

NGL Basin	
Pond volume (m3)	115 756
Pond elevation (m)	878.5
Pond surface area (m2)	125 908

Storm duration	48			
Grootfontein Rainfall Station : 674429 (TR102)				
Rainfall	1 Day (mm)	Catchment Area (m ²)	Run-off Coeff	Inflow Volume (m ³)
1:50	114	1 606 630.92	0.3	54 946.78
1:100	128			61 694.63

	1:50	1:100
Average inflow (m ³ /s)	0.32	0.36

$$Q = Cbh^{3/2}$$

Penstock ring dimensions						Comment
Design Diameter (mm), D	350	500	510	750	900	-
Design Radius (mm), R	175	250	255	375	450	-
Length, b (mm)	1099	1570	1601.4	2355	2826	Weir perimeter
Distance from weir crest to water surface, h (mm)	0.205	0.205	0.202	0.205	0.205	-
H/R	1.171428571	0.82	0.792156863	0.546666667	0.455555556	-
Weir Coefficient, C	1.65	1.65	1.65	1.65	1.65	Values read from chart
Discharge Q, (m3/s), 1 intake	0.168310972	0.240444246	0.23988927	0.360666369	0.432799642	For 1 intake
Discharge Q, (m3/s), 2 intake	0.336621944	0.480888492	0.47977854	0.721332737	0.865599285	for 2 intakes
Days to remove 1:50	0.94	0.66	0.66	1.76	0.37	
Days to remove 1:100	1.06	0.74	0.74	0.99	0.41	

Penstock Pipeline Sizing

Manning is used to size penstock pipeline

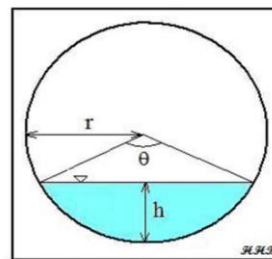
The conduit is only allowed to be 75% full at its maximum

Decant rate for design	0.72 m ³ /s
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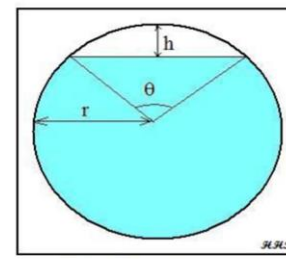
Assumed pipeline	Value
Diameter	0.65 m
Radius	0.325 m
Area	0.332 m ²
Effective Area (75% of total area)	0.249 m ²

Manning's parameter	Value	Units	Comment
Distance of conduit	1470	m	Horizontal
Height Difference	10	m	Vertical
Slope of conduit, S	147.00	-	Ratio 1 : 102.22
	0.68	%	
Wetted perimeter	1.36	m	Calculated using spread sheet
Wetted area, A	0.27	m ²	
Hydraulic radius, R	0.2	m	
Manning's coeff, n	0.013	-	Concrete pipe
Velocity, v	2.17	m/s	
Discharge Q, 1 outfall pipe	0.54	m ³ /s	1 Outfall pipe
Discharge Q, 2 outfall pipe	1.08	m ³ /s	2 Outfall pipes

A concrete conduit with internal radius of 0.325 m lying on a slope of 0.68% will flow at 0.54m3/s when 75% full. The pipe will be sufficient as the required flow is 0.72m3/s



Partially Full Pipe Flow Parameters
(Less Than Half Full)



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(More Than Half Full)

Equation 5.25, Manning Equation:

$$Q = \frac{k}{n} \cdot A \cdot R^{2/3} \cdot S^{1/2} \quad (5.25)$$

Where	Q	=	Discharge (m ³ /sec., ft ³ /sec.)
	k	=	Constant (1.00m ^{1/3} /m ^{1/3} SI, 1.49ft ^{1/3} /ft ^{1/3} U.S. customary)
	n	=	Manning's coefficient (unitless)
	A	=	Flow area (m ² , ft ²)
	R	=	Hydraulic radius (m, ft)
	S	=	Friction slope (m/m, ft/ft)