JOB TITLE : **Myagdi Khola hydropower Project (65 MW)**
JOB NO. :
SUBJECT : **HEADLOSS ESTIMATION**
STRUCTURE : HEADWORKS TO TAILRACE
Calculated by: PrM

SN	Description	Governing Equations/ Remarks	Symbol	Unit	Design Parameters	Baisakh	Jestha	Ashad	Srawan	Bhadra	Asoj	Kartik	Mangsir	Poush	Magh	Falgun	Chaitra
	Turbine Discharge	[40% exceedance flow]	Q40	m^3/s	12.50	5.65	11.36	12.50	12.50	12.50	12.50	12.50	6.67	5.12	4.10	3.92	3.97
	Orifice Discharge		Qo	m^3/s	15.00	6.78	13.64	15.00	15.00	15.00	15.00	15.00	8.01	6.15	4.92	4.71	4.77
	Settling Basin Discharge		Qs	m^3/s	13.750	6.219	12.500	13.750	13.750	13.750	13.750	13.750	7.341	5.636	4.514	4.316	4.371
	Weir Crest Elevation			masl	2482.00	2482.00	2482.00	2482.00	2482.00	2482.00	2482.00	2482.00	2482.00	2482.00	2482.00	2482.00	2482.00
	Bar thickness			mm	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
	No of bars in each rack			mm	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00
	Gross width of rack			m	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80
	Gross ara of racks			m2	9.94	9.94	9.94	9.94	9.94	9.94	9.94	9.94	9.94	9.94	9.94	9.94	9.94
	Net area of openings				17.65	17.65	17.65	17.65	17.65	17.65	17.65	17.65	17.65	17.65	17.65	17.65	17.65
	Approach Velocity		V_a	m/s	0.85	0.38	0.77	0.85	0.85	0.85	0.85	0.85	0.45	0.35	0.28	0.27	0.27
	Velocity Head		$V_a^2/2g$	m	0.037	0.008	0.030	0.037	0.037	0.037	0.037	0.037	0.010	0.006	0.004	0.004	0.004
	Total Energy Level			masl	2482.04	2482.01	2482.03	2482.04	2482.04	2482.04	2482.04	2482.04	2482.01	2482.01	2482.00	2482.00	2482.00
	Total water lelvel			masl	2482.00	2482.00	2482.00	2482.00	2482.00	2482.00	2482.00	2482.00	2482.00	2482.00	2482.00	2482.00	2482.00
1	**HEADWORKS**																
1.1	**COARSE TRASHRACK**																
	Shape of bar	Rectangular															
	Bar Thickness		t	mm	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
	Spacing between bars		b	mm	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00
	Number of Bars in each rack				70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00
	Rack Coefficient		K_t		2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42
	Rack inclination angle		Φ		75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
	Flow deviation angle		β		115.00	115.00	115.00	115.00	115.00	115.00	115.00	115.00	115.00	115.00	115.00	115.00	115.00
	Velocity through trashrack		V_a	m/s	0.85	0.38	0.77	0.85	0.85	0.85	0.85	0.85	0.45	0.35	0.28	0.27	0.27
	Velocity Head		$V_a^2/2g$	m	0.04	0.01	0.03	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.00	0.00	0.00
	Headloss due to trashrack	[$h_t = K_t (t/b)^{4/3} (V_a^2/2g) \sin\Phi$]	h_t	m	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
	Headloss due to flow deviation	[$h\beta = (V_a^2/2g) \sin\beta$]	h_β	m	0.03	0.01	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.00	0.00	0.00
	Total Headloss	[Headloss = $h_t + h_\beta$]		m	0.05	0.01	0.04	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.00	0.00	0.00
	Total energy level				2481.99	2482.00	2481.99	2481.99	2481.99	2481.99	2481.99	2481.99	2482.00	2482.00	2482.00	2482.00	2482.00
	Total water level				2481.95	2481.99	2481.96	2481.95	2481.95	2481.95	2481.95	2481.95	2481.99	2481.99	2482.00	2482.00	2482.00
1.2	**INTAKE ORIFICE**																
	Intake invert level				2479	2479.300	2479.300	2479.300	2479.300	2479.300	2479.300	2479.300	2479.300	2479.300	2479.300	2479.300	2479.300
	Coefficient of discharge		C_d		0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
	No. of Openings				2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Width			m	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80
	Orifice Height			m	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Net Area of orifice			m^2	9.60	9.60	9.60	9.60	9.60	9.60	9.60	9.60	9.60	9.60	9.60	9.60	9.60
	Velocity		Vo	m/s	0.78	0.35	0.71	0.78	0.78	0.78	0.78	0.78	0.42	0.32	0.26	0.25	0.25
	Velocity Head		$Vo^2/2g$	m	0.03	0.01	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.00	0.00	0.00
	invert level of orifice			m													
	Headloss through orifice	[Headloss = $(1/C_d^2).Vo^2/2g$]		m	0.09	0.02	0.07	0.09	0.09	0.09	0.09	0.09	0.02	0.01	0.01	0.01	0.01

JOB TITLE : **Myagdi Khola hydropower Project (65 MW)**
JOB NO. :
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STRUCTURE : HEADWORKS TO TAILRACE
Calculated by: PrM

SN	Description	Governing Equations/ Remarks	Symbol	Unit	Design Parameters	Baisakh	Jestha	Ashad	Srawan	Bhadra	Asoj	Kartik	Mangsir	Poush	Magh	Falgun	Chaitra
	Total loss				0.13	0.03	0.11	0.13	0.13	0.13	0.13	0.13	0.04	0.02	0.01	0.01	0.01
	Total energy level				2481.905	2481.981	2481.921	2481.905	2481.905	2481.905	2481.905	2481.905	2481.973	2481.984	2481.990	2481.991	2481.990
	Total water level				2481.874	2481.974	2481.896	2481.874	2481.874	2481.874	2481.874	2481.874	2481.964	2481.979	2481.986	2481.988	2481.987
1.3	**GATE LOSS**																
	Loss coefficient		Ke		0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
	No. of Openings				2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Width			m	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80
	Height			m	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Area of Canal			m^2	19.20	19.20	19.20	19.20	19.20	19.20	19.20	19.20	19.20	19.20	19.20	19.20	19.20
	Discharge			m^3/s	15.00	6.78	13.64	15.00	15.00	15.00	15.00	15.00	8.01	6.15	4.92	4.71	4.77
	Velocity		Vg	m/s	0.78	0.35	0.71	0.78	0.78	0.78	0.78	0.78	0.42	0.32	0.26	0.25	0.25
	Velocity Head		$Vg^2/2g$	m	0.0311	0.0064	0.0257	0.0311	0.0311	0.0311	0.0311	0.0311	0.0089	0.0052	0.0034	0.0031	0.0031
	Headloss through gate	[$hg = Kg.V_2^2/2g$]		m	0.00622	0.00127	0.00514	0.00622	0.00622	0.00622	0.00622	0.00622	0.00177	0.00105	0.00067	0.00061	0.00063
	Water level at inlet of Gravel Trap																
	Total Energy level				2481.90	2481.98	2481.92	2481.90	2481.90	2481.90	2481.90	2481.90	2481.97	2481.98	2481.99	2481.99	2481.99
	Total water level				2481.87	2481.97	2481.89	2481.87	2481.87	2481.87	2481.87	2481.87	2481.96	2481.98	2481.99	2481.99	2481.99
1.4	**GRAVEL TRAP**																
	Manning's Coefficient for hardstone lining				0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018
	Length		L_g	m	9.40	9.40	9.40	9.40	9.40	9.40	9.40	9.40	9.40	9.40	9.40	9.40	9.40
	Top Width			m	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80
	Water Depth			m	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57
	No. of Hoppers				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Width of Divide wall			m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Top width of Hopper			m	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80
	Bottom Width of Hopper			m	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80
	Hopper Depth			m	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
	Hopper Side Slope Horizontal Length			m	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
	Average Cross Sectional Area			m^2	43.93	43.93	43.93	43.93	43.93	43.93	43.93	43.93	43.93	43.93	43.93	43.93	43.93
	Wetted Perimeter			m	18.94	18.94	18.94	18.94	18.94	18.94	18.94	18.94	18.94	18.94	18.94	18.94	18.94
	Hydraulic Radius		R_g	m	2.32	2.32	2.32	2.32	2.32	2.32	2.32	2.32	2.32	2.32	2.32	2.32	2.32
	Longitudinal Bed slope																
	Bed Slope			m/m	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.50	0.50	0.50	0.50
	Velocity in gravel trap		V_g	m/s	0.3414	0.1544	0.3104	0.3414	0.3414	0.3414	0.3414	0.3414	0.1823	0.1400	0.1121	0.1072	0.1086
	Velocity Head in gravel trap		$V_g^2/2g$	m	0.0059	0.0012	0.0049	0.0059	0.0059	0.0059	0.0059	0.0059	0.0017	0.0010	0.0006	0.0006	0.0006
	Friction Loss	[$h_f = n^2.V_g^2.L_g/R_g^{4/3}$]	h_f	m	0.00012	0.00002	0.00010	0.00012	0.00012	0.00012	0.00012	0.00012	0.00003	0.00002	0.00001	0.00001	0.00001
	Contraction Loss	[$h_C = K_L.V_2^2/2g$]	h_C	m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total Headloss	[Headloss = $h_f + h_C$]		m	0.000116	0.000024	0.000096	0.000116	0.000116	0.000116	0.000116	0.000116	0.000033	0.000019	0.000012	0.000011	0.000012
	Total Energy level				2481.90	2481.98	2481.92	2481.90	2481.90	2481.90	2481.90	2481.90	2481.97	2481.98	2481.99	2481.99	2481.99
	Total water level				2481.89	2481.98	2481.91	2481.89	2481.89	2481.89	2481.89	2481.89	2481.97	2481.98	2481.99	2481.99	2481.99

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	TRANSITION TO APPROACH CULVERT																
	Invert Level			masl	2476.31	2476.31	2476.31	2476.31	2476.31	2476.31	2476.31	2476.31	2476.31	2476.31	2476.31	2476.31	2476.31
	Average Width		W_{avg}	m	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70
	Water Depth			m	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06
	Average velocity		V_{avg}	m/s	0.35	0.16	0.32	0.35	0.35	0.35	0.35	0.35	0.19	0.14	0.12	0.11	0.11
	Contraction loss coefficient		K_c		0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	Velocity d/s to contraction		V_2	m/s	1.53	0.69	1.39	1.53	1.53	1.53	1.53	1.53	0.82	0.63	0.50	0.48	0.49
	Velocity head		$V_g^2/2g$	m	0.11	0.02	0.09	0.11	0.11	0.11	0.11	0.11	0.03	0.02	0.01	0.01	0.01
	Contraction headloss	[$h_c = K_c.V_2^2/2g$]	h_c	m	0.03	0.01	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.00	0.00	0.00
	Energy Level			masl	2481.86	2481.97	2481.89	2481.86	2481.86	2481.86	2481.86	2481.86	2481.96	2481.98	2481.99	2481.99	2481.99
	Water level			masl	2481.75	2481.95	2481.80	2481.75	2481.75	2481.75	2481.75	2481.75	2481.93	2481.96	2481.97	2481.98	2481.97
	Culvert inlet Fine Trashrack																
	Width of opening			m	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
	Number				2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
	Height			m	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200
	Shape of bar	Rectangular															
	Bar Thickness		t	mm	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
	Spacing between bars		b	mm	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
	Number of Bars in each rack				43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
	Net width			m	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
	Rack Coefficient		K_t		2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42
	Rack inclination angle		Φ		75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
	Flow deviation angle		β		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Velocity through trashrack		V_a	m/s	4.40	1.99	4.00	4.40	4.40	4.40	4.40	4.40	2.35	1.80	1.45	1.38	1.40
	Velocity Head		$V_a^2/2g$	m	0.99	0.20	0.82	0.99	0.99	0.99	0.99	0.99	0.28	0.17	0.11	0.10	0.10
	Headloss due to trashrack	[$h_t = K_t\,(t/b)^{4/3}\,(V_a^2/2g)\,\mathrm{Sin}\Phi$]	h_t	m	1.00	0.20	0.83	1.00	1.00	1.00	1.00	1.00	0.28	0.17	0.11	0.10	0.10
	Headloss due to flow deviation	[$h\beta = (V_a^2/2g)\,\mathrm{Sin}\beta$]	h_β	m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total Headloss	[Headloss = $h_t + h_\beta$]		m	0.998	0.204	0.825	0.998	0.998	0.998	0.998	0.998	0.285	0.168	0.108	0.098	0.101
	Total energy level				2480.87	2481.77	2481.06	2480.87	2480.87	2480.87	2480.87	2480.87	2481.68	2481.81	2481.88	2481.89	2481.89
	Total water level				2479.88	2481.57	2480.25	2479.88	2479.88	2479.88	2479.88	2479.88	2481.40	2481.64	2481.77	2481.79	2481.79
1.5	**APPROACH CULVERT**																
	Manning's Coefficient			n	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
	Number of canal				2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Discharge per canal		Qc	m^3/s	6.88	3.11	6.25	6.88	6.88	6.88	6.88	6.88	3.67	2.82	2.26	2.16	2.19
	Width			m	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Water Depth			m	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
	Length		Lc	m	21.58	21.58	21.58	21.58	21.58	21.58	21.58	21.58	21.58	21.58	21.58	21.58	21.58
	Cross Sectional Area			m^2	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
	Wetted Perimeter			m	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
	Hydraulic Radius		Rc	m	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69

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	Discharge to be passed through canal				13.75	6.22	12.50	13.75	13.75	13.75	13.75	13.75	7.34	5.64	4.51	4.32	4.37
	No of feeder canals				2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Discharge per canal				6.88	3.11	6.25	6.88	6.88	6.88	6.88	6.88	3.67	2.82	2.26	2.16	2.19
	Velocity		Vc	m/s	1.528	0.691	1.389	1.528	1.528	1.528	1.528	1.528	0.816	0.626	0.502	0.480	0.486
	Area			m^2	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
	Velocity Head		$Vc^2/2g$	m	0.11897	0.02434	0.09832	0.11897	0.11897	0.11897	0.11897	0.11897	0.03391	0.01999	0.01282	0.01172	0.01202
	Headloss (Friction Loss)	[$hf = n^2.V_T^2.L_T/R_T^{4/3}$]		m	0.01850	0.00379	0.01529	0.01850	0.01850	0.01850	0.01850	0.01850	0.00528	0.00311	0.00199	0.00182	0.00187
	Total Energy level		masl		2480.85	2481.76	2481.05	2480.85	2480.85	2480.85	2480.85	2480.85	2481.67	2481.81	2481.88	2481.89	2481.88
	Total water level		masl		2480.73	2481.74	2480.95	2480.73	2480.73	2480.73	2480.73	2480.73	2481.64	2481.79	2481.86	2481.87	2481.87
1.6	**GATE LOSS**																
	Loss coefficient		Ke		0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
	No. of Openings				2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Width			m	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Height			m	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
	Area of Canal			m^2	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
	Discharge			m^3/s	6.88	3.11	6.25	6.88	6.88	6.88	6.88	6.88	3.67	2.82	2.26	2.16	2.19
	Velocity		Vg	m/s	1.53	0.69	1.39	1.53	1.53	1.53	1.53	1.53	0.82	0.63	0.50	0.48	0.49
	Velocity Head		$Vg^2/2g$	m	0.12	0.02	0.10	0.12	0.12	0.12	0.12	0.12	0.03	0.02	0.01	0.01	0.01
	Headloss through gate	[$hg = Kg.V_2^2/2g$]		m	0.02379	0.00487	0.01966	0.02379	0.02379	0.02379	0.02379	0.02379	0.00678	0.00400	0.00256	0.00234	0.00240
	Water level at inlet of approach culvert																
	Total Energy level			masl	2480.824336	2481.759467	2481.028314	2480.82434	2480.82434	2480.824336	2480.8243	2480.82434	2481.6649	2481.80245	2481.87327	2481.8841	2481.88117
	Total water level			masl	2480.70537	2481.735127	2480.929989	2480.70537	2480.70537	2480.70537	2480.7054	2480.70537	2481.6309	2481.78246	2481.860447	2481.8724	2481.86915
1.7	**SETTLING BASIN**																
	No. of bays				2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Discharge per bay			m^3/s	6.88	3.11	6.25	6.88	6.88	6.88	6.88	6.88	3.67	2.82	2.26	2.16	2.19
	Manning's Coefficient			n	0.01500	0.01500	0.0150	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
1.7.1	**INLET TRANSITION**																
	Inlet transition angle		α	degree	25	25	25	25	25	25	25	25	25	25	25	25	25
	Expansion loss coeffcient		Ke		0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
	Inlet transition Length		Li	m	21.81	21.81	21.81	21.81	21.81	21.81	21.81	21.81	21.81	21.81	21.81	21.81	21.81
	Average Width		W_T	m	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
	Average Height		H_T	m	5.84	5.84	5.84	5.84	5.84	5.84	5.84	5.84	5.84	5.84	5.84	5.84	5.84
	Average Area		A_T	m^2	37.96	37.96	37.96	37.96	37.96	37.96	37.96	37.96	37.96	37.96	37.96	37.96	37.96
	Wetted Perimeter		P_T	m	18.18	18.18	18.18	18.18	18.18	18.18	18.18	18.18	18.18	18.18	18.18	18.18	18.18
	Bed Slope				0.2448	0.2448	0.2448	0.2448	0.2448	0.2448	0.2448	0.2448	0.2448	0.2448	0.2448	0.2448	0.2448

JOB TITLE : **Myagdi Khola hydropower Project (65 MW)**
JOB NO. :
SUBJECT : **HEADLOSS ESTIMATION**
STRUCTURE : HEADWORKS TO TAILRACE
Calculated by: PrM

SN	Description	Governing Equations/ Remarks	Symbol	Unit	Design Parameters	Baisakh	Jestha	Ashad	Srawan	Bhadra	Asoj	Kartik	Mangsir	Poush	Magh	Falgun	Chaitra
	water height in canal			m	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
	Normal water level at inlet			m	2480.71	2481.74	2480.93	2480.71	2480.71	2480.71	2480.71	2480.71	2481.63	2481.78	2481.86	2481.87	2481.87
	Canal invert level at start			m	2478.46	2479.49	2478.68	2478.46	2478.46	2478.46	2478.46	2478.46	2479.38	2479.53	2479.61	2479.62	2479.62
	Canal invert level at end				2473.17	2474.20	2473.40	2473.17	2473.17	2473.17	2473.17	2473.17	2474.10	2474.25	2474.33	2474.34	2474.34
	Hydraulic Radius		R_T	m	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09
	Bed Slope			m/m	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
	Velocity		V_T	m/s	0.18	0.08	0.16	0.18	0.18	0.18	0.18	0.18	0.10	0.07	0.06	0.06	0.06
	Velocity Head		$V_T^2/2g$	m	0.0017	0.0003	0.0014	0.0017	0.0017	0.0017	0.0017	0.0017	0.0005	0.0003	0.0002	0.0002	0.0002
	Transition Loss	[ht = Ke. $(V_1-V_2)^2/2g$]	ht	m	0.053319	0.010909	0.044068	0.053319	0.053319	0.053319	0.053319	0.053319	0.015200	0.008959	0.005747	0.005254	0.005389
	Friction Loss	[hf = $n^2.V_T^2.L_T/R_T^{4/3}$]	hf	m	0.000060	0.000012	0.000050	0.000060	0.000060	0.000060	0.000060	0.000060	0.000017	0.000010	0.000007	0.000006	0.000006
	Total Headloss	[Headloss = ht + hf]		m	0.053380	0.010921	0.044118	0.053380	0.053380	0.053380	0.053380	0.053380	0.015217	0.008970	0.005754	0.005260	0.005395
	Total Energy level			masl	2480.771	2481.749	2480.984	2480.771	2480.771	2480.771	2480.771	2480.771	2481.650	2481.793	2481.868	2481.879	2481.876
	Total water level			masl	2480.769	2481.748	2480.983	2480.769	2480.769	2480.769	2480.769	2480.769	2481.649	2481.793	2481.867	2481.879	2481.876
1.7.2	**MAIN SECTION**																
	Length		Ls	m	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00
	No of bay				2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Width of bay at top (assume)			m	11.50	11.50	11.50	11.50	11.50	11.50	11.50	11.50	11.50	11.50	11.50	11.50	11.50
	thickness of divide wall at bottom			m	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	Water Width			m	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00
	Water Depth			m	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21
	discharge per bay			m^3/s	6.88	3.11	6.25	6.88	6.88	6.88	6.88	6.88	3.67	2.82	2.26	2.16	2.19
	constant a				0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44
	Camp's critical velocity				0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
	min depth of water required				4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21
	Cross Sectional Area of Flow		As	m^2	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26
	Adopt depth		Hw		4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21
	Wetted Perimeter		Ps	m	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41
	Hydraulic Radius		Rs	m	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38
	Bed Slope			m/m	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250
	Velocity		Vs	m/s	0.15	0.07	0.14	0.15	0.15	0.15	0.15	0.15	0.08	0.06	0.05	0.05	0.05
	Velocity Head		$Vs^2/2g$	m	0.00113	0.00023	0.00093	0.00113	0.00113	0.00113	0.00113	0.00113	0.00032	0.00019	0.00012	0.00011	0.00011
	Headloss (Friction Loss)	[Headloss = $n^2.Vs^2.Ls/Rs^{4/3}$]		m	0.000133	0.000027	0.000110	0.000133	0.000133	0.000133	0.000133	0.000133	0.000038	0.000022	0.000014	0.000013	0.000013
	total energy level			masl	2480.771	2481.749	2480.984	2480.771	2480.771	2480.771	2480.771	2480.771	2481.650	2481.793	2481.868	2481.879	2481.876
	Total water level			masl	2480.770	2481.748	2480.983	2480.770	2480.770	2480.770	2480.770	2480.770	2481.649	2481.793	2481.867	2481.879	2481.876

JOB TITLE : **Myagdi Khola hydropower Project (65 MW)**
JOB NO. :
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STRUCTURE : HEADWORKS TO TAILRACE
Calculated by: PrM

SN	Description	Governing Equations/ Remarks	Symbol	Unit	Design Parameters	Baisakh	Jestha	Ashad	Srawan	Bhadra	Asoj	Kartik	Mangsir	Poush	Magh	Falgun	Chaitra
1.7.3	**OUTLET ORIFICE**																
	Coefficient of discharge		C_d		0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
	No of Gates				4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
	Width of the Gate			m	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05
	Height			m	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
	Area of orifice			m^2	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30
	Total discharge			m^3/s	12.50	5.65	11.36	12.50	12.50	12.50	12.50	12.50	6.67	5.12	4.10	3.92	3.97
	Velocity		Vo	m/s	0.51	0.23	0.47	0.51	0.51	0.51	0.51	0.51	0.27	0.21	0.17	0.16	0.16
	Velocity Head		$Vo^2/2g$	m	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
	Headloss through orifice	[Headloss = $(1/C_d^2).Vo^2/2g$]		m	0.04	0.01	0.03	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.00	0.00	0.00
	total energy level			masl	2480.73	2481.74	2480.95	2480.73	2480.73	2480.73	2480.73	2480.73	2481.64	2481.79	2481.86	2481.88	2481.87
	Total water level			masl	2480.72	2481.74	2480.94	2480.72	2480.72	2480.72	2480.72	2480.72	2481.64	2481.78	2481.86	2481.87	2481.87
1.8	**HEADPOND/FOREBAY**																
	Manning's Coefficient			n	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
	Average Width			m	22.40	22.40	22.40	22.40	22.40	22.40	22.40	22.40	22.40	22.40	22.40	22.40	22.40
	Water Depth			m	8.66	8.66	8.66	8.66	8.66	8.66	8.66	8.66	8.66	8.66	8.66	8.66	8.66
	Length		Lh	m	10.85	10.85	10.85	10.85	10.85	10.85	10.85	10.85	10.85	10.85	10.85	10.85	10.85
	Cross Sectional Area			m^2	193.98	193.98	193.98	193.98	193.98	193.98	193.98	193.98	193.98	193.98	193.98	193.98	193.98
	Wetted Perimeter			m	39.72	39.72	39.72	39.72	39.72	39.72	39.72	39.72	39.72	39.72	39.72	39.72	39.72
	Hydraulic Radius		Rh	m	4.88	4.88	4.88	4.88	4.88	4.88	4.88	4.88	4.88	4.88	4.88	4.88	4.88
	Energy Slope			m/m	1.12753E-07	2.30685E-08	9.31903E-08	1.1275E-07	1.1275E-07	1.12753E-07	1.128E-07	1.1275E-07	3.214E-08	1.8946E-08	1.21541E-08	1.111E-08	1.1396E-08
	Velocity		Vh	m/s	0.06	0.03	0.06	0.06	0.06	0.06	0.06	0.06	0.03	0.03	0.02	0.02	0.02
	Velocity Head		$Vh^2/2g$	m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Coefficient of Contraction		K_L		0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	Headloss (Friction Loss)	[$h_H = n^2.Vh^2.Lh/Rh^{4/3}$]	h_H	m	0.000001	0.000000	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000000	0.000000	0.000000	0.000000	0.000000
	Contraction Loss	[$h_C = K_L.V_2^2/2g$]	h_C	m	0.03	0.01	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.00	0.00	0.00
	Total Headloss	[Headloss = $h_H + h_C$]		m	0.03	0.01	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.00	0.00	0.00
	total energy level			masl	2480.70	2481.73	2480.92	2480.70	2480.70	2480.70	2480.70	2480.70	2481.63	2481.78	2481.86	2481.87	2481.87
	Total water level			masl	2480.70	2481.73	2480.92	2480.70	2480.70	2480.70	2480.70	2480.70	2481.63	2481.78	2481.86	2481.87	2481.87
	Culvert inlet Fine Trashrack																
	Width of opening			m	4.800	4.800	4.800	4.800	4.800	4.800	4.800	4.800	4.800	4.800	4.800	4.800	4.800
	Number				1.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
	Height			m	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
	Shape of bar	Rectangular															
	Bar Thickness		t	mm	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
	Spacing between bars		b	mm	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
	Number of Bars in each rack				103.00	103.00	103.00	103.00	103.00	103.00	103.00	103.00	103.00	103.00	103.00	103.00	103.00
	Net width			m	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71

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	Rack Coefficient		K_t		2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42
	Rack inclination angle		Φ		80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00
	Flow deviation angle		β		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Velocity through trashrack		V_a	m/s	3.65	1.65	3.32	3.65	3.65	3.65	3.65	3.65	1.95	1.50	1.20	1.15	1.16
	Velocity Head		$V_a^2/2g$	m	0.68	0.14	0.56	0.68	0.68	0.68	0.68	0.68	0.19	0.11	0.07	0.07	0.07
	Headloss due to trashrack	[$h_t = K_t (t/b)^{4/3} (V_a^2/2g) \sin\Phi$]	h_t	m	0.70	0.14	0.58	0.70	0.70	0.70	0.70	0.70	0.20	0.12	0.08	0.07	0.07
	Headloss due to flow deviation	[$h\beta = (V_a^2/2g) \sin\beta$]	h_β	m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total Headloss	[Headloss = $h_t + h_\beta$]		m	0.70	0.14	0.58	0.70	0.70	0.70	0.70	0.70	0.20	0.12	0.08	0.07	0.07
	Total energy level				2480.00	2481.59	2480.34	2480.00	2480.00	2480.00	2480.00	2480.00	2481.43	2481.66	2481.78	2481.80	2481.80
	Total water level				2479.32	2481.45	2479.78	2479.32	2479.32	2479.32	2479.32	2479.32	2481.23	2481.55	2481.71	2481.74	2481.73
	TOTAL HEADLOSS IN HEADWORKS				**2.040**	**0.417**	**1.686**	**2.040**	**2.040**	**2.040**	**2.040**	**2.040**	**0.582**	**0.343**	**0.220**	**0.201**	**0.206**
2	**WATERWAY**																
2	**HEADRACE PIPE**																
	k	Roughness height		mm	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	k/D				0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045
	Re	ud/v			7.24.E+06	3.27.E+06	6.58.E+06	7.24.E+06	7.24.E+06	7.24.E+06	7.24.E+06	7.24.E+06	3.86.E+06	2.97.E+06	2.38.E+06	2.27.E+06	2.30.E+06
	Friction Factor for Headrace Pipe	0.004 to 0.0045 from moody's diagram	f		0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130
	Design discharge		Q	m3/s	12.50	5.65	11.36	12.50	12.50	12.50	12.50	12.50	6.67	5.12	4.10	3.92	3.97
	Length of Pipe		Lc	m	422.30	422.30	422.30	422.30	422.30	422.30	422.30	422.30	422.30	422.30	422.30	422.30	422.30
	Pipe Diameter		d	m	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20
	Pipe Area		Ac	m2	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80
	Flow Velocity in Pipe		Vp	m/s	3.29	1.49	2.99	3.29	3.29	3.29	3.29	3.29	1.76	1.35	1.08	1.03	1.05
	Velocity Head		$Vp^2/2g$	m	0.5517	0.1129	0.4560	0.5517	0.5517	0.5517	0.5517	0.5517	0.1573	0.0927	0.0595	0.0544	0.0558
	Headloss	[Headloss = $(f.L.v^2)/2.g.d$]	Hp	m	1.3767	0.2817	1.1378	1.3767	1.3767	1.3767	1.3767	1.3767	0.3925	0.2313	0.1484	0.1357	0.1391
	Bend Loss in HRP																
	Bend 1																
	Bend radius		R	m	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**
	Rb/D		Rb/D		**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**
	B	from NTNU vol 8 Fig 7.1			**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**
	Correction	From NTNU vol 8 fig 7.2			**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**
	Bend angle				**30.00**	**30.00**	**30.00**	**30.00**	**30.00**	**30.00**	**30.00**	**30.00**	**30.00**	**30.00**	**30.00**	**30.00**	**30.00**
	Bend Coefficient				**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**
	Total bend loss in tunnel			m	**0.028**	**0.006**	**0.023**	**0.028**	**0.028**	**0.028**	**0.028**	**0.028**	**0.008**	**0.005**	**0.003**	**0.003**	**0.003**
	Bend 2																
	Bend radius		R	m	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**
	Rb/D		Rb/D		**2.20**	**2.20**	**2.20**	**2.20**	**2.20**	**2.20**	**2.20**	**2.20**	**2.20**	**2.20**	**2.20**	**2.20**	**2.20**

JOB TITLE : **Myagdi Khola hydropower Project (65 MW)**
JOB NO. :
SUBJECT : **HEADLOSS ESTIMATION**
STRUCTURE : HEADWORKS TO TAILRACE
Calculated by: PrM

SN	Description	Governing Equations/ Remarks	Symbol	Unit	Design Parameters	Baisakh	Jestha	Ashad	Srawan	Bhadra	Asoj	Kartik	Mangsir	Poush	Magh	Falgun	Chaitra
	B	from NTNU vol 8 Fig 7.1			**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**
	Correction	From NTNU vol 8 fig 7.2			**0.36**	**0.36**	**0.36**	**0.36**	**0.36**	**0.36**	**0.36**	**0.36**	**0.36**	**0.36**	**0.36**	**0.36**	**0.36**
	Bend angle				**21.00**	**21.00**	**21.00**	**21.00**	**21.00**	**21.00**	**21.00**	**21.00**	**21.00**	**21.00**	**21.00**	**21.00**	**21.00**
	Bend Coefficient				**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**
	Total bend loss in tunnel			m	**0.020**	**0.004**	**0.016**	**0.020**	**0.020**	**0.020**	**0.020**	**0.020**	**0.006**	**0.003**	**0.002**	**0.002**	**0.002**
	Bend 3																
	Bend radius		R	m	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**
	Rb/D		Rb/D		**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**
	B	from NTNU vol 8 Fig 7.1			**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**
	Correction	From NTNU vol 8 fig 7.2			**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**
	Bend angle				**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**
	Bend Coefficient				**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**
	Total bend loss in tunnel			m	**0.041**	**0.008**	**0.034**	**0.041**	**0.041**	**0.041**	**0.041**	**0.041**	**0.012**	**0.007**	**0.004**	**0.004**	**0.004**
	Bend 4																
	Bend radius		R	m	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**	**6.60**
	Rb/D		Rb/D		**2.20**	**2.20**	**2.20**	**2.20**	**2.20**	**2.20**	**2.20**	**2.20**	**2.20**	**2.20**	**2.20**	**2.20**	**2.20**
	B	from NTNU vol 8 Fig 7.1			**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**
	Correction	From NTNU vol 8 fig 7.2			**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**
	Bend angle				**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**
	Bend Coefficient				**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**
	Total bend loss in tunnel			m	**0.041**	**0.008**	**0.034**	**0.041**	**0.041**	**0.041**	**0.041**	**0.041**	**0.012**	**0.007**	**0.004**	**0.004**	**0.004**
	TOTAL Bend loss in HRP				**0.130**	**0.027**	**0.108**	**0.130**	**0.130**	**0.130**	**0.130**	**0.130**	**0.037**	**0.022**	**0.014**	**0.013**	**0.013**
	Total Headloss in HRP				**1.507**	**0.308**	**1.245**	**1.507**	**1.507**	**1.507**	**1.507**	**1.507**	**0.430**	**0.253**	**0.162**	**0.148**	**0.152**
	total energy level				2478.49	2481.28	2479.10	2478.49	2478.49	2478.49	2478.49	2478.49	2481.00	2481.41	2481.62	2481.65	2481.65
	Total water level				**2477.94**	**2481.17**	**2478.64**	**2477.94**	**2477.94**	**2477.94**	**2477.94**	**2477.94**	**2480.84**	**2481.32**	**2481.56**	**2481.60**	**2481.59**
2.1	**HEADRACE TUNNEL**																
	Design Discharge		Q	m3/s	12.50	5.65	11.36	12.50	12.50	12.50	12.50	12.50	6.67	5.12	4.10	3.92	3.97
	Manning's coefficient for shotcrete tunnel		n		0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027
	Manning's coefficient for concrete lined tunnel		n		0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
	Total length from inlet portal to surge shaft		m		6110.00	6110.00	6110.00	6110.00	6110.00	6110.00	6110.00	6110.00	6110.00	6110.00	6110.00	6110.00	6110.00
	Shotcrete linned length		Ls	m	5110.00	5110.00	5110.00	5110.00	5110.00	5110.00	5110.00	5110.00	5110.00	5110.00	5110.00	5110.00	5110.00
	Concrete linned length		Lc	m	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00
	Diameter concrete lined		dt	m	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
	Diameter shotcrete lined			m	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
	height of rectangular portion(shotcrete)			m	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90
	height of rectangular portion(concrete)				1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
	Concrete lined portion																
	Sectional area	[A = $D^2/2$ +pi().$D^2/8$]	At	m2	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26
	Flow velocity in tunnel		Vts	m/s	1.514	0.685	1.376	1.514	1.514	1.514	1.514	1.514	0.808	0.620	0.497	0.475	0.481
	Wetted perimeter	[D+2.D/2+(pi () D/2)]	Pt	m	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00
	Hydraulic radius		R	m	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
	Shotcrete lined portion																

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SN	Description	Governing Equations/ Remarks	Symbol	Unit	Design Parameters	Baisakh	Jestha	Ashad	Srawan	Bhadra	Asoj	Kartik	Mangsir	Poush	Magh	Falgun	Chaitra
	Sectional area		At		10.10	10.10	10.10	10.10	10.10	10.10	10.10	10.10	10.10	10.10	10.10	10.10	10.10
	Flow velocity in tunnel		Vtc		1.24	0.56	1.13	1.24	1.24	1.24	1.24	1.24	0.66	0.51	0.41	0.39	0.39
	Wetted perimeter		Pt		12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03
	Hydraulic radius		R		0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
	Headloss (Friction Loss) - Shotcrete lined	[$hf = n^2.V_T^2.L_T/R_T^{4/3}$]	hlsl	m	**7.20**	**1.47**	**5.95**	**7.20**	**7.20**	**7.20**	**7.20**	**7.20**	**2.05**	**1.21**	**0.78**	**0.71**	**0.73**
	Headloss (Friction Loss) - Concrete lined	[$hf = n^2.V_T^2.L_T/R_T^{4/3}$]	hlcl	m	**0.76**	**0.15**	**0.62**	**0.76**	**0.76**	**0.76**	**0.76**	**0.76**	**0.22**	**0.13**	**0.08**	**0.07**	**0.08**
	Total Headloss			m	**7.95**	**1.63**	**6.57**	**7.95**	**7.95**	**7.95**	**7.95**	**7.95**	**2.27**	**1.34**	**0.86**	**0.78**	**0.80**
	Velocity Head (shotcrete Lined)			m	**0.08**	**0.02**	**0.06**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.02**	**0.01**	**0.01**	**0.01**	**0.01**
	Velocity Head (concrete lining)			m	**0.12**	**0.02**	**0.10**	**0.12**	**0.12**	**0.12**	**0.12**	**0.12**	**0.03**	**0.02**	**0.01**	**0.01**	**0.01**
2.1.1	**Bend Loss in Tunnel**																
	Bend radius		R	m	**20.00**	**20.00**	**20.00**	**20.00**	**20.00**	**20.00**	**20.00**	**20.00**	**20.00**	**20.00**	**20.00**	**20.00**	**20.00**
	Rb/D		Rb/D		**6.25**	**6.25**	**6.25**	**6.25**	**6.25**	**6.25**	**6.25**	**6.25**	**6.25**	**6.25**	**6.25**	**6.25**	**6.25**
	B	from NTNU vol 8 Fig 7.1			**0.08**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**
	Correction	From NTNU vol 8 fig 7.2			**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**
	Bend angle				**22.00**	**22.00**	**22.00**	**22.00**	**22.00**	**22.00**	**22.00**	**22.00**	**22.00**	**22.00**	**22.00**	**22.00**	**22.00**
	Bend Coefficient				**0.03**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**
	Total bend loss in tunnel			m	**0.002**	**0.001**	**0.003**	**0.003**	**0.003**	**0.003**	**0.003**	**0.003**	**0.001**	**0.001**	**0.000**	**0.000**	**0.000**
	Bend radius		R	m	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**	**50.00**
	Rb/D		Rb/D		**15.63**	**15.63**	**15.63**	**15.63**	**15.63**	**15.63**	**15.63**	**15.63**	**15.63**	**15.63**	**15.63**	**15.63**	**15.63**
	B	from NTNU vol 8 Fig 7.1			**0.08**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**
	Correction	From NTNU vol 8 fig 7.2			**0.65**	**0.65**	**0.65**	**0.65**	**0.65**	**0.65**	**0.65**	**0.65**	**0.65**	**0.65**	**0.65**	**0.65**	**0.65**
	Bend angle				**42.00**	**42.00**	**42.00**	**42.00**	**42.00**	**42.00**	**42.00**	**42.00**	**42.00**	**42.00**	**42.00**	**42.00**	**42.00**
	Bend Coefficient				**0.05**	**0.07**	**0.07**	**0.07**	**0.07**	**0.07**	**0.07**	**0.07**	**0.07**	**0.07**	**0.07**	**0.07**	**0.07**
	Total bend loss in tunnel			m	**0.004**	**0.001**	**0.004**	**0.005**	**0.005**	**0.005**	**0.005**	**0.005**	**0.001**	**0.001**	**0.001**	**0.000**	**0.001**
	Total Bend loss in HRT				**0.007**	**0.002**	**0.007**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.002**	**0.001**	**0.001**	**0.001**	**0.001**
	TOTAL HEADLOSS IN HRT				**7.9602**	**1.6289**	**6.5805**	**7.9619**	**7.9619**	**7.9619**	**7.9619**	**7.9619**	**2.2697**	**1.3379**	**0.8582**	**0.7846**	**0.8047**
	total energy level			masl	**2470.53**	**2479.65**	**2472.52**	**2470.53**	**2470.53**	**2470.53**	**2470.53**	**2470.53**	**2478.73**	**2480.07**	**2480.76**	**2480.87**	**2480.84**
	Total water level			masl	**2470.45**	**2479.64**	**2472.45**	**2470.45**	**2470.45**	**2470.45**	**2470.45**	**2470.45**	**2478.71**	**2480.06**	**2480.75**	**2480.86**	**2480.83**
2.2	**Contraction loss due to transition of penstock**																
	Coefficient of contraction		kc		0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	Dia of Penstock		d	m	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Velocity in Penstock		v	m/s	3.98	1.80	3.62	3.98	3.98	3.98	3.98	3.98	2.13	1.63	1.31	1.25	1.27
	Loss due to contraction	$H_{contraction}=kc*V^2/2g$	**Hc**	m	**0.24**	**0.05**	**0.20**	**0.24**	**0.24**	**0.24**	**0.24**	**0.24**	**0.07**	**0.04**	**0.03**	**0.02**	**0.02**
	Loss due to contraction			m	**0.242**	**0.050**	**0.200**	**0.242**	**0.242**	**0.242**	**0.242**	**0.242**	**0.069**	**0.041**	**0.026**	**0.024**	**0.024**
	Velocity head in shotcrete lined tunnel		$Vt^2/2g$	m	0.12	0.02	0.10	0.12	0.12	0.12	0.12	0.12	0.03	0.02	0.01	0.01	0.01

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2.3	**PENSTOCK INLET VALVE**																
	Discharge		Q	m3/s	12.50	5.65	11.36	12.50	12.50	12.50	12.50	12.50	6.67	5.12	4.10	3.92	3.97
	Diameter of Valve		Dv	m	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Cross Sectional Area		Av	m2	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14
	Velocity		Vv	m/s	3.98	1.80	3.62	3.98	3.98	3.98	3.98	3.98	2.12	1.63	1.31	1.25	1.26
	Velocity head		$V^2/(2*g)$		0.81	0.17	0.67	0.81	0.81	0.81	0.81	0.81	0.23	0.14	0.09	0.08	0.08
	Loss Coefficient for valve		Kv		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	Valve loss			m	**0.403**	**0.083**	**0.333**	**0.403**	**0.403**	**0.403**	**0.403**	**0.403**	**0.115**	**0.068**	**0.043**	**0.040**	**0.041**
	TOTAL HEADLOSS IN TUNNEL AFTER SURGE SHAFT			m	**0.646**	**0.132**	**0.534**	**0.646**	**0.646**	**0.646**	**0.646**	**0.646**	**0.184**	**0.109**	**0.070**	**0.064**	**0.065**
	total energy level			masl	**2469.88**	**2479.52**	**2471.98**	**2469.88**	**2469.88**	**2469.88**	**2469.88**	**2469.88**	**2478.55**	**2479.96**	**2480.69**	**2480.81**	**2480.78**
	Total water level			masl	**2469.08**	**2479.36**	**2471.32**	**2469.08**	**2469.08**	**2469.08**	**2469.08**	**2469.08**	**2478.32**	**2479.83**	**2480.61**	**2480.73**	**2480.69**
2.4	**PENSTOCK PIPE of 2m dia**																
2.4.1	**PENSTOCK PIPE FRICTIONAL LOSS**																
	Design Discharge		Q	m^3/s	12.50	5.65	11.36	12.50	12.50	12.50	12.50	12.50	6.67	5.12	4.10	3.92	3.97
	Discharge to plant				12.50	5.65	11.36	12.50	12.50	12.50	12.50	12.50	6.67	5.12	4.10	3.92	3.97
	Manning's Roughness Coefficient for Penstock Pipe		f		0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130
	Pipe length		Lp	m	1201.18	1201.18	1201.18	1201.18	1201.18	1201.18	1201.18	1201.18	1201.18	1201.18	1201.18	1201.18	1201.18
	Pipe diameter		D_p	m	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Pipe area		A_P	m^2	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14
	Flow velocity in pipe		V_p	m/s	3.98	1.80	3.62	3.98	3.98	3.98	3.98	3.98	2.12	1.63	1.31	1.25	1.26
	Velocity Head				0.81	0.17	0.67	0.81	0.81	0.81	0.81	0.81	0.23	0.14	0.09	0.08	0.08
	Headloss due to friction	$(H_f = fLV^2/2gD)$	**H_f**	m	**6.30**	**1.29**	**5.21**	**6.30**	**6.30**	**6.30**	**6.30**	**6.30**	**1.80**	**1.06**	**0.68**	**0.62**	**0.64**
	Rb/D				**4.000**	**4.000**	**4.000**	**4.000**	**4.000**	**4.000**	**4.000**	**4.000**	**4.000**	**4.000**	**4.000**	**4.000**	**4.000**
	B (bend loss coefficient)				**0.090**	**0.090**	**0.090**	**0.090**	**0.090**	**0.090**	**0.090**	**0.090**	**0.090**	**0.090**	**0.090**	**0.090**	**0.090**
2.4.2	**PENSTOCK BEND LOSS**																
	Calculated for six 90 degree bends			m	**0.44**	**0.09**	**0.36**	**0.44**	**0.44**	**0.44**	**0.44**	**0.44**	**0.12**	**0.07**	**0.05**	**0.04**	**0.04**
	contraction loss from 2.0m to 1.2m																
	Discharge after contraction				**4.167**	**2.827**	**3.788**	**4.167**	**4.167**	**4.167**	**4.167**	**4.167**	**3.337**	**2.562**	**4.104**	**3.924**	**3.974**
	Dia after contraction			m	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
	Velocity after contraction		Vc	m/s	3.68	2.50	3.35	3.68	3.68	3.68	3.68	3.68	2.95	2.27	3.63	3.47	3.51
	Coefficient of loss for cylindrical contraction (Guideline for design of Intake for																
	0.233333333		C_t		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	Velocity head				0.69	0.32	0.57	0.69	0.69	0.69	0.69	0.69	0.44	0.26	0.67	0.61	0.63
	Contraction loss	$H_{contraction}=kc*V^2/2g$		m	**0.35**	**0.16**	**0.29**	**0.35**	**0.35**	**0.35**	**0.35**	**0.35**	**0.22**	**0.13**	**0.34**	**0.31**	**0.31**
	Friction loss after trifurcation																
	Design Discharge		Q	m^3/s	4.17	2.83	3.79	4.17	4.17	4.17	4.17	4.17	3.34	2.56	4.10	3.92	3.97
	Discharge to plant				4.17	2.83	3.79	4.17	4.17	4.17	4.17	4.17	3.34	2.56	4.10	3.92	3.97
	Manning's Roughness Coefficient for Penstock Pipe		f		0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130
	Pipe length		Lp	m	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00

JOB TITLE : **Myagdi Khola hydropower Project (65 MW)**
JOB NO. :
SUBJECT : **HEADLOSS ESTIMATION**
STRUCTURE : HEADWORKS TO TAILRACE
Calculated by: PrM

SN	Description	Governing Equations/ Remarks	Symbol	Unit	Design Parameters	Baisakh	Jestha	Ashad	Srawan	Bhadra	Asoj	Kartik	Mangsir	Poush	Magh	Falgun	Chaitra
	Pipe diameter		D_p	m	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
	Pipe area		A_P	m^2	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
	Flow velocity in pipe		V_p	m/s	3.68	2.50	3.35	3.68	3.68	3.68	3.68	3.68	2.95	2.27	3.63	3.47	3.51
	Velocity Head				0.69	0.32	0.57	0.69	0.69	0.69	0.69	0.69	0.44	0.26	0.67	0.61	0.63
	Headloss due to friction	($H_f = fLV^2/2gD$)	**H_f**	m	**0.21**	**0.10**	**0.17**	**0.21**	**0.21**	**0.21**	**0.21**	**0.21**	**0.13**	**0.08**	**0.20**	**0.19**	**0.19**
	Friction loss for 0.9m pipe																
	Design Discharge		Q	m^3/s	4.17	2.83	3.79	4.17	4.17	4.17	4.17	4.17	3.34	2.56	4.10	3.92	3.97
	Discharge to plant				4.17	2.83	3.79	4.17	4.17	4.17	4.17	4.17	3.34	2.56	4.10	3.92	3.97
	Manning's Roughness Coefficient for Penstock Pipe		f		0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130
	Pipe length		Lp	m	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
	Pipe diameter		D_p	m	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
	Pipe area		A_P	m^2	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64
	Flow velocity in pipe		V_p	m/s	6.55	4.44	5.95	6.55	6.55	6.55	6.55	6.55	5.25	4.03	6.45	6.17	6.25
	Velocity Head				2.19	1.01	1.81	2.19	2.19	2.19	2.19	2.19	1.40	0.83	2.12	1.94	1.99
	Headloss due to friction	($H_f = fLV^2/2gD$)	**H_f**	m	**0.25**	**0.12**	**0.21**	**0.25**	**0.25**	**0.25**	**0.25**	**0.25**	**0.16**	**0.10**	**0.25**	**0.22**	**0.23**
	contraction loss from 2.0m to 1.2m																
	Discharge after contraction				**4.167**	**2.827**	**3.788**	**4.167**	**4.167**	**4.167**	**4.167**	**4.167**	**3.337**	**2.562**	**4.104**	**3.924**	**3.974**
	Dia after contraction			m	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
	Velocity after contraction		Vc	m/s	3.68	2.50	3.35	3.68	3.68	3.68	3.68	3.68	2.95	2.27	3.63	3.47	3.51
	Coefficient of loss for cylindrical contraction (Guideline for design of Intake for																
		0.233333333	C_t		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	Velocity head				0.88	0.41	0.73	0.88	0.88	0.88	0.88	0.88	0.57	0.33	0.86	0.78	0.80
	Contraction loss	$H_{contraction}=kc*V^2/2g$		m	**0.44**	**0.20**	**0.37**	**0.44**	**0.44**	**0.44**	**0.44**	**0.44**	**0.28**	**0.17**	**0.43**	**0.39**	**0.40**
	1.0728																
	Bend radius		R	m	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**
	Rb/D		Rb/D		**4.17**	**4.17**	**4.17**	**4.17**	**4.17**	**4.17**	**4.17**	**4.17**	**4.17**	**4.17**	**4.17**	**4.17**	**4.17**
	B	from NTNU vol 8 Fig 7.1			**0.09**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**
	Correction	From NTNU vol 8 fig 7.2			**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**
	bend loss		Θ		**45.00**	**45.00**	**45.00**	**45.00**	**45.00**	**45.00**	**45.00**	**45.00**	**45.00**	**45.00**	**45.00**	**45.00**	**45.00**
	Loss coefficient for 45 degreebend		B		0.06	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**
	Head Loss due to bifurcation bend		H_L	m	**0.14**	**0.06**	**0.11**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.09**	**0.05**	**0.13**	**0.12**	**0.13**
	Spherical valve loss																
	Discharge	12.500			4.17	2.83	3.79	4.17	4.17	4.17	4.17	4.17	3.34	2.56	4.10	3.92	3.97
	velocity	19.649			6.55	4.44	5.95	6.55	6.55	6.55	6.55	6.55	5.25	4.03	6.45	6.17	6.25
	Valve loss coefficient	0.100			0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000
	Valve diameter	0.900															
	C/S Area	0.636															
	Head loss				**0.2186**	**0.1006**	**0.1807**	**0.2186**	**0.2186**	**0.2186**	**0.2186**	**0.2186**	**0.1402**	**0.0827**	**0.2121**	**0.1939**	**0.1989**

JOB TITLE : **Myagdi Khola hydropower Project (65 MW)**
JOB NO. :
SUBJECT : **HEADLOSS ESTIMATION**
STRUCTURE : HEADWORKS TO TAILRACE
Calculated by: PrM

SN	Description	Governing Equations/ Remarks	Symbol	Unit	Design Parameters	Baisakh	Jestha	Ashad	Srawan	Bhadra	Asoj	Kartik	Mangsir	Poush	Magh	Falgun	Chaitra
													2.8903	0.8482			
	TOTAL HEADLOSS IN PENSTOCK			m	**8.34**	**2.12**	**6.90**	**8.34**	**8.34**	**8.34**	**8.34**	**8.34**	**2.95**	**1.74**	**2.29**	**2.09**	**2.14**
	total energy level			masl	**2461.54**	**2477.40**	**2465.09**	**2461.54**	**2461.54**	**2461.54**	**2461.54**	**2461.54**	**2475.59**	**2478.22**	**2478.41**	**2478.72**	**2478.63**
	Total water level			masl	**2460.85**	**2477.08**	**2464.52**	**2460.85**	**2460.85**	**2460.85**	**2460.85**	**2460.85**	**2475.15**	**2477.96**	**2477.74**	**2478.10**	**2478.00**
4	**OTHER MINOR LOSSES**																
	Other minor losses such as tappering and epansion in bifurcated pipe etc			m	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**
	Other minor loss coefficient																
	TOTAL HEAD LOSS			m	**20.996**	**5.105**	**17.441**	**20.998**	**20.998**	**20.998**	**20.998**	**20.998**	**6.916**	**4.282**	**4.096**	**3.787**	**3.871**