



# Environmental Monitoring Report

---

Project Number: 26522  
April 2010

## Sri Lanka: Southern Transport Development Project JICA Funded Section-Package 2

Prepared by egis bceom International,  
In association with Consulting Engineers and Architects Management Consultant,  
Colombo, Sri Lanka.

For Road Development Authority  
Ministry of Highways, Sri Lanka

This report has been submitted to ADB by the Ministry of Highways and is made publicly available in accordance with ADB's public communications policy (2005). It does not necessarily reflect the views of ADB.

**Asian Development Bank**



ADB

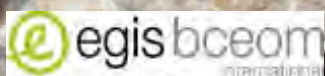
**DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA  
MINISTRY OF HIGHWAYS & ROAD DEVELOPMENT  
ROAD DEVELOPMENT AUTHORITY**



**SOUTHERN TRANSPORT DEVELOPMENT PROJECT  
JICA FUNDED SECTION PACKAGE -2  
(DODANGODA TO KURUNDUGAHAHETEKMA)**

**BI- ANNUAL ENVIRONMENTAL IMPACT  
MONITORING REPORT**

**JULY TO DECEMBER 2009**



In association with **Consulting Engineers and Architects  
Management Consultant**

## TABLE OF CONTENTS

	Page
Executive Summary	1
1. Introduction	3
2. Construction Activities during the Reporting Period	4
3. Environmental Impacts Monitoring and Mitigation Measures	12
3.1 Hydrology	14
3.1.1 Monitoring Methodology	15
3.1.2 Mitigation Measures to be adopted	16
3.2 Surface and Ground Water	17
3.2.1. Monitoring Methodology	17
3.2.2. Equipment and Calibration Detail	18
3.2.3. Monitoring Standards	19
3.2.4. Mitigation Measures to be adopted	20
3.3 Air Quality	21
3.3.1. Monitoring Methodology	21
3.3.2. Monitoring Equipment and Calibration Details	21
3.3.3. Regulatory Standards	21
3.3.4. Mitigation Measures to be adopted	22
3.4 Noise and Ground Vibration	23
3.4.1. Monitoring Methodology	24
3.4.2. Monitoring Equipment and Calibration Details	24
3.4.3. Regulatory Standards	24
3.4.4. Mitigation Measures to be adopted	24
3.5 Exploitation and Storage of Construction Material	26
3.5.1. Monitoring Methodology	26

3.5.2. Mitigation Measures to be adopted	26
4. Results of Environmental Monitoring and Mitigation Measures	28
4.1. Hydrology and Drainage aspects	28
4.2. Surface and Ground Water Quality	29
4.2.1. Monitoring of the Surface Water Quality	32
4.2.2. Average pH Values of Discharged Water from CVC Areas	34
4.2.3. Quality of Waste Water Discharged from Concrete Batching Plant at Ch.49+500	35
4.3. Air Quality Monitoring	36
4.4. Noise /Vibration Monitoring	37
4.4.1. Ground Vibration at Premises on Public Complaints	39
4.5. Exploitation Handling, transportation and Storage of Construction Materials	40
4.5.1. Mitigation Measures	40
5. Status of Environmental Licenses and Permits	42
6. Public Complaints	43
7. Social Impacts	45
8. Conclusion and Recommendation	45

## LIST OF TABLES

Table 01	Unclassified excavation and Embankment filling activities carried out from July to December 2009.	05
Table 02	Compaction activities and Rock Excavation/ Rock blasting carried out from July to December 2009.	07
Table 03	Construction of pipe culverts, and Construction of box culverts from July to December 2009.	08
Table 04	Soft Ground Location CVC operational activities and Import soil from Borrow pit and Disposal activities carried out from July to December 2009	10
Table 05	Environmental Parameters Monitored	12
Table 06	Locations of Ground Water Level Monitoring	14
Table 07	Locations Identified for Water Level Measurement at CVC Area	15
Table 08	Location of Ground water quality monitoring	17
Table 09	Location of Surface water quality monitoring	18
Table 10	Test Parameters and Method Details for Monitoring Water Quality	18
Table 11	General Standards for Discharge of Effluents into Inland Surface Waters	19
Table 12	National standard for the ambient air quality	22
Table 13	Noise/Vibration Monitoring Parameters	23
Table 14	Maximum permissible noise levels for the construction activities	25
Table 15	Maximum permissible noise levels for prescribed activities	25
Table 16	Maximum Permissible Vibration Levels	25
Table 17	Monthly Average Ground Water Levels (at Locations Suggested in FDR)	30
Table 18	Monthly Average Ground Water Levels (MSL-in meters at CVC Areas)	31
Table 19	Monthly Average pH Values in Water Discharged from CVC Areas	34
Table 20	Water Quality analysis Report of the waste water Discharged from Concrete Batching Plant	36
Table 21	Rock Blasting Locations of the Reporting Period	37

Table 22	Status of Blasting: Air Blast Over Pressure and Ground Vibration Exceedance	38
Table 23	Ground Vibration Measured at Premises on Public Complaints	39
Table 24	Summary of Public Complaints	43
Table 25	Effectiveness of mitigation Measures - July to December 2009	46
Table 26	Environmental Impact Mitigation Works (July to December 2009)	51

### LIST OF FIGURES

		Page
Figure 01	Monthly Rainfall – Variation in Project Area from July to December 2009	28
Figure 02	Monthly Average Ground Water Levels in Wells Suggested in the FDR	30
Figure 03	Monthly Average Ground Water Levels in Wells at CVC Areas	32
Figure 04	Total Suspended Solids(TSS) in Surface Water Bodies	33
Figure 05	pH in Surface Water Bodies	33
Figure 06	Monthly Average pH of Discharged Water from CVC Areas	35
Figure 07	Number of Blasting Measurements and Exceeding of GV & ABOP	38
Figure 08	Summary of Complaints at the end of December 2009	43
Figure 09	Categorization of Public Complaints	44

## LIST OF ANNEXURES

ANNEX I	Location Map
ANNEX II	Permits and Licenses
ANNEX III	Details on Complaints from January to June 2009
ANNEX IV	Water Quality analysis Report of the waste water Discharged from Concrete Batching Plant
ANNEX V	Test Report of Ambient Air Quality at Premises of Concrete Batching Plant at CH. 59+ 700
ANNEX VI	Report on Surface Water Quality Analysis

## ABBREVIATIONS

ADB	-	Asian Development Bank
AP	-	Affected Person
ABOP	-	Air blast Over Pressure
BOD	-	Biochemical Oxygen Demand
CEA	-	Central Environmental Authority
COD	-	Chemical Oxygen Demand
CSC	-	Supervision Consultant (Engineer)
DO	-	Dissolved Oxygen
dB	-	Decibel
EA	-	Executing Agency
EIA	-	Environmental Impact Assessment
EIMO	-	Environmental Impact Monitoring Officer
EMP	-	Environmental Management Plan
EMU	-	Environmental Management Unit of RDA
GN	-	Gramaseva Niladhari
ITI	-	Industrial Technology Institute
JBIC	-	Japanese Bank for International Co-operation
km	-	Kilometer
MC	-	Management Consultants
MOH	-	Ministry of Highways
NBRO	-	National Building Research Organization
NGO	-	Nongovernmental Organization
PCRM	-	Public Complaint Resolving Monitoring Meeting
PPV	-	Peak Particle Velocity
PD	-	Project Director
PM	-	Project Manager
PMO	-	Project Managers' Office
PMU	-	Project Management Unit
RDA	-	Road Development Authority
RIP	-	Resettlement Implementation Plan
ROW	-	Right of Way
RSC	-	Road Safety Component
STDP	-	Southern Transport Development Project
SPM	-	Suspended Particulate Matter
TSS	-	Total Suspended Solids

## EXECUTIVE SUMMARY

The Southern Transport Development Project comprises of the construction of 128 Km of new express highway between Colombo and Matara in the Southwestern province in Sri Lanka. The JICA funded Package 2 section extends 31.675 Km. from Dodangoda to Kurundugahahetekma. The Contractor, of this section is Taisei Corporation. This report covers the Environmental Impact Monitoring activities for the period from July to December 2009.

As per the National Environmental Act of No 47 of 1980 and the subsequent amendments, projects of this nature require Environmental Impact Assessment (EIA). The EIA of the project was approved on July 23, 1999 for a period of 3 years and the validity has been extended on April 08, 2002, August 03, 2005, and July 23, 2008 respectively until July 23, 2011. The CEA chaired monitoring committee approved the project Environmental Management Plan (EMP), on March 16, 2007 which included Environmental Impact Monitoring and Mitigation Plan of the project and this report covers the fulfillment of the requirements of the EMP during the construction period.

The Environmental Impact Monitoring and Mitigation of the project is carried out in accordance with the Environmental Action Plan prepared based on the Environmental Management Plan. The construction activities, which affect the environment, are identified as

- (1) Rock and Soil excavation,
- (2) Embankment filling and compaction,
- (3) Excavation and, removal of unsuitable soil and back filling,
- (4) Soft Ground treatment,
- (5) Sub base, base course and pavement laying
- (6) Construction of Underpasses, bridges and culverts
- (7) Slope protection and other miscellaneous works.

The following items are monitored during the implementation of the project.

- (1) Hydrology and Drainage
- (2) Surface and Ground water Quality
- (3) Air Quality
- (4) Noise & Vibration
- (5) Social Impacts

The hydrological and drainage impact such as soil erosion, sedimentation, water stagnation, water table fluctuation, trans-basin diversions, and, flood were monitored in the project area. The contractor has taken some measures to mitigate soil erosion and siltation. However, maintenance of these activities was not continuous and adequate manner.

Several irrigation channels, cropland, and low lands were silted due to poor application and maintenance of erosion control measures implemented by the contracting firm. However, soil erosion of cut slopes have been controlled successfully by applying turf on them. Surface water samples were collected from the Welipenna ganga at Km 45+500, the Dikduwa Ela at Km 46+540, Stream/Culvert to welipanna ganga (Close to Ittapana) at Km 50+340, Stream/Culvert (Down stream Bentota ganga, close to

Mahagoda) at Km 50+400, Stream/Culvert (Down stream Bentota ganga, close to Lulbadduwa) at Km 51+900, Bentota Ganga at Km 53+300 and Elpitiya Ela at Km 61+270.

The 6<sup>th</sup> periodic monitoring of surface water quality at locations suggested in the FDR has been carried out by the University of Moratuwa in 18<sup>th</sup> November 2009 and the analyzed parameters are within the permissible levels except total coli form which is not affected due to project activities.

The watering of the unpaved roads continued to control dust, which is the main contributor to air quality deterioration. The Employer, the Engineer, the Contractor, and the regulating agencies (GSMB & CEA) have set up controlling methodologies for blasting impacts. A blasting monitoring committee, which includes a field officer from the RDA, monitors each blasting operation and the committee monitors whether the contractor is carrying out the blasting according to the conditions of the mining license and the Environmental Protection license. Heavy steel blasting mats were used to cover the blasting locations which were closure to residents.

The Engineer, the Contractor, and the regulating agencies (GSMB & CEA) have set up controlling methodologies for controlling the blasting and the compaction impacts. The Contractor has attended to the public complaints and resolved them to certain extent.

Throughout the reporting period, 2094 Nos. blasting monitored by GSMB. 28 Nos. exceeding of Air blast over pressure measurements were reported during this period. However, Ground vibrations exceeding were not reported during this period. Six mining licenses were obtained during the reporting period. Test blasts were carried out at every location prior to production blasts to obtain GSMB mining license and Environmental recommendation from CEA. The conditions on the licenses of the relevant organizations helped to conduct blasting activities in a control manner. All the houses close the blasting sites were surveyed and the existing conditions prior to commence blasting activities were recorded.

Monitoring of ground vibration generated owing to constructional activities (compaction) has carried out during the reporting period based on 12 public complaints and the monitoring results reveal that vibration generated owing to compaction is within maximum permissible level for continuous vibration as specified in the Interim Standards, except at two locations.

A total number of 117 new complaints were received during the period from July to December 2009, and, the contractor has resolved 129 complaints during this period.

The highest number of complaints received during the reporting period is, 38 numbers due to Blasting related. Next to this, the highest numbers of complaints are respectively 18 Property damage due to blasting and compaction and 16 crop damage (See, Annex III).

According to the observations made during the site inspections by Management Consultant (MC), Supervision Consultant (CSC) and, RDA, further improvements were done at the site to mitigate environmental problems. Joint weekly inspections of the CSC with the Contractor, Joint inspections, and monthly meetings such as Public Complaints Resolving Monitoring Meeting (PCRM) have helped to sort out some of the problems at the site.

## **1.0 INTRODUCTION**

### **1.1 Basic Project Information**

As per the National Environmental Act of No 47 of 1980 and the subsequent amendments, projects of this nature (construction of national and provincial highways involving a length exceeding 10 kilometers) require Environmental Impact Assessment (EIA). The EIA of the project was approved on July 23, 1999, for a period of 3 years and the validity extended on April 08, 2002, August 03, 2005, and July 23, 2008 respectively until July 22, 2011. The CEA, which chaired monitoring committee, approved the project Environmental Management Plan (EMP) on March 16, 2007, which included Environmental Impact Monitoring and Mitigation Plan of the project and this report covers the fulfillment of the requirements of the EMP during the construction period.

### **1.2 Reporting**

The Management Consultant prepares this Bi-Annual Environmental Impact Monitoring Report on behalf of the RDA, for the period from July to December 2009 for Southern Transport Development Project of JICA funded section Package 2 from Dodangoda to Kurundugahahetekma based on the Oriental Consultants Company Limited, Supervision Consultant's Monthly Environmental Impact Monitoring and Mitigation Reports, and, field observations done by the MC.

### **1.3 Monitoring Overview**

Hydrological and drainage impacts, such as, soil erosion, siltation/ sedimentation, water table fluctuation, water stagnation, trans-basin diversions, flood and earth slips have been experienced in the project area, and, it is difficult to avoid all such incidents during the construction phase. Most of the existing drainage paths and agrarian channels have not been cleaned for a long period outside the ROW and they are not capable for catering for the storm water received.

The construction activities given below have a direct impact on the environment; Blasting/Rock excavation, Soil excavation, Embankment filling and compaction, Unsuitable Excavation, removal and back filling (Soft Ground Treatment), Sub-base, base course and pavement works, Slope protection and other miscellaneous works and Underpass, bridge and culvert structural construction.

During the reporting period, most of the existing drainage paths and agrarian channels outside the ROW were formed to be not capable to cater for the storm water and they have been cleaned for surface flow of water. The Contractor has taken sufficient mitigation measures to control soil erosion also during this period.

### **1.4 Structure of report**

The second Chapter of this report mentions the Construction Activities carried out during the reporting period. In the Chapter 3, Environmental Impacts Monitoring and Mitigation Measures discussed. Results of environmental impacts monitoring and Mitigation Measures discussed in the Chapter 4. A summary of the status on the environmental licenses and permits shows in the Chapter 5. Chapter 6 of this report discusses on the public complaints against the highway construction activities. Social impacts created from this project, discusses at Chapter 7 and, conclusion and recommendations mention at the Chapter 8.

## 2.0 CONSTRUCTION ACTIVITIES DURING THE PERIOD

The following construction activities of the JICA funded Package 2 section, from Dodangoda to Kurundugahahetekma (from Chainage 34+775 to 66+431) continued during the period from July to December 2009 (Table 01-04).

- (1) Unclassified excavation
- (2) Embankment filling and compaction
- (3) Turfing
- (4) Rock excavation –Rock Blasting
- (5) Construction of under passes, bridges, and culverts
- (6) Drainage Box Culvert Construction
- (7) Soft Ground Location CVC
- (8) Import soil from Borrow pit/ Disposal
- (9) Other miscellaneous and maintenance works.

Unclassified excavation activities carried out at Chainages 35+000, 35+500, 36+000, 36+500, 37+000, 37+500, 38+000, 38+500, 39+000, 39+500, 40+000, 40+500, 41+000, 41+500, 42+000, 42+500, 43+000, 43+500, 44+000, 44+500, 45+000, 45+500, 46+000, 46+500, 47+000, 47+500, 48+000, 48+500, 49+000, 49+500, 50+000, 50+500, 51+000, 51+500, 52+000, 52+500, 53+500, 54+000, 54+500, 55+000, 55+500, 56+000, 56+500, 57+000, 57+500, 58+000, 58+500, 59+000, 59+500, 60+000, 60+500, 61+000, 61+500, 62+000, 62+500, 63+000, 63+500, 64+000, 64+500, 65+000, 65+500, 66+000 during the reporting time.

Embankment Filling activities carried out at the Chainages 35+000, 35+500, 36+000, 36+500, 37+000, 37+500, 38+500, 39+000, 39+500, 40+000, 40+500, 41+000, 41+500, 42+000, 42+500, 43+000, 43+500, 44+000, 44+500, 45+000, 45+500, 46+000, 46+500, 47+000, 47+500, 48+000, 48+500, 49+000, 49+500, 50+000, 50+500, 51+000, 51+500, 52+000, 52+500, 53+500, 54+000, 54+500, 55+000, 55+500, 56+000, 56+500, 57+000, 57+500, 58+000, 58+500, 59+000, 59+500, 60+000, 60+500, 61+000, 61+500, 62+000, 62+500, 63+000, 63+500, 64+000, 64+500, 65+000, 65+500, 66+000.

During this time, Compaction activities carried out at Chainages 35+000, 35+500, 36+000, 37+000, 37+500, 38+000, 39+000, 39+500, 40+000, 41+000, 41+500, 43+000, 44+000, 44+500, 45+000, 45+500, 46+000, 46+500, 47+000, 47+500, 48+000, 50+000, 50+500, 51+000, 51+500, 52+000, 52+500, 54+000, 54+500, 55+000, 55+500, 56+000, 56+500, 57+000, 57+500, 58+000, 58+500, 59+000, 59+500, 60+000, 60+500, 61+000, 61+500, 62+000, 63+000, 63+500, 64+000, 65+000, 65+500, 66+000.

Rock Excavation/ Rock Blasting activities carried out at the Chainages 35+000, 36+000, 36+500, 37+000, 37+500, 42+000, 42+500, 46+500, 47+000, 47+500, 48+000, 48+500, 49+000, 49+500, 50+000, 50+500, 51+000, 51+500, 57+000, 62+000, 62+500, 63+000, 63+500, 64+000.

Pipe Culvert Construction at Chainages 35+500, 36+000, 38+500, 39+000, , 43+000, 43+500, 44+000, 44+500, 45+000, 45+500, 49+000, 49+500, 50+000, 55+000, 55+500, 57+500, 58+000, 58+500, 59+000, 59+500, 61+500, 62+000, 64+000, 64+500, 66+000 during the reporting time.

Drainage Box Culvert Construction at Chainages 35+000, 35+500, 36+000, 36+500, 37+000, 37+500, 38+000, 38+500, 39+000, 39+500, 40+500, 41+500, 42+000, 42+500, 43+500, 44+500, 45+500, 46+000, 46+500, 47+500, 48+000, 48+500, 49+000, 49+500, 50+000, 50+500, 51+000, 51+500, 52+000, 52+500, 54+000, 54+500, 55+000, 55+500, 56+000, 56+500, 57+000, 57+500, 58+000, 58+500, 59+000, 59+500, 61+000, 62+000, 62+500, 63+000, 63+500, 64+000, 64+500, 65+000, 65+500, 66+000 during the reporting time.

Soft Ground Location CVC operation carried out at Chainages 35+500, 36+500, 37+500, 38+500, 39+500, 40+500, 41+500, 42+000, 42+500, 43+000, 43+500, 44+500, 45+500, 46+000, 46+500, 47+000, 47+500, 48+000, 48+500, 49+000, 49+500, 50+000, 50+500, 51+000, 51+500, 52+000, 52+500, 53+000, 53+500, 54+000, 54+500, 56+000, 56+500, 59+000, 59+500, 60+000, 61+000, during the reporting time.

Import soil from Borrow pit and Disposal activities carried out at the Chainages 35+500, 36+500, 37+500, 39+500, 40+500, 41+000, 41+500, 42+000, 42+500, 43+000, 44+500, 45+000, 45+500, 46+000, 46+500, 47+000, 47+500, 48+000, 48+500, 49+500, 53+500, 54+000, 54+500, 55+000, 56+000, 56+500, 58+500, 59+000, 59+500, 60+000, 60+500, 61+500, 62+000, 65+500.

**Table 01 – Unclassified excavation and Embankment filling activities carried out from July to December 2009.**

	Unclassified excavation						Embankment filling					
	July	August	September	October	November	December	July	August	September	October	November	December
35+000												
35+500												
36+000												
36+500												
37+000												
37+500												
38+000												
38+500												
39+000												
39+500												
40+000												
40+500												
41+000												
41+500												
42+000												
42+500												
43+000												
43+500												

	Unclassified excavation						Embankment filling					
	July	August	September	October	November	December	July	August	September	October	November	December
44+000												
44+500												
45+000												
45+500												
46+000												
46+500												
47+000												
47+500												
48+000												
48+500												
49+000												
49+500												
50+000												
50+500												
51+000												
51+500												
52+000												
52+500												
53+000												
53+500												
54+000												
54+500												
55+000												
55+500												
56+000												
56+500												
57+000												
57+500												
58+000												
58+500												
59+000												
59+500												
60+000												
60+500												
61+000												
61+500												
62+000												
62+500												
63+000												
63+500												
64+000												
64+500												
65+000												
65+500												
66+000												

**Table 02 – Compaction activities and Rock Excavation/ Rock blasting carried out from July to December 2009.**

	Compaction							Rock Excavation/ Rock Blasting					
	July	August	September	October	November	December		July	August	September	October	November	December
35+000													
35+500													
36+000													
36+500													
37+000													
37+500													
38+000													
38+500													
39+000													
39+500													
40+000													
40+500													
41+000													
41+500													
42+000													
42+500													
43+000													
43+500													
44+000													
44+500													
45+000													
45+500													
46+000													
46+500													
47+000													
47+500													
48+000													
48+500													
49+000													
49+500													
50+000													
50+500													
51+000													
51+500													
52+000													
52+500													
53+000													
53+500													
54+000													
54+500													
55+000													

	Compaction							Rock Excavation/ Rock Blasting						
	July	August	September	October	November	December		July	August	September	October	November	December	
55+500														
56+000														
56+500														
57+000														
57+500														
58+000														
58+500														
59+000														
59+500														
60+000														
60+500														
61+000														
61+500														
62+000														
62+500														
63+000														
63+500														
64+000														
64+500														
65+000														
65+500														
66+000														

Table 03: Construction of pipe culverts and box culverts, from July to December 2009.

	Construction of pipe culverts							Construction of box culverts						
	July	August	September	October	November	December		July	August	September	October	November	December	
35+000														
35+500														
36+000														
36+500														
37+000														
37+500														
38+000														
38+500														
39+000														
39+500														
40+000														

	Construction of pipe culverts						Construction of box culverts					
	July	August	September	October	November	December	July	August	September	October	November	December
40+500												
41+000												
41+500												
42+000												
42+500												
43+000												
43+500												
44+000												
44+500												
45+000												
45+500												
46+000												
46+500												
47+000												
47+500												
48+000												
48+500												
49+000												
49+500												
50+000												
50+500												
51+000												
51+500												
52+000												
52+500												
53+000												
53+500												
54+000												
54+500												
55+000												
55+500												
56+000												
56+500												
57+000												
57+500												
58+000												
58+500												
59+000												
59+500												
60+000												
60+500												
61+000												
61+500												
62+000												
62+500												

	Construction of pipe culverts						Construction of box culverts					
	July	August	September	October	November	December	July	August	September	October	November	December
63+000												
63+500												
64+000												
64+500												
65+000												
65+500												
66+000												

Table 04 – Soft Ground Location CVC operational activities and Import soil from Borrow pit and Disposal activities carried out from July to December 2009.

	Soft Ground Location CVC operation						Import soil from Borrow pit and Disposal activities					
	July	August	September	October	November	December	July	August	September	October	November	December
35+000												
35+500												
36+000												
36+500												
37+000												
37+500												
38+000												
38+500												
39+000												
39+500												
40+000												
40+500												
41+000												
41+500												
42+000												
42+500												
43+000												
43+500												
44+000												
44+500												
45+000												
45+500												
46+000												

	Soft Ground Location CVC operation						Import soil from Borrow pit and Disposal activities					
	July	August	September	October	November	December	July	August	September	October	November	December
46+500												
47+000												
47+500												
48+000												
48+500												
49+000												
49+500												
50+000												
50+500												
51+000												
51+500												
52+000												
52+500												
53+000												
53+500												
54+000												
54+500												
55+000												
55+500												
56+000												
56+500												
57+000												
57+500												
58+000												
58+500												
59+000												
59+500												
60+000												
60+500												
61+000												
61+500												
62+000												
62+500												
63+000												
63+500												
64+000												
64+500												
65+000												
65+500												
66+000												

### 3. Environmental Impacts Monitoring and Mitigation Measures

**Table 05 - Environmental parameters monitored**

No	Discipline	Parameters	Monitoring Locations	Frequency
1	Hydrology	Water Table, Water level,	Wells at CH 34+880, CH 34+780, CH 35+440, CH 35+540, CH 37+460, CH 37+420, CH 39+010, CH 41+600.  Wells at CVC areas CH 47+530, CH 47+665, CH 47+950, CH 48+050, CH 48+070, CH 49+985, CH 50+160, CH 50+260, CH 50+490, CH 50+490, CH 50+560, CH 51+680.	Once in two weeks.
2	Surface water quality	pH Value, Conductivity, Salinity,DO level, BOD5, COD, SS, Nitrate, Phosphate, Chloride, Oil & Grease,Zinc,lead, Total coli form/Fecal coli form, Iron, Manganese,	Welipenna ganga at Km 45+500, the Dikduwa Ela at Km 46+540, Stream/Culvert to welipanna ganga (Close to Ittapana) at Km 50+340, Stream/Culvert (Down stream Bentota ganga, close to Mahagoda) at Km 50+400, Stream/Culvert (Down stream Bentota ganga, close to Lulbadduwa) at Km 51+900, Bentota Ganga at Km 53+300 and Elpitiya Ela at Km 61+270	Every six months during construction (Dry/wet seasonal basis) and at a higher frequency where necessary
3	1). Ground water quality	pH Value, Conductivity, Salinity, DO level, BOD5, COD, SS, Nitrate, Phosphate, Chloride, Oil & Grease, Zinc, lead, Iron, Total coli form/ Fecal coli form, manganese,	CH 35+440 - drinking well at Pahanwatte, CH 41+600- bathing well at Nauththuduwa Temple.	Every six months during construction (Dry/wet seasonal basis) and at a higher frequency where necessary

	2). Water quality in Water Discharged from CVC Areas	pH Value	CH 45+320, CH 45+380, CH 45+550, CH 45+620, CH 45+690, CH 46+030, CH 46+090, CH 46+160, CH 46+210, CH 46+330, CH 46+400, CH 47+640, CH 47+710, CH 50+370, CH 50+200, CH 51+525, CH 51+620, CH 51+770, CH 51+810, CH 51+880, CH 52+020, CH 52+090, CH 52+160, CH 52+340, CH 52+880, CH 52+940, CH 53+660, CH 53+800, CH 53+870, CH 53+940, CH 54+010, CH 54+300, CH 54+470, CH 56+370, CH 56+540, CH 56+650, CH 56+710, CH 56+780	Once in two weeks.
4	Air Quality	Suspended particulate Matters (SPM)	No air quality monitoring for Ambient SPM has been carried out during the reporting period.	On complaints during construction
5	Noise & Ground vibration	L <sub>A,eq</sub> One hour at Day time Peak particle velocity Air blast over pressure level	Depending on complaints made by local people, at relevant places where blasting and, other vibration including activities carried out	On complaints during construction
6	Exploitation Handling, Transportati on and storage of Constructio n Materials	Quantity of material in temporary storage, Type of materials, Hazard level of material in relation to environmental damage including water, drainage, Duration of storage and climatic season, Method of transportation		During construction Once a week

### 3.1. Hydrology

As per the EMP, the objectives of the monitoring of hydrology are to minimize hydrological and drainage impacts such as arising of local flood situations, changes of the surface drainage paths and depletion of ground water levels etc. Impact of the hydrological and drainage could cause;

According to the EMP parameters need to be monitored in areas of

- acidic or high sulfate soils,
- embankment areas in flood plains, and deep cut sections below ground water level,
- water levels just upstream of embankment,
- areas where soil contains high iron pyrites,
- pH and chemical components at just downstream of excavations and filling sections,
- erodible areas/cut and fill sections, temporary and permanent irrigation /drainage structure locations,
- general low lying high flood prone areas,
- irrigation schemes (paddy grown areas),
- major drainage, structures such as bridges and culverts to identify any significant impact due to the construction activity of the STDP

For the purpose of ground water level monitoring, the contractor has identified the relevant locations by referring the FDR. The locations identified for the periodical monitoring of ground water level in the STDP-JBIC-Package-02 is as per the Table 06. Monitoring of ground water level at such locations is carried out in consideration with climatic conditions and according to the schedule of cut and fillings activities etc.

**Table 06- Locations (Wells) Identified for Monitoring of Ground Water Level**

Chainage	Reason for selection
CH 34+880 CH 34+780	To check the water logging due to filling
CH 35+540 CH 35+440	Lowering of GW level due to deep cut may affect the wells
CH 37+460	Same as above
CH 37+420	Same as above
CH 39+020	To monitor water table to see whether there is a rise in water table due to filling
CH 41+600	Same as above
CH 48+100 CH 50+150 CH 52+000	CVC areas

In addition to the location suggested by the FDR the contractor has selected several locations at the CVC area for water level measurement. Those locations are given in the Table 07.

**Table 07 -Location Identified for Water Level Measurement at CVC Area**

No.	House Owner's Name & Address	Chainage	Well No.
01	A. Livinis, Kanana, Pannila	CH 47+530	A1-1/W-04
02	W.P. Nandasena, No103,Sandapahanwatta, Pannila	CH 47+665	A1-1/W-11
03	Sidney Dissanayaka,Sandapahanwatta Junction, Hidampola,Pannila	CH 47+950	A3/W-08
04	R.Somarathna, Miriswatta, Ittapana	CH 48+050	A3/W-03
05	K.V.D.Jayathissa, Miriswatta, Ittapana	CH 48+070	A3/W-01
06	R.Kannangara,Halwala,Via Mathugama	CH 49+985	B2-1/W-09
07	Chandrasena Kannangara,Halwala,Via Mathugama	CH 50+160	B2-1/W-01
08	L,Kannangara,Halwala,Via Mathugama	CH 50+260	B2-1/W-07
09	S.Somalatha Kannangara,Halwala,Via Mathugama	CH 50+490	B2-2/W-10
10	Sirisena Athukorala,Halwala,Via Mathugama	CH 50+560	B2-1/W-14
11	T.V.Saman Wickramasingha,Galatara, Ittapana	CH 51+680	C1-1/W-01

The southern expressway in JBIC- package 2 is mainly traverse through low lands. For the balanced movement of surface waters in such low areas, the ROW has been provided sufficient drainage facilities such as box culvert, pipe culverts, viaduct etc.

With this Hydrological impact monitoring & mitigation program, it is monitored all the culvert locations, low land areas and taken appropriate measures accordingly

The parameters such as water table, pH value, Sulphate content, Iron content and sedimentation level mention in the FDR were not monitored. Only water levels were monitoring in weekly basis.

### **3.1.1 Monitoring Methodology**

The parameters, which have been identified in the EMP for the monitoring of hydrology and drainage impact, are listed in the above Table 05.

### **3.1.2. Mitigation Measures to be Adopted for the hydrological and drainage impacts**

As mention in the EMP following mitigation measures should be adopted to minimize the Impact to the affected parties

- Preparation and implementation of a thorough plan (Hydrology and drainage) including its review and updating. Plan should be approved by CSC one month before construction and, reviewed and, or updated for implementation during construction.
- Use of extensive erosion and sedimentation control measures at all construction sites(e.g. geotextiles, siltfencing, benching of cuts, sediment basins and sediment traps, filter fabric fences, straw bale barriers)
- Provisioning proper drainage systems to all construction, material exploitation, and storage sites prior to their use. Stockpiles should also be covered before heavy rains and should be located within 20m of water causes. There should be an intervening vegetated buffer to control any unexpected runoff.
- Best engineering practice and timing of activities for erosion and sedimentation control measures at all construction sites (e.g., geotextiles, silt fencing, benching of cuts, stabilizing vegetation and using appropriate slope dimensions etc.]
- Scheduling of excavation operations to minimize potential erosion
- Limitations on excavation depths in use of recharge areas for material exploitation or spoil disposal.
- Minimizing the removal of vegetation cover and, re-vegetating at 1:1 on all construction sites in future.
- Ensure connectivity of all lead way drainage paths. This should be systematically recorded.
- Ensure sufficient crossings and openings in the service road to avoid short-term inundation.
- Examine critical, culverts and if necessary further increase the opening size to cater to a higher return period.
- Systematic collection and, analyze of the stakeholder complaints regarding drainage.
- Liaise with Irrigation Department, SLLRDC, etc. to obtain approvals for drainage structures.
- Incorporate additional measures as recommended in Drainage Report.

### 3.2. Surface and Ground Water

In view of effective mitigation of the impacts, periodical testing of water quality proposed to identify impacts at early stages of pollution. Parameters and frequencies for water quality monitoring were listed in the Environment Management Plan.

For the surface water quality-monitoring purposes, the contractor identified the relevant locations by referring the FDR. The locations identified for the monitoring of surface water quality in the STDP package 02 is as per the Table 09. Contractor has monitored surface water quality at such locations according to the frequencies proposed by the EMP.

Also for the ground water quality-monitoring purposes, the contractor has been identified the relevant locations by referring the FDR. The locations identified for the periodical monitoring of ground water quality in the STDP package 02 is as per the Table 08. All locations have been physically verified with RDA and with Engineer. Monitoring of ground water quality at the selected locations carried out according to the frequencies proposed by the EMP except for CVC areas.

Further, it has been decided to monitor both the ground water quality and ground water levels approximately CVC trial areas and take appropriate actions accordingly.

#### 3.2.1 Monitoring Methodology

Water quality monitoring parameters, which have been identified in the EMP for the monitoring of surface water quality, are listed in the Table 09. These parameters require both the detail laboratory analysis and techniques on in-situ field data collection, using specified equipments and simple measuring equipments respectively. Water quality monitoring was carried out once in six month during dry and wet period.

**Table 08- Locations (Wells) Identified for Monitoring of Ground Water Quality**

No.	Chainage (Approx)	Location	Nature of the Water body
2GW	CH 35+440	Pahanwatte	Drinking well
3GW	CH 41+600	Nauththuduwa Temple	Bathing Well

**Table- 09 - Locations Identified for the Monitoring of Surface Water Quality**

No	Chainage	Location	Nature of the water body
17 SW	CH 45+500	Welipanna Ganga	River
18 SW	CH 46+540	Dikduwa Ela	Stream/Culvert
19 SW	CH 50+340	Close to Ittapana	Stream/Culvert (to welipanna ganga)
20 SW	CH 50+400	Close to Mahagoda	Stream/Culvert (Downstream Bentota ganga)
21 SW	CH 51+900	Close to Lulbadduwa	Stream/Culvert (Downstream Bentota ganga)
22 SW	CH 53+300	Bentota Ganga	River
23 SW	CH 61+270	Elpitiya Ela	Stream/Culvert

### 3.2.2. Details on Equipment and Calibration.

The parameters identified for monitoring, equipments and calibration methods used by Industrial Technology Institute (ITI) with respect to water quality are depicted in Table 10.

**Table 10: Test Parameters and Method Details for Monitoring Water Quality**

No	Parameter	Test Method	Principle/Equipment
1	Temperature	APHA 2550 B	Thermometer
2	pH	APHA 4500-H+B	Electrometry
3	Electrical Conductivity	APHA 2510 B	Conductometry
4	Dissolved Oxygen	APHA 4500 O-G	Electrometry
5	Salinity	APHA 2520 B	Conductometry
6	Biochemical Oxygen Demand (BOD) 3 at 30°C/5 at 20°C	Modified DIN 38409 Part 5 APHA 5210 B APHA 5220 B	Manometry Electrometry Open reflux Titrimetry
7	Chemical Oxygen Demand (COD)	Modified APHA 5220 D	Closed reflux Colorimetry
8	Total Suspended Solids	APHA 2540 D	Gravimetry
9	Chloride	APHA 4500-CI B	Titrimetry
10	Nitrate Nitrogen	APHA 4500 –NO3B SLS 614 Part 1 1983	Colorimetry
11	Oil and Grease	APHA 1992 5520 B	Gravimetry
12	Total Phosphate	APHA 4500-PC APHA 3111 B	Colorimetry
13	Lead	APHA 3113B	AAS/Flame AAS/GTA
14	Zinc	APHA 3111 B	AAS/Flame
15	Iron	APHA 3111 B	AAS/Flame
16	Manganese	APHA 3111 B	AAS/Flame

No	Parameter	Test Method	Principle/Equipment
17	Coliform count (MPN)	SLS 614-Part 2-1983	-
18	E-Coli (MPN)	SLS 614-Part 2-1983	-

### 3.2.3 Monitoring Standards:

The standards for discharge of effluent into inland surface waters stipulated by the Central Environmental Authority are given in Table 11.

**Table 11: General Standards for Discharge of Effluents into Inland Surface Waters (Schedule 1 of the Gazette Notification No.595/16 dated 08.01.990 published under the National Environmental Act)**

No.	Determinant	Tolerance Limit
1.	Total Suspended Solids, mg/l, (max)	50
2.	Particle size of Total Suspended Solids	Shall pass sieve of aperture size 850 micro m.
3.	P <sup>H</sup> value of ambient temperature	6.0 to 8.5
4.	Biochemical Oxygen Demand-BOD <sub>5</sub> mg/l, (max)	30
5.	Temperature of discharge	Shall not exceed 40 °C of the stream within 15m down
6.	Oils and Grease, mg/ l (max)	10.0
7.	Total Residual Chlorine mg/l, (max)	1.0
8.	Phenolic Compounds (as phenolic OH) mg/l (max)	1.0
9.	Cyanides (as CN) mg/l, (max)	0.2
10.	Sulfides, mg/l, (max)	2.0
11.	Fluorides, mg/l, (max)	2.0
12.	Arsenic, mg/l, (max)	0.2
13.	Cadmium total, mg/l, (max)	0.1
14.	Chromium total, mg/l, (max)	0.1
15.	Copper total, mg/l, (max)	3.0
16.	Lead, total mg/l, (max)	0.1
17.	Mercury total, mg/l, (max)	0.0005
18.	Nickel total, mg/l, (max)	3.0
19.	Selenium total, mg/l, (max)	0.05.
20.	Zinc total, mg/l, (max)	5.0
21.	Ammonical Nitrogen mg/l, (max)	50.0
22.	Pesticides	Undetectable
23.	Radio active material (a) Alpha emitters micro curie/ml Beta-emitters micro curie/ml	10 <sup>-7</sup> 10 <sup>-8</sup>
24.	Chemical Oxygen Demand (COD), mg/l, (max)	250

### **3.2.4. Mitigation Measures to be adopted to minimize surface water quality and ground water quality deterioration**

As mentioned in the EMP following mitigation measures should be adopted to minimize the Impact of the affected parties.

#### **a) Surface Water Quality**

- Best management practices applied to equipment maintenance and operations to control contaminated run-off water.
- Storage of lubricants, fuels and other hydrocarbons in self-contained enclosures
- Properly disposing the solid waste generated from construction activities and work camps. (Licensed sanitary landfills or designated construction disposal sites)
- Cover of construction materials and spoil stockpiles with a suitable material to reduce material loss and sedimentation.
- Minimum distance of 100 m between stockpiles and water bodies, or greater distance as needed to minimize distance of natural drainage
- Borrow and spoils disposal sites at minimum distance of 100 meters from drinking water sources
- Planned and quantified vegetation clearing and deforestation
- Regulations and enforcement regard to washing construction vehicles, equipment, and machinery.
- Regulations and enforcement in the use of weedicides containing hazardous materials that are highly toxic and could bio accumulate.
- Regulations and enforcement in the use of weedicides, which are not containing hazardous materials that could bioaccumulation during rainy period).
- Treatment of waste water from asphalt or concrete plants using pH correction and physicochemical treatment to the CEA standards for inland surface water
- Provision of oil and grease traps to curtail run-off carrying them to water body
- Preparation of temporary drainage management plan; one month before commencement of works
- Meaningful water quality monitoring up and down stream at all bridges during construction within 100 m of rivers.

#### **b) Ground Water Quality**

- Regular and proper maintenance of machinery, construction vehicles and equipment to prevent oil spills
- Heavy restrictions on oil storage except in self-contained cans placed in sheds to prevent spills.
- Avoid heavy deforestation and excessive vegetation clearing as much as possible.
- Prohibiting the use of weedicides containing hazardous materials, that could bioaccumulation.
- Regulate the dumping of waste material and other wastes.

### **3.3 Air Quality**

The major contributors for the deterioration of air quality in the STDP are: (1) Vehicle emissions, (2) Dust during construction stage and (3) vehicular emissions during operation stage.

The air quality that contributed significant level for environmental pollution had considered necessary for continuous monitoring and included in the EMP. A baseline condition survey had carried out in the project area by the Industrial Technology Institute (ITI) jointly with the CEA officials from November 2002 to January 2003.

For this base line air quality monitoring program, two locations from STDP-JBIC-Package 02 has been selected. They are the vicinity of Dodangoda interchange and the vicinity of Welipenna interchange. However, the EMP of the STDP suggested monitoring 8 hours average dust level during construction depending on the complaints, at relevant premises.

During the construction phase, construction vehicles traveling on unpaved roads generate dust and operating vehicles at high speed under dry weather condition can increase such pollution. Improper handling transferring of materials can also potentially generate dust. Improper storage of materials can potentially generate dust if not properly covered.

Cut and fill operations of asphalt plant, crusher plant and pre mix plant can pollute the ambient air quality.

#### **3.3.1. Monitoring Methodology.**

According to the EMP at least 8 hour sampling should be carried out depending on the complaints from local people at relevant premises. In addition, EMP stated that 24 hours monitoring at critical locations in dry weather condition and at least every 2 weeks during construction phase. Crusher plants, asphalt plants, pre mix plants can be considered as the locations of emissions of dust in the project trace. Ambient Air quality monitoring carried out according to National Environmental (Ambient Air Quality) regulations 1994.

#### **3.3.2. Monitoring Equipment and Calibration Details.**

The monitoring of dust emission was carried out by the ITI instead of the contractor. The Central Environmental Authority at the schedule VIII of the Gazette extraordinary No 924/12 dated 23 05.1996 has published equipment calibration technique and the standard method of measuring the parameters.

#### **3.3.3. Regulatory Standards.**

The results of the actual monitoring should be compared with the base line data to identify the increasing trends. The prevailing stipulated national standards for the ambient air quality standards are given in the Table 12.

**Table 12- National Standard for the Ambient Air Quality (Schedule 1 of the Gazette Notification No.850/4 dated 05.10.1994 published under the National Environmental Act)**

No.	Pollutant	Average Time	Maximum permissible level	
			in mg/m <sup>3</sup>	in ppm
1	Carbon Monoxide	8 hr	10	9
		1 hr	30	26
		Any time	58	50
2	Nitrogen Dioxide	24hr	0.10	0.05
		8hr	0.15	0.08
		1hr	0.25	0.13
3	Sulfur Dioxide	24hr	0.08	0.03
		8hr	0.12	0.05
		1hr	0.20	0.08
4	Ozone	1hr	0.20	0.10
5	Lead	Annual	0.0005	--
		24hr	0.002	--
6	SPM	Annual	0.10	--
		24hr	0.30	--
		8hr	0.35	--
		3hr	0.45	--
		1hr	0.50	--

### 3.3.4. Mitigation Measures to be adopted for the air quality impacts

As mention in the EMP following mitigation measures should be adopted to minimize the Impact of the affected parties

- All heavy equipment and machinery shall be fitted in full compliance with the national and local regulations. [National environmental air emissions fuel and vehicle standards E.O Gazette 1137/35 of June 2000, updates by air emissions fuel and vehicle standards (importation standards) 1268/18 December 2002 and 1295/11 June 2003]
- Routine water sprays on stockpiled soil and sand to prevent dust generation
- Vehicles transporting soil, sand and other construction materials shall be covered.
- Speed limits to be rigorously enforced and transport through densely populated areas should be avoided where possible.
- Concrete plants, asphalt (hot-mix plants), and metal crusher activities to be controlled; these facilities should be upwind of sensitive receptors (e.g., schools and hospitals) a minimum 500 meters and downwind of sensitive receptors a minimum of 100 meters.
- Care should be taken in stockpiling construction material with adequate coverage against wind, Sun, and rain.
- Care should be taken to avoid spillage of construction material and dust emissions during unloading of construction material to the project site.

- Vehicles and machinery used to construction activities are properly maintained to avoid smoke emissions.
- Base line air quality standards to be monitored and a list of more sensitive areas to be prepared and ensures watering and other mitigation measures

### 3.4 Noise/Ground Vibrations

The major sources of noise and ground vibration of the Dodangoda to Kurundugahahetekma section are:

Drilling & Blasting,  
 Compaction  
 Heavy Vehicle Movements  
 Pile driving  
 Operation of Crusher Plants

The Contractor and the Employer have received large number of complaints regarding the damages due to blasting. Contractor has implemented a blasting monitoring system jointly with the Geological Survey and Mines Bureau (GS&MB) and the Road Development Authority (RDA).

Excessive noise levels were generated due to compaction, heavy vehicle movement, pile driving, and the operation of crusher plants, batching plants, motor pool area, and Pre cast yard.

Background noise measuring was carried out during the pre construction period, to measure background noise levels during two assessment periods;

- Twenty four hour background noise level measurements,
- Three hour background noise level measurements.

However, the EMP has proposed to monitor the noise levels (one hour at daytime) and vibration levels and depending on the complaints from local people at their premises. Parameters to be monitored regarding noise and vibrations are listed in Table 13.

To minimize the possible adverse effects to the residence approximately blasting locations, the GSMB instructed to monitor both the air blast over pressure and ground vibration on daily basis. In addition, ground vibration levels were monitored at the adjacent locations where the compaction operations were carried out. According to the monitoring results, appropriate action is taken when the limits are exceeded.

**Table 13 - Noise/Vibration Monitoring Parameters**

Noise/ vibration Parameter	Remarks
L <sub>Aeq</sub> , One hour for Day time	Day time (06.00 hrs to 18.00 hrs)
L <sub>Aeq</sub> , 5 min for Night time	Night Time (18.00 hrs to 06.00 hrs)
Vibration- Peak particle Velocity (PPV)-(mm/sec)	Construction activities, Vehicle movement and Blasting
ABOP (Air blast over pressure)	

### **3.4.1. Monitoring Methodology**

Environmental noise level measurements should be carried out generally in accordance with the methods laid down in National Environmental (Noise Control) Regulation 1996 No 924/12 dated 23.05.1996 and ISO 1996 (Part 1, 2, 3) and - 4142: 1990

### **3.4.2. Monitoring Equipment and Calibration Details**

Monitoring equipment and calibration procedure for noise monitoring should be comply with the standard methods published by the Central Environmental Authority at the schedule VIII of the Gazette extraordinary No 924/12 dated 23.05.1996.

### **3.4.3. Regulatory Standards**

As per the regulations made under the National Environmental Act, the prevailing standard for maximum permissible noise for the construction activities is as per the Table 14.

Maximum permissible noise level for the operation of other activities (Prescribed activities) in Pradeshiya Sabha areas and within silent zones is as per the Table 15.

Maximum permissible vibration levels for the construction activities, vehicle movements, and rock blasting operations are as per the Table 16.

### **3.4.4. Mitigation Measures to be adopted for noise and ground vibration**

As mention in the EMP following mitigation measures should be adopted to minimize the Impact of the affected parties

- All heavy equipment and machinery shall be fitted in full compliance with the national and local regulations. [Extra Ordinary Gazette No. 924/12 May 1996 amended by E.O Gazette 937/7 April 1999]
- Heavy equipment operations shall be restricted to daylight hours in sensitive locations.
- Percussion (pile driving) operations shall be avoided in sensitive areas unless geotechnical conditions require this method to be used. Hammer-type pile driving operations shall be avoided during nighttime.
- Borrow and disposal sites should be located at least 200 meters from residential areas unless suitable methods will be used to mitigate the noise and vibration impacts to acceptable levels.
- Blasting activities to be minimized and controlled. Blasting to be scheduled at regular intervals with prior notice to nearby residents. Reasonable compensation to be paid to those houses that are damaged by blasting effects.
- Contractor shall take adequate measures to minimize noise nuisance in the vicinity of construction sites by way of adopting available acoustic methods.  
- Contractor may obtain guidelines for noise reduction from ISO/TR11688-

1:1995(E), which enumerates methods, which air-borne may curtail liquid – born and structure-born noise sources curtailed with suitable design criteria. (Summary of design is in the Annex of EIA)

- Maintaining vehicles and machinery used to construction activities regular and proper manner to avoid undue noise including irritating hums.
- Intensive monitoring of noise levels specially in nearby noise sensitive areas such as residences and schools and if predicted noise levels are excessive, then provision of noise barriers.
- Use of explosives and mode of blasting for rock blasting activities are limited where feasible.
- Detonators to be selected according to the sensitivity of the site.
- Maximum blasting amount /specifications to be reduced based on monitoring of the impacts.
- Cover against fly rocks shall be used following adequate standards. (weight, durability)

**Table-14 - Maximum Permissible Noise Levels for the Construction Activities**

Permissible Noise Level at boundaries in $L_{Aeq,T}$ where the source of noise located	Day Time (06.00-21.00) 75 dB(A)	Night Time (21.00-06.00) 50 dB(A)
--	------------------------------------	--------------------------------------

**Table 15 - Maximum Permissible Noise Levels for Prescribed Activities**

Area	Maximum Permissible Noise Levels at Boundaries in $L_{Aeq}$	
	Day time dB(A)	Night time dB(A)
Low Noise (Pradeshya Sabha area)	55	45
Silent Zone	50	45

**Table 16 – Maximum Permissible Vibration Levels**

Activity	Category of the Structure	Frequency/type	Permissible Vibration in PPV (mm/Sec)	ABOP dB (L)
Construction activities / vehicle movement	Type 3	10 – 50 (Continuous)	2.0	
Rock Blasting with multi bore holes and with delay detonators	Type 3	Impulsive	5.0	120

### **3.5. Exploitation and Storage of Construction Material**

According to the EMP main objective of monitoring the material extraction, transportation and storage of construction materials as follows;

Unplanned exploitation of construction material from borrow areas could result in poor quality construction material and environmental problems such as collection and stagnation of rain water in the excavation.

Storage of construction material on sloping grounds could increase erosion and silting the low line areas.

When excavated material within the trace is used as fill material, and if proper planning and management of cut and fill operation is not followed, large amount of materials need to be kept in temporary storage thereby causing environmental issues such as : erosion, silting, landslides etc.

Unsafe and unhygienic conditions of those locations cause to people adjoining to have bad impacts. Also causes to visual segregation conditions.

To identify the impact due to the exploitation handling, transportation and storage of construction material following parameters should be monitored.

Quality of the material in temporary storage

Type of material

Hazard level of material in relation to environmental damage

Duration of storage and climatic season

Method of transportation

#### **3.5.1 Monitoring Methodology**

The parameters, which have been identified in the EMP for monitoring of exploitation handling, transportation, and storage of construction materials, are listed in the above. These parameters require techniques on in-situ field data collection using observation methods. The parameter such as hazard level of the material requires detail laboratory analysis. Temporary storage locations, the locations where material is exploited and transportation routes need to be monitored. According to the EMP the frequency of the monitoring is once a week.

#### **3.5.2. Mitigation Measures to be adopted**

As mention in the EMP following mitigation measures should be adopted to minimize the Impact of the affected parties

- Excavation of the material from the borrow pits should be carried out without creating unsuitable surfaces of excavation such as near vertical slopes.
- Avoid as much as possible, excavation and transportation of soil during rainy weather conditions.

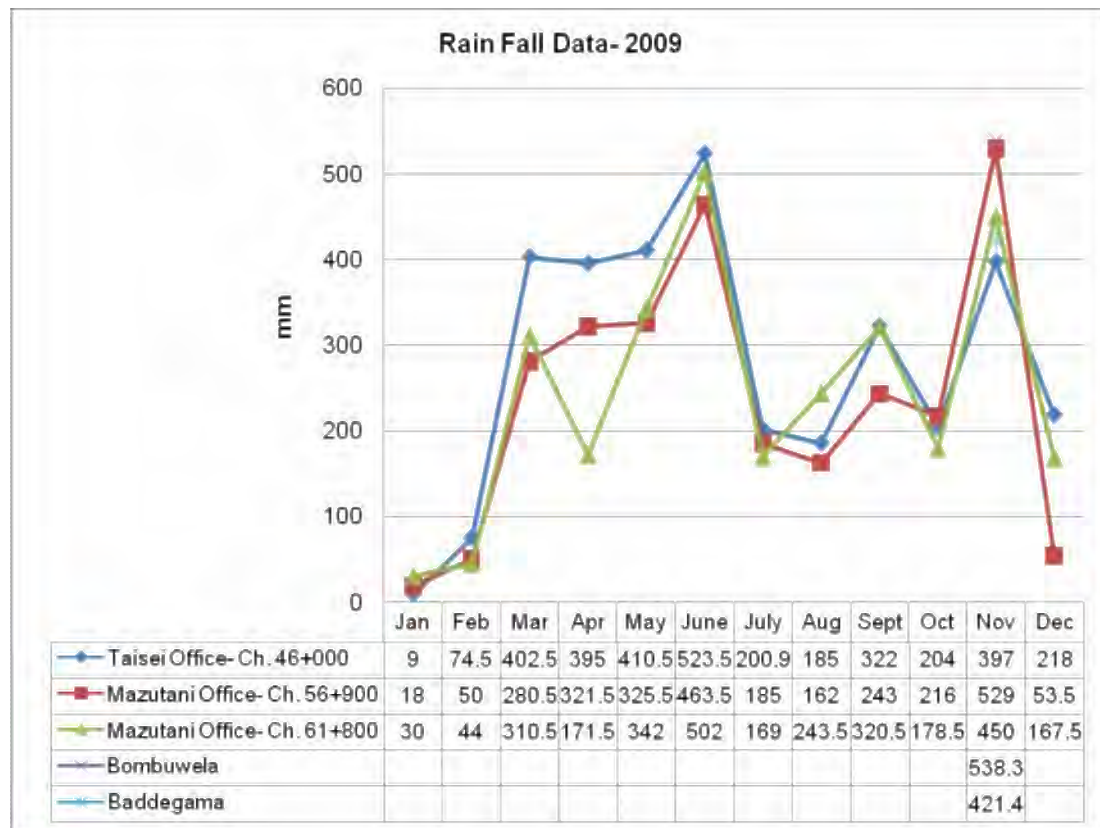
- When excavated material within the trace are used as fill material, proper planning and management of cut and fill operations to minimize distance of transport and temporary storage.
- Before beginning of the construction, the cut sections and the corresponding fill sections are marked on a map for the entire trace, considering distance of transport, easiness of transport and construction process etc.
- The map is revised regularly depending on the progress of construction.
- As much as possible, direct transportation of the exploited construction material from generated location to the fill section should be practice without keeping the exploited material in temporary storage.
- Maintaining and inventory of the volume of exploited material in temporary storage and revision of the construction sequence to minimize the volume in temporary storage.

## 4.0. RESULTS OF ENVIRONMENTAL MONITORING AND MITIGATION MEASURES

### 4.1. Hydrology and Drainage Aspects

The construction activity along with the rains compounded the problems of silt deposition and flooding. Therefore, rainfall data collected as a prominent indicator of environmental degradation along the trace. The rainfall data has measured continuously from July to December 2009. Rainfall data measurement was carried out at five locations in Taisei Office (Ch.46+000), Mazutani Office (Ch.56+900), Mazutani Office (Ch. 61+800), Bombuwela and Baddegama. The high rainfall was experience during November in the 2<sup>nd</sup> half of the year 2009 at the STDP JICA - Package 2 section (Figure 01).

**Figure -01- Rain Fall data from July to December 2009**



The construction activity during the rainy season aggravates the problem of the silt deposition due to soil erosion at open areas. Most of the culverts were blocked due to siltation during the rainy season and the culvert-clearing programme was launched during the period. In addition, construction firm provides sedimentation trap and basin, temporary beams/bunds, temporary slope drains, temporary diversion boulder packing to prevent the siltation in the downstream.

After turfing of the embankments, controls of soil erosion are being improved along the trace. In addition, construction of cascade drains and side drains helped to minimize the Soil erosion.

In addition the following activities are going on to minimize the hydrology and drainage issues along the JICA funded Package 02 section.

#### **4.2. Surface and Ground Water Quality**

Water quality monitoring of surface water and ground water was carried out selected location along the project corridor. Central Environmental Authority and Industrial Technology Institute carried out the initial monitoring. The monitoring of the water quality was started before the project commencement, which is considered the base line status. The proper analysis cannot be carried out with the available data because of the water samples were collected off and on since the commencement of the project. More number of samples is required to be collected to make proper analysis and to observe the trends of the pollution load. According to the EMP, water quality should be measured twice a year during dry and wet seasons.

Although the EIA team (EIA 1999) has not anticipated significant impacts on total surface water quantity, the topographic changes and clearing for road construction would create changes in surface water movement threatening the sustainability of water bodies.

Dust and sediments generated due to numerous construction works may deteriorate surface water quality. For the effective mitigation of impacts, periodical testing of water quality has been proposed by the EMP of STDP with the objectives to identify impacts at early stages of pollution.

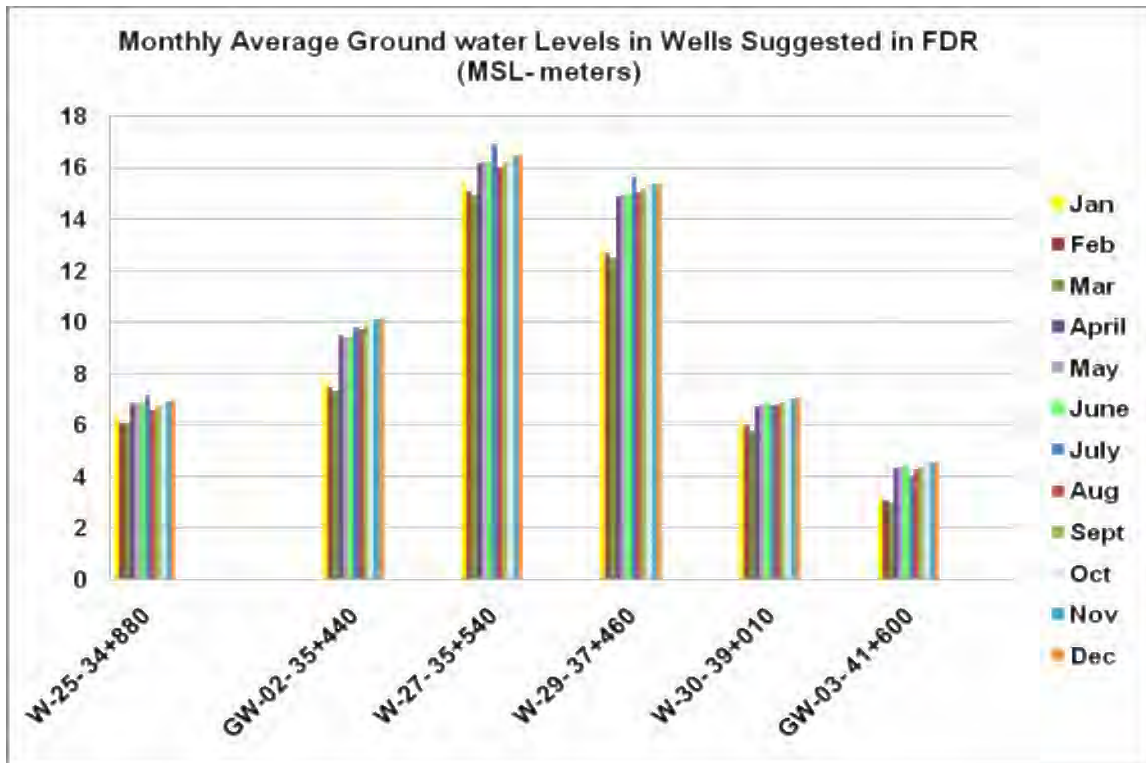
Also for the ground water quality-monitoring purposes, the contractor has identified the relevant locations by referring the FDR (Final Drainage Report of STDP, 2003- Prepared by the University of Moratuwa). The locations identified for the periodical monitoring of ground water quality in the STDP package 02 is as per the Table 08. All locations have been physically verified with RDA and with Engineer. Monitoring of ground water quality at the selected locations was carried out according to the frequencies proposed by the EMP except for CVC areas.

Further, it has been decided to monitor both the ground water quality and ground water levels approximately CVC trial areas and take appropriate actions accordingly.

For the surface water quality-monitoring purposes, the contractor identified the relevant locations by referring the FDR. The locations identified for the monitoring of surface water quality in the STDP package 02 is as per the Table 09. Contractor has monitored surface water quality at such locations according to the frequencies proposed by the EMP.

**Table: 17 Monthly Average Groundwater Levels (at Locations Suggested in FDR)**

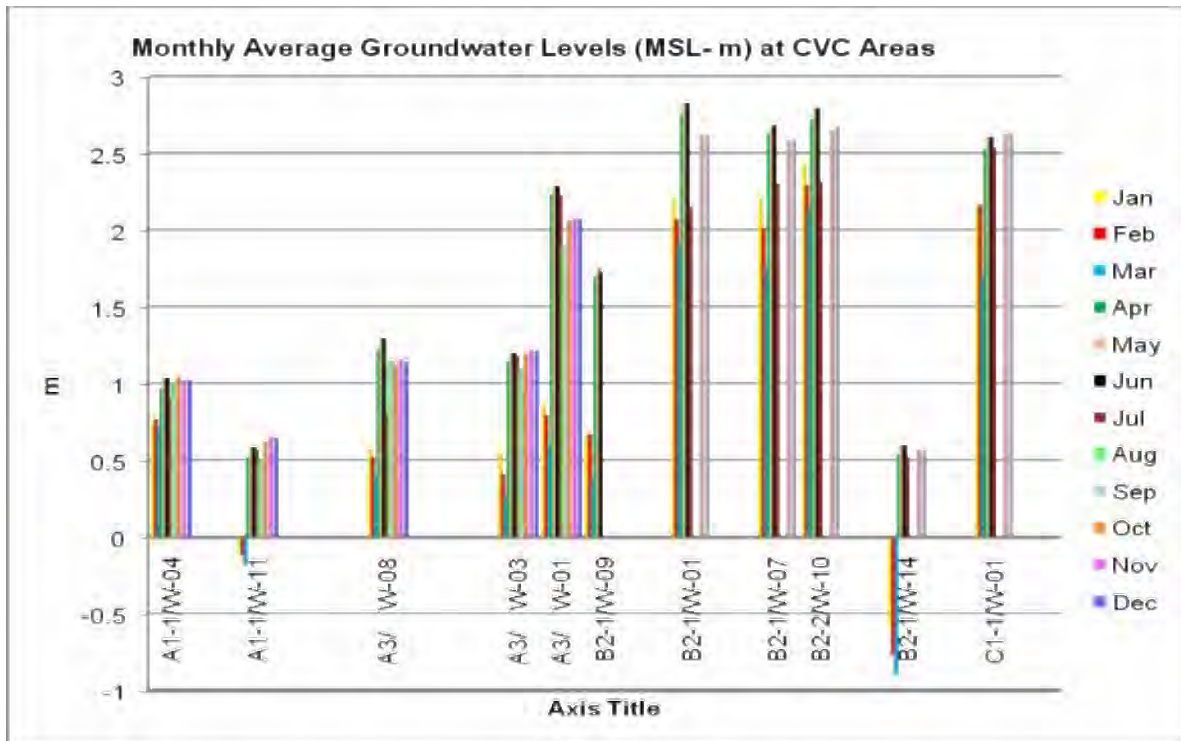
Well No.	Name and address	Ch.	Monthly Average Water Levels (MSL) in meters											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
W-25	U.K.Kusumawathi Sapugahwatta, Dodangoda	34+880	6.26	6.106	6.074	6.862	6.862	6.870	7.167	6.6	6.760	6.93	6.95	6.94
GW-02	Anurasiri Perera, Pahanwattha "C", Dodangoda	35+440	7.716	7.46	7.347	9.487	9.385	9.417	9.827	9.7	9.882	10.12	10.12	10.13
W-27	P.Rasamani, No. 71, Pahanwattha, "A", Dodangoda	35+540	15.32	15.03	14.93	16.15	16.21	16.22	16.86	16.0	16.2	16.41	16.42	16.46
W-29	K.A.Tissa, No.53, Mithurugama, Dodangoda	37+460	12.76	12.69	12.49	14.845	14.9245	14.936	15.62	15.0	15.188	15.33	15.35	15.38
W-30	Dany Jayathilaka, Kosgahawatta, Yatdolawattha	39+010	6.025	5.942	5.775	6.735	6.811	6.840	6.758	6.8	6.895	7.03	7.04	7.08
GW-03	Nauthuduwa Temple, Nauthuduwa	41+600	3.216	3.092	3.021	4.321	4.388	4.424	4.049	4.3	4.389	4.55	4.56	4.56



**Figure 02- Monthly Average Ground water Levels in Wells Suggested in the FDR- 2009**

**Table 18- Monthly Average Groundwater Levels (MSL- in Meters) at CVC Areas - 2009**

Well No.	Name and address	Ch.	Monthly Average Water Levels (MSL) in meters											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A1-1/W-04	A. Livinis, Kanana, Pannila	47+530	0.76	0.77	0.71	0.9745	1.04	1.04	0.905	1.00	0.91	1.044	1.025	1.025
A1-1/W-11	W.P. Nandasena, No.103, Sandapahanwatta, Pannila	47+665	-0.106	-0.118	-0.181	0.523	0.5865	0.5865	0.57	0.50	0.459	0.624	0.654	0.649
A3/W-08	Sidney Dissanayaka, Sandapahanwatta Junction, Hidampola, Pannila	47+950	0.577	0.519	0.389	1.231	1.297	1.297	0.812	1.15	1.147	1.1295	1.162	1.142
A3/W-03	R.Somarathna, Miriswatta, Ittapana	48+050	0.546	0.41	0.272	1.144	1.203	1.203	1.184	1.10	1.083	1.193	1.221	1.216
A3/W-01	K.V.D.Jayathissa, Miriswatta, Ittapana	48+070	0.869	0.792	0.596	2.2385	2.291	2.291	2.23	1.90	1.906	2.066	2.076	2.076
B2-1/W-09	R.Kannangara, Halwala, Via Mathugama	49+985	0.662	0.671	0.373	1.705	1.755	1.73	<b>Within ROW</b>					
B2-1/W-01	Chandrasena Kannangara, Halwala, Via Mathugama	50+160	2.213	2.073	1.91	2.765	2.83	2.83	2.155	2.65	2.63	2.605	2.625	2.62
B2-1/W-07	L,Kannangara, Halwala, Via Mathugama	50+260	2.208	2.014	1.76	2.6335	2.685	2.685	2.305	2.65	2.555	2.575	2.5875	2.595
B2-2/W-10	S.Somalatha Kannangara, Halwala, Via Mathugama	50+490	2.432	2.293	2.139	2.7245	2.797	2.797	2.32	2.57	2.642	2.622	2.657	2.6795
B2-1/W-14	Sirisena Athukorala, Halwala, Via Mathugama	50+560	-0.585	-0.770	-0.897	0.542	0.602	0.602	0.522	0.56	0.5295	0.5895	0.572	0.567
C1-1/W-01	T.V.Saman Wickramasingha, Galatara, Ittapana	51+680	2.158	2.169	1.693	2.535	2.609	2.609	2.541	2.52	2.499	2.594	2.629	2.6365



**Figure 03- Monthly Average Ground water Levels in Wells at CVC Area**

The above results reveal that no significant drop of the ground water levels at locations suggested in the FDR and approximately the CVC areas during the reporting period. However, variation in the monthly average groundwater levels both at the locations suggested in the FDR and approximately CVC areas can be observed; may be corresponded with the monthly average rainfall.

According to the graph of ground water level Figure 03 there is no significant variation of ground water levels from January to December.

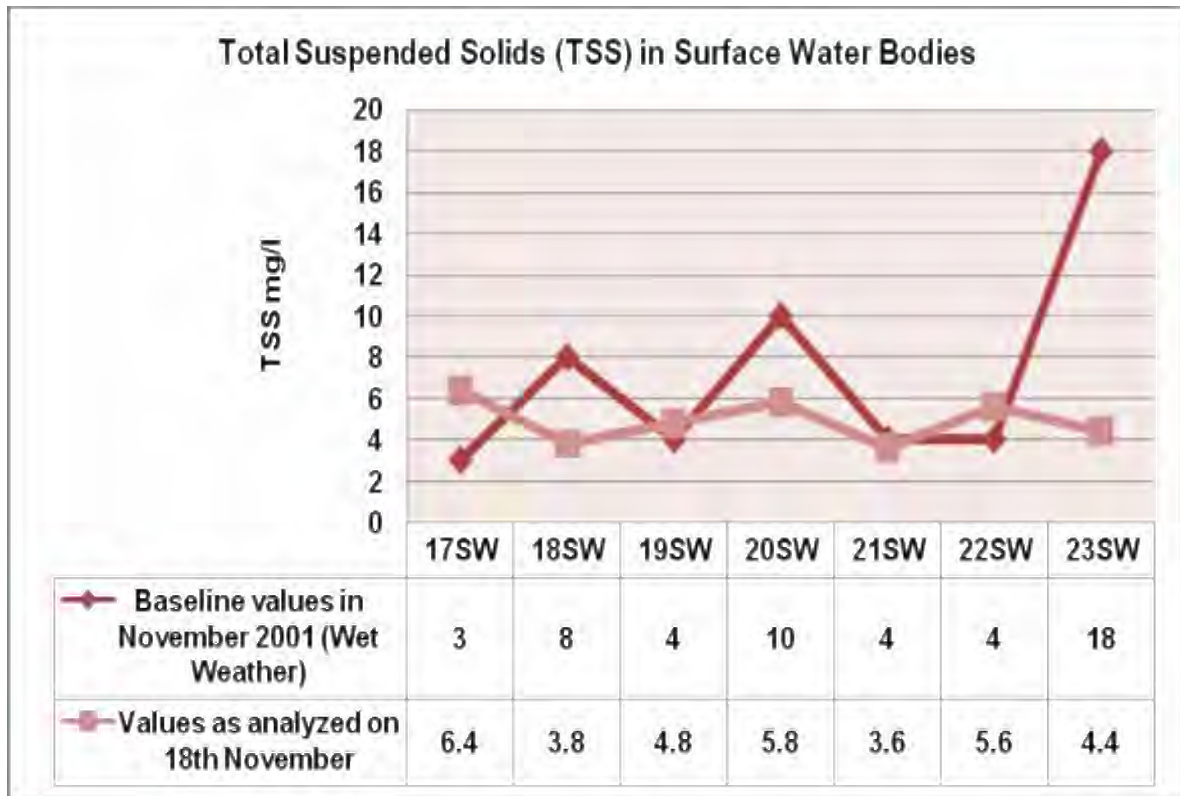
#### 4.2.1 Monitoring of the Surface Water Quality

The University of Moratuwa has carried out the sixth periodic monitoring of the quality of water in surface water bodies at locations suggested in the FDR in November 2009 and the report of it is given in the Annexure VI.

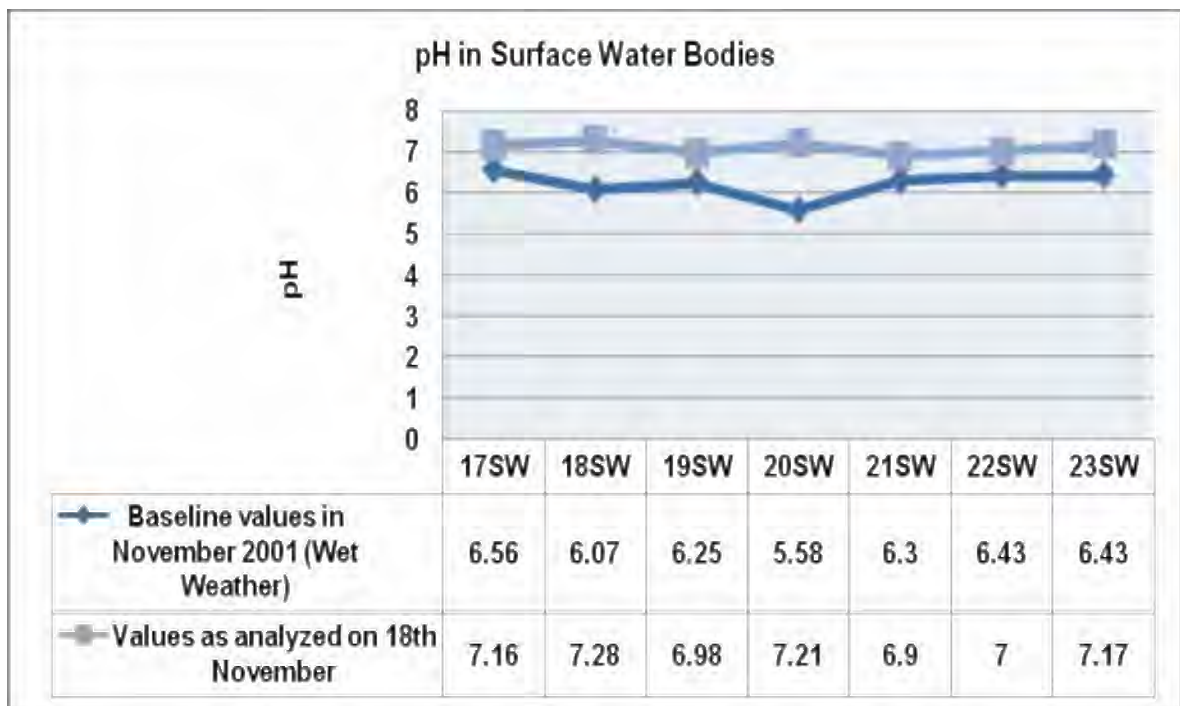
A comparison of TSS and pH values in the above analytical report with the baseline data is given in Figure 04 and 05.

Relevant Surface water bodies are;

- |                               |      |
|-------------------------------|------|
| 1. Welipenna River            | 17SW |
| 2. Dickduwa Ela               | 18SW |
| 3. Stream Close to Ittapana   | 19SW |
| 4. Stream Close to Mahagoda   | 20SW |
| 5. Stream Close to Lulbadduwa | 21SW |
| 6. Bentota River              | 22SW |
| 7. Elpitiya Stream            | 23SW |



**Figure 04- Total Suspended Solids (TSS) in Surface Water Bodies**



**Figure 05- pH in Surface Water Bodies**

The above figures show no remarkable change in the pH values and an increase of TSS in surface water bodies due to construction of expressway.

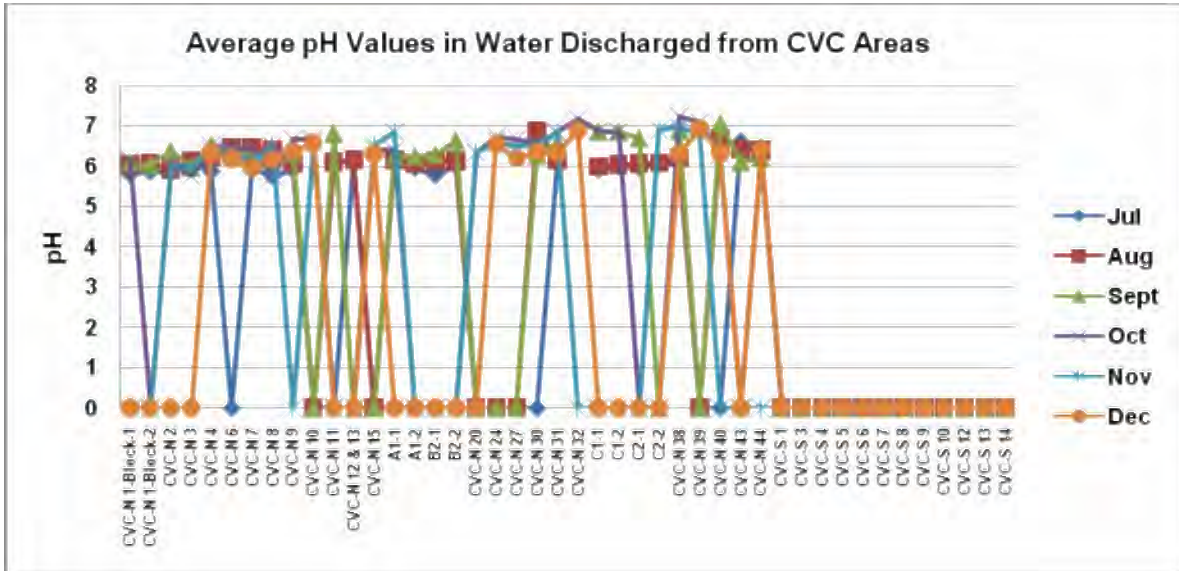
#### 4.2.2 Average pH values of Discharged Water from the CVC Areas

The monthly average pH in the water discharged from the CVC trial areas are given in the Table No. 19.

**Table: 19. Average pH Values in Water Discharged from CVC Areas**

Area	Jul	Aug	Sept	Oct	Nov	Dec
CVC-N 1-Block-1	5.805	6.025	6.07	6.16	-	TC
CVC-N 1-Block-2	5.87	6.065	6.02	-	-	TC
CVC-N 2	5.825	5.915	6.36	6.02	5.990	TC
CVC-N 3	6.105	6.125	5.96	5.77	5.930	TC
CVC-N 4	5.870	6.230	6.51	6.500	6.400	6.340
CVC-N 6	-	6.450	6.32	6.46	6.285	6.185
CVC-N 7	5.950	6.450	6.25	6.42	6.095	5.960
CVC-N 8	5.750	6.405	6.150	5.750	6.505	6.175
CVC-N 9	5.910	6.065	6.30	6.650	-	6.380
CVC-N 10	-	-	-	6.67	6.565	6.575
CVC-N 11	-	6.095	6.80	-	-	-
CVC-N 12 & 13	6.100	6.160	-	-	-	-
CVC-N 15	-	-	-	6.43	6.515	6.310
A1-1	6.075	6.145	6.23	6.39	6.850	TC
A1-2	5.965	6.050	6.23	-	-	TC
B2-1	5.780	6.115	6.27	-	-	TC
B2-2	6.000	6.115	6.62	-	-	TC
CVC-N 20	-	-	-	6.34	6.340	TC
CVC-N 24	-	-	-	6.71	6.595	6.550
CVC-N 27	-	-	-	6.66	6.475	6.200
CVC-N 30	-	6.875	6.27	6.550	6.545	6.350
CVC-N 31	6.060	6.155	6.550	6.830	6.795	6.335
CVC-N 32				7.18	-	6.890
C1-1	5.915	5.990	6.84	6.86	-	TC
C1-2	6.000	6.035	6.84	6.85	-	TC
C2-1	5.985	6.060	6.68	-	-	-
C2-2	6.040	6.080	-	-	6.890	TC
CVC-N 38	6.170	6.200	6.850	7.230	6.955	6.316
CVC-N 39	-	-	-	7.090	6.780	6.940
CVC-N 40	-	6.700	7.04	6.280	-	6.345
CVC-N 43	6.610	6.405	6.09	-	-	-
CVC-N 44	6.460	6.400	6.20	6.35	-	6.415
CVC-S 1		-	-	-	-	TC
CVC-S 3	-	-	-	-	-	-
CVC-S 4	-	-	-	-	-	-
CVC-S 5	-	-	-	-	-	-
CVC-S 6	-	-	-	-	-	-
CVC-S 7	-	-	-	-	-	TC
CVC-S 8	-	-	-	-	-	TC
CVC-S 9	-	-	-	-	-	-
CVC-S 10	-	-	-	-	-	TC
CVC-S 12	-	-	-	-	-	-
CVC-S 13	-	-	-	-	-	-
CVC-S 14	-	-	-	-	-	TC

- = Not monitored      TC= Treatment completed



**Figure 6- Average pH Values in Water Discharged from CVC Areas**

The above pH monitoring results reveal that pH in water discharged from CVC areas during the reporting period is complying with the General Standards for Discharge of Effluent into Inland Surface Waters, stipulated by the CEA, except at a few location.

The said exceptional cases may be natural by referring to the pH in the wells adjacent to CVC areas (Please see Table 20) and the report of the water quality of the surface water bodies as given in the FDR (Please refer the table 6.6 at page 142 of the FDR ), which also shows low pH values in ambient waters. So that pH in water discharged from the CVC areas may not adversely affect to the environment. However regular monitoring of pH in water discharges from the CVC areas and in ambient waters, both surface and ground is recommended and if such regular pH monitoring reveals any kind of adverse effect to environment, Contractor should take immediate actions to adjust pH in CVC waters to permissible levels prior to discharge to environment.

#### **4.2.3 Quality of the Waste Water Discharge from Concrete Batching Plant at Ch.49+500**

The treatment process of the wastewater, in the batching plant at Ch. 49+500 is not in a satisfactory level. The University of Moratuwa has sampled batching plant's wastewater on 01 July 2009 for quality analysis as per the conditions in the EPL and the report of the same reveals that the level of pH and Total Suspended Solids has not been maintained according to the tolerance limit of the CEA.

According to the report on water quality analysis, the wastewater sample obtained on 01-07-2009 from the University of Moratuwa, wastewater discharged from Concrete Batching Plant has exceeded the relevant tolerance limits (Annex III).

**Table 20- Water Quality analysis Report of the waste water discharged from Concrete Batching Plant**

Parameter	Tolerance Limit	Measured Value
TSS mg/l, max	50	<b>70</b>
pH	6.0-8.5	<b>11.88</b>
COD mg/l, max	250	240
Oil and Grease (mg/l)	10	0.380

Contractor should take immediate action to upgrade the sedimentation tanks and Engineer, Management Consultant, and Employer should monitor through joint field inspection. The Management Consultant has informed several times the Contractor's Supervision Consultant to instruct the Contractor to upgrade the sedimentation tanks.

### 4.3. Air Quality Monitoring

The main objective of air quality monitoring during construction phase is to minimize air pollution to ensure maintaining the Ambient Air Quality Standards.

The Industrial Technological Institute (ITI) jointly with the CEA has carried out baseline air quality monitoring in the project area in 2003 and results have been described in Air Quality Test Report in 2003.

The major causes of air quality deterioration during construction are;

- Generation of Air born particulate matters from earth works and movement of vehicles.
- Generation of Air born particulate matters owing to operation of batching plants, asphalt plants, metal quarries, crushers etc.
- Emissions generated from the vehicles and, machineries.

Air quality monitoring for Ambient Suspended Particulate Matter (SPM) has been carried out on 23<sup>rd</sup> July, 2009 at Concrete Batching Plant premises at Ch. 59+700 (RHS) for 08 hrs average and the relevant report is given in the Annexure V. The results reveal that SPM (08 hrs average) at the batching plant premises is complying with the National Environmental (Ambient Air Quality) Standards 1994 under the National Environmental Act No.47 of 1980.

Parameter/ unit	Method of analysis	Results	Max. Permissible Level (08hrs average)
SPM (08hrs average)	High volume sampling and Gravimetry	<b>0.23</b>	<b>0.35</b>

Following mitigation measures have been taken to control fugitive dust emissions.

- Exposed areas and sensitive locations were watered continuously to prevent dust emission from construction sites.
- Modification of the watering schedule accordingly to prevent dust.
- Water browsers had been employed to control dust in the entire the pilot road and public road sections crossing the expressway in the north section.
- The drilling machines were equipped with dust collectors to prevent dust in the drilling sites. However, the hand drill machines are lack of these equipments.
- The speed limits sign boards have been fixed all along the corridor.

In addition, the vehicle speed within the site is limited to 30 Km/hr and this appears to have not been adhered to by the Contractor's vehicles.

#### 4.4. Noise & Vibration Monitoring Results

Compaction and rock blasting activities were the noise and vibration sources in this section. End of December 2009 there were 07 rock excavation sites were operated along the trace.

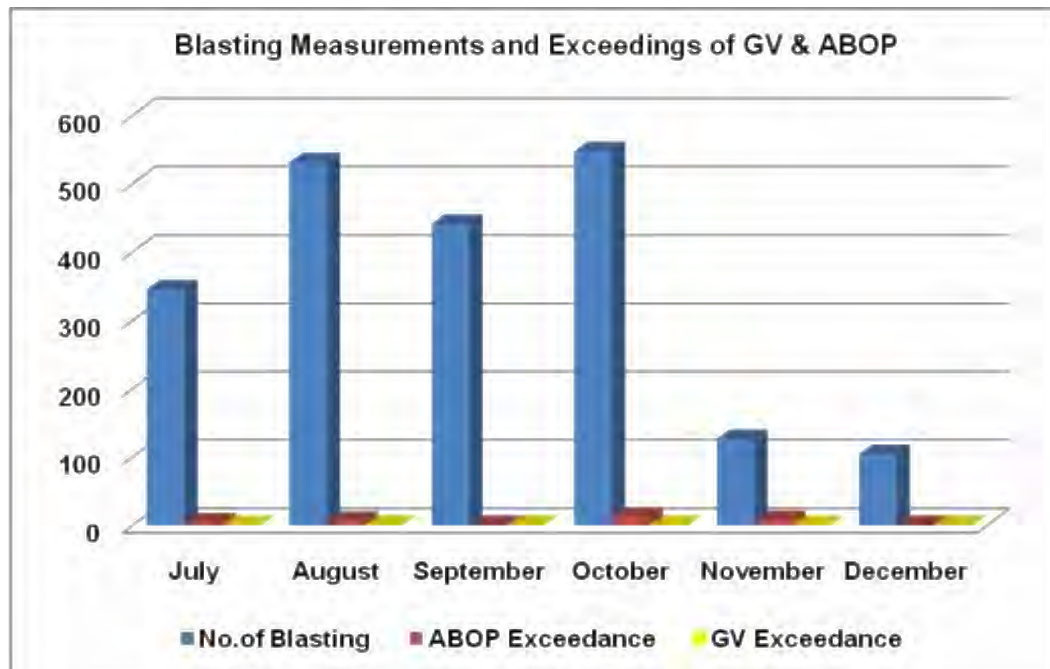
**Table 21- Rock blasting locations of the reporting period**

Location Ch.	July	Aug	Sept	Oct	Nov	Dec
36+100~36+370					Yellow	Red
37+400~37+830		Brown	Green	Orange		Red
42+200~42+500	Blue	Brown	Green	Orange		
46+900~47+400	Blue	Brown			Yellow	Red
48+100~48+300		Brown	Green	Orange	Yellow	Red
48+360~48+700		Brown	Green	Orange	Yellow	Red
48+970~49+030			Green	Orange	Yellow	Red
49+100~49+400	Blue					
49+200~49+470		Brown	Green	Orange	Yellow	Red
49+510~49+700	Blue	Brown	Green	Orange		
50+900~51+200	Blue	Brown	Green	Orange		
55+440~55+470			Green	Orange		
57+200~57+400			Green	Orange	Yellow	
62+200~62+400	Blue	Brown	Green	Orange	Yellow	
62+900~63+000		Brown			Yellow	
64+100~64+400	Blue					
66+400~66+440					Yellow	

**Table 22 - Status of Blasting: Air blast over pressure and ground vibration exceedance**

Month	Locations	No.of Blasting	ABOP Exceedance	GV Exceedance
July	07	345	04	0
August	10	531	06	0
September	11	441	00	0
October	11	547	11	0
November	10	126	07	0
December	07	104	00	0

Air blast over pressure and ground vibration was measured at the complaints houses during the blasting take place. Figure-6 shows the number of measurements carried out during the months July to December 2009 and the number of exceeding of ABOP and Ground vibration.



**Figure 7- Number of Blasting Measurements and Exceeding of GV & ABOP**

During the reporting period, 2094 numbers of blasting were monitored by GSMB. 28 Numbers of exceeding of Air blast over pressure measurements were reported during this period. Moreover, ground vibrations exceeding were not recorded during this period. Test blast is carried out at every location prior to production blasts to obtain GSMB mining license and Environmental recommendation from CEA.

The impacts to the public owing to rock blasting were minimized by evacuating on long term and short-term basis according to the conditions in the Mining Licenses with paying an evacuation fee. Fly rocks have been controlled by using an appropriate covering method (Heavy Blasting Net).

#### 4.4.1 Ground Vibration at Premises of Public Complaints

Baseline noise monitoring results have been described in Noise Monitoring Report in 2003.

Noise level monitoring has not been carried out during the reporting period at non-blasting sites.

Monitoring of ground vibration generated owing to constructional activities (compaction) has been carried out during the reporting period based on public complaints and the monitoring results are given in the Table No. 25. The results reveal that vibration generated owing to compaction is within maximum permissible level for continuous vibration as specified in the Interim Standards, except at two locations.

**Table 23- Ground Vibration measured at Premises on Public Complaints**

Date 2009	Location	Name of the House owner	Activity	Dominant frequency (Hz.)	PPV from event (mm/sec)	Remarks
24.07	Ch37+400 (LHS)	Mrs. M.K.M. Rohini	Compaction	7.4 Hz.	0.889mm/s	Measured level is within limit
04.08	Ch43+950 (RHS)	Mr. H.W. Rathnapala	Compaction	7.5 Hz.	0.635mm/s	Measured level is within limit
04.08	Ch44+000 (RHS)	Mrs. Malani Horwalawithana	Compaction	Over 50Hz.	1.02mm/s	Measured level is within limit
24.09	Ch43+650 (RHS)	Mr. U.D.C. Gunasinghe	Compaction	13.5 Hz.	1.89mm/s	Measured level is within limit
05.10	Ch41+600 (LHS)	Mr. U.D.C. Gunasinghe	Compaction	20.7 Hz.	1.92mm/s	Measured level is within limit
05.10	Ch44+360 (RHS)	Mr.Dinesh Siriwardana	Compaction	20.7 Hz.	0.923mm/s	Measured level is within limit

16.10	Ch43+920 (RHS)	Mr. H.W. Rathnapala	Compaction	13.9 Hz.	2.42mm/s	Measured level was exceeded the maximum permissible limit
27.10	Ch59+420 (LHS)	Mrs.Disna Priyangani	Compaction	20.0 Hz.	1.48mm/s	Measured level is within limit
27.10	Ch58+100 (LHS)	Mr. P. Edirisinghe	Compaction	18.0Hz.	1.75mm/s	Measured level is within limit
27.11	Ch65+500 (RHS)	Mr. D.G. Walter	Compaction	22.0 Hz.	2.44mm/s	Measured level was exceeded the maximum permissible limit
16.12	Ch58+100 (LHS)	Mr. P. Edirisinghe	Compaction	28.0Hz.	0.746mm/s	Measured level is within limit
21.12	Ch39+100 (RHS)	Mrs.W.K. Lilee Gunawathie	Compaction	20 Hz.	0.584mm/s	Measured level is within limit

#### 4.5 Extraction, Handling, transportation and Storage of Construction Materials

To minimize contamination of the surroundings due to Implementation of works, asphalt, concrete and metal crushing plants.

##### 4.5.1 Mitigation Measures

- Excavation material from the borrow pits should be carried out without creating unsuitable surfaces of excavation such as near vertical slopes. List of borrow areas to be prepared one month prior to stage 2 construction. A list of routes of transport of construction materials is to be prepared for the contract and agreed one month prior to constructions. In case substantial additional materials will be required and will be sourced from wooden sites, replacement of trees and woodland at a ration 3:1 and include in progress report.

- Avoid as much as possible, excavation and transportation of soil during rainy weather conditions.
- When excavated material within the trace are used as fill material, proper planning and management of cut and fill operations to minimize distance of transport and temporary storage.
  1. Before beginning of the construction, the cut sections and the corresponding fill sections are marked on a map for the entire trace considering distance of transport, easiness of transport, construction process etc.
  2. The map is revised regularly depending on the progress of construction.
  3. As much as possible, direct transportation of the exploited construction material from generated location to the fill section should be practice without keeping the exploited material in temporary storage.
- Maintaining and inventorying of the volume of exploited material in temporary storage and revision of the construction sequence to minimize the volume in temporary storage.
- Update material management plan monthly and include in progress report

## **5.0 STATUS OF ENVIRONMENTAL LICENSES AND PERMITS**

According to the Mining and Mineral Act No 33, 1992 and National Environmental Act, No. 47 of 1980 and its subsequent amendments, relevant licenses should be obtained from GSMB and CEA respectively.

For the month of July 2009, two Environmental Recommendations were obtained for two Unsuitable Material Disposal sites.

For the month of August 2009, three Environmental Recommendations for Borrow Pits, Environmental Recommendation for disposal yard and three mining licenses for rock blasting were obtained.

For the month of September 2009, one Mining License for rock blasting and one Mining License for a Borrow Pit were obtained.

For the month of October 2009, an Environmental Recommendation and one Mining License were obtained for two Borrow Pits.

For the month of November 2009, an Environmental Recommendation for a Disposal Yard was obtained.

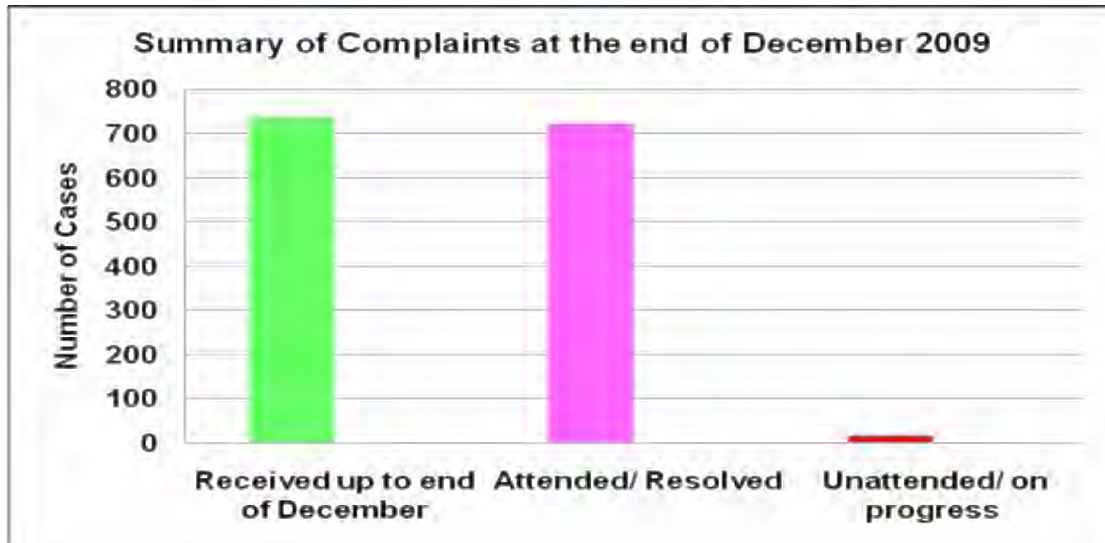
For the month of December 2009, two Mining Licenses for Rock Blasting were obtained.

## 6. PUBLIC COMPLAINTS

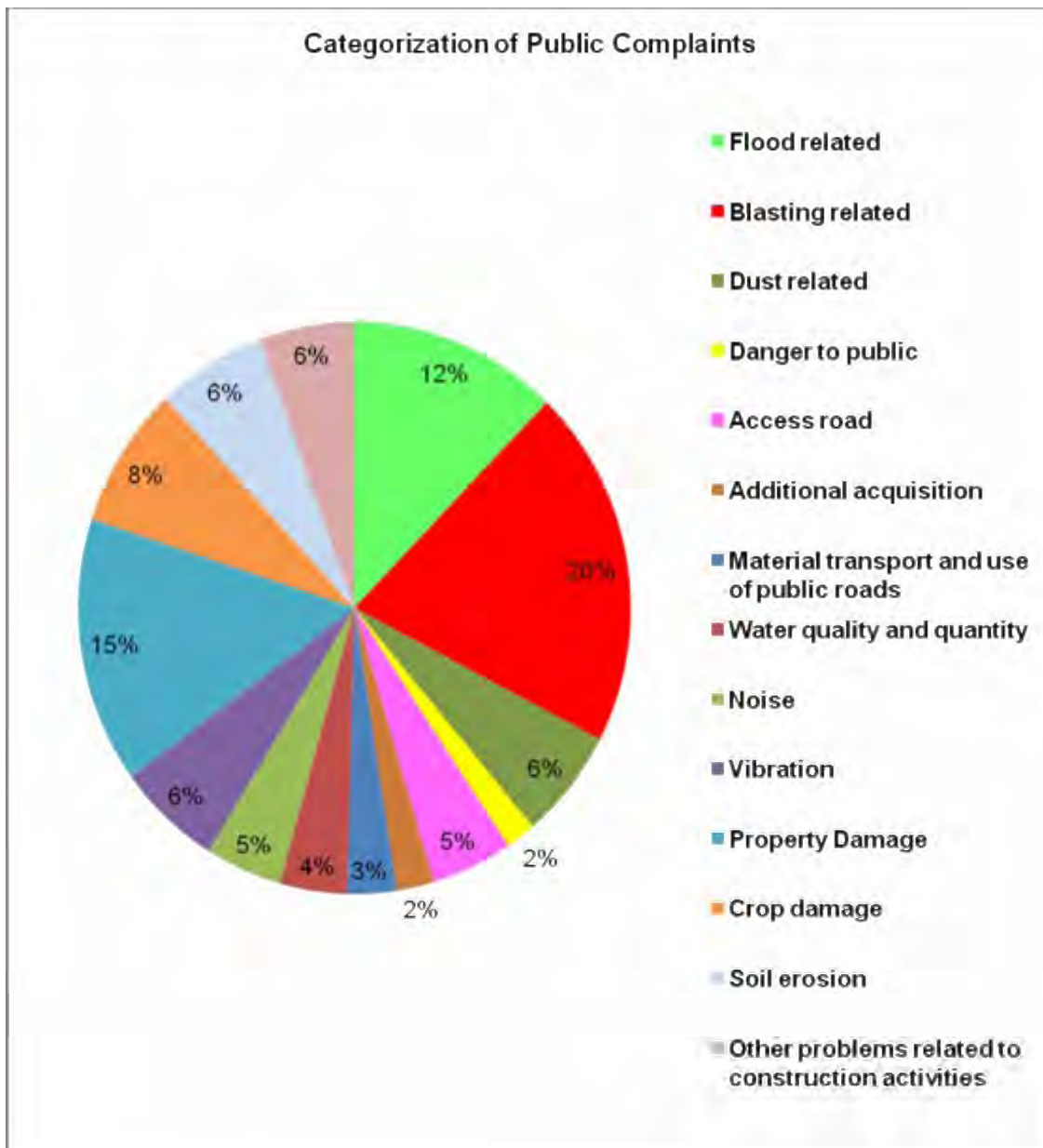
The summaries of the public complaints recorded from January 2007 to reporting period are given below.

**Table 24: A Summary of Public Complaints**

#	Complaint Category	Number of Complaints Recorded up to Reporting Period	Total No. of Complaints Attended/ Resolved	Complaints Unattended/ on progress
1	Flood related	90	89	1
2	Blasting related	150	147	3
3	Dust related	46	46	0
4	Danger to public	13	12	1
5	Access road	35	35	0
6	Additional acquisition	16	16	0
7	Material transport and use of public roads	21	20	1
8	Water quality and quantity	29	29	0
9	Noise	33	31	2
10	Vibration	45	45	0
11	Property Damage	111	109	2
12	Crop damage	59	56	3
13	Soil erosion	47	47	0
14	Other problems related to construction activities	41	40	1
	<b>Total</b>	<b>736</b>	<b>722</b>	<b>14</b>



**Figure 8: Summary of the complaints and complaints resolution up to December 2009.**



**Figure 9 - Categorization of Public Complaints**

## **7.0. SOCIAL IMPACTS**

The Contractor, Supervision Engineer, and the Employer have formed the joint committee to investigate the complaints. Combined meetings were held to monitor Public Complaints Resolving Monitoring (PRCM) during this period.

Families affected due to project activities have been identified. Actions have taken to evacuate the people residing in 100m radius from the blasting location and paying necessary evacuation fees. The vulnerable people subject to high risk owing to blasting have been evacuated on long-term temporary basis. In addition, income losses of the people from tea plucking and rubber latex tapping activities due to above evacuation have been paid as per the recommendations made by the Grievance Resolving Committee.

## **8.0. CONCLUSIONS AND RECOMMENDATIONS**

Environmental impacts due to construction activities of the STDP were minimized according to the description of planned mitigation measures outlined in the EMP. A summary of the mitigation measures adopted during the reporting period and the effectiveness of the mitigation measures and further actions recommended for improving the mitigation measures are given in the below Tables 25 and 26.

**Table: 25 Effectiveness of Mitigation Measures adopted from July to December, 2009.**

Environmental Concern.	Effectiveness of Mitigation Measures	Further Action	
1.	<p><b>Hydrology and drainage aspects</b></p>	<p>Flood situation recorded due to heavy rains during November but any adverse impact to upstream was not recorded.</p> <p>Contractor has taken action to clean the following drainage culverts to prevent any drainage impacts in the upstream.</p> <p>35+709 (PC), 36+720 (PC),36+805 (PC), 36+857 (PC), 37+363 (BC), 37+938 (PC), 38+042 (PC), 38+760 (PC), 39+091 (BC), 39+362 (PC), 40+068 (BC), 40+168 (BC), 40+628 (BC), 41+973 (PC), 43+400 (PC), 43+560 (PC), 44+354 (PC), 44+715 (PC).</p> <p>Ground water levels at locations suggested in FDR and at CVC areas have been monitored and the results reveal that no significant drop in the water levels; therefore no need for any mitigation measures.</p> <p>Contractor has been instructed to erect flood gauges at locations vulnerable for flooding but his compliance with the same is unsatisfactory.</p>	<p>Contractor should maintain the drainage culverts in a regular basis in order to prevent any drainage impact in the upstream.</p> <p>Erection of flood gauges should be done very urgently.</p> <p>Engineer to monitor.</p>
2.	<p><b>Water Quality</b></p>	<p>Contractor has taken action implement erosion and sedimentation control measures such as construction of sediment barriers, trenches and covering the embankments.</p> <p>Also Contractor has taken actions to adopt erosion control measures at following locations where severe siltation has been reported.</p> <p>Ch.63+000(LHS), Ch.63+530~Ch.63+740(LHS), Ch.64+000 (LHS) and Ch.65+500(LHS).</p> <p>Regular removing of sewage from Employee's Accommodation at Ch. 49+500 RHS is being practiced by the Contractor as per the conditions in the EPL.</p> <p>pH and salinity in water discharged from the CVC areas comply with the General Standards for Discharge of Effluent into Inland Surface Waters, stipulated by the CEA.</p>	<p>Contractor should well maintain the measures adopted to erosion control.</p> <p>Contractor to implement his plan to improve the wastewater treatment process in the batching plant at Ch. 49+500 (RHS) very urgently and submit of a fresh analytical report of the treated wastewater.</p> <p>Also Contractor to submit compliance monitoring reports for the Concrete Batching Plant and Foreign Employees</p>



Environmental Concern.	Effectiveness of Mitigation Measures	Further Action
	<p>Also the analytical report of the quality of the water in the surface water bodies reveals that construction of the expressway has no contribution to any change in the pH and TSS values of such water bodies.</p> <p>Contractor has still not taken action to;</p> <ol style="list-style-type: none"> <li>1. submit of a fresh analytical report of the treated wastewater discharged from the Concrete Batching Plant at Ch. 49+500 to confirm that pH and TSS are complying with the standards and</li> <li>2. submit compliance monitoring reports for the Concrete Batching Plant and Foreign Employees Accommodation at Ch. 49+500.</li> </ol> <p>However, Contractor has submitted his plan to improve the wastewater treatment process in the batching plant.</p>	<p>Accommodation at Ch. 49+500.</p> <p>Contractor to monitor compliance with the conditions in EPLs issued for the Employee's Accommodation and Concrete Batching Plant at Ch. 49+500 jointly with the Engineer immediately.</p> <p>Engineer to monitor.</p>
3.	<p><b>Ground water quality</b></p> <p>Disposal of unsuitable materials from construction activities has been conducted in accordance with the conditions laid down in the CEA approval letter and the approved work plan by the Engineer.</p> <p>No monitoring of the water quality in the wells close to disposal sites has been carried out during the reporting period.</p>	<p>Water quality in wells at new disposal sites should be monitored by the Contractor prior to start disposal activities.</p> <p>Engineer to monitor.</p>
4.	<p><b>Air quality</b></p> <p>All heavy equipment and machinery have been regularly maintained to avoid smoke emissions.</p> <p>Speed limits have been rigorously enforced within ROW.</p> <p>Dust emanation owing to operation of vehicles on the pilot road has been controlled by frequent watering.</p> <p>Fugitive dust emission has been control by covering the vehicles deployed for materials transportation. Every necessary action has been taken by the Contractor to mitigate dust emission from the stone crusher plants according to the Conditions in the Environmental Protection Licences issued by the CEA.</p> <p>Contractor has taken action to install dust collectors in track drill machines.</p>	<p>Contractor should ensure that frequency of watering the pilot road is compatible with the prevailing weather conditions.</p> <p>Engineer to monitor. The Contractor should take firm action to the high speed vehicles because the vehicle speed limit appears to have not been adhered to by the some vehicles in the site.</p> <p>Contractor shall ensure that track drill machines are in well fitted condition to operate at the site.</p>



Environmental Concern.	Effectiveness of Mitigation Measures	Further Action
5.	<p><b>Noise/ Ground Vibration</b></p> <p>Heavy equipment operations have been restricted to day hours at sensitive locations.</p> <p>Vibration and air blast over pressure generated owing to rock blasting have been minimized by controlled rock blasting.</p> <p>During the reporting period, 2094 numbers of blasting were monitored by GSMB. 28 numbers of exceeding of Air blast over pressure measurements were reported. Ground vibrations exceeding were not recorded during this period.</p> <p>Fly rocks have been controlled by an appropriate covering method approved by the GSMB and Engineer.</p> <p>Monitoring of vibration levels owing to compaction at 12 premises of public complaints has been carried out and measured values reveals that vibration levels is within the maximum permissible levels as specified in interim standards, except at two locations.</p> <p>The possible life hazards to people living vicinity to blasting locations were minimized by implementing a proper evacuation procedure.</p> <p>Monitoring of vibration levels owing to compaction at the premises of a public complaint (at Ch. 65+520 RHS) has been carried out and measured values show non compliance with the maximum permissible levels as specified in interim standards.</p> <p>Contractor therefore has taken action to evacuate the AP's long term until such time of finishing compaction at the said location.</p>	<p>Engineer to monitor</p> <p>If ABOP increase is very frequent, Contractor to change the rock blasting parameters to comply the ABOP with the standards.</p>
6.	<p><b>Soil erosion/ Surface run off</b></p> <p>Cut areas have been configured to maintain stability of the slopes.</p> <p>Turfing activities and construction of cut off drains, toe drains, vertical drains have been started and still continuing.</p>	<p>The Contractor should maintain silt drains and other measures adopted in a regular manner and should provide adequate silt control measures to all vulnerable locations for erosion.</p> <p>Engineer to monitor.</p>




Environmental Concern.	Effectiveness of Mitigation Measures	Further Action
7. <b>Extraction, Handling, Transportation and Storage of Construction materials</b>	<p>Borrow pit operation at Ch. 59+500 (RHS) is not according to the conditions in the CEA approval letters due to;</p> <ol style="list-style-type: none"> <li>1. close of side drain of the Eliptiya-Uragaha Road.</li> <li>2. damage to public road due to hauling of borrow materials and</li> <li>3. mining is being done in an improper manner up to boundary without keeping the required gradient at least 1:1 and burms which may therefore bring about adverse impacts to the neighbouring public and their properties if such cut slops are collapsed.</li> </ol> <p>Also same situation reported at Borrow pit at Ch. 56+100 as operation without keeping the required gradient.</p> <p>Contractor has taken action to stop disposal activities at Ch. 64+000 (LHS) as exceeding of its carrying capacity.</p> <p>Storage of construction materials are mainly been carried out within ROW and appropriate protection methods such as compacting, covering with geotextiles etc. have been implemented to avoid erosion of such stored materials.</p>	<p>Contractor should ensure that conditions in the CEA approval letters and GSMB mining Licences are compiled during operation of borrow pits very essentially.</p> <p>Also Contractor to ensure that the erosion control measures adopted at disposal site at Ch. 64+100 is well maintained until the disposal site naturally is established.</p> <p>Engineer to monitor.</p>
8. <b>Slope stability</b>	<p>Surface water infiltration into the cut slopes has been minimized by providing cut off drains.</p> <p>However the cut slopes of the borrow pits at Ch. 54+500 and Ch. 56+100 is not complying with CEA conditions.</p> <p>Turfing has been started and still continuing.</p>	<p>Engineer to monitor.</p>
9. <b>Solid wastes management</b>	<p>Still haphazard disposal of solid wastes takes place within the Employee's Accommodation at Ch. 49+500; however Contractor has planned a solid wastes management system.</p>	<p>Contractor to implement the solid waste management plan for the said accommodation as a matter of urgency.</p>
10. <b>Safety precautions for workers and general public.</b>	<p>In generally safety measures adopted by the Contractor is satisfactory.</p> <p>Workers orientation programs have been conducted by the Contractor's Safety Team.</p> <p>Flagmen have been deployed at every locations where public roads cross the ROW to minimize any traffic accidents.</p> <p>Also Contractor has taken action to prevent</p>	<p>Joint field investigations (safety patrol) to be made to identify shortcomings.</p> <p>Contractor and Engineer to conduct joint field investigations.</p>




Environmental Concern.	Effectiveness of Mitigation Measures	Further Action
	<p>trespassing of unauthorized persons by erecting warning banners and to aware the public on danger of such trespassing by distributing leaflets etc.</p> <p>However, the MC observed that</p> <ul style="list-style-type: none"> <li>- some small children had been roaming/playing at the pipe culvert, an unsafe water logged area at Ch. 58+050 (LHS).</li> </ul> <p>Although safety barricade tapes had been fixed on the road trace, no barricades were installed at the village side.</p> <ul style="list-style-type: none"> <li>- water ponding area under the bridge which was not barricaded and little children had been playing close to the water pond at Ch. 44+800.</li> </ul>	<p>MC informed the CSC to instruct the Contractor to</p> <ul style="list-style-type: none"> <li>- provide sufficient Safety Barricades at the village side</li> <li>- erect warning banners.</li> <li>- conduct awareness programmes again for parents.</li> </ul> <p>MC inform the CSC to instruct the Contractor to</p> <ul style="list-style-type: none"> <li>- dewater the water pond</li> <li>- barricade the area</li> <li>- exhibit warning signs and banners as to see the people not to give opportunity to the children to enter this unsafe area.</li> </ul> <p>Only dewatering was observed.</p>
11.	<p><b>Social Impacts</b></p> <p>Claims/complaints of the people on construction nuisance/damages close to ROW has been considered and responded by the Contractor.</p> <p>The possible life hazards to people living vicinity to blasting locations were minimized by implementing a proper evacuation procedure.</p> <p>Public Complaints Resolving Monitoring Committee Meeting held to make recommendations for resolving public complaints.</p>	<p>Engineer to monitor.</p>


**Table 26: Environmental Impact Mitigation Works Undertaken During the Period (July – December 2009)**

Environmental Concern	Objectives	Impact and location	Mitigation measures implemented	Comments/Status
<p><b>1. Hydrology and Drainage</b></p>	<p>1.To ensure the proper implementation of activities mentioned in CEA conditional approval letter and</p> <p>2.To avoid deterioration of water quality, sedimentation, temporary flooding, creation of stagnant water bodies and effects on ground water level and quality</p>	<p>1. Soil erosion and sedimentation experienced at locations, vulnerable to erosion (silting of culverts, sediment basins and trenches).</p>	<p>1. Erosion and sedimentation control measures such as construction of sediment basins, trenches, covering the embankments and de-silting of culverts, sediment basins and trenches have been implemented at sites vulnerable to erosion.</p>  <p>Ch.36+857</p>	<p>1. However, at following locations, de-silting of culverts has still not been completed.</p> <p>Ch.60+500(LHS), Ch. 57+520(RHS), Ch. 37+000~Ch.38+000(LHS)</p>  <p>Sand bags piled at the edge of the embankment were torn.</p> <p><b><i>(Instructions have been given)</i></b></p>

<p><b>1. Hydrology and Drainage</b></p>		<p>2. Lack of lead away to cater the storm water and inundation of pilot road.(some places along the pilot road) Ch. 46+420 (LHS)</p>  <p>3 No required flood release openings in areas such as Ch. 45+300-Ch. 46+620 (Welipenna Flood Plane) and Ch. 47+500-Ch. 48+100 (Miriswatte Flood Plane)</p> <p>4. Public complaints regarding flood issues</p>	<p>2. Improvement of toe drains to facilitate drainage.</p>  <p>3. As in the permanent road, design has been kept due to difficult to provide such openings since construction activities are still underway.</p> <p>4. Contractor has taken necessary steps to attend/ resolve these complaints. Systematically collected and analyzed the complaints on drainage issues.</p>	<p>2. Successful, However, regular maintenance required. However, the Contractor should take precautionary actions to prevent pilot road flooding.</p> <p>3. Flood release openings should be provided Till permanent structures are completed contractor should take measures to facilitate proper drainage at all vulnerable locations for flood and at areas where difficulty to take such action Contractor should be vigilant on any damage to outsiders due to flood aggravated with necessary action to implement the contingency plan.</p> <p>4. Out of 90 complaints related to flood issues, 89 complaints have been attended/ resolved. (See, Table 26 at Chapter 6).</p>
---	--	---	---	--

<p><b>1. Hydrology and Drainage</b></p>		<p>5. Lack of lead away to cater the storm water, and, Inadequacy of capacity of lead away beyond ROW. (Lead away drainage issue is one of the leading issues of the project) E.g. Ch 54+ area</p> <p>6. Expected flood issues due to inadequacy of capacity of Irrigation channels. E.g. Lewwanduwa Ela, Paraigama Ela and Parallel channel along the Ela, Duwa Ela, Lanthiri Ela, Welipenna flood prone area</p>	<p>5. After improvement</p>   	<p>5. Frequently cleaning is required (Remaining).</p> <p>6. Improvement activities are Successful. However, regular cleaning and maintenance is required. (← Improvement of Irrigation channels and construction of drainage structure at Ch. 46+ 480 - Welipenna flood prone area)</p>
---	--	--	---	--

<p><b>2. Surface and Ground Water Quality</b></p>	<p>1.To ensure the proper implementation of activities mentioned in CEA conditional approval letter and</p> <p>2.To avoid deterioration of water quality and prevent adverse water quality impacts due to negligence</p>	<p>7. Flood situation recorded due to heavy rains. E.g. Up stream flood at Ch. 45+300 (LHS)</p>  <p>8. Expected drop in the water levels and deterioration of water quality in the water levels at locations suggested in FDR at CVC areas.</p>	<p>7. Any adverse impact to upstream was not recorded. E.g. Down stream flood at Ch. 45+300 (RHS)</p>  <p>8. Ground water levels and water quality at locations suggested in FDR and at CVC areas have been monitored by the contractor.</p>  <p>Public complaint on contamination of well with silt has been attended and cleaned by dewatering. Ch. 50+500 (RHS)</p>	<p>7. No any adverse flood situation recorded.</p> <p>8. Results reveal that no significant drop in the water levels and salinity and pH in water discharged from the CVC areas may not adversely affect to the environment; therefore need for any mitigation measures did not arise. (Refer Chapter 4.2-Table 19 &amp; Figure 03, Table 20, Table 21 - Figure 05 &amp; Figure 06).</p> <p>If such regular pH monitoring reveals any kind of adverse effect to environment, Contractor should take immediate actions to adjust pH in CVC water to permissible levels prior to discharge.</p>
---	--	---	---	---

<p><b>2. Surface and Ground Water Quality</b></p>		<p>9. Oil spills from machinery, construction vehicles and equipments</p> <p>10. Discharging wastewater generated from the concrete batching plant at 59+700 in to a natural water way.</p>	 <p>9. Regular and proper maintenance of machinery, construction vehicles, and equipments have been carried out to prevent oil spills.</p> <p>10. Wastewater generated from the concrete batching plants at 59+700 is being treated using sedimentation tanks prior to discharge</p>	<p>9. Contractor shall ensure that any oil contaminated water discharge to water bodies from machinery, construction vehicles, and equipments is prevented and to maintain them in proper working order.</p> <p>10. The treatment process of the wastewater in the batching plant at Ch. 49+500 is not satisfactory; Batching plant's wastewater has been sampled by the University of Moratuwa on 01<sup>st</sup> July 2009 for quality analysis as per the conditions in the EPL and the report of the same reveals that the level of pH and Total Suspended Solids has not been maintained according to the tolerance limit of the CEA.</p> <p>Contractor should take Immediate action to upgrade the sedimentation tanks and Engineer, Management Consultant and Employer to monitor through joint field inspection.</p>
---	--	---	---	--

**2. Surface and Ground Water Quality**

11. Disposal of spoil materials from construction activities.

12. Open discharge of domestic wastewater and haphazard disposal of solid wastes in the Foreign Employees dormitory at Ch. 49+500.



Regular removing of sewage from Employee's Accommodation at Ch. 49+ 500 (RHS) is being practiced by the Contractor as per the conditions in the EPL.



11. Disposal of spoil materials from construction activities has been conducted in accordance with the conditions in the CEA approval letter and the work plan approved by the Engineer.

12. Contractor has attended and rectified. Introduction of a Solid Waste Management system



11. Contractor should adhere to the conditions in the Environmental Protection Licence (EPL) issued for the foreign employee's accommodations and motor pool very essentially.

12. Rectified according to the conditions in the Environmental Protection Licence (EPL)

<p><b>2. Surface and Ground Water Quality</b></p>		<p>13. Water quality deterioration due to unsuitable materials disposal within ROW.</p>	<p>13. Temporally disposed unsuitable materials within ROW should be removed to approved locations. Monitoring pH in a well close proximity to disposal site at Ch. 44+180</p> 	<p>13. Contractor should take action to remove temporally disposed unsuitable materials within ROW to approved locations.</p>
<p><b>3. Soil erosion / Surface runoff</b></p>	<p>1. To minimize soil erosion due to the construction activities of highway</p> <p>2. To prevent adverse water quality impacts due to negligence</p> <p>3. To ensure unavoidable impacts are managed effectively</p>	<p>14. Erosion and sedimentation due to unsuitable materials loosely disposed adjacent the ROW. E.g. Ch. 64+100 (LHS) Soil and silt washed out from the unsuitable soil disposal site are deposited onto a Cinnamon cultivated land during the rainy season.</p> 	<p>14. Sufficient mitigation measures not yet taken by the Contractor. However, check dams were built across the drain.</p>	<p>14. Contractor should take action to compact loosely disposed soil and debris should be compacted. The Cinnamon cultivated land should be desilted. A drain and check dams to be constructed around the disposal sites.</p>

<p><b>3. Soil erosion / Surface runoff</b></p>		<p>15. Soil erosion and sedimentation from the Embankments, Cut areas, and stockpiles.</p> 	<p>15. Erosion and sedimentation control measures such as construction of sediment basins, trenches, and covering the embankments have been implemented at sites vulnerable to erosion.</p>  <p>Toe drains are being constructed along ROW to prevent erosion and silting.</p>  <p>Silt barrier provided at Ch. 63+000 (Excavation area)</p>	<p>15. However, in some places erosion and sedimentation happen. E.g. Ch.57+500 (RHS), Ch.57+200 (RHS), Ch.48+ (RHS),</p> <p><i>(Instructions have been given to the Contractor to take immediate action to control the situation)</i></p> <p>Regular maintenance required.</p>
--	--	---	--	---

**3. Soil erosion /  
Surface run-  
off**



Provision of drainage at disposal site at Ch. 50+500 (RHS)










Embankment erosion control measures at Ch. 58+700











The Polythene sheets should be extended to prevent soil erosion.


No or less siltation issues are an advantage of rock embankments.

<p><b>3. Soil erosion / Surface runoff</b></p>		<p>16. Paddy land siltation</p> 	<p>Rock embankment location at Ch. 48+300 area.</p> <p>16. Mitigation measures applied to control siltation of the paddy fields by embankment erosion. E.g. Ch. 58+700 (LHS) Ch.40+061(RHS),</p>  <p>Rubble barrier constructed to prevent erosion at Ch. 58+700(LHS)</p>  <p>Toe drain provided at Ch. 58+700 (LHS)</p>	<p>16. Paddy land siltation due to lack of mitigation measures were noticed in some area. E.g. Ch.62+900(RHS), Ch. 37+950 (LHS)</p>
--	--	--	--	---

<p><b>3. Soil erosion / Surface run-off</b></p>		<p>7. Soil erosion and sedimentation from the, Cut areas.</p>  <p>18. Accidental siltation issues</p>	 <p>17. cut slopes turfing</p>  <p>18. Accidental siltation issues were solved by compensating. Evaluating the damages to paddy fields and crop lands due to siltation by Taisei Environment Officers joint hand with the farmers</p> 	<p>Regular maintenance required.</p> <p>17. Cut slopes turfing activities have been started and continuing.</p> <p>18. Contractor should take firm actions to mitigate such accidental siltation.</p>
---	--	---	---	---

<p><b>4.Air Quality</b></p>	<p>1.To ensure the proper implementation of activities mentioned in CEA conditional approval letter and</p> <p>2.To avoid deterioration of air quality and prevent adverse impacts due to construction activities</p>	<p>19. Smoke emissions from heavy vehicles and machinery, dust emanation owing to operation of vehicles on the pilot road and dust emission from track drill machines</p>  <p>20. Dust emanation owing to operation of the Stone Crushing Plant.</p> 	<p>19. All heavy equipment and machinery have been regularly maintained to avoid smoke emissions.</p> <p>Speed limits have been rigorously enforced within ROW (30Km/hr).</p> <p>Dust emanation owing to operation of vehicles on the pilot road has been controlled by frequent watering.</p>  <p>20. Dust screen has been erected to control dust emission and water sprinklers have been operated.</p> 	<p>19. The vehicle speed limit appears to have not been adhered to by the Contractor's vehicles.</p> <p>Pilot road should be wetted adequately and the frequency of watering should be increased in the dry period. E.g. Ch. 36 ~ 37 and Ch. 41 area</p> <p>20. Completed. Regular maintenance required</p> 
-----------------------------	---	---	--	---

<p><b>4. Air Quality</b></p>		<p>21. Uncontrolled dust emission from track drill machines were observed during this period also due to failures in dust absorption systems.</p>	<p>21. Heavy equipment operations have been restricted to daylight hours in sensitive locations.</p> <p>Vibration and air blast over pressure have been minimized by controlled rock blasting activities and with implementing proper evacuation procedure.</p> <p>The ground vibration and air blast over pressure levels generated owing to rock blasting is complied with the maximum permissible levels as specified in interim standards except an increase of air blast over pressure in twenty eight instances out of 2094 No's of blasting.</p>	<p>21. However Contractor has taken action to install dust collectors.</p> <p>Contractor shall ensure that track drill machines are in well fitted condition to operate at the site.</p> 
<p><b>5. Noise/ Ground vibration</b></p>	<p>1. To minimize excessive Noise and Ground vibration due to the construction activities of highway</p>	<p>22. Noise and Ground vibration due to heavy equipment operations, rock blasting activities and noise generated from CVC generators and pumps.</p> 	<p>22. Fly rocks have been controlled by an appropriate covering method approved by the GSMB and Engineer.</p> 	

<p><b>5. Noise/ Ground vibration</b></p>		<p>26. Weaknesses of safety measures.</p> <p>Small children were roaming/playing at the pipe culvert, an unsafe water logged area. Ch. 58+050 (LHS)</p>	<p>23. Monitoring of vibration levels owing to compaction at 12 premises of public complaints has been carried out and results reveal that vibration generated owing to compaction is within maximum permissible level for continuous vibration as specified in the Interim Standards, except at two locations.</p> <p>24. Proper monitoring of the houses adjacent to ROW to ascertain the impacts.</p>  <p>25. Sound proof generator provided for CVC Area to minimize sound pollution.</p> <p>26. Informed to tighten the safety measures. Sufficient Safety Barricades to be provided at the village side and warning banners should be erected. Awareness programmes should also be conducted again for parents.</p>	<p>23. Contractor shall ensure to maintain Noise and Ground vibration levels within appropriate limits.</p> <p>24. Contractor has taken action to calibrate (performance test) his sound meter (noise monitoring equipment) through the Industrial Technology Institute (ITI); but no calibration reports for the vibration monitoring equipment has been submitted to-date.</p> <p>Engineer to monitor.</p>
--	--	---	--	--

**6. Safety Issues**

Although safety barricade tapes have been fixed on the road trace, no barricades installed at the village side.



27. Water ponding area under the bridge has not barricaded. Little children were playing close to the water pond. Ch. 44+800



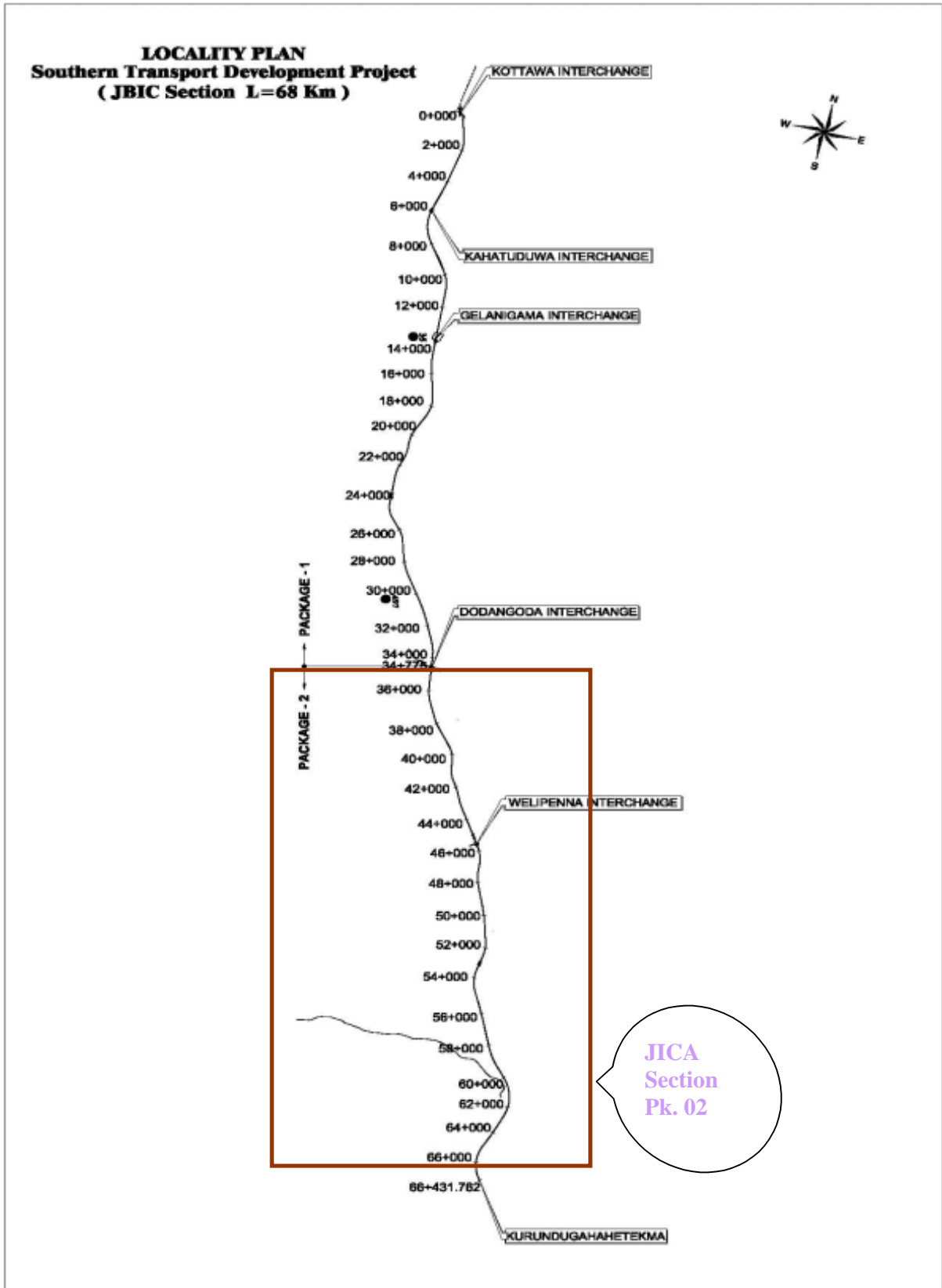
27. Inform the CSC to instruct the Contractor to  
- dewater the water pond  
- barricade the area  
- exhibit warning signs and banners as to see the people not to give opportunity to the children to enter this unsafe area.

27. Only dewatering has done.

## **ANNEX I**

### **Location Map**

ANNEX I Location Map



**ANNEX II**

**ENVIRONMENTAL PERMITS AND LICENCES GRANTED**

<b>Location No.</b>	<b>Purpose</b>	<b>Chainage</b>	<b>Type of Licence /Approval</b>	<b>Issuing Authority</b>	<b>Date of Issue</b>	<b>Validation Period</b>	<b>Status</b>
1	Batching Plant	49+500	Environmental Clearance	CEA	08.05.07	-	
			Building approval	Local Authority (Walallawita PS)	-	-	
			Environmental Protection Licence (No. 01965 (R0))	CEA	15.10.07	15.10.07-14.10.2010	
2	Borrow Pit	51+000-51+300	Environmental Clearance	CEA	08.10.2007	-	
			Mining Licence (No. IML/A/MD/7676)	GSMB	12.09.2007	One year from the date of issue	
3	Borrow Pit	51+100	Environmental Clearance	CEA	15.06.07	-	
			Mining Licence (No. IML/A/MD/7183)	GSMB	11.07.2007	One year from the date of issue	
4	Borrow Pit	Horawala	Environmental Clearance	CEA	02.05.2008	-	
			Mining Licence (No. IML/A/MD/8975)	GSMB	08.04.2008	One year from the date of issue	
5	Disposal Site	39+100	Environmental Clearance	CEA	16.11.06	-	Already completed
6	Disposal Site	42+600	Environmental Clearance	CEA	27.03.2008	One year from the date of issue	Already completed
7	Disposal Site	43+600	Environmental Clearance	CEA	27.03.2008	-	Already completed
8	Disposal Site	49+000	Environmental Clearance	CEA	26.02.2008	One year from the date of issue	Already completed
9	Disposal Site	51+600	Environmental Clearance	CEA	26.01.07	-	

Location No.	Purpose	Chainage	Type of Licence /Approval	Issuing Authority	Date of Issue	Validation Period	Status
10	Disposal Site	56+900	Environmental Clearance	CEA	08.02.2008	-	
11	Disposal Site	61+000	Environmental Clearance	CEA	11.10.2007	-	Already completed
12	Disposal Site	64+100	Environmental Clearance	CEA	January 2008	-	Already completed
13	Disposal Site	Yatadolawatte – Matugama Pradeshiya Sabha Area.	Environmental Recommendation (Issued for CML-Sub Contractor)	CEA	15.02.2008		
14	Disposal Site	Pahanwatte 35+500	Environmental Clearance	CEA	24.04.2008	-	
15	Rock Blasting	42+200-42+500	Environmental Approval	CEA	28.02.2008	-	
			Mining Licence (No. IML/B/MD/8546)	GSMB	07.02.2008	One year from the date of issue	
			Mining Licence (No. IML/A/HO/1822)	GSMB	25.02.2009	One year from the date of issue	
16	Rock Blasting	43+100-43+200	Environmental Approval	CEA	28.02.2008	-	
			Mining Licence (No. IML/B/MD/8542)	GSMB	07.02.2008	One year from the date of issue	
17	Rock Blasting	45+150-45+250	Environmental Approval	CEA	28.02.2008	-	
			Mining Licence (No. IML/B/MD/8544)	GSMB	07.02.2008	One year from the date of issue	
18	Rock Blasting	46+900-47+400	Environmental Approval	CEA	24.07.2007	-	
			Mining Licence (No. IML/A/MD/7128)	GSMB	06.07.2007	One year from the date of issue	
19	Rock Blasting	48+100-48+300	Environmental Approval	CEA	24.07.2007	-	

Location No.	Purpose	Chainage	Type of Licence /Approval	Issuing Authority	Date of Issue	Validation Period	Status
			Mining Licence (No. IML/A/MD/7192)	GSMB	13.07.2007	One year from the date of issue	
20	Rock Blasting	48+300-48+700	Environmental Approval	CEA	28.02.2008	-	
			Mining Licence (No. IML/B/MD/8545)	GSMB	07.02.2008	One year from the date of issue	
21	Rock Blasting	49+700-49+950	Environmental Approval	CEA	07.01.2007	-	
			Mining Licence (No. IML/A/MD/8273)	GSMB	27.12.2007	One year from the date of issue	
			Environmental Approval	CEA	17.03.2009	-	
			Mining Licence (No. IML/A/HO/1706)	GSMB	03.02.2009	Three month from 02.02.2009 - 01.05.2009	
22	Rock Blasting	52+570 (52+520-52+580)	Environmental Approval	CEA	21.03.2007	-	
			Mining Licence (No. IML/A/MD/6374)	GSMB	14.03.2007	One year from the date of issue	
			Environmental Approval	CEA	28.10.2008	Until 13.03.2009	
			Mining Licence (No. IML/A/MD/8817)	GSMB	14.03.2008	One year from the date of issue	
23	Rock Blasting	52+800-52+900	Environmental Approval	CEA	04.07.2008	-	
			Mining Licence (No. IML/A/MD/8764)	GSMB	04.03.2008	One year from the date of issue	
24	Rock Blasting	50+900-51+200	Environmental Approval	CEA	24.03.2008	-	
			Mining Licence (No. IML/A/MD/8765)	GSMB	07.03.2008	One year from the date of issue	
			Environmental Approval	CEA	07.04.2009	Until 05.03.2010	

Location No.	Purpose	Chainage	Type of Licence /Approval	Issuing Authority	Date of Issue	Validation Period	Status
			Mining Licence (No. IML/A/HO/1924)	GSMB	11.03.2009	Until 05.03.2010	
25	Rock Blasting	62+200-62+400	Environmental Approval	CEA	28.04.2008	-	
			Mining Licence (No. IML/A/MD/8766)	GSMB	07.03.2008	One year from the date of issue	
26	Rock Blasting	54+750-54+800	Environmental Approval	CEA	27.08.2008	-	
			Mining Licence (No. IML/A/HO/020)	GSMB	04.06.2008	-	
27	Rock Blasting	64+100-64+400	Environmental Approval	CEA			
			Mining Licence (No. IML/A/MD/9073 )	GSMB	07.05.2008	One year from the date of issue	
28	Rock Blasting	57+200-57+400	Environmental Approval	CEA			
			Mining Licence (No. IML/A/HO/165 )	GSMB	26.06.2008	One year from the date of issue	
29	Borrow pit - I	50+100	Environmental Clearance	CEA	08.10.2007	One year from the date of issue	
			Mining Licence (No. IML/A/MD/7676 )	GSMB	21.09.2007	One year from the date of issue	
30	Disposal Yard	57+400	Environmental Recommendation	CEA	10.01.2008		
31	Borrow pit - II	50+100	Environmental Clearance	CEA	24.01.2008	One year from the date of issue	
			Mining Licence (No. IML/A/MD/8282 )	GSMB	04.01.2008	One year from the date of issue	
32	Disposal Yard	42+740	Environmental Clearance	CEA	24.06.2008	One year from the date of issue	
33	Disposal Yard	43+700	Environmental Clearance	CEA	27.03.2008	One year from the date of issue	

Location No.	Purpose	Chainage	Type of Licence /Approval	Issuing Authority	Date of Issue	Validation Period	Status
34	Disposal Yard	43+750	Environmental Protection Licence No. 02141(R <sub>0</sub> )	CEA	27.03.2008	One year from the date of issue	
35	Disposal Yard	50+500	Environmental Clearance	CEA	07.04.2008	One year from the date of issue	
36	Rock blasting	48+300-48+600	Mining Licence (No.IML/A/HO/158)	GSMB	26.06.2008	One year from the date of issue	
			Environmental Approval	CEA	04.07.2008	Until 25.06.2009	
37	Disposal Yard	46+000	Environmental Approval	CEA	29.07.2008	One year from the date of issue	
38	Rock blasting	48+100-48+300	Environmental Approval	CEA	28.07.2008	Until 20.07.2009	
			Mining Licence (No.IML/A/HO/313)	GSMB	21.07.2008	One year from the date of issue	
39	Metal Crusher	46+860-47+500	Environmental Protection Licence - No. 02253 (R <sub>0</sub> )	CEA	25.09.2008	One year from the date of issue	
40	Metal Crusher	50+900-51+240	Environmental Protection Licence No. 02252 (R <sub>0</sub> )	CEA	25.09.2008	One year from the date of issue	
41	Rock Blasting	46+900- 47+400	Environmental Approval	CEA	04.11.2008	Until 16.10.2009	
			Mining Licence (No. IML/A/HO/981)	GSMB	17.10.2008	One year from the date of issue	
42	Rock blasting	49+100-49+400	Environmental Approval	CEA	26.11.2008	Until 12.11.2009	
			Mining Licence (No. IML/A/HO/1202)	GSMB	13.11.2008	One year from the date of issue	
43	Rock blasting	62+600-62+700	Mining Licence (No. IML/A/HO/932)	GSMB	09.10.2008	One year from the date of issue	
44	Rock blasting	57+600-57+950	Mining Licence (No.IML/A/HO/933)	GSMB	09.10.2008	One year from the date of issue	
45	Rock	48+700-49+050	Environmental	CEA	26.11.2008	Until 12.11.2009	

Location No.	Purpose	Chainage	Type of Licence /Approval	Issuing Authority	Date of Issue	Validation Period	Status
	blasting		Approval				
			Mining Licence (No.IML/A/HO/1197)	GSMB	13.11.2008	One year from the date of issue	
46	Borrow pit	61+500 (RDA resettlement site)	Environmental Clearance	CEA	17.11.2008	One year from the date of issue	
			Mining Licence (No. IML/A/HO/ 1163)	GSMB	10.11.2008	Six months from the date of issue	
47	Metal Crusher	64+400- 64+700 & 63+900-64+200	Environmental Protection Licence - No. 02325 (R <sub>0</sub> )	CEA	11.12.2008	One year from the date of issue	
48	Metal Crusher	61+800- 62+200	Environmental Protection Licence No. 02326 (R <sub>0</sub> )	CEA	11.12.2008	One year from the date of issue	
49	Rock blasting	62+900-63+000	Environmental Approval	CEA	13.02.2009	One year from the date of issue (2010.01.05)	
			Mining Licence (No.IML/A/HO/1527)	GSMB	16.01.2009	One year from 06.01.2009	
50	Borrow pit	55+150 (School premises)	Mining Licence (No. IML/A/HO/1678)	GSMB	28.01.2009	One year from the date of issue	
			Environmental Clearance	CEA	02.02.2009	One year from the date of issue	
51	Rock blasting	49 +510 -49+700	Environmental Approval	CEA	07.04.2009	Until 04.03.2010	
			Mining licence (No IML/A/HO/1932)	GSMB	05.03.2009	Until 04.03.2010	
52	Worker camp	49+500	Environmental Protection Licence No. 02531(R <sub>0</sub> )	CEA	18.05.2009	One year from the date of issue	
53	Disposal Yard	46+000	Environmental Approval	CEA	25.05.2009	One year from the date of issue	Not functioned
54	Borrow pit	58+300 (School premises)	Environmental Clearance	CEA	01.06.2009	One year from the date of issue	Not functioned

Location No.	Purpose	Chainage	Type of Licence /Approval	Issuing Authority	Date of Issue	Validation Period	Status
55	Rock blasting	36+210-36+400	Mining Licence (Minor Scale)	GSMB	01.06.2009	Valid up to 30.06.2009	
56	Rock Blasting	37+400-37+830	Environmental Approval	CEA	30.06.2009	Until 02.06.2009	On going
			Mining Licence (No. IML/A/HO/2413)	GSMB	04.06.2009	12 months	
57	Rock Blasting	49+200-49+470	Mining Licence (No. IML/A/HO/1202)	GSMB	13.11.2008	One year from the date of issue	On going
			Mining Licence (No. IML/A/HO/2421)		24.08.2009	01.06.2009-30.05.2010	
58	Rock blasting	47+417	Mining Licence (Minor Scale)	GSMB	27.05.2009	Valid up to 30.09.2009	Waiting for new licence
59	Borrow pit	56+100	Environmental Clearance	CEA	10.06.2009	One year from the date of issue	On going
			Mining Licence (No. IML/B/HO/2482 )	GSMB	10.06.2009	One year from the date of issue	
60	Disposal Yard	44+180	Environmental Approval	CEA	16.07.2009	One year from the date of issue	Waiting for Agrarian Services consent
61	Disposal Yard	46+000	Environmental Approval	CEA	16.07.2009	One year from the date of issue	Waiting for Agrarian Services consent
62	Rock blasting	55+400- 55+470	Mining Licence (Minor Scale)	GSMB	15.08.2009	Valid up to 30.09.2009	Waiting for new licence
63	Borrow pit	54+500	Environmental Clearance	CEA	25.08.2009	One year from the date of issue	On going
			Mining Licence (No. IML/B/HO/2838 )	GSMB	07.09.2009	26.08.2009-25.08.2010	
64	Disposal Yard	59+500	Environmental Clearance	CEA	25.08.2009	One year from the date of issue	On going
65	Borrow pit	55+200	Environmental Clearance	CEA	31.08.2009	One year from the date of issue	Completed

Location No.	Purpose	Chainage	Type of Licence /Approval	Issuing Authority	Date of Issue	Validation Period	Status
66	Rock blasting	48+970- 49+030	Mining Licence (No. IML/A/HO/2822)	GSMB	21.08.2009	21.08.2009-20.08.2010	On going
67	Rock Blasting	36+100-36+370	Mining Licence (No. IML/A/HO/2881)	GSMB	09.09.2009	08.09.2009-07.09.2010	On going
68	Borrow pit	60+350	Environmental Clearance	CEA	25.08.2009	One year from the date of issue	
			Mining Licence (No. IML/A/HO/3040 )	GSMB	14.10.2009	One year from the date of issue	
69	Disposal Yard	65+500	Environmental Approval	CEA	27.11.2009	One year from 23.11.2009	
70	Rock Blasting	64+500	Mining Licence (No. IML/A/HO )	GSMB	09.12.2009	One year from 07.12.2009	
71	Rock Blasting	57+590-57+600	Mining Licence (Minor Scale)	GSMB	14.12.2009	Till 15 <sup>th</sup> January 2010	

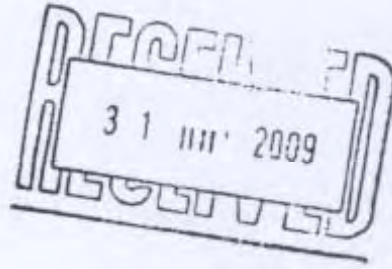
**ANNEX III**  
**Details on Complaints from July to December 2009**

Complaints category	July		August		September		October		November		December		Total	
	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
Flood related	2	2	1	1	1	1	1	2	0	0	1	1	06	07
Blasting related	10	11	5	4	3	3	10	10	9	6	1	8	38	42
Dust related	0	0	0	0	0	0	0	0	1	1	0	0	01	01
Danger to public	1	1	0	0	0	0	0	0	0	0	1	1	02	02
Access road	1	1	1	1	1	1	1	1	0	0	0	0	04	04
Additional acquisition	1	1	1	1	0	0	0	0	1	1	0	0	03	03
Material transport and use of public roads	0	0	1	1	0	0	0	0	0	0	0	0	01	01
Water quality and quantity	3	3	2	1	1	1	0	0	1	0	0	2	07	07
Noise	1	0	0	0	0	0	0	0	0	0	0	4	01	04
Vibration	0	0	1	1	2	2	0	0	2	1	2	3	07	07
Property damage	5	3	7	7	6	6	0	0	0	0	0	7	18	23
Crop damage	2	2	1	0	2	3	5	5	2	0	4	5	16	15
Soil erosion	0	0	2	2	2	0	0	2	2	0	1	3	07	07
Other problems related to construction activities	0	0	3	2	0	0	0	0	0	0	3	4	06	06
<b>Total</b>	<b>26</b>	<b>24</b>	<b>25</b>	<b>21</b>	<b>18</b>	<b>17</b>	<b>17</b>	<b>20</b>	<b>18</b>	<b>9</b>	<b>13</b>	<b>38</b>	<b>117</b>	<b>129</b>

X- New cases received during the period    Y- Cases investigated/resolved this period

**ANNEX IV**

**REPORT ON WATER QUALITY ANALYSIS  
at the Concrete Batching Plant**



**Report on Water Quality Analysis carried out for  
Taisei Corporation,  
Southern Transport Development Project,  
772/A, Pollegodawatta, Ritiketiya,  
Meegama.**

Report No: EN/09/WQ/53

July, 2009



Department of Civil Engineering  
University of Moratuwa  
Moratuwa, Sri Lanka

## Background

The University of Moratuwa undertook the testing of a water sample for Project Manager, Taisei Corporation, Southern Transport Development Project, 772/A, Pollegodawatta, Ritiketiya, Meegama. Sample was collected in the presence of the client and brought to the laboratory by the laboratory personnel of the Environmental Engineering Laboratory, Department of Civil Engineering, University of Moratuwa on 01.07.09. Locations for sampling, number of samples and number of parameters to be tested were selected by the client.

## Objective

The main objective of the study was to perform analysis of water quality parameters of the given samples in order to assess the background levels.

## Methodology

Table 1: Methodologies used for physical & chemical analysis

Parameter	Methodology
pH	pH meter Eutech (Ecoscan)
COD	APHA 5220 B-Open Reflux Method
Total Suspended Solids	APHA 2540 D- Total Suspended Solids Dried at 103-105 °C
Oil and Grease	APHA 5520 B – Liquid-Liquid, Partition-Gravimetric Method

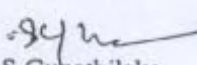
## Location of Sampling


Batching Plant Site – Hikkahawatte, Ittapana

## Results

Table 2: Results of Water Quality Analysis

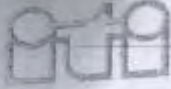
Parameter	Result
pH	11.88
Chemical Oxygen demand – COD (mg/l)	240.00
Total suspended solids (mg/l)	70.0
Oil and Grease (mg/l)	0.380

  
(Mrs) N.S. Gunathilake  
Technical Officer

  
Dr. J. Manatunga  
Head/ Division of Environmental Engineering  
Head  
Environmental Engineering  
Department of Civil Engineering  
University of Moratuwa.

**ANNEX V**

**TEST REPORT OF AMBIENT AIR QUALITY AT PREMISES OF CONCRETE  
BATCHING PLANT AT CH. 59+ 700**



# INDUSTRIAL TECHNOLOGY INSTITUTE (ITI)

P. O. Box, 787, 363, Bauddhaloka Mawatha, Colombo 7, Sri Lanka.  
Telephone: 2693807 Fax : 2691799

Vidya Mawatha Premises, Colombo 7, Sri Lanka.  
Telephone: 2674461 Fax : 2677051

## TEST REPORT

Reference No. SS 0906997

### Report to:

Taisei Corporation  
772/A, Pollegodawatta,  
Retiketiya,  
Meegama.  
Baddegama.

### Issued by :

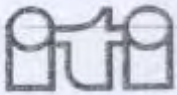
Chemical & Microbiological Laboratory  
Industrial Technology Institute

2009/08/06

Page 01 of 05 pages

LL  
19/08/09

THE REPORT IS ISSUED SUBJECT TO CONDITIONS MENTIONED OVERLEAF



... Continuation Sheet

TEST REPORT

Reference No. SS 090629\*

CUSTOMER :

Taisei Corporation  
700, Podigalawatta  
Mullatiya  
Meezama

TEST ITEM : AMBIENT AIR

Service requested :

Measurement of Suspended Particulate Matter in ambient air as  
in customer letter of 19<sup>th</sup> June, 2009 and Ref No.  
TAI - GTH - ENV- 10170

BACKGROUND INFORMATION :

Location : A/cn 59+000 area of Southern Highway in Uragaha area of Galle.

Type of Industry : Making concrete batches

Production process : Cement powder → Adding water & chemicals → Mixing  
quarry dust ↓  
metal stones ↓  
Final mixture of concrete

Present production rate : 225 m<sup>3</sup> / day

Working time : 24 hrs/day 7 days / week

Work Force : 30 Nos.

Emission generating activities : - Loading and unloading of raw material  
\* Activities of mixing plant  
- Movement of heavy vehicles

Emission controlling system : \* Vehicle moving pathways are moistured with water  
\* Inbuilt filter bag system is installed to cement feeding silo  
\* Quarry dust is stored separately in a covered area.

SAMPLE DETAILS:

Sample Location : At the eastern boundary of the plant premises. It was 2 m away the water sedimentation tanks and 10 m away from the sand stores.

Date of Time of sampling : 21<sup>st</sup> July, 2009 from 10.00 a.m - 6.00 p.m. (8 hrs)  
(Customer was informed about the visit.)

Sampling method

Parameter	Method	Equipment
SPM	Air was drawn through a high volume air sampler at a flow rate of 75 m <sup>3</sup> / hr. for sampling period of 08 hrs.	High volume air sampler (Envirotech APM 460 NL)

Sampling carried out by : Mr S P Hettiarachchi of ITI

Witness : Mr Damith Siribathana, Technical Officer of Taisei Corporation

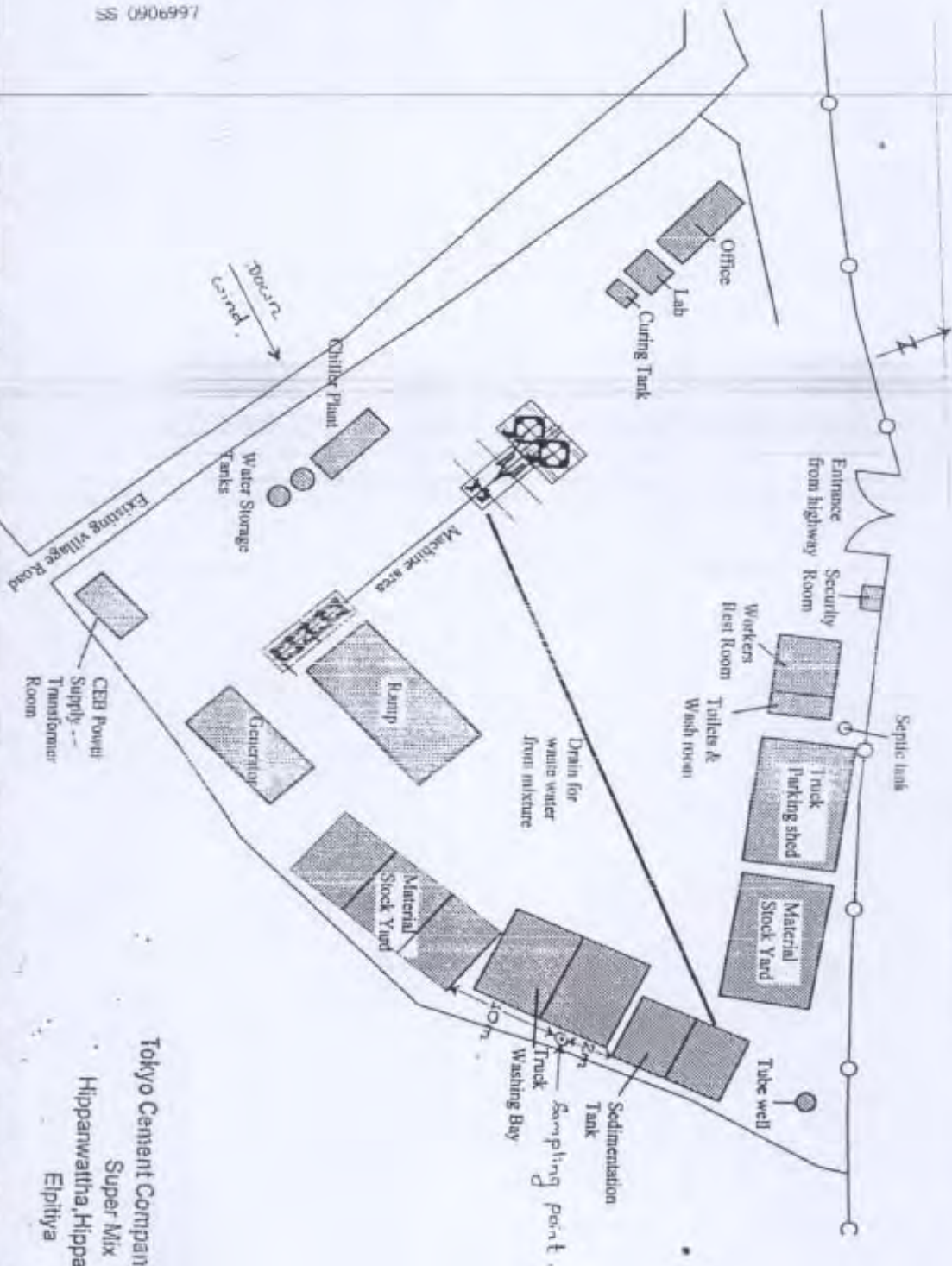
lll  
19/08/09



... Continuation Sheet

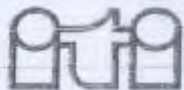
0906997

Sourthen Highway



Tokyo Cement Company (Lanka) Ltd.  
 Super Mix  
 Hippanwattha, Hippankanda  
 Elpitiya

Ambient air sampling location of Taisei Corporation at Urugaha area in Galle



SS 0906997

Weather condition : It was dry and sunny. Predominant wind blew from the west and recorded speed was  $2-3 \text{ mS}^{-1}$  during the period of sampling.

Date & Time of reception of sample at ITI : 21<sup>st</sup> July, 2009 at 9.30 p.m.

Condition of sample at reception : Satisfactory

Date of Analysis : 23<sup>rd</sup> July, 2009

**TEST METHOD** :

**RESULTS** :

Parameter / unit	Method of analysis *	Results	Max. P. level (08 hrs average)
Suspended Particulate Matter, $\text{mg}/\text{m}^3$ (08 hrs average)	High volume sampling and Gravimetry	0.23	0.35

\* As specified in the National Environmental (Ambient Air Quality) regulations 1994 under the National Environmental act No. 47 of 1980

.....  
Authorized Signatory

**M. N. A. Mubarak**  
B.Sc (sp. Hons), M.Sc (Delft)  
Senior Research Officer  
Chemical and Microbiological Laboratory

2009/08/06  
/kw

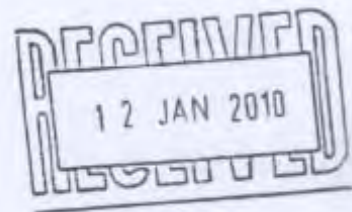
.....  
Mr. S.P. Hettiarachchi  
**TECHNICAL ASSISTANT**

**ANNEX VI**  
**REPORT ON SURFACE WATER QUALITY ANALYSIS**

**Report on Water Quality analysis carried out for  
Taisei Corporation, Southern Highway Construction Project,  
JBIC Funded Section, - Kottawa to Kurudugahahatekma**

Report No: EN/10/WQ/01

January - 2010



University of Moratuwa,  
Department of Civil Engineering  
Moratuwa, Sri Lanka

## Background

The University of Moratuwa undertook the water sampling and testing of water quality for Project Manager, Taisei Corporation, Southern Highway Construction Project, JBIC funded section, Kottawa to Kurudugahahetekma. Samples were collected by the laboratory personnel of the Environmental Engineering Laboratory, Department of Civil Engineering, University of Moratuwa on 18<sup>th</sup> November 2009, in the presence of the client. Locations for sampling, number of samples and number of parameters to be tested were selected by the client.

## Objective

The main objective of the study was to perform analysis of water quality parameters of selected locations in order to assess the background levels.

## Selection of sampling locations

The locations of sampling had been pre selected by the client.

## Sampling Criteria.

Grab samples were collected at the surfaces of the stream for analysis. Sample preservation was done in accordance to Standard Methods for the Examinations of Water and Wastewater (1995)

## Methodology

Table 1: Methodologies used for physical, chemical and microbiological analysis

Parameter	Methodology
pH	pH meter Eutech (Ecoscan)
Conductivity	Conductivity meter – Eutech
BOD	BOD, Azide Modification
COD	Open reflux method
Suspended Solids	Filtration followed by dried at 103°C and weighing using the analytical balance
Residual chlorine	UV visible spectrophotometric method – using DPD tablets
Ammonical Nitrogen	Kjeldahl digestion method
Phosphates	UV visible spectrophotometric method
Oil and Grease	Solvent extraction – Gravimetric method
Total Coliforms	Multiple tube fermentation technique
Heavy metals	Atomic absorption spectrophotometric method

## Results

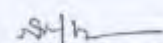
Table 2: Results of water quality analysis performed on 18<sup>th</sup> November 2009

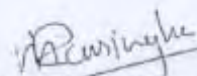
Sampling Point		Location No 1 (Welipanna Ganga)	Location No 2 (Dielduwa Ela)	Location No 3 (Close to Ittapana)	Location No 4 (Close to Mahagoda)	Location No 5 (Close to Luibaddawa)	Location No 6 (Elpitiya Ela)	Location No 7 (Elpitiya Ela)
Coordinates of each point	N	39.238	39.066	36.559	34.600	34.027	30.104	33.229
	E	23.945	24.556	23.964	23.870	24.936	25.431	24.747
Time		11.15 am	11.55 am	12.15 pm	12.30 pm	12.40 pm	13.20 pm	14.45 pm
Temperature °C		26.4	29.7	30.9	30.1	29.4	29.9	30.0
pH		7.16	7.28	6.98	7.21	6.90	7.00	7.17
Conductivity µS/cm		20.6	20.2	27.6	350.0	75.5	48.3	26.7
BOD mg/l		4.0	5.0	3.0	7.0	3.0	6.0	8.0
COD mg/l		24.0	24.0	16.0	24.0	16.0	16.0	16.0
Suspended Solids mg/l		6.4	3.8	4.8	5.8	3.6	5.6	4.4
Residual Chlorine mg/l		0.01	0.01	0.01	0.01	0.02	0.02	0.01
Ammonical Nitrogen mg/l		0.06	0.00	ND	ND	ND	ND	0.05
Total Phosphorous mg/l		0.142	0.217	0.045	0.751	0.101	0.575	0.348
Oil and Grease mg/l		0.028	0.011	0.011	0.011	0.011	0.011	0.021
Total Coliforms / MPN 100 ml		2200	1300	900	900	2200	800	800
Heavy Metals	Zinc mg/l	0.031	0.039	0.02	0.031	0.053	0.080	0.028
	Lead mg/l	0.076	0.133	0.137	0.065	0.159	0.199	0.115
	Manganese mg/l	0.015	0.000	0.000	0.000	0.000	0.000	0.000
	Iron mg/l	4.637	1.777	2.226	3.013	2.773	1.959	3.275


ND - Not Detected

Detection Level:

Zinc - 0.000 - 1.600 mg/l  
 Lead 0.100 - 20.000 mg/l  
 Manganese 0.000 - 4.000 mg/l  
 Iron 0.100 - 9.000 mg/l  
 Residual Chlorine 0.00-5.00 mg/l

  
 (Mrs) N.S. Gunathilake  
 Technical Officer

  
 (Mrs) E.H.M. Ranasinghe  
 Analytical Chemist

  
 Dr Jagath Manarunga  
 Head/ Division of Environmental Engineering

*Head*  
 Environmental Engineering  
 Department of Civil Engineering  
 University of Kelaniya