Sample1: P20 =40 microns

For n =1, particle size (mm) = 0.225

For n =2, particle size (mm) = 0.120

For n =3, particle size (mm) = 0.0675

For n =4, particle size (mm) = 0.0225

For n =1, amount read from PSD (%) = 14

For n =2, amount read from PSD (%) = 45.2

For n =3, amount read from PSD (%) = 19.6

For n =4, amount read from PSD (%) = 21.2

Critical deposition velocity (m/s) = 2.40 m/s

Critical laminar/turbulent transition velocity = 1.6 m/s

Deposition safety margin = 0.15 m/s

Operating flow velocity at Year 0 (m/s) = 2.6 m/s

Safety factor on friction loss calculations = 12%

Length of pipeline (km) = 187

Pressure drop (Mpa) = 18.092 (Single Pump Station with (2 operating + 1 standby) PD pump)

Specific weight of slurry (N/cum) =   16349.35

Discharge of slurry (cum/s) =   1.545

Efficiency of pump (%) = 80.00

Total required pump capacity (kW) = 34936.073

Total required pump capacity (hP) = 46831.198

Wave velocity for water hammer pressure (WHP) calculation (m/s) = 1036.60

WHP for worst condition of sudden valve closure at terminal valve station (Mpa) = 14.4917

Minimum time of valve closure for preventing WHP (s) =360.7960

Use of Carbon Steel Pipe 5L X65 is assumed

Pipe wall thickness required to sustain WHP (mm) = 5 mm throughout the length of pipeline

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Rupture Disc at Terminal Valve Station is recommended to decrease the wall thickness requirement for WHP

Pipe wall thickness required to sustain steady state hydraulic pressure (mm) = 13 mm at starting (Pump Station) decreasing uniformly to zero value at end of pipeline (Terminal Valve Station)

Variable pipe wall thickness along the length is recommended to counteract steady state hydraulic pressure and WHP optimally

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Settling velocity [unhindered(wo); hindered(w)]:

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n	wo(m/s)	w(m/s)
1	.03166666	.00704028
2	.01173122	.00200328
3	.00435532	.00069356
4	.00048392	.00007345

Normalized concentration of individual sizes(Cvj/Cvjf)

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y/D	n=1	n=2	n=3	n=4
.1	1.162	1.032	.999	.983
.2	1.121	1.025	.999	.987
.3	1.086	1.018	.999	.990
.4	1.045	1.010	.999	.994
.5	.996	1.000	.999	.998
.6	.947	.989	.999	1.003
.7	.905	.979	.998	1.007
.8	.870	.970	.998	1.011
.9	.828	.959	.997	1.015

Overall Concentration Profile:

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y/D	Cv(y)/Cvf	Cv(y)(%)
.1	1.03329	34.43958
.2	1.02496	34.16179
.3	1.01790	33.92652
.4	1.00921	33.63700
.5	.99872	33.28740
.6	.98790	32.92667
.7	.97840	32.61007
.8	.97029	32.33991
.9	.96024	32.00494

Wear at pipe bottom (mm/yr)= 0.61902860
Wear at pipe top (mm/yr)= 0.59430210
Pipe thickness provided (mm)= 20.0000
Pipe thickness available for wear (mm)= 7.0000
Life of pipe if not rotated periodically (yrs)= 11.3080
Life of pipe if rotated periodically (yrs)= 11.5385
Pipe diameter at end of life EOL (mm) = 884
Flow velocity to sustain required discharge (1.545 cum/s) in m/s = 2.517
Safe minimum operating velocity at EOL (m/s) = 2.46 m/s
Pipe will run without deposition for its entire life.