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Project	Gingin Mineral Sands	Client	Mining Metals Technology
Project No.	4567	Design Date	24/01/2017
Category	Demo Booster Line	Atmos. Press	100.19 kPa
Network Type	Liquid	Calc. Method	Darcy
Description	Mineral Sands Transport Pipeline		

Mineral Sands Tailings pipeline at new proposed plant at Gingin WA. A transfer rate of at least 310 tonnes/hr of solids is required.
Size the pipe diameter and calculate system head losses. Check the pipe size for slurry settlement and include slurry losses in the friction and system calculations.

The network System models a settling slurry series pipe system. Draw a system curve and select a slurry pump.
System is modelled using a tank and pump set at 140m operating head to deliver slurry to the MSU Feed tank at the plant.
Click on the on (say) Graph tab sheet on RHS and then on a pipe, say number 9. The Slurry system settling curve will be drawn for the pipe.
You can also get a System head graph for the complete system and then plot a pump curve over it.

Click the System Curve tab below and then press the Draw Curve button. The system curve of Head vs Flow rate for the pipes in the Pipe List will be drawn.
Now click on the Use Pump Curve checkbox on RHS and in the Pump Database dropdown, scroll to the near the end and select the
Warman 8/6-AH-WRT 550 pump. The pump curves for this pump will be listed.
Now click on one of the curve 'Use' checkboxes to the RHS of the Action button - click say 1100rpm curve and then press the Draw Curve button once again to draw this pump curve on top of the system curve.
The duty point will be where the pump curve and system curve intersect.
Explore the options, look at the Data, Pump database menu to see how to add your own pumps and data.
This pump at 1100 rpm will not deliver the flow or head required, a larger pump is required or 2 or three pumps in series could be used.
This is a sample network to illustrate the design process.

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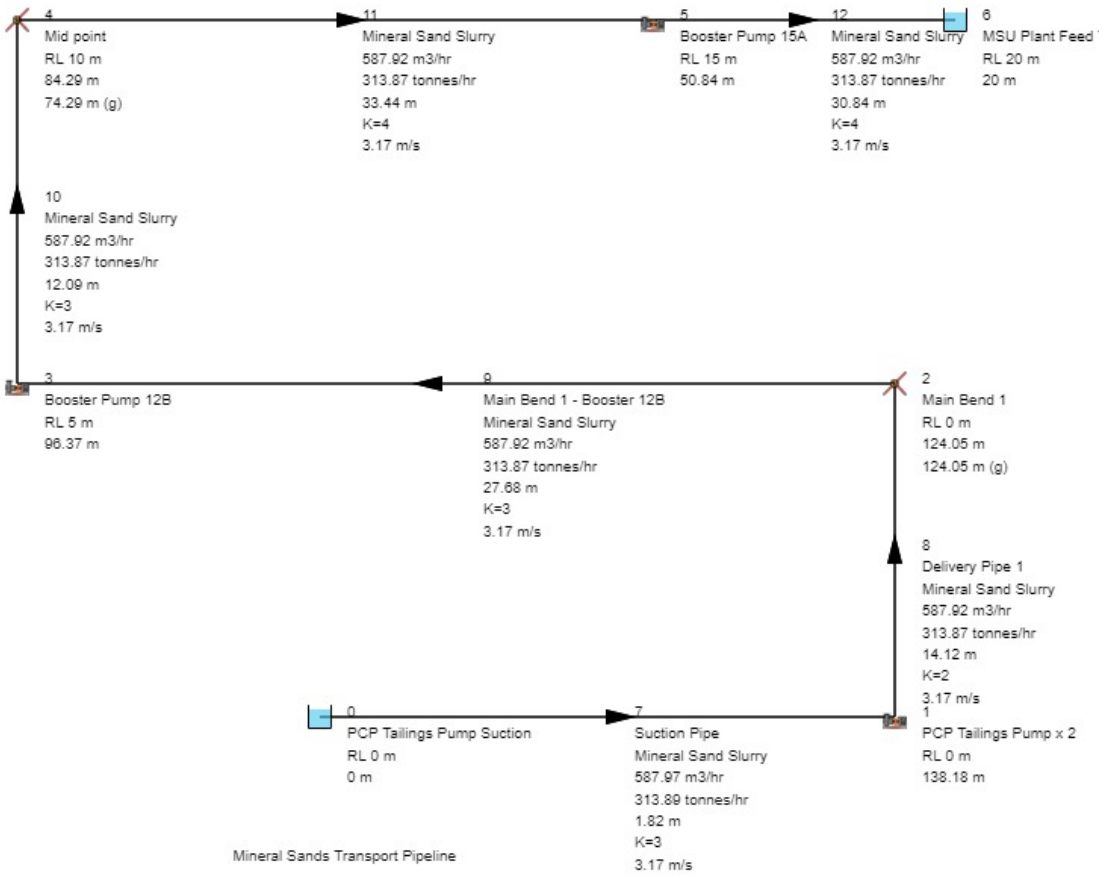
Category	Demo Booster Line	Atmos. Press	100.19 kPa
Description	Mineral Sands Transport Pipeline		



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Project	Gingin Mineral Sands	Client	Mining Metals Technology
Project No.	4567	Design Date	24/01/2017
Category	Demo Booster Line	Atmos. Press	100.19 kPa
Description	Mineral Sands Transport Pipeline		

Pipe No	7	From node to node	0 - 1
Description	Suction Pipe	Equipment No	
Slurry Type	Settling Slurry		
Slurry Description	Mineral Sand Slurry		
Slurry Reference	MS563		
SG Carrier Liquid Sl	1	Liquid Viscosity	1.14 cP
SG of Dry Solids	2.68	SG of Mixture	1.33
Conc. by Mass Cw	40 % w/w	Concentration by Vol	19.92 % v/v
Solids Flow Rate	313.89 tonnes/hr	Particle Size d50	0.18 mm
Durand co-eff. Fl	1.02	Settling Velocity Vl	2.97 m/s
Grading	Widely Graded	Settling Flow Rate	550.92 m3/hr
Pump Wear Factor Pw	0.9	Pump Head Ratio HR	0.91
Pipe Description	Polyethylene PE100 AS4130	Pipe Class	PN16
Nominal Diameter	315 mm	Inside Diameter	256 mm
Outside Diameter	315 mm	Pipe Length	5 m
Pipe Roughness	0.003 mm	Allowable Press.	1600 kPa
Orifice Plate Dia	-	Non Return Valve	No
Total Fittings k	3	Total Fittings kf	0
Flow Rate	587.97 m3/hr	Velocity	3.17 m/s
Friction Loss	0.28 m	Fitting Losses	1.54 m
Slurry Losses	0.16 m	Orifice Losses	0 m
Fixed Head Loss	0 m	Booster Pump Head	0 m
Total Head Loss	1.82 m	Total Pressure Drop	23.86 kPa
Entry Total Head	0 m	Exit Total Head	-1.82 m
Entry Gauge Head	0 m	Exit Gauge Head	-1.82 m
Reynolds No.	951018.44	Friction Factor	0.012 (Darcy f)

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Project	Gingin Mineral Sands	Client	Mining Metals Technology
Project No.	4567	Design Date	24/01/2017
Category	Demo Booster Line	Atmos. Press	100.19 kPa
Description	Mineral Sands Transport Pipeline		

Pipe No	8	From node to node	1 - 2
Description	Delivery Pipe 1	Equipment No	
Slurry Type	Settling Slurry		
Slurry Description	Mineral Sand Slurry		
Slurry Reference	MS563		
SG Carrier Liquid Sl	1	Liquid Viscosity	1.14 cP
SG of Dry Solids	2.68	SG of Mixture	1.33
Conc. by Mass Cw	40 % w/w	Concentration by Vol	19.92 % v/v
Solids Flow Rate	313.87 tonnes/hr	Particle Size d50	0.18 mm
Durand co-eff. Fl	1.02	Settling Velocity Vl	2.97 m/s
Grading	Widely Graded	Settling Flow Rate	550.92 m3/hr
Pump Wear Factor Pw	0.9	Pump Head Ratio HR	0.91
Pipe Description	Polyethylene PE100 AS4130	Pipe Class	PN16
Nominal Diameter	315 mm	Inside Diameter	256 mm
Outside Diameter	315 mm	Pipe Length	500 m
Pipe Roughness	0.003 mm	Allowable Press.	1600 kPa
Orifice Plate Dia	-	Non Return Valve	No
Total Fittings k	2	Total Fittings kf	0
Flow Rate	587.92 m3/hr	Velocity	3.17 m/s
Friction Loss	13.1 m	Fitting Losses	1.03 m
Slurry Losses	1.06 m	Orifice Losses	0 m
Fixed Head Loss	0 m	Booster Pump Head	0 m
Total Head Loss	14.12 m	Total Pressure Drop	184.84 kPa
Entry Total Head	138.18 m	Exit Total Head	124.05 m
Entry Gauge Head	138.18 m	Exit Gauge Head	124.05 m
Reynolds No.	950945.49	Friction Factor	0.012 (Darcy f)

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Project	Gingin Mineral Sands	Client	Mining Metals Technology
Project No.	4567	Design Date	24/01/2017
Category	Demo Booster Line	Atmos. Press	100.19 kPa
Description	Mineral Sands Transport Pipeline		

Pipe No	9	From node to node	2 - 3
Description	Main Bend 1 - Booster 12B	Equipment No	
Slurry Type	Settling Slurry		
Slurry Description	Mineral Sand Slurry		
Slurry Reference	MS563		
SG Carrier Liquid Sl	1	Liquid Viscosity	1.14 cP
SG of Dry Solids	2.68	SG of Mixture	1.33
Conc. by Mass Cw	40 % w/w	Concentration by Vol	19.92 % v/v
Solids Flow Rate	313.87 tonnes/hr	Particle Size d50	0.18 mm
Durand co-eff. Fl	1.02	Settling Velocity Vl	2.97 m/s
Grading	Widely Graded	Settling Flow Rate	550.92 m3/hr
Pump Wear Factor Pw	0.9	Pump Head Ratio HR	0.91
Pipe Description	Polyethylene PE100 AS4130	Pipe Class	PN16
Nominal Diameter	315 mm	Inside Diameter	256 mm
Outside Diameter	315 mm	Pipe Length	1000 m
Pipe Roughness	0.003 mm	Allowable Press.	1600 kPa
Orifice Plate Dia	-	Non Return Valve	No
Total Fittings k	3	Total Fittings kf	0
Flow Rate	587.92 m3/hr	Velocity	3.17 m/s
Friction Loss	26.14 m	Fitting Losses	1.54 m
Slurry Losses	2.07 m	Orifice Losses	0 m
Fixed Head Loss	0 m	Booster Pump Head	0 m
Total Head Loss	27.68 m	Total Pressure Drop	362.3 kPa
Entry Total Head	124.05 m	Exit Total Head	96.37 m
Entry Gauge Head	124.05 m	Exit Gauge Head	91.37 m
Reynolds No.	950945.85	Friction Factor	0.012 (Darcy f)

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Project	Gingin Mineral Sands	Client	Mining Metals Technology
Project No.	4567	Design Date	24/01/2017
Category	Demo Booster Line	Atmos. Press	100.19 kPa
Description	Mineral Sands Transport Pipeline		

Pipe No	10	From node to node	3 - 4
Description		Equipment No	
Slurry Type	Settling Slurry		
Slurry Description	Mineral Sand Slurry		
Slurry Reference	MS563		
SG Carrier Liquid Sl	1	Liquid Viscosity	1.14 cP
SG of Dry Solids	2.68	SG of Mixture	1.33
Conc. by Mass Cw	40 % w/w	Concentration by Vol	19.92 % v/v
Solids Flow Rate	313.87 tonnes/hr	Particle Size d50	0.18 mm
Durand co-eff. Fl	1.02	Settling Velocity Vl	2.97 m/s
Grading	Widely Graded	Settling Flow Rate	550.92 m3/hr
Pump Wear Factor Pw	0.9	Pump Head Ratio HR	0.91
Pipe Description	Polyethylene PE100 AS4130	Pipe Class	PN16
Nominal Diameter	315 mm	Inside Diameter	256 mm
Outside Diameter	315 mm	Pipe Length	400 m
Pipe Roughness	0.003 mm	Allowable Press.	1600 kPa
Orifice Plate Dia	-	Non Return Valve	No
Total Fittings k	3	Total Fittings kf	0
Flow Rate	587.92 m3/hr	Velocity	3.17 m/s
Friction Loss	10.55 m	Fitting Losses	1.54 m
Slurry Losses	0.92 m	Orifice Losses	0 m
Fixed Head Loss	0 m	Booster Pump Head	0 m
Total Head Loss	12.09 m	Total Pressure Drop	158.22 kPa
Entry Total Head	96.37 m	Exit Total Head	84.29 m
Entry Gauge Head	91.37 m	Exit Gauge Head	74.29 m
Reynolds No.	950944.33	Friction Factor	0.012 (Darcy f)

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Project	Gingin Mineral Sands	Client	Mining Metals Technology
Project No.	4567	Design Date	24/01/2017
Category	Demo Booster Line	Atmos. Press	100.19 kPa
Description	Mineral Sands Transport Pipeline		

Pipe No	11	From node to node	4 - 5
Description		Equipment No	
Slurry Type	Settling Slurry		
Slurry Description	Mineral Sand Slurry		
Slurry Reference	MS563		
SG Carrier Liquid Sl	1	Liquid Viscosity	1.14 cP
SG of Dry Solids	2.68	SG of Mixture	1.33
Conc. by Mass Cw	40 % w/w	Concentration by Vol	19.92 % v/v
Solids Flow Rate	313.87 tonnes/hr	Particle Size d50	0.18 mm
Durand co-eff. Fl	1.02	Settling Velocity Vl	2.97 m/s
Grading	Widely Graded	Settling Flow Rate	550.92 m3/hr
Pump Wear Factor Pw	0.9	Pump Head Ratio HR	0.91
Pipe Description	Polyethylene PE100 AS4130	Pipe Class	PN16
Nominal Diameter	315 mm	Inside Diameter	256 mm
Outside Diameter	315 mm	Pipe Length	1200 m
Pipe Roughness	0.003 mm	Allowable Press.	1600 kPa
Orifice Plate Dia	-	Non Return Valve	No
Total Fittings k	4	Total Fittings kf	0
Flow Rate	587.92 m3/hr	Velocity	3.17 m/s
Friction Loss	31.39 m	Fitting Losses	2.05 m
Slurry Losses	2.5 m	Orifice Losses	0 m
Fixed Head Loss	0 m	Booster Pump Head	0 m
Total Head Loss	33.44 m	Total Pressure Drop	437.71 kPa
Entry Total Head	84.29 m	Exit Total Head	50.84 m
Entry Gauge Head	74.29 m	Exit Gauge Head	35.84 m
Reynolds No.	950945.72	Friction Factor	0.012 (Darcy f)

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Project	Gingin Mineral Sands	Client	Mining Metals Technology
Project No.	4567	Design Date	24/01/2017
Category	Demo Booster Line	Atmos. Press	100.19 kPa
Description	Mineral Sands Transport Pipeline		

Pipe No	12	From node to node	5 - 6
Description		Equipment No	
Slurry Type	Settling Slurry		
Slurry Description	Mineral Sand Slurry		
Slurry Reference	MS563		
SG Carrier Liquid Sl	1	Liquid Viscosity	1.14 cP
SG of Dry Solids	2.68	SG of Mixture	1.33
Conc. by Mass Cw	40 % w/w	Concentration by Vol	19.92 % v/v
Solids Flow Rate	313.87 tonnes/hr	Particle Size d50	0.18 mm
Durand co-eff. Fl	1.02	Settling Velocity Vl	2.97 m/s
Grading	Widely Graded	Settling Flow Rate	550.92 m3/hr
Pump Wear Factor Pw	0.9	Pump Head Ratio HR	0.91
Pipe Description	Polyethylene PE100 AS4130	Pipe Class	PN16
Nominal Diameter	315 mm	Inside Diameter	256 mm
Outside Diameter	315 mm	Pipe Length	1100 m
Pipe Roughness	0.003 mm	Allowable Press.	1600 kPa
Orifice Plate Dia	-	Non Return Valve	No
Total Fittings k	4	Total Fittings kf	0
Flow Rate	587.92 m3/hr	Velocity	3.17 m/s
Friction Loss	28.79 m	Fitting Losses	2.05 m
Slurry Losses	2.31 m	Orifice Losses	0 m
Fixed Head Loss	0 m	Booster Pump Head	0 m
Total Head Loss	30.84 m	Total Pressure Drop	403.7 kPa
Entry Total Head	50.84 m	Exit Total Head	20 m
Entry Gauge Head	35.84 m	Exit Gauge Head	0 m
Reynolds No.	950945.59	Friction Factor	0.012 (Darcy f)

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Project	Gingin Mineral Sands	Client	Mining Metals Technology
Project No.	4567	Design Date	24/01/2017
Category	Demo Booster Line	Atmos. Press	100.19 kPa
Description	Mineral Sands Transport Pipeline		

Node No	0	Node Type	Tank
Description	PCP Tailings Pump Suction	Equipment No	TK-015
Rel. Level (RL)	0 m	Pressure Input	0 kPa
Nozzle K value	-	Ext Flow (+In/-Out)	-
Int.(Gauge) Head	-	Int.(Gauge) Pressure	-
Total Node Head	0 m		

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Project	Gingin Mineral Sands	Client	Mining Metals Technology
Project No.	4567	Design Date	24/01/2017
Category	Demo Booster Line	Atmos. Press	100.19 kPa
Description	Mineral Sands Transport Pipeline		

Node No	1	Node Type	Pump
Description	PCP Tailings Pump x 2	Equipment No	
Rel. Level (RL)	0 m	Pressure Input	0 kPa
Nozzle K value	-	Ext Flow (+In/-Out)	-
Int.(Gauge) Head	-	Int.(Gauge) Pressure	-
Total Node Head	138.18 m		
Pump Head	140 m	Pump Flow Rate	587.97 m3/hr
Pump Abs. Power	427.54 kW	Pump Efficiency	70 %

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Category	Demo Booster Line	Atmos. Press	100.19 kPa
Description	Mineral Sands Transport Pipeline		

Node No	2	Node Type	Junction
Description	Main Bend 1	Equipment No	
Rel. Level (RL)	0 m	Pressure Input	0 kPa
Nozzle K value	-	Ext Flow (+In/-Out)	0 m3/hr
Int.(Gauge) Head	124.05 m	Int.(Gauge) Pressure	1623.7 kPa
Total Node Head	124.05 m		

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Project	Gingin Mineral Sands	Client	Mining Metals Technology
Project No.	4567	Design Date	24/01/2017
Category	Demo Booster Line	Atmos. Press	100.19 kPa
Description	Mineral Sands Transport Pipeline		

Node No	3	Node Type	Pump
Description	Booster Pump 12B	Equipment No	
Rel. Level (RL)	5 m	Pressure Input	0 kPa
Nozzle K value	-	Ext Flow (+In/-Out)	-
Int.(Gauge) Head	-	Int.(Gauge) Pressure	-
Total Node Head	96.37 m		
Pump Head	0 m	Pump Flow Rate	587.92 m3/hr
Pump Abs. Power	0 kW	Pump Efficiency	70 %

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Project	Gingin Mineral Sands	Client	Mining Metals Technology
Project No.	4567	Design Date	24/01/2017
Category	Demo Booster Line	Atmos. Press	100.19 kPa
Description	Mineral Sands Transport Pipeline		

Node No	4	Node Type	Junction
Description	Mid point	Equipment No	
Rel. Level (RL)	10 m	Pressure Input	0 kPa
Nozzle K value	-	Ext Flow (+In/-Out)	0 m3/hr
Int.(Gauge) Head	74.29 m	Int.(Gauge) Pressure	972.3 kPa
Total Node Head	84.29 m		

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Project	Gingin Mineral Sands	Client	Mining Metals Technology
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Category	Demo Booster Line	Atmos. Press	100.19 kPa
Description	Mineral Sands Transport Pipeline		

Node No	5	Node Type	Pump
Description	Booster Pump 15A	Equipment No	
Rel. Level (RL)	15 m	Pressure Input	0 kPa
Nozzle K value	-	Ext Flow (+In/-Out)	-
Int.(Gauge) Head	-	Int.(Gauge) Pressure	-
Total Node Head	50.84 m		
Pump Head	0 m	Pump Flow Rate	587.92 m3/hr
Pump Abs. Power	0 kW	Pump Efficiency	70 %

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Project	Gingin Mineral Sands	Client	Mining Metals Technology
Project No.	4567	Design Date	24/01/2017
Category	Demo Booster Line	Atmos. Press	100.19 kPa
Description	Mineral Sands Transport Pipeline		

Node No	6	Node Type	Tank
Description	MSU Plant Feed Tank	Equipment No	Area 356
Rel. Level (RL)	20 m	Pressure Input	0 kPa
Nozzle K value	-	Ext Flow (+In/-Out)	-
Int.(Gauge) Head	-	Int.(Gauge) Pressure	-
Total Node Head	20 m		