the site the Contractor should fill up the prescribed reporting format and submit the same for approval to the Sr. Environmental Specialist of the Independent Engineer without which any activity shouldn't be started on the site.

D. Finalization of Selected Site/s

5. The selected site/s shall be approved by IE and PIU, after considering the compliance with the EMP clauses. No agreements or payments shall be made to the land owner/s prior to receipt of a written approval from the IE and PIU. Any consequence of rejection prior to the approval shall be the responsibility of the Contractor and shall be made good at his own cost.

E. Setting up of quarrying and Stone Crusher

6. Quarrying involves not only extraction of material (rock) but also crushing and screening that makes the rock suitable for use as construction material. Following are the major parameters to be considered before the start of quarrying and stone crushing operations:

<u>Site Preparation</u>

7. The stripping, stacking and preservation of top soil will be mandatory and absolutely no activity should be allowed prior to the satisfactory completion of this conservation measure as per guidelines in EMP. The boundary of the quarry should be demarcated using barbed wire fencing in order to avoid the future dispute over land as well as to avoid accidental trespassing of people. There should be recorded documents of exact no of trees cut. Contour trenches should be dug along the quarry area boundary and at any other appropriate places considering the topography to reduce the surface run off and conserve soil and water. Side slopes shall be constructed with slope drains at applicable locations to provide drainage and avoid any landslides. All the drainage constructed should be linked to existing drainages in order to avoid flooding and water logging.

Setting up of a Quarry Site

8. The layout of a quarry should provide a gravity flow of material from the face to the crusher, from the crusher to the storage bin and from the bin to the hauling equipment. Adequate arrangements should be made for avoiding fugitive emissions from quarry and crusher premises. This will include:

- housing the noise and dust producing units of the crusher plant in a building with wall of minimum 23 cm thickness and with suitable roofing
- control of air pollution through provision of in-built dust extraction systems in the crusher unit and all transfer points
- a chimney of appropriate height for the DG set (as specified by SPCB)
- water sprinkling facilities for the camp premises
- facilities to store water required for 3 days use

9. Consent to Operate the crusher unit should be obtained from SPCB under Air (Prevention and Control of Pollution) Act, 1981 before starting the operation.

Safety Aspects

- Blasting timings in quarry should be fixed avoiding the rush hours and these timings should be adhered to in order to avoid the conflict between the surrounding communities or population. Provide warning sirens 10 minutes before each explosion as a warning alarm to people in and outside the quarry. Damaged explosives must be disposed-off in a safe manner away from the operational area. Speed of the vehicles around the quarry should be restricted to a low speed in order to reduce the noise pollution and dust generation. Workers should not be exposed to sound of more than 85 – 90 dB for more than eight hours a day and shall be provided with adequate safety wears and personal protective equipment like ear muffs / plugs etc. Fire extinguishers should be provided in the site office.
-
- Traffic movements should be restricted along the access road around times that children walk to and from school. Proper first aid facilities should be provided within the site office and in case of an accident, quick access to nearby hospital /clinic should be provided.

Facilities for Workers

- Potable drinking water should be provided in the site office in a hygienic environment sufficient for all the people.
- Adequate no. of toilets shall be provided for the workers with adequate water supply, proper drainage and effluent treatment system like septic tank with soak pit. Soak pit should have a sealed bottom, honey comb wall and 75cm thick, 2mm sand envelope around that.
- The sewage system for the camp must be properly sited, designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place.

Waste Disposal

- The Contractor should provide separate garbage bins for biodegradable, non-biodegradable and hazardous wastes in the camps and ensure that these are regularly emptied and disposed-off in a hygienic manner.
- No incineration or burning of wastes shall be carried out by the Contractor.
- The disposal of any biodegradable matter shall be carried out in pits covered with a layer of earth within the camp site. Discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, hessian, metal containers, strips and scraps of metal, PVC pipe scrubber and poly urethane foam, auto mobile spares, tubes, tires, belts, filters, waste oil, drums and other such materials shall be either reused or sold /given out for recycling.
- POL (petroleum, oil and lubricants) waste shall be disposed-off by transfer only to recycler/ re-refiners possessing valid authorization from the State Pollution Control Board and valid registration from the Central Pollution Control Board.
- Used lead batteries, if any, should be disposed as per the Batteries (Management and Handling) Rules 2001.
- Quarry areas should be protected from illegal dumping of waste by third parties. The overburden should kept as minimum to maximize the commercial efficiency of the quarry, it can be utilized for creating earth bunds to mitigate the noise and visual impacts and also for the site rehabilitation process.
- No quarry waste shall be dumped within a 100 m either side of the road. The overburden should be reused or disposed properly. Site for overburden disposal should be planned within the quarry site or any other appropriate site.

Training to Workers

- Workers shall be trained in smooth and safe operation of plants and equipment, their regular maintenance and various safety measures to be followed as well as about the need and importance for adherence to these measures.
- All the drivers should be trained about safe driving and should be made aware about the need to observe caution while plying through access roads, especially during the time when children walk to and from school.
- Conduct education programs with the locals regarding the potential impacts of blasting, blasting warning systems, schedules etc.

Information Dissemination

- There should be a sign board of size 6’ x 4’ mentioning the project details and contractor’s details to disseminate the information to the public.

- There should be a second sign board displaying the latest air and noise monitoring data against the standards specified.
- Warning sign boards should be set up at the entrance gate for the public as well as at other required places for the workers to alert them about the nature of operation being undertaken.

Other Mitigation Measures

- The quarry should not damage any building, work, property or rights of other persons.
- The quarry should not alter any right of way, well or tank.
- Roads inside the crusher premises should be tarred or concreted.
- Water course, if any, from a higher slope should be properly drained out.
- Strom water drainage shall be provided to prevent water logging and flooding in and around the area.
- The possibility of collecting the storm water in a pit or a tank should be explored so that it can be reused for dust suppression and the dependence on other water sources could be reduced. If this is not possible, the water should be safely channeled out of the quarry without disturbing any nearby human settlement.
- A register should be provided in the camp site for public to record their grievances if any.
- Environmental monitoring (air, noise, surface & ground water) should be conducted on quarterly basis.
- The concerned authority – IE / PIU should regularly review the environmental, health and safety aspects. If any adverse effect on environment, habitat and concern of safety is noticed, appropriate measures should be taken as suggested by IE or should arrange an alternative for road construction materials.
- In the case of existing quarries and additional quarries, the contractor has to ensure that all actions in these quarries are in compliance with EMP.

F. Operation of Quarry Site and Stone Crushing Unit

- No quarrying operation shall be done without the approval from the concerned authority.
- The equipment used in quarry should be wear faced, which extends the equipment life and reduce the demand for spare parts.
- Adopt controlled blasting techniques and conduct quarrying in a skillful, scientific and systematic manner.
- All units should operate only between 6 am and 10 pm. or as specified by SPCB in the consent letter.
- Accessory facilities to be provided in the quarry includes sprinklers to spray water for dousing the dust generation, noise suppressers and rubberized mounting to reduce noise and vibration and tarpaulins or covers over material transporting vehicles.
- Provide sufficient water storage facility for 2 days' use.
- Measures have to be taken to reduce the dust generation during drilling operation. Deep wetting of drilling zones also to be done by water sprinkling and drilling machine shall be fitted with dust suppression, collection and disposal arrangements.

- To avoid spillage of fuel and lubricants, the vehicles and equipment should be properly maintained and repaired. Maintenance should be carried out on impervious platforms with spill collection provisions.

10. Following conditions regarding sound generation should be complied with in a quarry / crusher unit:

- The sound level (Leq) measured at a distance of 1 m from the boundary of the site shall not exceed 55 dB(A) during day time (6 a.m. to 6 p.m.) and 45 dB(A) during night time (6 p.m. to 6 a.m.).
- The DG set shall be provided with exhaust muffler /acoustic enclosure/acoustic treatment with an insertion loss of minimum 25 dB(A) and its emission levels should be within relevant SPCB guidelines.
- A proper, routine and preventive maintenance procedure for the DG set shall be set and followed in consultation with the DG set manufacturer.

G. Quarry Management Plan

11. Quarry Management Plan shall be documented as follows for each quarrying sites:

Sl. No.	Item	Unit	Details
1.	Name / identity of the location		
2.	Nearest project road Chainage		
3.	Name of the owner		
4.	Area involved	m^2	
5.	Existing land use (verification from land records with Revenue Dept.)		
6.	Land use of the area surrounding the proposed site including a Map		
7.	Access Roads – existing conditions, proposed development and maintenance		
8.	Tree cutting and vegetation clearance if any, along with compensation measures	Nos.	
9.	Arrangement with the owner (agreement with land owner should be attached as an annexure)		
10.	Quantity of material to be quarried	Cum	
11.	Machinery and equipment to be used		
12.	Copy of the Consents to Establish and Operate should be attached as an annexure		
13.	Copy of the license from Mining and Geology, Police and Fire Department		
14.	Conditions laid down in the clearances / licenses and plans to ensure compliance		
15.	Information on whether or not the quarry shall be closed under this project. If yes, the proposed closure and restoration plan.		
16.	Concern of the local people living in the immediate / near vicinity (through dialogue / consultation)		
17.	Photographs showing before and after conditions as well as during operations at regular intervals		
18.	Quarry Site Plan		
19.	Quarry Operation Plan		

Sl. No.	Item	Unit	Details
20.	Quality Plan		
21.	Safety Plan		
22.	Waste Management Plan		
23.	Restoration and Rehabilitation Plan		
24.	Monitoring Plan		

H. Redevelopment of Quarry Area

12. The main objective of the redevelopment of quarries is to make the area safe and secure place and adapt it to a suitable land use like leisure place or fishing place etc. which is suitable for the physical environment as well as for the community around. Along with the preparation of quarry and crusher management plan the contractor should also prepare a re-development plan, which will be submitted for approval to IE who in turn will be responsible for approving and monitoring these plans. The restoration plan should indicate following points:

- List of structures to be demolished and list of the cleanup activities that needs to be undertaken.
- Presence of facilities that could be put in use by the land owner if it is a leased out private land or community in case of a public property
- The proposed use of the quarry site with a layout plan showing the proposed facilities / improvement measures, list of local plant species that could be planted etc.
- Photographs of the site before and during the quarrying process

13. Possible re-development options include the following:

- Re-vegetation of the quarry to merge with surrounding landscape with reuse of top soil mixed together with farm yard manure.
- Development of exhausted quarries as water bodies, where the quarry pit is developed into pond or a rainwater harvesting structure
- Pits created as a result of blasting could be filled with over burden which are removed and stockpiled in other areas or with construction debris. Top soil should be spread back and trees should be planted along the boundary.
- Tree plantation where ever possible depending on the proposed use, erosion control measures etc. should be taken up as part of the redevelopment plan.

I. De-mobilization of the Site

- The contractor should clear all temporary structures; dispose all building debris, garbage, night soils and POL waste as per the approved debris management plan.
- All disposal pits or trenches should be filled in, disinfected and effectively sealed off.
- Once the re-development plan is implemented and the site is restored, the same should be intimated to IE by the contractor.
- The IE shall ensure that all clean-up and restoration operations are completed satisfactorily and written approval is given to the contractor before the ‘works completion’ certificate is issued / recommended.

- The PIU shall ensure through site inspection that the Contractor and IE have complied with all these provisions.
- The site can then be handed over to the concerned owner or local bodies or for local communities as the case may be.
- Certification / documentation pertaining to approval for clean-up and restoration operations and thereafter handing-over to the owner shall be properly maintained by the Contractor, Supervision Consultant and PIU.

ANNEX 8.6 GUIDELINES FOR SEDIMENT CONTROL

1. Right at the initial stage of the work, the operations such as clearing and grubbing, roadway and drainage excavation, embankment / sub-grade construction, bridges and other structures across, pavement courses and shoulders are undertaken. These activities generate huge wastes and debris, which should not find their way into drainage channels and water courses nor should remain exposed to wind at the site and allowed to erode and contaminate productive soils or generate windblown dust particles in the atmosphere.

2. Erosion and sediment control measures shall, therefore, be planned to prevent soil erosion and sedimentation. These measures may involve temporary measures at construction stage, such as of temporary berms, dikes, sediment basins, slope drains, use of temporary mulches, fabrics, mats, seeding or other control devices .Permanent erosion control measures aim at preventing erosion during the project life cycle and should be planned as a part of the project design. These may involve turfing or pitching the embankment Slopes, turfing / mulching / vegetating the exposed areas, vegetating or reinforcing the cut slopes by appropriate methods such as shot-creting, rock bolting, soil-nailing, gabions etc.

3. Sediment control, whether temporary or permanent, would be mostly project and site specific. However, some of the generic measures shall be as follows.

- Debris generated at construction site must be removed immediately and dumped at the designated dump sites after useful recyclable materials are sorted out, and properly stocked or stacked.
- The site cleared after removal of debris would usually be prone to erosion. These areas should be treated by mulching and other dust palliation measures.
- There could be many mulching options such as seeding top soil and spreading the mulch (organic) to permit growth of grass, or other methods like mulches of tiles, brick bats, stone chips, or any other non-erodible wastes, which cover the exposed soil, allow moisture to be retained within soil and prevent erosion.
- Dust palliation measures by any suitable commercially available dust palliatives, application of water, cement, lime or bitumen emulsion in thin application to bind the dust particles together.
- All slush at construction sites, which after drying up become erodible must be either dredged and removed or treated appropriately in-situ (say by mulching).
- Temporary drains combined with sedimentation tanks should be created at the periphery or edge of the work sites to arrest the sediments brought by rains or construction activities requiring water and discharge only sediment free water into the water courses.

ANNEX 8.7 GUIDELINES FOR SITING AND MANAGEMENT OF DEBRIS DISPOSAL SITE

A. Overview

1. Construction of highways generates huge quantity of building debris which needs to be disposed off in previously identified sites suitable for such an activity. This process entails close scrutiny of the sites with respect to their location and this section details out the criteria to be followed in doing so. Moreover, it also guides the contractor as to how to prepare the site without causing much impact on the surrounding environment.

B. Criteria for Locating the Site/s

2. The locations of debris disposal have to be selected such that:

- The said site shall be selected preferably from barren, infertile lands. In case agricultural land needs to be selected, top-soil stripping, stacking and preservation should be undertaken prior to initiation of any activities.
- Debris disposal site should be at least 200 m away from surface water bodies.
- No residential areas should be located downwind side of the site.
- The site should be minimum 1000 m. away from ponds / lakes or other water bodies, protected areas, forests, wildlife habitats, ecologically sensitive areas, seasonal streams, rivers, canals, flood plains, educational institutions, medical centers, religious sites, cultural or heritage sites and play grounds.
- The local governing body and the community should be consulted while selecting the site.
- The selected site should meet with the local regulatory requirements (including those of SPCB, Municipalities etc.).
- The site should preferably be owned by government so that there is no need to acquire the land for the same.
- After identification of the site the Contractor should fill up the prescribed reporting format and submit the same for approval to the Sr. Environmental Specialist of the Independent Engineer. Any activity on the site can be initiated only after obtaining permission form the IE.

C. Finalization of Selected Site/s

3. The selected site/s shall be approved by Sr. Environmental Specialist of the Independent Engineer and PIU, after considering compliance with the EMP clauses and this guideline. No agreements or payments shall be made to the land owner/s prior to receipt of a written approval from the IE and PIU. Any consequence of rejection prior to the approval shall be the responsibility of the Contractor and shall be made good at his own cost.

D. Disposal Site Management Plan

4. The Contractor after getting approval from the competitive authority for the selected site should submit a detailed Debris Disposal Site Management Plan comprising the following details:

- Details of site: Copy of approved site identification report along with location plan on a village map showing the site, its survey no., access road, project stretch, distance from the project stretch, surrounding features and land use like residences, agricultural land, water bodies etc., photograph of the site showing the topography and other existing features.
- Arrangements within the Camp: A layout plan showing the existing trees, green belt, locations were contour trenches should be dug etc.
- Mitigation Measures: Measures will be undertaken as per the EMP while preparing the site and dumping the waste should be separately listed out.
- Other details: Any other relevant details like copy of approvals / clearances obtained, species wise no. of trees to be cut and the details of top soil to be removed and conserved like quantity, location of storing etc. shall also be provided. All the drawings should have north direction marked in it along with prevailing wind direction. Necessary dimensions and specifications should be provided where ever necessary. The debris site management plan should be submitted to the IE for a written approval before any physical work is undertaken. The IE will carefully examine the proposals in light of the various EMP and regulatory provisions and provide suggestions, as necessary to the contractor who will implement it within the stipulated time period.

E. Setting up of Debris Disposal Site

5. Following steps has to be undertaken while setting up a debris disposal site:

- Top soil conservation has to be undertaken as per the guidelines given in EMP.
- Considering the topography of the site contour trenches should be made along the site boundary to prevent soil erosion.
- Fencing should be provided for the debris disposal site to prevent trespassing of humans and animals into the area as well as to prevent spread of the waste material through action of wind, water, scavengers or rag pickers.
- No of trees cut should be recorded and three times the same should be planted as green belt development or elsewhere as part of the project.
- Provide proper drainage facility so that the run off from the site doesn't contaminate any nearby surface water sources.

F. Redevelopment of Debris Disposal Site

6. Along with the format seeking permission / approval for the disposal site / location from the Independent Engineer, the contractor shall also submit a rehabilitation plan for the area. Following points have to be kept in view while undertaking the rehabilitation measure:

- The dump sites shall be suitably rehabilitated by planting local species of shrubs and other plants.
- Vegetative materials to be used are grasses, legumes, herbaceous or woody plants or a mixture thereof
- Plant material must be planted during the first growing season following the reclamation phase
- Selection and use of vegetative cover should take into account soil and site characteristics such as drainage, pH, nutrient availability and climate to ensure

permanent growth. Choice of plant species for the planting program shall be made in consultation with ecological consultant and local forest department.

- The vegetative cover is acceptable if within one growing season of seeding
- The planning of trees and shrubs results in a permanent stand or regeneration and succession rate, sufficient to assure a 75% survival rate
- The planning results in 90% ground coverage
- Rehabilitation can also include conversion into farm land, playground, parking area, block plantation area etc.
- Care should always be taken to maintain the hydrological flow in the area.

ANNEX 8.8 GUIDELINES FOR PREPARING COMPREHENSIVE WASTE MANAGEMENT PLAN

A. Overview

1. A comprehensive waste management plan shall be prepared by the contractor prior to initiation of any works. The purpose of the plan is to provide standardized procedures for the clearance, removal and disposal of waste generated during the construction work as well as to establish the most efficient and cost effective methods to resolve waste disposal issues.

B. Preparation of Comprehensive Waste Management Plan

2. The Contractor should prepare a Comprehensive Waste Management Plan to be submitted to Sr. Environmental Specialist of the Independent Engineer for approval prior to setting up of construction and labour camp and it should comprise the following details:

- Categorization of waste into degradable, biodegradable and hazardous categories and list out different types of waste that falls in each of these categories
- Estimates about the quantity of waste generated in each category and type of storage units required.
- Detail the provisions for storage and handling of waste until disposed. A plan of the respective camps / areas like construction camp, labour camp etc. to be attached indicating the space allocated for storage and handling of wastes.
- Detail the precautions to be taken while storing, handling and disposing each type of waste, trainings to be imparted to workers to create awareness about waste management.
- Details of each debris disposal site
- Copy of approved site identification report along with location plan on a village map showing the waste disposal sites, its survey no., access road, project stretch, distance from the project stretch, surrounding features and land use (like residences, agricultural land, water bodies etc.), photograph of the site showing the topography and other existing features.
- All staff and workers involved in the highway construction should be imparted training about comprehensive waste management plan including the need for such a plan, its components and measures adopted by the contractor for implementing it. In addition, all personnel involved should be made aware about various steps and measures each of them has to follow so as to ensure the compliance to the comprehensive waste management plan.
- Precautions to be adopted during disposal of waste material

3. The contractor shall take the following precautions during transportation and disposal of waste material:

- A register should be kept for recording the details of the waste generated and their disposal.
- The pre-designated disposal sites should be a part of Comprehensive Solid Waste Management Plan and should be identified prior to initiation of any work on a particular section of the road.

- The contractor will take full care to ensure that public or private properties are not damaged/ affected during the site clearance for disposal of debris and the traffic is not interrupted.
- In the event of any accidental spill or spread of wastes onto adjacent parcels of land, the contractor will immediately remove all such waste material/s and restore the affected area to its original state to the satisfaction of Sr. Environmental Specialist of the Independent Engineer.
- Contractor should ensure that any spoils / materials unsuitable for embankment fill shall not be disposed off near any water course; water body; agricultural land; flood plains, forests etc. pasture; eroded slopes; and in ditches, which may pollute the surrounding.
- Contractor should ensure effective water sprinkling during the handling and transportation of materials where dust is likely to be created.
- Materials having the potential to produce dust will not be loaded beyond the side and tail board level and will be covered with a tarpaulin in good condition.

C. Waste Disposal in Construction Camp

- Concrete flooring and oil interceptors should be provided for hot mix plant area, workshops, vehicle washing and fuel handling area.
- POL (petroleum, oil and lubricants) waste shall be stored safely in separate containers and should be disposed-off by transfer only to recycler / re-refiners possessing valid authorization from the State Pollution Control Board.
- Used lead batteries, if any, should be disposed as per the Batteries (Management and Handling) Rules 2001.
- Water separated and collected from oil interceptor should be reused for dust suppression.
- There should be a register to record the details of the oil wastes generated at the workshops and oil storage areas.
- The Contractor will provide separate garbage bins in the camps and ensure that these are regularly emptied and disposed-off in safe and scientific manner as per the Comprehensive Solid Waste Management Plans approved by the IE.
- No incineration or burning of wastes shall be carried out.
- Discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, hessian, metal containers, strips and scraps of metal, PVC pipes, rubber and poly urethane foam, auto mobile spares, tubes, tires, belts, filters, waste oil, drums and other such materials shall be either reused or will be sold / given out for recycling.
- Septic tank must be provided for toilets and the sludge should be cleared by municipal exhausters.

D. Waste Disposal in Labour Camp

- The Contractor should provide separate garbage bins in the camps for bio-degradable, non-biodegradable and domestic hazardous waste and ensure that these are regularly emptied and disposed off in safe and scientific manner.
- The disposal of kitchen waste and other biodegradable matter shall be carried out in pits covered with a layer of earth within the camp site to avoid smell and pests. The contractor may use the compost from such wastes as manure in the plantation sites.

- Noon-biodegradable waste like discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, metal containers, strips and scraps of metal etc. and other such materials shall be either reused or should be sold /given out for recycling.
- No incineration or burning of wastes should be carried out.
- Effluent treatment system like septic tank with soak pits provided for toilets should be sited, designed, built and operated in such a way that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place.
- Soak pits must be provided to collect waste water from bathrooms and kitchen.

E. Disposal of Bituminous Waste

- The bituminous waste should be used for development of roads inside the construction camps, haul roads or for filling pot holes in rural roads.
- Non reusable bituminous waste to be dumped in 30 cm thick clay lined pits with the top 30 cm layer covered with good earth for supporting vegetation growth over a period only after obtaining approval of Sr. Environmental Specialist of the Independent Engineer.
- The Contractor will suitably dispose-off unutilized non-toxic debris either through filling up of borrows areas located in wasteland or at pre-designated disposal sites, subject to the approval of Sr. Environmental Specialist of the Independent Engineer.
- Debris generated from pile driving or other construction activities along the rivers and streams drainage channels shall be carefully disposed in such a manner that it does not flow into the surface water bodies.

ANNEX 8.9 GUIDELINES FOR PREPARATION OF TRAFFIC MANAGEMENT PLAN

1. The Contractor shall at all times carry out work on the road in manner creating least interference to the flow of traffic with the satisfactory execution. For all works involving improvements to the existing state highway, the Contractor shall, in accordance with the directives of the Sr. Environmental Specialist of the Independent Engineer (IE), provide and maintain, during execution of the work, a passage for traffic either along a part of the existing carriageway under improvement, or along a temporary diversion constructed close to the state highway. The Contractor shall take prior approval of the IE regarding traffic arrangements during construction.

Traffic Safety and Roads Works

- Delineate advance warning zones, transition zones and construction zones at both ends of a work front. Use devices such as regulatory signs, delineators, barricades, cones, pavement markings, lanterns and traffic control lights, reflectors and signal men in appropriate manner round the clock.
- No work front should be 'touched' without putting appropriate safety measures in place. Sr. Environmental Specialist of the Independent Engineer will be responsible to ensure that the permission for any activity is not given without the required safety plan and practices in place.

- Put signage at appropriate locations as per the road construction activity plan to warn the road users, construction vehicles / equipment operators, pedestrians and local residents about the work in progress, speed controls, hindrances / blockages, diversions, depressions etc. in lines with contract requirements and IRC guidelines.

- Signage has to be: (i) simple, easy-to-understand and should convey only one message at a time; (ii) has florescent and reflective properties of the paints; (iii) broad, prominent and with appropriate size of letters and figures; (iv) placed at the appropriate 'point/s' as specified in the IRC guidelines to allow proper stoppage / reaction time to approaching vehicles.
- Express a regret signage for the inconvenience caused and alert about the dangers ahead on account of construction activity.

- Different sign boards shall have a mix of pictorial signs and messages in local language, Hindi and English.
- While using barricades, ensure that traffic is kept

away from work areas and the road user is guided to the safe, alternative movement track.

- Ensure that excavation sites are provided with effective barriers and reflecting signage to prevent any accidental approach by vehicles during the day or night.
- Provide proper uniform (light reflecting garments) to flagmen engaged in traffic control at diversions so that they can be singled out from the moving traffic.
- Prevent entry of cattle and wildlife through proper fencing / barricading around the excavation sites.
- Provide wide red and green flags or red and green lights to flagmen for controlling traffic. In high traffic zones and congested areas, use of wireless communication devices with protective headgear and shoes by flagmen has to be ensured to prevent confusion and minimize the risk of accidents.

Ensuring Traffic Control

- Where the execution of the works requires temporary closure of road traffic use, the Contractor should provide and maintain temporary traffic diversions. The diversions should generally consist of 200 mm thickness of gravel laid directly upon natural ground and earthworks.
- Where the execution of the works requires single-lane operation on public road, the Contractor should provide and maintain all necessary barriers, warning signs and traffic control signals.
- At the points where traffic is to deviate from its normal path (whether on temporary diversion or part width of the Carriageway) the lane width path for traffic should be clearly marked with the aid of pavement markings and painted drums or a similar device. At night, the passage should be delineated with lanterns or other suitable light source.
- One-way traffic operation shall be established whenever the traffic is to be passed over part of the carriageway inadequate for two-lane traffic. This should be done with the help of temporary traffic signals or flagmen kept positioned on opposite sides during all hours. For regulation of traffic, the flagmen should be equipped with red and green flags and lanterns / lights.
- On both sides, suitable regulatory / warnings signs as approved by the IE shall be installed for the guidance of road users. On each approach, at least two signs shall be put up, one close to the point where transition of carriageway begins and the other 120 m away. The signs should be of design and of reflector type.
- Upon completion of the works for which the temporary traffic arrangements or diversions have been made, the Contractor should remove all temporary installations and signs and reinstate all affected roads and other structures or installations to the conditions that existed before the work started.

ANNEX 8.10 GUIDELINES TO ENSURE WORKER'S SAFETY DURING CONSTRUCTION

1. In order to ensure worker's safety while undertaking various operations / stages of construction many safety measures needs to be followed, which are listed down below:

A. Tree Felling

- Use hard hats during tree felling
- Ensure safe use and storage of tools such as axes, power chain saw, hand saw of different types, HDPE ropes of approved thickness to drag felled trees and logs.
- Keep the saw blades in proper lubrication and sharpened state for efficient workability.
- Determine proper foot and body position when using the implements for felling, cutting and dragging.
- Wear appropriate foot protection
- Avoid cutting overhead branches
- Keep first aid kits ready at the site.
- Determine possible hazards in the area, e.g. electrical or telephone or other utility lines, buildings, vehicles and domestic cattle that may create unsafe work situations.
- Prior to felling, determine the safest direction of fall and orient fixing of ropes and cutting positions accordingly.
- Determine the proper hinge size before directing the fall.
- Keep machineries and workers ready for speedy removal of the tree from the main traffic movement area.
- Keep flag men and warning signal signage at either end of felling area to control movement of traffic and warn passers-by

B. Plant Sites, Construction Camp and Quarry Areas

- Install perimeter fencing
- Ensure good visibility and safe access at site entrances
- Provide adequate warning signs at the entrance and exit, as necessary
- Provide adequate space / area for loading and unloading, storage of materials, plant and machinery
- Display emergency procedure and statutory notices at conspicuous locations
- Provide areas for collecting garbage and other waste material, and also arrange for their regular / periodic disposal.
- Arrange appropriate storage, transportation and use of fuel, other flammable materials and explosives in line with the license requirements obtained from concerned authorities
- Provide defined access roads and movement areas within the site
- Ensure availability of first aid facilities and display notices at various work places showing the location of first aid facilities and emergency contact numbers
- Provide and enforce use of PPE at plant and quarry sites
-

C. House Keeping Practices

- Provide proper slope in kitchen, canteens, washrooms, toilets and bathrooms for easy and immediate draining of water
- Keep all walkways and circulation areas clear and unobstructed at all times
- Ensure that spillages of oil and grease are avoided and in case of accidental spills, these should be collected immediately
- Use metal bins for collection of oily and greasy rags
- Stack raw materials and finished products out of walkways
- Do not leave tools on the floor or in any location where they can be easily dislodged
- Keep windows and light fittings clean
- Maintain the workplace floors dry and in a non-slippery condition
- Provide and maintain proper drainage system to prevent water logging and unhygienic conditions
- Ensure that protruding nails in boards or walls are moved or bent over or removed so that they do not constitute a hazard to people
- Store all flammable materials in appropriate bins, racks or cabinets with proper cover and labels as required for various products
- Make sure that hazardous / dangerous chemicals are kept in the goods stores with the appropriate labeling, display of the material-safety-data-sheet (MSDS) and other precautionary measures.
- Display 'no smoking' signs in areas with high risks of fire, (e.g. near fuelling areas, diesel /oils / lubricant /paint storage area, hessians, rubber, wood and plastic etc.) in and around working area

D. Safety during Excavation

- The risk of accidents involving people and vehicles remains high in excavated sites. All pits or excavations shall to be barricaded to warn the road users and residents and to avoid any unauthorized entry of persons, children, domestic cattle or wildlife. For deep excavations and culvert construction sites, painted GI sheets, delineators, lamps (as required) and retro-reflective signage shall be used.
- Excavation more than 1.5 m is to be done in steps of minimum 500 mm offsets with plank and stuttering support, as required under contract clauses.
- For excavation in slippery or water logged area, try to dewater the area and spread minimum 150 mm thick sand layer to avoid slipping.
- For excavation for drain, the area should be properly barricaded with sign boards and illumination / lamps for night time safety. In congested stretches, watchmen / guards can also be placed for vigil.
- Snake bites or Scorpion stings during excavation - in areas with vegetation, tall grasses and forest cover, the contractor shall provide the labour with gum boots and gloves. He shall also make snake antidotes available on site. Emergency vehicles should also be kept ready to rush the patient to the nearest hospital.

E. Safety during Some Typical Construction Work

<u>Centering and Scaffolding</u>

- Many a times ballies joined together give away due to weak joints. Use of metal scaffolding and centering plates with metal fasteners are the safest and highly

recommended materials for use in all road construction works for ensuring safety, stability and casting of structures. All such scaffolding should be placed on a firm and a level base on the ground for ensuring stability. No wooden scaffolding or bamboo scaffolding is to be used for any casting of heavy (RCC) structural construction as the risk to safety of workers is higher.

- Railings are to be provided along working platforms and ladders for better safety. Nets shall be hung below the scaffolding or structures where work is on-going to prevent fall of debris, stones, bricks, equipment and other heavy to retain soil objects and even workmen, which could be fatal.

Form-work for small/light beams and slabs

- The collapse of bottom of the beam that may bring down the slab as well is a risk in such operations, which may injure the labour or supervision staff. Slender ballies without bracing are not be allowed for such works. No concreting should be allowed without bracing at 300 mm above ground and at midway for normal beams and slabs. The bracings should be for the support of beams as well as the slabs.
- Direct ballies support from the ground and the practice of tying planks with binding wire to the steel reinforcement shall not be allowed. A temporary railing and properly based working platforms along the periphery of slab reduces risk to the life of labour and supervision staff.

Dismantling of Scaffoldings

- Dismantled materials may fall on passer-by and workers. Workers could also get injured during the removal of such materials. Prior to dismantling of scaffoldings / working platforms, the area of operation should be closed for all outsiders. No one should be allowed within 50 m. from the place of demolition.
- Helmets, safety belts and other PPE must be worn by all the workers engaged in such a work. This work requires careful handling by an experienced supervisor / work force and should be executed with utmost caution. Gradual dislodging and use of PPE is required.

Column Reinforcements

- The tendency of bar-benders is to tie the vertical steel with coir rope or 8 mm steel rods as ties on all four sides of the column reinforcements. Reinforcement to columns shall be by welding MS rods with metal scaffolding to keep it in position till the final casting of RCC is done.
-

Falling of Objects or Debris from a Height

- At bridges construction sites (or in work areas at a height above ground level) thick nylon net or hessian barriers shall be used to prevent any splinter, debris, mortar or concrete from falling onto the passersby or workmen around.

Site Cleaning

- Throwing of waste materials, broken concrete pieces, brick bats, sand etc. straight from the top of a structure onto the ground can injure a worker or a passerby. Such materials should be brought to the ground with the help of lift or the use of rope over pully with a bucket.

Operation of Excavators

- Ensure that excavators are operated by authorized persons who have been adequately trained.
- Prevent any unauthorized use of the excavators.
- Ensure that only experienced and competent persons are engaged in supervising all excavations and leveling activity.
- Check and maintain as per the manufacturer’s manual.
- Issue relevant information, including that related to instructions, training, supervision and safe system of work in writing and provides expert supervision for guidance.
- Ensure that the operation and maintenance manuals, manufacturer's specifications, inspection and maintenance log books are provided for the use of the mechanics, service engineers or other safety personnel during periodic maintenance, inspection and examination.
- During tipping or running alongside the trenches, excavators must be provided with stop blocks.
- Excavators must be rested on firm ground after field operation away from the road
- Locate and identify underground services including telephone cables, OFC cables, sewerage and drainage lines, water supply, electrical cables etc. by checking with all concerned underground utility providers.
- When reversing or in cases where the operator's view is restricted, adequate supervision and signaling arrangements shall be provided.
- Ensure that the type and capacity of the excavator are properly chosen for the intended purposes and site conditions. Never use a machine for any purposes other than it is designed for.
- Check and report for excessive wear and any breakage of the bucket, blade, edge, tooth and other working tools of the excavator and ensure replacement / repair to avoid mishap and break down.
- Check that all linkages / hinges are properly lubricated and linkage pins are secured. Never use improper linkage pins.

Operation of Trucks and Dumpers

- Ensure that only trained, authorized and licensed drivers operate the vehicles.
- Switch-off the engine when not in use to save fuel, prevent accidents and unnecessary noise and air pollution.
- Lower the tipping bodies when the machine is unattended, but if it is necessary to leave them in the raised position they should be blocked to prevent their fall by fixing a sturdy support below.
- Carryout periodic servicing as per the manufacturer’s requirements
- All records of maintenance and repairs should be in writing and available for verification.

- Keep the vehicle tidy and the cabin free from clumsy utilities, which might obstruct the controls and create hazards.
- Follow safe driving principles including speed limits as per traffic signage.
- Avoid carrying additional passengers in the cabin or on the body of the dumper, while in field operation other than the connected workers.
- Provide stop blocks when the vehicle is tipping into or running alongside excavations or when it is parked.
- Do not overload the vehicle.
- Carry only well secured loads and use proper covers and fasteners.

Manual Handling and Lifting

- Avoid manual handling of heavy and hazardous objects and chemicals.
- Pre-assess the actual requirement of manpower in case of emergency situations.
- The hazardous and poisonous materials should not be manually handled without proper equipment /gears and prior declaration of the risks needs to be made to the involved workers.
- All concerned persons shall be trained in proper methods of lifting and carrying.
- In all manual operations where groups of workers are involved, a team leader with necessary training to handle the entire work force in unison has to be provided for.
- Watch and ward to control / supervise / guide movement of equipment and machineries, loading and unloading operations, stability of the stockpiled materials and irregularly shaped objects have to be provided for safety and security of workers.
- Carriageway used by the workers must be free from objects, which are dangerous.
- Loading and unloading from vehicles shall be under strict supervision.

Gas Welding

- The welders and welding units should follow all the basic principles of welding for safety and security
- Use face shield to protect the eyes
- Use goggles, particularly when chipping slag and cutting strips.
- Use gloves long enough to protect wrists and forearms against heat, sparks, molten metal and radiation hazards.
- Use high-top boots / gum boots to prevent sparks, splinters, sharp edges of metal and hot welded strips, welding rods, electric cables etc. from injuring the legs.
- Avoid inhaling the noxious fumes and gasses from burning electrodes by using gas masks and screen of the work area to prevent the glare moving outside it.

- Keep the key hung from the regulator control for split seconds operations to stop the valve in case of any accidental damage or leakage to supply pipeline that may catch fire and cause accidents in case acetylene or LPG cylinder.
- The welding area should have sufficient openings with fixed exhaust ventilators or adequate air flow openings to remove poisonous fumes and gases.
- Take precautions of wearing hard hats or fiber helmets to prevent injury due to fall of any object and accidental injury from projections while welding.
- Welders operating above ground should have adequate safety belt secured to stable platform to prevent accidental fall or injury from the scaffold. All electrical and gas connection lines up to the welder should be sufficiently insulated and protected from sharp edges and sharp objects. These shall not come into contact with hot metal.
- Do not use gas cylinders for supporting work or as rollers. While using LPG or CNG cylinders for welding, follow all safety precautions as has been prescribed by the supplier company.
- Avoid fire hazards and accidents by posting safety supervisors to oversee the activities of workers.
- Do not store explosives, high inflammable materials, loose hanging overhead objects, hot welded strips etc. near gas cylinders.
- Close all valves, switches and circuits while leaving the work place under proper lock and key. In case of mobile units, proper carriage procedure have to be followed for safety and security of men and materials.

F. Electrical Hazards in Construction Areas

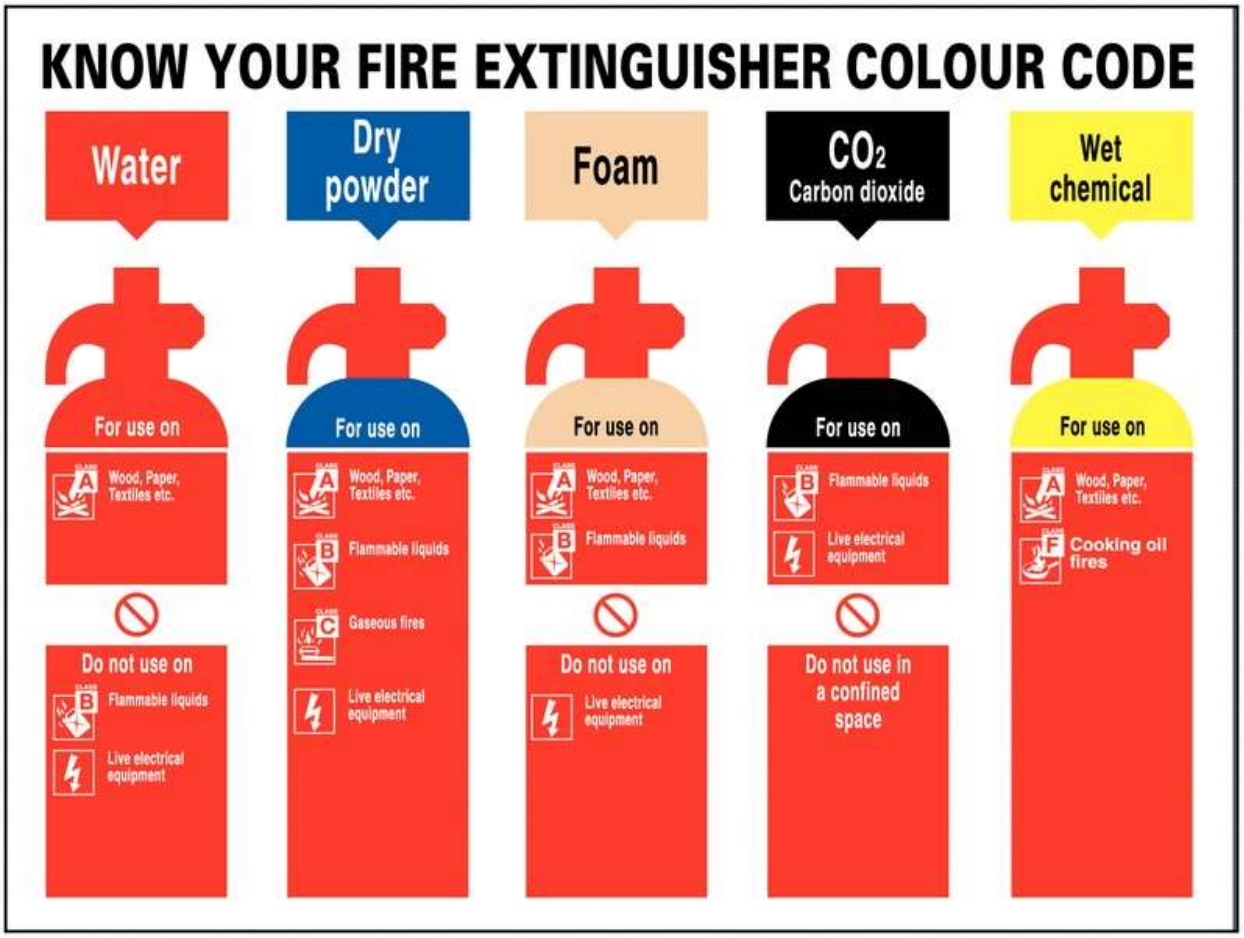
- Statutory warning leaflets / posters are to be distributed / displayed by the Contractor in the vicinity of work sites for the benefit of all workers, officers and supervisors as well as the public, indicating the do's and don'ts and warning related to electrical hazards associated with operations to be executed / in progress.
- All wires shall be treated as live wires
- Report about dangling wires to the site-in-charge and do not touch them.
- Only a qualified electrician should attempt electrical repairs.
- Train all workers about electrical safety.
- Shut down the equipment that is sparking or getting over heated or emitting smoke at the time of operation, if it is not the normal way of working of such machines.
- Inform technical person/s for required maintenance.
- Never used damaged wires for electrical connection
- Demolition, tree felling and removal of overhead transmission lines shall be undertaken with strong, efficient and closely monitored arrangements to avoid accidents.

G. Use and Storage of Gas (LPG)

- Store filled LPG cylinder in a secure area – mark this as a no smoking area.
- Transport, store, use and secure cylinders in upright position
- Ensure proper ventilation at the ground level in locations where LPG is in use.
- Avoid physical damage to the cylinders
- Never weld near the cylinder
- Store empty cylinders secured and upright
- Make sure that the cylinder is closed immediately after use
- Investigate immediately if there is the smell of LPG or gas
- Make sure that there is no other unrelated fire in the vicinity of the cylinder.

H. Fire Safety Practices

- Store flammable material in proper areas having adequate fire protection systems
- Display sufficient warning signs
- Install fire alarm wherever required and test regularly.
- Inspect fire extinguishers regularly and replace as necessary.
- Train selected personal on use of fire extinguishers
- Fire escape route should be kept clear at all times and clearly indicated
- Train workers about the escape route and assembly point/s.
- Carryout fire drill periodically
- When fire breaks out alert all persons through fire alarms or other methods.
- Put off the fire with appropriate fire extinguishers only when you are sure that you are safe to do so.
- Escape if you are in danger through the fire escape route to assembly point.
- Call-up Fire Service
- Fire officers to carryout head count at the assembly point.



I. Noise Hazards and its Control

- Plan camp lay-out in a manner that ensures barriers /buffers between residential / office units and high noise generating zones.
- Use sound meters to measure the level of noise and if it exceeds 75 dB(A), then ensure preventive measures.
- Make personnel aware of noisy areas by using suitable warning signs and insist on use of ear protectors / ear plugs to prevent excess noise affecting the workmen.
- Reduce noise at source by: use of improved equipment; regular and proper maintenance of the machinery as per the manufacturer's manual; by replacing rickety and noisy equipment and machineries.
- Screening locations with noise absorbing material; making changes in the process / equipment; controlling machine speeds; ensuring that two noise-generating machines are not running at the same time close to each other at same location; using cutting oils and hydraulic noise breakers; providing vibration and noise absorbing platform and firm embedding of equipment with fasteners.
- Appoint a competent person to carryout a detailed noise assessment of the site; designate ear protection zone/s; give training / instructions on the necessary

precautionary measures to be observed by site personnel including using suitable type of ear protection equipment.

J. Personal Protective Equipment (General)

- Provision of personal protective equipment has to be made over and above all measures taken for removing or controlling safety hazards on a work site.
- Ensure that sufficient personal protective equipment are provided and that they are readily available for every person who may need to use them.
- The Contractor's Project Manager shall ensure that all persons make full and proper use of the personal protective equipment provided.
- Provide instruction/s and training for the proper use and care of personal protective equipment.
- Ensure that the personal protective equipment is in good condition.
- Train workers to report unintentional damages for replacement and to always keep the personal protective equipment clean. PPE includes, but may not be limited to, hard hats, goggles, ear plugs, gloves, air filters/masks, boots, ropes etc.

Eye Protection

- Road construction work sites, quarries and crushers are full of dust particles, sand, splinter, harmful gases, bright light and welding arc lights, which are injurious for the eyes. Therefore, eye protection and adequate lighting in work areas is required. All workers, supervisors and inspection officers and dignitaries coming over for study of works should be compelled to wear eye protecting glasses /goggles properly fitting the eye sockets to prevent damage due to dust, gases and other particles.

Head Protection

- Hard hats are compulsory for all workers, supervisors and managers /officials while working and / or inspecting a work sites. Hard hat areas shall be demarcated clearly.

Hearing Protection

- Provide ear plugs or ear muffs to the workers and to those who need to get in and out of a high noise area frequently.
- Use re-usable earplugs when the reduction required (15-25 dBA) is not excessive.
- Use earmuffs where a large attenuation of up to 40 dBA is demanded.
- Do not use dry cotton wool for hearing protection because it doesn't provide any such protection.
- Provide disposable ear plugs for infrequent visitors and ensure that these are never re-used.
- Replenish ear plugs from time to time for those who need to work continuously for a long period in a high noise area/s.
- Use ear muffs with replaceable ear cushions because they deteriorate with age or may be damaged in use.
- Avoid wearing spectacles with ear muffs. Use soap and water or the recommended solvent for cleaning ear muffs.

Respiratory (Protective) Equipment

- Wear suitable masks for protection when there is a potential for small particles entering the lungs, e.g. emptying of cement bags, working at crusher sites etc.
- Provide training to all persons using the masks / respirators for their correct fitting, use, limitations and symptoms of exposure.
- Clean and inspect all respirators before and after use
- Store respirators properly when not in use

Safety Footwear

- Wear suitable footwear for work
- Wear suitable safety shoes or ankle boots when working anywhere where there is high risk of foot injuries from slippery or uneven ground, sharp objects, falling objects etc.
- All safety footwear, including safety shoes, ankle boots and rubber boots, should be fitted with steel toecaps.
- Avoid wearing flip flops, high heeled shoes, slippers, light sport shoes in situations where there is a risk of foot injury and keep shoelace knots tight.

Hand Protection

- Wear suitable gloves for selected activities such as welding, cutting and manual handling of materials and equipment.

- Do not wear gloves where there is a risk of them becoming entangled in moving parts of machinery.
- Wash hands properly with disinfectant soap and clean water before drinking or eating.
- Wash hands immediately after each operation on site when the situation warrants.

K. First Aid

- Provide first aid boxes at every work site in a cool and shaded place.
- Ensure that training on the use of the first aid box is provided to at least every supervisor on the site.
- Display the list of persons along with their contact numbers who are trained on providing first aid.
- Ensure that every first aid box is marked "First Aid" in English and in local language.
- Check for expiry dates and replace the contents, as necessary.
- Maintain a register on health records including injuries / accidents.

L. Accident Investigations

- Carryout the investigation/s as quickly as possible
- Investigation should be carried out both internally as well as through third party.
- Conduct interviews with as many witnesses as necessary including the affected persons and supervising officials.
- Do not rely on any one / limited source of evidence.
- Check all the log books, stock registers, issue registers and movement registers on site
- Safety regulations, traffic signals and signal men activities, signage, as well as other field positions and keep a record of all investigations through audio-visual and electronic medium for presenting an evaluation of the incident/s.
- After completion of the investigation / enquiry, a summary of the facts recorded, sequence of happenings, persons-in-charge, persons examined, equipment and machineries tested, follow-up of action as per legal requirements, copy of station diary entry, hospital entry, safety regulations etc. to be prepared with a comparative analysis for proper assessment.

ANNEX 8.11 GUIDELINES FOR STORAGE, HANDLING, USE AND EMERGENCY RESPONSE FOR HAZARDOUS SUBSTANCES

A. Handling Hazardous Substances (including Chemicals)

- As far as practicable the hazardous materials will be stockpiled under proper mechanical loading, unloading and stacking aided by manual labour where necessary.
- Exercise great care in the storage and use of chemicals because they may be explosive, poisonous, corrosive or combustible.
- Separate different chemicals physically and store accordingly after proper labeling.
- Stock taking of all hazardous will be mandatory together with enforcement of manufacturer's or supplier's safety standard/s and drill exercises.
- New and less known chemicals and building materials, for which toxicological studies are wanted, need to be properly evaluated prior to their inclusion in the materials list.
- All containers should be clearly labeled to indicate contents.
- Maintain the Material Safety Data Sheet of all chemicals for reference on safety precautions to be taken and the use of suitable PPE.
- Ensure use of correct personal protective equipment before allowing workers to handle chemicals.
- When opening containers, ensure holding of a rag over the cap / lid or use of safety gloves, as some volatile liquids tend to spurt up when released.
- Eye fountain, emergency shower and breathing apparatus should be available near the workplace.
- Ensure immediate medical attention in case of spill / splash of a chemical.
- Safety instructions for handling emergency situations shall be displayed prominently at both the storage and use locations.

B. Refueling / Maintenance procedure

- Truck or suitable containers will bring in all fuel and fluids. There will be no storage of fuel, oil or fluids within 200m of a water line.
- Prior to re-fueling or maintenance, drip pans and containment pans will be placed under the equipment. Absorbent blankets may also be required to be placed under the equipment and hoses where there is a possibility of spillage to occur.
- All used oils or fluids will be properly contained and transported to appropriately licensed (authorized) disposal facilities;
- Following re-fueling and maintenance, the absorbent blankets (if any) and spill pans will be picked up and the fuel truck or container moved outside of the 200m wide area.

C. Emergency Spill Procedure

1. The applicable emergency spill procedure as outlined below and / or as directed by the manufacturer / supplier shall be followed:

Spill Procedure (inside the stream)

2. In the case of a spill, overflow or release of fluid into the stream waterway (whether water is flowing during the spill or not), do what is practical and safely possible to control the situation, then get help.

a. Stop the flow

- Stop the release into the stream waterway
- Shutdown equipment
- Close valves and pumps
- Plug hoses

b. Remove Ignition sources

- Shut off vehicles and other engines
- Do not allow tiger torches, vehicles, smoking or other sources of ignition near the area. Keep a fire extinguisher on hand but keep it a safe distance away from the potential ignition source (if a fire starts, the extinguisher must be easily accessible)

c. Contact the Environmental Officer and initiate emergency response

- Notify the site supervisor and the Contractor's Environmental Officer as soon as possible
- The Environmental Officer will review the situation and decide if emergency services like fire brigade are required
- Appropriate parties to be notified of the spill are:
  - ❖ The contractor's Project Manager
  - ❖ The Engineer through his designated Environmental Officer
  - ❖ The Client
  - ❖ Regulatory Agencies like Pollution Control Board, Municipal Authorities, as applicable.
  - ❖ Site safety Officer

d. Cleanup and Disposal

- Emergency Services will be engaged for the containment, cleanup and disposal of contamination release into the environment.

e. Reporting

- The Contractor's Environmental Officer will document the event and submit repots to the Engineer, the client and appropriate regulatory agencies like the Pollution Control Board.

f. Procedure Review

- The Engineer will review the report, determine if changes are required to be incorporated in the plan of activity under the revised guidelines and recommendation/s that have been suggested by the technicians / manufacturer / supplier / fire brigade / SPCB / Environment Expert of the PIU, as the case may be.

Spill Procedure (on Land)

3. In the case of a spill, overflow or release fluid onto land, do what is practical and safety possible to control the situation and then get help.

a. Stop the flow
- Stop the release into the waterbody
- Shutdown equipment
- Close valves and pumps
- Plug hoses

b. Remove Ignition sources
- Shut off vehicles and other engines
- Do not allow tiger torches, vehicles, smoking or other sources of ignition near the area. Keep a fire extinguisher on hand but keep it a safe distance away from the potential ignition source (if a fire starts, the extinguisher must be easily accessible)

c. Contain the Spill
- Dike around the spill to contain the material
- Spread absorbent or place a spill blanket on the spill
- Enlist the help of personnel on site
- Notify your supervisor as soon as possible

d. Notification

4. Appropriate parties to be notified of the spill are

- The Contractor's Project Manager
- The Engineer through his designated Environmental officer
- The Client
- Regulatory Agencies like Pollution control Board, Municipal Authorities, as applicable
- Site Safety coordinator

e. Cleanup and Disposal
- The Engineer's Environmental officer will ensure that a proper cleanup and disposal method is determined. Absorbent pads will soak up the spilled material. The pads will be contained and removed from site for disposal at a licensed (authorized) facility.

f. Reporting
- The Contractor's Environmental Officer will document the event and submit reports to the Engineer, the Client and appropriate regulatory agencies like the Pollution control Board(s)

g. Procedure Review
- The Engineer will review the report, determine if changes are required to procedures and recommend implementation of all required changes.

ANNEX 8.12 TREE PLANTATION STRATEGY

A. Avenue Plantation

1. The greenbelt development aims for overall improvement in the environmental condition of the project area. Greenbelt development along the road addresses the loss of flora due to the execution of the proposed project. The other objectives are to combat soil erosion, enhance greenery in the area, to control air/noise pollution, mitigate climate change, maintain and improve the ecological and environmental balance.

2. Trees bind soil and control erosion, attract birds/ bees, provide shades, cooling effect and provide aesthetic value to the surroundings. Green belts are also effective mode to control air pollution, where green plants form a surface capable of absorbing air pollutants and forming a sink of pollutants. Leaves with their vast area in a tree crown, absorbs pollutants on their surface, thus effectively reduce pollutant concentration in the ambient air.

Specifications for Plantation

Items	Description
No. of Rows	1 row on each side of road outside drain line
No. of trees per Km	200
Spacing between the plants	10 m
Size of Pits	60 x 60 x 60 cm
Height of Plant	1.5 to 2m
Age of Plant	Not less than 2 Years

***** *Plantation cost includes maintenance for 5 years.*

3. Tree species attract birds, insects and butterflies and wildlife. Species such as *Tamarindus indica*, Ficus *microcarpa, Zizyphus mauritiana*, *Pongamia Pinnata*, *Aegle marmelos, Syzygium cumini*, *Annona squamosal etc* shall be preferred for plantation near Forests to support the wildlife dwelling the area.

4. Provision for plantation near settlements/urban periphery to improve aesthetic value and pollution sink, species such as *Azadirachta indica*, *Dalbergia sisoo Cassia fistula, Peltophorum pterocarpum, Bauhinia racemosa, Delonix regia etc*. List of tree species suitable for plantation along the road is given below:

.

List of Tree species suggested for Plantation

S.No.	Scientific name	Common Name
1.	*Albizia amara*	Chigare
2.	*Albizia lebbeck*	Sirish
3.	*Annona squamosa*	Custard Apple
4.	*Azadirachta indica*	Neem
5.	*Bauhinia racemosa*	Kachnar
6.	*Butea monosperma*	Palash
7.	*Cassia fistula*	Amaltas
8.	*Cassia siamea*	Kassod
9.	*Dalbergia sissoo*	Seesham
10.	*Delonix regia*	Gulmohar

S.No.	Scientific name	Common Name
11.	*Ficus benghalensis*	Banyan
12.	*Ficus microcarpa*	Indian Laurel
13.	*Ficus mysorensis*	Goni Mara
14.	*Ficus religiosa*	Peepal
15.	*Mangifera indica*	Mango
16.	*Peltophorum pterocarpum*	Radhachura
17.	*Phoenix sylvestris*	Khajur
18.	*Tamarindus indica*	Imli
19.	*Pongamia pinnata*	Karanj
20.	*Syzigium cumini*	Jamun
21.	*Tamarindus indica*	Imli
22.	*Terminalia arjuna*	Arjun
23.	*Ziziphus mauritiana*	Ber

Protection & Precautionary Measures

- Plantation activity should be carried out in monsoon season.
- All plants supplied must be planted within three days of removal from the nursery.
- The plants must be watered daily in initial stages; watering 2-3 times a week is a must.
- 2 kg of compost / manure is suggested for each pit before plantation.
- To ensure better growth and survival of plants, surface should have sufficient soil (up to 45 cm depth).
- Nurseries can be developed by local habitants with technical guidance from Forest Department so that saplings are available locally.
- Continuous monitoring of plant growth, immediate replacement of causalities, supplementation of nutrients, rescheduling watering regime are important aspects for survival of the plantation.
- Fencing of single row plantation shall be done by using iron/brick/cement guards.
- Progress of planting and status of plantation shall be monitoring on continuous basis for 5 Years.
- The survival rate of sapling should be maintained at 90% after raising the plantation with normal shape and size. Dead sapling shall be replaced.

ANNEX 8.13 REPORTING FORMAT FOR IDENTIFICATION OF CONSTRUCTION CAMP SITE

(Report to be prepared by the Contractor)

Sl. No.	Project Details	Information		
1.	Name and address of the Contractor			
2.	Contact details of the Contractor			
3.	Name of Project Road			
4.	Stage of the Project			
5.	Site Details	Information		
6.	Name of the Village		Panchayat	
7.	Name of the Taluk		District	
8.	Chainage (km)		Side	LHS/RHS
9.	Area of site		Current land use	
10.	Ownership of the land	Owned/Leased	Survey No.	
11.	If leased, name, address and contact details of owner			
12.	Distance from nearest settlement			
13.	Distance from surface water course or body			
14.	Distance from Ecologically Sensitive Areas			
15.	Width of access road			
16.	No of trees with girth > 0.3m			
17.	No of trees to be cut			
18.	Is top soil conservation required (Yes/ No)			
List of Enclosure		Location Map		
Remarks				

Submission Details	Submitted by Contractor	Approved by: Sr. Env. Specialist of IE
Signature		
Name		
Designation		

ANNEX 8.14 REPORTING FORMAT FOR SETTING-UP OF CONSTRUCTION CAMP

(Report to be prepared by the Contractor)

Name of Project Road: _____

Construction Stage Report: Date_____

Month: _____

Year: _____

(Site Layout of Construction camp and working drawings of dwelling units with allied facilities to be attached with format)

Format to be submitted before target date of establishing camps

Sl. No	Item	Unit	Details	Remarks by CSC if any
1	Detail of item camp			
	Size of Camp	m x m		
	Area of Camp	Sq.m		
	Distance from nearest settlement			
	Distance from the nearest water source	Type / Size / Capacity / Present Use / Ownership		
	Date of camp being operational dd / mm / yy			
	Present land use			
	No of trees with girth > 0.3m			
	Details of Storage area (Availability of impervious surface)	m x m		
	Availability of separate waste disposal	Cum		
2	Details of topsoil stacking			
	Quantity of top soil removed	Sq.m		
	Detail of storage of topsoil	Describe stacking arrangement		
3	Details of workforce	Nos.		
	Total No of Laborers	Nos.		
	Total no of Male Workers	Nos.		
	No of Male Workers below 18 years of age	Nos.		
	Total No of Female Workers	Nos.		
	No of Female workers below 18 years of age	Nos.		
	No of children	Nos.		

Sl. No	Item	Unit	Details	Remarks by CSC if any
4	Details of dwelling units			
	No of dwellings/huts			
	Minimum Size of Dwelling	m x m		
	No. of openings per dwelling	Nos.		
	Minimum size of opening	m x m		
	Walls	Specifications		
	Roofing	Specifications		
	Flooring	Specifications		
	Drinking Water Tank	Specifications		
	Capacity of Drinking Water Tank	Cum		
	Size of Drinking Water Tank	m x m		
	Total no of WC	Nos.		
	No of WCs for female workers	Nos.		
	Minimum Size of WC	m x m		
	Total No of Bathrooms for female workers	Nos.		
	Size of septic tank for WC / Baths	m x m		
	Capacity of Water Tank for WCs / Bathrooms and general purpose			
	Fencing around camp	Yes / No		
5	Details of facilities			
	Availability of security guard 24 hrs. a day	Yes / No		
	Details of First Aid Facility	Yes / No		
	Availability of Dav Care Centre	Yes / No		
	Availability of dust bins (capacity 60ltr)	Nos.		

Remark

Submitted

Signature

Name

Designation

Contractor

Approved

Signature

Name

Sr. Environmental Specialist

Independent Engineer

ANNEX 8.15 REPORTING FORMAT FOR ESTABLISHMENT OF HOT MIX PLANT / BATCH MIX PLANT

(To be submitted by the Contractor for taking permission from IE)

Name of Project Road: _____

Date_____

Sl. No	Location Details					Area (m^2)
	Name of Village	Chainage (Km)	Side (LHS/RHS)	Latitude and Longitude	Haul Road Length (m)	

Distance from nearest Water Course (m)	Distance from nearest Settlement (m)	Existing Land Use	Prevalent Wind Direction	Whether in Up Wind Direction from Settlement (Y/N)	Approved by EO (Y/N)	Remarks, if any

ANNEX 8.16 REPORTING FORMAT FOR IDENTIFICATION OF BORROW AREAS

(Report to be prepared by the Contractor)

Sl. No.	Project Details	Information		
1.	Name and address of the Contractor			
2.	Contact details of the Contractor			
3.	Name of Project Road			
4.	Stage of the project			
5.	Site Details			
6.	Name of the Village		Panchayat	
7.	Name of the Taluk		District	
8.	Chainage (km)		Side	LHS/RHS
9.	Area of site		Current land use	
10.	Ownership of the land	Owned/Leased	Survey No.	
11.	If leased, name, address and contact details of owner			
12.	Distance from settlement			
13.	Distance from surface water course or body			
14.	Distance from Ecologically Sensitive Areas			
15.	Width of access road			
16.	No of trees with girth > 0.3m			
17.	No of trees to be cut			
18.	Is top soil conservation required (Yes/ No)			
List of Enclosure		Location Map		
Remarks				

Submission Details	Submitted by Contractor	Approved by: Sr. Env. Specialist of IE
Signature		
Name		
Designation		

ANNEX 8.17 REPORTING FORMAT FOR ESTABLISHMENT OF BORROW AREA

(To be submitted by the Contractor for taking permission from IE)

Name of Project Road: _____

Date_____

Sl. No	Location Details					Area (m^2)	Land Use	
	Name of Village	Chainage (Km)	Side (LHS/RHS)	Latitude and Longitude	Haul Road Length (m)		Before	After

Distance from nearest Water Course (m)	Distance from nearest Settlement (m)	Quantity of available material (cum)	Type of material	No. of Trees to be felled	Approved by EO (Y/N)	Remarks, if any

Attach Photograph of proposed site, location map, agreement etc.

Re-development Plan:

Remarks

Submitted	Approved
Signature	Signature
Name	Name
Designation	Sr. Environmental Specialist
Contractor	Independent Engineer

ANNEX 8.18 REPORTING FORMAT FOR IDENTIFICATION OF QUARRY AND STONE CRUSHER SITE

(Report to be prepared by the Contractor)

Sl. No.	Project Details	Information		
1.	Name and address of the Contractor			
2.	Contact details of the Contractor			
3.	Name of Project Road			
4.	Stage of the project			
5.	Site Details	Information		
6.	Name of the Village		Panchayat	
7.	Name of the Taluk		District	
8.	Chainage (km)		Side	LHS/RHS
9.	Area of site		Current land use	
10.	Ownership of the land	Owned/Leased	Survey No.	
11.	If leased, name, address and contact details of owner			
12.	Distance from settlement			
13.	Distance from surface water course or body			
14.	Distance from Ecologically Sensitive Areas			
15.	Width of access road			
16.	No of trees with girth > 0.3m			
17.	No of trees to be cut			
18.	Is top soil conservation required (Yes/ No)			
List of Enclosure		Location Map		
Remarks				

Submission Details	Submitted by Contractor	Approved by: Sr. Env. Specialist of IE
Signature		
Name		
Designation		

ANNEX 8.19 REPORTING FORMAT FOR IDENTIFICATION OF DEBRIS DISPOSAL SITE

(Report to be prepared by the Contractor)

Sl. No.	Project Details	Information		
1.	Name and address of the Contractor			
2.	Contact details of the Contractor			
3.	Name of Project Road			
4.	Stage of the project			
5.	Site Details	Information		
6.	Name of the Village		Panchayat	
7.	Name of the Taluk		District	
8.	Chainage (km)		Side	LHS/RHS
9.	Area of site		Current land use	
10.	Ownership of the land	Owned/Leased	Survey No.	
11.	If leased, name, address and contact details of owner			
12.	Distance from settlement			
13.	Distance from surface water course or body			
14.	Distance from Ecologically Sensitive Areas			
15.	Width of access road			
16.	No of trees with girth > 0.3m			
17.	No of trees to be cut			
18.	Is top soil conservation required (Yes/ No)			
List of Enclosure		Location Map		
Remarks				

Submission Details	Submitted by Contractor	Approved by: Sr. Env. Specialist of IE
Signature		
Name		
Designation		

ANNEX 8.20 REPORTING FORMAT FOR SAFETY CHECKLIST

(Report to be prepared by the Contractor)

1. Name of the Project Road
2. Contract No.
3. Name of the Contractor
4. Name of Safety Officer
5. Date of Inspection
6. Location description: Location-1_____; Location-2_____

Particulars	Location-1			Location-2			Remarks
	A	B	C	A	B	C	
General							
House Keeping							
▪ Stacking of Material							
▪ Passageway							
▪ Lighting							
▪ Ventilation							
▪ Others							
Electrical							
▪ Switches							
▪ Wirings							
▪ Fixed Installation							
▪ Portable Lighting							
▪ Portable Tool							
▪ Welding Machine							
▪ Others							
Fire Prevention							
▪ Fire Fighting Appliance							
▪ Dangerous Goods Store							
▪ Gas Welding Cylinders							
Others							
▪ Dust Control							
▪ Noise Control							
▪ First Aid Equipment							
▪ Washing Facility							
▪ Latrine							
▪ Canteen							

Particulars	Location-1			Location-2			Remarks
	A	B	C	A	B	C	
Provision of Personal Protective							
▪ Helmet							
▪ Eye Protector							
▪ Ear Protector							
▪ Respirator							
▪ Safety Shoes							
▪ Safety Belts							
▪ Others							

A = Adequate at the time of Inspection
B = Needs Improvement
C = Needs Immediate Attention

ANNEX 8.21 REPORTING FORMAT FOR ROAD SAFETY MEASURES DURING CONSTRUCTION

(Report to be prepared by the Contractor)
One time reporting before commencement of construction (zone wise)

1. Name of the Project Road
2. Contract No.
3. Name of the Contractor
4. Name of Safety Officer
5. Date of Inspection
6. Location description: Location-1_____; Location-2_____

Sl. No.	Item	Unit	Compliance	Remarks
Details of Construction Zone				
1.	Length of Construction Zone			
2.	Distance between this and next construction zone			
3.	Length of work sub zone in urban stretch (should be <2 km)			
4.	Length of work sub zone in rural stretch (5-10 km)			
5.	Distance between two work sub zones			
Signage's in Construction Zones				
1.	Sign saying 'Men at Work' 1 km ahead of transition sub zone			
2.	Supplementary sign saying diversion 1 km provided			
3.	Sign saying 'Road Closed ahead' provided			
4.	Compulsory Right Turn /Left sign provided			
5.	Detour sign placed			
6.	Sharp deviation sign placed at end of advance warning sub zone			
Signage in Transition Sub Work Zone				
1.	Signage saying 'Keep Right / Left' provided			
2.	Delineators placed along length of transition			

Sl. No.	Item	Unit	Compliance	Remarks
Signage in work sub zone				
1.	Hazard Marker placed where railing for CD structure on diversion starts			
2.	Barricade on either side of work sub zone			
Signage in Termination sub zone				
1.	Sign for indication of end of work zone 120 m from end of termination sub zone			
Road Delineator				
1.	Roadway indicators provided			
2.	Hazard Makers provided			
3.	Object Makers Provided			

Submitted

Signature

Name

Designation

Contractor

Approved

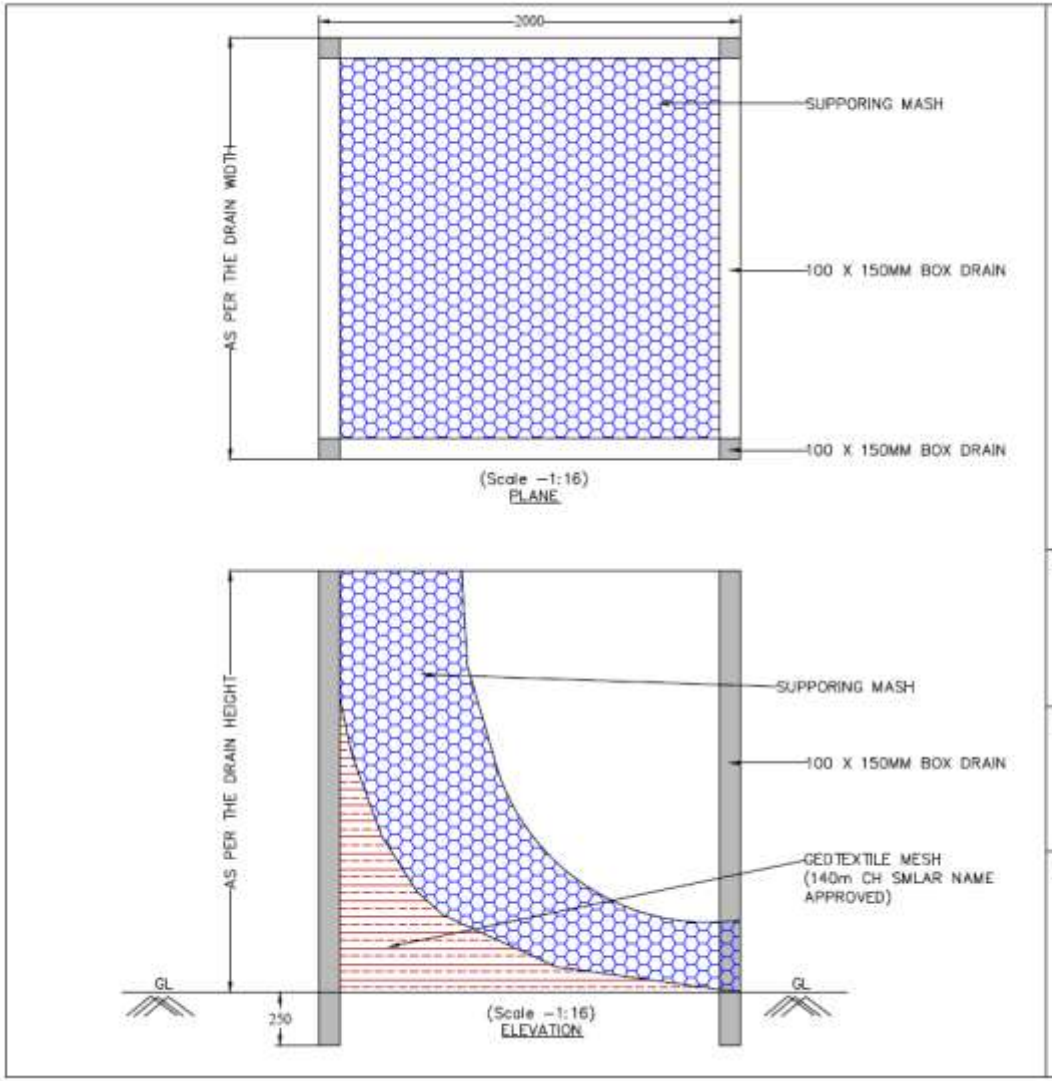
Signature

Name

Sr. Environmental Specialist

Independent Engineer

ANNEX 8.22 DRAWING TYPICAL SILT TRAP



ANNEX- 8.22
TYPICAL SILT TRAP

CLIENT

Government of Karnataka
Public Works, Ports & IWT Department
Karnataka State Highways Improvement Project

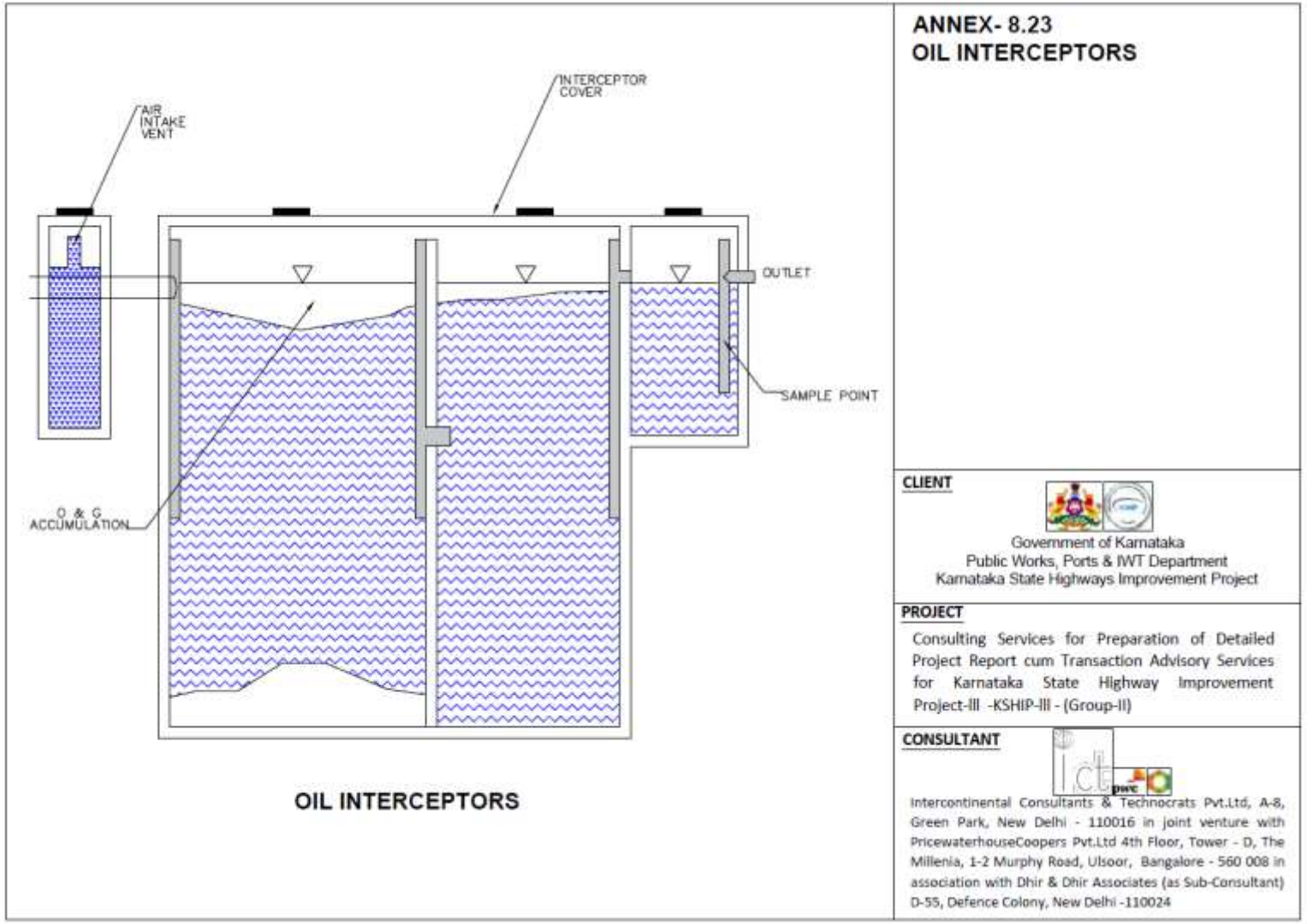
PROJECT

Consulting Services for Preparation of Detailed Project Report cum Transaction Advisory Services for Karnataka State Highway Improvement Project-III -KSHIP-III - (Group-II)

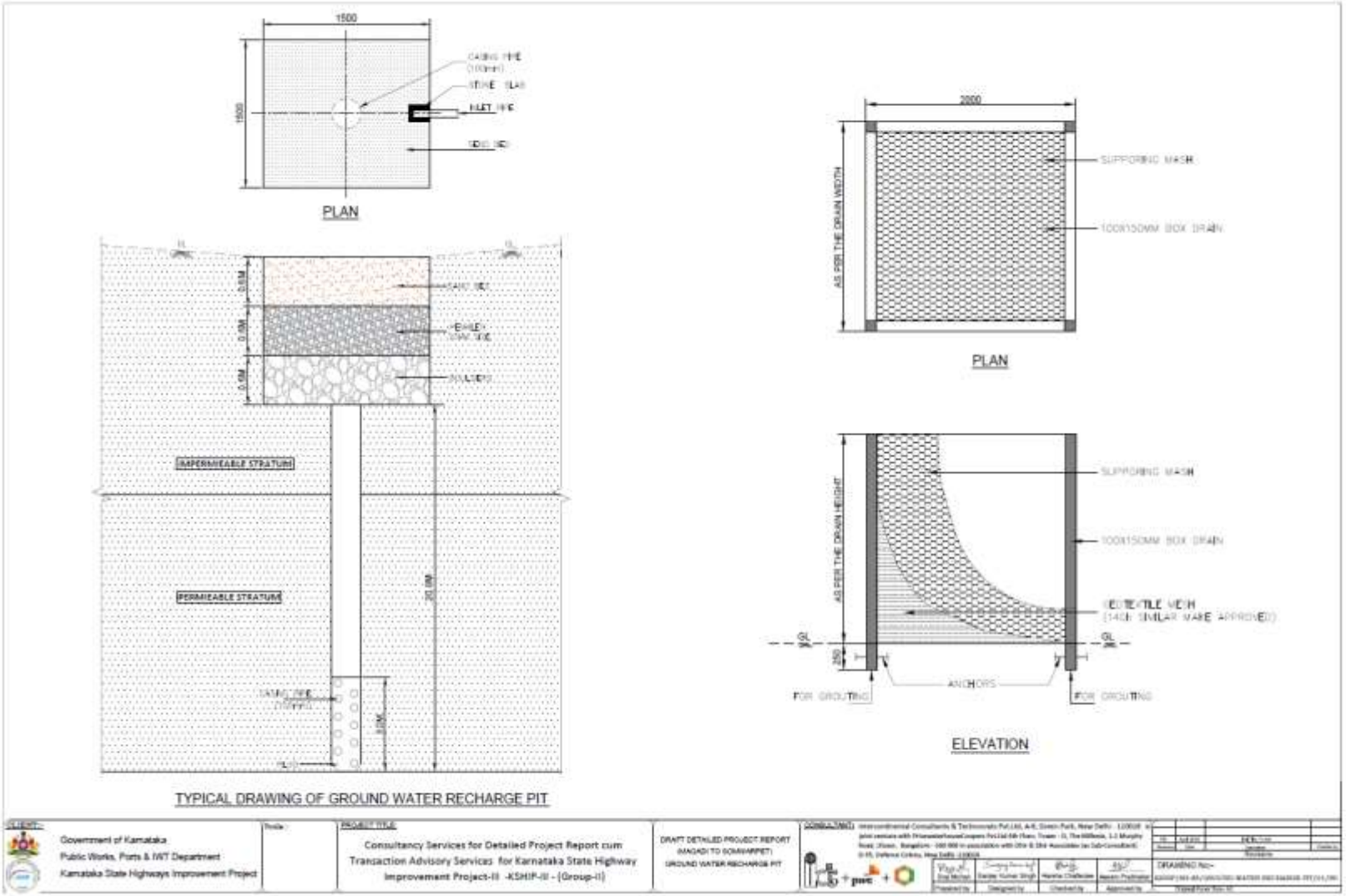
CONSULTANT

Intercontinental Consultants & Technocrats Pvt.Ltd, A-8, Green Park, New Delhi - 110016 in joint venture with PricewaterhouseCoopers Pvt.Ltd 4th Floor, Tower - D, The Millenia, 1-2 Murphy Road, Ulsoor, Bangalore - 560 008 in association with Dhir & Dhir Associates (as Sub-Consultant) D-55, Defence Colony, New Delhi -110024

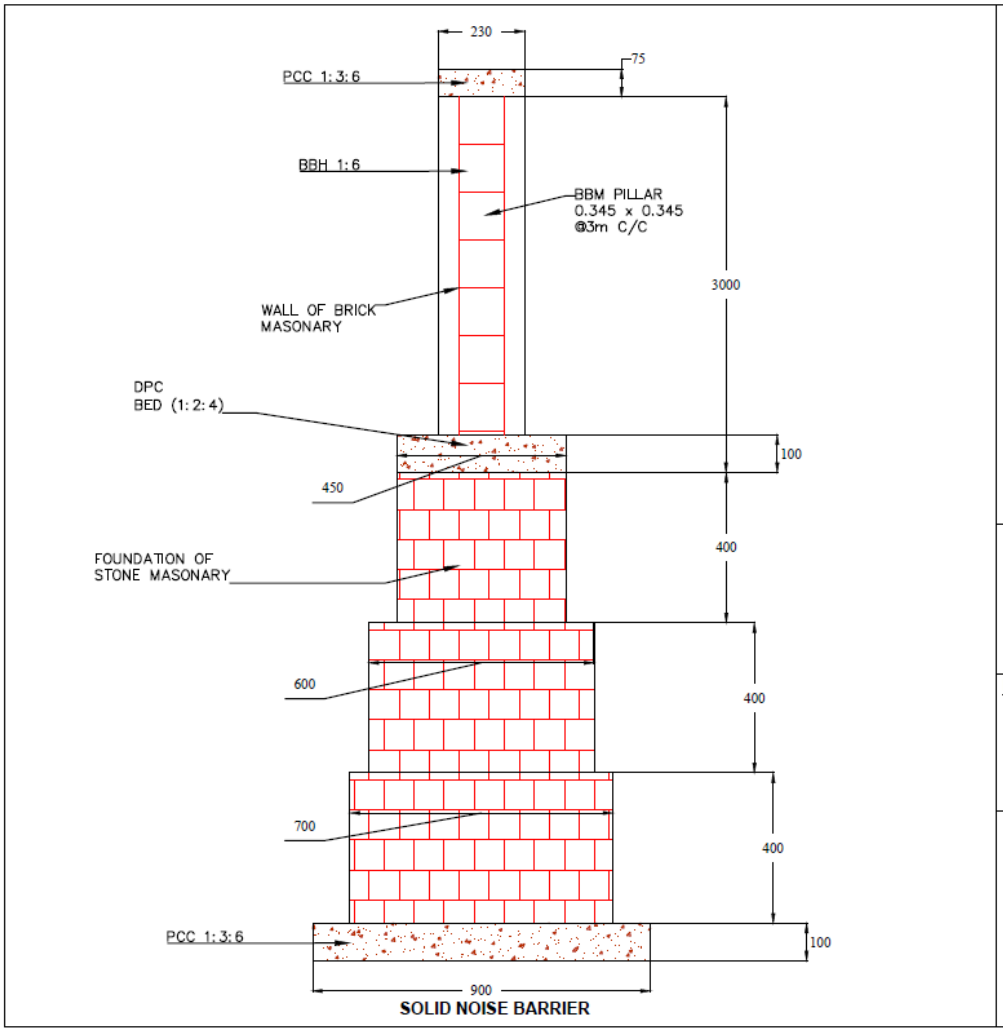
ANNEX 8.23 DRAWING TYPICAL OIL INTERCEPTOR



ANNEX 8.24 DRAWING OF GROUND WATER RECHARGE PIT



ANNEX 8.25 DRAWING OF TYPICAL SOLID NOISE BARRIER



ANNEX- 8.25
SOLID NOISE BARRIE

CLIENT

Government of Karnataka
Public Works, Ports & IWT Department
Karnataka State Highways Improvement Project

PROJECT

Consulting Services for Preparation of Detailed Project Report cum Transaction Advisory Services for Karnataka State Highway Improvement Project-III -KSHIP-III - (Group-II)

CONSULTANT

Intercontinental Consultants & Technocrats Pvt.Ltd, A-8, Green Park, New Delhi - 110016 in joint venture with PricewaterhouseCoopers Pvt.Ltd 4th Floor, Tower - D, The Millenia, 1-2 Murphy Road, Ulsoor, Bangalore - 560 008 in association with Dhir & Dhir Associates (as Sub-Consultant) D-55, Defence Colony, New Delhi -110024

ANNEX-8.26 PHYCO-REMEDIATION OF POND WATER USING NUALGI

A) Phyco - Remediation

1. Phyco- remediation is the use of algae to remediate polluted waters. Among all the algae, diatoms are the most prolific photosynthesizes because of their silica shells, which are translucent. This helps the diatoms to photosynthesize even in low light conditions. In that sense they outcompete cyanobacteria and other forms of algae. To understand NUALGI based Phyco-remediation, it is important to understand the diatoms.

B) Diatoms and Aquatic Eco Systems

2. Phytoplankton community composition is highly dependent on the quantity and ratio of macro and micronutrients in aquatic ecosystems. There are many examples of taxonomic shifts due to the relative supply of silica (Si) versus other nutrients for example nitrogen (N) and phosphorus (P). Bacillariophytes, or diatoms, are fast-growing phyto-planktons that utilize dissolved silicate (SiO_4) to make their siliceous-armored skeletal frustules *(Horner, 2002)*. In marine systems, diatoms require a particulate cell N/Si ratio of ~1 for balanced growth *(Brzezinski, 1985)*. Other phytoplankton species, such as dinoflagellates, cyanophytes, haptophytes, and raphidophytes, do not utilize silica. If silicate is limiting, other phytoplankton are capable of outcompeting diatoms despite generally slower growth rates *(Walsh et al., 2010)*. Therefore, by 'fertilizing' water that is depleted in silica, relative to other macronutrients, such as with a high Si-content solution, the potential exists to shift the phytoplankton community to diatom dominance.

3. Diatoms are a widespread, diverse group of microalgae found in all aquatic systems. They represent a major component at the base of the marine food web, responsible for up to 50% of total oceanic primary production *(Mann, 1999)* and 25% of all Oxygen produced on the planet. In fact, without their waste oxygen bubbling into the atmosphere for millions of years, we would all be left gasping for air. The secrets of their awesome powers of photosynthesis have been revealed, with enormous implications for the world's climate.

4. Each diatom lives in its own tiny glasshouse, shaped rather like a pill box. Diatoms began to make their mark in the oceans some 40 to 60 million years ago. At the time, the levels of carbon dioxide on Earth were so low that all plant life was gasping for this vital raw ingredient of photosynthesis. Scientists now believe that diatoms solved the carbon dioxide crisis by encasing themselves in glass, a strategy so successful that they came to dominate the world's oceans. Silica in the glass speeds up a vital chemical reaction needed to extract carbon dioxide from the surrounding seawater. The diatom then turns the carbon into sugary food. In fact, diatoms make a bigger contribution to fighting **global warming** than most plants on land. Because of their dead remains sink to the bottom of the ocean, they effectively lock away their carbon forever. It is the vast reserves of fossilized carbon

where much of our oil comes from - over millions of years, tiny globules of oil stored inside diatoms are squeezed out into petroleum deposits. Diatoms can be found from the poles to the tropics *(Horner, 2002)*, vary in size (2-200 µm), shape (centric, pinnate) and can exist as single cells, colonies, or chains *(Hasle and Syvertsen, 1997)*.

5. Diatoms are opportunistic, generally exhibiting high growth rates and blooming rapidly when nutrient and light conditions are favorable *(Furnas, 1990)*. Similarly, blooms can end as quickly when the diatoms have utilized all available nutrients and are either grazed upon (supporting higher trophic levels) or sink rapidly (driving the carbon pump). This combination of the diatom's abilities makes them an ideal organism for water remediation practices. This is called **Phyco- Remediation**.

C) Diatoms and Water Bodies

6. Diatoms work in aquatic and semi aquatic environments. They work from tropics to poles in any kind of water (fresh, brackish, marine, ice capped, sewage base). They also work in running waters like the rivers and drains, and equally in static waters like lakes, ponds, facultative water bodies' etc. They also work in bays, inland waters, wetlands, coastal areas, seas and oceans. Diatoms are also found along the entire cross section of surface, water column and sediment interface. They also attach themselves to plants, rocks or sediment interface in running or static waters. In other words, diatoms work in the entire water body.

D) Nualgi and Diatoms

7. NUALGI-TM is a patented research product specifically designed to provide Silica, Nitrogen, Phosphorous, and other macro and micronutrients at concentrations favorable for the algae in any water body. Diatom algae need less sunlight than any other algae so they grow in total water column.

8. During photosynthesis, diatoms consume Nitrates and Phosphorous, as also uses up CO_2 from the atmosphere. In the process, they release oxygen (pure oxygen in water) to almost saturation levels, which will help the water body regain its original levels of Dissolved Oxygen. The absorption of CO_2 will also mitigate the water acidification and pH levels would move towards more basic levels. The high levels of DO would set up a chain of benefits, primarily it promotes aerobic bacteria which would digest the excess nutrients in water and convert them into the base constituents. Such high levels of DO would also oxidize the heavy metals which would precipitate out of water, where other bacterial strains would consume them.

9. growth of higher order of diatoms in multiple environments. The potential exists for the use of NUALGI to grow diatoms as a solution to a myriad of ecological and economic problems such as remediation of running and static water bodies, sewage treatment, fish farming, energy development, and harmful algal bloom mitigation, to name a few. It has been invented by Mr. T Sampath Kumar of "Viraj Clean Sea Enterprises Ltd." after 12 years of intensive research and development. NUALGI is being exported to more than 15 countries, including USA.

10. The "NUALGI Technology" is based on providing micro nutrients required for diatom algae growth to speed up the nutrient removal in stagnant water / waste water and converting these nutrients to fish biomass. NUALGI contains micronutrients along with silica which is required for diatom growth, so it is consumed by Diatoms and triggers rapid growth diatom

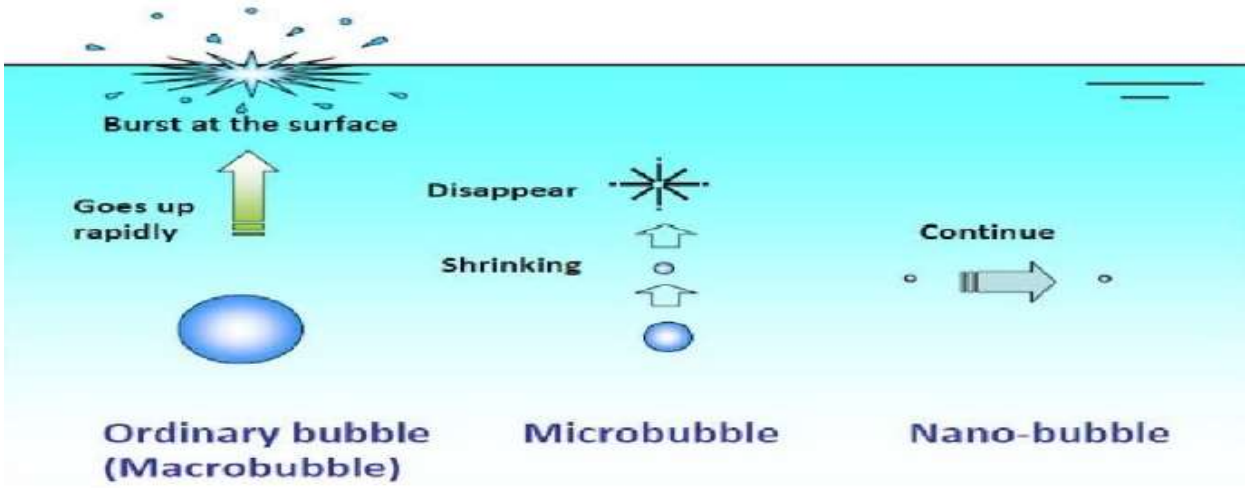
Phytoplankton is the elementary producers of the **pond** which carry out photosynthesis, converting the inorganic nutrients in the water into the organic nourishment needed for their growth and reproduction. Fertilization with livestock manure will provide phytoplankton with the materials essential for photosynthesis. As the phytoplankton photosynthesize and reproduce, zooplankton, which feed on phytoplankton start flourishing. NUALGI will also trigger growth of Zooplanktons, which consume diatom algae. The zooplanktons are consumed by fish, thus ensuring that the diatom algae exits the water as fish biomass and does not decay in water like other cellulose algae. Diatoms have silica shells and the zooplankton and fish love to eat this live food as it helps them to build up their body constitution. This will lead to environmentally friendly way of converting the excess nutrients to fish biomass.

E) Nano Scale Technology

11. NUALGI particles are 3 to 50 nanometers in diameter (1 millimeter = 1,000,000 nanometers). Nano particles are known to have different properties than larger sized particles of the same element. These tiny particles have a larger active surface area and can suspend themselves in liquid and are therefore more efficient by being biologically available.

12. For plants and organisms; it is a significant scientific challenge to provide nutrients in bioavailable form. NUALGI is the only product of its kind that effectively addresses this challenge in a water body. Its nutrient particles are small enough to suspend themselves in the water column and are therefore more available for diatom algae to bloom. The free oxygen produced by the Diatoms is in the form of **Nano size bubbles**, which have a very large surface area compared to the volume. This large surface area to volume ratio ('a' = Surface Area / Volume) is a key parameter in gas-liquid mass transfer process, between oxygen and water in any fluid medium. Thus, if the surface area to volume ratio ('a') is large, the mass transfer process between the oxygen and water will be faster and more efficient and as a result oxygen concentration in water body will increase significantly. More importantly, the rate of change of the concentration of oxygen in water also increases. Besides, increase in the level of dissolved oxygen and the increased rate of concentration change, the **nano sized bubbles** have higher internal air pressure, higher density and therefore rise slower than the coarse bubbles to the surface of water body.

F) Observed Benefits of Nualgi based Phyco- remediation



1.	Reduction in Fecal Coliform levels to satisfactory standard. Field trials of NUALGI in polluted water bodies have shown remarkable reduction in Fecal Coliform levels to as low as 23 from 3000+.
2.	Reduction in Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD). In field trials it has achieved more than 75 % reduction in BOD and 90% in COD.
3.	Enhancement in levels of Dissolved Oxygen (DO). DO is the major victim of pollution, an increase in DO would set up a chain of benefits. Only 1 litre of NUALGI can produce as much as 100 million mg of oxygen. Increase in DO levels as the treatment brings pure oxygen into water unlike aerators which bring a lot of Nitrogen with air. NUALGI substitutes for aerators, fountains etc.
4.	Elimination of foul smell from polluted waters caused due Hydrogen Sulphide or other foul smelling gases. This happens within hours of dosing.
5.	Cleaner water with low turbidity (NTU scale) and higher clarity (SD Levels increase)
6.	Fish and aquatic life thrives in oxygen rich waters after treatment with NUALGI. Fish get live food in the form of zooplankton and diatoms. Fish prefer silica shelled diatoms as against cellulose algae. Fish weight and numbers increase with each dose.
7.	Benthic diatoms promote bacteria in river beds digesting the sludge and making the river bed clean.
8.	Waste water plants like water hyacinths and weeds lose the nutrients in their roots and disappear over time. Manual cutting and cleaning may be required initially but these would not grow back.
9.	Outcompetes Blue Green Algae which disappears over few dosages. It will thus prevent toxicity in water bodies caused by few strains of BGA. BGA is the slimy green algae seen in stagnant waters all over the country.
10.	Prevents mass fish kill due to sudden fall in levels of Dissolved Oxygen. NUALGI is being used by fishermen during summers and monsoons to enhance DO levels thereby precluding mass fish kill due algae crash out.
11.	Diatoms consume carbon dioxide thus reducing the acidic levels in water
12.	Reduce nitrate (all form of Nitrogen including ammonia) and phosphate levels in water substantially.

G) The Process

13. The nano-nutrients in the NUALGI bottle spread rapidly into the water body on its own on the surface as well as at the plankton and benthic level. The coverage is very high as the constituents are at nano scale.

Dosing & Dosage:

- Each litre of NUALGI treats about 4 to 10 million liters in static waters and 10-20 million liters of affected water in a flowing river. Such a large effect is possible because of the nano scale of the nutrients. Such dose would continue till the parameters record within acceptable limits; usually 8 to 16 weeks for static waters and 4 to 6 weeks for running waters. Weekly dosing is required for static waters while daily dosage is required for running waters. As the water quality improves the dosage is brought down to a maintenance dose which is typically 25% of the corrective dose for both static & running waters and the frequency is reduced to about once in a month.

Application process	NUALGI mixes very easily in water, mechanical mixing is not required. It can be poured directly into the pond / lake / sewage or mixed in a small quantity of water – 1 liter in 20 liters and this can be mixed into the water body along the accessible areas of the periphery
Oxygen	1 liter of NUALGI results in release of at least 200 to 1000 kg of Oxygen depending on the condition of the water
Food	1 liter of NUALGI causes bloom of 200 to 1000 kg of Diatoms
Impact on Fish	NUALGI is invented for use in Aquaculture and is safe for all fish, shrimp, etc.
Nitrogen and Phosphorus	1 liter of NUALGI results in consumption of 16 to 80 kg of N and 2 to 11 kg of P
Impact on People	▪ NUALGI has no adverse impact on people ▪ It can be handled with bare hands ▪ There are no side effects and NUALGI does not have any adverse impact on other organisms in the water. ▪ Beneficial bacteria, Zooplankton, Fish, etc., grow in an healthy manner in ponds and lakes dosed with NUALGI

Safety:

- NUALGI has been tested (LD50) by “Council for Scientific and Industrial Research – Indian Institute of Toxicology Research (CSIR-IITR), Lucknow”. As per the Organization for Economic Co-operation and Development (OECD) guidelines for acute fish toxicity and has been classifies as Non-Toxic to fish, under test conditions. In practice too, NUALGI is used by many fishermen when

fish deaths are being reported. So, it is not just safe for fish, but also supports fish and other aquatic life.

- NUALGI has also been tested for acute dermal toxicity on Wistar rats as per the OECD guidelines and the test have concluded that, NUALGI falls under Category 5 or Unclassified according to the Globally Harmonized System (GHS) for the classification of chemicals.

Important Points:

- Since action happens on the top surface layer of water, it is important to keep it free of any rubbish, garbage or floating materials. A clean-up is advised prior to application.
- Preferred time of application is before 8.00 a.m. for first 12 weeks (This is because Diatom Algae comes to the surface of water in early morning)
- For pond area less than or equal to half acre, dosage can be done from the banks of the water body.
- For larger lakes, a paddle boat may be used to access inner lake areas.
- NUALGI is designed to spread quickly and evenly on the surface of water and hence is capable of reaching corners on its own. However for any small or tricky areas such as bends or natural curves, dosage can be applied specifically near the spot.

Effects of Treatment:

- Normally pond / lake waters shall show effect within 1-2 applications.
- It is not uncommon for BOD levels to decrease by 90-95% within 12 applications
- Complete start up course is for weekly application for 12 continuous weeks during which time, water shall be cleaned, clear and ready to sustain high biodiversity.
- Monthly once NUALGI application shall be sufficient thereafter to maintain dissolved oxygen levels.
- Increase in biodiversity such as fish growth, insects, reptiles and maybe birds can be observed after 1 year time.
- Any heavy metals in water will be decomposed into their non-toxic valents after 18 months.
- Weeds like Water Hyacinth shall turn yellow and start to disappear forever after 12- 18 months.

H) Cost Analysis

14. Each litre of NUALGI cost Rs. 9,000/- plus VAT

15. Surface area of the water body proposed for enhancement is 23 ha. Therefore, the requirement of NUALGI will be:

- Start-up course = 1.0 litres of NUALGI per week for 2 weeks = (23 x 2) = 46 liters
- Regular maintenance dosage for next 2 months = (11.5 X 2) = 23 liters
- Regular maintenance dosage for next 6 months = (5 x 6) = 30 liters
- Therefore, total requirement = (46 + 23 + 30) = 99 $\cong$ 100 litres of NUALGI
-

I) Where to Approach

Viraj Clean Sea Enterprises (P) Ltd.
D-440, 2nd floor, Vashi Plaza, Sector-17, Navi Mumbai - 400 703, Maharashtra
Telephone: 022 2765 7811
Website: www.virajces.com

Contact Person:
Ms. Supriya Varadhan, Business Development Manager, Mobile: +91 9920322351
Mr. Subodh Kumar, In-charge (North India), Mobile: +91 9999130073

16. **Cost Effectiveness:** The company provides a holistic solution, generally for 3-6 months for smaller water bodies such as drains, small ponds, creeks etc. and for 12 months in case of larger water bodies such as rivers, lakes etc. During this period, the product is not sold to the client, but instead the company itself takes control of the dosing and supervision. The client will have to provide for the physical treatment of the water body such as the removal of solid wastes, plastics etc.The treatment of NUALGI involves neither the use of costly machinery nor there is a requirement for any large manpower to dose it. NUALGI is very cost effective in the value it delivers.

J) Case Study

NUALGI TREATMENT OF MAN SINGH ROAD POND, RAJPATH, INDIA GATE, DELHI

17. **Pond location:** Pond is located on Man Singh Road off Rajpath Road connecting India gate to Raj Bhavan in New Delhi. This pond is one of the ponds located on either side of Rajpath which is a very high profile area with lot of VVIP movement.

18. **Pond Area:** The pond is 500 m x 26 m (3.2 acres) with a depth of 0.7 m (Picture-1) and volume is about 9 million liters

19. **Pond condition:** The pond selected for treatment was one of the dirtiest ponds on the Rajpath with heavy growth of Blue Green Algae (BGA) formed as a mat with a thickness of around 6 inches (**Picture-1A**). This BGA mat has covered around 125 M of the pond. Due to BGA mat water lacked air circulation and light penetration this led to anoxic conditions in the lake bottom leading to foul smell and cessation in biological activities like killing of frogs and fish.

20. **Treatment of Pond using NUALGI:** The pond was dosed with 4 liters of NUALGI

initially and then with 1 litre per week for 3 weeks. The dosing was carried out during the month of August and water samples were collected before and after treatment to test the water quality parameters.

21. **Results:** After treating with NUALGI for 3 weeks, the BGA crashed, which lead to disintegration of the thick layer and the dead algae has led to curding effect rather than mat. The dead algae were removed manually. The area of BGA mat reduced to 25 m from 125 m before treatment, about 85% reduction. This remaining mat was also disintegrating and eliminated after further treatment (**Picture-1B**). Foul smell has stopped and there were visible effects of biological activity with recolonization of water insects.

Picture 1A showing the covering of BGA as thick mat before treatment

Picture 1B Showing the remaining curded BGA mat after treatment
Picture 2A and 2B showing the pond after treatment with 85% reduction in BGA

Effect of Treatment on Pond Water Quality Parameters:

22. Water quality parameters were tested with water collected from the pond before and after treatment. There was a significant reduction of total nitrate and total phosphate along with

dissolved oxygen (DO) level which has seen a huge increase from 1.9 mg/l before treatment to 7.2 mg/l after treatment. There was improvement in all parameters except for Ammonia, this could be due to the absence of fish. Fish would have consumed the Diatoms and Zooplankton and this would help reduce Ammonia levels.

S. No.	Parameters	Untreated Water 03.08.2013	Treated Water 03.09.2013
1.	pH	7.7	7.98
2.	Electrical conductivity	1954	523
3.	TSS , mg/l	200	18
4.	Ammonia, mg/l	7.81	8.13
5.	Nitrate, mg/l	13.28	7.43
6.	Phosphorus, mg/l	0.30	0.03
7.	Potassium, mg/l	3.04	2.636
8.	Chloride, mg/l	217.69	53.81
9.	DO, mg/l	1.9	7.2
10.	BOD, mg/l	31	12
11.	COD, mg/l	106	56
12.	Total N, mg/l	22.34	16.86
13.	Total P, mg/l	0.513	0.081

23. **Conclusions:** The treatment using NUALGI has shown very significant effect on reducing BGA contamination and also resulted in resurrecting biological activity. It has also shown a positive effect on improving the water quality by reducing nutrient levels, increased DO and controlling foul odour. If this treatment is continued for longer time the pond quality will further improve and continuous use of this technology can totally eradicate the problem of BGA and poor water quality in future.

Photographs of few other Cases

L and T Ltd, Vadodara

Before

After

Bahadurpur, Uttarakhand

Before

After

ANNEX 8.27 POND ENHANCEMENT PLAN