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Appendix A

Actual system pumps curve in old & new intakes at Ambatale

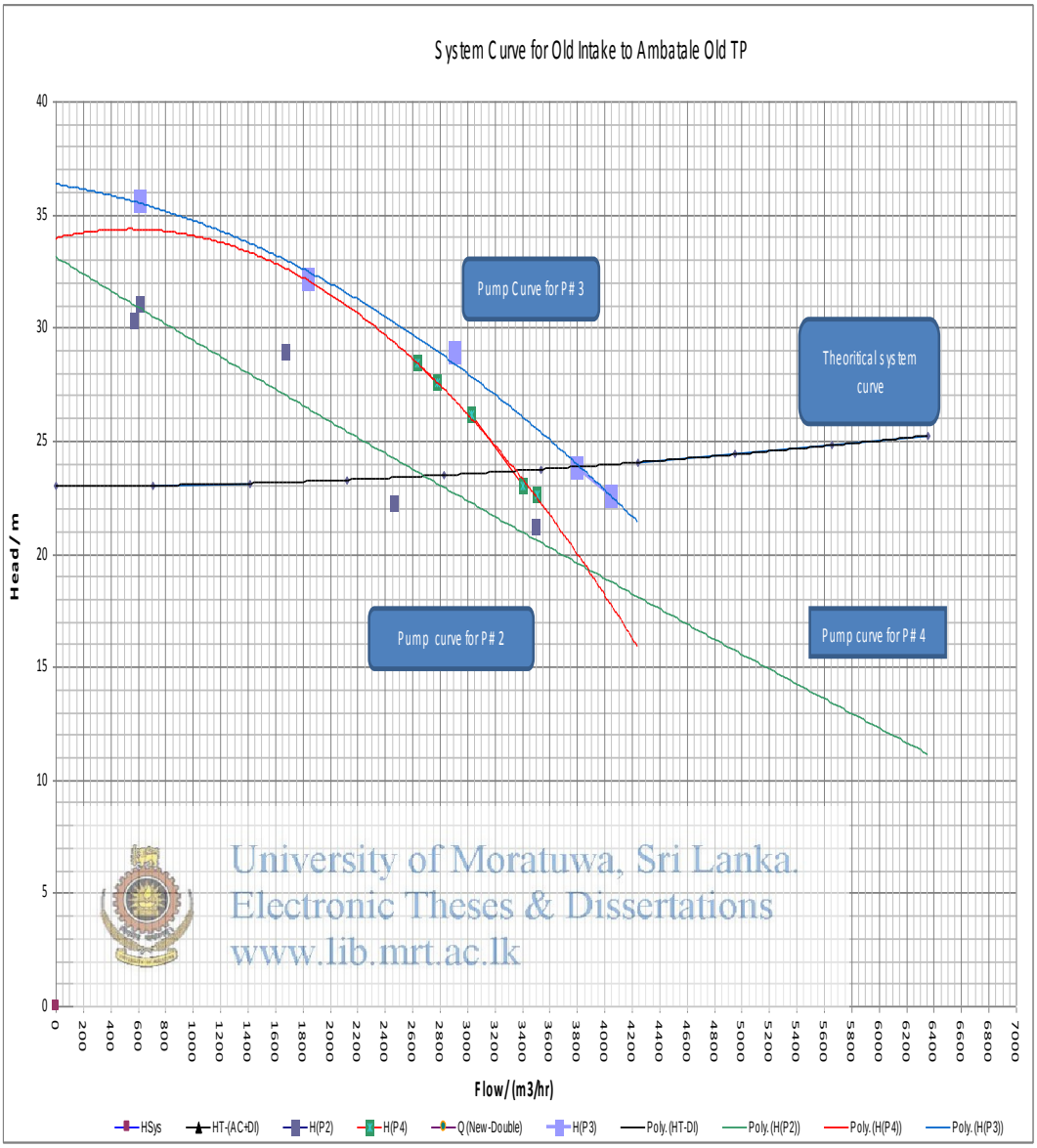


Figure A.1: Actual system curve in old intake pumps at Ambatale

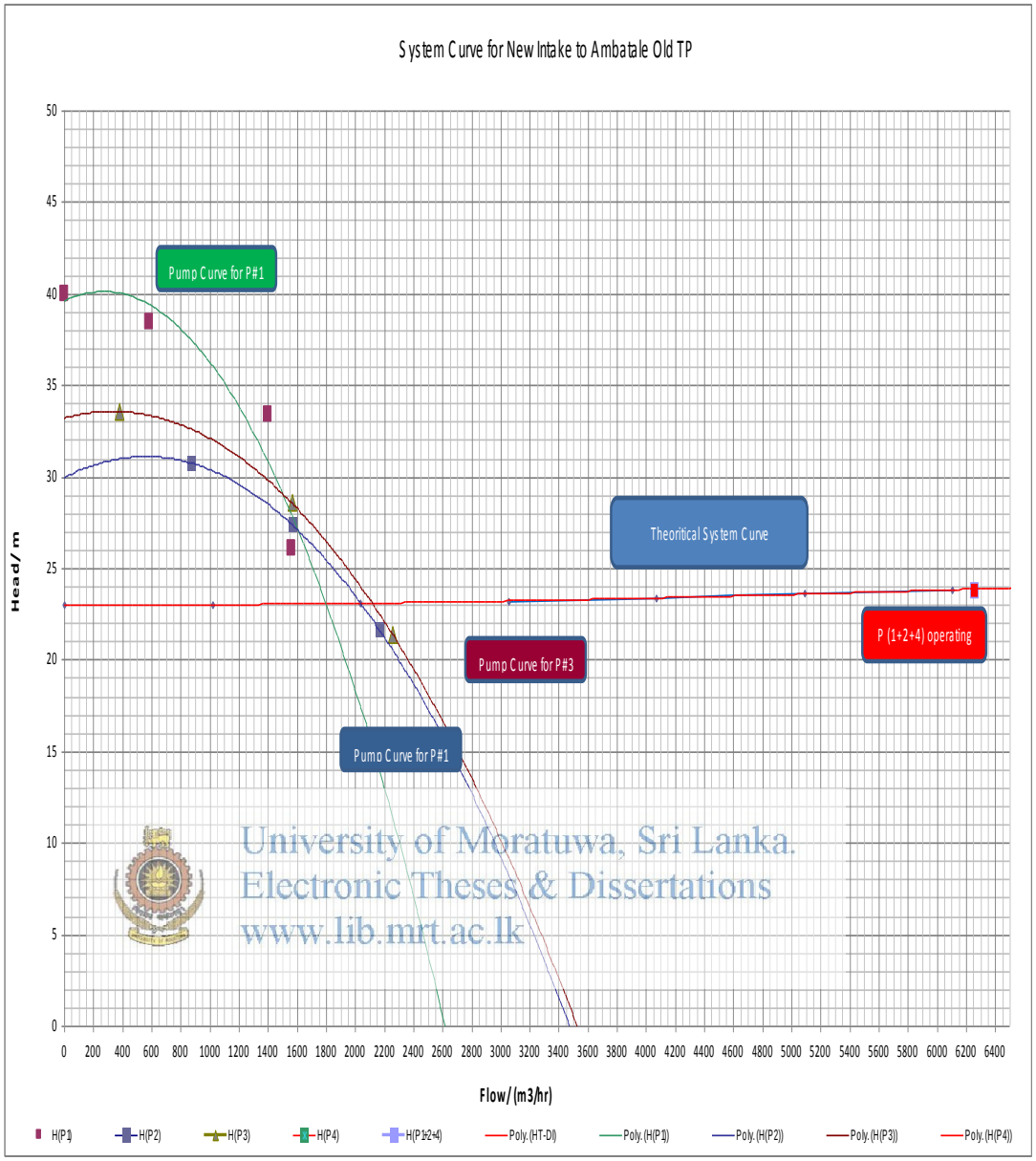


Figure A.2: Actual system curve in new intake pumps at Ambatale

Appendix B

Recommended friction factors

Table B-1: Recommended friction factors (K) for valves fully open

Recommended Energy Loss Coefficients, K, for Flanged Pipe Fittings[a]

Fitting	K
Entrance	
Bellmouth	0.05
Rounded	0.25
Sharp-edged	0.5
Projecting	0.8
Exits	
All of the above	1.0
Bends, mitered	
$\theta = 15°$	0.05
$\theta = 22.5°$	0.075
$\theta = 30°$	0.10
$\theta = 45°$	0.20
$\theta = 60°$	0.35
$\theta = 90°$	0.80
90° bend $3 \times 30° = 90°$ $4 \times 22.5° = 90°$	0.30
Forged or cast fittings	
90° elbow, standard	0.25
90° elbow long radius	0.18
45° elbow	0.18
Return bend, $r = 1.4$ D	0.40
Tee, line flow	0.30
Tee, branch flow	0.75
Cross, line flow	0.50
Cross, branch flow	0.75
Wye, 45°	0.50
Increasers	
Conical	$h = K\left[1 - \left(\frac{D_1}{D_2}\right)^2\right] v_2^2/2g$ $K = 3.5(\tan\theta)^{1.22}$
Conical (approximate)	$h = 0.25\left(v_1^2 - v_2^2\right)/2g$
Sudden	$h = \frac{v_1^2 - v_2^2}{2g} = \left[\left(\frac{A_2}{A_1}\right)^2 - 1\right]\frac{v_2^2}{2g}$
Reducers	
Conical	$h = Kv_2^2/2g$ $K = 0.03 \pm 0.01$
Sudden	$h = \frac{1}{2}\left[1 - \left(\frac{D_2}{D_1}\right)^2\right] v_2^2/2g$

[a] $h = Kv^2/2g$, where v is the maximum velocity in nonprismatic fittings. Increase K by 5% for each 25-mm (1-in.) decrement in pipe smaller than 300 mm (12 in.). Expect K values to vary from –20 to +30% or more.

Table B-2: Energy loss coefficients

Recommended Energy Loss Coefficients, K, for Valves Fully Open[a,b,c]

Valve type	K
Angle	1.8–2.9
Ball	0.04
Butterfly	
25-lb Class	0.16
75-lb Class	0.27
150-lb Class	0.35
Check valves	
Ball	0.9–1.7 but see Mfr's data for specific size and flowrate.
Center-guided globe style	2.6
Double door	
8 in. or smaller	2.5
10 to 16 in.	1.2
Foot	
Hinged disc	1–1.4
Poppet	5–14
Rubber flapper	
$v < 6$ft/s	2.0
$v > 6$ ft/s	1.1
Slanting disc[d]	0.25–2.0
Swing[d]	0.6–2.2, but see Figures B-2 and B-3.
Cone	0.04
Diaphragm or pinch	0.2–0.75
Gate	
Double disc	0.1–0.2
Resilient seat	0.3
Globe	4.0–6.0
Knife gate	
Metal seat	0.2
Resilient seat	0.3
Plug	
Lubricated	0.5–1.0
Eccentric	
Rectangular (80%) opening	1.0
Full bore opening	0.5

[a] $h = Kv^2/2g$, where v is the velocity in the approach piping.

[b] For 300-mm (12-in.) valves and velocities of about 2 m/s (6 ft/s). Note that K may increase significantly for smaller valves. Consult the manufacturer.

[c] Expect K to vary from –20 to +50% or more.

[d] Depending on adjustment of closure mechanism, velocity may have to exceed 4 m/s (12 ft/s) to open the valve fully. Adjustment is crucial to prevent valve slam.

Appendix C

Production, electricity and water level data in Ambatale WSS

Table C–1: Ambatale production details - 2011

Month	Production (m^3)
January	11,622,864
February	14,630,000
March	16,750,000
April	15,790,000
May	17,160,000
June	16,700,000
July	16,750,000
August	17,480,000
September	16,820,000
October	16,540,000
November	16,880,000
December	16,660,000

Table C–2: Ambatale average level variation of intake details - 2011

Month	Average Level variation of intake (m)
January	1.947
February	1.779
March	1.519
April	3.204
May	5.067
June	4.158
July	1.239
August	1.801
September	3.614
October	4.57
November	5.2
December	4.268

Table C– 3: Ambatale electricity details 2011

Month	kWh	kVA
January	5,570,464	8,601
February	5,534,012	8,804
March	5,152,910	8,956
April	5,742,162	9,308
May	5,542,061	9,268
June	5,776,329	9,119
July	5,641,391	9,156
August	5,744,477	9,112
September	5,708,306	8,947
October	5,671,752	9,249
November	5768757	9,021
December	5,621,387	9,212

Table C–4: Pasted yeas Specific Energy Consumption of electricity details (From 2004 to2008)

Date	kWh/ m^3	kVA/ 1000xm^3	kVA/ m^3
Sep-04	0.353329	0.6005222	0.0006005
Oct-04	0.3514411	0.5639098	0.0005639
Nov-04	0.2921087	0.5756792	0.0005757
Dec-04	0.3902378	0.563204	0.0005632
Jan-05	0.3116614	0.5642633	0.0005643
Feb-05	0.3589744	0.6306306	0.0006306
Mar-05	0.3353091	0.5736138	0.0005736
Apr-05	0.2786414	0.4964076	0.0004964
May-05	0.2831039	0.4881101	0.0004881
Jun-05	0.338764	0.5043632	0.0005044
Jul-05	0.2897787	0.4801218	0.0004801
Aug-05	0.2856721	0.4682126	0.0004682
Sep-05	0.3083245	0.4865585	0.0004866
Oct-05	0.2505173	0.4644943	0.0004645
Nov-05	0.2910558	0.4807132	0.0004807
Dec-05	0.2913778	0.4645973	0.0004646
Jan-06	0.2897889	0.4616659	0.0004617
Feb-06	0.2974444	0.506463	0.0005065
Mar-06	0.3220939	0.4537397	0.0004537
Apr-06	0.2481126	0.4734485	0.0004734
May-06	0.2987148	0.4528764	0.0004529
Jun-06	0.2704331	0.4645323	0.0004645
27-Jul-06	0.2795856	0.4631322	0.0004631
25-Aug-06	0.2681486	0.4750305	0.000475
28-Sep-06	0.3270833	0.479798	0.0004798
31-Oct-06	0.3007898	0.4495747	0.0004496
28-Nov-06	0.2590198	0.4659083	0.0004659
29-Dec-06	0.282876	0.4482404	0.0004482
24-Jan-07	0.2422141	0.4916805	0.0004917
27-Feb-07	0.3495539	0.5324546	0.0005325
26-Mar-07	0.2514298	0.4822812	0.0004823
3-May-07	0.3686347	0.502411	0.0005024
28-May-07	0.2343317	0.4726862	0.0004727
27-Jun-07	0.2829867	0.5660086	0.000566
27-Jul-07	0.2813743	0.4514042	0.0004514
28-Aug-07	0.2588471	0.6730055	0.000673
28-Sep-07	0.3772086	0.7347144	0.0007347
29-Oct-07	0.3777578	0.5457213	0.0005457
27-Nov-07	0.3161403	0.5267597	0.0005268
29-Dec-07	0.3594415	0.6848975	0.0006849
28-Jan-08	0.3333276	0.49562	0.0004956
28-Feb-08	0.341738	0.5343647	0.0005344
26-Mar-08	0.2878721	0.4959584	0.000496
29-Apr-08	0.3724522	0.5222222	0.0005222

26-May-08	0.2506665	0.5099938	0.00051
25-Jun-08	0.3662711	0.5454091	0.0005454
28-Jul-08	0.3313978	0.4923266	0.0004923
28-Aug-08	0.3515026	0.5038509	0.0005039
25-Sep-08	0.3184839	0.510523	0.0005105
Oct-08	0.2891637		

Appendix D

Sketch of the pumps arrangement in old & new intakes

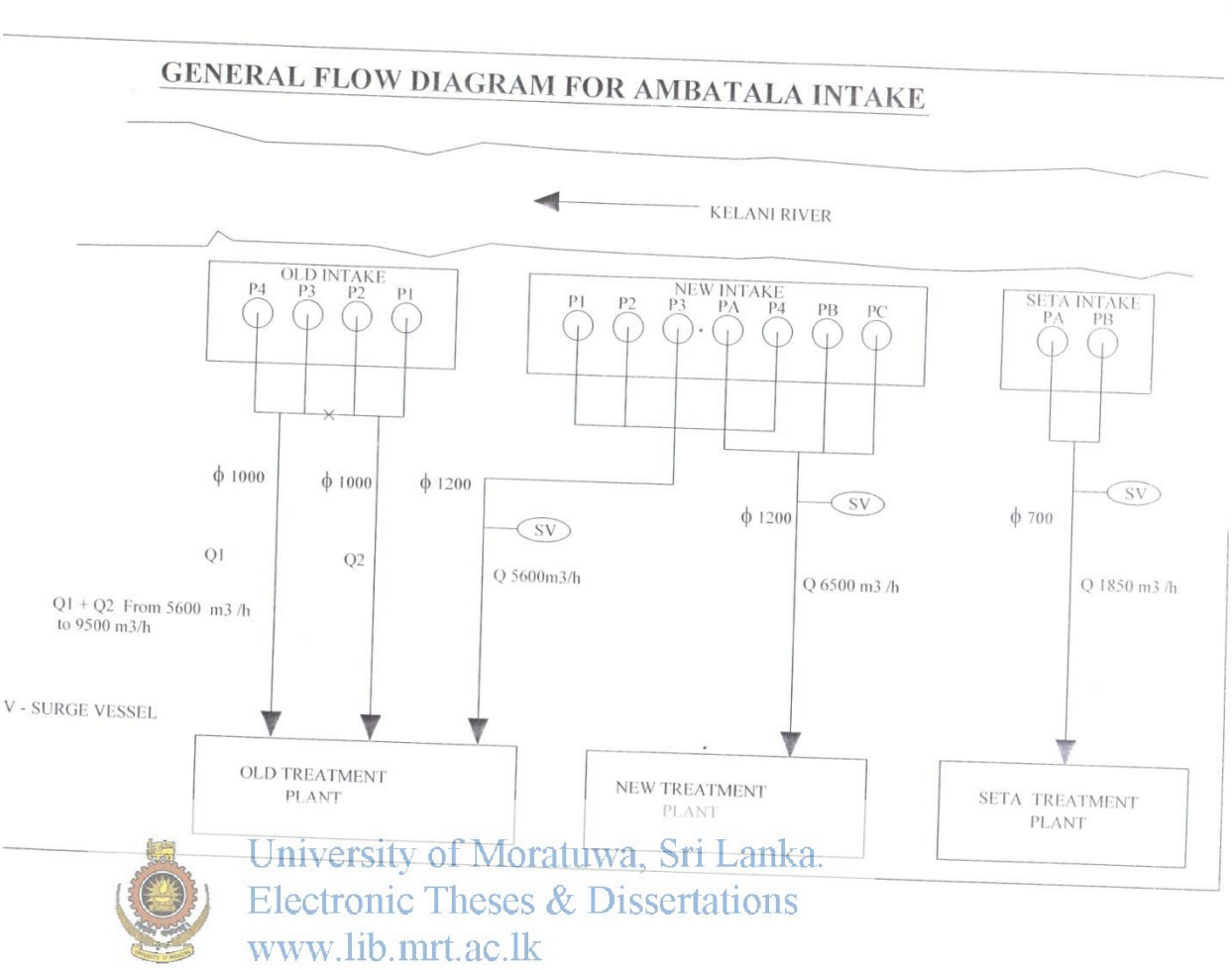


Figure D–1: General flow diagram in Ambatale intake

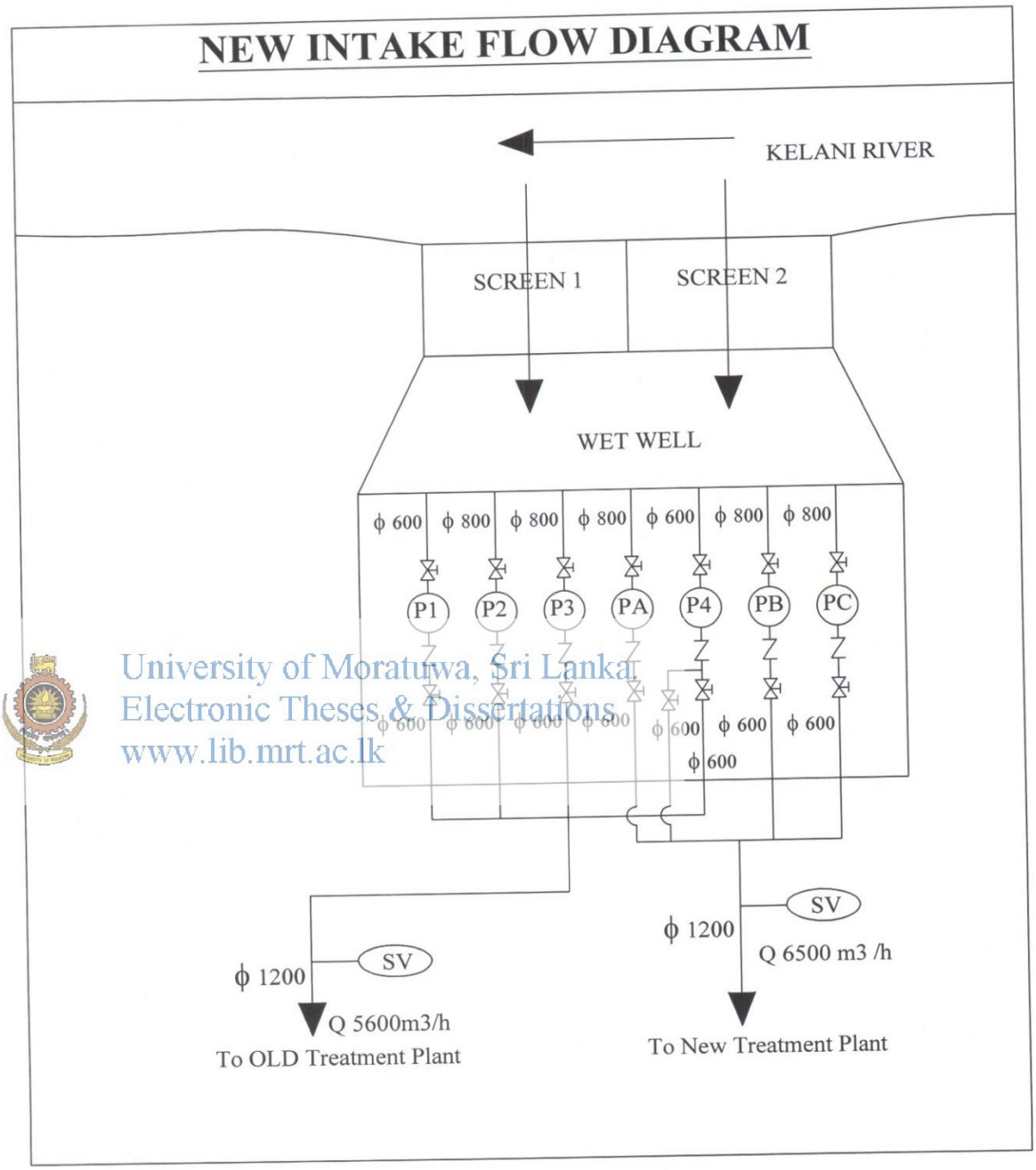


Figure D-2: Flow diagram in new intake

Appendix E

Results of analysis by using water CAD soft ware -

Minimum static head in old intake

E – 1. System profile diagram- Minimum static head in old intake

E-1. Outlet pipe detailed report(P-5) - Minimum static head in old intake

Scenario Summary

ID	1
Label	Base
Notes	
Active Topology	Base Active Topology
Physical	Base Physical
Demand	Base Demand
Initial Settings	Base Initial Settings
Operational	Base Operational
Age	Base Age
Constituent	Base Constituent
Trace	Base Trace
Fire Flow	Base Fire Flow
Energy Cost	Base Energy Cost
Transient	Base Transient
Pressure Dependent Demand	Base Pressure Dependent Demand
Failure History	Base Failure History
User Data Extensions	Base User Data Extensions
Steady State/EPS Solver Calculation Options	Base Calculation Options
Transient Solver Calculation Options	Base Calculation Options

<General>

ID	340	Hyperlinks	<Collection : 0 items>
Label	P-5	Start Node	TCV-2
Notes		Stop Node	R-2

GIS-IDs

Geometry

X (m)	Y (m)
-4.14	-5.01
3.59	-5.01
25.04	18.61

Active Topology

Is Active?	True

Initial Settings

Status (Initial)	Open

Physical

Zone	<None>	Length	746,000	mm

Diameter	1,000.0	mm	Has Check Valve?	False	
Material	Ductile Iron		Specify Local Minor Loss?	True	
Hazen-Williams C	130.0		Minor Loss Coefficient (Local)	0.220	
Has User Defined Length?	True		Installation Year	0	
Length (User Defined)	746,000	mm			

Results (Statistics)

Flow (Minimum Absolute)	3,948	m³/h	Age (Start) (Minimum)	(N/A)	hours
Flow (Maximum Absolute)	3,948	m³/h	Age (Start) (Maximum)	(N/A)	hours
Velocity (Maximum)	1.40	m/s	Age (Stop) (Minimum)	(N/A)	hours
Velocity (Minimum)	1.40	m/s	Age (Stop) (Maximum)	(N/A)	hours
Headloss Gradient (Minimum)	0.002	m/m	Trace (Start) (Minimum)	(N/A)	%
Headloss Gradient (Maximum)	0.002	m/m	Trace (Start) (Maximum)	(N/A)	%
Flow (Minimum)	3,948	m³/h	Trace (Stop) (Minimum)	(N/A)	%
Flow (Maximum)	3,948	m³/h	Trace (Stop) (Maximum)	(N/A)	%
Age (Minimum)	(N/A)	hours	Concentration (Start) (Minimum)	(N/A)	mg/L
Age (Maximum)	(N/A)	hours	Concentration (Start) (Maximum)	(N/A)	mg/L
Trace (Minimum)	(N/A)	%	Concentration (Stop) (Minimum)	(N/A)	mg/L
Trace (Maximum)	(N/A)	%	Concentration (Stop) (Maximum)	(N/A)	mg/L
Concentration (Minimum)	(N/A)	mg/L	Shear Stress (Maximum)	3.84	Pascals
Concentration (Maximum)	(N/A)	mg/L			

Results

Flow	3,948	m³/h	Pressure (Stop)	0	m H2O
Velocity	1.40	m/s	Travel Time	0.148	hours
Headloss Gradient	0.002	m/m	Headloss (Minor)	0.02	m
Headloss	1.17	m	Headloss (Friction)	1.15	m
Pressure Loss Gradient	15.35	Pa/m	Area Full	0.8	m²
Pressure Loss	1.2	m H2O	Shear Stress	3.84	Pascals
Flow (Absolute)	3,948	m³/h	Status (Calculated)	Open	
Hydraulic Grade (Start)	25.84	m	Controlled?	False	
Hydraulic Grade (Stop)	24.67	m	Has Calculation Messages Now?	False	
Pressure (Start)	26	m H2O			

Calculated Results Summary

Time (hours)	Trace (Calculated) (%)	Status (Calculated)	Flow (m^3/h)	Velocity (m/s)	Pressure (Start) (m H2O)	Pressure (Stop) (m H2O)	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)	Headloss (m)	Headloss Gradient (m/m)
0.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
1.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
2.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
3.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
4.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
5.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
6.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
7.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
8.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
9.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
10.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
11.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
12.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
13.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
14.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
15.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
16.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
17.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
18.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
19.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
20.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
21.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
22.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
23.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002
24.000	(N/A)	Open	3,948	1.40	26	0	25.84	24.67	1.17	0.002

E-3. Energy management detailed report: Minimum static head in old intake

<General>					
ID	44		Label	Energy Management - 1	

Category					
Energy Use (Total, Weighted)	(N/A)	kWh	Peak Power	(N/A)	kW
Percent of Billing Period	(N/A)	%	Peak Demand Cost	(N/A)	$

Energy Management Study					
Billing Period	30.0	days	Peak Demand Cost	40	$
Calculate Net Present Value	True		Total Cost (Billing Period)	23,665	$
Interest Rate	12.0	%	Other Costs (Total)	0	$
Interest Period	1	years	Overall Cost (Total per annum)	288,122	$
Number of Years	15		Annual Interest Rate	12.0	%
Billing Period	30.0	days	Years	15	
Energy Use (Total, Billing Period)	288,402.7	kWh	Net Present Value	1,962,359	$
Energy Cost (Total, Billing Period)	23,625	$			

Power Meter Results					
Billing Period	(N/A)	days	Average Energy Cost Per Day (Total)	(N/A)	$
Average Energy Use Per Day (Total)	(N/A)	kWh	Total Energy Cost (Billing Period)	(N/A)	$
Energy Use (Total, Billing Period)	(N/A)	kWh			

Power Meter Summary Results					
Billing Period	30.0	days	Energy Cost (Total, Billing Period)	23,625	$
Average Energy Use Per Day (Total)	9,613.4	kWh	Peak Demand Cost	40	$
Average Energy Cost Per Day (Total)	787	$	Total Cost (Billing Period)	23,665	$
Energy Use (Total, Billing Period)	288,402.7	kWh			

Power Meter Summary

Power Meter	Average Energy Use Per Day (kWh)	Energy Use (Total, Billing Period) (kWh)	Average Energy Cost Per Day ($)
Power Meter - 1	9,613.4	288,402.7	787

Energy Cost (Total, Billing Period) ($)	Peak Power (kW)	Peak Demand Cost ($)
23,625	400.6	40

Scenario Summary Results

Billing Period	30.0	days	Energy Cost (Total, Billing Period)	23,625	$
Average Energy Use Per Day (Total)	9,613.4	kWh	Peak Demand Cost	40	$
Average Energy Cost Per Day (Total)	787	$	Total Cost (Billing Period)	23,665	$
Energy Use (Total, Billing Period)	288,402.7	kWh			

Scenario Summary Results

Label	Energy Use (Scenario) (kWh)	Average Energy Use Per Day (kWh)	Energy Use (Total, Billing Period) (kWh)
Base	9,613.4	9,613.4	288,402.7

Percent of Billing Period (%)	Energy Use (Total, Weighted) (kWh)	Use for Peak?	Peak Power (kW)
100.0	288,402.7	True	400.6

Peak Demand Cost (Total, Billing Period) ($)
40

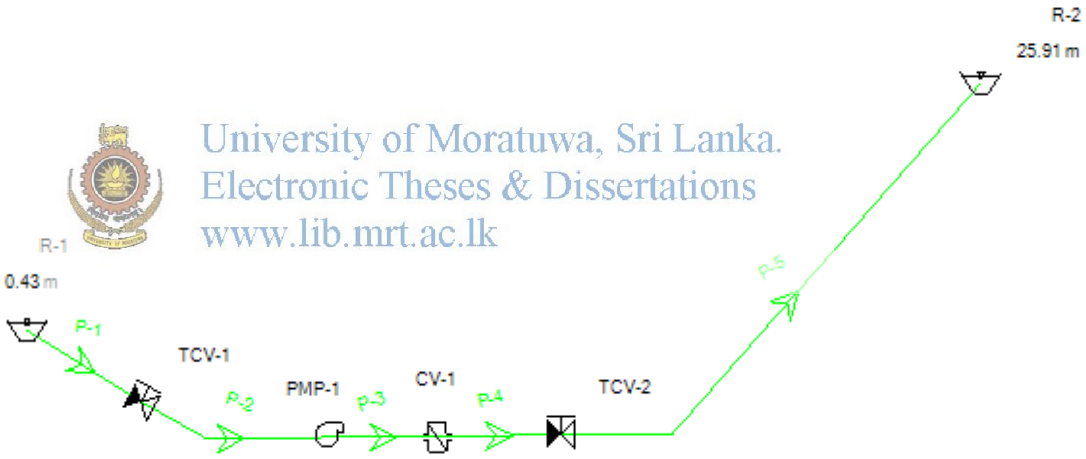
Scenario's Power Meter Results

Energy Use (Total, Scenario)	(N/A)	kWh	Energy Use (Total, Billing Period)	(N/A)	kWh
Average Energy Use Per Day (Total)	(N/A)	kWh	Peak Power	(N/A)	kW

Appendix F

Water CAD analysis & results -Maximum static head in old intake

F-1. Maximum static head in old intake –System profile



F-2. Energy management detailed report: Minimum static head in old intake

<General>

ID	44	Label	Energy Management - 1

Energy Management Study

Billing Period	30.0	days	Peak Demand Cost	40	$
Calculate Net Present Value	True		Total Cost (Billing Period)	23,665	$
Interest Rate	12.0	%	Other Costs (Total)	0	$
Interest Period	1	years	Overall Cost (Total per annum)	288,122	$

Number of Years	15		Annual Interest Rate	12.0	%
Billing Period	30.0	days	Years	15	
Energy Use (Total, Billing Period)	288,402.7	kWh	Net Present Value	1,962,359	$
Energy Cost (Total, Billing Period)	23,625	$			

Power Meter Results

Billing Period	(N/A)	days	Average Energy Cost Per Day (Total)	(N/A)	$
Average Energy Use Per Day (Total)	(N/A)	kWh	Total Energy Cost (Billing Period)	(N/A)	$
Energy Use (Total, Billing Period)	(N/A)	kWh			

Power Meter Summary Results

Billing Period	30.0	days	Energy Cost (Total, Billing Period)	23,625	$
Average Energy Use Per Day (Total)	9,613.4	kWh	Peak Demand Cost	40	$
Average Energy Cost Per Day (Total)	787	$	Total Cost (Billing Period)	23,665	$
Energy Use (Total, Billing Period)	288,402.7	kWh			

Power Meter Summary

Power Meter	Average Energy Use Per Day (kWh)	Energy Use (Total, Billing Period) (kWh)	Average Energy Cost Per Day ($)
Power Meter - 1	9,613.4	288,402.7	787

Energy Cost (Total, Billing Period) ($)	Peak Power (kW)	Peak Demand Cost ($)
23,625	400.6	40

Scenario Summary Results

Billing Period	30.0	days	Energy Cost (Total, Billing Period)	23,625	$
Average Energy Use Per Day (Total)	9,613.4	kWh	Peak Demand Cost	40	$
Average Energy Cost Per Day (Total)	787	$	Total Cost (Billing Period)	23,665	$
Energy Use (Total, Billing Period)	288,402.7	kWh			

Scenario Summary Results

Label	Energy Use (Scenario) (kWh)	Average Energy Use Per Day (kWh)	Energy Use (Total, Billing Period) (kWh)
Base	9,613.4	9,613.4	288,402.7

Percent of Billing Period (%)	Energy Use (Total, Weighted) (kWh)	Use for Peak?	Peak Power (kW)
100.0	288,402.7	True	400.6

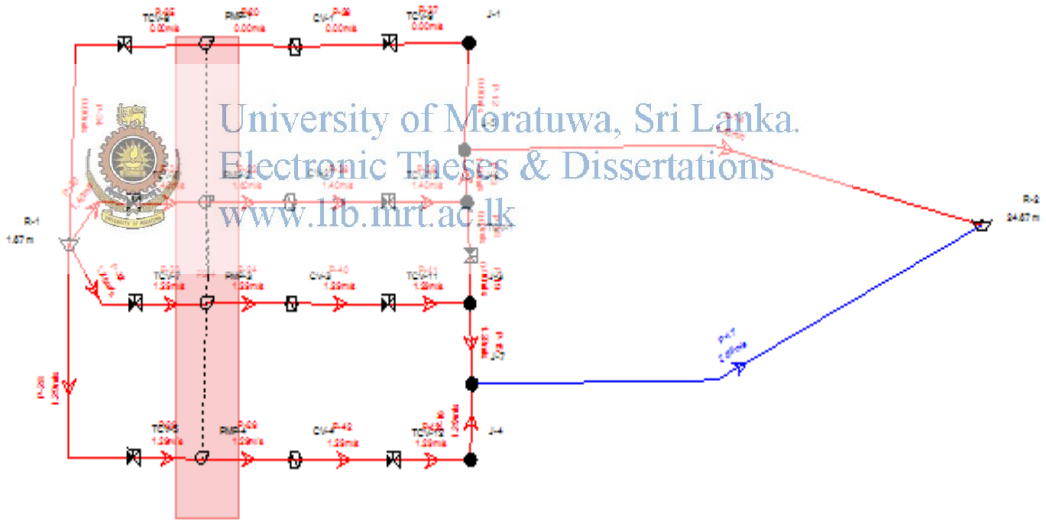
Peak Demand Cost (Total, Billing Period) ($)
40

Scenario's Power Meter Results

Energy Use (Total, Scenario)	(N/A)	kWh	Energy Use (Total, Billing Period)	(N/A)	kWh
Average Energy Use Per Day (Total)	(N/A)	kWh	Peak Power	(N/A)	kW

Appendix G
Water CAD analysis& results for three pumps - Minimum static head in old intake

G-1.Minimum static head profile



G-2.Pump station detailed report: PS-4 Minimum static head in old intake - three pumps operation

Scenario Summary

ID	1
Label	Base
Notes	
Active Topology	Base Active Topology
Physical	Base Physical
Demand	Base Demand
Initial Settings	Base Initial Settings
Operational	Base Operational
Age	Base Age
Constituent	Base Constituent
Trace	Base Trace
Fire Flow	Base Fire Flow
Energy Cost	Base Energy Cost
Transient	Base Transient
Pressure Dependent Demand	Base Pressure Dependent Demand
Failure History	Base Failure History
User Data Extensions	Base User Data Extensions
Steady State/EPS Solver Calculation Options	Base Calculation Options
Transient Solver Calculation Options	Base Calculation Options

<General>

ID	106	Notes	
Label	PS-4	Hyperlinks	<Collection: 0 items>

GIS-IDs

GIS-ID

<Geometry>

Scaled Area	0.053	ha

Geometry

X (m)	Y (m)
-14.61	30.37
-5.69	30.52
-5.84	-29.90
-14.61	-29.90

Active Topology	
Is Active?	True

Pumps

Pump	Pump Definition
PMP-1	Pump Definition - 1
PMP-2	Pump Definition - 1
PMP-3	Pump Definition - 1
PMP-4	Pump Definition - 1

Results (Energy Cost Summary)					
Time of Use	72.000	hours	Energy Usage (Total)	27,704.0	kWh
Volume Pumped (Total)	270.22	ML	Energy Use Cost (Total)	2,269.4	$
Water Power (Total)	473,791.5	kWh	Energy Usage (Daily)	27,704.0	kWh
Efficiency (Average) Pump Station	69.8	%	Energy Use Cost (Daily)	2,269.4	$
Wire to Water Efficiency (Average)	68.4	%	Cost per Unit Volume (Summary)	8.3993	$/ML
Wire Power (Total)	692,599.0	kWh			

Results (Energy Costs)					
Flow (Total)	11,259	m³/h	Energy Used (Incremental)	0.0	kWh
Volume Pumped (Incremental)	0.00	ML	Energy Used (Cumulative)	0.0	kWh
Volume Pumped (Cumulative)	0.00	ML	Energy Price	0.08	$/kWh
Water Power	789.7	kW	Energy Cost (Incremental)	0.0	$
Efficiency Pump Station	69.8	%	Energy Cost (Cumulative)	0.0	$
Wire to Water Efficiency	68.4	%	Cost per Unit Volume	0.0000	$/ML
Wire Power	1,154.3	kW			

G-3. Energy management detailed report: Minimum static head in old intake- 3 pumps operation

<General>

ID	112	Label	Energy Management - 1

Energy Management Study

Billing Period	30.0	days	Peak Demand Cost	115	$
Calculate Net Present Value	True		Total Cost (Billing Period)	68,198	$
Interest Rate	12.0	%	Other Costs (Total)	0	$
Interest Period	1	years	Overall Cost (Total per annum)	830,310	$
Number of Years	15		Annual Interest Rate	12.0	%
Billing Period	30.0	days	Years	15	
Energy Use (Total, Billing Period)	831,118.8	kWh	Net Present Value	5,655,126	$
Energy Cost (Total, Billing Period)	68,082	$			

Power Meter Summary Results

Billing Period	30.0	days	Energy Cost (Total, Billing Period)	68,082	$
Average Energy Use Per Day (Total)	27,704.0	kWh	Peak Demand Cost	115	$
Average Energy Cost Per Day (Total)	2,269	$	Total Cost (Billing Period)	68,198	$
Energy Use (Total, Billing Period)	831,118.8	kWh			

Power Meter Summary

Power Meter	Average Energy Use Per Day (kWh)	Energy Use (Total, Billing Period) (kWh)	Average Energy Cost PerDay ($)
Power Meter - 1	27,704.0	831,118.8	2,269

Energy Cost (Total, Billing Period) ($)	Peak Power (kW)	Peak Demand Cost ($)
68,082	1,154.3	115

Scenario Summary Results

Billing Period	30.0	days	Energy Cost (Total, Billing	68,082	$

			Period)		
Average Energy Use Per Day (Total)	27,704.0	kWh	Peak Demand Cost	115	$
Average Energy Cost Per Day (Total)	2,269	$	Total Cost (Billing Period)	68,198	$
Energy Use (Total, Billing Period)	831,118.8	kWh			

Scenario Summary Results

Label	Energy Use (kWh)	(Scenario)	Average Energy Use Per Day (kWh)	Energy Use (Total, Billing Period) (kWh)
Base	27,704.0		27,704.0	831,118.8

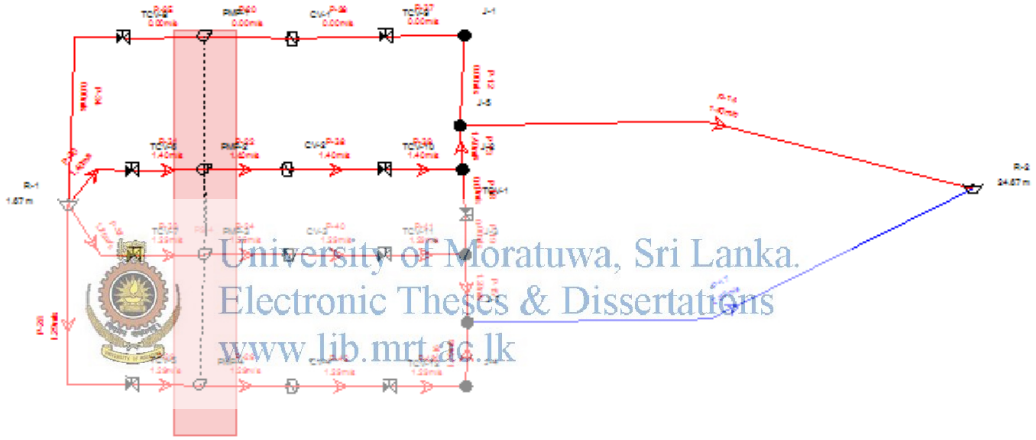
Percent of Billing Period (%)	Energy Use (Total, Weighted) (kWh)	Use for Peak?	Peak Power (kW)
100.0	831,118.8	True	1,154.3

Peak Demand Cost (Total, Billing Period) ($)

Appendix H

Water CAD analysis& results -Maximum static head in old intake for four pumps operation

H-1.System profile -Maximum static head in old intake



H-2.Pump station detailed report (PS-4) Maximum static head in old intake - four pumps operation

Scenario Summary

ID	1
Label	Base
Notes	
Active Topology	Base Active Topology
Physical	Base Physical
Demand	Base Demand
Initial Settings	Base Initial Settings
Operational	Base Operational
Age	Base Age
Constituent	Base Constituent
Trace	Base Trace
Fire Flow	Base Fire Flow
Energy Cost	Base Energy Cost
Transient	Base Transient
Pressure Dependent Demand	Base Pressure Dependent Demand
Failure History	Base Failure History
User Data Extensions	Base User Data Extensions
Steady State/EPS Solver Calculation Options	Base Calculation Options
Transient Solver Calculation Options	Base Calculation Options

<General>

ID	106	Notes	
Label	PS-4	Hyperlinks	<Collection: 0 items>

GIS-IDs

<Geometry>

Scaled Area	0.053	ha

Geometry

X (m)	Y (m)
-14.61	30.37
-5.69	30.52
-5.84	-29.90
-14.61	-29.90

Active Topology

Is Active?	True

Pumps

Pump	Pump Definition
PMP-1	Pump Definition - 1
PMP-2	Pump Definition - 1
PMP-3	Pump Definition - 1
PMP-4	Pump Definition - 1

Results (Energy Cost Summary)					
Time of Use	96.000	hours	Energy Usage (Total)	37,251.1	kWh
Volume Pumped (Total)	323.11	ML	Energy Use Cost (Total)	3,051.5	$
Water Power (Total)	628,381.2	kWh	Energy Usage (Daily)	37,251.1	kWh
Efficiency (Average) Pump Station	68.9	%	Energy Use Cost (Daily)	3,051.5	$
Wire to Water Efficiency (Average)	67.5	%	Cost per Unit Volume (Summary)	9.4451	$/ML
Wire Power (Total)	931,277.2	kWh			

Results (Energy Costs)					
Flow (Total)	13,463	m³/h	Energy Used (Incremental)	0.0	kWh
Volume Pumped (Incremental)	0.00	ML	Energy Used (Cumulative)	0.0	kWh
Volume Pumped (Cumulative)	0.00	ML	Energy Price	0.08	$/kWh
Water Power	1,047.3	kW	Energy Cost (Incremental)	0.0	$
Efficiency Pump Station	68.9	%	Energy Cost (Cumulative)	0.0	$
Wire to Water Efficiency	67.5	%	Cost per Unit Volume	0.0000	$/ML
Wire Power	1,552.1	kW			

H-3. Energy management detailed report: four pumps operation in old intake (maximum static head)

<General>

ID	112		Label	Energy Management - 1	

Energy Management Study

Billing Period	30.0	days	Peak Demand Cost	155	$
Calculate Net Present Value	True		Total Cost (Billing Period)	91,700	$
Interest Rate	12.0	%	Other Costs (Total)	0	$
Interest Period	1	years	Overall Cost (Total per annum)	1,116,445	$
Number of Years	15		Annual Interest Rate	12.0	%
Billing Period	30.0	days	Years	15	
Energy Use (Total, Billing Period)	1,117,532.7	kWh	Net Present Value	7,603,953	$
Energy Cost (Total, Billing Period)	91,545	$			

Power Meter Summary Results

Billing Period	30.0	days	Energy Cost (Total, Billing Period)	91,545	$
Average Energy Use Per Day (Total)	37,251.1	kWh	Peak Demand Cost	155	$
Average Energy Cost Per Day (Total)	3,051	$	Total Cost (Billing Period)	91,700	$
Energy Use (Total, Billing Period)	1,117,532.7	kWh			

Power Meter Summary

Power Meter	Average Energy Use Per Day (kWh)	Energy Use (Total, Billing Period) (kWh)	Average Energy Cost Per Day ($)
Power Meter - 1	37,251.1	1,117,532.7	3,051

Energy Cost (Total, Billing Period) ($)	Peak Power (kW)	Peak Demand Cost ($)
91,545	1,552.1	155

Power Meter's Scenario Results

Billing Period	(N/A)	days	Energy Use (Total, Billing Period)	(N/A)	kWh
Energy Use (Total, Scenario)	(N/A)	kWh	Peak Power	(N/A)	kW
Average Energy Use Per Day (Total)	(N/A)	kWh			

Scenario Summary Results

Billing Period	30.0	days	Energy Cost (Total, Billing Period)	91,545	$
Average Energy Use Per Day (Total)	37,251.1	kWh	Peak Demand Cost	155	$
Average Energy Cost Per Day (Total)	3,051	$	Total Cost (Billing Period)	91,700	$
Energy Use (Total, Billing Period)	1,117,532.7	kWh			

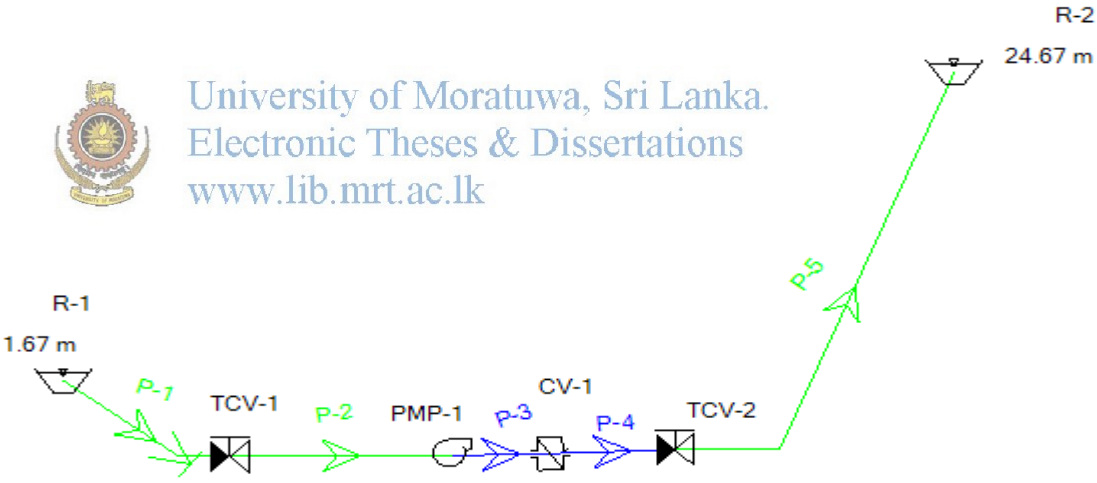
Scenario Summary Results

Label	Energy Use (Scenario) (kWh)	Average Energy Use Per Day (kWh)	Energy Use (Total, Billing Period) (kWh)
Base	37,251.1	37,251.1	1,117,532.7

Percent of Billing Period (%)	Energy Use (Total, Weighted) (kWh)	Use for Peak?	Peak Power (kW)	Peak Demand Cost (Total, Billing Period) ($)
100.0	1,117,532.7	True	1,552.1	

Appendix I
Water CAD analysis & results -Minimum static head in new intake

I-1. System profile - Minimum static head in new intake



I-2. Outlet pipe detailed report (P-5) - minimum static head in new intake

Scenario Summary

ID	1
Label	Base
Notes	
Active Topology	Base Active Topology
Physical	Base Physical
Demand	Base Demand
Initial Settings	Base Initial Settings
Operational	Base Operational
Age	Base Age
Constituent	Base Constituent
Trace	Base Trace
Fire Flow	Base Fire Flow
Energy Cost	Base Energy Cost
Transient	Base Transient
Pressure Dependent Demand	Base Pressure Dependent Demand
Failure History	Base Failure History
User Data Extensions	Base User Data Extensions
Steady State/EPS Solver Calculation Options	Base Calculation Options
Transient Solver Calculation Options	Base Calculation Options

<General>

ID	40	Hyperlinks	<Collection: 0 items>
Label	P-5	Start Node	TCV-2
Notes		Stop Node	R-2

GIS-IDs

Geometry

X (m)	Y (m)
8.86	-0.11
14.06	-0.06
22.71	21.96

Active Topology

Is Active?	True

Initial Settings

Status (Initial)	Open

Physical

Zone	<None>		Length	746	m
Diameter	1,200.0	mm	Has Check Valve?	False	
Material	Ductile Iron		Specify Local Minor Loss?	True	
Hazen-Williams C	130.0		Minor Loss Coefficient (Local)	0.370	
Has User Defined Length?	True		Installation Year	0	
Length (User Defined)	746	m			

Results (Statistics)

Flow (Minimum Absolute)	2,395	m³/h	Age (Start) (Minimum)	(N/A)	hours
Flow (Maximum Absolute)	2,395	m³/h	Age (Start) (Maximum)	(N/A)	hours
Velocity (Maximum)	0.59	m/s	Age (Stop) (Minimum)	(N/A)	hours
Velocity (Minimum)	0.59	m/s	Age (Stop) (Maximum)	(N/A)	hours
Headloss Gradient (Minimum)	0.000	m/m	Trace (Start) (Minimum)	(N/A)	%
Headloss Gradient (Maximum)	0.000	m/m	Trace (Start) (Maximum)	(N/A)	%
Flow (Minimum)	2,395	m³/h	Trace (Stop) (Minimum)	(N/A)	%
Flow (Maximum)	2,395	m³/h	Trace (Stop) (Maximum)	(N/A)	%
Age (Minimum)	(N/A)	hours	Concentration (Start) (Minimum)	(N/A)	mg/L
Age (Maximum)	(N/A)	hours	Concentration (Start) (Maximum)	(N/A)	mg/L
Trace (Minimum)	(N/A)	%	Concentration (Stop) (Minimum)	(N/A)	mg/L
Trace (Maximum)	(N/A)	%	Concentration (Stop) (Maximum)	(N/A)	mg/L
Concentration (Minimum)	(N/A)	mg/L	Shear Stress (Maximum)	0.00	m H2O
Concentration (Maximum)	(N/A)	mg/L			

Results

Flow	2,395	m³/h	Pressure (Stop)	0	m H2O
Velocity	0.59	m/s	Travel Time	0.352	hours
Headloss Gradient	0.000	m/m	Headloss (Minor)	0.01	m
Headloss	0.19	m	Headloss (Friction)	0.19	m
Pressure Loss Gradient	2.54	Pa/m	Area Full	1.1	m²
Pressure Loss	0.2	m H2O	Shear Stress	0.00	m H2O
Flow (Absolute)	2,395	m³/h	Status (Calculated)	Open	
Hydraulic Grade (Start)	24.86	m	Controlled?	False	
Hydraulic Grade (Stop)	24.67	m	Has Calculation Messages Now?	False	
Pressure (Start)	25	m H2O			

Calculation Messages

Time (hours)	Message

Calculated Results Summary

Time (hours)	Trace (Calculated) (%)	Status (Calculate)	Flow (m^3/h)	Velocity (m/s)	Pressure (Start) (m H2O)	Pressure (Stop) (m H2O)	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)	Headloss (m)	Headloss Gradient (m/m)
0.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
1.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
2.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
3.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
4.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
5.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
6.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
7.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
8.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
9.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
10.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
11.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
12.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
13.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
14.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
15.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
16.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
17.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
18.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
19.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
20.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
21.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
22.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
23.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000
24.000	(N/A)	Open	2,395	0.59	25	0	24.86	24.67	0.19	0.000

I-3. Energy management detailed report: Minimum static head in new intake

<General>					
ID	44		Label	Energy Management - 1	

Energy Management Study					
Billing Period	30.0	days	Peak Demand Cost	22	$
Calculate Net Present Value	True		Total Cost (Billing Period)	12,833	$
Interest Rate	12.0	%	Other Costs (Total)	0	$
Interest Period	1	years	Overall Cost (Total per annum)	156,241	$
Number of Years	15		Annual Interest Rate	12.0	%
Billing Period	30.0	days	Years	15	
Energy Use (Total, Billing Period)	156,393.2	kWh	Net Present Value	1,064,136	$
Energy Cost (Total, Billing Period)	12,811	$			

Power Meter Summary Results					
Billing Period	30.0	days	Energy Cost (Total, Billing Period)	12,811	$
Average Energy Use Per Day (Total)	5,213.1	kWh	Peak Demand Cost	22	$
Average Energy Cost Per Day (Total)	427	$	Total Cost (Billing Period)	12,833	$
Energy Use (Total, Billing Period)	156,393.2	kWh			

Power Meter Summary

Power Meter	Average Energy Use Per Day (kWh)	Energy Use (Total, Billing Period) (kWh)	Average Energy Cost Per Day ($)
Power Meter - 1	5,213.1	156,393.2	427

Energy Cost (Total, Billing Period) ($)	Peak Power (kW)	Peak Demand Cost ($)
12,811	217.2	22

Scenario Summary Results

Billing Period	30.0	days	Energy Cost (Total, Billing Period)	12,811	$
Average Energy Use Per Day (Total)	5,213.1	kWh	Peak Demand Cost	22	$
Average Energy Cost Per Day (Total)	427	$	Total Cost (Billing Period)	12,833	$
Energy Use (Total, Billing Period)	156,393.2	kWh			

Scenario Summary Results

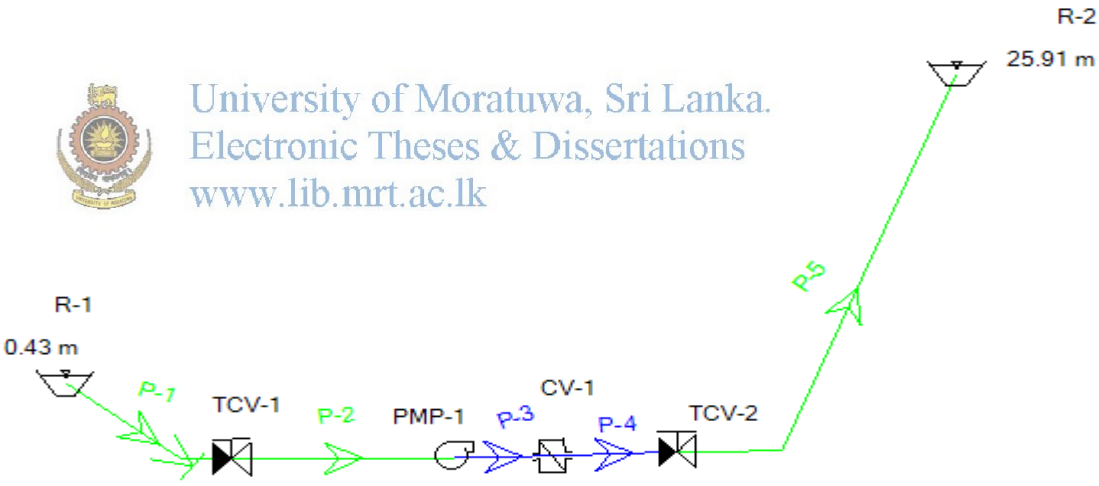
Label	Energy Use (Scenario) (kWh)	Average Energy Use Per Day (kWh)	Energy Use (Total, Billing Period) (kWh)
Base	5,213.1	5,213.1	156,393.2

Percent of Billing Period (%)	Energy Use (Total, Weighted) (kWh)	Use for Peak?	Peak Power (kW)
100.0	156,393.2	True	217.2

Peak Demand Cost (Total, Billing Period) ($)

Appendix J
Water CAD analysis & results -Maximum static head in new intake

J-1.System profile in Maximum static head in new intake



J-2. Outlet pipe detailed report (P-5) - Maximum static head in new intake

Scenario Summary

ID
Label
Notes
Active Topology
Physical
Demand
Initial Settings
Operational
Age
Constituent
Trace
Fire Flow
Energy Cost
Transient
Pressure Dependent Demand
Failure History
User Data Extensions
Steady State/EPS Solver Calculation Options
Transient Solver Calculation Options

<General>

ID	40	Hyperlinks	<Collection: 0 items>
Label	P-5	Start Node	TCV-2
Notes		Stop Node	R-2

GIS-IDs

Geometry

X (m)	Y (m)
8.86	-0.11
14.06	-0.06

22.71 21.96

Active Topology	
Is Active?	True

Initial Settings

Status (Initial)	Open

Physical

Zone	<None>		Length	746
Diameter	1,200.0	mm	Has Check Valve?	False
Material	Ductile Iron		Specify Local Minor Loss?	True
Hazen-Williams C	130.0		Minor Loss Coefficient (Local)	0.370
Has User Defined Length?	True		Installation Year	0
Length (User Defined)	746	m		

Results (Statistics)

Flow (Minimum Absolute)	2,186	m³/h	Age (Start) (Minimum)	(N/A)
Flow (Maximum Absolute)	2,186	m³/h	Age (Start) (Maximum)	(N/A)
Velocity (Maximum)	0.54	m/s	Age (Stop) (Minimum)	(N/A)
Velocity (Minimum)	0.54	m/s	Age (Stop) (Maximum)	(N/A)
Headloss Gradient (Minimum)	0.000	m/m	Trace (Start) (Minimum)	(N/A)
Headloss Gradient (Maximum)	0.000	m/m	Trace (Start) (Maximum)	(N/A)
Flow (Minimum)	2,186	m³/h	Trace (Stop) (Minimum)	(N/A)
Flow (Maximum)	2,186	m³/h	Trace (Stop) (Maximum)	(N/A)
Age (Minimum)	(N/A)	hours	Concentration (Start) (Minimum)	(N/A)
Age (Maximum)	(N/A)	hours	Concentration (Start) (Maximum)	(N/A)
Trace (Minimum)	(N/A)	%	Concentration (Stop) (Minimum)	(N/A)
Trace (Maximum)	(N/A)	%	Concentration (Stop) (Maximum)	(N/A)
Concentration (Minimum)	(N/A)	mg/L	Shear Stress (Maximum)	0.00
Concentration (Maximum)	(N/A)	mg/L		

Results

Flow	2,186	m³/h	Pressure (Stop)	0
Velocity	0.54	m/s	Travel Time	0.386
Headloss Gradient	0.000	m/m	Headloss (Minor)	0.01
Headloss	0.16	m	Headloss (Friction)	0.16
Pressure Loss Gradient	2.15	Pa/m	Area Full	1.1
Pressure Loss	0.2	m H2O	Shear Stress	0.00
Flow (Absolute)	2,186	m³/h	Status (Calculated)	Open
Hydraulic Grade (Start)	26.07	m	Controlled?	False

Hydraulic Grade (Stop)	25.91	m	Has Calculation Messages Now?	False
Pressure (Start)	26	m H2O		

Calculation Messages

Time (hours)	Message

Calculated Results Summary

Time (hours)	Trace (Calculated) (%)	Status (Calculated)	Flow (m³/h)	Velocity (m/s)	Pressure (Start) (m H2O)	Pressure (Stop) (m H2O)	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)	Headloss (m)	Headloss Gradient (m/m)
0.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
1.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
2.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
3.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
4.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
5.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
6.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
7.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
8.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
9.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
10.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
11.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
12.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
13.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
14.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
15.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
16.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
17.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000

18.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
19.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
20.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
21.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
22.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
23.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000
24.000	(N/A)	Open	2,186	0.54	26	0	26.07	25.91	0.16	0.000

J-3. Energy management detailed report: Maximum static head new intake

<General>

ID	45	Label	Energy Management - 2

Category

Energy Use (Total, Weighted)	(N/A)	kWh	Peak Power	(N/A)	kW
Percent of Billing Period	(N/A)	%	Peak Demand Cost	(N/A)	$

Energy Management Study

Billing Period	30.0	days	Peak Demand Cost	22	$
Calculate Net Present Value	True		Total Cost (Billing Period)	12,833	$
Interest Rate	12.0	%	Other Costs (Total)	0	$
Interest Period	1	years	Overall Cost (Total per annum)	156,241	$
Number of Years	15		Annual Interest Rate	12.0	%
Billing Period	30.0	days	Years	15	
Energy Use (Total, Billing Period)	156,393.2	kWh	Net Present Value	1,064,136	$
Energy Cost (Total, Billing Period)	12,811	$			

Power Meter Summary Results

Billing Period	30.0	days	Energy Cost (Total, Billing Period)	12,811	$
Average Energy Use Per Day (Total)	5,213.1	kWh	Peak Demand Cost	22	$
Average Energy Cost Per Day (Total)	427	$	Total Cost (Billing Period)	12,833	$

Energy Use (Total, Billing Period)	156,393.2	kWh

Power Meter Summary

Power Meter	Average Energy Use Per Day (kWh)	Energy Use (Total, Billing Period) (kWh)	Average Energy Cost Per Day ($)
Power Meter - 1	5,213.1	156,393.2	427

Energy Cost (Total, Billing Period) ($)	Peak Power (kW)	Peak Demand Cost ($)
12,811	217.2	22

Scenario Summary Results

Billing Period	30.0	days	Energy Cost (Total, Billing Period)	12,811	$
Average Energy Use Per Day (Total)	5,213.1	kWh	Peak Demand Cost	22	$
Average Energy Cost Per Day (Total)	427	$	Total Cost (Billing Period)	12,833	$
Energy Use (Total, Billing Period)	156,393.2	kWh			

Scenario Summary Results

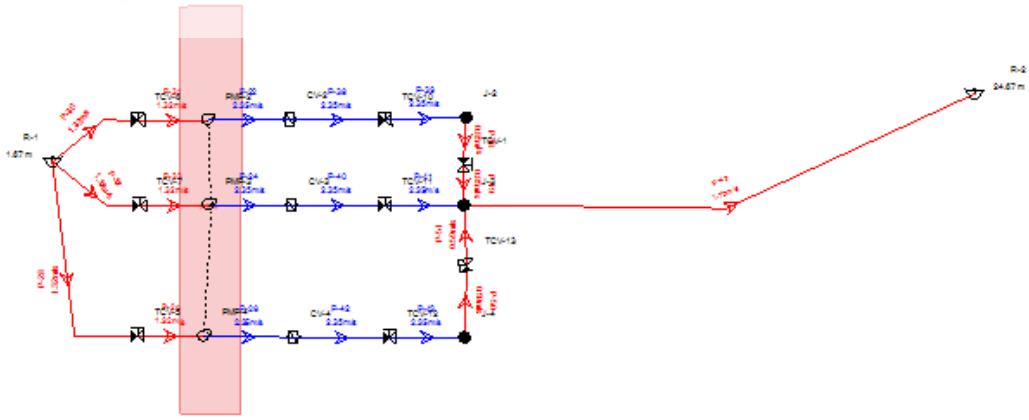
Label	Energy Use (Scenario) (kWh)	Average Energy Use Per Day (kWh)	Energy Use (Total, Billing Period) (kWh)
Base	5,213.1	5,213.1	156,393.2

Percent of Billing Period (%)	Energy Use (Total, Weighted) (kWh)	Use for Peak?	Power Peak (kW)
100.0	156,393.2	True	217.2

Peak Demand Cost (Total, Billing Period) ($)

Appendix K
Water CAD analysis & results for three pumps -Minimum static head in new intake

K-1. System profile - Minimum static head in new intake



K-2. Pump station detailed report: PS-4 - Minimum static head in new intake

Scenario Summary

ID	1
Label	Base
Notes	
Active Topology	Base Active Topology
Physical	Base Physical
Demand	Base Demand
Initial Settings	Base Initial Settings
Operational	Base Operational
Age	Base Age
Constituent	Base Constituent
Trace	Base Trace
Fire Flow	Base Fire Flow
Energy Cost	Base Energy Cost
Transient	Base Transient
Pressure Dependent Demand	Base Pressure Dependent Demand
Failure History	Base Failure History
User Data Extensions	Base User Data Extensions
Steady State/EPS Solver Calculation Options	Base Calculation Options
Transient Solver Calculation Options	Base Calculation Options

<General>

ID	106	Notes	
Label	PS-4	Hyperlinks	<Collection: 0 items>

GIS-IDs

GIS-ID

<Geometry>		
Scaled Area	0.053	ha

Geometry

X (m)	Y (m)
-14.40	26.39
-5.48	26.54
-5.63	-33.88
-14.40	-33.88

Active Topology	
Is Active?	True

Pumps

Pump	Pump Definition
PMP-2	Pump Definition - 1
PMP-3	Pump Definition - 1
PMP-4	Pump Definition - 1

Results (Energy Cost Summary)					
Time of Use	72.000	hours	Energy Usage (Total)	16,761.2	kWh
Volume Pumped (Total)	172.13	ML	Energy Use Cost (Total)	1,373.0	$
Water Power (Total)	272,728.1	kWh	Energy Usage (Daily)	16,761.2	kWh
Efficiency (Average) Pump Station	69.2	%	Energy Use Cost (Daily)	1,373.0	$
Wire to Water Efficiency (Average)	65.1	%	Cost per Unit Volume (Summary)	7.9776	$/ML
Wire Power (Total)	419,030.1	kWh			

Results (Energy Costs)					
Flow (Total)	7,172	m³/h	Energy Used (Incremental)	0.0	kWh
Volume Pumped (Incremental)	0.00	ML	Energy Used (Cumulative)	0.0	kWh
Volume Pumped (Cumulative)	0.00	ML	Energy Price	0.08	$/kWh
Water Power	454.5	kW	Energy Cost (Incremental)	0.0	$
Efficiency Pump Station	69.2	%	Energy Cost (Cumulative)	0.0	$
Wire to Water Efficiency	65.1	%	Cost per Unit Volume	0.0000	$/ML
Wire Power	698.4	kW			

K-3. Energy management detailed report: Minimum static head in new intake

<General>

ID	124	Label	Energy Management - 1

Energy Management Study

Billing Period	30.0	days	Peak Demand Cost	70	$
Calculate Net Present Value	True		Total Cost (Billing Period)	41,260	$
Interest Rate	12.0	%	Other Costs (Total)	0	$
Interest Period	1	years	Overall Cost (Total per annum)	502,347	$
Number of Years	15		Annual Interest Rate	12.0	%
Billing Period	30.0	days	Years	15	
Energy Use (Total, Billing Period)	502,836.1	kWh	Net Present Value	3,421,414	$
Energy Cost (Total, Billing Period)	41,191	$			

Power Meter Summary Results

Billing Period	30.0	days	Energy Cost (Total, Billing Period)	41,191	$
Average Energy Use Per Day (Total)	16,761.2	kWh	Peak Demand Cost	70	$
Average Energy Cost Per Day (Total)	1,373	$	Total Cost (Billing Period)	41,260	$
Energy Use (Total, Billing Period)	502,836.1	kWh			

Power Meter Summary

Power Meter	Average Energy Use Per Day (kWh)	Energy Use (Total, Billing Period) (kWh)	Average Energy Cost Per Day ($)
Power Meter - 1	16,761.2	502,836.1	1,373

Energy Cost (Total, Billing Period) ($)	Peak Power (kW)	Peak Demand Cost ($)
41,191	698.4	70

Scenario Summary Results

Billing Period	30.0	days	Energy Cost (Total, Billing Period)	41,191	$
Average Energy Use Per Day (Total)	16,761.2	kWh	Peak Demand Cost	70	$
Average Energy Cost Per Day (Total)	1,373	$	Total Cost (Billing Period)	41,260	$
Energy Use (Total, Billing Period)	502,836.1	kWh			

Scenario Summary Results

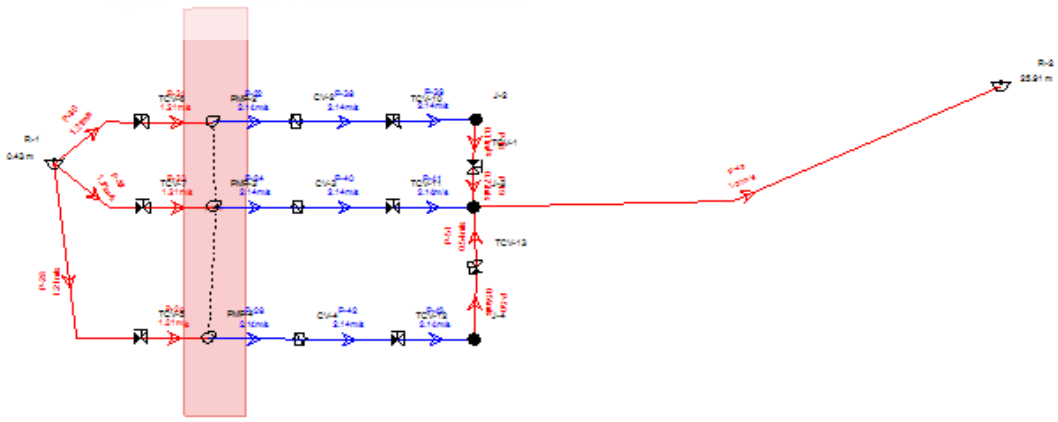
Label	Energy Use (Scenario) (kWh)	Average Energy Use Per Day (kWh)	Energy Use (Total, Billing Period) (kWh)
Base	16,761.2	16,761.2	502,836.1

Percent of Billing Period (%)	Energy Use (Total, Weighted) (kWh)	Use for Peak?	Peak Power (kW)
100.0	502,836.1	True	698.4

Peak Demand Cost (Total, Billing Period) ($)
70

Appendix L
Water CAD analysis& results for three pumps-Maximum static head in new intake

L-1. System profile for three pumps operation in new intake -Maximum static head



L-2. Pump station detailed report: PS-4, Maximum static head in new intake

Scenario Summary

ID	1
Label	Base
Notes	
Active Topology	Base Active Topology
Physical	Base Physical
Demand	Base Demand
Initial Settings	Base Initial Settings
Operational	Base Operational
Age	Base Age
Constituent	Base Constituent
Trace	Base Trace
Fire Flow	Base Fire Flow
Energy Cost	Base Energy Cost
Transient	Base Transient
Pressure Dependent Demand	Base Pressure Dependent Demand
Failure History	Base Failure History
User Data Extensions	Base User Data Extensions
Steady State/EPS Solver Calculation Options	Base Calculation Options
Transient Solver Calculation Options	Base Calculation Options

<General>

ID	106	Notes	
Label	PS-4	Hyperlinks	<Collection: 0 items>

GIS-IDs

GIS-ID

<Geometry>

Scaled Area	0.053	ha

Geometry

X (m)	Y (m)
-14.40	26.39
-5.48	26.54
-5.63	-33.88
-14.40	-33.88

Active Topology	
Is Active?	True

Pumps

Pump	Pump Definition
PMP-2	Pump Definition - 1
PMP-3	Pump Definition - 1
PMP-4	Pump Definition - 1

Results (Energy Cost Summary)					
Time of Use	72.000	hours	Energy Usage (Total)	16,725.7	kWh
Volume Pumped (Total)	157.12	ML	Energy Use Cost (Total)	1,370.1	$
Water Power (Total)	274,887.0	kWh	Energy Usage (Daily)	16,725.7	kWh
Efficiency (Average) Pump Station	69.9	%	Energy Use Cost (Daily)	1,370.1	$
Wire to Water Efficiency (Average)	65.7	%	Cost per Unit Volume (Summary)	8.7213	$/ML
Wire Power (Total)	418,141.5	kWh			

Results (Energy Costs)					
Flow (Total)	6,546	m³/h	Energy Used (Incremental)	0.0	kWh
Volume Pumped (Incremental)	0.00	ML	Energy Used (Cumulative)	0.0	kWh
Volume Pumped (Cumulative)	0.00	ML	Energy Price	0.08	$/kWh
Water Power	458.1	kW	Energy Cost (Incremental)	0.0	$
Efficiency Pump Station	69.9	%	Energy Cost (Cumulative)	0.0	$
Wire to Water Efficiency	65.7	%	Cost per Unit Volume	0.0000	$/ML
Wire Power	696.9	kW			

L-3 Out let Pipe details report

Scenario Summary

ID	1
Label	Base
Notes	
Active Topology	Base Active Topology
Physical	Base Physical
Demand	Base Demand
Initial Settings	Base Initial Settings
Operational	Base Operational
Age	Base Age
Constituent	Base Constituent
Trace	Base Trace
Fire Flow	Base Fire Flow
Energy Cost	Base Energy Cost
Transient	Base Transient
Pressure Dependent Demand	Base Pressure Dependent Demand
Failure History	Base Failure History
User Data Extensions	Base User Data Extensions
Steady State/EPS Solver Calculation Options	Base Calculation Options
Transient Solver Calculation Options	Base Calculation Options

<General>

ID	119	Hyperlinks	<Collection: 0 items>
Label	P-49	Start Node	J-3
Notes		Stop Node	R-2

GIS-IDs

GIS-ID

Geometry

X (m)	Y (m)

26.81	-3.00
63.82	-2.11
101.97	14.89

Active Topology

Is Active?	True

Initial Settings

Status (Initial)	Open

Physical

Zone	<None>		Length	79	m
Diameter	1,200.0	mm	Has Check Valve?	False	
Material	Ductile Iron		Specify Local Minor Loss?	True	
Hazen-Williams C	130.0		Minor Loss Coefficient (Local)	0.220	
Has User Defined Length?	False		Installation Year	0	
Length (Scaled)	79	m			

Results

Flow	6,546	m³/h	Pressure (Stop)	0.0	kPa
Velocity	1.61	m/s	Travel Time	0.013	hours
Headloss Gradient	0.002	m/m	Headloss (Minor)	0.03	m
Headloss	0.15	m	Headloss (Friction)	0.12	m
Pressure Loss Gradient	19.59	Pa/m	Area Full	1.1	m²
Pressure Loss	1.47	kPa	Shear Stress	0.12	lbs/ft²
Flow (Absolute)	6,546	m³/h	Status (Calculated)	Open	
Hydraulic Grade (Start)	26.06	m	Controlled?	False	
Hydraulic Grade (Stop)	25.91	m	Has Calculation Messages Now?	False	
Pressure (Start)	255.0	kPa			

Calculation Messages

Time (hours)	Message

L-4. Energy manag

ement detailed report: Maximum static head in new intake

<General>

ID	124	Label	Energy Management - 1	

Energy Management Study

Billing Period	30.0	days	Peak Demand Cost	70	$
Calculate Net Present Value	True		Total Cost (Billing Period)	41,173	$
Interest Rate	12.0	%	Other Costs (Total)	0	$
Interest Period	1	years	Overall Cost (Total per annum)	501,281	$
Number of Years	15		Annual Interest Rate	12.0	%
Billing Period	30.0	days	Years	15	
Energy Use (Total, Billing Period)	501,769.8	kWh	Net Present Value	3,414,159	$
Energy Cost (Total, Billing Period)	41,103	$			

Power Meter Summary Results

Billing Period	30.0	days	Energy Cost (Total, Billing Period)	41,103	$
Average Energy Use Per Day (Total)	16,725.7	kWh	Peak Demand Cost	70	$
Average Energy Cost Per Day (Total)	1,370	$	Total Cost (Billing Period)	41,173	$
Energy Use (Total, Billing Period)	501,769.8	kWh			

Power Meter Summary

Power Meter	Average Energy Use Per Day (kWh)	Energy Use (Total, Billing Period) (kWh)	Average Energy Cost Per Day ($)
Power Meter - 1	16,725.7	501,769.8	1,370

Energy Cost (Total, Billing Period) ($)	Peak Power (kW)	Peak Demand Cost ($)
41,103	696.9	70

Scenario Summary Results

Billing Period	30.0	days	Energy Cost (Total, Billing Period)	41,103	$
Average Energy Use Per Day (Total)	16,725.7	kWh	Peak Demand Cost	70	$
Average Energy Cost Per Day (Total)	1,370	$	Total Cost (Billing Period)	41,173	$
Energy Use (Total, Billing Period)	501,769.8	kWh			

Scenario Summary Results

Label	Energy Use (Scenario) (kWh)	Average Energy Use Per Day (kWh)	Energy Use (Total, Billing Period) (kWh)
Base	16,725.7	16,725.7	501,769.8

Percent of Billing Period (%)	Energy Use (Total, Weighted) (kWh)	Use for Peak?	Peak Power (kW)
100.0	501,769.8	True	696.9

Peak Demand Cost (Total, Billing Period) ($)
70