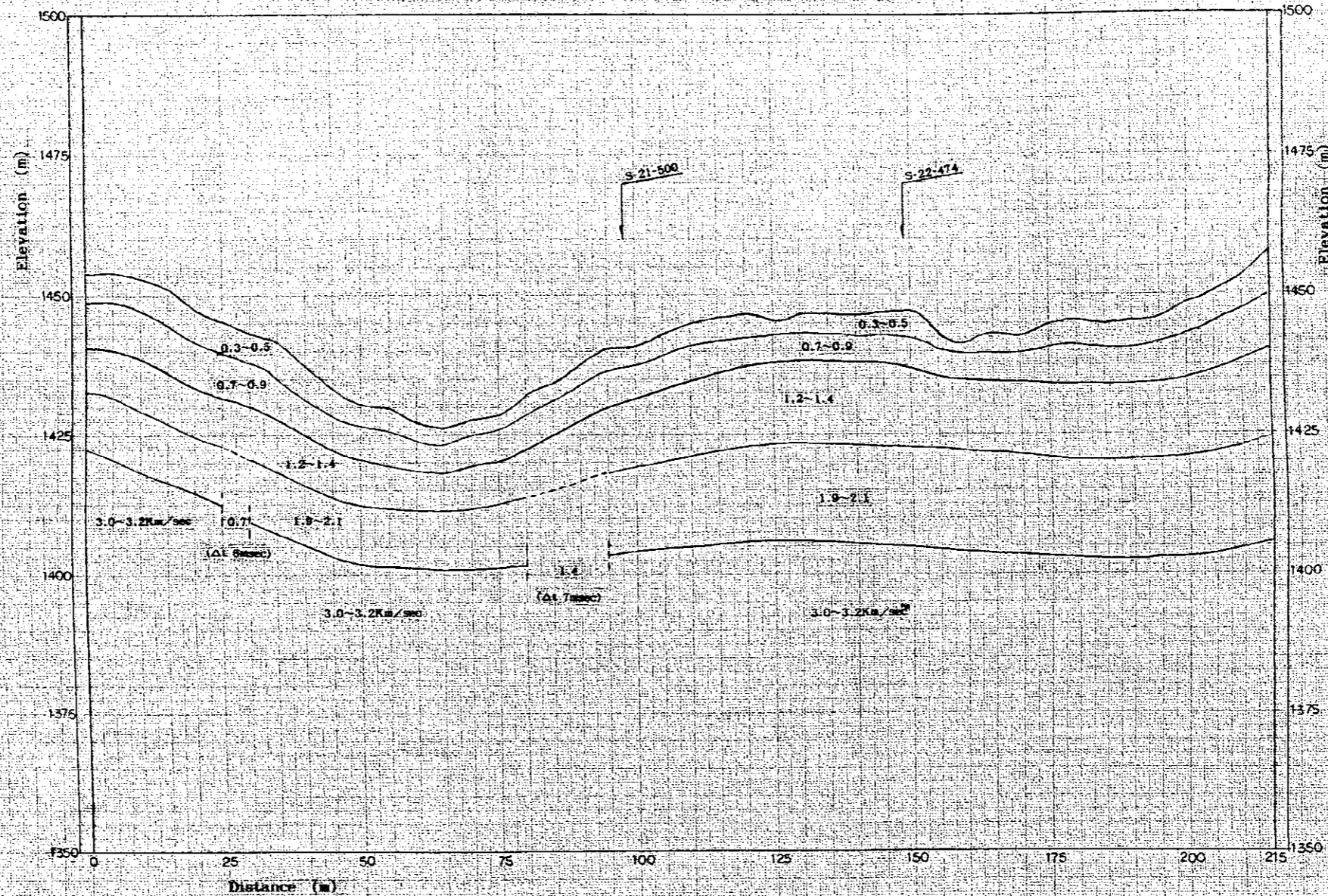


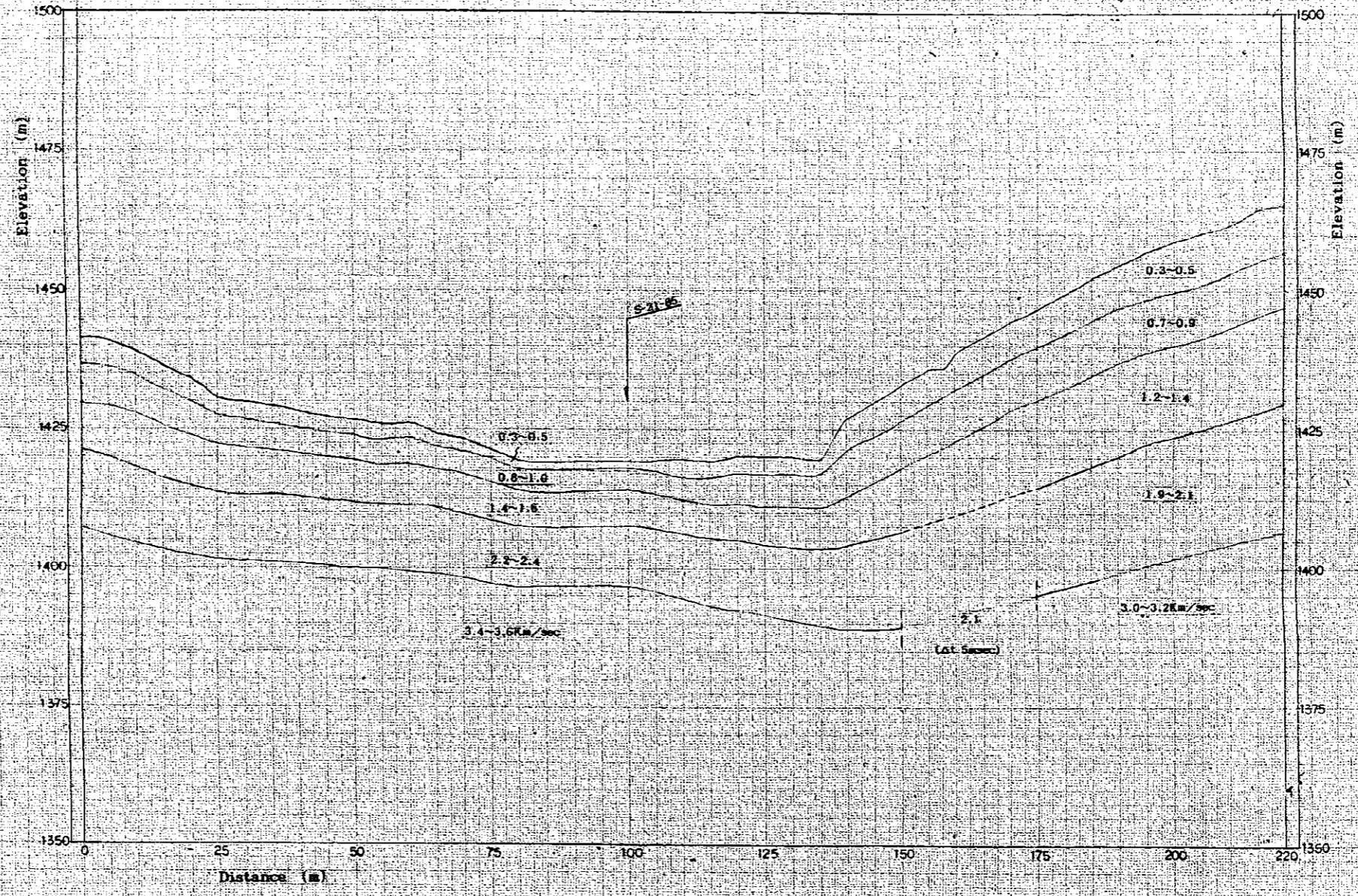
S-27 LINE VELOCITY LAYERS PROFILE

Line No. S-27



S-28 LINE VELOCITY LAYERS PROFILE

Line No. S-28



B-3 Result of Material Survey

REPORT ON

Material Investigation of Road Alignment for

**KATHMANDU - NAUBISE
ALTERNATE ROAD PROJECT**

Prepared for

JICA Study Team

Kathmandu - Naubise Alternate Road Project

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Submitted by

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December 2000

KATHMANDU - NAUBISE ALTERNATE ROAD PROJECT

MATERIAL INVESTIGATION

1. GENERAL

The Geotechnical Investigation is carried out for Kathmandu - Naubise Alternate Road Project as a part of detailed design work to accumulate sufficient geotechnical data necessary for designing suitable road, structures and others. This is an addendum to the previous report, submitted earlier.

2. SAMPLE COLLECTION AND TEST

2.1 Embankment

For the purpose of obtaining information on construction materials for embankments and sub base coarse, various borrow areas as suggested by the client were first identified and located properly. Among 27 borrow areas, 25 (M1 - M25) are embankment materials whereas two samples (C1, C2) are for sub base course.

2.2 Base coarse

Three quarry sites were investigated and samples were collected for the test for base courses. The quarry sites are

- ❖ Thankot (Q1)
- ❖ Shrestha Dhunga Udhog, Ramkot (Q2),
- ❖ Godawari Marble Factory at Godawari (Q3)

Since the appropriate size of sample required for lab test is easily available on these crusher plants, no further elaboration on sampling is required. General features of these quarry sites are presented in the annex.

3. LABORATORY TEST

The representative sample from the soil samples collected from each borrow area is selected for test for CBR values and compaction

CBR tests are carried out at 100, 95 & 90% of MDD for both materials for embankment and base course. Test results with appropriate curve is presented in the Annex.

Similarly aggregates suitable for base course from all quarry sites are tested for Modified Compaction Test to get the Optimum Moisture Content and Maximum Dry Density (MDD). The same samples are tested for different tests applicable for concrete.

A table of various tests carried out for both types of materials is given below:

Category	Test	Location of borrow areas	Remarks
Embankment	Compaction Test	M-2,6,9,12,16,19,22,24	Four samples from each area
	CBR Test	C1 & C2	3 samples from each area
Sub-base	Compaction Test	C1 & C2	Four samples from each area
	CBR Test	C1 & C2	3 samples from each area
Base Course	Compaction Test (mechanical stabilization)	Q-1~3	3soil classification* 3 times
	CBR Test (mechanical stabilization)	Q-1~3	3soil classification* 4 times
Concrete	Physical Test Gradation Analysis Density Specific Gravity Absorption Test Abrasion Test Impact and Crushing	Q-1~3	

4. CONCLUSION

A summary sheet with all lab test results is attached in the annex, which also present the classification of soil as per Unified Classification System.

CBR values of most of test pits shows their suitability for sub grades but in our visual inspection and our experience, part of soil located in borrow area C2, as indicated by its results of laboratory tests can be used for sub base coarse as well.

Test performed for quarry site aggregates indicates that samples from all quarry sites are good for base courses. Samples from Ramkot with CBR value of more than 50%, is seen exceptionally good for base courses in comparison to other two sources.

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Test Result Summary Sheet

Project: Kathmandu - Naubise Alternate Road Project

Tested by: S.R. Dali

Locat: Bhimdhunga - Sitapalla

Date: January 2001

Pit No.	Classification	Percentage of					Atterberg Limits			Field Density gm/cc	Natural Moisture Content %	Optimum Moisture Content %	Maximum Dry Density gm/cc	CBR %			Remarks
		Gravel	Sand		Silt	Clay	LL	PL	PI					at 90% compaction	at 90% compaction	at 90% compaction	
			Coarse to Medium	Fine													
M 1	ML	0.0	1.4	0.8	70.4	27.4	49.9	NP	-	2.1	7.5	-	-	-	-	-	
M 2	ML	0.0	2.9	1.8	78.2	17.1	38.0	NP	-	1.6	19.1	16.0	1.64	19.4	17.2	14.3	
M 3	ML	0.7	4.4	13.6	72.8	8.5	23.9	NP	-	2.0	19.0	-	-	-	-	-	
M 4	ML	0.0	2.1	11.6	68.4	18.0	27.0	NP	-	1.9	22.9	-	-	-	-	-	
M 5	ML	0.0	2.2	4.5	81.3	12.0	27.4	NP	-	1.9	20.5	-	-	-	-	-	
M 6	SM	43.4	29.5	5.4	13.4	8.3	27.0	NP	-	1.9	13.5	14.0	1.74	26.3	22.5	20.1	
M 7	ML	4.0	4.1	21.5	63.8	6.7	33.4	NP	-	1.6	7.3	-	-	-	-	-	
M 8	SM	10.8	28.3	32.1	24.2	4.6	27.4	NP	-	1.8	12.9	-	-	-	-	-	

SILT Consultants P. Ltd.

Test Result Summary Sheet

Project: **Kathmandu - Naubise Alternate Road Project**

Tested by: **S.R. Dali**

Locat: **Bhimdhunga - Sitapaila**

Date: **January 2001**

Pit No.	Classification	Percentage of					Atterberg Limits			Field Density gm/cc	Natural Moisture Content %	Optimum Moisture Content %	Maximum Dry Density gm/cc	CBR %			Remarks
		Gravel	Sand		Silt	Clay	LL	PL	PI					at 90% compaction	at 90% compaction	at 90% compaction	
			Coarse to Medium	Fine													
M 9	CL	9.3	14.0	18.5	38.5	19.8	-	-	NoPI	19.4	13.5	1.77	16.4	13.9	11.5		
M 10	CL	0.5	6.1	7.0	58.0	28.4	35.6	28.1	7.5	1.0	20.8	-	-	-	-	-	
M 11	ML	0.0	1.6	4.5	68.8	25.0	39.0	24.5	14.5	1.9	33.7	-	-	-	-	-	
M 12	ML	0.8	2.3	0.7	54.6	41.6	-	-	NoPI	14.5	14.0	1.76	14.1	12.9	9.8		
M 13	CL	0.0	1.4	4.7	74.9	19.0	33.5	NP	-	2.0	20.9	-	-	-	-	-	
M 14	CL	5.1	3.3	4.6	71.3	15.7	30.2	20.8	9.4	1.9	14.9	-	-	-	-	-	
M 15	CL	0.0	0.7	4.4	66.1	28.9	35.7	22.4	13.3	1.7	14.6	-	-	-	-	-	
M 16	CL	0.0	1.1	3.0	55.9	40.0	-	-	NoPI	16.0	14.0	1.75	18.1	15.8	12.4		
M 17	CL	0.0	0.9	2.2	74.6	22.3	38.0	25.5	12.5	3.4	22.5	-	-	-	-	-	

SILT Consultants P. Ltd.

Test Result Summary Sheet

Project: **Kathmandu - Naubise Alternate Road Project**

Tested by: **S.R. Dali**

Local: **Bhimdhunga - Sitapaila**

Date: **January 2001**

Pit No.	Classification	Percentage of					Atterberg Limits			Field Density gm/cc	Natural Moisture Content %	Optimum Moisture Content %	Maximum Dry Density gm/cc	CBR %			Remarks
		Gravel	Sand		Silt	Clay	LL	PL	PI					at 90% compaction	at 90% compaction	at 90% compaction	
			Coarse to Medium	Fine													
M 18	OL	4.3	4.8	1.9	72.3	16.7	51.5	28.8	22.7	1.5	15.8	-	-	-	-	-	-
M 19	CL	1.8	2.8	0.9	69.9	24.6	-	-	NoPI	-	23.4	15.0	1.70	14.4	12.3	7.9	-
M 20	ML	0.2	3.4	4.8	77.7	13.9	31.0	25.7	5.3	2.0	21.8	-	-	-	-	-	-
M 21	CL	0.0	0.2	2.3	70.2	27.4	29.9	20.8	9.1	2.0	32.1	-	-	-	-	-	-
M 22	ML	3.9	7.4	8.7	55.5	24.5	-	-	NoPI	-	28.9	13.5	1.82	23.1	18.3	16.2	-
M 23	ML	0.0	2.4	5.3	68.2	24.0	34.3	28.8	5.5	2.0	18.7	-	-	-	-	-	-
M24	CL	0.0	1.0	5.0	70.0	24.0	32.7	23.7	9.0	2.0	17.7	13.5	1.80	16.5	12.3	8.1	-
M 25	ML	0.0	2.4	8.8	77.0	11.8	27.0	25.7	1.3	26.8	30.9	-	-	-	-	-	-
C 1	CL	0.0	2.1	16.1	69.0	12.8	-	-	NoPI	-	17.5	9.5	1.98	11.8	8.9	7.2	-
C2	GW	55.9	20.1	9.9	11.2	2.9	28.2	NP	-	2.2	30.1	11.5	1.77	25.0	21.3	18.1	-

SILT Consultants P. Ltd.

Test Result Summary Sheet

Project : Kathmandu - Naubise Alternate Road Project

Tested by: S.R. Dali

Location Bhimdhunga-Sitapalla

Date: January 2001

Sample No.	Specific Gravity (G)	Water Absorption	AIV	ACV	Optimum Moisture Content %	Maximum Dry Density gm/cc	CBR (%)			Los Angeles Abrasion Value %	Remarks
							at 90% compaction	at 95% compaction	at MDD		
Q 1	2.65	0.33	15.0	23.73	6.7	2.23	42.9	19.2	6.4	32.39	
Q 2	2.64	0.28	11.1	23.73	6.5	2.22	68.3	28.0	7.2	31.68	
Q 3	2.74	0.30	15.3	26.93	6.0	2.22	44.0	17.0	5.5	29.95	

B-4 Result of House Interview Survey

1. Introduction

The household interview survey was carried out to collect the background information about the social, economic, and cultural aspects of the local people in the Study area, and to grasp their concerns on the project.

To meet the above objectives, the main items to be surveyed were settled as follows:

- Household Characteristics, and Situation of the House and Land Property
- Food Sufficiency Status
- Energy and Water Resources
- Cultural/Religious Aspects
- Participation in User's Group/Community Programs
- Status of Annual Income and Expenditure
- Opinions on the Project

The questionnaire was prepared for the interview survey beforehand considering these main items, and the fieldwork was conducted in May 2000.

2. Survey Area

7 VDCs were selected as the survey area. These are Sitapaila, Ramkot, and Bhimdhunga VDC of Kathmandu District, and Chhatre Deurali, Jiwanpur, Naubise, and Kegalpur of Dhading District.

3. Survey Methodology

After the quick reconnaissance of the alignment alternatives to identify the influenced wards of 7 VDCs, the target sample size of interview was determined based on the number of households within the identified area. 10% of the total households of the wards of Sitapaila, Ramkot, Bhimdhunga, Chhatre Deurali, and Jiwanpur VDCs were selected as the target, whereas in Naubise and Kegalpur VDCs, 15 and 5 households respectively were selected. All together 300 households as shown in Table 1 with breakdown were interviewed.

Table 1 Numbers of Household and Sample

DDC/VDC name		Nos. of HH	Nos. of Sample	Ward No.
Kathmandu	Sitapaila	521	52	1,2,3,4,5,6
	Ramkot	639	64	1,2,3,4,5,6,7,9
	Bhimdhunga	278	32	1,2,3,4,5,6,7,9
Dhading	Chhatre Deurali	651	67	1,2,3,4,5,8
	Jiwanpur	668	15	5,6,8,9
	Naubise	270	15	1,2
	Kewalpur	102	5	8
Total		3129	304	

Source: Field Survey

For the interview survey, two teams comprised of one supervisor and three surveyors respectively were dispatched to the field. Each survey team collected the data by means of direct interview to the target households with the prepared questionnaire. During the field survey, it was arranged that half of the interviewees of the target households should be covered with female.

The raw data collected in the field were processed statistically. Based on the analyzed data and field observation, the main issues related to living conditions of the local residents and concerns on the project were clarified.

4. Results and Findings

1) Demography and household characteristics

The average household size is 5.7 persons. 54% of the population of the surveyed households are males, and 46% are females in the Study area. 7.4% of the population are above 60 years of age while 24.3% are below 13 years. The largest percentage (68.4%) of population is between 14 - 60 years of age, and this group also plays an important part in the economic activity.

Brahmins (34.5% of total households) and Chhetries (27.0%) are predominant ethnic/caste groups in the Study area. Other groups found in the survey are Newars, Tamangs, Sanyasi, Damais, Sherpas, Magars and Gurungs. People live in separate clusters based on their ethnic/cast status. Meanwhile, Hindus are the major religious group that accounts for 91.1% of the population in the Study area, and 8.6% are Buddhists as the next major group.

The migrants from outside to the Study area are very few. 93.4% of households are resident, and they are not sure when and from where their ancestors have come. There were no in-migrants among the interviewed households in Bhimdhunga and Kewalpur VDCs. In Naubise VDC, the rate of the migrants is

comparatively high, since the construction of Prithvi Road gave impetus to increasing the migrants from the surrounding area.

The literacy rate in the Study area is 80.3%. This rate is considerably higher than that of the national level (39.6%). 32.9% of the population in the Study area have the primary level of education. Similarly, 15.7 % have lower secondary level, 20.3% have secondary level, 9% have certificate level or 10+2 level, 2.2 % have graduated level and 0.3% have post graduate level of education. Chhatre Deurali VDC has highest rate among the surveyed VDCs with not only primary level of education (45.2%) but also postgraduate level of education (1.0%).

Majority of the households in the Study area engages in agricultural work. 36% of the population are engaged in agriculture permanently. 7.2% of the population, mainly females, declared that they take care of the household and jobless, and 5.1% of populations are engaged in commerce. However, the highest rate of the population in the Study area is a student which accounts for 38.2%. It is noted that almost half of the population in Jiwanpur VDC is engaged in agriculture (49.0%), while that 11.4% in Naubise VDC are engaged in commerce. Besides, the distance to the location of principal activity is not so long since they take only 6.2 minutes walk from their houses on an average.

2) Situation of the house and land property

The occupied area of a house in the Study area is 5.2 square meters on an average. Most of the houses (86%) have mud and bricks walls with the thatched, tiled or corrugated sheet roof, while the rate of the houses made of RCC is less than 10%. 70% of the houses in the Study area have two floors, and the rest are divided into halves approximately between one floor and three floors.

One household in the Study area cultivates about 17 parcels on an average which constitutes 0.68 ha of lowland, 0.47 ha of upland, 0.08 ha grass land, and 0.09 ha private forest. The average household cultivates 0.31 ha of its own land and 0.02 ha of others' land (rented in). However, it also rented out 0.81 ha of its own land to others.

Animal husbandry is a major activity of the households in the Study area. Livestock products are one of the sources of households' income. Cattle and buffaloes are sold for ploughing a land while goats are sold for meat. In addition, chickens are reared to gain the meat and eggs both for consumption by household itself and for sale at the market. In the Study area, one household keeps 2 cattle, 7 buffaloes, 21 goats and 56 chickens on an average.

3) Food sufficiency status

Although the households over 70% in the Study area can not produce food grains sufficiently by themselves to feed their members for a year mainly due to small size of land holding, some of households purchase the shortage of grains with the cash earned from different activities. Moreover, since many households produce high value cash crops such as vegetables and fruits, they are able to feed their members for a whole year with the additional income by selling the cash crops.

4) Energy and water resources

The households in the Study area use firewood, kerosene, liquid petroleum gas (LPG), and electricity as the major energy sources for cooking. The respective rate of utilization of each source is roughly quartered in the whole Study area. Generally speaking, use of firewood is decreasing rapidly because of becoming very expensive due to depletion of the forest, whereas LPG is getting popular as a energy source for cooking. However, the individual status of the energy utilization for cooking is very diverse by VDCs. Maximum number of the households (40.6%) in Jiwanpur use firewood, 57.7% in Sitapaila use electricity, 39.0% in Ramkot use LPG, and 60.8% in Kewalpur use kerosene.

Electricity and kerosene are the major energy source used for lighting by the households in the Study area. 54% of the households are found to use electricity, and 45% use kerosene in whole Study area. Individually speaking, however, 93% and 100% of the households use Kerosene in Jiwanpur and Kewalpur respectively, whereas 98% use electricity in both Ramkot and Sitapaila.

The offices of VDCs in the Study area have constructed reservoir tanks in most of their wards for storing spring water. From these reservoirs, the water for drinking and other miscellaneous use is distributed through PVC pipes to the taps. One tap is provided for 5 - 15 households generally. During the rainy season, the water supply is often disrupted by the flood which sweeps away the PVC pipes. In the Study area, 73.2% of the households use tap water for drinking purpose, and other households use well, spring, and stream as a source of drinking water. On the other hand, 48% of households have drinking water sources close to their house, whereas others take about 10 minutes walk or more to fetch the water.

5) Cultural/religious aspects

The major festivals or religious activities in the Study area are Dashain, Tihar, Maghe Sankranti, Fagu Purnima, Sivaratri, Ghodejatra, Ram Nauami, Chaite Dashain, Nag Panchami, Krishnastami, Gaijatra, Indrajatra, Matatirtha Aunsi and Gokarna Aunsi. Most of these festivals and activities are very popular in Nepal, and both Hindus and Buddhists equally participate in these activities.

There are many social activities of the people in the Study area, and these are also popular in Nepal. The typical activities, for example, are Nwaran, Gufa Rakhne, Bratabandha, Shradha, etc.

6) Participation in user's group/community programs

Less than 20% of the households are found to be engaged in different types of user groups/community programs. 2% of the households are engaged in irrigation system committees (user's group), 6% are engaged in community forestry, 4% are engaged in community water supply committee, and 7% are engaged in other groups or programs. Jiwanpur VDC has the highest rate of households (36.2%) engaged in users groups/community programmes, while Bhimdhunga has low rate (3.1%).

However, about 70% of the households in the Study area are found to participate in one or more community programs by providing the voluntary labor or by cash donations. Therefore, most of the households have the opportunity to engage or participate in some user's groups or community programs.

7) Status of annual income and expenditure

The average annual income per household in the Study area is about Rps. 100,000. This income consists of Rps. 44,000 from agriculture, horticulture and livestock and of Rps. 56,000 from other activities. The major source of income from agriculture is selling grains, vegetables, and chicken (meat). The households in Naubise, Kewalpur, Chhatre Deurali and Bhimdhunga VDCs get the high income by selling vegetables and fruits while in Ramkot and Sitapaila VDCs earn more money from selling milk and from other activities such as service.

The annual average expenditure per households in the Study area is about Rps. 48,000. The households expend maximum amount in food items (29%), then in clothing (11%) and education of children (10%). On the other hand, they spend about 10% or more of total expenditure for on-farm activities such as purchase of fertilizer and agro-chemicals

8) Opinions on the Project

The local people in the Study area reported that they used the existing road for the various purposes. The existing road is, for example, used for the transportation of agricultural production to Kathmandu for selling them, for importing the consumer goods and kerosene from Kathmandu. On the other hand, more than 70% of the households are aware of the Project.

Over 90% of the households fully or just accept the Project, while only 1.3% do not accept the Project. 68% of the households told that they would agree the

resettlement program under some condition, however 25% had no idea whether they would agree or disagree. 56% of the households responded that they wished to resettle near their existing house when they would be asked to be resettled. On the other hand, 56% of the households showed their willingness to provide their land under certain or proper condition, and 25% had no idea. The interviewees showed different preferences for compensations. About 30% of the households told their preference for cash only as compensation, whereas 32% had a preference for cash and land combined. 16% told their preferences for land for land as compensation.

More than 95% of the households in the Study area think that the project will bring positive effects in the area. They gave the reasons of quick transportation including the emergency case, of increasing in the employment opportunity and business chance, of increasing in the land price, etc. However, a little people are afraid of negative effects caused by urbanization.

B-5 Result of Water Quality Survey

1. Introduction

During the implementation of the developmental project, possible environmental problems should be considered and attention should be given to reduce the extent of adverse environmental effects as much as possible. Water quality is one of the major components of environment. Its degradation causes various problems including health damage on human beings. In order to assess total impact on water quality and to apply appropriate mitigation measures, a time series monitoring of water quality in the Study area will be required.

Based on the above viewpoint, the existing water quality, as a baseline data, was collected in the Study area. The measured or analyzed items are temperature of ambient air and water, pH, electric conductivity (EC), dissolved oxygen (DO), total dissolved solids (TDS), turbidity, alkalinity, phosphate, nitrate, iron, manganese, copper, chemical oxygen demand (COD), biochemical oxygen demand (BOD), permanganate value, total coliforms, Escherichia coli (E-coli), and flow. The following shows the methodology, results, and some findings of the water quality survey conducted by the JICA Study Team.

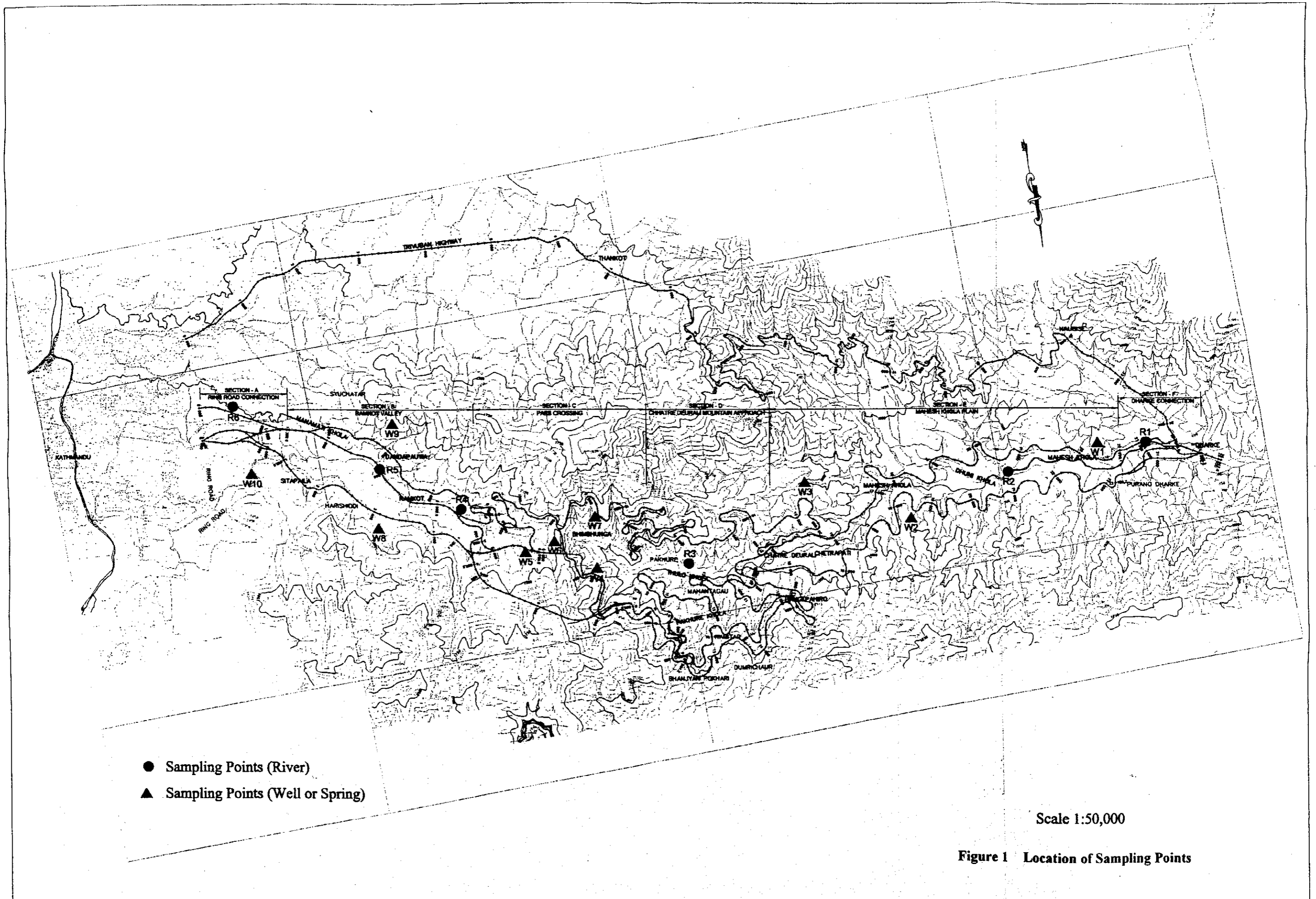
2. Date of Sampling and Field Measurement

The sampling and field measurement was carried out on the 5th and 6th of May, 2000 as the dry season survey, and on the 10th and 11th of June, 2000 as the wet season survey.

3. Location of Sampling Points

The sampling points were selected as shown in Figure 1, considering the characteristics of the study area and the project itself.

Among the total 16 sampling points, 6 were located on the rivers (Mahesh Khola and Triveni Khola) for the survey of surface water, whereas other 10 were located on the wells or springs for the survey of groundwater.



4. **Sampling, Field Measurement and Lab-analysis**

From each sampling point, the samples were collected in clean polythene bottles for physico-chemical and trace metal tests, and in sterilized bottles for microbial tests. The air and water temperature, pH, EC, and DO level were measured on the spot using portable thermometer, pH meter, conductivity meter and DO meter respectively. The flow in the rivers was calculated by using chemical tracer technique with dye.

The proper methodologies such as Japanese Industrial Standard (JIS) were applied to the laboratory tests and analysis.

5. **Results and Findings**

The analytical results of six river water samples and ten well or spring water samples are shown in Chapter 15 of the main report.

1) **Dry season**

- River water quality

The test results depict that the river water quality of Mahesh Khola is comparatively better than that of Triveni Khola. The DO level of Mahesh Khola seems over saturated at Dharke and Barabise with respect to river water temperature and its salinity whereas, the DO level at Pakhure remained slightly lower than saturation level. This water can well support the aquatic lives of even highly sensitive species including fish. Observed pH value however remained on higher side, which indicates the presence of carbonate type of rock system in these areas. Observed values of BOD, COD and permanganate value indicate that this river system is least polluted with organic pollutants. The observed counts of total coliforms and E-coli indicate that this river system is polluted with faecal contamination. The microbial water quality has got worsened at the lower segment of the river. Though the agriculture land covers the catchment area of the river system, the concentration of nitrate and phosphate is still lower in the dry season.

The water quality of Triveni River seems rather worse. This river is highly contaminated with total coliforms and E-coli. The dissolve oxygen level is lower than saturation, however, the existing DO level is still sufficient to support the aquatic life including fish. High values of COD, BOD and permanganate value indicate that the river system has been polluted with organic pollution, but the extent of organic pollution is not so extreme. Measured iron concentration is high. The observed turbidity value is very high at Shantinagar and Dandapauwa whereas the turbidity value is reduced enormously at Sitapaila (Mahadol). The quality of river water at Sitapila gets improved which is mainly due to the

dilution effect. Floating of paper pieces, polythene and wooden pieces, etc. were observed in this river system

In comparison, the existing water quality of Mahesh Khola is superior to Triveni Khola in all respects. Existence of high population density as well as high degree of human activities prevailing in the catchment area of Triveni Khola has degraded the water quality of this river system. Whereas such activities are comparatively very less in the catchment area of Mahesh Khola as a result of which the observed water quality of this river system remains far better than that of the previous one.

- Well/spring water quality

The test results depict that the quality of these water samples can be considered good from physico-chemical point of view except turbidity, where the turbidity value remains itself high in most of the analyzed water samples, compared to the World Health Organization (WHO) guideline value. The WHO guideline value of turbidity is exceeded by six water samples namely W1, W2, W3, W4, W6 and W10. The observed values of turbidity have ranged from 1 NTU - 36 NTU. The highest turbidity value is detected in water samples from W2. Iron concentration is remained marginally high only in two spring water samples (W1 & W6) whereas the observed value in other samples remained quite below than the WHO guideline value. In contrast to the physico-chemical quality, the microbial quality of these collected water samples remained worse. Most of the analyzed water samples are associated with high count of total coliforms and also contaminated with E-coli indicating the case of faecal contamination. However, water samples from sources W1, W6 and W8 can be considered good from microbial point of view. Observed nitrate value in W10 remains comparatively high than other sources. High level of nitrate in W10 may be due to the contamination of groundwater with un-sewered domestic sanitation as well as may be due to the extensive use of chemical fertilizers in and around the source. Comparatively high value of EC, TDS and observed microbiological count indicate the case of un-sewered sanitation contamination.

2) Wet season

- River water quality

The water quality comparison of two rivers shows that river water quality of Mahesh Khola is far better than that of Triveni Khola. The test results depict that the water quality of Mahesh Khola is suitable to be used for both recreational and agricultural purposes as well as the existing water quality can adequately support the all-fresh water aquatic lives including fish. In this river, over saturation state of DO was found at Dharke and Barabise whereas the existing DO level was slightly lower than the saturation level at Pakhure. All measured BOD, COD and

permanganate values indicate that this river is least polluted with organic load. On the other hand, high turbidity level is due to the high water current, prevailing human activities in the river and due to the agriculture runoff and other surface runoff. Common practice of discharging muddy water from the paddy field into the river system has played an important role to elevate the level of turbidity in river system. Comparatively high level of iron is also the cause of associated clay particles. Observed count of coliforms and E-coli indicate the contamination of river water with faecal matter, however, the contamination level itself remains within the safe limit of recreational, agriculture and fishery water uses.

Existing water quality of Triveni Khola is rather worse. The BOD, COD and permanganate values show that this river system is moderately polluted. Observed DO level is slightly lower than the saturation level, however, its level is sufficient to support all aquatic lives. Turbidity level is excessively high than normally found in common river system. Observed count of coliforms and E-coli remained beyond the tolerance limit for agriculture, recreational and fishery water uses, thereby indicating the case of sever faecal contamination. Measured level of iron is high and such high level of iron is particularly due to the large suspended clay particles.

- Well/spring water quality

The measured physico-chemical characteristics of these water samples are in fairly good condition except few parameters e.g. turbidity and iron. Observed level of turbidity is beyond the permissible value of WHO for drinking water in five water samples namely W₂, W₃, W₄, W₅ and W₁₀, whereas the iron concentration of W₄ marginally exceed the permissible level. Obtained data shows that the microbial quality of all these water samples is worse. Observed count of total coliforms and E-coli are far beyond the permissible level of WHO for drinking water in all water samples. However, water sample collected from W8 is free from E-coli.

Comparatively high level of nitrate was observed in water sample collected from W₁₀. High level of nitrate most possibly may be the cause of domestic sewage contamination into the groundwater source, which is mainly due to the unsewered sanitation as well as may be due to the extensive use of chemical fertilizers in and around the source. Corresponding high level of TDS and conductivity is also due to the cause of same reasons as mentioned above.

B-6 Ventilation System for Tunnel

Kathmundu-Naubise alternate Road Project
 Examination of Ventilation system for Tunnel

1. Codes and Standards

- Permanent International Association of Road Congresses (PIARC): Committee on Road Tunnels 1995.
- Japan Public Highway Corporation (JH): Design Standard

2. Conditions of Tunnel

• Length	L	0.705	km
• Area of inner section	AT	52.9	m ²
• Hydraulic Diameter	D	7.5	m
• Gradient	i	3.5	%
• Altitude	h	1381	m
• Traffic		two-way	tunnel

3. Required air volume: Q

Traffic flow ratio of each directional 50:50

(1) Diesel soot

According to PIARC, diesel soot includes exhaust gas from diesel engine. The required air volume for diesel soot is estimated by conditions of buses and trucks, since every buses and trucks have diesel engines and every passenger cars have gasoline engines.

$$Q = q \cdot M \cdot p \cdot L \cdot (1/V) \cdot (1/K) \cdot (1/60^2) \cdot f_i \cdot f_m \cdot f_h \quad \text{m}^3/\text{s}$$

herein q: Diesel soot emission	m ³ /h · veh	5ton 105, 10ton 205, 20ton 350
M: Traffic volume	veh/D	5ton 700, 10ton 1000, 20ton 2800
P: Hourly peak ratio of traffic	%	9.5
V: Average traffic speed	km/h	60
K: Density of soot	1/m	9 * 10 ⁻³
f _i : Gradient factor		1.02

Calculated by a proportion from Table21 HDV,10t,pre-EURO

f_h: Altitude factor 1.34

Calculated by a proportion from Table24 particulate

f_m: Mass Factor 5ton 1.0, 10ton 1.0, 20ton 1.6

Uses the number from Table22 at 60km/h, and the number of 5ton be same the number of 10ton

$$Q_{5ton} = 105 \cdot 530 \cdot 0.095 \cdot 0.705 \cdot (1/60) \cdot (1/9 \cdot 10^{-3}) \cdot (1/60^2) \cdot 1.02 \cdot 1.0 \cdot 1.34 = 2.6 \text{m}^3/\text{s}$$

$$Q_{10ton} = 205 \cdot 100 \cdot 0.095 \cdot 0.705 \cdot (1/60) \cdot (1/9 \cdot 10^{-3}) \cdot (1/60^2) \cdot 1.02 \cdot 1.0 \cdot 1.34 = 0.97 \text{m}^3/\text{s}$$

$$Q_{20ton} = 350 \cdot 1170 \cdot 0.095 \cdot 0.705 \cdot (1/60) \cdot (1/9 \cdot 10^{-3}) \cdot (1/60^2) \cdot 1.02 \cdot 1.6 \cdot 1.34 = 30.9 \text{m}^3/\text{s}$$

$$\Sigma Q = 34.5 \text{ m}^3/\text{s}$$

(2) Carbon monoxide : CO

Required air volume for passenger cars and heavy vehicles is calculated separately and added up later.

① Passenger cars

$$Q_p = q \cdot M \cdot p \cdot L \cdot (1/V) \cdot (1/C) \cdot (1/60^2) \cdot f_i \cdot f_h \cdot f_{cs} \cdot f_a \quad \text{m}^3/\text{s}$$

herein q: CO emission 1.25 m³/h·veh

M: Traffic volume 2290 veh/D

P: Hourly peak ratio of traffic 9.5%

V: Average traffic speed 60 km/h

C: Density of CO 0.0001 (100 ppm)

f_i: Gradient factor 1.54

Calculated by a proportion from Table 3 ECE 15/00 60km/h

f_h: Altitude factor 2.0

Calculated by a proportion from Table 17 gasoline conv.

f_{cs}: Cold start factor 1.0

Uses the number from Table 16 Travel-distance 3km

$$Q_p = 1.25 \cdot 2290 \cdot 0.095 \cdot 0.705 \cdot (1/60) \cdot (1/0.0001) \cdot (1/60^2) \cdot 1.54 \cdot 2.0 \cdot 1.0 \\ = 27.34 \text{ m}^3/\text{s}$$

② Buses and Trucks

$$Q_l = q \cdot M \cdot p \cdot L \cdot (1/V) \cdot (1/C) \cdot (1/60^2) \cdot f_i \cdot f_h \cdot f_m \cdot f_e \quad \text{m}^3/\text{s}$$

herein q: CO emission 0.08 m³/h·veh

M: Traffic volume veh/D 5ton 530, 10ton 100, 20ton 1170

P: Hourly peak ratio of traffic 0.095 D/h

V: Average traffic speed 60 km/h

C: Density of CO 0.0001 g/m³ (100 ppm)

f_i: Gradient factor 1.05

Calculated by a proportion from Table 19

f_h: Altitude factor 1.88

Calculated by a proportion from Table 24

f_m: Mass factor 5, 10ton 1.0, 20ton 1.6

Uses the number from Table 22

f_e: Factor for different emission standards 1.0

Uses the number from Table 23 pre EURO

$$Q_{5,10\text{ton}} = 0.08 \cdot (530+100) \cdot 0.095 \cdot 0.705 \cdot (1/60) \cdot (1/0.0001) \cdot (1/60^2) \cdot 1.05 \cdot 1.88 \cdot 1.0 \cdot 1.0$$

$$= 0.31 \text{ m}^3/\text{s}$$

$$Q_{20\text{ton}} = 0.08 \cdot 1170 \cdot 0.095 \cdot 0.705 \cdot (1/60) \cdot (1/0.0001) \cdot (1/60^2) \cdot 1.05 \cdot 1.88 \cdot 1.6 \cdot 1.0$$

$$= 0.92 \text{ m}^3/\text{s}$$

③ Addition

$$\Sigma Q = Q_p + Q_{5,10\text{ton}} + Q_{20\text{ton}} = 27.34 + 0.31 + 0.92 = 28.6 \text{ m}^3/\text{s}$$

(3) Required air volume

The required air volume for diesel soot is larger than that for carbon monoxide. Then the required air of ventilation uses the required air volume for diesel soot. Its volume is $34.5 \text{ m}^3/\text{s}$.

Required wind speed from this volume is only 0.65 m/s .

In generally, natural wind speed in the tunnel is 2 or 2.5 m/s .

Therefore the ventilation system of this tunnel is unnecessary.

The table from PIARC (1995)

Table-3

CO-Emission factors, gasoline, ECE15/00

ECE15/00 vm[km/h]	[g/h]						
	-6%	-4%	-2%	0%	2%	4%	6%
0	290.3	290.3	290.3	290.3	290.3	290.3	290.3
5	268.7	319.1	369.5	419.9	419.9	440.9	461.9
10	351.6	417.6	483.5	549.4	549.4	590.6	604.4
15	434.5	516.0	597.5	678.9	712.9	746.8	814.7
20	517.4	614.4	711.5	808.5	881.2	929.7	1051.0
30	614.5	729.7	845.0	960.2	1056.2	1200.2	1661.1
40	642.9	763.5	854.0	1004.6	1225.6	1597.3	2260.3
50	671.3	797.2	923.1	1049.0	1363.6	1993.0	2879.4
60	725.7	861.8	997.9	1134.0	1735.0	2874.6	3951.9
70	780.2	926.4	1072.7	1219.0	2425.8	4144.6	5388.0
80	834.6	991.1	1147.5	1304.0	3273.1	5424.7	6859.2
90	1235.2	1466.8	1698.4	1930.0	5732.1	9553.5	11647.6
100	1476.8	1789.2	2499.2	2840.0	8747.2	14384.6	16176.0
110	1344.0	1728.0	3397.2	3840.0	10560.0	16512.0	22464.0
115	1347.0	1796.0	3951.2	4490.0	11225.0	17062.0	23797.0

Table 17

Altitude factor

		CO	NOx	particulates
gasoline catalytic.	700m/0m	1.0	1.0	
	1000m/0m	2.6	1.0	
	2000m/0m	11.42	1.0	
	3000m/0m	13.0	1.0	
gasoline convent.	1000m/0m	1.78	0.74	
	2000m/0m	2.48	0.54	
	3000m/0m	3.18	0.54	
diesel	1000m/0m	1.21	1.0	1.0
	2000m/0m	1.50	1.0	1.25
	3000m/0m	1.81	1.0	1.5

Table 19

CO-Emission Factor for HDV, 10t, pre-EURO

pre-EURO vm[km/h]	[g/h]				
	6%	4%	2%	0%	-2%/-4%/-6%
5	143.2	135.4	129.3	126.0	63.0
10	173.6	157.7	145.1	137.7	68.8
15	204.5	180.5	161.4	149.5	74.7
20	235.7	203.4	177.0	159.4	79.7
25	267.8	227.2	193.7	170.6	85.3
30	300.7	251.9	210.9	181.9	90.9
35	334.4	277.0	228.1	191.9	95.9
40	370.5	304.4	247.2	203.2	101.6
45	404.7	330.0	264.1	211.6	105.8
50	439.9	356.3	281.4	219.8	109.9
55	477.7	385.7	301.8	231.6	115.8
60	516.9	415.7	323.3	244.0	122.0
65	557.1	446.9	345.4	256.7	128.3
70		479.4	368.4	269.8	134.9
75		513.7	392.4	281.8	140.9
80		549.9	417.9	294.6	147.3

Table-21

Particulate emission for HDV, 10t, pre-EURO

pre-EURO vm[km/h]	[m2/h]				
	6%	4%	2%	0%	-2%/-4%/-6%
5	98.6	94.0	90.5	88.6	44.3
10	116.0	106.9	99.7	95.3	47.7
15	133.8	120.0	109.0	102.1	51.1
20	151.8	133.2	118.0	107.8	53.9
25	170.2	146.9	127.6	114.3	57.1
30	189.2	161.1	137.5	120.8	60.4
35	208.6	175.6	147.4	126.6	63.3
40	229.4	191.4	158.4	133.1	66.5
45	249.1	206.0	168.1	137.9	69.0
50	269.3	221.2	178.1	142.6	71.3
55	292.1	237.9	189.8	149.4	74.7
60	313.7	255.4	202.2	156.6	78.3
65	336.8	273.4	214.9	163.9	81.9
70		292.0	228.2	171.4	85.7
75		311.8	242.0	178.3	89.2
80		332.7	256.6	185.7	92.9

Table-22

Mass factor fm dependent on velocity

vm [km/h]	5	10	20	30	40	50	60	70	80
20t/10t	1.8	1.8	1.8	1.8	1.8	1.7	1.6	1.6	1.5
30t/10t	2.5	2.6	2.6	2.6	2.5	2.4	2.3	2.1	2.0

Table-23

Factor for different emission standards

Regulation	CO	NOx	particulates
pre-EURO	1.0	1.0	1.0
EURO 0	0.62	1.11	0.65
EURO 1	0.4	0.84	0.55
EURO 2	0.34	0.64	0.30

Table-24

Altitude factor for HDV

		CO	NOx	particulates
diesel	1000m/0m	1.35	1.0	1.12
diesel inj.	2000m/0m	2.75	1.0	1.69
	3000m/0m	4.0	1.0	2.26

B-7 Alignment Data

VERTICAL ALIGNMENT DATA

Vertical Alignment Report
Alignment: KNAR51

Station	Elevation	Curve Length	Grade
0+000	1294.489		
0+400	1292.889	100	-0.400
0+700	1295.000	100	0.704
1+525	1315.625	100	2.500
1+775	1313.125	100	-1.000
2+500	1331.975	80	2.600
2+925	1336.706	60	1.113
4+200	1362.206	60	2.000
4+400	1368.206	100	3.000
4+625	1370.670	100	1.095
5+265	1389.870	130	3.000
6+200	1357.145	100	-3.500
8+450	1244.645	80	-5.000
8+850	1232.645	80	-3.000
9+675	1192.138	80	-4.910
9+800	1188.388	80	-3.000
11+275	1114.638	80	-5.000
12+175	1083.269	80	-3.485
14+250	979.519	120	-5.000
14+525	980.420	120	0.328
15+140	949.670	100	-5.000
15+425	950.322	80	0.229
16+100	930.072	80	-3.000
16+800	895.072	100	-5.000
16+925	897.686	100	2.092
17+400	877.736	80	-4.200
17+950	875.728	80	-0.365
18+600	852.978	100	-3.500
18+900	851.275	100	-0.568
19+310	840.000	100	-2.750
19+650	848.500	120	2.500
20+075	842.125	120	-1.500
20+550	818.375	100	-5.000
20+725	813.667	100	-2.690
21+260	786.917	120	-5.000
21+355.649	787.345		0.448

HORIZONTAL ALIGNMENT DATA

Spiral Curve Data: CLOTHOID
 SC 1+226.572 3066123.609 625581.409
 SPI 3066128.022 625565.311
 PC 1+276.572 3066132.764 625532.289
 Length: 50.000 L Tan: 33.361
 Radius: 200.000 S Tan: 16.692
 Theta: 7-09-43 P: 0.521
 X: 49.922 K: 24.987
 Y: 2.081 A: 100.000
 Chord: 49.965 Course: N 79-26-31 W
 Ts: 72.258

PI 1+699.147 3066192.823 625114.005
 Length: 625.266 Course: N 51-14-09 W
 Delta: 30-35-35

Tangent Data
 1+276.572 3066132.764 625532.289
 1+535.044 3066169.500 625276.442
 Length: 258.472 Course: N 81-49-45 W

Circular Curve Data
 PC 1+535.044 3066169.500 625276.442
 RP 3066763.409 625361.718
 PT 1+855.414 3066295.570 624986.049
 Delta: 30-35-35 Type: RIGHT
 Radius: 600.000 DOC: 09-32-57
 Length: 320.371 Tangent: 164.103
 Mid-Ord: 21.256 External: 22.037
 Chord: 316.578 Course: N 66-31-57 W
 Es: 22.037

PI 2+316.578 3066584.312 624626.466
 Length: 537.459 Course: N 67-04-58 W
 Delta: 15-50-49

Tangent Data
 1+855.414 3066295.570 624986.049
 2+233.071 3066532.027 624691.579
 Length: 377.657 Course: N 51-14-09 W

Circular Curve Data
 PC 2+233.071 3066532.027 624691.579
 RP 3066064.189 624315.909
 PT 2+399.019 3066616.830 624549.550
 Delta: 15-50-49 Type: LEFT
 Radius: 600.000 DOC: 09-32-57
 Length: 165.948 Tangent: 83.507
 Mid-Ord: 5.728 External: 5.783
 Chord: 165.419 Course: N 59-09-34 W
 Es: 5.783

PI 2+852.971 3066793.599 624131.429
 Length: 301.930 Course: N 03-42-24 W
 Delta: 63-22-34

Tangent Data

Horizontal Alignment Station and Curve Report.
 Alignment: KNAR51
 Desc. Station Spiral/Curve Data Northing Easting

PI 0+000 3065563.900 626649.362
 Length: 278.494 Course: N 84-31-32 W

PI 0+278.494 3065590.469 626372.138
 Length: 934.543 Course: N 55-17-58 W
 Delta: 29-13-34

Tangent Data
 0+000 3065563.900 626649.362
 0+122.060 3065575.545 626527.859
 Length: 122.060 Course: N 84-31-32 W

Circular Curve Data
 PC 0+122.060 3065575.545 626527.859
 RP 3066172.808 626585.100
 PT 0+428.115 3065679.526 626243.527
 Delta: 29-13-34 Type: RIGHT
 Radius: 600.000 DOC: 09-32-57
 Length: 306.056 Tangent: 156.435
 Mid-Ord: 19.409 External: 20.058
 Chord: 302.748 Course: N 69-54-45 W
 Es: 20.058

PI 1+206.224 3066122.494 625603.814
 Length: 494.833 Course: N 81-49-45 W
 Delta: 26-31-47

Tangent Data
 0+428.115 3065679.526 626243.527
 1+133.966 3066081.358 625663.220
 Length: 705.851 Course: N 55-17-58 W

Spiral Curve Data: CLOTHOID
 TS 1+133.966 3066081.358 625663.220
 SPI 3066100.350 625635.793
 SC 1+183.966 3066108.067 625620.993
 Length: 50.000 L Tan: 33.361
 Radius: 200.000 S Tan: 16.692
 Theta: 7-09-43 P: 0.521
 X: 49.922 K: 24.987
 Y: 2.081 A: 100.000
 Chord: 49.965 Course: N 57-41-11 W
 Ts: 72.258

Circular Curve Data
 SC 1+183.966 3066108.067 625620.993
 RP 3065930.727 625528.523
 SC 1+226.572 3066123.609 625581.409
 Delta: 12-12-21 Type: LEFT
 Radius: 200.000 DOC: 28-38-52
 Length: 42.606 Tangent: 21.384
 Mid-Ord: 1.133 External: 1.140
 Chord: 42.525 Course: N 68-33-51 W
 Es: 6.017

SC 3+141.467 3067117.732 624094.159
 Delta: 15-42-17 Type: LEFT
 Radius: 200.000 DOC: 28-38-52
 Length: 54.820 Tangent: 27.583
 Mid-Ord: 1.875 External: 1.893
 Chord: 54.649 Course: N 18-43-16 W
 Es: 7.608

Spiral Curve Data: CLOTHOID

SC 3+141.467 3067117.732 624094.159
 SPI 3067132.660 624086.692
 PC 3+191.467 3067160.404 624068.165
 Length: 50.000 L Tan: 33.361
 Radius: 200.000 S Tan: 16.692
 Theta: 7-09-43 P: 0.521
 X: 49.922 K: 24.987
 Y: 2.081 A: 100.000
 Chord: 49.965 Course: N 31-20-54 W
 Ts: 78.770

PI 3+551.836 3067460.090 623868.031
 Length: 196.762 Course: N 63-17-57 W
 Delta: 29-33-50

Tangent Data

3+191.467 3067160.404 624068.165
 3+473.937 3067395.309 623911.293
 Length: 282.470 Course: N 33-44-07 W

Spiral Curve Data: CLOTHOID

TS 3+473.937 3067395.309 623911.293
 SPI 3067423.052 623892.766
 SC 3+523.937 3067435.669 623881.838
 Length: 50.000 L Tan: 33.361
 Radius: 200.000 S Tan: 16.692
 Theta: 7-09-43 P: 0.521
 X: 49.922 K: 24.987
 Y: 2.081 A: 100.000
 Chord: 49.965 Course: N 36-07-21 W
 Ts: 77.899

Circular Curve Data

SC 3+523.937 3067435.669 623881.838
 RP 3067304.727 623730.661
 SC 3+577.134 3067470.802 623842.102
 Delta: 15-14-23 Type: LEFT
 Radius: 200.000 DOC: 28-38-52
 Length: 53.197 Tangent: 26.757
 Mid-Ord: 1.766 External: 1.782
 Chord: 53.040 Course: N 48-31-02 W
 Es: 7.384

Spiral Curve Data: CLOTHOID

SC 3+577.134 3067470.802 623842.102
 SPI 3067480.103 623828.242
 PC 3+627.134 3067495.093 623798.439
 Length: 50.000 L Tan: 33.361
 Radius: 200.000 S Tan: 16.692

2+399.019 3066616.830 624549.550
 2+629.811 3066706.700 624336.975
 Length: 230.792 Course: N 67-04-58 W

Spiral Curve Data: CLOTHOID

TS 2+629.811 3066706.700 624336.975
 SPI 3066726.186 624290.884
 SC 2+704.811 3066738.735 624269.218
 Length: 75.000 L Tan: 50.041
 Radius: 300.000 S Tan: 25.037
 Theta: 7-09-43 P: 0.781
 X: 74.883 K: 37.480
 Y: 3.122 A: 150.000
 Chord: 74.948 Course: N 64-41-45 W
 Ts: 223.160

Circular Curve Data

SC 2+704.811 3066738.735 624269.218
 RP 3066998.335 624419.577
 SC 2+961.647 3066941.768 624124.959
 Delta: 49-03-08 Type: RIGHT
 Radius: 300.000 DOC: 19-05-55
 Length: 256.837 Tangent: 136.883
 Mid-Ord: 27.068 External: 29.753
 Chord: 249.064 Course: N 35-23-41 W
 Es: 53.477

Spiral Curve Data: CLOTHOID

SC 2+961.647 3066941.768 624124.959
 SPI 3066966.366 624120.238
 PC 3+036.647 3067016.292 624117.003
 Length: 75.000 L Tan: 50.041
 Radius: 300.000 S Tan: 25.037
 Theta: 7-09-43 P: 0.781
 X: 74.883 K: 37.480
 Y: 3.122 A: 150.000
 Chord: 74.948 Course: N 06-05-37 W
 Ts: 223.160

PI 3+115.417 3067094.897 624111.910
 Length: 439.139 Course: N 33-44-07 W
 Delta: 30-01-43

Spiral Curve Data: CLOTHOID

TS 3+036.647 3067016.292 624117.003
 SPI 3067049.583 624114.846
 SC 3+086.647 3067065.975 624111.699
 Length: 50.000 L Tan: 33.361
 Radius: 200.000 S Tan: 16.692
 Theta: 7-09-43 P: 0.521
 X: 49.922 K: 24.987
 Y: 2.081 A: 100.000
 Chord: 49.965 Course: N 06-05-37 W
 Ts: 78.770

Circular Curve Data

SC 3+086.647 3067065.975 624111.699
 RP 3067028.264 623915.286

SC 4+485.033 3067878.782 623044.804
 Length: 60.000 L Tan: 40.047
 Radius: 200.000 S Tan: 20.043
 Theta: 8-35-40 P: 0.749
 X: 59.865 K: 29.978
 Y: 2.995 A: 109.545
 Chord: 59.940 Course: N 50-57-40 W
 Ts: 85.067

Circular Curve Data

SC 4+485.033 3067878.782 623044.804
 RP 3067711.637 622934.975
 SC 4+532.163 3067899.805 623002.745
 Delta: 13-30-06 Type: LEFT
 Radius: 200.000 DOC: 28-38-52
 Length: 47.130 Tangent: 23.675
 Mid-Ord: 1.387 External: 1.396
 Chord: 47.021 Course: N 63-26-32 W
 Es: 8.171

Spiral Curve Data: CLOTHOID

SC 4+532.163 3067899.805 623002.745
 SPI 3067906.597 622983.888
 PC 4+592.163 3067914.384 622944.605
 Length: 60.000 L Tan: 40.047
 Radius: 200.000 S Tan: 20.043
 Theta: 8-35-40 P: 0.749
 X: 59.865 K: 29.978
 Y: 2.995 A: 109.545
 Chord: 59.940 Course: N 75-55-24 W
 Ts: 85.067

PI 4+848.058 3067964.143 622693.594
 Length: 544.446 Course: N 47-03-41 W
 Delta: 31-43-34

Tangent Data

4+592.163 3067914.384 622944.605
 4+766.091 3067948.204 622773.995
 Length: 173.928 Course: N 78-47-15 W

Spiral Curve Data: CLOTHOID

TS 4+766.091 3067948.204 622773.996
 SPI 3067954.691 622741.272
 SC 4+816.091 3067959.953 622725.432
 Length: 50.000 L Tan: 33.361
 Radius: 200.000 S Tan: 16.692
 Theta: 7-09-43 P: 0.521
 X: 49.922 K: 24.987
 Y: 2.081 A: 100.000
 Chord: 49.965 Course: N 76-24-02 W
 Ts: 81.967

Circular Curve Data

SC 4+816.091 3067959.953 622725.432
 RP 3068149.756 622788.477
 SC 4+876.837 3067987.496 622671.551
 Delta: 17-24-08 Type: RIGHT

Theta: 7-09-43 P: 0.521
 X: 49.922 K: 24.987
 Y: 2.081 A: 100.000
 Chord: 49.965 Course: N 60-54-44 W
 Ts: 77.899

PI 3+745.997 3067548.502 623692.251
 Length: 431.159 Course: N 73-17-58 W
 Delta: 10-00-01

Tangent Data

3+627.134 3067495.093 623798.439
 3+693.502 3067524.914 623739.148
 Length: 66.368 Course: N 63-17-57 W

Circular Curve Data

PC 3+693.502 3067524.914 623739.148
 RP 3066988.895 623469.549
 PT 3+798.226 3067563.588 623641.969
 Delta: 10-00-01 Type: LEFT
 Radius: 600.000 DOC: 09-32-57
 Length: 104.724 Tangent: 52.495
 Mid-Ord: 2.283 External: 2.292
 Chord: 104.591 Course: N 68-17-58 W
 Es: 2.292

PI 4+176.890 3067672.403 623279.278
 Length: 337.549 Course: N 48-05-49 W
 Delta: 25-12-09

Tangent Data

3+798.226 3067563.588 623641.969
 4+042.759 3067633.859 623407.750
 Length: 244.533 Course: N 73-17-58 W

Circular Curve Data

PC 4+042.759 3067633.859 623407.750
 RP 3068208.551 623580.171
 PT 4+306.680 3067761.985 623179.448
 Delta: 25-12-09 Type: RIGHT
 Radius: 600.000 DOC: 09-32-57
 Length: 263.921 Tangent: 134.130
 Mid-Ord: 14.453 External: 14.810
 Chord: 261.798 Course: N 60-41-54 W
 Es: 14.810

PI 4+510.100 3067897.843 623028.048
 Length: 340.962 Course: N 78-47-15 W
 Delta: 30-41-26

Tangent Data

4+306.680 3067761.985 623179.448
 4+425.033 3067841.029 623091.361
 Length: 118.352 Course: N 48-05-49 W

Spiral Curve Data: CLOTHOID

TS 4+425.033 3067841.029 623091.361
 SPI 3067867.776 623061.555

Y: 2.081 A: 100.000
Chord: 49.965 Course: N 67-41-51 W
Ts: 65.826

PI 6+433.445 3068691.131 621312.119
Length: 181.139 Course: N 24-07-37 W
Delta: 45-57-27

Tangent Data
5+453.856 3068357.450 622233.125
6+357.230 3068665.170 621383.777
Length: 903.374 Course: N 70-05-04 W

Spiral Curve Data: CLOTHOID
TS 6+357.230 3068665.170 621383.777
SPI 3068676.550 621352.365
SC 6+407.230 3068685.382 621338.149
Length: 50.000 L Tan: 33.409
Radius: 120.000 S Tan: 16.736
Theta: 11-56-12 P: 0.867
X: 49.783 K: 24.964
Y: 3.461 A: 77.460
Chord: 49.904 Course: N 66-06-26 W
Ts: 76.216

Circular Curve Data
SC 6+407.230 3068685.382 621338.149
RP 3068787.312 621401.477
SC 6+453.483 3068716.669 621304.473
Delta: 22-05-03 Type: RIGHT
Radius: 120.000 DOC: 47-44-47
Length: 46.253 Tangent: 23.417
Mid-Ord: 2.222 External: 2.264
Chord: 45.967 Course: N 47-06-21 W
Es: 11.284

Spiral Curve Data: CLOTHOID
SC 6+453.483 3068716.669 621304.473
SPI 3068730.198 621294.621
PC 6+503.483 3068760.689 621280.965
Length: 50.000 L Tan: 33.409
Radius: 120.000 S Tan: 16.736
Theta: 11-56-12 P: 0.867
X: 49.783 K: 24.964
Y: 3.461 A: 77.460
Chord: 49.904 Course: N 28-06-16 W
Ts: 76.216

PI 6+608.406 3068856.446 621238.076
Length: 162.665 Course: N 42-52-19 E
Delta: 66-59-56

Tangent Data
6+503.483 3068760.689 621280.965
6+550.682 3068803.765 621261.671
Length: 47.199 Course: N 24-07-37 W

Spiral Curve Data: CLOTHOID

Radius: 200.000 DOC: 28-38-52
Length: 60.745 Tangent: 30.608
Mid-Ord: 2.302 External: 2.329
Chord: 60.512 Course: N 62-55-28 W
Es: 8.459

Spiral Curve Data: CLOTHOID
SC 4+876.837 3067987.496 622671.551
SPI 3067997.254 622658.010
PC 4+926.837 3068019.980 622633.587
Length: 50.000 L Tan: 33.361
Radius: 200.000 S Tan: 16.692
Theta: 7-09-43 P: 0.521
X: 49.922 K: 24.987
Y: 2.081 A: 100.000
Chord: 49.965 Course: N 49-26-54 W
Ts: 81.967

PI 5+389.315 3068335.028 622295.014
Length: 1045.415 Course: N 70-05-04 W
Delta: 23-01-24

Tangent Data
4+926.837 3068019.980 622633.587
5+323.490 3068290.186 622343.204
Length: 396.653 Course: N 47-03-41 W

Spiral Curve Data: CLOTHOID
TS 5+323.490 3068290.186 622343.204
SPI 3068312.912 622318.781
SC 5+373.490 3068322.670 622305.239
Length: 50.000 L Tan: 33.361
Radius: 200.000 S Tan: 16.692
Theta: 7-09-43 P: 0.521
X: 49.922 K: 24.987
Y: 2.081 A: 100.000
Chord: 49.965 Course: N 49-26-54 W
Ts: 65.826

Circular Curve Data
SC 5+373.490 3068322.670 622305.239
RP 3068160.410 622188.313
PC 5+403.856 3068338.488 622279.352
Delta: 08-41-57 Type: LEFT
Radius: 200.000 DOC: 28-38-52
Length: 30.366 Tangent: 15.212
Mid-Ord: 0.576 External: 0.578
Chord: 30.337 Course: N 58-34-22 W
Es: 4.637

Spiral Curve Data: CLOTHOID
SC 5+403.856 3068338.488 622279.352
SPI 3068346.086 622264.490
PC 5+453.856 3068357.450 622233.125
Length: 50.000 L Tan: 33.361
Radius: 200.000 S Tan: 16.692
Theta: 7-09-43 P: 0.521
X: 49.922 K: 24.987

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Chord: 74.654 Course: N 12-18-36 W
Es: 46.569

Spiral Curve Data: CLOTHOID

SC 6+771.416 3068999.423 621282.565
SPI 3069006.860 621273.453
PC 6+806.416 3069015.832 621251.800
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826
Chord: 34.868 Course: N 61-55-32 W
Ts: 104.941

PI 6+880.845 3069044.324 621183.040
Length: 145.736 Course: S 86-37-55 W
Delta: 25-52-33

Tangent Data

6+806.416 3069015.832 621251.800
6+839.768 3069028.600 621220.989
Length: 33.352 Course: N 67-29-32 W

Spiral Curve Data: CLOTHOID

TS 6+839.768 3069028.600 621220.989
SPI 3069037.803 621198.779
SC 6+875.768 3069040.345 621187.013
Length: 36.000 L Tan: 24.041
Radius: 100.000 S Tan: 12.037
Theta: 10-18-48 P: 0.539
X: 35.884 K: 17.981
Y: 2.155 A: 60.000
Chord: 35.948 Course: N 70-55-44 W
Ts: 41.077

Circular Curve Data

SC 6+875.768 3069040.345 621187.013
RP 3068942.602 621165.890
SC 6+884.930 3069041.868 621177.982
Delta: 05-14-58 Type: LEFT
Radius: 100.000 DOC: 57-17-45
Length: 9.162 Tangent: 4.584
Mid-Ord: 0.105 External: 0.105
Chord: 9.159 Course: N 80-25-48 W
Es: 3.158

Spiral Curve Data: CLOTHOID

SC 6+884.930 3069041.868 621177.982
SPI 3069043.324 621166.033
PC 6+920.930 3069041.911 621142.034
Length: 36.000 L Tan: 24.041
Radius: 100.000 S Tan: 12.037
Theta: 10-18-48 P: 0.539
X: 35.884 K: 17.981
Y: 2.155 A: 60.000
Chord: 35.948 Course: N 89-55-52 W
Ts: 41.077

TS 6+550.682 3068803.765 621261.671
SPI 3068825.156 621252.091
SC 6+585.682 3068836.819 621250.573
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826
Chord: 34.868 Course: N 18-33-38 W
Ts: 57.724

Circular Curve Data

SC 6+585.682 3068836.819 621250.573
RP 3068844.563 621310.071
SC 6+620.843 3068871.017 621256.217
Delta: 33-34-35 Type: RIGHT
Radius: 60.000 DOC: 95-29-35
Length: 35.161 Tangent: 18.102
Mid-Ord: 2.557 External: 2.671
Chord: 34.660 Course: N 09-22-21 E
Es: 12.969

Spiral Curve Data: CLOTHOID

SC 6+620.843 3068871.017 621256.217
SPI 3068881.574 621261.403
PC 6+655.843 3068898.751 621277.349
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826
Chord: 34.868 Course: N 37-18-20 E
Ts: 57.724

PI 6+760.784 3068975.660 621348.747
Length: 179.370 Course: N 67-29-32 W
Delta: 110-21-50

Spiral Curve Data: CLOTHOID

TS 6+655.843 3068898.751 621277.349
SPI 3068915.928 621293.296
SC 6+690.843 3068926.486 621298.481
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826
Chord: 34.868 Course: N 37-18-20 E
Ts: 104.941

Circular Curve Data

SC 6+690.843 3068926.486 621298.481
RP 3068952.939 621244.628
SC 6+771.416 3068999.423 621282.565
Delta: 76-56-29 Type: LEFT
Radius: 60.000 DOC: 95-29-35
Length: 80.573 Tangent: 47.676
Mid-Ord: 13.024 External: 16.636

RP 3069170.256 621014.651
 SC 7+123.050 3069186.657 621072.366
 Delta: 15-58-29 Type: LEFT
 Radius: 60.000 DOC: 95-29-35
 Length: 16.729 Tangent: 8.419
 Mid-Ord: 0.582 External: 0.588
 Chord: 16.675 Course: N 07-52-34 W
 Es: 8.688

Spiral Curve Data: CLOTHOID
 SC 7+123.050 3069186.657 621072.366
 SPI 3069201.340 621068.194
 PC 7+168.223 3069225.434 621049.751
 Length: 45.174 L Tan: 30.342
 Radius: 60.000 S Tan: 15.264
 Theta: 21-34-08 P: 1.410
 X: 44.538 K: 22.481
 Y: 5.611 A: 52.062
 Chord: 44.890 Course: N 30-15-05 W
 Ts: 53.250

PI 7+242.968 3069284.787 621004.319
 Length: 477.905 Course: N 43-58-49 E
 Delta: 81-24-46

Spiral Curve Data: CLOTHOID
 TS 7+168.223 3069225.434 621049.751
 SPI 3069249.528 621031.308
 SC 7+213.397 3069264.211 621027.136
 Length: 45.174 L Tan: 30.342
 Radius: 60.000 S Tan: 15.264
 Theta: 21-34-08 P: 1.410
 X: 44.538 K: 22.481
 Y: 5.611 A: 52.062
 Chord: 44.890 Course: N 30-15-05 W
 Ts: 74.745

Circular Curve Data
 SC 7+213.397 3069264.211 621027.136
 RP 3069280.612 621084.851
 SC 7+258.565 3069308.102 621031.519
 Delta: 43-07-57 Type: RIGHT
 Radius: 60.000 DOC: 95-29-35
 Length: 45.168 Tangent: 23.715
 Mid-Ord: 4.200 External: 4.517
 Chord: 44.109 Course: N 05-42-10 E
 Es: 20.640

Spiral Curve Data: CLOTHOID
 SC 7+258.565 3069308.102 621031.519
 SPI 3069318.557 621036.908
 PC 7+293.565 3069335.422 621053.183
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762
 Theta: 16-42-41 P: 0.848
 X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: N 38-24-50 E

PI 7+025.588 3069035.763 621037.556
 Length: 153.976 Course: N 16-49-21 E
 Delta: 110-11-26

Spiral Curve Data: CLOTHOID
 TS 6+920.930 3069041.911 621142.034
 SPI 3069040.534 621118.636
 SC 6+955.930 3069043.249 621107.192
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762
 Theta: 16-42-41 P: 0.848
 X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: N 87-48-06 W
 Ts: 104.659

Circular Curve Data
 SC 6+955.930 3069043.249 621107.192
 RP 3069101.629 621121.039
 SC 7+036.321 3069101.746 621061.039
 Delta: 76-46-05 Type: RIGHT
 Radius: 60.000 DOC: 95-29-35
 Length: 80.391 Tangent: 47.528
 Mid-Ord: 12.968 External: 16.544
 Chord: 74.511 Course: N 38-16-22 W
 Es: 46.338

Spiral Curve Data: CLOTHOID
 SC 7+036.321 3069101.746 621061.039
 SPI 3069113.508 621061.062
 PC 7+071.321 3069135.943 621067.845
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762
 Theta: 16-42-41 P: 0.848
 X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: N 11-15-22 E
 Ts: 104.659

PI 7+120.638 3069183.149 621082.118
 Length: 127.996 Course: N 37-25-56 W
 Delta: 54-15-18

Spiral Curve Data: CLOTHOID
 TS 7+071.321 3069135.943 621067.845
 SPI 3069158.378 621074.628
 SC 7+106.321 3069170.140 621074.651
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762
 Theta: 16-42-41 P: 0.848
 X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: N 11-15-22 E
 Ts: 49.317

Circular Curve Data
 SC 7+106.321 3069170.140 621074.651

SC 7+744.450 3069506.496 620968.682
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762
 Theta: 16-42-41 P: 0.848
 X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: S 76-40-33 W
 Ts: 43.080

Circular Curve Data

SC 7+744.450 3069506.496 620968.682
 RP 3069566.453 620966.400
 SC 7+757.289 3069507.379 620955.898
 Delta: 12-15-36 Type: RIGHT
 Radius: 60.000 DOC: 95-29-35
 Length: 12.839 Tangent: 6.444
 Mid-Ord: 0.343 External: 0.345
 Chord: 12.814 Course: N 86-02-57 W
 Es: 6.026

Spiral Curve Data: CLOTHOID

SC 7+757.289 3069507.379 620955.898
 SPI 3069509.438 620944.318
 PC 7+792.289 3069520.003 620923.396
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762
 Theta: 16-42-41 P: 0.848
 X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: N 68-46-28 W
 Ts: 43.080

PI 7+844.858 3069543.698 620876.470
 Length: 164.701 Course: S 74-26-00 W
 Delta: 42-21-31

Spiral Curve Data: CLOTHOID

TS 7+792.289 3069520.003 620923.396
 SPI 3069530.541 620902.526
 SC 7+827.289 3069533.700 620891.251
 Length: 35.000 L Tan: 23.380
 Radius: 90.000 S Tan: 11.709
 Theta: 11-08-27 P: 0.566
 X: 34.868 K: 17.478
 Y: 2.262 A: 56.125
 Chord: 34.941 Course: N 66-55-13 W
 Ts: 52.569

Circular Curve Data

SC 7+827.289 3069533.700 620891.251
 RP 3069447.037 620866.971
 SC 7+858.826 3069536.769 620860.026
 Delta: 20-04-37 Type: LEFT
 Radius: 90.000 DOC: 63-39-43
 Length: 31.537 Tangent: 15.932
 Mid-Ord: 1.378 External: 1.399
 Chord: 31.376 Course: N 84-23-14 W
 Es: 7.127

Ts: 70.368

PI 7+701.102 3069628.677 621336.181
 Length: 395.640 Course: S 71-06-34 W
 Delta: 152-52-15

Tangent Data

7+293.565 3069335.422 621053.183
 7+431.453 3069434.644 621148.935
 Length: 137.888 Course: N 43-58-49 E

Spiral Curve Data: CLOTHOID

TS 7+431.453 3069434.644 621148.935
 SPI 3069451.509 621165.210
 SC 7+466.453 3069461.964 621170.599
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762
 Theta: 16-42-41 P: 0.848
 X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: N 38-24-50 E
 Ts: 269.648

Circular Curve Data

SC 7+466.453 3069461.964 621170.599
 RP 3069489.454 621117.267
 SC 7+591.539 3069549.411 621114.986
 Delta: 119-26-54 Type: LEFT
 Radius: 60.000 DOC: 95-29-35
 Length: 125.086 Tangent: 102.777
 Mid-Ord: 29.750 External: 59.009
 Chord: 103.633 Course: N 32-27-18 W
 Es: 199.434

Spiral Curve Data: CLOTHOID

SC 7+591.539 3069549.411 621114.986
 SPI 3069548.964 621103.232
 PC 7+626.539 3069541.375 621081.057
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762
 Theta: 16-42-41 P: 0.848
 X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: S 76-40-33 W
 Ts: 269.648

PI 7+752.531 3069500.584 620961.851
 Length: 95.649 Course: N 63-12-29 W
 Delta: 45-40-57

Tangent Data

7+626.539 3069541.375 621081.057
 7+709.450 3069514.532 621002.611
 Length: 82.911 Course: S 71-06-34 W

Spiral Curve Data: CLOTHOID

TS 7+709.450 3069514.532 621002.611
 SPI 3069506.944 620980.435

Length: 278.315 Course: S 63-56-44 W
Delta: 129-04-05

Spiral Curve Data: CLOTHOID

TS 8+050.197 3069607.341 620731.078
SPI 3069630.604 620733.940
SC 8+085.197 3069642.198 620731.959
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826
Chord: 34.868 Course: N 01-26-50 E
Ts: 129.678

Circular Curve Data

SC 8+085.197 3069642.198 620731.959
RP 3069632.091 620672.816
SC 8+179.074 3069691.295 620663.075
Delta: 89-38-44 Type: LEFT
Radius: 60.000 DOC: 95-29-35
Length: 93.877 Tangent: 59.630
Mid-Ord: 17.443 External: 24.592
Chord: 84.590 Course: N 54-31-13 W
Es: 67.661

Spiral Curve Data: CLOTHOID

SC 8+179.074 3069691.295 620663.075
SPI 3069689.385 620651.469
PC 8+214.074 3069679.091 620630.413
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826
Chord: 34.868 Course: S 69-30-43 W
Ts: 129.678

PI 8+362.712 3069613.805 620496.880
Length: 223.734 Course: N 18-57-55 W
Delta: 97-05-21

Tangent Data

8+214.074 3069679.091 620630.413
8+276.377 3069651.726 620574.441
Length: 62.303 Course: S 63-56-44 W

Spiral Curve Data: CLOTHOID

TS 8+276.377 3069651.726 620574.441
SPI 3069641.431 620553.385
SC 8+311.377 3069639.521 620541.779
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826
Chord: 34.868 Course: S 69-30-43 W
Ts: 86.335

Spiral Curve Data: CLOTHOID

SC 7+858.826 3069536.769 620860.026
SPI 3069535.865 620848.352
PC 7+893.826 3069529.591 620825.830
Length: 35.000 L Tan: 23.380
Radius: 90.000 S Tan: 11.709
Theta: 11-08-27 P: 0.566
X: 34.868 K: 17.478
Y: 2.262 A: 56.125
Chord: 34.941 Course: S 78-08-45 W
Ts: 52.569

PI 8+005.958 3069499.500 620717.811
Length: 238.332 Course: N 07-00-49 E
Delta: 112-34-49

Tangent Data

7+893.826 3069529.591 620825.830
7+897.304 3069528.658 620822.480
Length: 3.478 Course: S 74-26-00 W

Spiral Curve Data: CLOTHOID

TS 7+897.304 3069528.658 620822.480
SPI 3069522.368 620799.901
SC 7+932.304 3069522.603 620788.141
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826
Chord: 34.868 Course: S 79-59-59 W
Ts: 108.654

Circular Curve Data

SC 7+932.304 3069522.603 620788.141
RP 3069582.591 620789.340
SC 8+015.197 3069572.484 620730.197
Delta: 79-09-28 Type: RIGHT
Radius: 60.000 DOC: 95-29-35
Length: 82.894 Tangent: 49.599
Mid-Ord: 13.755 External: 17.846
Chord: 76.457 Course: N 49-16-35 W
Es: 49.639

Spiral Curve Data: CLOTHOID

SC 8+015.197 3069572.484 620730.197
SPI 3069584.078 620728.216
PC 8+050.197 3069607.341 620731.078
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826
Chord: 34.868 Course: N 01-26-50 E
Ts: 108.654

PI 8+179.875 3069736.048 620746.912

SPI 3069841.062 620399.983
 PC 8+599.756 3069853.769 620380.368
 Length: 35.000 L Tan: 23.371
 Radius: 100.000 S Tan: 11.701
 Theta: 10-01-36 P: 0.510
 X: 34.893 K: 17.482
 Y: 2.037 A: 59.161
 Chord: 34.952 Course: N 53-43-22 W
 Ts: 52.188

PI 8+615.998 3069862.600 620366.736
 Length: 51.801 Course: N 61-45-59 E
 Delta: 118-49-50

Tangent Data
 8+599.756 3069853.769 620380.368
 8+690.863 3069903.303 620303.904
 Length: 91.107 Course: N 57-03-51 W

Spiral Curve Data: CLOTHOID
 TS 8+690.863 3069903.303 620303.904
 SPI 3069917.904 620281.366
 SC 8+730.863 3069920.734 620268.162
 Length: 40.000 L Tan: 26.854
 Radius: 55.000 S Tan: 13.504
 Theta: 20-50-05 P: 1.206
 X: 39.474 K: 19.912
 Y: 4.803 A: 46.904
 Chord: 39.765 Course: N 64-00-05 W
 Ts: 74.864

Circular Curve Data
 SC 8+730.863 3069920.734 620268.162
 RP 3069866.957 620256.632
 SC 8+924.869 3069812.793 620266.186
 Delta: 202-06-15 Type: LEFT
 Radius: 55.000 DOC: 104-10-27
 Length: 194.006 Tangent: 281.585
 Mid-Ord: 65.544 External: 341.906
 Chord: 107.960 Course: S 01-02-56 W
 Es: 55.189

Spiral Curve Data: CLOTHOID
 SC 8+924.869 3069812.793 620266.186
 SPI 3069814.839 620277.787
 PC 8+959.869 3069825.936 620298.455
 Length: 35.000 L Tan: 23.458
 Radius: 55.000 S Tan: 11.780
 Theta: 18-13-50 P: 0.925
 X: 34.647 K: 17.441
 Y: 3.685 A: 43.875
 Chord: 34.843 Course: N 67-50-17 E
 Ts: 77.502

PI 9+089.171 3069887.105 620412.374
 Length: 351.998 Course: S 04-06-04 W
 Delta: 122-20-05

Circular Curve Data
 SC 8+311.377 3069639.521 620541.779
 RP 3069698.725 620532.038
 SC 8+378.048 3069663.733 620483.299
 Delta: 63-40-00 Type: RIGHT
 Radius: 60.000 DOC: 95-29-35
 Length: 66.672 Tangent: 37.250
 Mid-Ord: 9.025 External: 10.623
 Chord: 63.294 Course: N 67-30-35 W
 Es: 31.911

Spiral Curve Data: CLOTHOID
 SC 8+378.048 3069663.733 620483.299
 SPI 3069673.288 620476.439
 PC 8+413.048 3069695.453 620468.822
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762
 Theta: 16-42-41 P: 0.848
 X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: N 24-31-54 W
 Ts: 86.335

PI 8+550.448 3069825.394 620424.168
 Length: 68.431 Course: N 57-03-51 W
 Delta: 38-05-57

Tangent Data
 8+413.048 3069695.453 620468.822
 8+498.260 3069776.039 620441.129
 Length: 85.212 Course: N 18-57-55 W

Spiral Curve Data: CLOTHOID
 TS 8+498.260 3069776.039 620441.129
 SPI 3069798.142 620433.533
 SC 8+533.260 3069808.376 620427.862
 Length: 35.000 L Tan: 23.371
 Radius: 100.000 S Tan: 11.701
 Theta: 10-01-36 P: 0.510
 X: 34.893 K: 17.482
 Y: 2.037 A: 59.161
 Chord: 34.952 Course: N 22-18-24 W
 Ts: 52.188

Circular Curve Data
 SC 8+533.260 3069808.376 620427.862
 RP 3069759.908 620340.393
 SC 8+564.756 3069833.088 620408.545
 Delta: 18-02-44 Type: LEFT
 Radius: 100.000 DOC: 57-17-45
 Length: 31.495 Tangent: 15.879
 Mid-Ord: 1.237 External: 1.253
 Chord: 31.365 Course: N 38-00-53 W
 Es: 6.333

Spiral Curve Data: CLOTHOID
 SC 8+564.756 3069833.088 620408.545

RP 3069591.831 620452.207
 SC 9+355.769 3069538.661 620424.406
 Delta: 49-47-13 Type: LEFT
 Radius: 60.000 DOC: 95-29-35
 Length: 52.137 Tangent: 27.843
 Mid-Ord: 5.574 External: 6.145
 Chord: 50.512 Course: S 37-30-13 E
 Es: 25.686

Spiral Curve Data: CLOTHOID

SC 9+355.769 3069538.661 620424.406
 SPI 3069531.317 620438.452
 PC 9+402.626 3069528.446 620469.812
 Length: 46.857 L Tan: 31.491
 Radius: 60.000 S Tan: 15.849
 Theta: 22-22-21 P: 1.516
 X: 46.148 K: 23.310
 Y: 6.033 A: 53.023
 Chord: 46.540 Course: S 77-19-19 E
 Ts: 82.957

PI 9+483.900 3069521.037 620550.747
 Length: 134.242 Course: S 08-07-38 E
 Delta: 76-38-33

Spiral Curve Data: CLOTHOID

TS 9+402.626 3069528.446 620469.812
 SPI 3069526.305 620493.202
 SC 9+437.769 3069522.705 620504.406
 Length: 35.143 L Tan: 23.488
 Radius: 80.000 S Tan: 11.768
 Theta: 12-35-05 P: 0.642
 X: 34.974 K: 17.543
 Y: 2.564 A: 53.023
 Chord: 35.068 Course: S 80-34-36 E
 Ts: 81.274

Circular Curve Data

SC 9+437.769 3069522.705 620504.406
 RP 3069446.541 620479.931
 SC 9+509.710 3069474.767 620554.786
 Delta: 51-31-28 Type: RIGHT
 Radius: 80.000 DOC: 71-37-11
 Length: 71.942 Tangent: 38.608
 Mid-Ord: 7.952 External: 8.829
 Chord: 69.542 Course: S 46-25-22 E
 Es: 22.785

Spiral Curve Data: CLOTHOID

SC 9+509.710 3069474.767 620554.786
 SPI 3069463.801 620558.921
 PC 9+544.710 3069440.644 620562.228
 Length: 35.000 L Tan: 23.392
 Radius: 80.000 S Tan: 11.720
 Theta: 12-32-00 P: 0.637
 X: 34.893 K: 17.472
 Y: 2.543 A: 52.915
 Chord: 34.926 Course: S 12-18-12 E

Spiral Curve Data: CLOTHOID

TS 8+959.869 3069825.936 620298.455
 SPI 3069837.024 620319.104
 SC 8+994.869 3069839.374 620330.629
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762
 Theta: 16-42-41 P: 0.848
 X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: N 67-19-58 E
 Ts: 129.303

Circular Curve Data

SC 8+994.869 3069839.374 620330.629
 RP 3069780.583 620342.614
 SC 9+078.801 3069802.449 620398.488
 Delta: 80-08-59 Type: RIGHT
 Radius: 60.000 DOC: 95-29-35
 Length: 83.933 Tangent: 50.480
 Mid-Ord: 14.088 External: 18.110
 Chord: 77.255 Course: S 61-26-51 E
 Es: 67.332

Spiral Curve Data: CLOTHOID

SC 9+078.801 3069802.449 620398.488
 SPI 3069785.569 620405.094
 PC 9+132.153 3069749.718 620402.523
 Length: 53.352 L Tan: 35.943
 Radius: 60.000 S Tan: 18.126
 Theta: 25-28-25 P: 1.963
 X: 52.307 K: 26.501
 Y: 7.796 A: 56.578
 Chord: 52.885 Course: S 04-22-33 E
 Ts: 137.740

PI 9+346.411 3069536.008 620387.200
 Length: 164.231 Course: S 84-46-11 E
 Delta: 88-52-15

Tangent Data

9+132.153 3069749.718 620402.523
 9+268.632 3069613.589 620392.762
 Length: 136.479 Course: S 04-06-04 W

Spiral Curve Data: CLOTHOID

TS 9+268.632 3069613.589 620392.762
 SPI 3069590.211 620391.086
 SC 9+303.632 3069578.732 620393.654
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762
 Theta: 16-42-41 P: 0.848
 X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: S 01-27-55 E
 Ts: 77.780

Circular Curve Data

SC 9+303.632 3069578.732 620393.654

SC 9+679.498 3069352.277 620651.164
 Length: 35.000 L Tan: 23.458
 Radius: 55.000 S Tan: 11.780
 Theta: 18-13-50 P: 0.925
 X: 34.647 K: 17.441
 Y: 3.685 A: 43.875
 Chord: 34.843 Course: S 62-31-58 E
 Ts: 698.637

Circular Curve Data

SC 9+679.498 3069352.277 620651.164
 RP 3069309.915 620616.086
 SC 9+820.905 3069255.317 620609.445
 Delta: 147-18-35 Type: RIGHT
 Radius: 55.000 DOC: 104-10-27
 Length: 141.407 Tangent: 187.536
 Mid-Ord: 39.522 External: 140.435
 Chord: 105.554 Course: S 23-16-51 W
 Es: 663.259

Spiral Curve Data: CLOTHOID

SC 9+820.905 3069255.317 620609.445
 SPI 3069257.158 620594.313
 PC 9+865.905 3069272.463 620568.200
 Length: 45.000 L Tan: 30.267
 Radius: 55.000 S Tan: 15.243
 Theta: 23-26-21 P: 1.525
 X: 44.253 K: 22.375
 Y: 6.063 A: 49.749
 Chord: 44.666 Course: N 67-25-37 W
 Ts: 693.656

PI 9+865.905 3069272.463 620568.200
 Length: 92.852 Course: N 59-37-30 W
 Delta: 180-00-00

PI 9+958.758 3069319.414 620488.093
 Length: 103.709 Course: N 29-45-51 W
 Delta: 29-51-40

Tangent Data

9+865.905 3069272.463 620568.200
 9+917.130 3069298.365 620524.007
 Length: 51.225 Course: N 59-37-30 W

Spiral Curve Data: CLOTHOID

TS 9+917.130 3069298.365 620524.007
 SPI 3069310.187 620503.836
 SC 9+952.130 3069317.948 620495.069
 Length: 35.000 L Tan: 23.380
 Radius: 90.000 S Tan: 11.709
 Theta: 11-08-27 P: 0.566
 X: 34.868 K: 17.478
 Y: 2.262 A: 56.125
 Chord: 34.941 Course: N 55-54-46 W
 Ts: 41.627

Circular Curve Data

Ts: 81.209

PI 9+597.743 3069388.143 620569.725
 Length: 644.375 Course: N 68-36-16 W
 Delta: 119-31-22

Tangent Data

9+544.710 3069440.644 620562.228
 9+544.823 3069440.532 620562.244
 Length: 0.113 Course: S 08-07-38 E

Spiral Curve Data: CLOTHOID

TS 9+544.823 3069440.532 620562.244
 SPI 3069417.329 620565.557
 SC 9+579.823 3069406.655 620570.498
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762
 Theta: 16-42-41 P: 0.848
 X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: S 13-41-37 E
 Ts: 52.920

Circular Curve Data

SC 9+579.823 3069406.655 620570.498
 RP 3069431.859 620624.948
 SC 9+608.155 3069384.647 620587.920
 Delta: 27-03-17 Type: LEFT
 Radius: 60.000 DOC: 95-29-35
 Length: 28.332 Tangent: 14.435
 Mid-Ord: 1.664 External: 1.712
 Chord: 28.069 Course: S 38-21-57 E
 Es: 10.431

Spiral Curve Data: CLOTHOID

SC 9+608.155 3069384.647 620587.920
 SPI 3069377.388 620597.175
 PC 9+643.155 3069368.838 620618.998
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762
 Theta: 16-42-41 P: 0.848
 X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: S 63-02-17 E
 Ts: 52.920

PI 8+945.861 3069623.214 619969.759
 Length: 693.656 Course: S 59-37-30 E
 Delta: 171-01-14

Tangent Data

9+643.155 3069368.838 620618.998
 9+644.498 3069368.348 620620.249
 Length: 1.343 Course: S 68-36-16 E

Spiral Curve Data: CLOTHOID

TS 9+644.498 3069368.348 620620.249
 SPI 3069359.790 620642.090

Chord: 34.868 Course: S 83-17-01 W
Ts: 62.081

PI 10+225.982 3069371.556 620262.599
Length: 340.021 Course: N 14-20-04 E
Delta: 116-37-02

Spiral Curve Data: CLOTHOID

TS 10+109.977 3069396.234 620375.949
SPI 3069391.248 620353.047
SC 10+144.977 3069392.156 620341.320
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826
Chord: 34.868 Course: S 83-17-01 W
Ts: 116.005

Circular Curve Data

SC 10+144.977 3069392.156 620341.320
RP 3069451.977 620345.953
SC 10+232.098 3069449.489 620286.005
Delta: 83-11-41 Type: RIGHT
Radius: 60.000 DOC: 95-29-35
Length: 87.121 Tangent: 53.265
Mid-Ord: 15.130 External: 20.232
Chord: 79.667 Course: N 43-58-27 W
Es: 55.825

Spiral Curve Data: CLOTHOID

SC 10+232.098 3069449.489 620286.005
SPI 3069461.241 620285.517
PC 10+267.098 3069483.949 620291.320
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826
Chord: 34.868 Course: N 08-46-05 E
Ts: 116.005

PI 10+491.114 3069700.991 620346.782
Length: 225.272 Course: S 63-39-20 W
Delta: 130-40-44

Tangent Data

10+267.098 3069483.949 620291.320
10+341.130 3069555.676 620309.648
Length: 74.032 Course: N 14-20-04 E

Spiral Curve Data: CLOTHOID

TS 10+341.130 3069555.676 620309.648
SPI 3069578.385 620315.451
SC 10+376.130 3069590.137 620314.964
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848

SC 9+952.130 3069317.948 620495.069
RP 3069385.338 620554.723
SC 9+964.036 3069326.405 620486.702
Delta: 07-34-45 Type: RIGHT
Radius: 90.000 DOC: 63-39-43
Length: 11.906 Tangent: 5.961
Mid-Ord: 0.197 External: 0.197
Chord: 11.897 Course: N 44-41-41 W
Es: 3.731

Spiral Curve Data: CLOTHOID

SC 9+964.036 3069326.405 620486.702
SPI 3069335.255 620479.035
PC 9+999.036 3069355.550 620467.428
Length: 35.000 L Tan: 23.380
Radius: 90.000 S Tan: 11.709
Theta: 11-08-27 P: 0.566
X: 34.868 K: 17.478
Y: 2.262 A: 56.125
Chord: 34.941 Course: N 33-28-35 W
Ts: 41.627

PI 10+061.117 3069409.441 620436.609
Length: 178.086 Course: S 77-43-02 W
Delta: 72-31-07

Spiral Curve Data: CLOTHOID

TS 9+999.036 3069355.550 620467.428
SPI 3069375.896 620455.793
SC 10+034.036 3069383.996 620447.264
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826
Chord: 34.868 Course: N 35-19-50 W
Ts: 62.081

Circular Curve Data

SC 10+034.036 3069383.996 620447.264
RP 3069340.492 620405.944
SC 10+074.977 3069400.312 620410.577
Delta: 39-05-46 Type: LEFT
Radius: 60.000 DOC: 95-29-35
Length: 40.941 Tangent: 21.304
Mid-Ord: 3.458 External: 3.670
Chord: 40.152 Course: N 66-01-24 W
Es: 15.461

Spiral Curve Data: CLOTHOID

SC 10+074.977 3069400.312 620410.577
SPI 3069401.221 620398.850
PC 10+109.977 3069396.234 620375.949
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826

PC 10+639.181 3069666.711 620108.118
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762
 Theta: 16-42-41 P: 0.848
 X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: N 34-49-00 W
 Ts: 75.288

PI 10+713.564 3069731.609 620071.773
 Length: 133.109 Course: S 64-33-31 W
 Delta: 86-11-28

Spiral Curve Data: CLOTHOID
 TS 10+639.181 3069666.711 620108.118
 SPI 3069687.161 620096.665
 SC 10+674.181 3069695.337 620088.210
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762
 Theta: 16-42-41 P: 0.848
 X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: N 34-49-00 W
 Ts: 74.382

Circular Curve Data
 SC 10+674.181 3069695.337 620088.210
 RP 3069652.205 620046.502
 SC 10+729.440 3069711.509 620037.395
 Delta: 52-46-06 Type: LEFT
 Radius: 60.000 DOC: 95-29-35
 Length: 55.259 Tangent: 29.764
 Mid-Ord: 6.250 External: 6.977
 Chord: 53.327 Course: N 72-20-45 W
 Es: 23.329

Spiral Curve Data: CLOTHOID
 SC 10+729.440 3069711.509 620037.395
 SPI 3069709.724 620025.769
 PC 10+764.440 3069699.655 620004.604
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762
 Theta: 16-42-41 P: 0.848
 X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: S 70-07-30 W
 Ts: 74.382

PI 10+823.168 3069674.427 619951.572
 Length: 208.256 Course: N 47-08-20 W
 Delta: 68-18-09

Spiral Curve Data: CLOTHOID
 TS 10+764.440 3069699.655 620004.604
 SPI 3069689.587 619983.438
 SC 10+799.440 3069687.802 619971.813
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762

X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: N 08-46-05 E
 Ts: 149.984

Circular Curve Data
 SC 10+376.130 3069590.137 620314.964
 RP 3069587.648 620255.015
 SC 10+477.977 3069646.802 620244.975
 Delta: 97-15-23 Type: LEFT
 Radius: 60.000 DOC: 95-29-35
 Length: 101.847 Tangent: 68.124
 Mid-Ord: 20.343 External: 30.779
 Chord: 90.052 Course: N 51-00-18 W
 Es: 85.834

Spiral Curve Data: CLOTHOID
 SC 10+477.977 3069646.802 620244.975
 SPI 3069644.834 620233.379
 PC 10+512.977 3069634.433 620212.375
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762
 Theta: 16-42-41 P: 0.848
 X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: S 69-13-19 W
 Ts: 149.984

PI 10+588.265 3069601.023 620144.906
 Length: 149.670 Course: N 29-15-01 W
 Delta: 87-05-39

Spiral Curve Data: CLOTHOID
 TS 10+512.977 3069634.433 620212.375
 SPI 3069624.032 620191.371
 SC 10+547.977 3069622.064 620179.775
 Length: 35.000 L Tan: 23.438
 Radius: 60.000 S Tan: 11.762
 Theta: 16-42-41 P: 0.848
 X: 34.703 K: 17.450
 Y: 3.382 A: 45.826
 Chord: 34.868 Course: S 69-13-19 W
 Ts: 75.288

Circular Curve Data
 SC 10+547.977 3069622.064 620179.775
 RP 3069681.218 620169.734
 SC 10+604.181 3069638.085 620128.026
 Delta: 53-40-18 Type: RIGHT
 Radius: 60.000 DOC: 95-29-35
 Length: 56.205 Tangent: 30.355
 Mid-Ord: 6.462 External: 7.242
 Chord: 54.172 Course: N 72-47-51 W
 Es: 23.951

Spiral Curve Data: CLOTHOID
 SC 10+604.181 3069638.085 620128.026
 SPI 3069646.261 620119.570

00

Chord: 53.238 Course: S 89-48-46 W
Es: 23.265

Spiral Curve Data: CLOTHOID

SC 11+036.367 3069786.508 619772.397
SPI 3069781.256 619761.873
PC 11+071.367 3069765.200 619744.797
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826
Chord: 34.868 Course: S 52-19-51 W
Ts: 74.288

PI 11+623.399 3069987.059 619342.618
Length: 552.032 Course: N 33-46-37 E
Delta: 167-00-46

Spiral Curve Data: CLOTHOID

TS 11+071.367 3069765.200 619744.797
SPI 3069749.145 619727.721
SC 11+106.367 3069743.893 619717.197
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826
Chord: 34.868 Course: S 52-19-51 W
Ts: 552.032

Circular Curve Data

SC 11+106.367 3069743.893 619717.197
RP 3069797.577 619690.402
SC 11+246.263 3069815.185 619633.044
Delta: 133-35-24 Type: RIGHT
Radius: 60.000 DOC: 95-29-35
Length: 139.895 Tangent: 139.957
Mid-Ord: 36.359 External: 92.276
Chord: 110.292 Course: N 49-43-45 W
Es: 478.033

Spiral Curve Data: CLOTHOID

SC 11+246.263 3069815.185 619633.044
SPI 3069826.430 619636.496
PC 11+281.263 3069845.912 619649.527
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826
Chord: 34.868 Course: N 28-12-38 E
Ts: 552.032

PI 11+281.263 3069845.912 619649.527
Length: 90.844 Course: S 33-46-37 W
Delta: 180-00-00

Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826
Chord: 34.868 Course: S 70-07-30 W
Ts: 58.727

Circular Curve Data

SC 10+799.440 3069687.802 619971.813
RP 3069747.106 619962.706
SC 10+835.967 3069693.248 619936.263
Delta: 34-52-48 Type: RIGHT
Radius: 60.000 DOC: 95-29-35
Length: 36.526 Tangent: 18.849
Mid-Ord: 2.758 External: 2.891
Chord: 35.965 Course: N 81-17-24 W
Es: 13.527

Spiral Curve Data: CLOTHOID

SC 10+835.967 3069693.248 619936.263
SPI 3069698.432 619925.705
PC 10+870.967 3069714.375 619908.524
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826
Chord: 34.868 Course: N 52-42-19 W
Ts: 58.727

PI 11+020.495 3069816.088 619798.919
Length: 626.321 Course: S 46-45-52 W
Delta: 86-05-49

Tangent Data

10+870.967 3069714.375 619908.524
10+946.207 3069765.555 619853.373
Length: 75.240 Course: N 47-08-20 W

Spiral Curve Data: CLOTHOID

TS 10+946.207 3069765.555 619853.373
SPI 3069781.498 619836.193
SC 10+981.207 3069786.682 619825.635
Length: 35.000 L Tan: 23.438
Radius: 60.000 S Tan: 11.762
Theta: 16-42-41 P: 0.848
X: 34.703 K: 17.450
Y: 3.382 A: 45.826
Chord: 34.868 Course: N 52-42-19 W
Ts: 74.288

Circular Curve Data

SC 10+981.207 3069786.682 619825.635
RP 3069732.824 619799.191
SC 11+036.367 3069786.508 619772.397
Delta: 52-40-27 Type: LEFT
Radius: 60.000 DOC: 95-29-35
Length: 55.160 Tangent: 29.702
Mid-Ord: 6.228 External: 6.949

Radius: 90.000 S Tan: 11.709
Theta: 11-08-27 P: 0.566
X: 34.868 K: 17.478
Y: 2.262 A: 56.125
Chord: 34.941 Course: S 13-39-47 E
Ts: 87.267

Circular Curve Data

SC 11+789.112 3069670.510 619618.842
RP 3069702.897 619702.813
SC 11+872.290 3069616.364 619678.073
Delta: 52-57-10 Type: LEFT
Radius: 90.000 DOC: 63-39-43
Length: 83.178 Tangent: 44.826
Mid-Ord: 9.439 External: 10.545
Chord: 80.249 Course: S 47-34-04 E
Es: 24.336

Spiral Curve Data: CLOTHOID

SC 11+872.290 3069616.364 619678.073
SPI 3069613.146 619689.330
PC 11+907.290 3069611.183 619712.628
Length: 35.000 L Tan: 23.380
Radius: 90.000 S Tan: 11.709
Theta: 11-08-27 P: 0.566
X: 34.868 K: 17.478
Y: 2.262 A: 56.125
Chord: 34.941 Course: S 81-28-22 E
Ts: 87.267

PI 11+950.825 3069607.529 619756.009
Length: 49.878 Course: N 54-21-40 W
Delta: 149-10-34

Tangent Data

11+907.290 3069611.183 619712.628
11+908.381 3069611.092 619713.714
Length: 1.090 Course: S 85-11-07 E

Spiral Curve Data: CLOTHOID

TS 11+908.381 3069611.092 619713.714
SPI 3069609.129 619737.011
SC 11+943.381 3069605.911 619748.269
Length: 35.000 L Tan: 23.380
Radius: 90.000 S Tan: 11.709
Theta: 11-08-27 P: 0.566
X: 34.868 K: 17.478
Y: 2.262 A: 56.125
Chord: 34.941 Course: S 81-28-22 E
Ts: 42.444

Circular Curve Data

SC 11+943.381 3069605.911 619748.269
RP 3069519.378 619723.529
SC 11+956.799 3069601.276 619760.848
Delta: 08-32-32 Type: RIGHT
Radius: 90.000 DOC: 63-39-43
Length: 13.418 Tangent: 6.721

PI 11+190.418 3069770.401 619599.021
Length: 154.213 Course: S 09-57-02 E
Delta: 43-43-39

Tangent Data

11+281.263 3069845.912 619649.527
11+308.911 3069868.893 619664.898
Length: 27.648 Course: N 33-46-37 E

Spiral Curve Data: CLOTHOID

TS 11+308.911 3069868.893 619664.898
SPI 3069894.051 619681.726
SC 11+353.911 3069909.047 619684.461
Length: 45.000 L Tan: 30.267
Radius: 55.000 S Tan: 15.243
Theta: 23-26-21 P: 1.525
X: 44.253 K: 22.375
Y: 6.063 A: 49.749
Chord: 44.666 Course: N 25-58-30 E
Ts: 118.492

Circular Curve Data

SC 11+353.911 3069909.047 619684.461
RP 3069918.917 619630.354
SC 11+523.674 3069931.746 619576.871
Delta: 176-50-57 Type: LEFT
Radius: 55.000 DOC: 104-10-27
Length: 169.763 Tangent: 1999.808
Mid-Ord: 53.488 External: 1945.564
Chord: 109.958 Course: N 78-05-12 W
Es: 96.785

Spiral Curve Data: CLOTHOID

SC 11+523.674 3069931.746 619576.871
SPI 3069916.923 619573.316
PC 11+568.674 3069887.111 619578.546
Length: 45.000 L Tan: 30.267
Radius: 55.000 S Tan: 15.243
Theta: 23-26-21 P: 1.525
X: 44.253 K: 22.375
Y: 6.063 A: 49.749
Chord: 44.666 Course: S 02-08-55 E
Ts: 118.492

PI 11+841.379 3069618.508 619625.669
Length: 130.802 Course: S 85-11-07 E
Delta: 75-14-05

Tangent Data

11+568.674 3069887.111 619578.546
11+754.112 3069704.462 619610.589
Length: 185.438 Course: S 09-57-02 E

Spiral Curve Data: CLOTHOID

TS 11+754.112 3069704.462 619610.589
SPI 3069681.434 619614.629
SC 11+789.112 3069670.510 619618.842
Length: 35.000 L Tan: 23.380