

APPENDIX 9

**HYDRAULIC ANALYSIS
ON CROSS DRAINAGE**

HYDRAULIC ANALYSIS ON CROSS DRAINAGE

1 Rainfall Discharge

(1) Probable Daily Rainfall

Table 1 and Table 2 show the maximum daily rainfall from year 1980 to 1997, and its incidence probability respectively. Figure 1 shows the maximum daily rainfall probability curve.

TABLE 1 MAXIMUM DAILY RAINFALL

Year	Maximum daily rainfall (mm)
1980	144
1981	142
1982	335
1983	122
1984	105
1985	166
1986	117
1987	107
1988	94
1989	101
1990	119
1991	124
1992	122
1993	150
1994	84
1995	91
1996	144
1997	85

TABLE 2 MAXIMUM DAILY RAINFALL INCIDENCE PROBABILITY

Maximum daily rainfall (mm)	Incidence probability
335	0.053
166	0.105
150	0.158
144	0.211
144	0.263
142	0.316
124	0.368
122	0.421
122	0.474
119	0.526
117	0.579
107	0.632
105	0.684
101	0.737
94	0.789
91	0.842
85	0.895
84	0.947

(2) Rainfall Intensity

Rainfall intensity for duration of "t" hours is estimated from the following equation:

$$\frac{R_t}{R_{24}} = \left(\frac{t}{24} \right)^{1/3}$$

where, R_t = rainfall intensity for duration of t hours (mm)
 R_{24} = daily rainfall (mm)
 t = duration of the time of concentration (hour)

The rainfall intensity - duration curve is shown in Figure 2.

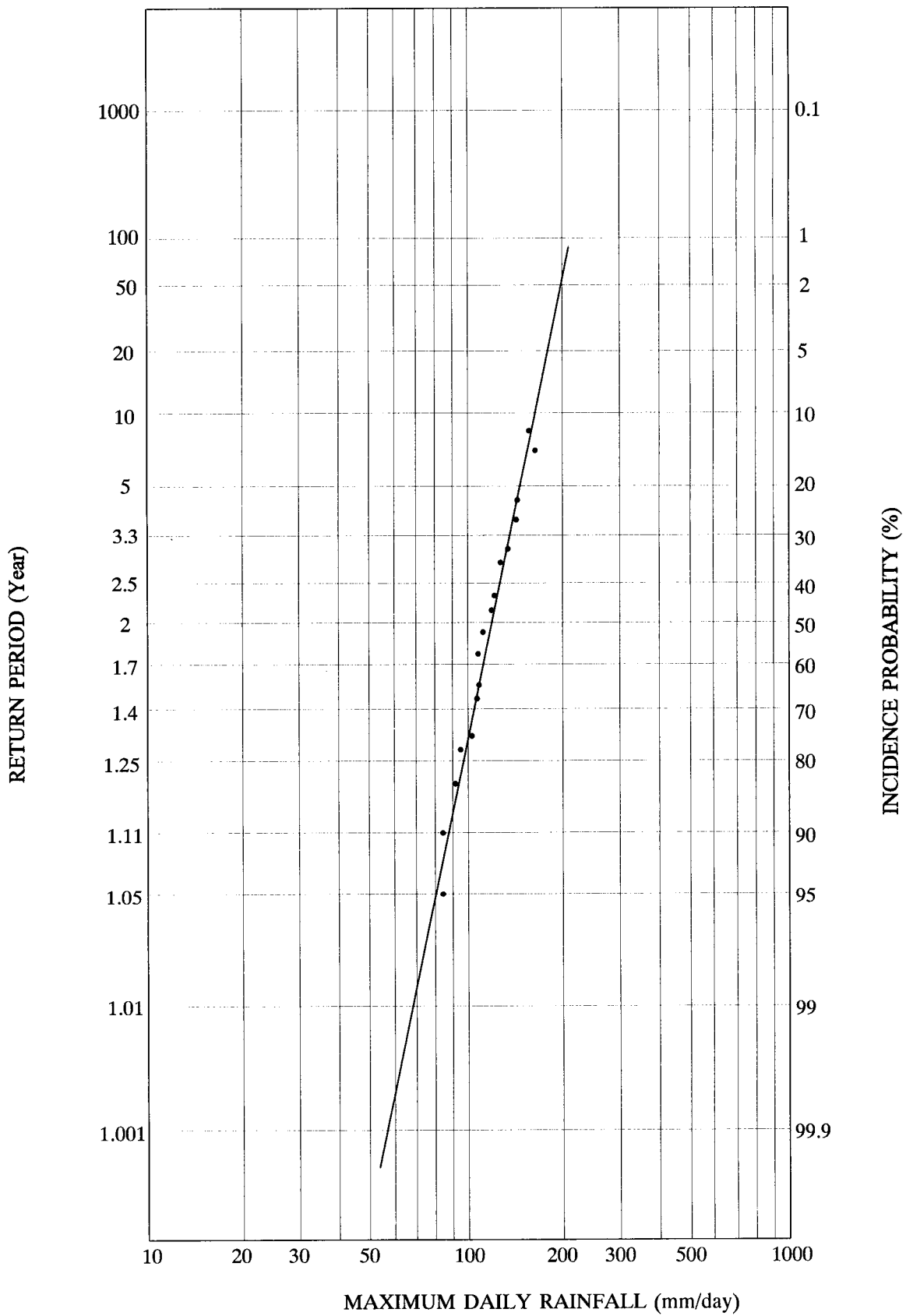


FIGURE 1 MAXIMUM DAILY RAINFALL PROBABILITY CURVE

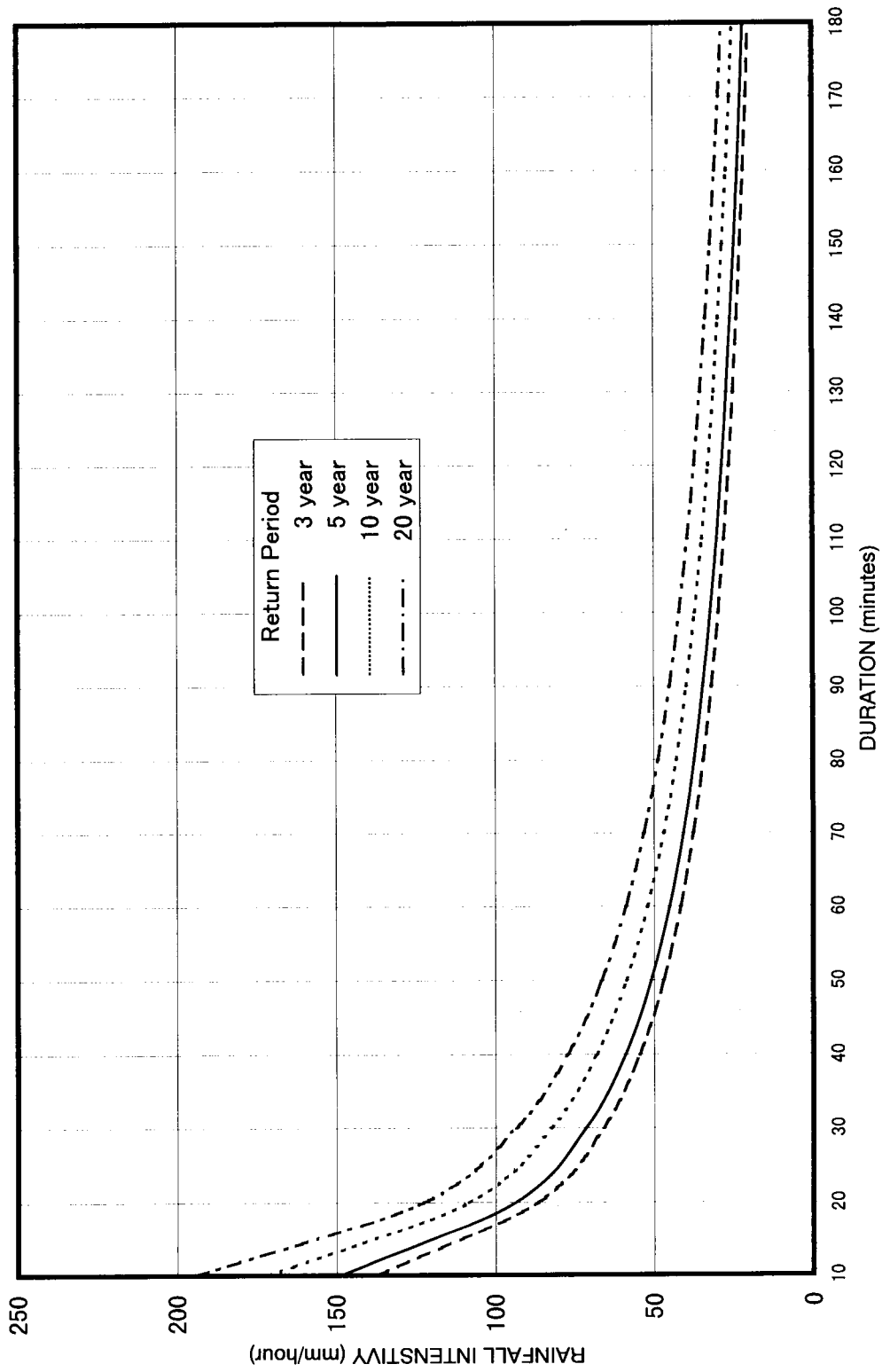


FIGURE 2 RAINFALL INTENSITY - DURATION CURVE

(3) Rainfall Discharge

Rainfall discharge is calculated from the following rational formula:

$$Q = \frac{1}{3.6 \times 10^6} \cdot C \cdot r \cdot a$$

where Q = Discharge (m³/sec)
 C = runoff coefficient
 r = rainfall intensity (mm/hour)
 a = catchment area (m²)

The catchment basin is shown in Figure 3. Rainfall discharge calculation is shown in Table 3.

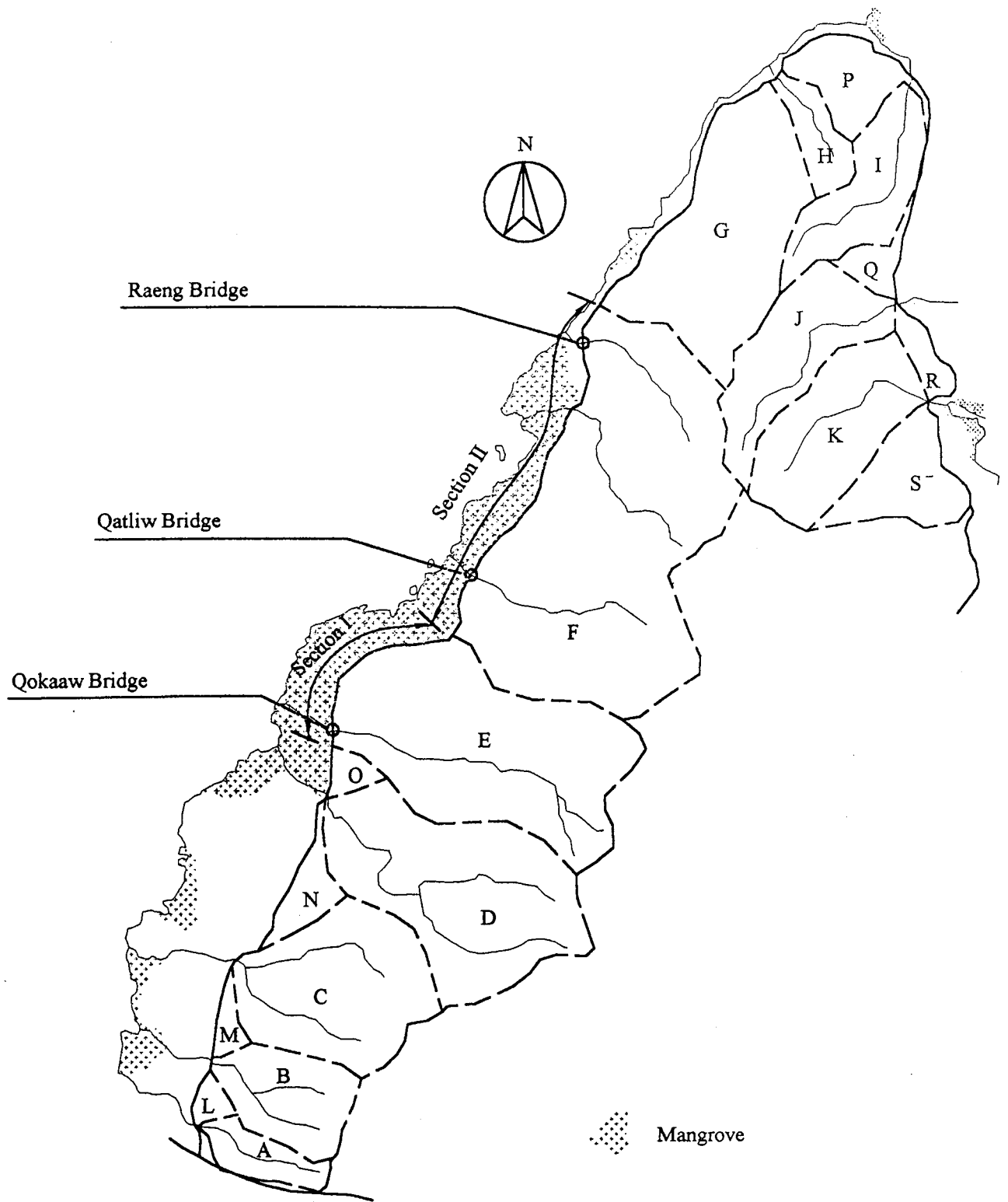


FIGURE 3 CATCHMENT BASIN REALTED TO CENTRAL YAP ROAD

TABLE 3 RAINFALL DISCHARGE CALCULATION

Catchment Basin	Dimension of Catchment Basin			Velocity V(m/s)	Time of Flow Tp(h)	Time of Inlet Ti(h)	Rainfall Intensity ri(mm/h)				Remarks			
	Area(m ²)	L(m)	H(m)				i	r3	r5	r10		Rainfall Discharge Qi(m ³ /s)		
										Q3	Q5	Q10		
A	160,000	800	21	0.063	3.50	0.063	0.083	150	162	187	0.0	0.0	0.0	
B	480,000	900	18	0.061	3.50	0.071	0.083	145	157	181	0.0	0.0	0.0	
C	807,000	900	23	0.078	3.50	0.071	0.083	145	157	181	0.0	0.0	0.0	
D	968,000	1,800	30	0.056	3.50	0.143	0.083	112	122	140	0.0	0.0	0.0	
E	1,521,854	1,550	15	0.029	3.50	0.123	0.083	119	129	149	0.0	0.0	0.0	
F	2,212,563	1,050	15	0.060	3.50	0.083	0.083	138	149	172	0.0	0.0	0.0	
G	1,220,000	1,000	20	0.055	3.50	0.079	0.083	140	151	175	0.0	0.0	0.0	
H	175,000	600	17	0.083	3.50	0.048	0.083	162	175	202	0.0	0.0	0.0	
I	472,500	1,350	26	0.056	3.50	0.107	0.083	126	136	157	0.0	0.0	0.0	
J	585,000	1,400	33	0.071	3.50	0.111	0.083	124	134	155	0.0	0.0	0.0	
K	660,000	1,200	30	0.063	3.50	0.095	0.083	131	142	164	0.0	0.0	0.0	
L	35,000	350	67	0.150	3.50	0.028	0.083	180	195	225	0.0	0.0	0.0	
M	54,000	600	60	0.160	3.50	0.048	0.083	162	175	202	0.0	0.0	0.0	
N	157,500	900	117	0.150	3.50	0.071	0.083	145	157	181	0.0	0.0	0.0	
O	40,000	500	133	0.100	3.50	0.040	0.083	168	183	211	0.0	0.0	0.0	
P	256,500	900	180	0.100	3.50	0.071	0.083	145	157	181	0.0	0.0	0.0	
Q	78,750	300	150	0.230	3.50	0.024	0.083	185	200	231	0.0	0.0	0.0	
R	75,000	800	100	0.170	3.50	0.063	0.083	150	162	187	0.0	0.0	0.0	
S	245,000	700	230	0.200	3.50	0.056	0.083	155	168	194	0.0	0.0	0.0	
Daily rainfall														
	Return period 3 years	: R24 =	120 mm											
	Return period 5 years	: R24 =	130 mm											
	Return period 10 years	: R24 =	150 mm											

$Q = C \cdot r \cdot A (3.6 \cdot 10^6)$
 $C = 0.8$
 i in r_i and Q_i : return period

$r = Rt / (Tp + Ti)$
 $Tp = L / V / 3600$
 V : Kraven's Formula
 Ti : 5 minutes/60
 $Rt = R24 \cdot \{(Tp + Ti) / 24\}^{1/3}$

2. Analysis of Flood Sections (Present Situation)

Analysis is made on the following two sections:

Section I : 4.6 km to 5.64 km

Section II : 5.64 km to 8.42 km

Above two sections include the portions where the road elevation is lower than high tide level.

The analysis is made on the rainfall discharge crossing the road at the time of high tide.

(1) Analysis Method

When the water levels of upstream and downstream sides of the road are assumed as certain values, the flow rates of the rivers, culverts and overflow sections can be estimated. Giving the water level of downstream side and total discharge volume, the water level of upstream side at which the sum of individual flow rates is equal to the given discharge is obtained by convergent calculation.

Individual flow rate is calculated as follows.

- Open Channels (rivers and culverts with free water surface)

The flow rate is calculated by the non-uniform flow analysis between downstream and upstream sides.

The following formula is used as velocity formula.

$$v = \frac{1}{n} \cdot R^{2/3} \cdot I^{1/2}$$

where, v = Mean velocity (m/sec)

n = Coefficient of roughness

(river: 0.04, culvert : 0.03, PVC pipe: 0.01)

R = Hydraulic radius (m)

I = Gradient of water surface

- Culverts filled with water

Flow rate, Q is calculated assuming the condition of submerged orifice.

$$Q = CA\sqrt{2gH}$$

where, Q = Flow rate (m^3/sec)
 C = Velocity-water head coefficient (0.62)
 A = Sectional area (m^2)
 g = Gravitational acceleration (m/sec^2)
 H = Difference in water level (m)

- Overflow

$H_1/H_2 < 0.6$: $Q = C_0 B H_1^{3/2}$ (complete overflow)
 $0.6 \leq H_1/H_2 \leq 0.7$: $Q = C B H_1^{3/2}$ (incomplete overflow)
 $H_1/H_2 > 0.7$: $Q = C' B H_2 \sqrt{H_1 - H_2}$ (submerged overflow)

where, Q = Flow rate (m^3/sec)
 C_0, C, C' = Flow rate coefficient
 $C_0 = 1.4$
 $C = (1.018 - 0.030 H_2/H_1) \cdot C_0$
 $C' = 2.6 \cdot C_0$
 B = Overflow width (m)
 H_1 = Upstream side overflow depth (m)
 H_2 = Downstream side overflow depth (m)

(2) Conditions in Analysis

Downstream side water level

: High tide elevation is 0.70m when the influence of atmospheric pressure is not considered and the fluctuation of tide by atmospheric pressure is about $\pm 0.23\text{m}$. Based thereon, downstream side water level is assumed to be 0.93m.

Rainfall discharge

: Rainfall discharge at the return period of 5 years (Section I : $43.7 \text{ m}^3/\text{sec}$, Section II : $73.3 \text{ m}^3/\text{sec}$) is assumed.

Cross-Section

: Cross-sections for analysis are shown in Figure 4 (upstream side and downstream side sections are assumed as the same).

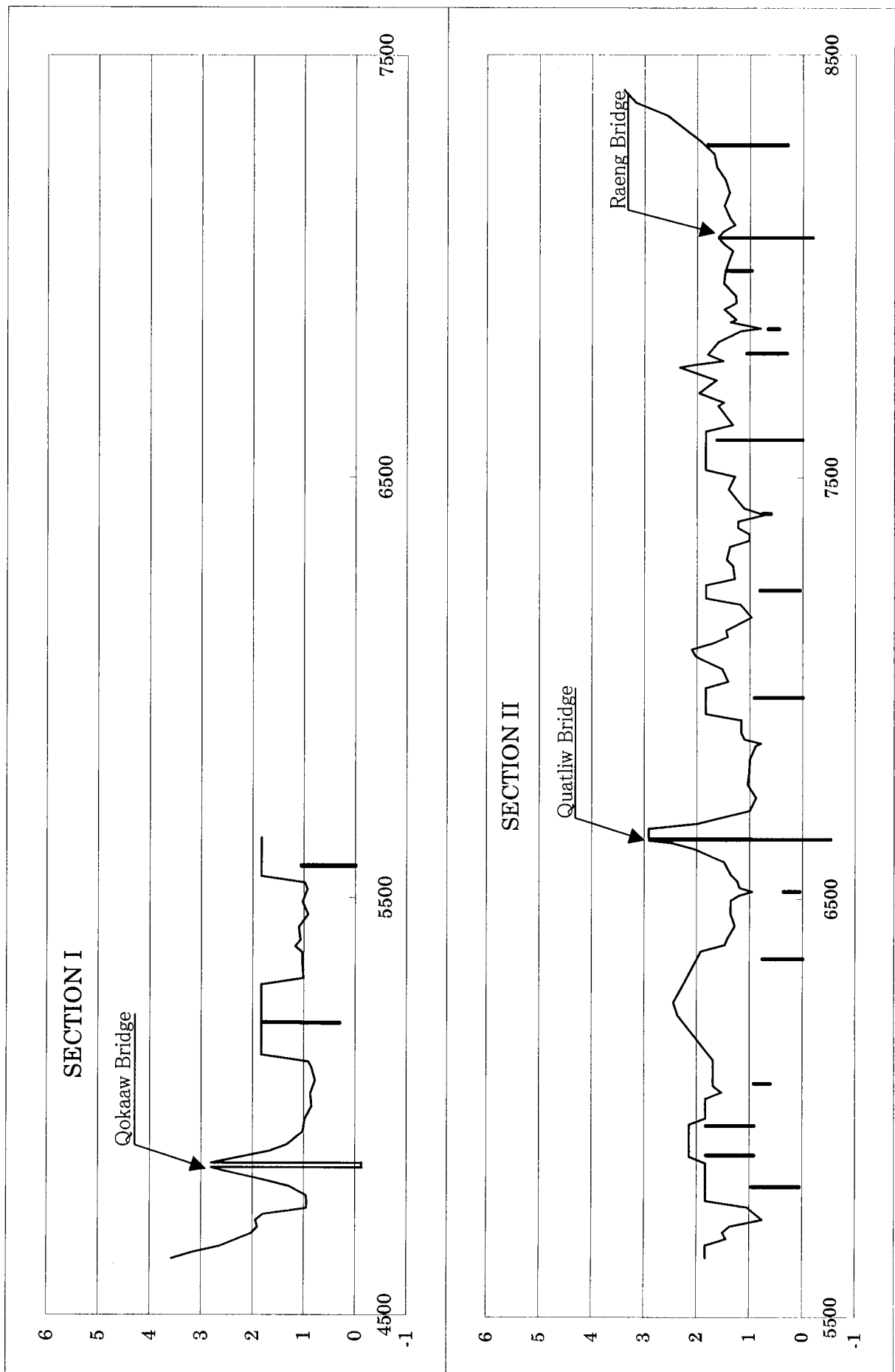


FIGURE 4 LONGITUDINAL PROFILE OF THE ROAD (PRESENT)

(3) Result of Analysis (Section I)

Upstream side water level : 1.037 m
 Downstream side water level : 0.930 m

Flow Rate and Velocity (upstream side)

	Flow rate (m ³ /sec)	Velocity (m/sec)	Length of overflow section (m)	Maximum water depth (m)
Qokaaw Bridge (4.862km)	21.961	1.863		
Overflow section (4.756~4.794km)	1.219	0.406	37	0.097
Overflow section (4.939~5.110km)	14.922	0.577	170	0.257
Overflow section (5.306~5.537km)	2.233	0.326	230	0.117
Pipe culvert No.11 (2-cell)	0.958	1.091		
Pipe culvert No.12 (2-cell)	2.406	1.393		
Total	43.700		437	

(4) Result of Analysis (Section II)

Upstream side water level : 1.154 m
 Downstream side water level : 0.930 m

Flow Rate and Velocity (upstream side)

	Flow rate (m ³ /sec)	Velocity (m/sec)	Length of overflow section (m)	Maximum water depth (m)
Quatliw Bridge (6.643km)	13.272	2.105		
Raeng Bridge (8.068km)	7.466	1.984		
Overflow section (5.724~5.767km)	6.776	0.690	43	0.394
Overflow section (6.510~6.526km)	0.755	0.475	16	0.204
Overflow section (6.705~6.892km)	18.888	0.592	186	0.364
Overflow section (7.156~7.194km)	1.598	0.451	38	0.184
Overflow section (7.345~7.376km)	1.607	0.479	31	0.144
Overflow section (7.398~7.434km)	4.298	0.658	35	0.424
Overflow section (7.848~7.863km)	1.676	0.625	15	0.354
Pipe culvert No.13	1.202	1.889		
Pipe culvert No.14	0.000	0.003		
Pipe culvert No.15 (3-cell)	0.000	0.003		
Pipe culvert No.16	0.092	1.300		
Pipe culvert No.18	0.092	1.300		
Pipe culvert No.19 (2-cell)	1.690	1.300		
Pipe culvert No.20	0.574	1.300		
Pipe culvert No.21 (2-cell)	0.052	1.300		
Box culvert No.22 (2-cell)	10.828	2.048		
Pipe culvert No.23	0.380	1.300		
Pipe culvert No.24	0.041	1.300		
Pipe culvert No.25	0.000	0.000		
Box culvert No.26	2.010	1.568		
Total	73.300		364	

The above calculated results are close to the information gotten from PW & T and inhabitants.

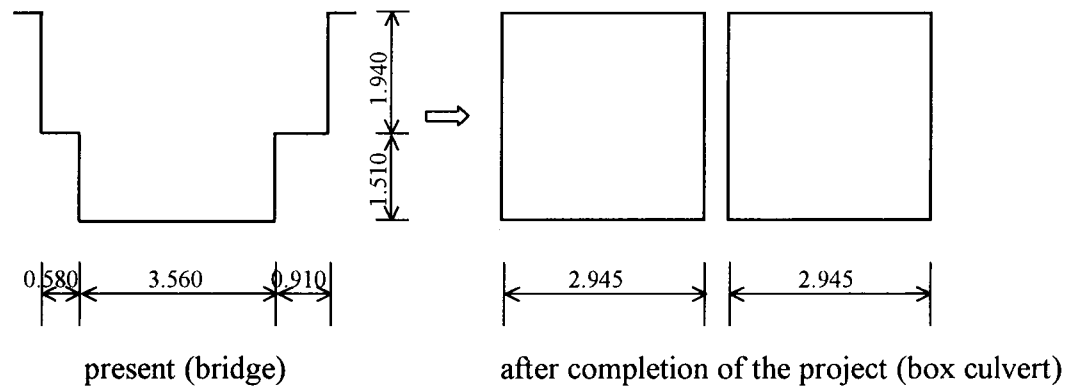
3. Analysis of Flood Sections (after Completion of the Project)

The same analysis method as used in the analysis of present situation is used. The cross-section for analysis is changed as follows (see Figure 5):

Profile of the road

- : raise of the sections with an elevation blow 1.0m up to 1.0m.
- : change of longitudinal profile resulting from laying of culverts under the FEMA project.

Bridge : change of the section of the Quatliw Bridge.



Culvert : Replacement/Addition under the FEMA project

No.	Diameter (m)	Replacement/Addition	Remarks
16	0.30→0.90	Replacement	PVC pipe
17	0.75	Addition	RC pipe
18	0.30→0.90	Replacement	PVC pipe
21	2 x 0.16→0.60	Replacement	PVC pipe
24	0.20→0.60	Replacement	PVC pipe

(1) Result of Analysis (Section I)

Upstream side water level : 1.092 m
 Downstream side water level : 0.930 m

Flow Rate and Velocity (upstream side)

	Flow rate (m ³ /sec)	Velocity (m/sec)	Length of overflow section (m)	Maximum water depth (m)
Qokaaw Bridge (4.862km)	25.657	2.079		
Overflow portion (4.937~5.110km)	6.137	0.415	173	0.092
Overflow portion (5.319~5.528km)	7.883	0.421	209	0.092
Pipe culvert No.11 (2-cell)	1.138	1.289		
Pipe culvert No.12 (2-cell)	2.886	1.666		
Total	43.700		382	

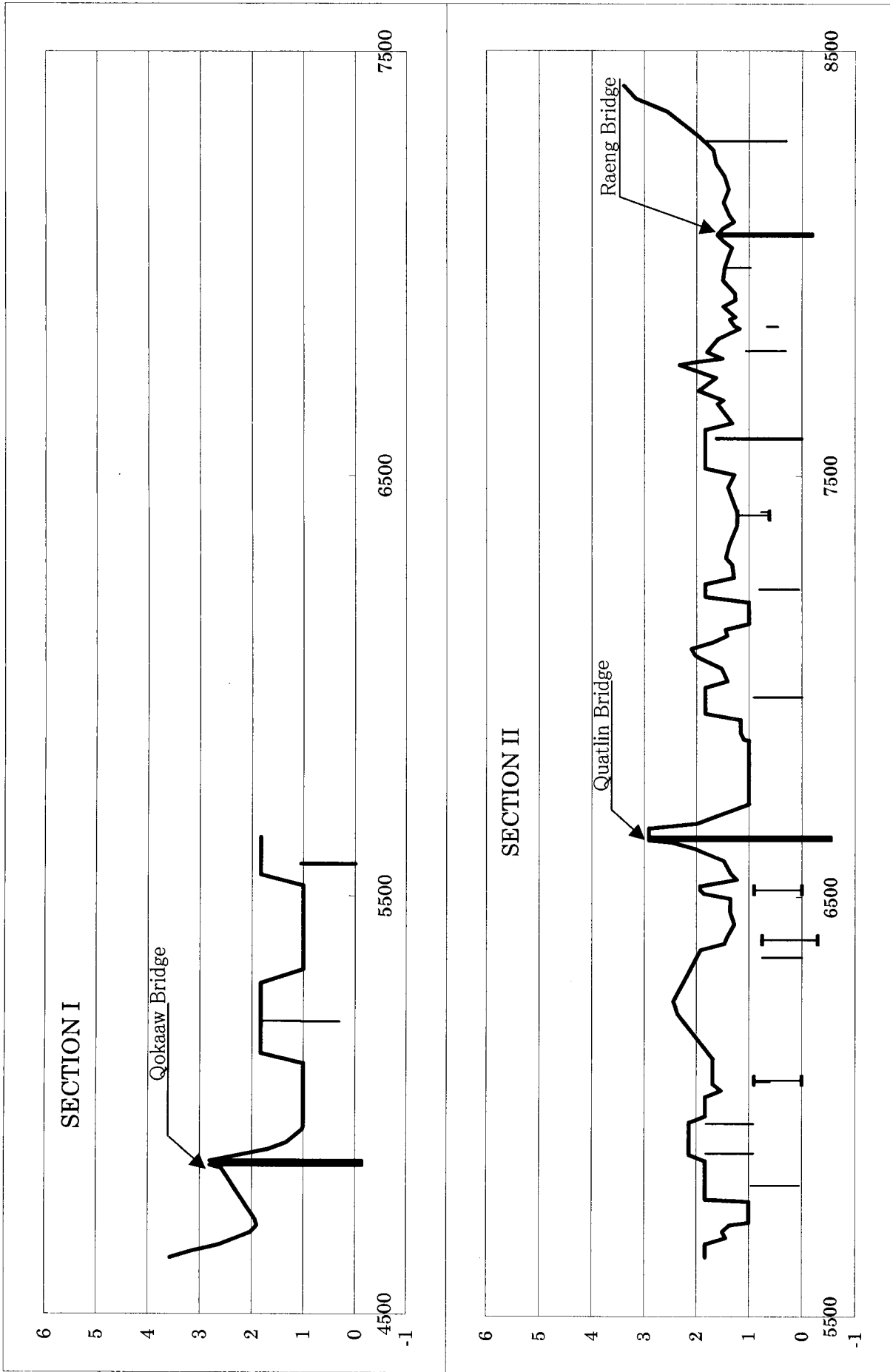


FIGURE 5 LONGITUDINAL PROFILE OF THE ROAD (AFTER COMPLETION OF PROJECT)

(2) Result of Analysis (Section II)

Upstream side water level : 1.149 m
 Downstream side water level : 0.930 m

Flow Rate and Velocity (upstream side)

	Flow rate (m ³ /sec)	Velocity (m/sec)	Length of overflow section (m)	Maximum water depth (m)
Quatliw Bridge (6.643km) (box culvert, 2-cell)	26.270	2.641		
Raeng Bridge (8.068km)	7.391	1.972		
Overflow portion (5.718~5.773km)	3.444	0.510	56	0.149
Overflow portion (6.713~6.898km)	13.033	0.523	185	0.149
Overflow portion (7.152~7.198km)	3.378	0.529	46	0.149
Pipe culvert No.13	1.187	1.866		
Pipe culvert No.14	0.000	0.003		
Pipe culvert No.15 (3-cell)	0.000	0.003		
Pipe culvert No.16 (FEMA)	0.817	1.284		
Pipe culvert No.17 (FEMA)	0.567	1.284		
Pipe culvert No.18 (FEMA)	0.817	1.284		
Pipe culvert No.19 (2-cell)	1.670	1.284		
Pipe culvert No.20	0.567	1.284		
Pipe culvert No.21 (FEMA)	0.352	1.316		
Box culvert No.22 (2-cell)	10.732	2.040		
Pipe culvert No.23	0.375	1.284		
Pipe culvert No.24 (FEMA)	0.710	2.513		
Pipe culvert No.25	0.000	0.000		
Box culvert No.26	1.989	1.562		
Total	73.300		287	

4. Analysis for Other Sections

(1) Analysis Method

Rainfall discharge of 5-year return period in each catchment basin is allocated to individual culverts. Discharge of individual culvert is calculated as follows:

- Culverts not affected by high tide (with free water surface)

The following equation for uniform flow is used:

$$Q = Av$$

$$v = \frac{1}{n} R^{2/3} I^{1/2}$$

- where, Q: Flow rate (m³/sec)
 A: Sectional area of flow (m²)
 v: Mean velocity (m/sec)
 n: Coefficient of roughness (culvert: 0.03, PVC pipe: 0.01)
 R: Hydraulic radius (m)
 I: Bottom gradient

- Culverts affected by high tide (with free water surface)

The downstream side water level is assumed to be 0.93m. The following equation for no-uniform flow is used:

$$\Delta H = \frac{\alpha}{2g} \left(\frac{Q^2}{A_2^2} - \frac{Q^2}{A_1^2} \right) + \frac{n^2}{2} \left(\frac{Q^2}{R_1^{4/3} A_1^2} + \frac{Q^2}{R_2^{4/3} A_1^2} \right) \Delta x$$

- where, ΔH : Difference in water level between upstream and downstream sides (m)
 α : 1.0
 g : 9.8 (m/sec²)
 Q : Flow rate (m³/sec)
 A1, A2 : Sectional areas of flow at upstream and downstream sides (m²)
 R1, R2 : Hydraulic radii of upstream and downstream sides (m)
 Δx : Length of culvert (m)

- Culvert filled with water

The following equation for submerged orifice is used:

$$Q = CA\sqrt{2gH}$$

- Q: Flow rate (m³/sec)

- C: Velocity-water head coefficient (0.62)
- A: Sectional area (m^2)
- g: $9.8 \text{ (m/sec}^2\text{)}$
- H: Difference in water level (m)

(2) Result of Analysis

Catchment Basin	No.	Sta.	Type	Size	Flow Rate (m ³ /s)	Velocity (m/s)	Water depth (m)	Upstream side water level	Condition	Influence of high tide
A +L +B	1	59	Pipe culvert (2-cell)	φ 0.46	0.886	2.668	0.13		Open flow	
	2	931	Pipe culvert	φ 0.46	0.311	0.808	0.20		Open flow	
	3	2.093	Pipe culvert (2-cell)	φ 1.20	11.614	4.970	0.34		Open flow	
	4	2.460	Box culvert	H2.4xB2.6	11.192	2.132	2.02		Open flow	
	Total				24.000					
C +M +N	5	2.615	Pipe culvert	φ 0.76	1.142	4.647	0.41		Open flow	
	6	3.127	Box culvert (2-cell)	H2.4xB2.6	33.499	3.816	1.69		Open flow	
	7	3.455	Pipe culvert	φ 1.07	1.059	2.175	0.57		Open flow	
	Total				35.700					
D +O	8	3.786	Pipe culvert	φ 0.91	1.955	3.007	0.91		Filled with water	
	9	4.390	Box culvert (3-cell)	H1.22xB2.14	24.915	3.181	1.22	2.273	Filled with water	Affected
	10	4.483	Pipe culvert	φ 0.61	0.929	3.181	0.61		Filled with water	Affected
	Total				27.800					
G	27	8.728	Box culvert (2-cell)	H1.35xB2.35	6.459	1.991	0.75	1.068	Open flow	Affected
	28	8.760	Box culvert	H1.3xB1.35	1.527	1.639	0.75		Open flow	Affected
	29	8.841	Box culvert (2-cell)	H1.2xB2.3	6.179	1.946	0.75		Open flow	Affected
	30	9.001	Box culvert (2-cell)	H1.7xB2.25	14.088	2.746	1.20		Open flow	Affected
	31	9.056	Box culvert	H0.4xB0.9	0.097	0.623	0.40		Open flow	Affected
	32	9.113	Box culvert	H0.4xB0.9	0.097	0.623	0.40		Open flow	Affected
	33	9.194	Box culvert	H1.22xB3.2	1.648	1.320	0.45		Open flow	Affected
	34	9.332	Box culvert	H1.22xB3.2	1.853	1.484	0.45		Open flow	Affected
	35	9.404	Box culvert (2-cell)	H1.4xB2.2	5.925	1.951	0.75		Open flow	Affected
	36	9.583	Pipe culvert	φ 0.61	1.076	4.211	0.50		Open flow	
	37	9.970	Pipe culvert (2-cell)	φ 0.61	2.151	4.211	0.50		Open flow	
Total				41.100						
H	38	10.159	Pipe culvert (2-cell)	φ 1.22	1.405	1.251	0.59		Open flow	
	39	10.192	Box culvert	H1.4xB2.3	5.397	2.625	0.89		Open flow	
	Total				6.800					
P	40	10.446	Pipe culvert	φ 0.76	0.190	3.142	0.26	1.160	Open flow	Affected
	41	10.710	Box culvert	H1.4xB2.3	8.524	3.547	1.16		Open flow	Affected
	42	10.955	Pipe culvert	φ 0.76	0.190	3.142	0.26		Open flow	Affected
	Total				8.900					
I + Q+J +R +K	43	11.142	Pipe culvert	φ 0.76	2.872	6.332	0.76	1.264	Open flow	Affected
	44	11.193	Box culvert (2-cell)	H1.22xB2.3	12.284	3.351	0.96		Open flow	Affected
	45	11.702	Pipe culvert	φ 0.61	0.673	3.713	0.49		Open flow	
	46	12.133	Pipe culvert	φ 0.61	0.596	2.538	0.46		Open flow	
	47	12.756	Box culvert	H2.13xB2.44	20.276	4.949	1.68		Open flow	
	48	13.590	Box culvert	H2.4x4.0	19.917	2.927	1.74	0.986	Open flow	Affected
	49	13.690	Pipe culvert	φ 1.2	2.283	3.509	0.69		Open flow	Affected
Total				58.900						
S	50	13.750	Pipe culvert	φ 1.20	2.959	3.870	0.77		Open flow	
	51	13.892	Pipe culvert	φ 0.61	0.250	1.316	0.38		Open flow	
	52	13.928	Pipe culvert	φ 0.61	0.457	2.400	0.38		Open flow	
	53	14.151	Pipe culvert (2-cell)	φ 1.20	3.689	5.238	0.51	1.109	Open flow	Affected
	54	14.200	Pipe culvert	φ 1.20	1.845	5.238	0.51		Open flow	Affected
	Total				9.200					

Capacity of culverts is sufficient.

APPENDIX 10

**HYDRAULIC ANALYSIS
ON ROAD SURFACE DRAINAGE**

Analysis results are shown on the following tables:

Table 1 : Estimated run-off (mountain side)

Table 2 : Estimated run-off (sea side)

Table 3 : Hydraulic analysis results : Examination of satisfying run-off < allowable discharge (mountain side)

Table 4 : Hydraulic analysis results : Examination of satisfying run-off < allowable discharge (sea side)

TABLE1 ESTIMATED RUN-OFF (MOUNTAIN SIDE) (1/5)

Station	Distance from Crest (m)	Catchment width, Pavement (m)	Catchment width, Ground surface/ slope (m)	Run-off (m ³ /sec)	Remarks
0+215	215.00	8.850	0.0	0.0027	
0+225	205.00	8.950	0.5	0.0072	
0+250	180.00	8.950	1.5	0.0069	
0+275	155.00	8.200	0.6	0.0070	
0+300	130.00	8.450	2.5	0.0059	
0+325	105.00	5.450	0.4	0.0047	
0+350	80.00	5.450	2.0	0.0047	
0+375	55.00	5.450	0.6	0.0044	
0+400	30.00	5.450	0.7	0.0043	
0+425	5.00	5.450	0.3	0.0008	
0+430	0.00	5.450	0.0		
0+555	45.00	5.450	0.0	0.0035	
0+575	25.00	5.450	1.0	0.0047	
0+600	0.00	5.450	1.6		
0+770	105.00	2.700	0.0	0.0004	
0+775	100.00	2.700	0.6	0.0025	
0+800	75.00	2.700	1.3	0.0029	
0+825	50.00	2.700	2.5	0.0032	
0+850	25.00	2.700	2.5	0.0030	
0+875	0.00	2.700	1.6		
0+900	25.00	5.450	0.6	0.0036	
0+915	40.00	5.450	0.0	0.0025	
1+078	72.00	8.630	0.0	0.0061	
1+100	50.00	8.950	1.6	0.0076	
1+125	25.00	8.840	2.5	0.0084	
1+150	0.00	8.383	5.6		
1+170	20.00	8.251	0.0	0.0060	
1+204	0.00	5.503	0.0		
1+225	21.00	5.527	0.9	0.0037	
1+235	31.00	5.557	0.0	0.0017	
1+384	0.00	8.450	0.0		
1+400	16.00	8.450	0.6	0.0041	
1+425	41.00	8.450	0.5	0.0066	
1+450	66.00	8.450	0.8	0.0066	
1+475	91.00	8.450	0.3	0.0066	
1+482	98.00	8.450	0.0	0.0018	
1+520	0.00	8.342	0.0		
1+525	5.00	8.315	0.3	0.0013	
1+550	30.00	5.450	0.9	0.0054	
1+575	55.00	5.450	0.6	0.0044	
1+600	80.00	8.356	0.6	0.0055	
1+625	105.00	8.450	0.8	0.0066	
1+650	130.00	8.450	0.9	0.0067	
1+675	155.00	8.450	0.5	0.0067	
1+685	165.00	8.450	0.0	0.0026	
1+790	0.00	8.378	0.0		
1+800	10.00	8.497	0.4	0.0026	
1+825	35.00	8.887	0.9	0.0068	
1+850	60.00	9.278	2.6	0.0076	

TABLE1 ESTIMATED RUN-OFF (MOUNTAIN SIDE) (2/5)

Station	Distance from Crest (m)	Catchment width, Pavement (m)	Catchment width, Ground surface/ slope (m)	Run-off (m ³ /sec)	Remarks
1+875	85.00	9.450	3.6	0.0085	
1+900	110.00	9.357	1.4	0.0082	
1+925	135.00	8.972	1.2	0.0075	
1+942	152.00	8.710	1.2	0.0049	
2+158	92.00	5.450	0.0	0.0038	
2+175	75.00	8.283	2.0	0.0079	
2+200	50.00	8.700	4.6	0.0085	
2+225	25.00	8.950	3.4	0.0080	
2+250	0.00	8.950	2.0		
2+275	25.00	8.783	1.4	0.0074	
2+300	50.00	8.367	1.0	0.0070	
2+325	75.00	5.450	0.5	0.0055	
2+350	100.00	5.450	0.8	0.0044	
2+362	112.00	5.450	0.0	0.0021	
2+540	45.00	2.700	0.0	0.0010	
2+550	35.00	2.700	2.0	0.0031	
2+575	10.00	2.700	2.6	0.0011	
2+585	0.00	2.700	0.0		
2+720	105.00	5.450	0.0	0.0009	
2+725	100.00	5.450	0.8	0.0049	
2+750	75.00	5.450	2.6	0.0038	
2+775	50.00	2.700	0.4	0.0026	
2+800	25.00	2.700	1.9	0.0031	
2+825	0.00	2.700	2.6		
2+850	25.00	2.700	1.2	0.0029	
2+860	35.00	2.700	0.0	0.0009	
2+915	0.00	8.200	0.0		
2+925	10.00	8.343	0.6	0.0025	
2+950	35.00	8.566	1.4	0.0068	
2+975	60.00	8.700	2.3	0.0073	
3+000	85.00	8.700	2.2	0.0076	
3+025	110.00	8.700	2.6	0.0077	
3+050	135.00	8.731	3.0	0.0078	
3+075	160.00	8.888	1.6	0.0077	
3+078	163.00	8.895	0.0	0.0008	
3+167	43.00	8.950	0.0	0.0022	
3+175	35.00	8.950	1.1	0.0071	
3+200	10.00	8.950	0.6	0.0027	
3+210	0.00	8.950	0.0		
3+370	0.00	2.700	0.0		
3+375	5.00	2.700	0.5	0.0004	
3+400	30.00	2.700	0.4	0.0022	
3+411	41.00	2.700	0.0	0.0009	
3+545	60.00	8.700	0.0	0.0013	
3+550	55.00	8.700	0.9	0.0069	
3+575	30.00	8.700	0.8	0.0067	
3+600	5.00	8.388	0.5	0.0013	
3+605	0.00	8.350	0.0		

TABLE1 ESTIMATED RUN-OFF (MOUNTAIN SIDE) (3/5)

Station	Distance from Crest (m)	Catchment width, Pavement (m)	Catchment width, Ground surface/ slope (m)	Run-off (m ³ /sec)	Remarks
3+840	60.00	5.450	0.0	0.0017	
3+850	50.00	5.450	0.6	0.0059	
3+875	25.00	8.338	2.6	0.0083	
3+900	0.00	8.650	5.6		
3+925	25.00	8.460	5.3	0.0090	
3+950	50.00	8.460	5.7	0.0089	
3+975	75.00	2.700	4.9	0.0067	
4+000	100.00	2.700	5.0	0.0043	
4+025	125.00	2.700	4.0	0.0041	
4+050	150.00	2.700	3.0	0.0037	
4+075	175.00	2.700	3.5	0.0035	
4+100	200.00	2.700	3.2	0.0036	
4+125	225.00	2.700	4.9	0.0039	
4+150	250.00	2.700	4.1	0.0041	
4+175	275.00	2.700	3.8	0.0039	
4+200	300.00	2.700	4.8	0.0040	
4+225	325.00	8.650	4.0	0.0063	
4+250	350.00	9.075	3.2	0.0083	
4+275	375.00	9.450	1.2	0.0080	
4+277	377.00	9.419	0.0	0.0006	
6+111	89.00	5.450	0.0	0.0025	
6+125	75.00	5.450	1.6	0.0056	
6+150	50.00	5.450	4.7	0.0064	
6+175	25.00	5.450	5.0	0.0073	
6+200	0.00	8.247	4.1		
6+225	25.00	8.637	4.5	0.0083	
6+250	50.00	8.700	3.0	0.0083	
6+275	75.00	8.700	0.7	0.0074	
6+300	100.00	8.700	3.5	0.0075	
6+325	125.00	8.606	5.4	0.0086	
6+337	137.00	8.606	5.4	0.0043	
6+339	0.00	8.606	5.4		
6+350	11.00	8.216	3.3	0.0037	
6+371	32.00	5.450	0.0	0.0050	
7+689	11.00	2.700	0.0	0.0013	
7+700	0.00	2.700	4.0		
7+725	25.00	2.700	0.3	0.0030	
7+750	50.00	2.700	1.7	0.0025	
7+759	59.00	2.700	0.0	0.0009	
8+383	17.00	2.700	0.0	0.0017	
8+400	0.00	2.700	2.0		
8+425	25.00	8.510	1.5	0.0050	
8+450	50.00	8.950	1.9	0.0073	
8+468	68.00	8.950	0.0	0.0052	
9+297	0.00	5.450	0.0		
9+300	3.00	5.450	0.0	0.0005	
9+325	28.00	5.450	1.1	0.0043	
9+328	31.00	5.450	0.0	0.0005	
9+721	54.00	8.700	0.0	0.0011	
9+725	50.00	8.700	0.3	0.0069	
9+750	25.00	8.700	1.4	0.0073	

TABLE1 ESTIMATED RUN-OFF (MOUNTAIN SIDE) (4/5)

Station	Distance from Crest (m)	Catchment width, Pavement (m)	Catchment width, Ground surface/slope (m)	Run-off (m ³ /sec)	Remarks
9+775	0.00	9.013	1.4		
9+800	25.00	9.200	1.4	0.0075	
9+825	50.00	9.037	1.5	0.0075	
9+850	75.00	8.456	1.0	0.0071	
9+875	100.00	2.700	1.3	0.0047	
9+900	125.00	2.700	0.9	0.0025	
9+925	150.00	2.700	1.2	0.0025	
9+950	175.00	2.700	0.3	0.0024	
9+969	194.00	2.700	0.3	0.0016	
9+971	0.00	8.580	0.3		
9+975	4.00	8.580	2.2	0.0011	
10+000	29.00	8.700	2.1	0.0075	
10+025	54.00	8.700	2.0	0.0075	
10+050	79.00	8.700	1.2	0.0073	
10+075	104.00	8.700	0.8	0.0070	
10+086	115.00	8.499	0.0	0.0029	
10+830	20.00	9.362	0.0	0.0060	
10+850	0.00	9.259	2.0		
10+875	25.00	8.825	0.4	0.0073	
10+876	26.00	8.808	0.0	0.0003	
10+995	80.00	2.700	0.0	0.0004	
11+000	75.00	2.700	0.5	0.0032	
11+025	50.00	2.700	4.3	0.0067	
11+050	25.00	8.642	6.3	0.0095	
11+075	0.00	9.200	5.8		
11+100	25.00	8.988	2.7	0.0088	
11+114	39.00	8.813	0.0	0.0041	
11+318	365.00	8.328	0.0	0.0017	
11+325	358.00	7.941	0.5	0.0073	
11+350	333.00	8.950	3.5	0.0082	
11+375	308.00	8.942	3.0	0.0084	
11+400	283.00	8.753	4.6	0.0090	
11+425	258.00	8.564	6.3	0.0092	
11+450	233.00	8.526	5.6	0.0088	
11+475	208.00	8.700	4.5	0.0085	
11+500	183.00	8.700	3.9	0.0082	
11+525	158.00	8.700	3.3	0.0078	
11+550	133.00	8.700	2.1	0.0074	
11+575	108.00	8.700	1.6	0.0074	
11+600	83.00	8.700	2.0	0.0089	
11+625	58.00	8.440	8.4	0.0078	
11+650	33.00	5.450	2.5	0.0053	
11+675	8.00	5.450	2.5	0.0012	
11+683	0.00	2.700	0.0		
11+970	0.00	2.700	0.0		
11+975	5.00	2.700	0.5	0.0004	
12+000	30.00	2.700	0.3	0.0022	
12+025	55.00	2.700	0.3	0.0022	
12+050	80.00	2.700	0.5	0.0022	
12+059	89.00	2.700	0.0	0.0008	
12+224	91.00	8.950	0.0	0.0003	

TABLE1 ESTIMATED RUN-OFF (MOUNTAIN SIDE) (5/5)

Station	Distance from Crest (m)	Catchment width, Pavement (m)	Catchment width, Ground surface/ slope (m)	Run-off (m ³ /sec)	Remarks
12+225	90.00	9.950	4.0	0.0087	
12+250	65.00	8.950	2.8	0.0076	
12+275	40.00	8.585	1.5	0.0049	
12+300	15.00	2.700	1.5	0.0014	
12+315	0.00	2.700	0.0		
12+358	0.00	2.700	0.0		
12+375	17.00	2.700	1.7	0.0016	
12+400	42.00	8.303	3.5	0.0053	
12+425	67.00	8.944	7.5	0.0090	
12+450	92.00	9.200	8.0	0.0104	
12+475	117.00	8.691	5.6	0.0099	
12+500	142.00	2.700	4.8	0.0067	
12+525	167.00	2.700	2.5	0.0037	
12+550	192.00	2.700	0.7	0.0028	
12+557	199.00	2.700	0.0	0.0006	
12+809	216.00	2.700	0.0	0.0015	
12+825	200.00	2.700	1.5	0.0035	
12+850	175.00	2.700	4.9	0.0067	
12+875	150.00	8.465	6.0	0.0099	
12+900	125.00	8.950	8.2	0.0103	
12+925	100.00	8.950	7.0	0.0091	
12+950	75.00	8.950	3.3	0.0077	
12+975	50.00	8.800	1.0	0.0075	
13+000	25.00	8.700	3.0	0.0079	
13+025	0.00	8.700	3.0		
13+050	25.00	8.700	1.5	0.0076	
13+075	50.00	8.700	1.1	0.0071	
13+100	75.00	8.250	0.9	0.0068	
13+125	100.00	2.700	1.0	0.0046	
13+150	125.00	2.700	0.3	0.0023	
13+164	139.00	2.700	0.0	0.0012	
13+790	101.00	8.320	0.0	0.0026	
13+800	91.00	8.200	0.9	0.0069	
13+825	66.00	8.200	2.2	0.0073	
13+850	41.00	8.200	2.8	0.0072	
13+875	16.00	8.200	1.8	0.0043	
13+891	0.00	8.200	0.4		
13+893	34.00	8.200	0.4	0.0018	
13+900	27.00	8.200	0.4	0.0068	
13+927	0.00	8.200	0.3		
13+929	0.00	8.200	0.3		
13+950	21.00	8.200	0.8	0.0054	
13+975	46.00	2.700	2.5	0.0049	
14+000	71.00	2.700	0.7	0.0028	
14+025	96.00	2.700	0.5	0.0023	
14+037	108.00	2.700	0.0	0.0010	
14+105	0.00	8.510	0.0		
14+125	20.00	8.898	0.7	0.0054	
14+150	45.00	8.950	0.8	0.0070	
14+152	0.00	8.950	0.8		
14+163	11.00	8.923	0.0	0.0030	

TABLE2 ESTIMATED RUN-OFF (SEA SIDE) (1/3)

Station	Distance from Crest (m)	Catchment width, Pavement (m)	Catchment width, Ground surface/ slope (m)	Run-off (m ³ /sec)	Remarks
0+748	138.00	8.450	0.0	0.0005	
0+750	136.00	8.450	0.3	0.0070	
0+775	111.00	8.867	1.7	0.0082	
0+800	86.00	9.200	4.5	0.0093	
0+825	61.00	9.183	5.9	0.0091	
0+850	36.00	8.767	4.0	0.0077	
0+875	11.00	8.350	1.4	0.0024	
0+886	0.00	5.450	0.0		
1+204	0.00	5.450	0.0		
1+225	21.00	5.450	1.5	0.0037	
1+250	46.00	5.450	1.5	0.0048	
1+275	71.00	5.450	0.4	0.0045	
1+287	83.00	5.450	0.0	0.0020	
1+343	0.00	5.450	0.0		
1+350	7.00	5.450	1.6	0.0012	
1+375	32.00	2.700	0.6	0.0036	
1+400	57.00	2.700	1.6	0.0025	
1+425	82.00	2.700	1.8	0.0028	
1+450	107.00	2.700	1.5	0.0028	
1+475	132.00	2.700	1.4	0.0027	
1+482	139.00	2.700	0.0	0.0007	
1+520	0.00	2.700	0.0		
1+525	5.00	2.700	0.5	0.0004	
1+550	30.00	5.450	1.0	0.0034	
1+575	55.00	5.450	0.4	0.0044	
1+600	80.00	2.700	0.8	0.0033	
1+625	105.00	2.700	1.1	0.0025	
1+650	130.00	2.700	0.5	0.0024	
1+675	155.00	2.700	0.3	0.0022	
1+685	165.00	2.700	0.0	0.0008	
1+846	0.00	2.700	0.0		
1+850	4.00	2.700	0.6	0.0003	
1+859	13.00	2.700	0.0	0.0008	
1+895	0.00	2.700	0.0		
1+900	5.00	2.700	0.3	0.0004	
1+907	12.00	2.700	0.0	0.0006	
2+286	0.00	2.700	0.0		
2+300	14.00	2.700	0.8	0.0012	
2+312	26.00	2.700	0.0	0.0011	
2+720	105.00	5.450	0.0	0.0009	
2+725	100.00	5.450	1.8	0.0051	
2+750	75.00	5.450	2.5	0.0061	
2+775	50.00	8.294	1.4	0.0071	
2+800	25.00	8.554	1.8	0.0073	
2+825	0.00	8.700	1.9		
2+850	25.00	8.700	0.6	0.0071	
2+860	35.00	8.670	0.0	0.0027	
3+313	62.00	8.700	0.0	0.0033	
3+325	50.00	9.000	0.7	0.0072	
3+350	25.00	9.450	0.5	0.0074	
3+375	0.00	9.450	0.9		

TABLE2 ESTIMATED RUN-OFF (SEA SIDE) (2/3)

Station	Distance from Crest (m)	Catchment width, Pavement (m)	Catchment width, Ground surface/ slope (m)	Run-off (m ³ /sec)	Remarks
3+400	25.00	9.450	1.4	0.0076	
3+411	36.00	9.254	0.0	0.0032	
3+545	60.00	2.700	0.0	0.0004	
3+550	55.00	2.700	0.5	0.0023	
3+575	30.00	2.700	0.8	0.0023	
3+600	5.00	2.700	0.5	0.0004	
3+605	0.00	2.700	0.0		
3+840	85.00	5.450	0.0	0.0017	
3+850	75.00	5.450	0.6	0.0038	
3+875	50.00	2.700	2.5	0.0032	
3+900	25.00	2.700	2.7	0.0035	
3+925	0.00	2.700	3.8		
3+950	25.00	2.700	4.4	0.0039	
3+975	50.00	8.500	5.4	0.0065	
4+000	75.00	8.700	5.0	0.0089	
4+025	100.00	8.700	4.8	0.0088	
4+050	125.00	8.506	4.1	0.0085	
4+075	150.00	8.443	2.3	0.0079	
4+100	175.00	8.877	1.0	0.0073	
4+125	200.00	9.311	1.8	0.0075	
4+150	225.00	9.450	1.6	0.0078	
4+175	250.00	9.200	1.7	0.0078	
4+200	275.00	8.575	2.0	0.0075	
4+225	300.00	2.700	2.7	0.0053	
4+250	325.00	2.700	1.5	0.0030	
4+275	350.00	2.700	0.3	0.0024	
4+277	352.00	2.700	0.0	0.0002	
9+865	0.00	8.396	0.0		
9+875	10.00	8.526	0.8	0.0026	
9+885	20.00	8.758	0.0	0.0027	
10+995	77.00	8.955	0.0	0.0014	
11+000	72.00	8.921	0.3	0.0068	
11+025	47.00	8.340	1.2	0.0047	
11+050	22.00	2.700	1.0	0.0020	
11+072	0.00	2.700	0.0		
11+341	213.00	2.700	0.0	0.0008	
11+350	204.00	2.700	0.6	0.0024	
11+375	179.00	2.700	1.0	0.0027	
11+400	154.00	2.700	1.9	0.0032	
11+425	129.00	2.700	3.0	0.0031	
11+450	104.00	2.700	1.7	0.0027	
11+475	79.00	2.700	1.1	0.0025	
11+500	54.00	2.700	0.8	0.0024	
11+525	29.00	2.700	0.6	0.0022	
11+550	4.00	2.700	0.0	0.0003	
11+554	0.00	2.700	0.0		
11+619	64.00	2.700	0.0	0.0005	
11+625	58.00	2.700	0.8	0.0035	
11+650	33.00	5.450	1.2	0.0045	
11+675	8.00	5.450	0.6	0.0014	
11+683	0.00	5.450	0.0		
11+937	0.00	5.450	0.0		

TABLE2 ESTIMATED RUN-OFF (SEA SIDE) (3/3)

Station	Distance from Crest (m)	Catchment width, Pavement (m)	Catchment width, Ground surface/ slope (m)	Run-off (m ³ /sec)	Remarks
11+950	13.00	8.367	2.4	0.0030	
11+975	38.00	8.700	7.0	0.0086	
12+000	63.00	8.700	7.3	0.0099	
12+025	88.00	8.388	6.6	0.0097	
12+050	113.00	8.200	4.0	0.0087	
12+075	138.00	8.200	0.8	0.0073	
12+080	143.00	8.200	0.0	0.0013	
12+224	63.00	2.700	0.0	0.0001	
12+225	62.00	2.700	0.0	0.0025	
12+250	37.00	2.700	2.0	0.0020	
12+275	12.00	2.700	1.8	0.0012	
12+287	0.00	2.700	0.0		
12+404	0.00	2.700	0.0		
12+425	21.00	2.700	3.0	0.0023	
12+450	46.00	2.700	3.3	0.0035	
12+475	71.00	2.700	2.3	0.0033	
12+500	96.00	8.340	2.3	0.0052	
12+525	121.00	8.921	1.8	0.0074	
12+550	146.00	9.200	0.3	0.0073	
12+557	153.00	9.193	0.0	0.0020	
12+827	113.00	8.913	0.0	0.0062	
12+850	90.00	8.487	0.9	0.0046	
12+875	65.00	2.700	1.0	0.0029	
12+900	40.00	2.700	2.7	0.0032	
12+925	15.00	2.700	2.4	0.0016	
12+940	0.00	2.700	0.0		
13+128	0.00	8.770	0.0		
13+150	22.00	9.200	0.5	0.0060	
13+164	36.00	9.200	0.0	0.0039	
13+264	0.00	2.700	0.0		
13+275	11.00	2.700	1.0	0.0010	
13+300	36.00	2.700	0.5	0.0024	
13+325	61.00	2.700	0.9	0.0024	
13+350	86.00	2.700	0.5	0.0024	
13+365	101.00	2.700	0.0	0.0013	
13+803	82.00	2.700	0.0	0.0020	
13+825	60.00	2.700	1.2	0.0027	
13+850	35.00	2.700	1.5	0.0025	
13+875	10.00	2.700	0.5	0.0009	
13+885	0.00	2.700	0.0		
13+954	0.00	2.700	0.0		
13+975	21.00	8.533	1.6	0.0039	
14+000	46.00	9.089	2.8	0.0076	
14+025	71.00	9.200	1.4	0.0078	
14+050	96.00	9.107	1.0	0.0074	
14+075	121.00	8.526	0.6	0.0070	
14+088	134.00	5.450	0.0	0.0028	

TABLE3 HYDRAULIC ANALYSIS (MOUNTAIN SIDE) (1/4)

Station	Distance from Crest (m)	Side Ditch Width (m)	Hydraulic Gradient (%)	Run-off (m ³ /sec)	Cumulative Run-off (m ³ /sec)	Allowable Discharge (m ³ /sec)	Mean Velocity (m/sec)	Effective Height of Ditch (m)	Effective Area of Ditch (m ²)	Hydraulic Radius (m)
0+215	215.00	1.200	7.469	0.0027	0.0486	0.630	3.280	0.400	0.240	0.164
0+225	205.00	1.200	6.096	0.0072	0.0459	0.569	2.963	0.400	0.240	0.164
0+250	180.00	1.200	4.728	0.0069	0.0387	0.501	2.610	0.400	0.240	0.164
0+275	155.00	1.200	3.096	0.0070	0.0318	0.405	2.112	0.400	0.240	0.164
0+300	130.00	1.200	2.568	0.0059	0.0248	0.369	1.923	0.400	0.240	0.164
0+325	105.00	1.200	2.440	0.0047	0.0189	0.360	1.875	0.400	0.240	0.164
0+350	80.00	1.200	2.440	0.0047	0.0142	0.360	1.875	0.400	0.240	0.164
0+375	55.00	1.200	2.440	0.0044	0.0095	0.360	1.875	0.400	0.240	0.164
0+400	30.00	1.200	2.464	0.0043	0.0052	0.362	1.884	0.400	0.240	0.164
0+425	5.00	1.200	2.464	0.0008	0.0008	0.362	1.884	0.400	0.240	0.164
0+430	0.00	1.200								
0+555	45.00	1.200	8.416	0.0035	0.0082	0.669	3.482	0.400	0.240	0.164
0+575	25.00	1.200	7.404	0.0047	0.0047	0.627	3.266	0.400	0.240	0.164
0+600	0.00	1.200								
0+770	105.00	1.200	5.246	0.0004	0.0120	0.528	2.749	0.400	0.240	0.164
0+775	100.00	1.200	4.315	0.0025	0.0116	0.479	2.493	0.400	0.240	0.164
0+800	75.00	1.200	2.902	0.0029	0.0091	0.393	2.045	0.400	0.240	0.164
0+825	50.00	1.200	1.550	0.0032	0.0062	0.287	1.494	0.400	0.240	0.164
0+850	25.00	1.200	0.300	0.0030	0.0030	0.119	0.672	0.420	0.252	0.170
0+875	0.00	1.200								
0+900	25.00	1.200	-0.493	0.0036	0.0036	0.162	0.843	0.400	0.240	0.164
0+915	40.00	1.200	-0.300	0.0025	0.0061	0.153	0.725	0.504	0.302	0.190
1+078	72.00	1.200	5.124	0.0061	0.0221	0.522	2.717	0.400	0.240	0.164
1+100	50.00	1.200	4.568	0.0076	0.0160	0.493	2.565	0.400	0.240	0.164
1+125	25.00	1.200	2.977	0.0084	0.0084	0.398	2.071	0.400	0.240	0.164
1+150	0.00	1.200								
1+170	20.00	1.200	-0.300	0.0060	0.0060	0.118	0.671	0.419	0.251	0.170
1+204	0.00	1.200								
1+225	21.00	1.200	-7.020	0.0037	0.0037	0.611	3.180	0.400	0.240	0.164
1+235	31.00	1.200	-7.020	0.0017	0.0054	0.611	3.180	0.400	0.240	0.164
1+384	0.00	1.200								
1+400	16.00	1.200	-8.248	0.0041	0.0041	0.662	3.447	0.400	0.240	0.164
1+425	41.00	1.200	-8.248	0.0066	0.0107	0.662	3.447	0.400	0.240	0.164
1+450	66.00	1.200	-8.252	0.0066	0.0174	0.662	3.448	0.400	0.240	0.164
1+475	91.00	1.200	-8.248	0.0066	0.0240	0.662	3.447	0.400	0.240	0.164
1+482	98.00	1.200	-8.248	0.0018	0.0258	0.662	3.447	0.400	0.240	0.164
1+520	0.00	1.200								
1+525	5.00	1.200	-8.007	0.0013	0.0013	0.652	3.396	0.400	0.240	0.164
1+550	30.00	1.200	-8.007	0.0054	0.0067	0.652	3.396	0.400	0.240	0.164
1+575	55.00	1.200	-6.808	0.0044	0.0111	0.601	3.132	0.400	0.240	0.164
1+600	80.00	1.200	-5.504	0.0055	0.0166	0.541	2.816	0.400	0.240	0.164
1+625	105.00	1.200	-4.380	0.0066	0.0232	0.482	2.512	0.400	0.240	0.164
1+650	130.00	1.200	-2.884	0.0067	0.0300	0.391	2.038	0.400	0.240	0.164
1+675	155.00	1.200	-1.684	0.0067	0.0366	0.299	1.558	0.400	0.240	0.164
1+685	165.00	1.200	-1.444	0.0026	0.0392	0.277	1.442	0.400	0.240	0.164
1+790	0.00	1.200								
1+800	10.00	1.200	-0.300	0.0026	0.0026	0.110	0.657	0.400	0.240	0.164
1+825	35.00	1.200	-0.300	0.0068	0.0094	0.144	0.712	0.481	0.289	0.185
1+850	60.00	1.200	-0.308	0.0076	0.0170	0.201	0.760	0.552	0.331	0.200
1+875	85.00	1.200	-3.125	0.0085	0.0255	0.407	2.122	0.400	0.240	0.164
1+900	110.00	1.200	-5.190	0.0082	0.0337	0.525	2.734	0.400	0.240	0.164
1+925	135.00	1.200	-7.247	0.0075	0.0412	0.620	3.231	0.400	0.240	0.164
1+942	152.00	1.200	-9.111	0.0049	0.0461	0.696	3.623	0.400	0.240	0.164
2+158	92.00	1.200	7.585	0.0038	0.0282	0.635	3.306	0.400	0.240	0.164
2+175	75.00	1.200	5.023	0.0079	0.0244	0.516	2.690	0.400	0.240	0.164
2+200	50.00	1.200	2.316	0.0085	0.0165	0.351	1.827	0.400	0.240	0.164
2+225	25.00	1.200	0.300	0.0080	0.0080	0.117	0.669	0.416	0.250	0.169
2+250	0.00	1.200								
2+275	25.00	1.200	-2.109	0.0074	0.0074	0.335	1.743	0.400	0.240	0.164
2+300	50.00	1.200	-4.356	0.0070	0.0144	0.481	2.505	0.400	0.240	0.164
2+325	75.00	1.200	-8.051	0.0055	0.0200	0.654	3.406	0.400	0.240	0.164
2+350	100.00	1.200	-9.944	0.0044	0.0244	0.727	3.785	0.400	0.240	0.164
2+362	112.00	1.200	-10.000	0.0021	0.0264	0.729	3.796	0.400	0.240	0.164
2+540	45.00	1.200	-0.300	0.0010	0.0052	0.158	0.730	0.514	0.308	0.192
2+550	35.00	1.200	-0.300	0.0031	0.0042	0.147	0.716	0.489	0.293	0.187

TABLE3 HYDRAULIC ANALYSIS (MOUNTAIN SIDE) (2/4)

Station	Distance from Crest (m)	Side Ditch Width (m)	Hydraulic Gradient (%)	Run-off (m ³ /sec)	Cumulative Run-off (m ³ /sec)	Allowable Discharge (m ³ /sec)	Mean Velocity (m/sec)	Effective Height of Ditch (m)	Effective Area of Ditch (m ²)	Hydraulic Radius (m)
2+575	10.00	1.200	-0.300	0.0011	0.0011	0.117	0.668	0.415	0.249	0.169
2+585	0.00	1.200								
2+720	105.00	1.200	7.880	0.0009	0.0151	0.647	3.369	0.400	0.240	0.164
2+725	100.00	1.200	7.880	0.0049	0.0143	0.647	3.369	0.400	0.240	0.164
2+750	75.00	1.200	5.808	0.0038	0.0094	0.555	2.893	0.400	0.240	0.164
2+775	50.00	1.200	3.338	0.0026	0.0056	0.421	2.193	0.400	0.240	0.164
2+800	25.00	1.200	0.788	0.0031	0.0031	0.205	1.066	0.400	0.240	0.164
2+825	0.00	1.200								
2+850	25.00	1.200	-1.768	0.0029	0.0029	0.306	1.596	0.400	0.240	0.164
2+860	35.00	1.200	-4.262	0.0009	0.0038	0.476	2.478	0.400	0.240	0.164
2+915	0.00	1.200								
2+925	10.00	1.200	-6.433	0.0025	0.0025	0.585	3.044	0.400	0.240	0.164
2+950	35.00	1.200	-6.433	0.0068	0.0093	0.585	3.044	0.400	0.240	0.164
2+975	60.00	1.200	-6.569	0.0073	0.0167	0.591	3.076	0.400	0.240	0.164
3+000	85.00	1.200	-6.688	0.0076	0.0243	0.596	3.104	0.400	0.240	0.164
3+025	110.00	1.200	-7.020	0.0077	0.0319	0.611	3.180	0.400	0.240	0.164
3+050	135.00	1.200	-7.081	0.0078	0.0398	0.613	3.194	0.400	0.240	0.164
3+075	160.00	1.200	-5.857	0.0077	0.0475	0.558	2.905	0.400	0.240	0.164
3+078	163.00	1.200	-5.857	0.0008	0.0483	0.558	2.905	0.400	0.240	0.164
3+167	43.00	1.200	8.664	0.0022	0.0121	0.678	3.533	0.400	0.240	0.164
3+175	35.00	1.200	8.664	0.0071	0.0099	0.678	3.533	0.400	0.240	0.164
3+200	10.00	1.200	8.664	0.0027	0.0027	0.678	3.533	0.400	0.240	0.164
3+210	0.00	1.200								
3+370	0.00	1.200								
3+375	5.00	1.200	-3.824	0.0004	0.0004	0.451	2.347	0.400	0.240	0.164
3+400	30.00	1.200	-3.824	0.0022	0.0027	0.451	2.347	0.400	0.240	0.164
3+411	41.00	1.200	-3.824	0.0009	0.0036	0.451	2.347	0.400	0.240	0.164
3+545	60.00	1.200	7.416	0.0013	0.0163	0.628	3.269	0.400	0.240	0.164
3+550	55.00	1.200	7.416	0.0069	0.0149	0.628	3.269	0.400	0.240	0.164
3+575	30.00	1.200	7.584	0.0067	0.0080	0.635	3.305	0.400	0.240	0.164
3+600	5.00	1.200	7.584	0.0013	0.0013	0.635	3.305	0.400	0.240	0.164
3+605	0.00	1.200								
3+840	60.00	1.200	6.833	0.0017	0.0159	0.602	3.137	0.400	0.240	0.164
3+850	50.00	1.200	6.833	0.0059	0.0142	0.602	3.137	0.400	0.240	0.164
3+875	25.00	1.200	2.943	0.0083	0.0083	0.395	2.059	0.400	0.240	0.164
3+900	0.00	1.200								
3+925	25.00	1.200	-0.300	0.0090	0.0090	0.133	0.696	0.456	0.274	0.179
3+950	50.00	1.200	-2.840	0.0089	0.0179	0.388	2.023	0.400	0.240	0.164
3+975	75.00	1.200	-6.302	0.0067	0.0246	0.579	3.013	0.400	0.240	0.164
4+000	100.00	1.200	-9.548	0.0043	0.0289	0.712	3.709	0.400	0.240	0.164
4+025	125.00	1.200	-10.000	0.0041	0.0330	0.729	3.796	0.400	0.240	0.164
4+050	150.00	1.200	-10.086	0.0037	0.0367	0.732	3.812	0.400	0.240	0.164
4+075	175.00	1.200	-9.963	0.0035	0.0403	0.727	3.789	0.400	0.240	0.164
4+100	200.00	1.200	-9.695	0.0036	0.0439	0.718	3.737	0.400	0.240	0.164
4+125	225.00	1.200	-9.694	0.0039	0.0478	0.718	3.737	0.400	0.240	0.164
4+150	250.00	1.200	-9.902	0.0041	0.0519	0.725	3.777	0.400	0.240	0.164
4+175	275.00	1.200	-10.220	0.0039	0.0558	0.737	3.837	0.400	0.240	0.164
4+200	300.00	1.200	-10.550	0.0040	0.0598	0.749	3.899	0.400	0.240	0.164
4+225	325.00	1.200	-10.550	0.0063	0.0661	0.749	3.899	0.400	0.240	0.164
4+250	350.00	1.200	-10.790	0.0083	0.0745	0.757	3.943	0.400	0.240	0.164
4+275	375.00	1.200	-10.474	0.0080	0.0825	0.746	3.884	0.400	0.240	0.164
4+277	377.00	1.200	-10.474	0.0006	0.0830	0.746	3.884	0.400	0.240	0.164
6+111	89.00	1.200	0.300	0.0025	0.0217	0.161	0.735	0.522	0.313	0.194
6+125	75.00	1.200	0.300	0.0056	0.0192	0.134	0.697	0.457	0.274	0.179
6+150	50.00	1.200	0.300	0.0064	0.0136	0.122	0.678	0.428	0.257	0.172
6+175	25.00	1.200	0.300	0.0073	0.0073	0.118	0.671	0.419	0.251	0.170
6+200	0.00	1.200								
6+225	25.00	1.200	-0.300	0.0083	0.0083	0.134	0.697	0.458	0.275	0.180
6+250	50.00	1.200	-0.300	0.0083	0.0166	0.164	0.738	0.528	0.317	0.195
6+275	75.00	1.200	-0.300	0.0074	0.0240	0.156	0.729	0.511	0.307	0.192
6+300	100.00	1.200	-0.300	0.0075	0.0315	0.134	0.697	0.458	0.275	0.180
6+325	125.00	1.200	-0.370	0.0086	0.0401	0.170	0.775	0.458	0.275	0.180
6+337	137.00	1.200	-0.370	0.0043	0.0444	0.170	0.775	0.458	0.275	0.180
6+339	0.00	1.200								
6+350	11.00	1.200	-0.300	0.0037	0.0037	0.142	0.709	0.477	0.286	0.184
6+371	32.00	1.200	-0.383	0.0050	0.0086	0.183	0.801	0.477	0.286	0.184

TABLE3 HYDRAULIC ANALYSIS (MOUNTAIN SIDE) (3/4)

Station	Distance form Crest (m)	Side Ditch Width (m)	Hydraulic Gradient (%)	Run-off (m ³ /sec)	Cumulative Run-off (m ³ /sec)	Allowable Discharge (m ³ /sec)	Mean Velocity (m/sec)	Effective Height of Ditch (m)	Effective Aree of Ditch (m ²)	Hydraulic Radius (m)
7+689	11.00	1.200	0.700	0.0013	0.0013	0.193	1.004	0.400	0.240	0.164
7+700	0.00	1.200								
7+725	25.00	1.200	-0.380	0.0030	0.0030	0.142	0.740	0.400	0.240	0.164
7+750	50.00	1.200	-1.374	0.0025	0.0055	0.270	1.407	0.400	0.240	0.164
7+759	59.00	1.200	-1.407	0.0009	0.0064	0.273	1.424	0.400	0.240	0.164
8+383	17.00	1.200	1.589	0.0017	0.0017	0.291	1.513	0.400	0.240	0.164
8+400	0.00	1.200								
8+425	25.00	1.200	-0.486	0.0050	0.0050	0.161	0.836	0.400	0.240	0.164
8+450	50.00	1.200	-2.756	0.0073	0.0124	0.383	1.992	0.400	0.240	0.164
8+468	68.00	1.200	-2.968	0.0052	0.0175	0.397	2.068	0.400	0.240	0.164
9+297	0.00	1.200								
9+300	3.00	1.200	-0.380	0.0005	0.0005	0.142	0.740	0.400	0.240	0.164
9+325	28.00	1.200	-0.300	0.0043	0.0048	0.133	0.696	0.455	0.273	0.179
9+328	31.00	1.200	-0.300	0.0005	0.0054	0.161	0.734	0.521	0.313	0.194
9+721	54.00	1.200	2.120	0.0011	0.0153	0.336	1.748	0.400	0.240	0.164
9+725	50.00	1.200	2.120	0.0069	0.0142	0.336	1.748	0.400	0.240	0.164
9+750	25.00	1.200	0.795	0.0073	0.0073	0.206	1.071	0.400	0.240	0.164
9+775	0.00	1.200								
9+800	25.00	1.200	-0.300	0.0075	0.0075	0.135	0.699	0.460	0.276	0.180
9+825	50.00	1.200	-0.300	0.0075	0.0150	0.135	0.699	0.460	0.276	0.180
9+850	75.00	1.200	-0.383	0.0071	0.0222	0.143	0.743	0.400	0.240	0.164
9+875	100.00	1.200	-1.663	0.0047	0.0269	0.297	1.548	0.400	0.240	0.164
9+900	125.00	1.200	-1.712	0.0025	0.0294	0.302	1.571	0.400	0.240	0.164
9+925	150.00	1.200	-2.668	0.0025	0.0319	0.376	1.960	0.400	0.240	0.164
9+950	175.00	1.200	-2.766	0.0024	0.0343	0.383	1.996	0.400	0.240	0.164
9+969	194.00	1.200	-2.490	0.0016	0.0360	0.364	1.894	0.400	0.240	0.164
9+971	0.00	1.200								
9+975	4.00	1.200	-1.600	0.0011	0.0011	0.291	1.518	0.400	0.240	0.164
10+000	29.00	1.200	-1.012	0.0075	0.0086	0.232	1.207	0.400	0.240	0.164
10+025	54.00	1.200	-0.980	0.0075	0.0161	0.228	1.188	0.400	0.240	0.164
10+050	79.00	1.200	-0.972	0.0073	0.0234	0.227	1.183	0.400	0.240	0.164
10+075	104.00	1.200	-0.300	0.0070	0.0304	0.142	0.709	0.476	0.286	0.184
10+086	115.00	1.200	-0.300	0.0029	0.0333	0.174	0.750	0.552	0.331	0.200
10+830	20.00	1.200	0.300	0.0060	0.0060	0.112	0.660	0.403	0.242	0.165
10+850	0.00	1.200								
10+875	25.00	1.200	-0.300	0.0073	0.0073	0.137	0.702	0.465	0.279	0.181
10+876	26.00	1.200	-0.465	0.0003	0.0076	0.195	0.874	0.465	0.279	0.181
10+995	80.00	1.200	-0.500	0.0004	0.0198	0.172	0.864	0.416	0.250	0.169
11+000	75.00	1.200	-0.640	0.0032	0.0194	0.184	0.960	0.400	0.240	0.164
11+025	50.00	1.200	-0.834	0.0067	0.0163	0.210	1.096	0.400	0.240	0.164
11+050	25.00	1.200	-1.204	0.0095	0.0095	0.253	1.317	0.400	0.240	0.164
11+075	0.00	1.200								
11+100	25.00	1.200	0.488	0.0088	0.0088	0.161	0.838	0.400	0.240	0.164
11+114	39.00	1.200	0.652	0.0041	0.0129	0.186	0.969	0.400	0.240	0.164
11+318	365.00	1.200	9.107	0.0017	0.1150	0.695	3.622	0.400	0.240	0.164
11+325	358.00	1.200	9.472	0.0073	0.1133	0.709	3.694	0.400	0.240	0.164
11+350	333.00	1.200	9.876	0.0082	0.1060	0.724	3.772	0.400	0.240	0.164
11+375	308.00	1.200	10.329	0.0084	0.0978	0.741	3.857	0.400	0.240	0.164
11+400	283.00	1.200	10.298	0.0090	0.0894	0.740	3.852	0.400	0.240	0.164
11+425	258.00	1.200	9.936	0.0092	0.0803	0.726	3.783	0.400	0.240	0.164
11+450	233.00	1.200	9.457	0.0088	0.0711	0.709	3.691	0.400	0.240	0.164
11+475	208.00	1.200	8.872	0.0085	0.0623	0.686	3.575	0.400	0.240	0.164
11+500	183.00	1.200	6.916	0.0082	0.0538	0.606	3.156	0.400	0.240	0.164
11+525	158.00	1.200	4.960	0.0078	0.0456	0.513	2.673	0.400	0.240	0.164
11+550	133.00	1.200	2.024	0.0074	0.0378	0.328	1.708	0.400	0.240	0.164
11+575	108.00	1.200	3.004	0.0074	0.0304	0.399	2.080	0.400	0.240	0.164
11+600	83.00	1.200	2.610	0.0089	0.0231	0.372	1.939	0.400	0.240	0.164
11+625	58.00	1.200	2.190	0.0078	0.0142	0.341	1.776	0.400	0.240	0.164
11+650	33.00	1.200	2.024	0.0053	0.0064	0.328	1.708	0.400	0.240	0.164
11+675	8.00	1.200	2.519	0.0012	0.0012	0.366	1.905	0.400	0.240	0.164
11+683	0.00	1.200								
11+970	0.00	1.200								
11+975	5.00	1.200	-7.316	0.0004	0.0004	0.623	3.246	0.400	0.240	0.164
12+000	30.00	1.200	-7.578	0.0022	0.0026	0.634	3.304	0.400	0.240	0.164
12+025	55.00	1.200	-7.496	0.0022	0.0048	0.631	3.286	0.400	0.240	0.164
12+050	80.00	1.200	-6.444	0.0022	0.0070	0.585	3.047	0.400	0.240	0.164
12+059	89.00	1.200	-6.444	0.0008	0.0078	0.585	3.047	0.400	0.240	0.164

TABLE3 HYDRAULIC ANALYSIS (MOUNTAIN SIDE) (4/4)

Station	Distance from Crest (m)	Side Ditch Width (m)	Hydraulic Gradient (%)	Run-off (m ³ /sec)	Cumulative Run-off (m ³ /sec)	Allowable Discharge (m ³ /sec)	Mean Velocity (m/sec)	Effective Height of Ditch (m)	Effective Area of Ditch (m ²)	Hydraulic Radius (m)
12+224	91.00	1.200	9.303	0.0003	0.0226	0.703	3.661	0.400	0.240	0.164
12+225	90.00	1.200	8.008	0.0083	0.0223	0.652	3.397	0.400	0.240	0.164
12+250	65.00	1.200	6.032	0.0076	0.0139	0.566	2.948	0.400	0.240	0.164
12+275	40.00	1.200	3.231	0.0049	0.0064	0.414	2.157	0.400	0.240	0.164
12+300	15.00	1.200	0.323	0.0014	0.0014	0.131	0.682	0.400	0.240	0.164
12+315	0.00	1.200								
12+358	0.00	1.200								
12+375	17.00	1.200	-6.301	0.0016	0.0016	0.579	3.013	0.400	0.240	0.164
12+400	42.00	1.200	-9.254	0.0053	0.0070	0.701	3.651	0.400	0.240	0.164
12+425	67.00	1.200	-11.055	0.0090	0.0160	0.766	3.991	0.400	0.240	0.164
12+450	92.00	1.200	-10.526	0.0104	0.0265	0.748	3.894	0.400	0.240	0.164
12+475	117.00	1.200	-9.003	0.0099	0.0364	0.692	3.601	0.400	0.240	0.164
12+500	142.00	1.200	-9.158	0.0067	0.0431	0.697	3.632	0.400	0.240	0.164
12+525	167.00	1.200	-9.360	0.0037	0.0468	0.705	3.672	0.400	0.240	0.164
12+550	192.00	1.200	-9.693	0.0028	0.0496	0.718	3.737	0.400	0.240	0.164
12+557	199.00	1.200	-10.106	0.0006	0.0502	0.733	3.816	0.400	0.240	0.164
12+809	216.00	1.200	4.640	0.0015	0.0600	0.496	2.585	0.400	0.240	0.164
12+825	200.00	1.200	7.672	0.0035	0.0585	0.638	3.325	0.400	0.240	0.164
12+850	175.00	1.200	9.283	0.0067	0.0550	0.702	3.657	0.400	0.240	0.164
12+875	150.00	1.200	8.972	0.0099	0.0482	0.690	3.595	0.400	0.240	0.164
12+900	125.00	1.200	10.000	0.0103	0.0384	0.729	3.796	0.400	0.240	0.164
12+925	100.00	1.200	10.000	0.0050	0.0281	0.729	3.796	0.400	0.240	0.164
12+950	75.00	1.200	9.889	0.0077	0.0231	0.725	3.774	0.400	0.240	0.164
12+975	50.00	1.200	6.667	0.0075	0.0154	0.595	3.099	0.400	0.240	0.164
13+000	25.00	1.200	30.520	0.0079	0.0079	0.403	6.631	0.400	0.240	0.164
13+025	0.00	1.200						0.400		
13+050	25.00	1.200	-0.300	0.0076	0.0076	0.131	0.666	0.411	0.247	0.167
13+075	50.00	1.200	-3.524	0.0071	0.0147	0.433	2.253	0.400	0.240	0.164
13+100	75.00	1.200	-5.245	0.0068	0.0215	0.528	2.749	0.400	0.240	0.164
13+125	100.00	1.200	-5.329	0.0046	0.0261	0.532	2.771	0.400	0.240	0.164
13+150	125.00	1.200	-5.340	0.0023	0.0284	0.533	2.774	0.400	0.240	0.164
13+164	139.00	1.200	-5.236	0.0012	0.0296	0.527	2.746	0.400	0.240	0.164
13+790	101.00	1.200	6.114	0.0026	0.0283	0.570	2.968	0.400	0.240	0.164
13+800	91.00	1.200	6.114	0.0069	0.0257	0.570	2.968	0.400	0.240	0.164
13+825	66.00	1.200	5.062	0.0073	0.0188	0.518	2.701	0.400	0.240	0.164
13+850	41.00	1.200	3.624	0.0072	0.0115	0.439	2.285	0.400	0.240	0.164
13+875	16.00	1.200	2.200	0.0043	0.0043	0.342	1.780	0.400	0.240	0.164
13+891	0.00	1.200								
13+892	34.00	1.200	0.892	0.0018	0.0018	0.225	1.145	0.409	0.245	0.167
13+900	27.00	1.200	0.300	0.0068	0.0086	0.114	0.664	0.409	0.245	0.167
13+925	0.00	1.200								
13+928	0.00	1.200								
13+950	21.00	1.200	-1.045	0.0054	0.0054	0.236	1.227	0.400	0.240	0.164
13+975	46.00	1.200	-3.081	0.0049	0.0102	0.404	2.107	0.400	0.240	0.164
14+000	71.00	1.200	-5.630	0.0028	0.0130	0.547	2.848	0.400	0.240	0.164
14+025	96.00	1.200	-7.878	0.0023	0.0153	0.647	3.369	0.400	0.240	0.164
14+037	108.00	1.200	-7.878	0.0010	0.0164	0.647	3.369	0.400	0.240	0.164
14+105	0.00	1.200								
14+125	20.00	1.200	-3.991	0.0054	0.0054	0.460	2.398	0.400	0.240	0.164
14+150	45.00	1.200	-0.500	0.0070	0.0124	0.206	0.911	0.471	0.283	0.183
14+152	0.00	1.200								
14+163	11.00	1.200	-0.300	0.0030	0.0030	0.115	0.666	0.412	0.247	0.168

TABLE4 HYDRAULIC ANALYSIS (SEA SIDE) (1/3)

Station	Distance from Crest (m)	Side Ditch Width (m)	Hydraulic Gradient (%)	Run-off (m ³ /sec)	Cumulative Run-off (m ³ /sec)	Allowable Discharge (m ³ /sec)	Mean Velocity (m/sec)	Effective Height of Ditch (m)	Effective Aree of Ditch (m ²)	Hydraulic Radius (m)
0+748	138.00	1.200	4.722	0.0005	0.0442	0.501	2.608	0.400	0.240	0.164
0+750	136.00	1.200	3.930	0.0070	0.0437	0.457	2.379	0.400	0.240	0.164
0+775	111.00	1.200	3.295	0.0082	0.0367	0.418	2.179	0.400	0.240	0.164
0+800	86.00	1.200	3.117	0.0093	0.0285	0.407	2.119	0.400	0.240	0.164
0+825	61.00	1.200	2.743	0.0091	0.0192	0.382	1.988	0.400	0.240	0.164
0+850	36.00	1.200	1.305	0.0077	0.0101	0.263	1.371	0.400	0.240	0.164
0+875	11.00	1.200	0.300	0.0024	0.0024	0.129	0.689	0.445	0.267	0.176
0+886	0.00	1.200								
1+204	0.00	1.200								
1+225	21.00	1.200	-7.020	0.0037	0.0037	0.611	3.180	0.400	0.240	0.164
1+250	46.00	1.200	-8.560	0.0048	0.0085	0.674	3.512	0.400	0.240	0.164
1+275	71.00	1.200	-8.608	0.0045	0.0131	0.676	3.522	0.400	0.240	0.164
1+287	83.00	1.200	-8.608	0.0020	0.0151	0.676	3.522	0.400	0.240	0.164
1+343	0.00	1.200								
1+350	7.00	1.200	-8.127	0.0012	0.0012	0.657	3.422	0.400	0.240	0.164
1+375	32.00	1.200	-8.127	0.0036	0.0048	0.657	3.422	0.400	0.240	0.164
1+400	57.00	1.200	-8.015	0.0025	0.0074	0.652	3.398	0.400	0.240	0.164
1+425	82.00	1.200	-8.248	0.0028	0.0102	0.662	3.447	0.400	0.240	0.164
1+450	107.00	1.200	-8.248	0.0028	0.0130	0.662	3.447	0.400	0.240	0.164
1+475	132.00	1.200	-8.252	0.0027	0.0157	0.662	3.448	0.400	0.240	0.164
1+482	139.00	1.200	-8.248	0.0007	0.0163	0.662	3.447	0.400	0.240	0.164
1+520	0.00	1.200								
1+525	5.00	1.200	-8.057	0.0004	0.0004	0.654	3.407	0.400	0.240	0.164
1+550	30.00	1.200	-8.057	0.0034	0.0038	0.654	3.407	0.400	0.240	0.164
1+575	55.00	1.200	-6.753	0.0044	0.0083	0.599	3.119	0.400	0.240	0.164
1+600	80.00	1.200	-5.160	0.0033	0.0116	0.523	2.727	0.400	0.240	0.164
1+625	105.00	1.200	-4.068	0.0025	0.0141	0.465	2.421	0.400	0.240	0.164
1+650	130.00	1.200	-2.884	0.0024	0.0165	0.391	2.038	0.400	0.240	0.164
1+675	155.00	1.200	-1.684	0.0022	0.0187	0.299	1.558	0.400	0.240	0.164
1+685	165.00	1.200	-1.444	0.0008	0.0195	0.277	1.442	0.400	0.240	0.164
1+846	0.00	1.200								
1+850	4.00	1.200	-2.629	0.0003	0.0003	0.374	1.946	0.400	0.240	0.164
1+859	13.00	1.200	-2.629	0.0008	0.0011	0.374	1.946	0.400	0.240	0.164
1+895	0.00	1.200								
1+900	5.00	1.200	-8.324	0.0004	0.0004	0.665	3.463	0.400	0.240	0.164
1+907	12.00	1.200	-8.324	0.0006	0.0010	0.665	3.463	0.400	0.240	0.164
2+286	0.00	1.200								
2+300	14.00	1.200	-5.846	0.0012	0.0012	0.557	2.902	0.400	0.240	0.164
2+312	26.00	1.200	-8.504	0.0011	0.0023	0.672	3.500	0.400	0.240	0.164
2+720	105.00	1.200	7.880	0.0009	0.0265	0.647	3.369	0.400	0.240	0.164
2+725	100.00	1.200	7.880	0.0051	0.0256	0.647	3.369	0.400	0.240	0.164
2+750	75.00	1.200	5.456	0.0061	0.0205	0.538	2.804	0.400	0.240	0.164
2+775	50.00	1.200	2.745	0.0071	0.0144	0.382	1.988	0.400	0.240	0.164
2+800	25.00	1.200	0.389	0.0073	0.0073	0.144	0.749	0.400	0.240	0.164
2+825	0.00	1.200								
2+850	25.00	1.200	-1.768	0.0071	0.0071	0.306	1.596	0.400	0.240	0.164
2+860	35.00	1.200	-4.034	0.0027	0.0098	0.463	2.411	0.400	0.240	0.164
3+313	62.00	1.200	7.472	0.0033	0.0179	0.630	3.281	0.400	0.240	0.164
3+325	50.00	1.200	3.704	0.0072	0.0146	0.444	2.310	0.400	0.240	0.164
3+350	25.00	1.200	0.372	0.0074	0.0074	0.141	0.732	0.400	0.240	0.164
3+375	0.00	1.200								
3+400	25.00	1.200	-3.824	0.0076	0.0076	0.451	2.347	0.400	0.240	0.164
3+411	36.00	1.200	-5.731	0.0032	0.0109	0.552	2.873	0.400	0.240	0.164
3+545	60.00	1.200	7.416	0.0004	0.0055	0.628	3.269	0.400	0.240	0.164
3+550	55.00	1.200	7.416	0.0023	0.0051	0.628	3.269	0.400	0.240	0.164
3+575	30.00	1.200	7.099	0.0023	0.0028	0.614	3.198	0.400	0.240	0.164
3+600	5.00	1.200	7.099	0.0004	0.0004	0.614	3.198	0.400	0.240	0.164
3+605	0.00	1.200								
3+840	85.00	1.200	9.212	0.0017	0.0123	0.699	3.643	0.400	0.240	0.164

TABLE4 HYDRAULIC ANALYSIS (SEA SIDE)

(2/3)

Station	Distance from Crest (m)	Side Ditch Width (m)	Hydraulic Gradient (%)	Run-off (m ³ /sec)	Cumulative Run-off (m ³ /sec)	Allowable Discharge (m ³ /sec)	Mean Velocity (m/sec)	Effective Height of Ditch (m)	Effective Area of Ditch (m ²)	Hydraulic Radius (m)
3+850	75.00	1.200	7.188	0.0038	0.0106	0.618	3.218	0.400	0.240	0.164
3+875	50.00	1.200	3.480	0.0032	0.0068	0.430	2.239	0.400	0.240	0.164
3+900	25.00	1.200	0.300	0.0035	0.0035	0.138	0.704	0.468	0.281	0.182
3+925	0.00	1.200								
3+950	25.00	1.200	-3.732	0.0039	0.0039	0.445	2.319	0.400	0.240	0.164
3+975	50.00	1.200	-7.506	0.0065	0.0104	0.631	3.288	0.400	0.240	0.164
4+000	75.00	1.200	-10.028	0.0089	0.0193	0.730	3.801	0.400	0.240	0.164
4+025	100.00	1.200	-10.000	0.0088	0.0282	0.729	3.796	0.400	0.240	0.164
4+050	125.00	1.200	-9.837	0.0085	0.0367	0.723	3.764	0.400	0.240	0.164
4+075	150.00	1.200	-10.048	0.0079	0.0445	0.730	3.805	0.400	0.240	0.164
4+100	175.00	1.200	-10.576	0.0073	0.0518	0.749	3.903	0.400	0.240	0.164
4+125	200.00	1.200	-10.672	0.0075	0.0593	0.753	3.921	0.400	0.240	0.164
4+150	225.00	1.200	-10.236	0.0078	0.0671	0.737	3.840	0.400	0.240	0.164
4+175	250.00	1.200	-9.504	0.0078	0.0749	0.710	3.700	0.400	0.240	0.164
4+200	275.00	1.200	-8.935	0.0075	0.0824	0.689	3.588	0.400	0.240	0.164
4+225	300.00	1.200	-9.357	0.0053	0.0878	0.705	3.672	0.400	0.240	0.164
4+250	325.00	1.200	-9.450	0.0030	0.0908	0.708	3.690	0.400	0.240	0.164
4+275	350.00	1.200	-9.670	0.0024	0.0932	0.717	3.732	0.400	0.240	0.164
4+277	352.00	1.200	-10.338	0.0002	0.0934	0.741	3.859	0.400	0.240	0.164
9+865	0.00	1.200								
9+875	10.00	1.200	-3.098	0.0026	0.0026	0.406	2.113	0.400	0.240	0.164
9+885	20.00	1.200	-3.557	0.0027	0.0053	0.435	2.264	0.400	0.240	0.164
10+995	77.00	1.200	0.374	0.0014	0.0148	0.141	0.734	0.400	0.240	0.164
11+000	72.00	1.200	1.090	0.0068	0.0135	0.241	1.253	0.400	0.240	0.164
11+025	47.00	1.200	0.647	0.0047	0.0066	0.185	0.966	0.400	0.240	0.164
11+050	22.00	1.200	0.614	0.0020	0.0020	0.181	0.940	0.400	0.240	0.164
11+072	0.00	1.200								
11+341	213.00	1.200	9.864	0.0008	0.0222	0.724	3.770	0.400	0.240	0.164
11+350	204.00	1.200	9.846	0.0024	0.0214	0.723	3.766	0.400	0.240	0.164
11+375	179.00	1.200	9.602	0.0027	0.0190	0.714	3.719	0.400	0.240	0.164
11+400	154.00	1.200	9.606	0.0032	0.0163	0.714	3.720	0.400	0.240	0.164
11+425	129.00	1.200	9.802	0.0031	0.0131	0.721	3.758	0.400	0.240	0.164
11+450	104.00	1.200	10.086	0.0027	0.0100	0.732	3.812	0.400	0.240	0.164
11+475	79.00	1.200	8.872	0.0025	0.0073	0.686	3.575	0.400	0.240	0.164
11+500	54.00	1.200	6.916	0.0024	0.0048	0.606	3.156	0.400	0.240	0.164
11+525	29.00	1.200	4.960	0.0022	0.0025	0.513	2.673	0.400	0.240	0.164
11+550	4.00	1.200	2.024	0.0003	0.0003	0.328	1.708	0.400	0.240	0.164
11+554	0.00	1.200								
11+619	64.00	1.200	1.680	0.0005	0.0099	0.299	1.556	0.400	0.240	0.164
11+625	58.00	1.200	1.680	0.0035	0.0094	0.299	1.556	0.400	0.240	0.164
11+650	33.00	1.200	1.832	0.0045	0.0059	0.312	1.624	0.400	0.240	0.164
11+675	8.00	1.200	1.832	0.0014	0.0014	0.312	1.624	0.400	0.240	0.164
11+683	0.00	1.200								
11+937	0.00	1.200								
11+950	13.00	1.200	-3.425	0.0030	0.0030	0.426	2.221	0.400	0.240	0.164
11+975	38.00	1.200	-6.227	0.0086	0.0116	0.575	2.995	0.400	0.240	0.164
12+000	63.00	1.200	-7.316	0.0099	0.0215	0.623	3.246	0.400	0.240	0.164
12+025	88.00	1.200	-6.987	0.0097	0.0311	0.609	3.173	0.400	0.240	0.164
12+050	113.00	1.200	-7.163	0.0087	0.0398	0.617	3.212	0.400	0.240	0.164
12+075	138.00	1.200	-6.444	0.0073	0.0471	0.585	3.047	0.400	0.240	0.164
12+080	143.00	1.200	-3.624	0.0013	0.0484	0.439	2.285	0.400	0.240	0.164
12+224	63.00	1.200	9.993	0.0001	0.0067	0.728	3.794	0.400	0.240	0.164
12+225	62.00	1.200	8.008	0.0025	0.0066	0.652	3.397	0.400	0.240	0.164
12+250	37.00	1.200	4.812	0.0029	0.0041	0.506	2.633	0.400	0.240	0.164
12+275	12.00	1.200	1.856	0.0012	0.0012	0.314	1.635	0.400	0.240	0.164
12+287	0.00	1.200								
12+404	0.00	1.200								
12+425	21.00	1.200	-9.365	0.0023	0.0023	0.705	3.673	0.400	0.240	0.164
12+450	46.00	1.200	-9.746	0.0035	0.0058	0.719	3.747	0.400	0.240	0.164
12+475	71.00	1.200	-10.504	0.0033	0.0091	0.747	3.890	0.400	0.240	0.164
12+500	96.00	1.200	-10.647	0.0052	0.0143	0.752	3.916	0.400	0.240	0.164
12+525	121.00	1.200	-11.090	0.0074	0.0218	0.767	3.997	0.400	0.240	0.164

TABLE4 HYDRAULIC ANALYSIS (SEA SIDE) (3/3)

Station	Distance form Crest (m)	Side Ditch Width (m)	Hydraulic Gradient (%)	Run-off (m ³ /sec)	Cumulative Run-off (m ³ /sec)	Allowable Discharge (m ³ /sec)	Mean Velocity (m/sec)	Effective Height of Ditch (m)	Effective Aree of Ditch (m ²)	Hydraulic Radius (m)
12+550	146.00	1.200	-10.633	0.0073	0.0291	0.751	3.914	0.400	0.240	0.164
12+557	153.00	1.200	-9.777	0.0020	0.0310	0.721	3.753	0.400	0.240	0.164
12+827	113.00	1.200	9.202	0.0062	0.0185	0.699	3.641	0.400	0.240	0.164
12+850	90.00	1.200	10.965	0.0046	0.0123	0.763	3.974	0.400	0.240	0.164
12+875	65.00	1.200	10.338	0.0029	0.0077	0.741	3.859	0.400	0.240	0.164
12+900	40.00	1.200	10.000	0.0032	0.0048	0.729	3.796	0.400	0.240	0.164
12+925	15.00	1.200	10.000	0.0016	0.0016	0.729	3.796	0.400	0.240	0.164
12+940	0.00	1.200								
13+128	0.00	1.200								
13+150	22.00	1.200	-6.785	0.0060	0.0060	0.600	3.126	0.400	0.240	0.164
13+164	36.00	1.200	-5.236	0.0039	0.0100	0.527	2.746	0.400	0.240	0.164
13+264	0.00	1.200								
13+275	11.00	1.200	-1.932	0.0010	0.0010	0.320	1.669	0.400	0.240	0.164
13+300	36.00	1.200	-1.976	0.0024	0.0034	0.324	1.687	0.400	0.240	0.164
13+325	61.00	1.200	-3.040	0.0024	0.0057	0.402	2.093	0.400	0.240	0.164
13+350	86.00	1.200	-4.356	0.0024	0.0081	0.481	2.505	0.400	0.240	0.164
13+365	101.00	1.200	-5.672	0.0013	0.0094	0.549	2.859	0.400	0.240	0.164
13+803	82.00	1.200	5.513	0.0020	0.0080	0.541	2.818	0.400	0.240	0.164
13+825	60.00	1.200	5.038	0.0027	0.0060	0.517	2.694	0.400	0.240	0.164
13+850	35.00	1.200	3.624	0.0025	0.0034	0.439	2.285	0.400	0.240	0.164
13+875	10.00	1.200	3.624	0.0009	0.0009	0.439	2.285	0.400	0.240	0.164
13+885	0.00	1.200								
13+954	0.00	1.200								
13+975	21.00	1.200	-4.842	0.0039	0.0039	0.507	2.641	0.400	0.240	0.164
14+000	46.00	1.200	-4.842	0.0076	0.0115	0.507	2.641	0.400	0.240	0.164
14+025	71.00	1.200	-6.011	0.0078	0.0193	0.565	2.943	0.400	0.240	0.164
14+050	96.00	1.200	-7.558	0.0074	0.0268	0.634	3.300	0.400	0.240	0.164
14+075	121.00	1.200	-7.309	0.0070	0.0338	0.623	3.245	0.400	0.240	0.164
14+088	134.00	1.200	-7.608	0.0028	0.0365	0.636	3.311	0.400	0.240	0.164

APPENDIX 11

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