Clay Pipe Development Association Ltd

# Bedding construction and flow capacity of vitrified clay pipelines

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# Contents



Advice on the design of drains and sewers in vitrified clay may be obtained from:

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# Determining the bedding construction of vitrified clay pipelines

## Introduction

In October 1967, the Ministry of Housing and Local Government Working Party on the Design and Construction of Underground Pipe Sewers issued its Second Report (Ref. 1) in which were stated design methods and criteria to be used where rational structural design of underground pipelines was to be applied. The Department of the Environment subsequently set up a new Working Party with the title "Sewers and Water Mains" which produced its First Report in 1975 (Ref. 2). This report confirmed the design criteria of the Second Report and gave recommendations with regard to various types of minimum bedding. The Water Authorities Association's Sewers and Water Mains Committee recommended in their Information and Guidance Note No.4-11-02, revised bedding factors for vitrified clay drains and sewers. This was published by WRc in February 1988 (Ref. 7).

These recommendations have been applied in this booklet.

## Revised Bedding Factors

This revision is due to the results from a prolonged research programme carried out for the Clay Pipe Development Association Limited at the Water Research Centre and British Ceramic Research Limited. The revised bedding factors are for Classes F, B and S granular beddings as shown on Pages 26 and 27 of the Tables.

The revised bedding factors are:-

**Class F 1.9**

**Class B 2.5**

**Class S 2.5**

These revised bedding factors are used in the structural design of **only Vitrified Clay Pipelines**.

## Design Tables

### Arrangement of Design Tables

The Tables are in two parts. The first, Section One in the booklet, comprises 20 Tables of Design loads and minimum bedding load factors for the combination of fill loads and loads due to two types of traffic wheel loads on 100 mm to 600 mm diameter vitrified clay pipes. The second, Section Three in the booklet, consists of two Tables of fill loads, and two Tables of loads acting upon the pipeline due to traffic wheel loads acting on the surface of the fill.

### Computation of Design Tables

The 1967 Working Party Report recommended that the basis for the structural design of sewers should be the work of Marston, Spangler and Schlick. The Report did not give all the data needed in design, but referred to the National Building Studies Special Report 37 (Ref. 3) for the remainder of the data and methods of design. The Transport and Road Research Laboratory Simplified Tables of External Loads on Buried Pipelines (Ref. 6) used the same data. These have been used in combination with the Working Party's values in the computation of the Tables.

The following design data are laid down by the 1967 Report:

**Two Wheel Traffic Loads, Surcharge Loads, Impact Factors, Safety Margin, Bedding Factors.**

Those extracted from Simplified Tables (Ref. 6) are:

**The product of the settlement deflection ratio and projection ratio.**

**The product of the Rankine coefficient of active soil pressure and the coefficient of internal soil friction.**

**The product of the Rankine coefficient of active soil pressure and the coefficient of soil friction between the trench wall and the fill.**

The format of the Tables is that the height of fill upon the crown of pipe called "cover" is shown vertically and for each cover the other variables are shown horizontally across the page.

## Section One

### Tables 1 - 20

Each design load in Tables 1 - 20 is calculated as the fill load plus the load due to the appropriate traffic load. The fill load is the smaller of the loads shown in Tables 21 and 22 for a given cover, trench width and pipe diameter. The load due to traffic is taken from the appropriate Tables 23 or 24.

The design load is multiplied by the safety factor which both the 1975 Report and IGN 4-11-02 give as 1.25; the result is then divided by the crushing strength of the pipe to give the minimum bedding factor.

The smallest trench width given is the minimum width of trench in which a socketed pipe can be correctly laid. The trench widths increase on 0.1 m increments.

In Marston's original Trench theory the load on a pipeline with a fixed cover increased continually with increasing trench width. Professor Schlick established a convention by which the use of the Trench theory was limited to trenches narrower than a Transition Width beyond which the load was assumed to be constant. Trenches less than this width are termed Narrow; those greater Wide. It follows from this convention and the nature of the load formulae that a Transition Depth or

cover also exists for trenches of a fixed width. When cover is less than this depth the trench is Wide; when greater, Narrow.

The figures given in light type-face are those in which the fill load has been calculated by the Wide Trench Formula, and are always found above the step line which represents the Transition Depth. The figures in bold type-faces are calculated by the Narrow Trench Formula.

The beddings of pipelines with 1.0 m or less of cover require precautions to be taken besides those needed to resist the loads acting upon them. For this reason horizontal thin double lines have been drawn in Tables 1 - 20 between the covers of 1.0 m and 1.1 m.

The crushing strengths for flexibly jointed clay pipes for drains and sewers are given in Tables 4 and 5 of BS EN 295-1 1991 and the sampling procedures specified in BS EN 295-2 1991 enable these strengths to be used in design without application of an additional factor of safety.

**BS EN 295-1**

**Table 4 - Crushing strength (FN) in kN/m - DN100 and 150**

| Nominal size (DN) | Crushing strength (FN) | | |
|---|---|---|---|
| 100 | 22 | 28 | 34 |
| 150 | 22 | 28 | 34 |

Manufacturers may declare higher crushing strengths for DN100 and DN150 pipes, provided that the increase is in stages of 6kN/m.

**BS EN 295-1**

**Table 5 - Crushing strength (FN) in kN/m - ≥ DN200**

| Nominal Size (DN) | Class L | Class Number 95 | 120 | 160 | 200 |
|---|---|---|---|---|---|
| 200 | | | 24 | 32 | 40 |
| 225 | | | 28 | 36 | 45 |
| 250 | | | 30 | 40 | 50 |
| 300 | | | 36 | 48 | 60 |
| 350 | | | 42 | 56 | 70 |
| 400 | | 38 | 48 | 64 | |
| 450 | | 43 | 54 | 72 | |
| 500 | | 48 | 60 | 80 | |
| 600 | 48 | 57 | 72 | | |

## Section Two

### Construction of Trench Beddings

The bedding construction described for bedding pipes directly on the trench bottom, on flat granular beds and granular surround is as recommended by the 1975 Working Party Report. However the depth of granular material is reduced to a minimum of 50 mm for sleeve jointed vitrified clay pipes as given in IGN No. 4-11-02 (Ref. 7). The depth of selected fill above the pipes should be specified as 150 mm minimum, also as given in IGN No. 4-11-02.

### Bedding Factors

The Bedding Factors are as recommended by the 1975 Working Party Report for pipes laid on a trench bottom and as recommended in IGN 4-11-02 for granular beddings. The Bedding Factors for concrete cradle constructions are as given in Simplified Tables (Ref. 6) and for concrete surround in the ASCE book Gravity Sanitary Sewer Design and Construction (Ref. 11).

### Equivalent Water Load

The weight of water in a pipe running full generates an additional load, the equivalent water load on the pipe. This load is approximately three quarters of the weight of water in the pipe, and may be calculated from the equation in Reference 6.

$$\text{Equivalent water load} = \frac{3}{4}\left(\frac{\pi}{4}\right)\left(\frac{9.81}{10^6}\right) D^2 \quad \text{kN/m}$$

Where D is the pipe diameter (mm).

The extra load is not significant for pipe diameters used in these tables. However, for interest, the equivalent water load for pipes of 600 mm diameter is 2.08 kN/m.

Where it is desired to incorporate this load in design, it should be added to the design load given in the tables, the total multiplied by the safety factor of 1.25, and the result divided by the crushing strength of the pipe to give the minimum bedding factor.

## Section Three

### Table 21

Table 21 is for fill loads on vitrified clay pipes of 100 mm to 600 mm diameter in Wide Trench Conditions and gives the loads per metre on the pipes.

The design criteria used in this Table are:

a. The product of the Rankine coefficient of active soil pressure and the coefficient of internal friction of the soil = 0.19.

b. The product of the settlement deflection ratio and the projection ratio

   (i) For pipe diameters up to and including 300 mm = 0.7.

   (ii) For pipe diameters of 375 mm and greater = 0.5.

c. Density of fill = 2000 kg/m$^3$.

d. **Outside Diameter ($B_c$)**

| Nominal diameter (mm) | Outside diameter (mm) |
|---|---|
| 100 | 130 |
| 150 | 190 |
| 200 | 245 |
| 225 | 280 |
| 300 | 370 |
| 375 | 460 |
| 400 | 500 |
| 450 | 550 |
| 500 | 615 |
| 600 | 730 |

The values of 'a', 'b' and 'c' above have been taken from Simplified Tables (Ref. 6). The values of 'a' and 'c' are for damp clay and 'b' (i) is for fill loads on pipes in trenches where the bedding extends the whole width of the trench.

**Table 22**

Table 22 is for fill loads in Narrow Trench Conditions and gives the loads per metre on pipes in trenches of widths from 0.5 m to 2.6 m.

The design data used in this Table are:

e. The product of the Rankine coefficient of active soil pressure and the coefficient of internal friction between the trench wall and the fill = 0.13.

f. Density of fill = 2000 kg/m$^3$.

The values of 'e' and 'f' above have been taken from Simplified Tables (Ref. 6) for damp clay.

**Tables 23 and 24**

Tables 23 and 24 are for traffic wheel loads recommended for design in the Working Party Report and used in Simplified Tables (Ref. 6) and are:

Table 23 for sewers laid in fields, gardens and lightly trafficked access roads, where provision is to be made for two wheel loads, each of 30 kN static weight, spaced 0.9 m apart, acting simultaneously with an impact factor of 2.0.

Table 24 for sewers laid under main traffic routes and under roads to be used for temporary diversion of heavy traffic loads, each of 112.5 kN acting simultaneously with an impact factor included, arranged as in BS 5400 Part 2: 1978 Type HB road loading.

Sewers laid under all roads accessible to normal traffic need to be designed for heavy traffic wheel loads.

The mean load on a 1.0 m length of vitrified clay pipe caused by traffic wheel loads in the 'worst' position has been calculated by the use of of the integration of the Boussinesq Equation for the intensity of vertical load at a point in an elastic isotropic halfspace due to a point surcharge on the surface. This mean load has been stated as an intensity of load per metre. For pipelines at normal depths the distribution of load due to a vehicle tyre is sensibly uniform across the pipe width but when cover is very shallow there is a marked concentration of load on the centre line of the pipe. Spangler proposed to allow for this by reducing the bedding factor for shallow pipelines.

A more rational solution is to use the factor proposed by Clarke and Young in their paper 'Loads on Underground Pipes caused by Vehicle Wheels', published by the Institution of Civil Engineers in January 1962. This factor has been used in the calculation of the Tables herein and therefore no reduction of bedding factor need be made.

## References


1. M.O.H.L.G. Working Party on the Design and Construction of Underground Pipe Sewers, Second Report, H.M.S.O. 1967.
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4. Road Note No. 29. A guide to the structural design of flexible and rigid pavements for new roads, H.M.S.O., London, 1965.
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6. Simplified tables of external loads on buried pipelines, H.M.S.O. 1986.
7. Information and Guidance Note No. 4-11-02, Revised Bedding Factors for Vitrified Clay Drains and Sewers, WAA Sewers and Water Mains Committee, WRc Engineering, February 1988.
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10. Information and Guidance Note No. 4-08-01, Bedding and sidefill materials for buried pipelines. UK Water Industry Engineering and Operations Committee: Materials and Standards. WRc 1994.
11. Gravity Sanitary Sewer Design and Construction, American Society of Civil Engineers and the Water Pollution Control Federation, 1982.

# Section One

## Design Load Tables 1 - 20

## TABLE 1. DESIGN LOADS
## 100 mm DIAMETER PIPE

2 WHEELS 30kN
IMPACT FACTOR 2.0

| Cover | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 22 | 28 | 34 | 40 | kN/m | 22 | 28 | 34 | 40 | kN/m | 22 | 28 | 34 | 40 | kN/m | 22 | 28 | 34 | 40 | kN/m | 22 | 28 | 34 | 40 |
| 0.1 | 63.6 | 3.61 | 2.84 | 2.34 | 1.99 | 63.6 | 3.61 | 2.84 | 2.34 | 1.99 | 63.6 | 3.61 | 2.84 | 2.34 | 1.99 | 63.6 | 3.61 | 2.84 | 2.34 | 1.99 | 63.6 | 3.61 | 2.84 | 2.34 | 1.99 |
| 0.2 | 32.1 | 1.82 | 1.43 | 1.18 | 1.00 | 32.1 | 1.82 | 1.43 | 1.18 | 1.00 | 32.1 | 1.82 | 1.43 | 1.18 | 1.00 | 32.1 | 1.82 | 1.43 | 1.18 | 1.00 | 32.1 | 1.82 | 1.43 | 1.18 | 1.00 |
| 0.3 | 21.1 | 1.20 | 0.94 | 0.78 | 0.66 | 21.1 | 1.20 | 0.94 | 0.78 | 0.66 | 21.1 | 1.20 | 0.94 | 0.78 | 0.66 | 21.1 | 1.20 | 0.94 | 0.78 | 0.66 | 21.1 | 1.20 | 0.94 | 0.78 | 0.66 |
| 0.4 | 15.9 | 0.91 | 0.71 | 0.59 | 0.50 | 15.9 | 0.91 | 0.71 | 0.59 | 0.50 | 15.9 | 0.91 | 0.71 | 0.59 | 0.50 | 15.9 | 0.91 | 0.71 | 0.59 | 0.50 | 15.9 | 0.91 | 0.71 | 0.59 | 0.50 |
| 0.5 | 13.1 | 0.74 | 0.58 | 0.48 | 0.41 | 13.1 | 0.74 | 0.58 | 0.48 | 0.41 | 13.1 | 0.74 | 0.58 | 0.48 | 0.41 | 13.1 | 0.74 | 0.58 | 0.48 | 0.41 | 13.1 | 0.74 | 0.58 | 0.48 | 0.41 |
| 0.6 | 11.4 | 0.65 | 0.51 | 0.42 | 0.35 | 11.4 | 0.65 | 0.51 | 0.42 | 0.35 | 11.4 | 0.65 | 0.51 | 0.42 | 0.35 | 11.4 | 0.65 | 0.51 | 0.42 | 0.35 | 11.4 | 0.65 | 0.51 | 0.42 | 0.35 |
| 0.7 | 10.2 | 0.58 | 0.46 | 0.38 | 0.32 | 10.2 | 0.58 | 0.46 | 0.38 | 0.32 | 10.2 | 0.58 | 0.46 | 0.38 | 0.32 | 10.2 | 0.58 | 0.46 | 0.38 | 0.32 | 10.2 | 0.58 | 0.46 | 0.38 | 0.32 |
| 0.8 | 9.5 | 0.54 | 0.42 | 0.35 | 0.30 | 9.5 | 0.54 | 0.42 | 0.35 | 0.30 | 9.5 | 0.54 | 0.42 | 0.35 | 0.30 | 9.5 | 0.54 | 0.42 | 0.35 | 0.30 | 9.5 | 0.54 | 0.42 | 0.35 | 0.30 |
| 0.9 | 9.0 | 0.51 | 0.40 | 0.33 | 0.28 | 9.0 | 0.51 | 0.40 | 0.33 | 0.28 | 9.0 | 0.51 | 0.40 | 0.33 | 0.28 | 9.0 | 0.51 | 0.40 | 0.33 | 0.28 | 9.0 | 0.51 | 0.40 | 0.33 | 0.28 |
| 1.0 | 8.7 | 0.49 | 0.39 | 0.32 | 0.27 | 8.7 | 0.49 | 0.39 | 0.32 | 0.27 | 8.7 | 0.49 | 0.39 | 0.32 | 0.27 | 8.7 | 0.49 | 0.39 | 0.32 | 0.27 | 8.7 | 0.49 | 0.39 | 0.32 | 0.27 |
| 1.1 | 8.5 | 0.48 | 0.38 | 0.31 | 0.27 | 8.5 | 0.48 | 0.38 | 0.31 | 0.27 | 8.5 | 0.48 | 0.38 | 0.31 | 0.27 | 8.5 | 0.48 | 0.38 | 0.31 | 0.27 | 8.5 | 0.48 | 0.38 | 0.31 | 0.27 |
| 1.2 | 8.4 | 0.48 | 0.38 | 0.31 | 0.26 | 8.4 | 0.48 | 0.38 | 0.31 | 0.26 | 8.4 | 0.48 | 0.38 | 0.31 | 0.26 | 8.4 | 0.48 | 0.38 | 0.31 | 0.26 | 8.4 | 0.48 | 0.38 | 0.31 | 0.26 |
| 1.3 | 8.4 | 0.48 | 0.38 | 0.31 | 0.26 | 8.4 | 0.48 | 0.38 | 0.31 | 0.26 | 8.4 | 0.48 | 0.38 | 0.31 | 0.26 | 8.4 | 0.48 | 0.38 | 0.31 | 0.26 | 8.4 | 0.48 | 0.38 | 0.31 | 0.26 |
| 1.4 | 8.5 | 0.48 | 0.38 | 0.31 | 0.27 | 8.5 | 0.48 | 0.38 | 0.31 | 0.27 | 8.5 | 0.48 | 0.38 | 0.31 | 0.27 | 8.5 | 0.48 | 0.38 | 0.31 | 0.27 | 8.5 | 0.48 | 0.38 | 0.31 | 0.27 |
| 1.5 | 8.6 | 0.49 | 0.38 | 0.32 | 0.27 | 8.6 | 0.49 | 0.38 | 0.32 | 0.27 | 8.6 | 0.49 | 0.38 | 0.32 | 0.27 | 8.6 | 0.49 | 0.38 | 0.32 | 0.27 | 8.6 | 0.49 | 0.38 | 0.32 | 0.27 |
| 1.6 | 8.8 | 0.50 | 0.39 | 0.32 | 0.27 | 8.8 | 0.50 | 0.39 | 0.32 | 0.27 | 8.8 | 0.50 | 0.39 | 0.32 | 0.27 | 8.8 | 0.50 | 0.39 | 0.32 | 0.27 | 8.8 | 0.50 | 0.39 | 0.32 | 0.27 |
| 1.7 | 9.0 | 0.51 | 0.40 | 0.33 | 0.28 | 9.0 | 0.51 | 0.40 | 0.33 | 0.28 | 9.0 | 0.51 | 0.40 | 0.33 | 0.28 | 9.0 | 0.51 | 0.40 | 0.33 | 0.28 | 9.0 | 0.51 | 0.40 | 0.33 | 0.28 |
| 1.8 | 9.2 | 0.52 | 0.41 | 0.34 | 0.29 | 9.2 | 0.52 | 0.41 | 0.34 | 0.29 | 9.2 | 0.52 | 0.41 | 0.34 | 0.29 | 9.2 | 0.52 | 0.41 | 0.34 | 0.29 | 9.2 | 0.52 | 0.41 | 0.34 | 0.29 |
| 1.9 | 9.4 | 0.53 | 0.42 | 0.35 | 0.29 | 9.4 | 0.53 | 0.42 | 0.35 | 0.29 | 9.4 | 0.53 | 0.42 | 0.35 | 0.29 | 9.4 | 0.53 | 0.42 | 0.35 | 0.29 | 9.4 | 0.53 | 0.42 | 0.35 | 0.29 |
| 2.0 | 9.7 | 0.55 | 0.43 | 0.36 | 0.30 | 9.7 | 0.55 | 0.43 | 0.36 | 0.30 | 9.7 | 0.55 | 0.43 | 0.36 | 0.30 | 9.7 | 0.55 | 0.43 | 0.36 | 0.30 | 9.7 | 0.55 | 0.43 | 0.36 | 0.30 |
| 2.1 | 9.9 | 0.57 | 0.44 | 0.37 | 0.31 | 9.9 | 0.57 | 0.44 | 0.37 | 0.31 | 9.9 | 0.57 | 0.44 | 0.37 | 0.31 | 9.9 | 0.57 | 0.44 | 0.37 | 0.31 | 9.9 | 0.57 | 0.44 | 0.37 | 0.31 |
| 2.2 | 10.2 | 0.58 | 0.46 | 0.38 | 0.32 | 10.2 | 0.58 | 0.46 | 0.38 | 0.32 | 10.2 | 0.58 | 0.46 | 0.38 | 0.32 | 10.2 | 0.58 | 0.46 | 0.38 | 0.32 | 10.2 | 0.58 | 0.46 | 0.38 | 0.32 |
| 2.3 | 10.5 | 0.60 | 0.47 | 0.39 | 0.33 | 10.5 | 0.60 | 0.47 | 0.39 | 0.33 | 10.5 | 0.60 | 0.47 | 0.39 | 0.33 | 10.5 | 0.60 | 0.47 | 0.39 | 0.33 | 10.5 | 0.60 | 0.47 | 0.39 | 0.33 |
| 2.4 | 10.7 | 0.61 | 0.48 | 0.39 | 0.33 | 10.9 | 0.62 | 0.48 | 0.40 | 0.34 | 10.9 | 0.62 | 0.48 | 0.40 | 0.34 | 10.9 | 0.62 | 0.48 | 0.40 | 0.34 | 10.9 | 0.62 | 0.48 | 0.40 | 0.34 |
| 2.5 | 10.8 | 0.61 | 0.48 | 0.40 | 0.34 | 11.2 | 0.64 | 0.50 | 0.41 | 0.35 | 11.2 | 0.64 | 0.50 | 0.41 | 0.35 | 11.2 | 0.64 | 0.50 | 0.41 | 0.35 | 11.2 | 0.64 | 0.50 | 0.41 | 0.35 |
| 2.6 | 10.8 | 0.62 | 0.48 | 0.40 | 0.34 | 11.5 | 0.65 | 0.51 | 0.42 | 0.36 | 11.5 | 0.65 | 0.51 | 0.42 | 0.36 | 11.5 | 0.65 | 0.51 | 0.42 | 0.36 | 11.5 | 0.65 | 0.51 | 0.42 | 0.36 |
| 2.7 | 10.9 | 0.62 | 0.49 | 0.40 | 0.34 | 11.8 | 0.67 | 0.53 | 0.44 | 0.37 | 11.8 | 0.67 | 0.53 | 0.44 | 0.37 | 11.8 | 0.67 | 0.53 | 0.44 | 0.37 | 11.8 | 0.67 | 0.53 | 0.44 | 0.37 |
| 2.8 | 11.0 | 0.62 | 0.49 | 0.40 | 0.34 | 12.2 | 0.69 | 0.54 | 0.45 | 0.38 | 12.2 | 0.69 | 0.54 | 0.45 | 0.38 | 12.2 | 0.69 | 0.54 | 0.45 | 0.38 | 12.2 | 0.69 | 0.54 | 0.45 | 0.38 |
| 2.9 | 11.1 | 0.63 | 0.49 | 0.41 | 0.35 | 12.5 | 0.71 | 0.56 | 0.46 | 0.39 | 12.5 | 0.71 | 0.56 | 0.46 | 0.39 | 12.5 | 0.71 | 0.56 | 0.46 | 0.39 | 12.5 | 0.71 | 0.56 | 0.46 | 0.39 |
| 3.0 | 11.1 | 0.63 | 0.50 | 0.41 | 0.35 | 12.9 | 0.73 | 0.58 | 0.47 | 0.40 | 12.9 | 0.73 | 0.58 | 0.47 | 0.40 | 12.9 | 0.73 | 0.58 | 0.47 | 0.40 | 12.9 | 0.73 | 0.58 | 0.47 | 0.40 |
| 3.1 | 11.2 | 0.64 | 0.50 | 0.41 | 0.35 | 13.3 | 0.75 | 0.59 | 0.49 | 0.41 | 13.3 | 0.75 | 0.59 | 0.49 | 0.41 | 13.3 | 0.75 | 0.59 | 0.49 | 0.41 | 13.3 | 0.75 | 0.59 | 0.49 | 0.41 |
| 3.2 | 11.2 | 0.64 | 0.50 | 0.41 | 0.35 | 13.6 | 0.77 | 0.61 | 0.50 | 0.43 | 13.6 | 0.77 | 0.61 | 0.50 | 0.43 | 13.6 | 0.77 | 0.61 | 0.50 | 0.43 | 13.6 | 0.77 | 0.61 | 0.50 | 0.43 |
| 3.3 | 11.3 | 0.64 | 0.50 | 0.42 | 0.35 | 14.0 | 0.79 | 0.62 | 0.51 | 0.44 | 14.0 | 0.79 | 0.62 | 0.51 | 0.44 | 14.0 | 0.79 | 0.62 | 0.51 | 0.44 | 14.0 | 0.79 | 0.62 | 0.51 | 0.44 |
| 3.4 | 11.4 | 0.65 | 0.51 | 0.42 | 0.35 | 14.4 | 0.82 | 0.64 | 0.53 | 0.45 | 14.4 | 0.82 | 0.64 | 0.53 | 0.45 | 14.4 | 0.82 | 0.64 | 0.53 | 0.45 | 14.4 | 0.82 | 0.64 | 0.53 | 0.45 |
| 3.5 | 11.4 | 0.65 | 0.51 | 0.42 | 0.36 | 14.7 | 0.84 | 0.66 | 0.54 | 0.46 | 14.7 | 0.84 | 0.66 | 0.54 | 0.46 | 14.7 | 0.84 | 0.66 | 0.54 | 0.46 | 14.7 | 0.84 | 0.66 | 0.54 | 0.46 |
| 3.6 | 11.5 | 0.65 | 0.51 | 0.42 | 0.36 | 15.1 | 0.86 | 0.67 | 0.56 | 0.47 | 15.1 | 0.86 | 0.67 | 0.56 | 0.47 | 15.1 | 0.86 | 0.67 | 0.56 | 0.47 | 15.1 | 0.86 | 0.67 | 0.56 | 0.47 |
| 3.7 | 11.5 | 0.65 | 0.51 | 0.42 | 0.36 | 15.5 | 0.88 | 0.69 | 0.57 | 0.48 | 15.5 | 0.88 | 0.69 | 0.57 | 0.48 | 15.5 | 0.88 | 0.69 | 0.57 | 0.48 | 15.5 | 0.88 | 0.69 | 0.57 | 0.48 |
| 3.8 | 11.5 | 0.66 | 0.52 | 0.42 | 0.36 | 15.9 | 0.90 | 0.71 | 0.58 | 0.50 | 15.9 | 0.90 | 0.71 | 0.58 | 0.50 | 15.9 | 0.90 | 0.71 | 0.58 | 0.50 | 15.9 | 0.90 | 0.71 | 0.58 | 0.50 |
| 3.9 | 11.6 | 0.66 | 0.52 | 0.43 | 0.36 | 16.2 | 0.92 | 0.73 | 0.60 | 0.51 | 16.2 | 0.92 | 0.73 | 0.60 | 0.51 | 16.2 | 0.92 | 0.73 | 0.60 | 0.51 | 16.2 | 0.92 | 0.73 | 0.60 | 0.51 |
| 4.0 | 11.6 | 0.66 | 0.52 | 0.43 | 0.36 | 16.6 | 0.95 | 0.74 | 0.61 | 0.52 | 16.6 | 0.95 | 0.74 | 0.61 | 0.52 | 16.6 | 0.95 | 0.74 | 0.61 | 0.52 | 16.6 | 0.95 | 0.74 | 0.61 | 0.52 |
| 4.1 | 11.7 | 0.66 | 0.52 | 0.43 | 0.36 | 17.0 | 0.97 | 0.76 | 0.63 | 0.53 | 17.0 | 0.97 | 0.76 | 0.63 | 0.53 | 17.0 | 0.97 | 0.76 | 0.63 | 0.53 | 17.0 | 0.97 | 0.76 | 0.63 | 0.53 |
| 4.2 | 11.7 | 0.66 | 0.52 | 0.43 | 0.37 | 17.1 | 0.97 | 0.77 | 0.63 | 0.54 | 17.4 | 0.99 | 0.78 | 0.64 | 0.54 | 17.4 | 0.99 | 0.78 | 0.64 | 0.54 | 17.4 | 0.99 | 0.78 | 0.64 | 0.54 |
| 4.3 | 11.7 | 0.67 | 0.52 | 0.43 | 0.37 | 17.2 | 0.98 | 0.77 | 0.63 | 0.54 | 17.8 | 1.01 | 0.79 | 0.65 | 0.56 | 17.8 | 1.01 | 0.79 | 0.65 | 0.56 | 17.8 | 1.01 | 0.79 | 0.65 | 0.56 |
| 4.4 | 11.7 | 0.67 | 0.52 | 0.43 | 0.37 | 17.3 | 0.98 | 0.77 | 0.64 | 0.54 | 18.2 | 1.03 | 0.81 | 0.67 | 0.57 | 18.2 | 1.03 | 0.81 | 0.67 | 0.57 | 18.2 | 1.03 | 0.81 | 0.67 | 0.57 |
| 4.5 | 11.8 | 0.67 | 0.53 | 0.43 | 0.37 | 17.4 | 0.99 | 0.78 | 0.64 | 0.54 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 |
| 4.6 | 11.8 | 0.67 | 0.53 | 0.43 | 0.37 | 17.5 | 0.99 | 0.78 | 0.64 | 0.55 | 19.0 | 1.08 | 0.85 | 0.70 | 0.59 | 19.0 | 1.08 | 0.85 | 0.70 | 0.59 | 19.0 | 1.08 | 0.85 | 0.70 | 0.59 |
| 4.7 | 11.8 | 0.67 | 0.53 | 0.43 | 0.37 | 17.5 | 1.00 | 0.78 | 0.65 | 0.55 | 19.4 | 1.10 | 0.86 | 0.71 | 0.60 | 19.4 | 1.10 | 0.86 | 0.71 | 0.60 | 19.4 | 1.10 | 0.86 | 0.71 | 0.60 |
| 4.8 | 11.9 | 0.67 | 0.53 | 0.44 | 0.37 | 17.6 | 1.00 | 0.79 | 0.65 | 0.55 | 19.7 | 1.12 | 0.88 | 0.73 | 0.62 | 19.7 | 1.12 | 0.88 | 0.73 | 0.62 | 19.7 | 1.12 | 0.88 | 0.73 | 0.62 |
| 4.9 | 11.9 | 0.67 | 0.53 | 0.44 | 0.37 | 17.7 | 1.00 | 0.79 | 0.65 | 0.55 | 20.1 | 1.14 | 0.90 | 0.74 | 0.63 | 20.1 | 1.14 | 0.90 | 0.74 | 0.63 | 20.1 | 1.14 | 0.90 | 0.74 | 0.63 |
| 5.0 | 11.9 | 0.68 | 0.53 | 0.44 | 0.37 | 17.7 | 1.01 | 0.79 | 0.65 | 0.55 | 20.5 | 1.17 | 0.92 | 0.75 | 0.64 | 20.5 | 1.17 | 0.92 | 0.75 | 0.64 | 20.5 | 1.17 | 0.92 | 0.75 | 0.64 |
| 5.1 | 11.9 | 0.68 | 0.53 | 0.44 | 0.37 | 17.8 | 1.01 | 0.79 | 0.65 | 0.56 | 20.9 | 1.19 | 0.93 | 0.77 | 0.65 | 20.9 | 1.19 | 0.93 | 0.77 | 0.65 | 20.9 | 1.19 | 0.93 | 0.77 | 0.65 |
| 5.2 | 11.9 | 0.68 | 0.53 | 0.44 | 0.37 | 17.9 | 1.02 | 0.80 | 0.66 | 0.56 | 21.3 | 1.21 | 0.95 | 0.78 | 0.67 | 21.3 | 1.21 | 0.95 | 0.78 | 0.67 | 21.3 | 1.21 | 0.95 | 0.78 | 0.67 |
| 5.3 | 11.9 | 0.68 | 0.53 | 0.44 | 0.37 | 17.9 | 1.02 | 0.80 | 0.66 | 0.56 | 21.7 | 1.23 | 0.97 | 0.80 | 0.68 | 21.7 | 1.23 | 0.97 | 0.80 | 0.68 | 21.7 | 1.23 | 0.97 | 0.80 | 0.68 |
| 5.4 | 12.0 | 0.68 | 0.53 | 0.44 | 0.37 | 18.0 | 1.02 | 0.80 | 0.66 | 0.56 | 22.1 | 1.26 | 0.99 | 0.81 | 0.69 | 22.1 | 1.26 | 0.99 | 0.81 | 0.69 | 22.1 | 1.26 | 0.99 | 0.81 | 0.69 |
| 5.5 | 12.0 | 0.68 | 0.53 | 0.44 | 0.37 | 18.0 | 1.02 | 0.80 | 0.66 | 0.56 | 22.5 | 1.28 | 1.00 | 0.83 | 0.70 | 22.5 | 1.28 | 1.00 | 0.83 | 0.70 | 22.5 | 1.28 | 1.00 | 0.83 | 0.70 |
| 5.6 | 12.0 | 0.68 | 0.54 | 0.44 | 0.37 | 18.1 | 1.03 | 0.81 | 0.66 | 0.56 | 22.9 | 1.30 | 1.02 | 0.84 | 0.72 | 22.9 | 1.30 | 1.02 | 0.84 | 0.72 | 22.9 | 1.30 | 1.02 | 0.84 | 0.72 |
| 5.7 | 12.0 | 0.68 | 0.54 | 0.44 | 0.37 | 18.1 | 1.03 | 0.81 | 0.67 | 0.57 | 23.3 | 1.32 | 1.04 | 0.86 | 0.73 | 23.3 | 1.32 | 1.04 | 0.86 | 0.73 | 23.3 | 1.32 | 1.04 | 0.86 | 0.73 |
| 5.8 | 12.0 | 0.68 | 0.54 | 0.44 | 0.38 | 18.2 | 1.03 | 0.81 | 0.67 | 0.57 | 23.7 | 1.35 | 1.06 | 0.87 | 0.74 | 23.7 | 1.35 | 1.06 | 0.87 | 0.74 | 23.7 | 1.35 | 1.06 | 0.87 | 0.74 |
| 5.9 | 12.0 | 0.68 | 0.54 | 0.44 | 0.38 | 18.2 | 1.03 | 0.81 | 0.67 | 0.57 | 24.1 | 1.37 | 1.08 | 0.89 | 0.75 | 24.1 | 1.37 | 1.08 | 0.89 | 0.75 | 24.1 | 1.37 | 1.08 | 0.89 | 0.75 |
| 6.0 | 12.0 | 0.68 | 0.54 | 0.44 | 0.38 | 18.2 | 1.04 | 0.81 | 0.67 | 0.57 | 24.5 | 1.39 | 1.09 | 0.90 | 0.77 | 24.5 | 1.39 | 1.09 | 0.90 | 0.77 | 24.5 | 1.39 | 1.09 | 0.90 | 0.77 |
| 6.1 | 12.0 | 0.68 | 0.54 | 0.44 | 0.38 | 18.3 | 1.04 | 0.82 | 0.67 | 0.57 | 24.9 | 1.41 | 1.11 | 0.92 | 0.78 | 24.9 | 1.41 | 1.11 | 0.92 | 0.78 | 24.9 | 1.41 | 1.11 | 0.92 | 0.78 |
| 6.2 | 12.0 | 0.68 | 0.54 | 0.44 | 0.38 | 18.3 | 1.04 | 0.82 | 0.67 | 0.57 | 25.3 | 1.44 | 1.13 | 0.93 | 0.79 | 25.3 | 1.44 | 1.13 | 0.93 | 0.79 | 25.3 | 1.44 | 1.13 | 0.93 | 0.79 |
| 6.3 | 12.1 | 0.68 | 0.54 | 0.44 | 0.38 | 18.3 | 1.04 | 0.82 | 0.67 | 0.57 | 25.6 | 1.45 | 1.14 | 0.94 | 0.80 | 25.7 | 1.46 | 1.15 | 0.94 | 0.80 | 25.7 | 1.46 | 1.15 | 0.94 | 0.80 |
| 6.4 | 12.1 | 0.69 | 0.54 | 0.44 | 0.38 | 18.4 | 1.04 | 0.82 | 0.68 | 0.57 | 25.6 | 1.46 | 1.14 | 0.94 | 0.80 | 26.1 | 1.48 | 1.16 | 0.96 | 0.82 | 26.1 | 1.48 | 1.16 | 0.96 | 0.82 |
| 6.5 | 12.1 | 0.69 | 0.54 | 0.44 | 0.38 | 18.4 | 1.04 | 0.82 | 0.68 | 0.57 | 25.7 | 1.46 | 1.15 | 0.95 | 0.80 | 26.5 | 1.51 | 1.18 | 0.97 | 0.83 | 26.5 | 1.51 | 1.18 | 0.97 | 0.83 |
| 6.6 | 12.1 | 0.69 | 0.54 | 0.44 | 0.38 | 18.4 | 1.05 | 0.82 | 0.68 | 0.58 | 25.8 | 1.46 | 1.15 | 0.95 | 0.81 | 26.9 | 1.53 | 1.20 | 0.99 | 0.84 | 26.9 | 1.53 | 1.20 | 0.99 | 0.84 |
| 6.7 | 12.1 | 0.69 | 0.54 | 0.44 | 0.38 | 18.4 | 1.05 | 0.82 | 0.68 | 0.58 | 25.8 | 1.47 | 1.15 | 0.95 | 0.81 | 27.3 | 1.55 | 1.22 | 1.00 | 0.85 | 27.3 | 1.55 | 1.22 | 1.00 | 0.85 |
| 6.8 | 12.1 | 0.69 | 0.54 | 0.44 | 0.38 | 18.5 | 1.05 | 0.82 | 0.68 | 0.58 | 25.9 | 1.47 | 1.16 | 0.95 | 0.81 | 27.7 | 1.57 | 1.24 | 1.02 | 0.87 | 27.7 | 1.57 | 1.24 | 1.02 | 0.87 |
| 6.9 | 12.1 | 0.69 | 0.54 | 0.44 | 0.38 | 18.5 | 1.05 | 0.83 | 0.68 | 0.58 | 25.9 | 1.47 | 1.16 | 0.95 | 0.81 | 28.1 | 1.60 | 1.25 | 1.03 | 0.88 | 28.1 | 1.60 | 1.25 | 1.03 | 0.88 |
| 7.0 | 12.1 | 0.69 | 0.54 | 0.44 | 0.38 | 18.5 | 1.05 | 0.83 | 0.68 | 0.58 | 26.0 | 1.48 | 1.16 | 0.96 | 0.81 | 28.5 | 1.62 | 1.27 | 1.05 | 0.89 | 28.5 | 1.62 | 1.27 | 1.05 | 0.89 |
| 7.1 | 12.1 | 0.69 | 0.54 | 0.44 | 0.38 | 18.5 | 1.05 | 0.83 | 0.68 | 0.58 | 26.1 | 1.48 | 1.16 | 0.96 | 0.81 | 28.9 | 1.64 | 1.29 | 1.06 | 0.90 | 28.9 | 1.64 | 1.29 | 1.06 | 0.90 |
| 7.2 | 12.1 | 0.69 | 0.54 | 0.44 | 0.38 | 18.6 | 1.05 | 0.83 | 0.68 | 0.58 | 26.1 | 1.48 | 1.17 | 0.98 | 0.82 | 29.3 | 1.66 | 1.31 | 1.08 | 0.92 | 29.3 | 1.66 | 1.31 | 1.08 | 0.92 |
| 7.3 | 12.1 | 0.69 | 0.54 | 0.44 | 0.38 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 | 26.1 | 1.49 | 1.17 | 0.98 | 0.82 | 29.7 | 1.69 | 1.33 | 1.09 | 0.93 | 29.7 | 1.69 | 1.33 | 1.09 | 0.93 |
| 7.4 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 | 26.2 | 1.49 | 1.17 | 0.98 | 0.82 | 30.1 | 1.71 | 1.34 | 1.11 | 0.94 | 30.1 | 1.71 | 1.34 | 1.11 | 0.94 |
| 7.5 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 | 26.2 | 1.49 | 1.17 | 0.98 | 0.82 | 30.5 | 1.73 | 1.36 | 1.12 | 0.95 | 30.5 | 1.73 | 1.36 | 1.12 | 0.95 |
| 7.6 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 | 26.3 | 1.49 | 1.17 | 0.97 | 0.82 | 30.9 | 1.76 | 1.38 | 1.14 | 0.97 | 30.9 | 1.76 | 1.38 | 1.14 | 0.97 |
| 7.7 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.6 | 1.06 | 0.83 | 0.69 | 0.58 | 26.3 | 1.50 | 1.17 | 0.97 | 0.82 | 31.3 | 1.78 | 1.40 | 1.15 | 0.98 | 31.3 | 1.78 | 1.40 | 1.15 | 0.98 |
| 7.8 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.7 | 1.06 | 0.83 | 0.69 | 0.58 | 26.4 | 1.50 | 1.18 | 0.97 | 0.82 | 31.7 | 1.80 | 1.42 | 1.17 | 0.99 | 31.7 | 1.80 | 1.42 | 1.17 | 0.99 |
| 7.9 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.7 | 1.06 | 0.83 | 0.69 | 0.58 | 26.4 | 1.50 | 1.18 | 0.97 | 0.82 | 32.1 | 1.82 | 1.43 | 1.18 | 1.00 | 32.1 | 1.82 | 1.43 | 1.18 | 1.00 |
| 8.0 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.7 | 1.06 | 0.83 | 0.69 | 0.58 | 26.4 | 1.50 | 1.18 | 0.97 | 0.83 | 32.5 | 1.85 | 1.45 | 1.20 | 1.02 | 32.5 | 1.85 | 1.45 | 1.20 | 1.02 |
| 8.1 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.7 | 1.06 | 0.83 | 0.69 | 0.58 | 26.5 | 1.50 | 1.18 | 0.97 | 0.83 | 32.9 | 1.87 | 1.47 | 1.21 | 1.03 | 32.9 | 1.87 | 1.47 | 1.21 | 1.03 |
| 8.2 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.7 | 1.06 | 0.83 | 0.69 | 0.58 | 26.5 | 1.51 | 1.18 | 0.97 | 0.83 | 33.3 | 1.89 | 1.49 | 1.23 | 1.04 | 33.3 | 1.89 | 1.49 | 1.23 | 1.04 |
| 8.3 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.7 | 1.06 | 0.84 | 0.69 | 0.58 | 26.5 | 1.51 | 1.18 | 0.97 | 0.83 | 33.7 | 1.92 | 1.51 | 1.24 | 1.05 | 33.7 | 1.92 | 1.51 | 1.24 | 1.05 |
| 8.4 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.7 | 1.06 | 0.84 | 0.69 | 0.59 | 26.5 | 1.51 | 1.19 | 0.98 | 0.83 | 34.1 | 1.94 | 1.52 | 1.25 | 1.07 | 34.1 | 1.94 | 1.52 | 1.25 | 1.07 |
| 8.5 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.7 | 1.06 | 0.84 | 0.69 | 0.59 | 26.6 | 1.51 | 1.19 | 0.98 | 0.83 | 34.5 | 1.96 | 1.54 | 1.27 | 1.08 | 34.5 | 1.96 | 1.54 | 1.27 | 1.08 |
| 8.6 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.7 | 1.06 | 0.84 | 0.69 | 0.59 | 26.6 | 1.51 | 1.19 | 0.98 | 0.83 | 34.9 | 1.98 | 1.56 | 1.28 | 1.09 | 34.9 | 1.98 | 1.56 | 1.28 | 1.09 |
| 8.7 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.6 | 1.51 | 1.19 | 0.98 | 0.83 | 35.3 | 2.01 | 1.58 | 1.30 | 1.10 | 35.3 | 2.01 | 1.58 | 1.30 | 1.10 |
| 8.8 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.7 | 1.51 | 1.19 | 0.98 | 0.83 | 35.7 | 2.03 | 1.59 | 1.31 | 1.11 | 35.7 | 2.03 | 1.60 | 1.31 | 1.12 |
| 8.9 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.7 | 1.52 | 1.19 | 0.98 | 0.83 | 35.7 | 2.03 | 1.59 | 1.31 | 1.12 | 36.1 | 2.05 | 1.61 | 1.33 | 1.13 |
| 9.0 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.7 | 1.52 | 1.19 | 0.98 | 0.83 | 35.7 | 2.03 | 1.60 | 1.31 | 1.12 | 36.5 | 2.08 | 1.63 | 1.34 | 1.14 |
| 9.1 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.7 | 1.52 | 1.19 | 0.98 | 0.83 | 35.8 | 2.03 | 1.80 | 1.32 | 1.12 | 37.0 | 2.10 | 1.65 | 1.36 | 1.15 |
| 9.2 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.7 | 1.52 | 1.19 | 0.98 | 0.84 | 35.8 | 2.04 | 1.60 | 1.32 | 1.12 | 37.4 | 2.12 | 1.67 | 1.37 | 1.17 |
| 9.3 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.8 | 1.52 | 1.19 | 0.98 | 0.84 | 35.9 | 2.04 | 1.60 | 1.32 | 1.12 | 37.8 | 2.15 | 1.69 | 1.39 | 1.18 |
| 9.4 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.8 | 1.52 | 1.20 | 0.98 | 0.84 | 35.9 | 2.04 | 1.60 | 1.32 | 1.12 | 38.2 | 2.17 | 1.70 | 1.40 | 1.19 |
| 9.5 | 12.1 | 0.69 | 0.54 | 0.45 | 0.38 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.8 | 1.52 | 1.20 | 0.99 | 0.84 | 36.0 | 2.04 | 1.61 | 1.32 | 1.12 | 38.6 | 2.19 | 1.72 | 1.42 | 1.21 |
| Trench Width m | | 0.4 | | | | | 0.5 | | | | | 0.6 | | | | | 0.7 | | | | | 0.8 | | | |

**TABLE 2. DESIGN LOADS**
**150 mm DIAMETER PIPE**

2 WHEELS 30kN
IMPACT FACTOR 2.0

| Cover | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 22 | 28 | 34 | 40 | kN/m | 22 | 28 | 34 | 40 | kN/m | 22 | 28 | 34 | 40 | kN/m | 22 | 28 | 34 | 40 | kN/m | 22 | 28 | 34 | 40 |
| 0.6 | 16.5 | 0.93 | 0.73 | 0.60 | 0.51 | 16.5 | 0.93 | 0.73 | 0.60 | 0.51 | 16.5 | 0.93 | 0.73 | 0.60 | 0.51 | 16.5 | 0.93 | 0.73 | 0.60 | 0.51 | 16.5 | 0.93 | 0.73 | 0.60 | 0.51 |
| 0.7 | 14.9 | 0.84 | 0.66 | 0.55 | 0.46 | 14.9 | 0.84 | 0.66 | 0.55 | 0.46 | 14.9 | 0.84 | 0.66 | 0.55 | 0.46 | 14.9 | 0.84 | 0.66 | 0.55 | 0.46 | 14.9 | 0.84 | 0.66 | 0.55 | 0.46 |
| 0.8 | 13.8 | 0.78 | 0.62 | 0.51 | 0.43 | 13.8 | 0.78 | 0.62 | 0.51 | 0.43 | 13.8 | 0.78 | 0.62 | 0.51 | 0.43 | 13.8 | 0.78 | 0.62 | 0.51 | 0.43 | 13.8 | 0.78 | 0.62 | 0.51 | 0.43 |
| 0.9 | 13.1 | 0.75 | 0.59 | 0.48 | 0.41 | 13.1 | 0.75 | 0.59 | 0.48 | 0.41 | 13.1 | 0.75 | 0.59 | 0.48 | 0.41 | 13.1 | 0.75 | 0.59 | 0.48 | 0.41 | 13.1 | 0.75 | 0.59 | 0.48 | 0.41 |
| 1.0 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 |
| 1.1 | 12.4 | 0.71 | 0.55 | 0.46 | 0.39 | 12.4 | 0.71 | 0.55 | 0.46 | 0.39 | 12.4 | 0.71 | 0.55 | 0.46 | 0.39 | 12.4 | 0.71 | 0.55 | 0.46 | 0.39 | 12.4 | 0.71 | 0.55 | 0.46 | 0.39 |
| 1.2 | 12.3 | 0.70 | 0.55 | 0.45 | 0.38 | 12.3 | 0.70 | 0.55 | 0.45 | 0.38 | 12.3 | 0.70 | 0.55 | 0.45 | 0.38 | 12.3 | 0.70 | 0.55 | 0.45 | 0.38 | 12.3 | 0.70 | 0.55 | 0.45 | 0.38 |
| 1.3 | 12.3 | 0.70 | 0.55 | 0.45 | 0.38 | 12.3 | 0.70 | 0.55 | 0.45 | 0.38 | 12.3 | 0.70 | 0.55 | 0.45 | 0.38 | 12.3 | 0.70 | 0.55 | 0.45 | 0.38 | 12.3 | 0.70 | 0.55 | 0.45 | 0.38 |
| 1.4 | 12.4 | 0.70 | 0.55 | 0.46 | 0.39 | 12.4 | 0.70 | 0.55 | 0.46 | 0.39 | 12.4 | 0.70 | 0.55 | 0.46 | 0.39 | 12.4 | 0.70 | 0.55 | 0.46 | 0.39 | 12.4 | 0.70 | 0.55 | 0.46 | 0.39 |
| 1.5 | 12.6 | 0.71 | 0.56 | 0.46 | 0.39 | 12.6 | 0.71 | 0.56 | 0.46 | 0.39 | 12.6 | 0.71 | 0.56 | 0.46 | 0.39 | 12.6 | 0.71 | 0.56 | 0.46 | 0.39 | 12.6 | 0.71 | 0.56 | 0.46 | 0.39 |
| 1.6 | 12.8 | 0.73 | 0.57 | 0.47 | 0.40 | 12.8 | 0.73 | 0.57 | 0.47 | 0.40 | 12.8 | 0.73 | 0.57 | 0.47 | 0.40 | 12.8 | 0.73 | 0.57 | 0.47 | 0.40 | 12.8 | 0.73 | 0.57 | 0.47 | 0.40 |
| 1.7 | 13.1 | 0.74 | 0.58 | 0.48 | 0.41 | 13.1 | 0.74 | 0.58 | 0.48 | 0.41 | 13.1 | 0.74 | 0.58 | 0.48 | 0.41 | 13.1 | 0.74 | 0.58 | 0.48 | 0.41 | 13.1 | 0.74 | 0.58 | 0.48 | 0.41 |
| 1.8 | 13.4 | 0.76 | 0.60 | 0.49 | 0.42 | 13.4 | 0.76 | 0.60 | 0.49 | 0.42 | 13.4 | 0.76 | 0.60 | 0.49 | 0.42 | 13.4 | 0.76 | 0.60 | 0.49 | 0.42 | 13.4 | 0.76 | 0.60 | 0.49 | 0.42 |
| 1.9 | 13.7 | 0.78 | 0.61 | 0.50 | 0.43 | 13.7 | 0.78 | 0.61 | 0.50 | 0.43 | 13.7 | 0.78 | 0.61 | 0.50 | 0.43 | 13.7 | 0.78 | 0.61 | 0.50 | 0.43 | 13.7 | 0.78 | 0.61 | 0.50 | 0.43 |
| 2.0 | 14.1 | 0.80 | 0.63 | 0.52 | 0.44 | 14.1 | 0.80 | 0.63 | 0.52 | 0.44 | 14.1 | 0.80 | 0.63 | 0.52 | 0.44 | 14.1 | 0.80 | 0.63 | 0.52 | 0.44 | 14.1 | 0.80 | 0.63 | 0.52 | 0.44 |
| 2.1 | 14.5 | 0.82 | 0.65 | 0.53 | 0.45 | 14.5 | 0.82 | 0.65 | 0.53 | 0.45 | 14.5 | 0.82 | 0.65 | 0.53 | 0.45 | 14.5 | 0.82 | 0.65 | 0.53 | 0.45 | 14.5 | 0.82 | 0.65 | 0.53 | 0.45 |
| 2.2 | 14.8 | 0.84 | 0.66 | 0.54 | 0.46 | 14.9 | 0.85 | 0.67 | 0.55 | 0.47 | 14.9 | 0.85 | 0.67 | 0.55 | 0.47 | 14.9 | 0.85 | 0.67 | 0.55 | 0.47 | 14.9 | 0.85 | 0.67 | 0.55 | 0.47 |
| 2.3 | 15.0 | 0.85 | 0.67 | 0.55 | 0.47 | 15.4 | 0.87 | 0.69 | 0.57 | 0.48 | 15.4 | 0.87 | 0.69 | 0.57 | 0.48 | 15.4 | 0.87 | 0.69 | 0.57 | 0.48 | 15.4 | 0.87 | 0.69 | 0.57 | 0.48 |
| 2.4 | 15.1 | 0.86 | 0.68 | 0.58 | 0.47 | 15.8 | 0.90 | 0.71 | 0.58 | 0.50 | 15.8 | 0.90 | 0.71 | 0.58 | 0.50 | 15.8 | 0.90 | 0.71 | 0.58 | 0.50 | 15.8 | 0.90 | 0.71 | 0.58 | 0.50 |
| 2.5 | 15.3 | 0.87 | 0.68 | 0.58 | 0.48 | 16.3 | 0.93 | 0.73 | 0.60 | 0.51 | 16.3 | 0.93 | 0.73 | 0.60 | 0.51 | 16.3 | 0.93 | 0.73 | 0.60 | 0.51 | 16.3 | 0.93 | 0.73 | 0.60 | 0.51 |
| 2.6 | 15.4 | 0.88 | 0.69 | 0.57 | 0.48 | 16.8 | 0.95 | 0.75 | 0.62 | 0.53 | 16.8 | 0.95 | 0.75 | 0.62 | 0.53 | 16.8 | 0.95 | 0.75 | 0.62 | 0.53 | 16.8 | 0.95 | 0.75 | 0.62 | 0.53 |
| 2.7 | 15.6 | 0.89 | 0.70 | 0.57 | 0.49 | 17.3 | 0.98 | 0.77 | 0.64 | 0.54 | 17.3 | 0.98 | 0.77 | 0.64 | 0.54 | 17.3 | 0.98 | 0.77 | 0.64 | 0.54 | 17.3 | 0.98 | 0.77 | 0.64 | 0.54 |
| 2.8 | 15.7 | 0.89 | 0.70 | 0.58 | 0.49 | 17.8 | 1.01 | 0.79 | 0.65 | 0.56 | 17.8 | 1.01 | 0.79 | 0.65 | 0.56 | 17.8 | 1.01 | 0.79 | 0.65 | 0.56 | 17.8 | 1.01 | 0.79 | 0.65 | 0.56 |
| 2.9 | 15.9 | 0.90 | 0.71 | 0.58 | 0.50 | 18.3 | 1.04 | 0.82 | 0.67 | 0.57 | 18.3 | 1.04 | 0.82 | 0.67 | 0.57 | 18.3 | 1.04 | 0.82 | 0.67 | 0.57 | 18.3 | 1.04 | 0.82 | 0.67 | 0.57 |
| 3.0 | 16.0 | 0.91 | 0.72 | 0.59 | 0.50 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 |
| 3.1 | 16.2 | 0.92 | 0.72 | 0.59 | 0.50 | 19.4 | 1.10 | 0.86 | 0.71 | 0.60 | 19.4 | 1.10 | 0.86 | 0.71 | 0.60 | 19.4 | 1.10 | 0.86 | 0.71 | 0.60 | 19.4 | 1.10 | 0.86 | 0.71 | 0.60 |
| 3.2 | 16.3 | 0.93 | 0.73 | 0.60 | 0.51 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 |
| 3.3 | 16.4 | 0.93 | 0.73 | 0.60 | 0.51 | 20.4 | 1.16 | 0.91 | 0.75 | 0.64 | 20.4 | 1.16 | 0.91 | 0.75 | 0.64 | 20.4 | 1.16 | 0.91 | 0.75 | 0.64 | 20.4 | 1.16 | 0.91 | 0.75 | 0.64 |
| 3.4 | 16.5 | 0.94 | 0.74 | 0.61 | 0.52 | 21.0 | 1.19 | 0.94 | 0.77 | 0.66 | 21.0 | 1.19 | 0.94 | 0.77 | 0.66 | 21.0 | 1.19 | 0.94 | 0.77 | 0.66 | 21.0 | 1.19 | 0.94 | 0.77 | 0.66 |
| 3.5 | 16.6 | 0.95 | 0.74 | 0.61 | 0.52 | 21.5 | 1.22 | 0.96 | 0.79 | 0.67 | 21.5 | 1.22 | 0.96 | 0.79 | 0.67 | 21.5 | 1.22 | 0.96 | 0.79 | 0.67 | 21.5 | 1.22 | 0.96 | 0.79 | 0.67 |
| 3.6 | 16.8 | 0.95 | 0.75 | 0.62 | 0.52 | 22.1 | 1.25 | 0.98 | 0.81 | 0.69 | 22.1 | 1.25 | 0.98 | 0.81 | 0.69 | 22.1 | 1.25 | 0.98 | 0.81 | 0.69 | 22.1 | 1.25 | 0.98 | 0.81 | 0.69 |
| 3.7 | 16.9 | 0.96 | 0.75 | 0.62 | 0.53 | 22.4 | 1.28 | 1.00 | 0.83 | 0.70 | 22.6 | 1.28 | 1.01 | 0.83 | 0.71 | 22.6 | 1.28 | 1.01 | 0.83 | 0.71 | 22.6 | 1.28 | 1.01 | 0.83 | 0.71 |
| 3.8 | 17.0 | 0.96 | 0.76 | 0.62 | 0.53 | 22.6 | 1.29 | 1.01 | 0.83 | 0.71 | 23.2 | 1.32 | 1.03 | 0.85 | 0.72 | 23.2 | 1.32 | 1.03 | 0.85 | 0.72 | 23.2 | 1.32 | 1.03 | 0.85 | 0.72 |
| 3.9 | 17.1 | 0.97 | 0.76 | 0.63 | 0.53 | 22.8 | 1.30 | 1.02 | 0.84 | 0.71 | 23.7 | 1.35 | 1.06 | 0.87 | 0.74 | 23.7 | 1.35 | 1.06 | 0.87 | 0.74 | 23.7 | 1.35 | 1.06 | 0.87 | 0.74 |
| 4.0 | 17.2 | 0.97 | 0.77 | 0.63 | 0.54 | 23.0 | 1.31 | 1.03 | 0.85 | 0.72 | 24.3 | 1.38 | 1.08 | 0.89 | 0.76 | 24.3 | 1.38 | 1.08 | 0.89 | 0.76 | 24.3 | 1.38 | 1.08 | 0.89 | 0.76 |
| 4.1 | 17.2 | 0.96 | 0.77 | 0.63 | 0.54 | 23.2 | 1.32 | 1.03 | 0.85 | 0.72 | 24.9 | 1.41 | 1.11 | 0.91 | 0.78 | 24.9 | 1.41 | 1.11 | 0.91 | 0.78 | 24.9 | 1.41 | 1.11 | 0.91 | 0.78 |
| 4.2 | 17.3 | 0.98 | 0.77 | 0.64 | 0.54 | 23.3 | 1.33 | 1.04 | 0.86 | 0.73 | 25.4 | 1.44 | 1.13 | 0.93 | 0.79 | 25.4 | 1.44 | 1.13 | 0.93 | 0.79 | 25.4 | 1.44 | 1.13 | 0.93 | 0.79 |
| 4.3 | 17.4 | 0.99 | 0.78 | 0.64 | 0.54 | 23.5 | 1.34 | 1.05 | 0.86 | 0.73 | 26.0 | 1.48 | 1.16 | 0.96 | 0.81 | 26.0 | 1.48 | 1.16 | 0.96 | 0.81 | 26.0 | 1.48 | 1.16 | 0.96 | 0.81 |
| 4.4 | 17.5 | 0.99 | 0.78 | 0.64 | 0.55 | 23.7 | 1.34 | 1.06 | 0.87 | 0.74 | 26.5 | 1.51 | 1.19 | 0.98 | 0.83 | 26.5 | 1.51 | 1.19 | 0.98 | 0.83 | 26.5 | 1.51 | 1.19 | 0.98 | 0.83 |
| 4.5 | 17.6 | 1.00 | 0.78 | 0.65 | 0.55 | 23.8 | 1.35 | 1.06 | 0.88 | 0.74 | 27.1 | 1.54 | 1.21 | 1.00 | 0.85 | 27.1 | 1.54 | 1.21 | 1.00 | 0.85 | 27.1 | 1.54 | 1.21 | 1.00 | 0.85 |
| 4.6 | 17.6 | 1.00 | 0.79 | 0.65 | 0.55 | 24.0 | 1.36 | 1.07 | 0.88 | 0.75 | 27.7 | 1.57 | 1.24 | 1.02 | 0.87 | 27.7 | 1.57 | 1.24 | 1.02 | 0.87 | 27.7 | 1.57 | 1.24 | 1.02 | 0.87 |
| 4.7 | 17.7 | 1.01 | 0.79 | 0.65 | 0.55 | 24.1 | 1.37 | 1.08 | 0.89 | 0.75 | 28.3 | 1.61 | 1.26 | 1.04 | 0.88 | 28.3 | 1.61 | 1.26 | 1.04 | 0.88 | 28.3 | 1.61 | 1.26 | 1.04 | 0.88 |
| 4.8 | 17.8 | 1.01 | 0.79 | 0.65 | 0.56 | 24.2 | 1.38 | 1.08 | 0.89 | 0.76 | 28.8 | 1.64 | 1.29 | 1.06 | 0.90 | 28.8 | 1.64 | 1.29 | 1.06 | 0.90 | 28.8 | 1.64 | 1.29 | 1.06 | 0.90 |
| 4.9 | 17.8 | 1.01 | 0.80 | 0.68 | 0.56 | 24.3 | 1.38 | 1.09 | 0.90 | 0.76 | 29.4 | 1.67 | 1.31 | 1.08 | 0.92 | 29.4 | 1.67 | 1.31 | 1.08 | 0.92 | 29.4 | 1.67 | 1.31 | 1.08 | 0.92 |
| 5.0 | 17.9 | 1.02 | 0.80 | 0.66 | 0.56 | 24.5 | 1.39 | 1.09 | 0.90 | 0.76 | 30.0 | 1.70 | 1.34 | 1.10 | 0.94 | 30.0 | 1.70 | 1.34 | 1.10 | 0.94 | 30.0 | 1.70 | 1.34 | 1.10 | 0.94 |
| 5.1 | 17.9 | 1.02 | 0.80 | 0.66 | 0.56 | 24.6 | 1.40 | 1.10 | 0.90 | 0.77 | 30.6 | 1.74 | 1.36 | 1.12 | 0.96 | 30.6 | 1.74 | 1.36 | 1.12 | 0.96 | 30.6 | 1.74 | 1.36 | 1.12 | 0.96 |
| 5.2 | 18.0 | 1.02 | 0.80 | 0.66 | 0.56 | 24.7 | 1.40 | 1.10 | 0.91 | 0.77 | 31.1 | 1.77 | 1.39 | 1.14 | 0.97 | 31.1 | 1.77 | 1.39 | 1.14 | 0.97 | 31.1 | 1.77 | 1.39 | 1.14 | 0.97 |
| 5.3 | 18.0 | 1.02 | 0.81 | 0.66 | 0.56 | 24.8 | 1.41 | 1.11 | 0.91 | 0.78 | 31.7 | 1.80 | 1.42 | 1.17 | 0.99 | 31.7 | 1.80 | 1.42 | 1.17 | 0.99 | 31.7 | 1.80 | 1.42 | 1.17 | 0.99 |
| 5.4 | 18.1 | 1.03 | 0.81 | 0.66 | 0.57 | 24.9 | 1.42 | 1.11 | 0.92 | 0.78 | 32.3 | 1.84 | 1.44 | 1.19 | 1.01 | 32.3 | 1.84 | 1.44 | 1.19 | 1.01 | 32.3 | 1.84 | 1.44 | 1.19 | 1.01 |
| 5.5 | 18.1 | 1.03 | 0.81 | 0.87 | 0.57 | 25.0 | 1.42 | 1.12 | 0.92 | 0.78 | 32.5 | 1.85 | 1.45 | 1.20 | 1.02 | 32.9 | 1.87 | 1.47 | 1.21 | 1.03 | 32.9 | 1.87 | 1.47 | 1.21 | 1.03 |
| 5.6 | 18.2 | 1.03 | 0.81 | 0.67 | 0.57 | 25.1 | 1.43 | 1.12 | 0.92 | 0.78 | 32.7 | 1.86 | 1.46 | 1.20 | 1.02 | 33.5 | 1.05 | 33.5 | 1.90 | 1.49 | 1.23 | 1.05 | 1.90 | 1.49 | 1.23 |
| 5.7 | 18.2 | 1.03 | 0.81 | 0.87 | 0.57 | 25.2 | 1.43 | 1.12 | 0.93 | 0.79 | 32.8 | 1.87 | 1.47 | 1.21 | 1.03 | 34.0 | 1.93 | 1.52 | 1.25 | 1.06 | 34.0 | 1.93 | 1.52 | 1.25 | 1.06 |
| 5.8 | 18.3 | 1.04 | 0.81 | 0.87 | 0.57 | 25.3 | 1.44 | 1.13 | 0.93 | 0.79 | 33.0 | 1.87 | 1.47 | 1.21 | 1.03 | 34.6 | 1.97 | 1.55 | 1.27 | 1.08 | 34.6 | 1.97 | 1.55 | 1.27 | 1.08 |
| 5.9 | 18.3 | 1.04 | 0.82 | 0.67 | 0.57 | 25.4 | 1.44 | 1.13 | 0.93 | 0.79 | 33.1 | 1.88 | 1.48 | 1.22 | 1.04 | 35.2 | 2.00 | 1.57 | 1.29 | 1.10 | 35.2 | 2.00 | 1.57 | 1.29 | 1.10 |
| 6.0 | 18.3 | 1.04 | 0.82 | 0.87 | 0.57 | 25.4 | 1.45 | 1.14 | 0.94 | 0.79 | 33.3 | 1.89 | 1.49 | 1.22 | 1.04 | 35.8 | 2.03 | 1.60 | 1.32 | 1.12 | 35.8 | 2.03 | 1.60 | 1.32 | 1.12 |
| 6.1 | 18.4 | 1.04 | 0.82 | 0.67 | 0.57 | 25.5 | 1.45 | 1.14 | 0.94 | 0.80 | 33.4 | 1.90 | 1.49 | 1.23 | 1.04 | 36.4 | 2.07 | 1.62 | 1.34 | 1.14 | 36.4 | 2.07 | 1.62 | 1.34 | 1.14 |
| 6.2 | 18.4 | 1.04 | 0.82 | 0.68 | 0.57 | 25.6 | 1.45 | 1.14 | 0.94 | 0.80 | 33.5 | 1.91 | 1.50 | 1.23 | 1.05 | 37.0 | 2.10 | 1.65 | 1.36 | 1.15 | 37.0 | 2.10 | 1.65 | 1.36 | 1.15 |
| 6.3 | 18.4 | 1.05 | 0.82 | 0.68 | 0.58 | 25.7 | 1.46 | 1.15 | 0.94 | 0.80 | 33.7 | 1.91 | 1.50 | 1.24 | 1.05 | 37.5 | 2.13 | 1.68 | 1.38 | 1.17 | 37.5 | 2.13 | 1.68 | 1.38 | 1.17 |
| 6.4 | 18.4 | 1.05 | 0.82 | 0.88 | 0.58 | 25.7 | 1.46 | 1.15 | 0.95 | 0.80 | 33.8 | 1.92 | 1.51 | 1.24 | 1.06 | 38.1 | 2.17 | 1.70 | 1.40 | 1.19 | 38.1 | 2.17 | 1.70 | 1.40 | 1.19 |
| 6.5 | 18.5 | 1.05 | 0.82 | 0.68 | 0.58 | 25.8 | 1.47 | 1.15 | 0.95 | 0.81 | 33.9 | 1.93 | 1.51 | 1.25 | 1.06 | 38.7 | 2.20 | 1.73 | 1.42 | 1.21 | 38.7 | 2.20 | 1.73 | 1.42 | 1.21 |
| 6.6 | 18.5 | 1.05 | 0.83 | 0.68 | 0.58 | 25.8 | 1.47 | 1.15 | 0.95 | 0.81 | 34.0 | 1.93 | 1.52 | 1.25 | 1.06 | 39.3 | 2.23 | 1.75 | 1.44 | 1.23 | 39.3 | 2.23 | 1.75 | 1.44 | 1.23 |
| 6.7 | 18.5 | 1.05 | 0.83 | 0.68 | 0.58 | 25.9 | 1.47 | 1.16 | 0.95 | 0.81 | 34.1 | 1.94 | 1.52 | 1.25 | 1.07 | 39.9 | 2.27 | 1.78 | 1.47 | 1.25 | 39.9 | 2.27 | 1.78 | 1.47 | 1.25 |
| 6.8 | 18.5 | 1.06 | 0.83 | 0.68 | 0.58 | 26.0 | 1.48 | 1.16 | 0.95 | 0.81 | 34.2 | 1.95 | 1.53 | 1.26 | 1.07 | 40.5 | 2.30 | 1.81 | 1.49 | 1.26 | 40.5 | 2.30 | 1.81 | 1.49 | 1.26 |
| 6.9 | 18.6 | 1.05 | 0.83 | 0.68 | 0.58 | 26.0 | 1.48 | 1.16 | 0.96 | 0.81 | 34.3 | 1.95 | 1.53 | 1.26 | 1.07 | 41.0 | 2.33 | 1.83 | 1.51 | 1.28 | 41.0 | 2.33 | 1.83 | 1.51 | 1.28 |
| 7.0 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 | 26.1 | 1.48 | 1.16 | 0.96 | 0.81 | 34.4 | 1.96 | 1.54 | 1.27 | 1.08 | 41.6 | 2.37 | 1.86 | 1.53 | 1.30 | 41.6 | 2.37 | 1.86 | 1.53 | 1.30 |
| 7.1 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 | 26.1 | 1.48 | 1.17 | 0.96 | 0.82 | 34.5 | 1.96 | 1.54 | 1.27 | 1.08 | 42.2 | 2.40 | 1.88 | 1.55 | 1.32 | 42.2 | 2.40 | 1.88 | 1.55 | 1.32 |
| 7.2 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 | 26.2 | 1.49 | 1.17 | 0.96 | 0.82 | 34.6 | 1.97 | 1.55 | 1.27 | 1.08 | 42.8 | 2.43 | 1.91 | 1.57 | 1.34 | 42.8 | 2.43 | 1.91 | 1.57 | 1.34 |
| 7.3 | 18.6 | 1.06 | 0.83 | 0.89 | 0.58 | 26.2 | 1.49 | 1.17 | 0.96 | 0.82 | 34.7 | 1.97 | 1.55 | 1.28 | 1.08 | 43.4 | 2.47 | 1.94 | 1.60 | 1.36 | 43.4 | 2.47 | 1.94 | 1.60 | 1.36 |
| 7.4 | 18.7 | 1.06 | 0.83 | 0.69 | 0.58 | 28.3 | 1.49 | 1.17 | 0.97 | 0.82 | 34.8 | 1.98 | 1.55 | 1.28 | 1.09 | 44.0 | 2.50 | 1.96 | 1.62 | 1.37 | 44.0 | 2.50 | 1.96 | 1.62 | 1.37 |
| 7.5 | 18.7 | 1.06 | 0.83 | 0.69 | 0.58 | 28.3 | 1.49 | 1.17 | 0.97 | 0.82 | 34.9 | 1.98 | 1.56 | 1.28 | 1.09 | 44.3 | 2.51 | 1.98 | 1.63 | 1.38 | 44.6 | 2.53 | 1.99 | 1.64 | 1.39 |
| 7.6 | 18.7 | 1.06 | 0.83 | 0.69 | 0.58 | 26.3 | 1.50 | 1.18 | 0.97 | 0.82 | 35.0 | 1.99 | 1.56 | 1.29 | 1.09 | 44.4 | 2.52 | 1.98 | 1.63 | 1.39 | 45.2 | 2.57 | 2.02 | 1.66 | 1.41 |
| 7.7 | 18.7 | 1.06 | 0.83 | 0.69 | 0.58 | 26.4 | 1.50 | 1.18 | 0.97 | 0.82 | 35.0 | 1.99 | 1.56 | 1.29 | 1.09 | 44.5 | 2.53 | 1.99 | 1.64 | 1.39 | 45.7 | 2.60 | 2.04 | 1.68 | 1.43 |
| 7.8 | 18.7 | 1.06 | 0.84 | 0.69 | 0.58 | 26.4 | 1.50 | 1.18 | 0.97 | 0.83 | 35.1 | 1.99 | 1.57 | 1.29 | 1.10 | 44.6 | 2.54 | 1.99 | 1.64 | 1.39 | 46.3 | 2.63 | 2.07 | 1.70 | 1.45 |
| 7.9 | 18.7 | 1.06 | 0.84 | 0.69 | 0.59 | 26.4 | 1.50 | 1.18 | 0.97 | 0.83 | 35.2 | 2.00 | 1.57 | 1.29 | 1.10 | 44.7 | 2.54 | 2.00 | 1.65 | 1.40 | 46.9 | 2.67 | 2.09 | 1.72 | 1.47 |
| 8.0 | 18.7 | 1.06 | 0.84 | 0.69 | 0.59 | 26.5 | 1.50 | 1.18 | 0.97 | 0.83 | 35.2 | 2.00 | 1.57 | 1.30 | 1.10 | 44.9 | 2.55 | 2.00 | 1.65 | 1.40 | 47.5 | 2.70 | 2.12 | 1.75 | 1.48 |
| 8.1 | 18.7 | 1.06 | 0.84 | 0.69 | 0.59 | 26.5 | 1.51 | 1.18 | 0.97 | 0.83 | 35.3 | 2.01 | 1.58 | 1.30 | 1.10 | 45.0 | 2.58 | 2.01 | 1.65 | 1.41 | 48.1 | 2.73 | 2.15 | 1.77 | 1.50 |
| 8.2 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.5 | 1.51 | 1.18 | 0.98 | 0.83 | 35.4 | 2.01 | 1.58 | 1.30 | 1.11 | 45.1 | 2.56 | 2.01 | 1.66 | 1.41 | 48.7 | 2.77 | 2.17 | 1.79 | 1.52 |
| 8.3 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.6 | 1.51 | 1.19 | 0.98 | 0.83 | 35.4 | 2.01 | 1.58 | 1.30 | 1.11 | 45.2 | 2.57 | 2.02 | 1.66 | 1.41 | 49.3 | 2.80 | 2.20 | 1.81 | 1.54 |
| 8.4 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.6 | 1.51 | 1.19 | 0.98 | 0.83 | 35.5 | 2.02 | 1.58 | 1.30 | 1.11 | 45.3 | 2.57 | 2.02 | 1.66 | 1.42 | 49.9 | 2.83 | 2.23 | 1.83 | 1.56 |
| 8.5 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.6 | 1.51 | 1.19 | 0.98 | 0.83 | 35.5 | 2.02 | 1.59 | 1.31 | 1.11 | 45.4 | 2.58 | 2.03 | 1.67 | 1.42 | 50.4 | 2.87 | 2.25 | 1.85 | 1.58 |
| 8.6 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.6 | 1.51 | 1.19 | 0.98 | 0.83 | 35.6 | 2.02 | 1.59 | 1.31 | 1.11 | 45.5 | 2.58 | 2.03 | 1.67 | 1.42 | 51.0 | 2.90 | 2.28 | 1.88 | 1.59 |
| 8.7 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.7 | 1.52 | 1.19 | 0.98 | 0.83 | 35.6 | 2.03 | 1.59 | 1.31 | 1.11 | 45.6 | 2.59 | 2.03 | 1.68 | 1.42 | 51.6 | 2.93 | 2.30 | 1.90 | 1.61 |
| 8.8 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.7 | 1.52 | 1.19 | 0.98 | 0.83 | 35.7 | 2.03 | 1.59 | 1.31 | 1.12 | 45.7 | 2.59 | 2.04 | 1.68 | 1.43 | 52.2 | 2.97 | 2.33 | 1.92 | 1.63 |
| 8.9 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.7 | 1.52 | 1.19 | 0.98 | 0.83 | 35.7 | 2.03 | 1.60 | 1.31 | 1.12 | 45.7 | 2.60 | 2.04 | 1.68 | 1.43 | 52.8 | 3.00 | 2.36 | 1.94 | 1.65 |
| 9.0 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.7 | 1.52 | 1.19 | 0.98 | 0.84 | 35.8 | 2.03 | 1.60 | 1.32 | 1.12 | 45.8 | 2.60 | 2.05 | 1.68 | 1.43 | 53.4 | 3.03 | 2.38 | 1.96 | 1.67 |
| 9.1 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.8 | 1.52 | 1.19 | 0.98 | 0.84 | 35.8 | 2.04 | 1.60 | 1.32 | 1.12 | 45.9 | 2.61 | 2.06 | 1.69 | 1.43 | 54.0 | 3.07 | 2.41 | 1.98 | 1.69 |
| 9.2 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.8 | 1.52 | 1.20 | 0.98 | 0.84 | 35.9 | 2.04 | 1.60 | 1.32 | 1.12 | 46.0 | 2.61 | 2.05 | 1.69 | 1.44 | 54.6 | 3.10 | 2.44 | 2.01 | 1.71 |
| 9.3 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.8 | 1.52 | 1.20 | 0.99 | 0.84 | 35.9 | 2.04 | 1.60 | 1.32 | 1.12 | 46.1 | 2.62 | 2.06 | 1.69 | 1.44 | 55.2 | 3.13 | 2.46 | 2.03 | 1.72 |
| 9.4 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.8 | 1.52 | 1.20 | 0.99 | 0.84 | 36.0 | 2.04 | 1.61 | 1.32 | 1.12 | 46.1 | 2.62 | 2.06 | 1.70 | 1.44 | 55.8 | 3.17 | 2.49 | 2.05 | 1.74 |
| 9.5 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.8 | 1.52 | 1.20 | 0.99 | 0.84 | 36.0 | 2.06 | 1.81 | 1.32 | 1.12 | 46.2 | 2.62 | 2.06 | 1.70 | 1.44 | 56.3 | 3.20 | 2.52 | 2.07 | 1.76 |
| 9.6 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 26.9 | 1.53 | 1.20 | 0.99 | 0.84 | 36.0 | 2.05 | 1.61 | 1.32 | 1.13 | 46.3 | 2.63 | 2.07 | 1.70 | 1.45 | 56.9 | 3.23 | 2.54 | 2.09 | 1.78 |
| 9.7 | 18.9 | 1.07 | 0.84 | 0.69 | 0.59 | 26.9 | 1.53 | 1.20 | 0.99 | 0.84 | 36.1 | 2.05 | 1.61 | 1.33 | 1.13 | 46.3 | 2.63 | 2.07 | 1.70 | 1.45 | 57.5 | 3.27 | 2.57 | 2.11 | 1.80 |
| 9.8 | 18.9 | 1.07 | 0.84 | 0.69 | 0.59 | 26.9 | 1.53 | 1.20 | 0.99 | 0.84 | 36.1 | 2.05 | 1.61 | 1.33 | 1.13 | 46.4 | 2.64 | 2.07 | 1.71 | 1.45 | 57.6 | 3.27 | 2.57 | 2.12 | 1.80 |
| 9.9 | 18.9 | 1.07 | 0.84 | 0.69 | 0.59 | 26.9 | 1.53 | 1.20 | 0.99 | 0.84 | 36.1 | 2.05 | 1.61 | 1.33 | 1.13 | 46.5 | 2.64 | 2.07 | 1.71 | 1.45 | 57.7 | 3.28 | 2.58 | 2.12 | 1.80 |
| 10.0 | 18.9 | 1.07 | 0.84 | 0.69 | 0.59 | 26.9 | 1.53 | 1.20 | 0.99 | 0.84 | 36.2 | 2.06 | 1.61 | 1.33 | 1.13 | 46.5 | 2.64 | 2.08 | 1.71 | 1.45 | 57.8 | 3.28 | 2.58 | 2.13 | 1.81 |
| Trench Width m | | 0.5 | | | | | 0.6 | | | | | 0.7 | | | | | 0.8 | | | | | 0.9 | | | |

**TABLE 3. DESIGN LOADS**
**200 mm DIAMETER PIPE**

2 WHEELS 30kN
IMPACT FACTOR 2.0

| Cover | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 24 | 32 | 40 | kN/m | 24 | 32 | 40 | kN/m | 24 | 32 | 40 | kN/m | 24 | 32 | 40 | kN/m | 24 | 32 | 40 | kN/m | 24 | 32 | 40 |
| 0.6 | 21.0 | 1.09 | 0.82 | 0.66 | 21.0 | 1.09 | 0.82 | 0.66 | 21.0 | 1.09 | 0.82 | 0.66 | 21.0 | 1.09 | 0.82 | 0.66 | 21.0 | 1.09 | 0.82 | 0.66 | 21.0 | 1.09 | 0.82 | 0.66 |
| 0.7 | 19.0 | 0.99 | 0.74 | 0.59 | 19.0 | 0.99 | 0.74 | 0.59 | 19.0 | 0.99 | 0.74 | 0.59 | 19.0 | 0.99 | 0.74 | 0.59 | 19.0 | 0.99 | 0.74 | 0.59 | 19.0 | 0.99 | 0.74 | 0.59 |
| 0.8 | 17.7 | 0.92 | 0.69 | 0.55 | 17.7 | 0.92 | 0.69 | 0.55 | 17.7 | 0.92 | 0.69 | 0.55 | 17.7 | 0.92 | 0.69 | 0.55 | 17.7 | 0.92 | 0.69 | 0.55 | 17.7 | 0.92 | 0.69 | 0.55 |
| 0.9 | 16.8 | 0.88 | 0.66 | 0.53 | 16.8 | 0.88 | 0.66 | 0.53 | 16.8 | 0.88 | 0.66 | 0.53 | 16.8 | 0.88 | 0.66 | 0.53 | 16.8 | 0.88 | 0.66 | 0.53 | 16.8 | 0.88 | 0.66 | 0.53 |
| 1.0 | 16.3 | 0.85 | 0.64 | 0.51 | 16.3 | 0.85 | 0.64 | 0.51 | 16.3 | 0.85 | 0.64 | 0.51 | 16.3 | 0.85 | 0.64 | 0.51 | 16.3 | 0.85 | 0.64 | 0.51 | 16.3 | 0.85 | 0.64 | 0.51 |
| 1.1 | 16.0 | 0.83 | 0.62 | 0.50 | 16.0 | 0.83 | 0.62 | 0.50 | 16.0 | 0.83 | 0.62 | 0.50 | 16.0 | 0.83 | 0.62 | 0.50 | 16.0 | 0.83 | 0.62 | 0.50 | 16.0 | 0.83 | 0.62 | 0.50 |
| 1.2 | 15.8 | 0.82 | 0.62 | 0.49 | 15.8 | 0.82 | 0.62 | 0.49 | 15.8 | 0.82 | 0.62 | 0.49 | 15.8 | 0.82 | 0.62 | 0.49 | 15.8 | 0.82 | 0.62 | 0.49 | 15.8 | 0.82 | 0.62 | 0.49 |
| 1.3 | 15.8 | 0.82 | 0.62 | 0.49 | 15.8 | 0.82 | 0.62 | 0.49 | 15.8 | 0.82 | 0.62 | 0.49 | 15.8 | 0.82 | 0.62 | 0.49 | 15.8 | 0.82 | 0.62 | 0.49 | 15.8 | 0.82 | 0.62 | 0.49 |
| 1.4 | 16.0 | 0.83 | 0.62 | 0.50 | 16.0 | 0.83 | 0.62 | 0.50 | 16.0 | 0.83 | 0.62 | 0.50 | 16.0 | 0.83 | 0.62 | 0.50 | 16.0 | 0.83 | 0.62 | 0.50 | 16.0 | 0.83 | 0.62 | 0.50 |
| 1.5 | 16.2 | 0.84 | 0.63 | 0.51 | 16.2 | 0.84 | 0.63 | 0.51 | 16.2 | 0.84 | 0.63 | 0.51 | 16.2 | 0.84 | 0.63 | 0.51 | 16.2 | 0.84 | 0.63 | 0.51 | 16.2 | 0.84 | 0.63 | 0.51 |
| 1.6 | 16.5 | 0.86 | 0.64 | 0.51 | 16.5 | 0.86 | 0.64 | 0.51 | 16.5 | 0.86 | 0.64 | 0.51 | 16.5 | 0.86 | 0.64 | 0.51 | 16.5 | 0.86 | 0.64 | 0.51 | 16.5 | 0.86 | 0.64 | 0.51 |
| 1.7 | 16.8 | 0.88 | 0.66 | 0.53 | 16.8 | 0.88 | 0.66 | 0.53 | 16.8 | 0.88 | 0.66 | 0.53 | 16.8 | 0.88 | 0.66 | 0.53 | 16.8 | 0.88 | 0.66 | 0.53 | 16.8 | 0.88 | 0.66 | 0.53 |
| 1.8 | 17.2 | 0.90 | 0.67 | 0.54 | 17.2 | 0.90 | 0.67 | 0.54 | 17.2 | 0.90 | 0.67 | 0.54 | 17.2 | 0.90 | 0.67 | 0.54 | 17.2 | 0.90 | 0.67 | 0.54 | 17.2 | 0.90 | 0.67 | 0.54 |
| 1.9 | 17.7 | 0.92 | 0.69 | 0.55 | 17.7 | 0.92 | 0.69 | 0.55 | 17.7 | 0.92 | 0.69 | 0.55 | 17.7 | 0.92 | 0.69 | 0.55 | 17.7 | 0.92 | 0.69 | 0.55 | 17.7 | 0.92 | 0.69 | 0.55 |
| 2.0 | 18.2 | 0.95 | 0.71 | 0.57 | 18.2 | 0.95 | 0.71 | 0.57 | 18.2 | 0.95 | 0.71 | 0.57 | 18.2 | 0.95 | 0.71 | 0.57 | 18.2 | 0.95 | 0.71 | 0.57 | 18.2 | 0.95 | 0.71 | 0.57 |
| 2.1 | 18.7 | 0.97 | 0.73 | 0.58 | 18.7 | 0.97 | 0.73 | 0.58 | 18.7 | 0.97 | 0.73 | 0.58 | 18.7 | 0.97 | 0.73 | 0.58 | 18.7 | 0.97 | 0.73 | 0.58 | 18.7 | 0.97 | 0.73 | 0.58 |
| 2.2 | 19.2 | 1.00 | 0.75 | 0.60 | 19.2 | 1.00 | 0.75 | 0.60 | 19.2 | 1.00 | 0.75 | 0.60 | 19.2 | 1.00 | 0.75 | 0.60 | 19.2 | 1.00 | 0.75 | 0.60 | 19.2 | 1.00 | 0.75 | 0.60 |
| 2.3 | 19.5 | 1.01 | 0.76 | 0.61 | 19.8 | 1.03 | 0.77 | 0.62 | 19.8 | 1.03 | 0.77 | 0.62 | 19.8 | 1.03 | 0.77 | 0.62 | 19.8 | 1.03 | 0.77 | 0.62 | 19.8 | 1.03 | 0.77 | 0.62 |
| 2.4 | 19.7 | 1.03 | 0.77 | 0.62 | 20.4 | 1.06 | 0.80 | 0.64 | 20.4 | 1.06 | 0.80 | 0.64 | 20.4 | 1.06 | 0.80 | 0.64 | 20.4 | 1.06 | 0.80 | 0.64 | 20.4 | 1.06 | 0.80 | 0.64 |
| 2.5 | 20.0 | 1.04 | 0.78 | 0.62 | 21.0 | 1.09 | 0.82 | 0.66 | 21.0 | 1.09 | 0.82 | 0.66 | 21.0 | 1.09 | 0.82 | 0.66 | 21.0 | 1.09 | 0.82 | 0.66 | 21.0 | 1.09 | 0.82 | 0.66 |
| 2.6 | 20.2 | 1.05 | 0.79 | 0.63 | 21.6 | 1.13 | 0.85 | 0.68 | 21.6 | 1.13 | 0.85 | 0.68 | 21.6 | 1.13 | 0.85 | 0.68 | 21.6 | 1.13 | 0.85 | 0.68 | 21.6 | 1.13 | 0.85 | 0.68 |
| 2.7 | 20.5 | 1.07 | 0.80 | 0.64 | 22.3 | 1.16 | 0.87 | 0.70 | 22.3 | 1.16 | 0.87 | 0.70 | 22.3 | 1.16 | 0.87 | 0.70 | 22.3 | 1.16 | 0.87 | 0.70 | 22.3 | 1.16 | 0.87 | 0.70 |
| 2.8 | 20.7 | 1.08 | 0.81 | 0.65 | 22.9 | 1.19 | 0.90 | 0.72 | 22.9 | 1.19 | 0.90 | 0.72 | 22.9 | 1.19 | 0.90 | 0.72 | 22.9 | 1.19 | 0.90 | 0.72 | 22.9 | 1.19 | 0.90 | 0.72 |
| 2.9 | 21.0 | 1.09 | 0.82 | 0.66 | 23.6 | 1.23 | 0.92 | 0.74 | 23.6 | 1.23 | 0.92 | 0.74 | 23.6 | 1.23 | 0.92 | 0.74 | 23.6 | 1.23 | 0.92 | 0.74 | 23.6 | 1.23 | 0.92 | 0.74 |
| 3.0 | 21.2 | 1.10 | 0.83 | 0.65 | 24.3 | 1.26 | 0.95 | 0.76 | 24.3 | 1.26 | 0.95 | 0.76 | 24.3 | 1.26 | 0.95 | 0.76 | 24.3 | 1.26 | 0.95 | 0.76 | 24.3 | 1.26 | 0.95 | 0.76 |
| 3.1 | 21.4 | 1.12 | 0.84 | 0.67 | 24.9 | 1.30 | 0.97 | 0.78 | 24.9 | 1.30 | 0.97 | 0.78 | 24.9 | 1.30 | 0.97 | 0.78 | 24.9 | 1.30 | 0.97 | 0.78 | 24.9 | 1.30 | 0.97 | 0.78 |
| 3.2 | 21.7 | 1.13 | 0.85 | 0.68 | 25.6 | 1.33 | 1.00 | 0.80 | 25.6 | 1.33 | 1.00 | 0.80 | 25.6 | 1.33 | 1.00 | 0.80 | 25.6 | 1.33 | 1.00 | 0.80 | 25.6 | 1.33 | 1.00 | 0.80 |
| 3.3 | 21.9 | 1.14 | 0.85 | 0.68 | 26.3 | 1.37 | 1.03 | 0.82 | 26.3 | 1.37 | 1.03 | 0.82 | 26.3 | 1.37 | 1.03 | 0.82 | 26.3 | 1.37 | 1.03 | 0.82 | 26.3 | 1.37 | 1.03 | 0.82 |
| 3.4 | 22.1 | 1.15 | 0.86 | 0.69 | 27.0 | 1.41 | 1.06 | 0.84 | 27.0 | 1.41 | 1.06 | 0.84 | 27.0 | 1.41 | 1.06 | 0.84 | 27.0 | 1.41 | 1.06 | 0.84 | 27.0 | 1.41 | 1.06 | 0.84 |
| 3.5 | 22.3 | 1.16 | 0.87 | 0.70 | 27.7 | 1.44 | 1.08 | 0.87 | 27.7 | 1.44 | 1.08 | 0.87 | 27.7 | 1.44 | 1.08 | 0.87 | 27.7 | 1.44 | 1.08 | 0.87 | 27.7 | 1.44 | 1.08 | 0.87 |
| 3.6 | 22.5 | 1.17 | 0.88 | 0.70 | 28.3 | 1.47 | 1.10 | 0.68 | 28.4 | 1.48 | 1.11 | 0.89 | 28.4 | 1.48 | 1.11 | 0.89 | 28.4 | 1.48 | 1.11 | 0.89 | 28.4 | 1.48 | 1.11 | 0.89 |
| 3.7 | 22.7 | 1.18 | 0.89 | 0.71 | 28.6 | 1.49 | 1.12 | 0.69 | 29.1 | 1.52 | 1.14 | 0.91 | 29.1 | 1.52 | 1.14 | 0.91 | 29.1 | 1.52 | 1.14 | 0.91 | 29.1 | 1.52 | 1.14 | 0.91 |
| 3.8 | 22.9 | 1.19 | 0.89 | 0.71 | 28.9 | 1.50 | 1.13 | 0.90 | 29.9 | 1.55 | 1.17 | 0.93 | 29.9 | 1.55 | 1.17 | 0.93 | 29.9 | 1.55 | 1.17 | 0.93 | 29.9 | 1.55 | 1.17 | 0.93 |
| 3.9 | 23.0 | 1.20 | 0.90 | 0.72 | 29.2 | 1.52 | 1.14 | 0.91 | 30.6 | 1.59 | 1.19 | 0.96 | 30.6 | 1.59 | 1.19 | 0.96 | 30.6 | 1.59 | 1.19 | 0.96 | 30.6 | 1.59 | 1.19 | 0.96 |
| 4.0 | 23.2 | 1.21 | 0.91 | 0.72 | 29.4 | 1.53 | 1.15 | 0.92 | 31.3 | 1.63 | 1.22 | 0.98 | 31.3 | 1.63 | 1.22 | 0.98 | 31.3 | 1.63 | 1.22 | 0.98 | 31.3 | 1.63 | 1.22 | 0.98 |
| 4.1 | 23.4 | 1.22 | 0.91 | 0.73 | 29.7 | 1.55 | 1.16 | 0.93 | 32.0 | 1.67 | 1.25 | 1.00 | 32.0 | 1.67 | 1.25 | 1.00 | 32.0 | 1.67 | 1.25 | 1.00 | 32.0 | 1.67 | 1.25 | 1.00 |
| 4.2 | 23.5 | 1.23 | 0.92 | 0.74 | 30.0 | 1.56 | 1.17 | 0.94 | 32.7 | 1.71 | 1.28 | 1.02 | 32.7 | 1.71 | 1.28 | 1.02 | 32.7 | 1.71 | 1.28 | 1.02 | 32.7 | 1.71 | 1.28 | 1.02 |
| 4.3 | 23.7 | 1.23 | 0.92 | 0.74 | 30.2 | 1.57 | 1.18 | 0.94 | 33.5 | 1.74 | 1.31 | 1.05 | 33.5 | 1.74 | 1.31 | 1.05 | 33.5 | 1.74 | 1.31 | 1.05 | 33.5 | 1.74 | 1.31 | 1.05 |
| 4.4 | 23.8 | 1.24 | 0.93 | 0.74 | 30.5 | 1.59 | 1.19 | 0.95 | 34.2 | 1.78 | 1.34 | 1.07 | 34.2 | 1.78 | 1.34 | 1.07 | 34.2 | 1.78 | 1.34 | 1.07 | 34.2 | 1.78 | 1.34 | 1.07 |
| 4.5 | 24.0 | 1.25 | 0.94 | 0.75 | 30.7 | 1.60 | 1.20 | 0.96 | 34.9 | 1.82 | 1.37 | 1.09 | 34.9 | 1.82 | 1.37 | 1.09 | 34.9 | 1.82 | 1.37 | 1.09 | 34.9 | 1.82 | 1.37 | 1.09 |
| 4.6 | 24.1 | 1.26 | 0.94 | 0.75 | 30.9 | 1.61 | 1.21 | 0.97 | 35.7 | 1.86 | 1.39 | 1.12 | 35.7 | 1.86 | 1.39 | 1.12 | 35.7 | 1.86 | 1.39 | 1.12 | 35.7 | 1.86 | 1.39 | 1.12 |
| 4.7 | 24.2 | 1.26 | 0.95 | 0.76 | 31.1 | 1.62 | 1.22 | 0.97 | 36.4 | 1.90 | 1.42 | 1.14 | 36.4 | 1.90 | 1.42 | 1.14 | 36.4 | 1.90 | 1.42 | 1.14 | 36.4 | 1.90 | 1.42 | 1.14 |
| 4.8 | 24.4 | 1.27 | 0.95 | 0.76 | 31.3 | 1.63 | 1.22 | 0.98 | 37.2 | 1.94 | 1.45 | 1.16 | 37.2 | 1.94 | 1.45 | 1.16 | 37.2 | 1.94 | 1.45 | 1.16 | 37.2 | 1.94 | 1.45 | 1.16 |
| 4.9 | 24.5 | 1.27 | 0.96 | 0.76 | 31.5 | 1.64 | 1.23 | 0.99 | 37.9 | 1.97 | 1.48 | 1.18 | 37.9 | 1.97 | 1.48 | 1.18 | 37.9 | 1.97 | 1.48 | 1.18 | 37.9 | 1.97 | 1.48 | 1.18 |
| 5.0 | 24.6 | 1.28 | 0.96 | 0.77 | 31.7 | 1.65 | 1.24 | 0.99 | 38.6 | 2.01 | 1.51 | 1.21 | 38.6 | 2.01 | 1.51 | 1.21 | 38.6 | 2.01 | 1.51 | 1.21 | 38.6 | 2.01 | 1.51 | 1.21 |
| 5.1 | 24.7 | 1.29 | 0.96 | 0.77 | 31.9 | 1.66 | 1.25 | 1.00 | 39.4 | 2.05 | 1.54 | 1.23 | 39.4 | 2.05 | 1.54 | 1.23 | 39.4 | 2.05 | 1.54 | 1.23 | 39.4 | 2.05 | 1.54 | 1.23 |
| 5.2 | 24.8 | 1.29 | 0.97 | 0.78 | 32.1 | 1.67 | 1.25 | 1.00 | 39.9 | 2.08 | 1.56 | 1.25 | 40.1 | 2.09 | 1.57 | 1.25 | 40.1 | 2.09 | 1.57 | 1.25 | 40.1 | 2.09 | 1.57 | 1.25 |
| 5.3 | 24.9 | 1.30 | 0.97 | 0.78 | 32.3 | 1.68 | 1.26 | 1.01 | 40.1 | 2.09 | 1.57 | 1.25 | 40.9 | 2.13 | 1.60 | 1.28 | 40.9 | 2.13 | 1.60 | 1.28 | 40.9 | 2.13 | 1.60 | 1.28 |
| 5.4 | 25.0 | 1.30 | 0.98 | 0.78 | 32.5 | 1.69 | 1.27 | 1.01 | 40.4 | 2.10 | 1.58 | 1.26 | 41.6 | 2.17 | 1.63 | 1.30 | 41.6 | 2.17 | 1.63 | 1.30 | 41.6 | 2.17 | 1.63 | 1.30 |
| 5.5 | 25.1 | 1.31 | 0.98 | 0.78 | 32.6 | 1.70 | 1.27 | 1.02 | 40.7 | 2.12 | 1.59 | 1.27 | 42.4 | 2.21 | 1.66 | 1.32 | 42.4 | 2.21 | 1.66 | 1.32 | 42.4 | 2.21 | 1.66 | 1.32 |
| 5.6 | 25.2 | 1.31 | 0.98 | 0.79 | 32.8 | 1.71 | 1.28 | 1.02 | 40.9 | 2.13 | 1.60 | 1.28 | 43.1 | 2.25 | 1.68 | 1.35 | 43.1 | 2.25 | 1.68 | 1.35 | 43.1 | 2.25 | 1.68 | 1.35 |
| 5.7 | 25.3 | 1.32 | 0.99 | 0.79 | 32.9 | 1.72 | 1.29 | 1.03 | 41.1 | 2.14 | 1.61 | 1.29 | 43.9 | 2.28 | 1.71 | 1.37 | 43.9 | 2.28 | 1.71 | 1.37 | 43.9 | 2.28 | 1.71 | 1.37 |
| 5.8 | 25.4 | 1.32 | 0.99 | 0.79 | 33.1 | 1.72 | 1.29 | 1.03 | 41.4 | 2.15 | 1.62 | 1.29 | 44.6 | 2.32 | 1.74 | 1.39 | 44.6 | 2.32 | 1.74 | 1.39 | 44.6 | 2.32 | 1.74 | 1.39 |
| 5.9 | 25.4 | 1.33 | 0.99 | 0.80 | 33.2 | 1.73 | 1.30 | 1.04 | 41.6 | 2.17 | 1.62 | 1.30 | 45.4 | 2.36 | 1.77 | 1.42 | 45.4 | 2.36 | 1.77 | 1.42 | 45.4 | 2.36 | 1.77 | 1.42 |
| 6.0 | 25.5 | 1.33 | 1.00 | 0.80 | 33.4 | 1.74 | 1.30 | 1.04 | 41.8 | 2.18 | 1.63 | 1.31 | 46.1 | 2.40 | 1.80 | 1.44 | 46.1 | 2.40 | 1.80 | 1.44 | 46.1 | 2.40 | 1.80 | 1.44 |
| 6.1 | 25.6 | 1.33 | 1.00 | 0.80 | 33.5 | 1.74 | 1.31 | 1.05 | 42.0 | 2.19 | 1.64 | 1.31 | 46.9 | 2.44 | 1.83 | 1.46 | 46.9 | 2.44 | 1.83 | 1.46 | 46.9 | 2.44 | 1.83 | 1.46 |
| 6.2 | 25.7 | 1.34 | 1.00 | 0.80 | 33.6 | 1.75 | 1.31 | 1.05 | 42.2 | 2.20 | 1.65 | 1.32 | 47.6 | 2.48 | 1.86 | 1.49 | 47.6 | 2.48 | 1.86 | 1.49 | 47.6 | 2.48 | 1.86 | 1.49 |
| 6.3 | 25.7 | 1.34 | 1.01 | 0.80 | 33.8 | 1.76 | 1.32 | 1.05 | 42.4 | 2.21 | 1.66 | 1.32 | 48.4 | 2.52 | 1.89 | 1.51 | 48.4 | 2.52 | 1.89 | 1.51 | 48.4 | 2.52 | 1.89 | 1.51 |
| 6.4 | 25.8 | 1.34 | 1.01 | 0.81 | 33.9 | 1.76 | 1.32 | 1.08 | 42.6 | 2.22 | 1.66 | 1.33 | 49.1 | 2.56 | 1.92 | 1.54 | 49.1 | 2.56 | 1.92 | 1.54 | 49.1 | 2.56 | 1.92 | 1.54 |
| 6.5 | 25.9 | 1.35 | 1.01 | 0.81 | 34.0 | 1.77 | 1.33 | 1.08 | 42.8 | 2.23 | 1.67 | 1.34 | 49.9 | 2.60 | 1.95 | 1.56 | 49.9 | 2.60 | 1.95 | 1.56 | 49.9 | 2.60 | 1.95 | 1.56 |
| 6.6 | 25.9 | 1.35 | 1.01 | 0.81 | 34.1 | 1.78 | 1.33 | 1.07 | 42.9 | 2.24 | 1.68 | 1.34 | 50.6 | 2.64 | 1.98 | 1.58 | 50.6 | 2.64 | 1.98 | 1.58 | 50.6 | 2.64 | 1.98 | 1.58 |
| 6.7 | 26.0 | 1.35 | 1.01 | 0.81 | 34.2 | 1.78 | 1.34 | 1.07 | 43.1 | 2.25 | 1.68 | 1.35 | 51.4 | 2.68 | 2.01 | 1.61 | 51.4 | 2.68 | 2.01 | 1.61 | 51.4 | 2.68 | 2.01 | 1.61 |
| 6.8 | 26.0 | 1.36 | 1.02 | 0.81 | 34.3 | 1.79 | 1.34 | 1.07 | 43.3 | 2.25 | 1.69 | 1.35 | 52.1 | 2.72 | 2.04 | 1.63 | 52.1 | 2.72 | 2.04 | 1.63 | 52.1 | 2.72 | 2.04 | 1.63 |
| 6.9 | 26.1 | 1.36 | 1.02 | 0.82 | 34.4 | 1.79 | 1.34 | 1.08 | 43.4 | 2.26 | 1.70 | 1.36 | 52.9 | 2.76 | 2.07 | 1.65 | 52.9 | 2.76 | 2.07 | 1.65 | 52.9 | 2.76 | 2.07 | 1.65 |
| 7.0 | 26.1 | 1.36 | 1.02 | 0.82 | 34.5 | 1.80 | 1.35 | 1.08 | 43.6 | 2.27 | 1.70 | 1.36 | 53.3 | 2.78 | 2.08 | 1.67 | 53.7 | 2.79 | 2.10 | 1.68 | 53.7 | 2.79 | 2.10 | 1.68 |
| 7.1 | 26.2 | 1.36 | 1.02 | 0.82 | 34.6 | 1.80 | 1.35 | 1.08 | 43.7 | 2.28 | 1.71 | 1.37 | 53.5 | 2.79 | 2.09 | 1.67 | 54.4 | 2.83 | 2.13 | 1.70 | 54.4 | 2.83 | 2.13 | 1.70 |
| 7.2 | 26.2 | 1.37 | 1.02 | 0.82 | 34.7 | 1.81 | 1.35 | 1.08 | 43.9 | 2.29 | 1.71 | 1.37 | 53.7 | 2.80 | 2.10 | 1.68 | 55.2 | 2.87 | 2.16 | 1.72 | 55.2 | 2.87 | 2.16 | 1.72 |
| 7.3 | 26.3 | 1.37 | 1.03 | 0.82 | 34.8 | 1.81 | 1.36 | 1.09 | 44.0 | 2.29 | 1.72 | 1.38 | 53.9 | 2.81 | 2.11 | 1.69 | 55.9 | 2.91 | 2.18 | 1.75 | 55.9 | 2.91 | 2.18 | 1.75 |
| 7.4 | 26.3 | 1.37 | 1.03 | 0.82 | 34.9 | 1.82 | 1.36 | 1.09 | 44.2 | 2.30 | 1.73 | 1.38 | 54.2 | 2.82 | 2.12 | 1.69 | 56.7 | 2.95 | 2.21 | 1.77 | 56.7 | 2.95 | 2.21 | 1.77 |
| 7.5 | 26.4 | 1.37 | 1.03 | 0.82 | 34.9 | 1.82 | 1.36 | 1.09 | 44.3 | 2.31 | 1.73 | 1.38 | 54.3 | 2.83 | 2.12 | 1.70 | 57.4 | 2.99 | 2.24 | 1.80 | 57.4 | 2.99 | 2.24 | 1.80 |
| 7.6 | 26.4 | 1.37 | 1.03 | 0.82 | 35.0 | 1.82 | 1.37 | 1.09 | 44.4 | 2.31 | 1.74 | 1.39 | 54.5 | 2.84 | 2.13 | 1.70 | 58.2 | 3.03 | 2.27 | 1.82 | 58.2 | 3.03 | 2.27 | 1.82 |
| 7.7 | 26.4 | 1.38 | 1.03 | 0.83 | 35.1 | 1.83 | 1.37 | 1.10 | 44.6 | 2.32 | 1.74 | 1.39 | 54.7 | 2.85 | 2.14 | 1.71 | 59.0 | 3.07 | 2.30 | 1.84 | 59.0 | 3.07 | 2.30 | 1.84 |
| 7.8 | 26.5 | 1.38 | 1.03 | 0.83 | 35.2 | 1.83 | 1.37 | 1.10 | 44.7 | 2.33 | 1.75 | 1.40 | 54.9 | 2.86 | 2.15 | 1.72 | 59.7 | 3.11 | 2.33 | 1.87 | 59.7 | 3.11 | 2.33 | 1.87 |
| 7.9 | 26.5 | 1.38 | 1.03 | 0.83 | 35.2 | 1.83 | 1.38 | 1.10 | 44.8 | 2.33 | 1.75 | 1.40 | 55.1 | 2.87 | 2.15 | 1.72 | 60.5 | 3.15 | 2.36 | 1.89 | 60.5 | 3.15 | 2.36 | 1.89 |
| 8.0 | 26.5 | 1.38 | 1.04 | 0.83 | 35.3 | 1.84 | 1.38 | 1.10 | 44.9 | 2.34 | 1.75 | 1.40 | 55.3 | 2.68 | 2.16 | 1.73 | 61.2 | 3.19 | 2.39 | 1.91 | 61.2 | 3.19 | 2.39 | 1.91 |
| 8.1 | 26.6 | 1.38 | 1.04 | 0.83 | 35.4 | 1.84 | 1.38 | 1.10 | 45.0 | 2.34 | 1.76 | 1.41 | 55.4 | 2.89 | 2.17 | 1.73 | 62.0 | 3.23 | 2.42 | 1.94 | 62.0 | 3.23 | 2.42 | 1.94 |
| 8.2 | 26.6 | 1.38 | 1.04 | 0.83 | 35.4 | 1.84 | 1.38 | 1.11 | 45.1 | 2.35 | 1.76 | 1.41 | 55.6 | 2.90 | 2.17 | 1.74 | 62.8 | 3.27 | 2.45 | 1.96 | 62.8 | 3.27 | 2.45 | 1.96 |
| 8.3 | 26.6 | 1.39 | 1.04 | 0.83 | 35.5 | 1.85 | 1.39 | 1.11 | 45.2 | 2.36 | 1.77 | 1.41 | 55.7 | 2.90 | 2.18 | 1.74 | 63.5 | 3.31 | 2.48 | 1.98 | 63.5 | 3.31 | 2.48 | 1.98 |
| 8.4 | 26.6 | 1.39 | 1.04 | 0.83 | 35.5 | 1.85 | 1.39 | 1.11 | 45.3 | 2.36 | 1.77 | 1.42 | 55.9 | 2.91 | 2.18 | 1.75 | 64.3 | 3.35 | 2.51 | 2.01 | 64.3 | 3.35 | 2.51 | 2.01 |
| 8.5 | 26.7 | 1.39 | 1.04 | 0.83 | 35.6 | 1.85 | 1.39 | 1.11 | 45.4 | 2.37 | 1.77 | 1.42 | 56.1 | 2.92 | 2.19 | 1.75 | 65.0 | 3.39 | 2.54 | 2.03 | 65.0 | 3.39 | 2.54 | 2.03 |
| 8.6 | 26.7 | 1.39 | 1.04 | 0.83 | 35.6 | 1.86 | 1.39 | 1.11 | 45.5 | 2.37 | 1.78 | 1.42 | 56.2 | 2.93 | 2.20 | 1.76 | 65.8 | 3.43 | 2.57 | 2.06 | 65.8 | 3.43 | 2.57 | 2.06 |
| 8.7 | 26.7 | 1.39 | 1.04 | 0.83 | 35.7 | 1.86 | 1.39 | 1.12 | 45.6 | 2.38 | 1.78 | 1.43 | 56.3 | 2.93 | 2.20 | 1.76 | 66.5 | 3.47 | 2.60 | 2.08 | 66.5 | 3.47 | 2.60 | 2.08 |
| 8.8 | 26.7 | 1.39 | 1.04 | 0.84 | 35.7 | 1.86 | 1.40 | 1.12 | 45.7 | 2.38 | 1.78 | 1.43 | 56.5 | 2.94 | 2.21 | 1.76 | 67.3 | 3.51 | 2.63 | 2.10 | 67.3 | 3.51 | 2.63 | 2.10 |
| 8.9 | 26.8 | 1.39 | 1.05 | 0.84 | 35.8 | 1.86 | 1.40 | 1.12 | 45.8 | 2.38 | 1.79 | 1.43 | 56.6 | 2.95 | 2.21 | 1.77 | 68.1 | 3.55 | 2.66 | 2.13 | 68.1 | 3.55 | 2.66 | 2.13 |
| 9.0 | 26.8 | 1.39 | 1.05 | 0.84 | 35.8 | 1.87 | 1.40 | 1.12 | 45.9 | 2.39 | 1.79 | 1.43 | 56.7 | 2.96 | 2.22 | 1.77 | 68.3 | 3.56 | 2.67 | 2.14 | 68.8 | 3.58 | 2.69 | 2.15 |
| 9.1 | 26.8 | 1.40 | 1.05 | 0.84 | 35.9 | 1.87 | 1.40 | 1.12 | 45.9 | 2.39 | 1.79 | 1.44 | 56.9 | 2.96 | 2.22 | 1.78 | 68.5 | 3.57 | 2.68 | 2.14 | 69.6 | 3.62 | 2.72 | 2.17 |
| 9.2 | 26.8 | 1.40 | 1.05 | 0.84 | 35.9 | 1.87 | 1.40 | 1.12 | 46.0 | 2.40 | 1.80 | 1.44 | 57.0 | 2.97 | 2.23 | 1.78 | 68.7 | 3.58 | 2.68 | 2.15 | 70.3 | 3.66 | 2.75 | 2.20 |
| 9.3 | 26.8 | 1.40 | 1.05 | 0.84 | 36.0 | 1.87 | 1.40 | 1.12 | 46.1 | 2.40 | 1.80 | 1.44 | 57.1 | 2.97 | 2.23 | 1.78 | 68.9 | 3.59 | 2.68 | 2.15 | 71.1 | 3.70 | 2.78 | 2.22 |
| 9.4 | 26.9 | 1.40 | 1.05 | 0.84 | 36.0 | 1.87 | 1.41 | 1.12 | 46.2 | 2.40 | 1.80 | 1.44 | 57.2 | 2.98 | 2.24 | 1.79 | 69.0 | 3.60 | 2.70 | 2.16 | 71.9 | 3.74 | 2.81 | 2.25 |
| 9.5 | 26.9 | 1.40 | 1.05 | 0.84 | 36.0 | 1.88 | 1.41 | 1.13 | 46.2 | 2.41 | 1.81 | 1.44 | 57.3 | 2.99 | 2.24 | 1.79 | 69.2 | 3.60 | 2.70 | 2.16 | 72.6 | 3.78 | 2.84 | 2.27 |
| 9.6 | 26.9 | 1.40 | 1.05 | 0.84 | 36.1 | 1.88 | 1.41 | 1.13 | 46.3 | 2.41 | 1.81 | 1.45 | 57.4 | 2.99 | 2.24 | 1.79 | 69.4 | 3.61 | 2.71 | 2.17 | 73.4 | 3.82 | 2.87 | 2.29 |
| 9.7 | 26.9 | 1.40 | 1.05 | 0.84 | 36.1 | 1.88 | 1.41 | 1.13 | 46.4 | 2.41 | 1.81 | 1.45 | 57.5 | 3.00 | 2.25 | 1.80 | 69.5 | 3.62 | 2.72 | 2.17 | 74.2 | 3.86 | 2.90 | 2.32 |
| 9.8 | 26.9 | 1.40 | 1.05 | 0.84 | 36.1 | 1.88 | 1.41 | 1.13 | 46.4 | 2.42 | 1.81 | 1.45 | 57.6 | 3.00 | 2.25 | 1.80 | 69.7 | 3.63 | 2.72 | 2.18 | 74.9 | 3.90 | 2.93 | 2.34 |
| 9.9 | 26.9 | 1.40 | 1.05 | 0.84 | 36.2 | 1.88 | 1.41 | 1.13 | 46.5 | 2.42 | 1.82 | 1.45 | 57.7 | 3.01 | 2.26 | 1.80 | 69.8 | 3.64 | 2.73 | 2.18 | 75.7 | 3.94 | 2.96 | 2.36 |
| 10.0 | 26.9 | 1.40 | 1.05 | 0.84 | 36.2 | 1.89 | 1.41 | 1.13 | 46.5 | 2.42 | 1.82 | 1.45 | 57.8 | 3.01 | 2.26 | 1.81 | 70.0 | 3.64 | 2.73 | 2.19 | 76.4 | 3.98 | 2.99 | 2.39 |
| Trench Width m | | 0.6 | | | | 0.7 | | | | 0.8 | | | | 0.9 | | | | 1.0 | | | | 1.1 | | |

## TABLE 4. DESIGN LOADS
## 225 mm DIAMETER PIPE

2 WHEELS 30kN
IMPACT FACTOR 2.0

| Cover | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 28 | 36 | 45 | kN/m | 28 | 36 | 45 | kN/m | 28 | 36 | 45 | kN/m | 28 | 36 | 45 | kN/m | 28 | 36 | 45 | kN/m | 28 | 36 | 45 |
| 0.6 | 24.1 | 1.08 | 0.84 | 0.67 | 24.1 | 1.08 | 0.84 | 0.67 | 24.1 | 1.08 | 0.84 | 0.67 | 24.1 | 1.08 | 0.84 | 0.67 | 24.1 | 1.08 | 0.84 | 0.67 | 24.1 | 1.08 | 0.84 | 0.67 |
| 0.7 | 21.8 | 0.97 | 0.76 | 0.61 | 21.8 | 0.97 | 0.76 | 0.61 | 21.8 | 0.97 | 0.76 | 0.61 | 21.8 | 0.97 | 0.76 | 0.61 | 21.8 | 0.97 | 0.76 | 0.61 | 21.8 | 0.97 | 0.76 | 0.61 |
| 0.8 | 20.2 | 0.90 | 0.70 | 0.56 | 20.2 | 0.90 | 0.70 | 0.56 | 20.2 | 0.90 | 0.70 | 0.56 | 20.2 | 0.90 | 0.70 | 0.56 | 20.2 | 0.90 | 0.70 | 0.56 | 20.2 | 0.90 | 0.70 | 0.56 |
| 0.9 | 19.2 | 0.86 | 0.67 | 0.53 | 19.2 | 0.86 | 0.67 | 0.53 | 19.2 | 0.86 | 0.67 | 0.53 | 19.2 | 0.86 | 0.67 | 0.53 | 19.2 | 0.86 | 0.67 | 0.53 | 19.2 | 0.86 | 0.67 | 0.53 |
| 1.0 | 18.6 | 0.83 | 0.64 | 0.52 | 18.6 | 0.83 | 0.64 | 0.52 | 18.6 | 0.83 | 0.64 | 0.52 | 18.6 | 0.83 | 0.64 | 0.52 | 18.6 | 0.83 | 0.64 | 0.52 | 18.6 | 0.83 | 0.64 | 0.52 |
| 1.1 | 18.2 | 0.81 | 0.63 | 0.51 | 18.2 | 0.81 | 0.63 | 0.51 | 18.2 | 0.81 | 0.63 | 0.51 | 18.2 | 0.81 | 0.63 | 0.51 | 18.2 | 0.81 | 0.63 | 0.51 | 18.2 | 0.81 | 0.63 | 0.51 |
| 1.2 | 18.1 | 0.81 | 0.63 | 0.50 | 18.1 | 0.81 | 0.63 | 0.50 | 18.1 | 0.81 | 0.63 | 0.50 | 18.1 | 0.81 | 0.63 | 0.50 | 18.1 | 0.81 | 0.63 | 0.50 | 18.1 | 0.81 | 0.63 | 0.50 |
| 1.3 | 18.1 | 0.81 | 0.63 | 0.50 | 18.1 | 0.81 | 0.63 | 0.50 | 18.1 | 0.81 | 0.63 | 0.50 | 18.1 | 0.81 | 0.63 | 0.50 | 18.1 | 0.81 | 0.63 | 0.50 | 18.1 | 0.81 | 0.63 | 0.50 |
| 1.4 | 18.2 | 0.81 | 0.63 | 0.51 | 18.2 | 0.81 | 0.63 | 0.51 | 18.2 | 0.81 | 0.63 | 0.51 | 18.2 | 0.81 | 0.63 | 0.51 | 18.2 | 0.81 | 0.63 | 0.51 | 18.2 | 0.81 | 0.63 | 0.51 |
| 1.5 | 18.5 | 0.82 | 0.64 | 0.51 | 18.5 | 0.82 | 0.64 | 0.51 | 18.5 | 0.82 | 0.64 | 0.51 | 18.5 | 0.82 | 0.64 | 0.51 | 18.5 | 0.82 | 0.64 | 0.51 | 18.5 | 0.82 | 0.64 | 0.51 |
| 1.6 | 18.8 | 0.84 | 0.65 | 0.52 | 18.8 | 0.84 | 0.65 | 0.52 | 18.8 | 0.84 | 0.65 | 0.52 | 18.8 | 0.84 | 0.65 | 0.52 | 18.8 | 0.84 | 0.65 | 0.52 | 18.8 | 0.84 | 0.65 | 0.52 |
| 1.7 | 19.2 | 0.86 | 0.67 | 0.53 | 19.2 | 0.86 | 0.67 | 0.53 | 19.2 | 0.86 | 0.67 | 0.53 | 19.2 | 0.86 | 0.67 | 0.53 | 19.2 | 0.86 | 0.67 | 0.53 | 19.2 | 0.86 | 0.67 | 0.53 |
| 1.8 | 19.7 | 0.88 | 0.68 | 0.55 | 19.7 | 0.88 | 0.68 | 0.55 | 19.7 | 0.88 | 0.68 | 0.55 | 19.7 | 0.88 | 0.68 | 0.55 | 19.7 | 0.88 | 0.68 | 0.55 | 19.7 | 0.88 | 0.68 | 0.55 |
| 1.9 | 20.2 | 0.90 | 0.70 | 0.56 | 20.2 | 0.90 | 0.70 | 0.56 | 20.2 | 0.90 | 0.70 | 0.56 | 20.2 | 0.90 | 0.70 | 0.56 | 20.2 | 0.90 | 0.70 | 0.56 | 20.2 | 0.90 | 0.70 | 0.56 |
| 2.0 | 20.7 | 0.93 | 0.72 | 0.58 | 20.7 | 0.93 | 0.72 | 0.58 | 20.7 | 0.93 | 0.72 | 0.58 | 20.7 | 0.93 | 0.72 | 0.58 | 20.7 | 0.93 | 0.72 | 0.58 | 20.7 | 0.93 | 0.72 | 0.58 |
| 2.1 | 21.3 | 0.95 | 0.74 | 0.59 | 21.3 | 0.95 | 0.74 | 0.59 | 21.3 | 0.95 | 0.74 | 0.59 | 21.3 | 0.95 | 0.74 | 0.59 | 21.3 | 0.95 | 0.74 | 0.59 | 21.3 | 0.95 | 0.74 | 0.59 |
| 2.2 | 22.0 | 0.98 | 0.76 | 0.61 | 22.0 | 0.98 | 0.76 | 0.61 | 22.0 | 0.98 | 0.76 | 0.61 | 22.0 | 0.98 | 0.76 | 0.61 | 22.0 | 0.98 | 0.76 | 0.61 | 22.0 | 0.98 | 0.76 | 0.61 |
| 2.3 | 22.6 | 1.01 | 0.79 | 0.63 | 22.6 | 1.01 | 0.79 | 0.63 | 22.6 | 1.01 | 0.79 | 0.63 | 22.6 | 1.01 | 0.79 | 0.63 | 22.6 | 1.01 | 0.79 | 0.63 | 22.6 | 1.01 | 0.79 | 0.63 |
| 2.4 | 23.3 | 1.04 | 0.81 | 0.65 | 23.3 | 1.04 | 0.81 | 0.65 | 23.3 | 1.04 | 0.81 | 0.65 | 23.3 | 1.04 | 0.81 | 0.65 | 23.3 | 1.04 | 0.81 | 0.65 | 23.3 | 1.04 | 0.81 | 0.65 |
| 2.5 | 24.0 | 1.07 | 0.83 | 0.67 | 24.0 | 1.07 | 0.83 | 0.67 | 24.0 | 1.07 | 0.83 | 0.67 | 24.0 | 1.07 | 0.83 | 0.67 | 24.0 | 1.07 | 0.83 | 0.67 | 24.0 | 1.07 | 0.83 | 0.67 |
| 2.6 | 24.7 | 1.10 | 0.86 | 0.69 | 24.7 | 1.10 | 0.86 | 0.69 | 24.7 | 1.10 | 0.86 | 0.69 | 24.7 | 1.10 | 0.86 | 0.69 | 24.7 | 1.10 | 0.86 | 0.69 | 24.7 | 1.10 | 0.86 | 0.69 |
| 2.7 | **25.4** | **1.13** | **0.88** | **0.71** | 25.4 | 1.14 | 0.88 | 0.71 | 25.4 | 1.14 | 0.88 | 0.71 | 25.4 | 1.14 | 0.88 | 0.71 | 25.4 | 1.14 | 0.88 | 0.71 | 25.4 | 1.14 | 0.88 | 0.71 |
| 2.8 | **25.8** | **1.15** | **0.89** | **0.72** | 26.2 | 1.17 | 0.91 | 0.73 | 26.2 | 1.17 | 0.91 | 0.73 | 26.2 | 1.17 | 0.91 | 0.73 | 26.2 | 1.17 | 0.91 | 0.73 | 26.2 | 1.17 | 0.91 | 0.73 |
| 2.9 | **28.1** | **1.17** | **0.91** | **0.73** | 26.9 | 1.20 | 0.94 | 0.75 | 26.9 | 1.20 | 0.94 | 0.75 | 26.9 | 1.20 | 0.94 | 0.75 | 26.9 | 1.20 | 0.94 | 0.75 | 26.9 | 1.20 | 0.94 | 0.75 |
| 3.0 | **28.5** | **1.18** | **0.92** | **0.74** | 27.7 | 1.24 | 0.96 | 0.77 | 27.7 | 1.24 | 0.96 | 0.77 | 27.7 | 1.24 | 0.96 | 0.77 | 27.7 | 1.24 | 0.96 | 0.77 | 27.7 | 1.24 | 0.96 | 0.77 |
| 3.1 | **28.8** | **1.20** | **0.93** | **0.75** | 28.5 | 1.27 | 0.99 | 0.79 | 28.5 | 1.27 | 0.99 | 0.79 | 28.5 | 1.27 | 0.99 | 0.79 | 28.5 | 1.27 | 0.99 | 0.79 | 28.5 | 1.27 | 0.99 | 0.79 |
| 3.2 | **27.2** | **1.21** | **0.94** | **0.75** | 29.3 | 1.31 | 1.02 | 0.81 | 29.3 | 1.31 | 1.02 | 0.81 | 29.3 | 1.31 | 1.02 | 0.81 | 29.3 | 1.31 | 1.02 | 0.81 | 29.3 | 1.31 | 1.02 | 0.81 |
| 3.3 | **27.5** | **1.23** | **0.95** | **0.76** | 30.1 | 1.34 | 1.04 | 0.83 | 30.1 | 1.34 | 1.04 | 0.83 | 30.1 | 1.34 | 1.04 | 0.83 | 30.1 | 1.34 | 1.04 | 0.83 | 30.1 | 1.34 | 1.04 | 0.83 |
| 3.4 | **27.8** | **1.24** | **0.97** | **0.77** | 30.9 | 1.38 | 1.07 | 0.86 | 30.9 | 1.38 | 1.07 | 0.86 | 30.9 | 1.38 | 1.07 | 0.86 | 30.9 | 1.38 | 1.07 | 0.86 | 30.9 | 1.38 | 1.07 | 0.86 |
| 3.5 | **28.1** | **1.26** | **0.98** | **0.78** | 31.7 | 1.41 | 1.10 | 0.88 | 31.7 | 1.41 | 1.10 | 0.88 | 31.7 | 1.41 | 1.10 | 0.88 | 31.7 | 1.41 | 1.10 | 0.88 | 31.7 | 1.41 | 1.10 | 0.88 |
| 3.6 | **28.4** | **1.27** | **0.99** | **0.79** | 32.5 | 1.45 | 1.13 | 0.90 | 32.5 | 1.45 | 1.13 | 0.90 | 32.5 | 1.45 | 1.13 | 0.90 | 32.5 | 1.45 | 1.13 | 0.90 | 32.5 | 1.45 | 1.13 | 0.90 |
| 3.7 | **28.7** | **1.28** | **1.00** | **0.80** | 33.3 | 1.49 | 1.16 | 0.92 | 33.3 | 1.49 | 1.16 | 0.92 | 33.3 | 1.49 | 1.16 | 0.92 | 33.3 | 1.49 | 1.16 | 0.92 | 33.3 | 1.49 | 1.16 | 0.92 |
| 3.8 | **29.0** | **1.30** | **1.01** | **0.81** | 34.1 | 1.52 | 1.18 | 0.95 | 34.1 | 1.52 | 1.18 | 0.95 | 34.1 | 1.52 | 1.18 | 0.95 | 34.1 | 1.52 | 1.18 | 0.95 | 34.1 | 1.52 | 1.18 | 0.95 |
| 3.9 | **29.3** | **1.31** | **1.02** | **0.81** | 34.9 | 1.56 | 1.21 | 0.97 | 34.9 | 1.56 | 1.21 | 0.97 | 34.9 | 1.56 | 1.21 | 0.97 | 34.9 | 1.56 | 1.21 | 0.97 | 34.9 | 1.56 | 1.21 | 0.97 |
| 4.0 | **29.6** | **1.32** | **1.03** | **0.82** | 35.7 | 1.60 | 1.24 | 0.99 | 35.7 | 1.60 | 1.24 | 0.99 | 35.7 | 1.60 | 1.24 | 0.99 | 35.7 | 1.60 | 1.24 | 0.99 | 35.7 | 1.60 | 1.24 | 0.99 |
| 4.1 | **29.8** | **1.33** | **1.04** | **0.83** | **36.5** | **1.63** | **1.27** | **1.01** | 36.6 | 1.63 | 1.27 | 1.02 | 36.6 | 1.63 | 1.27 | 1.02 | 36.6 | 1.63 | 1.27 | 1.02 | 36.6 | 1.63 | 1.27 | 1.02 |
| 4.2 | **30.1** | **1.34** | **1.04** | **0.84** | **36.8** | **1.64** | **1.28** | **1.02** | 37.4 | 1.67 | 1.30 | 1.04 | 37.4 | 1.67 | 1.30 | 1.04 | 37.4 | 1.67 | 1.30 | 1.04 | 37.4 | 1.67 | 1.30 | 1.04 |
| 4.3 | **30.3** | **1.35** | **1.05** | **0.84** | **37.2** | **1.68** | **1.29** | **1.03** | 38.2 | 1.71 | 1.33 | 1.06 | 38.2 | 1.71 | 1.33 | 1.06 | 38.2 | 1.71 | 1.33 | 1.06 | 38.2 | 1.71 | 1.33 | 1.06 |
| 4.4 | **30.6** | **1.36** | **1.06** | **0.85** | **37.5** | **1.68** | **1.30** | **1.04** | 39.1 | 1.74 | 1.36 | 1.09 | 39.1 | 1.74 | 1.36 | 1.09 | 39.1 | 1.74 | 1.36 | 1.09 | 39.1 | 1.74 | 1.36 | 1.09 |
| 4.5 | **30.8** | **1.37** | **1.07** | **0.88** | **37.9** | **1.69** | **1.31** | **1.05** | 39.9 | 1.78 | 1.39 | 1.11 | 39.9 | 1.78 | 1.39 | 1.11 | 39.9 | 1.78 | 1.39 | 1.11 | 39.9 | 1.78 | 1.39 | 1.11 |
| 4.6 | **31.0** | **1.38** | **1.08** | **0.88** | **38.2** | **1.70** | **1.33** | **1.06** | 40.8 | 1.82 | 1.42 | 1.13 | 40.8 | 1.82 | 1.42 | 1.13 | 40.8 | 1.82 | 1.42 | 1.13 | 40.8 | 1.82 | 1.42 | 1.13 |
| 4.7 | **31.2** | **1.39** | **1.08** | **0.87** | **38.5** | **1.72** | **1.34** | **1.07** | 41.6 | 1.86 | 1.44 | 1.16 | 41.6 | 1.86 | 1.44 | 1.16 | 41.6 | 1.86 | 1.44 | 1.16 | 41.6 | 1.86 | 1.44 | 1.16 |
| 4.8 | **31.4** | **1.40** | **1.09** | **0.87** | **38.8** | **1.73** | **1.35** | **1.08** | 42.4 | 1.90 | 1.47 | 1.18 | 42.4 | 1.90 | 1.47 | 1.18 | 42.4 | 1.90 | 1.47 | 1.18 | 42.4 | 1.90 | 1.47 | 1.18 |
| 4.9 | **31.6** | **1.41** | **1.10** | **0.88** | **39.1** | **1.75** | **1.36** | **1.09** | 43.3 | 1.93 | 1.50 | 1.20 | 43.3 | 1.93 | 1.50 | 1.20 | 43.3 | 1.93 | 1.50 | 1.20 | 43.3 | 1.93 | 1.50 | 1.20 |
| 5.0 | **31.8** | **1.42** | **1.10** | **0.88** | **39.4** | **1.78** | **1.37** | **1.09** | 44.1 | 1.97 | 1.53 | 1.23 | 44.1 | 1.97 | 1.53 | 1.23 | 44.1 | 1.97 | 1.53 | 1.23 | 44.1 | 1.97 | 1.53 | 1.23 |
| 5.1 | **32.0** | **1.43** | **1.11** | **0.89** | **39.7** | **1.77** | **1.38** | **1.10** | 45.0 | 2.01 | 1.56 | 1.25 | 45.0 | 2.01 | 1.56 | 1.25 | 45.0 | 2.01 | 1.56 | 1.25 | 45.0 | 2.01 | 1.56 | 1.25 |
| 5.2 | **32.2** | **1.44** | **1.12** | **0.89** | **39.9** | **1.78** | **1.39** | **1.11** | 45.8 | 2.05 | 1.59 | 1.27 | 45.8 | 2.05 | 1.59 | 1.27 | 45.8 | 2.05 | 1.59 | 1.27 | 45.8 | 2.05 | 1.59 | 1.27 |
| 5.3 | **32.4** | **1.44** | **1.12** | **0.90** | **40.2** | **1.80** | **1.40** | **1.12** | 46.7 | 2.08 | 1.62 | 1.30 | 46.7 | 2.08 | 1.62 | 1.30 | 46.7 | 2.08 | 1.62 | 1.30 | 46.7 | 2.08 | 1.62 | 1.30 |
| 5.4 | **32.5** | **1.45** | **1.13** | **0.90** | **40.5** | **1.81** | **1.41** | **1.12** | 47.6 | 2.12 | 1.65 | 1.32 | 47.6 | 2.12 | 1.65 | 1.32 | 47.6 | 2.12 | 1.65 | 1.32 | 47.6 | 2.12 | 1.65 | 1.32 |
| 5.5 | **32.7** | **1.48** | **1.14** | **0.91** | **40.7** | **1.82** | **1.41** | **1.13** | 48.4 | 2.16 | 1.68 | 1.34 | 48.4 | 2.16 | 1.68 | 1.34 | 48.4 | 2.16 | 1.68 | 1.34 | 48.4 | 2.16 | 1.68 | 1.34 |
| 5.6 | **32.8** | **1.47** | **1.14** | **0.91** | **41.0** | **1.83** | **1.42** | **1.14** | 49.3 | 2.20 | 1.71 | 1.37 | 49.3 | 2.20 | 1.71 | 1.37 | 49.3 | 2.20 | 1.71 | 1.37 | 49.3 | 2.20 | 1.71 | 1.37 |
| 5.7 | **33.0** | **1.47** | **1.15** | **0.92** | **41.2** | **1.84** | **1.43** | **1.14** | **49.8** | **2.22** | **1.73** | **1.38** | 50.1 | 2.24 | 1.74 | 1.39 | 50.1 | 2.24 | 1.74 | 1.39 | 50.1 | 2.24 | 1.74 | 1.39 |
| 5.8 | **33.1** | **1.48** | **1.15** | **0.92** | **41.4** | **1.85** | **1.44** | **1.15** | **50.1** | **2.24** | **1.74** | **1.39** | 51.0 | 2.28 | 1.77 | 1.42 | 51.0 | 2.28 | 1.77 | 1.42 | 51.0 | 2.28 | 1.77 | 1.42 |
| 5.9 | **33.3** | **1.49** | **1.16** | **0.92** | **41.8** | **1.86** | **1.45** | **1.16** | **50.4** | **2.25** | **1.75** | **1.40** | 51.8 | 2.31 | 1.80 | 1.44 | 51.8 | 2.31 | 1.80 | 1.44 | 51.8 | 2.31 | 1.80 | 1.44 |
| 6.0 | **33.4** | **1.49** | **1.18** | **0.93** | **41.8** | **1.87** | **1.46** | **1.18** | **50.7** | **2.27** | **1.78** | **1.41** | 52.7 | 2.35 | 1.83 | 1.46 | 52.7 | 2.35 | 1.83 | 1.46 | 52.7 | 2.35 | 1.83 | 1.46 |
| 6.1 | **33.8** | **1.50** | **1.18** | **0.93** | **42.1** | **1.88** | **1.48** | **1.17** | **51.0** | **2.28** | **1.77** | **1.42** | 53.5 | 2.39 | 1.86 | 1.49 | 53.5 | 2.39 | 1.86 | 1.49 | 53.5 | 2.39 | 1.86 | 1.49 |
| 6.2 | **33.7** | **1.50** | **1.17** | **0.94** | **42.3** | **1.89** | **1.47** | **1.17** | **51.3** | **2.29** | **1.78** | **1.43** | 54.4 | 2.43 | 1.89 | 1.51 | 54.4 | 2.43 | 1.89 | 1.51 | 54.4 | 2.43 | 1.89 | 1.51 |
| 6.3 | **33.8** | **1.51** | **1.17** | **0.94** | **42.4** | **1.89** | **1.47** | **1.18** | **51.8** | **2.30** | **1.79** | **1.43** | 55.3 | 2.47 | 1.92 | 1.54 | 55.3 | 2.47 | 1.92 | 1.54 | 55.3 | 2.47 | 1.92 | 1.54 |
| 6.4 | **33.9** | **1.51** | **1.18** | **0.94** | **42.6** | **1.90** | **1.46** | **1.18** | **51.9** | **2.32** | **1.80** | **1.44** | 56.1 | 2.51 | 1.95 | 1.56 | 56.1 | 2.51 | 1.95 | 1.56 | 56.1 | 2.51 | 1.95 | 1.56 |
| 6.5 | **34.0** | **1.52** | **1.18** | **0.95** | **42.8** | **1.91** | **1.49** | **1.19** | **52.1** | **2.33** | **1.81** | **1.45** | 57.0 | 2.54 | 1.98 | 1.58 | 57.0 | 2.54 | 1.98 | 1.58 | 57.0 | 2.54 | 1.98 | 1.58 |
| 6.6 | **34.1** | **1.52** | **1.19** | **0.95** | **43.0** | **1.92** | **1.49** | **1.19** | **52.4** | **2.34** | **1.82** | **1.46** | 57.9 | 2.58 | 2.01 | 1.61 | 57.9 | 2.58 | 2.01 | 1.61 | 57.9 | 2.58 | 2.01 | 1.61 |
| 6.7 | **34.2** | **1.53** | **1.19** | **0.95** | **43.2** | **1.93** | **1.50** | **1.20** | **52.8** | **2.35** | **1.83** | **1.46** | 58.7 | 2.62 | 2.04 | 1.63 | 58.7 | 2.62 | 2.04 | 1.63 | 58.7 | 2.62 | 2.04 | 1.63 |
| 6.8 | **34.3** | **1.53** | **1.19** | **0.95** | **43.3** | **1.93** | **1.50** | **1.20** | **52.9** | **2.38** | **1.84** | **1.47** | 59.6 | 2.66 | 2.07 | 1.65 | 59.6 | 2.66 | 2.07 | 1.65 | 59.6 | 2.66 | 2.07 | 1.65 |
| 6.9 | **34.4** | **1.54** | **1.20** | **0.96** | **43.5** | **1.94** | **1.51** | **1.21** | **53.1** | **2.37** | **1.84** | **1.48** | 60.4 | 2.70 | 2.10 | 1.68 | 60.4 | 2.70 | 2.10 | 1.68 | 60.4 | 2.70 | 2.10 | 1.68 |
| 7.0 | **34.5** | **1.54** | **1.20** | **0.96** | **43.8** | **1.95** | **1.52** | **1.21** | **53.3** | **2.38** | **1.85** | **1.48** | 61.3 | 2.74 | 2.13 | 1.70 | 61.3 | 2.74 | 2.13 | 1.70 | 61.3 | 2.74 | 2.13 | 1.70 |
| 7.1 | **34.8** | **1.86** | **1.20** | **0.96** | **43.8** | **1.95** | **1.52** | **1.22** | **53.8** | **2.39** | **1.88** | **1.49** | 62.2 | 2.78 | 2.16 | 1.73 | 62.2 | 2.78 | 2.16 | 1.73 | 62.2 | 2.78 | 2.16 | 1.73 |
| 7.2 | **34.7** | **1.55** | **1.21** | **0.98** | **43.9** | **1.96** | **1.53** | **1.22** | **53.8** | **2.40** | **1.87** | **1.49** | 63.0 | 2.81 | 2.19 | 1.75 | 63.0 | 2.81 | 2.19 | 1.75 | 63.0 | 2.81 | 2.19 | 1.75 |
| 7.3 | **34.8** | **1.56** | **1.21** | **0.97** | **44.1** | **1.97** | **1.53** | **1.22** | **54.0** | **2.41** | **1.87** | **1.50** | 63.9 | 2.85 | 2.22 | 1.78 | 63.9 | 2.85 | 2.22 | 1.78 | 63.9 | 2.85 | 2.22 | 1.78 |
| 7.4 | **34.9** | **1.56** | **1.21** | **0.97** | **44.2** | **1.97** | **1.54** | **1.23** | **54.2** | **2.42** | **1.88** | **1.51** | **64.7** | **2.89** | **2.25** | **1.80** | 64.8 | 2.89 | 2.25 | 1.80 | 64.8 | 2.89 | 2.25 | 1.80 |
| 7.5 | **35.0** | **1.58** | **1.21** | **0.97** | **44.3** | **1.98** | **1.54** | **1.23** | **54.4** | **2.43** | **1.89** | **1.61** | **85.0** | **2.90** | **2.28** | **1.81** | 65.6 | 2.93 | 2.28 | 1.82 | 65.6 | 2.93 | 2.28 | 1.82 |
| 7.6 | **35.0** | **1.56** | **1.22** | **0.97** | **44.5** | **1.99** | **1.54** | **1.24** | **54.8** | **2.44** | **1.90** | **1.52** | **65.3** | **2.91** | **2.27** | **1.81** | 66.5 | 2.97 | 2.31 | 1.85 | 66.5 | 2.97 | 2.31 | 1.85 |
| 7.7 | **35.1** | **1.57** | **1.22** | **0.98** | **44.8** | **1.99** | **1.56** | **1.24** | **54.8** | **2.44** | **1.90** | **1.52** | **65.5** | **2.92** | **2.27** | **1.82** | 67.4 | 3.01 | 2.34 | 1.87 | 67.4 | 3.01 | 2.34 | 1.87 |
| 7.8 | **35.2** | **1.57** | **1.22** | **0.98** | **44.7** | **2.00** | **1.55** | **1.24** | **54.9** | **2.45** | **1.91** | **1.53** | **65.8** | **2.84** | **2.28** | **1.83** | 68.2 | 3.05 | 2.37 | 1.90 | 68.2 | 3.05 | 2.37 | 1.90 |
| 7.9 | **35.3** | **1.57** | **1.22** | **0.96** | **44.8** | **2.00** | **1.56** | **1.26** | **55.1** | **2.46** | **1.91** | **1.53** | **65.0** | **2.95** | **2.29** | **1.83** | 69.1 | 3.08 | 2.40 | 1.92 | 69.1 | 3.08 | 2.40 | 1.92 |
| 8.0 | **35.3** | **1.58** | **1.23** | **0.98** | **44.9** | **2.01** | **1.56** | **1.25** | **55.3** | **2.47** | **1.92** | **1.54** | **66.3** | **2.96** | **2.30** | **1.84** | 70.0 | 3.12 | 2.43 | 1.94 | 70.0 | 3.12 | 2.43 | 1.94 |
| 8.1 | **35.4** | **1.58** | **1.23** | **0.98** | **45.0** | **2.01** | **1.56** | **1.25** | **55.6** | **2.48** | **1.93** | **1.54** | **68.5** | **2.97** | **2.31** | **1.86** | 70.8 | 3.16 | 2.46 | 1.97 | 70.8 | 3.16 | 2.46 | 1.97 |
| 8.2 | **35.4** | **1.58** | **1.23** | **0.99** | **45.2** | **2.02** | **1.57** | **1.26** | **55.8** | **2.48** | **1.93** | **1.55** | **66.7** | **2.98** | **2.32** | **1.86** | 71.7 | 3.20 | 2.49 | 1.99 | 71.7 | 3.20 | 2.49 | 1.99 |
| 8.3 | **35.5** | **1.58** | **1.23** | **0.99** | **45.3** | **2.02** | **1.57** | **1.28** | **55.8** | **2.49** | **1.94** | **1.55** | **68.9** | **2.89** | **2.32** | **1.86** | 72.6 | 3.24 | 2.52 | 2.02 | 72.6 | 3.24 | 2.52 | 2.02 |
| 8.4 | **35.8** | **1.59** | **1.23** | **0.99** | **45.4** | **2.02** | **1.57** | **1.28** | **55.9** | **2.50** | **1.94** | **1.55** | **87.2** | **3.00** | **2.33** | **1.87** | 73.4 | 3.28 | 2.55 | 2.04 | 73.4 | 3.28 | 2.55 | 2.04 |
| 8.5 | **35.8** | **1.59** | **1.24** | **0.99** | **45.6** | **2.03** | **1.58** | **1.28** | **56.1** | **2.50** | **1.95** | **1.56** | **87.4** | **3.01** | **2.34** | **1.87** | 74.3 | 3.32 | 2.58 | 2.06 | 74.3 | 3.32 | 2.58 | 2.06 |
| 8.6 | **35.7** | **1.69** | **1.24** | **0.99** | **45.5** | **2.03** | **1.59** | **1.27** | **56.2** | **2.51** | **1.95** | **1.56** | **87.8** | **3.02** | **2.35** | **1.88** | 75.2 | 3.36 | 2.61 | 2.09 | 75.2 | 3.36 | 2.61 | 2.09 |
| 8.7 | **35.7** | **1.69** | **1.24** | **0.99** | **45.8** | **2.04** | **1.58** | **1.27** | **56.4** | **2.52** | **1.96** | **1.57** | **87.8** | **3.03** | **2.35** | **1.88** | 76.0 | 3.39 | 2.64 | 2.11 | 76.0 | 3.39 | 2.64 | 2.11 |
| 8.8 | **35.8** | **1.60** | **1.24** | **0.99** | **45.7** | **2.04** | **1.59** | **1.27** | **56.5** | **2.52** | **1.96** | **1.57** | **68.0** | **3.04** | **2.36** | **1.89** | 76.9 | 3.43 | 2.67 | 2.14 | 76.9 | 3.43 | 2.67 | 2.14 |
| 8.9 | **35.8** | **1.60** | **1.24** | **0.96** | **45.8** | **2.04** | **1.59** | **1.27** | **56.6** | **2.53** | **1.97** | **1.57** | **68.2** | **3.04** | **2.37** | **1.89** | 77.8 | 3.47 | 2.70 | 2.16 | 77.8 | 3.47 | 2.70 | 2.16 |
| 9.0 | **35.9** | **1.60** | **1.24** | **1.00** | **45.9** | **2.06** | **1.59** | **1.27** | **56.8** | **2.53** | **1.97** | **1.58** | **68.4** | **3.05** | **2.37** | **1.90** | 78.6 | 3.51 | 2.73 | 2.18 | 78.6 | 3.51 | 2.73 | 2.18 |
| 9.1 | **35.9** | **1.60** | **1.25** | **1.00** | **46.0** | **2.06** | **1.60** | **1.28** | **56.9** | **2.54** | **1.98** | **1.58** | **68.5** | **3.06** | **2.38** | **1.90** | 79.5 | 3.55 | 2.76 | 2.21 | 79.5 | 3.55 | 2.76 | 2.21 |
| 9.2 | **35.9** | **1.60** | **1.25** | **1.00** | **46.0** | **2.06** | **1.60** | **1.28** | **57.0** | **2.54** | **1.98** | **1.58** | **68.7** | **3.07** | **2.39** | **1.91** | 80.4 | 3.59 | 2.79 | 2.23 | 80.4 | 3.59 | 2.79 | 2.23 |
| 9.3 | **36.0** | **1.81** | **1.26** | **1.00** | **46.1** | **2.06** | **1.60** | **1.28** | **57.1** | **2.55** | **1.98** | **1.59** | **68.9** | **3.08** | **2.39** | **1.91** | 81.3 | 3.63 | 2.82 | 2.26 | 81.3 | 3.63 | 2.82 | 2.26 |
| 9.4 | **36.0** | **1.81** | **1.25** | **1.00** | **46.2** | **2.06** | **1.60** | **1.28** | **57.2** | **2.56** | **1.99** | **1.59** | **69.1** | **3.08** | **2.40** | **1.92** | **81.8** | **3.64** | **2.83** | **2.27** | 82.1 | 3.67 | 2.85 | 2.28 |
| 9.5 | **36.1** | **1.81** | **1.25** | **1.00** | **46.3** | **2.06** | **1.61** | **1.28** | **57.4** | **2.56** | **1.98** | **1.59** | **69.2** | **3.09** | **2.40** | **1.92** | **81.6** | **3.65** | **2.84** | **2.27** | 83.0 | 3.70 | 2.88 | 2.31 |
| 9.6 | **36.1** | **1.61** | **1.25** | **1.00** | **46.3** | **2.07** | **1.61** | **1.29** | **57.8** | **2.57** | **2.00** | **1.60** | **69.4** | **3.10** | **2.41** | **1.93** | **82.0** | **3.66** | **2.85** | **2.28** | 83.9 | 3.74 | 2.91 | 2.33 |
| 9.7 | **36.1** | **1.81** | **1.25** | **1.00** | **46.4** | **2.07** | **1.61** | **1.29** | **57.8** | **2.57** | **2.00** | **1.60** | **69.5** | **3.10** | **2.41** | **1.93** | **82.2** | **3.67** | **2.86** | **2.28** | 84.7 | 3.78 | 2.94 | 2.35 |
| 9.8 | **36.2** | **1.61** | **1.28** | **1.00** | **46.4** | **2.07** | **1.61** | **1.29** | **57.7** | **2.57** | **2.00** | **1.60** | **69.7** | **3.11** | **2.42** | **1.94** | **82.4** | **3.68** | **2.86** | **2.29** | 85.6 | 3.82 | 2.97 | 2.38 |
| 9.9 | **36.2** | **1.62** | **1.26** | **1.01** | **46.5** | **2.08** | **1.61** | **1.29** | **57.8** | **2.58** | **2.01** | **1.60** | **68.8** | **3.12** | **2.43** | **1.94** | **82.6** | **3.69** | **2.87** | **2.30** | 86.5 | 3.86 | 3.00 | 2.40 |
| 10.0 | **36.2** | **1.62** | **1.26** | **1.01** | **46.6** | **2.08** | **1.82** | **1.29** | **57.9** | **2.58** | **2.01** | **1.61** | **70.0** | **3.12** | **2.43** | **1.94** | **82.8** | **3.70** | **2.86** | **2.30** | 87.3 | 3.90 | 3.03 | 2.43 |
| Trench Width m | | 0.7 | | | | 0.8 | | | | 0.9 | | | | 1.0 | | | | 1.1 | | | | 1.2 | | |

**TABLE 5. DESIGN LOADS**
**300 mm DIAMETER PIPE**

2 WHEELS 30kN
IMPACT FACTOR 2.0

| Cover | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 36 | 48 | 60 | kN/m | 36 | 48 | 60 | kN/m | 36 | 48 | 60 | kN/m | 36 | 48 | 60 | kN/m | 36 | 48 | 60 | kN/m | 36 | 48 | 60 |
| 0.6 | 30.9 | 1.07 | 0.80 | 0.64 | 30.9 | 1.07 | 0.80 | 0.64 | 30.9 | 1.07 | 0.80 | 0.64 | 30.9 | 1.07 | 0.80 | 0.64 | 30.9 | 1.07 | 0.80 | 0.64 | 30.9 | 1.07 | 0.80 | 0.64 |
| 0.7 | 28.2 | 0.98 | 0.73 | 0.59 | 28.2 | 0.98 | 0.73 | 0.59 | 28.2 | 0.98 | 0.73 | 0.59 | 28.2 | 0.98 | 0.73 | 0.59 | 28.2 | 0.98 | 0.73 | 0.59 | 28.2 | 0.98 | 0.73 | 0.59 |
| 0.8 | 26.6 | 0.92 | 0.69 | 0.55 | 26.6 | 0.92 | 0.69 | 0.55 | 26.6 | 0.92 | 0.69 | 0.55 | 26.6 | 0.92 | 0.69 | 0.55 | 26.6 | 0.92 | 0.69 | 0.55 | 26.6 | 0.92 | 0.69 | 0.55 |
| 0.9 | 25.3 | 0.88 | 0.66 | 0.53 | 25.3 | 0.88 | 0.66 | 0.53 | 25.3 | 0.88 | 0.66 | 0.53 | 25.3 | 0.88 | 0.66 | 0.53 | 25.3 | 0.88 | 0.66 | 0.53 | 25.3 | 0.88 | 0.66 | 0.53 |
| 1.0 | 24.4 | 0.85 | 0.64 | 0.51 | 24.4 | 0.85 | 0.64 | 0.51 | 24.4 | 0.85 | 0.64 | 0.51 | 24.4 | 0.85 | 0.64 | 0.51 | 24.4 | 0.85 | 0.64 | 0.51 | 24.4 | 0.85 | 0.64 | 0.51 |
| 1.1 | 24.0 | 0.83 | 0.62 | 0.50 | 24.0 | 0.83 | 0.62 | 0.50 | 24.0 | 0.83 | 0.62 | 0.50 | 24.0 | 0.83 | 0.62 | 0.50 | 24.0 | 0.83 | 0.62 | 0.50 | 24.0 | 0.83 | 0.62 | 0.50 |
| 1.2 | 23.8 | 0.82 | 0.62 | 0.49 | 23.8 | 0.82 | 0.62 | 0.49 | 23.8 | 0.82 | 0.62 | 0.49 | 23.8 | 0.82 | 0.62 | 0.49 | 23.8 | 0.82 | 0.62 | 0.49 | 23.8 | 0.82 | 0.62 | 0.49 |
| 1.3 | 23.8 | 0.83 | 0.62 | 0.50 | 23.8 | 0.83 | 0.62 | 0.50 | 23.8 | 0.83 | 0.62 | 0.50 | 23.8 | 0.83 | 0.62 | 0.50 | 23.8 | 0.83 | 0.62 | 0.50 | 23.8 | 0.83 | 0.62 | 0.50 |
| 1.4 | 24.0 | 0.83 | 0.62 | 0.50 | 24.0 | 0.83 | 0.62 | 0.50 | 24.0 | 0.83 | 0.62 | 0.50 | 24.0 | 0.83 | 0.62 | 0.50 | 24.0 | 0.83 | 0.62 | 0.50 | 24.0 | 0.83 | 0.62 | 0.50 |
| 1.5 | 24.3 | 0.84 | 0.63 | 0.51 | 24.3 | 0.84 | 0.63 | 0.51 | 24.3 | 0.84 | 0.63 | 0.51 | 24.3 | 0.84 | 0.63 | 0.51 | 24.3 | 0.84 | 0.63 | 0.51 | 24.3 | 0.84 | 0.63 | 0.51 |
| 1.6 | 24.7 | 0.86 | 0.64 | 0.52 | 24.7 | 0.86 | 0.64 | 0.52 | 24.7 | 0.86 | 0.64 | 0.52 | 24.7 | 0.86 | 0.64 | 0.52 | 24.7 | 0.86 | 0.64 | 0.52 | 24.7 | 0.86 | 0.64 | 0.52 |
| 1.7 | 25.3 | 0.88 | 0.66 | 0.53 | 25.3 | 0.88 | 0.66 | 0.53 | 25.3 | 0.88 | 0.66 | 0.53 | 25.3 | 0.88 | 0.66 | 0.53 | 25.3 | 0.88 | 0.66 | 0.53 | 25.3 | 0.88 | 0.66 | 0.53 |
| 1.8 | 25.9 | 0.90 | 0.67 | 0.54 | 25.9 | 0.90 | 0.67 | 0.54 | 25.9 | 0.90 | 0.67 | 0.54 | 25.9 | 0.90 | 0.67 | 0.54 | 25.9 | 0.90 | 0.67 | 0.54 | 25.9 | 0.90 | 0.67 | 0.54 |
| 1.9 | 26.6 | 0.92 | 0.69 | 0.55 | 26.6 | 0.92 | 0.69 | 0.55 | 26.6 | 0.92 | 0.69 | 0.55 | 26.6 | 0.92 | 0.69 | 0.55 | 26.6 | 0.92 | 0.69 | 0.55 | 26.6 | 0.92 | 0.69 | 0.55 |
| 2.0 | 27.3 | 0.95 | 0.71 | 0.57 | 27.3 | 0.95 | 0.71 | 0.57 | 27.3 | 0.95 | 0.71 | 0.57 | 27.3 | 0.95 | 0.71 | 0.57 | 27.3 | 0.95 | 0.71 | 0.57 | 27.3 | 0.95 | 0.71 | 0.57 |
| 2.1 | 28.0 | 0.97 | 0.73 | 0.58 | 28.1 | 0.98 | 0.73 | 0.59 | 28.1 | 0.98 | 0.73 | 0.59 | 28.1 | 0.98 | 0.73 | 0.59 | 28.1 | 0.98 | 0.73 | 0.59 | 28.1 | 0.98 | 0.73 | 0.59 |
| 2.2 | 28.5 | 0.99 | 0.74 | 0.59 | 29.0 | 1.01 | 0.75 | 0.60 | 29.0 | 1.01 | 0.75 | 0.60 | 29.0 | 1.01 | 0.75 | 0.60 | 29.0 | 1.01 | 0.75 | 0.60 | 29.0 | 1.01 | 0.75 | 0.60 |
| 2.3 | 28.9 | 1.01 | 0.75 | 0.60 | 29.8 | 1.04 | 0.78 | 0.62 | 29.8 | 1.04 | 0.78 | 0.62 | 29.8 | 1.04 | 0.78 | 0.62 | 29.8 | 1.04 | 0.78 | 0.62 | 29.8 | 1.04 | 0.78 | 0.62 |
| 2.4 | 29.4 | 1.02 | 0.77 | 0.61 | 30.7 | 1.07 | 0.80 | 0.64 | 30.7 | 1.07 | 0.80 | 0.64 | 30.7 | 1.07 | 0.80 | 0.64 | 30.7 | 1.07 | 0.80 | 0.64 | 30.7 | 1.07 | 0.80 | 0.64 |
| 2.5 | 29.9 | 1.04 | 0.78 | 0.62 | 31.6 | 1.10 | 0.82 | 0.66 | 31.6 | 1.10 | 0.82 | 0.66 | 31.6 | 1.10 | 0.82 | 0.66 | 31.6 | 1.10 | 0.82 | 0.66 | 31.6 | 1.10 | 0.82 | 0.66 |
| 2.6 | 30.4 | 1.05 | 0.79 | 0.63 | 32.6 | 1.13 | 0.85 | 0.68 | 32.6 | 1.13 | 0.85 | 0.68 | 32.6 | 1.13 | 0.85 | 0.68 | 32.6 | 1.13 | 0.85 | 0.68 | 32.6 | 1.13 | 0.85 | 0.68 |
| 2.7 | 30.8 | 1.07 | 0.80 | 0.64 | 33.6 | 1.17 | 0.87 | 0.70 | 33.6 | 1.17 | 0.87 | 0.70 | 33.6 | 1.17 | 0.87 | 0.70 | 33.6 | 1.17 | 0.87 | 0.70 | 33.6 | 1.17 | 0.87 | 0.70 |
| 2.8 | 31.3 | 1.09 | 0.82 | 0.65 | 34.5 | 1.20 | 0.90 | 0.72 | 34.5 | 1.20 | 0.90 | 0.72 | 34.5 | 1.20 | 0.90 | 0.72 | 34.5 | 1.20 | 0.90 | 0.72 | 34.5 | 1.20 | 0.90 | 0.72 |
| 2.9 | 31.8 | 1.10 | 0.83 | 0.66 | 35.5 | 1.23 | 0.93 | 0.74 | 35.5 | 1.23 | 0.93 | 0.74 | 35.5 | 1.23 | 0.93 | 0.74 | 35.5 | 1.23 | 0.93 | 0.74 | 35.5 | 1.23 | 0.93 | 0.74 |
| 3.0 | 32.2 | 1.12 | 0.84 | 0.67 | 36.6 | 1.27 | 0.95 | 0.76 | 36.6 | 1.27 | 0.95 | 0.76 | 36.6 | 1.27 | 0.95 | 0.76 | 36.6 | 1.27 | 0.95 | 0.76 | 36.6 | 1.27 | 0.95 | 0.76 |
| 3.1 | 32.7 | 1.14 | 0.85 | 0.66 | 37.6 | 1.30 | 0.98 | 0.78 | 37.6 | 1.30 | 0.98 | 0.78 | 37.6 | 1.30 | 0.98 | 0.78 | 37.6 | 1.30 | 0.98 | 0.78 | 37.6 | 1.30 | 0.98 | 0.78 |
| 3.2 | 33.1 | 1.15 | 0.86 | 0.69 | 38.6 | 1.34 | 1.01 | 0.80 | 38.6 | 1.34 | 1.01 | 0.80 | 38.6 | 1.34 | 1.01 | 0.80 | 38.6 | 1.34 | 1.01 | 0.80 | 38.6 | 1.34 | 1.01 | 0.80 |
| 3.3 | 33.6 | 1.17 | 0.87 | 0.70 | 39.4 | 1.37 | 1.03 | 0.82 | 39.7 | 1.38 | 1.03 | 0.83 | 39.7 | 1.38 | 1.03 | 0.83 | 39.7 | 1.38 | 1.03 | 0.83 | 39.7 | 1.38 | 1.03 | 0.83 |
| 3.4 | 34.0 | 1.18 | 0.89 | 0.71 | 39.9 | 1.39 | 1.04 | 0.83 | 40.7 | 1.41 | 1.06 | 0.85 | 40.7 | 1.41 | 1.06 | 0.85 | 40.7 | 1.41 | 1.06 | 0.85 | 40.7 | 1.41 | 1.06 | 0.85 |
| 3.5 | 34.4 | 1.20 | 0.90 | 0.72 | 40.5 | 1.41 | 1.05 | 0.84 | 41.8 | 1.45 | 1.09 | 0.87 | 41.8 | 1.45 | 1.09 | 0.87 | 41.8 | 1.45 | 1.09 | 0.87 | 41.8 | 1.45 | 1.09 | 0.87 |
| 3.6 | 34.8 | 1.21 | 0.91 | 0.73 | 41.1 | 1.43 | 1.07 | 0.86 | 42.8 | 1.49 | 1.12 | 0.89 | 42.8 | 1.49 | 1.12 | 0.89 | 42.8 | 1.49 | 1.12 | 0.89 | 42.8 | 1.49 | 1.12 | 0.89 |
| 3.7 | 35.2 | 1.22 | 0.92 | 0.73 | 41.6 | 1.44 | 1.08 | 0.87 | 43.9 | 1.53 | 1.14 | 0.92 | 43.9 | 1.53 | 1.14 | 0.92 | 43.9 | 1.53 | 1.14 | 0.92 | 43.9 | 1.53 | 1.14 | 0.92 |
| 3.8 | 35.6 | 1.24 | 0.93 | 0.74 | 42.1 | 1.46 | 1.10 | 0.88 | 45.0 | 1.56 | 1.17 | 0.94 | 45.0 | 1.56 | 1.17 | 0.94 | 45.0 | 1.56 | 1.17 | 0.94 | 45.0 | 1.56 | 1.17 | 0.94 |
| 3.9 | 36.0 | 1.25 | 0.94 | 0.75 | 42.6 | 1.48 | 1.11 | 0.89 | 46.1 | 1.60 | 1.20 | 0.96 | 46.1 | 1.60 | 1.20 | 0.96 | 46.1 | 1.60 | 1.20 | 0.96 | 46.1 | 1.60 | 1.20 | 0.96 |
| 4.0 | 36.4 | 1.26 | 0.95 | 0.76 | 43.1 | 1.50 | 1.12 | 0.90 | 47.2 | 1.64 | 1.23 | 0.98 | 47.2 | 1.64 | 1.23 | 0.98 | 47.2 | 1.64 | 1.23 | 0.98 | 47.2 | 1.64 | 1.23 | 0.98 |
| 4.1 | 36.8 | 1.28 | 0.96 | 0.77 | 43.6 | 1.51 | 1.14 | 0.91 | 48.3 | 1.68 | 1.26 | 1.01 | 48.3 | 1.68 | 1.26 | 1.01 | 48.3 | 1.68 | 1.26 | 1.01 | 48.3 | 1.68 | 1.26 | 1.01 |
| 4.2 | 37.1 | 1.29 | 0.97 | 0.77 | 44.1 | 1.53 | 1.15 | 0.92 | 49.4 | 1.71 | 1.29 | 1.03 | 49.4 | 1.71 | 1.29 | 1.03 | 49.4 | 1.71 | 1.29 | 1.03 | 49.4 | 1.71 | 1.29 | 1.03 |
| 4.3 | 37.4 | 1.30 | 0.98 | 0.78 | 44.6 | 1.55 | 1.16 | 0.93 | 50.5 | 1.75 | 1.31 | 1.05 | 50.5 | 1.75 | 1.31 | 1.05 | 50.5 | 1.75 | 1.31 | 1.05 | 50.5 | 1.75 | 1.31 | 1.05 |
| 4.4 | 37.8 | 1.31 | 0.98 | 0.79 | 45.0 | 1.56 | 1.17 | 0.94 | 51.6 | 1.79 | 1.34 | 1.07 | 51.6 | 1.79 | 1.34 | 1.07 | 51.6 | 1.79 | 1.34 | 1.07 | 51.6 | 1.79 | 1.34 | 1.07 |
| 4.5 | 38.1 | 1.32 | 0.99 | 0.79 | 45.5 | 1.58 | 1.18 | 0.95 | 52.7 | 1.83 | 1.37 | 1.10 | 52.7 | 1.83 | 1.37 | 1.10 | 52.7 | 1.83 | 1.37 | 1.10 | 52.7 | 1.83 | 1.37 | 1.10 |
| 4.6 | 38.4 | 1.33 | 1.00 | 0.80 | 45.9 | 1.59 | 1.20 | 0.96 | 53.6 | 1.86 | 1.40 | 1.12 | 53.8 | 1.87 | 1.40 | 1.12 | 53.8 | 1.87 | 1.40 | 1.12 | 53.8 | 1.87 | 1.40 | 1.12 |
| 4.7 | 38.7 | 1.34 | 1.01 | 0.81 | 46.3 | 1.61 | 1.21 | 0.96 | 54.1 | 1.88 | 1.41 | 1.13 | 54.9 | 1.91 | 1.43 | 1.14 | 54.9 | 1.91 | 1.43 | 1.14 | 54.9 | 1.91 | 1.43 | 1.14 |
| 4.8 | 39.0 | 1.38 | 1.02 | 0.81 | 46.7 | 1.62 | 1.22 | 0.97 | 54.7 | 1.90 | 1.42 | 1.14 | 56.0 | 1.95 | 1.46 | 1.17 | 56.0 | 1.95 | 1.46 | 1.17 | 56.0 | 1.95 | 1.46 | 1.17 |
| 4.9 | 39.3 | 1.37 | 1.02 | 0.82 | 47.1 | 1.64 | 1.23 | 0.98 | 55.2 | 1.92 | 1.44 | 1.15 | 57.2 | 1.98 | 1.49 | 1.19 | 57.2 | 1.98 | 1.49 | 1.19 | 57.2 | 1.98 | 1.49 | 1.19 |
| 5.0 | 39.6 | 1.37 | 1.03 | 0.82 | 47.5 | 1.65 | 1.24 | 0.99 | 55.7 | 1.93 | 1.45 | 1.16 | 58.3 | 2.02 | 1.52 | 1.21 | 58.3 | 2.02 | 1.52 | 1.21 | 58.3 | 2.02 | 1.52 | 1.21 |
| 5.1 | 38.9 | 1.38 | 1.04 | 0.83 | 47.9 | 1.66 | 1.25 | 1.00 | 56.2 | 1.95 | 1.46 | 1.17 | 59.4 | 2.06 | 1.55 | 1.24 | 59.4 | 2.06 | 1.55 | 1.24 | 59.4 | 2.06 | 1.55 | 1.24 |
| 5.2 | 40.1 | 1.39 | 1.05 | 0.84 | 48.3 | 1.68 | 1.26 | 1.01 | 56.7 | 1.97 | 1.48 | 1.18 | 60.5 | 2.10 | 1.58 | 1.26 | 60.5 | 2.10 | 1.58 | 1.26 | 60.5 | 2.10 | 1.58 | 1.26 |
| 5.3 | 40.4 | 1.40 | 1.05 | 0.84 | 46.6 | 1.69 | 1.27 | 1.01 | 57.2 | 1.98 | 1.49 | 1.19 | 61.6 | 2.14 | 1.61 | 1.28 | 61.6 | 2.14 | 1.61 | 1.28 | 61.6 | 2.14 | 1.61 | 1.28 |
| 5.4 | 40.6 | 1.41 | 1.06 | 0.85 | 49.0 | 1.70 | 1.28 | 1.02 | 57.6 | 2.00 | 1.50 | 1.20 | 62.8 | 2.18 | 1.63 | 1.31 | 62.8 | 2.18 | 1.63 | 1.31 | 62.8 | 2.18 | 1.63 | 1.31 |
| 5.5 | 40.9 | 1.42 | 1.06 | 0.85 | 49.3 | 1.71 | 1.28 | 1.03 | 58.1 | 2.02 | 1.51 | 1.21 | 63.9 | 2.22 | 1.66 | 1.33 | 63.9 | 2.22 | 1.66 | 1.33 | 63.9 | 2.22 | 1.66 | 1.33 |
| 5.6 | 41.1 | 1.43 | 1.07 | 0.68 | 49.6 | 1.72 | 1.29 | 1.03 | 58.5 | 2.03 | 1.52 | 1.22 | 65.0 | 2.26 | 1.69 | 1.35 | 65.0 | 2.26 | 1.69 | 1.35 | 65.0 | 2.26 | 1.69 | 1.35 |
| 5.7 | 41.3 | 1.44 | 1.08 | 0.68 | 50.0 | 1.73 | 1.30 | 1.04 | 58.9 | 2.05 | 1.53 | 1.23 | 66.2 | 2.30 | 1.72 | 1.38 | 66.2 | 2.30 | 1.72 | 1.38 | 66.2 | 2.30 | 1.72 | 1.38 |
| 5.8 | 41.6 | 1.44 | 1.08 | 0.87 | 50.3 | 1.75 | 1.31 | 1.05 | 59.4 | 2.06 | 1.55 | 1.24 | 67.3 | 2.34 | 1.75 | 1.40 | 67.3 | 2.34 | 1.75 | 1.40 | 67.3 | 2.34 | 1.75 | 1.40 |
| 5.9 | 41.8 | 1.45 | 1.09 | 0.87 | 50.6 | 1.76 | 1.32 | 1.05 | 59.8 | 2.08 | 1.56 | 1.25 | 68.4 | 2.38 | 1.78 | 1.43 | 68.4 | 2.38 | 1.78 | 1.43 | 68.4 | 2.38 | 1.78 | 1.43 |
| 6.0 | 42.0 | 1.46 | 1.09 | 0.87 | 50.9 | 1.77 | 1.33 | 1.06 | 60.2 | 2.09 | 1.57 | 1.25 | 69.6 | 2.42 | 1.81 | 1.45 | 69.6 | 2.42 | 1.81 | 1.45 | 69.6 | 2.42 | 1.81 | 1.45 |
| 6.1 | 42.2 | 1.46 | 1.10 | 0.88 | 51.2 | 1.78 | 1.33 | 1.07 | 60.5 | 2.10 | 1.58 | 1.26 | 70.2 | 2.44 | 1.83 | 1.46 | 70.7 | 2.45 | 1.84 | 1.47 | 70.7 | 2.45 | 1.84 | 1.47 |
| 6.2 | 42.4 | 1.47 | 1.10 | 0.88 | 51.5 | 1.79 | 1.34 | 1.07 | 60.9 | 2.12 | 1.59 | 1.27 | 70.7 | 2.46 | 1.84 | 1.47 | 71.8 | 2.49 | 1.87 | 1.50 | 71.8 | 2.49 | 1.87 | 1.50 |
| 6.3 | 42.6 | 1.48 | 1.11 | 0.89 | 51.7 | 1.80 | 1.35 | 1.08 | 61.3 | 2.13 | 1.60 | 1.28 | 71.2 | 2.47 | 1.85 | 1.48 | 73.0 | 2.53 | 1.90 | 1.52 | 73.0 | 2.53 | 1.90 | 1.52 |
| 6.4 | 42.8 | 1.48 | 1.11 | 0.89 | 52.0 | 1.81 | 1.35 | 1.08 | 61.7 | 2.14 | 1.61 | 1.28 | 71.7 | 2.49 | 1.87 | 1.49 | 74.1 | 2.57 | 1.93 | 1.54 | 74.1 | 2.57 | 1.93 | 1.54 |
| 6.5 | 42.9 | 1.49 | 1.12 | 0.89 | 52.3 | 1.81 | 1.36 | 1.09 | 62.0 | 2.15 | 1.61 | 1.29 | 72.1 | 2.50 | 1.88 | 1.50 | 75.3 | 2.61 | 1.96 | 1.57 | 75.3 | 2.61 | 1.96 | 1.57 |
| 6.6 | 43.1 | 1.50 | 1.12 | 0.90 | 52.5 | 1.82 | 1.37 | 1.09 | 62.4 | 2.17 | 1.62 | 1.30 | 72.6 | 2.52 | 1.89 | 1.51 | 76.4 | 2.65 | 1.99 | 1.59 | 76.4 | 2.65 | 1.99 | 1.59 |
| 6.7 | 43.3 | 1.50 | 1.13 | 0.90 | 52.7 | 1.83 | 1.37 | 1.10 | 62.7 | 2.18 | 1.63 | 1.31 | 73.0 | 2.54 | 1.90 | 1.52 | 77.5 | 2.69 | 2.02 | 1.62 | 77.5 | 2.69 | 2.02 | 1.62 |
| 6.8 | 43.4 | 1.51 | 1.13 | 0.90 | 53.0 | 1.84 | 1.38 | 1.10 | 63.0 | 2.19 | 1.64 | 1.31 | 73.4 | 2.55 | 1.91 | 1.53 | 78.7 | 2.73 | 2.05 | 1.64 | 78.7 | 2.73 | 2.05 | 1.64 |
| 6.9 | 43.6 | 1.51 | 1.14 | 0.91 | 53.2 | 1.85 | 1.39 | 1.11 | 63.3 | 2.20 | 1.65 | 1.32 | 73.8 | 2.56 | 1.92 | 1.54 | 79.8 | 2.77 | 2.08 | 1.66 | 79.8 | 2.77 | 2.08 | 1.66 |
| 7.0 | 43.7 | 1.52 | 1.14 | 0.91 | 53.4 | 1.86 | 1.39 | 1.11 | 63.6 | 2.21 | 1.66 | 1.33 | 74.3 | 2.58 | 1.93 | 1.55 | 81.0 | 2.81 | 2.11 | 1.69 | 81.0 | 2.81 | 2.11 | 1.69 |
| 7.1 | 43.9 | 1.52 | 1.14 | 0.91 | 53.7 | 1.86 | 1.40 | 1.12 | 63.9 | 2.22 | 1.67 | 1.33 | 74.6 | 2.59 | 1.94 | 1.56 | 82.1 | 2.85 | 2.14 | 1.71 | 82.1 | 2.85 | 2.14 | 1.71 |
| 7.2 | 44.0 | 1.53 | 1.15 | 0.92 | 53.9 | 1.87 | 1.40 | 1.12 | 64.2 | 2.23 | 1.67 | 1.34 | 75.0 | 2.61 | 1.95 | 1.56 | 83.2 | 2.89 | 2.17 | 1.73 | 83.2 | 2.89 | 2.17 | 1.73 |
| 7.3 | 44.2 | 1.53 | 1.15 | 0.92 | 54.1 | 1.88 | 1.41 | 1.13 | 64.5 | 2.24 | 1.68 | 1.34 | 75.4 | 2.62 | 1.96 | 1.57 | 84.4 | 2.93 | 2.20 | 1.76 | 84.4 | 2.93 | 2.20 | 1.76 |
| 7.4 | 44.3 | 1.54 | 1.15 | 0.92 | 54.3 | 1.88 | 1.41 | 1.13 | 64.8 | 2.25 | 1.69 | 1.35 | 75.8 | 2.63 | 1.97 | 1.58 | 85.5 | 2.97 | 2.23 | 1.78 | 85.5 | 2.97 | 2.23 | 1.78 |
| 7.5 | 44.4 | 1.54 | 1.16 | 0.93 | 54.5 | 1.89 | 1.42 | 1.13 | 65.1 | 2.26 | 1.69 | 1.36 | 76.1 | 2.64 | 1.98 | 1.59 | 86.7 | 3.01 | 2.26 | 1.81 | 86.7 | 3.01 | 2.26 | 1.81 |
| 7.6 | 44.6 | 1.55 | 1.16 | 0.93 | 54.7 | 1.90 | 1.42 | 1.14 | 65.3 | 2.27 | 1.70 | 1.36 | 76.5 | 2.66 | 1.99 | 1.59 | 87.8 | 3.05 | 2.29 | 1.83 | 87.8 | 3.05 | 2.29 | 1.83 |
| 7.7 | 44.7 | 1.55 | 1.16 | 0.93 | 54.8 | 1.90 | 1.43 | 1.14 | 65.6 | 2.28 | 1.71 | 1.37 | 76.8 | 2.67 | 2.00 | 1.60 | 88.5 | 3.07 | 2.30 | 1.84 | 89.0 | 3.09 | 2.32 | 1.85 |
| 7.8 | 44.8 | 1.56 | 1.17 | 0.93 | 55.0 | 1.91 | 1.43 | 1.15 | 65.9 | 2.29 | 1.71 | 1.37 | 77.2 | 2.68 | 2.01 | 1.61 | 88.9 | 3.09 | 2.32 | 1.85 | 90.1 | 3.13 | 2.35 | 1.88 |
| 7.9 | 44.9 | 1.56 | 1.17 | 0.94 | 55.2 | 1.92 | 1.44 | 1.15 | 66.1 | 2.30 | 1.72 | 1.38 | 77.5 | 2.69 | 2.02 | 1.61 | 89.3 | 3.10 | 2.33 | 1.86 | 91.2 | 3.17 | 2.38 | 1.90 |
| 8.0 | 45.0 | 1.56 | 1.17 | 0.94 | 55.4 | 1.92 | 1.44 | 1.15 | 66.3 | 2.30 | 1.73 | 1.38 | 77.8 | 2.70 | 2.03 | 1.82 | 89.8 | 3.12 | 2.34 | 1.87 | 92.4 | 3.21 | 2.41 | 1.92 |
| 8.1 | 45.1 | 1.57 | 1.18 | 0.94 | 55.5 | 1.93 | 1.45 | 1.16 | 66.6 | 2.31 | 1.73 | 1.39 | 78.1 | 2.71 | 2.03 | 1.63 | 90.2 | 3.13 | 2.35 | 1.88 | 93.5 | 3.25 | 2.44 | 1.95 |
| 8.2 | 45.2 | 1.57 | 1.18 | 0.94 | 55.7 | 1.93 | 1.45 | 1.16 | 66.8 | 2.32 | 1.74 | 1.39 | 78.4 | 2.72 | 2.04 | 1.63 | 90.6 | 3.14 | 2.36 | 1.89 | 94.7 | 3.29 | 2.47 | 1.97 |
| 8.3 | 45.3 | 1.57 | 1.18 | 0.94 | 55.9 | 1.94 | 1.46 | 1.16 | 67.0 | 2.33 | 1.75 | 1.40 | 78.7 | 2.73 | 2.05 | 1.64 | 90.9 | 3.16 | 2.37 | 1.89 | 95.8 | 3.33 | 2.50 | 2.00 |
| 8.4 | 45.4 | 1.58 | 1.18 | 0.95 | 56.0 | 1.94 | 1.46 | 1.17 | 67.2 | 2.33 | 1.75 | 1.40 | 79.0 | 2.74 | 2.06 | 1.65 | 91.3 | 3.17 | 2.38 | 1.90 | 97.0 | 3.37 | 2.53 | 2.02 |
| 8.5 | 45.5 | 1.58 | 1.19 | 0.95 | 56.1 | 1.95 | 1.46 | 1.17 | 67.5 | 2.34 | 1.76 | 1.41 | 79.3 | 2.75 | 2.07 | 1.65 | 91.7 | 3.18 | 2.39 | 1.91 | 98.1 | 3.41 | 2.56 | 2.04 |
| 8.6 | 45.6 | 1.58 | 1.19 | 0.95 | 56.3 | 1.95 | 1.47 | 1.17 | 67.7 | 2.35 | 1.76 | 1.41 | 79.6 | 2.76 | 2.07 | 1.66 | 92.1 | 3.20 | 2.40 | 1.92 | 99.3 | 3.45 | 2.59 | 2.07 |
| 8.7 | 45.7 | 1.59 | 1.19 | 0.95 | 56.4 | 1.96 | 1.47 | 1.18 | 67.9 | 2.36 | 1.77 | 1.41 | 79.9 | 2.77 | 2.08 | 1.66 | 92.4 | 3.21 | 2.41 | 1.93 | 100.4 | 3.49 | 2.62 | 2.09 |
| 8.8 | 45.8 | 1.59 | 1.19 | 0.95 | 56.6 | 1.96 | 1.47 | 1.18 | 66.1 | 2.36 | 1.77 | 1.42 | 80.1 | 2.78 | 2.09 | 1.67 | 92.8 | 3.22 | 2.42 | 1.93 | 101.6 | 3.53 | 2.65 | 2.12 |
| 8.9 | 45.9 | 1.59 | 1.19 | 0.96 | 56.7 | 1.97 | 1.48 | 1.18 | 68.2 | 2.37 | 1.78 | 1.42 | 80.4 | 2.79 | 2.09 | 1.68 | 93.1 | 3.23 | 2.42 | 1.94 | 102.7 | 3.57 | 2.67 | 2.14 |
| 9.0 | 45.9 | 1.60 | 1.20 | 0.96 | 56.8 | 1.97 | 1.48 | 1.18 | 68.4 | 2.38 | 1.78 | 1.43 | 80.7 | 2.80 | 2.10 | 1.68 | 93.4 | 3.24 | 2.43 | 1.95 | 103.9 | 3.61 | 2.70 | 2.16 |
| 9.1 | 46.0 | 1.60 | 1.20 | 0.96 | 56.9 | 1.96 | 1.48 | 1.19 | 68.6 | 2.38 | 1.79 | 1.43 | 80.9 | 2.81 | 2.11 | 1.68 | 93.8 | 3.26 | 2.44 | 1.96 | 105.0 | 3.65 | 2.73 | 2.19 |
| 9.2 | 46.1 | 1.60 | 1.20 | 0.96 | 57.1 | 1.98 | 1.49 | 1.19 | 68.8 | 2.39 | 1.79 | 1.43 | 81.2 | 2.82 | 2.11 | 1.69 | 94.1 | 3.27 | 2.45 | 1.96 | 106.2 | 3.69 | 2.76 | 2.21 |
| 9.3 | 46.2 | 1.60 | 1.20 | 0.96 | 57.2 | 1.99 | 1.49 | 1.19 | 69.0 | 2.39 | 1.80 | 1.44 | 81.4 | 2.83 | 2.12 | 1.70 | 94.4 | 3.28 | 2.46 | 1.97 | 107.3 | 3.73 | 2.79 | 2.24 |
| 9.4 | 46.2 | 1.61 | 1.20 | 0.96 | 57.3 | 1.99 | 1.49 | 1.19 | 69.1 | 2.40 | 1.80 | 1.44 | 81.6 | 2.83 | 2.13 | 1.70 | 94.7 | 3.29 | 2.47 | 1.97 | 108.5 | 3.76 | 2.82 | 2.26 |
| 9.5 | 46.3 | 1.61 | 1.21 | 0.96 | 57.4 | 1.99 | 1.50 | 1.20 | 69.3 | 2.41 | 1.80 | 1.44 | 81.8 | 2.84 | 2.13 | 1.71 | 95.0 | 3.30 | 2.47 | 1.98 | 108.7 | 3.77 | 2.83 | 2.26 |
| 9.6 | 46.4 | 1.61 | 1.21 | 0.97 | 57.5 | 2.00 | 1.50 | 1.20 | 69.4 | 2.41 | 1.81 | 1.45 | 82.1 | 2.85 | 2.14 | 1.71 | 95.3 | 3.31 | 2.48 | 1.99 | 109.0 | 3.79 | 2.84 | 2.27 |
| 9.7 | 46.4 | 1.61 | 1.21 | 0.97 | 57.6 | 2.00 | 1.50 | 1.20 | 68.6 | 2.42 | 1.81 | 1.46 | 82.3 | 2.86 | 2.14 | 1.71 | 95.6 | 3.32 | 2.49 | 1.99 | 109.4 | 3.80 | 2.85 | 2.28 |
| 9.8 | 46.5 | 1.61 | 1.21 | 0.97 | 57.7 | 2.00 | 1.50 | 1.20 | 69.8 | 2.42 | 1.82 | 1.45 | 82.5 | 2.86 | 2.15 | 1.72 | 95.9 | 3.33 | 2.50 | 2.00 | 109.7 | 3.81 | 2.86 | 2.29 |
| 9.9 | 46.6 | 1.62 | 1.21 | 0.97 | 57.8 | 2.01 | 1.51 | 1.20 | 69.9 | 2.43 | 1.82 | 1.46 | 82.7 | 2.87 | 2.15 | 1.72 | 96.1 | 3.34 | 2.50 | 2.00 | 110.1 | 3.82 | 2.87 | 2.29 |
| 10.0 | 46.6 | 1.62 | 1.21 | 0.97 | 57.9 | 2.01 | 1.51 | 1.21 | 70.0 | 2.43 | 1.82 | 1.46 | 82.9 | 2.88 | 2.16 | 1.73 | 96.4 | 3.35 | 2.51 | 2.01 | 110.4 | 3.83 | 2.88 | 2.30 |
| Trench Width m | | 0.8 | | | | 0.9 | | | | 1.0 | | | | 1.1 | | | | 1.2 | | | | 1.3 | | |

## TABLE 6. DESIGN LOADS
## 375 mm DIAMETER PIPE

2 WHEELS 30kN
IMPACT FACTOR 2.0

| Cover | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 36 | 45 | 60 | kN/m | 36 | 45 | 60 | kN/m | 36 | 45 | 60 | kN/m | 36 | 45 | 60 | kN/m | 36 | 45 | 60 | kN/m | 36 | 45 | 60 |
| 0.6 | 37.5 | 1.30 | 1.04 | 0.78 | 37.5 | 1.30 | 1.04 | 0.78 | 37.5 | 1.30 | 1.04 | 0.78 | 37.5 | 1.30 | 1.04 | 0.78 | 37.5 | 1.30 | 1.04 | 0.78 | 37.5 | 1.30 | 1.04 | 0.78 |
| 0.7 | 34.1 | 1.18 | 0.95 | 0.71 | 34.1 | 1.18 | 0.95 | 0.71 | 34.1 | 1.18 | 0.95 | 0.71 | 34.1 | 1.18 | 0.95 | 0.71 | 34.1 | 1.18 | 0.95 | 0.71 | 34.1 | 1.18 | 0.95 | 0.71 |
| 0.8 | 31.9 | 1.11 | 0.89 | 0.66 | 31.9 | 1.11 | 0.89 | 0.66 | 31.9 | 1.11 | 0.89 | 0.66 | 31.9 | 1.11 | 0.89 | 0.66 | 31.9 | 1.11 | 0.89 | 0.66 | 31.9 | 1.11 | 0.89 | 0.66 |
| 0.9 | 30.6 | 1.06 | 0.85 | 0.64 | 30.6 | 1.06 | 0.85 | 0.64 | 30.6 | 1.06 | 0.85 | 0.64 | 30.6 | 1.06 | 0.85 | 0.64 | 30.6 | 1.06 | 0.85 | 0.64 | 30.6 | 1.06 | 0.85 | 0.64 |
| 1.0 | 29.5 | 1.02 | 0.82 | 0.61 | 29.5 | 1.02 | 0.82 | 0.61 | 29.5 | 1.02 | 0.82 | 0.61 | 29.5 | 1.02 | 0.82 | 0.61 | 29.5 | 1.02 | 0.82 | 0.61 | 29.5 | 1.02 | 0.82 | 0.61 |
| 1.1 | 28.8 | 1.00 | 0.80 | 0.60 | 28.8 | 1.00 | 0.80 | 0.60 | 28.8 | 1.00 | 0.80 | 0.60 | 28.8 | 1.00 | 0.80 | 0.60 | 28.8 | 1.00 | 0.80 | 0.60 | 28.8 | 1.00 | 0.80 | 0.60 |
| 1.2 | 28.5 | 0.99 | 0.79 | 0.59 | 28.5 | 0.99 | 0.79 | 0.59 | 28.5 | 0.99 | 0.79 | 0.59 | 28.5 | 0.99 | 0.79 | 0.59 | 28.5 | 0.99 | 0.79 | 0.59 | 28.5 | 0.99 | 0.79 | 0.59 |
| 1.3 | 28.5 | 0.99 | 0.79 | 0.59 | 28.5 | 0.99 | 0.79 | 0.59 | 28.5 | 0.99 | 0.79 | 0.59 | 28.5 | 0.99 | 0.79 | 0.59 | 28.5 | 0.99 | 0.79 | 0.59 | 28.5 | 0.99 | 0.79 | 0.59 |
| 1.4 | 28.6 | 0.99 | 0.80 | 0.60 | 28.6 | 0.99 | 0.80 | 0.60 | 28.6 | 0.99 | 0.80 | 0.60 | 28.6 | 0.99 | 0.80 | 0.60 | 28.6 | 0.99 | 0.80 | 0.60 | 28.6 | 0.99 | 0.80 | 0.60 |
| 1.5 | 29.0 | 1.01 | 0.80 | 0.60 | 29.0 | 1.01 | 0.80 | 0.60 | 29.0 | 1.01 | 0.80 | 0.60 | 29.0 | 1.01 | 0.80 | 0.60 | 29.0 | 1.01 | 0.80 | 0.60 | 29.0 | 1.01 | 0.80 | 0.60 |
| 1.6 | 29.4 | 1.02 | 0.82 | 0.61 | 29.4 | 1.02 | 0.82 | 0.61 | 29.4 | 1.02 | 0.82 | 0.61 | 29.4 | 1.02 | 0.82 | 0.61 | 29.4 | 1.02 | 0.82 | 0.61 | 29.4 | 1.02 | 0.82 | 0.61 |
| 1.7 | 30.0 | 1.04 | 0.83 | 0.63 | 30.0 | 1.04 | 0.83 | 0.63 | 30.0 | 1.04 | 0.83 | 0.63 | 30.0 | 1.04 | 0.83 | 0.63 | 30.0 | 1.04 | 0.83 | 0.63 | 30.0 | 1.04 | 0.83 | 0.63 |
| 1.8 | 30.7 | 1.07 | 0.85 | 0.64 | 30.7 | 1.07 | 0.85 | 0.64 | 30.7 | 1.07 | 0.85 | 0.64 | 30.7 | 1.07 | 0.85 | 0.64 | 30.7 | 1.07 | 0.85 | 0.64 | 30.7 | 1.07 | 0.85 | 0.64 |
| 1.9 | 31.5 | 1.09 | 0.88 | 0.66 | 31.5 | 1.09 | 0.88 | 0.66 | 31.5 | 1.09 | 0.88 | 0.66 | 31.5 | 1.09 | 0.88 | 0.66 | 31.5 | 1.09 | 0.88 | 0.66 | 31.5 | 1.09 | 0.88 | 0.66 |
| 2.0 | 32.4 | 1.12 | 0.90 | 0.67 | 32.4 | 1.12 | 0.90 | 0.67 | 32.4 | 1.12 | 0.90 | 0.67 | 32.4 | 1.12 | 0.90 | 0.67 | 32.4 | 1.12 | 0.90 | 0.67 | 32.4 | 1.12 | 0.90 | 0.67 |
| 2.1 | 32.9 | 1.14 | 0.91 | 0.69 | 33.3 | 1.15 | 0.92 | 0.69 | 33.3 | 1.15 | 0.92 | 0.69 | 33.3 | 1.15 | 0.92 | 0.69 | 33.3 | 1.15 | 0.92 | 0.69 | 33.3 | 1.15 | 0.92 | 0.69 |
| 2.2 | 33.5 | 1.16 | 0.93 | 0.70 | 34.2 | 1.19 | 0.95 | 0.71 | 34.2 | 1.19 | 0.95 | 0.71 | 34.2 | 1.19 | 0.95 | 0.71 | 34.2 | 1.19 | 0.95 | 0.71 | 34.2 | 1.19 | 0.95 | 0.71 |
| 2.3 | 34.0 | 1.18 | 0.95 | 0.71 | 35.2 | 1.22 | 0.98 | 0.73 | 35.2 | 1.22 | 0.98 | 0.73 | 35.2 | 1.22 | 0.98 | 0.73 | 35.2 | 1.22 | 0.98 | 0.73 | 35.2 | 1.22 | 0.98 | 0.73 |
| 2.4 | 34.6 | 1.20 | 0.96 | 0.72 | 36.2 | 1.26 | 1.01 | 0.76 | 36.2 | 1.26 | 1.01 | 0.76 | 36.2 | 1.26 | 1.01 | 0.76 | 36.2 | 1.26 | 1.01 | 0.76 | 36.2 | 1.26 | 1.01 | 0.76 |
| 2.5 | 35.2 | 1.22 | 0.98 | 0.73 | 37.3 | 1.30 | 1.04 | 0.78 | 37.3 | 1.30 | 1.04 | 0.78 | 37.3 | 1.30 | 1.04 | 0.78 | 37.3 | 1.30 | 1.04 | 0.78 | 37.3 | 1.30 | 1.04 | 0.78 |
| 2.6 | 35.8 | 1.24 | 0.99 | 0.75 | 38.4 | 1.33 | 1.07 | 0.80 | 38.4 | 1.33 | 1.07 | 0.80 | 38.4 | 1.33 | 1.07 | 0.80 | 38.4 | 1.33 | 1.07 | 0.80 | 38.4 | 1.33 | 1.07 | 0.80 |
| 2.7 | 36.4 | 1.26 | 1.01 | 0.76 | 39.5 | 1.37 | 1.10 | 0.82 | 39.5 | 1.37 | 1.10 | 0.82 | 39.5 | 1.37 | 1.10 | 0.82 | 39.5 | 1.37 | 1.10 | 0.82 | 39.5 | 1.37 | 1.10 | 0.82 |
| 2.8 | 37.0 | 1.28 | 1.03 | 0.77 | 40.7 | 1.41 | 1.13 | 0.85 | 40.7 | 1.41 | 1.13 | 0.85 | 40.7 | 1.41 | 1.13 | 0.85 | 40.7 | 1.41 | 1.13 | 0.85 | 40.7 | 1.41 | 1.13 | 0.85 |
| 2.9 | 37.5 | 1.30 | 1.04 | 0.78 | 41.8 | 1.45 | 1.16 | 0.87 | 41.8 | 1.45 | 1.16 | 0.87 | 41.8 | 1.45 | 1.16 | 0.87 | 41.8 | 1.45 | 1.16 | 0.87 | 41.8 | 1.45 | 1.16 | 0.87 |
| 3.0 | 38.1 | 1.32 | 1.06 | 0.79 | 43.0 | 1.49 | 1.19 | 0.90 | 43.0 | 1.49 | 1.19 | 0.90 | 43.0 | 1.49 | 1.19 | 0.90 | 43.0 | 1.49 | 1.19 | 0.90 | 43.0 | 1.49 | 1.19 | 0.90 |
| 3.1 | 38.7 | 1.34 | 1.07 | 0.81 | 44.2 | 1.53 | 1.23 | 0.92 | 44.2 | 1.53 | 1.23 | 0.92 | 44.2 | 1.53 | 1.23 | 0.92 | 44.2 | 1.53 | 1.23 | 0.92 | 44.2 | 1.53 | 1.23 | 0.92 |
| 3.2 | 39.3 | 1.36 | 1.09 | 0.82 | 45.0 | 1.56 | 1.25 | 0.94 | 45.4 | 1.58 | 1.26 | 0.95 | 45.4 | 1.58 | 1.26 | 0.95 | 45.4 | 1.58 | 1.26 | 0.95 | 45.4 | 1.58 | 1.26 | 0.95 |
| 3.3 | 39.8 | 1.38 | 1.11 | 0.83 | 45.7 | 1.59 | 1.27 | 0.95 | 46.6 | 1.62 | 1.30 | 0.97 | 46.6 | 1.62 | 1.30 | 0.97 | 46.6 | 1.62 | 1.30 | 0.97 | 46.6 | 1.62 | 1.30 | 0.97 |
| 3.4 | 40.4 | 1.40 | 1.12 | 0.84 | 46.4 | 1.61 | 1.29 | 0.97 | 47.9 | 1.66 | 1.33 | 1.00 | 47.9 | 1.66 | 1.33 | 1.00 | 47.9 | 1.66 | 1.33 | 1.00 | 47.9 | 1.66 | 1.33 | 1.00 |
| 3.5 | 40.9 | 1.42 | 1.14 | 0.85 | 47.1 | 1.64 | 1.31 | 0.98 | 49.1 | 1.70 | 1.36 | 1.02 | 49.1 | 1.70 | 1.36 | 1.02 | 49.1 | 1.70 | 1.36 | 1.02 | 49.1 | 1.70 | 1.36 | 1.02 |
| 3.6 | 41.4 | 1.44 | 1.15 | 0.86 | 47.8 | 1.66 | 1.33 | 1.00 | 50.4 | 1.75 | 1.40 | 1.05 | 50.4 | 1.75 | 1.40 | 1.05 | 50.4 | 1.75 | 1.40 | 1.05 | 50.4 | 1.75 | 1.40 | 1.05 |
| 3.7 | 41.9 | 1.46 | 1.17 | 0.87 | 48.4 | 1.68 | 1.35 | 1.01 | 51.6 | 1.79 | 1.43 | 1.08 | 51.6 | 1.79 | 1.43 | 1.08 | 51.6 | 1.79 | 1.43 | 1.08 | 51.6 | 1.79 | 1.43 | 1.08 |
| 3.8 | 42.5 | 1.47 | 1.18 | 0.88 | 49.1 | 1.70 | 1.36 | 1.02 | 52.9 | 1.84 | 1.47 | 1.10 | 52.9 | 1.84 | 1.47 | 1.10 | 52.9 | 1.84 | 1.47 | 1.10 | 52.9 | 1.84 | 1.47 | 1.10 |
| 3.9 | 43.0 | 1.49 | 1.19 | 0.89 | 49.7 | 1.73 | 1.38 | 1.04 | 54.1 | 1.88 | 1.50 | 1.13 | 54.1 | 1.88 | 1.50 | 1.13 | 54.1 | 1.88 | 1.50 | 1.13 | 54.1 | 1.88 | 1.50 | 1.13 |
| 4.0 | 43.4 | 1.51 | 1.21 | 0.90 | 50.3 | 1.75 | 1.40 | 1.05 | 55.4 | 1.92 | 1.54 | 1.15 | 55.4 | 1.92 | 1.54 | 1.15 | 55.4 | 1.92 | 1.54 | 1.15 | 55.4 | 1.92 | 1.54 | 1.15 |
| 4.1 | 43.9 | 1.52 | 1.22 | 0.91 | 51.0 | 1.77 | 1.42 | 1.06 | 56.7 | 1.97 | 1.57 | 1.18 | 56.7 | 1.97 | 1.57 | 1.18 | 56.7 | 1.97 | 1.57 | 1.18 | 56.7 | 1.97 | 1.57 | 1.18 |
| 4.2 | 44.4 | 1.54 | 1.23 | 0.92 | 51.6 | 1.79 | 1.43 | 1.07 | 58.0 | 2.01 | 1.61 | 1.21 | 58.0 | 2.01 | 1.61 | 1.21 | 58.0 | 2.01 | 1.61 | 1.21 | 58.0 | 2.01 | 1.61 | 1.21 |
| 4.3 | 44.8 | 1.56 | 1.25 | 0.93 | 52.1 | 1.81 | 1.45 | 1.09 | 59.3 | 2.06 | 1.65 | 1.23 | 59.3 | 2.06 | 1.65 | 1.23 | 59.3 | 2.06 | 1.65 | 1.23 | 59.3 | 2.06 | 1.65 | 1.23 |
| 4.4 | 45.3 | 1.57 | 1.26 | 0.94 | 52.7 | 1.83 | 1.46 | 1.10 | 60.3 | 2.09 | 1.68 | 1.26 | 60.6 | 2.10 | 1.68 | 1.26 | 60.6 | 2.10 | 1.68 | 1.26 | 60.6 | 2.10 | 1.68 | 1.26 |
| 4.5 | 45.7 | 1.59 | 1.27 | 0.95 | 53.3 | 1.85 | 1.48 | 1.11 | 61.0 | 2.12 | 1.70 | 1.27 | 61.9 | 2.15 | 1.72 | 1.29 | 61.9 | 2.15 | 1.72 | 1.29 | 61.9 | 2.15 | 1.72 | 1.29 |
| 4.6 | 46.1 | 1.60 | 1.28 | 0.96 | 53.8 | 1.87 | 1.50 | 1.12 | 61.7 | 2.14 | 1.71 | 1.29 | 63.2 | 2.19 | 1.75 | 1.32 | 63.2 | 2.19 | 1.75 | 1.32 | 63.2 | 2.19 | 1.75 | 1.32 |
| 4.7 | 46.5 | 1.62 | 1.29 | 0.97 | 54.4 | 1.89 | 1.51 | 1.13 | 62.4 | 2.17 | 1.73 | 1.30 | 64.5 | 2.24 | 1.79 | 1.34 | 64.5 | 2.24 | 1.79 | 1.34 | 64.5 | 2.24 | 1.79 | 1.34 |
| 4.8 | 46.9 | 1.63 | 1.30 | 0.98 | 54.9 | 1.91 | 1.52 | 1.14 | 63.0 | 2.19 | 1.75 | 1.31 | 65.8 | 2.28 | 1.83 | 1.37 | 65.8 | 2.28 | 1.83 | 1.37 | 65.8 | 2.28 | 1.83 | 1.37 |
| 4.9 | 47.3 | 1.64 | 1.31 | 0.99 | 55.4 | 1.92 | 1.54 | 1.15 | 63.7 | 2.21 | 1.77 | 1.33 | 67.1 | 2.33 | 1.86 | 1.40 | 67.1 | 2.33 | 1.86 | 1.40 | 67.1 | 2.33 | 1.86 | 1.40 |
| 5.0 | 47.7 | 1.66 | 1.33 | 0.99 | 55.9 | 1.94 | 1.55 | 1.16 | 64.3 | 2.23 | 1.79 | 1.34 | 68.4 | 2.37 | 1.90 | 1.42 | 68.4 | 2.37 | 1.90 | 1.42 | 68.4 | 2.37 | 1.90 | 1.42 |
| 5.1 | 48.1 | 1.67 | 1.34 | 1.00 | 56.4 | 1.96 | 1.57 | 1.17 | 64.9 | 2.25 | 1.80 | 1.35 | 69.7 | 2.42 | 1.94 | 1.45 | 69.7 | 2.42 | 1.94 | 1.45 | 69.7 | 2.42 | 1.94 | 1.45 |
| 5.2 | 48.4 | 1.68 | 1.35 | 1.01 | 56.9 | 1.97 | 1.58 | 1.18 | 65.5 | 2.28 | 1.82 | 1.37 | 71.0 | 2.47 | 1.97 | 1.48 | 71.0 | 2.47 | 1.97 | 1.48 | 71.0 | 2.47 | 1.97 | 1.48 |
| 5.3 | 48.8 | 1.69 | 1.36 | 1.02 | 57.3 | 1.99 | 1.59 | 1.19 | 66.1 | 2.30 | 1.84 | 1.38 | 72.3 | 2.51 | 2.01 | 1.51 | 72.3 | 2.51 | 2.01 | 1.51 | 72.3 | 2.51 | 2.01 | 1.51 |
| 5.4 | 49.1 | 1.71 | 1.37 | 1.02 | 57.8 | 2.01 | 1.61 | 1.20 | 66.7 | 2.32 | 1.85 | 1.39 | 73.7 | 2.56 | 2.05 | 1.53 | 73.7 | 2.56 | 2.05 | 1.53 | 73.7 | 2.56 | 2.05 | 1.53 |
| 5.5 | 49.5 | 1.72 | 1.37 | 1.03 | 58.2 | 2.02 | 1.62 | 1.21 | 67.3 | 2.34 | 1.87 | 1.40 | 75.0 | 2.60 | 2.08 | 1.56 | 75.0 | 2.60 | 2.08 | 1.56 | 75.0 | 2.60 | 2.08 | 1.56 |
| 5.6 | 49.8 | 1.73 | 1.38 | 1.04 | 58.7 | 2.04 | 1.63 | 1.22 | 67.8 | 2.35 | 1.86 | 1.41 | 76.3 | 2.65 | 2.12 | 1.59 | 76.3 | 2.65 | 2.12 | 1.59 | 76.3 | 2.65 | 2.12 | 1.59 |
| 5.7 | 50.1 | 1.74 | 1.39 | 1.04 | 59.1 | 2.05 | 1.64 | 1.23 | 68.3 | 2.37 | 1.90 | 1.42 | 77.6 | 2.70 | 2.16 | 1.62 | 77.6 | 2.70 | 2.16 | 1.62 | 77.6 | 2.70 | 2.16 | 1.62 |
| 5.8 | 50.4 | 1.75 | 1.40 | 1.05 | 59.5 | 2.07 | 1.65 | 1.24 | 68.9 | 2.39 | 1.91 | 1.43 | 78.5 | 2.72 | 2.18 | 1.63 | 79.0 | 2.74 | 2.19 | 1.65 | 79.0 | 2.74 | 2.19 | 1.65 |
| 5.9 | 50.7 | 1.76 | 1.41 | 1.06 | 59.9 | 2.08 | 1.66 | 1.25 | 69.4 | 2.41 | 1.93 | 1.45 | 79.1 | 2.75 | 2.20 | 1.65 | 80.3 | 2.79 | 2.23 | 1.67 | 80.3 | 2.79 | 2.23 | 1.67 |
| 6.0 | 51.0 | 1.77 | 1.42 | 1.06 | 60.3 | 2.09 | 1.68 | 1.26 | 69.9 | 2.43 | 1.94 | 1.46 | 79.7 | 2.77 | 2.22 | 1.66 | 81.6 | 2.83 | 2.27 | 1.70 | 81.6 | 2.83 | 2.27 | 1.70 |
| 6.1 | 51.3 | 1.78 | 1.43 | 1.07 | 60.7 | 2.11 | 1.69 | 1.26 | 70.4 | 2.44 | 1.96 | 1.47 | 80.4 | 2.79 | 2.23 | 1.67 | 83.0 | 2.88 | 2.30 | 1.73 | 83.0 | 2.88 | 2.30 | 1.73 |
| 6.2 | 51.6 | 1.79 | 1.43 | 1.07 | 61.1 | 2.12 | 1.70 | 1.27 | 70.9 | 2.46 | 1.97 | 1.48 | 81.0 | 2.81 | 2.25 | 1.69 | 84.3 | 2.93 | 2.34 | 1.76 | 84.3 | 2.93 | 2.34 | 1.76 |
| 6.3 | 51.9 | 1.80 | 1.44 | 1.08 | 61.4 | 2.13 | 1.71 | 1.28 | 71.3 | 2.48 | 1.98 | 1.49 | 81.5 | 2.83 | 2.26 | 1.70 | 85.6 | 2.97 | 2.38 | 1.78 | 85.6 | 2.97 | 2.38 | 1.78 |
| 6.4 | 52.1 | 1.81 | 1.45 | 1.09 | 61.8 | 2.15 | 1.72 | 1.29 | 71.8 | 2.49 | 1.99 | 1.50 | 82.1 | 2.85 | 2.28 | 1.71 | 87.0 | 3.02 | 2.42 | 1.81 | 87.0 | 3.02 | 2.42 | 1.81 |
| 6.5 | 52.4 | 1.82 | 1.45 | 1.09 | 62.1 | 2.16 | 1.73 | 1.29 | 72.3 | 2.51 | 2.01 | 1.51 | 82.7 | 2.87 | 2.30 | 1.72 | 88.3 | 3.07 | 2.45 | 1.84 | 88.3 | 3.07 | 2.45 | 1.84 |
| 6.6 | 52.6 | 1.83 | 1.46 | 1.10 | 62.5 | 2.17 | 1.74 | 1.30 | 72.7 | 2.52 | 2.02 | 1.51 | 83.2 | 2.89 | 2.31 | 1.73 | 89.6 | 3.11 | 2.49 | 1.87 | 89.6 | 3.11 | 2.49 | 1.87 |
| 6.7 | 52.9 | 1.84 | 1.47 | 1.10 | 62.8 | 2.18 | 1.74 | 1.31 | 73.1 | 2.54 | 2.03 | 1.52 | 83.8 | 2.91 | 2.33 | 1.75 | 91.0 | 3.16 | 2.53 | 1.89 | 91.0 | 3.16 | 2.53 | 1.89 |
| 6.8 | 53.1 | 1.84 | 1.47 | 1.11 | 63.1 | 2.19 | 1.75 | 1.32 | 73.5 | 2.55 | 2.04 | 1.53 | 84.3 | 2.93 | 2.34 | 1.76 | 92.3 | 3.20 | 2.56 | 1.92 | 92.3 | 3.20 | 2.56 | 1.92 |
| 6.9 | 53.3 | 1.85 | 1.48 | 1.11 | 63.4 | 2.20 | 1.76 | 1.32 | 74.0 | 2.57 | 2.05 | 1.54 | 84.8 | 2.94 | 2.36 | 1.77 | 93.6 | 3.25 | 2.60 | 1.95 | 93.6 | 3.25 | 2.60 | 1.95 |
| 7.0 | 53.5 | 1.86 | 1.49 | 1.12 | 63.7 | 2.21 | 1.77 | 1.33 | 74.4 | 2.58 | 2.07 | 1.55 | 85.3 | 2.96 | 2.37 | 1.78 | 95.0 | 3.30 | 2.64 | 1.98 | 95.0 | 3.30 | 2.64 | 1.98 |
| 7.1 | 53.8 | 1.87 | 1.49 | 1.12 | 64.0 | 2.22 | 1.78 | 1.33 | 74.7 | 2.60 | 2.08 | 1.56 | 85.8 | 2.98 | 2.38 | 1.79 | 96.3 | 3.34 | 2.68 | 2.01 | 96.3 | 3.34 | 2.68 | 2.01 |
| 7.2 | 54.0 | 1.87 | 1.50 | 1.12 | 64.3 | 2.23 | 1.79 | 1.34 | 75.1 | 2.61 | 2.09 | 1.57 | 86.3 | 3.00 | 2.40 | 1.80 | 97.6 | 3.39 | 2.71 | 2.03 | 97.6 | 3.39 | 2.71 | 2.03 |
| 7.3 | 54.2 | 1.88 | 1.50 | 1.13 | 64.8 | 2.24 | 1.79 | 1.35 | 75.5 | 2.62 | 2.10 | 1.57 | 86.8 | 3.01 | 2.41 | 1.81 | 98.4 | 3.42 | 2.73 | 2.05 | 99.0 | 3.44 | 2.75 | 2.06 |
| 7.4 | 54.4 | 1.89 | 1.51 | 1.13 | 64.9 | 2.25 | 1.80 | 1.35 | 75.9 | 2.63 | 2.11 | 1.58 | 87.2 | 3.03 | 2.42 | 1.82 | 98.9 | 3.44 | 2.75 | 2.06 | 100.3 | 3.48 | 2.79 | 2.09 |
| 7.5 | 54.6 | 1.89 | 1.52 | 1.14 | 65.2 | 2.26 | 1.81 | 1.36 | 76.2 | 2.65 | 2.12 | 1.59 | 87.7 | 3.05 | 2.44 | 1.83 | 99.5 | 3.45 | 2.76 | 2.07 | 101.7 | 3.53 | 2.82 | 2.12 |
| 7.6 | 54.8 | 1.90 | 1.52 | 1.14 | 65.4 | 2.27 | 1.82 | 1.36 | 76.6 | 2.66 | 2.13 | 1.60 | 88.1 | 3.06 | 2.45 | 1.84 | 100.1 | 3.47 | 2.78 | 2.08 | 103.0 | 3.58 | 2.86 | 2.15 |
| 7.7 | 54.9 | 1.91 | 1.53 | 1.14 | 65.7 | 2.28 | 1.82 | 1.37 | 76.9 | 2.67 | 2.14 | 1.60 | 88.6 | 3.08 | 2.46 | 1.85 | 100.6 | 3.49 | 2.79 | 2.10 | 104.4 | 3.62 | 2.90 | 2.17 |
| 7.8 | 55.1 | 1.91 | 1.53 | 1.15 | 65.9 | 2.29 | 1.83 | 1.37 | 77.3 | 2.68 | 2.15 | 1.61 | 89.0 | 3.09 | 2.47 | 1.85 | 101.1 | 3.51 | 2.81 | 2.11 | 105.7 | 3.67 | 2.94 | 2.20 |
| 7.9 | 55.3 | 1.92 | 1.54 | 1.15 | 66.2 | 2.30 | 1.84 | 1.38 | 77.6 | 2.69 | 2.16 | 1.62 | 89.4 | 3.11 | 2.48 | 1.86 | 101.6 | 3.53 | 2.82 | 2.12 | 107.0 | 3.72 | 2.97 | 2.23 |
| 8.0 | 55.5 | 1.93 | 1.54 | 1.16 | 86.4 | 2.31 | 1.84 | 1.38 | 77.9 | 2.71 | 2.16 | 1.62 | 89.8 | 3.12 | 2.50 | 1.87 | 102.2 | 3.55 | 2.84 | 2.13 | 108.4 | 3.76 | 3.01 | 2.26 |
| 8.1 | 55.6 | 1.93 | 1.54 | 1.16 | 66.7 | 2.31 | 1.85 | 1.39 | 78.2 | 2.72 | 2.17 | 1.63 | 90.2 | 3.13 | 2.51 | 1.88 | 102.7 | 3.56 | 2.85 | 2.14 | 109.7 | 3.81 | 3.05 | 2.29 |
| 8.2 | 55.8 | 1.94 | 1.55 | 1.16 | 66.9 | 2.32 | 1.86 | 1.39 | 78.5 | 2.73 | 2.18 | 1.64 | 90.6 | 3.15 | 2.52 | 1.89 | 103.1 | 3.58 | 2.87 | 2.15 | 111.1 | 3.86 | 3.09 | 2.31 |
| 8.3 | 55.9 | 1.94 | 1.55 | 1.17 | 67.1 | 2.33 | 1.86 | 1.40 | 78.8 | 2.74 | 2.19 | 1.64 | 91.0 | 3.16 | 2.53 | 1.90 | 103.6 | 3.60 | 2.88 | 2.16 | 112.4 | 3.90 | 3.12 | 2.34 |
| 8.4 | 56.1 | 1.95 | 1.56 | 1.17 | 67.3 | 2.34 | 1.87 | 1.40 | 79.1 | 2.75 | 2.20 | 1.65 | 91.4 | 3.17 | 2.54 | 1.90 | 104.1 | 3.61 | 2.89 | 2.17 | 113.8 | 3.95 | 3.16 | 2.37 |
| 8.5 | 56.2 | 1.95 | 1.56 | 1.17 | 67.5 | 2.34 | 1.88 | 1.41 | 79.4 | 2.76 | 2.21 | 1.65 | 91.8 | 3.19 | 2.55 | 1.91 | 104.6 | 3.63 | 2.90 | 2.18 | 115.1 | 4.00 | 3.20 | 2.40 |
| 8.6 | 56.4 | 1.96 | 1.57 | 1.17 | 67.7 | 2.35 | 1.88 | 1.41 | 79.7 | 2.77 | 2.21 | 1.66 | 92.1 | 3.20 | 2.56 | 1.92 | 105.0 | 3.65 | 2.92 | 2.19 | 116.4 | 4.04 | 3.23 | 2.43 |
| 8.7 | 56.5 | 1.96 | 1.57 | 1.18 | 67.9 | 2.36 | 1.89 | 1.42 | 79.9 | 2.78 | 2.22 | 1.67 | 92.5 | 3.21 | 2.57 | 1.93 | 105.5 | 3.66 | 2.93 | 2.20 | 117.8 | 4.09 | 3.27 | 2.45 |
| 8.8 | 56.6 | 1.97 | 1.57 | 1.18 | 68.1 | 2.37 | 1.89 | 1.42 | 80.2 | 2.79 | 2.23 | 1.67 | 92.8 | 3.22 | 2.56 | 1.93 | 105.9 | 3.68 | 2.94 | 2.21 | 119.1 | 4.14 | 3.31 | 2.48 |
| 8.9 | 56.8 | 1.97 | 1.58 | 1.18 | 68.3 | 2.37 | 1.90 | 1.42 | 80.5 | 2.79 | 2.24 | 1.68 | 93.2 | 3.23 | 2.59 | 1.94 | 106.3 | 3.69 | 2.95 | 2.21 | 119.9 | 4.16 | 3.33 | 2.50 |
| 9.0 | 56.9 | 1.98 | 1.58 | 1.19 | 68.5 | 2.38 | 1.90 | 1.43 | 80.7 | 2.80 | 2.24 | 1.68 | 93.5 | 3.25 | 2.60 | 1.95 | 106.7 | 3.71 | 2.96 | 2.22 | 120.4 | 4.18 | 3.34 | 2.51 |
| 9.1 | 57.0 | 1.98 | 1.58 | 1.19 | 68.7 | 2.38 | 1.91 | 1.43 | 81.0 | 2.81 | 2.25 | 1.69 | 93.8 | 3.26 | 2.61 | 1.95 | 107.1 | 3.72 | 2.98 | 2.23 | 120.9 | 4.20 | 3.36 | 2.52 |
| 9.2 | 57.1 | 1.98 | 1.59 | 1.19 | 68.8 | 2.39 | 1.91 | 1.43 | 81.2 | 2.82 | 2.26 | 1.69 | 94.1 | 3.27 | 2.61 | 1.96 | 107.5 | 3.73 | 2.99 | 2.24 | 121.4 | 4.21 | 3.37 | 2.53 |
| 9.3 | 57.2 | 1.99 | 1.59 | 1.19 | 69.0 | 2.40 | 1.92 | 1.44 | 81.4 | 2.83 | 2.26 | 1.70 | 94.4 | 3.28 | 2.62 | 1.97 | 107.9 | 3.75 | 3.00 | 2.25 | 121.9 | 4.23 | 3.39 | 2.54 |
| 9.4 | 57.4 | 1.99 | 1.59 | 1.19 | 69.2 | 2.40 | 1.92 | 1.44 | 81.7 | 2.84 | 2.27 | 1.70 | 94.8 | 3.29 | 2.63 | 1.97 | 108.3 | 3.76 | 3.01 | 2.26 | 122.3 | 4.25 | 3.40 | 2.55 |
| 9.5 | 57.5 | 2.00 | 1.60 | 1.20 | 69.3 | 2.41 | 1.93 | 1.44 | 81.9 | 2.84 | 2.28 | 1.71 | 95.0 | 3.30 | 2.64 | 1.98 | 108.7 | 3.77 | 3.02 | 2.26 | 122.8 | 4.26 | 3.41 | 2.56 |
| 9.6 | 57.6 | 2.00 | 1.60 | 1.20 | 69.5 | 2.41 | 1.93 | 1.46 | 82.1 | 2.85 | 2.28 | 1.71 | 95.3 | 3.31 | 2.65 | 1.99 | 109.1 | 3.79 | 3.03 | 2.27 | 123.3 | 4.28 | 3.42 | 2.57 |
| 9.7 | 57.7 | 2.00 | 1.60 | 1.20 | 69.7 | 2.42 | 1.93 | 1.45 | 82.3 | 2.86 | 2.29 | 1.72 | 95.6 | 3.32 | 2.66 | 1.99 | 109.4 | 3.80 | 3.04 | 2.28 | 123.7 | 4.30 | 3.44 | 2.58 |
| 9.8 | 57.8 | 2.01 | 1.60 | 1.20 | 69.8 | 2.42 | 1.94 | 1.45 | 82.5 | 2.87 | 2.29 | 1.72 | 95.9 | 3.33 | 2.66 | 2.00 | 109.8 | 3.81 | 3.05 | 2.29 | 124.2 | 4.31 | 3.45 | 2.59 |
| 9.9 | 57.9 | 2.01 | 1.61 | 1.21 | 70.0 | 2.43 | 1.94 | 1.46 | 82.8 | 2.87 | 2.30 | 1.72 | 96.2 | 3.34 | 2.67 | 2.00 | 110.2 | 3.82 | 3.06 | 2.29 | 124.6 | 4.33 | 3.46 | 2.60 |
| 10.0 | 58.0 | 2.01 | 1.61 | 1.21 | 70.1 | 2.43 | 1.95 | 1.46 | 83.0 | 2.88 | 2.30 | 1.73 | 96.4 | 3.35 | 2.68 | 2.01 | 110.5 | 3.84 | 3.07 | 2.30 | 125.0 | 4.34 | 3.47 | 2.60 |
| Trench Width m | 0.9 | | | | 1.0 | | | | 1.1 | | | | 1.2 | | | | 1.3 | | | | 1.4 | | | |

**TABLE 7. DESIGN LOADS**
**400 mm DIAMETER PIPE**

2 WHEELS 30kN
IMPACT FACTOR 2.0

| Cover | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 38 | 48 | 64 | kN/m | 38 | 48 | 64 | kN/m | 38 | 48 | 64 | kN/m | 38 | 48 | 64 | kN/m | 38 | 48 | 64 | kN/m | 38 | 48 | 64 |
| 0.6 | 40.4 | 1.33 | 1.05 | 0.79 | 40.4 | 1.33 | 1.05 | 0.79 | 40.4 | 1.33 | 1.05 | 0.79 | 40.4 | 1.33 | 1.05 | 0.79 | 40.4 | 1.33 | 1.05 | 0.79 | 40.4 | 1.33 | 1.05 | 0.79 |
| 0.7 | 36.7 | 1.21 | 0.95 | 0.72 | 36.7 | 1.21 | 0.95 | 0.72 | 36.7 | 1.21 | 0.95 | 0.72 | 36.7 | 1.21 | 0.95 | 0.72 | 36.7 | 1.21 | 0.95 | 0.72 | 36.7 | 1.21 | 0.95 | 0.72 |
| 0.8 | 34.3 | 1.13 | 0.89 | 0.67 | 34.3 | 1.13 | 0.89 | 0.67 | 34.3 | 1.13 | 0.89 | 0.67 | 34.3 | 1.13 | 0.89 | 0.67 | 34.3 | 1.13 | 0.89 | 0.67 | 34.3 | 1.13 | 0.89 | 0.67 |
| 0.9 | 32.9 | 1.08 | 0.86 | 0.64 | 32.9 | 1.08 | 0.86 | 0.64 | 32.9 | 1.08 | 0.86 | 0.64 | 32.9 | 1.08 | 0.86 | 0.64 | 32.9 | 1.08 | 0.86 | 0.64 | 32.9 | 1.08 | 0.86 | 0.64 |
| 1.0 | 32.0 | 1.05 | 0.83 | 0.62 | 32.0 | 1.05 | 0.83 | 0.62 | 32.0 | 1.05 | 0.83 | 0.62 | 32.0 | 1.05 | 0.83 | 0.62 | 32.0 | 1.05 | 0.83 | 0.62 | 32.0 | 1.05 | 0.83 | 0.62 |
| 1.1 | 31.3 | 1.03 | 0.81 | 0.61 | 31.3 | 1.03 | 0.81 | 0.61 | 31.3 | 1.03 | 0.81 | 0.61 | 31.3 | 1.03 | 0.81 | 0.61 | 31.3 | 1.03 | 0.81 | 0.61 | 31.3 | 1.03 | 0.81 | 0.61 |
| 1.2 | 31.0 | 1.02 | 0.81 | 0.60 | 31.0 | 1.02 | 0.81 | 0.60 | 31.0 | 1.02 | 0.81 | 0.60 | 31.0 | 1.02 | 0.81 | 0.60 | 31.0 | 1.02 | 0.81 | 0.60 | 31.0 | 1.02 | 0.81 | 0.60 |
| 1.3 | 30.9 | 1.02 | 0.80 | 0.60 | 30.9 | 1.02 | 0.80 | 0.60 | 30.9 | 1.02 | 0.80 | 0.60 | 30.9 | 1.02 | 0.80 | 0.60 | 30.9 | 1.02 | 0.80 | 0.60 | 30.9 | 1.02 | 0.80 | 0.60 |
| 1.4 | 31.1 | 1.02 | 0.81 | 0.61 | 31.1 | 1.02 | 0.81 | 0.61 | 31.1 | 1.02 | 0.81 | 0.61 | 31.1 | 1.02 | 0.81 | 0.61 | 31.1 | 1.02 | 0.81 | 0.61 | 31.1 | 1.02 | 0.81 | 0.61 |
| 1.5 | 31.5 | 1.03 | 0.82 | 0.61 | 31.5 | 1.03 | 0.82 | 0.61 | 31.5 | 1.03 | 0.82 | 0.61 | 31.5 | 1.03 | 0.82 | 0.61 | 31.5 | 1.03 | 0.82 | 0.61 | 31.5 | 1.03 | 0.82 | 0.61 |
| 1.6 | 32.0 | 1.05 | 0.83 | 0.62 | 32.0 | 1.05 | 0.83 | 0.62 | 32.0 | 1.05 | 0.83 | 0.62 | 32.0 | 1.05 | 0.83 | 0.62 | 32.0 | 1.05 | 0.83 | 0.62 | 32.0 | 1.05 | 0.83 | 0.62 |
| 1.7 | 32.6 | 1.07 | 0.85 | 0.64 | 32.6 | 1.07 | 0.85 | 0.64 | 32.6 | 1.07 | 0.85 | 0.64 | 32.6 | 1.07 | 0.85 | 0.64 | 32.6 | 1.07 | 0.85 | 0.64 | 32.6 | 1.07 | 0.85 | 0.64 |
| 1.8 | 33.4 | 1.10 | 0.87 | 0.65 | 33.4 | 1.10 | 0.87 | 0.65 | 33.4 | 1.10 | 0.87 | 0.65 | 33.4 | 1.10 | 0.87 | 0.65 | 33.4 | 1.10 | 0.87 | 0.65 | 33.4 | 1.10 | 0.87 | 0.65 |
| 1.9 | 34.2 | 1.13 | 0.89 | 0.67 | 34.2 | 1.13 | 0.89 | 0.67 | 34.2 | 1.13 | 0.89 | 0.67 | 34.2 | 1.13 | 0.89 | 0.67 | 34.2 | 1.13 | 0.89 | 0.67 | 34.2 | 1.13 | 0.89 | 0.67 |
| 2.0 | 35.1 | 1.16 | 0.91 | 0.69 | 35.1 | 1.16 | 0.91 | 0.69 | 35.1 | 1.16 | 0.91 | 0.69 | 35.1 | 1.16 | 0.91 | 0.69 | 35.1 | 1.16 | 0.91 | 0.69 | 35.1 | 1.16 | 0.91 | 0.69 |
| 2.1 | 36.1 | 1.19 | 0.94 | 0.71 | 36.1 | 1.19 | 0.94 | 0.71 | 36.1 | 1.19 | 0.94 | 0.71 | 36.1 | 1.19 | 0.94 | 0.71 | 36.1 | 1.19 | 0.94 | 0.71 | 36.1 | 1.19 | 0.94 | 0.71 |
| 2.2 | 37.2 | 1.22 | 0.97 | 0.73 | 37.2 | 1.22 | 0.97 | 0.73 | 37.2 | 1.22 | 0.97 | 0.73 | 37.2 | 1.22 | 0.97 | 0.73 | 37.2 | 1.22 | 0.97 | 0.73 | 37.2 | 1.22 | 0.97 | 0.73 |
| 2.3 | 38.2 | 1.26 | 1.00 | 0.75 | 38.2 | 1.26 | 1.00 | 0.75 | 38.2 | 1.26 | 1.00 | 0.75 | 38.2 | 1.26 | 1.00 | 0.75 | 38.2 | 1.26 | 1.00 | 0.75 | 38.2 | 1.26 | 1.00 | 0.75 |
| 2.4 | 39.4 | 1.29 | 1.03 | 0.77 | 39.4 | 1.29 | 1.03 | 0.77 | 39.4 | 1.29 | 1.03 | 0.77 | 39.4 | 1.29 | 1.03 | 0.77 | 39.4 | 1.29 | 1.03 | 0.77 | 39.4 | 1.29 | 1.03 | 0.77 |
| 2.5 | 40.2 | 1.32 | 1.06 | 0.78 | 40.5 | 1.33 | 1.06 | 0.79 | 40.5 | 1.33 | 1.06 | 0.79 | 40.5 | 1.33 | 1.06 | 0.79 | 40.5 | 1.33 | 1.06 | 0.79 | 40.5 | 1.33 | 1.06 | 0.79 |
| 2.6 | 40.9 | 1.34 | 1.06 | 0.80 | 41.7 | 1.37 | 1.09 | 0.81 | 41.7 | 1.37 | 1.09 | 0.81 | 41.7 | 1.37 | 1.09 | 0.81 | 41.7 | 1.37 | 1.09 | 0.81 | 41.7 | 1.37 | 1.09 | 0.81 |
| 2.7 | 41.6 | 1.37 | 1.08 | 0.81 | 42.9 | 1.41 | 1.12 | 0.84 | 42.9 | 1.41 | 1.12 | 0.84 | 42.9 | 1.41 | 1.12 | 0.84 | 42.9 | 1.41 | 1.12 | 0.84 | 42.9 | 1.41 | 1.12 | 0.84 |
| 2.8 | 42.3 | 1.39 | 1.10 | 0.83 | 44.2 | 1.45 | 1.15 | 0.86 | 44.2 | 1.45 | 1.15 | 0.86 | 44.2 | 1.45 | 1.15 | 0.86 | 44.2 | 1.45 | 1.15 | 0.86 | 44.2 | 1.45 | 1.15 | 0.86 |
| 2.9 | 43.1 | 1.42 | 1.12 | 0.84 | 45.4 | 1.49 | 1.18 | 0.89 | 45.4 | 1.49 | 1.18 | 0.89 | 45.4 | 1.49 | 1.18 | 0.89 | 45.4 | 1.49 | 1.18 | 0.89 | 45.4 | 1.49 | 1.18 | 0.89 |
| 3.0 | 43.8 | 1.44 | 1.14 | 0.86 | 46.7 | 1.54 | 1.22 | 0.91 | 46.7 | 1.54 | 1.22 | 0.91 | 46.7 | 1.54 | 1.22 | 0.91 | 46.7 | 1.54 | 1.22 | 0.91 | 46.7 | 1.54 | 1.22 | 0.91 |
| 3.1 | 44.5 | 1.46 | 1.16 | 0.87 | 48.0 | 1.58 | 1.25 | 0.94 | 48.0 | 1.58 | 1.25 | 0.94 | 48.0 | 1.58 | 1.25 | 0.94 | 48.0 | 1.58 | 1.25 | 0.94 | 48.0 | 1.58 | 1.25 | 0.94 |
| 3.2 | 45.2 | 1.49 | 1.18 | 0.88 | 49.3 | 1.62 | 1.28 | 0.96 | 49.3 | 1.62 | 1.28 | 0.96 | 49.3 | 1.62 | 1.28 | 0.96 | 49.3 | 1.62 | 1.28 | 0.96 | 49.3 | 1.62 | 1.28 | 0.96 |
| 3.3 | 45.9 | 1.51 | 1.20 | 0.90 | 50.7 | 1.67 | 1.32 | 0.99 | 50.7 | 1.67 | 1.32 | 0.99 | 50.7 | 1.67 | 1.32 | 0.99 | 50.7 | 1.67 | 1.32 | 0.99 | 50.7 | 1.67 | 1.32 | 0.99 |
| 3.4 | 46.6 | 1.53 | 1.21 | 0.91 | 52.0 | 1.71 | 1.35 | 1.02 | 52.0 | 1.71 | 1.35 | 1.02 | 52.0 | 1.71 | 1.35 | 1.02 | 52.0 | 1.71 | 1.35 | 1.02 | 52.0 | 1.71 | 1.35 | 1.02 |
| 3.5 | 47.3 | 1.56 | 1.23 | 0.92 | 53.3 | 1.75 | 1.39 | 1.04 | 53.3 | 1.75 | 1.39 | 1.04 | 53.3 | 1.75 | 1.39 | 1.04 | 53.3 | 1.75 | 1.39 | 1.04 | 53.3 | 1.75 | 1.39 | 1.04 |
| 3.6 | 47.9 | 1.58 | 1.25 | 0.94 | 54.4 | 1.79 | 1.42 | 1.06 | 54.7 | 1.80 | 1.42 | 1.07 | 54.7 | 1.80 | 1.42 | 1.07 | 54.7 | 1.80 | 1.42 | 1.07 | 54.7 | 1.80 | 1.42 | 1.07 |
| 3.7 | 48.6 | 1.60 | 1.27 | 0.95 | 55.2 | 1.82 | 1.44 | 1.08 | 56.1 | 1.84 | 1.46 | 1.10 | 56.1 | 1.84 | 1.46 | 1.10 | 56.1 | 1.84 | 1.46 | 1.10 | 56.1 | 1.84 | 1.46 | 1.10 |
| 3.8 | 49.2 | 1.62 | 1.28 | 0.96 | 56.0 | 1.84 | 1.46 | 1.09 | 57.4 | 1.89 | 1.50 | 1.12 | 57.4 | 1.89 | 1.50 | 1.12 | 57.4 | 1.89 | 1.50 | 1.12 | 57.4 | 1.89 | 1.50 | 1.12 |
| 3.9 | 49.9 | 1.64 | 1.30 | 0.97 | 56.8 | 1.87 | 1.48 | 1.11 | 58.8 | 1.93 | 1.53 | 1.15 | 58.8 | 1.93 | 1.53 | 1.15 | 58.8 | 1.93 | 1.53 | 1.15 | 58.8 | 1.93 | 1.53 | 1.15 |
| 4.0 | 50.5 | 1.66 | 1.31 | 0.99 | 57.5 | 1.89 | 1.50 | 1.12 | 60.2 | 1.98 | 1.57 | 1.18 | 60.2 | 1.98 | 1.57 | 1.18 | 60.2 | 1.98 | 1.57 | 1.18 | 60.2 | 1.98 | 1.57 | 1.18 |
| 4.1 | 51.1 | 1.68 | 1.33 | 1.00 | 58.3 | 1.92 | 1.52 | 1.14 | 61.6 | 2.03 | 1.60 | 1.20 | 61.6 | 2.03 | 1.60 | 1.20 | 61.6 | 2.03 | 1.60 | 1.20 | 61.6 | 2.03 | 1.60 | 1.20 |
| 4.2 | 51.7 | 1.70 | 1.35 | 1.01 | 59.0 | 1.94 | 1.54 | 1.15 | 63.0 | 2.07 | 1.64 | 1.23 | 63.0 | 2.07 | 1.64 | 1.23 | 63.0 | 2.07 | 1.64 | 1.23 | 63.0 | 2.07 | 1.64 | 1.23 |
| 4.3 | 52.3 | 1.72 | 1.36 | 1.02 | 59.7 | 1.96 | 1.56 | 1.17 | 64.4 | 2.12 | 1.68 | 1.26 | 64.4 | 2.12 | 1.68 | 1.26 | 64.4 | 2.12 | 1.68 | 1.26 | 64.4 | 2.12 | 1.68 | 1.26 |
| 4.4 | 52.8 | 1.74 | 1.38 | 1.03 | 60.4 | 1.99 | 1.57 | 1.18 | 65.8 | 2.16 | 1.71 | 1.29 | 65.8 | 2.16 | 1.71 | 1.29 | 65.8 | 2.16 | 1.71 | 1.29 | 65.8 | 2.16 | 1.71 | 1.29 |
| 4.5 | 53.4 | 1.76 | 1.39 | 1.04 | 61.1 | 2.01 | 1.59 | 1.19 | 67.2 | 2.21 | 1.75 | 1.31 | 67.2 | 2.21 | 1.75 | 1.31 | 67.2 | 2.21 | 1.75 | 1.31 | 67.2 | 2.21 | 1.75 | 1.31 |
| 4.6 | 53.9 | 1.77 | 1.40 | 1.05 | 61.8 | 2.03 | 1.61 | 1.21 | 68.6 | 2.26 | 1.79 | 1.34 | 68.6 | 2.26 | 1.79 | 1.34 | 68.6 | 2.26 | 1.79 | 1.34 | 68.6 | 2.26 | 1.79 | 1.34 |
| 4.7 | 54.5 | 1.79 | 1.42 | 1.06 | 62.5 | 2.06 | 1.63 | 1.22 | 70.0 | 2.30 | 1.82 | 1.37 | 70.0 | 2.30 | 1.82 | 1.37 | 70.0 | 2.30 | 1.82 | 1.37 | 70.0 | 2.30 | 1.82 | 1.37 |
| 4.8 | 55.0 | 1.81 | 1.43 | 1.07 | 63.1 | 2.08 | 1.64 | 1.23 | 71.4 | 2.35 | 1.86 | 1.40 | 71.5 | 2.35 | 1.86 | 1.40 | 71.5 | 2.35 | 1.86 | 1.40 | 71.5 | 2.35 | 1.86 | 1.40 |
| 4.9 | 55.5 | 1.83 | 1.45 | 1.08 | 63.8 | 2.10 | 1.66 | 1.25 | 72.2 | 2.38 | 1.88 | 1.41 | 72.9 | 2.40 | 1.90 | 1.42 | 72.9 | 2.40 | 1.90 | 1.42 | 72.9 | 2.40 | 1.90 | 1.42 |
| 5.0 | 56.0 | 1.84 | 1.46 | 1.09 | 64.4 | 2.12 | 1.68 | 1.26 | 73.0 | 2.40 | 1.90 | 1.43 | 74.3 | 2.44 | 1.94 | 1.45 | 74.3 | 2.44 | 1.94 | 1.45 | 74.3 | 2.44 | 1.94 | 1.45 |
| 5.1 | 56.5 | 1.86 | 1.47 | 1.10 | 65.0 | 2.14 | 1.69 | 1.27 | 73.7 | 2.42 | 1.92 | 1.44 | 75.7 | 2.49 | 1.97 | 1.48 | 75.7 | 2.49 | 1.97 | 1.48 | 75.7 | 2.49 | 1.97 | 1.48 |
| 5.2 | 56.9 | 1.87 | 1.48 | 1.11 | 65.6 | 2.16 | 1.71 | 1.28 | 74.5 | 2.45 | 1.94 | 1.45 | 77.2 | 2.54 | 2.01 | 1.51 | 77.2 | 2.54 | 2.01 | 1.51 | 77.2 | 2.54 | 2.01 | 1.51 |
| 5.3 | 57.4 | 1.89 | 1.50 | 1.12 | 66.2 | 2.18 | 1.72 | 1.29 | 75.2 | 2.47 | 1.96 | 1.47 | 78.6 | 2.59 | 2.05 | 1.54 | 78.6 | 2.59 | 2.05 | 1.54 | 78.6 | 2.59 | 2.05 | 1.54 |
| 5.4 | 57.9 | 1.90 | 1.51 | 1.13 | 66.8 | 2.20 | 1.74 | 1.30 | 75.9 | 2.50 | 1.98 | 1.48 | 80.0 | 2.63 | 2.08 | 1.56 | 80.0 | 2.63 | 2.08 | 1.56 | 80.0 | 2.63 | 2.08 | 1.56 |
| 5.5 | 58.3 | 1.92 | 1.52 | 1.14 | 67.3 | 2.21 | 1.75 | 1.31 | 76.6 | 2.52 | 1.99 | 1.50 | 81.5 | 2.68 | 2.12 | 1.59 | 81.5 | 2.68 | 2.12 | 1.59 | 81.5 | 2.68 | 2.12 | 1.59 |
| 5.6 | 58.7 | 1.93 | 1.53 | 1.15 | 67.9 | 2.23 | 1.77 | 1.33 | 77.2 | 2.54 | 2.01 | 1.51 | 82.9 | 2.73 | 2.16 | 1.62 | 82.9 | 2.73 | 2.16 | 1.62 | 82.9 | 2.73 | 2.16 | 1.62 |
| 5.7 | 59.2 | 1.95 | 1.54 | 1.16 | 68.4 | 2.25 | 1.78 | 1.34 | 77.9 | 2.56 | 2.03 | 1.52 | 84.4 | 2.78 | 2.20 | 1.65 | 84.4 | 2.78 | 2.20 | 1.65 | 84.4 | 2.78 | 2.20 | 1.65 |
| 5.8 | 59.6 | 1.96 | 1.55 | 1.16 | 68.9 | 2.27 | 1.80 | 1.35 | 78.5 | 2.58 | 2.05 | 1.53 | 85.8 | 2.82 | 2.23 | 1.68 | 85.8 | 2.82 | 2.23 | 1.68 | 85.8 | 2.82 | 2.23 | 1.68 |
| 5.9 | 60.0 | 1.97 | 1.56 | 1.17 | 69.5 | 2.28 | 1.81 | 1.36 | 79.2 | 2.60 | 2.06 | 1.55 | 87.3 | 2.87 | 2.27 | 1.70 | 87.3 | 2.87 | 2.27 | 1.70 | 87.3 | 2.87 | 2.27 | 1.70 |
| 6.0 | 60.4 | 1.99 | 1.57 | 1.18 | 70.0 | 2.30 | 1.82 | 1.37 | 79.8 | 2.63 | 2.08 | 1.56 | 88.7 | 2.92 | 2.31 | 1.73 | 88.7 | 2.92 | 2.31 | 1.73 | 88.7 | 2.92 | 2.31 | 1.73 |
| 6.1 | 60.7 | 2.00 | 1.58 | 1.19 | 70.4 | 2.32 | 1.83 | 1.38 | 80.4 | 2.65 | 2.09 | 1.57 | 90.1 | 2.97 | 2.35 | 1.76 | 90.1 | 2.97 | 2.35 | 1.76 | 90.1 | 2.97 | 2.35 | 1.76 |
| 6.2 | 61.1 | 2.01 | 1.59 | 1.19 | 70.9 | 2.33 | 1.85 | 1.39 | 81.0 | 2.66 | 2.11 | 1.58 | 91.3 | 3.00 | 2.38 | 1.78 | 91.6 | 3.01 | 2.39 | 1.79 | 91.6 | 3.01 | 2.39 | 1.79 |
| 6.3 | 61.5 | 2.02 | 1.60 | 1.20 | 71.4 | 2.35 | 1.88 | 1.39 | 81.6 | 2.68 | 2.12 | 1.59 | 92.0 | 3.03 | 2.40 | 1.80 | 93.0 | 3.06 | 2.42 | 1.82 | 93.0 | 3.06 | 2.42 | 1.82 |
| 6.4 | 61.8 | 2.03 | 1.61 | 1.21 | 71.9 | 2.36 | 1.87 | 1.40 | 82.2 | 2.70 | 2.14 | 1.60 | 92.7 | 3.05 | 2.41 | 1.81 | 94.5 | 3.11 | 2.46 | 1.85 | 94.5 | 3.11 | 2.46 | 1.85 |
| 6.5 | 62.2 | 2.05 | 1.62 | 1.21 | 72.3 | 2.38 | 1.88 | 1.41 | 82.7 | 2.72 | 2.15 | 1.62 | 93.4 | 3.07 | 2.43 | 1.82 | 95.9 | 3.16 | 2.50 | 1.87 | 95.9 | 3.16 | 2.50 | 1.87 |
| 6.6 | 62.5 | 2.06 | 1.63 | 1.22 | 72.7 | 2.39 | 1.89 | 1.42 | 83.3 | 2.74 | 2.17 | 1.63 | 94.1 | 3.09 | 2.45 | 1.84 | 97.4 | 3.20 | 2.54 | 1.90 | 97.4 | 3.20 | 2.54 | 1.90 |
| 6.7 | 62.8 | 2.07 | 1.64 | 1.23 | 73.2 | 2.41 | 1.91 | 1.43 | 83.8 | 2.76 | 2.18 | 1.64 | 94.7 | 3.12 | 2.47 | 1.85 | 98.8 | 3.25 | 2.57 | 1.93 | 98.8 | 3.25 | 2.57 | 1.93 |
| 6.8 | 63.2 | 2.08 | 1.65 | 1.23 | 73.6 | 2.42 | 1.92 | 1.44 | 84.3 | 2.77 | 2.20 | 1.65 | 95.4 | 3.14 | 2.48 | 1.86 | 100.3 | 3.30 | 2.61 | 1.96 | 100.3 | 3.30 | 2.61 | 1.96 |
| 6.9 | 63.5 | 2.09 | 1.65 | 1.24 | 74.0 | 2.43 | 1.93 | 1.45 | 84.9 | 2.79 | 2.21 | 1.66 | 96.0 | 3.16 | 2.50 | 1.88 | 101.7 | 3.35 | 2.65 | 1.99 | 101.7 | 3.35 | 2.65 | 1.99 |
| 7.0 | 63.8 | 2.10 | 1.66 | 1.25 | 74.4 | 2.45 | 1.94 | 1.45 | 85.4 | 2.81 | 2.22 | 1.67 | 96.6 | 3.18 | 2.52 | 1.89 | 103.2 | 3.39 | 2.69 | 2.02 | 103.2 | 3.39 | 2.69 | 2.02 |
| 7.1 | 64.1 | 2.11 | 1.67 | 1.25 | 74.8 | 2.46 | 1.95 | 1.46 | 85.9 | 2.82 | 2.24 | 1.68 | 97.2 | 3.20 | 2.53 | 1.90 | 104.7 | 3.44 | 2.73 | 2.04 | 104.7 | 3.44 | 2.73 | 2.04 |
| 7.2 | 64.4 | 2.12 | 1.68 | 1.26 | 75.2 | 2.47 | 1.96 | 1.47 | 86.3 | 2.84 | 2.25 | 1.69 | 97.8 | 3.22 | 2.55 | 1.91 | 106.1 | 3.49 | 2.76 | 2.07 | 106.1 | 3.49 | 2.76 | 2.07 |
| 7.3 | 64.7 | 2.13 | 1.68 | 1.26 | 75.6 | 2.49 | 1.97 | 1.48 | 86.8 | 2.86 | 2.26 | 1.70 | 98.4 | 3.24 | 2.56 | 1.92 | 107.6 | 3.54 | 2.80 | 2.10 | 107.6 | 3.54 | 2.80 | 2.10 |
| 7.4 | 64.9 | 2.14 | 1.69 | 1.27 | 75.9 | 2.50 | 1.98 | 1.48 | 87.3 | 2.87 | 2.27 | 1.70 | 99.0 | 3.26 | 2.58 | 1.93 | 109.0 | 3.59 | 2.84 | 2.13 | 109.0 | 3.59 | 2.84 | 2.13 |
| 7.5 | 65.2 | 2.14 | 1.70 | 1.27 | 76.3 | 2.51 | 1.99 | 1.49 | 87.7 | 2.89 | 2.28 | 1.71 | 99.5 | 3.27 | 2.59 | 1.94 | 110.5 | 3.63 | 2.88 | 2.16 | 110.5 | 3.63 | 2.88 | 2.16 |
| 7.6 | 65.5 | 2.15 | 1.70 | 1.28 | 76.6 | 2.52 | 2.00 | 1.50 | 88.2 | 2.90 | 2.30 | 1.72 | 100.1 | 3.29 | 2.61 | 1.95 | 111.9 | 3.68 | 2.92 | 2.19 | 111.9 | 3.68 | 2.92 | 2.19 |
| 7.7 | 65.7 | 2.16 | 1.71 | 1.28 | 77.0 | 2.53 | 2.00 | 1.50 | 88.6 | 2.92 | 2.31 | 1.73 | 100.6 | 3.31 | 2.62 | 1.97 | 112.9 | 3.72 | 2.94 | 2.21 | 113.4 | 3.73 | 2.95 | 2.21 |
| 7.8 | 66.0 | 2.17 | 1.72 | 1.29 | 77.3 | 2.54 | 2.01 | 1.51 | 89.0 | 2.93 | 2.32 | 1.74 | 101.2 | 3.33 | 2.63 | 1.98 | 113.6 | 3.74 | 2.96 | 2.22 | 114.9 | 3.78 | 2.99 | 2.24 |
| 7.9 | 66.2 | 2.18 | 1.72 | 1.29 | 77.6 | 2.55 | 2.02 | 1.52 | 89.5 | 2.94 | 2.33 | 1.75 | 101.7 | 3.34 | 2.65 | 1.99 | 114.2 | 3.76 | 2.97 | 2.23 | 116.3 | 3.83 | 3.03 | 2.27 |
| 8.0 | 66.5 | 2.19 | 1.73 | 1.30 | 77.9 | 2.56 | 2.03 | 1.52 | 89.9 | 2.96 | 2.34 | 1.76 | 102.2 | 3.36 | 2.66 | 2.00 | 114.8 | 3.78 | 2.99 | 2.24 | 117.8 | 3.87 | 3.07 | 2.30 |
| 8.1 | 66.7 | 2.19 | 1.74 | 1.30 | 78.3 | 2.57 | 2.04 | 1.53 | 90.3 | 2.97 | 2.35 | 1.76 | 102.7 | 3.38 | 2.67 | 2.01 | 115.4 | 3.80 | 3.01 | 2.25 | 119.2 | 3.92 | 3.11 | 2.33 |
| 8.2 | 66.9 | 2.20 | 1.74 | 1.31 | 78.6 | 2.58 | 2.05 | 1.53 | 90.7 | 2.98 | 2.36 | 1.77 | 103.2 | 3.39 | 2.69 | 2.02 | 116.0 | 3.82 | 3.02 | 2.27 | 120.7 | 3.97 | 3.14 | 2.36 |
| 8.3 | 67.1 | 2.21 | 1.75 | 1.31 | 78.9 | 2.59 | 2.05 | 1.54 | 91.1 | 3.00 | 2.37 | 1.78 | 103.7 | 3.41 | 2.70 | 2.02 | 116.6 | 3.84 | 3.04 | 2.28 | 122.2 | 4.02 | 3.18 | 2.39 |
| 8.4 | 67.3 | 2.22 | 1.75 | 1.32 | 79.1 | 2.60 | 2.06 | 1.55 | 91.4 | 3.01 | 2.36 | 1.79 | 104.1 | 3.43 | 2.71 | 2.03 | 117.2 | 3.85 | 3.05 | 2.29 | 123.6 | 4.07 | 3.22 | 2.41 |
| 8.5 | 67.6 | 2.22 | 1.76 | 1.32 | 79.4 | 2.61 | 2.07 | 1.55 | 91.8 | 3.02 | 2.39 | 1.79 | 104.6 | 3.44 | 2.72 | 2.04 | 117.7 | 3.87 | 3.07 | 2.30 | 125.1 | 4.11 | 3.26 | 2.44 |
| 8.6 | 67.8 | 2.23 | 1.76 | 1.32 | 79.7 | 2.62 | 2.08 | 1.56 | 92.2 | 3.03 | 2.40 | 1.80 | 105.0 | 3.46 | 2.74 | 2.05 | 118.3 | 3.89 | 3.08 | 2.31 | 126.5 | 4.16 | 3.30 | 2.47 |
| 8.7 | 68.0 | 2.24 | 1.77 | 1.33 | 80.0 | 2.63 | 2.08 | 1.56 | 92.5 | 3.04 | 2.41 | 1.81 | 105.5 | 3.47 | 2.75 | 2.06 | 118.8 | 3.91 | 3.09 | 2.32 | 128.0 | 4.21 | 3.33 | 2.50 |
| 8.8 | 68.1 | 2.24 | 1.77 | 1.33 | 80.2 | 2.64 | 2.09 | 1.57 | 92.9 | 3.05 | 2.42 | 1.81 | 105.9 | 3.48 | 2.76 | 2.07 | 119.4 | 3.93 | 3.11 | 2.33 | 129.5 | 4.26 | 3.37 | 2.53 |
| 8.9 | 68.3 | 2.25 | 1.78 | 1.33 | 80.5 | 2.65 | 2.10 | 1.57 | 93.2 | 3.07 | 2.43 | 1.82 | 106.3 | 3.50 | 2.77 | 2.08 | 119.9 | 3.94 | 3.12 | 2.34 | 130.9 | 4.31 | 3.41 | 2.56 |
| 9.0 | 68.5 | 2.25 | 1.78 | 1.34 | 80.8 | 2.68 | 2.10 | 1.58 | 93.5 | 3.08 | 2.44 | 1.83 | 106.8 | 3.51 | 2.78 | 2.09 | 120.4 | 3.96 | 3.14 | 2.35 | 132.4 | 4.36 | 3.45 | 2.59 |
| 9.1 | 68.7 | 2.26 | 1.79 | 1.34 | 81.0 | 2.66 | 2.11 | 1.58 | 93.8 | 3.09 | 2.44 | 1.83 | 107.2 | 3.53 | 2.79 | 2.09 | 120.9 | 3.98 | 3.15 | 2.36 | 133.9 | 4.40 | 3.49 | 2.61 |
| 9.2 | 68.9 | 2.27 | 1.79 | 1.35 | 81.2 | 2.67 | 2.12 | 1.59 | 94.2 | 3.10 | 2.45 | 1.84 | 107.6 | 3.54 | 2.80 | 2.10 | 121.4 | 3.89 | 3.16 | 2.37 | 135.3 | 4.45 | 3.52 | 2.64 |
| 9.3 | 68.0 | 2.27 | 1.80 | 1.35 | 81.5 | 2.66 | 2.12 | 1.59 | 94.5 | 3.11 | 2.46 | 1.85 | 108.0 | 3.55 | 2.81 | 2.11 | 121.9 | 4.01 | 3.17 | 2.38 | 136.2 | 4.48 | 3.55 | 2.66 |
| 9.4 | 69.2 | 2.28 | 1.80 | 1.35 | 81.7 | 2.69 | 2.13 | 1.60 | 94.8 | 3.12 | 2.47 | 1.85 | 108.4 | 3.56 | 2.82 | 2.12 | 122.4 | 4.03 | 3.19 | 2.39 | 136.8 | 4.50 | 3.56 | 2.67 |
| 9.5 | 69.4 | 2.28 | 1.81 | 1.35 | 81.9 | 2.69 | 2.13 | 1.60 | 95.1 | 3.13 | 2.48 | 1.86 | 108.7 | 3.58 | 2.83 | 2.12 | 122.8 | 4.04 | 3.20 | 2.40 | 137.3 | 4.52 | 3.58 | 2.68 |
| 9.6 | 69.5 | 2.29 | 1.81 | 1.36 | 82.1 | 2.70 | 2.14 | 1.60 | 95.4 | 3.14 | 2.48 | 1.86 | 109.1 | 3.59 | 2.84 | 2.13 | 123.3 | 4.06 | 3.21 | 2.41 | 137.9 | 4.54 | 3.59 | 2.69 |
| 9.7 | 69.7 | 2.29 | 1.81 | 1.36 | 82.4 | 2.71 | 2.14 | 1.61 | 95.6 | 3.15 | 2.49 | 1.87 | 109.5 | 3.60 | 2.85 | 2.14 | 123.8 | 4.07 | 3.22 | 2.42 | 138.4 | 4.55 | 3.61 | 2.70 |
| 9.8 | 69.8 | 2.30 | 1.82 | 1.36 | 82.6 | 2.72 | 2.15 | 1.61 | 95.9 | 3.16 | 2.50 | 1.87 | 109.8 | 3.61 | 2.86 | 2.15 | 124.2 | 4.09 | 3.23 | 2.43 | 139.0 | 4.57 | 3.62 | 2.71 |
| 9.9 | 70.0 | 2.30 | 1.82 | 1.37 | 82.8 | 2.72 | 2.16 | 1.62 | 96.2 | 3.16 | 2.51 | 1.88 | 110.2 | 3.62 | 2.87 | 2.15 | 124.6 | 4.10 | 3.25 | 2.43 | 139.5 | 4.59 | 3.63 | 2.72 |
| 10.0 | 70.1 | 2.31 | 1.83 | 1.37 | 83.0 | 2.73 | 2.16 | 1.62 | 96.5 | 3.17 | 2.51 | 1.88 | 110.5 | 3.64 | 2.88 | 2.16 | 125.1 | 4.11 | 3.26 | 2.44 | 140.0 | 4.61 | 3.65 | 2.73 |
| Trench Width m | | 1.0 | | | 1.1 | | | | 1.2 | | | | 1.3 | | | | 1.4 | | | | 1.5 | | | |

**TABLE 8. DESIGN LOADS**
**450 mm DIAMETER PIPE**

2 WHEELS 30kN
IMPACT FACTOR 2.0

| Cover | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 43 | 54 | 72 | kN/m | 43 | 54 | 72 | kN/m | 43 | 54 | 72 | kN/m | 43 | 54 | 72 | kN/m | 43 | 54 | 72 | kN/m | 43 | 54 | 72 |
| 0.6 | 44.0 | 1.28 | 1.02 | 0.76 | 44.0 | 1.28 | 1.02 | 0.76 | 44.0 | 1.28 | 1.02 | 0.76 | 44.0 | 1.28 | 1.02 | 0.76 | 44.0 | 1.28 | 1.02 | 0.76 | 44.0 | 1.28 | 1.02 | 0.76 |
| 0.7 | 39.9 | 1.16 | 0.92 | 0.69 | 39.9 | 1.16 | 0.92 | 0.69 | 39.9 | 1.16 | 0.92 | 0.69 | 39.9 | 1.16 | 0.92 | 0.69 | 39.9 | 1.16 | 0.92 | 0.69 | 39.9 | 1.16 | 0.92 | 0.69 |
| 0.8 | 37.2 | 1.08 | 0.86 | 0.65 | 37.2 | 1.08 | 0.86 | 0.65 | 37.2 | 1.08 | 0.86 | 0.65 | 37.2 | 1.08 | 0.86 | 0.65 | 37.2 | 1.08 | 0.86 | 0.65 | 37.2 | 1.08 | 0.86 | 0.65 |
| 0.9 | 35.6 | 1.04 | 0.82 | 0.62 | 35.6 | 1.04 | 0.82 | 0.62 | 35.6 | 1.04 | 0.82 | 0.62 | 35.6 | 1.04 | 0.82 | 0.62 | 35.6 | 1.04 | 0.82 | 0.62 | 35.6 | 1.04 | 0.82 | 0.62 |
| 1.0 | 34.8 | 1.01 | 0.81 | 0.60 | 34.8 | 1.01 | 0.81 | 0.60 | 34.8 | 1.01 | 0.81 | 0.60 | 34.8 | 1.01 | 0.81 | 0.60 | 34.8 | 1.01 | 0.81 | 0.60 | 34.8 | 1.01 | 0.81 | 0.60 |
| 1.1 | 34.3 | 1.00 | 0.79 | 0.60 | 34.3 | 1.00 | 0.79 | 0.60 | 34.3 | 1.00 | 0.79 | 0.60 | 34.3 | 1.00 | 0.79 | 0.60 | 34.3 | 1.00 | 0.79 | 0.60 | 34.3 | 1.00 | 0.79 | 0.60 |
| 1.2 | 34.0 | 0.99 | 0.79 | 0.59 | 34.0 | 0.99 | 0.79 | 0.59 | 34.0 | 0.99 | 0.79 | 0.59 | 34.0 | 0.99 | 0.79 | 0.59 | 34.0 | 0.99 | 0.79 | 0.59 | 34.0 | 0.99 | 0.79 | 0.59 |
| 1.3 | 33.9 | 0.99 | 0.79 | 0.59 | 33.9 | 0.99 | 0.79 | 0.59 | 33.9 | 0.99 | 0.79 | 0.59 | 33.9 | 0.99 | 0.79 | 0.59 | 33.9 | 0.99 | 0.79 | 0.59 | 33.9 | 0.99 | 0.79 | 0.59 |
| 1.4 | 34.1 | 0.99 | 0.79 | 0.59 | 34.1 | 0.99 | 0.79 | 0.59 | 34.1 | 0.99 | 0.79 | 0.59 | 34.1 | 0.99 | 0.79 | 0.59 | 34.1 | 0.99 | 0.79 | 0.59 | 34.1 | 0.99 | 0.79 | 0.59 |
| 1.5 | 34.5 | 1.00 | 0.80 | 0.60 | 34.5 | 1.00 | 0.80 | 0.60 | 34.5 | 1.00 | 0.80 | 0.60 | 34.5 | 1.00 | 0.80 | 0.60 | 34.5 | 1.00 | 0.80 | 0.60 | 34.5 | 1.00 | 0.80 | 0.60 |
| 1.6 | 35.1 | 1.02 | 0.81 | 0.61 | 35.1 | 1.02 | 0.81 | 0.61 | 35.1 | 1.02 | 0.81 | 0.61 | 35.1 | 1.02 | 0.81 | 0.61 | 35.1 | 1.02 | 0.81 | 0.61 | 35.1 | 1.02 | 0.81 | 0.61 |
| 1.7 | 35.8 | 1.04 | 0.83 | 0.62 | 35.8 | 1.04 | 0.83 | 0.62 | 35.8 | 1.04 | 0.83 | 0.62 | 35.8 | 1.04 | 0.83 | 0.62 | 35.8 | 1.04 | 0.83 | 0.62 | 35.8 | 1.04 | 0.83 | 0.62 |
| 1.8 | 36.7 | 1.07 | 0.85 | 0.64 | 36.7 | 1.07 | 0.85 | 0.64 | 36.7 | 1.07 | 0.85 | 0.64 | 36.7 | 1.07 | 0.85 | 0.64 | 36.7 | 1.07 | 0.85 | 0.64 | 36.7 | 1.07 | 0.85 | 0.64 |
| 1.9 | 37.6 | 1.09 | 0.87 | 0.65 | 37.6 | 1.09 | 0.87 | 0.65 | 37.6 | 1.09 | 0.87 | 0.65 | 37.6 | 1.09 | 0.87 | 0.65 | 37.6 | 1.09 | 0.87 | 0.65 | 37.6 | 1.09 | 0.87 | 0.65 |
| 2.0 | 38.6 | 1.12 | 0.89 | 0.67 | 38.6 | 1.12 | 0.89 | 0.67 | 38.6 | 1.12 | 0.89 | 0.67 | 38.6 | 1.12 | 0.89 | 0.67 | 38.6 | 1.12 | 0.89 | 0.67 | 38.6 | 1.12 | 0.89 | 0.67 |
| 2.1 | 39.7 | 1.15 | 0.92 | 0.69 | 39.7 | 1.15 | 0.92 | 0.69 | 39.7 | 1.15 | 0.92 | 0.69 | 39.7 | 1.15 | 0.92 | 0.69 | 39.7 | 1.15 | 0.92 | 0.69 | 39.7 | 1.15 | 0.92 | 0.69 |
| 2.2 | 40.8 | 1.19 | 0.94 | 0.71 | 40.8 | 1.19 | 0.94 | 0.71 | 40.8 | 1.19 | 0.94 | 0.71 | 40.8 | 1.19 | 0.94 | 0.71 | 40.8 | 1.19 | 0.94 | 0.71 | 40.8 | 1.19 | 0.94 | 0.71 |
| 2.3 | 42.0 | 1.22 | 0.97 | 0.73 | 42.0 | 1.22 | 0.97 | 0.73 | 42.0 | 1.22 | 0.97 | 0.73 | 42.0 | 1.22 | 0.97 | 0.73 | 42.0 | 1.22 | 0.97 | 0.73 | 42.0 | 1.22 | 0.97 | 0.73 |
| 2.4 | 43.3 | 1.26 | 1.00 | 0.75 | 43.3 | 1.26 | 1.00 | 0.75 | 43.3 | 1.26 | 1.00 | 0.75 | 43.3 | 1.26 | 1.00 | 0.75 | 43.3 | 1.26 | 1.00 | 0.75 | 43.3 | 1.26 | 1.00 | 0.75 |
| 2.5 | 44.5 | 1.29 | 1.03 | 0.77 | 44.5 | 1.29 | 1.03 | 0.77 | 44.5 | 1.29 | 1.03 | 0.77 | 44.5 | 1.29 | 1.03 | 0.77 | 44.5 | 1.29 | 1.03 | 0.77 | 44.5 | 1.29 | 1.03 | 0.77 |
| 2.6 | 45.8 | 1.33 | 1.06 | 0.80 | 45.8 | 1.33 | 1.06 | 0.80 | 45.8 | 1.33 | 1.06 | 0.80 | 45.8 | 1.33 | 1.06 | 0.80 | 45.8 | 1.33 | 1.06 | 0.80 | 45.8 | 1.33 | 1.06 | 0.80 |
| 2.7 | 47.0 | 1.37 | 1.09 | 0.82 | 47.2 | 1.37 | 1.09 | 0.82 | 47.2 | 1.37 | 1.09 | 0.82 | 47.2 | 1.37 | 1.09 | 0.82 | 47.2 | 1.37 | 1.09 | 0.82 | 47.2 | 1.37 | 1.09 | 0.82 |
| 2.8 | 47.9 | 1.39 | 1.11 | 0.83 | 48.6 | 1.41 | 1.12 | 0.84 | 48.6 | 1.41 | 1.12 | 0.84 | 48.6 | 1.41 | 1.12 | 0.84 | 48.6 | 1.41 | 1.12 | 0.84 | 48.6 | 1.41 | 1.12 | 0.84 |
| 2.9 | 48.7 | 1.42 | 1.13 | 0.85 | 49.9 | 1.45 | 1.16 | 0.87 | 49.9 | 1.45 | 1.16 | 0.87 | 49.9 | 1.45 | 1.16 | 0.87 | 49.9 | 1.45 | 1.16 | 0.87 | 49.9 | 1.45 | 1.16 | 0.87 |
| 3.0 | 49.6 | 1.44 | 1.15 | 0.86 | 51.4 | 1.49 | 1.19 | 0.89 | 51.4 | 1.49 | 1.19 | 0.89 | 51.4 | 1.49 | 1.19 | 0.89 | 51.4 | 1.49 | 1.19 | 0.89 | 51.4 | 1.49 | 1.19 | 0.89 |
| 3.1 | 50.4 | 1.47 | 1.17 | 0.88 | 52.8 | 1.53 | 1.22 | 0.92 | 52.8 | 1.53 | 1.22 | 0.92 | 52.8 | 1.53 | 1.22 | 0.92 | 52.8 | 1.53 | 1.22 | 0.92 | 52.8 | 1.53 | 1.22 | 0.92 |
| 3.2 | 51.3 | 1.49 | 1.19 | 0.89 | 54.2 | 1.58 | 1.26 | 0.94 | 54.2 | 1.58 | 1.26 | 0.94 | 54.2 | 1.58 | 1.26 | 0.94 | 54.2 | 1.58 | 1.26 | 0.94 | 54.2 | 1.58 | 1.26 | 0.94 |
| 3.3 | 52.1 | 1.52 | 1.21 | 0.91 | 55.7 | 1.62 | 1.29 | 0.97 | 55.7 | 1.62 | 1.29 | 0.97 | 55.7 | 1.62 | 1.29 | 0.97 | 55.7 | 1.62 | 1.29 | 0.97 | 55.7 | 1.62 | 1.29 | 0.97 |
| 3.4 | 53.0 | 1.54 | 1.23 | 0.92 | 57.2 | 1.66 | 1.32 | 0.99 | 57.2 | 1.66 | 1.32 | 0.99 | 57.2 | 1.66 | 1.32 | 0.99 | 57.2 | 1.66 | 1.32 | 0.99 | 57.2 | 1.66 | 1.32 | 0.99 |
| 3.5 | 53.8 | 1.56 | 1.25 | 0.93 | 58.6 | 1.70 | 1.36 | 1.02 | 58.6 | 1.70 | 1.36 | 1.02 | 58.6 | 1.70 | 1.36 | 1.02 | 58.6 | 1.70 | 1.36 | 1.02 | 58.6 | 1.70 | 1.36 | 1.02 |
| 3.6 | 54.6 | 1.59 | 1.26 | 0.95 | 60.1 | 1.75 | 1.39 | 1.04 | 60.1 | 1.75 | 1.39 | 1.04 | 60.1 | 1.75 | 1.39 | 1.04 | 60.1 | 1.75 | 1.39 | 1.04 | 60.1 | 1.75 | 1.39 | 1.04 |
| 3.7 | 55.4 | 1.61 | 1.28 | 0.96 | 61.6 | 1.79 | 1.43 | 1.07 | 61.6 | 1.79 | 1.43 | 1.07 | 61.6 | 1.79 | 1.43 | 1.07 | 61.6 | 1.79 | 1.43 | 1.07 | 61.6 | 1.79 | 1.43 | 1.07 |
| 3.8 | 56.2 | 1.63 | 1.30 | 0.98 | 83.0 | 1.83 | 1.46 | 1.09 | 63.1 | 1.84 | 1.46 | 1.10 | 63.1 | 1.84 | 1.46 | 1.10 | 63.1 | 1.84 | 1.46 | 1.10 | 63.1 | 1.84 | 1.46 | 1.10 |
| 3.9 | 56.9 | 1.66 | 1.32 | 0.99 | 83.9 | 1.86 | 1.48 | 1.11 | 64.7 | 1.88 | 1.50 | 1.12 | 64.7 | 1.88 | 1.50 | 1.12 | 64.7 | 1.88 | 1.50 | 1.12 | 64.7 | 1.88 | 1.50 | 1.12 |
| 4.0 | 57.7 | 1.68 | 1.34 | 1.00 | 64.8 | 1.89 | 1.50 | 1.13 | 66.2 | 1.92 | 1.53 | 1.15 | 66.2 | 1.92 | 1.53 | 1.15 | 66.2 | 1.92 | 1.53 | 1.15 | 66.2 | 1.92 | 1.53 | 1.15 |
| 4.1 | 58.4 | 1.70 | 1.35 | 1.01 | 65.7 | 1.91 | 1.52 | 1.14 | 67.7 | 1.97 | 1.57 | 1.18 | 67.7 | 1.97 | 1.57 | 1.18 | 67.7 | 1.97 | 1.57 | 1.18 | 67.7 | 1.97 | 1.57 | 1.18 |
| 4.2 | 59.2 | 1.72 | 1.37 | 1.03 | 66.6 | 1.94 | 1.54 | 1.16 | 69.3 | 2.01 | 1.60 | 1.20 | 69.3 | 2.01 | 1.60 | 1.20 | 69.3 | 2.01 | 1.60 | 1.20 | 69.3 | 2.01 | 1.60 | 1.20 |
| 4.3 | 59.9 | 1.74 | 1.39 | 1.04 | 67.5 | 1.96 | 1.56 | 1.17 | 70.8 | 2.06 | 1.64 | 1.23 | 70.8 | 2.06 | 1.64 | 1.23 | 70.8 | 2.06 | 1.64 | 1.23 | 70.8 | 2.06 | 1.64 | 1.23 |
| 4.4 | 60.6 | 1.76 | 1.40 | 1.05 | 68.3 | 1.99 | 1.58 | 1.19 | 72.3 | 2.10 | 1.67 | 1.26 | 72.3 | 2.10 | 1.67 | 1.26 | 72.3 | 2.10 | 1.67 | 1.26 | 72.3 | 2.10 | 1.67 | 1.26 |
| 4.5 | 61.3 | 1.78 | 1.42 | 1.06 | 69.2 | 2.01 | 1.60 | 1.20 | 73.9 | 2.15 | 1.71 | 1.28 | 73.9 | 2.15 | 1.71 | 1.28 | 73.9 | 2.15 | 1.71 | 1.28 | 73.9 | 2.15 | 1.71 | 1.28 |
| 4.6 | 61.9 | 1.80 | 1.43 | 1.08 | 70.0 | 2.03 | 1.62 | 1.21 | 75.5 | 2.19 | 1.75 | 1.31 | 75.5 | 2.19 | 1.75 | 1.31 | 75.5 | 2.19 | 1.75 | 1.31 | 75.5 | 2.19 | 1.75 | 1.31 |
| 4.7 | 62.6 | 1.82 | 1.45 | 1.09 | 70.8 | 2.06 | 1.64 | 1.23 | 77.0 | 2.24 | 1.78 | 1.34 | 77.0 | 2.24 | 1.78 | 1.34 | 77.0 | 2.24 | 1.78 | 1.34 | 77.0 | 2.24 | 1.78 | 1.34 |
| 4.8 | 63.2 | 1.84 | 1.46 | 1.10 | 71.6 | 2.08 | 1.66 | 1.24 | 78.6 | 2.28 | 1.82 | 1.36 | 78.6 | 2.28 | 1.82 | 1.36 | 78.6 | 2.28 | 1.82 | 1.36 | 78.6 | 2.28 | 1.82 | 1.36 |
| 4.9 | 63.9 | 1.86 | 1.48 | 1.11 | 72.3 | 2.10 | 1.67 | 1.26 | 80.1 | 2.33 | 1.86 | 1.39 | 80.1 | 2.33 | 1.86 | 1.39 | 80.1 | 2.33 | 1.86 | 1.39 | 80.1 | 2.33 | 1.86 | 1.39 |
| 5.0 | 64.5 | 1.88 | 1.49 | 1.12 | 73.1 | 2.12 | 1.69 | 1.27 | 81.7 | 2.38 | 1.89 | 1.42 | 81.7 | 2.38 | 1.89 | 1.42 | 81.7 | 2.38 | 1.89 | 1.42 | 81.7 | 2.38 | 1.89 | 1.42 |
| 5.1 | 65.1 | 1.89 | 1.51 | 1.13 | 73.8 | 2.15 | 1.71 | 1.28 | 82.7 | 2.40 | 1.91 | 1.44 | 83.3 | 2.42 | 1.93 | 1.45 | 83.3 | 2.42 | 1.93 | 1.45 | 83.3 | 2.42 | 1.93 | 1.45 |
| 5.2 | 65.7 | 1.91 | 1.52 | 1.14 | 74.6 | 2.17 | 1.73 | 1.29 | 83.6 | 2.43 | 1.93 | 1.45 | 84.9 | 2.47 | 1.96 | 1.47 | 84.9 | 2.47 | 1.96 | 1.47 | 84.9 | 2.47 | 1.96 | 1.47 |
| 5.3 | 66.3 | 1.93 | 1.53 | 1.15 | 75.3 | 2.19 | 1.74 | 1.31 | 84.4 | 2.45 | 1.95 | 1.47 | 86.4 | 2.51 | 2.00 | 1.50 | 86.4 | 2.51 | 2.00 | 1.50 | 86.4 | 2.51 | 2.00 | 1.50 |
| 5.4 | 66.9 | 1.94 | 1.55 | 1.16 | 76.0 | 2.21 | 1.76 | 1.32 | 85.2 | 2.48 | 1.97 | 1.48 | 88.0 | 2.56 | 2.04 | 1.53 | 88.0 | 2.56 | 2.04 | 1.53 | 88.0 | 2.56 | 2.04 | 1.53 |
| 5.5 | 67.4 | 1.96 | 1.56 | 1.17 | 76.7 | 2.23 | 1.77 | 1.33 | 86.1 | 2.50 | 1.99 | 1.49 | 89.6 | 2.60 | 2.07 | 1.56 | 89.6 | 2.60 | 2.07 | 1.56 | 89.6 | 2.60 | 2.07 | 1.56 |
| 5.6 | 68.0 | 1.98 | 1.57 | 1.18 | 77.3 | 2.25 | 1.79 | 1.34 | 86.9 | 2.53 | 2.01 | 1.51 | 91.2 | 2.65 | 2.11 | 1.58 | 91.2 | 2.65 | 2.11 | 1.58 | 91.2 | 2.65 | 2.11 | 1.58 |
| 5.7 | 68.5 | 1.99 | 1.59 | 1.19 | 78.0 | 2.27 | 1.81 | 1.35 | 87.7 | 2.55 | 2.03 | 1.52 | 92.8 | 2.70 | 2.15 | 1.61 | 92.8 | 2.70 | 2.15 | 1.61 | 92.8 | 2.70 | 2.15 | 1.61 |
| 5.8 | 69.0 | 2.01 | 1.60 | 1.20 | 78.6 | 2.29 | 1.82 | 1.37 | 88.4 | 2.57 | 2.05 | 1.54 | 94.3 | 2.74 | 2.18 | 1.64 | 94.3 | 2.74 | 2.18 | 1.64 | 94.3 | 2.74 | 2.18 | 1.64 |
| 5.9 | 69.5 | 2.02 | 1.61 | 1.21 | 79.3 | 2.30 | 1.83 | 1.38 | 89.2 | 2.59 | 2.06 | 1.55 | 95.9 | 2.79 | 2.22 | 1.67 | 95.9 | 2.79 | 2.22 | 1.67 | 95.9 | 2.79 | 2.22 | 1.67 |
| 6.0 | 70.0 | 2.04 | 1.62 | 1.22 | 79.9 | 2.32 | 1.85 | 1.39 | 89.9 | 2.61 | 2.08 | 1.56 | 97.5 | 2.84 | 2.26 | 1.69 | 97.5 | 2.84 | 2.26 | 1.69 | 97.5 | 2.84 | 2.26 | 1.69 |
| 6.1 | 70.5 | 2.05 | 1.63 | 1.22 | 80.5 | 2.34 | 1.86 | 1.40 | 90.7 | 2.64 | 2.10 | 1.57 | 99.1 | 2.88 | 2.29 | 1.72 | 99.1 | 2.88 | 2.29 | 1.72 | 99.1 | 2.88 | 2.29 | 1.72 |
| 6.2 | 71.0 | 2.06 | 1.64 | 1.23 | 81.1 | 2.36 | 1.88 | 1.41 | 91.4 | 2.66 | 2.12 | 1.59 | 100.7 | 2.93 | 2.33 | 1.75 | 100.7 | 2.93 | 2.33 | 1.75 | 100.7 | 2.93 | 2.33 | 1.75 |
| 6.3 | 71.5 | 2.08 | 1.65 | 1.24 | 81.7 | 2.37 | 1.89 | 1.42 | 92.1 | 2.68 | 2.13 | 1.60 | 102.3 | 2.97 | 2.37 | 1.78 | 102.3 | 2.97 | 2.37 | 1.78 | 102.3 | 2.97 | 2.37 | 1.78 |
| 6.4 | 71.9 | 2.09 | 1.66 | 1.25 | 82.2 | 2.39 | 1.90 | 1.43 | 92.8 | 2.70 | 2.15 | 1.61 | 103.6 | 3.01 | 2.40 | 1.80 | 103.9 | 3.02 | 2.41 | 1.80 | 103.9 | 3.02 | 2.41 | 1.80 |
| 6.5 | 72.4 | 2.10 | 1.68 | 1.26 | 82.8 | 2.41 | 1.92 | 1.44 | 93.5 | 2.72 | 2.16 | 1.62 | 104.4 | 3.03 | 2.42 | 1.81 | 105.5 | 3.07 | 2.44 | 1.83 | 105.5 | 3.07 | 2.44 | 1.83 |
| 6.6 | 72.8 | 2.12 | 1.69 | 1.26 | 83.3 | 2.42 | 1.93 | 1.45 | 94.1 | 2.74 | 2.18 | 1.63 | 105.2 | 3.06 | 2.43 | 1.83 | 107.1 | 3.11 | 2.48 | 1.86 | 107.1 | 3.11 | 2.48 | 1.86 |
| 6.7 | 73.2 | 2.13 | 1.70 | 1.27 | 83.9 | 2.44 | 1.94 | 1.46 | 94.8 | 2.76 | 2.19 | 1.65 | 105.9 | 3.08 | 2.45 | 1.84 | 108.7 | 3.16 | 2.52 | 1.89 | 108.7 | 3.16 | 2.52 | 1.89 |
| 6.8 | 73.7 | 2.14 | 1.70 | 1.28 | 84.4 | 2.45 | 1.95 | 1.47 | 95.4 | 2.77 | 2.21 | 1.66 | 106.7 | 3.10 | 2.47 | 1.85 | 110.3 | 3.21 | 2.55 | 1.91 | 110.3 | 3.21 | 2.55 | 1.91 |
| 6.9 | 74.1 | 2.15 | 1.71 | 1.29 | 84.9 | 2.47 | 1.97 | 1.47 | 96.1 | 2.79 | 2.22 | 1.67 | 107.5 | 3.12 | 2.49 | 1.87 | 111.9 | 3.25 | 2.59 | 1.94 | 111.9 | 3.25 | 2.59 | 1.94 |
| 7.0 | 74.5 | 2.16 | 1.72 | 1.29 | 85.4 | 2.48 | 1.98 | 1.48 | 96.7 | 2.81 | 2.24 | 1.68 | 108.2 | 3.15 | 2.50 | 1.88 | 113.5 | 3.30 | 2.63 | 1.97 | 113.5 | 3.30 | 2.63 | 1.97 |
| 7.1 | 74.9 | 2.18 | 1.73 | 1.30 | 85.9 | 2.50 | 1.99 | 1.49 | 97.3 | 2.83 | 2.25 | 1.69 | 108.9 | 3.17 | 2.52 | 1.89 | 115.1 | 3.35 | 2.66 | 2.00 | 115.1 | 3.35 | 2.66 | 2.00 |
| 7.2 | 75.2 | 2.19 | 1.74 | 1.31 | 86.4 | 2.51 | 2.00 | 1.50 | 97.9 | 2.85 | 2.27 | 1.70 | 109.6 | 3.19 | 2.54 | 1.90 | 116.7 | 3.39 | 2.70 | 2.03 | 116.7 | 3.39 | 2.70 | 2.03 |
| 7.3 | 75.6 | 2.20 | 1.75 | 1.31 | 86.9 | 2.53 | 2.01 | 1.51 | 98.5 | 2.86 | 2.28 | 1.71 | 110.3 | 3.21 | 2.55 | 1.92 | 118.3 | 3.44 | 2.74 | 2.05 | 118.3 | 3.44 | 2.74 | 2.05 |
| 7.4 | 76.0 | 2.21 | 1.76 | 1.32 | 87.3 | 2.54 | 2.02 | 1.52 | 99.0 | 2.88 | 2.29 | 1.72 | 111.0 | 3.23 | 2.57 | 1.93 | 119.9 | 3.49 | 2.78 | 2.08 | 119.9 | 3.49 | 2.78 | 2.08 |
| 7.5 | 76.3 | 2.22 | 1.77 | 1.33 | 87.8 | 2.55 | 2.03 | 1.52 | 99.6 | 2.90 | 2.31 | 1.73 | 111.7 | 3.25 | 2.59 | 1.94 | 121.5 | 3.53 | 2.81 | 2.11 | 121.5 | 3.53 | 2.81 | 2.11 |
| 7.6 | 76.7 | 2.23 | 1.77 | 1.33 | 88.2 | 2.56 | 2.04 | 1.53 | 100.1 | 2.91 | 2.32 | 1.74 | 112.3 | 3.27 | 2.60 | 1.95 | 123.1 | 3.58 | 2.85 | 2.14 | 123.1 | 3.58 | 2.85 | 2.14 |
| 7.7 | 77.0 | 2.24 | 1.78 | 1.34 | 88.7 | 2.58 | 2.05 | 1.54 | 100.7 | 2.93 | 2.33 | 1.75 | 113.0 | 3.28 | 2.62 | 1.95 | 124.7 | 3.63 | 2.89 | 2.16 | 124.7 | 3.63 | 2.89 | 2.16 |
| 7.8 | 77.3 | 2.25 | 1.79 | 1.34 | 89.1 | 2.59 | 2.06 | 1.55 | 101.2 | 2.94 | 2.34 | 1.76 | 113.6 | 3.30 | 2.83 | 1.97 | 126.3 | 3.67 | 2.92 | 2.19 | 126.3 | 3.67 | 2.92 | 2.19 |
| 7.9 | 77.7 | 2.26 | 1.80 | 1.35 | 89.5 | 2.60 | 2.07 | 1.55 | 101.7 | 2.96 | 2.35 | 1.77 | 114.3 | 3.32 | 2.64 | 1.98 | 127.1 | 3.69 | 2.94 | 2.21 | 127.9 | 3.72 | 2.96 | 2.22 |
| 8.0 | 78.0 | 2.27 | 1.81 | 1.35 | 89.9 | 2.61 | 2.08 | 1.56 | 102.2 | 2.97 | 2.37 | 1.77 | 114.9 | 3.34 | 2.66 | 1.99 | 127.8 | 3.72 | 2.96 | 2.22 | 129.5 | 3.77 | 3.00 | 2.25 |
| 8.1 | 78.3 | 2.28 | 1.81 | 1.36 | 90.3 | 2.83 | 2.09 | 1.57 | 102.7 | 2.99 | 2.38 | 1.78 | 115.5 | 3.36 | 2.67 | 2.00 | 128.5 | 3.74 | 2.97 | 2.23 | 131.1 | 3.81 | 3.04 | 2.28 |
| 8.2 | 78.6 | 2.28 | 1.82 | 1.36 | 90.7 | 2.64 | 2.10 | 1.57 | 103.2 | 3.00 | 2.39 | 1.79 | 116.1 | 3.37 | 2.69 | 2.02 | 129.2 | 3.76 | 2.99 | 2.24 | 132.7 | 3.86 | 3.07 | 2.30 |
| 8.3 | 78.9 | 2.29 | 1.83 | 1.37 | 91.1 | 2.65 | 2.11 | 1.58 | 103.7 | 3.01 | 2.40 | 1.80 | 116.7 | 3.39 | 2.70 | 2.03 | 129.9 | 3.78 | 3.01 | 2.26 | 134.3 | 3.91 | 3.11 | 2.33 |
| 8.4 | 79.2 | 2.30 | 1.83 | 1.37 | 91.5 | 2.66 | 2.12 | 1.59 | 104.2 | 3.03 | 2.41 | 1.81 | 117.2 | 3.41 | 2.71 | 2.04 | 130.6 | 3.80 | 3.02 | 2.27 | 135.9 | 3.95 | 3.15 | 2.36 |
| 8.5 | 79.5 | 2.31 | 1.84 | 1.38 | 91.8 | 2.67 | 2.13 | 1.59 | 104.6 | 3.04 | 2.42 | 1.82 | 117.8 | 3.42 | 2.73 | 2.04 | 131.3 | 3.82 | 3.04 | 2.28 | 137.6 | 4.00 | 3.18 | 2.39 |
| 8.6 | 79.7 | 2.32 | 1.85 | 1.38 | 92.2 | 2.66 | 2.13 | 1.60 | 105.1 | 3.05 | 2.43 | 1.82 | 118.3 | 3.44 | 2.74 | 2.05 | 131.9 | 3.84 | 3.05 | 2.29 | 139.2 | 4.05 | 3.22 | 2.42 |
| 8.7 | 80.0 | 2.33 | 1.85 | 1.39 | 92.5 | 2.69 | 2.14 | 1.61 | 105.5 | 3.07 | 2.44 | 1.83 | 118.9 | 3.46 | 2.75 | 2.06 | 132.6 | 3.85 | 3.07 | 2.30 | 140.8 | 4.09 | 3.26 | 2.44 |
| 8.8 | 80.3 | 2.33 | 1.86 | 1.39 | 92.9 | 2.70 | 2.15 | 1.61 | 106.0 | 3.08 | 2.45 | 1.84 | 119.4 | 3.47 | 2.76 | 2.07 | 133.2 | 3.87 | 3.08 | 2.31 | 142.4 | 4.14 | 3.30 | 2.47 |
| 8.9 | 80.5 | 2.34 | 1.86 | 1.40 | 93.2 | 2.71 | 2.16 | 1.62 | 106.4 | 3.09 | 2.46 | 1.85 | 119.9 | 3.49 | 2.78 | 2.08 | 133.8 | 3.69 | 3.10 | 2.32 | 144.0 | 4.19 | 3.33 | 2.50 |
| 9.0 | 80.8 | 2.35 | 1.87 | 1.40 | 93.6 | 2.72 | 2.17 | 1.62 | 106.8 | 3.10 | 2.47 | 1.85 | 120.4 | 3.50 | 2.79 | 2.09 | 134.4 | 3.91 | 3.11 | 2.33 | 145.6 | 4.23 | 3.37 | 2.53 |
| 9.1 | 81.0 | 2.36 | 1.88 | 1.41 | 93.9 | 2.73 | 2.17 | 1.63 | 107.2 | 3.12 | 2.48 | 1.86 | 120.9 | 3.52 | 2.80 | 2.10 | 135.1 | 3.93 | 3.13 | 2.34 | 147.2 | 4.28 | 3.41 | 2.56 |
| 9.2 | 81.3 | 2.36 | 1.88 | 1.41 | 94.2 | 2.74 | 2.18 | 1.64 | 107.6 | 3.13 | 2.49 | 1.87 | 121.4 | 3.53 | 2.81 | 2.11 | 135.6 | 3.94 | 3.14 | 2.36 | 148.8 | 4.33 | 3.44 | 2.58 |
| 9.3 | 81.5 | 2.37 | 1.89 | 1.42 | 94.5 | 2.75 | 2.19 | 1.64 | 108.0 | 3.14 | 2.50 | 1.88 | 121.9 | 3.54 | 2.82 | 2.12 | 136.2 | 3.96 | 3.15 | 2.37 | 150.4 | 4.37 | 3.48 | 2.61 |
| 9.4 | 81.7 | 2.36 | 1.89 | 1.42 | 94.8 | 2.76 | 2.19 | 1.65 | 108.4 | 3.15 | 2.51 | 1.88 | 122.4 | 3.56 | 2.83 | 2.13 | 136.8 | 3.98 | 3.17 | 2.38 | 151.5 | 4.41 | 3.51 | 2.63 |
| 9.5 | 82.0 | 2.38 | 1.90 | 1.42 | 95.1 | 2.76 | 2.20 | 1.65 | 108.8 | 3.16 | 2.52 | 1.89 | 122.9 | 3.57 | 2.84 | 2.13 | 137.4 | 3.99 | 3.18 | 2.38 | 152.2 | 4.42 | 3.52 | 2.64 |
| 9.6 | 82.2 | 2.39 | 1.90 | 1.43 | 95.4 | 2.77 | 2.21 | 1.66 | 109.1 | 3.17 | 2.53 | 1.89 | 123.3 | 3.59 | 2.85 | 2.14 | 137.9 | 4.01 | 3.19 | 2.39 | 152.9 | 4.44 | 3.54 | 2.65 |
| 9.7 | 82.4 | 2.40 | 1.91 | 1.43 | 95.7 | 2.78 | 2.21 | 1.66 | 109.5 | 3.18 | 2.53 | 1.90 | 123.8 | 3.60 | 2.87 | 2.15 | 138.5 | 4.03 | 3.21 | 2.40 | 153.5 | 4.48 | 3.55 | 2.67 |
| 9.8 | 82.6 | 2.40 | 1.91 | 1.43 | 96.0 | 2.79 | 2.22 | 1.67 | 109.9 | 3.19 | 2.54 | 1.91 | 124.2 | 3.61 | 2.88 | 2.16 | 139.0 | 4.04 | 3.22 | 2.41 | 154.2 | 4.48 | 3.57 | 2.69 |
| 9.9 | 82.8 | 2.41 | 1.92 | 1.44 | 96.2 | 2.80 | 2.23 | 1.67 | 110.2 | 3.20 | 2.55 | 1.91 | 124.7 | 3.62 | 2.89 | 2.16 | 139.5 | 4.06 | 3.23 | 2.42 | 154.8 | 4.50 | 3.58 | 2.69 |
| 10.0 | 83.0 | 2.41 | 1.92 | 1.44 | 96.5 | 2.81 | 2.23 | 1.68 | 110.5 | 3.21 | 2.56 | 1.92 | 125.1 | 3.64 | 2.90 | 2.17 | 140.1 | 4.07 | 3.24 | 2.43 | 155.4 | 4.52 | 3.60 | 2.70 |
| Trench Width m | | 1.1 | | | | 1.2 | | | | 1.3 | | | | 1.4 | | | | 1.5 | | | | 1.6 | | |

**TABLE 9. DESIGN LOADS**
**500 mm DIAMETER PIPE**

2 WHEELS 30kN
IMPACT FACTOR 2.0

| Cover | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 48 | 60 | 80 | kN/m | 48 | 60 | 80 | kN/m | 48 | 60 | 80 | kN/m | 48 | 60 | 80 | kN/m | 48 | 60 | 80 | kN/m | 48 | 60 | 80 |
| 0.6 | 48.5 | 1.26 | 1.01 | 0.76 | 48.5 | 1.26 | 1.01 | 0.76 | 48.5 | 1.26 | 1.01 | 0.76 | 48.5 | 1.26 | 1.01 | 0.76 | 48.5 | 1.26 | 1.01 | 0.76 | 48.5 | 1.26 | 1.01 | 0.76 |
| 0.7 | 44.0 | 1.15 | 0.92 | 0.69 | 44.0 | 1.15 | 0.92 | 0.69 | 44.0 | 1.15 | 0.92 | 0.69 | 44.0 | 1.15 | 0.92 | 0.69 | 44.0 | 1.15 | 0.92 | 0.69 | 44.0 | 1.15 | 0.92 | 0.69 |
| 0.8 | 41.0 | 1.07 | 0.85 | 0.64 | 41.0 | 1.07 | 0.85 | 0.64 | 41.0 | 1.07 | 0.85 | 0.64 | 41.0 | 1.07 | 0.85 | 0.64 | 41.0 | 1.07 | 0.85 | 0.64 | 41.0 | 1.07 | 0.85 | 0.64 |
| 0.9 | 39.2 | 1.02 | 0.82 | 0.61 | 39.2 | 1.02 | 0.82 | 0.61 | 39.2 | 1.02 | 0.82 | 0.61 | 39.2 | 1.02 | 0.82 | 0.61 | 39.2 | 1.02 | 0.82 | 0.61 | 39.2 | 1.02 | 0.82 | 0.61 |
| 1.0 | 38.2 | 0.99 | 0.80 | 0.60 | 38.2 | 0.99 | 0.80 | 0.60 | 38.2 | 0.99 | 0.80 | 0.60 | 38.2 | 0.99 | 0.80 | 0.60 | 38.2 | 0.99 | 0.80 | 0.60 | 38.2 | 0.99 | 0.80 | 0.60 |
| 1.1 | 37.9 | 0.99 | 0.79 | 0.59 | 37.9 | 0.99 | 0.79 | 0.59 | 37.9 | 0.99 | 0.79 | 0.59 | 37.9 | 0.99 | 0.79 | 0.59 | 37.9 | 0.99 | 0.79 | 0.59 | 37.9 | 0.99 | 0.79 | 0.59 |
| 1.2 | 37.9 | 0.99 | 0.79 | 0.59 | 37.9 | 0.99 | 0.79 | 0.59 | 37.9 | 0.99 | 0.79 | 0.59 | 37.9 | 0.99 | 0.79 | 0.59 | 37.9 | 0.99 | 0.79 | 0.59 | 37.9 | 0.99 | 0.79 | 0.59 |
| 1.3 | 37.8 | 0.99 | 0.79 | 0.59 | 37.8 | 0.99 | 0.79 | 0.59 | 37.8 | 0.99 | 0.79 | 0.59 | 37.8 | 0.99 | 0.79 | 0.59 | 37.8 | 0.99 | 0.79 | 0.59 | 37.8 | 0.99 | 0.79 | 0.59 |
| 1.4 | 38.1 | 0.99 | 0.79 | 0.59 | 38.1 | 0.99 | 0.79 | 0.59 | 38.1 | 0.99 | 0.79 | 0.59 | 38.1 | 0.99 | 0.79 | 0.59 | 38.1 | 0.99 | 0.79 | 0.59 | 38.1 | 0.99 | 0.79 | 0.59 |
| 1.5 | 38.5 | 1.00 | 0.80 | 0.60 | 38.5 | 1.00 | 0.80 | 0.60 | 38.5 | 1.00 | 0.80 | 0.60 | 38.5 | 1.00 | 0.80 | 0.60 | 38.5 | 1.00 | 0.80 | 0.60 | 38.5 | 1.00 | 0.80 | 0.60 |
| 1.6 | 39.2 | 1.02 | 0.82 | 0.61 | 39.2 | 1.02 | 0.82 | 0.61 | 39.2 | 1.02 | 0.82 | 0.61 | 39.2 | 1.02 | 0.82 | 0.61 | 39.2 | 1.02 | 0.82 | 0.61 | 39.2 | 1.02 | 0.82 | 0.61 |
| 1.7 | 40.0 | 1.04 | 0.83 | 0.62 | 40.0 | 1.04 | 0.83 | 0.62 | 40.0 | 1.04 | 0.83 | 0.62 | 40.0 | 1.04 | 0.83 | 0.62 | 40.0 | 1.04 | 0.83 | 0.62 | 40.0 | 1.04 | 0.83 | 0.62 |
| 1.8 | 40.9 | 1.07 | 0.85 | 0.64 | 40.9 | 1.07 | 0.85 | 0.64 | 40.9 | 1.07 | 0.85 | 0.64 | 40.9 | 1.07 | 0.85 | 0.64 | 40.9 | 1.07 | 0.85 | 0.64 | 40.9 | 1.07 | 0.85 | 0.64 |
| 1.9 | 42.0 | 1.09 | 0.87 | 0.66 | 42.0 | 1.09 | 0.87 | 0.66 | 42.0 | 1.09 | 0.87 | 0.66 | 42.0 | 1.09 | 0.87 | 0.66 | 42.0 | 1.09 | 0.87 | 0.66 | 42.0 | 1.09 | 0.87 | 0.66 |
| 2.0 | 43.1 | 1.12 | 0.90 | 0.67 | 43.1 | 1.12 | 0.90 | 0.67 | 43.1 | 1.12 | 0.90 | 0.67 | 43.1 | 1.12 | 0.90 | 0.67 | 43.1 | 1.12 | 0.90 | 0.67 | 43.1 | 1.12 | 0.90 | 0.67 |
| 2.1 | 44.3 | 1.15 | 0.92 | 0.69 | 44.3 | 1.15 | 0.92 | 0.69 | 44.3 | 1.15 | 0.92 | 0.69 | 44.3 | 1.15 | 0.92 | 0.69 | 44.3 | 1.15 | 0.92 | 0.69 | 44.3 | 1.15 | 0.92 | 0.69 |
| 2.2 | 45.6 | 1.19 | 0.95 | 0.71 | 45.6 | 1.19 | 0.95 | 0.71 | 45.6 | 1.19 | 0.95 | 0.71 | 45.6 | 1.19 | 0.95 | 0.71 | 45.6 | 1.19 | 0.95 | 0.71 | 45.6 | 1.19 | 0.95 | 0.71 |
| 2.3 | 46.9 | 1.22 | 0.98 | 0.73 | 46.9 | 1.22 | 0.98 | 0.73 | 46.9 | 1.22 | 0.98 | 0.73 | 46.9 | 1.22 | 0.98 | 0.73 | 46.9 | 1.22 | 0.98 | 0.73 | 46.9 | 1.22 | 0.98 | 0.73 |
| 2.4 | 48.3 | 1.26 | 1.01 | 0.75 | 48.3 | 1.26 | 1.01 | 0.75 | 48.3 | 1.26 | 1.01 | 0.75 | 48.3 | 1.26 | 1.01 | 0.75 | 48.3 | 1.26 | 1.01 | 0.75 | 48.3 | 1.26 | 1.01 | 0.75 |
| 2.5 | 49.7 | 1.30 | 1.04 | 0.78 | 49.7 | 1.30 | 1.04 | 0.78 | 49.7 | 1.30 | 1.04 | 0.78 | 49.7 | 1.30 | 1.04 | 0.78 | 49.7 | 1.30 | 1.04 | 0.78 | 49.7 | 1.30 | 1.04 | 0.78 |
| 2.6 | 51.2 | 1.33 | 1.07 | 0.80 | 51.2 | 1.33 | 1.07 | 0.80 | 51.2 | 1.33 | 1.07 | 0.80 | 51.2 | 1.33 | 1.07 | 0.80 | 51.2 | 1.33 | 1.07 | 0.80 | 51.2 | 1.33 | 1.07 | 0.80 |
| 2.7 | 52.5 | 1.37 | 1.09 | 0.82 | 52.7 | 1.37 | 1.10 | 0.82 | 52.7 | 1.37 | 1.10 | 0.82 | 52.7 | 1.37 | 1.10 | 0.82 | 52.7 | 1.37 | 1.10 | 0.82 | 52.7 | 1.37 | 1.10 | 0.82 |
| 2.8 | 53.5 | 1.39 | 1.11 | 0.84 | 54.2 | 1.41 | 1.13 | 0.85 | 54.2 | 1.41 | 1.13 | 0.85 | 54.2 | 1.41 | 1.13 | 0.85 | 54.2 | 1.41 | 1.13 | 0.85 | 54.2 | 1.41 | 1.13 | 0.85 |
| 2.9 | 54.5 | 1.42 | 1.14 | 0.85 | 55.8 | 1.45 | 1.16 | 0.87 | 55.8 | 1.45 | 1.16 | 0.87 | 55.8 | 1.45 | 1.16 | 0.87 | 55.8 | 1.45 | 1.16 | 0.87 | 55.8 | 1.45 | 1.16 | 0.87 |
| 3.0 | 55.5 | 1.45 | 1.16 | 0.87 | 57.4 | 1.49 | 1.20 | 0.90 | 57.4 | 1.49 | 1.20 | 0.90 | 57.4 | 1.49 | 1.20 | 0.90 | 57.4 | 1.49 | 1.20 | 0.90 | 57.4 | 1.49 | 1.20 | 0.90 |
| 3.1 | 56.5 | 1.47 | 1.18 | 0.88 | 59.0 | 1.54 | 1.23 | 0.92 | 59.0 | 1.54 | 1.23 | 0.92 | 59.0 | 1.54 | 1.23 | 0.92 | 59.0 | 1.54 | 1.23 | 0.92 | 59.0 | 1.54 | 1.23 | 0.92 |
| 3.2 | 57.5 | 1.50 | 1.20 | 0.90 | 60.6 | 1.58 | 1.26 | 0.95 | 60.6 | 1.58 | 1.26 | 0.95 | 60.6 | 1.58 | 1.26 | 0.95 | 60.6 | 1.58 | 1.26 | 0.95 | 60.6 | 1.58 | 1.26 | 0.95 |
| 3.3 | 58.5 | 1.52 | 1.22 | 0.91 | 62.2 | 1.62 | 1.30 | 0.97 | 62.2 | 1.62 | 1.30 | 0.97 | 62.2 | 1.62 | 1.30 | 0.97 | 62.2 | 1.62 | 1.30 | 0.97 | 62.2 | 1.62 | 1.30 | 0.97 |
| 3.4 | 59.5 | 1.55 | 1.24 | 0.93 | 63.9 | 1.66 | 1.33 | 1.00 | 63.9 | 1.66 | 1.33 | 1.00 | 63.9 | 1.66 | 1.33 | 1.00 | 63.9 | 1.66 | 1.33 | 1.00 | 63.9 | 1.66 | 1.33 | 1.00 |
| 3.5 | 60.4 | 1.57 | 1.26 | 0.94 | 65.5 | 1.71 | 1.36 | 1.02 | 65.5 | 1.71 | 1.36 | 1.02 | 65.5 | 1.71 | 1.36 | 1.02 | 65.5 | 1.71 | 1.36 | 1.02 | 65.5 | 1.71 | 1.36 | 1.02 |
| 3.6 | 61.4 | 1.60 | 1.28 | 0.96 | 67.2 | 1.75 | 1.40 | 1.05 | 67.2 | 1.75 | 1.40 | 1.05 | 67.2 | 1.75 | 1.40 | 1.05 | 67.2 | 1.75 | 1.40 | 1.05 | 67.2 | 1.75 | 1.40 | 1.05 |
| 3.7 | 62.3 | 1.62 | 1.30 | 0.97 | 68.9 | 1.79 | 1.43 | 1.08 | 68.9 | 1.79 | 1.43 | 1.08 | 68.9 | 1.79 | 1.43 | 1.08 | 68.9 | 1.79 | 1.43 | 1.08 | 68.9 | 1.79 | 1.43 | 1.08 |
| 3.8 | 63.3 | 1.65 | 1.32 | 0.99 | 70.2 | 1.83 | 1.46 | 1.10 | 70.5 | 1.84 | 1.47 | 1.10 | 70.5 | 1.84 | 1.47 | 1.10 | 70.5 | 1.84 | 1.47 | 1.10 | 70.5 | 1.84 | 1.47 | 1.10 |
| 3.9 | 64.2 | 1.67 | 1.34 | 1.00 | 71.2 | 1.86 | 1.48 | 1.11 | 72.2 | 1.88 | 1.51 | 1.13 | 72.2 | 1.88 | 1.51 | 1.13 | 72.2 | 1.88 | 1.51 | 1.13 | 72.2 | 1.88 | 1.51 | 1.13 |
| 4.0 | 65.1 | 1.69 | 1.36 | 1.02 | 72.3 | 1.88 | 1.51 | 1.13 | 74.0 | 1.93 | 1.54 | 1.16 | 74.0 | 1.93 | 1.54 | 1.16 | 74.0 | 1.93 | 1.54 | 1.16 | 74.0 | 1.93 | 1.54 | 1.16 |
| 4.1 | 85.9 | 1.72 | 1.37 | 1.03 | 73.3 | 1.91 | 1.53 | 1.15 | 75.7 | 1.97 | 1.58 | 1.18 | 75.7 | 1.97 | 1.58 | 1.18 | 75.7 | 1.97 | 1.58 | 1.18 | 75.7 | 1.97 | 1.58 | 1.18 |
| 4.2 | 68.8 | 1.74 | 1.39 | 1.04 | 74.4 | 1.94 | 1.55 | 1.16 | 77.4 | 2.02 | 1.61 | 1.21 | 77.4 | 2.02 | 1.61 | 1.21 | 77.4 | 2.02 | 1.61 | 1.21 | 77.4 | 2.02 | 1.61 | 1.21 |
| 4.3 | 67.7 | 1.76 | 1.41 | 1.06 | 75.4 | 1.96 | 1.57 | 1.18 | 79.1 | 2.06 | 1.65 | 1.24 | 79.1 | 2.06 | 1.65 | 1.24 | 79.1 | 2.06 | 1.65 | 1.24 | 79.1 | 2.06 | 1.65 | 1.24 |
| 4.4 | 68.5 | 1.78 | 1.43 | 1.07 | 76.4 | 1.99 | 1.59 | 1.19 | 80.8 | 2.11 | 1.68 | 1.26 | 80.8 | 2.11 | 1.68 | 1.26 | 80.8 | 2.11 | 1.68 | 1.26 | 80.8 | 2.11 | 1.68 | 1.26 |
| 4.5 | 69.3 | 1.81 | 1.44 | 1.08 | 77.3 | 2.01 | 1.61 | 1.21 | 82.6 | 2.15 | 1.72 | 1.29 | 82.6 | 2.15 | 1.72 | 1.29 | 82.6 | 2.15 | 1.72 | 1.29 | 82.6 | 2.15 | 1.72 | 1.29 |
| 4.6 | 70.1 | 1.83 | 1.46 | 1.10 | 78.3 | 2.04 | 1.63 | 1.22 | 84.3 | 2.20 | 1.76 | 1.32 | 84.3 | 2.20 | 1.76 | 1.32 | 84.3 | 2.20 | 1.76 | 1.32 | 84.3 | 2.20 | 1.76 | 1.32 |
| 4.7 | 70.9 | 1.85 | 1.48 | 1.11 | 79.2 | 2.06 | 1.65 | 1.24 | 86.1 | 2.24 | 1.79 | 1.34 | 86.1 | 2.24 | 1.79 | 1.34 | 86.1 | 2.24 | 1.79 | 1.34 | 86.1 | 2.24 | 1.79 | 1.34 |
| 4.8 | 71.7 | 1.87 | 1.49 | 1.12 | 80.2 | 2.09 | 1.67 | 1.25 | 87.8 | 2.29 | 1.83 | 1.37 | 87.8 | 2.29 | 1.83 | 1.37 | 87.8 | 2.29 | 1.83 | 1.37 | 87.8 | 2.29 | 1.83 | 1.37 |
| 4.9 | 72.5 | 1.89 | 1.51 | 1.13 | 81.1 | 2.11 | 1.69 | 1.27 | 89.6 | 2.33 | 1.87 | 1.40 | 89.6 | 2.33 | 1.87 | 1.40 | 89.6 | 2.33 | 1.87 | 1.40 | 89.6 | 2.33 | 1.87 | 1.40 |
| 5.0 | 73.2 | 1.91 | 1.53 | 1.14 | 82.0 | 2.13 | 1.71 | 1.28 | 90.8 | 2.36 | 1.89 | 1.42 | 91.3 | 2.38 | 1.90 | 1.43 | 91.3 | 2.38 | 1.90 | 1.43 | 91.3 | 2.38 | 1.90 | 1.43 |
| 5.1 | 74.0 | 1.93 | 1.54 | 1.16 | 82.8 | 2.16 | 1.73 | 1.29 | 91.8 | 2.39 | 1.91 | 1.43 | 93.1 | 2.42 | 1.94 | 1.45 | 93.1 | 2.42 | 1.94 | 1.45 | 93.1 | 2.42 | 1.94 | 1.45 |
| 5.2 | 74.7 | 1.94 | 1.56 | 1.17 | 83.7 | 2.18 | 1.74 | 1.31 | 92.8 | 2.42 | 1.93 | 1.45 | 94.8 | 2.47 | 1.98 | 1.48 | 94.8 | 2.47 | 1.98 | 1.48 | 94.8 | 2.47 | 1.98 | 1.48 |
| 5.3 | 75.4 | 1.96 | 1.57 | 1.18 | 84.5 | 2.20 | 1.76 | 1.32 | 93.8 | 2.44 | 1.95 | 1.47 | 96.6 | 2.52 | 2.01 | 1.51 | 96.6 | 2.52 | 2.01 | 1.51 | 96.6 | 2.52 | 2.01 | 1.51 |
| 5.4 | 76.1 | 1.98 | 1.59 | 1.19 | 85.4 | 2.22 | 1.78 | 1.33 | 94.8 | 2.47 | 1.97 | 1.48 | 98.4 | 2.56 | 2.05 | 1.54 | 98.4 | 2.56 | 2.05 | 1.54 | 98.4 | 2.56 | 2.05 | 1.54 |
| 5.5 | 76.8 | 2.00 | 1.60 | 1.20 | 88.2 | 2.24 | 1.80 | 1.35 | 95.8 | 2.49 | 1.99 | 1.50 | 100.1 | 2.61 | 2.09 | 1.56 | 100.1 | 2.61 | 2.09 | 1.56 | 100.1 | 2.61 | 2.09 | 1.56 |
| 5.6 | 77.4 | 2.02 | 1.61 | 1.21 | 87.0 | 2.27 | 1.81 | 1.36 | 96.7 | 2.52 | 2.01 | 1.51 | 101.9 | 2.65 | 2.12 | 1.59 | 101.9 | 2.65 | 2.12 | 1.59 | 101.9 | 2.65 | 2.12 | 1.59 |
| 5.7 | 78.1 | 2.03 | 1.63 | 1.22 | 87.8 | 2.29 | 1.83 | 1.37 | 97.6 | 2.54 | 2.03 | 1.53 | 103.7 | 2.70 | 2.16 | 1.62 | 103.7 | 2.70 | 2.16 | 1.62 | 103.7 | 2.70 | 2.16 | 1.62 |
| 5.8 | 78.7 | 2.05 | 1.64 | 1.23 | 88.5 | 2.31 | 1.84 | 1.38 | 98.5 | 2.57 | 2.05 | 1.54 | 105.4 | 2.75 | 2.20 | 1.65 | 105.4 | 2.75 | 2.20 | 1.65 | 105.4 | 2.75 | 2.20 | 1.65 |
| 5.9 | 79.4 | 2.07 | 1.65 | 1.24 | 89.3 | 2.33 | 1.86 | 1.40 | 99.4 | 2.59 | 2.07 | 1.55 | 107.2 | 2.79 | 2.23 | 1.68 | 107.2 | 2.79 | 2.23 | 1.68 | 107.2 | 2.79 | 2.23 | 1.68 |
| 6.0 | 80.0 | 2.08 | 1.67 | 1.25 | 90.0 | 2.34 | 1.88 | 1.41 | 100.3 | 2.61 | 2.09 | 1.57 | 109.0 | 2.84 | 2.27 | 1.70 | 109.0 | 2.84 | 2.27 | 1.70 | 109.0 | 2.84 | 2.27 | 1.70 |
| 6.1 | 80.6 | 2.10 | 1.68 | 1.26 | 90.8 | 2.36 | 1.89 | 1.42 | 101.2 | 2.63 | 2.11 | 1.58 | 110.8 | 2.88 | 2.31 | 1.73 | 110.8 | 2.88 | 2.31 | 1.73 | 110.8 | 2.88 | 2.31 | 1.73 |
| 6.2 | 81.2 | 2.11 | 1.69 | 1.27 | 91.5 | 2.38 | 1.91 | 1.43 | 102.0 | 2.66 | 2.13 | 1.59 | 112.6 | 2.93 | 2.34 | 1.76 | 112.6 | 2.93 | 2.34 | 1.76 | 112.6 | 2.93 | 2.34 | 1.76 |
| 6.3 | 81.8 | 2.13 | 1.70 | 1.28 | 92.2 | 2.40 | 1.92 | 1.44 | 102.8 | 2.68 | 2.14 | 1.61 | 113.6 | 2.96 | 2.37 | 1.78 | 114.3 | 2.98 | 2.38 | 1.79 | 114.3 | 2.98 | 2.38 | 1.79 |
| 6.4 | 82.3 | 2.14 | 1.72 | 1.29 | 92.9 | 2.42 | 1.94 | 1.45 | 103.7 | 2.70 | 2.16 | 1.62 | 114.6 | 2.98 | 2.39 | 1.79 | 116.1 | 3.02 | 2.42 | 1.81 | 116.1 | 3.02 | 2.42 | 1.81 |
| 6.5 | 82.9 | 2.16 | 1.73 | 1.30 | 93.6 | 2.44 | 1.95 | 1.46 | 104.5 | 2.72 | 2.18 | 1.63 | 115.5 | 3.01 | 2.41 | 1.81 | 117.9 | 3.07 | 2.46 | 1.84 | 117.9 | 3.07 | 2.46 | 1.84 |
| 6.6 | 83.4 | 2.17 | 1.74 | 1.30 | 94.2 | 2.45 | 1.96 | 1.47 | 105.2 | 2.74 | 2.19 | 1.64 | 116.5 | 3.03 | 2.43 | 1.82 | 119.7 | 3.12 | 2.49 | 1.87 | 119.7 | 3.12 | 2.49 | 1.87 |
| 6.7 | 84.0 | 2.19 | 1.75 | 1.31 | 94.9 | 2.47 | 1.98 | 1.48 | 106.0 | 2.76 | 2.21 | 1.66 | 117.4 | 3.06 | 2.45 | 1.83 | 121.5 | 3.16 | 2.53 | 1.90 | 121.5 | 3.16 | 2.53 | 1.90 |
| 6.8 | 84.5 | 2.20 | 1.76 | 1.32 | 95.5 | 2.49 | 1.99 | 1.49 | 106.8 | 2.78 | 2.22 | 1.67 | 118.3 | 3.08 | 2.46 | 1.85 | 123.3 | 3.21 | 2.57 | 1.93 | 123.3 | 3.21 | 2.57 | 1.93 |
| 6.9 | 85.0 | 2.21 | 1.77 | 1.33 | 96.1 | 2.50 | 2.00 | 1.50 | 107.5 | 2.80 | 2.24 | 1.68 | 119.1 | 3.10 | 2.48 | 1.86 | 125.1 | 3.26 | 2.61 | 1.95 | 125.1 | 3.26 | 2.61 | 1.95 |
| 7.0 | 85.5 | 2.23 | 1.78 | 1.34 | 96.8 | 2.52 | 2.02 | 1.51 | 108.3 | 2.82 | 2.26 | 1.89 | 120.0 | 3.12 | 2.50 | 1.87 | 126.8 | 3.30 | 2.64 | 1.98 | 126.8 | 3.30 | 2.64 | 1.98 |
| 7.1 | 86.0 | 2.24 | 1.79 | 1.34 | 97.4 | 2.54 | 2.03 | 1.52 | 109.0 | 2.84 | 2.27 | 1.70 | 120.8 | 3.15 | 2.52 | 1.89 | 128.6 | 3.35 | 2.68 | 2.01 | 128.6 | 3.35 | 2.68 | 2.01 |
| 7.2 | 86.5 | 2.25 | 1.80 | 1.35 | 98.0 | 2.55 | 2.04 | 1.53 | 109.7 | 2.86 | 2.29 | 1.71 | 121.7 | 3.17 | 2.53 | 1.90 | 130.4 | 3.40 | 2.72 | 2.04 | 130.4 | 3.40 | 2.72 | 2.04 |
| 7.3 | 86.9 | 2.26 | 1.81 | 1.36 | 98.5 | 2.57 | 2.05 | 1.54 | 110.4 | 2.87 | 2.30 | 1.72 | 122.5 | 3.19 | 2.55 | 1.91 | 132.2 | 3.44 | 2.75 | 2.07 | 132.2 | 3.44 | 2.75 | 2.07 |
| 7.4 | 87.4 | 2.28 | 1.82 | 1.37 | 99.1 | 2.58 | 2.06 | 1.55 | 111.1 | 2.89 | 2.31 | 1.74 | 123.3 | 3.21 | 2.57 | 1.93 | 134.0 | 3.49 | 2.79 | 2.09 | 134.0 | 3.49 | 2.79 | 2.09 |
| 7.5 | 87.9 | 2.29 | 1.83 | 1.37 | 99.7 | 2.60 | 2.08 | 1.56 | 111.8 | 2.91 | 2.33 | 1.75 | 124.1 | 3.23 | 2.59 | 1.94 | 135.8 | 3.54 | 2.83 | 2.12 | 135.8 | 3.54 | 2.83 | 2.12 |
| 7.6 | 88.3 | 2.30 | 1.84 | 1.38 | 100.2 | 2.61 | 2.09 | 1.57 | 112.4 | 2.93 | 2.34 | 1.76 | 124.9 | 3.25 | 2.60 | 1.95 | 137.6 | 3.58 | 2.87 | 2.15 | 137.6 | 3.58 | 2.87 | 2.15 |
| 7.7 | 88.7 | 2.31 | 1.85 | 1.39 | 100.7 | 2.62 | 2.10 | 1.57 | 113.1 | 2.94 | 2.36 | 1.77 | 125.6 | 3.27 | 2.62 | 1.96 | 138.4 | 3.61 | 2.88 | 2.16 | 139.4 | 3.63 | 2.90 | 2.18 |
| 7.8 | 89.2 | 2.32 | 1.86 | 1.39 | 101.3 | 2.64 | 2.11 | 1.56 | 113.7 | 2.96 | 2.37 | 1.78 | 126.4 | 3.29 | 2.63 | 1.97 | 139.3 | 3.63 | 2.90 | 2.18 | 141.2 | 3.68 | 2.94 | 2.21 |
| 7.9 | 89.6 | 2.33 | 1.87 | 1.40 | 101.8 | 2.65 | 2.12 | 1.59 | 114.3 | 2.98 | 2.38 | 1.79 | 127.1 | 3.31 | 2.65 | 1.99 | 140.2 | 3.65 | 2.92 | 2.19 | 143.0 | 3.72 | 2.98 | 2.23 |
| 8.0 | 90.0 | 2.34 | 1.87 | 1.41 | 102.3 | 2.66 | 2.13 | 1.60 | 114.9 | 2.99 | 2.39 | 1.80 | 127.9 | 3.33 | 2.68 | 2.00 | 141.0 | 3.67 | 2.94 | 2.20 | 144.8 | 3.77 | 3.02 | 2.26 |
| 8.1 | 90.4 | 2.35 | 1.88 | 1.41 | 102.8 | 2.68 | 2.14 | 1.61 | 115.5 | 3.01 | 2.41 | 1.81 | 128.6 | 3.35 | 2.68 | 2.01 | 141.9 | 3.69 | 2.96 | 2.22 | 146.6 | 3.82 | 3.05 | 2.29 |
| 8.2 | 90.8 | 2.36 | 1.89 | 1.42 | 103.3 | 2.69 | 2.15 | 1.61 | 116.1 | 3.02 | 2.42 | 1.81 | 129.3 | 3.37 | 2.69 | 2.02 | 142.7 | 3.72 | 2.97 | 2.23 | 148.4 | 3.86 | 3.09 | 2.32 |
| 8.3 | 91.1 | 2.37 | 1.90 | 1.42 | 103.8 | 2.70 | 2.16 | 1.62 | 116.7 | 3.04 | 2.43 | 1.82 | 130.0 | 3.38 | 2.71 | 2.03 | 143.5 | 3.74 | 2.99 | 2.24 | 150.2 | 3.91 | 3.13 | 2.35 |
| 8.4 | 91.5 | 2.38 | 1.91 | 1.43 | 104.2 | 2.71 | 2.17 | 1.63 | 117.3 | 3.05 | 2.44 | 1.83 | 130.6 | 3.40 | 2.72 | 2.04 | 144.3 | 3.76 | 3.01 | 2.25 | 152.0 | 3.96 | 3.17 | 2.37 |
| 8.5 | 91.9 | 2.39 | 1.91 | 1.44 | 104.7 | 2.73 | 2.18 | 1.64 | 117.8 | 3.07 | 2.45 | 1.84 | 131.3 | 3.42 | 2.74 | 2.05 | 145.1 | 3.78 | 3.02 | 2.27 | 153.8 | 4.00 | 3.20 | 2.40 |
| 8.6 | 92.2 | 2.40 | 1.92 | 1.44 | 105.1 | 2.74 | 2.19 | 1.64 | 118.4 | 3.08 | 2.47 | 1.85 | 132.0 | 3.44 | 2.75 | 2.06 | 145.8 | 3.80 | 3.04 | 2.28 | 155.6 | 4.05 | 3.24 | 2.43 |
| 8.7 | 92.6 | 2.41 | 1.93 | 1.45 | 105.6 | 2.75 | 2.20 | 1.65 | 118.9 | 3.10 | 2.48 | 1.86 | 132.6 | 3.45 | 2.76 | 2.07 | 146.6 | 3.82 | 3.05 | 2.29 | 157.4 | 4.10 | 3.28 | 2.46 |
| 8.8 | 92.9 | 2.42 | 1.94 | 1.45 | 106.0 | 2.76 | 2.21 | 1.68 | 119.5 | 3.11 | 2.49 | 1.87 | 133.3 | 3.47 | 2.78 | 2.08 | 147.4 | 3.84 | 3.07 | 2.30 | 159.2 | 4.14 | 3.32 | 2.49 |
| 8.9 | 93.3 | 2.43 | 1.94 | 1.48 | 106.4 | 2.77 | 2.22 | 1.66 | 120.0 | 3.12 | 2.50 | 1.87 | 133.9 | 3.49 | 2.79 | 2.09 | 148.1 | 3.86 | 3.09 | 2.31 | 161.0 | 4.19 | 3.35 | 2.51 |
| 9.0 | 93.6 | 2.44 | 1.95 | 1.46 | 106.8 | 2.78 | 2.23 | 1.67 | 120.5 | 3.14 | 2.51 | 1.88 | 134.5 | 3.50 | 2.80 | 2.10 | 148.8 | 3.88 | 3.10 | 2.33 | 162.8 | 4.24 | 3.39 | 2.54 |
| 9.1 | 93.9 | 2.45 | 1.96 | 1.47 | 107.3 | 2.79 | 2.23 | 1.68 | 121.0 | 3.15 | 2.52 | 1.89 | 135.1 | 3.52 | 2.81 | 2.11 | 149.5 | 3.89 | 3.12 | 2.34 | 164.2 | 4.28 | 3.42 | 2.57 |
| 9.2 | 94.2 | 2.45 | 1.96 | 1.47 | 107.7 | 2.80 | 2.24 | 1.88 | 121.5 | 3.16 | 2.53 | 1.90 | 135.7 | 3.53 | 2.83 | 2.12 | 150.2 | 3.91 | 3.13 | 2.35 | 185.0 | 4.30 | 3.44 | 2.58 |
| 9.3 | 94.5 | 2.48 | 1.97 | 1.48 | 108.0 | 2.81 | 2.25 | 1.69 | 122.0 | 3.18 | 2.54 | 1.91 | 136.3 | 3.55 | 2.84 | 2.13 | 150.9 | 3.93 | 3.14 | 2.36 | 165.8 | 4.32 | 3.46 | 2.59 |
| 9.4 | 94.9 | 2.47 | 1.98 | 1.48 | 108.4 | 2.82 | 2.26 | 1.69 | 122.4 | 3.19 | 2.55 | 1.91 | 136.8 | 3.56 | 2.85 | 2.14 | 151.6 | 3.95 | 3.16 | 2.37 | 166.6 | 4.34 | 3.47 | 2.60 |
| 9.5 | 95.1 | 2.48 | 1.98 | 1.49 | 108.8 | 2.83 | 2.27 | 1.70 | 122.9 | 3.20 | 2.58 | 1.92 | 137.4 | 3.58 | 2.86 | 2.15 | 152.3 | 3.97 | 3.17 | 2.38 | 167.4 | 4.36 | 3.49 | 2.82 |
| 9.6 | 95.4 | 2.49 | 1.99 | 1.49 | 109.2 | 2.84 | 2.27 | 1.71 | 123.4 | 3.21 | 2.57 | 1.93 | 138.0 | 3.59 | 2.87 | 2.16 | 152.9 | 3.98 | 3.19 | 2.39 | 168.2 | 4.38 | 3.50 | 2.83 |
| 9.7 | 95.7 | 2.49 | 1.99 | 1.50 | 109.5 | 2.85 | 2.28 | 1.71 | 123.8 | 3.22 | 2.58 | 1.93 | 138.5 | 3.61 | 2.89 | 2.16 | 153.6 | 4.00 | 3.20 | 2.40 | 168.9 | 4.40 | 3.52 | 2.64 |
| 9.8 | 96.0 | 2.50 | 2.00 | 1.50 | 109.9 | 2.88 | 2.29 | 1.72 | 124.3 | 3.24 | 2.59 | 1.94 | 139.0 | 3.62 | 2.90 | 2.17 | 154.2 | 4.02 | 3.21 | 2.41 | 169.7 | 4.42 | 3.53 | 2.65 |
| 9.9 | 96.3 | 2.51 | 2.01 | 1.50 | 110.2 | 2.87 | 2.30 | 1.72 | 124.7 | 3.25 | 2.60 | 1.95 | 139.6 | 3.63 | 2.91 | 2.18 | 154.8 | 4.03 | 3.23 | 2.42 | 170.4 | 4.44 | 3.55 | 2.66 |
| 10.0 | 96.5 | 2.51 | 2.01 | 1.51 | 110.6 | 2.88 | 2.30 | 1.73 | 125.1 | 3.26 | 2.61 | 1.96 | 140.1 | 3.65 | 2.92 | 2.19 | 155.4 | 4.05 | 3.24 | 2.43 | 171.1 | 4.46 | 3.57 | 2.67 |
| Trench Width m | | 1.2 | | | | 1.3 | | | | 1.4 | | | | 1.5 | | | | 1.6 | | | | 1.7 | | |

## TABLE 10. DESIGN LOADS
## 600 mm DIAMETER PIPE

2 WHEELS 30kN
IMPACT FACTOR 2.0

| Cover | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 48 | 57 | 72 | kN/m | 48 | 57 | 72 | kN/m | 48 | 57 | 72 | kN/m | 48 | 57 | 72 | kN/m | 48 | 57 | 72 | kN/m | 48 | 57 | 72 |
| 0.6 | 56.1 | 1.46 | 1.23 | 0.97 | 56.1 | 1.46 | 1.23 | 0.97 | 56.1 | 1.46 | 1.23 | 0.97 | 56.1 | 1.46 | 1.23 | 0.97 | 56.1 | 1.46 | 1.23 | 0.97 | 56.1 | 1.46 | 1.23 | 0.97 |
| 0.7 | 51.0 | 1.33 | 1.12 | 0.89 | 51.0 | 1.33 | 1.12 | 0.89 | 51.0 | 1.33 | 1.12 | 0.89 | 51.0 | 1.33 | 1.12 | 0.89 | 51.0 | 1.33 | 1.12 | 0.89 | 51.0 | 1.33 | 1.12 | 0.89 |
| 0.8 | 47.6 | 1.24 | 1.04 | 0.83 | 47.6 | 1.24 | 1.04 | 0.83 | 47.6 | 1.24 | 1.04 | 0.83 | 47.6 | 1.24 | 1.04 | 0.83 | 47.6 | 1.24 | 1.04 | 0.83 | 47.6 | 1.24 | 1.04 | 0.83 |
| 0.9 | 45.3 | 1.18 | 0.99 | 0.79 | 45.3 | 1.18 | 0.99 | 0.79 | 45.3 | 1.18 | 0.99 | 0.79 | 45.3 | 1.18 | 0.99 | 0.79 | 45.3 | 1.18 | 0.99 | 0.79 | 45.3 | 1.18 | 0.99 | 0.79 |
| 1.0 | 44.0 | 1.15 | 0.97 | 0.76 | 44.0 | 1.15 | 0.97 | 0.76 | 44.0 | 1.15 | 0.97 | 0.76 | 44.0 | 1.15 | 0.97 | 0.76 | 44.0 | 1.15 | 0.97 | 0.76 | 44.0 | 1.15 | 0.97 | 0.76 |
| 1.1 | 43.5 | 1.13 | 0.95 | 0.75 | 43.5 | 1.13 | 0.95 | 0.75 | 43.5 | 1.13 | 0.95 | 0.75 | 43.5 | 1.13 | 0.95 | 0.75 | 43.5 | 1.13 | 0.95 | 0.75 | 43.5 | 1.13 | 0.95 | 0.75 |
| 1.2 | 43.5 | 1.13 | 0.95 | 0.76 | 43.5 | 1.13 | 0.95 | 0.76 | 43.5 | 1.13 | 0.95 | 0.76 | 43.5 | 1.13 | 0.95 | 0.76 | 43.5 | 1.13 | 0.95 | 0.76 | 43.5 | 1.13 | 0.95 | 0.76 |
| 1.3 | 44.1 | 1.15 | 0.97 | 0.77 | 44.1 | 1.15 | 0.97 | 0.77 | 44.1 | 1.15 | 0.97 | 0.77 | 44.1 | 1.15 | 0.97 | 0.77 | 44.1 | 1.15 | 0.97 | 0.77 | 44.1 | 1.15 | 0.97 | 0.77 |
| 1.4 | 45.0 | 1.17 | 0.99 | 0.78 | 45.0 | 1.17 | 0.99 | 0.78 | 45.0 | 1.17 | 0.99 | 0.78 | 45.0 | 1.17 | 0.99 | 0.78 | 45.0 | 1.17 | 0.99 | 0.78 | 45.0 | 1.17 | 0.99 | 0.78 |
| 1.5 | 45.6 | 1.19 | 1.00 | 0.79 | 45.6 | 1.19 | 1.00 | 0.79 | 45.6 | 1.19 | 1.00 | 0.79 | 45.6 | 1.19 | 1.00 | 0.79 | 45.6 | 1.19 | 1.00 | 0.79 | 45.6 | 1.19 | 1.00 | 0.79 |
| 1.6 | 46.3 | 1.21 | 1.02 | 0.80 | 46.3 | 1.21 | 1.02 | 0.80 | 46.3 | 1.21 | 1.02 | 0.80 | 46.3 | 1.21 | 1.02 | 0.80 | 46.3 | 1.21 | 1.02 | 0.80 | 46.3 | 1.21 | 1.02 | 0.80 |
| 1.7 | 47.3 | 1.23 | 1.04 | 0.82 | 47.3 | 1.23 | 1.04 | 0.82 | 47.3 | 1.23 | 1.04 | 0.82 | 47.3 | 1.23 | 1.04 | 0.82 | 47.3 | 1.23 | 1.04 | 0.82 | 47.3 | 1.23 | 1.04 | 0.82 |
| 1.8 | 48.4 | 1.26 | 1.06 | 0.84 | 48.4 | 1.26 | 1.06 | 0.84 | 48.4 | 1.26 | 1.06 | 0.84 | 48.4 | 1.26 | 1.06 | 0.84 | 48.4 | 1.26 | 1.06 | 0.84 | 48.4 | 1.26 | 1.06 | 0.84 |
| 1.9 | 49.7 | 1.29 | 1.09 | 0.86 | 49.7 | 1.29 | 1.09 | 0.86 | 49.7 | 1.29 | 1.09 | 0.86 | 49.7 | 1.29 | 1.09 | 0.86 | 49.7 | 1.29 | 1.09 | 0.86 | 49.7 | 1.29 | 1.09 | 0.86 |
| 2.0 | 51.0 | 1.33 | 1.12 | 0.89 | 51.0 | 1.33 | 1.12 | 0.89 | 51.0 | 1.33 | 1.12 | 0.89 | 51.0 | 1.33 | 1.12 | 0.89 | 51.0 | 1.33 | 1.12 | 0.89 | 51.0 | 1.33 | 1.12 | 0.89 |
| 2.1 | 52.5 | 1.37 | 1.15 | 0.91 | 52.5 | 1.37 | 1.15 | 0.91 | 52.5 | 1.37 | 1.15 | 0.91 | 52.5 | 1.37 | 1.15 | 0.91 | 52.5 | 1.37 | 1.15 | 0.91 | 52.5 | 1.37 | 1.15 | 0.91 |
| 2.2 | 54.0 | 1.41 | 1.18 | 0.94 | 54.0 | 1.41 | 1.18 | 0.94 | 54.0 | 1.41 | 1.18 | 0.94 | 54.0 | 1.41 | 1.18 | 0.94 | 54.0 | 1.41 | 1.18 | 0.94 | 54.0 | 1.41 | 1.18 | 0.94 |
| 2.3 | 55.6 | 1.45 | 1.22 | 0.96 | 55.6 | 1.45 | 1.22 | 0.96 | 55.6 | 1.45 | 1.22 | 0.96 | 55.6 | 1.45 | 1.22 | 0.96 | 55.6 | 1.45 | 1.22 | 0.96 | 55.6 | 1.45 | 1.22 | 0.96 |
| 2.4 | 57.2 | 1.49 | 1.25 | 0.99 | 57.2 | 1.49 | 1.25 | 0.99 | 57.2 | 1.49 | 1.25 | 0.99 | 57.2 | 1.49 | 1.25 | 0.99 | 57.2 | 1.49 | 1.25 | 0.99 | 57.2 | 1.49 | 1.25 | 0.99 |
| 2.5 | 58.9 | 1.53 | 1.29 | 1.02 | 58.9 | 1.53 | 1.29 | 1.02 | 58.9 | 1.53 | 1.29 | 1.02 | 58.9 | 1.53 | 1.29 | 1.02 | 58.9 | 1.53 | 1.29 | 1.02 | 58.9 | 1.53 | 1.29 | 1.02 |
| 2.6 | 60.6 | 1.58 | 1.33 | 1.05 | 60.6 | 1.58 | 1.33 | 1.05 | 60.6 | 1.58 | 1.33 | 1.05 | 60.6 | 1.58 | 1.33 | 1.05 | 60.6 | 1.58 | 1.33 | 1.05 | 60.6 | 1.58 | 1.33 | 1.05 |
| 2.7 | 62.4 | 1.63 | 1.37 | 1.08 | 62.4 | 1.63 | 1.37 | 1.08 | 62.4 | 1.63 | 1.37 | 1.08 | 62.4 | 1.63 | 1.37 | 1.08 | 62.4 | 1.63 | 1.37 | 1.08 | 62.4 | 1.63 | 1.37 | 1.08 |
| 2.8 | 64.2 | 1.67 | 1.41 | 1.12 | 64.2 | 1.67 | 1.41 | 1.12 | 64.2 | 1.67 | 1.41 | 1.12 | 64.2 | 1.67 | 1.41 | 1.12 | 64.2 | 1.67 | 1.41 | 1.12 | 64.2 | 1.67 | 1.41 | 1.12 |
| 2.9 | 66.1 | 1.72 | 1.45 | 1.15 | 66.1 | 1.72 | 1.45 | 1.15 | 66.1 | 1.72 | 1.45 | 1.15 | 66.1 | 1.72 | 1.45 | 1.15 | 66.1 | 1.72 | 1.45 | 1.15 | 66.1 | 1.72 | 1.45 | 1.15 |
| 3.0 | 67.4 | 1.76 | 1.48 | 1.17 | 68.0 | 1.77 | 1.49 | 1.18 | 68.0 | 1.77 | 1.49 | 1.18 | 68.0 | 1.77 | 1.49 | 1.18 | 68.0 | 1.77 | 1.49 | 1.18 | 68.0 | 1.77 | 1.49 | 1.18 |
| 3.1 | 68.7 | 1.79 | 1.51 | 1.19 | 69.9 | 1.82 | 1.53 | 1.21 | 69.9 | 1.82 | 1.53 | 1.21 | 69.9 | 1.82 | 1.53 | 1.21 | 69.9 | 1.82 | 1.53 | 1.21 | 69.9 | 1.82 | 1.53 | 1.21 |
| 3.2 | 70.0 | 1.82 | 1.54 | 1.22 | 71.8 | 1.87 | 1.57 | 1.25 | 71.8 | 1.87 | 1.57 | 1.25 | 71.8 | 1.87 | 1.57 | 1.25 | 71.8 | 1.87 | 1.57 | 1.25 | 71.8 | 1.87 | 1.57 | 1.25 |
| 3.3 | 71.3 | 1.86 | 1.56 | 1.24 | 73.7 | 1.92 | 1.62 | 1.28 | 73.7 | 1.92 | 1.62 | 1.28 | 73.7 | 1.92 | 1.62 | 1.28 | 73.7 | 1.92 | 1.62 | 1.28 | 73.7 | 1.92 | 1.62 | 1.28 |
| 3.4 | 72.6 | 1.89 | 1.59 | 1.26 | 75.7 | 1.97 | 1.66 | 1.31 | 75.7 | 1.97 | 1.66 | 1.31 | 75.7 | 1.97 | 1.66 | 1.31 | 75.7 | 1.97 | 1.66 | 1.31 | 75.7 | 1.97 | 1.66 | 1.31 |
| 3.5 | 73.9 | 1.92 | 1.62 | 1.28 | 77.6 | 2.02 | 1.70 | 1.35 | 77.6 | 2.02 | 1.70 | 1.35 | 77.6 | 2.02 | 1.70 | 1.35 | 77.6 | 2.02 | 1.70 | 1.35 | 77.6 | 2.02 | 1.70 | 1.35 |
| 3.6 | 75.1 | 1.96 | 1.65 | 1.30 | 79.6 | 2.07 | 1.75 | 1.38 | 79.6 | 2.07 | 1.75 | 1.38 | 79.6 | 2.07 | 1.75 | 1.38 | 79.6 | 2.07 | 1.75 | 1.38 | 79.6 | 2.07 | 1.75 | 1.38 |
| 3.7 | 76.4 | 1.99 | 1.67 | 1.33 | 81.6 | 2.13 | 1.79 | 1.42 | 81.6 | 2.13 | 1.79 | 1.42 | 81.6 | 2.13 | 1.79 | 1.42 | 81.6 | 2.13 | 1.79 | 1.42 | 81.6 | 2.13 | 1.79 | 1.42 |
| 3.8 | 77.6 | 2.02 | 1.70 | 1.35 | 83.6 | 2.18 | 1.83 | 1.45 | 83.6 | 2.18 | 1.83 | 1.45 | 83.6 | 2.18 | 1.83 | 1.45 | 83.6 | 2.18 | 1.83 | 1.45 | 83.6 | 2.18 | 1.83 | 1.45 |
| 3.9 | 78.8 | 2.05 | 1.73 | 1.37 | 85.6 | 2.23 | 1.88 | 1.49 | 85.6 | 2.23 | 1.88 | 1.49 | 85.6 | 2.23 | 1.88 | 1.49 | 85.6 | 2.23 | 1.88 | 1.49 | 85.6 | 2.23 | 1.88 | 1.49 |
| 4.0 | 80.0 | 2.08 | 1.75 | 1.39 | 87.4 | 2.28 | 1.92 | 1.52 | 87.7 | 2.28 | 1.92 | 1.52 | 87.7 | 2.28 | 1.92 | 1.52 | 87.7 | 2.28 | 1.92 | 1.52 | 87.7 | 2.28 | 1.92 | 1.52 |
| 4.1 | 81.2 | 2.11 | 1.78 | 1.41 | 66.7 | 2.31 | 1.95 | 1.54 | 89.7 | 2.34 | 1.97 | 1.56 | 89.7 | 2.34 | 1.97 | 1.56 | 89.7 | 2.34 | 1.97 | 1.56 | 89.7 | 2.34 | 1.97 | 1.56 |
| 4.2 | 82.3 | 2.14 | 1.81 | 1.43 | 90.0 | 2.34 | 1.97 | 1.56 | 91.7 | 2.39 | 2.01 | 1.59 | 91.7 | 2.39 | 2.01 | 1.59 | 91.7 | 2.39 | 2.01 | 1.59 | 91.7 | 2.39 | 2.01 | 1.59 |
| 4.3 | 83.5 | 2.17 | 1.83 | 1.45 | 91.3 | 2.38 | 2.00 | 1.59 | 93.8 | 2.44 | 2.06 | 1.63 | 93.8 | 2.44 | 2.06 | 1.63 | 93.8 | 2.44 | 2.06 | 1.63 | 93.8 | 2.44 | 2.06 | 1.63 |
| 4.4 | 84.6 | 2.20 | 1.86 | 1.47 | 92.6 | 2.41 | 2.03 | 1.61 | 95.8 | 2.50 | 2.10 | 1.66 | 95.8 | 2.50 | 2.10 | 1.66 | 95.8 | 2.50 | 2.10 | 1.66 | 95.8 | 2.50 | 2.10 | 1.66 |
| 4.5 | 85.7 | 2.23 | 1.88 | 1.49 | 93.9 | 2.45 | 2.06 | 1.63 | 97.9 | 2.55 | 2.15 | 1.70 | 97.9 | 2.55 | 2.15 | 1.70 | 97.9 | 2.55 | 2.15 | 1.70 | 97.9 | 2.55 | 2.15 | 1.70 |
| 4.6 | 86.8 | 2.26 | 1.90 | 1.51 | 95.2 | 2.48 | 2.09 | 1.65 | 100.0 | 2.60 | 2.19 | 1.74 | 100.0 | 2.60 | 2.19 | 1.74 | 100.0 | 2.60 | 2.19 | 1.74 | 100.0 | 2.60 | 2.19 | 1.74 |
| 4.7 | 87.9 | 2.29 | 1.93 | 1.53 | 96.4 | 2.51 | 2.11 | 1.67 | 102.0 | 2.66 | 2.24 | 1.77 | 102.0 | 2.66 | 2.24 | 1.77 | 102.0 | 2.66 | 2.24 | 1.77 | 102.0 | 2.66 | 2.24 | 1.77 |
| 4.8 | 89.0 | 2.32 | 1.95 | 1.54 | 97.6 | 2.54 | 2.14 | 1.69 | 104.1 | 2.71 | 2.28 | 1.81 | 104.1 | 2.71 | 2.28 | 1.81 | 104.1 | 2.71 | 2.28 | 1.81 | 104.1 | 2.71 | 2.28 | 1.81 |
| 4.9 | 90.0 | 2.34 | 1.97 | 1.56 | 98.8 | 2.57 | 2.17 | 1.72 | 106.2 | 2.77 | 2.33 | 1.84 | 106.2 | 2.77 | 2.33 | 1.84 | 106.2 | 2.77 | 2.33 | 1.84 | 106.2 | 2.77 | 2.33 | 1.84 |
| 5.0 | 91.1 | 2.37 | 2.00 | 1.58 | 100.0 | 2.60 | 2.19 | 1.74 | 108.3 | 2.82 | 2.37 | 1.88 | 108.3 | 2.82 | 2.37 | 1.88 | 108.3 | 2.82 | 2.37 | 1.88 | 108.3 | 2.82 | 2.37 | 1.88 |
| 5.1 | 92.1 | 2.40 | 2.02 | 1.60 | 101.2 | 2.83 | 2.22 | 1.76 | 110.4 | 2.87 | 2.42 | 1.92 | 110.4 | 2.87 | 2.42 | 1.92 | 110.4 | 2.87 | 2.42 | 1.92 | 110.4 | 2.87 | 2.42 | 1.92 |
| 5.2 | 93.1 | 2.42 | 2.04 | 1.62 | 102.3 | 2.66 | 2.24 | 1.78 | 111.7 | 2.91 | 2.45 | 1.94 | 112.4 | 2.93 | 2.47 | 1.95 | 112.4 | 2.93 | 2.47 | 1.95 | 112.4 | 2.93 | 2.47 | 1.95 |
| 5.3 | 94.0 | 2.45 | 2.06 | 1.63 | 103.4 | 2.89 | 2.27 | 1.80 | 112.9 | 2.94 | 2.48 | 1.96 | 114.5 | 2.98 | 2.51 | 1.99 | 114.5 | 2.98 | 2.51 | 1.99 | 114.5 | 2.98 | 2.51 | 1.99 |
| 5.4 | 95.0 | 2.47 | 2.08 | 1.65 | 104.6 | 2.72 | 2.29 | 1.82 | 114.2 | 2.97 | 2.50 | 1.98 | 116.6 | 3.04 | 2.56 | 2.02 | 116.6 | 3.04 | 2.56 | 2.02 | 116.6 | 3.04 | 2.56 | 2.02 |
| 5.5 | 96.0 | 2.50 | 2.10 | 1.67 | 105.7 | 2.75 | 2.32 | 1.83 | 115.5 | 3.01 | 2.53 | 2.00 | 118.7 | 3.09 | 2.60 | 2.06 | 118.7 | 3.09 | 2.60 | 2.06 | 118.7 | 3.09 | 2.60 | 2.06 |
| 5.6 | 96.9 | 2.52 | 2.12 | 1.68 | 106.7 | 2.78 | 2.34 | 1.85 | 116.7 | 3.04 | 2.56 | 2.03 | 120.8 | 3.15 | 2.65 | 2.10 | 120.8 | 3.15 | 2.65 | 2.10 | 120.8 | 3.15 | 2.65 | 2.10 |
| 5.7 | 97.8 | 2.55 | 2.14 | 1.70 | 107.8 | 2.81 | 2.36 | 1.87 | 117.9 | 3.07 | 2.59 | 2.05 | 122.9 | 3.20 | 2.70 | 2.13 | 122.9 | 3.20 | 2.70 | 2.13 | 122.9 | 3.20 | 2.70 | 2.13 |
| 5.8 | 98.7 | 2.57 | 2.16 | 1.71 | 108.8 | 2.83 | 2.39 | 1.89 | 119.1 | 3.10 | 2.61 | 2.07 | 125.0 | 3.26 | 2.74 | 2.17 | 125.0 | 3.26 | 2.74 | 2.17 | 125.0 | 3.26 | 2.74 | 2.17 |
| 5.9 | 99.6 | 2.59 | 2.18 | 1.73 | 109.9 | 2.86 | 2.41 | 1.91 | 120.3 | 3.13 | 2.64 | 2.09 | 127.2 | 3.31 | 2.79 | 2.21 | 127.2 | 3.31 | 2.79 | 2.21 | 127.2 | 3.31 | 2.79 | 2.21 |
| 6.0 | 100.5 | 2.62 | 2.20 | 1.74 | 110.9 | 2.89 | 2.43 | 1.92 | 121.4 | 3.16 | 2.66 | 2.11 | 129.3 | 3.37 | 2.83 | 2.24 | 129.3 | 3.37 | 2.83 | 2.24 | 129.3 | 3.37 | 2.83 | 2.24 |
| 6.1 | 101.3 | 2.64 | 2.22 | 1.76 | 111.9 | 2.91 | 2.45 | 1.94 | 122.5 | 3.19 | 2.69 | 2.13 | 131.4 | 3.42 | 2.88 | 2.28 | 131.4 | 3.42 | 2.88 | 2.28 | 131.4 | 3.42 | 2.88 | 2.28 |
| 6.2 | 102.2 | 2.66 | 2.24 | 1.77 | 112.8 | 2.94 | 2.47 | 1.96 | 123.7 | 3.22 | 2.71 | 2.15 | 133.5 | 3.48 | 2.93 | 2.32 | 133.5 | 3.48 | 2.93 | 2.32 | 33.5 | 3.48 | 2.93 | 2.32 |
| 6.3 | 103.0 | 2.68 | 2.26 | 1.79 | 113.8 | 2.96 | 2.50 | 1.98 | 124.8 | 3.25 | 2.74 | 2.17 | 135.6 | 3.53 | 2.97 | 2.35 | 135.6 | 3.53 | 2.97 | 2.35 | 135.6 | 3.53 | 2.97 | 2.35 |
| 6.4 | 103.8 | 2.70 | 2.28 | 1.60 | 114.8 | 2.99 | 2.52 | 1.99 | 125.9 | 3.28 | 2.76 | 2.19 | 137.1 | 3.57 | 3.01 | 2.38 | 137.7 | 3.59 | 3.02 | 2.39 | 137.7 | 3.59 | 3.02 | 2.39 |
| 6.5 | 104.6 | 2.72 | 2.29 | 1.62 | 115.7 | 3.01 | 2.54 | 2.01 | 126.9 | 3.31 | 2.78 | 2.20 | 138.3 | 3.60 | 3.03 | 2.40 | 139.8 | 3.64 | 3.07 | 2.43 | 139.8 | 3.64 | 3.07 | 2.43 |
| 6.6 | 105.4 | 2.74 | 2.31 | 1.83 | 116.6 | 3.04 | 2.56 | 2.02 | 128.0 | 3.33 | 2.81 | 2.22 | 139.5 | 3.63 | 3.06 | 2.42 | 142.0 | 3.70 | 3.11 | 2.46 | 142.0 | 3.70 | 3.11 | 2.46 |
| 6.7 | 106.2 | 2.76 | 2.33 | 1.84 | 117.5 | 3.06 | 2.58 | 2.04 | 129.0 | 3.36 | 2.63 | 2.24 | 140.7 | 3.66 | 3.09 | 2.44 | 144.1 | 3.75 | 3.16 | 2.50 | 144.1 | 3.75 | 3.16 | 2.50 |
| 6.8 | 106.9 | 2.78 | 2.34 | 1.86 | 118.4 | 3.08 | 2.60 | 2.06 | 130.0 | 3.39 | 2.85 | 2.26 | 141.8 | 3.69 | 3.11 | 2.46 | 146.2 | 3.81 | 3.21 | 2.54 | 146.2 | 3.81 | 3.21 | 2.54 |
| 6.9 | 107.7 | 2.80 | 2.36 | 1.87 | 119.3 | 3.11 | 2.62 | 2.07 | 131.0 | 3.41 | 2.87 | 2.28 | 143.0 | 3.72 | 3.14 | 2.48 | 148.3 | 3.86 | 3.25 | 2.58 | 148.3 | 3.86 | 3.25 | 2.58 |
| 7.0 | 108.4 | 2.82 | 2.38 | 1.88 | 120.1 | 3.13 | 2.63 | 2.09 | 132.0 | 3.44 | 2.90 | 2.29 | 144.1 | 3.75 | 3.16 | 2.50 | 150.4 | 3.92 | 3.30 | 2.61 | 150.4 | 3.92 | 3.30 | 2.61 |
| 7.1 | 109.1 | 2.84 | 2.39 | 1.89 | 121.0 | 3.15 | 2.65 | 2.10 | 133.0 | 3.46 | 2.92 | 2.31 | 145.2 | 3.78 | 3.18 | 2.52 | 152.6 | 3.97 | 3.35 | 2.65 | 152.6 | 3.97 | 3.35 | 2.65 |
| 7.2 | 109.8 | 2.86 | 2.41 | 1.91 | 121.8 | 3.17 | 2.67 | 2.11 | 134.0 | 3.49 | 2.94 | 2.33 | 146.3 | 3.81 | 3.21 | 2.54 | 154.7 | 4.03 | 3.39 | 2.69 | 154.7 | 4.03 | 3.39 | 2.69 |
| 7.3 | 110.5 | 2.88 | 2.42 | 1.92 | 122.6 | 3.19 | 2.69 | 2.13 | 134.9 | 3.51 | 2.98 | 2.34 | 147.4 | 3.84 | 3.23 | 2.56 | 156.8 | 4.08 | 3.44 | 2.72 | 156.8 | 4.08 | 3.44 | 2.72 |
| 7.4 | 111.2 | 2.90 | 2.44 | 1.93 | 123.4 | 3.21 | 2.71 | 2.14 | 135.8 | 3.54 | 2.98 | 2.36 | 148.5 | 3.87 | 3.26 | 2.58 | 158.9 | 4.14 | 3.49 | 2.76 | 158.9 | 4.14 | 3.49 | 2.76 |
| 7.5 | 111.9 | 2.91 | 2.45 | 1.94 | 124.2 | 3.23 | 2.72 | 2.16 | 136.8 | 3.56 | 3.00 | 2.37 | 149.5 | 3.89 | 3.28 | 2.60 | 161.1 | 4.19 | 3.53 | 2.80 | 161.1 | 4.19 | 3.53 | 2.80 |
| 7.6 | 112.5 | 2.93 | 2.47 | 1.95 | 125.0 | 3.25 | 2.74 | 2.17 | 137.7 | 3.59 | 3.02 | 2.39 | 150.5 | 3.92 | 3.30 | 2.61 | 163.2 | 4.25 | 3.58 | 2.83 | 163.2 | 4.25 | 3.58 | 2.83 |
| 7.7 | 113.2 | 2.95 | 2.48 | 1.96 | 125.7 | 3.27 | 2.76 | 2.18 | 138.6 | 3.61 | 3.04 | 2.41 | 151.6 | 3.95 | 3.32 | 2.63 | 164.7 | 4.29 | 3.61 | 2.66 | 165.3 | 4.31 | 3.63 | 2.87 |
| 7.8 | 113.8 | 2.96 | 2.50 | 1.98 | 126.5 | 3.29 | 2.77 | 2.20 | 139.4 | 3.63 | 3.06 | 2.42 | 152.6 | 3.97 | 3.35 | 2.65 | 165.9 | 4.32 | 3.64 | 2.88 | 167.5 | 4.36 | 3.67 | 2.91 |
| 7.9 | 114.4 | 2.98 | 2.51 | 1.99 | 127.2 | 3.31 | 2.79 | 2.21 | 140.3 | 3.65 | 3.08 | 2.44 | 153.5 | 4.00 | 3.37 | 2.67 | 167.0 | 4.35 | 3.66 | 2.90 | 169.6 | 4.42 | 3.72 | 2.94 |
| 8.0 | 115.0 | 3.00 | 2.52 | 2.00 | 128.0 | 3.33 | 2.81 | 2.22 | 141.1 | 3.68 | 3.09 | 2.45 | 154.5 | 4.02 | 3.39 | 2.68 | 168.1 | 4.38 | 3.69 | 2.92 | 171.7 | 4.47 | 3.77 | 2.98 |
| 8.1 | 115.6 | 3.01 | 2.54 | 2.01 | 128.7 | 3.35 | 2.82 | 2.23 | 142.0 | 3.70 | 3.11 | 2.46 | 155.5 | 4.05 | 3.41 | 2.70 | 169.2 | 4.41 | 3.71 | 2.94 | 173.9 | 4.53 | 3.81 | 3.02 |
| 8.2 | 116.2 | 3.03 | 2.55 | 2.02 | 129.4 | 3.37 | 2.84 | 2.25 | 142.8 | 3.72 | 3.13 | 2.48 | 156.4 | 4.07 | 3.43 | 2.72 | 170.3 | 4.43 | 3.73 | 2.96 | 176.0 | 4.58 | 3.86 | 3.06 |
| 8.3 | 116.8 | 3.04 | 2.56 | 2.03 | 130.1 | 3.39 | 2.85 | 2.26 | 143.6 | 3.74 | 3.15 | 2.49 | 157.3 | 4.10 | 3.45 | 2.73 | 171.3 | 4.46 | 3.76 | 2.97 | 178.1 | 4.64 | 3.91 | 3.09 |
| 8.4 | 117.4 | 3.06 | 2.57 | 2.04 | 130.7 | 3.40 | 2.87 | 2.27 | 144.4 | 3.76 | 3.17 | 2.51 | 158.3 | 4.12 | 3.47 | 2.75 | 172.4 | 4.49 | 3.78 | 2.99 | 180.3 | 4.69 | 3.95 | 3.13 |
| 8.5 | 117.9 | 3.07 | 2.59 | 2.05 | 131.4 | 3.42 | 2.88 | 2.28 | 145.2 | 3.78 | 3.18 | 2.52 | 159.2 | 4.14 | 3.49 | 2.76 | 173.4 | 4.52 | 3.80 | 3.01 | 182.4 | 4.75 | 4.00 | 3.17 |
| 8.6 | 118.5 | 3.09 | 2.60 | 2.06 | 132.1 | 3.44 | 2.90 | 2.29 | 145.9 | 3.80 | 3.20 | 2.53 | 160.1 | 4.17 | 3.51 | 2.78 | 174.4 | 4.54 | 3.82 | 3.03 | 184.5 | 4.81 | 4.05 | 3.20 |
| 8.7 | 119.0 | 3.10 | 2.61 | 2.07 | 132.7 | 3.46 | 2.91 | 2.30 | 146.7 | 3.82 | 3.22 | 2.55 | 160.9 | 4.19 | 3.53 | 2.79 | 175.4 | 4.57 | 3.85 | 3.05 | 186.7 | 4.86 | 4.09 | 3.24 |
| 8.8 | 119.5 | 3.11 | 2.82 | 2.08 | 133.3 | 3.47 | 2.92 | 2.31 | 147.4 | 3.84 | 3.23 | 2.56 | 161.8 | 4.21 | 3.55 | 2.81 | 176.4 | 4.59 | 3.87 | 3.06 | 188.8 | 4.92 | 4.14 | 3.28 |
| 8.9 | 120.1 | 3.13 | 2.63 | 2.08 | 134.0 | 3.49 | 2.84 | 2.33 | 148.2 | 3.66 | 3.25 | 2.57 | 162.6 | 4.24 | 3.57 | 2.82 | 177.4 | 4.62 | 3.89 | 3.08 | 190.9 | 4.97 | 4.19 | 3.31 |
| 9.0 | 120.6 | 3.14 | 2.84 | 2.09 | 134.6 | 3.50 | 2.95 | 2.34 | 148.9 | 3.88 | 3.27 | 2.58 | 163.5 | 4.26 | 3.59 | 2.84 | 178.3 | 4.64 | 3.91 | 3.10 | 193.1 | 5.03 | 4.23 | 3.35 |
| 9.1 | 121.1 | 3.15 | 2.66 | 2.10 | 135.2 | 3.52 | 2.96 | 2.35 | 149.6 | 3.90 | 3.28 | 2.60 | 164.3 | 4.28 | 3.60 | 2.85 | 179.3 | 4.67 | 3.93 | 3.11 | 194.4 | 5.06 | 4.26 | 3.38 |
| 9.2 | 121.6 | 3.17 | 2.67 | 2.11 | 135.8 | 3.54 | 2.98 | 2.36 | 150.3 | 3.91 | 3.30 | 2.61 | 166.1 | 4.30 | 3.62 | 2.87 | 180.2 | 4.69 | 3.95 | 3.13 | 195.5 | 5.09 | 4.29 | 3.39 |
| 9.3 | 122.0 | 3.18 | 2.66 | 2.12 | 136.4 | 3.55 | 2.99 | 2.37 | 151.0 | 3.93 | 3.31 | 2.62 | 165.9 | 4.32 | 3.64 | 2.88 | 181.1 | 4.72 | 3.97 | 3.14 | 196.5 | 5.12 | 4.31 | 3.41 |
| 9.4 | 122.5 | 3.19 | 2.68 | 2.13 | 136.9 | 3.57 | 3.00 | 2.38 | 151.7 | 3.85 | 3.33 | 2.63 | 166.7 | 4.34 | 3.66 | 2.89 | 182.0 | 4.74 | 3.99 | 3.16 | 197.6 | 5.14 | 4.33 | 3.43 |
| 9.5 | 123.0 | 3.20 | 2.70 | 2.14 | 137.5 | 3.58 | 3.02 | 2.39 | 152.3 | 3.97 | 3.34 | 2.64 | 167.5 | 4.38 | 3.67 | 2.91 | 182.9 | 4.76 | 4.01 | 3.18 | 198.6 | 5.17 | 4.35 | 3.45 |
| 9.6 | 123.4 | 3.21 | 2.71 | 2.14 | 138.0 | 3.59 | 3.03 | 2.40 | 153.0 | 3.98 | 3.38 | 2.66 | 168.2 | 4.38 | 3.69 | 2.92 | 183.8 | 4.79 | 4.03 | 3.19 | 199.6 | 5.20 | 4.38 | 3.46 |
| 9.7 | 123.9 | 3.23 | 2.72 | 2.15 | 138.6 | 3.61 | 3.04 | 2.41 | 153.6 | 4.00 | 3.37 | 2.67 | 169.0 | 4.40 | 3.71 | 2.93 | 184.6 | 4.81 | 4.05 | 3.21 | 200.6 | 5.22 | 4.40 | 3.48 |
| 9.8 | 24.3 | 3.24 | 2.73 | 2.16 | 139.1 | 3.62 | 3.05 | 2.42 | 154.3 | 4.02 | 3.39 | 2.68 | 169.7 | 4.42 | 3.72 | 2.95 | 185.5 | 4.83 | 4.07 | 3.22 | 201.5 | 5.25 | 4.42 | 3.50 |
| 9.9 | 124.8 | 3.25 | 2.74 | 2.17 | 139.6 | 3.84 | 3.06 | 2.42 | 154.9 | 4.03 | 3.40 | 2.69 | 170.5 | 4.44 | 3.74 | 2.96 | 186.3 | 4.85 | 4.09 | 3.24 | 202.5 | 5.27 | 4.44 | 3.52 |
| 10.0 | 125.2 | 3.26 | 2.75 | 2.17 | 140.2 | 3.65 | 3.07 | 2.43 | 155.5 | 4.05 | 3.41 | 2.70 | 171.2 | 4.46 | 3.75 | 2.97 | 187.2 | 4.87 | 4.10 | 3.25 | 203.4 | 5.30 | 4.46 | 3.53 |
| Trench Width m | | 1.4 | | | | 1.5 | | | | 1.6 | | | | 1.7 | | | | 1.8 | | | | 1.9 | | |

## TABLE 11. DESIGN LOADS
## 100 mm DIAMETER PIPE

8 WHEELS 112.5kN
IMPACT FACTOR 1.3

| Cover | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 22 | 28 | 34 | 40 | kN/m | 22 | 28 | 34 | 40 | kN/m | 22 | 28 | 34 | 40 | kN/m | 22 | 28 | 34 | 40 | kN/m | 22 | 28 | 34 | 40 |
| 0.1 | 74.3 | 4.22 | 3.32 | 2.73 | 2.32 | 74.3 | 4.22 | 3.32 | 2.73 | 2.32 | 74.3 | 4.22 | 3.32 | 2.73 | 2.32 | 74.3 | 4.22 | 3.32 | 2.73 | 2.32 | 74.3 | 4.22 | 3.32 | 2.73 | 2.32 |
| 0.2 | 44.3 | 2.51 | 1.98 | 1.63 | 1.38 | 44.3 | 2.51 | 1.98 | 1.63 | 1.38 | 44.3 | 2.51 | 1.98 | 1.63 | 1.38 | 44.3 | 2.51 | 1.98 | 1.63 | 1.38 | 44.3 | 2.51 | 1.98 | 1.63 | 1.38 |
| 0.3 | 31.3 | 1.78 | 1.40 | 1.15 | 0.98 | 31.3 | 1.78 | 1.40 | 1.15 | 0.98 | 31.3 | 1.78 | 1.40 | 1.15 | 0.98 | 31.3 | 1.78 | 1.40 | 1.15 | 0.98 | 31.3 | 1.78 | 1.40 | 1.15 | 0.98 |
| 0.4 | 24.5 | 1.39 | 1.09 | 0.90 | 0.77 | 24.5 | 1.39 | 1.09 | 0.90 | 0.77 | 24.5 | 1.39 | 1.09 | 0.90 | 0.77 | 24.5 | 1.39 | 1.09 | 0.90 | 0.77 | 24.5 | 1.39 | 1.09 | 0.90 | 0.77 |
| 0.5 | 20.5 | 1.16 | 0.91 | 0.75 | 0.64 | 20.5 | 1.16 | 0.91 | 0.75 | 0.64 | 20.5 | 1.16 | 0.91 | 0.75 | 0.64 | 20.5 | 1.16 | 0.91 | 0.75 | 0.64 | 20.5 | 1.16 | 0.91 | 0.75 | 0.64 |
| 0.6 | 17.9 | 1.02 | 0.80 | 0.66 | 0.56 | 17.9 | 1.02 | 0.80 | 0.66 | 0.56 | 17.9 | 1.02 | 0.80 | 0.66 | 0.56 | 17.9 | 1.02 | 0.80 | 0.66 | 0.56 | 17.9 | 1.02 | 0.80 | 0.66 | 0.56 |
| 0.7 | 16.1 | 0.92 | 0.72 | 0.59 | 0.50 | 16.1 | 0.92 | 0.72 | 0.59 | 0.50 | 16.1 | 0.92 | 0.72 | 0.59 | 0.50 | 16.1 | 0.92 | 0.72 | 0.59 | 0.50 | 16.1 | 0.92 | 0.72 | 0.59 | 0.50 |
| 0.8 | 14.9 | 0.85 | 0.67 | 0.55 | 0.47 | 14.9 | 0.85 | 0.67 | 0.55 | 0.47 | 14.9 | 0.85 | 0.67 | 0.55 | 0.47 | 14.9 | 0.85 | 0.67 | 0.55 | 0.47 | 14.9 | 0.85 | 0.67 | 0.55 | 0.47 |
| 0.9 | 14.1 | 0.80 | 0.63 | 0.52 | 0.44 | 14.1 | 0.80 | 0.63 | 0.52 | 0.44 | 14.1 | 0.80 | 0.63 | 0.52 | 0.44 | 14.1 | 0.80 | 0.63 | 0.52 | 0.44 | 14.1 | 0.80 | 0.63 | 0.52 | 0.44 |
| 1.0 | 13.5 | 0.77 | 0.60 | 0.50 | 0.42 | 13.5 | 0.77 | 0.60 | 0.50 | 0.42 | 13.5 | 0.77 | 0.60 | 0.50 | 0.42 | 13.5 | 0.77 | 0.60 | 0.50 | 0.42 | 13.5 | 0.77 | 0.60 | 0.50 | 0.42 |
| 1.1 | 13.1 | 0.75 | 0.59 | 0.48 | 0.41 | 13.1 | 0.75 | 0.59 | 0.48 | 0.41 | 13.1 | 0.75 | 0.59 | 0.48 | 0.41 | 13.1 | 0.75 | 0.59 | 0.48 | 0.41 | 13.1 | 0.75 | 0.59 | 0.48 | 0.41 |
| 1.2 | 12.9 | 0.73 | 0.58 | 0.47 | 0.40 | 12.9 | 0.73 | 0.58 | 0.47 | 0.40 | 12.9 | 0.73 | 0.58 | 0.47 | 0.40 | 12.9 | 0.73 | 0.58 | 0.47 | 0.40 | 12.9 | 0.73 | 0.58 | 0.47 | 0.40 |
| 1.3 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 |
| 1.4 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 |
| 1.5 | 12.7 | 0.72 | 0.56 | 0.47 | 0.40 | 12.7 | 0.72 | 0.56 | 0.47 | 0.40 | 12.7 | 0.72 | 0.56 | 0.47 | 0.40 | 12.7 | 0.72 | 0.56 | 0.47 | 0.40 | 12.7 | 0.72 | 0.56 | 0.47 | 0.40 |
| 1.6 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 |
| 1.7 | 12.8 | 0.73 | 0.57 | 0.47 | 0.40 | 12.8 | 0.73 | 0.57 | 0.47 | 0.40 | 12.8 | 0.73 | 0.57 | 0.47 | 0.40 | 12.8 | 0.73 | 0.57 | 0.47 | 0.40 | 12.8 | 0.73 | 0.57 | 0.47 | 0.40 |
| 1.8 | 12.9 | 0.73 | 0.58 | 0.47 | 0.40 | 12.9 | 0.73 | 0.58 | 0.47 | 0.40 | 12.9 | 0.73 | 0.58 | 0.47 | 0.40 | 12.9 | 0.73 | 0.58 | 0.47 | 0.40 | 12.9 | 0.73 | 0.58 | 0.47 | 0.40 |
| 1.9 | 13.0 | 0.74 | 0.58 | 0.48 | 0.41 | 13.0 | 0.74 | 0.58 | 0.48 | 0.41 | 13.0 | 0.74 | 0.58 | 0.48 | 0.41 | 13.0 | 0.74 | 0.58 | 0.48 | 0.41 | 13.0 | 0.74 | 0.58 | 0.48 | 0.41 |
| 2.0 | 13.2 | 0.75 | 0.59 | 0.49 | 0.41 | 13.2 | 0.75 | 0.59 | 0.49 | 0.41 | 13.2 | 0.75 | 0.59 | 0.49 | 0.41 | 13.2 | 0.75 | 0.59 | 0.49 | 0.41 | 13.2 | 0.75 | 0.59 | 0.49 | 0.41 |
| 2.1 | 13.4 | 0.76 | 0.60 | 0.49 | 0.42 | 13.4 | 0.76 | 0.60 | 0.49 | 0.42 | 13.4 | 0.76 | 0.60 | 0.49 | 0.42 | 13.4 | 0.76 | 0.60 | 0.49 | 0.42 | 13.4 | 0.76 | 0.60 | 0.49 | 0.42 |
| 2.2 | 13.6 | 0.77 | 0.61 | 0.50 | 0.43 | 13.6 | 0.77 | 0.61 | 0.50 | 0.43 | 13.6 | 0.77 | 0.61 | 0.50 | 0.43 | 13.6 | 0.77 | 0.61 | 0.50 | 0.43 | 13.6 | 0.77 | 0.61 | 0.50 | 0.43 |
| 2.3 | 13.8 | 0.79 | 0.62 | 0.51 | 0.43 | 13.8 | 0.79 | 0.62 | 0.51 | 0.43 | 13.8 | 0.79 | 0.62 | 0.51 | 0.43 | 13.8 | 0.79 | 0.62 | 0.51 | 0.43 | 13.8 | 0.79 | 0.62 | 0.51 | 0.43 |
| 2.4 | 13.9 | 0.79 | 0.62 | 0.51 | 0.43 | 14.1 | 0.80 | 0.63 | 0.52 | 0.44 | 14.1 | 0.80 | 0.63 | 0.52 | 0.44 | 14.1 | 0.80 | 0.63 | 0.52 | 0.44 | 14.1 | 0.80 | 0.63 | 0.52 | 0.44 |
| 2.5 | 13.9 | 0.79 | 0.62 | 0.51 | 0.43 | 14.3 | 0.81 | 0.64 | 0.53 | 0.45 | 14.3 | 0.81 | 0.64 | 0.53 | 0.45 | 14.3 | 0.81 | 0.64 | 0.53 | 0.45 | 14.3 | 0.81 | 0.64 | 0.53 | 0.45 |
| 2.6 | 13.9 | 0.79 | 0.62 | 0.51 | 0.43 | 14.5 | 0.83 | 0.65 | 0.53 | 0.45 | 14.5 | 0.83 | 0.65 | 0.53 | 0.45 | 14.5 | 0.83 | 0.65 | 0.53 | 0.45 | 14.5 | 0.83 | 0.65 | 0.53 | 0.45 |
| 2.7 | 13.9 | 0.79 | 0.62 | 0.51 | 0.43 | 14.8 | 0.84 | 0.66 | 0.54 | 0.46 | 14.8 | 0.84 | 0.66 | 0.54 | 0.46 | 14.8 | 0.84 | 0.66 | 0.54 | 0.46 | 14.8 | 0.84 | 0.66 | 0.54 | 0.46 |
| 2.8 | 13.8 | 0.79 | 0.62 | 0.51 | 0.43 | 15.1 | 0.86 | 0.67 | 0.55 | 0.47 | 15.1 | 0.86 | 0.67 | 0.55 | 0.47 | 15.1 | 0.86 | 0.67 | 0.55 | 0.47 | 15.1 | 0.86 | 0.67 | 0.55 | 0.47 |
| 2.9 | 13.8 | 0.79 | 0.62 | 0.51 | 0.43 | 15.3 | 0.87 | 0.68 | 0.56 | 0.48 | 15.3 | 0.87 | 0.68 | 0.56 | 0.48 | 15.3 | 0.87 | 0.68 | 0.56 | 0.48 | 15.3 | 0.87 | 0.68 | 0.56 | 0.48 |
| 3.0 | 13.8 | 0.78 | 0.62 | 0.51 | 0.43 | 15.6 | 0.89 | 0.70 | 0.57 | 0.49 | 15.6 | 0.89 | 0.70 | 0.57 | 0.49 | 15.6 | 0.89 | 0.70 | 0.57 | 0.49 | 15.6 | 0.89 | 0.70 | 0.57 | 0.49 |
| 3.1 | 13.8 | 0.78 | 0.62 | 0.51 | 0.43 | 15.9 | 0.90 | 0.71 | 0.58 | 0.50 | 15.9 | 0.90 | 0.71 | 0.58 | 0.50 | 15.9 | 0.90 | 0.71 | 0.58 | 0.50 | 15.9 | 0.90 | 0.71 | 0.58 | 0.50 |
| 3.2 | 13.8 | 0.78 | 0.61 | 0.51 | 0.43 | 16.1 | 0.92 | 0.72 | 0.59 | 0.50 | 16.1 | 0.92 | 0.72 | 0.59 | 0.50 | 16.1 | 0.92 | 0.72 | 0.59 | 0.50 | 16.1 | 0.92 | 0.72 | 0.59 | 0.50 |
| 3.3 | 13.7 | 0.78 | 0.61 | 0.51 | 0.43 | 16.4 | 0.93 | 0.73 | 0.60 | 0.51 | 16.4 | 0.93 | 0.73 | 0.60 | 0.51 | 16.4 | 0.93 | 0.73 | 0.60 | 0.51 | 16.4 | 0.93 | 0.73 | 0.60 | 0.51 |
| 3.4 | 13.7 | 0.78 | 0.61 | 0.50 | 0.43 | 16.7 | 0.95 | 0.75 | 0.62 | 0.52 | 16.7 | 0.95 | 0.75 | 0.62 | 0.52 | 16.7 | 0.95 | 0.75 | 0.62 | 0.52 | 16.7 | 0.95 | 0.75 | 0.62 | 0.52 |
| 3.5 | 13.7 | 0.78 | 0.61 | 0.50 | 0.43 | 17.0 | 0.97 | 0.76 | 0.63 | 0.53 | 17.0 | 0.97 | 0.76 | 0.63 | 0.53 | 17.0 | 0.97 | 0.76 | 0.63 | 0.53 | 17.0 | 0.97 | 0.76 | 0.63 | 0.53 |
| 3.6 | 13.7 | 0.78 | 0.61 | 0.50 | 0.43 | 17.3 | 0.98 | 0.77 | 0.64 | 0.54 | 17.3 | 0.98 | 0.77 | 0.64 | 0.54 | 17.3 | 0.98 | 0.77 | 0.64 | 0.54 | 17.3 | 0.98 | 0.77 | 0.64 | 0.54 |
| 3.7 | 13.6 | 0.78 | 0.61 | 0.50 | 0.43 | 17.6 | 1.00 | 0.79 | 0.65 | 0.55 | 17.6 | 1.00 | 0.79 | 0.65 | 0.55 | 17.6 | 1.00 | 0.79 | 0.65 | 0.55 | 17.6 | 1.00 | 0.79 | 0.65 | 0.55 |
| 3.8 | 13.6 | 0.77 | 0.61 | 0.50 | 0.43 | 18.0 | 1.02 | 0.80 | 0.66 | 0.56 | 18.0 | 1.02 | 0.80 | 0.66 | 0.56 | 18.0 | 1.02 | 0.80 | 0.66 | 0.56 | 18.0 | 1.02 | 0.80 | 0.66 | 0.56 |
| 3.9 | 13.6 | 0.77 | 0.61 | 0.50 | 0.42 | 18.3 | 1.04 | 0.82 | 0.67 | 0.57 | 18.3 | 1.04 | 0.82 | 0.67 | 0.57 | 18.3 | 1.04 | 0.82 | 0.67 | 0.57 | 18.3 | 1.04 | 0.82 | 0.67 | 0.57 |
| 4.0 | 13.6 | 0.77 | 0.61 | 0.50 | 0.42 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 |
| 4.1 | 13.5 | 0.77 | 0.60 | 0.50 | 0.42 | 18.9 | 1.07 | 0.84 | 0.70 | 0.59 | 18.9 | 1.07 | 0.84 | 0.70 | 0.59 | 18.9 | 1.07 | 0.84 | 0.70 | 0.59 | 18.9 | 1.07 | 0.84 | 0.70 | 0.59 |
| 4.2 | 13.5 | 0.77 | 0.60 | 0.50 | 0.42 | 19.0 | 1.08 | 0.85 | 0.70 | 0.59 | 19.2 | 1.09 | 0.86 | 0.71 | 0.60 | 19.2 | 1.09 | 0.86 | 0.71 | 0.60 | 19.2 | 1.09 | 0.86 | 0.71 | 0.60 |
| 4.3 | 13.5 | 0.77 | 0.60 | 0.50 | 0.42 | 19.0 | 1.08 | 0.85 | 0.70 | 0.59 | 19.6 | 1.11 | 0.87 | 0.72 | 0.61 | 19.6 | 1.11 | 0.87 | 0.72 | 0.61 | 19.6 | 1.11 | 0.87 | 0.72 | 0.61 |
| 4.4 | 13.5 | 0.77 | 0.60 | 0.50 | 0.42 | 19.0 | 1.08 | 0.85 | 0.70 | 0.60 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 |
| 4.5 | 13.5 | 0.76 | 0.60 | 0.49 | 0.42 | 19.1 | 1.08 | 0.85 | 0.70 | 0.60 | 20.2 | 1.15 | 0.90 | 0.74 | 0.63 | 20.2 | 1.15 | 0.90 | 0.74 | 0.63 | 20.2 | 1.15 | 0.90 | 0.74 | 0.63 |
| 4.6 | 13.4 | 0.76 | 0.60 | 0.49 | 0.42 | 19.1 | 1.09 | 0.85 | 0.70 | 0.60 | 20.6 | 1.17 | 0.92 | 0.76 | 0.64 | 20.6 | 1.17 | 0.92 | 0.76 | 0.64 | 20.6 | 1.17 | 0.92 | 0.76 | 0.64 |
| 4.7 | 13.4 | 0.76 | 0.60 | 0.49 | 0.42 | 19.1 | 1.09 | 0.85 | 0.70 | 0.60 | 20.9 | 1.19 | 0.93 | 0.77 | 0.65 | 20.9 | 1.19 | 0.93 | 0.77 | 0.65 | 20.9 | 1.19 | 0.93 | 0.77 | 0.65 |
| 4.8 | 13.4 | 0.76 | 0.60 | 0.49 | 0.42 | 19.1 | 1.09 | 0.85 | 0.70 | 0.60 | 21.3 | 1.21 | 0.95 | 0.78 | 0.66 | 21.3 | 1.21 | 0.95 | 0.78 | 0.66 | 21.3 | 1.21 | 0.95 | 0.78 | 0.66 |
| 4.9 | 13.4 | 0.76 | 0.60 | 0.49 | 0.42 | 19.2 | 1.09 | 0.86 | 0.70 | 0.60 | 21.6 | 1.23 | 0.97 | 0.79 | 0.68 | 21.6 | 1.23 | 0.97 | 0.79 | 0.68 | 21.6 | 1.23 | 0.97 | 0.79 | 0.68 |
| 5.0 | 13.3 | 0.76 | 0.60 | 0.49 | 0.42 | 19.2 | 1.09 | 0.86 | 0.71 | 0.60 | 22.0 | 1.25 | 0.98 | 0.81 | 0.69 | 22.0 | 1.25 | 0.98 | 0.81 | 0.69 | 22.0 | 1.25 | 0.98 | 0.81 | 0.69 |
| 5.1 | 13.3 | 0.76 | 0.59 | 0.49 | 0.42 | 19.2 | 1.09 | 0.86 | 0.71 | 0.60 | 22.3 | 1.27 | 1.00 | 0.82 | 0.70 | 22.3 | 1.27 | 1.00 | 0.82 | 0.70 | 22.3 | 1.27 | 1.00 | 0.82 | 0.70 |
| 5.2 | 13.3 | 0.75 | 0.59 | 0.49 | 0.42 | 19.2 | 1.09 | 0.86 | 0.71 | 0.60 | 22.7 | 1.29 | 1.01 | 0.83 | 0.71 | 22.7 | 1.29 | 1.01 | 0.83 | 0.71 | 22.7 | 1.29 | 1.01 | 0.83 | 0.71 |
| 5.3 | 13.3 | 0.75 | 0.59 | 0.49 | 0.41 | 19.2 | 1.09 | 0.86 | 0.71 | 0.60 | 23.0 | 1.31 | 1.03 | 0.85 | 0.72 | 23.0 | 1.31 | 1.03 | 0.85 | 0.72 | 23.0 | 1.31 | 1.03 | 0.85 | 0.72 |
| 5.4 | 13.2 | 0.75 | 0.59 | 0.49 | 0.41 | 19.3 | 1.09 | 0.86 | 0.71 | 0.60 | 23.4 | 1.33 | 1.04 | 0.86 | 0.73 | 23.4 | 1.33 | 1.04 | 0.86 | 0.73 | 23.4 | 1.33 | 1.04 | 0.86 | 0.73 |
| 5.5 | 13.2 | 0.75 | 0.59 | 0.49 | 0.41 | 19.3 | 1.09 | 0.86 | 0.71 | 0.60 | 23.8 | 1.35 | 1.06 | 0.87 | 0.74 | 23.8 | 1.35 | 1.06 | 0.87 | 0.74 | 23.8 | 1.35 | 1.06 | 0.87 | 0.74 |
| 5.6 | 13.2 | 0.75 | 0.59 | 0.49 | 0.41 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 24.1 | 1.37 | 1.08 | 0.89 | 0.75 | 24.1 | 1.37 | 1.08 | 0.89 | 0.75 | 24.1 | 1.37 | 1.08 | 0.89 | 0.75 |
| 5.7 | 13.2 | 0.75 | 0.59 | 0.48 | 0.41 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 24.5 | 1.39 | 1.09 | 0.90 | 0.77 | 24.5 | 1.39 | 1.09 | 0.90 | 0.77 | 24.5 | 1.39 | 1.09 | 0.90 | 0.77 |
| 5.8 | 13.2 | 0.75 | 0.59 | 0.48 | 0.41 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 24.8 | 1.41 | 1.11 | 0.91 | 0.78 | 24.8 | 1.41 | 1.11 | 0.91 | 0.78 | 24.8 | 1.41 | 1.11 | 0.91 | 0.78 |
| 5.9 | 13.1 | 0.75 | 0.59 | 0.48 | 0.41 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 25.2 | 1.43 | 1.13 | 0.93 | 0.79 | 25.2 | 1.43 | 1.13 | 0.93 | 0.79 | 25.2 | 1.43 | 1.13 | 0.93 | 0.79 |
| 6.0 | 13.1 | 0.75 | 0.59 | 0.48 | 0.41 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 25.6 | 1.45 | 1.14 | 0.94 | 0.80 | 25.6 | 1.45 | 1.14 | 0.94 | 0.80 | 25.6 | 1.45 | 1.14 | 0.94 | 0.80 |
| 6.1 | 13.1 | 0.74 | 0.58 | 0.48 | 0.41 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 26.0 | 1.47 | 1.16 | 0.95 | 0.81 | 26.0 | 1.47 | 1.16 | 0.95 | 0.81 | 26.0 | 1.47 | 1.16 | 0.95 | 0.81 |
| 6.2 | 13.1 | 0.74 | 0.58 | 0.48 | 0.41 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 26.3 | 1.50 | 1.18 | 0.97 | 0.82 | 26.3 | 1.50 | 1.18 | 0.97 | 0.82 | 26.3 | 1.50 | 1.18 | 0.97 | 0.82 |
| 6.3 | 13.1 | 0.74 | 0.58 | 0.48 | 0.41 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 26.6 | 1.51 | 1.19 | 0.98 | 0.83 | 26.7 | 1.52 | 1.19 | 0.98 | 0.83 | 26.7 | 1.52 | 1.19 | 0.98 | 0.83 |
| 6.4 | 13.0 | 0.74 | 0.58 | 0.48 | 0.41 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 26.6 | 1.51 | 1.19 | 0.98 | 0.83 | 27.1 | 1.54 | 1.21 | 1.00 | 0.85 | 27.1 | 1.54 | 1.21 | 1.00 | 0.85 |
| 6.5 | 13.0 | 0.74 | 0.58 | 0.48 | 0.41 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 26.7 | 1.51 | 1.19 | 0.98 | 0.83 | 27.4 | 1.56 | 1.23 | 1.01 | 0.86 | 27.4 | 1.56 | 1.23 | 1.01 | 0.86 |
| 6.6 | 13.0 | 0.74 | 0.58 | 0.48 | 0.41 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 26.7 | 1.52 | 1.19 | 0.98 | 0.83 | 27.8 | 1.58 | 1.24 | 1.02 | 0.87 | 27.8 | 1.58 | 1.24 | 1.02 | 0.87 |
| 6.7 | 13.0 | 0.74 | 0.58 | 0.48 | 0.41 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 26.7 | 1.52 | 1.19 | 0.98 | 0.84 | 28.2 | 1.60 | 1.26 | 1.04 | 0.88 | 28.2 | 1.60 | 1.26 | 1.04 | 0.88 |
| 6.8 | 13.0 | 0.74 | 0.58 | 0.48 | 0.41 | 19.4 | 1.10 | 0.86 | 0.71 | 0.60 | 26.8 | 1.52 | 1.20 | 0.98 | 0.84 | 28.6 | 1.62 | 1.28 | 1.05 | 0.89 | 28.6 | 1.62 | 1.28 | 1.05 | 0.89 |
| 6.9 | 13.0 | 0.74 | 0.58 | 0.48 | 0.40 | 19.4 | 1.10 | 0.86 | 0.71 | 0.60 | 26.8 | 1.52 | 1.20 | 0.99 | 0.84 | 29.0 | 1.65 | 1.29 | 1.06 | 0.90 | 29.0 | 1.65 | 1.29 | 1.06 | 0.90 |
| 7.0 | 12.9 | 0.73 | 0.58 | 0.48 | 0.40 | 19.4 | 1.10 | 0.86 | 0.71 | 0.60 | 26.8 | 1.53 | 1.20 | 0.99 | 0.84 | 29.3 | 1.67 | 1.31 | 1.08 | 0.92 | 29.3 | 1.67 | 1.31 | 1.08 | 0.92 |
| 7.1 | 12.9 | 0.73 | 0.58 | 0.47 | 0.40 | 19.4 | 1.10 | 0.86 | 0.71 | 0.60 | 26.9 | 1.53 | 1.20 | 0.99 | 0.84 | 29.7 | 1.69 | 1.33 | 1.09 | 0.93 | 29.7 | 1.69 | 1.33 | 1.09 | 0.93 |
| 7.2 | 12.9 | 0.73 | 0.58 | 0.47 | 0.40 | 19.4 | 1.10 | 0.86 | 0.71 | 0.60 | 26.9 | 1.53 | 1.20 | 0.99 | 0.84 | 30.1 | 1.71 | 1.34 | 1.11 | 0.94 | 30.1 | 1.71 | 1.34 | 1.11 | 0.94 |
| 7.3 | 12.9 | 0.73 | 0.58 | 0.47 | 0.40 | 19.4 | 1.10 | 0.86 | 0.71 | 0.60 | 26.9 | 1.53 | 1.20 | 0.99 | 0.84 | 30.5 | 1.73 | 1.36 | 1.12 | 0.95 | 30.5 | 1.73 | 1.36 | 1.12 | 0.95 |
| 7.4 | 12.9 | 0.73 | 0.57 | 0.47 | 0.40 | 19.4 | 1.10 | 0.86 | 0.71 | 0.60 | 27.0 | 1.53 | 1.20 | 0.99 | 0.84 | 30.9 | 1.75 | 1.38 | 1.13 | 0.96 | 30.9 | 1.75 | 1.38 | 1.13 | 0.96 |
| 7.5 | 12.9 | 0.73 | 0.57 | 0.47 | 0.40 | 19.4 | 1.10 | 0.86 | 0.71 | 0.60 | 27.0 | 1.53 | 1.20 | 0.99 | 0.84 | 31.3 | 1.78 | 1.40 | 1.15 | 0.98 | 31.3 | 1.78 | 1.40 | 1.15 | 0.98 |
| 7.6 | 12.8 | 0.73 | 0.57 | 0.47 | 0.40 | 19.4 | 1.10 | 0.86 | 0.71 | 0.60 | 27.0 | 1.53 | 1.21 | 0.99 | 0.84 | 31.6 | 1.80 | 1.41 | 1.16 | 0.99 | 31.6 | 1.80 | 1.41 | 1.16 | 0.99 |
| 7.7 | 12.8 | 0.73 | 0.57 | 0.47 | 0.40 | 19.4 | 1.10 | 0.86 | 0.71 | 0.60 | 27.0 | 1.54 | 1.21 | 0.99 | 0.84 | 32.0 | 1.82 | 1.43 | 1.18 | 1.00 | 32.0 | 1.82 | 1.43 | 1.18 | 1.00 |
| 7.8 | 12.8 | 0.73 | 0.57 | 0.47 | 0.40 | 19.4 | 1.10 | 0.86 | 0.71 | 0.60 | 27.1 | 1.54 | 1.21 | 0.99 | 0.85 | 32.4 | 1.84 | 1.45 | 1.19 | 1.01 | 32.4 | 1.84 | 1.45 | 1.19 | 1.01 |
| 7.9 | 12.8 | 0.73 | 0.57 | 0.47 | 0.40 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 27.1 | 1.54 | 1.21 | 1.00 | 0.85 | 32.8 | 1.86 | 1.46 | 1.21 | 1.02 | 32.8 | 1.86 | 1.46 | 1.21 | 1.02 |
| 8.0 | 12.8 | 0.73 | 0.57 | 0.47 | 0.40 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 27.1 | 1.54 | 1.21 | 1.00 | 0.85 | 33.2 | 1.89 | 1.48 | 1.22 | 1.04 | 33.2 | 1.89 | 1.48 | 1.22 | 1.04 |
| 8.1 | 12.8 | 0.73 | 0.57 | 0.47 | 0.40 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 27.1 | 1.54 | 1.21 | 1.00 | 0.85 | 33.6 | 1.91 | 1.50 | 1.23 | 1.05 | 33.6 | 1.91 | 1.50 | 1.23 | 1.05 |
| 8.2 | 12.8 | 0.73 | 0.57 | 0.47 | 0.40 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 27.1 | 1.54 | 1.21 | 1.00 | 0.85 | 34.0 | 1.93 | 1.52 | 1.25 | 1.06 | 34.0 | 1.93 | 1.52 | 1.25 | 1.06 |
| 8.3 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 27.1 | 1.54 | 1.21 | 1.00 | 0.85 | 34.4 | 1.95 | 1.53 | 1.26 | 1.07 | 34.4 | 1.95 | 1.53 | 1.26 | 1.07 |
| 8.4 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 27.2 | 1.54 | 1.21 | 1.00 | 0.85 | 34.7 | 1.97 | 1.55 | 1.28 | 1.09 | 34.7 | 1.97 | 1.55 | 1.28 | 1.09 |
| 8.5 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 27.2 | 1.54 | 1.21 | 1.00 | 0.85 | 35.1 | 2.00 | 1.57 | 1.29 | 1.10 | 35.1 | 2.00 | 1.57 | 1.29 | 1.10 |
| 8.6 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 27.2 | 1.54 | 1.21 | 1.00 | 0.85 | 35.5 | 2.02 | 1.59 | 1.31 | 1.11 | 35.5 | 2.02 | 1.59 | 1.31 | 1.11 |
| 8.7 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 27.2 | 1.55 | 1.21 | 1.00 | 0.85 | 35.9 | 2.04 | 1.60 | 1.32 | 1.12 | 35.9 | 2.04 | 1.60 | 1.32 | 1.12 |
| 8.8 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 27.2 | 1.55 | 1.22 | 1.00 | 0.85 | 36.2 | 2.06 | 1.62 | 1.33 | 1.13 | 36.3 | 2.06 | 1.62 | 1.33 | 1.13 |
| 8.9 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 27.2 | 1.55 | 1.22 | 1.00 | 0.85 | 36.3 | 2.06 | 1.62 | 1.33 | 1.13 | 36.7 | 2.09 | 1.64 | 1.35 | 1.15 |
| 9.0 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 27.2 | 1.55 | 1.22 | 1.00 | 0.85 | 36.3 | 2.06 | 1.62 | 1.33 | 1.13 | 37.1 | 2.11 | 1.66 | 1.36 | 1.16 |
| 9.1 | 12.7 | 0.72 | 0.57 | 0.47 | 0.40 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 27.2 | 1.55 | 1.22 | 1.00 | 0.85 | 36.3 | 2.06 | 1.62 | 1.34 | 1.14 | 37.5 | 2.13 | 1.67 | 1.38 | 1.17 |
| 9.2 | 12.6 | 0.72 | 0.56 | 0.46 | 0.40 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 27.3 | 1.55 | 1.22 | 1.00 | 0.85 | 36.4 | 2.07 | 1.62 | 1.34 | 1.14 | 37.9 | 2.15 | 1.69 | 1.39 | 1.18 |
| 9.3 | 12.8 | 0.72 | 0.56 | 0.46 | 0.39 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 27.3 | 1.55 | 1.22 | 1.00 | 0.85 | 36.4 | 2.07 | 1.62 | 1.34 | 1.14 | 38.3 | 2.17 | 1.71 | 1.41 | 1.20 |
| 9.4 | 12.6 | 0.72 | 0.56 | 0.46 | 0.39 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 27.3 | 1.55 | 1.22 | 1.00 | 0.85 | 36.4 | 2.07 | 1.63 | 1.34 | 1.14 | 38.7 | 2.20 | 1.73 | 1.42 | 1.21 |
| 9.5 | 12.6 | 0.72 | 0.56 | 0.46 | 0.39 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 27.3 | 1.55 | 1.22 | 1.00 | 0.85 | 36.5 | 2.07 | 1.63 | 1.34 | 1.14 | 39.1 | 2.22 | 1.74 | 1.44 | 1.22 |
| Trench Width m | | 0.4 | | | | | 0.5 | | | | | 0.6 | | | | | 0.7 | | | | | 0.8 | | | |

**TABLE 12. DESIGN LOADS**
**150 mm DIAMETER PIPE**

8 WHEELS 112.5kN
IMPACT FACTOR 1.3

| Cover | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 22 | 28 | 34 | 40 | kN/m | 22 | 28 | 34 | 40 | kN/m | 22 | 28 | 34 | 40 | kN/m | 22 | 28 | 34 | 40 | kN/m | 22 | 28 | 34 | 40 |
| 0.6 | 25.9 | 1.47 | 1.16 | 0.95 | 0.81 | 25.9 | 1.47 | 1.16 | 0.95 | 0.81 | 25.9 | 1.47 | 1.16 | 0.95 | 0.81 | 25.9 | 1.47 | 1.16 | 0.95 | 0.81 | 25.9 | 1.47 | 1.16 | 0.95 | 0.81 |
| 0.7 | 23.4 | 1.33 | 1.05 | 0.86 | 0.73 | 23.4 | 1.33 | 1.05 | 0.86 | 0.73 | 23.4 | 1.33 | 1.05 | 0.86 | 0.73 | 23.4 | 1.33 | 1.05 | 0.86 | 0.73 | 23.4 | 1.33 | 1.05 | 0.86 | 0.73 |
| 0.8 | 21.7 | 1.23 | 0.97 | 0.80 | 0.68 | 21.7 | 1.23 | 0.97 | 0.80 | 0.68 | 21.7 | 1.23 | 0.97 | 0.80 | 0.68 | 21.7 | 1.23 | 0.97 | 0.80 | 0.68 | 21.7 | 1.23 | 0.97 | 0.80 | 0.68 |
| 0.9 | 20.5 | 1.17 | 0.92 | 0.76 | 0.64 | 20.5 | 1.17 | 0.92 | 0.76 | 0.64 | 20.5 | 1.17 | 0.92 | 0.76 | 0.64 | 20.5 | 1.17 | 0.92 | 0.76 | 0.64 | 20.5 | 1.17 | 0.92 | 0.76 | 0.64 |
| 1.0 | 19.7 | 1.12 | 0.88 | 0.72 | 0.62 | 19.7 | 1.12 | 0.88 | 0.72 | 0.62 | 19.7 | 1.12 | 0.88 | 0.72 | 0.62 | 19.7 | 1.12 | 0.88 | 0.72 | 0.62 | 19.7 | 1.12 | 0.88 | 0.72 | 0.62 |
| 1.1 | 19.2 | 1.09 | 0.86 | 0.70 | 0.60 | 19.2 | 1.09 | 0.86 | 0.70 | 0.60 | 19.2 | 1.09 | 0.86 | 0.70 | 0.60 | 19.2 | 1.09 | 0.86 | 0.70 | 0.60 | 19.2 | 1.09 | 0.86 | 0.70 | 0.60 |
| 1.2 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 |
| 1.3 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 | 18.6 | 1.06 | 0.83 | 0.68 | 0.58 |
| 1.4 | 18.5 | 1.05 | 0.82 | 0.68 | 0.58 | 18.5 | 1.05 | 0.82 | 0.68 | 0.58 | 18.5 | 1.05 | 0.82 | 0.68 | 0.58 | 18.5 | 1.05 | 0.82 | 0.68 | 0.58 | 18.5 | 1.05 | 0.82 | 0.68 | 0.58 |
| 1.5 | 18.5 | 1.05 | 0.82 | 0.68 | 0.58 | 18.5 | 1.05 | 0.82 | 0.68 | 0.58 | 18.5 | 1.05 | 0.82 | 0.68 | 0.58 | 18.5 | 1.05 | 0.82 | 0.68 | 0.58 | 18.5 | 1.05 | 0.82 | 0.68 | 0.58 |
| 1.6 | 18.5 | 1.05 | 0.83 | 0.68 | 0.58 | 18.5 | 1.05 | 0.83 | 0.68 | 0.58 | 18.5 | 1.05 | 0.83 | 0.68 | 0.58 | 18.5 | 1.05 | 0.83 | 0.68 | 0.58 | 18.5 | 1.05 | 0.83 | 0.68 | 0.58 |
| 1.7 | 18.6 | 1.06 | 0.83 | 0.69 | 0.58 | 18.6 | 1.06 | 0.83 | 0.69 | 0.58 | 18.6 | 1.06 | 0.83 | 0.69 | 0.58 | 18.6 | 1.06 | 0.83 | 0.69 | 0.58 | 18.6 | 1.06 | 0.83 | 0.69 | 0.58 |
| 1.8 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 | 18.8 | 1.07 | 0.84 | 0.69 | 0.59 |
| 1.9 | 19.0 | 1.08 | 0.85 | 0.70 | 0.60 | 19.0 | 1.08 | 0.85 | 0.70 | 0.60 | 19.0 | 1.08 | 0.85 | 0.70 | 0.60 | 19.0 | 1.08 | 0.85 | 0.70 | 0.60 | 19.0 | 1.08 | 0.85 | 0.70 | 0.60 |
| 2.0 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 | 19.3 | 1.10 | 0.86 | 0.71 | 0.60 |
| 2.1 | 19.6 | 1.11 | 0.87 | 0.72 | 0.61 | 19.6 | 1.11 | 0.87 | 0.72 | 0.61 | 19.6 | 1.11 | 0.87 | 0.72 | 0.61 | 19.6 | 1.11 | 0.87 | 0.72 | 0.61 | 19.6 | 1.11 | 0.87 | 0.72 | 0.61 |
| 2.2 | 19.8 | 1.12 | 0.88 | 0.73 | 0.62 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 |
| 2.3 | 19.8 | 1.13 | 0.88 | 0.73 | 0.62 | 20.2 | 1.15 | 0.90 | 0.74 | 0.63 | 20.2 | 1.15 | 0.90 | 0.74 | 0.63 | 20.2 | 1.15 | 0.90 | 0.74 | 0.63 | 20.2 | 1.15 | 0.90 | 0.74 | 0.63 |
| 2.4 | 19.8 | 1.13 | 0.89 | 0.73 | 0.62 | 20.5 | 1.17 | 0.92 | 0.76 | 0.64 | 20.5 | 1.17 | 0.92 | 0.76 | 0.64 | 20.5 | 1.17 | 0.92 | 0.76 | 0.64 | 20.5 | 1.17 | 0.92 | 0.76 | 0.64 |
| 2.5 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 20.9 | 1.19 | 0.93 | 0.77 | 0.65 | 20.9 | 1.19 | 0.93 | 0.77 | 0.65 | 20.9 | 1.19 | 0.93 | 0.77 | 0.65 | 20.9 | 1.19 | 0.93 | 0.77 | 0.65 |
| 2.6 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 21.2 | 1.21 | 0.95 | 0.78 | 0.66 | 21.2 | 1.21 | 0.95 | 0.78 | 0.66 | 21.2 | 1.21 | 0.95 | 0.78 | 0.75 | 24.0 | 1.36 | 1.07 | 0.88 | 0.75 |
| 2.7 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 21.6 | 1.23 | 0.96 | 0.79 | 0.68 | 21.6 | 1.23 | 0.96 | 0.79 | 0.68 | 21.6 | 1.23 | 0.96 | 0.79 | 0.66 | 21.2 | 1.21 | 0.95 | 0.78 | 0.66 |
| 2.8 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 22.0 | 1.25 | 0.98 | 0.81 | 0.69 | 22.0 | 1.25 | 0.98 | 0.81 | 0.69 | 22.0 | 1.25 | 0.98 | 0.81 | 0.68 | 21.6 | 1.23 | 0.96 | 0.79 | 0.68 |
| 2.9 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 22.4 | 1.27 | 1.00 | 0.82 | 0.70 | 22.4 | 1.27 | 1.00 | 0.82 | 0.70 | 22.4 | 1.27 | 1.00 | 0.82 | 0.69 | 22.0 | 1.25 | 0.98 | 0.81 | 0.69 |
| 3.0 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 22.8 | 1.29 | 1.02 | 0.84 | 0.71 | 22.8 | 1.29 | 1.02 | 0.84 | 0.71 | 22.8 | 1.29 | 1.02 | 0.84 | 0.70 | 22.4 | 1.27 | 1.00 | 0.82 | 0.70 |
| 3.1 | 20.0 | 1.13 | 0.89 | 0.73 | 0.62 | 23.2 | 1.32 | 1.03 | 0.85 | 0.72 | 23.2 | 1.32 | 1.03 | 0.85 | 0.72 | 23.2 | 1.32 | 1.03 | 0.85 | 0.71 | 22.8 | 1.29 | 1.02 | 0.84 | 0.71 |
| 3.2 | 20.0 | 1.13 | 0.89 | 0.73 | 0.62 | 23.6 | 1.34 | 1.05 | 0.87 | 0.74 | 23.6 | 1.34 | 1.05 | 0.87 | 0.74 | 23.6 | 1.34 | 1.05 | 0.87 | 0.72 | 23.2 | 1.32 | 1.03 | 0.85 | 0.72 |
| 3.3 | 20.0 | 1.14 | 0.89 | 0.73 | 0.62 | 24.0 | 1.36 | 1.07 | 0.88 | 0.75 | 24.0 | 1.36 | 1.07 | 0.88 | 0.75 | 24.0 | 1.36 | 1.07 | 0.88 | 0.74 | 23.6 | 1.34 | 1.05 | 0.87 | 0.74 |
| 3.4 | 20.0 | 1.14 | 0.89 | 0.73 | 0.62 | 24.4 | 1.39 | 1.09 | 0.90 | 0.76 | 24.4 | 1.39 | 1.09 | 0.90 | 0.76 | 24.4 | 1.39 | 1.09 | 0.90 | 0.76 | 24.4 | 1.39 | 1.09 | 0.90 | 0.76 |
| 3.5 | 20.0 | 1.14 | 0.89 | 0.74 | 0.62 | 24.9 | 1.41 | 1.11 | 0.91 | 0.78 | 24.9 | 1.41 | 1.11 | 0.91 | 0.78 | 24.9 | 1.41 | 1.11 | 0.91 | 0.78 | 24.9 | 1.41 | 1.11 | 0.91 | 0.78 |
| 3.6 | 20.0 | 1.14 | 0.89 | 0.74 | 0.63 | 25.3 | 1.44 | 1.13 | 0.93 | 0.79 | 25.3 | 1.44 | 1.13 | 0.93 | 0.79 | 25.3 | 1.44 | 1.13 | 0.93 | 0.79 | 25.3 | 1.44 | 1.13 | 0.93 | 0.79 |
| 3.7 | 20.0 | 1.14 | 0.89 | 0.74 | 0.63 | 25.6 | 1.45 | 1.14 | 0.94 | 0.80 | 25.8 | 1.46 | 1.15 | 0.95 | 0.80 | 25.8 | 1.46 | 1.15 | 0.95 | 0.80 | 25.8 | 1.46 | 1.15 | 0.95 | 0.80 |
| 3.8 | 20.0 | 1.14 | 0.89 | 0.74 | 0.63 | 25.7 | 1.46 | 1.15 | 0.94 | 0.80 | 26.2 | 1.49 | 1.17 | 0.96 | 0.82 | 26.2 | 1.49 | 1.17 | 0.96 | 0.82 | 26.2 | 1.49 | 1.17 | 0.96 | 0.82 |
| 3.9 | 20.0 | 1.14 | 0.89 | 0.74 | 0.63 | 25.8 | 1.46 | 1.15 | 0.95 | 0.81 | 26.7 | 1.52 | 1.19 | 0.98 | 0.83 | 26.7 | 1.52 | 1.19 | 0.98 | 0.83 | 26.7 | 1.52 | 1.19 | 0.98 | 0.83 |
| 4.0 | 20.0 | 1.14 | 0.89 | 0.74 | 0.63 | 25.9 | 1.47 | 1.15 | 0.95 | 0.81 | 27.1 | 1.54 | 1.21 | 1.00 | 0.85 | 27.1 | 1.54 | 1.21 | 1.00 | 0.85 | 27.1 | 1.54 | 1.21 | 1.00 | 0.85 |
| 4.1 | 20.0 | 1.14 | 0.89 | 0.74 | 0.63 | 26.0 | 1.47 | 1.16 | 0.95 | 0.81 | 27.6 | 1.57 | 1.23 | 1.02 | 0.86 | 27.6 | 1.57 | 1.23 | 1.02 | 0.86 | 27.6 | 1.57 | 1.23 | 1.02 | 0.86 |
| 4.2 | 20.0 | 1.14 | 0.89 | 0.74 | 0.63 | 26.0 | 1.48 | 1.16 | 0.96 | 0.81 | 28.1 | 1.60 | 1.25 | 1.03 | 0.88 | 28.1 | 1.60 | 1.25 | 1.03 | 0.88 | 28.1 | 1.60 | 1.25 | 1.03 | 0.88 |
| 4.3 | 20.0 | 1.14 | 0.89 | 0.74 | 0.63 | 26.1 | 1.48 | 1.17 | 0.96 | 0.82 | 28.6 | 1.62 | 1.28 | 1.05 | 0.89 | 28.6 | 1.62 | 1.28 | 1.05 | 0.89 | 28.6 | 1.62 | 1.28 | 1.05 | 0.89 |
| 4.4 | 20.0 | 1.14 | 0.89 | 0.74 | 0.63 | 26.2 | 1.49 | 1.17 | 0.96 | 0.82 | 29.1 | 1.65 | 1.30 | 1.07 | 0.91 | 29.1 | 1.65 | 1.30 | 1.07 | 0.91 | 29.1 | 1.65 | 1.30 | 1.07 | 0.91 |
| 4.5 | 20.0 | 1.14 | 0.89 | 0.74 | 0.63 | 26.3 | 1.49 | 1.17 | 0.97 | 0.82 | 29.6 | 1.68 | 1.32 | 1.09 | 0.92 | 29.6 | 1.68 | 1.32 | 1.09 | 0.92 | 29.6 | 1.68 | 1.32 | 1.09 | 0.92 |
| 4.6 | 20.0 | 1.14 | 0.89 | 0.74 | 0.63 | 26.3 | 1.50 | 1.18 | 0.97 | 0.82 | 30.1 | 1.71 | 1.34 | 1.11 | 0.94 | 30.1 | 1.71 | 1.34 | 1.11 | 0.94 | 30.1 | 1.71 | 1.34 | 1.11 | 0.94 |
| 4.7 | 20.0 | 1.14 | 0.89 | 0.74 | 0.62 | 26.4 | 1.50 | 1.18 | 0.97 | 0.82 | 30.6 | 1.74 | 1.36 | 1.12 | 0.96 | 30.6 | 1.74 | 1.36 | 1.12 | 0.96 | 30.6 | 1.74 | 1.36 | 1.12 | 0.96 |
| 4.8 | 20.0 | 1.14 | 0.89 | 0.74 | 0.62 | 26.5 | 1.50 | 1.18 | 0.97 | 0.83 | 31.1 | 1.77 | 1.39 | 1.14 | 0.97 | 31.1 | 1.77 | 1.39 | 1.14 | 0.97 | 31.1 | 1.77 | 1.39 | 1.14 | 0.97 |
| 4.9 | 20.0 | 1.14 | 0.89 | 0.73 | 0.62 | 26.5 | 1.51 | 1.18 | 0.97 | 0.83 | 31.6 | 1.79 | 1.41 | 1.16 | 0.99 | 31.6 | 1.79 | 1.41 | 1.16 | 0.99 | 31.6 | 1.79 | 1.41 | 1.16 | 0.99 |
| 5.0 | 20.0 | 1.14 | 0.89 | 0.73 | 0.62 | 26.6 | 1.51 | 1.19 | 0.98 | 0.83 | 32.1 | 1.82 | 1.43 | 1.18 | 1.00 | 32.1 | 1.82 | 1.43 | 1.18 | 1.00 | 32.1 | 1.82 | 1.43 | 1.18 | 1.00 |
| 5.1 | 20.0 | 1.14 | 0.89 | 0.73 | 0.62 | 26.6 | 1.51 | 1.19 | 0.98 | 0.83 | 32.6 | 1.85 | 1.46 | 1.20 | 1.02 | 32.6 | 1.85 | 1.46 | 1.20 | 1.02 | 32.6 | 1.85 | 1.46 | 1.20 | 1.02 |
| 5.2 | 20.0 | 1.13 | 0.89 | 0.73 | 0.62 | 26.7 | 1.52 | 1.19 | 0.98 | 0.83 | 33.1 | 1.88 | 1.48 | 1.22 | 1.04 | 33.1 | 1.88 | 1.48 | 1.22 | 1.04 | 33.1 | 1.88 | 1.48 | 1.22 | 1.04 |
| 5.3 | 20.0 | 1.13 | 0.89 | 0.73 | 0.62 | 26.7 | 1.52 | 1.19 | 0.98 | 0.84 | 33.6 | 1.91 | 1.50 | 1.24 | 1.05 | 33.6 | 1.91 | 1.50 | 1.24 | 1.05 | 33.6 | 1.91 | 1.50 | 1.24 | 1.05 |
| 5.4 | 20.0 | 1.13 | 0.89 | 0.73 | 0.62 | 26.8 | 1.52 | 1.20 | 0.98 | 0.84 | 34.2 | 1.94 | 1.53 | 1.26 | 1.07 | 34.2 | 1.94 | 1.53 | 1.26 | 1.07 | 34.2 | 1.94 | 1.53 | 1.26 | 1.07 |
| 5.5 | 20.0 | 1.13 | 0.89 | 0.73 | 0.62 | 26.8 | 1.52 | 1.20 | 0.99 | 0.84 | 34.3 | 1.95 | 1.53 | 1.26 | 1.07 | 34.7 | 1.97 | 1.55 | 1.28 | 1.08 | 34.7 | 1.97 | 1.55 | 1.28 | 1.08 |
| 5.6 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 26.9 | 1.53 | 1.20 | 0.99 | 0.84 | 34.5 | 1.96 | 1.54 | 1.27 | 1.08 | 35.2 | 2.00 | 1.57 | 1.30 | 1.10 | 35.2 | 2.00 | 1.57 | 1.30 | 1.10 |
| 5.7 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 26.9 | 1.53 | 1.20 | 0.99 | 0.84 | 34.6 | 1.96 | 1.54 | 1.27 | 1.08 | 35.8 | 2.03 | 1.60 | 1.31 | 1.12 | 35.8 | 2.03 | 1.60 | 1.31 | 1.12 |
| 5.8 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 26.9 | 1.53 | 1.20 | 0.99 | 0.84 | 34.7 | 1.97 | 1.55 | 1.27 | 1.08 | 36.3 | 2.06 | 1.62 | 1.33 | 1.13 | 36.3 | 2.06 | 1.62 | 1.33 | 1.13 |
| 5.9 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 27.0 | 1.53 | 1.20 | 0.99 | 0.84 | 34.8 | 1.98 | 1.55 | 1.28 | 1.09 | 36.8 | 2.09 | 1.64 | 1.35 | 1.15 | 36.8 | 2.09 | 1.64 | 1.35 | 1.15 |
| 6.0 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 27.0 | 1.54 | 1.21 | 0.99 | 0.84 | 34.9 | 1.98 | 1.56 | 1.28 | 1.09 | 37.4 | 2.12 | 1.67 | 1.37 | 1.17 | 37.4 | 2.12 | 1.67 | 1.37 | 1.17 |
| 6.1 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 27.1 | 1.54 | 1.21 | 0.99 | 0.85 | 35.0 | 1.99 | 1.56 | 1.29 | 1.09 | 37.9 | 2.15 | 1.69 | 1.39 | 1.18 | 37.9 | 2.15 | 1.69 | 1.39 | 1.18 |
| 6.2 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 27.1 | 1.54 | 1.21 | 1.00 | 0.85 | 35.1 | 1.99 | 1.56 | 1.29 | 1.10 | 38.5 | 2.18 | 1.72 | 1.41 | 1.20 | 38.5 | 2.18 | 1.72 | 1.41 | 1.20 |
| 6.3 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 27.1 | 1.54 | 1.21 | 1.00 | 0.85 | 35.1 | 2.00 | 1.57 | 1.29 | 1.10 | 39.0 | 2.22 | 1.74 | 1.43 | 1.22 | 39.0 | 2.22 | 1.74 | 1.43 | 1.22 |
| 6.4 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 27.2 | 1.54 | 1.21 | 1.00 | 0.85 | 35.2 | 2.00 | 1.57 | 1.29 | 1.10 | 39.5 | 2.25 | 1.77 | 1.45 | 1.24 | 39.5 | 2.25 | 1.77 | 1.45 | 1.24 |
| 6.5 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 27.2 | 1.54 | 1.21 | 1.00 | 0.85 | 35.3 | 2.01 | 1.58 | 1.30 | 1.10 | 40.1 | 2.28 | 1.79 | 1.47 | 1.25 | 40.1 | 2.28 | 1.79 | 1.47 | 1.25 |
| 6.6 | 19.9 | 1.13 | 0.89 | 0.73 | 0.62 | 27.2 | 1.55 | 1.21 | 1.00 | 0.85 | 35.4 | 2.01 | 1.58 | 1.30 | 1.11 | 40.6 | 2.31 | 1.81 | 1.49 | 1.27 | 40.6 | 2.31 | 1.81 | 1.49 | 1.27 |
| 6.7 | 19.8 | 1.13 | 0.89 | 0.73 | 0.62 | 27.2 | 1.55 | 1.22 | 1.00 | 0.85 | 35.5 | 2.01 | 1.58 | 1.30 | 1.11 | 41.2 | 2.34 | 1.84 | 1.51 | 1.29 | 41.2 | 2.34 | 1.84 | 1.51 | 1.29 |
| 6.8 | 19.8 | 1.13 | 0.89 | 0.73 | 0.62 | 27.3 | 1.55 | 1.22 | 1.00 | 0.85 | 35.5 | 2.02 | 1.59 | 1.31 | 1.11 | 41.8 | 2.37 | 1.86 | 1.53 | 1.30 | 41.8 | 2.37 | 1.86 | 1.53 | 1.30 |
| 6.9 | 19.8 | 1.13 | 0.88 | 0.73 | 0.62 | 27.3 | 1.55 | 1.22 | 1.00 | 0.85 | 35.6 | 2.02 | 1.59 | 1.31 | 1.11 | 42.3 | 2.40 | 1.89 | 1.56 | 1.32 | 42.3 | 2.40 | 1.89 | 1.56 | 1.32 |
| 7.0 | 19.8 | 1.13 | 0.88 | 0.73 | 0.62 | 27.3 | 1.55 | 1.22 | 1.00 | 0.85 | 35.7 | 2.03 | 1.59 | 1.31 | 1.11 | 42.9 | 2.44 | 1.91 | 1.58 | 1.34 | 42.9 | 2.44 | 1.91 | 1.58 | 1.34 |
| 7.1 | 19.8 | 1.13 | 0.88 | 0.73 | 0.62 | 27.3 | 1.55 | 1.22 | 1.00 | 0.85 | 35.7 | 2.03 | 1.60 | 1.31 | 1.12 | 43.4 | 2.47 | 1.94 | 1.60 | 1.36 | 43.4 | 2.47 | 1.94 | 1.60 | 1.36 |
| 7.2 | 19.8 | 1.12 | 0.88 | 0.73 | 0.62 | 27.3 | 1.55 | 1.22 | 1.01 | 0.85 | 35.8 | 2.03 | 1.60 | 1.32 | 1.12 | 44.0 | 2.50 | 1.96 | 1.62 | 1.37 | 44.0 | 2.50 | 1.96 | 1.62 | 1.37 |
| 7.3 | 19.8 | 1.12 | 0.88 | 0.73 | 0.62 | 27.4 | 1.55 | 1.22 | 1.01 | 0.85 | 35.9 | 2.04 | 1.60 | 1.32 | 1.12 | 44.5 | 2.53 | 1.99 | 1.64 | 1.39 | 44.5 | 2.53 | 1.99 | 1.64 | 1.39 |
| 7.4 | 19.8 | 1.12 | 0.88 | 0.73 | 0.62 | 27.4 | 1.56 | 1.22 | 1.01 | 0.86 | 35.9 | 2.04 | 1.60 | 1.32 | 1.12 | 45.1 | 2.56 | 2.01 | 1.66 | 1.41 | 45.1 | 2.56 | 2.01 | 1.66 | 1.41 |
| 7.5 | 19.8 | 1.12 | 0.88 | 0.73 | 0.62 | 27.4 | 1.56 | 1.22 | 1.01 | 0.86 | 36.0 | 2.04 | 1.61 | 1.32 | 1.12 | 45.3 | 2.58 | 2.02 | 1.67 | 1.42 | 45.7 | 2.59 | 2.04 | 1.68 | 1.43 |
| 7.6 | 19.8 | 1.12 | 0.88 | 0.73 | 0.62 | 27.4 | 1.56 | 1.22 | 1.01 | 0.86 | 36.0 | 2.05 | 1.61 | 1.32 | 1.13 | 45.4 | 2.58 | 2.03 | 1.67 | 1.42 | 46.2 | 2.63 | 2.06 | 1.70 | 1.44 |
| 7.7 | 19.7 | 1.12 | 0.88 | 0.73 | 0.62 | 27.4 | 1.56 | 1.22 | 1.01 | 0.86 | 36.1 | 2.05 | 1.61 | 1.33 | 1.13 | 45.6 | 2.59 | 2.03 | 1.67 | 1.42 | 46.8 | 2.66 | 2.09 | 1.72 | 1.46 |
| 7.8 | 19.7 | 1.12 | 0.88 | 0.73 | 0.62 | 27.4 | 1.56 | 1.22 | 1.01 | 0.86 | 36.1 | 2.05 | 1.61 | 1.33 | 1.13 | 45.6 | 2.59 | 2.04 | 1.68 | 1.43 | 47.3 | 2.69 | 2.11 | 1.74 | 1.48 |
| 7.9 | 19.7 | 1.12 | 0.88 | 0.72 | 0.62 | 27.4 | 1.56 | 1.23 | 1.01 | 0.86 | 36.2 | 2.06 | 1.61 | 1.33 | 1.13 | 45.7 | 2.60 | 2.04 | 1.68 | 1.43 | 47.9 | 2.72 | 2.14 | 1.76 | 1.50 |
| 8.0 | 19.7 | 1.12 | 0.88 | 0.72 | 0.62 | 27.5 | 1.56 | 1.23 | 1.01 | 0.86 | 36.2 | 2.06 | 1.62 | 1.33 | 1.13 | 45.8 | 2.60 | 2.05 | 1.69 | 1.43 | 48.5 | 2.75 | 2.16 | 1.78 | 1.52 |
| 8.1 | 19.7 | 1.12 | 0.88 | 0.72 | 0.62 | 27.5 | 1.56 | 1.23 | 1.01 | 0.86 | 36.3 | 2.06 | 1.62 | 1.33 | 1.13 | 45.9 | 2.61 | 2.05 | 1.69 | 1.44 | 49.0 | 2.79 | 2.19 | 1.80 | 1.53 |
| 8.2 | 19.7 | 1.12 | 0.88 | 0.72 | 0.62 | 27.5 | 1.56 | 1.23 | 1.01 | 0.86 | 36.3 | 2.06 | 1.62 | 1.33 | 1.13 | 46.0 | 2.61 | 2.05 | 1.69 | 1.44 | 49.6 | 2.82 | 2.22 | 1.82 | 1.55 |
| 8.3 | 19.7 | 1.12 | 0.88 | 0.72 | 0.61 | 27.5 | 1.56 | 1.23 | 1.01 | 0.86 | 36.3 | 2.06 | 1.62 | 1.34 | 1.14 | 46.1 | 2.62 | 2.06 | 1.69 | 1.44 | 50.2 | 2.85 | 2.24 | 1.85 | 1.57 |
| 8.4 | 19.7 | 1.12 | 0.88 | 0.72 | 0.61 | 27.5 | 1.56 | 1.23 | 1.01 | 0.86 | 36.4 | 2.07 | 1.62 | 1.34 | 1.14 | 46.2 | 2.62 | 2.06 | 1.70 | 1.44 | 50.8 | 2.88 | 2.27 | 1.87 | 1.59 |
| 8.5 | 19.7 | 1.12 | 0.88 | 0.72 | 0.61 | 27.5 | 1.56 | 1.23 | 1.01 | 0.86 | 36.4 | 2.07 | 1.63 | 1.34 | 1.14 | 46.3 | 2.63 | 2.07 | 1.70 | 1.45 | 51.3 | 2.92 | 2.29 | 1.89 | 1.60 |
| 8.6 | 19.6 | 1.12 | 0.88 | 0.72 | 0.61 | 27.5 | 1.56 | 1.23 | 1.01 | 0.86 | 36.5 | 2.07 | 1.63 | 1.34 | 1.14 | 46.3 | 2.63 | 2.07 | 1.70 | 1.45 | 51.9 | 2.95 | 2.32 | 1.91 | 1.62 |
| 8.7 | 19.6 | 1.12 | 0.88 | 0.72 | 0.61 | 27.5 | 1.56 | 1.23 | 1.01 | 0.86 | 36.5 | 2.07 | 1.63 | 1.34 | 1.14 | 46.4 | 2.64 | 2.07 | 1.71 | 1.45 | 52.5 | 2.98 | 2.34 | 1.93 | 1.64 |
| 8.8 | 19.6 | 1.12 | 0.88 | 0.72 | 0.61 | 27.5 | 1.56 | 1.23 | 1.01 | 0.86 | 36.5 | 2.07 | 1.63 | 1.34 | 1.14 | 46.5 | 2.64 | 2.07 | 1.71 | 1.45 | 53.0 | 3.01 | 2.37 | 1.95 | 1.66 |
| 8.9 | 19.6 | 1.11 | 0.88 | 0.72 | 0.61 | 27.5 | 1.56 | 1.23 | 1.01 | 0.86 | 36.6 | 2.08 | 1.63 | 1.34 | 1.14 | 46.5 | 2.64 | 2.08 | 1.71 | 1.45 | 53.6 | 3.05 | 2.39 | 1.97 | 1.68 |
| 9.0 | 19.6 | 1.11 | 0.88 | 0.72 | 0.61 | 27.5 | 1.56 | 1.23 | 1.01 | 0.86 | 36.6 | 2.08 | 1.63 | 1.34 | 1.14 | 46.6 | 2.65 | 2.08 | 1.71 | 1.46 | 54.2 | 3.08 | 2.42 | 1.99 | 1.69 |
| 9.1 | 19.6 | 1.11 | 0.87 | 0.72 | 0.61 | 27.5 | 1.56 | 1.23 | 1.01 | 0.86 | 36.6 | 2.08 | 1.63 | 1.35 | 1.14 | 46.7 | 2.65 | 2.08 | 1.72 | 1.46 | 54.8 | 3.11 | 2.44 | 2.01 | 1.71 |
| 9.2 | 19.6 | 1.11 | 0.87 | 0.72 | 0.61 | 27.5 | 1.56 | 1.23 | 1.01 | 0.86 | 36.6 | 2.08 | 1.64 | 1.35 | 1.14 | 46.7 | 2.66 | 2.09 | 1.72 | 1.46 | 55.3 | 3.14 | 2.47 | 2.03 | 1.73 |
| 9.3 | 19.6 | 1.11 | 0.87 | 0.72 | 0.61 | 27.5 | 1.57 | 1.23 | 1.01 | 0.86 | 36.7 | 2.08 | 1.64 | 1.35 | 1.15 | 46.8 | 2.66 | 2.09 | 1.72 | 1.46 | 55.9 | 3.18 | 2.50 | 2.06 | 1.75 |
| 9.4 | 19.6 | 1.11 | 0.87 | 0.72 | 0.61 | 27.5 | 1.57 | 1.23 | 1.01 | 0.86 | 36.7 | 2.08 | 1.64 | 1.35 | 1.15 | 46.9 | 2.66 | 2.09 | 1.72 | 1.46 | 56.5 | 3.21 | 2.52 | 2.08 | 1.77 |
| 9.5 | 19.6 | 1.11 | 0.87 | 0.72 | 0.61 | 27.6 | 1.57 | 1.23 | 1.01 | 0.86 | 36.7 | 2.09 | 1.64 | 1.35 | 1.15 | 46.9 | 2.67 | 2.08 | 1.72 | 1.47 | 57.1 | 3.24 | 2.55 | 2.10 | 1.78 |
| 9.6 | 19.6 | 1.11 | 0.87 | 0.72 | 0.61 | 27.6 | 1.57 | 1.23 | 1.01 | 0.86 | 36.7 | 2.09 | 1.64 | 1.35 | 1.15 | 47.0 | 2.67 | 2.10 | 1.73 | 1.47 | 57.6 | 3.27 | 2.57 | 2.12 | 1.80 |
| 9.7 | 19.5 | 1.11 | 0.87 | 0.72 | 0.61 | 27.6 | 1.57 | 1.23 | 1.01 | 0.86 | 36.8 | 2.09 | 1.64 | 1.35 | 1.15 | 47.0 | 2.67 | 2.10 | 1.73 | 1.47 | 58.2 | 3.31 | 2.60 | 2.14 | 1.82 |
| 9.8 | 19.5 | 1.11 | 0.87 | 0.72 | 0.61 | 27.6 | 1.57 | 1.23 | 1.01 | 0.86 | 36.8 | 2.09 | 1.64 | 1.35 | 1.15 | 47.1 | 2.67 | 2.10 | 1.73 | 1.47 | 58.3 | 3.31 | 2.60 | 2.14 | 1.82 |
| 9.9 | 19.5 | 1.11 | 0.87 | 0.72 | 0.61 | 27.6 | 1.57 | 1.23 | 1.01 | 0.86 | 36.8 | 2.09 | 1.64 | 1.35 | 1.15 | 47.1 | 2.68 | 2.10 | 1.73 | 1.47 | 58.4 | 3.32 | 2.61 | 2.15 | 1.82 |
| 10.0 | 19.5 | 1.11 | 0.87 | 0.72 | 0.61 | 27.6 | 1.57 | 1.23 | 1.01 | 0.88 | 36.8 | 2.09 | 1.64 | 1.35 | 1.15 | 47.2 | 2.68 | 2.11 | 1.73 | 1.47 | 58.5 | 3.32 | 2.61 | 2.15 | 1.83 |
| Trench Width m | | 0.5 | | | | | 0.6 | | | | | 0.7 | | | | | 0.8 | | | | | 0.9 | | | |

## TABLE 13. DESIGN LOADS
## 200 mm DIAMETER PIPE

8 WHEELS 112.5kN
IMPACT FACTOR 1.3

| Cover | Design Load | Min Bedding Factor — Crushing Strength kN/m | | | Design Load | Min Bedding Factor — Crushing Strength kN/m | | | Design Load | Min Bedding Factor — Crushing Strength kN/m | | | Design Load | Min Bedding Factor — Crushing Strength kN/m | | | Design Load | Min Bedding Factor — Crushing Strength kN/m | | | Design Load | Min Bedding Factor — Crushing Strength kN/m | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 24 | 32 | 40 | kN/m | 24 | 32 | 40 | kN/m | 24 | 32 | 40 | kN/m | 24 | 32 | 40 | kN/m | 24 | 32 | 40 | kN/m | 24 | 32 | 40 |
| 0.6 | 33.1 | 1.72 | 1.29 | 1.03 | 33.1 | 1.72 | 1.29 | 1.03 | 33.1 | 1.72 | 1.29 | 1.03 | 33.1 | 1.72 | 1.29 | 1.03 | 33.1 | 1.72 | 1.29 | 1.03 | 33.1 | 1.72 | 1.29 | 1.03 |
| 0.7 | 30.0 | 1.56 | 1.17 | 0.94 | 30.0 | 1.56 | 1.17 | 0.94 | 30.0 | 1.56 | 1.17 | 0.94 | 30.0 | 1.56 | 1.17 | 0.94 | 30.0 | 1.56 | 1.17 | 0.94 | 30.0 | 1.56 | 1.17 | 0.94 |
| 0.8 | 27.9 | 1.45 | 1.09 | 0.87 | 27.9 | 1.45 | 1.09 | 0.87 | 27.9 | 1.45 | 1.09 | 0.87 | 27.9 | 1.45 | 1.09 | 0.87 | 27.9 | 1.45 | 1.09 | 0.87 | 27.9 | 1.45 | 1.09 | 0.87 |
| 0.9 | 26.4 | 1.37 | 1.03 | 0.82 | 26.4 | 1.37 | 1.03 | 0.82 | 26.4 | 1.37 | 1.03 | 0.82 | 26.4 | 1.37 | 1.03 | 0.82 | 26.4 | 1.37 | 1.03 | 0.82 | 26.4 | 1.37 | 1.03 | 0.82 |
| 1.0 | 25.3 | 1.32 | 0.99 | 0.79 | 25.3 | 1.32 | 0.99 | 0.79 | 25.3 | 1.32 | 0.99 | 0.79 | 25.3 | 1.32 | 0.99 | 0.79 | 25.3 | 1.32 | 0.99 | 0.79 | 25.3 | 1.32 | 0.99 | 0.79 |
| 1.1 | 24.6 | 1.28 | 0.96 | 0.77 | 24.6 | 1.28 | 0.96 | 0.77 | 24.6 | 1.28 | 0.96 | 0.77 | 24.6 | 1.28 | 0.96 | 0.77 | 24.6 | 1.28 | 0.96 | 0.77 | 24.6 | 1.28 | 0.96 | 0.77 |
| 1.2 | 24.2 | 1.26 | 0.94 | 0.76 | 24.2 | 1.26 | 0.94 | 0.76 | 24.2 | 1.26 | 0.94 | 0.76 | 24.2 | 1.26 | 0.94 | 0.76 | 24.2 | 1.26 | 0.94 | 0.76 | 24.2 | 1.26 | 0.94 | 0.76 |
| 1.3 | 23.9 | 1.24 | 0.93 | 0.75 | 23.9 | 1.24 | 0.93 | 0.75 | 23.9 | 1.24 | 0.93 | 0.75 | 23.9 | 1.24 | 0.93 | 0.75 | 23.9 | 1.24 | 0.93 | 0.75 | 23.9 | 1.24 | 0.93 | 0.75 |
| 1.4 | 23.8 | 1.24 | 0.93 | 0.74 | 23.8 | 1.24 | 0.93 | 0.74 | 23.8 | 1.24 | 0.93 | 0.74 | 23.8 | 1.24 | 0.93 | 0.74 | 23.8 | 1.24 | 0.93 | 0.74 | 23.8 | 1.24 | 0.93 | 0.74 |
| 1.5 | 23.8 | 1.24 | 0.93 | 0.74 | 23.8 | 1.24 | 0.93 | 0.74 | 23.8 | 1.24 | 0.93 | 0.74 | 23.8 | 1.24 | 0.93 | 0.74 | 23.8 | 1.24 | 0.93 | 0.74 | 23.8 | 1.24 | 0.93 | 0.74 |
| 1.6 | 23.8 | 1.24 | 0.93 | 0.75 | 23.8 | 1.24 | 0.93 | 0.75 | 23.8 | 1.24 | 0.93 | 0.75 | 23.8 | 1.24 | 0.93 | 0.75 | 23.8 | 1.24 | 0.93 | 0.75 | 23.8 | 1.24 | 0.93 | 0.75 |
| 1.7 | 24.0 | 1.25 | 0.94 | 0.75 | 24.0 | 1.25 | 0.94 | 0.75 | 24.0 | 1.25 | 0.94 | 0.75 | 24.0 | 1.25 | 0.94 | 0.75 | 24.0 | 1.25 | 0.94 | 0.75 | 24.0 | 1.25 | 0.94 | 0.75 |
| 1.8 | 24.2 | 1.26 | 0.95 | 0.76 | 24.2 | 1.26 | 0.95 | 0.76 | 24.2 | 1.26 | 0.95 | 0.76 | 24.2 | 1.26 | 0.95 | 0.76 | 24.2 | 1.26 | 0.95 | 0.76 | 24.2 | 1.26 | 0.95 | 0.76 |
| 1.9 | 24.5 | 1.28 | 0.96 | 0.77 | 24.5 | 1.28 | 0.96 | 0.77 | 24.5 | 1.28 | 0.96 | 0.77 | 24.5 | 1.28 | 0.96 | 0.77 | 24.5 | 1.28 | 0.96 | 0.77 | 24.5 | 1.28 | 0.96 | 0.77 |
| 2.0 | 24.9 | 1.30 | 0.97 | 0.78 | 24.9 | 1.30 | 0.97 | 0.78 | 24.9 | 1.30 | 0.97 | 0.78 | 24.9 | 1.30 | 0.97 | 0.78 | 24.9 | 1.30 | 0.97 | 0.78 | 24.9 | 1.30 | 0.97 | 0.78 |
| 2.1 | 25.2 | 1.31 | 0.99 | 0.79 | 25.2 | 1.31 | 0.99 | 0.79 | 25.2 | 1.31 | 0.99 | 0.79 | 25.2 | 1.31 | 0.99 | 0.79 | 25.2 | 1.31 | 0.99 | 0.79 | 25.2 | 1.31 | 0.99 | 0.79 |
| 2.2 | 25.6 | 1.33 | 1.00 | 0.80 | 25.6 | 1.34 | 1.00 | 0.80 | 25.6 | 1.34 | 1.00 | 0.80 | 25.6 | 1.34 | 1.00 | 0.80 | 25.6 | 1.34 | 1.00 | 0.80 | 25.6 | 1.34 | 1.00 | 0.80 |
| 2.3 | 25.7 | 1.34 | 1.00 | 0.80 | 26.0 | 1.36 | 1.02 | 0.81 | 26.0 | 1.36 | 1.02 | 0.81 | 26.0 | 1.36 | 1.02 | 0.81 | 26.0 | 1.36 | 1.02 | 0.81 | 26.0 | 1.36 | 1.02 | 0.81 |
| 2.4 | 25.8 | 1.34 | 1.01 | 0.81 | 26.5 | 1.38 | 1.03 | 0.83 | 26.5 | 1.38 | 1.03 | 0.83 | 26.5 | 1.38 | 1.03 | 0.83 | 26.5 | 1.38 | 1.03 | 0.83 | 26.5 | 1.38 | 1.03 | 0.83 |
| 2.5 | 25.9 | 1.35 | 1.01 | 0.81 | 26.9 | 1.40 | 1.05 | 0.84 | 26.9 | 1.40 | 1.05 | 0.84 | 26.9 | 1.40 | 1.05 | 0.84 | 26.9 | 1.40 | 1.05 | 0.84 | 26.9 | 1.40 | 1.05 | 0.84 |
| 2.6 | 26.0 | 1.35 | 1.01 | 0.81 | 27.4 | 1.43 | 1.07 | 0.86 | 27.4 | 1.43 | 1.07 | 0.86 | 27.4 | 1.43 | 1.07 | 0.86 | 27.4 | 1.43 | 1.07 | 0.86 | 27.4 | 1.43 | 1.07 | 0.86 |
| 2.7 | 26.0 | 1.36 | 1.02 | 0.81 | 27.8 | 1.45 | 1.09 | 0.87 | 27.8 | 1.45 | 1.09 | 0.87 | 27.8 | 1.45 | 1.09 | 0.87 | 27.8 | 1.45 | 1.09 | 0.87 | 27.8 | 1.45 | 1.09 | 0.87 |
| 2.8 | 26.1 | 1.36 | 1.02 | 0.82 | 28.3 | 1.48 | 1.11 | 0.89 | 28.3 | 1.48 | 1.11 | 0.89 | 28.3 | 1.48 | 1.11 | 0.89 | 28.3 | 1.48 | 1.11 | 0.89 | 28.3 | 1.48 | 1.11 | 0.89 |
| 2.9 | 26.2 | 1.36 | 1.02 | 0.82 | 28.8 | 1.50 | 1.13 | 0.90 | 28.8 | 1.50 | 1.13 | 0.90 | 28.8 | 1.50 | 1.13 | 0.90 | 28.8 | 1.50 | 1.13 | 0.90 | 28.8 | 1.50 | 1.13 | 0.90 |
| 3.0 | 26.3 | 1.37 | 1.03 | 0.82 | 29.3 | 1.53 | 1.15 | 0.92 | 29.3 | 1.53 | 1.15 | 0.92 | 29.3 | 1.53 | 1.15 | 0.92 | 29.3 | 1.53 | 1.15 | 0.92 | 29.3 | 1.53 | 1.15 | 0.92 |
| 3.1 | 26.3 | 1.37 | 1.03 | 0.82 | 29.8 | 1.55 | 1.17 | 0.93 | 29.8 | 1.55 | 1.17 | 0.93 | 29.8 | 1.55 | 1.17 | 0.93 | 29.8 | 1.55 | 1.17 | 0.93 | 29.8 | 1.55 | 1.17 | 0.93 |
| 3.2 | 26.4 | 1.38 | 1.03 | 0.83 | 30.4 | 1.58 | 1.19 | 0.95 | 30.4 | 1.58 | 1.19 | 0.95 | 30.4 | 1.58 | 1.19 | 0.95 | 30.4 | 1.58 | 1.19 | 0.95 | 30.4 | 1.58 | 1.19 | 0.95 |
| 3.3 | 26.5 | 1.38 | 1.03 | 0.83 | 30.9 | 1.61 | 1.21 | 0.97 | 30.9 | 1.61 | 1.21 | 0.97 | 30.9 | 1.61 | 1.21 | 0.97 | 30.9 | 1.61 | 1.21 | 0.97 | 30.9 | 1.61 | 1.21 | 0.97 |
| 3.4 | 26.5 | 1.38 | 1.04 | 0.83 | 31.5 | 1.64 | 1.23 | 0.98 | 31.5 | 1.64 | 1.23 | 0.98 | 31.5 | 1.64 | 1.23 | 0.98 | 31.5 | 1.64 | 1.23 | 0.98 | 31.5 | 1.64 | 1.23 | 0.98 |
| 3.5 | 26.6 | 1.39 | 1.04 | 0.83 | 32.0 | 1.67 | 1.25 | 1.00 | 32.0 | 1.67 | 1.25 | 1.00 | 32.0 | 1.67 | 1.25 | 1.00 | 32.0 | 1.67 | 1.25 | 1.00 | 32.0 | 1.67 | 1.25 | 1.00 |
| 3.6 | 26.7 | 1.39 | 1.04 | 0.83 | 32.5 | 1.69 | 1.27 | 1.01 | 32.6 | 1.70 | 1.27 | 1.02 | 32.6 | 1.70 | 1.27 | 1.02 | 32.6 | 1.70 | 1.27 | 1.02 | 32.6 | 1.70 | 1.27 | 1.02 |
| 3.7 | 26.7 | 1.39 | 1.04 | 0.84 | 32.6 | 1.70 | 1.27 | 1.02 | 33.2 | 1.73 | 1.30 | 1.04 | 33.2 | 1.73 | 1.30 | 1.04 | 33.2 | 1.73 | 1.30 | 1.04 | 33.2 | 1.73 | 1.30 | 1.04 |
| 3.8 | 26.8 | 1.39 | 1.05 | 0.84 | 32.8 | 1.71 | 1.28 | 1.03 | 33.8 | 1.76 | 1.32 | 1.06 | 33.8 | 1.76 | 1.32 | 1.06 | 33.8 | 1.76 | 1.32 | 1.06 | 33.8 | 1.76 | 1.32 | 1.06 |
| 3.9 | 26.8 | 1.40 | 1.05 | 0.84 | 33.0 | 1.72 | 1.29 | 1.03 | 34.4 | 1.79 | 1.34 | 1.07 | 34.4 | 1.79 | 1.34 | 1.07 | 34.4 | 1.79 | 1.34 | 1.07 | 34.4 | 1.79 | 1.34 | 1.07 |
| 4.0 | 26.9 | 1.40 | 1.05 | 0.84 | 33.1 | 1.73 | 1.29 | 1.04 | 35.0 | 1.82 | 1.37 | 1.09 | 35.0 | 1.82 | 1.37 | 1.09 | 35.0 | 1.82 | 1.37 | 1.09 | 35.0 | 1.82 | 1.37 | 1.09 |
| 4.1 | 26.9 | 1.40 | 1.05 | 0.84 | 33.3 | 1.73 | 1.30 | 1.04 | 35.6 | 1.85 | 1.39 | 1.11 | 35.6 | 1.85 | 1.39 | 1.11 | 35.6 | 1.85 | 1.39 | 1.11 | 35.6 | 1.85 | 1.39 | 1.11 |
| 4.2 | 27.0 | 1.41 | 1.05 | 0.84 | 33.4 | 1.74 | 1.31 | 1.04 | 36.2 | 1.89 | 1.41 | 1.13 | 36.2 | 1.89 | 1.41 | 1.13 | 36.2 | 1.89 | 1.41 | 1.13 | 36.2 | 1.89 | 1.41 | 1.13 |
| 4.3 | 27.0 | 1.41 | 1.06 | 0.84 | 33.6 | 1.75 | 1.31 | 1.05 | 36.8 | 1.92 | 1.44 | 1.15 | 36.8 | 1.92 | 1.44 | 1.15 | 36.8 | 1.92 | 1.44 | 1.15 | 36.8 | 1.92 | 1.44 | 1.15 |
| 4.4 | 27.1 | 1.41 | 1.06 | 0.85 | 33.7 | 1.76 | 1.32 | 1.05 | 37.5 | 1.95 | 1.46 | 1.17 | 37.5 | 1.95 | 1.46 | 1.17 | 37.5 | 1.95 | 1.46 | 1.17 | 37.5 | 1.95 | 1.46 | 1.17 |
| 4.5 | 27.1 | 1.41 | 1.06 | 0.85 | 33.8 | 1.76 | 1.32 | 1.06 | 38.1 | 1.98 | 1.49 | 1.19 | 38.1 | 1.98 | 1.49 | 1.19 | 38.1 | 1.98 | 1.49 | 1.19 | 38.1 | 1.98 | 1.49 | 1.19 |
| 4.6 | 27.2 | 1.41 | 1.08 | 0.85 | 34.0 | 1.77 | 1.33 | 1.06 | 38.7 | 2.02 | 1.51 | 1.21 | 38.7 | 2.02 | 1.51 | 1.21 | 38.7 | 2.02 | 1.51 | 1.21 | 38.7 | 2.02 | 1.51 | 1.21 |
| 4.7 | 27.2 | 1.42 | 1.08 | 0.85 | 34.1 | 1.78 | 1.33 | 1.07 | 39.4 | 2.05 | 1.54 | 1.23 | 39.4 | 2.05 | 1.54 | 1.23 | 39.4 | 2.05 | 1.54 | 1.23 | 39.4 | 2.05 | 1.54 | 1.23 |
| 4.8 | 27.2 | 1.42 | 1.06 | 0.85 | 34.2 | 1.78 | 1.34 | 1.07 | 40.0 | 2.09 | 1.56 | 1.25 | 40.0 | 2.09 | 1.56 | 1.25 | 40.0 | 2.09 | 1.56 | 1.25 | 40.0 | 2.09 | 1.56 | 1.25 |
| 4.9 | 27.3 | 1.42 | 1.07 | 0.85 | 34.3 | 1.79 | 1.34 | 1.07 | 40.7 | 2.12 | 1.59 | 1.27 | 40.7 | 2.12 | 1.59 | 1.27 | 40.7 | 2.12 | 1.59 | 1.27 | 40.7 | 2.12 | 1.59 | 1.27 |
| 5.0 | 27.3 | 1.42 | 1.07 | 0.85 | 34.5 | 1.79 | 1.35 | 1.08 | 41.4 | 2.15 | 1.62 | 1.29 | 41.4 | 2.15 | 1.62 | 1.29 | 41.4 | 2.15 | 1.62 | 1.29 | 41.4 | 2.15 | 1.62 | 1.29 |
| 5.1 | 27.3 | 1.42 | 1.07 | 0.85 | 34.6 | 1.80 | 1.35 | 1.08 | 42.0 | 2.19 | 1.64 | 1.31 | 42.0 | 2.19 | 1.64 | 1.31 | 42.0 | 2.19 | 1.64 | 1.31 | 42.0 | 2.19 | 1.64 | 1.31 |
| 5.2 | 27.4 | 1.43 | 1.07 | 0.86 | 34.7 | 1.81 | 1.35 | 1.08 | 42.4 | 2.21 | 1.66 | 1.33 | 42.7 | 2.22 | 1.67 | 1.33 | 42.7 | 2.22 | 1.67 | 1.33 | 42.7 | 2.22 | 1.67 | 1.33 |
| 5.3 | 27.4 | 1.43 | 1.07 | 0.86 | 34.8 | 1.81 | 1.36 | 1.09 | 42.6 | 2.22 | 1.67 | 1.33 | 43.4 | 2.26 | 1.69 | 1.36 | 43.4 | 2.26 | 1.69 | 1.36 | 43.4 | 2.26 | 1.69 | 1.36 |
| 5.4 | 27.4 | 1.43 | 1.07 | 0.86 | 34.9 | 1.82 | 1.36 | 1.09 | 42.8 | 2.23 | 1.67 | 1.34 | 44.0 | 2.29 | 1.72 | 1.38 | 44.0 | 2.29 | 1.72 | 1.38 | 44.0 | 2.29 | 1.72 | 1.38 |
| 5.5 | 27.5 | 1.43 | 1.07 | 0.86 | 35.0 | 1.82 | 1.37 | 1.09 | 43.0 | 2.24 | 1.68 | 1.34 | 44.7 | 2.33 | 1.75 | 1.40 | 44.7 | 2.33 | 1.75 | 1.40 | 44.7 | 2.33 | 1.75 | 1.40 |
| 5.6 | 27.5 | 1.43 | 1.07 | 0.86 | 35.1 | 1.83 | 1.37 | 1.10 | 43.2 | 2.25 | 1.69 | 1.35 | 45.4 | 2.36 | 1.77 | 1.42 | 45.4 | 2.36 | 1.77 | 1.42 | 45.4 | 2.36 | 1.77 | 1.42 |
| 5.7 | 27.5 | 1.43 | 1.07 | 0.86 | 35.2 | 1.83 | 1.37 | 1.10 | 43.4 | 2.26 | 1.69 | 1.35 | 46.1 | 2.40 | 1.80 | 1.44 | 46.1 | 2.40 | 1.80 | 1.44 | 46.1 | 2.40 | 1.80 | 1.44 |
| 5.8 | 27.5 | 1.43 | 1.08 | 0.86 | 35.2 | 1.84 | 1.38 | 1.10 | 43.5 | 2.27 | 1.70 | 1.36 | 46.8 | 2.44 | 1.83 | 1.46 | 46.8 | 2.44 | 1.83 | 1.46 | 46.8 | 2.44 | 1.83 | 1.46 |
| 5.9 | 27.5 | 1.43 | 1.08 | 0.86 | 35.3 | 1.84 | 1.38 | 1.10 | 43.7 | 2.28 | 1.71 | 1.37 | 47.5 | 2.47 | 1.85 | 1.48 | 47.5 | 2.47 | 1.85 | 1.48 | 47.5 | 2.47 | 1.85 | 1.48 |
| 6.0 | 27.6 | 1.44 | 1.08 | 0.86 | 35.4 | 1.84 | 1.38 | 1.11 | 43.8 | 2.28 | 1.71 | 1.37 | 48.2 | 2.51 | 1.88 | 1.51 | 48.2 | 2.51 | 1.88 | 1.51 | 48.2 | 2.51 | 1.88 | 1.51 |
| 6.1 | 27.6 | 1.44 | 1.08 | 0.86 | 35.5 | 1.85 | 1.39 | 1.11 | 44.0 | 2.29 | 1.72 | 1.37 | 48.9 | 2.54 | 1.91 | 1.53 | 48.9 | 2.54 | 1.91 | 1.53 | 48.9 | 2.54 | 1.91 | 1.53 |
| 6.2 | 27.6 | 1.44 | 1.08 | 0.96 | 35.6 | 1.85 | 1.39 | 1.11 | 44.1 | 2.30 | 1.72 | 1.38 | 49.6 | 2.58 | 1.94 | 1.55 | 49.6 | 2.58 | 1.94 | 1.55 | 49.6 | 2.58 | 1.94 | 1.55 |
| 6.3 | 27.6 | 1.44 | 1.08 | 0.86 | 35.6 | 1.86 | 1.39 | 1.11 | 44.3 | 2.31 | 1.73 | 1.38 | 50.3 | 2.62 | 1.96 | 1.57 | 50.3 | 2.62 | 1.96 | 1.57 | 50.3 | 2.62 | 1.96 | 1.57 |
| 6.4 | 27.6 | 1.44 | 1.08 | 0.86 | 35.7 | 1.86 | 1.40 | 1.12 | 44.4 | 2.31 | 1.74 | 1.39 | 51.0 | 2.65 | 1.99 | 1.59 | 51.0 | 2.65 | 1.99 | 1.59 | 51.0 | 2.65 | 1.99 | 1.59 |
| 6.5 | 27.7 | 1.44 | 1.08 | 0.86 | 35.8 | 1.86 | 1.40 | 1.12 | 44.6 | 2.32 | 1.74 | 1.39 | 51.7 | 2.69 | 2.02 | 1.61 | 51.7 | 2.69 | 2.02 | 1.61 | 51.7 | 2.69 | 2.02 | 1.61 |
| 6.6 | 27.7 | 1.44 | 1.08 | 0.86 | 35.8 | 1.87 | 1.40 | 1.12 | 44.7 | 2.33 | 1.75 | 1.40 | 52.4 | 2.73 | 2.05 | 1.64 | 52.4 | 2.73 | 2.05 | 1.64 | 52.4 | 2.73 | 2.05 | 1.64 |
| 6.7 | 27.7 | 1.44 | 1.08 | 0.87 | 35.9 | 1.87 | 1.40 | 1.12 | 44.8 | 2.33 | 1.75 | 1.40 | 53.1 | 2.77 | 2.07 | 1.66 | 53.1 | 2.77 | 2.07 | 1.66 | 53.1 | 2.77 | 2.07 | 1.66 |
| 6.8 | 27.7 | 1.44 | 1.08 | 0.87 | 36.0 | 1.87 | 1.41 | 1.12 | 44.9 | 2.34 | 1.76 | 1.40 | 53.8 | 2.80 | 2.10 | 1.68 | 53.8 | 2.80 | 2.10 | 1.68 | 53.8 | 2.80 | 2.10 | 1.68 |
| 6.9 | 27.7 | 1.44 | 1.08 | 0.87 | 38.0 | 1.88 | 1.41 | 1.13 | 45.1 | 2.35 | 1.76 | 1.41 | 54.5 | 2.84 | 2.13 | 1.70 | 54.5 | 2.84 | 2.13 | 1.70 | 54.5 | 2.84 | 2.13 | 1.70 |
| 7.0 | 27.7 | 1.44 | 1.08 | 0.87 | 36.1 | 1.88 | 1.41 | 1.13 | 45.2 | 2.35 | 1.77 | 1.41 | 54.9 | 2.86 | 2.14 | 1.72 | 55.2 | 2.88 | 2.16 | 1.73 | 55.2 | 2.88 | 2.16 | 1.73 |
| 7.1 | 27.7 | 1.44 | 1.08 | 0.87 | 36.1 | 1.88 | 1.41 | 1.13 | 45.3 | 2.36 | 1.77 | 1.42 | 55.1 | 2.87 | 2.15 | 1.72 | 56.0 | 2.91 | 2.19 | 1.75 | 56.0 | 2.91 | 2.19 | 1.75 |
| 7.2 | 27.7 | 1.44 | 1.08 | 0.87 | 36.2 | 1.89 | 1.41 | 1.13 | 45.4 | 2.36 | 1.77 | 1.42 | 55.2 | 2.88 | 2.16 | 1.73 | 56.7 | 2.95 | 2.21 | 1.77 | 56.7 | 2.95 | 2.21 | 1.77 |
| 7.3 | 27.7 | 1.45 | 1.08 | 0.87 | 36.2 | 1.89 | 1.42 | 1.13 | 45.5 | 2.37 | 1.78 | 1.42 | 55.4 | 2.89 | 2.16 | 1.73 | 57.4 | 2.99 | 2.24 | 1.79 | 57.4 | 2.99 | 2.24 | 1.79 |
| 7.4 | 27.8 | 1.45 | 1.08 | 0.87 | 36.3 | 1.89 | 1.42 | 1.13 | 45.6 | 2.38 | 1.78 | 1.43 | 55.6 | 2.90 | 2.17 | 1.74 | 58.1 | 3.03 | 2.27 | 1.82 | 58.1 | 3.03 | 2.27 | 1.82 |
| 7.5 | 27.8 | 1.45 | 1.08 | 0.87 | 36.3 | 1.89 | 1.42 | 1.14 | 45.7 | 2.38 | 1.79 | 1.43 | 55.8 | 2.90 | 2.18 | 1.74 | 58.9 | 3.07 | 2.30 | 1.84 | 58.9 | 3.07 | 2.30 | 1.84 |
| 7.6 | 27.8 | 1.45 | 1.08 | 0.87 | 36.4 | 1.89 | 1.42 | 1.14 | 45.8 | 2.39 | 1.79 | 1.43 | 55.9 | 2.91 | 2.18 | 1.75 | 59.6 | 3.10 | 2.33 | 1.86 | 59.6 | 3.10 | 2.33 | 1.86 |
| 7.7 | 27.8 | 1.45 | 1.08 | 0.87 | 36.4 | 1.90 | 1.42 | 1.14 | 45.9 | 2.39 | 1.79 | 1.43 | 56.1 | 2.92 | 2.19 | 1.75 | 60.3 | 3.14 | 2.36 | 1.88 | 60.3 | 3.14 | 2.36 | 1.88 |
| 7.8 | 27.8 | 1.45 | 1.08 | 0.87 | 36.5 | 1.90 | 1.42 | 1.14 | 46.0 | 2.40 | 1.80 | 1.44 | 56.2 | 2.93 | 2.20 | 1.76 | 61.0 | 3.18 | 2.38 | 1.91 | 61.0 | 3.18 | 2.38 | 1.91 |
| 7.9 | 27.8 | 1.45 | 1.09 | 0.87 | 36.5 | 1.90 | 1.43 | 1.14 | 46.1 | 2.40 | 1.80 | 1.44 | 56.4 | 2.94 | 2.20 | 1.76 | 61.8 | 3.22 | 2.41 | 1.93 | 61.8 | 3.22 | 2.41 | 1.93 |
| 8.0 | 27.8 | 1.45 | 1.09 | 0.87 | 36.5 | 1.90 | 1.43 | 1.14 | 46.2 | 2.40 | 1.80 | 1.44 | 56.5 | 2.94 | 2.21 | 1.77 | 62.5 | 3.25 | 2.44 | 1.95 | 62.5 | 3.25 | 2.44 | 1.95 |
| 8.1 | 27.8 | 1.45 | 1.09 | 0.87 | 36.6 | 1.91 | 1.43 | 1.14 | 46.3 | 2.41 | 1.81 | 1.45 | 56.7 | 2.95 | 2.21 | 1.77 | 63.2 | 3.29 | 2.47 | 1.98 | 63.2 | 3.29 | 2.47 | 1.98 |
| 8.2 | 27.8 | 1.45 | 1.09 | 0.87 | 36.6 | 1.91 | 1.43 | 1.14 | 46.3 | 2.41 | 1.81 | 1.45 | 56.8 | 2.96 | 2.22 | 1.77 | 64.0 | 3.33 | 2.50 | 2.00 | 64.0 | 3.33 | 2.50 | 2.00 |
| 8.3 | 27.8 | 1.45 | 1.09 | 0.87 | 36.7 | 1.91 | 1.43 | 1.15 | 46.4 | 2.42 | 1.81 | 1.45 | 56.9 | 2.97 | 2.22 | 1.78 | 64.7 | 3.37 | 2.53 | 2.02 | 64.7 | 3.37 | 2.53 | 2.02 |
| 8.4 | 27.8 | 1.45 | 1.09 | 0.87 | 36.7 | 1.91 | 1.43 | 1.15 | 46.5 | 2.42 | 1.82 | 1.45 | 57.1 | 2.97 | 2.23 | 1.78 | 65.4 | 3.41 | 2.56 | 2.04 | 65.4 | 3.41 | 2.56 | 2.04 |
| 8.5 | 27.8 | 1.45 | 1.09 | 0.87 | 36.7 | 1.91 | 1.43 | 1.15 | 46.6 | 2.42 | 1.82 | 1.45 | 57.2 | 2.98 | 2.23 | 1.79 | 66.2 | 3.45 | 2.58 | 2.07 | 66.2 | 3.45 | 2.58 | 2.07 |
| 8.6 | 27.8 | 1.45 | 1.09 | 0.87 | 36.7 | 1.91 | 1.44 | 1.15 | 46.6 | 2.43 | 1.82 | 1.46 | 57.3 | 2.98 | 2.24 | 1.79 | 66.9 | 3.48 | 2.61 | 2.09 | 66.9 | 3.48 | 2.61 | 2.09 |
| 8.7 | 27.8 | 1.45 | 1.09 | 0.87 | 36.8 | 1.92 | 1.44 | 1.15 | 46.7 | 2.43 | 1.82 | 1.48 | 57.4 | 2.99 | 2.24 | 1.79 | 67.6 | 3.52 | 2.64 | 2.11 | 67.6 | 3.52 | 2.64 | 2.11 |
| 8.8 | 27.8 | 1.45 | 1.09 | 0.87 | 36.8 | 1.92 | 1.44 | 1.15 | 46.8 | 2.44 | 1.83 | 1.46 | 57.5 | 3.00 | 2.25 | 1.80 | 68.4 | 3.56 | 2.67 | 2.14 | 68.4 | 3.56 | 2.67 | 2.14 |
| 8.9 | 27.8 | 1.45 | 1.09 | 0.87 | 36.8 | 1.92 | 1.44 | 1.15 | 46.8 | 2.44 | 1.83 | 1.46 | 57.6 | 3.00 | 2.25 | 1.80 | 69.1 | 3.60 | 2.70 | 2.16 | 69.1 | 3.60 | 2.70 | 2.16 |
| 9.0 | 27.8 | 1.45 | 1.09 | 0.87 | 36.8 | 1.92 | 1.44 | 1.15 | 46.9 | 2.44 | 1.83 | 1.46 | 57.8 | 3.01 | 2.26 | 1.80 | 69.4 | 3.61 | 2.71 | 2.17 | 69.8 | 3.64 | 2.73 | 2.18 |
| 9.1 | 27.8 | 1.45 | 1.09 | 0.87 | 36.9 | 1.92 | 1.44 | 1.15 | 46.9 | 2.44 | 1.83 | 1.47 | 57.9 | 3.01 | 2.26 | 1.81 | 69.5 | 3.62 | 2.72 | 2.17 | 70.6 | 3.68 | 2.76 | 2.21 |
| 9.2 | 27.8 | 1.45 | 1.09 | 0.87 | 36.9 | 1.92 | 1.44 | 1.15 | 47.0 | 2.45 | 1.84 | 1.47 | 58.0 | 3.02 | 2.26 | 1.81 | 69.7 | 3.63 | 2.72 | 2.18 | 71.3 | 3.72 | 2.79 | 2.23 |
| 9.3 | 27.8 | 1.46 | 1.09 | 0.87 | 36.9 | 1.92 | 1.44 | 1.15 | 47.1 | 2.45 | 1.84 | 1.47 | 58.1 | 3.02 | 2.27 | 1.81 | 69.8 | 3.64 | 2.73 | 2.18 | 72.1 | 3.75 | 2.82 | 2.25 |
| 9.4 | 27.8 | 1.45 | 1.09 | 0.87 | 36.9 | 1.92 | 1.44 | 1.15 | 47.1 | 2.45 | 1.84 | 1.47 | 58.2 | 3.03 | 2.27 | 1.82 | 70.0 | 3.65 | 2.73 | 2.19 | 72.8 | 3.79 | 2.84 | 2.28 |
| 9.5 | 27.8 | 1.45 | 1.09 | 0.87 | 37.0 | 1.92 | 1.44 | 1.15 | 47.2 | 2.46 | 1.84 | 1.47 | 58.3 | 3.03 | 2.28 | 1.82 | 70.1 | 3.65 | 2.74 | 2.19 | 73.6 | 3.83 | 2.87 | 2.30 |
| 9.6 | 27.8 | 1.45 | 1.09 | 0.87 | 37.0 | 1.93 | 1.44 | 1.16 | 47.2 | 2.46 | 1.84 | 1.48 | 58.3 | 3.04 | 2.28 | 1.82 | 70.3 | 3.66 | 2.75 | 2.20 | 74.3 | 3.87 | 2.90 | 2.32 |
| 9.7 | 27.8 | 1.45 | 1.09 | 0.87 | 37.0 | 1.93 | 1.45 | 1.16 | 47.3 | 2.46 | 1.85 | 1.48 | 58.4 | 3.04 | 2.28 | 1.83 | 70.4 | 3.67 | 2.75 | 2.20 | 75.0 | 3.91 | 2.93 | 2.35 |
| 9.8 | 27.8 | 1.45 | 1.09 | 0.87 | 37.0 | 1.93 | 1.45 | 1.16 | 47.3 | 2.46 | 1.85 | 1.46 | 58.5 | 3.05 | 2.29 | 1.83 | 70.6 | 3.67 | 2.76 | 2.20 | 75.8 | 3.95 | 2.96 | 2.37 |
| 9.9 | 27.8 | 1.45 | 1.09 | 0.87 | 37.0 | 1.93 | 1.45 | 1.16 | 47.3 | 2.47 | 1.85 | 1.48 | 58.6 | 3.05 | 2.29 | 1.83 | 70.7 | 3.68 | 2.76 | 2.21 | 76.5 | 3.99 | 2.99 | 2.39 |
| 10.0 | 27.8 | 1.45 | 1.09 | 0.87 | 37.0 | 1.93 | 1.45 | 1.16 | 47.4 | 2.47 | 1.85 | 1.46 | 58.7 | 3.06 | 2.29 | 1.83 | 70.8 | 3.69 | 2.77 | 2.21 | 77.3 | 4.02 | 3.02 | 2.41 |
| Trench Width m | | 0.6 | | | | 0.7 | | | | 0.8 | | | | 0.9 | | | | 1.0 | | | | 1.1 | | |

**TABLE 14. DESIGN LOADS**
**225 mm DIAMETER PIPE**

8 WHEELS 112.5kN
IMPACT FACTOR 1.3

| Cover | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 28 | 36 | 45 | kN/m | 28 | 36 | 45 | kN/m | 28 | 36 | 45 | kN/m | 28 | 36 | 45 | kN/m | 28 | 36 | 45 | kN/m | 28 | 36 | 45 |
| 0.6 | 38.0 | 1.70 | 1.32 | 1.06 | 38.0 | 1.70 | 1.32 | 1.06 | 38.0 | 1.70 | 1.32 | 1.06 | 38.0 | 1.70 | 1.32 | 1.06 | 38.0 | 1.70 | 1.32 | 1.06 | 38.0 | 1.70 | 1.32 | 1.06 |
| 0.7 | 34.4 | 1.53 | 1.19 | 0.96 | 34.4 | 1.53 | 1.19 | 0.96 | 34.4 | 1.53 | 1.19 | 0.96 | 34.4 | 1.53 | 1.19 | 0.96 | 34.4 | 1.53 | 1.19 | 0.96 | 34.4 | 1.53 | 1.19 | 0.96 |
| 0.8 | 31.9 | 1.42 | 1.11 | 0.89 | 31.9 | 1.42 | 1.11 | 0.89 | 31.9 | 1.42 | 1.11 | 0.89 | 31.9 | 1.42 | 1.11 | 0.89 | 31.9 | 1.42 | 1.11 | 0.89 | 31.9 | 1.42 | 1.11 | 0.89 |
| 0.9 | 30.1 | 1.34 | 1.05 | 0.84 | 30.1 | 1.34 | 1.05 | 0.84 | 30.1 | 1.34 | 1.05 | 0.84 | 30.1 | 1.34 | 1.05 | 0.84 | 30.1 | 1.34 | 1.05 | 0.84 | 30.1 | 1.34 | 1.05 | 0.84 |
| 1.0 | 28.9 | 1.29 | 1.00 | 0.80 | 28.9 | 1.29 | 1.00 | 0.80 | 28.9 | 1.29 | 1.00 | 0.80 | 28.9 | 1.29 | 1.00 | 0.80 | 28.9 | 1.29 | 1.00 | 0.80 | 28.9 | 1.29 | 1.00 | 0.80 |
| 1.1 | 28.1 | 1.25 | 0.98 | 0.78 | 28.1 | 1.25 | 0.98 | 0.78 | 28.1 | 1.25 | 0.98 | 0.78 | 28.1 | 1.25 | 0.98 | 0.78 | 28.1 | 1.25 | 0.98 | 0.78 | 28.1 | 1.25 | 0.98 | 0.78 |
| 1.2 | 27.6 | 1.23 | 0.96 | 0.77 | 27.6 | 1.23 | 0.96 | 0.77 | 27.6 | 1.23 | 0.96 | 0.77 | 27.6 | 1.23 | 0.96 | 0.77 | 27.6 | 1.23 | 0.96 | 0.77 | 27.6 | 1.23 | 0.96 | 0.77 |
| 1.3 | 27.3 | 1.22 | 0.95 | 0.76 | 27.3 | 1.22 | 0.95 | 0.76 | 27.3 | 1.22 | 0.95 | 0.76 | 27.3 | 1.22 | 0.95 | 0.76 | 27.3 | 1.22 | 0.95 | 0.76 | 27.3 | 1.22 | 0.95 | 0.76 |
| 1.4 | 27.1 | 1.21 | 0.94 | 0.75 | 27.1 | 1.21 | 0.94 | 0.75 | 27.1 | 1.21 | 0.94 | 0.75 | 27.1 | 1.21 | 0.94 | 0.75 | 27.1 | 1.21 | 0.94 | 0.75 | 27.1 | 1.21 | 0.94 | 0.75 |
| 1.5 | 27.1 | 1.21 | 0.94 | 0.75 | 27.1 | 1.21 | 0.94 | 0.75 | 27.1 | 1.21 | 0.94 | 0.75 | 27.1 | 1.21 | 0.94 | 0.75 | 27.1 | 1.21 | 0.94 | 0.75 | 27.1 | 1.21 | 0.94 | 0.75 |
| 1.6 | 27.2 | 1.22 | 0.95 | 0.76 | 27.2 | 1.22 | 0.95 | 0.76 | 27.2 | 1.22 | 0.95 | 0.76 | 27.2 | 1.22 | 0.95 | 0.76 | 27.2 | 1.22 | 0.95 | 0.76 | 27.2 | 1.22 | 0.95 | 0.76 |
| 1.7 | 27.4 | 1.22 | 0.95 | 0.76 | 27.4 | 1.22 | 0.95 | 0.76 | 27.4 | 1.22 | 0.95 | 0.76 | 27.4 | 1.22 | 0.95 | 0.76 | 27.4 | 1.22 | 0.95 | 0.76 | 27.4 | 1.22 | 0.95 | 0.76 |
| 1.8 | 27.7 | 1.23 | 0.96 | 0.77 | 27.7 | 1.23 | 0.96 | 0.77 | 27.7 | 1.23 | 0.96 | 0.77 | 27.7 | 1.23 | 0.96 | 0.77 | 27.7 | 1.23 | 0.96 | 0.77 | 27.7 | 1.23 | 0.96 | 0.77 |
| 1.9 | 28.0 | 1.25 | 0.97 | 0.78 | 28.0 | 1.25 | 0.97 | 0.78 | 28.0 | 1.25 | 0.97 | 0.78 | 28.0 | 1.25 | 0.97 | 0.78 | 28.0 | 1.25 | 0.97 | 0.78 | 28.0 | 1.25 | 0.97 | 0.78 |
| 2.0 | 28.4 | 1.27 | 0.99 | 0.79 | 28.4 | 1.27 | 0.99 | 0.79 | 28.4 | 1.27 | 0.99 | 0.79 | 28.4 | 1.27 | 0.99 | 0.79 | 28.4 | 1.27 | 0.99 | 0.79 | 28.4 | 1.27 | 0.99 | 0.79 |
| 2.1 | 28.8 | 1.29 | 1.00 | 0.80 | 28.8 | 1.29 | 1.00 | 0.80 | 28.8 | 1.29 | 1.00 | 0.80 | 28.8 | 1.29 | 1.00 | 0.80 | 28.8 | 1.29 | 1.00 | 0.80 | 28.8 | 1.29 | 1.00 | 0.80 |
| 2.2 | 29.3 | 1.31 | 1.02 | 0.81 | 29.3 | 1.31 | 1.02 | 0.81 | 29.3 | 1.31 | 1.02 | 0.81 | 29.3 | 1.31 | 1.02 | 0.81 | 29.3 | 1.31 | 1.02 | 0.81 | 29.3 | 1.31 | 1.02 | 0.81 |
| 2.3 | 29.7 | 1.33 | 1.03 | 0.83 | 29.7 | 1.33 | 1.03 | 0.83 | 29.7 | 1.33 | 1.03 | 0.83 | 29.7 | 1.33 | 1.03 | 0.83 | 29.7 | 1.33 | 1.03 | 0.83 | 29.7 | 1.33 | 1.03 | 0.83 |
| 2.4 | 30.2 | 1.35 | 1.05 | 0.84 | 30.2 | 1.35 | 1.05 | 0.84 | 30.2 | 1.35 | 1.05 | 0.84 | 30.2 | 1.35 | 1.05 | 0.84 | 30.2 | 1.35 | 1.05 | 0.84 | 30.2 | 1.35 | 1.05 | 0.84 |
| 2.5 | 30.7 | 1.37 | 1.07 | 0.85 | 30.7 | 1.37 | 1.07 | 0.85 | 30.7 | 1.37 | 1.07 | 0.85 | 30.7 | 1.37 | 1.07 | 0.85 | 30.7 | 1.37 | 1.07 | 0.85 | 30.7 | 1.37 | 1.07 | 0.85 |
| 2.6 | 31.3 | 1.40 | 1.09 | 0.87 | 31.3 | 1.40 | 1.09 | 0.87 | 31.3 | 1.40 | 1.09 | 0.87 | 31.3 | 1.40 | 1.09 | 0.87 | 31.3 | 1.40 | 1.09 | 0.87 | 31.3 | 1.40 | 1.09 | 0.87 |
| 2.7 | **31.8** | **1.42** | **1.10** | **0.88** | 31.8 | 1.42 | 1.10 | 0.88 | 31.8 | 1.42 | 1.10 | 0.88 | 31.8 | 1.42 | 1.10 | 0.88 | 31.8 | 1.42 | 1.10 | 0.88 | 31.8 | 1.42 | 1.10 | 0.88 |
| 2.8 | **31.9** | **1.43** | **1.11** | **0.89** | 32.3 | 1.44 | 1.12 | 0.90 | 32.3 | 1.44 | 1.12 | 0.90 | 32.3 | 1.44 | 1.12 | 0.90 | 32.3 | 1.44 | 1.12 | 0.90 | 32.3 | 1.44 | 1.12 | 0.90 |
| 2.9 | **32.1** | **1.43** | **1.11** | **0.89** | 32.9 | 1.47 | 1.14 | 0.91 | 32.9 | 1.47 | 1.14 | 0.91 | 32.9 | 1.47 | 1.14 | 0.91 | 32.9 | 1.47 | 1.14 | 0.91 | 32.9 | 1.47 | 1.14 | 0.91 |
| 3.0 | **32.3** | **1.44** | **1.12** | **0.90** | 33.5 | 1.50 | 1.16 | 0.93 | 33.5 | 1.50 | 1.16 | 0.93 | 33.5 | 1.50 | 1.16 | 0.93 | 33.5 | 1.50 | 1.16 | 0.93 | 33.5 | 1.50 | 1.16 | 0.93 |
| 3.1 | **32.4** | **1.45** | **1.13** | **0.90** | 34.1 | 1.52 | 1.18 | 0.95 | 34.1 | 1.52 | 1.18 | 0.95 | 34.1 | 1.52 | 1.18 | 0.95 | 34.1 | 1.52 | 1.18 | 0.95 | 34.1 | 1.52 | 1.18 | 0.95 |
| 3.2 | **32.6** | **1.46** | **1.13** | **0.91** | 34.7 | 1.55 | 1.21 | 0.96 | 34.7 | 1.55 | 1.21 | 0.96 | 34.7 | 1.55 | 1.21 | 0.96 | 34.7 | 1.55 | 1.21 | 0.96 | 34.7 | 1.55 | 1.21 | 0.96 |
| 3.3 | **32.8** | **1.46** | **1.14** | **0.91** | 35.3 | 1.58 | 1.23 | 0.98 | 35.3 | 1.58 | 1.23 | 0.98 | 35.3 | 1.58 | 1.23 | 0.98 | 35.3 | 1.58 | 1.23 | 0.98 | 35.3 | 1.58 | 1.23 | 0.98 |
| 3.4 | **32.9** | **1.47** | **1.14** | **0.91** | 36.0 | 1.61 | 1.25 | 1.00 | 36.0 | 1.61 | 1.25 | 1.00 | 36.0 | 1.61 | 1.25 | 1.00 | 36.0 | 1.61 | 1.25 | 1.00 | 36.0 | 1.61 | 1.25 | 1.00 |
| 3.5 | **33.1** | **1.48** | **1.15** | **0.92** | 36.6 | 1.63 | 1.27 | 1.02 | 36.6 | 1.63 | 1.27 | 1.02 | 36.6 | 1.63 | 1.27 | 1.02 | 36.6 | 1.63 | 1.27 | 1.02 | 36.6 | 1.63 | 1.27 | 1.02 |
| 3.6 | **33.2** | **1.48** | **1.15** | **0.92** | 37.3 | 1.66 | 1.29 | 1.03 | 37.3 | 1.66 | 1.29 | 1.03 | 37.3 | 1.66 | 1.29 | 1.03 | 37.3 | 1.66 | 1.29 | 1.03 | 37.3 | 1.66 | 1.29 | 1.03 |
| 3.7 | **33.4** | **1.49** | **1.16** | **0.93** | 37.9 | 1.69 | 1.32 | 1.05 | 37.9 | 1.69 | 1.32 | 1.05 | 37.9 | 1.69 | 1.32 | 1.05 | 37.9 | 1.69 | 1.32 | 1.05 | 37.9 | 1.69 | 1.32 | 1.05 |
| 3.8 | **33.5** | **1.50** | **1.16** | **0.93** | 38.6 | 1.72 | 1.34 | 1.07 | 38.6 | 1.72 | 1.34 | 1.07 | 38.6 | 1.72 | 1.34 | 1.07 | 38.6 | 1.72 | 1.34 | 1.07 | 38.6 | 1.72 | 1.34 | 1.07 |
| 3.9 | **33.6** | **1.50** | **1.17** | **0.93** | 39.3 | 1.75 | 1.36 | 1.09 | 39.3 | 1.75 | 1.36 | 1.09 | 39.3 | 1.75 | 1.36 | 1.09 | 39.3 | 1.75 | 1.36 | 1.09 | 39.3 | 1.75 | 1.36 | 1.09 |
| 4.0 | **33.8** | **1.51** | **1.17** | **0.94** | 40.0 | 1.78 | 1.39 | 1.11 | 40.0 | 1.78 | 1.39 | 1.11 | 40.0 | 1.78 | 1.39 | 1.11 | 40.0 | 1.78 | 1.39 | 1.11 | 40.0 | 1.78 | 1.39 | 1.11 |
| 4.1 | **33.9** | **1.51** | **1.18** | **0.94** | **40.5** | **1.81** | **1.41** | **1.13** | 40.7 | 1.82 | 1.41 | 1.13 | 40.7 | 1.82 | 1.41 | 1.13 | 40.7 | 1.82 | 1.41 | 1.13 | 40.7 | 1.82 | 1.41 | 1.13 |
| 4.2 | **34.0** | **1.52** | **1.18** | **0.95** | **40.8** | **1.82** | **1.42** | **1.13** | 41.4 | 1.85 | 1.44 | 1.15 | 41.4 | 1.85 | 1.44 | 1.15 | 41.4 | 1.85 | 1.44 | 1.15 | 41.4 | 1.85 | 1.44 | 1.15 |
| 4.3 | **34.1** | **1.52** | **1.19** | **0.95** | **41.0** | **1.83** | **1.42** | **1.14** | 42.1 | 1.88 | 1.46 | 1.17 | 42.1 | 1.88 | 1.46 | 1.17 | 42.1 | 1.88 | 1.46 | 1.17 | 42.1 | 1.88 | 1.46 | 1.17 |
| 4.4 | **34.3** | **1.53** | **1.19** | **0.95** | **41.2** | **1.84** | **1.43** | **1.15** | 42.8 | 1.91 | 1.49 | 1.19 | 42.8 | 1.91 | 1.49 | 1.19 | 42.8 | 1.91 | 1.49 | 1.19 | 42.8 | 1.91 | 1.49 | 1.19 |
| 4.5 | **34.4** | **1.53** | **1.19** | **0.96** | **41.5** | **1.85** | **1.44** | **1.15** | 43.5 | 1.94 | 1.51 | 1.21 | 43.5 | 1.94 | 1.51 | 1.21 | 43.5 | 1.94 | 1.51 | 1.21 | 43.5 | 1.94 | 1.51 | 1.21 |
| 4.6 | **34.5** | **1.54** | **1.20** | **0.96** | **41.7** | **1.86** | **1.45** | **1.16** | 44.3 | 1.98 | 1.54 | 1.23 | 44.3 | 1.98 | 1.54 | 1.23 | 44.3 | 1.98 | 1.54 | 1.23 | 44.3 | 1.98 | 1.54 | 1.23 |
| 4.7 | **34.6** | **1.54** | **1.20** | **0.96** | **41.9** | **1.87** | **1.45** | **1.16** | 45.0 | 2.01 | 1.56 | 1.25 | 45.0 | 2.01 | 1.56 | 1.25 | 45.0 | 2.01 | 1.56 | 1.25 | 45.0 | 2.01 | 1.56 | 1.25 |
| 4.8 | **34.7** | **1.55** | **1.21** | **0.96** | **42.1** | **1.88** | **1.46** | **1.17** | 45.7 | 2.04 | 1.59 | 1.27 | 45.7 | 2.04 | 1.59 | 1.27 | 45.7 | 2.04 | 1.59 | 1.27 | 45.7 | 2.04 | 1.59 | 1.27 |
| 4.9 | **34.8** | **1.55** | **1.21** | **0.97** | **42.3** | **1.89** | **1.47** | **1.17** | 46.5 | 2.08 | 1.61 | 1.29 | 46.5 | 2.08 | 1.61 | 1.29 | 46.5 | 2.08 | 1.61 | 1.29 | 46.5 | 2.08 | 1.61 | 1.29 |
| 5.0 | **34.9** | **1.58** | **1.21** | **0.97** | **42.5** | **1.90** | **1.48** | **1.18** | 47.2 | 2.11 | 1.64 | 1.31 | 47.2 | 2.11 | 1.64 | 1.31 | 47.2 | 2.11 | 1.64 | 1.31 | 47.2 | 2.11 | 1.64 | 1.31 |
| 5.1 | **35.0** | **1.58** | **1.22** | **0.97** | **42.7** | **1.91** | **1.48** | **1.19** | 48.0 | 2.14 | 1.67 | 1.33 | 48.0 | 2.14 | 1.67 | 1.33 | 48.0 | 2.14 | 1.67 | 1.33 | 48.0 | 2.14 | 1.67 | 1.33 |
| 5.2 | **35.1** | **1.57** | **1.22** | **0.98** | **42.9** | **1.91** | **1.49** | **1.19** | 48.8 | 2.18 | 1.69 | 1.35 | 48.8 | 2.18 | 1.69 | 1.35 | 48.8 | 2.18 | 1.69 | 1.35 | 48.8 | 2.18 | 1.69 | 1.35 |
| 5.3 | **35.2** | **1.57** | **1.22** | **0.98** | **43.1** | **1.92** | **1.49** | **1.20** | 49.5 | 2.21 | 1.72 | 1.38 | 49.5 | 2.21 | 1.72 | 1.38 | 49.5 | 2.21 | 1.72 | 1.38 | 49.5 | 2.21 | 1.72 | 1.38 |
| 5.4 | **35.3** | **1.58** | **1.23** | **0.98** | **43.2** | **1.93** | **1.50** | **1.20** | 50.3 | 2.25 | 1.75 | 1.40 | 50.3 | 2.25 | 1.75 | 1.40 | 50.3 | 2.25 | 1.75 | 1.40 | 50.3 | 2.25 | 1.75 | 1.40 |
| 5.5 | **35.4** | **1.58** | **1.23** | **0.98** | **43.4** | **1.94** | **1.51** | **1.21** | 51.1 | 2.28 | 1.77 | 1.42 | 51.1 | 2.28 | 1.77 | 1.42 | 51.1 | 2.28 | 1.77 | 1.42 | 51.1 | 2.28 | 1.77 | 1.42 |
| 5.6 | **35.5** | **1.58** | **1.23** | **0.98** | **43.6** | **1.94** | **1.51** | **1.21** | 51.9 | 2.32 | 1.80 | 1.44 | 51.9 | 2.32 | 1.80 | 1.44 | 51.9 | 2.32 | 1.80 | 1.44 | 51.9 | 2.32 | 1.80 | 1.44 |
| 5.7 | **35.5** | **1.59** | **1.23** | **0.99** | **43.7** | **1.95** | **1.52** | **1.21** | **52.3** | **2.34** | **1.82** | **1.45** | **52.7** | 2.35 | 1.83 | 1.46 | 52.7 | 2.35 | 1.83 | 1.46 | 52.7 | 2.35 | 1.83 | 1.46 |
| 5.8 | **35.6** | **1.59** | **1.24** | **0.99** | **43.9** | **1.96** | **1.52** | **1.22** | **52.6** | **2.35** | **1.83** | **1.46** | **53.4** | 2.39 | 1.86 | 1.48 | 53.4 | 2.39 | 1.86 | 1.48 | 53.4 | 2.39 | 1.86 | 1.48 |
| 5.9 | **35.7** | **1.59** | **1.24** | **0.99** | **44.0** | **1.97** | **1.53** | **1.22** | **52.8** | **2.36** | **1.83** | **1.47** | **54.2** | 2.42 | 1.88 | 1.51 | 54.2 | 2.42 | 1.88 | 1.51 | 54.2 | 2.42 | 1.88 | 1.51 |
| 6.0 | **35.8** | **1.60** | **1.24** | **0.99** | **44.2** | **1.97** | **1.53** | **1.23** | **53.1** | **2.37** | **1.84** | **1.47** | **55.0** | 2.46 | 1.91 | 1.53 | 55.0 | 2.46 | 1.91 | 1.53 | 55.0 | 2.46 | 1.91 | 1.53 |
| 6.1 | **35.8** | **1.60** | **1.24** | **1.00** | **44.3** | **1.98** | **1.54** | **1.23** | **53.3** | **2.38** | **1.85** | **1.48** | **55.8** | 2.49 | 1.94 | 1.55 | 55.8 | 2.49 | 1.94 | 1.55 | 55.8 | 2.49 | 1.94 | 1.55 |
| 6.2 | **35.9** | **1.60** | **1.25** | **1.00** | **44.5** | **1.99** | **1.54** | **1.24** | **53.5** | **2.39** | **1.86** | **1.49** | **56.6** | 2.53 | 1.97 | 1.57 | 56.6 | 2.53 | 1.97 | 1.57 | 56.6 | 2.53 | 1.97 | 1.57 |
| 6.3 | **36.0** | **1.61** | **1.25** | **1.00** | **44.6** | **1.99** | **1.55** | **1.24** | **53.8** | **2.40** | **1.87** | **1.49** | **57.4** | 2.56 | 1.99 | 1.60 | 57.4 | 2.56 | 1.99 | 1.60 | 57.4 | 2.56 | 1.99 | 1.60 |
| 6.4 | **36.0** | **1.61** | **1.25** | **1.00** | **44.7** | **2.00** | **1.55** | **1.24** | **54.0** | **2.41** | **1.87** | **1.50** | **58.2** | 2.60 | 2.02 | 1.62 | 58.2 | 2.60 | 2.02 | 1.62 | 58.2 | 2.60 | 2.02 | 1.62 |
| 6.5 | **36.1** | **1.61** | **1.25** | **1.00** | **44.9** | **2.00** | **1.58** | **1.25** | **54.2** | **2.42** | **1.88** | **1.51** | **59.0** | 2.64 | 2.05 | 1.64 | 59.0 | 2.64 | 2.05 | 1.64 | 59.0 | 2.64 | 2.05 | 1.64 |
| 6.6 | **36.1** | **1.61** | **1.25** | **1.00** | **45.0** | **2.01** | **1.58** | **1.25** | **54.4** | **2.43** | **1.89** | **1.51** | **59.9** | 2.67 | 2.08 | 1.66 | 59.9 | 2.67 | 2.08 | 1.66 | 59.9 | 2.67 | 2.08 | 1.66 |
| 6.7 | **36.2** | **1.62** | **1.26** | **1.01** | **45.1** | **2.01** | **1.57** | **1.25** | **54.6** | **2.44** | **1.90** | **1.52** | **60.7** | 2.71 | 2.11 | 1.69 | 60.7 | 2.71 | 2.11 | 1.69 | 60.7 | 2.71 | 2.11 | 1.69 |
| 6.8 | **36.3** | **1.62** | **1.26** | **1.01** | **45.2** | **2.02** | **1.57** | **1.26** | **54.8** | **2.45** | **1.90** | **1.52** | **61.5** | 2.74 | 2.13 | 1.71 | 61.5 | 2.74 | 2.13 | 1.71 | 61.5 | 2.74 | 2.13 | 1.71 |
| 6.9 | **36.3** | **1.62** | **1.26** | **1.01** | **45.3** | **2.02** | **1.57** | **1.26** | **55.0** | **2.45** | **1.91** | **1.53** | **62.3** | 2.78 | 2.16 | 1.73 | 62.3 | 2.78 | 2.16 | 1.73 | 62.3 | 2.78 | 2.16 | 1.73 |
| 7.0 | **36.4** | **1.62** | **1.26** | **1.01** | **45.5** | **2.03** | **1.58** | **1.26** | **55.2** | **2.46** | **1.91** | **1.53** | **63.1** | 2.82 | 2.19 | 1.75 | 63.1 | 2.82 | 2.19 | 1.75 | 63.1 | 2.82 | 2.19 | 1.75 |
| 7.1 | **36.4** | **1.63** | **1.26** | **1.01** | **45.6** | **2.03** | **1.58** | **1.27** | **55.3** | **2.47** | **1.92** | **1.54** | **63.9** | 2.85 | 2.22 | 1.78 | 63.9 | 2.85 | 2.22 | 1.78 | 63.9 | 2.85 | 2.22 | 1.78 |
| 7.2 | **36.4** | **1.63** | **1.27** | **1.01** | **45.7** | **2.04** | **1.59** | **1.27** | **55.5** | **2.48** | **1.93** | **1.54** | **64.8** | 2.89 | 2.25 | 1.80 | 64.8 | 2.89 | 2.25 | 1.80 | 64.8 | 2.89 | 2.25 | 1.80 |
| 7.3 | **36.5** | **1.63** | **1.27** | **1.01** | **45.8** | **2.04** | **1.59** | **1.27** | **55.7** | **2.49** | **1.93** | **1.55** | **65.6** | 2.93 | 2.28 | 1.82 | 65.6 | 2.93 | 2.28 | 1.82 | 65.6 | 2.93 | 2.28 | 1.82 |
| 7.4 | **36.5** | **1.63** | **1.27** | **1.01** | **45.9** | **2.05** | **1.59** | **1.27** | **55.8** | **2.49** | **1.94** | **1.55** | **86.4** | **2.96** | **2.30** | **1.84** | **66.4** | 2.96 | 2.31 | 1.84 | 66.4 | 2.96 | 2.31 | 1.84 |
| 7.5 | **36.6** | **1.63** | **1.27** | **1.02** | **46.0** | **2.05** | **1.60** | **1.28** | **56.0** | **2.50** | **1.94** | **1.56** | **66.6** | **2.97** | **2.31** | **1.85** | **67.2** | 3.00 | 2.33 | 1.87 | 67.2 | 3.00 | 2.33 | 1.87 |
| 7.6 | **36.6** | **1.63** | **1.27** | **1.02** | **46.0** | **2.06** | **1.60** | **1.28** | **58.1** | **2.51** | **1.95** | **1.56** | **86.8** | **2.98** | **2.32** | **1.66** | **68.1** | 3.04 | 2.36 | 1.89 | 68.1 | 3.04 | 2.36 | 1.89 |
| 7.7 | **36.7** | **1.64** | **1.27** | **1.02** | **46.1** | **2.06** | **1.60** | **1.28** | **58.3** | **2.51** | **1.95** | **1.58** | **87.1** | **2.99** | **2.33** | **1.86** | **68.9** | 3.08 | 2.39 | 1.91 | 68.9 | 3.08 | 2.39 | 1.91 |
| 7.8 | **36.7** | **1.64** | **1.27** | **1.02** | **46.2** | **2.06** | **1.60** | **1.28** | **58.4** | **2.52** | **1.98** | **1.57** | **87.3** | **3.00** | **2.34** | **1.87** | **69.7** | 3.11 | 2.42 | 1.94 | 69.7 | 3.11 | 2.42 | 1.94 |
| 7.9 | **36.7** | **1.64** | **1.28** | **1.02** | **46.3** | **2.07** | **1.81** | **1.29** | **58.6** | **2.53** | **1.98** | **1.57** | **87.5** | **3.01** | **2.34** | **1.87** | **70.6** | 3.15 | 2.45 | 1.96 | 70.6 | 3.15 | 2.45 | 1.96 |
| 8.0 | **36.8** | **1.64** | **1.28** | **1.02** | **46.4** | **2.07** | **1.61** | **1.29** | **56.7** | **2.53** | **1.97** | **1.58** | **87.7** | **3.02** | **2.35** | **1.88** | **71.4** | 3.19 | 2.48 | 1.98 | 71.4 | 3.19 | 2.48 | 1.98 |
| 8.1 | **36.8** | **1.64** | **1.28** | **1.02** | **46.5** | **2.07** | **1.81** | **1.29** | **56.9** | **2.54** | **1.97** | **1.58** | **87.9** | **3.03** | **2.36** | **1.89** | **72.2** | 3.22 | 2.51 | 2.01 | 72.2 | 3.22 | 2.51 | 2.01 |
| 8.2 | **36.8** | **1.64** | **1.28** | **1.02** | **46.5** | **2.08** | **1.62** | **1.29** | **57.0** | **2.54** | **1.98** | **1.58** | **68.1** | **3.04** | **2.36** | **1.89** | **73.1** | 3.26 | 2.54 | 2.03 | 73.1 | 3.26 | 2.54 | 2.03 |
| 8.3 | **36.8** | **1.64** | **1.28** | **1.02** | **46.6** | **2.08** | **1.62** | **1.29** | **57.1** | **2.55** | **1.98** | **1.59** | **68.3** | **3.05** | **2.37** | **1.90** | **73.9** | 3.30 | 2.57 | 2.05 | 73.9 | 3.30 | 2.57 | 2.05 |
| 8.4 | **36.9** | **1.85** | **1.28** | **1.02** | **46.7** | **2.08** | **1.62** | **1.30** | **57.2** | **2.56** | **1.99** | **1.59** | **68.5** | **3.06** | **2.38** | **1.90** | **74.8** | 3.34 | 2.60 | 2.08 | 74.8 | 3.34 | 2.60 | 2.08 |
| 8.5 | **36.9** | **1.85** | **1.28** | **1.03** | **46.7** | **2.09** | **1.62** | **1.30** | **57.4** | **2.56** | **1.99** | **1.59** | **68.7** | **3.07** | **2.38** | **1.91** | **75.6** | 3.37 | 2.62 | 2.10 | 75.6 | 3.37 | 2.62 | 2.10 |
| 8.6 | **36.9** | **1.85** | **1.28** | **1.03** | **46.8** | **2.09** | **1.63** | **1.30** | **57.5** | **2.57** | **2.00** | **1.80** | **68.9** | **3.07** | **2.39** | **1.91** | **76.4** | 3.41 | 2.65 | 2.12 | 76.4 | 3.41 | 2.65 | 2.12 |
| 8.7 | **37.0** | **1.85** | **1.28** | **1.03** | **46.9** | **2.09** | **1.63** | **1.30** | **57.6** | **2.57** | **2.00** | **1.80** | **89.0** | **3.08** | **2.40** | **1.92** | **77.3** | 3.45 | 2.68 | 2.15 | 77.3 | 3.45 | 2.68 | 2.15 |
| 8.8 | **37.0** | **1.65** | **1.28** | **1.03** | **46.9** | **2.10** | **1.63** | **1.30** | **57.7** | **2.58** | **2.00** | **1.60** | **69.2** | **3.09** | **2.40** | **1.92** | **78.1** | 3.49 | 2.71 | 2.17 | 78.1 | 3.49 | 2.71 | 2.17 |
| 8.9 | **37.0** | **1.85** | **1.28** | **1.03** | **47.0** | **2.10** | **1.63** | **1.31** | **57.8** | **2.58** | **2.01** | **1.61** | **69.4** | **3.10** | **2.41** | **1.93** | **79.0** | 3.53 | 2.74 | 2.19 | 79.0 | 3.53 | 2.74 | 2.19 |
| 9.0 | **37.0** | **1.65** | **1.29** | **1.03** | **47.0** | **2.10** | **1.63** | **1.31** | **57.9** | **2.59** | **2.01** | **1.61** | **69.5** | **3.10** | **2.41** | **1.93** | **79.8** | 3.56 | 2.77 | 2.22 | 79.8 | 3.56 | 2.77 | 2.22 |
| 9.1 | **37.0** | **1.65** | **1.29** | **1.03** | **47.1** | **2.10** | **1.64** | **1.31** | **58.0** | **2.59** | **2.01** | **1.81** | **69.7** | **3.11** | **2.42** | **1.94** | **80.7** | 3.60 | 2.80 | 2.24 | 80.7 | 3.60 | 2.80 | 2.24 |
| 9.2 | **37.1** | **1.65** | **1.29** | **1.03** | **47.2** | **2.11** | **1.84** | **1.31** | **58.1** | **2.59** | **2.02** | **1.81** | **69.8** | **3.12** | **2.43** | **1.94** | **81.5** | 3.64 | 2.83 | 2.26 | 81.5 | 3.64 | 2.83 | 2.26 |
| 9.3 | **37.1** | **1.66** | **1.29** | **1.03** | **47.2** | **2.11** | **1.84** | **1.31** | **58.2** | **2.60** | **2.02** | **1.62** | **70.0** | **3.12** | **2.43** | **1.94** | **82.3** | 3.68 | 2.86 | 2.29 | 82.3 | 3.68 | 2.86 | 2.29 |
| 9.4 | **37.1** | **1.66** | **1.29** | **1.03** | **47.3** | **2.11** | **1.64** | **1.31** | **58.3** | **2.60** | **2.02** | **1.62** | **70.1** | **3.13** | **2.44** | **1.95** | **82.6** | **3.69** | **2.87** | **2.30** | 83.2 | 3.71 | 2.89 | 2.31 |
| 9.5 | **37.1** | **1.66** | **1.29** | **1.03** | **47.3** | **2.11** | **1.64** | **1.31** | **58.4** | **2.61** | **2.03** | **1.62** | **70.3** | **3.14** | **2.44** | **1.95** | **82.8** | **3.70** | **2.88** | **2.30** | 84.0 | 3.75 | 2.92 | 2.33 |
| 9.6 | **37.1** | **1.66** | **1.29** | **1.03** | **47.4** | **2.11** | **1.84** | **1.32** | **58.5** | **2.81** | **2.03** | **1.62** | **70.4** | **3.14** | **2.45** | **1.98** | **83.0** | **3.71** | **2.88** | **2.31** | 84.9 | 3.79 | 2.95 | 2.36 |
| 9.7 | **37.1** | **1.66** | **1.29** | **1.03** | **47.4** | **2.12** | **1.65** | **1.32** | **58.6** | **2.62** | **2.03** | **1.63** | **70.6** | **3.15** | **2.45** | **1.96** | **83.2** | **3.72** | **2.89** | **2.31** | 85.7 | 3.83 | 2.98 | 2.38 |
| 9.8 | **37.2** | **1.66** | **1.29** | **1.03** | **47.4** | **2.12** | **1.65** | **1.32** | **58.7** | **2.62** | **2.04** | **1.63** | **70.7** | **3.16** | **2.45** | **1.96** | **83.4** | **3.72** | **2.90** | **2.32** | 86.6 | 3.87 | 3.01 | 2.41 |
| 9.9 | **37.2** | **1.66** | **1.29** | **1.03** | **47.5** | **2.12** | **1.65** | **1.32** | **58.7** | **2.62** | **2.04** | **1.63** | **70.8** | **3.18** | **2.46** | **1.97** | **83.6** | **3.73** | **2.90** | **2.32** | 87.4 | 3.90 | 3.04 | 2.43 |
| 10.0 | **37.2** | **1.66** | **1.29** | **1.03** | **47.5** | **2.12** | **1.65** | **1.32** | **58.8** | **2.63** | **2.04** | **1.63** | **71.0** | **3.17** | **2.46** | **1.97** | **83.8** | **3.74** | **2.91** | **2.33** | 88.3 | 3.94 | 3.07 | 2.45 |
| Trench Width m | | 0.7 | | | | 0.8 | | | | 0.9 | | | | 1.0 | | | | 1.1 | | | | 1.2 | | |

## TABLE 15. DESIGN LOADS
## 300 mm DIAMETER PIPE

8 WHEELS 112.5kN
IMPACT FACTOR 1.3

| Cover | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | | Design Load | Min Bedding Factor Crushing Strength kN/m | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 36 | 48 | 60 | kN/m | 36 | 48 | 60 | kN/m | 36 | 48 | 60 | kN/m | 36 | 48 | 60 | kN/m | 36 | 48 | 60 | kN/m | 36 | 48 | 60 |
| 0.6 | 49.1 | 1.71 | 1.28 | 1.02 | 49.1 | 1.71 | 1.28 | 1.02 | 49.1 | 1.71 | 1.28 | 1.02 | 49.1 | 1.71 | 1.28 | 1.02 | 49.1 | 1.71 | 1.28 | 1.02 | 49.1 | 1.71 | 1.28 | 1.02 |
| 0.7 | 44.7 | 1.55 | 1.16 | 0.93 | 44.7 | 1.55 | 1.16 | 0.93 | 44.7 | 1.55 | 1.16 | 0.93 | 44.7 | 1.55 | 1.16 | 0.93 | 44.7 | 1.55 | 1.16 | 0.93 | 44.7 | 1.55 | 1.16 | 0.93 |
| 0.8 | 41.9 | 1.46 | 1.09 | 0.87 | 41.9 | 1.46 | 1.09 | 0.87 | 41.9 | 1.46 | 1.09 | 0.87 | 41.9 | 1.46 | 1.09 | 0.87 | 41.9 | 1.46 | 1.09 | 0.87 | 41.9 | 1.46 | 1.09 | 0.87 |
| 0.9 | 39.6 | 1.38 | 1.03 | 0.83 | 39.6 | 1.38 | 1.03 | 0.83 | 39.6 | 1.38 | 1.03 | 0.83 | 39.6 | 1.38 | 1.03 | 0.83 | 39.6 | 1.38 | 1.03 | 0.83 | 39.6 | 1.38 | 1.03 | 0.83 |
| 1.0 | 38.1 | 1.32 | 0.99 | 0.79 | 38.1 | 1.32 | 0.99 | 0.79 | 38.1 | 1.32 | 0.99 | 0.79 | 38.1 | 1.32 | 0.99 | 0.79 | 38.1 | 1.32 | 0.99 | 0.79 | 38.1 | 1.32 | 0.99 | 0.79 |
| 1.1 | 37.0 | 1.29 | 0.96 | 0.77 | 37.0 | 1.29 | 0.96 | 0.77 | 37.0 | 1.29 | 0.96 | 0.77 | 37.0 | 1.29 | 0.96 | 0.77 | 37.0 | 1.29 | 0.96 | 0.77 | 37.0 | 1.29 | 0.96 | 0.77 |
| 1.2 | 36.3 | 1.26 | 0.95 | 0.76 | 36.3 | 1.26 | 0.95 | 0.76 | 36.3 | 1.26 | 0.95 | 0.76 | 36.3 | 1.26 | 0.95 | 0.76 | 36.3 | 1.26 | 0.95 | 0.76 | 36.3 | 1.26 | 0.95 | 0.76 |
| 1.3 | 35.9 | 1.25 | 0.94 | 0.75 | 35.9 | 1.25 | 0.94 | 0.75 | 35.9 | 1.25 | 0.94 | 0.75 | 35.9 | 1.25 | 0.94 | 0.75 | 35.9 | 1.25 | 0.94 | 0.75 | 35.9 | 1.25 | 0.94 | 0.75 |
| 1.4 | 35.7 | 1.24 | 0.93 | 0.74 | 35.7 | 1.24 | 0.93 | 0.74 | 35.7 | 1.24 | 0.93 | 0.74 | 35.7 | 1.24 | 0.93 | 0.74 | 35.7 | 1.24 | 0.93 | 0.74 | 35.7 | 1.24 | 0.93 | 0.74 |
| 1.5 | 35.7 | 1.24 | 0.93 | 0.74 | 35.7 | 1.24 | 0.93 | 0.74 | 35.7 | 1.24 | 0.93 | 0.74 | 35.7 | 1.24 | 0.93 | 0.74 | 35.7 | 1.24 | 0.93 | 0.74 | 35.7 | 1.24 | 0.93 | 0.74 |
| 1.6 | 35.9 | 1.25 | 0.93 | 0.75 | 35.9 | 1.25 | 0.93 | 0.75 | 35.9 | 1.25 | 0.93 | 0.75 | 35.9 | 1.25 | 0.93 | 0.75 | 35.9 | 1.25 | 0.93 | 0.75 | 35.9 | 1.25 | 0.93 | 0.75 |
| 1.7 | 36.1 | 1.25 | 0.94 | 0.75 | 36.1 | 1.25 | 0.94 | 0.75 | 36.1 | 1.25 | 0.94 | 0.75 | 36.1 | 1.25 | 0.94 | 0.75 | 36.1 | 1.25 | 0.94 | 0.75 | 36.1 | 1.25 | 0.94 | 0.75 |
| 1.8 | 36.5 | 1.27 | 0.95 | 0.76 | 36.5 | 1.27 | 0.95 | 0.76 | 36.5 | 1.27 | 0.95 | 0.76 | 36.5 | 1.27 | 0.95 | 0.76 | 36.5 | 1.27 | 0.95 | 0.76 | 36.5 | 1.27 | 0.95 | 0.76 |
| 1.9 | 37.0 | 1.28 | 0.96 | 0.77 | 37.0 | 1.28 | 0.96 | 0.77 | 37.0 | 1.28 | 0.96 | 0.77 | 37.0 | 1.28 | 0.96 | 0.77 | 37.0 | 1.28 | 0.96 | 0.77 | 37.0 | 1.28 | 0.96 | 0.77 |
| 2.0 | 37.5 | 1.30 | 0.98 | 0.78 | 37.5 | 1.30 | 0.98 | 0.78 | 37.5 | 1.30 | 0.98 | 0.78 | 37.5 | 1.30 | 0.98 | 0.78 | 37.5 | 1.30 | 0.98 | 0.78 | 37.5 | 1.30 | 0.98 | 0.78 |
| 2.1 | 37.9 | 1.32 | 0.99 | 0.79 | 38.0 | 1.32 | 0.99 | 0.79 | 38.0 | 1.32 | 0.99 | 0.79 | 38.0 | 1.32 | 0.99 | 0.79 | 38.0 | 1.32 | 0.99 | 0.79 | 38.0 | 1.32 | 0.99 | 0.79 |
| 2.2 | 38.1 | 1.32 | 0.99 | 0.79 | 38.6 | 1.34 | 1.01 | 0.80 | 38.6 | 1.34 | 1.01 | 0.80 | 38.6 | 1.34 | 1.01 | 0.80 | 38.6 | 1.34 | 1.01 | 0.80 | 38.6 | 1.34 | 1.01 | 0.80 |
| 2.3 | 38.4 | 1.33 | 1.00 | 0.80 | 39.2 | 1.36 | 1.02 | 0.82 | 39.2 | 1.36 | 1.02 | 0.82 | 39.2 | 1.36 | 1.02 | 0.82 | 39.2 | 1.36 | 1.02 | 0.82 | 39.2 | 1.36 | 1.02 | 0.82 |
| 2.4 | 38.6 | 1.34 | 1.00 | 0.80 | 39.9 | 1.38 | 1.04 | 0.83 | 39.9 | 1.38 | 1.04 | 0.83 | 39.9 | 1.38 | 1.04 | 0.83 | 39.9 | 1.38 | 1.04 | 0.83 | 39.9 | 1.38 | 1.04 | 0.83 |
| 2.5 | 38.8 | 1.35 | 1.01 | 0.81 | 40.5 | 1.41 | 1.06 | 0.84 | 40.5 | 1.41 | 1.06 | 0.84 | 40.5 | 1.41 | 1.06 | 0.84 | 40.5 | 1.41 | 1.06 | 0.84 | 40.5 | 1.41 | 1.06 | 0.84 |
| 2.6 | 39.0 | 1.35 | 1.02 | 0.81 | 41.2 | 1.43 | 1.07 | 0.86 | 41.2 | 1.43 | 1.07 | 0.86 | 41.2 | 1.43 | 1.07 | 0.86 | 41.2 | 1.43 | 1.07 | 0.86 | 41.2 | 1.43 | 1.07 | 0.86 |
| 2.7 | 39.2 | 1.36 | 1.02 | 0.82 | 42.0 | 1.46 | 1.09 | 0.87 | 42.0 | 1.46 | 1.09 | 0.87 | 42.0 | 1.46 | 1.09 | 0.87 | 42.0 | 1.46 | 1.09 | 0.87 | 42.0 | 1.46 | 1.09 | 0.87 |
| 2.8 | 39.5 | 1.37 | 1.03 | 0.82 | 42.7 | 1.48 | 1.11 | 0.89 | 42.7 | 1.48 | 1.11 | 0.89 | 42.7 | 1.48 | 1.11 | 0.89 | 42.7 | 1.48 | 1.11 | 0.89 | 42.7 | 1.48 | 1.11 | 0.89 |
| 2.9 | 39.7 | 1.38 | 1.03 | 0.83 | 43.4 | 1.51 | 1.13 | 0.90 | 43.4 | 1.51 | 1.13 | 0.90 | 43.4 | 1.51 | 1.13 | 0.90 | 43.4 | 1.51 | 1.13 | 0.90 | 43.4 | 1.51 | 1.13 | 0.90 |
| 3.0 | 39.9 | 1.39 | 1.04 | 0.83 | 44.2 | 1.53 | 1.15 | 0.92 | 44.2 | 1.53 | 1.15 | 0.92 | 44.2 | 1.53 | 1.15 | 0.92 | 44.2 | 1.53 | 1.15 | 0.92 | 44.2 | 1.53 | 1.15 | 0.92 |
| 3.1 | 40.1 | 1.39 | 1.04 | 0.84 | 45.0 | 1.56 | 1.17 | 0.94 | 45.0 | 1.56 | 1.17 | 0.94 | 45.0 | 1.56 | 1.17 | 0.94 | 45.0 | 1.56 | 1.17 | 0.94 | 45.0 | 1.56 | 1.17 | 0.94 |
| 3.2 | 40.3 | 1.40 | 1.05 | 0.84 | 45.8 | 1.59 | 1.19 | 0.95 | 45.8 | 1.59 | 1.19 | 0.95 | 45.8 | 1.59 | 1.19 | 0.95 | 45.8 | 1.59 | 1.19 | 0.95 | 45.8 | 1.59 | 1.19 | 0.95 |
| 3.3 | 40.5 | 1.41 | 1.06 | 0.84 | 46.3 | 1.61 | 1.21 | 0.97 | 46.6 | 1.62 | 1.21 | 0.97 | 46.6 | 1.62 | 1.21 | 0.97 | 46.6 | 1.62 | 1.21 | 0.97 | 46.6 | 1.62 | 1.21 | 0.97 |
| 3.4 | 40.8 | 1.41 | 1.06 | 0.85 | 46.7 | 1.62 | 1.22 | 0.97 | 47.5 | 1.65 | 1.24 | 0.99 | 47.5 | 1.65 | 1.24 | 0.99 | 47.5 | 1.65 | 1.24 | 0.99 | 47.5 | 1.65 | 1.24 | 0.99 |
| 3.5 | 41.0 | 1.42 | 1.07 | 0.85 | 47.0 | 1.63 | 1.22 | 0.98 | 48.3 | 1.68 | 1.26 | 1.01 | 48.3 | 1.68 | 1.26 | 1.01 | 48.3 | 1.68 | 1.26 | 1.01 | 48.3 | 1.68 | 1.26 | 1.01 |
| 3.6 | 41.2 | 1.43 | 1.07 | 0.86 | 47.4 | 1.64 | 1.23 | 0.99 | 49.2 | 1.71 | 1.28 | 1.02 | 49.2 | 1.71 | 1.28 | 1.02 | 49.2 | 1.71 | 1.28 | 1.02 | 49.2 | 1.71 | 1.28 | 1.02 |
| 3.7 | 41.4 | 1.44 | 1.08 | 0.86 | 47.7 | 1.66 | 1.24 | 0.99 | 50.0 | 1.74 | 1.30 | 1.04 | 50.0 | 1.74 | 1.30 | 1.04 | 50.0 | 1.74 | 1.30 | 1.04 | 50.0 | 1.74 | 1.30 | 1.04 |
| 3.8 | 41.6 | 1.44 | 1.08 | 0.87 | 48.0 | 1.67 | 1.25 | 1.00 | 50.9 | 1.77 | 1.33 | 1.06 | 50.9 | 1.77 | 1.33 | 1.06 | 50.9 | 1.77 | 1.33 | 1.06 | 50.9 | 1.77 | 1.33 | 1.06 |
| 3.9 | 41.8 | 1.45 | 1.09 | 0.87 | 48.4 | 1.68 | 1.28 | 1.01 | 51.8 | 1.80 | 1.35 | 1.08 | 51.8 | 1.80 | 1.35 | 1.08 | 51.8 | 1.80 | 1.35 | 1.08 | 51.8 | 1.80 | 1.35 | 1.08 |
| 4.0 | 42.0 | 1.46 | 1.09 | 0.87 | 48.7 | 1.69 | 1.27 | 1.01 | 52.7 | 1.83 | 1.37 | 1.10 | 52.7 | 1.83 | 1.37 | 1.10 | 52.7 | 1.83 | 1.37 | 1.10 | 52.7 | 1.83 | 1.37 | 1.10 |
| 4.1 | 42.1 | 1.46 | 1.10 | 0.88 | 49.0 | 1.70 | 1.28 | 1.02 | 53.7 | 1.86 | 1.40 | 1.12 | 53.7 | 1.86 | 1.40 | 1.12 | 53.7 | 1.86 | 1.40 | 1.12 | 53.7 | 1.86 | 1.40 | 1.12 |
| 4.2 | 42.3 | 1.47 | 1.10 | 0.88 | 49.3 | 1.71 | 1.28 | 1.03 | 54.6 | 1.90 | 1.42 | 1.14 | 54.6 | 1.90 | 1.42 | 1.14 | 54.6 | 1.90 | 1.42 | 1.14 | 54.6 | 1.90 | 1.42 | 1.14 |
| 4.3 | 42.5 | 1.48 | 1.11 | 0.89 | 49.6 | 1.72 | 1.29 | 1.03 | 55.5 | 1.93 | 1.45 | 1.16 | 55.5 | 1.93 | 1.45 | 1.16 | 55.5 | 1.93 | 1.45 | 1.16 | 55.5 | 1.93 | 1.45 | 1.16 |
| 4.4 | 42.7 | 1.48 | 1.11 | 0.89 | 49.9 | 1.73 | 1.30 | 1.04 | 56.5 | 1.96 | 1.47 | 1.18 | 56.5 | 1.96 | 1.47 | 1.18 | 56.5 | 1.96 | 1.47 | 1.18 | 56.5 | 1.96 | 1.47 | 1.18 |
| 4.5 | 42.9 | 1.49 | 1.12 | 0.89 | 50.2 | 1.74 | 1.31 | 1.05 | 57.5 | 1.99 | 1.50 | 1.20 | 57.5 | 1.99 | 1.50 | 1.20 | 57.5 | 1.99 | 1.50 | 1.20 | 57.5 | 1.99 | 1.50 | 1.20 |
| 4.6 | 43.0 | 1.49 | 1.12 | 0.90 | 50.5 | 1.75 | 1.32 | 1.05 | 58.2 | 2.02 | 1.52 | 1.21 | 58.4 | 2.03 | 1.52 | 1.22 | 58.4 | 2.03 | 1.52 | 1.22 | 58.4 | 2.03 | 1.52 | 1.22 |
| 4.7 | 43.2 | 1.50 | 1.13 | 0.90 | 50.8 | 1.76 | 1.32 | 1.06 | 58.6 | 2.04 | 1.53 | 1.22 | 59.4 | 2.06 | 1.55 | 1.24 | 59.4 | 2.06 | 1.55 | 1.24 | 59.4 | 2.06 | 1.55 | 1.24 |
| 4.8 | 43.4 | 1.51 | 1.13 | 0.90 | 51.1 | 1.77 | 1.33 | 1.06 | 59.0 | 2.05 | 1.54 | 1.23 | 60.4 | 2.10 | 1.57 | 1.26 | 60.4 | 2.10 | 1.57 | 1.26 | 60.4 | 2.10 | 1.57 | 1.26 |
| 4.9 | 43.5 | 1.51 | 1.13 | 0.91 | 51.3 | 1.78 | 1.34 | 1.07 | 59.4 | 2.06 | 1.55 | 1.24 | 61.4 | 2.13 | 1.60 | 1.28 | 61.4 | 2.13 | 1.60 | 1.28 | 61.4 | 2.13 | 1.60 | 1.28 |
| 5.0 | 43.7 | 1.52 | 1.14 | 0.91 | 51.6 | 1.79 | 1.34 | 1.08 | 59.8 | 2.08 | 1.56 | 1.25 | 62.4 | 2.17 | 1.62 | 1.30 | 62.4 | 2.17 | 1.62 | 1.30 | 62.4 | 2.17 | 1.62 | 1.30 |
| 5.1 | 43.8 | 1.52 | 1.14 | 0.91 | 51.9 | 1.80 | 1.35 | 1.08 | 60.2 | 2.09 | 1.57 | 1.25 | 63.4 | 2.20 | 1.65 | 1.32 | 63.4 | 2.20 | 1.65 | 1.32 | 63.4 | 2.20 | 1.65 | 1.32 |
| 5.2 | 44.0 | 1.53 | 1.15 | 0.92 | 52.1 | 1.81 | 1.36 | 1.09 | 60.5 | 2.10 | 1.58 | 1.26 | 64.4 | 2.24 | 1.68 | 1.34 | 64.4 | 2.24 | 1.68 | 1.34 | 64.4 | 2.24 | 1.68 | 1.34 |
| 5.3 | 44.1 | 1.53 | 1.15 | 0.92 | 52.4 | 1.82 | 1.36 | 1.09 | 60.9 | 2.11 | 1.59 | 1.27 | 65.4 | 2.27 | 1.70 | 1.36 | 65.4 | 2.27 | 1.70 | 1.36 | 65.4 | 2.27 | 1.70 | 1.36 |
| 5.4 | 44.3 | 1.54 | 1.15 | 0.92 | 52.6 | 1.83 | 1.37 | 1.10 | 61.3 | 2.13 | 1.60 | 1.28 | 66.4 | 2.31 | 1.73 | 1.38 | 66.4 | 2.31 | 1.73 | 1.38 | 66.4 | 2.31 | 1.73 | 1.38 |
| 5.5 | 44.4 | 1.54 | 1.16 | 0.93 | 52.9 | 1.84 | 1.38 | 1.10 | 61.6 | 2.14 | 1.60 | 1.28 | 67.4 | 2.34 | 1.76 | 1.41 | 67.4 | 2.34 | 1.76 | 1.41 | 67.4 | 2.34 | 1.76 | 1.41 |
| 5.6 | 44.6 | 1.55 | 1.16 | 0.93 | 53.1 | 1.84 | 1.38 | 1.11 | 62.0 | 2.15 | 1.61 | 1.29 | 68.5 | 2.38 | 1.78 | 1.43 | 68.5 | 2.38 | 1.78 | 1.43 | 68.5 | 2.38 | 1.78 | 1.43 |
| 5.7 | 44.7 | 1.55 | 1.16 | 0.93 | 53.3 | 1.85 | 1.39 | 1.11 | 62.3 | 2.16 | 1.62 | 1.30 | 69.5 | 2.41 | 1.81 | 1.45 | 69.5 | 2.41 | 1.81 | 1.45 | 69.5 | 2.41 | 1.81 | 1.45 |
| 5.8 | 44.8 | 1.56 | 1.17 | 0.93 | 53.5 | 1.86 | 1.39 | 1.12 | 62.6 | 2.17 | 1.63 | 1.30 | 70.6 | 2.45 | 1.84 | 1.47 | 70.6 | 2.45 | 1.84 | 1.47 | 70.6 | 2.45 | 1.84 | 1.47 |
| 5.9 | 45.0 | 1.56 | 1.17 | 0.94 | 53.8 | 1.87 | 1.40 | 1.12 | 62.9 | 2.19 | 1.64 | 1.31 | 71.6 | 2.49 | 1.86 | 1.49 | 71.6 | 2.49 | 1.86 | 1.49 | 71.6 | 2.49 | 1.86 | 1.49 |
| 6.0 | 45.1 | 1.57 | 1.17 | 0.94 | 54.0 | 1.87 | 1.41 | 1.12 | 63.3 | 2.20 | 1.65 | 1.32 | 72.7 | 2.52 | 1.89 | 1.51 | 72.7 | 2.52 | 1.89 | 1.51 | 72.7 | 2.52 | 1.89 | 1.51 |
| 6.1 | 45.2 | 1.57 | 1.18 | 0.94 | 54.2 | 1.88 | 1.41 | 1.13 | 63.6 | 2.21 | 1.66 | 1.32 | 73.3 | 2.54 | 1.91 | 1.53 | 73.7 | 2.56 | 1.92 | 1.54 | 73.7 | 2.56 | 1.92 | 1.54 |
| 6.2 | 45.3 | 1.57 | 1.18 | 0.94 | 54.4 | 1.89 | 1.42 | 1.13 | 63.9 | 2.22 | 1.66 | 1.33 | 73.7 | 2.56 | 1.92 | 1.53 | 74.8 | 2.60 | 1.95 | 1.56 | 74.8 | 2.60 | 1.95 | 1.56 |
| 6.3 | 45.4 | 1.58 | 1.18 | 0.95 | 54.6 | 1.90 | 1.42 | 1.14 | 64.2 | 2.23 | 1.67 | 1.34 | 74.1 | 2.57 | 1.93 | 1.54 | 75.8 | 2.63 | 1.97 | 1.58 | 75.8 | 2.63 | 1.97 | 1.58 |
| 6.4 | 45.5 | 1.58 | 1.19 | 0.95 | 54.8 | 1.90 | 1.43 | 1.14 | 64.4 | 2.24 | 1.68 | 1.34 | 74.5 | 2.59 | 1.94 | 1.55 | 76.9 | 2.67 | 2.00 | 1.60 | 76.9 | 2.67 | 2.00 | 1.60 |
| 6.5 | 45.6 | 1.58 | 1.19 | 0.95 | 55.0 | 1.91 | 1.43 | 1.15 | 64.7 | 2.25 | 1.69 | 1.35 | 74.8 | 2.60 | 1.95 | 1.56 | 78.0 | 2.71 | 2.03 | 1.62 | 78.0 | 2.71 | 2.03 | 1.62 |
| 6.6 | 45.7 | 1.59 | 1.19 | 0.95 | 55.1 | 1.91 | 1.44 | 1.15 | 65.0 | 2.26 | 1.69 | 1.35 | 75.2 | 2.61 | 1.96 | 1.57 | 79.0 | 2.74 | 2.06 | 1.65 | 79.0 | 2.74 | 2.06 | 1.65 |
| 6.7 | 45.9 | 1.59 | 1.19 | 0.96 | 55.3 | 1.92 | 1.44 | 1.15 | 65.3 | 2.27 | 1.70 | 1.36 | 75.6 | 2.62 | 1.97 | 1.57 | 80.1 | 2.78 | 2.09 | 1.67 | 80.1 | 2.78 | 2.09 | 1.67 |
| 6.8 | 45.9 | 1.60 | 1.20 | 0.96 | 55.5 | 1.93 | 1.45 | 1.16 | 65.5 | 2.28 | 1.71 | 1.37 | 75.9 | 2.64 | 1.98 | 1.58 | 81.2 | 2.82 | 2.11 | 1.69 | 81.2 | 2.82 | 2.11 | 1.69 |
| 6.9 | 46.0 | 1.60 | 1.20 | 0.96 | 55.7 | 1.93 | 1.45 | 1.16 | 65.8 | 2.28 | 1.71 | 1.37 | 76.3 | 2.65 | 1.99 | 1.59 | 82.3 | 2.86 | 2.14 | 1.71 | 82.3 | 2.86 | 2.14 | 1.71 |
| 7.0 | 46.1 | 1.60 | 1.20 | 0.96 | 55.8 | 1.94 | 1.45 | 1.16 | 66.0 | 2.29 | 1.72 | 1.38 | 76.6 | 2.66 | 2.00 | 1.60 | 83.3 | 2.89 | 2.17 | 1.74 | 83.3 | 2.89 | 2.17 | 1.74 |
| 7.1 | 46.2 | 1.61 | 1.20 | 0.96 | 56.0 | 1.94 | 1.46 | 1.17 | 66.3 | 2.30 | 1.73 | 1.38 | 77.0 | 2.67 | 2.00 | 1.60 | 84.4 | 2.93 | 2.20 | 1.76 | 84.4 | 2.93 | 2.20 | 1.76 |
| 7.2 | 46.3 | 1.61 | 1.21 | 0.96 | 56.2 | 1.95 | 1.46 | 1.17 | 66.5 | 2.31 | 1.73 | 1.39 | 77.3 | 2.68 | 2.01 | 1.61 | 85.5 | 2.97 | 2.23 | 1.78 | 85.5 | 2.97 | 2.23 | 1.78 |
| 7.3 | 46.4 | 1.61 | 1.21 | 0.97 | 56.3 | 1.96 | 1.47 | 1.17 | 66.8 | 2.32 | 1.74 | 1.39 | 77.6 | 2.70 | 2.02 | 1.62 | 86.6 | 3.01 | 2.26 | 1.80 | 86.6 | 3.01 | 2.26 | 1.80 |
| 7.4 | 46.5 | 1.61 | 1.21 | 0.97 | 56.5 | 1.96 | 1.47 | 1.18 | 67.0 | 2.33 | 1.74 | 1.40 | 78.0 | 2.71 | 2.03 | 1.62 | 87.7 | 3.05 | 2.28 | 1.83 | 87.7 | 3.05 | 2.28 | 1.83 |
| 7.5 | 46.6 | 1.62 | 1.21 | 0.97 | 56.6 | 1.97 | 1.47 | 1.18 | 67.2 | 2.33 | 1.75 | 1.40 | 78.3 | 2.72 | 2.04 | 1.63 | 88.8 | 3.08 | 2.31 | 1.85 | 88.8 | 3.08 | 2.31 | 1.85 |
| 7.6 | 46.6 | 1.62 | 1.21 | 0.97 | 56.7 | 1.97 | 1.48 | 1.18 | 67.4 | 2.34 | 1.76 | 1.40 | 78.8 | 2.73 | 2.05 | 1.64 | 89.9 | 3.12 | 2.34 | 1.87 | 89.9 | 3.12 | 2.34 | 1.87 |
| 7.7 | 46.7 | 1.62 | 1.22 | 0.97 | 56.9 | 1.98 | 1.48 | 1.19 | 67.6 | 2.35 | 1.76 | 1.41 | 78.9 | 2.74 | 2.05 | 1.64 | 90.5 | 3.14 | 2.36 | 1.89 | 91.0 | 3.16 | 2.37 | 1.90 |
| 7.8 | 46.8 | 1.62 | 1.22 | 0.97 | 57.0 | 1.98 | 1.48 | 1.19 | 67.8 | 2.36 | 1.77 | 1.41 | 79.2 | 2.75 | 2.06 | 1.65 | 90.9 | 3.16 | 2.37 | 1.89 | 92.1 | 3.20 | 2.40 | 1.92 |
| 7.9 | 46.9 | 1.63 | 1.22 | 0.98 | 57.1 | 1.98 | 1.49 | 1.19 | 68.0 | 2.36 | 1.77 | 1.42 | 79.4 | 2.76 | 2.07 | 1.66 | 91.3 | 3.17 | 2.38 | 1.90 | 93.2 | 3.24 | 2.43 | 1.94 |
| 8.0 | 46.9 | 1.63 | 1.22 | 0.98 | 57.3 | 1.99 | 1.49 | 1.19 | 68.2 | 2.37 | 1.78 | 1.42 | 79.7 | 2.77 | 2.08 | 1.66 | 91.7 | 3.18 | 2.39 | 1.91 | 94.3 | 3.27 | 2.46 | 1.96 |
| 8.1 | 47.0 | 1.63 | 1.22 | 0.98 | 57.4 | 1.99 | 1.49 | 1.20 | 68.4 | 2.38 | 1.78 | 1.43 | 80.0 | 2.78 | 2.08 | 1.67 | 92.0 | 3.20 | 2.40 | 1.92 | 95.4 | 3.31 | 2.48 | 1.99 |
| 8.2 | 47.0 | 1.63 | 1.23 | 0.98 | 57.5 | 2.00 | 1.50 | 1.20 | 68.6 | 2.38 | 1.79 | 1.43 | 80.3 | 2.79 | 2.09 | 1.67 | 92.4 | 3.21 | 2.41 | 1.92 | 96.5 | 3.35 | 2.51 | 2.01 |
| 8.3 | 47.1 | 1.64 | 1.23 | 0.98 | 57.6 | 2.00 | 1.50 | 1.20 | 68.8 | 2.39 | 1.79 | 1.43 | 80.5 | 2.80 | 2.10 | 1.68 | 92.7 | 3.22 | 2.41 | 1.93 | 97.6 | 3.39 | 2.54 | 2.03 |
| 8.4 | 47.2 | 1.64 | 1.23 | 0.98 | 57.7 | 2.01 | 1.50 | 1.20 | 89.0 | 2.40 | 1.80 | 1.44 | 80.8 | 2.80 | 2.10 | 1.68 | 93.1 | 3.23 | 2.42 | 1.94 | 98.7 | 3.43 | 2.57 | 2.06 |
| 8.5 | 47.2 | 1.64 | 1.23 | 0.98 | 57.9 | 2.01 | 1.51 | 1.21 | 69.2 | 2.40 | 1.80 | 1.44 | 81.0 | 2.81 | 2.11 | 1.69 | 93.4 | 3.24 | 2.43 | 1.95 | 99.8 | 3.47 | 2.60 | 2.08 |
| 8.6 | 47.3 | 1.64 | 1.23 | 0.99 | 58.0 | 2.01 | 1.51 | 1.21 | 69.3 | 2.41 | 1.81 | 1.44 | 81.3 | 2.82 | 2.12 | 1.69 | 93.7 | 3.25 | 2.44 | 1.95 | 100.9 | 3.51 | 2.63 | 2.10 |
| 8.7 | 47.3 | 1.64 | 1.23 | 0.99 | 58.1 | 2.02 | 1.51 | 1.21 | 69.5 | 2.41 | 1.81 | 1.45 | 81.5 | 2.83 | 2.12 | 1.70 | 94.0 | 3.27 | 2.45 | 1.96 | 102.1 | 3.54 | 2.66 | 2.13 |
| 8.8 | 47.4 | 1.65 | 1.23 | 0.99 | 58.2 | 2.02 | 1.51 | 1.21 | 69.7 | 2.42 | 1.81 | 1.45 | 81.7 | 2.84 | 2.13 | 1.70 | 94.4 | 3.28 | 2.46 | 1.97 | 103.2 | 3.58 | 2.69 | 2.15 |
| 8.9 | 47.4 | 1.65 | 1.24 | 0.99 | 58.3 | 2.02 | 1.52 | 1.21 | 69.8 | 2.42 | 1.82 | 1.45 | 82.0 | 2.85 | 2.13 | 1.71 | 94.7 | 3.29 | 2.47 | 1.97 | 104.3 | 3.62 | 2.72 | 2.17 |
| 9.0 | 47.5 | 1.65 | 1.24 | 0.99 | 58.4 | 2.03 | 1.52 | 1.22 | 70.0 | 2.43 | 1.82 | 1.46 | 82.2 | 2.85 | 2.14 | 1.71 | 95.0 | 3.30 | 2.47 | 1.98 | 105.4 | 3.66 | 2.74 | 2.20 |
| 9.1 | 47.5 | 1.65 | 1.24 | 0.99 | 58.5 | 2.03 | 1.52 | 1.22 | 70.1 | 2.43 | 1.83 | 1.46 | 82.4 | 2.86 | 2.15 | 1.72 | 95.3 | 3.31 | 2.48 | 1.98 | 106.5 | 3.70 | 2.77 | 2.22 |
| 9.2 | 47.6 | 1.65 | 1.24 | 0.99 | 58.5 | 2.03 | 1.52 | 1.22 | 70.3 | 2.44 | 1.83 | 1.46 | 82.6 | 2.87 | 2.15 | 1.72 | 95.6 | 3.32 | 2.49 | 1.99 | 107.6 | 3.74 | 2.80 | 2.24 |
| 9.3 | 47.6 | 1.65 | 1.24 | 0.99 | 58.6 | 2.04 | 1.53 | 1.22 | 70.4 | 2.44 | 1.83 | 1.47 | 82.8 | 2.88 | 2.18 | 1.73 | 95.8 | 3.33 | 2.50 | 2.00 | 108.8 | 3.78 | 2.83 | 2.27 |
| 9.4 | 47.7 | 1.66 | 1.24 | 0.99 | 58.7 | 2.04 | 1.53 | 1.22 | 70.5 | 2.45 | 1.84 | 1.47 | 83.0 | 2.88 | 2.16 | 1.73 | 98.1 | 3.34 | 2.50 | 2.00 | 109.7 | 3.81 | 2.86 | 2.29 |
| 9.5 | 47.7 | 1.66 | 1.24 | 0.99 | 58.8 | 2.04 | 1.53 | 1.23 | 70.7 | 2.45 | 1.84 | 1.47 | 83.2 | 2.99 | 2.17 | 1.73 | 96.4 | 3.35 | 2.51 | 2.01 | 110.0 | 3.82 | 2.87 | 2.29 |
| 9.6 | 47.7 | 1.66 | 1.24 | 0.99 | 58.9 | 2.04 | 1.53 | 1.23 | 70.8 | 2.46 | 1.84 | 1.48 | 83.4 | 2.90 | 2.17 | 1.74 | 96.7 | 3.36 | 2.52 | 2.01 | 110.4 | 3.83 | 2.87 | 2.30 |
| 9.7 | 47.8 | 1.66 | 1.24 | 1.00 | 59.0 | 2.05 | 1.54 | 1.23 | 70.9 | 2.46 | 1.85 | 1.48 | 83.8 | 2.90 | 2.18 | 1.74 | 96.9 | 3.37 | 2.52 | 2.02 | 110.7 | 3.84 | 2.88 | 2.31 |
| 9.8 | 47.8 | 1.66 | 1.25 | 1.00 | 59.0 | 2.05 | 1.54 | 1.23 | 71.1 | 2.47 | 1.85 | 1.48 | 83.8 | 2.91 | 2.18 | 1.75 | 97.2 | 3.37 | 2.53 | 2.02 | 111.1 | 3.88 | 2.89 | 2.31 |
| 9.9 | 47.9 | 1.66 | 1.25 | 1.00 | 59.1 | 2.05 | 1.54 | 1.23 | 71.2 | 2.47 | 1.85 | 1.48 | 84.0 | 2.92 | 2.19 | 1.75 | 97.4 | 3.38 | 2.54 | 2.03 | 111.4 | 3.87 | 2.90 | 2.32 |
| 10.0 | 47.9 | 1.66 | 1.25 | 1.00 | 59.2 | 2.05 | 1.54 | 1.23 | 71.3 | 2.48 | 1.86 | 1.49 | 84.2 | 2.92 | 2.19 | 1.75 | 97.7 | 3.39 | 2.54 | 2.03 | 111.7 | 3.88 | 2.91 | 2.33 |
| Trench Width m | | 0.8 | | | | 0.9 | | | | 1.0 | | | | 1.1 | | | | 1.2 | | | | 1.3 | | |

## TABLE 16. DESIGN LOADS
## 375 mm DIAMETER PIPE

8 WHEELS 112.5kN
IMPACT FACTOR 1.3

| Cover | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 36 | 45 | 60 | kN/m | 36 | 45 | 60 | kN/m | 35 | 45 | 60 | kN/m | 35 | 45 | 60 | kN/m | 36 | 45 | 60 | kN/m | 35 | 45 | 60 |
| 0.6 | 60.0 | 2.08 | 1.67 | 1.25 | 60.0 | 2.08 | 1.67 | 1.25 | 60.0 | 2.08 | 1.67 | 1.25 | 60.0 | 2.08 | 1.67 | 1.25 | 60.0 | 2.08 | 1.67 | 1.25 | 60.0 | 2.08 | 1.67 | 1.25 |
| 0.7 | 54.6 | 1.89 | 1.52 | 1.14 | 54.6 | 1.89 | 1.52 | 1.14 | 54.6 | 1.89 | 1.52 | 1.14 | 54.6 | 1.89 | 1.52 | 1.14 | 54.6 | 1.89 | 1.52 | 1.14 | 54.6 | 1.89 | 1.52 | 1.14 |
| 0.8 | 50.9 | 1.77 | 1.41 | 1.06 | 50.9 | 1.77 | 1.41 | 1.06 | 50.9 | 1.77 | 1.41 | 1.06 | 50.9 | 1.77 | 1.41 | 1.06 | 50.9 | 1.77 | 1.41 | 1.06 | 50.9 | 1.77 | 1.41 | 1.06 |
| 0.9 | 48.4 | 1.68 | 1.35 | 1.01 | 48.4 | 1.68 | 1.35 | 1.01 | 48.4 | 1.68 | 1.35 | 1.01 | 48.4 | 1.68 | 1.35 | 1.01 | 48.4 | 1.68 | 1.35 | 1.01 | 48.4 | 1.68 | 1.35 | 1.01 |
| 1.0 | 46.4 | 1.61 | 1.29 | 0.97 | 46.4 | 1.61 | 1.29 | 0.97 | 46.4 | 1.61 | 1.29 | 0.97 | 46.4 | 1.61 | 1.29 | 0.97 | 46.4 | 1.61 | 1.29 | 0.97 | 46.4 | 1.61 | 1.29 | 0.97 |
| 1.1 | 45.1 | 1.56 | 1.25 | 0.94 | 45.1 | 1.56 | 1.25 | 0.94 | 45.1 | 1.56 | 1.25 | 0.94 | 45.1 | 1.56 | 1.25 | 0.94 | 45.1 | 1.56 | 1.25 | 0.94 | 45.1 | 1.56 | 1.25 | 0.94 |
| 1.2 | 44.2 | 1.53 | 1.23 | 0.92 | 44.2 | 1.53 | 1.23 | 0.92 | 44.2 | 1.53 | 1.23 | 0.92 | 44.2 | 1.53 | 1.23 | 0.92 | 44.2 | 1.53 | 1.23 | 0.92 | 44.2 | 1.53 | 1.23 | 0.92 |
| 1.3 | 43.6 | 1.51 | 1.21 | 0.91 | 43.6 | 1.51 | 1.21 | 0.91 | 43.6 | 1.51 | 1.21 | 0.91 | 43.6 | 1.51 | 1.21 | 0.91 | 43.6 | 1.51 | 1.21 | 0.91 | 43.6 | 1.51 | 1.21 | 0.91 |
| 1.4 | 43.3 | 1.50 | 1.20 | 0.90 | 43.3 | 1.50 | 1.20 | 0.90 | 43.3 | 1.50 | 1.20 | 0.90 | 43.3 | 1.50 | 1.20 | 0.90 | 43.3 | 1.50 | 1.20 | 0.90 | 43.3 | 1.50 | 1.20 | 0.90 |
| 1.5 | 43.2 | 1.50 | 1.20 | 0.90 | 43.2 | 1.50 | 1.20 | 0.90 | 43.2 | 1.50 | 1.20 | 0.90 | 43.2 | 1.50 | 1.20 | 0.90 | 43.2 | 1.50 | 1.20 | 0.90 | 43.2 | 1.50 | 1.20 | 0.90 |
| 1.6 | 43.3 | 1.50 | 1.20 | 0.90 | 43.3 | 1.50 | 1.20 | 0.90 | 43.3 | 1.50 | 1.20 | 0.90 | 43.3 | 1.50 | 1.20 | 0.90 | 43.3 | 1.50 | 1.20 | 0.90 | 43.3 | 1.50 | 1.20 | 0.90 |
| 1.7 | 43.5 | 1.51 | 1.21 | 0.91 | 43.5 | 1.51 | 1.21 | 0.91 | 43.5 | 1.51 | 1.21 | 0.91 | 43.5 | 1.51 | 1.21 | 0.91 | 43.5 | 1.51 | 1.21 | 0.91 | 43.5 | 1.51 | 1.21 | 0.91 |
| 1.8 | 43.9 | 1.52 | 1.22 | 0.91 | 43.9 | 1.52 | 1.22 | 0.91 | 43.9 | 1.52 | 1.22 | 0.91 | 43.9 | 1.52 | 1.22 | 0.91 | 43.9 | 1.52 | 1.22 | 0.91 | 43.9 | 1.52 | 1.22 | 0.91 |
| 1.9 | 44.4 | 1.54 | 1.23 | 0.93 | 44.4 | 1.54 | 1.23 | 0.93 | 44.4 | 1.54 | 1.23 | 0.93 | 44.4 | 1.54 | 1.23 | 0.93 | 44.4 | 1.54 | 1.23 | 0.93 | 44.4 | 1.54 | 1.23 | 0.93 |
| 2.0 | 45.0 | 1.56 | 1.25 | 0.94 | 45.0 | 1.56 | 1.25 | 0.94 | 45.0 | 1.56 | 1.25 | 0.94 | 45.0 | 1.56 | 1.25 | 0.94 | 45.0 | 1.56 | 1.25 | 0.94 | 45.0 | 1.56 | 1.25 | 0.94 |
| 2.1 | 45.2 | 1.57 | 1.26 | 0.94 | 45.6 | 1.58 | 1.27 | 0.95 | 45.6 | 1.58 | 1.27 | 0.95 | 45.6 | 1.58 | 1.27 | 0.95 | 45.6 | 1.58 | 1.27 | 0.95 | 45.6 | 1.58 | 1.27 | 0.95 |
| 2.2 | 45.5 | 1.58 | 1.26 | 0.95 | 46.2 | 1.61 | 1.28 | 0.96 | 46.2 | 1.61 | 1.28 | 0.96 | 46.2 | 1.61 | 1.28 | 0.96 | 46.2 | 1.61 | 1.28 | 0.96 | 46.2 | 1.61 | 1.28 | 0.96 |
| 2.3 | 45.7 | 1.59 | 1.27 | 0.95 | 46.9 | 1.63 | 1.30 | 0.98 | 46.9 | 1.63 | 1.30 | 0.98 | 46.9 | 1.63 | 1.30 | 0.98 | 46.9 | 1.63 | 1.30 | 0.98 | 46.9 | 1.63 | 1.30 | 0.98 |
| 2.4 | 46.0 | 1.60 | 1.28 | 0.96 | 47.6 | 1.65 | 1.32 | 0.99 | 47.6 | 1.65 | 1.32 | 0.99 | 47.6 | 1.65 | 1.32 | 0.99 | 47.6 | 1.65 | 1.32 | 0.99 | 47.6 | 1.65 | 1.32 | 0.99 |
| 2.5 | 46.3 | 1.81 | 1.29 | 0.96 | 48.4 | 1.68 | 1.34 | 1.01 | 48.4 | 1.68 | 1.34 | 1.01 | 48.4 | 1.68 | 1.34 | 1.01 | 48.4 | 1.68 | 1.34 | 1.01 | 48.4 | 1.68 | 1.34 | 1.01 |
| 2.6 | 46.5 | 1.62 | 1.29 | 0.97 | 49.2 | 1.71 | 1.37 | 1.02 | 49.2 | 1.71 | 1.37 | 1.02 | 49.2 | 1.71 | 1.37 | 1.02 | 49.2 | 1.71 | 1.37 | 1.02 | 49.2 | 1.71 | 1.37 | 1.02 |
| 2.7 | 46.8 | 1.63 | 1.30 | 0.98 | 50.0 | 1.73 | 1.39 | 1.04 | 50.0 | 1.73 | 1.39 | 1.04 | 50.0 | 1.73 | 1.39 | 1.04 | 50.0 | 1.73 | 1.39 | 1.04 | 50.0 | 1.73 | 1.39 | 1.04 |
| 2.8 | 47.1 | 1.63 | 1.31 | 0.98 | 50.8 | 1.76 | 1.41 | 1.06 | 50.8 | 1.76 | 1.41 | 1.06 | 50.8 | 1.76 | 1.41 | 1.06 | 50.8 | 1.76 | 1.41 | 1.06 | 50.8 | 1.76 | 1.41 | 1.06 |
| 2.9 | 47.4 | 1.64 | 1.32 | 0.99 | 51.6 | 1.79 | 1.43 | 1.08 | 51.6 | 1.79 | 1.43 | 1.08 | 51.6 | 1.79 | 1.43 | 1.08 | 51.6 | 1.79 | 1.43 | 1.08 | 51.6 | 1.79 | 1.43 | 1.08 |
| 3.0 | 47.8 | 1.65 | 1.32 | 0.99 | 52.5 | 1.82 | 1.46 | 1.09 | 52.5 | 1.82 | 1.46 | 1.09 | 52.5 | 1.82 | 1.46 | 1.09 | 52.5 | 1.82 | 1.46 | 1.09 | 52.5 | 1.82 | 1.46 | 1.09 |
| 3.1 | 47.9 | 1.66 | 1.33 | 1.00 | 53.4 | 1.85 | 1.48 | 1.11 | 53.4 | 1.85 | 1.48 | 1.11 | 53.4 | 1.85 | 1.48 | 1.11 | 53.4 | 1.85 | 1.48 | 1.11 | 53.4 | 1.85 | 1.48 | 1.11 |
| 3.2 | 48.2 | 1.67 | 1.34 | 1.00 | 53.9 | 1.87 | 1.50 | 1.12 | 54.3 | 1.89 | 1.51 | 1.13 | 54.3 | 1.89 | 1.51 | 1.13 | 54.3 | 1.89 | 1.51 | 1.13 | 54.3 | 1.89 | 1.51 | 1.13 |
| 3.3 | 48.5 | 1.88 | 1.35 | 1.01 | 54.4 | 1.89 | 1.51 | 1.13 | 55.3 | 1.92 | 1.54 | 1.15 | 55.3 | 1.92 | 1.54 | 1.15 | 55.3 | 1.92 | 1.54 | 1.15 | 55.3 | 1.92 | 1.54 | 1.15 |
| 3.4 | 48.7 | 1.69 | 1.35 | 1.02 | 54.8 | 1.90 | 1.52 | 1.14 | 56.2 | 1.95 | 1.56 | 1.17 | 56.2 | 1.95 | 1.56 | 1.17 | 56.2 | 1.95 | 1.56 | 1.17 | 56.2 | 1.95 | 1.56 | 1.17 |
| 3.5 | 49.0 | 1.70 | 1.36 | 1.02 | 55.2 | 1.92 | 1.53 | 1.15 | 57.2 | 1.99 | 1.59 | 1.19 | 57.2 | 1.99 | 1.59 | 1.19 | 57.2 | 1.99 | 1.59 | 1.19 | 57.2 | 1.99 | 1.59 | 1.19 |
| 3.6 | 49.3 | 1.71 | 1.37 | 1.03 | 55.8 | 1.93 | 1.55 | 1.16 | 58.2 | 2.02 | 1.62 | 1.21 | 58.2 | 2.02 | 1.62 | 1.21 | 58.2 | 2.02 | 1.62 | 1.21 | 58.2 | 2.02 | 1.62 | 1.21 |
| 3.7 | 49.8 | 1.72 | 1.38 | 1.03 | 56.0 | 1.95 | 1.58 | 1.17 | 59.2 | 2.06 | 1.64 | 1.23 | 59.2 | 2.06 | 1.64 | 1.23 | 59.2 | 2.06 | 1.64 | 1.23 | 59.2 | 2.06 | 1.64 | 1.23 |
| 3.8 | 49.8 | 1.73 | 1.38 | 1.04 | 56.5 | 1.96 | 1.57 | 1.18 | 60.2 | 2.09 | 1.67 | 1.25 | 60.2 | 2.09 | 1.67 | 1.25 | 60.2 | 2.09 | 1.67 | 1.25 | 60.2 | 2.09 | 1.67 | 1.25 |
| 3.9 | 50.1 | 1.74 | 1.39 | 1.04 | 56.9 | 1.97 | 1.58 | 1.18 | 61.3 | 2.13 | 1.70 | 1.28 | 61.3 | 2.13 | 1.70 | 1.28 | 61.3 | 2.13 | 1.70 | 1.28 | 61.3 | 2.13 | 1.70 | 1.28 |
| 4.0 | 50.3 | 1.75 | 1.40 | 1.05 | 57.3 | 1.99 | 1.59 | 1.19 | 62.3 | 2.16 | 1.73 | 1.30 | 62.3 | 2.16 | 1.73 | 1.30 | 62.3 | 2.16 | 1.73 | 1.30 | 62.3 | 2.16 | 1.73 | 1.30 |
| 4.1 | 50.8 | 1.78 | 1.41 | 1.05 | 57.7 | 2.00 | 1.60 | 1.20 | 63.4 | 2.20 | 1.76 | 1.32 | 63.4 | 2.20 | 1.76 | 1.32 | 63.4 | 2.20 | 1.76 | 1.32 | 63.4 | 2.20 | 1.76 | 1.32 |
| 4.2 | 50.9 | 1.77 | 1.41 | 1.06 | 58.0 | 2.02 | 1.81 | 1.21 | 64.5 | 2.24 | 1.79 | 1.34 | 64.5 | 2.24 | 1.79 | 1.34 | 64.5 | 2.24 | 1.79 | 1.34 | 64.5 | 2.24 | 1.79 | 1.34 |
| 4.3 | 51.1 | 1.78 | 1.42 | 1.07 | 58.4 | 2.03 | 1.62 | 1.22 | 65.6 | 2.28 | 1.82 | 1.37 | 65.6 | 2.28 | 1.82 | 1.37 | 65.6 | 2.28 | 1.82 | 1.37 | 65.6 | 2.28 | 1.82 | 1.37 |
| 4.4 | 51.4 | 1.78 | 1.43 | 1.07 | 58.8 | 2.04 | 1.63 | 1.23 | 66.4 | 2.31 | 1.85 | 1.38 | 66.7 | 2.31 | 1.85 | 1.39 | 66.7 | 2.31 | 1.85 | 1.39 | 66.7 | 2.31 | 1.85 | 1.39 |
| 4.5 | 51.8 | 1.79 | 1.43 | 1.06 | 59.2 | 2.08 | 1.64 | 1.23 | 66.9 | 2.32 | 1.86 | 1.39 | 67.8 | 2.35 | 1.88 | 1.41 | 67.8 | 2.35 | 1.88 | 1.41 | 67.8 | 2.35 | 1.88 | 1.41 |
| 4.6 | 51.9 | 1.80 | 1.44 | 1.06 | 59.8 | 2.07 | 1.65 | 1.24 | 67.4 | 2.34 | 1.87 | 1.41 | 68.9 | 2.39 | 1.91 | 1.44 | 68.9 | 2.39 | 1.91 | 1.44 | 68.9 | 2.39 | 1.91 | 1.44 |
| 4.7 | 52.1 | 1.81 | 1.45 | 1.09 | 59.9 | 2.08 | 1.66 | 1.25 | 67.9 | 2.36 | 1.89 | 1.42 | 70.0 | 2.43 | 1.95 | 1.46 | 70.0 | 2.43 | 1.95 | 1.46 | 70.0 | 2.43 | 1.95 | 1.46 |
| 4.8 | 52.3 | 1.82 | 1.45 | 1.09 | 60.3 | 2.09 | 1.87 | 1.26 | 68.4 | 2.38 | 1.90 | 1.43 | 71.2 | 2.47 | 1.98 | 1.48 | 71.2 | 2.47 | 1.98 | 1.48 | 71.2 | 2.47 | 1.98 | 1.48 |
| 4.9 | 52.6 | 1.83 | 1.46 | 1.10 | 60.6 | 2.11 | 1.68 | 1.26 | 68.9 | 2.39 | 1.91 | 1.44 | 72.3 | 2.51 | 2.01 | 1.51 | 72.3 | 2.51 | 2.01 | 1.51 | 72.3 | 2.51 | 2.01 | 1.51 |
| 5.0 | 52.8 | 1.63 | 1.47 | 1.10 | 61.0 | 2.12 | 1.69 | 1.27 | 69.4 | 2.41 | 1.93 | 1.45 | 73.5 | 2.55 | 2.04 | 1.53 | 73.5 | 2.55 | 2.04 | 1.53 | 73.5 | 2.55 | 2.04 | 1.53 |
| 5.1 | 53.0 | 1.64 | 1.47 | 1.10 | 81.3 | 2.13 | 1.70 | 1.28 | 69.9 | 2.43 | 1.94 | 1.46 | 74.7 | 2.59 | 2.07 | 1.56 | 74.7 | 2.59 | 2.07 | 1.56 | 74.7 | 2.59 | 2.07 | 1.56 |
| 5.2 | 53.2 | 1.85 | 1.48 | 1.11 | 61.7 | 2.14 | 1.71 | 1.28 | 70.3 | 2.44 | 1.95 | 1.47 | 75.8 | 2.63 | 2.11 | 1.58 | 75.8 | 2.63 | 2.11 | 1.58 | 75.8 | 2.63 | 2.11 | 1.58 |
| 5.3 | 53.5 | 1.86 | 1.49 | 1.11 | 82.0 | 2.15 | 1.72 | 1.29 | 70.8 | 2.46 | 1.97 | 1.47 | 77.0 | 2.67 | 2.14 | 1.60 | 77.0 | 2.67 | 2.14 | 1.60 | 77.0 | 2.67 | 2.14 | 1.60 |
| 5.4 | 53.7 | 1.86 | 1.49 | 1.12 | 62.3 | 2.18 | 1.73 | 1.30 | 71.2 | 2.47 | 1.98 | 1.49 | 78.2 | 2.72 | 2.17 | 1.63 | 78.2 | 2.72 | 2.17 | 1.63 | 78.2 | 2.72 | 2.17 | 1.63 |
| 5.5 | 53.9 | 1.87 | 1.50 | 1.12 | 62.8 | 2.17 | 1.74 | 1.30 | 71.7 | 2.49 | 1.99 | 1.49 | 79.4 | 2.76 | 2.21 | 1.65 | 79.4 | 2.76 | 2.21 | 1.65 | 79.4 | 2.76 | 2.21 | 1.65 |
| 5.6 | 54.1 | 1.88 | 1.50 | 1.13 | 63.0 | 2.19 | 1.75 | 1.31 | 72.1 | 2.50 | 2.00 | 1.50 | 80.6 | 2.80 | 2.24 | 1.68 | 80.6 | 2.80 | 2.24 | 1.68 | 80.6 | 2.80 | 2.24 | 1.68 |
| 5.7 | 54.3 | 1.89 | 1.51 | 1.13 | 63.3 | 2.20 | 1.76 | 1.32 | 72.5 | 2.52 | 2.01 | 1.51 | 81.8 | 2.84 | 2.27 | 1.70 | 81.8 | 2.84 | 2.27 | 1.70 | 81.8 | 2.84 | 2.27 | 1.70 |
| 5.8 | 54.5 | 1.89 | 1.51 | 1.14 | 63.6 | 2.21 | 1.77 | 1.32 | 72.9 | 2.53 | 2.03 | 1.52 | 82.5 | 2.87 | 2.29 | 1.72 | 83.0 | 2.88 | 2.31 | 1.73 | 83.0 | 2.88 | 2.31 | 1.73 |
| 5.9 | 54.7 | 1.90 | 1.52 | 1.14 | 63.9 | 2.22 | 1.77 | 1.33 | 73.3 | 2.55 | 2.04 | 1.53 | 83.1 | 2.88 | 2.31 | 1.73 | 84.2 | 2.93 | 2.34 | 1.76 | 84.2 | 2.93 | 2.34 | 1.76 |
| 6.0 | 54.9 | 1.91 | 1.52 | 1.14 | 64.1 | 2.23 | 1.78 | 1.34 | 73.7 | 2.56 | 2.05 | 1.54 | 83.6 | 2.90 | 2.32 | 1.74 | 85.5 | 2.97 | 2.37 | 1.78 | 85.5 | 2.97 | 2.37 | 1.78 |
| 6.1 | 55.0 | 1.91 | 1.53 | 1.15 | 64.4 | 2.24 | 1.79 | 1.34 | 74.1 | 2.57 | 2.06 | 1.54 | 84.1 | 2.92 | 2.34 | 1.75 | 86.7 | 3.01 | 2.41 | 1.81 | 86.7 | 3.01 | 2.41 | 1.81 |
| 6.2 | 55.2 | 1.92 | 1.53 | 1.15 | 84.7 | 2.25 | 1.80 | 1.35 | 74.5 | 2.59 | 2.07 | 1.55 | 84.6 | 2.94 | 2.35 | 1.76 | 87.9 | 3.05 | 2.44 | 1.83 | 87.9 | 3.05 | 2.44 | 1.83 |
| 6.3 | 55.4 | 1.92 | 1.54 | 1.15 | 65.0 | 2.26 | 1.80 | 1.35 | 74.9 | 2.60 | 2.08 | 1.56 | 85.1 | 2.95 | 2.36 | 1.77 | 89.2 | 3.10 | 2.48 | 1.86 | 89.2 | 3.10 | 2.48 | 1.86 |
| 6.4 | 55.6 | 1.93 | 1.54 | 1.18 | 65.2 | 2.27 | 1.81 | 1.36 | 75.3 | 2.61 | 2.09 | 1.57 | 85.8 | 2.97 | 2.38 | 1.78 | 90.4 | 3.14 | 2.51 | 1.88 | 90.4 | 3.14 | 2.51 | 1.88 |
| 6.5 | 55.7 | 1.94 | 1.55 | 1.18 | 65.5 | 2.27 | 1.82 | 1.36 | 75.8 | 2.63 | 2.10 | 1.58 | 86.0 | 2.99 | 2.39 | 1.79 | 91.7 | 3.18 | 2.55 | 1.91 | 91.7 | 3.18 | 2.55 | 1.91 |
| 6.6 | 55.9 | 1.94 | 1.55 | 1.16 | 65.8 | 2.28 | 1.83 | 1.37 | 78.0 | 2.64 | 2.11 | 1.58 | 86.5 | 3.00 | 2.40 | 1.80 | 92.9 | 3.23 | 2.58 | 1.94 | 92.9 | 3.23 | 2.58 | 1.94 |
| 6.7 | 56.1 | 1.95 | 1.56 | 1.17 | 66.0 | 2.29 | 1.83 | 1.38 | 78.3 | 2.65 | 2.12 | 1.59 | 87.0 | 3.02 | 2.42 | 1.81 | 94.2 | 3.27 | 2.62 | 1.96 | 94.2 | 3.27 | 2.62 | 1.96 |
| 6.8 | 58.2 | 1.95 | 1.56 | 1.17 | 68.2 | 2.30 | 1.84 | 1.38 | 76.7 | 2.66 | 2.13 | 1.60 | 87.4 | 3.04 | 2.43 | 1.82 | 95.4 | 3.31 | 2.65 | 1.99 | 95.4 | 3.31 | 2.65 | 1.99 |
| 6.9 | 56.4 | 1.96 | 1.57 | 1.17 | 66.5 | 2.31 | 1.85 | 1.39 | 77.0 | 2.67 | 2.14 | 1.60 | 87.9 | 3.05 | 2.44 | 1.63 | 96.7 | 3.36 | 2.69 | 2.01 | 96.7 | 3.36 | 2.69 | 2.01 |
| 7.0 | 58.5 | 1.98 | 1.57 | 1.18 | 66.7 | 2.32 | 1.85 | 1.39 | 77.3 | 2.89 | 2.15 | 1.81 | 88.3 | 3.07 | 2.45 | 1.84 | 97.9 | 3.40 | 2.72 | 2.04 | 97.9 | 3.40 | 2.72 | 2.04 |
| 7.1 | 56.7 | 1.97 | 1.57 | 1.18 | 66.9 | 2.32 | 1.86 | 1.39 | 77.7 | 2.70 | 2.18 | 1.82 | 88.7 | 3.08 | 2.46 | 1.85 | 99.2 | 3.44 | 2.76 | 2.07 | 99.2 | 3.44 | 2.76 | 2.07 |
| 7.2 | 56.8 | 1.97 | 1.58 | 1.18 | 67.2 | 2.33 | 1.87 | 1.40 | 78.0 | 2.71 | 2.17 | 1.62 | 89.1 | 3.10 | 2.48 | 1.86 | 100.5 | 3.49 | 2.79 | 2.09 | 100.5 | 3.49 | 2.79 | 2.09 |
| 7.3 | 56.9 | 1.98 | 1.58 | 1.19 | 87.4 | 2.34 | 1.87 | 1.40 | 78.3 | 2.72 | 2.17 | 1.63 | 89.5 | 3.11 | 2.49 | 1.87 | 101.1 | 3.51 | 2.81 | 2.11 | 101.8 | 3.53 | 2.83 | 2.12 |
| 7.4 | 57.1 | 1.98 | 1.59 | 1.19 | 67.8 | 2.35 | 1.88 | 1.41 | 78.6 | 2.73 | 2.18 | 1.64 | 89.9 | 3.12 | 2.50 | 1.87 | 101.6 | 3.53 | 2.82 | 2.12 | 103.0 | 3.58 | 2.86 | 2.15 |
| 7.5 | 57.2 | 1.99 | 1.59 | 1.19 | 67.8 | 2.35 | 1.88 | 1.41 | 78.9 | 2.74 | 2.19 | 1.64 | 90.3 | 3.14 | 2.51 | 1.88 | 102.1 | 3.55 | 2.84 | 2.13 | 104.3 | 3.62 | 2.90 | 2.17 |
| 7.6 | 57.3 | 1.99 | 1.59 | 1.19 | 68.0 | 2.36 | 1.89 | 1.42 | 79.2 | 2.75 | 2.20 | 1.65 | 90.7 | 3.15 | 2.52 | 1.89 | 102.6 | 3.56 | 2.85 | 2.14 | 105.6 | 3.67 | 2.93 | 2.20 |
| 7.7 | 57.5 | 2.00 | 1.60 | 1.20 | 68.2 | 2.37 | 1.89 | 1.42 | 79.5 | 2.76 | 2.21 | 1.66 | 91.1 | 3.16 | 2.53 | 1.90 | 103.1 | 3.58 | 2.88 | 2.15 | 106.9 | 3.71 | 2.97 | 2.23 |
| 7.8 | 57.8 | 2.00 | 1.60 | 1.20 | 68.4 | 2.38 | 1.90 | 1.43 | 79.7 | 2.77 | 2.21 | 1.66 | 91.5 | 3.18 | 2.54 | 1.91 | 103.6 | 3.60 | 2.88 | 2.16 | 108.2 | 3.76 | 3.00 | 2.25 |
| 7.9 | 57.7 | 2.00 | 1.60 | 1.20 | 68.8 | 2.38 | 1.91 | 1.43 | 80.0 | 2.78 | 2.22 | 1.87 | 91.8 | 3.19 | 2.55 | 1.91 | 104.1 | 3.61 | 2.89 | 2.17 | 109.5 | 3.80 | 3.04 | 2.28 |
| 8.0 | 57.8 | 2.01 | 1.81 | 1.20 | 68.8 | 2.39 | 1.91 | 1.43 | 80.3 | 2.79 | 2.23 | 1.87 | 92.2 | 3.20 | 2.56 | 1.92 | 104.5 | 3.63 | 2.90 | 2.18 | 110.7 | 3.85 | 3.08 | 2.31 |
| 8.1 | 57.9 | 2.01 | 1.81 | 1.21 | 69.0 | 2.39 | 1.92 | 1.44 | 80.5 | 2.80 | 2.24 | 1.68 | 92.8 | 3.21 | 2.57 | 1.93 | 105.0 | 3.64 | 2.92 | 2.19 | 112.0 | 3.89 | 3.11 | 2.33 |
| 8.2 | 58.0 | 2.02 | 1.81 | 1.21 | 69.1 | 2.40 | 1.92 | 1.44 | 80.8 | 2.81 | 2.24 | 1.68 | 92.9 | 3.23 | 2.58 | 1.94 | 105.4 | 3.86 | 2.93 | 2.20 | 113.3 | 3.94 | 3.15 | 2.36 |
| 8.3 | 58.1 | 2.02 | 1.81 | 1.21 | 69.3 | 2.41 | 1.93 | 1.44 | 81.0 | 2.81 | 2.25 | 1.69 | 93.2 | 3.24 | 2.59 | 1.94 | 105.8 | 3.87 | 2.94 | 2.20 | 114.6 | 3.98 | 3.18 | 2.39 |
| 8.4 | 58.2 | 2.02 | 1.82 | 1.21 | 69.5 | 2.41 | 1.93 | 1.45 | 81.3 | 2.82 | 2.26 | 1.69 | 93.8 | 3.25 | 2.60 | 1.95 | 106.3 | 3.69 | 2.95 | 2.21 | 115.9 | 4.03 | 3.22 | 2.42 |
| 8.5 | 58.3 | 2.03 | 1.62 | 1.22 | 69.6 | 2.42 | 1.93 | 1.45 | 81.5 | 2.63 | 2.28 | 1.70 | 93.9 | 3.26 | 2.61 | 1.96 | 106.7 | 3.70 | 2.96 | 2.22 | 117.2 | 4.07 | 3.26 | 2.44 |
| 8.6 | 58.4 | 2.03 | 1.62 | 1.22 | 69.8 | 2.42 | 1.94 | 1.45 | 81.8 | 2.64 | 2.27 | 1.70 | 94.2 | 3.27 | 2.62 | 1.96 | 107.1 | 3.72 | 2.97 | 2.23 | 118.5 | 4.12 | 3.29 | 2.47 |
| 8.7 | 58.5 | 2.03 | 1.63 | 1.22 | 70.0 | 2.43 | 1.94 | 1.46 | 82.0 | 2.85 | 2.28 | 1.71 | 94.5 | 3.28 | 2.63 | 1.97 | 107.5 | 3.73 | 2.99 | 2.24 | 119.8 | 4.16 | 3.33 | 2.50 |
| 8.8 | 58.8 | 2.04 | 1.63 | 1.22 | 70.1 | 2.43 | 1.95 | 1.46 | 82.2 | 2.85 | 2.28 | 1.71 | 94.8 | 3.29 | 2.63 | 1.98 | 107.9 | 3.75 | 3.00 | 2.25 | 121.1 | 4.21 | 3.36 | 2.52 |
| 8.9 | 58.7 | 2.04 | 1.63 | 1.22 | 70.3 | 2.44 | 1.95 | 1.46 | 82.4 | 2.88 | 2.29 | 1.72 | 95.1 | 3.30 | 2.64 | 1.98 | 108.3 | 3.76 | 3.01 | 2.26 | 121.8 | 4.23 | 3.38 | 2.54 |
| 9.0 | 58.8 | 2.04 | 1.63 | 1.23 | 70.4 | 2.44 | 1.96 | 1.47 | 82.6 | 2.87 | 2.30 | 1.72 | 95.4 | 3.31 | 2.65 | 1.99 | 108.6 | 3.77 | 3.02 | 2.26 | 122.3 | 4.25 | 3.40 | 2.55 |
| 9.1 | 58.9 | 2.04 | 1.64 | 1.23 | 70.5 | 2.46 | 1.96 | 1.47 | 82.8 | 2.88 | 2.30 | 1.73 | 95.7 | 3.32 | 2.88 | 1.99 | 109.0 | 3.79 | 3.03 | 2.27 | 122.8 | 4.26 | 3.41 | 2.58 |
| 9.2 | 59.0 | 2.05 | 1.64 | 1.23 | 70.7 | 2.45 | 1.96 | 1.47 | 83.1 | 2.88 | 2.31 | 1.73 | 96.0 | 3.33 | 2.87 | 2.00 | 109.4 | 3.80 | 3.04 | 2.28 | 123.2 | 4.28 | 3.42 | 2.57 |
| 9.3 | 59.0 | 2.05 | 1.64 | 1.23 | 70.8 | 2.46 | 1.97 | 1.48 | 83.3 | 2.89 | 2.31 | 1.73 | 96.3 | 3.34 | 2.67 | 2.01 | 109.7 | 3.81 | 3.05 | 2.29 | 123.7 | 4.29 | 3.44 | 2.58 |
| 9.4 | 59.1 | 2.05 | 1.64 | 1.23 | 71.0 | 2.46 | 1.97 | 1.48 | 83.4 | 2.90 | 2.32 | 1.74 | 96.5 | 3.35 | 2.68 | 2.01 | 110.1 | 3.82 | 3.06 | 2.29 | 124.1 | 4.31 | 3.45 | 2.59 |
| 9.5 | 59.2 | 2.06 | 1.64 | 1.23 | 71.1 | 2.47 | 1.97 | 1.48 | 83.6 | 2.90 | 2.32 | 1.74 | 96.8 | 3.36 | 2.88 | 2.02 | 110.4 | 3.83 | 3.07 | 2.30 | 124.5 | 4.32 | 3.48 | 2.59 |
| 9.6 | 59.3 | 2.06 | 1.65 | 1.23 | 71.2 | 2.47 | 1.98 | 1.48 | 83.8 | 2.91 | 2.33 | 1.75 | 97.0 | 3.37 | 2.70 | 2.02 | 110.8 | 3.85 | 3.08 | 2.31 | 125.0 | 4.34 | 3.47 | 2.80 |
| 9.7 | 59.3 | 2.06 | 1.65 | 1.24 | 71.3 | 2.48 | 1.98 | 1.49 | 84.0 | 2.92 | 2.33 | 1.75 | 97.3 | 3.38 | 2.70 | 2.03 | 111.1 | 3.86 | 3.09 | 2.31 | 125.4 | 4.35 | 3.48 | 2.61 |
| 9.8 | 59.4 | 2.06 | 1.65 | 1.24 | 71.4 | 2.48 | 1.98 | 1.49 | 84.2 | 2.92 | 2.34 | 1.75 | 97.5 | 3.39 | 2.71 | 2.03 | 111.4 | 3.87 | 3.10 | 2.32 | 125.8 | 4.37 | 3.49 | 2.62 |
| 9.9 | 59.5 | 2.07 | 1.65 | 1.24 | 71.6 | 2.48 | 1.98 | 1.49 | 84.4 | 2.93 | 2.34 | 1.76 | 97.8 | 3.40 | 2.72 | 2.04 | 111.8 | 3.88 | 3.10 | 2.33 | 126.2 | 4.38 | 3.51 | 2.63 |
| 10.0 | 59.5 | 2.07 | 1.65 | 1.24 | 71.7 | 2.49 | 1.99 | 1.49 | 84.5 | 2.94 | 2.35 | 1.76 | 98.0 | 3.40 | 2.72 | 2.04 | 112.1 | 3.89 | 3.11 | 2.33 | 126.6 | 4.40 | 3.52 | 2.64 |
| Trench Width m | | 0.9 | | | | 1.0 | | | | 1.1 | | | | 1.2 | | | | 1.3 | | | | 1.4 | | |

**TABLE 17. DESIGN LOADS**
**400 mm DIAMETER PIPE**

8 WHEELS 112.5kN
IMPACT FACTOR 1.3

| Cover | Design Load | Min Bedding Factor — Crushing Strength kN/m | | | Design Load | Min Bedding Factor — Crushing Strength kN/m | | | Design Load | Min Bedding Factor — Crushing Strength kN/m | | | Design Load | Min Bedding Factor — Crushing Strength kN/m | | | Design Load | Min Bedding Factor — Crushing Strength kN/m | | | Design Load | Min Bedding Factor — Crushing Strength kN/m | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 38 | 48 | 64 | kN/m | 38 | 48 | 64 | kN/m | 38 | 48 | 64 | kN/m | 38 | 48 | 64 | kN/m | 38 | 48 | 64 | kN/m | 38 | 48 | 64 |
| 0.6 | 64.7 | 2.13 | 1.69 | 1.26 | 64.7 | 2.13 | 1.69 | 1.26 | 64.7 | 2.13 | 1.69 | 1.26 | 64.7 | 2.13 | 1.69 | 1.26 | 64.7 | 2.13 | 1.69 | 1.26 | 64.7 | 2.13 | 1.69 | 1.26 |
| 0.7 | 58.9 | 1.94 | 1.53 | 1.15 | 58.9 | 1.94 | 1.53 | 1.15 | 58.9 | 1.94 | 1.53 | 1.15 | 58.9 | 1.94 | 1.53 | 1.15 | 58.9 | 1.94 | 1.53 | 1.15 | 58.9 | 1.94 | 1.53 | 1.15 |
| 0.8 | 54.9 | 1.81 | 1.43 | 1.07 | 54.9 | 1.81 | 1.43 | 1.07 | 54.9 | 1.81 | 1.43 | 1.07 | 54.9 | 1.81 | 1.43 | 1.07 | 54.9 | 1.81 | 1.43 | 1.07 | 54.9 | 1.81 | 1.43 | 1.07 |
| 0.9 | 52.3 | 1.72 | 1.36 | 1.02 | 52.3 | 1.72 | 1.36 | 1.02 | 52.3 | 1.72 | 1.36 | 1.02 | 52.3 | 1.72 | 1.36 | 1.02 | 52.3 | 1.72 | 1.36 | 1.02 | 52.3 | 1.72 | 1.36 | 1.02 |
| 1.0 | 50.4 | 1.66 | 1.31 | 0.98 | 50.4 | 1.66 | 1.31 | 0.98 | 50.4 | 1.66 | 1.31 | 0.98 | 50.4 | 1.66 | 1.31 | 0.98 | 50.4 | 1.66 | 1.31 | 0.98 | 50.4 | 1.66 | 1.31 | 0.98 |
| 1.1 | 48.9 | 1.61 | 1.27 | 0.96 | 48.9 | 1.61 | 1.27 | 0.96 | 48.9 | 1.61 | 1.27 | 0.96 | 48.9 | 1.61 | 1.27 | 0.96 | 48.9 | 1.61 | 1.27 | 0.96 | 48.9 | 1.61 | 1.27 | 0.96 |
| 1.2 | 47.9 | 1.58 | 1.25 | 0.94 | 47.9 | 1.58 | 1.25 | 0.94 | 47.9 | 1.58 | 1.25 | 0.94 | 47.9 | 1.58 | 1.25 | 0.94 | 47.9 | 1.58 | 1.25 | 0.94 | 47.9 | 1.58 | 1.25 | 0.94 |
| 1.3 | 47.3 | 1.56 | 1.23 | 0.92 | 47.3 | 1.56 | 1.23 | 0.92 | 47.3 | 1.56 | 1.23 | 0.92 | 47.3 | 1.56 | 1.23 | 0.92 | 47.3 | 1.56 | 1.23 | 0.92 | 47.3 | 1.56 | 1.23 | 0.92 |
| 1.4 | 47.0 | 1.55 | 1.22 | 0.92 | 47.0 | 1.55 | 1.22 | 0.92 | 47.0 | 1.55 | 1.22 | 0.92 | 47.0 | 1.55 | 1.22 | 0.92 | 47.0 | 1.55 | 1.22 | 0.92 | 47.0 | 1.55 | 1.22 | 0.92 |
| 1.5 | 46.9 | 1.54 | 1.22 | 0.92 | 46.9 | 1.54 | 1.22 | 0.92 | 46.9 | 1.54 | 1.22 | 0.92 | 46.9 | 1.54 | 1.22 | 0.92 | 46.9 | 1.54 | 1.22 | 0.92 | 46.9 | 1.54 | 1.22 | 0.92 |
| 1.6 | 47.0 | 1.55 | 1.22 | 0.92 | 47.0 | 1.55 | 1.22 | 0.92 | 47.0 | 1.55 | 1.22 | 0.92 | 47.0 | 1.55 | 1.22 | 0.92 | 47.0 | 1.55 | 1.22 | 0.92 | 47.0 | 1.55 | 1.22 | 0.92 |
| 1.7 | 47.3 | 1.55 | 1.23 | 0.92 | 47.3 | 1.55 | 1.23 | 0.92 | 47.3 | 1.55 | 1.23 | 0.92 | 47.3 | 1.55 | 1.23 | 0.92 | 47.3 | 1.55 | 1.23 | 0.92 | 47.3 | 1.55 | 1.23 | 0.92 |
| 1.8 | 47.7 | 1.57 | 1.24 | 0.93 | 47.7 | 1.57 | 1.24 | 0.93 | 47.7 | 1.57 | 1.24 | 0.93 | 47.7 | 1.57 | 1.24 | 0.93 | 47.7 | 1.57 | 1.24 | 0.93 | 47.7 | 1.57 | 1.24 | 0.93 |
| 1.9 | 48.3 | 1.59 | 1.26 | 0.94 | 48.3 | 1.59 | 1.26 | 0.94 | 48.3 | 1.59 | 1.26 | 0.94 | 48.3 | 1.59 | 1.26 | 0.94 | 48.3 | 1.59 | 1.26 | 0.94 | 48.3 | 1.59 | 1.26 | 0.94 |
| 2.0 | 48.9 | 1.61 | 1.27 | 0.95 | 48.9 | 1.61 | 1.27 | 0.95 | 48.9 | 1.61 | 1.27 | 0.95 | 48.9 | 1.61 | 1.27 | 0.95 | 48.9 | 1.61 | 1.27 | 0.95 | 48.9 | 1.61 | 1.27 | 0.95 |
| 2.1 | 49.5 | 1.63 | 1.29 | 0.97 | 49.5 | 1.63 | 1.29 | 0.97 | 49.5 | 1.63 | 1.29 | 0.97 | 49.5 | 1.63 | 1.29 | 0.97 | 49.5 | 1.63 | 1.29 | 0.97 | 49.5 | 1.63 | 1.29 | 0.97 |
| 2.2 | 50.2 | 1.65 | 1.31 | 0.98 | 50.2 | 1.65 | 1.31 | 0.98 | 50.2 | 1.65 | 1.31 | 0.98 | 50.2 | 1.65 | 1.31 | 0.98 | 50.2 | 1.65 | 1.31 | 0.98 | 50.2 | 1.65 | 1.31 | 0.98 |
| 2.3 | 51.0 | 1.68 | 1.33 | 1.00 | 51.0 | 1.68 | 1.33 | 1.00 | 51.0 | 1.68 | 1.33 | 1.00 | 51.0 | 1.68 | 1.33 | 1.00 | 51.0 | 1.68 | 1.33 | 1.00 | 51.0 | 1.68 | 1.33 | 1.00 |
| 2.4 | 51.7 | 1.70 | 1.35 | 1.01 | 51.7 | 1.70 | 1.35 | 1.01 | 51.7 | 1.70 | 1.35 | 1.01 | 51.7 | 1.70 | 1.35 | 1.01 | 51.7 | 1.70 | 1.35 | 1.01 | 51.7 | 1.70 | 1.35 | 1.01 |
| 2.5 | 52.2 | 1.72 | 1.36 | 1.02 | 52.6 | 1.73 | 1.37 | 1.03 | 52.6 | 1.73 | 1.37 | 1.03 | 52.6 | 1.73 | 1.37 | 1.03 | 52.6 | 1.73 | 1.37 | 1.03 | 52.6 | 1.73 | 1.37 | 1.03 |
| 2.6 | 52.6 | 1.73 | 1.37 | 1.03 | 53.4 | 1.76 | 1.39 | 1.04 | 53.4 | 1.76 | 1.39 | 1.04 | 53.4 | 1.76 | 1.39 | 1.04 | 53.4 | 1.76 | 1.39 | 1.04 | 53.4 | 1.76 | 1.39 | 1.04 |
| 2.7 | 53.0 | 1.74 | 1.38 | 1.03 | 54.3 | 1.79 | 1.41 | 1.06 | 54.3 | 1.79 | 1.41 | 1.06 | 54.3 | 1.79 | 1.41 | 1.06 | 54.3 | 1.79 | 1.41 | 1.06 | 54.3 | 1.79 | 1.41 | 1.06 |
| 2.8 | 53.3 | 1.75 | 1.39 | 1.04 | 55.2 | 1.82 | 1.44 | 1.08 | 55.2 | 1.82 | 1.44 | 1.08 | 55.2 | 1.82 | 1.44 | 1.08 | 55.2 | 1.82 | 1.44 | 1.08 | 55.2 | 1.82 | 1.44 | 1.08 |
| 2.9 | 53.7 | 1.77 | 1.40 | 1.05 | 56.1 | 1.85 | 1.46 | 1.10 | 56.1 | 1.85 | 1.46 | 1.10 | 56.1 | 1.85 | 1.46 | 1.10 | 56.1 | 1.85 | 1.46 | 1.10 | 56.1 | 1.85 | 1.46 | 1.10 |
| 3.0 | 54.1 | 1.78 | 1.41 | 1.06 | 57.1 | 1.88 | 1.49 | 1.11 | 57.1 | 1.88 | 1.49 | 1.11 | 57.1 | 1.88 | 1.49 | 1.11 | 57.1 | 1.88 | 1.49 | 1.11 | 57.1 | 1.88 | 1.49 | 1.11 |
| 3.1 | 54.5 | 1.79 | 1.42 | 1.06 | 58.0 | 1.91 | 1.51 | 1.13 | 58.0 | 1.91 | 1.51 | 1.13 | 58.0 | 1.91 | 1.51 | 1.13 | 58.0 | 1.91 | 1.51 | 1.13 | 58.0 | 1.91 | 1.51 | 1.13 |
| 3.2 | 54.9 | 1.81 | 1.43 | 1.07 | 59.0 | 1.94 | 1.54 | 1.15 | 59.0 | 1.94 | 1.54 | 1.15 | 59.0 | 1.94 | 1.54 | 1.15 | 59.0 | 1.94 | 1.54 | 1.15 | 59.0 | 1.94 | 1.54 | 1.15 |
| 3.3 | 55.3 | 1.82 | 1.44 | 1.08 | 60.1 | 1.98 | 1.56 | 1.17 | 60.1 | 1.98 | 1.56 | 1.17 | 60.1 | 1.98 | 1.56 | 1.17 | 60.1 | 1.98 | 1.56 | 1.17 | 60.1 | 1.98 | 1.56 | 1.17 |
| 3.4 | 55.7 | 1.83 | 1.45 | 1.09 | 61.1 | 2.01 | 1.59 | 1.19 | 61.1 | 2.01 | 1.59 | 1.19 | 61.1 | 2.01 | 1.59 | 1.19 | 61.1 | 2.01 | 1.59 | 1.19 | 61.1 | 2.01 | 1.59 | 1.19 |
| 3.5 | 56.1 | 1.84 | 1.46 | 1.10 | 62.2 | 2.04 | 1.62 | 1.21 | 62.2 | 2.04 | 1.62 | 1.21 | 62.2 | 2.04 | 1.62 | 1.21 | 62.2 | 2.04 | 1.62 | 1.21 | 62.2 | 2.04 | 1.62 | 1.21 |
| 3.6 | 56.5 | 1.86 | 1.47 | 1.10 | 62.9 | 2.07 | 1.64 | 1.23 | 63.2 | 2.08 | 1.65 | 1.24 | 63.2 | 2.08 | 1.65 | 1.24 | 63.2 | 2.08 | 1.65 | 1.24 | 63.2 | 2.08 | 1.65 | 1.24 |
| 3.7 | 56.9 | 1.87 | 1.48 | 1.11 | 63.5 | 2.09 | 1.65 | 1.24 | 64.3 | 2.12 | 1.68 | 1.26 | 64.3 | 2.12 | 1.68 | 1.26 | 64.3 | 2.12 | 1.68 | 1.26 | 64.3 | 2.12 | 1.68 | 1.26 |
| 3.8 | 57.2 | 1.88 | 1.49 | 1.12 | 64.0 | 2.10 | 1.67 | 1.25 | 65.4 | 2.15 | 1.70 | 1.28 | 65.4 | 2.15 | 1.70 | 1.28 | 65.4 | 2.15 | 1.70 | 1.28 | 65.4 | 2.15 | 1.70 | 1.28 |
| 3.9 | 57.6 | 1.90 | 1.50 | 1.13 | 64.5 | 2.12 | 1.68 | 1.26 | 66.6 | 2.19 | 1.73 | 1.30 | 66.6 | 2.19 | 1.73 | 1.30 | 66.6 | 2.19 | 1.73 | 1.30 | 66.6 | 2.19 | 1.73 | 1.30 |
| 4.0 | 58.0 | 1.91 | 1.51 | 1.13 | 65.0 | 2.14 | 1.69 | 1.27 | 67.7 | 2.23 | 1.76 | 1.32 | 67.7 | 2.23 | 1.76 | 1.32 | 67.7 | 2.23 | 1.76 | 1.32 | 67.7 | 2.23 | 1.76 | 1.32 |
| 4.1 | 58.4 | 1.92 | 1.52 | 1.14 | 65.6 | 2.16 | 1.71 | 1.28 | 68.9 | 2.27 | 1.79 | 1.35 | 68.9 | 2.27 | 1.79 | 1.35 | 68.9 | 2.27 | 1.79 | 1.35 | 68.9 | 2.27 | 1.79 | 1.35 |
| 4.2 | 58.7 | 1.93 | 1.53 | 1.15 | 66.1 | 2.17 | 1.72 | 1.29 | 70.0 | 2.30 | 1.82 | 1.37 | 70.0 | 2.30 | 1.82 | 1.37 | 70.0 | 2.30 | 1.82 | 1.37 | 70.0 | 2.30 | 1.82 | 1.37 |
| 4.3 | 59.1 | 1.94 | 1.54 | 1.15 | 66.6 | 2.19 | 1.73 | 1.30 | 71.2 | 2.34 | 1.86 | 1.39 | 71.2 | 2.34 | 1.86 | 1.39 | 71.2 | 2.34 | 1.86 | 1.39 | 71.2 | 2.34 | 1.86 | 1.39 |
| 4.4 | 59.5 | 1.96 | 1.55 | 1.16 | 67.1 | 2.21 | 1.75 | 1.31 | 72.4 | 2.38 | 1.89 | 1.41 | 72.4 | 2.38 | 1.89 | 1.41 | 72.4 | 2.38 | 1.89 | 1.41 | 72.4 | 2.38 | 1.89 | 1.41 |
| 4.5 | 59.8 | 1.97 | 1.56 | 1.17 | 67.6 | 2.22 | 1.76 | 1.32 | 73.6 | 2.42 | 1.92 | 1.44 | 73.6 | 2.42 | 1.92 | 1.44 | 73.6 | 2.42 | 1.92 | 1.44 | 73.6 | 2.42 | 1.92 | 1.44 |
| 4.6 | 60.2 | 1.98 | 1.57 | 1.18 | 68.0 | 2.24 | 1.77 | 1.33 | 74.9 | 2.46 | 1.95 | 1.46 | 74.9 | 2.46 | 1.95 | 1.46 | 74.9 | 2.46 | 1.95 | 1.46 | 74.9 | 2.46 | 1.95 | 1.46 |
| 4.7 | 60.5 | 1.99 | 1.58 | 1.18 | 68.5 | 2.25 | 1.78 | 1.34 | 76.1 | 2.50 | 1.98 | 1.49 | 76.1 | 2.50 | 1.98 | 1.49 | 76.1 | 2.50 | 1.98 | 1.49 | 76.1 | 2.50 | 1.98 | 1.49 |
| 4.8 | 60.9 | 2.00 | 1.56 | 1.19 | 69.0 | 2.27 | 1.80 | 1.35 | 77.3 | 2.54 | 2.01 | 1.51 | 77.3 | 2.54 | 2.01 | 1.51 | 77.3 | 2.54 | 2.01 | 1.51 | 77.3 | 2.54 | 2.01 | 1.51 |
| 4.9 | 61.2 | 2.01 | 1.59 | 1.20 | 69.5 | 2.28 | 1.81 | 1.36 | 77.9 | 2.56 | 2.03 | 1.52 | 78.6 | 2.59 | 2.05 | 1.53 | 78.6 | 2.59 | 2.05 | 1.53 | 78.6 | 2.59 | 2.05 | 1.53 |
| 5.0 | 61.5 | 2.02 | 1.60 | 1.20 | 69.9 | 2.30 | 1.82 | 1.37 | 78.5 | 2.58 | 2.04 | 1.53 | 79.8 | 2.63 | 2.08 | 1.56 | 79.8 | 2.63 | 2.08 | 1.56 | 79.8 | 2.63 | 2.08 | 1.56 |
| 5.1 | 61.8 | 2.03 | 1.61 | 1.21 | 70.4 | 2.31 | 1.83 | 1.37 | 79.1 | 2.60 | 2.06 | 1.54 | 81.1 | 2.67 | 2.11 | 1.58 | 81.1 | 2.67 | 2.11 | 1.58 | 81.1 | 2.67 | 2.11 | 1.58 |
| 5.2 | 62.2 | 2.04 | 1.62 | 1.21 | 70.8 | 2.33 | 1.84 | 1.38 | 79.7 | 2.62 | 2.07 | 1.56 | 82.4 | 2.71 | 2.15 | 1.61 | 82.4 | 2.71 | 2.15 | 1.61 | 82.4 | 2.71 | 2.15 | 1.61 |
| 5.3 | 62.5 | 2.06 | 1.63 | 1.22 | 71.3 | 2.34 | 1.86 | 1.39 | 80.2 | 2.64 | 2.09 | 1.57 | 83.7 | 2.75 | 2.18 | 1.63 | 83.7 | 2.75 | 2.18 | 1.63 | 83.7 | 2.75 | 2.18 | 1.63 |
| 5.4 | 62.8 | 2.07 | 1.64 | 1.23 | 71.7 | 2.36 | 1.87 | 1.40 | 80.8 | 2.66 | 2.10 | 1.58 | 85.0 | 2.80 | 2.21 | 1.66 | 85.0 | 2.80 | 2.21 | 1.66 | 85.0 | 2.80 | 2.21 | 1.66 |
| 5.5 | 63.1 | 2.08 | 1.64 | 1.23 | 72.1 | 2.37 | 1.88 | 1.41 | 81.3 | 2.68 | 2.12 | 1.59 | 86.3 | 2.84 | 2.25 | 1.69 | 86.3 | 2.84 | 2.25 | 1.69 | 86.3 | 2.84 | 2.25 | 1.69 |
| 5.6 | 63.4 | 2.09 | 1.65 | 1.24 | 72.5 | 2.39 | 1.89 | 1.42 | 81.9 | 2.69 | 2.13 | 1.60 | 87.6 | 2.88 | 2.28 | 1.71 | 87.6 | 2.88 | 2.28 | 1.71 | 87.6 | 2.88 | 2.28 | 1.71 |
| 5.7 | 63.7 | 2.10 | 1.66 | 1.24 | 72.9 | 2.40 | 1.90 | 1.42 | 82.4 | 2.71 | 2.15 | 1.61 | 88.9 | 2.92 | 2.31 | 1.74 | 88.9 | 2.92 | 2.31 | 1.74 | 88.9 | 2.92 | 2.31 | 1.74 |
| 5.8 | 64.0 | 2.10 | 1.67 | 1.25 | 73.3 | 2.41 | 1.91 | 1.43 | 83.0 | 2.73 | 2.16 | 1.62 | 90.2 | 2.97 | 2.35 | 1.76 | 90.2 | 2.97 | 2.35 | 1.76 | 90.2 | 2.97 | 2.35 | 1.76 |
| 5.9 | 64.3 | 2.11 | 1.67 | 1.26 | 73.7 | 2.43 | 1.92 | 1.44 | 83.5 | 2.75 | 2.17 | 1.63 | 91.5 | 3.01 | 2.38 | 1.79 | 91.5 | 3.01 | 2.38 | 1.79 | 91.5 | 3.01 | 2.38 | 1.79 |
| 6.0 | 64.5 | 2.12 | 1.68 | 1.26 | 74.1 | 2.44 | 1.93 | 1.45 | 84.0 | 2.76 | 2.19 | 1.64 | 92.9 | 3.05 | 2.42 | 1.81 | 92.9 | 3.05 | 2.42 | 1.81 | 92.9 | 3.05 | 2.42 | 1.81 |
| 6.1 | 64.8 | 2.13 | 1.69 | 1.27 | 74.5 | 2.45 | 1.94 | 1.46 | 84.5 | 2.78 | 2.20 | 1.65 | 94.2 | 3.10 | 2.45 | 1.84 | 94.2 | 3.10 | 2.45 | 1.84 | 94.2 | 3.10 | 2.45 | 1.84 |
| 6.2 | 65.1 | 2.14 | 1.69 | 1.27 | 74.9 | 2.46 | 1.95 | 1.46 | 85.0 | 2.79 | 2.21 | 1.66 | 95.3 | 3.13 | 2.48 | 1.86 | 95.5 | 3.14 | 2.49 | 1.87 | 95.5 | 3.14 | 2.49 | 1.87 |
| 6.3 | 65.3 | 2.15 | 1.70 | 1.28 | 75.3 | 2.48 | 1.96 | 1.47 | 85.5 | 2.81 | 2.23 | 1.67 | 95.9 | 3.15 | 2.50 | 1.87 | 96.9 | 3.19 | 2.52 | 1.89 | 96.9 | 3.19 | 2.52 | 1.89 |
| 6.4 | 65.6 | 2.16 | 1.71 | 1.28 | 75.6 | 2.49 | 1.97 | 1.48 | 85.9 | 2.83 | 2.24 | 1.68 | 96.5 | 3.17 | 2.51 | 1.88 | 98.2 | 3.23 | 2.56 | 1.92 | 98.2 | 3.23 | 2.56 | 1.92 |
| 6.5 | 65.8 | 2.17 | 1.71 | 1.29 | 76.0 | 2.50 | 1.98 | 1.48 | 86.4 | 2.84 | 2.25 | 1.69 | 97.1 | 3.19 | 2.53 | 1.90 | 99.6 | 3.28 | 2.59 | 1.95 | 99.6 | 3.28 | 2.59 | 1.95 |
| 6.6 | 66.1 | 2.17 | 1.72 | 1.29 | 76.3 | 2.51 | 1.99 | 1.49 | 86.8 | 2.86 | 2.26 | 1.70 | 97.6 | 3.21 | 2.54 | 1.91 | 101.0 | 3.32 | 2.63 | 1.97 | 101.0 | 3.32 | 2.63 | 1.97 |
| 6.7 | 66.3 | 2.18 | 1.73 | 1.30 | 76.7 | 2.52 | 2.00 | 1.50 | 87.3 | 2.87 | 2.27 | 1.71 | 98.2 | 3.23 | 2.56 | 1.92 | 102.3 | 3.37 | 2.66 | 2.00 | 102.3 | 3.37 | 2.66 | 2.00 |
| 6.8 | 66.6 | 2.19 | 1.73 | 1.30 | 77.0 | 2.53 | 2.00 | 1.50 | 87.7 | 2.89 | 2.28 | 1.71 | 98.8 | 3.25 | 2.57 | 1.93 | 103.7 | 3.41 | 2.70 | 2.03 | 103.7 | 3.41 | 2.70 | 2.03 |
| 6.9 | 66.8 | 2.20 | 1.74 | 1.30 | 77.3 | 2.54 | 2.01 | 1.51 | 88.2 | 2.90 | 2.30 | 1.72 | 99.3 | 3.27 | 2.59 | 1.94 | 105.1 | 3.46 | 2.74 | 2.05 | 105.1 | 3.46 | 2.74 | 2.05 |
| 7.0 | 67.0 | 2.20 | 1.75 | 1.31 | 77.6 | 2.55 | 2.02 | 1.52 | 88.6 | 2.91 | 2.31 | 1.73 | 99.9 | 3.28 | 2.60 | 1.95 | 106.4 | 3.50 | 2.77 | 2.08 | 106.4 | 3.50 | 2.77 | 2.08 |
| 7.1 | 67.2 | 2.21 | 1.75 | 1.31 | 78.0 | 2.56 | 2.03 | 1.52 | 89.0 | 2.93 | 2.32 | 1.74 | 100.4 | 3.30 | 2.61 | 1.96 | 107.8 | 3.55 | 2.81 | 2.11 | 107.8 | 3.55 | 2.81 | 2.11 |
| 7.2 | 67.5 | 2.22 | 1.76 | 1.32 | 78.3 | 2.57 | 2.04 | 1.53 | 89.4 | 2.94 | 2.33 | 1.75 | 100.9 | 3.32 | 2.63 | 1.97 | 109.2 | 3.59 | 2.84 | 2.13 | 109.2 | 3.59 | 2.84 | 2.13 |
| 7.3 | 67.7 | 2.23 | 1.76 | 1.32 | 78.6 | 2.58 | 2.05 | 1.53 | 89.8 | 2.95 | 2.34 | 1.75 | 101.4 | 3.34 | 2.64 | 1.98 | 110.6 | 3.64 | 2.88 | 2.16 | 110.6 | 3.64 | 2.88 | 2.16 |
| 7.4 | 67.9 | 2.23 | 1.77 | 1.33 | 78.9 | 2.59 | 2.05 | 1.54 | 90.2 | 2.97 | 2.35 | 1.76 | 101.9 | 3.35 | 2.65 | 1.99 | 112.0 | 3.68 | 2.92 | 2.19 | 112.0 | 3.68 | 2.92 | 2.19 |
| 7.5 | 68.1 | 2.24 | 1.77 | 1.33 | 79.1 | 2.60 | 2.06 | 1.55 | 90.6 | 2.98 | 2.36 | 1.77 | 102.4 | 3.37 | 2.67 | 2.00 | 113.4 | 3.73 | 2.95 | 2.21 | 113.4 | 3.73 | 2.95 | 2.21 |
| 7.6 | 68.3 | 2.25 | 1.78 | 1.33 | 79.4 | 2.61 | 2.07 | 1.55 | 91.0 | 2.99 | 2.37 | 1.78 | 102.9 | 3.38 | 2.68 | 2.01 | 114.7 | 3.77 | 2.99 | 2.24 | 114.7 | 3.77 | 2.99 | 2.24 |
| 7.7 | 68.5 | 2.25 | 1.78 | 1.34 | 79.7 | 2.62 | 2.08 | 1.56 | 91.4 | 3.01 | 2.38 | 1.78 | 103.4 | 3.40 | 2.69 | 2.02 | 115.7 | 3.81 | 3.01 | 2.26 | 116.1 | 3.82 | 3.02 | 2.27 |
| 7.8 | 68.7 | 2.26 | 1.79 | 1.34 | 80.0 | 2.63 | 2.08 | 1.56 | 91.7 | 3.02 | 2.39 | 1.79 | 103.8 | 3.42 | 2.70 | 2.03 | 116.3 | 3.82 | 3.03 | 2.27 | 117.5 | 3.87 | 3.06 | 2.30 |
| 7.9 | 68.8 | 2.28 | 1.79 | 1.34 | 80.2 | 2.64 | 2.09 | 1.57 | 92.1 | 3.03 | 2.40 | 1.80 | 104.3 | 3.43 | 2.72 | 2.04 | 116.8 | 3.84 | 3.04 | 2.28 | 118.9 | 3.91 | 3.10 | 2.32 |
| 8.0 | 69.0 | 2.27 | 1.80 | 1.35 | 80.5 | 2.65 | 2.10 | 1.57 | 92.4 | 3.04 | 2.41 | 1.81 | 104.8 | 3.45 | 2.73 | 2.05 | 117.4 | 3.86 | 3.06 | 2.29 | 120.3 | 3.96 | 3.13 | 2.35 |
| 8.1 | 69.2 | 2.28 | 1.80 | 1.35 | 80.8 | 2.66 | 2.10 | 1.58 | 92.8 | 3.05 | 2.42 | 1.81 | 105.2 | 3.46 | 2.74 | 2.05 | 117.9 | 3.88 | 3.07 | 2.30 | 121.8 | 4.00 | 3.17 | 2.38 |
| 8.2 | 69.4 | 2.28 | 1.81 | 1.35 | 81.0 | 2.66 | 2.11 | 1.56 | 93.1 | 3.06 | 2.43 | 1.82 | 105.6 | 3.47 | 2.75 | 2.06 | 118.5 | 3.90 | 3.09 | 2.31 | 123.2 | 4.05 | 3.21 | 2.41 |
| 8.3 | 69.5 | 2.29 | 1.81 | 1.36 | 81.3 | 2.67 | 2.12 | 1.59 | 93.5 | 3.07 | 2.43 | 1.83 | 106.1 | 3.49 | 2.76 | 2.07 | 119.0 | 3.92 | 3.10 | 2.32 | 124.6 | 4.10 | 3.24 | 2.43 |
| 8.4 | 69.7 | 2.29 | 1.82 | 1.36 | 81.5 | 2.88 | 2.12 | 1.59 | 93.8 | 3.08 | 2.44 | 1.83 | 108.5 | 3.50 | 2.77 | 2.08 | 119.5 | 3.93 | 3.11 | 2.33 | 126.0 | 4.14 | 3.28 | 2.46 |
| 8.5 | 69.9 | 2.30 | 1.82 | 1.36 | 81.7 | 2.69 | 2.13 | 1.60 | 94.1 | 3.10 | 2.45 | 1.84 | 106.9 | 3.52 | 2.78 | 2.09 | 120.1 | 3.95 | 3.13 | 2.34 | 127.4 | 4.19 | 3.32 | 2.49 |
| 8.6 | 70.0 | 2.30 | 1.82 | 1.37 | 82.0 | 2.70 | 2.13 | 1.60 | 94.4 | 3.11 | 2.46 | 1.84 | 107.3 | 3.53 | 2.79 | 2.10 | 120.6 | 3.97 | 3.14 | 2.35 | 128.8 | 4.24 | 3.35 | 2.52 |
| 8.7 | 70.2 | 2.31 | 1.83 | 1.37 | 82.2 | 2.70 | 2.14 | 1.61 | 94.7 | 3.12 | 2.47 | 1.85 | 107.7 | 3.54 | 2.80 | 2.10 | 121.1 | 3.98 | 3.15 | 2.36 | 130.2 | 4.28 | 3.39 | 2.54 |
| 8.8 | 70.3 | 2.31 | 1.83 | 1.37 | 82.4 | 2.71 | 2.15 | 1.61 | 95.0 | 3.13 | 2.47 | 1.86 | 108.1 | 3.56 | 2.81 | 2.11 | 121.5 | 4.00 | 3.17 | 2.37 | 131.6 | 4.33 | 3.43 | 2.57 |
| 8.9 | 70.5 | 2.32 | 1.83 | 1.38 | 82.6 | 2.72 | 2.15 | 1.61 | 95.3 | 3.14 | 2.48 | 1.86 | 108.5 | 3.57 | 2.82 | 2.12 | 122.0 | 4.01 | 3.18 | 2.38 | 133.1 | 4.38 | 3.47 | 2.60 |
| 9.0 | 70.6 | 2.32 | 1.84 | 1.38 | 82.8 | 2.72 | 2.16 | 1.62 | 95.6 | 3.14 | 2.49 | 1.87 | 108.8 | 3.58 | 2.83 | 2.13 | 122.5 | 4.03 | 3.19 | 2.39 | 134.5 | 4.42 | 3.50 | 2.63 |
| 9.1 | 70.7 | 2.33 | 1.84 | 1.38 | 83.0 | 2.73 | 2.16 | 1.62 | 95.9 | 3.15 | 2.50 | 1.87 | 109.2 | 3.59 | 2.84 | 2.13 | 123.0 | 4.04 | 3.20 | 2.40 | 135.9 | 4.47 | 3.54 | 2.65 |
| 9.2 | 70.9 | 2.33 | 1.85 | 1.38 | 83.2 | 2.74 | 2.17 | 1.63 | 96.2 | 3.16 | 2.50 | 1.88 | 109.6 | 3.60 | 2.85 | 2.14 | 123.4 | 4.06 | 3.21 | 2.41 | 137.3 | 4.52 | 3.58 | 2.68 |
| 9.3 | 71.0 | 2.34 | 1.85 | 1.39 | 83.4 | 2.74 | 2.17 | 1.63 | 96.4 | 3.17 | 2.51 | 1.88 | 109.9 | 3.62 | 2.86 | 2.15 | 123.9 | 4.07 | 3.23 | 2.42 | 138.2 | 4.54 | 3.60 | 2.70 |
| 9.4 | 71.1 | 2.34 | 1.85 | 1.39 | 83.6 | 2.75 | 2.18 | 1.63 | 96.7 | 3.18 | 2.52 | 1.89 | 110.3 | 3.63 | 2.87 | 2.15 | 124.3 | 4.09 | 3.24 | 2.43 | 138.7 | 4.56 | 3.61 | 2.71 |
| 9.5 | 71.3 | 2.34 | 1.88 | 1.39 | 83.8 | 2.76 | 2.18 | 1.64 | 97.0 | 3.19 | 2.52 | 1.89 | 110.6 | 3.64 | 2.88 | 2.16 | 124.7 | 4.10 | 3.25 | 2.44 | 139.2 | 4.58 | 3.63 | 2.72 |
| 9.6 | 71.4 | 2.35 | 1.86 | 1.39 | 84.0 | 2.76 | 2.19 | 1.64 | 97.2 | 3.20 | 2.53 | 1.90 | 111.0 | 3.65 | 2.89 | 2.17 | 125.1 | 4.12 | 3.26 | 2.44 | 139.7 | 4.60 | 3.64 | 2.73 |
| 9.7 | 71.5 | 2.35 | 1.86 | 1.40 | 84.2 | 2.77 | 2.19 | 1.64 | 97.5 | 3.21 | 2.54 | 1.90 | 111.3 | 3.66 | 2.90 | 2.17 | 125.6 | 4.13 | 3.27 | 2.45 | 140.3 | 4.61 | 3.65 | 2.74 |
| 9.8 | 71.6 | 2.36 | 1.86 | 1.40 | 84.4 | 2.77 | 2.20 | 1.65 | 97.7 | 3.21 | 2.54 | 1.91 | 111.6 | 3.67 | 2.91 | 2.18 | 126.0 | 4.14 | 3.28 | 2.46 | 140.8 | 4.63 | 3.67 | 2.75 |
| 9.9 | 71.7 | 2.36 | 1.87 | 1.40 | 84.5 | 2.78 | 2.20 | 1.65 | 97.9 | 3.22 | 2.55 | 1.91 | 111.9 | 3.68 | 2.91 | 2.19 | 126.4 | 4.16 | 3.29 | 2.47 | 141.3 | 4.65 | 3.68 | 2.76 |
| 10.0 | 71.8 | 2.36 | 1.87 | 1.40 | 84.7 | 2.79 | 2.21 | 1.65 | 98.2 | 3.23 | 2.56 | 1.92 | 112.2 | 3.69 | 2.92 | 2.19 | 126.8 | 4.17 | 3.30 | 2.48 | 141.7 | 4.66 | 3.69 | 2.77 |
| Trench Width m | 1.0 | | | | 1.1 | | | | 1.2 | | | | 1.3 | | | | 1.4 | | | | 1.5 | | | |

## TABLE 18. DESIGN LOADS
## 450 mm DIAMETER PIPE

8 WHEELS 112.5kN
IMPACT FACTOR 1.3

| Cover | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 43 | 54 | 72 | kN/m | 43 | 54 | 72 | kN/m | 43 | 54 | 72 | kN/m | 43 | 54 | 72 | kN/m | 43 | 54 | 72 | kN/m | 43 | 54 | 72 |
| 0.6 | 70.6 | 2.05 | 1.63 | 1.23 | 70.6 | 2.05 | 1.63 | 1.23 | 70.6 | 2.05 | 1.63 | 1.23 | 70.6 | 2.05 | 1.63 | 1.23 | 70.6 | 2.05 | 1.63 | 1.23 | 70.6 | 2.05 | 1.63 | 1.23 |
| 0.7 | 64.2 | 1.87 | 1.49 | 1.11 | 64.2 | 1.87 | 1.49 | 1.11 | 64.2 | 1.87 | 1.49 | 1.11 | 64.2 | 1.87 | 1.49 | 1.11 | 64.2 | 1.87 | 1.49 | 1.11 | 64.2 | 1.87 | 1.49 | 1.11 |
| 0.8 | 59.8 | 1.74 | 1.39 | 1.04 | 59.8 | 1.74 | 1.39 | 1.04 | 59.8 | 1.74 | 1.39 | 1.04 | 59.8 | 1.74 | 1.39 | 1.04 | 59.8 | 1.74 | 1.39 | 1.04 | 59.8 | 1.74 | 1.39 | 1.04 |
| 0.9 | 56.9 | 1.65 | 1.32 | 0.99 | 56.9 | 1.65 | 1.32 | 0.99 | 56.9 | 1.65 | 1.32 | 0.99 | 56.9 | 1.65 | 1.32 | 0.99 | 56.9 | 1.65 | 1.32 | 0.99 | 56.9 | 1.65 | 1.32 | 0.99 |
| 1.0 | 55.1 | 1.60 | 1.28 | 0.96 | 55.1 | 1.60 | 1.28 | 0.96 | 55.1 | 1.60 | 1.28 | 0.96 | 55.1 | 1.60 | 1.28 | 0.96 | 55.1 | 1.60 | 1.28 | 0.96 | 55.1 | 1.60 | 1.28 | 0.96 |
| 1.1 | 53.7 | 1.56 | 1.24 | 0.93 | 53.7 | 1.56 | 1.24 | 0.93 | 53.7 | 1.56 | 1.24 | 0.93 | 53.7 | 1.56 | 1.24 | 0.93 | 53.7 | 1.56 | 1.24 | 0.93 | 53.7 | 1.56 | 1.24 | 0.93 |
| 1.2 | 52.7 | 1.53 | 1.22 | 0.91 | 52.7 | 1.53 | 1.22 | 0.91 | 52.7 | 1.53 | 1.22 | 0.91 | 52.7 | 1.53 | 1.22 | 0.91 | 52.7 | 1.53 | 1.22 | 0.91 | 52.7 | 1.53 | 1.22 | 0.91 |
| 1.3 | 52.0 | 1.51 | 1.20 | 0.90 | 52.0 | 1.51 | 1.20 | 0.90 | 52.0 | 1.51 | 1.20 | 0.90 | 52.0 | 1.51 | 1.20 | 0.90 | 52.0 | 1.51 | 1.20 | 0.90 | 52.0 | 1.51 | 1.20 | 0.90 |
| 1.4 | 51.7 | 1.50 | 1.20 | 0.90 | 51.7 | 1.50 | 1.20 | 0.90 | 51.7 | 1.50 | 1.20 | 0.90 | 51.7 | 1.50 | 1.20 | 0.90 | 51.7 | 1.50 | 1.20 | 0.90 | 51.7 | 1.50 | 1.20 | 0.90 |
| 1.5 | 51.6 | 1.50 | 1.19 | 0.90 | 51.6 | 1.50 | 1.19 | 0.90 | 51.6 | 1.50 | 1.19 | 0.90 | 51.6 | 1.50 | 1.19 | 0.90 | 51.6 | 1.50 | 1.19 | 0.90 | 51.6 | 1.50 | 1.19 | 0.90 |
| 1.6 | 51.7 | 1.50 | 1.20 | 0.90 | 51.7 | 1.50 | 1.20 | 0.90 | 51.7 | 1.50 | 1.20 | 0.90 | 51.7 | 1.50 | 1.20 | 0.90 | 51.7 | 1.50 | 1.20 | 0.90 | 51.7 | 1.50 | 1.20 | 0.90 |
| 1.7 | 52.0 | 1.51 | 1.20 | 0.90 | 52.0 | 1.51 | 1.20 | 0.90 | 52.0 | 1.51 | 1.20 | 0.90 | 52.0 | 1.51 | 1.20 | 0.90 | 52.0 | 1.51 | 1.20 | 0.90 | 52.0 | 1.51 | 1.20 | 0.90 |
| 1.8 | 52.5 | 1.53 | 1.22 | 0.91 | 52.5 | 1.53 | 1.22 | 0.91 | 52.5 | 1.53 | 1.22 | 0.91 | 52.5 | 1.53 | 1.22 | 0.91 | 52.5 | 1.53 | 1.22 | 0.91 | 52.5 | 1.53 | 1.22 | 0.91 |
| 1.9 | 53.1 | 1.54 | 1.23 | 0.92 | 53.1 | 1.54 | 1.23 | 0.92 | 53.1 | 1.54 | 1.23 | 0.92 | 53.1 | 1.54 | 1.23 | 0.92 | 53.1 | 1.54 | 1.23 | 0.92 | 53.1 | 1.54 | 1.23 | 0.92 |
| 2.0 | 53.7 | 1.56 | 1.24 | 0.93 | 53.7 | 1.56 | 1.24 | 0.93 | 53.7 | 1.56 | 1.24 | 0.93 | 53.7 | 1.56 | 1.24 | 0.93 | 53.7 | 1.56 | 1.24 | 0.93 | 53.7 | 1.56 | 1.24 | 0.93 |
| 2.1 | 54.4 | 1.58 | 1.26 | 0.95 | 54.4 | 1.58 | 1.26 | 0.95 | 54.4 | 1.58 | 1.26 | 0.95 | 54.4 | 1.58 | 1.26 | 0.95 | 54.4 | 1.58 | 1.26 | 0.95 | 54.4 | 1.58 | 1.26 | 0.95 |
| 2.2 | 55.2 | 1.60 | 1.28 | 0.96 | 55.2 | 1.60 | 1.28 | 0.96 | 55.2 | 1.60 | 1.28 | 0.96 | 55.2 | 1.60 | 1.28 | 0.96 | 55.2 | 1.60 | 1.28 | 0.96 | 55.2 | 1.60 | 1.28 | 0.96 |
| 2.3 | 56.0 | 1.63 | 1.30 | 0.97 | 56.0 | 1.63 | 1.30 | 0.97 | 56.0 | 1.63 | 1.30 | 0.97 | 56.0 | 1.63 | 1.30 | 0.97 | 56.0 | 1.63 | 1.30 | 0.97 | 56.0 | 1.63 | 1.30 | 0.97 |
| 2.4 | 56.9 | 1.65 | 1.32 | 0.99 | 56.9 | 1.65 | 1.32 | 0.99 | 56.9 | 1.65 | 1.32 | 0.99 | 56.9 | 1.65 | 1.32 | 0.99 | 56.9 | 1.65 | 1.32 | 0.99 | 56.9 | 1.65 | 1.32 | 0.99 |
| 2.5 | 57.8 | 1.68 | 1.34 | 1.00 | 57.8 | 1.68 | 1.34 | 1.00 | 57.8 | 1.68 | 1.34 | 1.00 | 57.8 | 1.68 | 1.34 | 1.00 | 57.8 | 1.68 | 1.34 | 1.00 | 57.8 | 1.68 | 1.34 | 1.00 |
| 2.6 | 58.7 | 1.71 | 1.36 | 1.02 | 58.7 | 1.71 | 1.36 | 1.02 | 58.7 | 1.71 | 1.36 | 1.02 | 58.7 | 1.71 | 1.36 | 1.02 | 58.7 | 1.71 | 1.36 | 1.02 | 58.7 | 1.71 | 1.36 | 1.02 |
| 2.7 | 59.4 | 1.73 | 1.38 | 1.03 | 59.7 | 1.73 | 1.38 | 1.04 | 59.7 | 1.73 | 1.38 | 1.04 | 59.7 | 1.73 | 1.38 | 1.04 | 59.7 | 1.73 | 1.38 | 1.04 | 59.7 | 1.73 | 1.38 | 1.04 |
| 2.8 | 59.9 | 1.74 | 1.39 | 1.04 | 60.7 | 1.76 | 1.40 | 1.05 | 60.7 | 1.76 | 1.40 | 1.05 | 60.7 | 1.76 | 1.40 | 1.05 | 60.7 | 1.76 | 1.40 | 1.05 | 60.7 | 1.76 | 1.40 | 1.05 |
| 2.9 | 60.4 | 1.76 | 1.40 | 1.05 | 61.7 | 1.79 | 1.43 | 1.07 | 61.7 | 1.79 | 1.43 | 1.07 | 61.7 | 1.79 | 1.43 | 1.07 | 61.7 | 1.79 | 1.43 | 1.07 | 61.7 | 1.79 | 1.43 | 1.07 |
| 3.0 | 81.0 | 1.77 | 1.41 | 1.08 | 62.7 | 1.82 | 1.45 | 1.09 | 62.7 | 1.82 | 1.45 | 1.09 | 62.7 | 1.82 | 1.45 | 1.09 | 62.7 | 1.82 | 1.45 | 1.09 | 62.7 | 1.82 | 1.45 | 1.09 |
| 3.1 | 81.5 | 1.79 | 1.42 | 1.07 | 63.8 | 1.85 | 1.48 | 1.11 | 63.8 | 1.85 | 1.48 | 1.11 | 63.8 | 1.85 | 1.48 | 1.11 | 63.8 | 1.85 | 1.48 | 1.11 | 63.8 | 1.85 | 1.48 | 1.11 |
| 3.2 | 62.0 | 1.80 | 1.43 | 1.08 | 64.9 | 1.89 | 1.50 | 1.13 | 64.9 | 1.89 | 1.50 | 1.13 | 64.9 | 1.89 | 1.50 | 1.13 | 64.9 | 1.89 | 1.50 | 1.13 | 64.9 | 1.89 | 1.50 | 1.13 |
| 3.3 | 62.6 | 1.82 | 1.45 | 1.08 | 66.0 | 1.92 | 1.53 | 1.15 | 66.0 | 1.92 | 1.53 | 1.15 | 66.0 | 1.92 | 1.53 | 1.15 | 66.0 | 1.92 | 1.53 | 1.15 | 66.0 | 1.92 | 1.53 | 1.15 |
| 3.4 | 63.0 | 1.83 | 1.48 | 1.09 | 67.2 | 1.95 | 1.55 | 1.17 | 67.2 | 1.95 | 1.55 | 1.17 | 67.2 | 1.95 | 1.55 | 1.17 | 67.2 | 1.95 | 1.55 | 1.17 | 67.2 | 1.95 | 1.55 | 1.17 |
| 3.5 | 63.5 | 1.85 | 1.47 | 1.10 | 68.3 | 1.99 | 1.58 | 1.19 | 68.3 | 1.99 | 1.58 | 1.19 | 68.3 | 1.99 | 1.58 | 1.19 | 68.3 | 1.99 | 1.58 | 1.19 | 68.3 | 1.99 | 1.58 | 1.19 |
| 3.6 | 64.0 | 1.88 | 1.48 | 1.11 | 69.5 | 2.02 | 1.61 | 1.21 | 69.5 | 2.02 | 1.61 | 1.21 | 69.5 | 2.02 | 1.61 | 1.21 | 69.5 | 2.02 | 1.61 | 1.21 | 69.5 | 2.02 | 1.61 | 1.21 |
| 3.7 | 64.5 | 1.87 | 1.49 | 1.12 | 70.7 | 2.06 | 1.64 | 1.23 | 70.7 | 2.06 | 1.64 | 1.23 | 70.7 | 2.06 | 1.64 | 1.23 | 70.7 | 2.06 | 1.64 | 1.23 | 70.7 | 2.06 | 1.64 | 1.23 |
| 3.8 | 65.0 | 1.89 | 1.50 | 1.13 | 71.8 | 2.09 | 1.68 | 1.25 | 71.9 | 2.09 | 1.67 | 1.25 | 71.9 | 2.09 | 1.67 | 1.25 | 71.9 | 2.09 | 1.67 | 1.25 | 71.9 | 2.09 | 1.67 | 1.25 |
| 3.9 | 86.5 | 1.90 | 1.52 | 1.14 | 72.5 | 2.11 | 1.88 | 1.26 | 73.2 | 2.13 | 1.69 | 1.27 | 73.2 | 2.13 | 1.69 | 1.27 | 73.2 | 2.13 | 1.69 | 1.27 | 73.2 | 2.13 | 1.69 | 1.27 |
| 4.0 | 68.0 | 1.92 | 1.53 | 1.15 | 73.1 | 2.13 | 1.69 | 1.27 | 74.4 | 2.16 | 1.72 | 1.29 | 74.4 | 2.16 | 1.72 | 1.29 | 74.4 | 2.16 | 1.72 | 1.29 | 74.4 | 2.16 | 1.72 | 1.29 |
| 4.1 | 66.4 | 1.93 | 1.54 | 1.15 | 73.7 | 2.14 | 1.71 | 1.28 | 75.7 | 2.20 | 1.75 | 1.31 | 75.7 | 2.20 | 1.75 | 1.31 | 75.7 | 2.20 | 1.75 | 1.31 | 75.7 | 2.20 | 1.75 | 1.31 |
| 4.2 | 66.9 | 1.95 | 1.55 | 1.16 | 74.4 | 2.16 | 1.72 | 1.29 | 77.0 | 2.24 | 1.78 | 1.34 | 77.0 | 2.24 | 1.78 | 1.34 | 77.0 | 2.24 | 1.78 | 1.34 | 77.0 | 2.24 | 1.78 | 1.34 |
| 4.3 | 87.4 | 1.96 | 1.58 | 1.17 | 75.0 | 2.18 | 1.74 | 1.30 | 78.3 | 2.28 | 1.81 | 1.36 | 78.3 | 2.28 | 1.81 | 1.36 | 78.3 | 2.28 | 1.81 | 1.36 | 78.3 | 2.28 | 1.81 | 1.36 |
| 4.4 | 67.9 | 1.97 | 1.57 | 1.18 | 75.6 | 2.20 | 1.75 | 1.31 | 79.6 | 2.31 | 1.84 | 1.38 | 79.6 | 2.31 | 1.84 | 1.38 | 79.6 | 2.31 | 1.84 | 1.38 | 79.6 | 2.31 | 1.84 | 1.38 |
| 4.5 | 68.3 | 1.99 | 1.58 | 1.19 | 76.2 | 2.22 | 1.76 | 1.32 | 81.0 | 2.35 | 1.87 | 1.41 | 81.0 | 2.35 | 1.87 | 1.41 | 81.0 | 2.35 | 1.87 | 1.41 | 81.0 | 2.35 | 1.87 | 1.41 |
| 4.6 | 68.8 | 2.00 | 1.59 | 1.19 | 76.8 | 2.23 | 1.78 | 1.33 | 82.3 | 2.39 | 1.91 | 1.43 | 82.3 | 2.39 | 1.91 | 1.43 | 82.3 | 2.39 | 1.91 | 1.43 | 82.3 | 2.39 | 1.91 | 1.43 |
| 4.7 | 89.3 | 2.01 | 1.60 | 1.20 | 77.4 | 2.25 | 1.79 | 1.34 | 83.7 | 2.43 | 1.94 | 1.45 | 83.7 | 2.43 | 1.94 | 1.45 | 83.7 | 2.43 | 1.94 | 1.45 | 83.7 | 2.43 | 1.94 | 1.45 |
| 4.8 | 89.7 | 2.03 | 1.81 | 1.21 | 78.0 | 2.27 | 1.81 | 1.35 | 85.0 | 2.47 | 1.97 | 1.48 | 85.0 | 2.47 | 1.97 | 1.48 | 85.0 | 2.47 | 1.97 | 1.48 | 85.0 | 2.47 | 1.97 | 1.48 |
| 4.9 | 70.1 | 2.04 | 1.62 | 1.22 | 78.6 | 2.28 | 1.82 | 1.36 | 86.4 | 2.51 | 2.00 | 1.50 | 86.4 | 2.51 | 2.00 | 1.50 | 86.4 | 2.51 | 2.00 | 1.50 | 86.4 | 2.51 | 2.00 | 1.50 |
| 5.0 | 70.8 | 2.06 | 1.83 | 1.23 | 79.2 | 2.30 | 1.83 | 1.37 | 87.8 | 2.55 | 2.03 | 1.52 | 87.8 | 2.55 | 2.03 | 1.52 | 87.8 | 2.55 | 2.03 | 1.52 | 87.8 | 2.55 | 2.03 | 1.52 |
| 5.1 | 71.0 | 2.08 | 1.64 | 1.23 | 79.7 | 2.32 | 1.85 | 1.38 | 88.6 | 2.58 | 2.05 | 1.54 | 89.2 | 2.59 | 2.06 | 1.55 | 89.2 | 2.59 | 2.06 | 1.55 | 89.2 | 2.59 | 2.06 | 1.55 |
| 5.2 | 71.4 | 2.08 | 1.85 | 1.24 | 80.3 | 2.33 | 1.88 | 1.39 | 89.3 | 2.60 | 2.07 | 1.55 | 90.6 | 2.63 | 2.10 | 1.57 | 90.6 | 2.63 | 2.10 | 1.57 | 90.6 | 2.63 | 2.10 | 1.57 |
| 5.3 | 71.9 | 2.09 | 1.66 | 1.25 | 80.8 | 2.35 | 1.87 | 1.40 | 90.0 | 2.62 | 2.08 | 1.56 | 92.0 | 2.67 | 2.13 | 1.60 | 92.0 | 2.67 | 2.13 | 1.60 | 92.0 | 2.67 | 2.13 | 1.60 |
| 5.4 | 72.3 | 2.10 | 1.67 | 1.25 | 81.4 | 2.37 | 1.88 | 1.41 | 90.7 | 2.64 | 2.10 | 1.57 | 93.4 | 2.72 | 2.16 | 1.62 | 93.4 | 2.72 | 2.16 | 1.62 | 93.4 | 2.72 | 2.16 | 1.62 |
| 5.5 | 72.7 | 2.11 | 1.88 | 1.28 | 81.9 | 2.38 | 1.90 | 1.42 | 91.3 | 2.65 | 2.11 | 1.59 | 94.9 | 2.76 | 2.20 | 1.65 | 94.9 | 2.76 | 2.20 | 1.65 | 94.9 | 2.76 | 2.20 | 1.65 |
| 5.6 | 73.1 | 2.12 | 1.69 | 1.27 | 82.4 | 2.40 | 1.91 | 1.43 | 92.0 | 2.67 | 2.13 | 1.60 | 96.3 | 2.80 | 2.23 | 1.67 | 96.3 | 2.80 | 2.23 | 1.67 | 96.3 | 2.80 | 2.23 | 1.67 |
| 5.7 | 73.5 | 2.14 | 1.70 | 1.28 | 83.0 | 2.41 | 1.92 | 1.44 | 92.6 | 2.69 | 2.14 | 1.61 | 97.7 | 2.84 | 2.26 | 1.70 | 97.7 | 2.84 | 2.26 | 1.70 | 97.7 | 2.84 | 2.26 | 1.70 |
| 5.8 | 73.9 | 2.15 | 1.71 | 1.28 | 83.6 | 2.43 | 1.93 | 1.45 | 93.3 | 2.71 | 2.18 | 1.62 | 99.2 | 2.88 | 2.30 | 1.72 | 99.2 | 2.88 | 2.30 | 1.72 | 99.2 | 2.88 | 2.30 | 1.72 |
| 5.9 | 74.2 | 2.18 | 1.72 | 1.29 | 84.0 | 2.44 | 1.94 | 1.46 | 93.9 | 2.73 | 2.17 | 1.63 | 100.7 | 2.93 | 2.33 | 1.75 | 100.7 | 2.93 | 2.33 | 1.75 | 100.7 | 2.93 | 2.33 | 1.75 |
| 6.0 | 74.8 | 2.17 | 1.73 | 1.30 | 64.5 | 2.48 | 1.96 | 1.47 | 94.5 | 2.75 | 2.19 | 1.64 | 102.1 | 2.97 | 2.36 | 1.77 | 102.1 | 2.97 | 2.36 | 1.77 | 102.1 | 2.97 | 2.36 | 1.77 |
| 6.1 | 76.0 | 2.18 | 1.74 | 1.30 | 85.0 | 2.47 | 1.97 | 1.47 | 95.1 | 2.77 | 2.20 | 1.65 | 103.6 | 3.01 | 2.40 | 1.80 | 103.6 | 3.01 | 2.40 | 1.80 | 103.6 | 3.01 | 2.40 | 1.80 |
| 6.2 | 75.4 | 2.19 | 1.74 | 1.31 | 85.4 | 2.48 | 1.98 | 1.48 | 95.8 | 2.78 | 2.22 | 1.66 | 105.1 | 3.05 | 2.43 | 1.82 | 105.1 | 3.05 | 2.43 | 1.82 | 105.1 | 3.05 | 2.43 | 1.82 |
| 6.3 | 76.7 | 2.20 | 1.76 | 1.31 | 85.9 | 2.50 | 1.99 | 1.49 | 96.3 | 2.80 | 2.23 | 1.67 | 106.5 | 3.10 | 2.47 | 1.85 | 106.5 | 3.10 | 2.47 | 1.85 | 106.5 | 3.10 | 2.47 | 1.85 |
| 6.4 | 78.1 | 2.21 | 1.78 | 1.32 | 86.4 | 2.51 | 2.00 | 1.50 | 98.9 | 2.82 | 2.24 | 1.68 | 107.7 | 3.13 | 2.49 | 1.87 | 108.0 | 3.14 | 2.50 | 1.88 | 108.0 | 3.14 | 2.50 | 1.88 |
| 6.5 | 78.4 | 2.22 | 1.77 | 1.33 | 88.8 | 2.52 | 2.01 | 1.51 | 97.5 | 2.83 | 2.26 | 1.69 | 108.4 | 3.15 | 2.51 | 1.88 | 109.5 | 3.18 | 2.54 | 1.90 | 109.5 | 3.18 | 2.54 | 1.90 |
| 6.6 | 78.7 | 2.23 | 1.78 | 1.33 | 87.3 | 2.54 | 2.02 | 1.52 | 98.1 | 2.85 | 2.27 | 1.70 | 109.1 | 3.17 | 2.53 | 1.89 | 111.0 | 3.23 | 2.57 | 1.93 | 111.0 | 3.23 | 2.57 | 1.93 |
| 6.7 | 77.1 | 2.24 | 1.78 | 1.34 | 87.7 | 2.55 | 2.03 | 1.52 | 98.8 | 2.87 | 2.28 | 1.71 | 109.8 | 3.19 | 2.54 | 1.91 | 112.5 | 3.27 | 2.60 | 1.95 | 112.5 | 3.27 | 2.60 | 1.95 |
| 6.8 | 77.4 | 2.25 | 1.79 | 1.34 | 88.1 | 2.56 | 2.04 | 1.53 | 99.2 | 2.88 | 2.30 | 1.72 | 110.4 | 3.21 | 2.56 | 1.92 | 114.0 | 3.31 | 2.64 | 1.98 | 114.0 | 3.31 | 2.64 | 1.98 |
| 6.9 | 77.7 | 2.26 | 1.80 | 1.35 | 88.6 | 2.57 | 2.05 | 1.54 | 99.7 | 2.90 | 2.31 | 1.73 | 111.1 | 3.23 | 2.57 | 1.93 | 115.5 | 3.36 | 2.67 | 2.01 | 115.5 | 3.36 | 2.67 | 2.01 |
| 7.0 | 78.0 | 2.27 | 1.81 | 1.35 | 89.0 | 2.59 | 2.06 | 1.54 | 100.2 | 2.91 | 2.32 | 1.74 | 111.7 | 3.25 | 2.59 | 1.94 | 117.0 | 3.40 | 2.71 | 2.03 | 117.0 | 3.40 | 2.71 | 2.03 |
| 7.1 | 78.3 | 2.28 | 1.81 | 1.38 | 89.4 | 2.60 | 2.07 | 1.56 | 100.8 | 2.93 | 2.33 | 1.75 | 112.4 | 3.27 | 2.60 | 1.95 | 118.6 | 3.45 | 2.74 | 2.06 | 118.6 | 3.45 | 2.74 | 2.06 |
| 7.2 | 78.8 | 2.29 | 1.82 | 1.38 | 89.8 | 2.81 | 2.08 | 1.56 | 101.3 | 2.94 | 2.34 | 1.76 | 113.0 | 3.29 | 2.62 | 1.96 | 120.1 | 3.49 | 2.78 | 2.08 | 120.1 | 3.49 | 2.78 | 2.08 |
| 7.3 | 78.9 | 2.29 | 1.83 | 1.37 | 90.2 | 2.62 | 2.09 | 1.57 | 101.8 | 2.96 | 2.38 | 1.77 | 113.6 | 3.30 | 2.63 | 1.97 | 121.6 | 3.53 | 2.81 | 2.11 | 121.6 | 3.53 | 2.81 | 2.11 |
| 7.4 | 79.2 | 2.30 | 1.83 | 1.38 | 90.6 | 2.63 | 2.10 | 1.57 | 102.3 | 2.97 | 2.37 | 1.78 | 114.2 | 3.32 | 2.64 | 1.98 | 123.1 | 3.58 | 2.85 | 2.14 | 123.1 | 3.58 | 2.85 | 2.14 |
| 7.5 | 79.5 | 2.31 | 1.64 | 1.38 | 91.0 | 2.64 | 2.11 | 1.58 | 102.8 | 2.99 | 2.38 | 1.78 | 114.8 | 3.34 | 2.66 | 1.99 | 124.7 | 3.62 | 2.89 | 2.16 | 124.7 | 3.62 | 2.89 | 2.16 |
| 7.6 | 79.8 | 2.32 | 1.85 | 1.38 | 91.3 | 2.65 | 2.11 | 1.59 | 103.2 | 3.00 | 2.39 | 1.79 | 115.4 | 3.36 | 2.67 | 2.00 | 126.2 | 3.67 | 2.92 | 2.19 | 126.2 | 3.67 | 2.92 | 2.19 |
| 7.7 | 80.0 | 2.33 | 1.85 | 1.39 | 91.7 | 2.67 | 2.12 | 1.59 | 103.7 | 3.01 | 2.40 | 1.80 | 118.0 | 3.37 | 2.69 | 2.01 | 127.7 | 3.71 | 2.96 | 2.22 | 127.7 | 3.71 | 2.96 | 2.22 |
| 7.8 | 80.3 | 2.33 | 1.66 | 1.39 | 92.0 | 2.68 | 2.13 | 1.60 | 104.2 | 3.03 | 2.41 | 1.81 | 118.8 | 3.39 | 2.70 | 2.02 | 129.3 | 3.76 | 2.99 | 2.24 | 129.3 | 3.76 | 2.99 | 2.24 |
| 7.9 | 80.6 | 2.34 | 1.88 | 1.40 | 92.4 | 2.69 | 2.14 | 1.60 | 104.8 | 3.04 | 2.42 | 1.82 | 117.1 | 3.41 | 2.71 | 2.03 | 130.0 | 3.78 | 3.01 | 2.26 | 130.8 | 3.80 | 3.03 | 2.27 |
| 8.0 | 80.8 | 2.35 | 1.87 | 1.40 | 92.7 | 2.70 | 2.15 | 1.81 | 105.1 | 3.05 | 2.43 | 1.82 | 117.7 | 3.42 | 2.72 | 2.04 | 130.8 | 3.90 | 3.02 | 2.27 | 132.3 | 3.85 | 3.06 | 2.30 |
| 8.1 | 81.1 | 2.38 | 1.88 | 1.41 | 93.1 | 2.71 | 2.15 | 1.62 | 105.5 | 3.07 | 2.44 | 1.83 | 118.2 | 3.44 | 2.74 | 2.05 | 131.3 | 3.82 | 3.04 | 2.28 | 133.9 | 3.89 | 3.10 | 2.32 |
| 8.2 | 81.3 | 2.38 | 1.88 | 1.41 | 93.4 | 2.72 | 2.18 | 1.62 | 105.9 | 3.08 | 2.45 | 1.64 | 118.8 | 3.45 | 2.75 | 2.06 | 131.9 | 3.64 | 3.05 | 2.29 | 135.4 | 3.94 | 3.14 | 2.35 |
| 8.3 | 81.5 | 2.37 | 1.89 | 1.42 | 93.7 | 2.72 | 2.17 | 1.83 | 108.3 | 3.09 | 2.46 | 1.85 | 119.3 | 3.47 | 2.76 | 2.07 | 132.6 | 3.85 | 3.07 | 2.30 | 137.0 | 3.98 | 3.17 | 2.38 |
| 8.4 | 81.8 | 2.38 | 1.89 | 1.42 | 94.1 | 2.73 | 2.18 | 1.83 | 106.8 | 3.10 | 2.47 | 1.85 | 119.8 | 3.48 | 2.77 | 2.08 | 133.2 | 3.87 | 3.08 | 2.31 | 138.5 | 4.03 | 3.21 | 2.41 |
| 8.5 | 82.0 | 2.38 | 1.90 | 1.42 | 94.4 | 2.74 | 2.18 | 1.64 | 107.2 | 3.12 | 2.48 | 1.86 | 120.3 | 3.50 | 2.79 | 2.09 | 133.8 | 3.89 | 3.10 | 2.32 | 140.1 | 4.07 | 3.24 | 2.43 |
| 8.6 | 82.2 | 2.39 | 1.90 | 1.43 | 94.7 | 2.75 | 2.19 | 1.64 | 107.8 | 3.13 | 2.49 | 1.87 | 120.8 | 3.51 | 2.80 | 2.10 | 134.4 | 3.91 | 3.11 | 2.33 | 141.6 | 4.12 | 3.28 | 2.46 |
| 8.7 | 82.4 | 2.40 | 1.91 | 1.43 | 95.0 | 2.78 | 2.20 | 1.65 | 108.0 | 3.14 | 2.50 | 1.87 | 121.3 | 3.53 | 2.81 | 2.11 | 136.0 | 3.92 | 3.13 | 2.34 | 143.2 | 4.16 | 3.31 | 2.49 |
| 8.8 | 82.7 | 2.40 | 1.91 | 1.44 | 95.3 | 2.77 | 2.21 | 1.85 | 108.3 | 3.15 | 2.51 | 1.88 | 121.8 | 3.54 | 2.82 | 2.11 | 135.6 | 3.94 | 3.14 | 2.35 | 144.8 | 4.21 | 3.35 | 2.51 |
| 8.9 | 82.9 | 2.41 | 1.92 | 1.44 | 95.6 | 2.78 | 2.21 | 1.66 | 108.7 | 3.16 | 2.52 | 1.89 | 122.3 | 3.55 | 2.83 | 2.12 | 138.2 | 3.96 | 3.15 | 2.38 | 146.3 | 4.25 | 3.39 | 2.54 |
| 9.0 | 83.1 | 2.41 | 1.92 | 1.44 | 95.8 | 2.79 | 2.22 | 1.66 | 109.1 | 3.17 | 2.53 | 1.89 | 122.7 | 3.57 | 2.84 | 2.13 | 138.7 | 3.97 | 3.17 | 2.37 | 147.9 | 4.30 | 3.42 | 2.57 |
| 9.1 | 83.3 | 2.42 | 1.93 | 1.45 | 96.1 | 2.79 | 2.23 | 1.87 | 109.4 | 3.18 | 2.53 | 1.90 | 123.2 | 3.58 | 2.85 | 2.14 | 137.3 | 3.99 | 3.18 | 2.38 | 149.5 | 4.34 | 3.46 | 2.59 |
| 9.2 | 83.5 | 2.43 | 1.93 | 1.45 | 96.4 | 2.80 | 2.23 | 1.87 | 109.8 | 3.19 | 2.54 | 1.91 | 123.8 | 3.59 | 2.86 | 2.15 | 137.8 | 4.01 | 3.19 | 2.39 | 151.0 | 4.39 | 3.50 | 2.62 |
| 9.3 | 83.7 | 2.43 | 1.94 | 1.45 | 96.7 | 2.81 | 2.24 | 1.88 | 110.2 | 3.20 | 2.55 | 1.91 | 124.1 | 3.61 | 2.87 | 2.15 | 138.4 | 4.02 | 3.20 | 2.40 | 152.6 | 4.44 | 3.53 | 2.65 |
| 9.4 | 83.8 | 2.44 | 1.94 | 1.46 | 96.9 | 2.82 | 2.24 | 1.68 | 110.5 | 3.21 | 2.56 | 1.92 | 124.5 | 3.62 | 2.88 | 2.16 | 138.9 | 4.04 | 3.22 | 2.41 | 153.7 | 4.47 | 3.56 | 2.67 |
| 9.5 | 84.0 | 2.44 | 1.95 | 1.46 | 97.2 | 2.82 | 2.25 | 1.69 | 110.8 | 3.22 | 2.57 | 1.92 | 124.9 | 3.63 | 2.89 | 2.17 | 139.4 | 4.05 | 3.23 | 2.42 | 154.3 | 4.49 | 3.57 | 2.68 |
| 9.6 | 84.2 | 2.45 | 1.95 | 1.46 | 97.4 | 2.83 | 2.28 | 1.69 | 111.2 | 3.23 | 2.57 | 1.93 | 125.4 | 3.64 | 2.90 | 2.18 | 140.0 | 4.07 | 3.24 | 2.43 | 154.9 | 4.50 | 3.59 | 2.69 |
| 9.7 | 84.4 | 2.45 | 1.95 | 1.47 | 97.7 | 2.84 | 2.26 | 1.70 | 111.5 | 3.24 | 2.58 | 1.94 | 125.8 | 3.68 | 2.91 | 2.18 | 140.5 | 4.08 | 3.25 | 2.44 | 155.5 | 4.52 | 3.60 | 2.70 |
| 9.8 | 84.6 | 2.46 | 1.96 | 1.47 | 97.9 | 2.85 | 2.27 | 1.70 | 111.8 | 3.25 | 2.59 | 1.94 | 128.2 | 3.87 | 2.92 | 2.19 | 141.0 | 4.10 | 3.26 | 2.45 | 156.1 | 4.54 | 3.61 | 2.71 |
| 9.9 | 84.7 | 2.46 | 1.96 | 1.47 | 98.2 | 2.86 | 2.27 | 1.70 | 112.1 | 3.28 | 2.60 | 1.95 | 128.8 | 3.68 | 2.93 | 2.20 | 141.5 | 4.11 | 3.27 | 2.48 | 156.7 | 4.56 | 3.63 | 2.72 |
| 10.0 | 84.8 | 2.47 | 1.97 | 1.47 | 98.4 | 2.86 | 2.28 | 1.71 | 112.4 | 3.27 | 2.60 | 1.95 | 127.0 | 3.89 | 2.94 | 2.20 | 141.9 | 4.13 | 3.29 | 2.46 | 157.3 | 4.57 | 3.64 | 2.73 |
| Trench Width m | | 1.1 | | | | 1.2 | | | | 1.3 | | | | 1.4 | | | | 1.5 | | | | 1.6 | | |

## TABLE 19. DESIGN LOADS
## 500 mm DIAMETER PIPE

8 WHEELS 112.5kN
IMPACT FACTOR 1.3

| Cover | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 48 | 60 | 80 | kN/m | 48 | 60 | 80 | kN/m | 48 | 60 | 80 | kN/m | 48 | 60 | 80 | kN/m | 48 | 60 | 80 | kN/m | 48 | 60 | 80 |
| 0.6 | 78.0 | 2.03 | 1.63 | 1.22 | 78.0 | 2.03 | 1.63 | 1.22 | 78.0 | 2.03 | 1.63 | 1.22 | 78.0 | 2.03 | 1.63 | 1.22 | 78.0 | 2.03 | 1.63 | 1.22 | 78.0 | 2.03 | 1.63 | 1.22 |
| 0.7 | 71.1 | 1.85 | 1.48 | 1.11 | 71.1 | 1.85 | 1.48 | 1.11 | 71.1 | 1.85 | 1.48 | 1.11 | 71.1 | 1.85 | 1.48 | 1.11 | 71.1 | 1.85 | 1.48 | 1.11 | 71.1 | 1.85 | 1.48 | 1.11 |
| 0.8 | 66.2 | 1.72 | 1.38 | 1.03 | 66.2 | 1.72 | 1.38 | 1.03 | 66.2 | 1.72 | 1.38 | 1.03 | 66.2 | 1.72 | 1.38 | 1.03 | 66.2 | 1.72 | 1.38 | 1.03 | 66.2 | 1.72 | 1.38 | 1.03 |
| 0.9 | 62.9 | 1.64 | 1.31 | 0.98 | 62.9 | 1.64 | 1.31 | 0.98 | 62.9 | 1.64 | 1.31 | 0.98 | 62.9 | 1.64 | 1.31 | 0.98 | 62.9 | 1.64 | 1.31 | 0.98 | 62.9 | 1.64 | 1.31 | 0.98 |
| 1.0 | 60.8 | 1.58 | 1.27 | 0.95 | 60.8 | 1.58 | 1.27 | 0.95 | 60.8 | 1.58 | 1.27 | 0.95 | 60.8 | 1.58 | 1.27 | 0.95 | 60.8 | 1.58 | 1.27 | 0.95 | 60.8 | 1.58 | 1.27 | 0.95 |
| 1.1 | 59.6 | 1.55 | 1.24 | 0.93 | 59.6 | 1.55 | 1.24 | 0.93 | 59.6 | 1.55 | 1.24 | 0.93 | 59.6 | 1.55 | 1.24 | 0.93 | 59.6 | 1.55 | 1.24 | 0.93 | 59.6 | 1.55 | 1.24 | 0.93 |
| 1.2 | 58.8 | 1.53 | 1.22 | 0.92 | 58.8 | 1.53 | 1.22 | 0.92 | 58.8 | 1.53 | 1.22 | 0.92 | 58.8 | 1.53 | 1.22 | 0.92 | 58.8 | 1.53 | 1.22 | 0.92 | 58.8 | 1.53 | 1.22 | 0.92 |
| 1.3 | 58.1 | 1.51 | 1.21 | 0.91 | 58.1 | 1.51 | 1.21 | 0.91 | 58.1 | 1.51 | 1.21 | 0.91 | 58.1 | 1.51 | 1.21 | 0.91 | 58.1 | 1.51 | 1.21 | 0.91 | 58.1 | 1.51 | 1.21 | 0.91 |
| 1.4 | 57.7 | 1.50 | 1.20 | 0.90 | 57.7 | 1.50 | 1.20 | 0.90 | 57.7 | 1.50 | 1.20 | 0.90 | 57.7 | 1.50 | 1.20 | 0.90 | 57.7 | 1.50 | 1.20 | 0.90 | 57.7 | 1.50 | 1.20 | 0.90 |
| 1.5 | 57.6 | 1.50 | 1.20 | 0.90 | 57.6 | 1.50 | 1.20 | 0.90 | 57.6 | 1.50 | 1.20 | 0.90 | 57.6 | 1.50 | 1.20 | 0.90 | 57.6 | 1.50 | 1.20 | 0.90 | 57.6 | 1.50 | 1.20 | 0.90 |
| 1.6 | 57.7 | 1.50 | 1.20 | 0.90 | 57.7 | 1.50 | 1.20 | 0.90 | 57.7 | 1.50 | 1.20 | 0.90 | 57.7 | 1.50 | 1.20 | 0.90 | 57.7 | 1.50 | 1.20 | 0.90 | 57.7 | 1.50 | 1.20 | 0.90 |
| 1.7 | 58.1 | 1.51 | 1.21 | 0.91 | 58.1 | 1.51 | 1.21 | 0.91 | 58.1 | 1.51 | 1.21 | 0.91 | 58.1 | 1.51 | 1.21 | 0.91 | 58.1 | 1.51 | 1.21 | 0.91 | 58.1 | 1.51 | 1.21 | 0.91 |
| 1.8 | 58.7 | 1.53 | 1.22 | 0.92 | 58.7 | 1.53 | 1.22 | 0.92 | 58.7 | 1.53 | 1.22 | 0.92 | 58.7 | 1.53 | 1.22 | 0.92 | 58.7 | 1.53 | 1.22 | 0.92 | 58.7 | 1.53 | 1.22 | 0.92 |
| 1.9 | 59.4 | 1.55 | 1.24 | 0.93 | 59.4 | 1.55 | 1.24 | 0.93 | 59.4 | 1.55 | 1.24 | 0.93 | 59.4 | 1.55 | 1.24 | 0.93 | 59.4 | 1.55 | 1.24 | 0.93 | 59.4 | 1.55 | 1.24 | 0.93 |
| 2.0 | 60.1 | 1.56 | 1.25 | 0.94 | 60.1 | 1.56 | 1.25 | 0.94 | 60.1 | 1.56 | 1.25 | 0.94 | 60.1 | 1.56 | 1.25 | 0.94 | 60.1 | 1.56 | 1.25 | 0.94 | 60.1 | 1.56 | 1.25 | 0.94 |
| 2.1 | 60.9 | 1.58 | 1.27 | 0.95 | 60.9 | 1.58 | 1.27 | 0.95 | 60.9 | 1.58 | 1.27 | 0.95 | 60.9 | 1.58 | 1.27 | 0.95 | 60.9 | 1.58 | 1.27 | 0.95 | 60.9 | 1.58 | 1.27 | 0.95 |
| 2.2 | 61.7 | 1.61 | 1.29 | 0.96 | 61.7 | 1.61 | 1.29 | 0.96 | 61.7 | 1.61 | 1.29 | 0.96 | 61.7 | 1.61 | 1.29 | 0.96 | 61.7 | 1.61 | 1.29 | 0.96 | 61.7 | 1.61 | 1.29 | 0.96 |
| 2.3 | 62.6 | 1.63 | 1.30 | 0.98 | 62.6 | 1.63 | 1.30 | 0.98 | 62.6 | 1.63 | 1.30 | 0.98 | 62.6 | 1.63 | 1.30 | 0.98 | 62.6 | 1.63 | 1.30 | 0.98 | 62.6 | 1.63 | 1.30 | 0.98 |
| 2.4 | 63.5 | 1.65 | 1.32 | 0.99 | 63.5 | 1.65 | 1.32 | 0.99 | 63.5 | 1.65 | 1.32 | 0.99 | 63.5 | 1.65 | 1.32 | 0.99 | 63.5 | 1.65 | 1.32 | 0.99 | 63.5 | 1.65 | 1.32 | 0.99 |
| 2.5 | 64.5 | 1.68 | 1.34 | 1.01 | 64.5 | 1.68 | 1.34 | 1.01 | 64.5 | 1.68 | 1.34 | 1.01 | 64.5 | 1.68 | 1.34 | 1.01 | 64.5 | 1.68 | 1.34 | 1.01 | 64.5 | 1.68 | 1.34 | 1.01 |
| 2.6 | 65.6 | 1.71 | 1.37 | 1.02 | 65.6 | 1.71 | 1.37 | 1.02 | 65.6 | 1.71 | 1.37 | 1.02 | 65.6 | 1.71 | 1.37 | 1.02 | 65.6 | 1.71 | 1.37 | 1.02 | 65.6 | 1.71 | 1.37 | 1.02 |
| 2.7 | 66.4 | 1.73 | 1.38 | 1.04 | 66.6 | 1.74 | 1.39 | 1.04 | 66.6 | 1.74 | 1.39 | 1.04 | 66.6 | 1.74 | 1.39 | 1.04 | 66.6 | 1.74 | 1.39 | 1.04 | 66.6 | 1.74 | 1.39 | 1.04 |
| 2.8 | 67.0 | 1.75 | 1.40 | 1.05 | 67.8 | 1.76 | 1.41 | 1.06 | 67.8 | 1.76 | 1.41 | 1.06 | 67.8 | 1.76 | 1.41 | 1.06 | 67.8 | 1.76 | 1.41 | 1.06 | 67.8 | 1.76 | 1.41 | 1.06 |
| 2.9 | 67.6 | 1.76 | 1.41 | 1.06 | 68.9 | 1.79 | 1.44 | 1.08 | 68.9 | 1.79 | 1.44 | 1.08 | 68.9 | 1.79 | 1.44 | 1.08 | 68.9 | 1.79 | 1.44 | 1.08 | 68.9 | 1.79 | 1.44 | 1.08 |
| 3.0 | 68.2 | 1.78 | 1.42 | 1.07 | 70.1 | 1.82 | 1.46 | 1.09 | 70.1 | 1.82 | 1.46 | 1.09 | 70.1 | 1.82 | 1.46 | 1.09 | 70.1 | 1.82 | 1.46 | 1.09 | 70.1 | 1.82 | 1.46 | 1.09 |
| 3.1 | 68.8 | 1.79 | 1.43 | 1.08 | 71.3 | 1.86 | 1.48 | 1.11 | 71.3 | 1.86 | 1.48 | 1.11 | 71.3 | 1.86 | 1.48 | 1.11 | 71.3 | 1.86 | 1.48 | 1.11 | 71.3 | 1.86 | 1.48 | 1.11 |
| 3.2 | 69.4 | 1.81 | 1.45 | 1.09 | 72.5 | 1.89 | 1.51 | 1.13 | 72.5 | 1.89 | 1.51 | 1.13 | 72.5 | 1.89 | 1.51 | 1.13 | 72.5 | 1.89 | 1.51 | 1.13 | 72.5 | 1.89 | 1.51 | 1.13 |
| 3.3 | 70.1 | 1.82 | 1.46 | 1.09 | 73.8 | 1.92 | 1.54 | 1.15 | 73.8 | 1.92 | 1.54 | 1.15 | 73.8 | 1.92 | 1.54 | 1.15 | 73.8 | 1.92 | 1.54 | 1.15 | 73.8 | 1.92 | 1.54 | 1.15 |
| 3.4 | 70.7 | 1.84 | 1.47 | 1.10 | 75.0 | 1.95 | 1.56 | 1.17 | 75.0 | 1.95 | 1.56 | 1.17 | 75.0 | 1.95 | 1.56 | 1.17 | 75.0 | 1.95 | 1.56 | 1.17 | 75.0 | 1.95 | 1.56 | 1.17 |
| 3.5 | 71.3 | 1.86 | 1.48 | 1.11 | 76.3 | 1.99 | 1.59 | 1.19 | 76.3 | 1.99 | 1.59 | 1.19 | 76.3 | 1.99 | 1.59 | 1.19 | 76.3 | 1.99 | 1.59 | 1.19 | 76.3 | 1.99 | 1.59 | 1.19 |
| 3.6 | 71.9 | 1.87 | 1.50 | 1.12 | 77.7 | 2.02 | 1.62 | 1.21 | 77.7 | 2.02 | 1.62 | 1.21 | 77.7 | 2.02 | 1.62 | 1.21 | 77.7 | 2.02 | 1.62 | 1.21 | 77.7 | 2.02 | 1.62 | 1.21 |
| 3.7 | 72.5 | 1.89 | 1.51 | 1.13 | 79.0 | 2.06 | 1.65 | 1.23 | 79.0 | 2.06 | 1.65 | 1.23 | 79.0 | 2.06 | 1.65 | 1.23 | 79.0 | 2.06 | 1.65 | 1.23 | 79.0 | 2.06 | 1.65 | 1.23 |
| 3.8 | 73.1 | 1.90 | 1.52 | 1.14 | 80.0 | 2.08 | 1.67 | 1.25 | 80.4 | 2.09 | 1.67 | 1.26 | 80.4 | 2.09 | 1.67 | 1.26 | 80.4 | 2.09 | 1.67 | 1.26 | 80.4 | 2.09 | 1.67 | 1.26 |
| 3.9 | 73.7 | 1.92 | 1.54 | 1.15 | 80.8 | 2.10 | 1.68 | 1.26 | 81.8 | 2.13 | 1.70 | 1.28 | 81.8 | 2.13 | 1.70 | 1.28 | 81.8 | 2.13 | 1.70 | 1.28 | 81.8 | 2.13 | 1.70 | 1.28 |
| 4.0 | 74.3 | 1.93 | 1.55 | 1.16 | 81.5 | 2.12 | 1.70 | 1.27 | 83.2 | 2.17 | 1.73 | 1.30 | 83.2 | 2.17 | 1.73 | 1.30 | 83.2 | 2.17 | 1.73 | 1.30 | 83.2 | 2.17 | 1.73 | 1.30 |
| 4.1 | 74.9 | 1.95 | 1.56 | 1.17 | 82.3 | 2.14 | 1.71 | 1.29 | 84.6 | 2.20 | 1.76 | 1.32 | 84.6 | 2.20 | 1.76 | 1.32 | 84.6 | 2.20 | 1.76 | 1.32 | 84.6 | 2.20 | 1.76 | 1.32 |
| 4.2 | 75.5 | 1.97 | 1.57 | 1.18 | 83.0 | 2.16 | 1.73 | 1.30 | 86.1 | 2.24 | 1.79 | 1.34 | 86.1 | 2.24 | 1.79 | 1.34 | 86.1 | 2.24 | 1.79 | 1.34 | 86.1 | 2.24 | 1.79 | 1.34 |
| 4.3 | 76.1 | 1.98 | 1.58 | 1.19 | 83.8 | 2.18 | 1.75 | 1.31 | 87.5 | 2.28 | 1.82 | 1.37 | 87.5 | 2.28 | 1.82 | 1.37 | 87.5 | 2.28 | 1.82 | 1.37 | 87.5 | 2.28 | 1.82 | 1.37 |
| 4.4 | 76.7 | 2.00 | 1.60 | 1.20 | 84.5 | 2.20 | 1.76 | 1.32 | 89.0 | 2.32 | 1.85 | 1.39 | 89.0 | 2.32 | 1.85 | 1.39 | 89.0 | 2.32 | 1.85 | 1.39 | 89.0 | 2.32 | 1.85 | 1.39 |
| 4.5 | 77.2 | 2.01 | 1.61 | 1.21 | 85.2 | 2.22 | 1.78 | 1.33 | 90.5 | 2.36 | 1.88 | 1.41 | 90.5 | 2.36 | 1.88 | 1.41 | 90.5 | 2.36 | 1.88 | 1.41 | 90.5 | 2.36 | 1.88 | 1.41 |
| 4.6 | 77.8 | 2.03 | 1.62 | 1.22 | 85.9 | 2.24 | 1.79 | 1.34 | 92.0 | 2.40 | 1.92 | 1.44 | 92.0 | 2.40 | 1.92 | 1.44 | 92.0 | 2.40 | 1.92 | 1.44 | 92.0 | 2.40 | 1.92 | 1.44 |
| 4.7 | 78.4 | 2.04 | 1.63 | 1.22 | 86.7 | 2.26 | 1.81 | 1.35 | 93.5 | 2.43 | 1.95 | 1.46 | 93.5 | 2.43 | 1.95 | 1.46 | 93.5 | 2.43 | 1.95 | 1.46 | 93.5 | 2.43 | 1.95 | 1.46 |
| 4.8 | 78.9 | 2.06 | 1.64 | 1.23 | 87.4 | 2.28 | 1.82 | 1.37 | 95.0 | 2.47 | 1.98 | 1.48 | 95.0 | 2.47 | 1.98 | 1.48 | 95.0 | 2.47 | 1.98 | 1.48 | 95.0 | 2.47 | 1.98 | 1.48 |
| 4.9 | 79.5 | 2.07 | 1.66 | 1.24 | 68.1 | 2.29 | 1.83 | 1.38 | 96.6 | 2.51 | 2.01 | 1.51 | 96.6 | 2.51 | 2.01 | 1.51 | 96.6 | 2.51 | 2.01 | 1.51 | 96.6 | 2.51 | 2.01 | 1.51 |
| 5.0 | 80.0 | 2.08 | 1.67 | 1.25 | 88.8 | 2.31 | 1.85 | 1.39 | 97.6 | 2.54 | 2.03 | 1.52 | 98.1 | 2.55 | 2.04 | 1.53 | 98.1 | 2.55 | 2.04 | 1.53 | 98.1 | 2.55 | 2.04 | 1.53 |
| 5.1 | 80.6 | 2.10 | 1.68 | 1.26 | 89.4 | 2.33 | 1.86 | 1.40 | 98.4 | 2.56 | 2.05 | 1.54 | 99.7 | 2.60 | 2.08 | 1.56 | 99.7 | 2.60 | 2.08 | 1.56 | 99.7 | 2.60 | 2.08 | 1.56 |
| 5.2 | 81.1 | 2.11 | 1.69 | 1.27 | 90.1 | 2.35 | 1.88 | 1.41 | 99.2 | 2.58 | 2.07 | 1.55 | 101.2 | 2.64 | 2.11 | 1.58 | 101.2 | 2.64 | 2.11 | 1.58 | 101.2 | 2.64 | 2.11 | 1.58 |
| 5.3 | 81.6 | 2.13 | 1.70 | 1.28 | 90.8 | 2.36 | 1.89 | 1.42 | 100.1 | 2.61 | 2.08 | 1.56 | 102.8 | 2.68 | 2.14 | 1.61 | 102.8 | 2.68 | 2.14 | 1.61 | 102.8 | 2.68 | 2.14 | 1.61 |
| 5.4 | 82.1 | 2.14 | 1.71 | 1.28 | 91.4 | 2.38 | 1.90 | 1.43 | 100.8 | 2.63 | 2.10 | 1.58 | 104.4 | 2.72 | 2.18 | 1.63 | 104.4 | 2.72 | 2.18 | 1.63 | 104.4 | 2.72 | 2.18 | 1.63 |
| 5.5 | 82.7 | 2.15 | 1.72 | 1.29 | 92.1 | 2.40 | 1.92 | 1.44 | 101.6 | 2.65 | 2.12 | 1.59 | 106.0 | 2.76 | 2.21 | 1.66 | 106.0 | 2.76 | 2.21 | 1.66 | 106.0 | 2.76 | 2.21 | 1.66 |
| 5.6 | 83.2 | 2.17 | 1.73 | 1.30 | 92.7 | 2.41 | 1.93 | 1.45 | 102.4 | 2.67 | 2.13 | 1.60 | 107.6 | 2.80 | 2.24 | 1.68 | 107.6 | 2.80 | 2.24 | 1.68 | 107.6 | 2.80 | 2.24 | 1.68 |
| 5.7 | 83.7 | 2.18 | 1.74 | 1.31 | 93.3 | 2.43 | 1.94 | 1.46 | 103.2 | 2.69 | 2.15 | 1.61 | 109.2 | 2.84 | 2.28 | 1.71 | 109.2 | 2.84 | 2.28 | 1.71 | 109.2 | 2.84 | 2.28 | 1.71 |
| 5.8 | 84.2 | 2.19 | 1.75 | 1.31 | 94.0 | 2.45 | 1.96 | 1.47 | 103.9 | 2.71 | 2.17 | 1.62 | 110.9 | 2.89 | 2.31 | 1.73 | 110.9 | 2.89 | 2.31 | 1.73 | 110.9 | 2.89 | 2.31 | 1.73 |
| 5.9 | 84.6 | 2.20 | 1.76 | 1.32 | 94.6 | 2.48 | 1.97 | 1.48 | 104.7 | 2.73 | 2.18 | 1.64 | 112.5 | 2.93 | 2.34 | 1.76 | 112.5 | 2.93 | 2.34 | 1.76 | 112.5 | 2.93 | 2.34 | 1.76 |
| 6.0 | 85.1 | 2.22 | 1.77 | 1.33 | 95.2 | 2.48 | 1.98 | 1.49 | 105.4 | 2.75 | 2.20 | 1.65 | 114.1 | 2.97 | 2.38 | 1.78 | 114.1 | 2.97 | 2.38 | 1.78 | 114.1 | 2.97 | 2.38 | 1.78 |
| 6.1 | 85.6 | 2.23 | 1.78 | 1.34 | 95.8 | 2.49 | 2.00 | 1.50 | 106.2 | 2.76 | 2.21 | 1.66 | 115.8 | 3.01 | 2.41 | 1.81 | 115.8 | 3.01 | 2.41 | 1.81 | 115.8 | 3.01 | 2.41 | 1.81 |
| 6.2 | 86.0 | 2.24 | 1.79 | 1.34 | 96.4 | 2.51 | 2.01 | 1.51 | 106.9 | 2.78 | 2.23 | 1.67 | 117.4 | 3.06 | 2.45 | 1.83 | 117.4 | 3.06 | 2.45 | 1.83 | 117.4 | 3.06 | 2.45 | 1.83 |
| 6.3 | 86.5 | 2.25 | 1.80 | 1.35 | 96.9 | 2.52 | 2.02 | 1.51 | 107.6 | 2.80 | 2.24 | 1.68 | 118.4 | 3.08 | 2.47 | 1.85 | 119.1 | 3.10 | 2.48 | 1.86 | 119.1 | 3.10 | 2.48 | 1.86 |
| 6.4 | 86.9 | 2.26 | 1.81 | 1.36 | 97.5 | 2.54 | 2.03 | 1.52 | 108.3 | 2.82 | 2.26 | 1.69 | 119.2 | 3.10 | 2.48 | 1.86 | 120.7 | 3.14 | 2.52 | 1.89 | 120.7 | 3.14 | 2.52 | 1.89 |
| 6.5 | 87.4 | 2.28 | 1.82 | 1.37 | 98.1 | 2.55 | 2.04 | 1.53 | 109.0 | 2.84 | 2.27 | 1.70 | 120.0 | 3.13 | 2.50 | 1.88 | 122.4 | 3.19 | 2.55 | 1.91 | 122.4 | 3.19 | 2.55 | 1.91 |
| 6.6 | 87.8 | 2.29 | 1.83 | 1.37 | 98.6 | 2.57 | 2.05 | 1.54 | 109.6 | 2.86 | 2.28 | 1.71 | 120.8 | 3.15 | 2.52 | 1.89 | 124.1 | 3.23 | 2.59 | 1.94 | 124.1 | 3.23 | 2.59 | 1.94 |
| 6.7 | 88.2 | 2.30 | 1.84 | 1.38 | 99.2 | 2.58 | 2.07 | 1.55 | 110.3 | 2.87 | 2.30 | 1.72 | 121.6 | 3.17 | 2.53 | 1.90 | 125.8 | 3.27 | 2.62 | 1.96 | 125.8 | 3.27 | 2.62 | 1.96 |
| 6.8 | 88.7 | 2.31 | 1.85 | 1.39 | 99.7 | 2.60 | 2.08 | 1.56 | 111.0 | 2.89 | 2.31 | 1.73 | 122.4 | 3.19 | 2.55 | 1.91 | 127.4 | 3.32 | 2.66 | 1.99 | 127.4 | 3.32 | 2.66 | 1.99 |
| 6.9 | 89.1 | 2.32 | 1.86 | 1.39 | 100.2 | 2.61 | 2.09 | 1.57 | 111.6 | 2.91 | 2.33 | 1.74 | 123.2 | 3.21 | 2.57 | 1.93 | 129.1 | 3.36 | 2.69 | 2.02 | 129.1 | 3.36 | 2.69 | 2.02 |
| 7.0 | 89.5 | 2.33 | 1.86 | 1.40 | 100.7 | 2.62 | 2.10 | 1.57 | 112.2 | 2.92 | 2.34 | 1.75 | 124.0 | 3.23 | 2.58 | 1.94 | 130.8 | 3.41 | 2.73 | 2.04 | 130.8 | 3.41 | 2.73 | 2.04 |
| 7.1 | 89.9 | 2.34 | 1.87 | 1.40 | 101.2 | 2.64 | 2.11 | 1.58 | 112.9 | 2.94 | 2.35 | 1.76 | 124.7 | 3.25 | 2.60 | 1.95 | 132.5 | 3.45 | 2.76 | 2.07 | 132.5 | 3.45 | 2.76 | 2.07 |
| 7.2 | 90.3 | 2.36 | 1.88 | 1.41 | 101.7 | 2.65 | 2.12 | 1.59 | 113.5 | 2.96 | 2.36 | 1.77 | 125.5 | 3.27 | 2.61 | 1.96 | 134.2 | 3.50 | 2.80 | 2.10 | 134.2 | 3.50 | 2.80 | 2.10 |
| 7.3 | 90.6 | 2.36 | 1.89 | 1.42 | 102.2 | 2.68 | 2.13 | 1.60 | 114.1 | 2.97 | 2.38 | 1.78 | 126.2 | 3.29 | 2.63 | 1.97 | 135.9 | 3.54 | 2.83 | 2.12 | 135.9 | 3.54 | 2.83 | 2.12 |
| 7.4 | 91.0 | 2.37 | 1.90 | 1.42 | 102.7 | 2.67 | 2.14 | 1.80 | 114.7 | 2.99 | 2.39 | 1.79 | 126.9 | 3.31 | 2.64 | 1.98 | 137.6 | 3.58 | 2.87 | 2.15 | 137.6 | 3.58 | 2.87 | 2.15 |
| 7.5 | 91.4 | 2.38 | 1.90 | 1.43 | 103.2 | 2.69 | 2.15 | 1.61 | 115.3 | 3.00 | 2.40 | 1.80 | 127.6 | 3.32 | 2.66 | 1.99 | 139.3 | 3.63 | 2.90 | 2.18 | 139.3 | 3.63 | 2.90 | 2.18 |
| 7.6 | 91.8 | 2.39 | 1.91 | 1.43 | 103.7 | 2.70 | 2.16 | 1.62 | 115.9 | 3.02 | 2.41 | 1.81 | 128.3 | 3.34 | 2.67 | 2.01 | 141.0 | 3.67 | 2.94 | 2.20 | 141.0 | 3.67 | 2.94 | 2.20 |
| 7.7 | 92.1 | 2.40 | 1.92 | 1.44 | 104.1 | 2.71 | 2.17 | 1.63 | 116.4 | 3.03 | 2.43 | 1.82 | 129.0 | 3.36 | 2.69 | 2.02 | 141.8 | 3.69 | 2.95 | 2.22 | 142.8 | 3.72 | 2.97 | 2.23 |
| 7.8 | 92.5 | 2.41 | 1.93 | 1.44 | 104.6 | 2.72 | 2.18 | 1.63 | 117.0 | 3.05 | 2.44 | 1.83 | 129.7 | 3.38 | 2.70 | 2.03 | 142.6 | 3.71 | 2.97 | 2.23 | 144.5 | 3.76 | 3.01 | 2.26 |
| 7.9 | 92.8 | 2.42 | 1.93 | 1.45 | 105.0 | 2.73 | 2.19 | 1.64 | 117.5 | 3.06 | 2.45 | 1.84 | 130.4 | 3.39 | 2.72 | 2.04 | 143.4 | 3.73 | 2.99 | 2.24 | 146.2 | 3.81 | 3.05 | 2.28 |
| 8.0 | 93.1 | 2.43 | 1.94 | 1.46 | 105.4 | 2.75 | 2.20 | 1.65 | 118.1 | 3.08 | 2.48 | 1.85 | 131.0 | 3.41 | 2.73 | 2.05 | 144.2 | 3.75 | 3.00 | 2.25 | 147.9 | 3.85 | 3.08 | 2.31 |
| 8.1 | 93.5 | 2.43 | 1.95 | 1.46 | 105.9 | 2.76 | 2.21 | 1.65 | 118.6 | 3.09 | 2.47 | 1.85 | 131.7 | 3.43 | 2.74 | 2.06 | 145.0 | 3.77 | 3.02 | 2.26 | 149.7 | 3.90 | 3.12 | 2.34 |
| 8.2 | 93.8 | 2.44 | 1.95 | 1.47 | 106.3 | 2.77 | 2.21 | 1.66 | 119.1 | 3.10 | 2.48 | 1.86 | 132.3 | 3.45 | 2.76 | 2.07 | 145.7 | 3.79 | 3.04 | 2.28 | 151.4 | 3.94 | 3.15 | 2.37 |
| 8.3 | 94.1 | 2.45 | 1.96 | 1.47 | 106.7 | 2.78 | 2.22 | 1.67 | 119.7 | 3.12 | 2.49 | 1.87 | 132.9 | 3.46 | 2.77 | 2.08 | 146.5 | 3.81 | 3.05 | 2.29 | 153.1 | 3.99 | 3.19 | 2.39 |
| 8.4 | 94.4 | 2.46 | 1.97 | 1.48 | 107.1 | 2.79 | 2.23 | 1.67 | 120.2 | 3.13 | 2.50 | 1.88 | 133.5 | 3.48 | 2.76 | 2.09 | 147.2 | 3.83 | 3.07 | 2.30 | 154.9 | 4.03 | 3.23 | 2.42 |
| 8.5 | 94.7 | 2.47 | 1.97 | 1.48 | 107.5 | 2.80 | 2.24 | 1.68 | 120.7 | 3.14 | 2.51 | 1.89 | 134.2 | 3.49 | 2.79 | 2.10 | 147.9 | 3.85 | 3.08 | 2.31 | 156.6 | 4.08 | 3.26 | 2.45 |
| 8.6 | 95.0 | 2.47 | 1.98 | 1.48 | 107.9 | 2.81 | 2.25 | 1.69 | 121.2 | 3.16 | 2.52 | 1.89 | 134.8 | 3.51 | 2.81 | 2.11 | 148.6 | 3.87 | 3.10 | 2.32 | 158.3 | 4.12 | 3.30 | 2.47 |
| 8.7 | 95.3 | 2.48 | 1.99 | 1.49 | 108.3 | 2.82 | 2.26 | 1.69 | 121.6 | 3.17 | 2.53 | 1.90 | 135.3 | 3.52 | 2.82 | 2.11 | 149.3 | 3.89 | 3.11 | 2.33 | 160.1 | 4.17 | 3.33 | 2.50 |
| 8.8 | 95.6 | 2.49 | 1.99 | 1.49 | 108.7 | 2.83 | 2.26 | 1.70 | 122.1 | 3.18 | 2.54 | 1.91 | 135.9 | 3.54 | 2.83 | 2.12 | 150.0 | 3.91 | 3.13 | 2.34 | 161.8 | 4.21 | 3.37 | 2.53 |
| 8.9 | 95.9 | 2.50 | 2.00 | 1.50 | 109.0 | 2.84 | 2.27 | 1.70 | 122.6 | 3.19 | 2.55 | 1.92 | 136.5 | 3.55 | 2.84 | 2.13 | 150.7 | 3.92 | 3.14 | 2.35 | 163.6 | 4.26 | 3.41 | 2.56 |
| 9.0 | 96.2 | 2.50 | 2.00 | 1.50 | 109.4 | 2.85 | 2.28 | 1.71 | 123.0 | 3.20 | 2.56 | 1.92 | 137.1 | 3.57 | 2.86 | 2.14 | 151.4 | 3.94 | 3.15 | 2.37 | 165.3 | 4.30 | 3.44 | 2.58 |
| 9.1 | 96.4 | 2.51 | 2.01 | 1.51 | 109.8 | 2.86 | 2.29 | 1.71 | 123.5 | 3.22 | 2.57 | 1.93 | 137.6 | 3.58 | 2.87 | 2.15 | 152.0 | 3.96 | 3.17 | 2.38 | 166.7 | 4.34 | 3.47 | 2.61 |
| 9.2 | 96.7 | 2.52 | 2.01 | 1.51 | 110.1 | 2.87 | 2.29 | 1.72 | 123.9 | 3.23 | 2.58 | 1.94 | 138.1 | 3.60 | 2.88 | 2.16 | 152.7 | 3.98 | 3.18 | 2.39 | 167.5 | 4.36 | 3.49 | 2.62 |
| 9.3 | 97.0 | 2.52 | 2.02 | 1.51 | 110.5 | 2.88 | 2.30 | 1.73 | 124.4 | 3.24 | 2.59 | 1.94 | 138.7 | 3.61 | 2.89 | 2.17 | 153.3 | 3.99 | 3.19 | 2.40 | 168.3 | 4.38 | 3.51 | 2.63 |
| 9.4 | 97.2 | 2.53 | 2.03 | 1.52 | 110.8 | 2.89 | 2.31 | 1.73 | 124.8 | 3.25 | 2.60 | 1.95 | 139.2 | 3.63 | 2.90 | 2.18 | 154.0 | 4.01 | 3.21 | 2.41 | 169.0 | 4.40 | 3.52 | 2.64 |
| 9.5 | 97.5 | 2.54 | 2.03 | 1.52 | 111.1 | 2.89 | 2.32 | 1.74 | 125.2 | 3.26 | 2.61 | 1.96 | 139.7 | 3.64 | 2.91 | 2.18 | 154.6 | 4.03 | 3.22 | 2.42 | 169.7 | 4.42 | 3.54 | 2.65 |
| 9.6 | 97.7 | 2.54 | 2.04 | 1.53 | 111.4 | 2.90 | 2.32 | 1.74 | 125.6 | 3.27 | 2.62 | 1.96 | 140.2 | 3.65 | 2.92 | 2.19 | 155.2 | 4.04 | 3.23 | 2.42 | 170.4 | 4.44 | 3.55 | 2.66 |
| 9.7 | 98.0 | 2.55 | 2.04 | 1.53 | 111.8 | 2.91 | 2.33 | 1.75 | 128.1 | 3.28 | 2.63 | 1.97 | 140.7 | 3.67 | 2.93 | 2.20 | 155.8 | 4.06 | 3.25 | 2.43 | 171.2 | 4.46 | 3.57 | 2.67 |
| 9.8 | 98.2 | 2.56 | 2.05 | 1.53 | 112.1 | 2.92 | 2.34 | 1.75 | 126.5 | 3.29 | 2.63 | 1.98 | 141.2 | 3.68 | 2.94 | 2.21 | 156.4 | 4.07 | 3.26 | 2.44 | 171.9 | 4.48 | 3.58 | 2.69 |
| 9.9 | 98.4 | 2.56 | 2.05 | 1.54 | 112.4 | 2.93 | 2.34 | 1.76 | 126.8 | 3.30 | 2.64 | 1.98 | 141.7 | 3.69 | 2.95 | 2.21 | 157.0 | 4.09 | 3.27 | 2.45 | 172.6 | 4.49 | 3.59 | 2.70 |
| 10.0 | 98.6 | 2.57 | 2.06 | 1.54 | 112.7 | 2.93 | 2.35 | 1.76 | 127.2 | 3.31 | 2.65 | 1.99 | 142.2 | 3.70 | 2.96 | 2.22 | 157.5 | 4.10 | 3.28 | 2.48 | 173.2 | 4.51 | 3.61 | 2.71 |
| Trench Width m | | 1.2 | | | | 1.3 | | | | 1.4 | | | | 1.5 | | | | 1.6 | | | | 1.7 | | |

**TABLE 20. DESIGN LOADS**
**600 mm DIAMETER PIPE**

8 WHEELS 112.5kN
IMPACT FACTOR 1.3

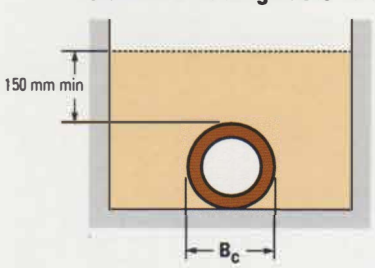
| Cover | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | | Design Load | Min Bedding Factor / Crushing Strength kN/m | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | 48 | 57 | 72 | kN/m | 48 | 57 | 72 | kN/m | 48 | 57 | 72 | kN/m | 48 | 57 | 72 | kN/m | 48 | 57 | 72 | kN/m | 48 | 57 | 72 |
| 0.6 | 90.7 | 2.36 | 1.99 | 1.57 | 90.7 | 2.36 | 1.99 | 1.57 | 90.7 | 2.36 | 1.99 | 1.57 | 90.7 | 2.36 | 1.99 | 1.57 | 90.7 | 2.36 | 1.99 | 1.57 | 90.7 | 2.36 | 1.99 | 1.57 |
| 0.7 | 82.9 | 2.16 | 1.82 | 1.44 | 82.9 | 2.16 | 1.82 | 1.44 | 82.9 | 2.16 | 1.82 | 1.44 | 82.9 | 2.16 | 1.82 | 1.44 | 82.9 | 2.16 | 1.82 | 1.44 | 82.9 | 2.16 | 1.82 | 1.44 |
| 0.8 | 77.3 | 2.01 | 1.70 | 1.34 | 77.3 | 2.01 | 1.70 | 1.34 | 77.3 | 2.01 | 1.70 | 1.34 | 77.3 | 2.01 | 1.70 | 1.34 | 77.3 | 2.01 | 1.70 | 1.34 | 77.3 | 2.01 | 1.70 | 1.34 |
| 0.9 | 73.4 | 1.91 | 1.61 | 1.28 | 73.4 | 1.91 | 1.61 | 1.28 | 73.4 | 1.91 | 1.61 | 1.28 | 73.4 | 1.91 | 1.61 | 1.28 | 73.4 | 1.91 | 1.61 | 1.28 | 73.4 | 1.91 | 1.61 | 1.28 |
| 1.0 | 70.8 | 1.84 | 1.55 | 1.23 | 70.8 | 1.84 | 1.55 | 1.23 | 70.8 | 1.84 | 1.55 | 1.23 | 70.8 | 1.84 | 1.55 | 1.23 | 70.8 | 1.84 | 1.55 | 1.23 | 70.8 | 1.84 | 1.55 | 1.23 |
| 1.1 | 69.2 | 1.80 | 1.52 | 1.20 | 69.2 | 1.80 | 1.52 | 1.20 | 69.2 | 1.80 | 1.52 | 1.20 | 69.2 | 1.80 | 1.52 | 1.20 | 69.2 | 1.80 | 1.52 | 1.20 | 69.2 | 1.80 | 1.52 | 1.20 |
| 1.2 | 68.4 | 1.78 | 1.50 | 1.19 | 68.4 | 1.78 | 1.50 | 1.19 | 68.4 | 1.78 | 1.50 | 1.19 | 68.4 | 1.78 | 1.50 | 1.19 | 68.4 | 1.78 | 1.50 | 1.19 | 68.4 | 1.78 | 1.50 | 1.19 |
| 1.3 | 68.2 | 1.78 | 1.50 | 1.18 | 68.2 | 1.78 | 1.50 | 1.18 | 68.2 | 1.78 | 1.50 | 1.18 | 68.2 | 1.78 | 1.50 | 1.18 | 68.2 | 1.78 | 1.50 | 1.18 | 68.2 | 1.78 | 1.50 | 1.18 |
| 1.4 | 68.4 | 1.78 | 1.50 | 1.19 | 68.4 | 1.78 | 1.50 | 1.19 | 68.4 | 1.78 | 1.50 | 1.19 | 68.4 | 1.78 | 1.50 | 1.19 | 68.4 | 1.78 | 1.50 | 1.19 | 68.4 | 1.78 | 1.50 | 1.19 |
| 1.5 | 68.3 | 1.78 | 1.50 | 1.19 | 68.3 | 1.78 | 1.50 | 1.19 | 68.3 | 1.78 | 1.50 | 1.19 | 68.3 | 1.78 | 1.50 | 1.19 | 68.3 | 1.78 | 1.50 | 1.19 | 68.3 | 1.78 | 1.50 | 1.19 |
| 1.6 | 68.6 | 1.79 | 1.50 | 1.19 | 68.6 | 1.79 | 1.50 | 1.19 | 68.6 | 1.79 | 1.50 | 1.19 | 68.6 | 1.79 | 1.50 | 1.19 | 68.6 | 1.79 | 1.50 | 1.19 | 68.6 | 1.79 | 1.50 | 1.19 |
| 1.7 | 69.1 | 1.80 | 1.51 | 1.20 | 69.1 | 1.80 | 1.51 | 1.20 | 69.1 | 1.80 | 1.51 | 1.20 | 69.1 | 1.80 | 1.51 | 1.20 | 69.1 | 1.80 | 1.51 | 1.20 | 69.1 | 1.80 | 1.51 | 1.20 |
| 1.8 | 69.7 | 1.82 | 1.53 | 1.21 | 69.7 | 1.82 | 1.53 | 1.21 | 69.7 | 1.82 | 1.53 | 1.21 | 69.7 | 1.82 | 1.53 | 1.21 | 69.7 | 1.82 | 1.53 | 1.21 | 69.7 | 1.82 | 1.53 | 1.21 |
| 1.9 | 70.5 | 1.83 | 1.55 | 1.22 | 70.5 | 1.83 | 1.55 | 1.22 | 70.5 | 1.83 | 1.55 | 1.22 | 70.5 | 1.83 | 1.55 | 1.22 | 70.5 | 1.83 | 1.55 | 1.22 | 70.5 | 1.83 | 1.55 | 1.22 |
| 2.0 | 71.3 | 1.86 | 1.56 | 1.24 | 71.3 | 1.86 | 1.56 | 1.24 | 71.3 | 1.86 | 1.56 | 1.24 | 71.3 | 1.86 | 1.56 | 1.24 | 71.3 | 1.86 | 1.56 | 1.24 | 71.3 | 1.86 | 1.56 | 1.24 |
| 2.1 | 72.2 | 1.88 | 1.58 | 1.25 | 72.2 | 1.88 | 1.58 | 1.25 | 72.2 | 1.88 | 1.58 | 1.25 | 72.2 | 1.88 | 1.58 | 1.25 | 72.2 | 1.88 | 1.58 | 1.25 | 72.2 | 1.88 | 1.58 | 1.25 |
| 2.2 | 73.2 | 1.91 | 1.61 | 1.27 | 73.2 | 1.91 | 1.61 | 1.27 | 73.2 | 1.91 | 1.61 | 1.27 | 73.2 | 1.91 | 1.61 | 1.27 | 73.2 | 1.91 | 1.61 | 1.27 | 73.2 | 1.91 | 1.61 | 1.27 |
| 2.3 | 74.2 | 1.93 | 1.63 | 1.29 | 74.2 | 1.93 | 1.63 | 1.29 | 74.2 | 1.93 | 1.63 | 1.29 | 74.2 | 1.93 | 1.63 | 1.29 | 74.2 | 1.93 | 1.63 | 1.29 | 74.2 | 1.93 | 1.63 | 1.29 |
| 2.4 | 75.4 | 1.96 | 1.65 | 1.31 | 75.4 | 1.96 | 1.65 | 1.31 | 75.4 | 1.96 | 1.65 | 1.31 | 75.4 | 1.96 | 1.65 | 1.31 | 75.4 | 1.96 | 1.65 | 1.31 | 75.4 | 1.96 | 1.65 | 1.31 |
| 2.5 | 76.5 | 1.99 | 1.68 | 1.33 | 76.5 | 1.99 | 1.68 | 1.33 | 76.5 | 1.99 | 1.68 | 1.33 | 76.5 | 1.99 | 1.68 | 1.33 | 76.5 | 1.99 | 1.68 | 1.33 | 76.5 | 1.99 | 1.68 | 1.33 |
| 2.6 | 77.7 | 2.02 | 1.70 | 1.35 | 77.7 | 2.02 | 1.70 | 1.35 | 77.7 | 2.02 | 1.70 | 1.35 | 77.7 | 2.02 | 1.70 | 1.35 | 77.7 | 2.02 | 1.70 | 1.35 | 77.7 | 2.02 | 1.70 | 1.35 |
| 2.7 | 79.0 | 2.06 | 1.73 | 1.37 | 79.0 | 2.06 | 1.73 | 1.37 | 79.0 | 2.06 | 1.73 | 1.37 | 79.0 | 2.06 | 1.73 | 1.37 | 79.0 | 2.06 | 1.73 | 1.37 | 79.0 | 2.06 | 1.73 | 1.37 |
| 2.8 | 80.3 | 2.09 | 1.76 | 1.39 | 80.3 | 2.09 | 1.76 | 1.39 | 80.3 | 2.09 | 1.76 | 1.39 | 80.3 | 2.09 | 1.76 | 1.39 | 80.3 | 2.09 | 1.76 | 1.39 | 80.3 | 2.09 | 1.76 | 1.39 |
| 2.9 | 81.6 | 2.13 | 1.79 | 1.42 | 81.6 | 2.13 | 1.79 | 1.42 | 81.6 | 2.13 | 1.79 | 1.42 | 81.6 | 2.13 | 1.79 | 1.42 | 81.6 | 2.13 | 1.79 | 1.42 | 81.6 | 2.13 | 1.79 | 1.42 |
| 3.0 | 82.5 | 2.15 | 1.81 | 1.43 | 83.0 | 2.16 | 1.82 | 1.44 | 83.0 | 2.16 | 1.82 | 1.44 | 83.0 | 2.16 | 1.82 | 1.44 | 83.0 | 2.16 | 1.82 | 1.44 | 83.0 | 2.16 | 1.82 | 1.44 |
| 3.1 | 83.3 | 2.17 | 1.83 | 1.45 | 84.5 | 2.20 | 1.85 | 1.47 | 84.5 | 2.20 | 1.85 | 1.47 | 84.5 | 2.20 | 1.85 | 1.47 | 84.5 | 2.20 | 1.85 | 1.47 | 84.5 | 2.20 | 1.85 | 1.47 |
| 3.2 | 84.2 | 2.19 | 1.85 | 1.46 | 85.9 | 2.24 | 1.88 | 1.49 | 85.9 | 2.24 | 1.88 | 1.49 | 85.9 | 2.24 | 1.88 | 1.49 | 85.9 | 2.24 | 1.88 | 1.49 | 85.9 | 2.24 | 1.88 | 1.49 |
| 3.3 | 85.0 | 2.21 | 1.86 | 1.48 | 87.4 | 2.28 | 1.92 | 1.52 | 87.4 | 2.28 | 1.92 | 1.52 | 87.4 | 2.28 | 1.92 | 1.52 | 87.4 | 2.28 | 1.92 | 1.52 | 87.4 | 2.28 | 1.92 | 1.52 |
| 3.4 | 85.9 | 2.24 | 1.88 | 1.49 | 88.9 | 2.32 | 1.95 | 1.54 | 88.9 | 2.32 | 1.95 | 1.54 | 88.9 | 2.32 | 1.95 | 1.54 | 88.9 | 2.32 | 1.95 | 1.54 | 88.9 | 2.32 | 1.95 | 1.54 |
| 3.5 | 86.7 | 2.26 | 1.90 | 1.51 | 90.5 | 2.36 | 1.98 | 1.57 | 90.5 | 2.36 | 1.98 | 1.57 | 90.5 | 2.36 | 1.98 | 1.57 | 90.5 | 2.36 | 1.98 | 1.57 | 90.5 | 2.36 | 1.98 | 1.57 |
| 3.6 | 87.8 | 2.28 | 1.92 | 1.52 | 92.1 | 2.40 | 2.02 | 1.60 | 92.1 | 2.40 | 2.02 | 1.60 | 92.1 | 2.40 | 2.02 | 1.60 | 92.1 | 2.40 | 2.02 | 1.60 | 92.1 | 2.40 | 2.02 | 1.60 |
| 3.7 | 88.4 | 2.30 | 1.94 | 1.53 | 93.7 | 2.44 | 2.05 | 1.63 | 93.7 | 2.44 | 2.05 | 1.63 | 93.7 | 2.44 | 2.05 | 1.63 | 93.7 | 2.44 | 2.05 | 1.63 | 93.7 | 2.44 | 2.05 | 1.63 |
| 3.8 | 89.3 | 2.32 | 1.96 | 1.55 | 95.3 | 2.48 | 2.09 | 1.65 | 95.3 | 2.48 | 2.09 | 1.65 | 95.3 | 2.48 | 2.09 | 1.65 | 95.3 | 2.48 | 2.09 | 1.65 | 95.3 | 2.48 | 2.09 | 1.65 |
| 3.9 | 90.1 | 2.35 | 1.98 | 1.56 | 96.9 | 2.52 | 2.13 | 1.68 | 96.9 | 2.52 | 2.13 | 1.68 | 96.9 | 2.52 | 2.13 | 1.68 | 96.9 | 2.52 | 2.13 | 1.68 | 96.9 | 2.52 | 2.13 | 1.68 |
| 4.0 | 90.9 | 2.37 | 1.99 | 1.58 | 98.3 | 2.56 | 2.16 | 1.71 | 98.6 | 2.57 | 2.16 | 1.71 | 98.6 | 2.57 | 2.16 | 1.71 | 98.6 | 2.57 | 2.16 | 1.71 | 98.6 | 2.57 | 2.16 | 1.71 |
| 4.1 | 91.8 | 2.39 | 2.01 | 1.59 | 99.3 | 2.59 | 2.18 | 1.72 | 100.3 | 2.61 | 2.20 | 1.74 | 100.3 | 2.61 | 2.20 | 1.74 | 100.3 | 2.61 | 2.20 | 1.74 | 100.3 | 2.61 | 2.20 | 1.74 |
| 4.2 | 92.6 | 2.41 | 2.03 | 1.61 | 100.3 | 2.81 | 2.20 | 1.74 | 102.0 | 2.66 | 2.24 | 1.77 | 102.0 | 2.66 | 2.24 | 1.77 | 102.0 | 2.66 | 2.24 | 1.77 | 102.0 | 2.66 | 2.24 | 1.77 |
| 4.3 | 93.5 | 2.43 | 2.05 | 1.62 | 101.3 | 2.64 | 2.22 | 1.78 | 103.7 | 2.70 | 2.28 | 1.80 | 103.7 | 2.70 | 2.28 | 1.80 | 103.7 | 2.70 | 2.28 | 1.80 | 103.7 | 2.70 | 2.28 | 1.80 |
| 4.4 | 94.3 | 2.46 | 2.07 | 1.64 | 102.3 | 2.66 | 2.24 | 1.78 | 105.5 | 2.75 | 2.31 | 1.83 | 105.5 | 2.75 | 2.31 | 1.83 | 105.5 | 2.75 | 2.31 | 1.83 | 105.5 | 2.75 | 2.31 | 1.83 |
| 4.5 | 95.1 | 2.48 | 2.09 | 1.85 | 103.3 | 2.89 | 2.26 | 1.79 | 107.3 | 2.79 | 2.35 | 1.86 | 107.3 | 2.79 | 2.35 | 1.86 | 107.3 | 2.79 | 2.35 | 1.86 | 107.3 | 2.79 | 2.35 | 1.86 |
| 4.6 | 95.9 | 2.50 | 2.10 | 1.67 | 104.3 | 2.71 | 2.29 | 1.81 | 109.1 | 2.84 | 2.39 | 1.89 | 109.1 | 2.84 | 2.39 | 1.89 | 109.1 | 2.84 | 2.39 | 1.89 | 109.1 | 2.84 | 2.39 | 1.89 |
| 4.7 | 96.7 | 2.52 | 2.12 | 1.88 | 105.2 | 2.74 | 2.31 | 1.83 | 110.9 | 2.89 | 2.43 | 1.92 | 110.9 | 2.89 | 2.43 | 1.92 | 110.9 | 2.89 | 2.43 | 1.92 | 110.9 | 2.89 | 2.43 | 1.92 |
| 4.8 | 97.5 | 2.54 | 2.14 | 1.69 | 106.2 | 2.76 | 2.33 | 1.84 | 112.7 | 2.93 | 2.47 | 1.96 | 112.7 | 2.93 | 2.47 | 1.96 | 112.7 | 2.93 | 2.47 | 1.96 | 112.7 | 2.93 | 2.47 | 1.96 |
| 4.9 | 96.3 | 2.56 | 2.16 | 1.71 | 107.1 | 2.79 | 2.35 | 1.88 | 114.5 | 2.98 | 2.51 | 1.99 | 114.5 | 2.98 | 2.51 | 1.99 | 114.5 | 2.98 | 2.51 | 1.99 | 114.5 | 2.98 | 2.51 | 1.99 |
| 5.0 | 99.1 | 2.58 | 2.17 | 1.72 | 108.1 | 2.81 | 2.37 | 1.88 | 116.3 | 3.03 | 2.55 | 2.02 | 116.3 | 3.03 | 2.55 | 2.02 | 116.3 | 3.03 | 2.55 | 2.02 | 116.3 | 3.03 | 2.55 | 2.02 |
| 5.1 | 99.9 | 2.60 | 2.19 | 1.73 | 109.0 | 2.84 | 2.39 | 1.89 | 118.2 | 3.08 | 2.59 | 2.05 | 118.2 | 3.08 | 2.59 | 2.05 | 118.2 | 3.08 | 2.59 | 2.05 | 118.2 | 3.08 | 2.59 | 2.05 |
| 5.2 | 100.7 | 2.62 | 2.21 | 1.75 | 109.9 | 2.86 | 2.41 | 1.91 | 119.3 | 3.11 | 2.62 | 2.07 | 120.1 | 3.13 | 2.63 | 2.08 | 120.1 | 3.13 | 2.63 | 2.08 | 120.1 | 3.13 | 2.63 | 2.08 |
| 5.3 | 101.4 | 2.64 | 2.22 | 1.76 | 110.8 | 2.89 | 2.43 | 1.92 | 120.3 | 3.13 | 2.64 | 2.09 | 121.9 | 3.18 | 2.67 | 2.12 | 121.9 | 3.18 | 2.67 | 2.12 | 121.9 | 3.18 | 2.67 | 2.12 |
| 5.4 | 102.2 | 2.66 | 2.24 | 1.77 | 111.7 | 2.91 | 2.45 | 1.94 | 121.4 | 3.16 | 2.66 | 2.11 | 123.8 | 3.22 | 2.72 | 2.15 | 123.8 | 3.22 | 2.72 | 2.15 | 123.8 | 3.22 | 2.72 | 2.15 |
| 5.5 | 102.9 | 2.68 | 2.26 | 1.79 | 112.6 | 2.93 | 2.47 | 1.96 | 122.4 | 3.19 | 2.69 | 2.13 | 125.7 | 3.27 | 2.76 | 2.18 | 125.7 | 3.27 | 2.76 | 2.18 | 125.7 | 3.27 | 2.76 | 2.18 |
| 5.6 | 103.7 | 2.70 | 2.27 | 1.80 | 113.5 | 2.96 | 2.49 | 1.97 | 123.5 | 3.22 | 2.71 | 2.14 | 127.6 | 3.32 | 2.80 | 2.22 | 127.6 | 3.32 | 2.80 | 2.22 | 127.6 | 3.32 | 2.80 | 2.22 |
| 5.7 | 104.4 | 2.72 | 2.29 | 1.81 | 114.4 | 2.96 | 2.51 | 1.99 | 124.5 | 3.24 | 2.73 | 2.18 | 129.5 | 3.37 | 2.84 | 2.25 | 129.5 | 3.37 | 2.84 | 2.25 | 129.5 | 3.37 | 2.84 | 2.25 |
| 5.8 | 105.1 | 2.74 | 2.31 | 1.83 | 115.3 | 3.00 | 2.53 | 2.00 | 125.5 | 3.27 | 2.75 | 2.18 | 131.5 | 3.42 | 2.88 | 2.28 | 131.5 | 3.42 | 2.88 | 2.28 | 131.5 | 3.42 | 2.88 | 2.28 |
| 5.9 | 105.9 | 2.78 | 2.32 | 1.84 | 118.1 | 3.02 | 2.55 | 2.02 | 126.5 | 3.29 | 2.77 | 2.20 | 133.4 | 3.47 | 2.93 | 2.32 | 133.4 | 3.47 | 2.93 | 2.32 | 133.4 | 3.47 | 2.93 | 2.32 |
| 6.0 | 106.8 | 2.77 | 2.34 | 1.85 | 117.0 | 3.05 | 2.56 | 2.03 | 127.5 | 3.32 | 2.80 | 2.21 | 135.4 | 3.52 | 2.97 | 2.35 | 135.4 | 3.52 | 2.97 | 2.35 | 135.4 | 3.52 | 2.97 | 2.35 |
| 6.1 | 107.3 | 2.79 | 2.35 | 1.86 | 117.8 | 3.07 | 2.58 | 2.05 | 126.5 | 3.35 | 2.82 | 2.23 | 137.3 | 3.58 | 3.01 | 2.38 | 137.3 | 3.58 | 3.01 | 2.38 | 137.3 | 3.58 | 3.01 | 2.38 |
| 6.2 | 107.9 | 2.81 | 2.37 | 1.87 | 118.6 | 3.09 | 2.60 | 2.08 | 129.4 | 3.37 | 2.84 | 2.25 | 139.3 | 3.63 | 3.05 | 2.42 | 139.3 | 3.63 | 3.05 | 2.42 | 139.3 | 3.63 | 3.05 | 2.42 |
| 6.3 | 108.6 | 2.83 | 2.38 | 1.99 | 119.4 | 3.11 | 2.62 | 2.07 | 130.4 | 3.40 | 2.86 | 2.26 | 141.2 | 3.68 | 3.10 | 2.45 | 141.2 | 3.68 | 3.10 | 2.45 | 141.2 | 3.68 | 3.10 | 2.45 |
| 6.4 | 109.3 | 2.85 | 2.40 | 1.90 | 120.2 | 3.13 | 2.64 | 2.09 | 131.3 | 3.42 | 2.88 | 2.28 | 142.6 | 3.71 | 3.13 | 2.48 | 143.2 | 3.73 | 3.14 | 2.49 | 143.2 | 3.73 | 3.14 | 2.49 |
| 6.5 | 110.0 | 2.88 | 2.41 | 1.91 | 121.0 | 3.15 | 2.65 | 2.10 | 132.3 | 3.44 | 2.90 | 2.30 | 143.8 | 3.74 | 3.15 | 2.49 | 145.2 | 3.78 | 3.18 | 2.52 | 145.2 | 3.78 | 3.18 | 2.52 |
| 6.6 | 110.6 | 2.88 | 2.43 | 1.92 | 121.8 | 3.17 | 2.67 | 2.11 | 133.2 | 3.47 | 2.92 | 2.31 | 144.7 | 3.77 | 3.17 | 2.51 | 147.2 | 3.83 | 3.23 | 2.55 | 147.2 | 3.83 | 3.23 | 2.55 |
| 6.7 | 111.2 | 2.90 | 2.44 | 1.93 | 122.8 | 3.19 | 2.69 | 2.13 | 134.1 | 3.49 | 2.94 | 2.33 | 145.8 | 3.80 | 3.20 | 2.53 | 149.2 | 3.88 | 3.27 | 2.59 | 149.2 | 3.88 | 3.27 | 2.59 |
| 6.8 | 111.9 | 2.91 | 2.45 | 1.94 | 123.3 | 3.21 | 2.71 | 2.14 | 135.0 | 3.52 | 2.96 | 2.34 | 146.8 | 3.82 | 3.22 | 2.55 | 151.2 | 3.94 | 3.31 | 2.62 | 151.2 | 3.94 | 3.31 | 2.62 |
| 6.9 | 112.5 | 2.93 | 2.47 | 1.95 | 124.1 | 3.23 | 2.72 | 2.15 | 135.9 | 3.54 | 2.98 | 2.36 | 147.8 | 3.85 | 3.24 | 2.57 | 153.2 | 3.99 | 3.36 | 2.66 | 153.2 | 3.99 | 3.36 | 2.66 |
| 7.0 | 113.1 | 2.95 | 2.48 | 1.96 | 124.8 | 3.25 | 2.74 | 2.17 | 136.8 | 3.58 | 3.00 | 2.37 | 148.8 | 3.88 | 3.26 | 2.58 | 155.2 | 4.04 | 3.40 | 2.69 | 155.2 | 4.04 | 3.40 | 2.69 |
| 7.1 | 113.7 | 2.96 | 2.49 | 1.97 | 125.6 | 3.27 | 2.75 | 2.18 | 137.6 | 3.58 | 3.02 | 2.39 | 149.8 | 3.90 | 3.29 | 2.60 | 157.2 | 4.09 | 3.45 | 2.73 | 157.2 | 4.09 | 3.45 | 2.73 |
| 7.2 | 114.3 | 2.98 | 2.51 | 1.98 | 126.3 | 3.29 | 2.77 | 2.19 | 138.5 | 3.61 | 3.04 | 2.40 | 150.8 | 3.93 | 3.31 | 2.62 | 159.2 | 4.15 | 3.49 | 2.76 | 159.2 | 4.15 | 3.49 | 2.76 |
| 7.3 | 114.9 | 2.99 | 2.52 | 1.99 | 127.0 | 3.31 | 2.79 | 2.20 | 139.3 | 3.63 | 3.06 | 2.42 | 151.8 | 3.95 | 3.33 | 2.64 | 161.2 | 4.20 | 3.54 | 2.80 | 161.2 | 4.20 | 3.54 | 2.80 |
| 7.4 | 115.5 | 3.01 | 2.53 | 2.00 | 127.7 | 3.33 | 2.80 | 2.22 | 140.1 | 3.65 | 3.07 | 2.43 | 152.8 | 3.98 | 3.35 | 2.65 | 163.2 | 4.25 | 3.58 | 2.83 | 163.2 | 4.25 | 3.58 | 2.83 |
| 7.5 | 116.1 | 3.02 | 2.55 | 2.01 | 128.4 | 3.34 | 2.82 | 2.23 | 141.0 | 3.67 | 3.09 | 2.45 | 153.7 | 4.00 | 3.37 | 2.87 | 165.3 | 4.30 | 3.62 | 2.87 | 165.3 | 4.30 | 3.62 | 2.87 |
| 7.6 | 116.8 | 3.04 | 2.56 | 2.02 | 129.1 | 3.36 | 2.83 | 2.24 | 141.8 | 3.69 | 3.11 | 2.46 | 154.8 | 4.03 | 3.39 | 2.68 | 167.3 | 4.36 | 3.67 | 2.90 | 167.3 | 4.36 | 3.67 | 2.90 |
| 7.7 | 117.2 | 3.05 | 2.57 | 2.03 | 129.7 | 3.38 | 2.85 | 2.25 | 142.6 | 3.71 | 3.13 | 2.47 | 155.8 | 4.05 | 3.41 | 2.70 | 188.7 | 4.39 | 3.70 | 2.93 | 169.3 | 4.41 | 3.71 | 2.94 |
| 7.8 | 117.7 | 3.07 | 2.58 | 2.04 | 130.4 | 3.40 | 2.86 | 2.26 | 143.3 | 3.73 | 3.14 | 2.49 | 156.5 | 4.07 | 3.43 | 2.72 | 189.8 | 4.42 | 3.72 | 2.95 | 171.4 | 4.46 | 3.76 | 2.98 |
| 7.9 | 118.3 | 3.08 | 2.59 | 2.05 | 131.1 | 3.41 | 2.87 | 2.28 | 144.1 | 3.75 | 3.16 | 2.50 | 157.4 | 4.10 | 3.45 | 2.73 | 170.8 | 4.45 | 3.75 | 2.97 | 173.4 | 4.52 | 3.80 | 3.01 |
| 8.0 | 118.8 | 3.09 | 2.60 | 2.06 | 131.7 | 3.43 | 2.99 | 2.29 | 144.9 | 3.77 | 3.18 | 2.52 | 158.3 | 4.12 | 3.47 | 2.75 | 171.8 | 4.48 | 3.77 | 2.98 | 175.5 | 4.57 | 3.85 | 3.05 |
| 8.1 | 119.3 | 3.11 | 2.62 | 2.07 | 132.3 | 3.45 | 2.90 | 2.30 | 145.8 | 3.79 | 3.19 | 2.53 | 158.1 | 4.14 | 3.49 | 2.78 | 172.8 | 4.50 | 3.79 | 3.00 | 177.5 | 4.62 | 3.89 | 3.08 |
| 8.2 | 119.8 | 3.12 | 2.63 | 2.08 | 133.0 | 3.46 | 2.92 | 2.31 | 146.4 | 3.81 | 3.21 | 2.54 | 160.0 | 4.17 | 3.51 | 2.78 | 173.8 | 4.53 | 3.81 | 3.02 | 179.6 | 4.68 | 3.94 | 3.12 |
| 8.3 | 120.3 | 3.13 | 2.64 | 2.09 | 133.8 | 3.48 | 2.93 | 2.32 | 147.1 | 3.83 | 3.23 | 2.55 | 160.9 | 4.19 | 3.53 | 2.79 | 174.8 | 4.55 | 3.83 | 3.04 | 181.6 | 4.73 | 3.98 | 3.15 |
| 8.4 | 120.8 | 3.15 | 2.65 | 2.10 | 134.2 | 3.49 | 2.94 | 2.33 | 147.8 | 3.85 | 3.24 | 2.57 | 161.7 | 4.21 | 3.55 | 2.81 | 175.8 | 4.58 | 3.86 | 3.05 | 183.7 | 4.78 | 4.03 | 3.19 |
| 8.5 | 121.3 | 3.18 | 2.68 | 2.11 | 134.8 | 3.51 | 2.96 | 2.34 | 148.5 | 3.87 | 3.26 | 2.58 | 182.5 | 4.23 | 3.56 | 2.82 | 178.7 | 4.60 | 3.68 | 3.07 | 185.8 | 4.84 | 4.07 | 3.22 |
| 8.6 | 121.8 | 3.17 | 2.87 | 2.11 | 135.4 | 3.52 | 2.97 | 2.35 | 149.2 | 3.99 | 3.27 | 2.59 | 183.3 | 4.25 | 3.58 | 2.84 | 177.7 | 4.83 | 3.90 | 3.08 | 187.8 | 4.89 | 4.12 | 3.26 |
| 8.7 | 122.2 | 3.18 | 2.68 | 2.12 | 135.9 | 3.54 | 2.98 | 2.36 | 149.9 | 3.90 | 3.29 | 2.60 | 164.2 | 4.27 | 3.60 | 2.85 | 178.8 | 4.65 | 3.92 | 3.10 | 189.9 | 4.94 | 4.16 | 3.30 |
| 8.8 | 122.7 | 3.20 | 2.69 | 2.13 | 138.5 | 3.55 | 2.99 | 2.37 | 150.8 | 3.92 | 3.30 | 2.81 | 185.0 | 4.30 | 3.62 | 2.96 | 179.5 | 4.68 | 3.94 | 3.12 | 192.0 | 5.00 | 4.21 | 3.33 |
| 8.9 | 123.2 | 3.21 | 2.70 | 2.14 | 137.1 | 3.57 | 3.01 | 2.38 | 151.3 | 3.94 | 3.32 | 2.83 | 185.7 | 4.32 | 3.83 | 2.88 | 180.5 | 4.70 | 3.98 | 3.13 | 194.0 | 5.05 | 4.26 | 3.37 |
| 9.0 | 123.6 | 3.22 | 2.71 | 2.15 | 137.6 | 3.58 | 3.02 | 2.39 | 151.9 | 3.96 | 3.33 | 2.64 | 186.5 | 4.34 | 3.65 | 2.89 | 181.3 | 4.72 | 3.98 | 3.15 | 196.1 | 5.11 | 4.30 | 3.40 |
| 9.1 | 124.0 | 3.23 | 2.72 | 2.15 | 138.2 | 3.60 | 3.03 | 2.40 | 152.8 | 3.97 | 3.35 | 2.65 | 167.3 | 4.38 | 3.87 | 2.90 | 182.2 | 4.75 | 4.00 | 3.18 | 197.4 | 5.14 | 4.33 | 3.43 |
| 9.2 | 124.5 | 3.24 | 2.73 | 2.18 | 138.7 | 3.81 | 3.04 | 2.41 | 153.2 | 3.99 | 3.38 | 2.66 | 168.0 | 4.38 | 3.68 | 2.92 | 183.1 | 4.77 | 4.02 | 3.18 | 198.4 | 5.17 | 4.35 | 3.44 |
| 9.3 | 124.9 | 3.25 | 2.74 | 2.17 | 139.2 | 3.63 | 3.05 | 2.42 | 153.8 | 4.01 | 3.37 | 2.67 | 168.8 | 4.40 | 3.70 | 2.93 | 184.0 | 4.79 | 4.03 | 3.19 | 199.4 | 5.19 | 4.37 | 3.46 |
| 9.4 | 125.3 | 3.26 | 2.75 | 2.18 | 139.7 | 3.64 | 3.06 | 2.43 | 154.5 | 4.02 | 3.39 | 2.68 | 169.5 | 4.41 | 3.72 | 2.94 | 184.8 | 4.81 | 4.05 | 3.21 | 200.4 | 5.22 | 4.39 | 3.48 |
| 9.5 | 125.7 | 3.27 | 2.78 | 2.18 | 140.2 | 3.65 | 3.08 | 2.43 | 155.1 | 4.04 | 3.40 | 2.69 | 170.2 | 4.43 | 3.73 | 2.96 | 165.7 | 4.83 | 4.07 | 3.22 | 201.3 | 5.24 | 4.41 | 3.50 |
| 9.6 | 126.1 | 3.28 | 2.77 | 2.19 | 140.7 | 3.68 | 3.09 | 2.44 | 155.7 | 4.05 | 3.41 | 2.70 | 170.9 | 4.45 | 3.75 | 2.97 | 185.5 | 4.86 | 4.09 | 3.24 | 202.3 | 5.27 | 4.44 | 3.51 |
| 9.7 | 126.5 | 3.30 | 2.77 | 2.20 | 141.2 | 3.68 | 3.10 | 2.45 | 156.3 | 4.07 | 3.43 | 2.71 | 171.8 | 4.47 | 3.76 | 2.96 | 187.3 | 4.88 | 4.11 | 3.25 | 203.2 | 5.29 | 4.46 | 3.53 |
| 9.8 | 126.9 | 3.31 | 2.78 | 2.20 | 141.7 | 3.69 | 3.11 | 2.46 | 156.9 | 4.08 | 3.44 | 2.72 | 172.3 | 4.49 | 3.78 | 2.99 | 188.1 | 4.90 | 4.13 | 3.27 | 204.1 | 5.32 | 4.48 | 3.54 |
| 9.9 | 127.3 | 3.32 | 2.79 | 2.21 | 142.2 | 3.70 | 3.12 | 2.47 | 157.4 | 4.10 | 3.45 | 2.73 | 173.0 | 4.51 | 3.79 | 3.00 | 188.9 | 4.92 | 4.14 | 3.28 | 205.0 | 5.34 | 4.50 | 3.56 |
| 10.0 | 127.7 | 3.33 | 2.80 | 2.22 | 142.7 | 3.72 | 3.13 | 2.48 | 158.0 | 4.11 | 3.47 | 2.74 | 173.7 | 4.52 | 3.81 | 3.02 | 189.7 | 4.94 | 4.18 | 3.29 | 205.9 | 5.36 | 4.52 | 3.58 |
| Trench Width m | | 1.4 | | | | 1.5 | | | | 1.6 | | | | 1.7 | | | | 1.8 | | | | 1.9 | | |

# Section Two

## Construction of Trench Beddings

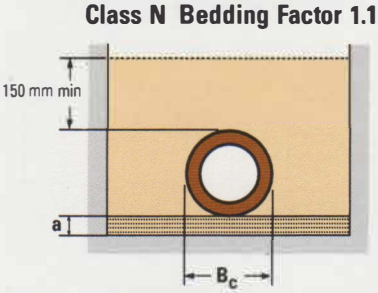
- Vitrified clay pipe
- Graded or all-in aggregate or compacted sand or suitable as-dug material
- Fill selected from excavated material and lightly compacted by hand.
- Concrete 28 day cube strength to be at least 20 MN/m²
- Single-size granular material
- Undisturbed natural soil

**Class D Bedding Factor 1.1**



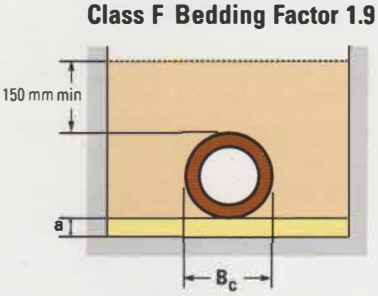

Trimmed trench bottom

**Class N Bedding Factor 1.1**




Granular material bed
Generally suitable for all conditions.

**Class F Bedding Factor 1.9**




Single size granular material bed.
Generally suitable for all conditions.

### Trench bottom - Class D

The bottom will be suitable for laying pipes direct, providing the formation can be hand-trimmed with a spade and is not puddled when walked upon. The pipes should be laid so that the barrels make reasonable contact with the formation, and socket holes should be dug so that there is at least 50 mm clearance under the sockets of pipes.

### Granular material for Class N

**All-in aggregate**

All-in aggregate should be 10 mm nominal size for 100 mm and 150 mm diameter pipes. 20 mm nominal size may be used for pipes of over 150 mm diameter and 40 mm nominal size for pipes of 600 mm diameter and larger.

**Sand**

Sand may be coarse, medium or fine and conform to Table 4 of BS 882 : 1992 the specification for aggregates from natural sources for concrete or conform to Table 2 of BS 3797 : 1990 the specification for lightweight aggregates for masonry and structural concrete.

**As dug material**

A material is suitable which has a compaction fraction of up to 0.3 (Ref. 1) and does not exceed 10 mm for 100 mm diameter pipes, 14 mm for 150 mm diameter pipes, 20 mm for 200 mm diameter to 500 mm diameter pipes and 40 mm for 600 mm diameter or larger pipes.

### Granular material for Classes F, B and S

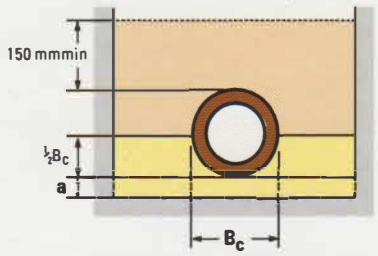
**Single size granular material**

Single size granular material should conform to either Table 3 of BS 882 : 1992, Table 3 of BS 1047 : 1983 the specification for air-cooled blastfurnace slag aggregate for use in construction or Table 1 of BS 3797 : 1990. The nominal single size to be used for 100 mm diameter pipes is 10 mm, for 150 mm is 10 mm or 14 mm, for 200 mm to 300 mm is 10 mm, 14mm or 20 mm, for 375 mm to 500 mm 14 mm or 20 mm, and for 600 mm and larger, 14 mm, 20 mm or 40 mm (Refs. 7, 8, 9 and 10).

**Graded granular material**

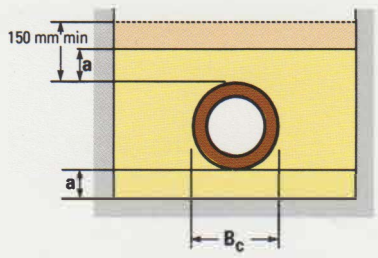
Graded granular material should conform to either Table 3 of BS 882 : 1992, Table 3 of BS 1047 : 1983 or Table 1 of BS 3797 : 1990. The sizes to be used for 150 mm diameter pipes are 14 to 5 mm, for 200 mm to 500 mm diameter 14 to 5 mm or 20 to 5 mm, and for 600 mm and larger, 14 to 5 mm, 20 to 5 mm or 40 to 5 mm (Refs. 7, 8, 9 and 10).

**Class B Bedding Factor 2.5**



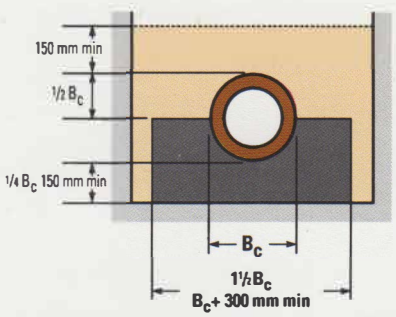

Machine-cut trench bottom.
Generally suitable for all conditions.

**Class S Bedding Factor 2.5**



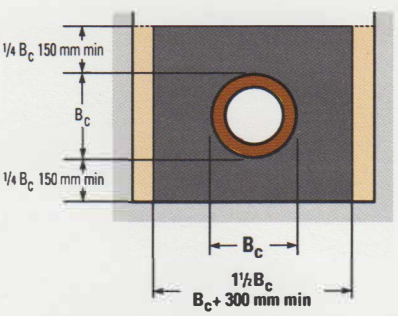

Granular Surround.
Generally suitable for all conditions.

**Class A Bedding Factor 2.6**




Plain concrete cradle. Generally suitable for all conditions, but for rock in mining areas, use granular base course.

**Class A Bedding Factor 4.5**




Plain concrete surround. Generally suitable for all conditions, but for rock in mining areas, use granular base course.

## Selected fill

Selected fill, whether selected from locally excavated material or imported, shall consist of uniform, readily compactible material, free from vegetable matter, building rubbish and frozen material, or materials susceptible to spontaneous combustion, and excluding clay of liquid limit greater than 80 and/or plastic limit greater than 55 and materials of excessively high moisture content. Clay lumps and stones retained on 75 mm and 37,5 mm sieves respectively shall be excluded from the fill material.

The sidefill should be placed to the top of the pipe and hand tamped in 150 mm layers ensuring that the line of laid pipeline is not disturbed. The backfill should be placed to 150 mm above the crown of the pipe and hand tamped.

## Dimension a (Ref. 7)

In machine-dug uniform soils:

a = For sleeve jointed pipes, a minimum of 50 mm or 1/6 $B_C$, whichever is the greater, for socketed pipes a minimum of 100 mm or 1/6 $B_C$, whichever is the greater under barrels but not less than 50 mm under sockets.

In rock or mixed soils containing rock bands, boulders, large flints or stones or other irregular hard spots:

a = For sleeve jointed pipes, a minimum of 150 mm or 1/4 $B_C$, whichever is the greater, for socketed pipes a minimum of 200 mm or 1/4 $B_C$, whichever is the greater under barrels and 150 mm minimum under sockets.

## Pipes laid in water bearing soils

Precautions are necessary in water bearing soils to prevent the fine sand and silt from being carried by ground water into the granular material.

## Concrete bedding - Class A

For all Class A beddings: the concrete (reinforced or plain) cradle or surround, to be monolithic with a minimum cube strength within 28 days of 20 MN/m². The backfill, other than the first 150 mm of cover, should not be placed before the compressive strength of the site concrete has reached 14MN/m². The concrete mix should be so designed that this strength is reached without unnecessary delay.

The vertical sides of the concrete should be properly shuttered or the concrete extended across the full width of the trench.

For concrete surround construction the width of the concrete should be used in the calculation of the load instead of the breadth of the pipe and the cover measured to the top of the concrete. Therefore, the values given in the table for the outside diameter of the pipe equal to the width of the concrete, or the same trench width, should be used in design.

For Class A reinforced concrete bed, the minimum transverse steel area must be 0.4% of the concrete area in longitudinal section to give a bedding factor of 3.4 (Refs. 6 and 11).

For a concrete surround the bedding factor is 4.5 (Ref. 10). For a reinforced concrete surround, an increased bedding factor of 4.8 can be used, provided that the area of transverse steel is at least 1.0% both above and below the pipe, and there is vertical steel joining the main steel. This bedding factor has been derived from the 4.8 for a 1.0% reinforced concrete arch (Refs. 6 and 11). A concrete arch is not a practicable construction.

Where a complete concrete surround is to be used, the width of concrete on either side of the pipe should be increased to a minimum of 150 mm (Ref. 11) to achieve the stated bedding factors.

# Section Three

## Fill Load and Traffic Load Tables 21 - 24

## TABLE 21. FILL LOADS
## WIDE TRENCH

### PIPE DIAMETER

| Cover m | 100 kN/m | 150 kN/m | 200 kN/m | 225 kN/m | 300 kN/m | 375 kN/m | 400 kN/m | 450 kN/m | 500 kN/m | 600 kN/m | 700 kN/m | 800 kN/m | 900 kN/m | 1000 kN/m | Cover m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.6 | 2.40 | 3.49 | 4.48 | 5.09 | 6.02 | 7.01 | 7.45 | 8.02 | 8.76 | 10.08 | 11.41 | 12.87 | 14.33 | 15.79 | 0.6 |
| 0.7 | 2.81 | 4.08 | 5.24 | 5.97 | 7.43 | 8.55 | 9.06 | 9.71 | 10.56 | 12.09 | 13.63 | 15.32 | 17.02 | 18.72 | 0.7 |
| 0.8 | 3.21 | 4.68 | 6.01 | 6.85 | 8.99 | 10.23 | 10.80 | 11.52 | 12.48 | 14.21 | 15.96 | 17.87 | 19.80 | 21.74 | 0.8 |
| 0.9 | 3.62 | 5.27 | 6.77 | 7.72 | 10.14 | 11.89 | 12.67 | 13.46 | 14.52 | 16.44 | 18.39 | 20.53 | 22.69 | 24.86 | 0.9 |
| 1.0 | 4.02 | 5.86 | 7.53 | 8.59 | 11.30 | 13.24 | 14.37 | 15.54 | 16.69 | 18.78 | 20.93 | 23.29 | 25.67 | 28.07 | 1.0 |
| 1.1 | 4.43 | 6.45 | 8.30 | 9.47 | 12.45 | 14.60 | 15.84 | 17.38 | 19.00 | 21.26 | 23.59 | 26.16 | 28.77 | 31.39 | 1.1 |
| 1.2 | 4.84 | 7.05 | 9.06 | 10.34 | 13.60 | 15.95 | 17.31 | 19.00 | 21.19 | 23.86 | 26.37 | 29.15 | 31.97 | 34.82 | 1.2 |
| 1.3 | 5.24 | 7.64 | 9.83 | 11.21 | 14.76 | 17.30 | 18.78 | 20.62 | 23.00 | 26.61 | 29.27 | 32.25 | 35.28 | 38.35 | 1.3 |
| 1.4 | 5.65 | 8.23 | 10.59 | 12.09 | 15.91 | 18.66 | 20.25 | 22.24 | 24.81 | 29.34 | 32.31 | 35.48 | 38.71 | 41.99 | 1.4 |
| 1.5 | 6.05 | 8.82 | 11.35 | 12.96 | 17.07 | 20.01 | 21.72 | 23.86 | 26.62 | 31.48 | 35.50 | 38.84 | 42.27 | 45.75 | 1.5 |
| 1.6 | 6.46 | 9.42 | 12.12 | 13.83 | 18.22 | 21.36 | 23.19 | 25.47 | 28.43 | 33.63 | 38.80 | 42.33 | 45.94 | 49.63 | 1.6 |
| 1.7 | 6.86 | 10.01 | 12.88 | 14.71 | 19.37 | 22.72 | 24.66 | 27.09 | 30.24 | 35.78 | 41.28 | 45.96 | 49.75 | 53.63 | 1.7 |
| 1.8 | 7.27 | 10.60 | 13.65 | 15.58 | 20.53 | 24.07 | 26.13 | 28.71 | 32.05 | 37.93 | 43.77 | 49.74 | 53.69 | 57.76 | 1.8 |
| 1.9 | 7.67 | 11.19 | 14.41 | 16.45 | 21.68 | 25.42 | 27.61 | 30.33 | 33.86 | 40.07 | 46.25 | 52.93 | 57.77 | 62.01 | 1.9 |
| 2.0 | 8.08 | 11.79 | 15.17 | 17.33 | 22.84 | 26.78 | 29.08 | 31.95 | 35.67 | 42.22 | 48.74 | 55.78 | 62.00 | 66.41 | 2.0 |
| 2.1 | 8.48 | 12.38 | 15.94 | 18.20 | 23.99 | 28.13 | 30.55 | 33.56 | 37.48 | 44.37 | 51.23 | 58.64 | 66.00 | 70.94 | 2.1 |
| 2.2 | 8.89 | 12.97 | 16.70 | 19.07 | 25.14 | 29.48 | 32.02 | 35.18 | 39.29 | 46.52 | 53.71 | 61.49 | 69.23 | 75.61 | 2.2 |
| 2.3 | 9.29 | 13.56 | 17.47 | 19.94 | 26.30 | 30.84 | 33.49 | 36.80 | 41.10 | 48.66 | 56.20 | 64.34 | 72.45 | 80.44 | 2.3 |
| 2.4 | 9.70 | 14.16 | 18.23 | 20.82 | 27.45 | 32.19 | 34.96 | 38.42 | 42.90 | 50.81 | 58.68 | 67.20 | 75.67 | 84.10 | 2.4 |
| 2.5 | 10.11 | 14.75 | 18.99 | 21.69 | 28.60 | 33.54 | 36.43 | 40.04 | 44.71 | 52.96 | 61.17 | 70.05 | 78.89 | 87.69 | 2.5 |
| 2.6 | 10.51 | 15.34 | 19.76 | 22.56 | 29.76 | 34.90 | 37.90 | 41.66 | 46.52 | 55.11 | 63.66 | 72.91 | 82.11 | 91.28 | 2.6 |
| 2.7 | 10.92 | 15.93 | 20.52 | 23.44 | 30.91 | 36.25 | 39.37 | 43.27 | 48.33 | 57.26 | 66.14 | 75.76 | 85.33 | 94.87 | 2.7 |
| 2.8 | 11.32 | 16.53 | 21.29 | 24.31 | 32.07 | 37.60 | 40.84 | 44.89 | 50.14 | 59.40 | 68.63 | 78.61 | 88.56 | 98.46 | 2.8 |
| 2.9 | 11.73 | 17.12 | 22.05 | 25.18 | 33.22 | 38.96 | 42.32 | 46.51 | 51.95 | 61.55 | 71.11 | 81.47 | 91.78 | 102.04 | 2.9 |
| 3.0 | 12.13 | 17.71 | 22.82 | 26.06 | 34.37 | 40.31 | 43.79 | 48.13 | 53.76 | 63.70 | 73.60 | 84.32 | 95.00 | 105.63 | 3.0 |
| 3.1 | 12.54 | 18.30 | 23.58 | 26.93 | 35.53 | 41.66 | 45.26 | 49.75 | 55.57 | 65.85 | 76.09 | 87.17 | 98.22 | 109.22 | 3.1 |
| 3.2 | 12.94 | 18.90 | 24.34 | 27.80 | 36.68 | 43.02 | 46.73 | 51.36 | 57.38 | 67.99 | 78.57 | 90.03 | 101.44 | 112.81 | 3.2 |
| 3.3 | 13.35 | 19.49 | 25.11 | 28.68 | 37.84 | 44.37 | 48.20 | 52.98 | 59.19 | 70.14 | 81.06 | 92.88 | 104.66 | 116.40 | 3.3 |
| 3.4 | 13.75 | 20.08 | 25.87 | 29.55 | 38.99 | 45.72 | 49.67 | 54.60 | 61.00 | 72.29 | 83.54 | 95.74 | 107.88 | 119.99 | 3.4 |
| 3.5 | 14.16 | 20.67 | 26.64 | 30.42 | 40.14 | 47.08 | 51.14 | 56.22 | 62.81 | 74.44 | 86.03 | 98.59 | 111.11 | 123.58 | 3.5 |
| 3.6 | 14.56 | 21.27 | 27.40 | 31.30 | 41.30 | 48.43 | 52.61 | 57.84 | 64.62 | 76.58 | 88.52 | 101.44 | 114.33 | 127.17 | 3.6 |
| 3.7 | 14.97 | 21.86 | 28.16 | 32.17 | 42.45 | 49.78 | 54.08 | 59.45 | 66.43 | 78.73 | 91.00 | 104.30 | 117.55 | 130.76 | 3.7 |
| 3.8 | 15.38 | 22.45 | 28.93 | 33.04 | 43.60 | 51.14 | 55.55 | 61.07 | 68.24 | 80.88 | 93.49 | 107.15 | 120.77 | 134.35 | 3.8 |
| 3.9 | 15.78 | 23.04 | 29.69 | 33.92 | 44.76 | 52.49 | 57.03 | 62.69 | 70.04 | 83.03 | 95.97 | 110.00 | 123.99 | 137.94 | 3.9 |
| 4.0 | 16.19 | 23.64 | 30.46 | 34.79 | 45.91 | 53.84 | 58.50 | 64.31 | 71.85 | 85.17 | 98.46 | 112.86 | 127.21 | 141.53 | 4.0 |
| 4.1 | 16.59 | 24.23 | 31.22 | 35.66 | 47.07 | 55.20 | 59.97 | 65.93 | 73.66 | 87.32 | 100.95 | 115.71 | 130.43 | 145.12 | 4.1 |
| 4.2 | 17.00 | 24.82 | 31.98 | 36.54 | 48.22 | 56.55 | 61.44 | 67.54 | 75.47 | 89.47 | 103.43 | 118.57 | 133.66 | 148.70 | 4.2 |
| 4.3 | 17.40 | 25.41 | 32.75 | 37.41 | 49.37 | 57.90 | 62.91 | 69.16 | 77.28 | 91.62 | 105.92 | 121.42 | 136.88 | 152.29 | 4.3 |
| 4.4 | 17.81 | 26.01 | 33.51 | 38.28 | 50.53 | 59.26 | 64.38 | 70.78 | 79.09 | 93.77 | 108.40 | 124.27 | 140.10 | 155.88 | 4.4 |
| 4.5 | 18.21 | 26.60 | 34.28 | 39.15 | 51.68 | 60.61 | 65.85 | 72.40 | 80.90 | 95.91 | 110.89 | 127.13 | 143.32 | 159.47 | 4.5 |
| 4.6 | 18.62 | 27.19 | 35.04 | 40.03 | 52.84 | 61.96 | 67.32 | 74.02 | 82.71 | 98.06 | 113.38 | 129.98 | 146.54 | 163.06 | 4.6 |
| 4.7 | 19.02 | 27.78 | 35.80 | 40.90 | 53.99 | 63.32 | 68.79 | 75.64 | 84.52 | 100.21 | 115.86 | 132.83 | 149.76 | 166.65 | 4.7 |
| 4.8 | 19.43 | 28.38 | 36.57 | 41.77 | 55.14 | 64.67 | 70.26 | 77.25 | 86.33 | 102.36 | 118.35 | 135.69 | 152.99 | 170.24 | 4.8 |
| 4.9 | 19.84 | 28.97 | 37.33 | 42.65 | 56.30 | 66.02 | 71.74 | 78.87 | 88.14 | 104.50 | 120.83 | 138.54 | 156.21 | 173.83 | 4.9 |
| 5.0 | 20.24 | 29.56 | 38.10 | 43.52 | 57.45 | 67.38 | 73.21 | 80.49 | 89.95 | 106.65 | 123.32 | 141.39 | 159.43 | 177.42 | 5.0 |
| 5.1 | 20.65 | 30.15 | 38.86 | 44.39 | 58.60 | 68.73 | 74.68 | 82.11 | 91.76 | 108.80 | 125.80 | 144.25 | 162.65 | 181.01 | 5.1 |
| 5.2 | 21.05 | 30.75 | 39.62 | 45.27 | 59.76 | 70.08 | 76.15 | 83.73 | 93.57 | 110.95 | 128.29 | 147.10 | 165.87 | 184.60 | 5.2 |
| 5.3 | 21.46 | 31.34 | 40.39 | 46.14 | 60.91 | 71.44 | 77.62 | 85.34 | 95.38 | 113.09 | 130.78 | 149.96 | 169.09 | 188.19 | 5.3 |
| 5.4 | 21.86 | 31.93 | 41.15 | 47.01 | 62.07 | 72.79 | 79.09 | 86.96 | 97.18 | 115.24 | 133.26 | 152.81 | 172.31 | 191.78 | 5.4 |
| 5.5 | 22.27 | 32.52 | 41.92 | 47.89 | 63.22 | 74.14 | 80.56 | 88.58 | 98.99 | 117.39 | 135.75 | 155.66 | 175.54 | 195.36 | 5.5 |
| 5.6 | 22.67 | 33.12 | 42.68 | 48.76 | 64.37 | 75.50 | 82.03 | 90.20 | 100.80 | 119.54 | 138.23 | 158.52 | 178.76 | 198.95 | 5.6 |
| 5.7 | 23.08 | 33.71 | 43.44 | 49.63 | 65.53 | 76.85 | 83.50 | 91.82 | 102.61 | 121.68 | 140.72 | 161.37 | 181.98 | 202.54 | 5.7 |
| 5.8 | 23.48 | 34.30 | 44.21 | 50.51 | 66.68 | 78.20 | 84.97 | 93.43 | 104.42 | 123.83 | 143.21 | 164.22 | 185.20 | 206.13 | 5.8 |
| 5.9 | 23.89 | 34.89 | 44.97 | 51.38 | 67.84 | 79.56 | 86.45 | 95.05 | 106.23 | 125.98 | 145.69 | 167.08 | 188.42 | 209.72 | 5.9 |
| 6.0 | 24.29 | 35.49 | 45.74 | 52.25 | 68.99 | 80.91 | 87.92 | 96.67 | 108.04 | 128.13 | 148.18 | 169.93 | 191.64 | 213.31 | 6.0 |
| 6.1 | 24.70 | 36.08 | 46.50 | 53.13 | 70.14 | 82.26 | 89.39 | 98.29 | 109.85 | 130.28 | 150.66 | 172.79 | 194.86 | 216.90 | 6.1 |
| 6.2 | 25.11 | 36.67 | 47.26 | 54.00 | 71.30 | 83.62 | 90.86 | 99.91 | 111.66 | 132.42 | 153.15 | 175.64 | 198.09 | 220.49 | 6.2 |
| 6.3 | 25.51 | 37.26 | 48.03 | 54.87 | 72.45 | 84.97 | 92.33 | 101.52 | 113.47 | 134.57 | 155.64 | 178.49 | 201.31 | 224.08 | 6.3 |
| 6.4 | 25.92 | 37.86 | 48.79 | 55.75 | 73.60 | 86.32 | 93.80 | 103.14 | 115.28 | 136.72 | 158.12 | 181.35 | 204.53 | 227.67 | 6.4 |
| 6.5 | 26.32 | 38.45 | 49.56 | 56.62 | 74.76 | 87.68 | 95.27 | 104.76 | 117.09 | 138.87 | 160.61 | 184.20 | 207.75 | 231.26 | 6.5 |
| 6.6 | 26.73 | 39.04 | 50.32 | 57.49 | 75.91 | 89.03 | 96.74 | 106.38 | 118.90 | 141.01 | 163.09 | 187.05 | 210.97 | 234.85 | 6.6 |
| 6.7 | 27.13 | 39.63 | 51.08 | 58.36 | 77.07 | 90.38 | 98.21 | 108.00 | 120.71 | 143.16 | 165.58 | 189.91 | 214.19 | 238.44 | 6.7 |
| 6.8 | 27.54 | 40.23 | 51.85 | 59.24 | 78.22 | 91.74 | 99.68 | 109.62 | 122.51 | 145.31 | 168.07 | 192.76 | 217.41 | 242.02 | 6.8 |
| 6.9 | 27.94 | 40.82 | 52.61 | 60.11 | 79.37 | 93.09 | 101.16 | 111.23 | 124.32 | 147.46 | 170.55 | 195.62 | 220.64 | 245.61 | 6.9 |
| 7.0 | 28.35 | 41.41 | 53.38 | 60.98 | 80.53 | 94.44 | 102.63 | 112.85 | 126.13 | 149.60 | 173.04 | 198.47 | 223.86 | 249.20 | 7.0 |
| 7.1 | 28.75 | 42.01 | 54.14 | 61.86 | 81.68 | 95.80 | 104.10 | 114.47 | 127.94 | 151.75 | 175.52 | 201.32 | 227.08 | 252.79 | 7.1 |
| 7.2 | 29.16 | 42.60 | 54.90 | 62.73 | 82.84 | 97.15 | 105.57 | 116.09 | 129.75 | 153.90 | 178.01 | 204.18 | 230.30 | 256.38 | 7.2 |
| 7.3 | 29.56 | 43.19 | 55.67 | 63.60 | 83.99 | 98.50 | 107.04 | 117.71 | 131.56 | 156.05 | 180.50 | 207.03 | 233.52 | 259.97 | 7.3 |
| 7.4 | 29.97 | 43.78 | 56.43 | 64.48 | 85.14 | 99.85 | 108.51 | 119.32 | 133.37 | 158.19 | 182.98 | 209.88 | 236.74 | 263.56 | 7.4 |
| 7.5 | 30.38 | 44.38 | 57.20 | 65.35 | 86.30 | 101.21 | 109.98 | 120.94 | 135.18 | 160.34 | 185.47 | 212.74 | 239.97 | 267.15 | 7.5 |
| 7.6 | 30.78 | 44.97 | 57.96 | 66.22 | 87.45 | 102.56 | 111.45 | 122.56 | 136.99 | 162.49 | 187.95 | 215.59 | 243.19 | 270.74 | 7.6 |
| 7.7 | 31.19 | 45.56 | 58.72 | 67.10 | 88.60 | 103.91 | 112.92 | 124.18 | 138.80 | 164.64 | 190.44 | 218.45 | 246.41 | 274.33 | 7.7 |
| 7.8 | 31.59 | 46.15 | 59.49 | 67.97 | 89.76 | 105.27 | 114.39 | 125.80 | 140.61 | 166.79 | 192.93 | 221.30 | 249.63 | 277.92 | 7.8 |
| 7.9 | 32.00 | 46.75 | 60.25 | 68.84 | 90.91 | 106.62 | 115.87 | 127.41 | 142.42 | 168.93 | 195.41 | 224.15 | 252.85 | 281.51 | 7.9 |
| 8.0 | 32.40 | 47.34 | 61.02 | 69.72 | 92.07 | 107.97 | 117.34 | 129.03 | 144.23 | 171.08 | 197.90 | 227.01 | 256.07 | 285.10 | 8.0 |
| 8.1 | 32.81 | 47.93 | 61.78 | 70.59 | 93.22 | 109.33 | 118.81 | 130.65 | 146.04 | 173.23 | 200.38 | 229.86 | 259.29 | 288.68 | 8.1 |
| 8.2 | 33.21 | 48.52 | 62.55 | 71.46 | 94.37 | 110.68 | 120.28 | 132.27 | 147.85 | 175.38 | 202.87 | 232.71 | 262.52 | 292.27 | 8.2 |
| 8.3 | 33.62 | 49.12 | 63.31 | 72.34 | 95.53 | 112.03 | 121.75 | 133.89 | 149.65 | 177.52 | 205.36 | 235.57 | 265.74 | 295.86 | 8.3 |
| 8.4 | 34.02 | 49.71 | 64.07 | 73.21 | 96.68 | 113.39 | 123.22 | 135.50 | 151.46 | 179.67 | 207.84 | 238.42 | 268.96 | 299.45 | 8.4 |
| 8.5 | 34.43 | 50.30 | 64.84 | 74.08 | 97.84 | 114.74 | 124.69 | 137.12 | 153.27 | 181.82 | 210.33 | 241.28 | 272.18 | 303.04 | 8.5 |
| 8.6 | 34.84 | 50.89 | 65.60 | 74.96 | 98.99 | 116.09 | 126.16 | 138.74 | 155.08 | 183.97 | 212.81 | 244.13 | 275.40 | 306.63 | 8.6 |
| 8.7 | 35.24 | 51.49 | 66.37 | 75.83 | 100.14 | 117.45 | 127.63 | 140.36 | 156.89 | 186.11 | 215.30 | 246.98 | 278.62 | 310.22 | 8.7 |
| 8.8 | 35.65 | 52.08 | 67.13 | 76.70 | 101.30 | 118.80 | 129.10 | 141.98 | 158.70 | 188.26 | 217.79 | 249.84 | 281.84 | 313.81 | 8.8 |
| 8.9 | 36.05 | 52.67 | 67.89 | 77.57 | 102.45 | 120.15 | 130.58 | 143.60 | 160.51 | 190.41 | 220.27 | 252.69 | 285.07 | 317.40 | 8.9 |
| 9.0 | 36.46 | 53.26 | 68.66 | 78.45 | 103.60 | 121.51 | 132.05 | 145.21 | 162.32 | 192.56 | 222.76 | 255.54 | 288.29 | 320.99 | 9.0 |
| 9.1 | 36.86 | 53.86 | 69.42 | 79.32 | 104.76 | 122.86 | 133.52 | 146.83 | 164.13 | 194.71 | 225.24 | 258.40 | 291.51 | 324.58 | 9.1 |
| 9.2 | 37.27 | 54.45 | 70.19 | 80.19 | 105.91 | 124.21 | 134.99 | 148.45 | 165.94 | 196.85 | 227.73 | 261.25 | 294.73 | 328.17 | 9.2 |
| 9.3 | 37.67 | 55.04 | 70.95 | 81.07 | 107.07 | 125.57 | 136.46 | 150.07 | 167.75 | 199.00 | 230.22 | 264.11 | 297.95 | 331.76 | 9.3 |
| 9.4 | 38.08 | 55.63 | 71.71 | 81.94 | 108.22 | 126.92 | 137.93 | 151.69 | 169.56 | 201.15 | 232.70 | 266.96 | 301.17 | 335.34 | 9.4 |
| 9.5 | 38.48 | 56.23 | 72.48 | 82.81 | 109.37 | 128.27 | 139.40 | 153.30 | 171.37 | 203.30 | 235.19 | 269.81 | 304.39 | 338.93 | 9.5 |
| 9.6 | 38.89 | 56.82 | 73.24 | 83.69 | 110.53 | 129.63 | 140.87 | 154.92 | 173.18 | 205.44 | 237.67 | 272.67 | 307.62 | 342.52 | 9.6 |
| 9.7 | 39.29 | 57.41 | 74.01 | 84.56 | 111.68 | 130.98 | 142.34 | 156.54 | 174.99 | 207.59 | 240.16 | 275.52 | 310.84 | 346.11 | 9.7 |
| 9.8 | 39.70 | 58.00 | 74.77 | 85.43 | 112.84 | 132.33 | 143.81 | 158.16 | 176.79 | 209.74 | 242.65 | 278.37 | 314.06 | 349.70 | 9.8 |
| 9.9 | 40.11 | 58.60 | 75.53 | 86.31 | 113.99 | 133.69 | 145.29 | 159.78 | 178.60 | 211.89 | 245.13 | 281.23 | 317.28 | 353.29 | 9.9 |
| 10.0 | 40.51 | 59.19 | 76.30 | 87.18 | 115.14 | 135.04 | 146.76 | 161.39 | 180.41 | 214.03 | 247.62 | 284.08 | 320.50 | 356.88 | 10.0 |

## TABLE 22. FILL LOADS
## NARROW TRENCH

TRENCH WIDTH

| Cover m | 0.5 kN/m | 0.6 kN/m | 0.7 kN/m | 0.8 kN/m | 0.9 kN/m | 1.0 kN/m | 1.1 kN/m | 1.2 kN/m | 1.3 kN/m | 1.4 kN/m | 1.5 kN/m | Cover m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.6 | 5.05 | 6.22 | 7.38 | 8.55 | 9.72 | 10.90 | 12.07 | 13.24 | 14.42 | 15.59 | 16.77 | 0.6 |
| 0.7 | 5.75 | 7.11 | 8.46 | 9.82 | 11.19 | 12.55 | 13.92 | 15.29 | 16.66 | 18.02 | 19.39 | 0.7 |
| 0.8 | 6.42 | 7.96 | 9.50 | 11.05 | 12.61 | 14.17 | 15.73 | 17.29 | 18.85 | 20.41 | 21.98 | 0.8 |
| 0.9 | 7.05 | 8.77 | 10.50 | 12.24 | 13.99 | 15.74 | 17.49 | 19.25 | 21.00 | 22.76 | 24.52 | 0.9 |
| 1.0 | 7.65 | 9.55 | 11.47 | 13.40 | 15.33 | 17.27 | 19.21 | 21.16 | 23.11 | 25.06 | 27.01 | 1.0 |
| 1.1 | 8.22 | 10.30 | 12.40 | 14.51 | 16.63 | 18.76 | 20.90 | 23.04 | 25.18 | 27.32 | 29.46 | 1.1 |
| 1.2 | 8.75 | 11.01 | 13.29 | 15.59 | 17.90 | 20.22 | 22.54 | 24.87 | 27.20 | 29.54 | 31.87 | 1.2 |
| 1.3 | 9.27 | 11.70 | 14.16 | 16.64 | 19.13 | 21.64 | 24.15 | 26.67 | 29.19 | 31.71 | 34.24 | 1.3 |
| 1.4 | 9.75 | 12.35 | 14.99 | 17.65 | 20.33 | 23.02 | 25.72 | 28.42 | 31.13 | 33.85 | 36.57 | 1.4 |
| 1.5 | 10.21 | 12.98 | 15.79 | 18.63 | 21.49 | 24.36 | 27.25 | 30.14 | 33.04 | 35.95 | 38.86 | 1.5 |
| 1.6 | 10.65 | 13.58 | 16.56 | 19.58 | 22.62 | 25.67 | 28.74 | 31.82 | 34.91 | 38.01 | 41.11 | 1.6 |
| 1.7 | 11.07 | 14.16 | 17.31 | 20.49 | 23.71 | 26.95 | 30.20 | 33.47 | 36.75 | 40.03 | 43.32 | 1.7 |
| 1.8 | 11.46 | 14.71 | 18.02 | 21.38 | 24.78 | 28.19 | 31.63 | 35.08 | 38.54 | 42.01 | 45.49 | 1.8 |
| 1.9 | 11.84 | 15.24 | 18.71 | 22.24 | 25.81 | 29.41 | 33.02 | 36.66 | 40.30 | 43.96 | 47.63 | 1.9 |
| 2.0 | 12.19 | 15.74 | 19.38 | 23.08 | 26.82 | 30.59 | 34.38 | 38.20 | 42.03 | 45.87 | 49.72 | 2.0 |
| 2.1 | 12.53 | 16.23 | 20.02 | 23.88 | 27.79 | 31.74 | 35.71 | 39.71 | 43.72 | 47.75 | 51.79 | 2.1 |
| 2.2 | 12.85 | 16.69 | 20.64 | 24.66 | 28.74 | 32.86 | 37.01 | 41.19 | 45.38 | 49.59 | 53.81 | 2.2 |
| 2.3 | 13.16 | 17.13 | 21.23 | 25.42 | 29.66 | 33.95 | 38.28 | 42.63 | 47.01 | 51.40 | 55.80 | 2.3 |
| 2.4 | 13.44 | 17.56 | 21.81 | 26.15 | 30.56 | 35.02 | 39.52 | 44.05 | 48.60 | 53.17 | 57.76 | 2.4 |
| 2.5 | 13.72 | 17.97 | 22.36 | 26.86 | 31.43 | 36.05 | 40.73 | 45.43 | 50.16 | 54.92 | 59.69 | 2.5 |
| 2.6 | 13.98 | 18.36 | 22.89 | 27.54 | 32.27 | 37.07 | 41.91 | 46.78 | 51.69 | 56.63 | 61.58 | 2.6 |
| 2.7 | 14.23 | 18.73 | 23.40 | 28.20 | 33.09 | 38.05 | 43.06 | 48.11 | 53.19 | 58.30 | 63.44 | 2.7 |
| 2.8 | 14.46 | 19.09 | 23.90 | 28.85 | 33.89 | 39.01 | 44.19 | 49.41 | 54.67 | 59.95 | 65.26 | 2.8 |
| 2.9 | 14.68 | 19.43 | 24.37 | 29.47 | 34.67 | 39.94 | 45.29 | 50.68 | 56.11 | 61.57 | 67.06 | 2.9 |
| 3.0 | 14.90 | 19.76 | 24.83 | 30.07 | 35.42 | 40.86 | 46.36 | 51.92 | 57.52 | 63.16 | 68.82 | 3.0 |
| 3.1 | 15.10 | 20.07 | 25.28 | 30.65 | 36.15 | 41.74 | 47.41 | 53.13 | 58.91 | 64.72 | 70.56 | 3.1 |
| 3.2 | 15.29 | 20.37 | 25.70 | 31.21 | 36.86 | 42.61 | 48.43 | 54.32 | 60.26 | 66.25 | 72.26 | 3.2 |
| 3.3 | 15.47 | 20.66 | 26.11 | 31.76 | 37.55 | 43.45 | 49.44 | 55.49 | 61.59 | 67.75 | 73.94 | 3.3 |
| 3.4 | 15.64 | 20.93 | 26.51 | 32.29 | 38.22 | 44.27 | 50.41 | 56.63 | 62.90 | 69.22 | 75.58 | 3.4 |
| 3.5 | 15.80 | 21.20 | 26.89 | 32.80 | 38.87 | 45.07 | 51.37 | 57.74 | 64.18 | 70.67 | 77.20 | 3.5 |
| 3.6 | 15.96 | 21.45 | 27.26 | 33.29 | 39.51 | 45.85 | 52.30 | 58.83 | 65.43 | 72.09 | 78.79 | 3.6 |
| 3.7 | 16.11 | 21.69 | 27.61 | 33.77 | 40.12 | 46.61 | 53.21 | 59.90 | 66.66 | 73.48 | 80.35 | 3.7 |
| 3.8 | 16.24 | 21.92 | 27.95 | 34.24 | 40.72 | 47.35 | 54.10 | 60.94 | 67.87 | 74.85 | 81.89 | 3.8 |
| 3.9 | 16.38 | 22.15 | 28.28 | 34.69 | 41.30 | 48.07 | 54.97 | 61.97 | 69.05 | 76.19 | 83.40 | 3.9 |
| 4.0 | 16.50 | 22.36 | 28.60 | 35.12 | 41.86 | 48.77 | 55.82 | 62.97 | 70.20 | 77.51 | 84.88 | 4.0 |
| 4.1 | 16.62 | 22.56 | 28.90 | 35.54 | 42.41 | 49.46 | 56.64 | 63.94 | 71.34 | 78.81 | 86.34 | 4.1 |
| 4.2 | 16.74 | 22.76 | 29.20 | 35.95 | 42.94 | 50.12 | 57.45 | 64.90 | 72.45 | 80.08 | 87.77 | 4.2 |
| 4.3 | 16.84 | 22.94 | 29.48 | 36.34 | 43.46 | 50.77 | 58.24 | 65.84 | 73.54 | 81.32 | 89.18 | 4.3 |
| 4.4 | 16.95 | 23.12 | 29.75 | 36.73 | 43.96 | 51.41 | 59.01 | 66.76 | 74.61 | 82.55 | 90.56 | 4.4 |
| 4.5 | 17.04 | 23.29 | 30.02 | 37.09 | 44.45 | 52.02 | 59.77 | 67.65 | 75.65 | 83.75 | 91.93 | 4.5 |
| 4.6 | 17.13 | 23.46 | 30.27 | 37.45 | 44.92 | 52.62 | 60.50 | 68.53 | 76.68 | 84.93 | 93.26 | 4.6 |
| 4.7 | 17.22 | 23.61 | 30.51 | 37.80 | 45.39 | 53.21 | 61.22 | 69.39 | 77.69 | 86.09 | 94.58 | 4.7 |
| 4.8 | 17.30 | 23.76 | 30.75 | 38.13 | 45.83 | 53.78 | 61.93 | 70.23 | 78.67 | 87.22 | 95.87 | 4.8 |
| 4.9 | 17.38 | 23.91 | 30.97 | 38.46 | 46.27 | 54.34 | 62.61 | 71.06 | 79.64 | 88.34 | 97.14 | 4.9 |
| 5.0 | 17.46 | 24.05 | 31.19 | 38.77 | 46.69 | 54.88 | 63.28 | 71.86 | 80.59 | 89.43 | 98.38 | 5.0 |
| 5.1 | 17.53 | 24.18 | 31.40 | 39.08 | 47.10 | 55.40 | 63.93 | 72.65 | 81.52 | 90.51 | 99.61 | 5.1 |
| 5.2 | 17.60 | 24.30 | 31.61 | 39.37 | 47.50 | 55.92 | 64.57 | 73.42 | 82.43 | 91.56 | 100.82 | 5.2 |
| 5.3 | 17.66 | 24.43 | 31.80 | 39.66 | 47.89 | 56.42 | 65.20 | 74.17 | 83.32 | 92.60 | 102.00 | 5.3 |
| 5.4 | 17.72 | 24.54 | 31.99 | 39.93 | 48.26 | 56.91 | 65.81 | 74.91 | 84.19 | 93.62 | 103.16 | 5.4 |
| 5.5 | 17.78 | 24.65 | 32.17 | 40.20 | 48.63 | 57.38 | 66.40 | 75.64 | 85.05 | 94.61 | 104.31 | 5.5 |
| 5.6 | 17.83 | 24.76 | 32.35 | 40.46 | 48.98 | 57.85 | 66.98 | 76.34 | 85.89 | 95.59 | 105.43 | 5.6 |
| 5.7 | 17.89 | 24.86 | 32.51 | 40.71 | 49.33 | 58.30 | 67.55 | 77.03 | 86.71 | 96.56 | 106.54 | 5.7 |
| 5.8 | 17.93 | 24.96 | 32.68 | 40.95 | 49.66 | 58.74 | 68.10 | 77.71 | 87.52 | 97.50 | 107.62 | 5.8 |
| 5.9 | 17.98 | 25.05 | 32.83 | 41.18 | 49.99 | 59.17 | 68.65 | 78.37 | 88.31 | 98.43 | 108.69 | 5.9 |
| 6.0 | 18.03 | 25.14 | 32.98 | 41.41 | 50.31 | 59.58 | 69.17 | 79.02 | 89.09 | 99.34 | 109.74 | 6.0 |
| 6.1 | 18.07 | 25.23 | 33.13 | 41.63 | 50.61 | 59.99 | 69.69 | 79.66 | 89.85 | 100.23 | 110.77 | 6.1 |
| 6.2 | 18.11 | 25.31 | 33.27 | 41.84 | 50.91 | 60.39 | 70.19 | 80.28 | 90.59 | 101.10 | 111.78 | 6.2 |
| 6.3 | 18.15 | 25.39 | 33.40 | 42.05 | 51.20 | 60.77 | 70.69 | 80.89 | 91.32 | 101.97 | 112.78 | 6.3 |
| 6.4 | 18.18 | 25.46 | 33.53 | 42.25 | 51.48 | 61.15 | 71.17 | 81.48 | 92.04 | 102.81 | 113.76 | 6.4 |
| 6.5 | 18.22 | 25.53 | 33.66 | 42.44 | 51.76 | 61.52 | 71.64 | 82.06 | 92.74 | 103.64 | 114.72 | 6.5 |
| 6.6 | 18.25 | 25.60 | 33.78 | 42.63 | 52.02 | 61.87 | 72.10 | 82.63 | 93.43 | 104.45 | 115.66 | 6.6 |
| 6.7 | 18.28 | 25.67 | 33.89 | 42.81 | 52.28 | 62.22 | 72.54 | 83.19 | 94.10 | 105.25 | 116.59 | 6.7 |
| 6.8 | 18.31 | 25.73 | 34.01 | 42.98 | 52.53 | 62.56 | 72.98 | 83.73 | 94.77 | 106.03 | 117.51 | 6.8 |
| 6.9 | 18.34 | 25.79 | 34.11 | 43.15 | 52.78 | 62.89 | 73.41 | 84.27 | 95.41 | 106.80 | 118.40 | 6.9 |
| 7.0 | 18.36 | 25.85 | 34.22 | 43.32 | 53.02 | 63.21 | 73.83 | 84.79 | 96.06 | 107.56 | 119.29 | 7.0 |
| 7.1 | 18.39 | 25.90 | 34.32 | 43.47 | 53.25 | 63.53 | 74.23 | 85.30 | 96.67 | 108.30 | 120.15 | 7.1 |
| 7.2 | 18.41 | 25.96 | 34.41 | 43.63 | 53.47 | 63.83 | 74.63 | 85.80 | 97.28 | 109.03 | 121.00 | 7.2 |
| 7.3 | 18.44 | 26.01 | 34.51 | 43.78 | 53.69 | 64.13 | 75.02 | 86.29 | 97.88 | 109.74 | 121.84 | 7.3 |
| 7.4 | 18.46 | 26.06 | 34.60 | 43.92 | 53.90 | 64.42 | 75.40 | 86.77 | 98.47 | 110.44 | 122.66 | 7.4 |
| 7.5 | 18.48 | 26.10 | 34.68 | 44.06 | 54.10 | 64.70 | 75.77 | 87.24 | 99.04 | 111.13 | 123.47 | 7.5 |
| 7.6 | 18.50 | 26.15 | 34.77 | 44.20 | 54.30 | 64.98 | 76.13 | 87.70 | 99.60 | 111.81 | 124.27 | 7.6 |
| 7.7 | 18.51 | 26.19 | 34.85 | 44.33 | 54.50 | 65.25 | 76.49 | 88.14 | 100.16 | 112.47 | 125.05 | 7.7 |
| 7.8 | 18.53 | 26.23 | 34.92 | 44.45 | 54.68 | 65.51 | 76.83 | 88.58 | 100.70 | 113.12 | 125.82 | 7.8 |
| 7.9 | 18.55 | 26.27 | 35.00 | 44.57 | 54.87 | 65.76 | 77.17 | 89.01 | 101.23 | 113.76 | 126.57 | 7.9 |
| 8.0 | 18.56 | 26.31 | 35.07 | 44.69 | 55.04 | 66.01 | 77.50 | 89.43 | 101.75 | 114.39 | 127.31 | 8.0 |
| 8.1 | 18.58 | 26.34 | 35.14 | 44.81 | 55.22 | 66.25 | 77.82 | 89.85 | 102.26 | 115.00 | 128.04 | 8.1 |
| 8.2 | 18.59 | 26.38 | 35.21 | 44.92 | 55.38 | 66.49 | 78.14 | 90.25 | 102.76 | 115.61 | 128.76 | 8.2 |
| 8.3 | 18.61 | 26.41 | 35.27 | 45.03 | 55.55 | 66.72 | 78.44 | 90.64 | 103.25 | 116.20 | 129.46 | 8.3 |
| 8.4 | 18.62 | 26.44 | 35.33 | 45.13 | 55.71 | 66.94 | 78.74 | 91.03 | 103.73 | 116.78 | 130.15 | 8.4 |
| 8.5 | 18.63 | 26.47 | 35.39 | 45.23 | 55.86 | 67.16 | 79.04 | 91.40 | 104.20 | 117.36 | 130.83 | 8.5 |
| 8.6 | 18.64 | 26.50 | 35.45 | 45.33 | 56.01 | 67.37 | 79.32 | 91.77 | 104.66 | 117.92 | 131.50 | 8.6 |
| 8.7 | 18.65 | 26.53 | 35.50 | 45.42 | 56.15 | 67.58 | 79.60 | 92.13 | 106.11 | 118.47 | 132.16 | 8.7 |
| 8.8 | 18.66 | 26.56 | 35.56 | 45.51 | 56.29 | 67.78 | 79.87 | 92.49 | 106.55 | 119.01 | 132.81 | 8.8 |
| 8.9 | 18.67 | 26.58 | 35.61 | 45.60 | 56.43 | 67.98 | 80.14 | 92.83 | 106.99 | 119.54 | 133.44 | 8.9 |
| 9.0 | 18.68 | 26.61 | 35.66 | 45.69 | 56.56 | 68.17 | 80.40 | 93.17 | 106.41 | 120.06 | 134.06 | 9.0 |
| 9.1 | 18.69 | 26.63 | 35.71 | 45.77 | 56.69 | 68.36 | 80.65 | 93.50 | 106.83 | 120.57 | 134.68 | 9.1 |
| 9.2 | 18.70 | 26.65 | 35.75 | 45.85 | 56.82 | 68.54 | 80.90 | 93.83 | 107.24 | 121.07 | 135.28 | 9.2 |
| 9.3 | 18.71 | 26.67 | 35.80 | 45.93 | 56.94 | 68.71 | 81.15 | 94.15 | 107.64 | 121.57 | 135.87 | 9.3 |
| 9.4 | 18.72 | 26.69 | 35.84 | 46.00 | 57.06 | 68.89 | 81.38 | 94.46 | 108.03 | 122.06 | 136.45 | 9.4 |
| 9.5 | 18.72 | 26.71 | 35.88 | 46.08 | 57.13 | 69.06 | 81.61 | 94.76 | 108.42 | 122.53 | 137.02 | 9.5 |
| 9.6 | 18.73 | 26.73 | 35.92 | 46.15 | 57.29 | 69.22 | 81.84 | 95.06 | 108.80 | 122.99 | 137.59 | 9.6 |
| 9.7 | 18.74 | 26.75 | 35.96 | 46.22 | 57.40 | 69.38 | 82.06 | 95.35 | 109.17 | 123.45 | 138.14 | 9.7 |
| 9.8 | 18.74 | 26.77 | 35.99 | 46.28 | 57.50 | 69.53 | 82.27 | 95.63 | 109.53 | 123.90 | 138.68 | 9.8 |
| 9.9 | 18.75 | 26.78 | 36.03 | 46.35 | 57.60 | 69.69 | 82.48 | 95.91 | 109.88 | 124.34 | 139.22 | 9.9 |
| 10.0 | 18.75 | 26.80 | 36.06 | 46.41 | 57.70 | 69.83 | 82.69 | 96.18 | 110.23 | 124.77 | 139.74 | 10.0 |

**TABLE 22. FILL LOADS (continued)**
**NARROW TRENCH**

**TRENCH WIDTH**

| Cover m | 1.6 kN/m | 1.7 kN/m | 1.8 kN/m | 1.9 kN/m | 2.0 kN/m | 2.1 kN/m | 2.2 kN/m | 2.3 kN/m | 2.4 kN/m | 2.5 kN/m | 2.6 kN/m | Cover m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.6 | 17.94 | 19.12 | 20.29 | 21.47 | 22.64 | 23.82 | 24.99 | 26.17 | 27.34 | 28.52 | 29.70 | 0.6 |
| 0.7 | 20.76 | 22.13 | 23.50 | 24.88 | 26.25 | 27.62 | 28.99 | 30.36 | 31.73 | 33.10 | 34.48 | 0.7 |
| 0.8 | 23.54 | 25.11 | 26.67 | 28.24 | 29.80 | 31.37 | 32.94 | 34.50 | 36.07 | 37.64 | 39.21 | 0.8 |
| 0.9 | 26.27 | 28.03 | 29.79 | 31.56 | 33.32 | 35.08 | 36.84 | 38.60 | 40.36 | 42.13 | 43.89 | 0.9 |
| 1.0 | 28.96 | 30.92 | 32.87 | 34.83 | 36.78 | 38.74 | 40.70 | 42.65 | 44.61 | 46.57 | 48.53 | 1.0 |
| 1.1 | 31.61 | 33.76 | 35.91 | 38.06 | 40.21 | 42.36 | 44.51 | 46.66 | 48.81 | 50.97 | 53.12 | 1.1 |
| 1.2 | 34.21 | 36.55 | 38.90 | 41.24 | 43.58 | 45.93 | 48.28 | 50.62 | 52.97 | 55.32 | 57.66 | 1.2 |
| 1.3 | 36.77 | 39.31 | 41.84 | 44.38 | 46.92 | 49.46 | 52.00 | 54.54 | 57.08 | 59.62 | 62.16 | 1.3 |
| 1.4 | 39.29 | 42.02 | 44.75 | 47.48 | 50.21 | 52.94 | 55.68 | 58.41 | 61.15 | 63.88 | 66.62 | 1.4 |
| 1.5 | 41.77 | 44.69 | 47.61 | 50.53 | 53.46 | 56.38 | 59.31 | 62.24 | 65.17 | 68.10 | 71.03 | 1.5 |
| 1.6 | 44.21 | 47.32 | 50.43 | 53.55 | 56.67 | 59.78 | 62.90 | 66.03 | 69.15 | 72.27 | 75.40 | 1.6 |
| 1.7 | 46.61 | 49.91 | 53.22 | 56.52 | 59.83 | 63.14 | 66.45 | 69.77 | 73.09 | 76.40 | 79.72 | 1.7 |
| 1.8 | 48.98 | 52.46 | 55.96 | 59.45 | 62.96 | 66.46 | 69.96 | 73.47 | 76.98 | 80.49 | 84.00 | 1.8 |
| 1.9 | 51.30 | 54.98 | 58.66 | 62.35 | 66.04 | 69.73 | 73.43 | 77.13 | 80.83 | 84.54 | 88.24 | 1.9 |
| 2.0 | 53.58 | 57.45 | 61.32 | 65.20 | 69.08 | 72.97 | 76.86 | 80.75 | 84.64 | 88.54 | 92.44 | 2.0 |
| 2.1 | 55.83 | 59.89 | 63.95 | 68.02 | 72.09 | 76.16 | 80.24 | 84.33 | 88.41 | 92.50 | 96.59 | 2.1 |
| 2.2 | 58.05 | 62.29 | 66.54 | 70.79 | 75.05 | 79.32 | 83.59 | 87.87 | 92.14 | 96.42 | 100.70 | 2.2 |
| 2.3 | 60.22 | 64.65 | 69.09 | 73.53 | 77.98 | 82.44 | 86.90 | 91.36 | 95.83 | 100.30 | 104.78 | 2.3 |
| 2.4 | 62.37 | 66.98 | 71.60 | 76.23 | 80.87 | 85.52 | 90.17 | 94.82 | 99.48 | 104.14 | 108.81 | 2.4 |
| 2.5 | 64.47 | 69.27 | 74.08 | 78.90 | 83.73 | 88.56 | 93.40 | 98.24 | 103.09 | 107.94 | 112.80 | 2.5 |
| 2.6 | 66.55 | 71.53 | 76.52 | 81.53 | 86.54 | 91.56 | 96.59 | 101.62 | 106.66 | 111.70 | 116.75 | 2.6 |
| 2.7 | 68.59 | 73.75 | 78.93 | 84.12 | 89.32 | 94.53 | 99.74 | 104.97 | 110.19 | 115.43 | 120.66 | 2.7 |
| 2.8 | 70.59 | 75.94 | 81.30 | 86.68 | 92.06 | 97.46 | 102.86 | 108.27 | 113.69 | 119.11 | 124.54 | 2.8 |
| 2.9 | 72.57 | 78.10 | 83.64 | 89.20 | 94.77 | 100.35 | 105.94 | 111.54 | 117.15 | 122.76 | 128.37 | 2.9 |
| 3.0 | 74.51 | 80.22 | 85.95 | 91.69 | 97.45 | 103.21 | 108.99 | 114.77 | 120.56 | 126.36 | 132.17 | 3.0 |
| 3.1 | 76.42 | 82.31 | 88.22 | 94.15 | 100.08 | 106.04 | 112.00 | 117.97 | 123.95 | 129.93 | 135.93 | 3.1 |
| 3.2 | 78.30 | 84.37 | 90.46 | 96.57 | 102.69 | 108.82 | 114.97 | 121.13 | 127.29 | 133.47 | 139.65 | 3.2 |
| 3.3 | 80.15 | 86.40 | 92.67 | 98.96 | 105.26 | 111.58 | 117.91 | 124.25 | 130.60 | 136.96 | 143.33 | 3.3 |
| 3.4 | 81.98 | 88.40 | 94.84 | 101.31 | 107.80 | 114.30 | 120.81 | 127.34 | 133.88 | 140.43 | 146.98 | 3.4 |
| 3.5 | 83.77 | 90.37 | 96.99 | 103.64 | 110.30 | 116.99 | 123.68 | 130.39 | 137.12 | 143.85 | 150.59 | 3.5 |
| 3.6 | 85.53 | 92.30 | 99.10 | 105.93 | 112.78 | 119.64 | 126.52 | 133.41 | 140.32 | 147.24 | 154.17 | 3.6 |
| 3.7 | 87.26 | 94.21 | 101.19 | 108.19 | 115.22 | 122.26 | 129.32 | 136.40 | 143.49 | 150.59 | 157.71 | 3.7 |
| 3.8 | 88.97 | 96.09 | 103.24 | 110.42 | 117.63 | 124.85 | 132.09 | 139.35 | 146.63 | 153.91 | 161.21 | 3.8 |
| 3.9 | 90.65 | 97.94 | 105.27 | 112.62 | 120.00 | 127.41 | 134.83 | 142.27 | 149.73 | 157.20 | 164.68 | 3.9 |
| 4.0 | 92.30 | 99.76 | 107.26 | 114.79 | 122.35 | 129.93 | 137.54 | 145.16 | 152.80 | 160.45 | 168.12 | 4.0 |
| 4.1 | 93.93 | 101.56 | 109.23 | 116.93 | 124.67 | 132.43 | 140.21 | 148.01 | 155.83 | 163.67 | 171.52 | 4.1 |
| 4.2 | 95.52 | 103.32 | 111.17 | 119.05 | 126.95 | 134.89 | 142.85 | 150.83 | 158.84 | 166.85 | 174.89 | 4.2 |
| 4.3 | 97.10 | 105.07 | 113.08 | 121.13 | 129.21 | 137.33 | 145.46 | 153.62 | 161.81 | 170.01 | 178.22 | 4.3 |
| 4.4 | 98.64 | 106.78 | 114.96 | 123.18 | 131.44 | 139.73 | 148.04 | 156.38 | 164.74 | 173.12 | 181.52 | 4.4 |
| 4.5 | 100.17 | 108.47 | 116.82 | 125.21 | 133.64 | 142.10 | 150.59 | 159.11 | 167.65 | 176.21 | 184.79 | 4.5 |
| 4.6 | 101.67 | 110.13 | 118.65 | 127.21 | 135.81 | 144.45 | 153.11 | 161.81 | 170.53 | 179.27 | 188.03 | 4.6 |
| 4.7 | 103.14 | 111.77 | 120.45 | 129.18 | 137.95 | 146.76 | 155.61 | 164.48 | 173.37 | 182.29 | 191.23 | 4.7 |
| 4.8 | 104.59 | 113.38 | 122.23 | 131.13 | 140.07 | 149.05 | 158.07 | 167.11 | 176.18 | 185.28 | 194.40 | 4.8 |
| 4.9 | 106.02 | 114.97 | 123.98 | 133.05 | 142.16 | 151.31 | 160.50 | 169.72 | 178.97 | 188.24 | 197.54 | 4.9 |
| 5.0 | 107.42 | 116.53 | 125.71 | 134.94 | 144.22 | 153.54 | 162.90 | 172.30 | 181.72 | 191.17 | 200.65 | 5.0 |
| 5.1 | 108.80 | 118.07 | 127.41 | 136.81 | 146.25 | 155.75 | 165.28 | 174.85 | 184.45 | 194.07 | 203.73 | 5.1 |
| 5.2 | 110.16 | 119.59 | 129.09 | 138.65 | 148.26 | 157.92 | 167.63 | 177.37 | 187.14 | 196.94 | 206.77 | 5.2 |
| 5.3 | 111.50 | 121.08 | 130.74 | 140.47 | 150.24 | 160.07 | 169.95 | 179.86 | 189.81 | 199.78 | 209.79 | 5.3 |
| 5.4 | 112.81 | 122.55 | 132.37 | 142.26 | 152.20 | 162.20 | 172.24 | 182.32 | 192.44 | 202.59 | 212.78 | 5.4 |
| 5.5 | 114.11 | 124.00 | 133.98 | 144.02 | 154.13 | 164.30 | 174.51 | 184.76 | 195.05 | 205.38 | 215.73 | 5.5 |
| 5.6 | 115.38 | 125.43 | 135.56 | 145.77 | 156.04 | 166.37 | 176.74 | 187.17 | 197.63 | 208.13 | 218.66 | 5.6 |
| 5.7 | 116.63 | 126.84 | 137.12 | 147.49 | 157.92 | 168.41 | 178.96 | 189.55 | 200.18 | 210.85 | 221.56 | 5.7 |
| 5.8 | 117.87 | 128.22 | 138.66 | 149.19 | 159.78 | 170.43 | 181.14 | 191.90 | 202.71 | 213.55 | 224.43 | 5.8 |
| 5.9 | 119.08 | 129.58 | 140.18 | 150.86 | 161.61 | 172.43 | 183.31 | 194.23 | 205.21 | 216.22 | 227.27 | 5.9 |
| 6.0 | 120.27 | 130.92 | 141.67 | 152.51 | 163.42 | 174.40 | 185.44 | 196.54 | 207.68 | 218.86 | 230.08 | 6.0 |
| 6.1 | 121.45 | 132.25 | 143.15 | 154.14 | 165.21 | 176.35 | 187.55 | 198.81 | 210.12 | 221.47 | 232.87 | 6.1 |
| 6.2 | 122.60 | 133.55 | 144.60 | 155.74 | 166.97 | 178.27 | 189.64 | 201.06 | 212.54 | 224.06 | 235.62 | 6.2 |
| 6.3 | 123.74 | 134.83 | 146.03 | 157.33 | 168.71 | 180.17 | 191.70 | 203.29 | 214.93 | 226.62 | 238.35 | 6.3 |
| 6.4 | 124.86 | 136.09 | 147.44 | 158.89 | 170.43 | 182.05 | 193.74 | 205.49 | 217.30 | 229.15 | 241.06 | 6.4 |
| 6.5 | 125.96 | 137.34 | 148.83 | 160.43 | 172.13 | 183.90 | 195.75 | 207.66 | 219.64 | 231.66 | 243.73 | 6.5 |
| 6.6 | 127.04 | 138.56 | 150.20 | 161.95 | 173.80 | 185.73 | 197.74 | 209.82 | 221.95 | 234.14 | 246.38 | 6.6 |
| 6.7 | 128.11 | 139.77 | 151.55 | 163.45 | 175.45 | 187.54 | 199.71 | 211.94 | 224.24 | 236.60 | 249.00 | 6.7 |
| 6.8 | 129.15 | 140.95 | 152.89 | 164.93 | 177.08 | 189.33 | 201.65 | 214.05 | 226.51 | 239.03 | 251.60 | 6.8 |
| 6.9 | 130.18 | 142.12 | 154.20 | 166.39 | 178.69 | 191.09 | 203.57 | 216.13 | 228.75 | 241.43 | 254.17 | 6.9 |
| 7.0 | 131.20 | 143.27 | 155.49 | 167.83 | 180.28 | 192.83 | 205.47 | 218.18 | 230.97 | 243.81 | 256.71 | 7.0 |
| 7.1 | 132.20 | 144.41 | 156.77 | 169.25 | 181.85 | 194.55 | 207.34 | 220.22 | 233.16 | 246.17 | 259.23 | 7.1 |
| 7.2 | 133.18 | 145.53 | 158.02 | 170.66 | 183.40 | 196.25 | 209.20 | 222.23 | 235.33 | 248.50 | 261.73 | 7.2 |
| 7.3 | 134.14 | 146.63 | 159.26 | 172.04 | 184.93 | 197.93 | 211.03 | 224.21 | 237.47 | 250.80 | 264.20 | 7.3 |
| 7.4 | 135.10 | 147.71 | 160.48 | 173.40 | 186.44 | 199.59 | 212.84 | 226.18 | 239.60 | 253.09 | 266.64 | 7.4 |
| 7.5 | 136.03 | 148.78 | 161.69 | 174.74 | 187.93 | 201.23 | 214.63 | 228.12 | 241.70 | 255.35 | 269.06 | 7.5 |
| 7.6 | 136.95 | 149.83 | 162.87 | 176.07 | 189.40 | 202.84 | 216.40 | 230.04 | 243.77 | 257.58 | 271.46 | 7.6 |
| 7.7 | 137.86 | 150.86 | 164.04 | 177.38 | 190.85 | 204.44 | 218.14 | 231.94 | 245.83 | 259.80 | 273.83 | 7.7 |
| 7.8 | 138.75 | 151.88 | 165.20 | 178.67 | 192.28 | 206.02 | 219.87 | 233.82 | 247.86 | 261.99 | 276.18 | 7.8 |
| 7.9 | 139.62 | 152.88 | 166.33 | 179.94 | 193.70 | 207.58 | 221.58 | 235.68 | 249.87 | 264.15 | 278.51 | 7.9 |
| 8.0 | 140.49 | 153.87 | 167.45 | 181.20 | 195.09 | 209.12 | 223.26 | 237.52 | 251.86 | 266.30 | 280.81 | 8.0 |
| 8.1 | 141.33 | 154.85 | 168.56 | 182.43 | 196.47 | 210.64 | 224.93 | 239.33 | 253.83 | 268.42 | 283.09 | 8.1 |
| 8.2 | 142.17 | 156.81 | 169.64 | 183.66 | 197.83 | 212.14 | 226.58 | 241.13 | 255.78 | 270.52 | 285.35 | 8.2 |
| 8.3 | 142.99 | 156.75 | 170.71 | 184.86 | 199.17 | 213.62 | 228.20 | 242.90 | 257.70 | 272.60 | 287.58 | 8.3 |
| 8.4 | 143.80 | 157.68 | 171.77 | 186.05 | 200.49 | 215.09 | 229.81 | 244.66 | 259.61 | 274.66 | 289.80 | 8.4 |
| 8.5 | 144.59 | 158.59 | 172.81 | 187.22 | 201.80 | 216.53 | 231.40 | 246.39 | 261.49 | 276.70 | 291.99 | 8.5 |
| 8.6 | 145.37 | 159.50 | 173.84 | 188.38 | 203.09 | 217.96 | 232.97 | 248.11 | 263.36 | 278.71 | 294.16 | 8.6 |
| 8.7 | 146.14 | 160.38 | 174.85 | 189.52 | 204.37 | 219.37 | 234.53 | 249.81 | 265.20 | 280.70 | 296.30 | 8.7 |
| 8.8 | 146.90 | 161.26 | 175.85 | 190.66 | 205.63 | 220.77 | 236.06 | 251.48 | 267.03 | 282.68 | 298.43 | 8.8 |
| 8.9 | 147.65 | 162.12 | 176.83 | 191.76 | 206.87 | 222.15 | 237.58 | 253.14 | 268.83 | 284.63 | 300.53 | 8.9 |
| 9.0 | 148.38 | 162.97 | 177.80 | 192.35 | 208.09 | 223.51 | 239.07 | 254.78 | 270.62 | 286.56 | 302.62 | 9.0 |
| 9.1 | 149.10 | 163.80 | 178.76 | 193.93 | 209.30 | 224.85 | 240.55 | 256.40 | 272.38 | 288.48 | 304.68 | 9.1 |
| 9.2 | 149.81 | 164.63 | 179.70 | 195.00 | 210.50 | 226.18 | 242.02 | 258.01 | 274.13 | 290.37 | 306.72 | 9.2 |
| 9.3 | 150.51 | 165.44 | 180.63 | 196.05 | 211.67 | 227.49 | 243.46 | 259.59 | 275.86 | 292.24 | 308.74 | 9.3 |
| 9.4 | 151.19 | 166.24 | 181.54 | 197.08 | 212.84 | 228.78 | 244.89 | 261.16 | 277.57 | 294.10 | 310.75 | 9.4 |
| 9.5 | 151.87 | 167.02 | 182.44 | 198.11 | 213.99 | 230.08 | 246.31 | 262.71 | 279.26 | 295.93 | 312.73 | 9.5 |
| 9.6 | 152.54 | 167.79 | 183.33 | 199.12 | 215.12 | 231.32 | 247.70 | 264.24 | 280.93 | 297.75 | 314.69 | 9.6 |
| 9.7 | 153.19 | 168.58 | 184.21 | 200.11 | 216.24 | 232.57 | 249.08 | 265.76 | 282.59 | 299.55 | 316.63 | 9.7 |
| 9.8 | 153.83 | 169.31 | 185.07 | 201.09 | 217.34 | 233.80 | 260.44 | 267.26 | 284.22 | 301.33 | 318.56 | 9.8 |
| 9.9 | 154.47 | 170.05 | 185.92 | 202.06 | 218.43 | 235.02 | 251.79 | 288.74 | 286.84 | 303.09 | 320.46 | 9.9 |
| 10.0 | 155.09 | 170.77 | 186.76 | 203.01 | 219.51 | 236.22 | 253.12 | 270.20 | 287.44 | 304.83 | 322.35 | 10.0 |

## TABLE 23. TRAFFIC LOADS

2 WHEELS 30kN
IMPACT FACTOR 2.0

PIPE DIAMETER

| Cover m | 100 kN/m | 150 kN/m | 200 kN/m | 225 kN/m | 300 kN/m | 375 kN/m | 400 kN/m | 450 kN/m | 500 kN/m | 600 kN/m | 700 kN/m | 800 kN/m | 900 kN/m | 1000 kN/m | Cover m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.6 | 8.95 | 12.96 | 16.53 | 18.92 | 24.59 | 30.02 | 32.30 | 35.57 | 39.04 | 46.15 | 52.16 | 58.22 | 63.76 | 68.85 | 0.6 |
| 0.7 | 7.43 | 10.78 | 13.79 | 15.77 | 20.63 | 25.29 | 27.35 | 30.05 | 33.19 | 39.05 | 44.47 | 50.04 | 55.42 | 59.20 | 0.7 |
| 0.8 | 6.28 | 9.13 | 11.70 | 13.36 | 17.56 | 21.60 | 23.36 | 25.61 | 28.09 | 33.20 | 38.05 | 43.16 | 47.93 | 52.23 | 0.8 |
| 0.9 | 5.39 | 7.85 | 10.06 | 11.46 | 15.11 | 18.61 | 20.14 | 22.01 | 23.94 | 28.26 | 32.66 | 37.14 | 41.43 | 45.45 | 0.9 |
| 1.0 | 4.68 | 6.81 | 8.74 | 9.96 | 13.12 | 16.16 | 17.45 | 19.05 | 20.78 | 24.66 | 28.49 | 32.51 | 36.35 | 40.05 | 1.0 |
| 1.1 | 4.09 | 5.96 | 7.66 | 8.73 | 11.44 | 14.07 | 15.21 | 16.60 | 18.37 | 21.34 | 24.12 | 26.90 | 29.43 | 31.72 | 1.1 |
| 1.2 | 3.61 | 5.26 | 6.76 | 7.71 | 10.11 | 12.46 | 13.48 | 14.73 | 16.32 | 19.02 | 21.56 | 24.14 | 26.51 | 28.68 | 1.2 |
| 1.3 | 3.20 | 4.67 | 6.01 | 6.85 | 8.99 | 11.09 | 12.01 | 13.14 | 14.79 | 17.02 | 19.35 | 21.73 | 23.94 | 25.99 | 1.3 |
| 1.4 | 2.86 | 4.17 | 5.36 | 6.12 | 8.04 | 9.93 | 10.75 | 11.77 | 13.07 | 15.30 | 17.43 | 19.62 | 21.68 | 23.59 | 1.4 |
| 1.5 | 2.57 | 3.74 | 4.82 | 5.50 | 7.23 | 8.93 | 9.68 | 10.60 | 11.96 | 13.81 | 15.76 | 17.77 | 19.68 | 21.48 | 1.5 |
| 1.6 | 2.31 | 3.38 | 4.34 | 4.96 | 6.52 | 8.07 | 8.74 | 9.58 | 10.65 | 12.51 | 14.29 | 16.15 | 17.92 | 19.60 | 1.6 |
| 1.7 | 2.09 | 3.06 | 3.94 | 4.49 | 5.91 | 7.32 | 7.93 | 8.69 | 9.67 | 11.37 | 13.01 | 14.73 | 16.37 | 17.93 | 1.7 |
| 1.8 | 1.90 | 2.78 | 3.58 | 4.09 | 5.38 | 6.66 | 7.22 | 7.92 | 8.82 | 10.37 | 11.88 | 13.47 | 14.99 | 16.45 | 1.8 |
| 1.9 | 1.74 | 2.54 | 3.27 | 3.73 | 4.91 | 6.09 | 6.60 | 7.24 | 8.06 | 9.49 | 10.89 | 12.36 | 13.77 | 15.13 | 1.9 |
| 2.0 | 1.59 | 2.32 | 2.99 | 3.42 | 4.50 | 5.58 | 6.05 | 6.64 | 7.40 | 8.72 | 10.01 | 11.37 | 12.68 | 13.95 | 2.0 |
| 2.1 | 1.46 | 2.14 | 2.75 | 3.14 | 4.14 | 5.13 | 5.57 | 6.11 | 6.81 | 8.03 | 9.22 | 10.48 | 11.71 | 12.89 | 2.1 |
| 2.2 | 1.35 | 1.97 | 2.54 | 2.90 | 3.82 | 4.73 | 5.14 | 5.64 | 6.28 | 7.41 | 8.52 | 9.69 | 10.83 | 11.94 | 2.2 |
| 2.3 | 1.25 | 1.82 | 2.34 | 2.68 | 3.53 | 4.38 | 4.75 | 5.21 | 5.82 | 6.86 | 7.89 | 8.99 | 10.05 | 11.09 | 2.3 |
| 2.4 | 1.15 | 1.69 | 2.17 | 2.48 | 3.27 | 4.06 | 4.41 | 4.84 | 5.39 | 6.37 | 7.33 | 8.35 | 9.35 | 10.32 | 2.4 |
| 2.5 | 1.07 | 1.57 | 2.02 | 2.31 | 3.04 | 3.77 | 4.10 | 4.50 | 5.02 | 5.93 | 6.82 | 7.78 | 8.71 | 9.62 | 2.5 |
| 2.6 | 1.00 | 1.46 | 1.88 | 2.15 | 2.83 | 3.52 | 3.82 | 4.19 | 4.68 | 5.53 | 6.36 | 7.26 | 8.13 | 8.99 | 2.6 |
| 2.7 | 0.93 | 1.36 | 1.76 | 2.01 | 2.65 | 3.28 | 3.56 | 3.91 | 4.37 | 5.16 | 5.95 | 6.79 | 7.61 | 8.41 | 2.7 |
| 2.8 | 0.87 | 1.27 | 1.64 | 1.88 | 2.48 | 3.07 | 3.34 | 3.66 | 4.09 | 4.83 | 5.57 | 6.36 | 7.13 | 7.89 | 2.8 |
| 2.9 | 0.82 | 1.19 | 1.54 | 1.76 | 2.32 | 2.88 | 3.13 | 3.44 | 3.84 | 4.54 | 5.23 | 5.97 | 6.70 | 7.41 | 2.9 |
| 3.0 | 0.77 | 1.12 | 1.45 | 1.65 | 2.18 | 2.71 | 2.94 | 3.23 | 3.60 | 4.26 | 4.91 | 5.61 | 6.30 | 6.98 | 3.0 |
| 3.1 | 0.72 | 1.06 | 1.36 | 1.55 | 2.05 | 2.55 | 2.76 | 3.04 | 3.39 | 4.01 | 4.63 | 5.29 | 5.94 | 6.58 | 3.1 |
| 3.2 | 0.68 | 0.99 | 1.28 | 1.46 | 1.93 | 2.40 | 2.61 | 2.86 | 3.20 | 3.78 | 4.36 | 4.99 | 5.60 | 6.21 | 3.2 |
| 3.3 | 0.64 | 0.94 | 1.21 | 1.38 | 1.82 | 2.27 | 2.46 | 2.70 | 3.02 | 3.57 | 4.12 | 4.71 | 5.30 | 5.87 | 3.3 |
| 3.4 | 0.61 | 0.89 | 1.14 | 1.31 | 1.72 | 2.14 | 2.33 | 2.56 | 2.86 | 3.38 | 3.90 | 4.46 | 5.01 | 5.56 | 3.4 |
| 3.5 | 0.57 | 0.84 | 1.08 | 1.24 | 1.63 | 2.03 | 2.20 | 2.42 | 2.70 | 3.20 | 3.69 | 4.23 | 4.75 | 5.27 | 3.5 |
| 3.6 | 0.55 | 0.80 | 1.03 | 1.17 | 1.55 | 1.92 | 2.09 | 2.30 | 2.56 | 3.04 | 3.50 | 4.01 | 4.51 | 5.00 | 3.6 |
| 3.7 | 0.52 | 0.76 | 0.97 | 1.11 | 1.47 | 1.83 | 1.98 | 2.18 | 2.43 | 2.88 | 3.33 | 3.81 | 4.28 | 4.75 | 3.7 |
| 3.8 | 0.49 | 0.72 | 0.93 | 1.06 | 1.40 | 1.74 | 1.89 | 2.07 | 2.31 | 2.74 | 3.17 | 3.62 | 4.07 | 4.52 | 3.8 |
| 3.9 | 0.47 | 0.68 | 0.88 | 1.01 | 1.33 | 1.65 | 1.79 | 1.97 | 2.20 | 2.61 | 3.01 | 3.45 | 3.88 | 4.31 | 3.9 |
| 4.0 | 0.45 | 0.65 | 0.84 | 0.96 | 1.27 | 1.57 | 1.71 | 1.88 | 2.10 | 2.49 | 2.87 | 3.29 | 3.70 | 4.11 | 4.0 |
| 4.1 | 0.43 | 0.62 | 0.80 | 0.92 | 1.21 | 1.50 | 1.63 | 1.79 | 2.00 | 2.37 | 2.74 | 3.14 | 3.53 | 3.92 | 4.1 |
| 4.2 | 0.41 | 0.59 | 0.76 | 0.87 | 1.15 | 1.43 | 1.56 | 1.71 | 1.91 | 2.27 | 2.62 | 3.00 | 3.37 | 3.75 | 4.2 |
| 4.3 | 0.39 | 0.57 | 0.73 | 0.84 | 1.10 | 1.37 | 1.49 | 1.64 | 1.83 | 2.17 | 2.50 | 2.87 | 3.23 | 3.58 | 4.3 |
| 4.4 | 0.37 | 0.54 | 0.70 | 0.80 | 1.05 | 1.31 | 1.42 | 1.57 | 1.75 | 2.07 | 2.39 | 2.74 | 3.09 | 3.43 | 4.4 |
| 4.5 | 0.36 | 0.52 | 0.67 | 0.76 | 1.01 | 1.25 | 1.36 | 1.50 | 1.68 | 1.99 | 2.29 | 2.63 | 2.96 | 3.29 | 4.5 |
| 4.6 | 0.34 | 0.50 | 0.64 | 0.73 | 0.97 | 1.20 | 1.31 | 1.44 | 1.61 | 1.90 | 2.20 | 2.52 | 2.84 | 3.15 | 4.6 |
| 4.7 | 0.33 | 0.48 | 0.62 | 0.70 | 0.93 | 1.15 | 1.25 | 1.38 | 1.54 | 1.83 | 2.11 | 2.42 | 2.72 | 3.02 | 4.7 |
| 4.8 | 0.31 | 0.46 | 0.59 | 0.68 | 0.89 | 1.11 | 1.20 | 1.32 | 1.48 | 1.75 | 2.03 | 2.32 | 2.61 | 2.91 | 4.8 |
| 4.9 | 0.30 | 0.44 | 0.57 | 0.65 | 0.86 | 1.06 | 1.16 | 1.27 | 1.42 | 1.68 | 1.95 | 2.23 | 2.51 | 2.79 | 4.9 |
| 5.0 | 0.29 | 0.42 | 0.55 | 0.62 | 0.82 | 1.02 | 1.11 | 1.22 | 1.37 | 1.62 | 1.87 | 2.15 | 2.42 | 2.69 | 5.0 |
| 5.1 | 0.28 | 0.41 | 0.53 | 0.60 | 0.79 | 0.98 | 1.07 | 1.18 | 1.31 | 1.56 | 1.80 | 2.06 | 2.33 | 2.59 | 5.1 |
| 5.2 | 0.27 | 0.39 | 0.51 | 0.58 | 0.76 | 0.95 | 1.03 | 1.13 | 1.27 | 1.50 | 1.74 | 1.99 | 2.24 | 2.49 | 5.2 |
| 5.3 | 0.26 | 0.38 | 0.49 | 0.56 | 0.74 | 0.91 | 0.99 | 1.09 | 1.22 | 1.45 | 1.67 | 1.92 | 2.16 | 2.40 | 5.3 |
| 5.4 | 0.25 | 0.36 | 0.47 | 0.54 | 0.71 | 0.88 | 0.96 | 1.05 | 1.18 | 1.40 | 1.61 | 1.85 | 2.08 | 2.32 | 5.4 |
| 5.5 | 0.24 | 0.35 | 0.45 | 0.52 | 0.68 | 0.85 | 0.92 | 1.02 | 1.14 | 1.35 | 1.56 | 1.78 | 2.01 | 2.24 | 5.5 |
| 5.6 | 0.23 | 0.34 | 0.44 | 0.50 | 0.66 | 0.82 | 0.89 | 0.98 | 1.10 | 1.30 | 1.50 | 1.72 | 1.94 | 2.16 | 5.6 |
| 5.7 | 0.22 | 0.33 | 0.42 | 0.48 | 0.64 | 0.79 | 0.86 | 0.95 | 1.06 | 1.26 | 1.45 | 1.66 | 1.88 | 2.09 | 5.7 |
| 5.8 | 0.22 | 0.32 | 0.41 | 0.47 | 0.62 | 0.77 | 0.83 | 0.92 | 1.02 | 1.21 | 1.40 | 1.61 | 1.81 | 2.02 | 5.8 |
| 5.9 | 0.21 | 0.31 | 0.40 | 0.45 | 0.60 | 0.74 | 0.81 | 0.89 | 0.99 | 1.17 | 1.36 | 1.56 | 1.75 | 1.95 | 5.9 |
| 6.0 | 0.20 | 0.30 | 0.38 | 0.44 | 0.58 | 0.72 | 0.78 | 0.86 | 0.96 | 1.14 | 1.31 | 1.51 | 1.70 | 1.89 | 6.0 |
| 6.1 | 0.20 | 0.29 | 0.37 | 0.42 | 0.56 | 0.69 | 0.75 | 0.83 | 0.93 | 1.10 | 1.27 | 1.46 | 1.64 | 1.83 | 6.1 |
| 6.2 | 0.19 | 0.28 | 0.36 | 0.41 | 0.54 | 0.67 | 0.73 | 0.80 | 0.90 | 1.07 | 1.23 | 1.41 | 1.59 | 1.77 | 6.2 |
| 6.3 | 0.18 | 0.27 | 0.35 | 0.40 | 0.52 | 0.65 | 0.71 | 0.78 | 0.87 | 1.03 | 1.19 | 1.37 | 1.54 | 1.72 | 6.3 |
| 6.4 | 0.18 | 0.26 | 0.34 | 0.38 | 0.51 | 0.63 | 0.69 | 0.76 | 0.84 | 1.00 | 1.16 | 1.33 | 1.50 | 1.66 | 6.4 |
| 6.5 | 0.17 | 0.25 | 0.33 | 0.37 | 0.49 | 0.61 | 0.67 | 0.73 | 0.82 | 0.97 | 1.12 | 1.29 | 1.45 | 1.62 | 6.5 |
| 6.6 | 0.17 | 0.25 | 0.32 | 0.36 | 0.48 | 0.59 | 0.65 | 0.71 | 0.79 | 0.94 | 1.09 | 1.25 | 1.41 | 1.57 | 6.6 |
| 6.7 | 0.16 | 0.24 | 0.31 | 0.35 | 0.46 | 0.58 | 0.63 | 0.69 | 0.77 | 0.91 | 1.06 | 1.21 | 1.37 | 1.52 | 6.7 |
| 6.8 | 0.16 | 0.23 | 0.30 | 0.34 | 0.45 | 0.56 | 0.61 | 0.67 | 0.75 | 0.89 | 1.03 | 1.18 | 1.33 | 1.48 | 6.8 |
| 6.9 | 0.15 | 0.23 | 0.29 | 0.33 | 0.44 | 0.54 | 0.59 | 0.65 | 0.73 | 0.86 | 1.00 | 1.15 | 1.29 | 1.44 | 6.9 |
| 7.0 | 0.15 | 0.22 | 0.28 | 0.32 | 0.43 | 0.53 | 0.58 | 0.63 | 0.71 | 0.84 | 0.97 | 1.11 | 1.26 | 1.40 | 7.0 |
| 7.1 | 0.15 | 0.21 | 0.27 | 0.31 | 0.41 | 0.52 | 0.56 | 0.62 | 0.69 | 0.82 | 0.94 | 1.08 | 1.22 | 1.36 | 7.1 |
| 7.2 | 0.14 | 0.21 | 0.27 | 0.31 | 0.40 | 0.50 | 0.54 | 0.60 | 0.67 | 0.79 | 0.92 | 1.05 | 1.19 | 1.32 | 7.2 |
| 7.3 | 0.14 | 0.20 | 0.26 | 0.30 | 0.39 | 0.49 | 0.53 | 0.58 | 0.65 | 0.77 | 0.89 | 1.03 | 1.16 | 1.29 | 7.3 |
| 7.4 | 0.13 | 0.20 | 0.25 | 0.29 | 0.38 | 0.47 | 0.52 | 0.57 | 0.63 | 0.75 | 0.87 | 1.00 | 1.13 | 1.25 | 7.4 |
| 7.5 | 0.13 | 0.19 | 0.25 | 0.28 | 0.37 | 0.46 | 0.50 | 0.55 | 0.62 | 0.73 | 0.85 | 0.97 | 1.10 | 1.22 | 7.5 |
| 7.6 | 0.13 | 0.19 | 0.24 | 0.27 | 0.36 | 0.45 | 0.49 | 0.54 | 0.60 | 0.71 | 0.83 | 0.95 | 1.07 | 1.19 | 7.6 |
| 7.7 | 0.12 | 0.18 | 0.23 | 0.27 | 0.35 | 0.44 | 0.48 | 0.52 | 0.59 | 0.70 | 0.80 | 0.92 | 1.04 | 1.16 | 7.7 |
| 7.8 | 0.12 | 0.18 | 0.23 | 0.26 | 0.34 | 0.43 | 0.47 | 0.51 | 0.57 | 0.68 | 0.78 | 0.90 | 1.02 | 1.13 | 7.8 |
| 7.9 | 0.12 | 0.17 | 0.22 | 0.25 | 0.34 | 0.42 | 0.45 | 0.50 | 0.56 | 0.66 | 0.77 | 0.88 | 0.99 | 1.10 | 7.9 |
| 8.0 | 0.12 | 0.17 | 0.22 | 0.25 | 0.33 | 0.41 | 0.44 | 0.49 | 0.54 | 0.65 | 0.75 | 0.86 | 0.97 | 1.08 | 8.0 |
| 8.1 | 0.11 | 0.16 | 0.21 | 0.24 | 0.32 | 0.40 | 0.43 | 0.47 | 0.53 | 0.63 | 0.73 | 0.84 | 0.94 | 1.05 | 8.1 |
| 8.2 | 0.11 | 0.16 | 0.21 | 0.24 | 0.31 | 0.39 | 0.42 | 0.46 | 0.52 | 0.61 | 0.71 | 0.82 | 0.92 | 1.02 | 8.2 |
| 8.3 | 0.11 | 0.16 | 0.20 | 0.23 | 0.30 | 0.38 | 0.41 | 0.45 | 0.51 | 0.60 | 0.69 | 0.80 | 0.90 | 1.00 | 8.3 |
| 8.4 | 0.10 | 0.15 | 0.20 | 0.23 | 0.30 | 0.37 | 0.40 | 0.44 | 0.49 | 0.59 | 0.68 | 0.78 | 0.88 | 0.98 | 8.4 |
| 8.5 | 0.10 | 0.15 | 0.19 | 0.22 | 0.29 | 0.36 | 0.39 | 0.43 | 0.48 | 0.57 | 0.66 | 0.76 | 0.86 | 0.95 | 8.5 |
| 8.6 | 0.10 | 0.15 | 0.19 | 0.21 | 0.28 | 0.35 | 0.38 | 0.42 | 0.47 | 0.56 | 0.65 | 0.74 | 0.84 | 0.93 | 8.6 |
| 8.7 | 0.10 | 0.14 | 0.18 | 0.21 | 0.28 | 0.34 | 0.37 | 0.41 | 0.46 | 0.55 | 0.63 | 0.73 | 0.82 | 0.91 | 8.7 |
| 8.8 | 0.10 | 0.14 | 0.18 | 0.21 | 0.27 | 0.34 | 0.37 | 0.40 | 0.45 | 0.53 | 0.62 | 0.71 | 0.80 | 0.89 | 8.8 |
| 8.9 | 0.09 | 0.14 | 0.18 | 0.20 | 0.27 | 0.33 | 0.36 | 0.39 | 0.44 | 0.52 | 0.60 | 0.69 | 0.78 | 0.87 | 8.9 |
| 9.0 | 0.09 | 0.13 | 0.17 | 0.20 | 0.26 | 0.32 | 0.35 | 0.39 | 0.43 | 0.51 | 0.59 | 0.68 | 0.77 | 0.85 | 9.0 |
| 9.1 | 0.09 | 0.13 | 0.17 | 0.19 | 0.25 | 0.32 | 0.34 | 0.38 | 0.42 | 0.50 | 0.58 | 0.66 | 0.75 | 0.83 | 9.1 |
| 9.2 | 0.09 | 0.13 | 0.16 | 0.19 | 0.25 | 0.31 | 0.34 | 0.37 | 0.41 | 0.49 | 0.57 | 0.65 | 0.73 | 0.82 | 9.2 |
| 9.3 | 0.09 | 0.12 | 0.16 | 0.18 | 0.24 | 0.30 | 0.33 | 0.36 | 0.40 | 0.48 | 0.55 | 0.64 | 0.72 | 0.80 | 9.3 |
| 9.4 | 0.08 | 0.12 | 0.16 | 0.18 | 0.24 | 0.30 | 0.32 | 0.35 | 0.40 | 0.47 | 0.54 | 0.62 | 0.70 | 0.78 | 9.4 |
| 9.5 | 0.08 | 0.12 | 0.15 | 0.18 | 0.23 | 0.29 | 0.31 | 0.35 | 0.39 | 0.46 | 0.53 | 0.61 | 0.69 | 0.77 | 9.5 |
| 9.6 | 0.08 | 0.12 | 0.15 | 0.17 | 0.23 | 0.28 | 0.31 | 0.34 | 0.38 | 0.45 | 0.52 | 0.60 | 0.67 | 0.75 | 9.6 |
| 9.7 | 0.08 | 0.11 | 0.15 | 0.17 | 0.22 | 0.28 | 0.30 | 0.33 | 0.37 | 0.44 | 0.51 | 0.59 | 0.66 | 0.73 | 9.7 |
| 9.8 | 0.08 | 0.11 | 0.15 | 0.17 | 0.22 | 0.27 | 0.30 | 0.33 | 0.36 | 0.43 | 0.50 | 0.57 | 0.65 | 0.72 | 9.8 |
| 9.9 | 0.08 | 0.11 | 0.14 | 0.16 | 0.21 | 0.27 | 0.29 | 0.32 | 0.36 | 0.42 | 0.49 | 0.56 | 0.63 | 0.71 | 9.9 |
| 10.0 | 0.07 | 0.11 | 0.14 | 0.16 | 0.21 | 0.26 | 0.28 | 0.31 | 0.35 | 0.41 | 0.48 | 0.55 | 0.62 | 0.69 | 10.0 |

## TABLE 24. TRAFFIC LOADS

8 WHEELS 112.5kN
INCLUDING IMPACT FACTOR

PIPE DIAMETER

| Cover | 100 | 150 | 200 | 225 | 300 | 375 | 400 | 450 | 500 | 600 | 700 | 800 | 900 | 1000 | Cover |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | kN/m | kN/m | kN/m | kN/m | kN/m | kN/m | kN/m | kN/m | kN/m | kN/m | kN/m | kN/m | kN/m | kN/m | m |
| 0.6 | 15.47 | 22.41 | 28.60 | 32.74 | 42.63 | 52.14 | 56.16 | 61.91 | 68.07 | 80.73 | 91.58 | 102.65 | 121.49 | 143.20 | 0.6 |
| 0.7 | 13.33 | 19.36 | 24.77 | 28.33 | 37.13 | 45.61 | 49.36 | 54.31 | 60.09 | 70.95 | 81.12 | 91.70 | 108.13 | 123.99 | 0.7 |
| 0.8 | 11.73 | 17.06 | 21.87 | 24.98 | 32.87 | 40.52 | 43.87 | 48.16 | 52.92 | 62.77 | 72.26 | 82.38 | 96.42 | 111.34 | 0.8 |
| 0.9 | 10.49 | 15.27 | 19.61 | 22.33 | 29.50 | 36.40 | 39.45 | 43.16 | 47.03 | 55.75 | 64.73 | 74.03 | 86.43 | 99.47 | 0.9 |
| 1.0 | 9.51 | 13.85 | 17.80 | 20.29 | 26.76 | 33.04 | 35.72 | 39.04 | 42.68 | 50.86 | 59.05 | 67.88 | 79.00 | 90.61 | 1.0 |
| 1.1 | 8.71 | 12.70 | 16.33 | 18.62 | 24.43 | 30.11 | 32.58 | 35.62 | 39.50 | 46.10 | 54.19 | 62.75 | 72.85 | 83.10 | 1.1 |
| 1.2 | 8.05 | 11.74 | 15.10 | 17.23 | 22.64 | 27.95 | 30.27 | 33.13 | 36.79 | 43.07 | 49.82 | 58.14 | 67.25 | 76.32 | 1.2 |
| 1.3 | 7.49 | 10.93 | 14.07 | 16.06 | 21.12 | 26.10 | 28.29 | 30.99 | 34.45 | 40.43 | 46.20 | 54.48 | 62.92 | 71.39 | 1.3 |
| 1.4 | 7.01 | 10.24 | 13.18 | 15.05 | 19.81 | 24.51 | 26.57 | 29.13 | 32.42 | 38.12 | 43.74 | 51.19 | 58.99 | 66.91 | 1.4 |
| 1.5 | 6.60 | 9.64 | 12.41 | 14.17 | 18.66 | 23.11 | 25.07 | 27.49 | 30.62 | 36.06 | 41.65 | 48.25 | 55.48 | 62.80 | 1.5 |
| 1.6 | 6.24 | 9.11 | 11.73 | 13.39 | 17.65 | 21.87 | 23.73 | 26.04 | 29.02 | 34.36 | 39.73 | 45.56 | 52.48 | 59.40 | 1.6 |
| 1.7 | 5.91 | 8.63 | 11.12 | 12.70 | 16.74 | 20.75 | 22.53 | 24.77 | 27.68 | 32.83 | 37.96 | 43.51 | 49.87 | 56.44 | 1.7 |
| 1.8 | 5.62 | 8.20 | 10.57 | 12.08 | 15.96 | 19.83 | 21.55 | 23.70 | 26.48 | 31.40 | 36.31 | 41.61 | 47.36 | 53.70 | 1.8 |
| 1.9 | 5.37 | 7.85 | 10.13 | 11.57 | 15.28 | 18.99 | 20.64 | 22.69 | 25.36 | 30.07 | 34.76 | 39.84 | 45.11 | 50.90 | 1.9 |
| 2.0 | 5.15 | 7.53 | 9.71 | 11.09 | 14.65 | 18.20 | 19.78 | 21.75 | 24.31 | 28.82 | 33.31 | 38.17 | 43.00 | 47.80 | 2.0 |
| 2.1 | 4.94 | 7.22 | 9.31 | 10.64 | 14.05 | 17.46 | 18.97 | 20.86 | 23.31 | 27.63 | 31.94 | 36.60 | 41.23 | 45.83 | 2.1 |
| 2.2 | 4.74 | 6.93 | 8.93 | 10.21 | 13.48 | 16.75 | 18.20 | 20.01 | 22.37 | 26.52 | 30.65 | 35.11 | 39.55 | 43.96 | 2.2 |
| 2.3 | 4.55 | 6.65 | 8.58 | 9.80 | 12.94 | 16.08 | 17.48 | 19.21 | 21.47 | 25.45 | 29.42 | 33.71 | 37.97 | 42.20 | 2.3 |
| 2.4 | 4.37 | 6.39 | 8.24 | 9.41 | 12.43 | 15.45 | 16.78 | 18.45 | 20.62 | 24.45 | 28.25 | 32.37 | 36.46 | 40.52 | 2.4 |
| 2.5 | 4.20 | 6.14 | 7.91 | 9.04 | 11.94 | 14.84 | 16.13 | 17.73 | 19.81 | 23.49 | 27.15 | 31.10 | 35.03 | 38.93 | 2.5 |
| 2.6 | 4.04 | 5.90 | 7.61 | 8.69 | 11.48 | 14.26 | 15.50 | 17.04 | 19.04 | 22.57 | 26.09 | 29.89 | 33.67 | 37.42 | 2.6 |
| 2.7 | 3.88 | 5.67 | 7.31 | 8.36 | 11.04 | 13.71 | 14.90 | 16.39 | 18.31 | 21.70 | 25.09 | 28.74 | 32.37 | 35.98 | 2.7 |
| 2.8 | 3.73 | 5.46 | 7.03 | 8.04 | 10.62 | 13.19 | 14.33 | 15.76 | 17.61 | 20.88 | 24.13 | 27.64 | 31.14 | 34.61 | 2.8 |
| 2.9 | 3.59 | 5.25 | 6.77 | 7.73 | 10.21 | 12.69 | 13.79 | 15.16 | 16.94 | 20.09 | 23.21 | 26.60 | 29.96 | 33.30 | 2.9 |
| 3.0 | 3.46 | 5.05 | 6.51 | 7.44 | 9.83 | 12.21 | 13.27 | 14.59 | 16.31 | 19.33 | 22.34 | 25.60 | 28.84 | 32.05 | 3.0 |
| 3.1 | 3.33 | 4.86 | 6.27 | 7.17 | 9.46 | 11.76 | 12.78 | 14.05 | 15.70 | 18.61 | 21.51 | 24.65 | 27.76 | 30.86 | 3.1 |
| 3.2 | 3.21 | 4.68 | 6.04 | 6.90 | 9.11 | 11.32 | 12.31 | 13.53 | 15.12 | 17.92 | 20.72 | 23.74 | 26.74 | 29.72 | 3.2 |
| 3.3 | 3.09 | 4.51 | 5.82 | 6.65 | 8.78 | 10.91 | 11.86 | 13.04 | 14.57 | 17.27 | 19.96 | 22.87 | 25.77 | 28.64 | 3.3 |
| 3.4 | 2.98 | 4.35 | 5.61 | 6.41 | 8.46 | 10.51 | 11.43 | 12.56 | 14.04 | 16.64 | 19.24 | 22.04 | 24.83 | 27.61 | 3.4 |
| 3.5 | 2.87 | 4.19 | 5.40 | 6.18 | 8.16 | 10.14 | 11.01 | 12.11 | 13.53 | 16.05 | 18.55 | 21.25 | 23.95 | 26.62 | 3.5 |
| 3.6 | 2.77 | 4.04 | 5.21 | 5.96 | 7.87 | 9.78 | 10.62 | 11.68 | 13.05 | 15.48 | 17.89 | 20.50 | 23.10 | 25.68 | 3.6 |
| 3.7 | 2.67 | 3.90 | 5.03 | 5.75 | 7.59 | 9.43 | 10.25 | 11.27 | 12.59 | 14.93 | 17.26 | 19.78 | 22.29 | 24.78 | 3.7 |
| 3.8 | 2.58 | 3.76 | 4.85 | 5.55 | 7.32 | 9.10 | 9.89 | 10.87 | 12.15 | 14.41 | 16.66 | 19.09 | 21.51 | 23.92 | 3.8 |
| 3.9 | 2.49 | 3.63 | 4.68 | 5.35 | 7.07 | 8.79 | 9.55 | 10.50 | 11.73 | 13.91 | 16.08 | 18.43 | 20.77 | 23.09 | 3.9 |
| 4.0 | 2.40 | 3.51 | 4.52 | 5.17 | 6.83 | 8.49 | 9.22 | 10.14 | 11.33 | 13.44 | 15.53 | 17.80 | 20.06 | 22.31 | 4.0 |
| 4.1 | 2.32 | 3.39 | 4.37 | 4.99 | 6.60 | 8.20 | 8.91 | 9.80 | 10.95 | 12.98 | 15.01 | 17.20 | 19.39 | 21.56 | 4.1 |
| 4.2 | 2.24 | 3.28 | 4.22 | 4.83 | 6.38 | 7.92 | 8.61 | 9.47 | 10.58 | 12.55 | 14.51 | 16.63 | 18.74 | 20.84 | 4.2 |
| 4.3 | 2.17 | 3.17 | 4.08 | 4.67 | 6.17 | 7.66 | 8.32 | 9.15 | 10.23 | 12.13 | 14.03 | 16.08 | 18.12 | 20.15 | 4.3 |
| 4.4 | 2.10 | 3.06 | 3.95 | 4.51 | 5.96 | 7.41 | 8.05 | 8.85 | 9.90 | 11.73 | 13.57 | 15.55 | 17.53 | 19.49 | 4.4 |
| 4.5 | 2.03 | 2.96 | 3.82 | 4.37 | 5.77 | 7.17 | 7.79 | 8.57 | 9.57 | 11.35 | 13.13 | 15.05 | 16.96 | 18.86 | 4.5 |
| 4.6 | 1.96 | 2.87 | 3.70 | 4.23 | 5.58 | 6.94 | 7.54 | 8.29 | 9.27 | 10.99 | 12.71 | 14.57 | 16.42 | 18.26 | 4.6 |
| 4.7 | 1.90 | 2.78 | 3.58 | 4.09 | 5.41 | 6.72 | 7.30 | 8.03 | 8.97 | 10.64 | 12.31 | 14.11 | 15.90 | 17.69 | 4.7 |
| 4.8 | 1.84 | 2.69 | 3.47 | 3.96 | 5.24 | 6.51 | 7.07 | 7.78 | 8.69 | 10.31 | 11.92 | 13.67 | 15.40 | 17.13 | 4.8 |
| 4.9 | 1.78 | 2.61 | 3.36 | 3.84 | 5.07 | 6.31 | 6.85 | 7.54 | 8.42 | 9.99 | 11.55 | 13.24 | 14.93 | 16.60 | 4.9 |
| 5.0 | 1.73 | 2.53 | 3.26 | 3.72 | 4.92 | 6.11 | 6.64 | 7.30 | 8.16 | 9.68 | 11.20 | 12.84 | 14.47 | 16.10 | 5.0 |
| 5.1 | 1.68 | 2.45 | 3.16 | 3.61 | 4.77 | 5.93 | 6.44 | 7.08 | 7.92 | 9.39 | 10.86 | 12.45 | 14.03 | 15.61 | 5.1 |
| 5.2 | 1.63 | 2.38 | 3.06 | 3.50 | 4.63 | 5.75 | 6.25 | 6.87 | 7.68 | 9.11 | 10.53 | 12.07 | 13.61 | 15.14 | 5.2 |
| 5.3 | 1.58 | 2.31 | 2.97 | 3.40 | 4.49 | 5.58 | 6.06 | 6.67 | 7.45 | 8.84 | 10.22 | 11.72 | 13.21 | 14.70 | 5.3 |
| 5.4 | 1.53 | 2.24 | 2.89 | 3.30 | 4.36 | 5.41 | 5.88 | 6.47 | 7.23 | 8.58 | 9.92 | 11.37 | 12.82 | 14.27 | 5.4 |
| 5.5 | 1.49 | 2.17 | 2.80 | 3.20 | 4.23 | 5.26 | 5.71 | 6.28 | 7.02 | 8.33 | 9.63 | 11.04 | 12.45 | 13.85 | 5.5 |
| 5.6 | 1.44 | 2.11 | 2.72 | 3.11 | 4.11 | 5.11 | 5.55 | 6.10 | 6.82 | 8.09 | 9.36 | 10.73 | 12.10 | 13.46 | 5.6 |
| 5.7 | 1.40 | 2.05 | 2.64 | 3.02 | 3.99 | 4.96 | 5.39 | 5.93 | 6.63 | 7.86 | 9.09 | 10.42 | 11.75 | 13.08 | 5.7 |
| 5.8 | 1.36 | 1.99 | 2.57 | 2.94 | 3.88 | 4.82 | 5.24 | 5.76 | 6.44 | 7.64 | 8.64 | 10.13 | 11.42 | 12.71 | 5.8 |
| 5.9 | 1.33 | 1.94 | 2.50 | 2.85 | 3.77 | 4.69 | 5.09 | 5.60 | 6.26 | 7.43 | 8.59 | 9.85 | 11.11 | 12.36 | 5.9 |
| 6.0 | 1.29 | 1.88 | 2.43 | 2.78 | 3.67 | 4.56 | 4.95 | 5.45 | 6.09 | 7.22 | 8.35 | 9.58 | 10.80 | 12.02 | 6.0 |
| 6.1 | 1.25 | 1.83 | 2.36 | 2.70 | 3.57 | 4.43 | 4.82 | 5.30 | 5.92 | 7.03 | 8.13 | 9.32 | 10.51 | 11.70 | 6.1 |
| 6.2 | 1.22 | 1.78 | 2.30 | 2.63 | 3.47 | 4.31 | 4.69 | 5.16 | 5.76 | 6.84 | 7.91 | 9.07 | 10.23 | 11.38 | 6.2 |
| 6.3 | 1.19 | 1.74 | 2.24 | 2.56 | 3.38 | 4.20 | 4.56 | 5.02 | 5.61 | 6.66 | 7.70 | 8.83 | 9.96 | 11.08 | 6.3 |
| 6.4 | 1.16 | 1.69 | 2.18 | 2.49 | 3.29 | 4.09 | 4.44 | 4.89 | 5.46 | 6.48 | 7.50 | 8.60 | 9.70 | 10.79 | 6.4 |
| 6.5 | 1.13 | 1.65 | 2.12 | 2.43 | 3.20 | 3.98 | 4.33 | 4.76 | 5.32 | 6.31 | 7.30 | 8.38 | 9.45 | 10.51 | 6.5 |
| 6.6 | 1.10 | 1.60 | 2.07 | 2.36 | 3.12 | 3.88 | 4.22 | 4.64 | 5.18 | 6.15 | 7.12 | 8.16 | 9.20 | 10.24 | 6.6 |
| 6.7 | 1.07 | 1.56 | 2.02 | 2.30 | 3.04 | 3.78 | 4.11 | 4.52 | 5.05 | 5.99 | 6.93 | 7.95 | 8.97 | 9.98 | 6.7 |
| 6.8 | 1.04 | 1.52 | 1.96 | 2.24 | 2.97 | 3.69 | 4.01 | 4.41 | 4.93 | 5.84 | 6.76 | 7.75 | 8.74 | 9.73 | 6.8 |
| 6.9 | 1.02 | 1.49 | 1.92 | 2.19 | 2.89 | 3.59 | 3.91 | 4.30 | 4.80 | 5.70 | 6.59 | 7.56 | 8.53 | 9.49 | 6.9 |
| 7.0 | 0.99 | 1.45 | 1.87 | 2.13 | 2.82 | 3.51 | 3.81 | 4.19 | 4.68 | 5.56 | 6.43 | 7.37 | 8.32 | 9.26 | 7.0 |
| 7.1 | 0.97 | 1.41 | 1.82 | 2.08 | 2.75 | 3.42 | 3.72 | 4.09 | 4.57 | 5.42 | 6.27 | 7.19 | 8.11 | 9.03 | 7.1 |
| 7.2 | 0.94 | 1.38 | 1.78 | 2.03 | 2.69 | 3.34 | 3.63 | 3.99 | 4.46 | 5.29 | 6.12 | 7.02 | 7.92 | 8.82 | 7.2 |
| 7.3 | 0.92 | 1.35 | 1.74 | 1.98 | 2.62 | 3.26 | 3.54 | 3.89 | 4.35 | 5.16 | 5.97 | 6.85 | 7.73 | 8.61 | 7.3 |
| 7.4 | 0.90 | 1.31 | 1.69 | 1.94 | 2.56 | 3.18 | 3.46 | 3.80 | 4.25 | 5.04 | 5.83 | 6.69 | 7.55 | 8.40 | 7.4 |
| 7.5 | 0.88 | 1.28 | 1.66 | 1.89 | 2.50 | 3.11 | 3.38 | 3.71 | 4.15 | 4.92 | 5.70 | 6.54 | 7.37 | 8.21 | 7.5 |
| 7.6 | 0.86 | 1.25 | 1.62 | 1.85 | 2.44 | 3.03 | 3.30 | 3.63 | 4.05 | 4.81 | 5.57 | 6.38 | 7.20 | 8.02 | 7.6 |
| 7.7 | 0.84 | 1.23 | 1.58 | 1.81 | 2.38 | 2.96 | 3.22 | 3.54 | 3.96 | 4.70 | 5.44 | 6.24 | 7.04 | 7.83 | 7.7 |
| 7.8 | 0.82 | 1.20 | 1.54 | 1.76 | 2.33 | 2.90 | 3.15 | 3.46 | 3.87 | 4.59 | 5.31 | 6.10 | 6.88 | 7.66 | 7.8 |
| 7.9 | 0.80 | 1.17 | 1.51 | 1.72 | 2.28 | 2.83 | 3.08 | 3.38 | 3.78 | 4.49 | 5.19 | 5.96 | 6.72 | 7.48 | 7.9 |
| 8.0 | 0.78 | 1.14 | 1.48 | 1.69 | 2.23 | 2.77 | 3.01 | 3.31 | 3.70 | 4.39 | 5.08 | 5.83 | 6.57 | 7.32 | 8.0 |
| 8.1 | 0.77 | 1.12 | 1.44 | 1.65 | 2.18 | 2.71 | 2.94 | 3.24 | 3.62 | 4.29 | 4.97 | 5.70 | 6.43 | 7.16 | 8.1 |
| 8.2 | 0.75 | 1.09 | 1.41 | 1.61 | 2.13 | 2.65 | 2.88 | 3.17 | 3.54 | 4.20 | 4.86 | 5.57 | 6.29 | 7.00 | 8.2 |
| 8.3 | 0.73 | 1.07 | 1.38 | 1.58 | 2.08 | 2.59 | 2.82 | 3.10 | 3.46 | 4.11 | 4.75 | 5.45 | 6.15 | 6.85 | 8.3 |
| 8.4 | 0.72 | 1.05 | 1.35 | 1.54 | 2.04 | 2.54 | 2.76 | 3.03 | 3.39 | 4.02 | 4.65 | 5.34 | 6.02 | 6.70 | 8.4 |
| 8.5 | 0.70 | 1.03 | 1.32 | 1.51 | 2.00 | 2.48 | 2.70 | 2.97 | 3.32 | 3.94 | 4.55 | 5.22 | 5.89 | 6.56 | 8.5 |
| 8.6 | 0.69 | 1.00 | 1.29 | 1.48 | 1.95 | 2.43 | 2.64 | 2.90 | 3.25 | 3.85 | 4.46 | 5.11 | 5.77 | 6.42 | 8.6 |
| 8.7 | 0.67 | 0.98 | 1.27 | 1.45 | 1.91 | 2.38 | 2.59 | 2.84 | 3.18 | 3.77 | 4.36 | 5.01 | 5.65 | 6.29 | 8.7 |
| 8.8 | 0.66 | 0.96 | 1.24 | 1.42 | 1.87 | 2.33 | 2.53 | 2.79 | 3.11 | 3.69 | 4.27 | 4.90 | 5.53 | 6.16 | 8.8 |
| 8.9 | 0.65 | 0.94 | 1.22 | 1.39 | 1.84 | 2.28 | 2.48 | 2.73 | 3.05 | 3.62 | 4.19 | 4.80 | 5.42 | 6.04 | 8.9 |
| 9.0 | 0.63 | 0.92 | 1.19 | 1.36 | 1.80 | 2.24 | 2.43 | 2.67 | 2.99 | 3.55 | 4.10 | 4.71 | 5.31 | 5.91 | 9.0 |
| 9.1 | 0.62 | 0.91 | 1.17 | 1.33 | 1.76 | 2.19 | 2.38 | 2.62 | 2.93 | 3.47 | 4.02 | 4.61 | 5.20 | 5.80 | 9.1 |
| 9.2 | 0.61 | 0.89 | 1.14 | 1.31 | 1.73 | 2.15 | 2.33 | 2.57 | 2.87 | 3.41 | 3.94 | 4.52 | 5.10 | 5.68 | 9.2 |
| 9.3 | 0.60 | 0.87 | 1.12 | 1.28 | 1.69 | 2.11 | 2.29 | 2.52 | 2.81 | 3.34 | 3.86 | 4.43 | 5.00 | 5.57 | 9.3 |
| 9.4 | 0.58 | 0.85 | 1.10 | 1.26 | 1.66 | 2.06 | 2.24 | 2.47 | 2.76 | 3.27 | 3.79 | 4.35 | 4.90 | 5.46 | 9.4 |
| 9.5 | 0.57 | 0.64 | 1.08 | 1.23 | 1.63 | 2.02 | 2.20 | 2.42 | 2.71 | 3.21 | 3.71 | 4.26 | 4.81 | 5.35 | 9.5 |
| 9.6 | 0.56 | 0.82 | 1.06 | 1.21 | 1.60 | 1.99 | 2.16 | 2.37 | 2.65 | 3.15 | 3.64 | 4.18 | 4.72 | 5.25 | 9.6 |
| 9.7 | 0.55 | 0.80 | 1.04 | 1.19 | 1.57 | 1.95 | 2.12 | 2.33 | 2.60 | 3.09 | 3.57 | 4.10 | 4.63 | 5.15 | 9.7 |
| 9.8 | 0.54 | 0.79 | 1.02 | 1.16 | 1.54 | 1.91 | 2.08 | 2.28 | 2.55 | 3.03 | 3.51 | 4.02 | 4.54 | 5.06 | 9.8 |
| 9.9 | 0.53 | 0.77 | 1.00 | 1.14 | 1.51 | 1.88 | 2.04 | 2.24 | 2.51 | 2.97 | 3.44 | 3.95 | 4.46 | 4.96 | 9.9 |
| 10.0 | 0.52 | 0.76 | 0.98 | 1.12 | 1.48 | 1.84 | 2.00 | 2.20 | 2.46 | 2.92 | 3.38 | 3.88 | 4.37 | 4.87 | 10.0 |

# Determining the flow capacity of vitrified clay pipelines

## Introduction

This section of the book has been written to assist the designer of foul and surface water drainage and sewerage schemes to size pipelines hydraulically by the use of the Uniform Flow equation derived by Colebrook and White. The information is in tabular form and the range of nominal bores covered is 100 to 1000 mm.

## Hydraulic Formulae

Around 1770, Chezy developed a hydraulic discharge equation which was used by engineers for over a century. During the past hundred years many empirical equations have been used. In the 1930's von Karman and Prandtl proposed a theory for turbulent flow in pipelines. In 1939, Colebrook with White studied the hydraulic properties of commercial pipelines, over a large range of flow conditions. From their experimental results and the von Karman and Prandtl theory they derived an equation which has been used in calculating the design tables for this section of the book.

## Hydraulic Roughness

In the equation of Colebrook and White, the velocity of flow is dependent on the pipe bore, the kinematic viscosity, the gradient and the surface roughness of the interior of the pipe line. This roughness ($k_S$) is dependent upon the following factors:

**Length of pipes.**

**Surface texture of pipes.**

**Types of joints.**

**Deposited grit on the invert.**

**Adherent slime and grease on the walls.**

**Deviation from nominal circular cross-section.**

**Deviation from longitudinal straightness.**

Each factor has its own effect on the apparent roughness and hence the flow in the pipeline.

When a drain or sewer is conveying sewage or a combination of sewage and surface water, slime, mostly microbiological, adheres to and grows on the interior surface. After a short period of time a film of slime coats the surface of the pipeline covered by the flow. This slime blankets most effects of the other factors affecting the hydraulic roughness of rigid pipes. The same case applies where grit is deposited on the invert of a surface water sewer. In pipelines of flexible materials, the cross-sectional area of the pipeline can be reduced by the fill and surcharge loads. This will have an effect on the apparent hydraulic roughness and will be additional to the effect of the slime.

## Hydraulic Experiments

The Clay Pipe Development Association has conducted many experiments to determine the hydraulic roughness of various pipelines; firstly with clean water at Messrs. Wimpey's Central Hydraulic Research Laboratory at Hayes, Middlesex, and then with sewage at the Water Research Centre (Stevenage Laboratory). Further tests with clean water were carried out by the Hydraulics Research Station, Wallingford and were followed by tests using sewage.

## Clean Water Tests

The $k_S$ values determined at Wimpey's and the Hydraulics Research Station for clean vitrified clay pipes of three interior surface finishes, flowing full, over the range of discharges for which tests were carried out, are as follows:

| Nominal Bore (mm) | Interior Finish | Joint | $k_S$ (mm) |
|---|---|---|---|
| 100 | Salt Glazed | Sleeve | 0.030 |
| | Unglazed | Sleeve | 0.023 |
| | Ceramic glazed | Sleeve | 0.006 |
| 150 | Ceramic glazed | 'O' ring | 0.022 |
| | Unglazed | Sleeve | 0.024 |
| | Unglazed | 'O' ring | 0.024 |
| 300 | Unglazed | 'O' ring | 0.060 |

## Foul Water Tests

When drains and sewers are in service they carry foul not clean water. Therefore, the hydraulic roughness derived from experiments with clean pipes are not appropriate for the hydraulic design of foul and surface water drains and sewers.

The Clay Pipe Development Association sponsored research at the Water Research Centre (Ref. 12) (Stevenage Laboratory) to determine the amount of slime which adheres to the interior surface of pipes made of various materials. The materials tested were: vitrified clay with salt glazed, unglazed and ceramic glazed interior finishes; asbestos cement; pitch fibre; and pvc pipes. A continuous flow of domestic sewage was passed through them for six weeks. The pipes were flowing half full.

The results showed that the growth and weight of slime were statistically independent of the pipe material, but dependent upon the velocity of the sewage flow.

In order to determine the hydraulic roughness of unglazed vitrified clay and pvc pipes, a second series of tests was conducted with the pipes flowing full.

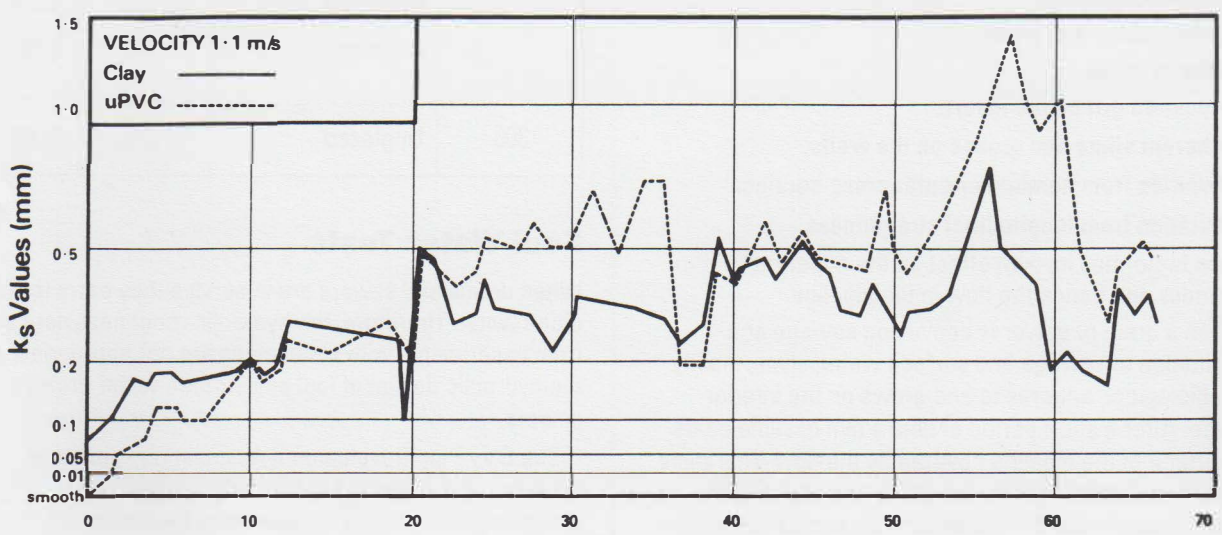
It was found that the pvc pipeline, at the commencement of the test, was hydraulically smoother than the vitrified clay pipeline, but, as the test progressed the difference between the two diminished until the time came when the pvc pipeline was hydraulically rougher than the vitrified clay pipeline. Then as some of the microbiological slime was sloughed off, the vitrified clay pipeline became rougher until sloughing again took place. This alternation happened quite often. The velocities of sewage flow in these tests varied from 0.75 m/sec to 2.25 m/sec but there was no significant difference in the hydraulic roughness of the vitrified clay and pvc pipelines as shown in Figure 1. Therefore, as the first series of tests showed negligible differences in the weight of microbiological slime on any of the materials tested and the second series of tests showed negligible difference in hydraulic roughness between the matured vitrified clay and pvc pipelines, it would be anticipated that there would be negligible significant difference in hydraulic roughness between pvc and clay pipes and hence for design purposes the same hydraulic roughness would apply.

The Hydraulic Research Station continued the research at the Littlemore Sewage Pumping Station, Oxford. In these experiments, 225 mm nominal bore vertically-cast and spun concrete, asbestos cement, pvc and clay pipes had sewage passing through them. In each year of the work a different hydrograph of flow was used. Maximum proportional depth was 0.60 (0.78 m/s) and the minimum 0.16 (0.38 m/s). The maximum velocity was 1.18 m/s.

Typical variations of roughness with time graphs are shown in figures 2 and 3.

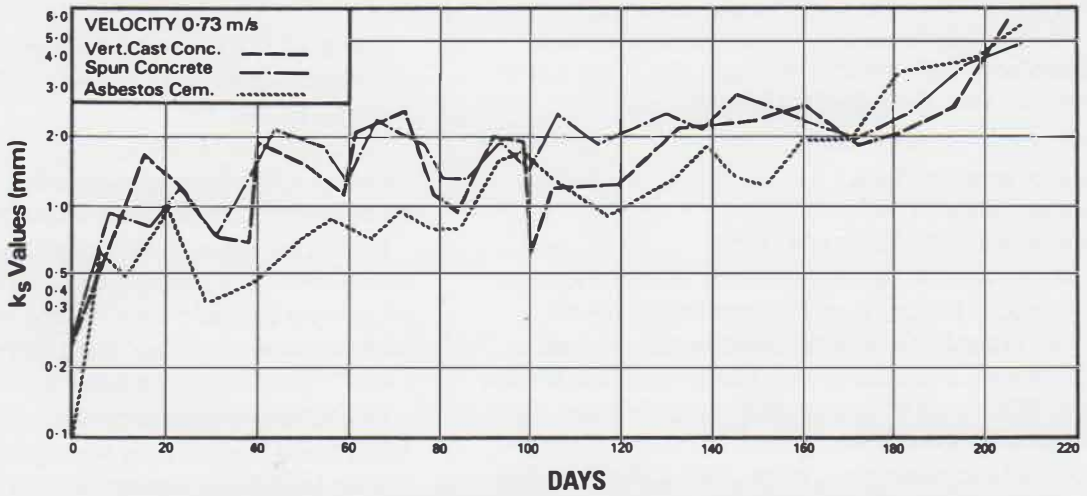
Subsequently, the Water Research Engineering Centre carried out a programme of analysis of sewerage systems. It was found that the $k_s$ values were larger at low velocities than at higher velocities. A range of 3 values of ks was published in the "Sewer Rehabilitation Manual" (Ref. 16), dependent on velocity of flow.

**Figure 1**



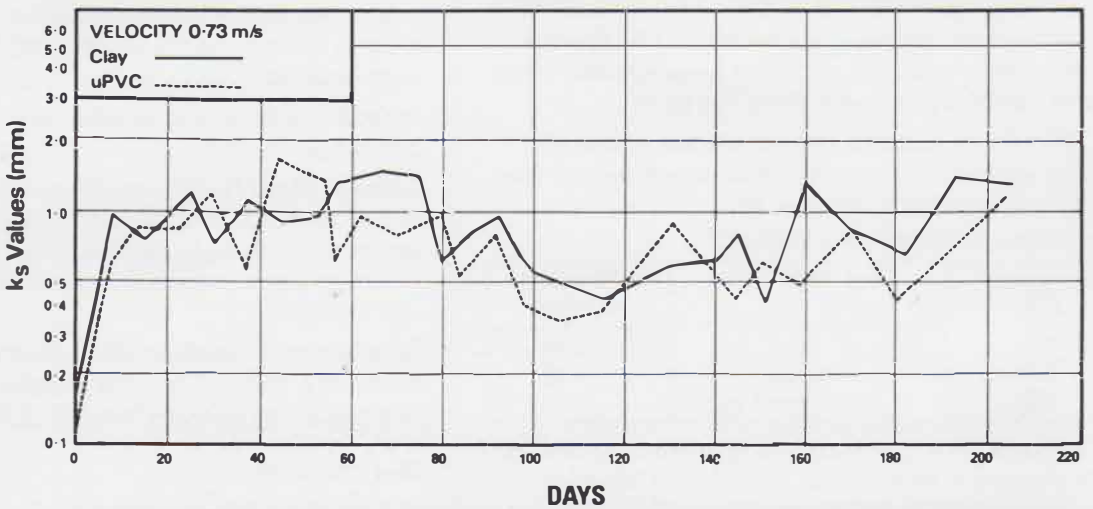

A typical $k_s$ time graph for 100 mm bore pipes flowing full, plotted from the results of the experimental work at W.R.C.

**Figure 2**




$k_s$ time graph from the 1977 experimental work by HRS showing the results for Concrete and Asbestos-Cement pipes

**Figure 3**




$k_s$ time graph from the 1977 experimental work by HRS showing the results for Clay and uPVC pipes

## Design $k_s$ Values

### Surface Water Pipelines

The $k_s$ Values obtained from the clean water tests at Wimpey's and the Hydraulics Research Station were confirmed in the subsequent publication by the Water Research Centre of values of $k_s$ for a range of pipe materials in the "Sewer Rehabilitation Manual" (Ref. 16). The same values have now been published in BS 8005 : 1987, the British Standard for Sewerage (Ref. 13).

Table 3 of BS 8005 : Part 1 : 1987 gives design $k_s$ values of 0.03 mm for sleeve jointed clay pipes and 0.06 mm for spigot and socket jointed clay pipes.

The Water Authorities Association design and construction guide for developers "Sewers for Adoption"(Ref. 17) specifies a design $k_s$ value of 0.6 mm.

The Code of Practice for Building Drainage , BS 8301 : 1985 (Ref. 14) defines two methods of calculating surface water run-off for building drainage depending on the size of area to be drained.

For small areas, the flat rate of rainfall method is recommended and a specific $k_s$ value is not given. It has been traditional to use the conservative $k_s$ value of 0.6 mm for all pipe materials for this method. It should be noted that this value has also been used to calculate the design flow chart in Approved Document H to the Building Regulations 1991.

BS 8301 recommends for larger areas the use of the "Wallingford Rational" method (Ref. 18) of calculating run-off and the Hydraulics Research Station "Tables for the Hydraulic design of pipes" (Ref. 19) for flow calculations. The $k_s$ values given in these tables are similar to those quoted in BS 8005 : 1987, for pipelines which are assumed to be clean and new.

Tables are provided within this section of the book to enable the designer to use any of the $k_s$ values quoted for clay pipes.

## Foul Water Pipelines

The range of three values of $k_s$ for pipe sewers put forward in the "Sewer Rehabilitation Manual" (Ref. 16) are now advocated in Table 4 of BS 8005 : Part 1 (Ref. 13) for typical peak DWF velocities, as set out below.

| Pipe sewers of any material | $k_s$ (mm) |
|---|---|
| Velocity exceeds 1.5 m/s | 0.3 |
| Velocity exceeds 1.0 m/s | 0.6 |
| Velocity between 0.76 m/s and 1.0 m/s | 1.5 |

BS 8301 (Ref. 14) also recognised the change of $k_s$ value with velocity. Design values of 1.5 mm and 0.6 mm are shown, dependant on whether pipes flow continuously or intermittently. It is recommended that the approach adopted by BS 8005 should be used in design using the tables in this section of the book.

BS 8301 also recommends that foul drains should not flow at a proportional depth greater than 0.75, in order to prevent trap syphonage. This will also limit the likelihood of solids being deposited on manhole and inspection chamber benching. The flow chart in Approved Document H (Ref. 15) to the Building Regulations 1991 is based on the same principle.

The minimum size of pipe for a foul drain is DN100, where there is a minimum of 1 wc connected. Sewerage Undertakers do not normally adopt sewers of less than DN150.

The minimum gradients of foul drains and sewers which will be self cleansing are given below, where the peak flow rates are calculated by using the flow rates from the discharge unit method given in BS 8301.

| Pipe size (DN) | Peak flow (l/s) | Minimum Gradient |
|---|---|---|
| 100 | <1 | 1:40 |
| 100 | >1 | 1:80 |
| 150 | >1 (min: 5 wc's) | 1:150 |

Gradients flatter than those given above can be used if a high standard of workmanship is maintained. Minimum gradients of 1:130 for DN100 and 1:200 for DN150 have worked successfully.

For pipes larger than DN150 a minimum velocity of 0.75 m/s can be used for design. The hydraulic capacity is based on the water consumption of the population served and twice the average domestic flow rate is used for the peak flow which should achieve the minimum velocity.

## Design Tables

The tables are calculated from the following equation derived by Ackers from Colebrook and White.

$$V = 2\sqrt{(2gDi)}\ \mathrm{Log}\left(\frac{k_s}{3.7D} + \frac{2.51\mu}{D\sqrt{(2gDi)}}\right)$$

and $Q = VA$

$A$ = Cross sectional area of flow
$D$ = Bore of pipeline
$g$ = Gravitational acceleration
$i$ = Hydraulic gradient
$k_s$ = Linear measure of roughness
$Q$ = Discharge
$V$ = Mean velocity of flow
$\mu$ = Kinematic viscosity

The values of D used were the Nominal Bores. The value of the kinematic viscosity used was $1.141 \times 10^{-6}$ m²/sec for water at 15°C (Ref. 19).

In drainage and sewerage design it is usual to know the discharge and optimum gradient, and to require a suitable combination of nominal bore and velocity.

The first two columns of the tables show the gradients in both decimal and vulgar fraction form. The remaining columns are grouped in pairs for each nominal bore of pipe, the first column of each pair giving the velocity in metres per second and the second the discharge in litres per second.

The individual tables are constituted as follows:

**Tables 25 and 26** are for pipes flowing full at $k_s$ values of 0.03 mm and 0.06 mm respectively. They may be applied to the design of pipe lines carrying clean water or chemical waste which will not deposit material on the walls or invert of the pipeline.

**Table 27** is for pipes flowing at a proportional depth of 0.75. It incorporates the use of different $k_s$ values over the velocity range as recommended by BS 8005 : 1987 (Ref. 13) for foul water pipelines.

**Table 28** uses the same $k_s$ values as Table 27, but is for pipes flowing full.

**Tables 29, 30 and 31** are for pipes flowing full at $k_s$ values of 0.3 mm, 0.6 mm and 1.5 mm, where these values are required separately for design, for example for surface water design or in carrying out proportional flow calculations in conjunction with Table 32.

**Table 32** gives the depth, simplified velocity and discharge as a proportion of the full-bore values for pipes flowing part-full. This table can be used with Tables 25, 26, 29, 30 and 31.

## References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13. BS 8005 : 1987, British Standard for Sewerage. Part 1. Guide to new sewerage construction, British Standards Institution 1987.
14. BS 8301 : 1985, British Standard Code of Practice for Building Drainage, British Standards Institution 1985.
15. Approved Document H to the Building Regulations 1991, Drainage and waste disposal, H.M.S.O. 1992.
16. Sewerage Rehabilitation Manual, Water Authorities Association, 1986.
17. Sewers for Adoption. A design and construction guide for developers, Water Services Association, 1995.
18. Design and analysis of urban storm drainage, The Wallingford Procedure, Volume 4, The Modified Rational Method, National Water Council, 1981.
19. Tables for the hydraulic design of pipes, Hydraulics Research Station, H.M.S.O. 1990.

# Hydraulic Design Tables

| Nominal Bore mm | | 100 | | 150 | | 200 | | 225 | | 300 | | 375 | | 400 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hydraulic Gradient | 1 in | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s |
| .0010 | 1000.0 | 0.28 | 2.18 | 0.37 | 6.50 | 0.45 | 14.05 | 0.48 | 19.24 | 0.59 | 41.42 | 0.68 | 74.94 | 0.71 | 88.94 |
| .0011 | 909.1 | 0.29 | 2.30 | 0.39 | 6.85 | 0.47 | 14.81 | 0.51 | 20.28 | 0.62 | 43.64 | 0.71 | 78.93 | 0.75 | 93.66 |
| .0012 | 833.3 | 0.31 | 2.42 | 0.41 | 7.19 | 0.49 | 15.53 | 0.53 | 21.27 | 0.65 | 45.76 | 0.75 | 82.75 | 0.78 | 98.19 |
| .0013 | 769.2 | 0.32 | 2.53 | 0.43 | 7.52 | 0.52 | 16.23 | 0.56 | 22.23 | 0.68 | 47.80 | 0.78 | 86.42 | 0.82 | 102.55 |
| .0014 | 714.3 | 0.34 | 2.64 | 0.44 | 7.83 | 0.54 | 16.91 | 0.58 | 23.15 | 0.70 | 49.77 | 0.81 | 89.97 | 0.85 | 106.74 |
| .0015 | 666.7 | 0.35 | 2.74 | 0.46 | 8.14 | 0.56 | 17.56 | 0.60 | 24.04 | 0.73 | 51.67 | 0.85 | 93.39 | 0.88 | 110.80 |
| .0016 | 625.0 | 0.36 | 2.84 | 0.48 | 8.43 | 0.58 | 18.19 | 0.63 | 24.90 | 0.76 | 53.52 | 0.88 | 96.72 | 0.91 | 114.74 |
| .0017 | 588.2 | 0.37 | 2.94 | 0.49 | 8.72 | 0.60 | 18.81 | 0.65 | 25.74 | 0.78 | 55.31 | 0.90 | 99.94 | 0.94 | 118.56 |
| .0018 | 555.6 | 0.39 | 3.03 | 0.51 | 9.00 | 0.62 | 19.41 | 0.67 | 26.56 | 0.81 | 57.06 | 0.93 | 103.08 | 0.97 | 122.28 |
| .0019 | 526.3 | 0.40 | 3.13 | 0.52 | 9.27 | 0.64 | 19.99 | 0.69 | 27.36 | 0.83 | 58.75 | 0.96 | 106.13 | 1.00 | 125.89 |
| .0020 | 500.0 | 0.41 | 3.22 | 0.54 | 9.54 | 0.65 | 20.56 | 0.71 | 28.13 | 0.85 | 60.41 | 0.99 | 109.11 | 1.03 | 129.42 |
| .0022 | 454.5 | 0.43 | 3.39 | 0.57 | 10.05 | 0.69 | 21.66 | 0.75 | 29.63 | 0.90 | 63.61 | 1.04 | 114.87 | 1.08 | 136.24 |
| .0024 | 416.7 | 0.45 | 3.56 | 0.60 | 10.55 | 0.72 | 22.71 | 0.78 | 31.07 | 0.94 | 66.68 | 1.09 | 120.38 | 1.14 | 142.77 |
| .0026 | 384.6 | 0.47 | 3.72 | 0.62 | 11.02 | 0.76 | 23.73 | 0.82 | 32.45 | 0.99 | 69.63 | 1.14 | 125.68 | 1.19 | 149.05 |
| .0028 | 357.1 | 0.49 | 3.88 | 0.65 | 11.48 | 0.79 | 24.70 | 0.85 | 33.79 | 1.03 | 72.47 | 1.18 | 130.79 | 1.23 | 155.10 |
| .0030 | 333.3 | 0.51 | 4.03 | 0.67 | 11.92 | 0.82 | 25.65 | 0.88 | 35.08 | 1.06 | 75.22 | 1.23 | 135.73 | 1.28 | 160.95 |
| .0032 | 312.5 | 0.53 | 4.17 | 0.70 | 12.35 | 0.85 | 26.57 | 0.91 | 36.33 | 1.10 | 77.89 | 1.27 | 140.51 | 1.33 | 166.62 |
| .0034 | 294.1 | 0.55 | 4.32 | 0.72 | 12.76 | 0.87 | 27.46 | 0.94 | 37.54 | 1.14 | 80.47 | 1.31 | 145.15 | 1.37 | 172.11 |
| .0036 | 277.8 | 0.57 | 4.45 | 0.75 | 13.17 | 0.90 | 28.32 | 0.97 | 38.72 | 1.17 | 82.99 | 1.36 | 149.67 | 1.41 | 177.46 |
| .0038 | 263.2 | 0.58 | 4.59 | 0.77 | 13.56 | 0.93 | 29.16 | 1.00 | 39.87 | 1.21 | 85.44 | 1.39 | 154.07 | 1.45 | 182.67 |
| .0040 | 250.0 | 0.60 | 4.72 | 0.79 | 13.95 | 0.95 | 29.99 | 1.03 | 40.99 | 1.24 | 87.82 | 1.43 | 158.35 | 1.49 | 187.75 |
| .0042 | 238.1 | 0.62 | 4.85 | 0.81 | 14.32 | 0.98 | 30.79 | 1.06 | 42.09 | 1.28 | 90.16 | 1.47 | 162.54 | 1.53 | 192.70 |
| .0044 | 227.3 | 0.63 | 4.98 | 0.83 | 14.69 | 1.01 | 31.58 | 1.09 | 43.16 | 1.31 | 92.44 | 1.51 | 166.63 | 1.57 | 197.55 |
| .0046 | 217.4 | 0.65 | 5.10 | 0.85 | 15.05 | 1.03 | 32.34 | 1.11 | 44.21 | 1.34 | 94.67 | 1.54 | 170.64 | 1.61 | 202.29 |
| .0048 | 208.3 | 0.66 | 5.22 | 0.87 | 15.41 | 1.05 | 33.10 | 1.14 | 45.23 | 1.37 | 96.85 | 1.58 | 174.56 | 1.65 | 206.93 |
| .0050 | 200.0 | 0.68 | 5.34 | 0.89 | 15.75 | 1.08 | 33.84 | 1.16 | 46.24 | 1.40 | 99.00 | 1.62 | 178.40 | 1.68 | 211.48 |
| .0055 | 181.8 | 0.72 | 5.62 | 0.94 | 16.59 | 1.13 | 35.62 | 1.22 | 48.68 | 1.47 | 104.18 | 1.70 | 187.70 | 1.77 | 222.49 |
| .0060 | 166.7 | 0.75 | 5.90 | 0.98 | 17.39 | 1.19 | 37.34 | 1.28 | 51.01 | 1.54 | 109.14 | 1.78 | 196.60 | 1.85 | 233.03 |
| .0065 | 153.8 | 0.78 | 6.16 | 1.03 | 18.16 | 1.24 | 38.98 | 1.34 | 53.25 | 1.61 | 113.91 | 1.86 | 205.15 | 1.93 | 243.15 |
| .0070 | 142.9 | 0.82 | 6.42 | 1.07 | 18.91 | 1.29 | 40.57 | 1.39 | 55.41 | 1.68 | 118.51 | 1.93 | 213.39 | 2.01 | 252.90 |
| .0075 | 133.3 | 0.85 | 6.67 | 1.11 | 19.63 | 1.34 | 42.10 | 1.45 | 57.50 | 1.74 | 122.95 | 2.00 | 221.35 | 2.09 | 262.32 |
| .0080 | 125.0 | 0.88 | 6.90 | 1.15 | 20.32 | 1.39 | 43.59 | 1.50 | 59.53 | 1.80 | 127.25 | 2.07 | 229.06 | 2.16 | 271.45 |
| .0085 | 117.6 | 0.91 | 7.14 | 1.19 | 21.00 | 1.43 | 45.03 | 1.55 | 61.49 | 1.86 | 131.42 | 2.14 | 236.53 | 2.23 | 280.30 |
| .0090 | 111.1 | 0.94 | 7.36 | 1.23 | 21.66 | 1.48 | 46.43 | 1.59 | 63.40 | 1.92 | 135.47 | 2.21 | 243.80 | 2.30 | 288.90 |
| .0095 | 105.3 | 0.97 | 7.58 | 1.26 | 22.30 | 1.52 | 47.79 | 1.64 | 65.26 | 1.97 | 139.42 | 2.27 | 250.88 | 2.37 | 297.27 |
| .0100 | 100.0 | 0.99 | 7.80 | 1.30 | 22.92 | 1.56 | 49.12 | 1.69 | 67.07 | 2.03 | 143.27 | 2.33 | 257.77 | 2.43 | 305.43 |
| .0110 | 90.9 | 1.05 | 8.21 | 1.37 | 24.13 | 1.65 | 51.69 | 1.77 | 70.57 | 2.13 | 150.70 | 2.45 | 271.08 | 2.56 | 321.19 |
| .0120 | 83.3 | 1.10 | 8.61 | 1.43 | 25.29 | 1.72 | 54.15 | 1.86 | 73.92 | 2.23 | 157.81 | 2.57 | 283.82 | 2.68 | 336.25 |
| .0130 | 76.9 | 1.14 | 8.99 | 1.49 | 26.40 | 1.80 | 56.52 | 1.94 | 77.13 | 2.33 | 164.64 | 2.68 | 296.04 | 2.79 | 350.72 |
| .0140 | 71.4 | 1.19 | 9.36 | 1.55 | 27.47 | 1.87 | 58.79 | 2.02 | 80.23 | 2.42 | 171.22 | 2.79 | 307.82 | 2.90 | 364.66 |
| .0150 | 66.7 | 1.24 | 9.71 | 1.61 | 28.50 | 1.94 | 60.99 | 2.09 | 83.23 | 2.51 | 177.57 | 2.89 | 319.20 | 3.01 | 378.12 |
| .0160 | 62.5 | 1.28 | 10.06 | 1.67 | 29.50 | 2.01 | 63.12 | 2.17 | 86.13 | 2.60 | 183.72 | 2.99 | 330.21 | 3.11 | 391.15 |
| .0170 | 58.8 | 1.32 | 10.39 | 1.72 | 30.48 | 2.08 | 65.19 | 2.24 | 88.94 | 2.68 | 189.69 | 3.09 | 340.89 | 3.21 | 403.79 |
| .0180 | 55.6 | 1.36 | 10.72 | 1.78 | 31.42 | 2.14 | 67.20 | 2.31 | 91.68 | 2.77 | 195.49 | 3.18 | 351.27 | 3.31 | 416.07 |
| .0190 | 52.6 | 1.41 | 11.04 | 1.83 | 32.34 | 2.20 | 69.15 | 2.37 | 94.34 | 2.85 | 201.13 | 3.27 | 361.37 | 3.41 | 428.02 |
| .0200 | 50.0 | 1.44 | 11.34 | 1.88 | 33.24 | 2.26 | 71.06 | 2.44 | 96.93 | 2.92 | 206.63 | 3.36 | 371.21 | 3.50 | 439.66 |
| .0220 | 45.5 | 1.52 | 11.94 | 1.98 | 34.97 | 2.38 | 74.74 | 2.56 | 101.94 | 3.07 | 217.25 | 3.53 | 390.20 | 3.68 | 462.13 |
| .0240 | 41.7 | 1.59 | 12.51 | 2.07 | 36.63 | 2.49 | 78.26 | 2.68 | 106.73 | 3.22 | 227.40 | 3.70 | 408.36 | 3.85 | 483.61 |
| .0260 | 38.5 | 1.66 | 13.06 | 2.16 | 38.22 | 2.60 | 81.64 | 2.80 | 111.33 | 3.35 | 237.15 | 3.86 | 425.79 | 4.01 | 504.23 |
| .0280 | 35.7 | 1.73 | 13.59 | 2.25 | 39.75 | 2.70 | 84.90 | 2.91 | 115.76 | 3.49 | 246.53 | 4.01 | 442.58 | 4.17 | 524.09 |
| .0300 | 33.3 | 1.80 | 14.10 | 2.33 | 41.23 | 2.80 | 88.04 | 3.02 | 120.04 | 3.62 | 255.60 | 4.15 | 458.79 | 4.32 | 543.26 |
| .0320 | 31.2 | 1.86 | 14.60 | 2.41 | 42.67 | 2.90 | 91.09 | 3.12 | 124.18 | 3.74 | 264.37 | 4.30 | 474.47 | 4.47 | 561.82 |
| .0340 | 29.4 | 1.92 | 15.08 | 2.49 | 44.06 | 2.99 | 94.04 | 3.22 | 128.20 | 3.86 | 272.87 | 4.43 | 489.68 | 4.61 | 579.81 |
| .0360 | 27.8 | 1.98 | 15.54 | 2.57 | 45.41 | 3.08 | 96.91 | 3.32 | 132.10 | 3.98 | 281.14 | 4.57 | 504.46 | 4.75 | 597.28 |
| .0380 | 26.3 | 2.04 | 16.00 | 2.64 | 46.73 | 3.17 | 99.70 | 3.42 | 135.90 | 4.09 | 289.18 | 4.70 | 518.84 | 4.89 | 614.29 |
| .0400 | 25.0 | 2.09 | 16.44 | 2.72 | 48.01 | 3.26 | 102.42 | 3.51 | 139.60 | 4.20 | 297.02 | 4.82 | 532.84 | 5.02 | 630.86 |
| .0420 | 23.8 | 2.15 | 16.87 | 2.79 | 49.26 | 3.34 | 105.08 | 3.60 | 143.21 | 4.31 | 304.66 | 4.95 | 546.51 | 5.15 | 647.02 |
| .0440 | 22.7 | 2.20 | 17.30 | 2.86 | 50.48 | 3.43 | 107.67 | 3.69 | 146.74 | 4.42 | 312.13 | 5.07 | 559.86 | 5.27 | 662.81 |
| .0460 | 21.7 | 2.25 | 17.71 | 2.92 | 51.68 | 3.51 | 110.21 | 3.78 | 150.19 | 4.52 | 319.44 | 5.19 | 572.92 | 5.40 | 678.25 |
| .0480 | 20.8 | 2.31 | 18.11 | 2.99 | 52.85 | 3.59 | 112.70 | 3.86 | 153.57 | 4.62 | 326.59 | 5.30 | 585.70 | 5.52 | 693.37 |
| .0500 | 20.0 | 2.36 | 18.51 | 3.06 | 54.00 | 3.66 | 115.13 | 3.95 | 156.88 | 4.72 | 333.59 | 5.42 | 598.21 | 5.64 | 708.17 |
| .0550 | 18.2 | 2.48 | 19.47 | 3.21 | 56.77 | 3.85 | 121.01 | 4.15 | 164.88 | 4.96 | 350.52 | 5.69 | 628.46 | 5.92 | 743.95 |
| .0600 | 16.7 | 2.60 | 20.39 | 3.36 | 59.43 | 4.03 | 126.64 | 4.34 | 172.53 | 5.19 | 366.70 | 5.95 | 657.39 | 6.19 | 778.15 |
| .0650 | 15.4 | 2.71 | 21.27 | 3.51 | 61.98 | 4.20 | 132.04 | 4.52 | 179.87 | 5.41 | 382.24 | 6.20 | 685.14 | 6.45 | 810.97 |
| .0700 | 14.3 | 2.82 | 22.12 | 3.65 | 64.43 | 4.37 | 137.24 | 4.70 | 186.94 | 5.62 | 397.19 | 6.45 | 711.85 | 6.70 | 842.57 |
| .0750 | 13.3 | 2.92 | 22.94 | 3.78 | 66.80 | 4.53 | 142.26 | 4.87 | 193.76 | 5.82 | 411.63 | 6.68 | 737.64 | 6.95 | 873.06 |
| .0800 | 12.5 | 3.02 | 23.73 | 3.91 | 69.09 | 4.68 | 147.12 | 5.04 | 200.37 | 6.02 | 425.59 | 6.90 | 762.59 | 7.18 | 902.56 |
| .0850 | 11.8 | 3.12 | 24.50 | 4.04 | 71.32 | 4.83 | 151.83 | 5.20 | 206.77 | 6.21 | 439.13 | 7.12 | 786.78 | 7.41 | 931.17 |
| .0900 | 11.1 | 3.22 | 25.25 | 4.16 | 73.48 | 4.98 | 156.41 | 5.36 | 212.99 | 6.40 | 452.29 | 7.34 | 810.27 | 7.63 | 958.94 |
| .0950 | 10.5 | 3.31 | 25.98 | 4.28 | 75.58 | 5.12 | 160.86 | 5.51 | 219.04 | 6.58 | 465.08 | 7.54 | 833.12 | 7.85 | 985.97 |

| Nominal Bore mm | | 450 | | 500 | | 600 | | 700 | | 800 | | 900 | | 1000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hydraulic Gradient | 1 in | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s |
| .0010 | 1000.0 | 0.76 | 121.53 | 0.82 | 160.63 | 0.92 | 260.11 | 1.02 | 390.74 | 1.11 | 555.61 | 1.19 | 757.66 | 1.27 | 999.68 |
| .0011 | 909.1 | 0.80 | 127.97 | 0.86 | 169.12 | 0.97 | 273.82 | 1.07 | 411.27 | 1.16 | 584.73 | 1.25 | 797.29 | 1.34 | 1051.87 |
| .0012 | 833.3 | 0.84 | 134.14 | 0.90 | 177.26 | 1.01 | 286.95 | 1.12 | 430.93 | 1.22 | 612.62 | 1.31 | 835.24 | 1.40 | 1101.83 |
| .0013 | 769.2 | 0.88 | 140.07 | 0.94 | 185.09 | 1.06 | 299.58 | 1.17 | 449.83 | 1.27 | 639.42 | 1.37 | 871.70 | 1.46 | 1149.85 |
| .0014 | 714.3 | 0.92 | 145.80 | 0.98 | 192.63 | 1.10 | 311.74 | 1.22 | 468.05 | 1.32 | 665.26 | 1.43 | 906.85 | 1.52 | 1196.12 |
| .0015 | 666.7 | 0.95 | 151.33 | 1.02 | 199.93 | 1.14 | 323.51 | 1.26 | 485.66 | 1.37 | 690.23 | 1.48 | 940.81 | 1.58 | 1240.83 |
| .0016 | 625.0 | 0.99 | 156.69 | 1.05 | 206.99 | 1.18 | 334.90 | 1.31 | 502.72 | 1.42 | 714.41 | 1.53 | 973.70 | 1.64 | 1284.14 |
| .0017 | 588.2 | 1.02 | 161.89 | 1.09 | 213.85 | 1.22 | 345.97 | 1.35 | 519.28 | 1.47 | 737.88 | 1.58 | 1005.63 | 1.69 | 1326.16 |
| .0018 | 555.6 | 1.05 | 166.95 | 1.12 | 220.53 | 1.26 | 356.72 | 1.39 | 535.38 | 1.51 | 760.70 | 1.63 | 1036.66 | 1.74 | 1367.01 |
| .0019 | 526.3 | 1.08 | 171.88 | 1.16 | 227.03 | 1.30 | 367.20 | 1.43 | 551.06 | 1.56 | 782.92 | 1.68 | 1066.88 | 1.79 | 1406.78 |
| .0020 | 500.0 | 1.11 | 176.69 | 1.19 | 233.36 | 1.33 | 377.41 | 1.47 | 566.34 | 1.60 | 804.59 | 1.72 | 1096.34 | 1.84 | 1445.56 |
| .0022 | 454.5 | 1.17 | 185.98 | 1.25 | 245.60 | 1.40 | 397.14 | 1.55 | 595.85 | 1.68 | 846.42 | 1.81 | 1153.21 | 1.94 | 1520.41 |
| .0024 | 416.7 | 1.23 | 194.87 | 1.31 | 257.32 | 1.47 | 416.02 | 1.62 | 624.11 | 1.76 | 886.45 | 1.90 | 1207.64 | 2.03 | 1592.04 |
| .0026 | 384.6 | 1.28 | 203.42 | 1.37 | 268.59 | 1.54 | 434.17 | 1.69 | 651.25 | 1.84 | 924.91 | 1.98 | 1259.92 | 2.11 | 1660.83 |
| .0028 | 357.1 | 1.33 | 211.66 | 1.42 | 279.44 | 1.60 | 451.66 | 1.76 | 677.40 | 1.91 | 961.96 | 2.06 | 1310.30 | 2.20 | 1727.12 |
| .0030 | 333.3 | 1.38 | 219.62 | 1.48 | 289.93 | 1.66 | 468.55 | 1.83 | 702.68 | 1.98 | 997.77 | 2.14 | 1358.96 | 2.28 | 1791.14 |
| .0032 | 312.5 | 1.43 | 227.33 | 1.53 | 300.09 | 1.72 | 484.92 | 1.89 | 727.15 | 2.05 | 1032.43 | 2.21 | 1406.08 | 2.36 | 1853.13 |
| .0034 | 294.1 | 1.48 | 234.82 | 1.58 | 309.95 | 1.77 | 500.80 | 1.95 | 750.89 | 2.12 | 1066.07 | 2.28 | 1451.79 | 2.44 | 1913.27 |
| .0036 | 277.8 | 1.52 | 242.10 | 1.63 | 319.54 | 1.83 | 516.23 | 2.01 | 773.97 | 2.19 | 1098.75 | 2.35 | 1496.22 | 2.51 | 1971.71 |
| .0038 | 263.2 | 1.57 | 249.18 | 1.67 | 328.88 | 1.88 | 531.26 | 2.07 | 796.44 | 2.25 | 1130.58 | 2.42 | 1539.46 | 2.58 | 2028.60 |
| .0040 | 250.0 | 1.61 | 256.09 | 1.72 | 337.98 | 1.93 | 545.91 | 2.13 | 818.35 | 2.31 | 1161.60 | 2.49 | 1581.62 | 2.65 | 2084.05 |
| .0042 | 238.1 | 1.65 | 262.84 | 1.77 | 346.86 | 1.98 | 560.22 | 2.18 | 839.73 | 2.37 | 1191.87 | 2.55 | 1622.76 | 2.72 | 2138.16 |
| .0044 | 227.3 | 1.69 | 269.43 | 1.81 | 355.55 | 2.03 | 574.19 | 2.24 | 860.62 | 2.43 | 1221.46 | 2.61 | 1662.96 | 2.79 | 2191.04 |
| .0046 | 217.4 | 1.73 | 275.88 | 1.85 | 364.04 | 2.08 | 587.87 | 2.29 | 881.06 | 2.49 | 1250.40 | 2.68 | 1702.28 | 2.86 | 2242.75 |
| .0048 | 208.3 | 1.77 | 282.20 | 1.90 | 372.36 | 2.13 | 601.26 | 2.34 | 901.07 | 2.54 | 1278.73 | 2.74 | 1740.78 | 2.92 | 2293.39 |
| .0050 | 200.0 | 1.81 | 288.39 | 1.94 | 380.52 | 2.17 | 614.38 | 2.39 | 920.68 | 2.60 | 1306.50 | 2.80 | 1778.50 | 2.98 | 2343.00 |
| .0055 | 181.8 | 1.91 | 303.37 | 2.04 | 400.24 | 2.29 | 646.12 | 2.52 | 968.11 | 2.73 | 1373.64 | 2.94 | 1869.72 | 3.14 | 2462.95 |
| .0060 | 166.7 | 2.00 | 317.71 | 2.13 | 419.11 | 2.39 | 676.48 | 2.63 | 1013.48 | 2.86 | 1437.87 | 3.08 | 1956.97 | 3.28 | 2577.69 |
| .0065 | 153.8 | 2.08 | 331.47 | 2.23 | 437.24 | 2.50 | 705.64 | 2.75 | 1057.05 | 2.98 | 1499.55 | 3.21 | 2040.74 | 3.42 | 2687.84 |
| .0070 | 142.9 | 2.17 | 344.74 | 2.32 | 454.70 | 2.60 | 733.73 | 2.86 | 1099.01 | 3.10 | 1558.94 | 3.33 | 2121.42 | 3.56 | 2793.92 |
| .0075 | 133.3 | 2.25 | 357.55 | 2.40 | 471.57 | 2.69 | 760.86 | 2.96 | 1139.54 | 3.22 | 1616.30 | 3.46 | 2199.32 | 3.69 | 2896.35 |
| .0080 | 125.0 | 2.33 | 369.96 | 2.48 | 487.90 | 2.78 | 787.13 | 3.06 | 1178.77 | 3.33 | 1671.82 | 3.58 | 2274.72 | 3.81 | 2995.48 |
| .0085 | 117.6 | 2.40 | 382.00 | 2.57 | 503.74 | 2.87 | 812.60 | 3.16 | 1216.82 | 3.43 | 1725.67 | 3.69 | 2347.85 | 3.94 | 3091.62 |
| .0090 | 111.1 | 2.48 | 393.69 | 2.64 | 519.14 | 2.96 | 837.36 | 3.26 | 1253.80 | 3.54 | 1777.99 | 3.80 | 2418.90 | 4.06 | 3185.02 |
| .0095 | 105.3 | 2.55 | 405.08 | 2.72 | 534.12 | 3.05 | 861.45 | 3.35 | 1289.78 | 3.64 | 1828.90 | 3.91 | 2488.03 | 4.17 | 3275.91 |
| .0100 | 100.0 | 2.62 | 416.18 | 2.79 | 548.73 | 3.13 | 884.93 | 3.44 | 1324.84 | 3.74 | 1878.52 | 4.02 | 2555.41 | 4.28 | 3364.47 |
| .0110 | 90.9 | 2.75 | 437.59 | 2.94 | 576.91 | 3.29 | 930.24 | 3.62 | 1392.49 | 3.93 | 1974.23 | 4.22 | 2685.37 | 4.50 | 3535.30 |
| .0120 | 83.3 | 2.88 | 458.08 | 3.08 | 603.87 | 3.44 | 973.57 | 3.79 | 1457.19 | 4.11 | 2065.76 | 4.42 | 2809.64 | 4.71 | 3698.64 |
| .0130 | 76.9 | 3.00 | 477.75 | 3.21 | 629.75 | 3.59 | 1015.17 | 3.95 | 1519.29 | 4.28 | 2153.61 | 4.60 | 2928.91 | 4.91 | 3855.41 |
| .0140 | 71.4 | 3.12 | 496.70 | 3.33 | 654.68 | 3.73 | 1055.22 | 4.10 | 1579.09 | 4.45 | 2238.20 | 4.78 | 3043.75 | 5.10 | 4006.34 |
| .0150 | 66.7 | 3.24 | 514.99 | 3.46 | 678.75 | 3.87 | 1093.90 | 4.25 | 1636.83 | 4.62 | 2319.87 | 4.96 | 3154.61 | 5.29 | 4152.05 |
| .0160 | 62.5 | 3.35 | 532.70 | 3.58 | 702.04 | 4.00 | 1131.33 | 4.40 | 1692.70 | 4.77 | 2398.90 | 5.13 | 3261.89 | 5.47 | 4293.03 |
| .0170 | 58.8 | 3.46 | 549.87 | 3.69 | 724.64 | 4.13 | 1167.63 | 4.54 | 1746.88 | 4.92 | 2475.53 | 5.29 | 3365.91 | 5.64 | 4429.73 |
| .0180 | 55.6 | 3.56 | 566.56 | 3.80 | 746.59 | 4.25 | 1202.90 | 4.68 | 1799.52 | 5.07 | 2549.97 | 5.45 | 3466.95 | 5.81 | 4562.51 |
| .0190 | 52.6 | 3.66 | 582.80 | 3.91 | 767.95 | 4.38 | 1237.21 | 4.81 | 1850.73 | 5.22 | 2622.39 | 5.60 | 3565.26 | 5.97 | 4691.70 |
| .0200 | 50.0 | 3.76 | 598.62 | 4.02 | 788.76 | 4.49 | 1270.65 | 4.94 | 1900.63 | 5.36 | 2692.96 | 5.75 | 3661.04 | 6.13 | 4817.56 |
| .0220 | 45.5 | 3.96 | 629.15 | 4.22 | 828.92 | 4.72 | 1335.14 | 5.19 | 1996.87 | 5.63 | 2829.06 | 6.05 | 3845.76 | 6.44 | 5060.29 |
| .0240 | 41.7 | 4.14 | 658.34 | 4.42 | 867.31 | 4.94 | 1396.81 | 5.43 | 2088.89 | 5.89 | 2959.18 | 6.32 | 4022.35 | 6.74 | 5292.32 |
| .0260 | 38.5 | 4.32 | 686.36 | 4.60 | 904.16 | 5.15 | 1455.99 | 5.66 | 2177.19 | 6.14 | 3084.03 | 6.59 | 4191.79 | 7.02 | 5514.96 |
| .0280 | 35.7 | 4.49 | 713.34 | 4.79 | 939.64 | 5.35 | 1512.96 | 5.88 | 2262.20 | 6.37 | 3204.23 | 6.85 | 4354.90 | 7.29 | 5729.26 |
| .0300 | 33.3 | 4.65 | 739.38 | 4.96 | 973.89 | 5.55 | 1567.96 | 6.09 | 2344.26 | 6.61 | 3320.24 | 7.09 | 4512.34 | 7.56 | 5936.11 |
| .0320 | 31.2 | 4.81 | 764.58 | 5.13 | 1007.04 | 5.73 | 1621.18 | 6.30 | 2423.65 | 6.83 | 3432.49 | 7.33 | 4664.66 | 7.81 | 6136.23 |
| .0340 | 29.4 | 4.96 | 789.02 | 5.29 | 1039.17 | 5.92 | 1672.78 | 6.50 | 2500.62 | 7.05 | 3541.31 | 7.56 | 4812.32 | 8.06 | 6330.23 |
| .0360 | 27.8 | 5.11 | 812.76 | 5.45 | 1070.39 | 6.09 | 1722.90 | 6.69 | 2575.39 | 7.26 | 3647.01 | 7.79 | 4955.74 | 8.30 | 6518.65 |
| .0380 | 26.3 | 5.26 | 835.86 | 5.61 | 1100.76 | 6.27 | 1771.66 | 6.88 | 2648.12 | 7.46 | 3749.83 | 8.01 | 5095.26 | 8.53 | 6701.94 |
| .0400 | 25.0 | 5.40 | 858.37 | 5.76 | 1130.35 | 6.43 | 1819.16 | 7.07 | 2718.99 | 7.66 | 3850.00 | 8.22 | 5231.19 | 8.76 | 6880.51 |
| .0420 | 23.8 | 5.54 | 880.32 | 5.90 | 1159.22 | 6.60 | 1865.51 | 7.24 | 2788.11 | 7.85 | 3947.72 | 8.43 | 5363.78 | 8.98 | 7054.69 |
| .0440 | 22.7 | 5.67 | 901.77 | 6.05 | 1187.42 | 6.76 | 1910.77 | 7.42 | 2855.63 | 8.04 | 4043.16 | 8.63 | 5493.27 | 9.20 | 7224.80 |
| .0460 | 21.7 | 5.80 | 922.74 | 6.19 | 1214.99 | 6.91 | 1955.03 | 7.59 | 2921.64 | 8.23 | 4136.47 | 8.83 | 5619.87 | 9.41 | 7391.11 |
| .0480 | 20.8 | 5.93 | 943.26 | 6.33 | 1241.97 | 7.07 | 1998.34 | 7.76 | 2986.24 | 8.41 | 4227.79 | 9.03 | 5743.77 | 9.62 | 7553.87 |
| .0500 | 20.0 | 6.06 | 963.37 | 6.46 | 1268.41 | 7.22 | 2040.77 | 7.92 | 3049.52 | 8.59 | 4317.23 | 9.22 | 5865.12 | 9.82 | 7713.29 |
| .0550 | 18.2 | 6.36 | 1011.96 | 6.79 | 1332.29 | 7.58 | 2143.30 | 8.32 | 3202.43 | 9.02 | 4533.37 | 9.68 | 6158.36 | 10.31 | 8098.49 |
| .0600 | 16.7 | 6.65 | 1058.40 | 7.10 | 1393.35 | 7.93 | 2241.30 | 8.70 | 3348.59 | 9.43 | 4739.95 | 10.12 | 6438.62 | 10.78 | 8466.63 |
| .0650 | 15.4 | 6.94 | 1102.97 | 7.39 | 1451.94 | 8.26 | 2335.33 | 9.07 | 3488.81 | 9.82 | 4938.14 | 10.54 | 6707.49 | 11.23 | 8819.81 |
| .0700 | 14.3 | 7.20 | 1145.87 | 7.68 | 1508.33 | 8.58 | 2425.83 | 9.42 | 3623.77 | 10.20 | 5128.88 | 10.95 | 6966.26 | 11.66 | 9159.71 |
| .0750 | 13.3 | 7.47 | 1187.28 | 7.96 | 1562.76 | 8.89 | 2513.17 | 9.75 | 3754.02 | 10.57 | 5312.96 | 11.34 | 7215.98 | 12.08 | 9487.72 |
| .0800 | 12.5 | 7.72 | 1227.34 | 8.23 | 1615.42 | 9.19 | 2597.67 | 10.08 | 3880.02 | 10.92 | 5491.03 | 11.72 | 7457.55 | 12.48 | 9805.02 |
| .0850 | 11.8 | 7.96 | 1266.17 | 8.49 | 1666.47 | 9.48 | 2679.58 | 10.40 | 4002.16 | 11.27 | 5663.65 | 12.09 | 7691.72 | 12.88 | 10112.59 |
| .0900 | 11.1 | 8.20 | 1303.89 | 8.74 | 1716.05 | 9.76 | 2759.13 | 10.71 | 4120.78 | 11.60 | 5831.28 | 12.45 | 7919.12 | 13.26 | 10411.27 |
| .0950 | 10.5 | 8.43 | 1340.58 | 8.99 | 1764.27 | 10.03 | 2836.51 | 11.01 | 4236.16 | 11.93 | 5994.34 | 12.80 | 8140.31 | 13.63 | 10701.79 |

| Nominal Bore mm | | 100 | | 150 | | 200 | | 225 | | 300 | | 375 | | 400 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hydraulic Gradient | 1 in | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s |
| .0010 | 1000.0 | 0.27 | 2.15 | 0.36 | 6.40 | 0.44 | 13.81 | 0.48 | 18.91 | 0.58 | 40.65 | 0.67 | 73.47 | 0.69 | 87.17 |
| .0011 | 909.1 | 0.29 | 2.27 | 0.38 | 6.74 | 0.46 | 14.55 | 0.50 | 19.91 | 0.61 | 42.79 | 0.70 | 77.33 | 0.73 | 91.75 |
| .0012 | 833.3 | 0.30 | 2.38 | 0.40 | 7.07 | 0.49 | 15.25 | 0.53 | 20.88 | 0.63 | 44.85 | 0.73 | 81.03 | 0.76 | 96.12 |
| .0013 | 769.2 | 0.32 | 2.49 | 0.42 | 7.39 | 0.51 | 15.93 | 0.55 | 21.80 | 0.66 | 46.83 | 0.77 | 84.58 | 0.80 | 100.33 |
| .0014 | 714.3 | 0.33 | 2.59 | 0.44 | 7.69 | 0.53 | 16.58 | 0.57 | 22.69 | 0.69 | 48.73 | 0.80 | 88.01 | 0.83 | 104.39 |
| .0015 | 666.7 | 0.34 | 2.69 | 0.45 | 7.99 | 0.55 | 17.22 | 0.59 | 23.56 | 0.72 | 50.57 | 0.83 | 91.32 | 0.86 | 108.31 |
| .0016 | 625.0 | 0.36 | 2.79 | 0.47 | 8.28 | 0.57 | 17.83 | 0.61 | 24.39 | 0.74 | 52.36 | 0.86 | 94.52 | 0.89 | 112.10 |
| .0017 | 588.2 | 0.37 | 2.89 | 0.48 | 8.55 | 0.59 | 18.43 | 0.63 | 25.21 | 0.77 | 54.09 | 0.88 | 97.63 | 0.92 | 115.78 |
| .0018 | 555.6 | 0.38 | 2.98 | 0.50 | 8.82 | 0.60 | 19.00 | 0.65 | 26.00 | 0.79 | 55.77 | 0.91 | 100.65 | 0.95 | 119.36 |
| .0019 | 526.3 | 0.39 | 3.07 | 0.51 | 9.09 | 0.62 | 19.57 | 0.67 | 26.76 | 0.81 | 57.41 | 0.94 | 103.59 | 0.98 | 122.85 |
| .0020 | 500.0 | 0.40 | 3.16 | 0.53 | 9.35 | 0.64 | 20.12 | 0.69 | 27.51 | 0.83 | 59.01 | 0.96 | 106.46 | 1.00 | 126.25 |
| .0022 | 454.5 | 0.42 | 3.33 | 0.56 | 9.84 | 0.67 | 21.18 | 0.73 | 28.96 | 0.88 | 62.09 | 1.01 | 112.00 | 1.06 | 132.80 |
| .0024 | 416.7 | 0.44 | 3.49 | 0.58 | 10.32 | 0.71 | 22.20 | 0.76 | 30.35 | 0.92 | 65.04 | 1.06 | 117.30 | 1.11 | 139.08 |
| .0026 | 384.6 | 0.46 | 3.64 | 0.61 | 10.78 | 0.74 | 23.17 | 0.80 | 31.68 | 0.96 | 67.88 | 1.11 | 122.39 | 1.15 | 145.11 |
| .0028 | 357.1 | 0.48 | 3.80 | 0.63 | 11.22 | 0.77 | 24.11 | 0.83 | 32.96 | 1.00 | 70.61 | 1.15 | 127.29 | 1.20 | 150.91 |
| .0030 | 333.3 | 0.50 | 3.94 | 0.66 | 11.64 | 0.80 | 25.02 | 0.86 | 34.20 | 1.04 | 73.25 | 1.20 | 132.03 | 1.25 | 156.52 |
| .0032 | 312.5 | 0.52 | 4.08 | 0.68 | 12.06 | 0.82 | 25.91 | 0.89 | 35.41 | 1.07 | 75.81 | 1.24 | 136.62 | 1.29 | 161.95 |
| .0034 | 294.1 | 0.54 | 4.22 | 0.70 | 12.46 | 0.85 | 26.76 | 0.92 | 36.57 | 1.11 | 78.29 | 1.28 | 141.07 | 1.33 | 167.22 |
| .0036 | 277.8 | 0.55 | 4.35 | 0.73 | 12.85 | 0.88 | 27.59 | 0.95 | 37.71 | 1.14 | 80.70 | 1.32 | 145.39 | 1.37 | 172.34 |
| .0038 | 263.2 | 0.57 | 4.48 | 0.75 | 13.23 | 0.90 | 28.40 | 0.98 | 38.81 | 1.17 | 83.05 | 1.35 | 149.60 | 1.41 | 177.32 |
| .0040 | 250.0 | 0.59 | 4.61 | 0.77 | 13.60 | 0.93 | 29.19 | 1.00 | 39.88 | 1.21 | 85.33 | 1.39 | 153.70 | 1.45 | 182.17 |
| .0042 | 238.1 | 0.60 | 4.73 | 0.79 | 13.96 | 0.95 | 29.96 | 1.03 | 40.93 | 1.24 | 87.57 | 1.43 | 157.70 | 1.49 | 186.91 |
| .0044 | 227.3 | 0.62 | 4.86 | 0.81 | 14.31 | 0.98 | 30.72 | 1.06 | 41.96 | 1.27 | 89.75 | 1.46 | 161.61. | 1.52 | 191.54 |
| .0046 | 217.4 | 0.63 | 4.97 | 0.83 | 14.66 | 1.00 | 31.45 | 1.08 | 42.96 | 1.30 | 91.88 | 1.50 | 165.44 | 1.56 | 196.07 |
| .0048 | 208.3 | 0.65 | 5.09 | 0.85 | 15.00 | 1.02 | 32.17 | 1.11 | 43.95 | 1.33 | 93.97 | 1.53 | 169.18 | 1.60 | 200.50 |
| .0050 | 200.0 | 0.66 | 5.20 | 0.87 | 15.33 | 1.05 | 32.88 | 1.13 | 44.91 | 1.36 | 96.02 | 1.57 | 172.85 | 1.63 | 204.85 |
| .0055 | 181.8 | 0.70 | 5.48 | 0.91 | 16.13 | 1.10 | 34.59 | 1.19 | 47.24 | 1.43 | 100.97 | 1.65 | 181.73 | 1.71 | 215.35 |
| .0060 | 166.7 | 0.73 | 5.74 | 0.96 | 16.90 | 1.15 | 36.23 | 1.24 | 49.47 | 1.50 | 105.70 | 1.72 | 190.21 | 1.79 | 225.39 |
| .0065 | 153.8 | 0.76 | 6.00 | 1.00 | 17.64 | 1.20 | 37.80 | 1.30 | 51.61 | 1.56 | 110.25 | 1.80 | 198.36 | 1.87 | 235.03 |
| .0070 | 142.9 | 0.79 | 6.24 | 1.04 | 18.35 | 1.25 | 39.31 | 1.35 | 53.67 | 1.62 | 114.63 | 1.87 | 206.20 | 1.94 | 244.32 |
| .0075 | 133.3 | 0.82 | 6.48 | 1.08 | 19.04 | 1.30 | 40.78 | 1.40 | 55.66 | 1.68 | 118.86 | 1.94 | 213.78 | 2.02 | 253.28 |
| .0080 | 125.0 | 0.85 | 6.71 | 1.11 | 19.70 | 1.34 | 42.19 | 1.45 | 57.59 | 1.74 | 122.95 | 2.00 | 221.11 | 2.08 | 261.95 |
| .0085 | 117.6 | 0.88 | 6.93 | 1.15 | 20.35 | 1.39 | 43.57 | 1.50 | 59.46 | 1.80 | 126.92 | 2.07 | 228.22 | 2.15 | 270.37 |
| .0090 | 111.1 | 0.91 | 7.14 | 1.19 | 20.97 | 1.43 | 44.90 | 1.54 | 61.28 | 1.85 | 130.78 | 2.13 | 235.12 | 2.22 | 278.54 |
| .0095 | 105.3 | 0.94 | 7.35 | 1.22 | 21.58 | 1.47 | 46.20 | 1.59 | 63.05 | 1.90 | 134.53 | 2.19 | 241.84 | 2.28 | 286.49 |
| .0100 | 100.0 | 0.96 | 7.56 | 1.26 | 22.18 | 1.51 | 47.47 | 1.63 | 64.77 | 1.95 | 138.19 | 2.25 | 248.39 | 2.34 | 294.24 |
| .0110 | 90.9 | 1.01 | 7.95 | 1.32 | 23.33 | 1.59 | 49.91 | 1.71 | 68.10 | 2.05 | 145.24 | 2.36 | 261.02 | 2.46 | 309.18 |
| .0120 | 83.3 | 1.06 | 8.33 | 1.38 | 24.43 | 1.66 | 52.24 | 1.79 | 71.27 | 2.15 | 151.98 | 2.47 | 273.09 | 2.57 | 323.47 |
| .0130 | 76.9 | 1.11 | 8.69 | 1.44 | 25.48 | 1.73 | 54.49 | 1.87 | 74.33 | 2.24 | 158.46 | 2.58 | 284.68 | 2.68 | 337.18 |
| .0140 | 71.4 | 1.15 | 9.05 | 1.50 | 26.50 | 1.80 | 56.65 | 1.94 | 77.27 | 2.33 | 164.69 | 2.68 | 295.84 | 2.79 | 350.38 |
| .0150 | 66.7 | 1.19 | 9.38 | 1.56 | 27.48 | 1.87 | 58.73 | 2.01 | 80.10 | 2.42 | 170.71 | 2.78 | 306.61 | 2.89 | 363.12 |
| .0160 | 62.5 | 1.24 | 9.71 | 1.61 | 28.43 | 1.93 | 60.75 | 2.08 | 82.85 | 2.50 | 176.53 | 2.87 | 317.03 | 2.99 | 375.45 |
| .0170 | 58.8 | 1.28 | 10.03 | 1.66 | 29.35 | 2.00 | 62.71 | 2.15 | 85.51 | 2.58 | 182.18 | 2.96 | 327.13 | 3.08 | 387.40 |
| .0180 | 55.6 | 1.32 | 10.34 | 1.71 | 30.25 | 2.06 | 64.61 | 2.22 | 88.10 | 2.65 | 187.66 | 3.05 | 336.94 | 3.18 | 399.01 |
| .0190 | 52.6 | 1.35 | 10.64 | 1.76 | 31.12 | 2.12 | 66.46 | 2.28 | 90.62 | 2.73 | 193.00 | 3.14 | 346.49 | 3.27 | 410.31 |
| .0200 | 50.0 | 1.39 | 10.93 | 1.81 | 31.97 | 2.17 | 68.26 | 2.34 | 93.07 | 2.80 | 198.20 | 3.22 | 355.79 | 3.35 | 421.31 |
| .0220 | 45.5 | 1.46 | 11.49 | 1.90 | 33.60 | 2.28 | 71.74 | 2.46 | 97.80 | 2.95 | 208.22 | 3.38 | 373.73 | 3.52 | 442.53 |
| .0240 | 41.7 | 1.53 | 12.04 | 1.99 | 35.17 | 2.39 | 75.06 | 2.57 | 102.33 | 3.08 | 217.81 | 3.54 | 390.87 | 3.68 | 462.81 |
| .0260 | 38.5 | 1.60 | 12.55 | 2.08 | 36.67 | 2.49 | 78.25 | 2.68 | 106.67 | 3.21 | 227.00 | 3.69 | 407.32 | 3.84 | 482.28 |
| .0280 | 35.7 | 1.66 | 13.05 | 2.16 | 38.12 | 2.59 | 81.33 | 2.79 | 110.85 | 3.34 | 235.86 | 3.83 | 423.16 | 3.99 | 501.01 |
| .0300 | 33.3 | 1.72 | 13.54 | 2.24 | 39.52 | 2.68 | 84.29 | 2.89 | 114.88 | 3.46 | 244.40 | 3.97 | 438.44 | 4.13 | 519.09 |
| .0320 | 31.2 | 1.78 | 14.00 | 2.31 | 40.87 | 2.77 | 87.16 | 2.99 | 118.78 | 3.57 | 252.67 | 4.10 | 453.22 | 4.27 | 536.57 |
| .0340 | 29.4 | 1.84 | 14.46 | 2.39 | 42.18 | 2.86 | 89.94 | 3.08 | 122.57 | 3.69 | 260.68 | 4.23 | 467.56 | 4.40 | 553.53 |
| .0360 | 27.8 | 1.90 | 14.90 | 2.46 | 43.45 | 2.95 | 92.65 | 3.18 | 126.24 | 3.80 | 268.47 | 4.36 | 481.48 | 4.54 | 569.99 |
| .0380 | 26.3 | 1.95 | 15.32 | 2.53 | 44.69 | 3.03 | 95.27 | 3.26 | 129.82 | 3.91 | 276.04 | 4.48 | 495.02 | 4.66 | 586.01 |
| .0400 | 25.0 | 2.00 | 15.74 | 2.60 | 45.90 | 3.11 | 97.84 | 3.35 | 133.30 | 4.01 | 283.42 | 4.60 | 508.21 | 4.79 | 601.61 |
| .0420 | 23.8 | 2.06 | 16.15 | 2.66 | 47.08 | 3.19 | 100.33 | 3.44 | 136.70 | 4.11 | 290.61 | 4.72 | 521.07 | 4.91 | 616.83 |
| .0440 | 22.7 | 2.11 | 16.55 | 2.73 | 48.23 | 3.27 | 102.78 | 3.52 | 140.02 | 4.21 | 297.64 | 4.83 | 533.64 | 5.03 | 631.70 |
| .0460 | 21.7 | 2.16 | 16.93 | 2.79 | 49.35 | 3.35 | 105.16 | 3.60 | 143.26 | 4.31 | 304.51 | 4.94 | 545.92 | 5.14 | 646.23 |
| .0480 | 20.8 | 2.20 | 17.32 | 2.86 | 50.45 | 3.42 | 107.50 | 3.68 | 146.44 | 4.40 | 311.23 | 5.05 | 557.95 | 5.26 | 660.45 |
| .0500 | 20.0 | 2.25 | 17.69 | 2.92 | 51.53 | 3.49 | 109.78 | 3.76 | 149.55 | 4.50 | 317.82 | 5.16 | 569.72 | 5.37 | 674.38 |
| .0550 | 18.2 | 2.37 | 18.59 | 3.06 | 54.14 | 3.67 | 115.31 | 3.95 | 157.07 | 4.72 | 333.74 | 5.42 | 598.17 | 5.63 | 708.03 |
| .0600 | 16.7 | 2.48 | 19.45 | 3.20 | 56.63 | 3.84 | 120.60 | 4.13 | 164.25 | 4.94 | 348.94 | 5.66 | 625.36 | 5.89 | 740.19 |
| .0650 | 15.4 | 2.58 | 20.28 | 3.34 | 59.02 | 4.00 | 125.66 | 4.30 | 171.15 | 5.14 | 363.54 | 5.90 | 651.45 | 6.14 | 771.05 |
| .0700 | 14.3 | 2.68 | 21.07 | 3.47 | 61.32 | 4.16 | 130.54 | 4.47 | 177.78 | 5.34 | 377.58 | 6.13 | 676.55 | 6.37 | 800.74 |
| .0750 | 13.3 | 2.78 | 21.84 | 3.60 | 63.54 | 4.31 | 135.25 | 4.63 | 184.18 | 5.53 | 391.13 | 6.34 | 700.77 | 6.60 | 829.39 |
| .0800 | 12.5 | 2.88 | 22.59 | 3.72 | 65.69 | 4.45 | 139.81 | 4.79 | 190.38 | 5.72 | 404.24 | 6.56 | 724.21 | 6.82 | 857.11 |
| .0850 | 11.8 | 2.97 | 23.31 | 3.84 | 67.78 | 4.59 | 144.22 | 4.94 | 196.38 | 5.90 | 416.95 | 6.76 | 746.92 | 7.03 | 883.97 |
| .0900 | 11.1 | 3.06 | 24.01 | 3.95 | 69.80 | 4.73 | 148.51 | 5.09 | 202.21 | 6.07 | 429.29 | 6.96 | 768.98 | 7.24 | 910.06 |
| .0950 | 10.5 | 3.14 | 24.69 | 4.06 | 71.77 | 4.86 | 152.68 | 5.23 | 207.89 | 6.24 | 441.29 | 7.16 | 790.43 | 7.44 | 935.43 |

**TABLE 26** *(continued)* **PIPE FLOWING FULL** $k_s = 0.06mm$ **450mm to 1000mm Nominal Bore**

| Nominal Bore mm | | 450 | | 500 | | 600 | | 700 | | 800 | | 900 | | 1000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hydraulic Gradient | 1 in | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s |
| .0010 | 1000.0 | 0.75 | 119.05 | 0.80 | 157.28 | 0.90 | 254.49 | 0.99 | 382.02 | 1.08 | 542.89 | 1.16 | 739.92 | 1.24 | 975.80 |
| .0011 | 909.1 | 0.79 | 125.28 | 0.84 | 165.49 | 0.95 | 267.73 | 1.04 | 401.84 | 1.14 | 570.97 | 1.22 | 778.11 | 1.31 | 1026.06 |
| .0012 | 833.3 | 0.83 | 131.25 | 0.88 | 173.36 | 0.99 | 280.40 | 1.09 | 420.80 | 1.19 | 597.84 | 1.28 | 814.64 | 1.37 | 1074.15 |
| .0013 | 769.2 | 0.86 | 136.98 | 0.92 | 180.91 | 1.03 | 292.57 | 1.14 | 439.00 | 1.24 | 623.65 | 1.34 | 849.73 | 1.43 | 1120.32 |
| .0014 | 714.3 | 0.90 | 142.50 | 0.96 | 188.19 | 1.08 | 304.30 | 1.19 | 456.55 | 1.29 | 648.50 | 1.39 | 883.52 | 1.48 | 1164.79 |
| .0015 | 666.7 | 0.93 | 147.84 | 0.99 | 195.22 | 1.12 | 315.62 | 1.23 | 473.49 | 1.34 | 672.51 | 1.44 | 916.16 | 1.54 | 1207.74 |
| .0016 | 625.0 | 0.96 | 153.00 | 1.03 | 202.03 | 1.16 | 326.59 | 1.27 | 489.89 | 1.38 | 695.75 | 1.49 | 947.75 | 1.59 | 1249.31 |
| .0017 | 588.2 | 0.99 | 158.02 | 1.06 | 208.63 | 1.19 | 337.23 | 1.31 | 505.81 | 1.43 | 718.29 | 1.54 | 978.40 | 1.64 | 1289.63 |
| .0018 | 555.6 | 1.02 | 162.89 | 1.10 | 215.05 | 1.23 | 347.57 | 1.35 | 521.27 | 1.47 | 740.20 | 1.58 | 1008.17 | 1.69 | 1328.81 |
| .0019 | 526.3 | 1.05 | 167.63 | 1.13 | 221.30 | 1.26 | 357.64 | 1.39 | 536.32 | 1.51 | 761.52 | 1.63 | 1037.15 | 1.74 | 1366.93 |
| .0020 | 500.0 | 1.08 | 172.26 | 1.16 | 227.39 | 1.30 | 367.45 | 1.43 | 550.99 | 1.56 | 782.30 | 1.67 | 1065.40 | 1.79 | 1404.09 |
| .0022 | 454.5 | 1.14 | 181.18 | 1.22 | 239.15 | 1.37 | 386.38 | 1.51 | 579.30 | 1.64 | 822.39 | 1.76 | 1119.88 | 1.88 | 1475.76 |
| .0024 | 416.7 | 1.19 | 189.72 | 1.28 | 250.40 | 1.43 | 404.49 | 1.58 | 606.37 | 1.71 | 860.74 | 1.84 | 1171.99 | 1.97 | 1544.31 |
| .0026 | 384.6 | 1.24 | 197.93 | 1.33 | 261.20 | 1.49 | 421.88 | 1.64 | 632.37 | 1.79 | 897.55 | 1.92 | 1222.01 | 2.05 | 1610.10 |
| .0028 | 357.1 | 1.29 | 205.83 | 1.38 | 271.61 | 1.55 | 438.63 | 1.71 | 657.40 | 1.86 | 932.99 | 2.00 | 1270.17 | 2.13 | 1673.46 |
| .0030 | 333.3 | 1.34 | 213.46 | 1.43 | 281.66 | 1.61 | 454.80 | 1.77 | 681.57 | 1.92 | 967.22 | 2.07 | 1316.68 | 2.21 | 1734.62 |
| .0032 | 312.5 | 1.39 | 220.85 | 1.48 | 291.39 | 1.66 | 470.45 | 1.83 | 704.97 | 1.99 | 1000.35 | 2.14 | 1361.68 | 2.28 | 1793.81 |
| .0034 | 294.1 | 1.43 | 228.01 | 1.53 | 300.82 | 1.72 | 485.64 | 1.89 | 727.66 | 2.05 | 1032.47 | 2.21 | 1405.32 | 2.36 | 1851.21 |
| .0036 | 277.8 | 1.48 | 234.98 | 1.58 | 309.99 | 1.77 | 500.39 | 1.95 | 749.70 | 2.12 | 1063.68 | 2.28 | 1447.72 | 2.43 | 1906.96 |
| .0038 | 263.2 | 1.52 | 241.75 | 1.62 | 318.91 | 1.82 | 514.74 | 2.00 | 771.15 | 2.18 | 1094.04 | 2.34 | 1488.97 | 2.50 | 1961.21 |
| .0040 | 250.0 | 1.56 | 248.36 | 1.67 | 327.61 | 1.87 | 528.73 | 2.06 | 792.05 | 2.24 | 1123.63 | 2.40 | 1529.17 | 2.56 | 2014.07 |
| .0042 | 238.1 | 1.60 | 254.80 | 1.71 | 336.09 | 1.92 | 542.38 | 2.11 | 812.45 | 2.29 | 1152.50 | 2.47 | 1568.39 | 2.63 | 2065.64 |
| .0044 | 227.3 | 1.64 | 261.10 | 1.75 | 344.39 | 1.97 | 555.72 | 2.16 | 832.37 | 2.35 | 1180.70 | 2.53 | 1606.69 | 2.69 | 2116.01 |
| .0046 | 217.4 | 1.68 | 267.26 | 1.80 | 352.49 | 2.01 | 568.76 | 2.21 | 851.86 | 2.40 | 1208.28 | 2.58 | 1644.15 | 2.76 | 2165.27 |
| .0048 | 208.3 | 1.72 | 273.29 | 1.84 | 360.43 | 2.06 | 581.53 | 2.26 | 870.93 | 2.46 | 1235.27 | 2.64 | 1680.82 | 2.82 | 2213.48 |
| .0050 | 200.0 | 1.76 | 279.20 | 1.88 | 368.21 | 2.10 | 594.03 | 2.31 | 889.61 | 2.51 | 1261.72 | 2.70 | 1716.73 | 2.88 | 2260.70 |
| .0055 | 181.8 | 1.85 | 293.48 | 1.97 | 387.00 | 2.21 | 624.26 | 2.43 | 934.77 | 2.64 | 1325.63 | 2.83 | 1803.54 | 3.02 | 2374.84 |
| .0060 | 166.7 | 1.93 | 307.13 | 2.06 | 404.98 | 2.31 | 653.17 | 2.54 | 977.94 | 2.76 | 1386.73 | 2.97 | 1886.53 | 3.16 | 2483.95 |
| .0065 | 153.8 | 2.01 | 320.24 | 2.15 | 422.23 | 2.41 | 680.91 | 2.65 | 1019.38 | 2.88 | 1445.37 | 3.09 | 1966.16 | 3.30 | 2588.64 |
| .0070 | 142.9 | 2.09 | 332.87 | 2.24 | 438.85 | 2.50 | 707.62 | 2.75 | 1059.27 | 2.99 | 1501.82 | 3.21 | 2042.82 | 3.42 | 2689.42 |
| .0075 | 133.3 | 2.17 | 345.05 | 2.32 | 454.89 | 2.59 | 733.41 | 2.85 | 1097.78 | 3.10 | 1556.31 | 3.33 | 2116.81 | 3.55 | 2786.70 |
| .0080 | 125.0 | 2.24 | 356.85 | 2.40 | 470.41 | 2.68 | 758.36 | 2.95 | 1135.04 | 3.20 | 1609.02 | 3.44 | 2188.40 | 3.67 | 2880.81 |
| .0085 | 117.6 | 2.32 | 368.28 | 2.47 | 485.46 | 2.77 | 782.55 | 3.04 | 1171.16 | 3.30 | 1660.14 | 3.55 | 2257.80 | 3.78 | 2972.05 |
| .0090 | 111.1 | 2.39 | 379.39 | 2.55 | 500.07 | 2.85 | 806.05 | 3.13 | 1206.25 | 3.40 | 1709.78 | 3.65 | 2325.21 | 3.90 | 3060.66 |
| .0095 | 105.3 | 2.45 | 390.20 | 2.62 | 514.30 | 2.93 | 828.91 | 3.22 | 1240.38 | 3.50 | 1758.07 | 3.76 | 2390.79 | 4.01 | 3146.86 |
| .0100 | 100.0 | 2.52 | 400.74 | 2.69 | 528.16 | 3.01 | 851.19 | 3.31 | 1273.64 | 3.59 | 1805.13 | 3.86 | 2454.67 | 4.11 | 3230.84 |
| .0110 | 90.9 | 2.65 | 421.05 | 2.83 | 554.88 | 3.16 | 894.14 | 3.48 | 1337.77 | 3.77 | 1895.85 | 4.05 | 2577.86 | 4.32 | 3392.77 |
| .0120 | 83.3 | 2.77 | 440.47 | 2.96 | 580.43 | 3.31 | 935.20 | 3.64 | 1399.07 | 3.94 | 1982.58 | 4.24 | 2695.60 | 4.52 | 3547.53 |
| .0130 | 76.9 | 2.89 | 459.11 | 3.08 | 604.95 | 3.45 | 974.60 | 3.79 | 1457.89 | 4.11 | 2065.78 | 4.41 | 2808.57 | 4.71 | 3696.02 |
| .0140 | 71.4 | 3.00 | 477.05 | 3.20 | 628.55 | 3.58 | 1012.52 | 3.94 | 1514.51 | 4.27 | 2145.87 | 4.59 | 2917.29 | 4.89 | 3838.92 |
| .0150 | 66.7 | 3.11 | 494.36 | 3.32 | 651.34 | 3.71 | 1049.13 | 4.08 | 1569.15 | 4.42 | 2223.16 | 4.75 | 3022.22 | 5.06 | 3976.84 |
| .0160 | 62.5 | 3.21 | 511.12 | 3.43 | 673.38 | 3.84 | 1084.54 | 4.21 | 1622.01 | 4.57 | 2297.93 | 4.91 | 3123.73 | 5.23 | 4110.25 |
| .0170 | 58.8 | 3.32 | 527.36 | 3.54 | 694.74 | 3.96 | 1118.87 | 4.35 | 1673.25 | 4.72 | 2370.41 | 5.06 | 3222.13 | 5.40 | 4239.58 |
| .0180 | 55.6 | 3.42 | 543.14 | 3.64 | 715.50 | 4.08 | 1152.22 | 4.48 | 1723.02 | 4.86 | 2440.81 | 5.22 | 3317.69 | 5.56 | 4365.18 |
| .0190 | 52.6 | 3.51 | 558.49 | 3.75 | 735.69 | 4.19 | 1184.65 | 4.60 | 1771.43 | 4.99 | 2509.28 | 5.36 | 3410.65 | 5.71 | 4487.35 |
| .0200 | 50.0 | 3.61 | 573.44 | 3.85 | 755.36 | 4.30 | 1216.25 | 4.73 | 1818.60 | 5.12 | 2575.99 | 5.50 | 3501.20 | 5.86 | 4606.35 |
| .0220 | 45.5 | 3.79 | 602.27 | 4.04 | 793.28 | 4.52 | 1277.18 | 4.96 | 1909.53 | 5.38 | 2704.59 | 5.78 | 3675.78 | 6.16 | 4835.80 |
| .0240 | 41.7 | 3.96 | 629.83 | 4.22 | 829.53 | 4.72 | 1335.41 | 5.19 | 1996.43 | 5.63 | 2827.51 | 6.04 | 3842.63 | 6.44 | 5055.06 |
| .0260 | 38.5 | 4.13 | 656.27 | 4.40 | 864.31 | 4.92 | 1391.27 | 5.40 | 2079.81 | 5.86 | 2945.42 | 6.29 | 4002.68 | 6.70 | 5265.41 |
| .0280 | 35.7 | 4.29 | 681.72 | 4.57 | 897.78 | 5.11 | 1445.04 | 5.61 | 2160.04 | 6.09 | 3058.89 | 6.53 | 4156.71 | 6.96 | 5467.83 |
| .0300 | 33.3 | 4.44 | 706.28 | 4.74 | 930.09 | 5.29 | 1496.92 | 5.81 | 2237.48 | 6.30 | 3168.40 | 6.77 | 4305.35 | 7.21 | 5663.17 |
| .0320 | 31.2 | 4.59 | 730.05 | 4.90 | 961.34 | 5.47 | 1547.12 | 6.01 | 2312.38 | 6.51 | 3274.33 | 6.99 | 4449.13 | 7.45 | 5852.12 |
| .0340 | 29.4 | 4.74 | 753.08 | 5.05 | 991.63 | 5.64 | 1595.77 | 6.20 | 2384.98 | 6.72 | 3377.00 | 7.21 | 4588.50 | 7.68 | 6035.26 |
| .0360 | 27.8 | 4.88 | 775.45 | 5.20 | 1021.05 | 5.81 | 1643.02 | 6.38 | 2455.49 | 6.92 | 3476.71 | 7.43 | 4723.83 | 7.91 | 6213.11 |
| .0380 | 26.3 | 5.01 | 797.21 | 5.35 | 1049.67 | 5.97 | 1688.98 | 6.56 | 2524.08 | 7.11 | 3573.70 | 7.63 | 4855.47 | 8.13 | 6386.10 |
| .0400 | 25.0 | 5.15 | 818.41 | 5.49 | 1077.55 | 6.13 | 1733.75 | 6.73 | 2590.88 | 7.30 | 3668.17 | 7.83 | 4983.70 | 8.35 | 6554.61 |
| .0420 | 23.8 | 5.28 | 839.08 | 5.63 | 1104.74 | 6.29 | 1777.42 | 6.90 | 2656.04 | 7.48 | 3760.32 | 8.03 | 5108.77 | 8.55 | 6718.96 |
| .0440 | 22.7 | 5.40 | 859.27 | 5.76 | 1131.30 | 6.44 | 1820.07 | 7.07 | 2719.68 | 7.66 | 3850.30 | 8.22 | 5230.90 | 8.76 | 6879.45 |
| .0460 | 21.7 | 5.53 | 879.01 | 5.89 | 1157.26 | 6.58 | 1861.76 | 7.23 | 2781.89 | 7.83 | 3938.27 | 8.41 | 5350.30 | 8.96 | 7036.34 |
| .0480 | 20.8 | 5.65 | 898.33 | 6.02 | 1182.66 | 6.73 | 1902.55 | 7.39 | 2842.76 | 8.01 | 4024.35 | 8.59 | 5467.13 | 9.15 | 7189.87 |
| .0500 | 20.0 | 5.77 | 917.25 | 6.15 | 1207.54 | 6.87 | 1942.51 | 7.54 | 2902.38 | 8.17 | 4108.66 | 8.77 | 5581.55 | 9.35 | 7340.24 |
| .0550 | 18.2 | 6.05 | 962.97 | 6.46 | 1267.66 | 7.21 | 2039.05 | 7.92 | 3046.43 | 8.58 | 4312.34 | 9.21 | 5858.01 | 9.81 | 7703.51 |
| .0600 | 16.7 | 6.33 | 1006.66 | 6.75 | 1325.11 | 7.54 | 2131.31 | 8.27 | 3184.08 | 8.97 | 4506.99 | 9.62 | 6122.18 | 10.25 | 8050.65 |
| .0650 | 15.4 | 6.59 | 1048.57 | 7.03 | 1380.22 | 7.85 | 2219.80 | 8.62 | 3316.12 | 9.34 | 4693.69 | 10.02 | 6375.58 | 10.67 | 8383.62 |
| .0700 | 14.3 | 6.85 | 1088.90 | 7.30 | 1433.26 | 8.15 | 2304.96 | 8.95 | 3443.18 | 9.70 | 4873.36 | 10.41 | 6619.42 | 11.08 | 8704.04 |
| .0750 | 13.3 | 7.09 | 1127.82 | 7.56 | 1484.44 | 8.44 | 2387.14 | 9.27 | 3565.79 | 10.04 | 5046.73 | 10.77 | 6854.71 | 11.48 | 9013.22 |
| .0800 | 12.5 | 7.33 | 1165.46 | 7.81 | 1533.94 | 8.72 | 2466.63 | 9.57 | 3684.39 | 10.37 | 5214.42 | 11.13 | 7082.30 | 11.86 | 9312.27 |
| .0850 | 11.8 | 7.56 | 1201.96 | 8.06 | 1581.93 | 9.00 | 2543.68 | 9.87 | 3799.34 | 10.70 | 5376.95 | 11.48 | 7302.89 | 12.23 | 9602.12 |
| .0900 | 11.1 | 7.78 | 1237.39 | 8.29 | 1628.52 | 9.26 | 2618.49 | 10.16 | 3910.96 | 11.01 | 5534.78 | 11.82 | 7517.09 | 12.58 | 9883.58 |
| .0950 | 10.5 | 8.00 | 1271.86 | 8.52 | 1673.85 | 9.52 | 2691.26 | 10.44 | 4019.53 | 11.32 | 5688.29 | 12.14 | 7725.42 | 12.93 | 10157.33 |

**TABLE 27** **PIPE FLOWING AT A PROPORTIONAL DEPTH OF 0.75**

$k_s$ = 1.5mm for velocities less than or equal to 1.0m/s
$k_s$ = 0.6mm for velocities greater than 1.0m/s less than or equal to 1.5m/s
$k_s$ = 0.3mm for velocities greater than 1.5m/s

**100mm to 400mm Nominal Bore**

| Nominal Bore mm | | 100 | | 150 | | 200 | | 225 | | 300 | | 375 | | 400 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hydraulic Gradient | 1 in | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s |
| .0010 | 1000.0 | 0.23 | 1.47 | 0.31 | 4.38 | 0.37 | 9.47 | 0.41 | 12.97 | 0.49 | 27.91 | 0.57 | 50.49 | 0.59 | 59.91 |
| .0011 | 909.1 | 0.24 | 1.55 | 0.32 | 4.60 | 0.39 | 9.94 | 0.43 | 13.61 | 0.52 | 29.29 | 0.60 | 52.98 | 0.62 | 62.87 |
| .0012 | 833.3 | 0.26 | 1.62 | 0.34 | 4.81 | 0.41 | 10.39 | 0.44 | 14.22 | 0.54 | 30.60 | 0.62 | 55.36 | 0.65 | 65.69 |
| .0013 | 769.2 | 0.27 | 1.68 | 0.35 | 5.01 | 0.43 | 10.82 | 0.46 | 14.81 | 0.56 | 31.87 | 0.65 | 57.64 | 0.68 | 68.40 |
| .0014 | 714.3 | 0.28 | 1.75 | 0.37 | 5.20 | 0.44 | 11.23 | 0.48 | 15.38 | 0.58 | 33.09 | 0.67 | 59.84 | 0.70 | 71.01 |
| .0015 | 666.7 | 0.29 | 1.81 | 0.38 | 5.39 | 0.46 | 11.63 | 0.50 | 15.93 | 0.60 | 34.26 | 0.70 | 61.96 | 0.73 | 73.53 |
| .0016 | 625.0 | 0.30 | 1.87 | 0.39 | 5.57 | 0.48 | 12.02 | 0.51 | 16.46 | 0.62 | 35.40 | 0.72 | 64.01 | 0.75 | 75.96 |
| .0017 | 588.2 | 0.31 | 1.93 | 0.40 | 5.74 | 0.49 | 12.39 | 0.53 | 16.97 | 0.64 | 36.50 | 0.74 | 66.00 | 0.77 | 78.32 |
| .0018 | 555.6 | 0.31 | 1.99 | 0.42 | 5.91 | 0.50 | 12.76 | 0.55 | 17.47 | 0.66 | 37.56 | 0.76 | 67.93 | 0.80 | 80.61 |
| .0019 | 526.3 | 0.32 | 2.04 | 0.43 | 6.07 | 0.52 | 13.11 | 0.56 | 17.95 | 0.68 | 38.60 | 0.79 | 69.81 | 0.82 | 82.83 |
| .0020 | 500.0 | 0.33 | 2.10 | 0.44 | 6.23 | 0.53 | 13.46 | 0.58 | 18.42 | 0.70 | 39.62 | 0.81 | 71.64 | 0.84 | 85.00 |
| .0022 | 454.5 | 0.35 | 2.20 | 0.46 | 6.54 | 0.56 | 14.12 | 0.60 | 19.33 | 0.73 | 41.57 | 0.85 | 75.16 | 0.88 | 89.18 |
| .0024 | 416.7 | 0.36 | 2.30 | 0.48 | 6.84 | 0.58 | 14.76 | 0.63 | 20.20 | 0.76 | 43.43 | 0.88 | 78.53 | 0.92 | 93.18 |
| .0026 | 384.6 | 0.38 | 2.40 | 0.50 | 7.12 | 0.61 | 15.36 | 0.66 | 21.03 | 0.80 | 45.22 | 0.92 | 81.76 | 0.96 | 97.01 |
| .0028 | 357.1 | 0.39 | 2.49 | 0.52 | 7.39 | 0.63 | 15.95 | 0.68 | 21.84 | 0.83 | 46.94 | 0.96 | 84.87 | 1.00 | 100.70 |
| .0030 | 333.3 | 0.41 | 2.58 | 0.54 | 7.66 | 0.65 | 16.52 | 0.71 | 22.61 | 0.85 | 48.60 | 0.99 | 87.87 | 1.16 | 117.23 |
| .0032 | 312.5 | 0.42 | 2.66 | 0.56 | 7.91 | 0.68 | 17.06 | 0.73 | 23.36 | 0.88 | 50.21 | 1.15 | 102.17 | 1.20 | 121.13 |
| .0034 | 294.1 | 0.43 | 2.75 | 0.57 | 8.16 | 0.70 | 17.59 | 0.75 | 24.08 | 0.91 | 51.77 | 1.19 | 105.36 | 1.24 | 124.90 |
| .0036 | 277.8 | 0.45 | 2.83 | 0.59 | 8.40 | 0.72 | 18.11 | 0.77 | 24.79 | 0.94 | 53.28 | 1.22 | 108.45 | 1.27 | 128.57 |
| .0038 | 263.2 | 0.46 | 2.91 | 0.61 | 8.63 | 0.74 | 18.61 | 0.80 | 25.47 | 0.96 | 54.75 | 1.25 | 111.46 | 1.31 | 132.14 |
| .0040 | 250.0 | 0.47 | 2.98 | 0.62 | 8.85 | 0.76 | 19.10 | 0.82 | 26.14 | 0.99 | 56.18 | 1.29 | 114.39 | 1.34 | 135.61 |
| .0042 | 238.1 | 0.48 | 3.06 | 0.64 | 9.08 | 0.77 | 19.57 | 0.84 | 26.79 | 1.14 | 65.07 | 1.32 | 117.25 | 1.38 | 139.00 |
| .0044 | 227.3 | 0.50 | 3.13 | 0.65 | 9.29 | 0.79 | 20.04 | 0.86 | 27.43 | 1.17 | 66.62 | 1.35 | 120.05 | 1.41 | 142.31 |
| .0046 | 217.4 | 0.51 | 3.20 | 0.67 | 9.50 | 0.81 | 20.49 | 0.88 | 28.05 | 1.20 | 68.14 | 1.38 | 122.78 | 1.44 | 145.54 |
| .0048 | 208.3 | 0.52 | 3.27 | 0.68 | 9.71 | 0.83 | 20.94 | 0.90 | 28.65 | 1.22 | 69.62 | 1.41 | 125.45 | 1.47 | 148.71 |
| .0050 | 200.0 | 0.53 | 3.34 | 0.70 | 9.91 | 0.85 | 21.37 | 0.91 | 29.25 | 1.25 | 71.08 | 1.44 | 128.06 | 1.62 | 163.88 |
| .0055 | 181.8 | 0.55 | 3.51 | 0.73 | 10.40 | 0.89 | 22.42 | 0.96 | 30.69 | 1.31 | 74.59 | 1.63 | 145.18 | 1.70 | 172.02 |
| .0060 | 166.7 | 0.58 | 3.66 | 0.76 | 10.87 | 0.93 | 23.43 | 1.14 | 36.43 | 1.37 | 77.95 | 1.71 | 151.75 | 1.78 | 179.81 |
| .0065 | 153.8 | 0.60 | 3.81 | 0.80 | 11.31 | 0.97 | 24.39 | 1.19 | 37.94 | 1.43 | 81.17 | 1.78 | 158.05 | 1.85 | 187.27 |
| .0070 | 142.9 | 0.63 | 3.96 | 0.83 | 11.74 | 1.14 | 28.84 | 1.23 | 39.39 | 1.48 | 84.26 | 1.85 | 164.12 | 1.92 | 194.46 |
| .0075 | 133.3 | 0.65 | 4.10 | 0.86 | 12.16 | 1.18 | 29.86 | 1.28 | 40.79 | 1.66 | 94.50 | 1.91 | 169.97 | 1.99 | 201.39 |
| .0080 | 125.0 | 0.67 | 4.24 | 0.88 | 12.56 | 1.22 | 30.86 | 1.32 | 42.15 | 1.72 | 97.66 | 1.98 | 175.64 | 2.06 | 208.09 |
| .0085 | 117.6 | 0.69 | 4.37 | 0.91 | 12.95 | 1.26 | 31.82 | 1.36 | 43.46 | 1.77 | 100.72 | 2.04 | 181.13 | 2.12 | 214.59 |
| .0090 | 111.1 | 0.71 | 4.50 | 0.94 | 13.33 | 1.30 | 32.75 | 1.40 | 44.74 | 1.82 | 103.69 | 2.10 | 186.46 | 2.19 | 220.90 |
| .0095 | 105.3 | 0.73 | 4.62 | 0.96 | 13.70 | 1.33 | 33.66 | 1.44 | 45.97 | 1.87 | 106.57 | 2.16 | 191.64 | 2.25 | 227.04 |
| .0100 | 100.0 | 0.75 | 4.74 | 0.99 | 14.06 | 1.37 | 34.55 | 1.48 | 47.18 | 1.92 | 109.39 | 2.21 | 196.69 | 2.31 | 233.02 |
| .0110 | 90.9 | 0.79 | 4.97 | 1.19 | 16.91 | 1.43 | 36.25 | 1.68 | 53.81 | 2.02 | 114.81 | 2.32 | 206.42 | 2.42 | 244.55 |
| .0120 | 83.3 | 0.82 | 5.20 | 1.24 | 17.67 | 1.50 | 37.88 | 1.76 | 56.24 | 2.11 | 119.99 | 2.43 | 215.72 | 2.53 | 255.56 |
| .0130 | 76.9 | 0.86 | 5.41 | 1.29 | 18.40 | 1.70 | 42.94 | 1.83 | 58.58 | 2.20 | 124.96 | 2.53 | 224.64 | 2.63 | 266.13 |
| .0140 | 71.4 | 0.89 | 5.62 | 1.34 | 19.10 | 1.76 | 44.59 | 1.90 | 60.83 | 2.28 | 129.75 | 2.63 | 233.23 | 2.73 | 276.29 |
| .0150 | 66.7 | 0.92 | 5.82 | 1.39 | 19.78 | 1.83 | 46.18 | 1.97 | 63.00 | 2.36 | 134.36 | 2.72 | 241.51 | 2.83 | 286.10 |
| .0160 | 62.5 | 0.95 | 6.01 | 1.44 | 20.44 | 1.89 | 47.72 | 2.04 | 65.10 | 2.44 | 138.83 | 2.81 | 249.52 | 2.92 | 295.59 |
| .0170 | 58.8 | 0.98 | 6.19 | 1.48 | 21.07 | 1.95 | 49.21 | 2.10 | 67.13 | 2.52 | 143.15 | 2.90 | 257.29 | 3.02 | 304.78 |
| .0180 | 55.6 | 1.17 | 7.38 | 1.67 | 23.70 | 2.00 | 50.66 | 2.16 | 69.10 | 2.59 | 147.36 | 2.98 | 264.83 | 3.10 | 313.71 |
| .0190 | 52.6 | 1.20 | 7.59 | 1.71 | 24.36 | 2.06 | 52.07 | 2.22 | 71.03 | 2.66 | 151.44 | 3.06 | 272.16 | 3.19 | 322.39 |
| .0200 | 50.0 | 1.23 | 7.79 | 1.76 | 25.00 | 2.11 | 53.44 | 2.28 | 72.90 | 2.73 | 155.42 | 3.14 | 279.31 | 3.27 | 330.85 |
| .0220 | 45.5 | 1.29 | 8.17 | 1.85 | 26.24 | 2.22 | 56.09 | 2.39 | 76.50 | 2.87 | 163.10 | 3.30 | 293.08 | 3.43 | 347.16 |
| .0240 | 41.7 | 1.35 | 8.54 | 1.93 | 27.43 | 2.32 | 58.61 | 2.50 | 79.95 | 3.00 | 170.43 | 3.45 | 306.24 | 3.59 | 362.74 |
| .0260 | 38.5 | 1.41 | 8.89 | 2.01 | 28.57 | 2.42 | 61.04 | 2.60 | 83.25 | 3.12 | 177.46 | 3.59 | 318.86 | 3.74 | 377.68 |
| .0280 | 35.7 | 1.46 | 9.23 | 2.09 | 29.66 | 2.51 | 63.37 | 2.70 | 86.43 | 3.24 | 184.23 | 3.73 | 331.00 | 3.88 | 392.06 |
| .0300 | 33.3 | 1.66 | 10.50 | 2.16 | 30.72 | 2.60 | 65.63 | 2.80 | 89.50 | 3.35 | 190.76 | 3.86 | 342.72 | 4.02 | 405.94 |
| .0320 | 31.2 | 1.72 | 10.85 | 2.23 | 31.74 | 2.68 | 67.81 | 2.89 | 92.47 | 3.47 | 197.07 | 3.99 | 354.05 | 4.15 | 419.36 |
| .0340 | 29.4 | 1.77 | 11.19 | 2.30 | 32.73 | 2.77 | 69.92 | 2.98 | 95.35 | 3.57 | 203.20 | 4.11 | 365.04 | 4.28 | 432.37 |
| .0360 | 27.8 | 1.82 | 11.52 | 2.37 | 33.69 | 2.85 | 71.97 | 3.07 | 98.14 | 3.68 | 209.14 | 4.23 | 375.70 | 4.40 | 445.00 |
| .0380 | 26.3 | 1.87 | 11.84 | 2.44 | 34.63 | 2.93 | 73.96 | 3.15 | 100.86 | 3.78 | 214.92 | 4.35 | 386.08 | 4.52 | 457.28 |
| .0400 | 25.0 | 1.92 | 12.16 | 2.50 | 35.54 | 3.00 | 75.90 | 3.24 | 103.51 | 3.88 | 220.55 | 4.46 | 396.18 | 4.64 | 469.25 |
| .0420 | 23.8 | 1.97 | 12.46 | 2.56 | 36.43 | 3.08 | 77.80 | 3.32 | 106.09 | 3.98 | 226.04 | 4.57 | 406.04 | 4.76 | 480.92 |
| .0440 | 22.7 | 2.02 | 12.76 | 2.62 | 37.29 | 3.15 | 79.65 | 3.40 | 108.61 | 4.07 | 231.41 | 4.68 | 415.66 | 4.87 | 492.31 |
| .0460 | 21.7 | 2.07 | 13.05 | 2.68 | 38.14 | 3.22 | 81.46 | 3.47 | 111.07 | 4.16 | 236.65 | 4.78 | 425.07 | 4.98 | 503.45 |
| .0480 | 20.8 | 2.11 | 13.33 | 2.74 | 38.97 | 3.29 | 83.22 | 3.55 | 113.48 | 4.25 | 241.78 | 4.89 | 434.27 | 5.09 | 514.35 |
| .0500 | 20.0 | 2.15 | 13.61 | 2.80 | 39.79 | 3.36 | 84.96 | 3.62 | 115.85 | 4.34 | 246.80 | 4.99 | 443.29 | 5.19 | 525.02 |
| .0550 | 18.2 | 2.26 | 14.29 | 2.94 | 41.75 | 3.53 | 89.14 | 3.80 | 121.55 | 4.55 | 258.94 | 5.23 | 465.07 | 5.45 | 550.81 |
| .0600 | 16.7 | 2.36 | 14.93 | 3.07 | 43.63 | 3.69 | 93.14 | 3.97 | 127.00 | 4.76 | 270.54 | 5.47 | 485.88 | 5.69 | 575.45 |
| .0650 | 15.4 | 2.46 | 15.55 | 3.20 | 45.43 | 3.84 | 96.98 | 4.13 | 132.23 | 4.95 | 281.66 | 5.69 | 505.84 | 5.93 | 599.09 |
| .0700 | 14.3 | 2.56 | 16.14 | 3.32 | 47.16 | 3.98 | 100.67 | 4.29 | 137.26 | 5.14 | 292.36 | 5.91 | 525.04 | 6.15 | 621.83 |
| .0750 | 13.3 | 2.65 | 16.72 | 3.43 | 48.83 | 4.12 | 104.23 | 4.44 | 142.11 | 5.32 | 302.69 | 6.12 | 543.57 | 6.37 | 643.77 |
| .0800 | 12.5 | 2.73 | 17.27 | 3.55 | 50.45 | 4.26 | 107.68 | 4.59 | 146.81 | 5.50 | 312.68 | 6.32 | 561.50 | 6.58 | 664.99 |
| .0850 | 11.8 | 2.82 | 17.81 | 3.66 | 52.01 | 4.39 | 111.02 | 4.73 | 151.36 | 5.67 | 322.36 | 6.52 | 578.87 | 6.78 | 685.56 |
| .0900 | 11.1 | 2.90 | 18.33 | 3.77 | 53.53 | 4.52 | 114.26 | 4.87 | 155.78 | 5.83 | 331.76 | 6.71 | 595.74 | 6.98 | 705.53 |
| .0950 | 10.5 | 2.98 | 18.84 | 3.87 | 55.01 | 4.65 | 117.42 | 5.00 | 160.08 | 6.00 | 340.90 | 6.89 | 612.14 | 7.17 | 724.96 |

**TABLE 27** *(continued)* **PIPE FLOWING AT A PROPORTIONAL DEPTH OF 0.75**

$k_S$ = 1.5mm for velocities less than or equal to 1.0m/s
$k_S$ = 0.6mm for velocities greater than 1.0m/s less than or equal to 1.5m/s
$k_S$ = 0.3mm for velocities greater than 1.5m/s

**450mm to 1000mm Nominal Bore**

| Nominal Bore mm | | 450 | | 500 | | 600 | | 700 | | 800 | | 900 | | 1000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hydraulic Gradient | 1 in | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s |
| .0010 | 1000.0 | 0.64 | 81.87 | 0.69 | 108.21 | 0.77 | 175.25 | 0.85 | 263.30 | 0.93 | 374.47 | 1.00 | 510.75 | 1.18 | 747.57 |
| .0011 | 909.1 | 0.67 | 85.90 | 0.72 | 113.54 | 0.81 | 183.88 | 0.89 | 276.25 | 0.97 | 392.87 | 1.16 | 595.08 | 1.24 | 784.54 |
| .0012 | 833.3 | 0.70 | 89.76 | 0.75 | 118.64 | 0.84 | 192.12 | 0.93 | 288.62 | 1.13 | 456.50 | 1.22 | 621.90 | 1.30 | 819.86 |
| .0013 | 769.2 | 0.73 | 93.46 | 0.78 | 123.52 | 0.88 | 200.03 | 0.97 | 300.49 | 1.18 | 475.40 | 1.27 | 647.61 | 1.35 | 853.74 |
| .0014 | 714.3 | 0.76 | 97.02 | 0.81 | 128.22 | 0.91 | 207.63 | 1.12 | 347.56 | 1.22 | 493.58 | 1.31 | 672.36 | 1.40 | 886.34 |
| .0015 | 666.7 | 0.79 | 100.45 | 0.84 | 132.76 | 0.95 | 214.97 | 1.16 | 359.92 | 1.26 | 511.12 | 1.36 | 696.24 | 1.45 | 917.79 |
| .0016 | 625.0 | 0.81 | 103.77 | 0.87 | 137.15 | 0.98 | 222.07 | 1.20 | 371.88 | 1.31 | 528.09 | 1.41 | 719.34 | 1.61 | 1014.83 |
| .0017 | 588.2 | 0.84 | 106.99 | 0.90 | 141.40 | 1.12 | 255.71 | 1.24 | 383.48 | 1.35 | 544.54 | 1.45 | 741.72 | 1.66 | 1046.63 |
| .0018 | 555.6 | 0.86 | 110.12 | 0.92 | 145.53 | 1.16 | 263.22 | 1.28 | 394.73 | 1.39 | 560.51 | 1.49 | 763.46 | 1.71 | 1077.50 |
| .0019 | 526.3 | 0.88 | 113.16 | 0.95 | 149.55 | 1.19 | 270.53 | 1.31 | 405.68 | 1.42 | 576.04 | 1.64 | 840.61 | 1.75 | 1107.53 |
| .0020 | 500.0 | 0.91 | 116.12 | 0.97 | 153.46 | 1.22 | 277.65 | 1.34 | 416.35 | 1.46 | 591.17 | 1.69 | 862.83 | b.80 | 1136.79 |
| .0022 | 454.5 | 0.95 | 121.83 | 1.14 | 180.35 | 1.28 | 291.38 | 1.41 | 436.90 | 1.65 | 665.31 | 1.77 | 905.68 | 1.89 | 1193.18 |
| .0024 | 416.7 | 0.99 | 127.29 | 1.19 | 188.48 | 1.34 | 304.49 | 1.47 | 456.55 | 1.72 | 695.42 | 1.85 | 946.62 | 1.97 | 1247.08 |
| .0026 | 384.6 | 1.16 | 148.72 | 1.24 | 196.28 | 1.39 | 317.07 | 1.65 | 510.47 | 1.79 | 724.30 | 1.93 | 985.89 | 2.06 | 1298.77 |
| .0028 | 357.1 | 1.21 | 154.41 | 1.29 | 203.78 | 1.45 | 329.18 | 1.71 | 530.09 | 1.86 | 752.09 | 2.00 | 1023.69 | 2.13 | 1348.51 |
| .0030 | 333.3 | 1.25 | 159.90 | 1.34 | 211.02 | 1.50 | 340.86 | 1.77 | 549.01 | 1.93 | 778.91 | 2.07 | 1060.16 | 2.21 | 1396.51 |
| .0032 | 312.5 | 1.29 | 165.21 | 1.38 | 218.02 | 1.67 | 378.71 | 1.83 | 567.32 | 1.99 | 804.86 | 2.14 | 1095.43 | 2.28 | 1442.94 |
| .0034 | 294.1 | 1.33 | 170.35 | 1.42 | 224.81 | 1.72 | 390.57 | 1.89 | 585.06 | 2.05 | 830.00 | 2.21 | 1129.62 | 2.36 | 1487.94 |
| .0036 | 277.8 | 1.37 | 175.35 | 1.47 | 231.40 | 1.77 | 402.09 | 1.95 | 602.29 | 2.11 | 854.42 | 2.27 | 1162.82 | 2.42 | 1531.64 |
| .0038 | 263.2 | 1.41 | 180.21 | 1.62 | 256.14 | 1.82 | 413.29 | 2.00 | 619.05 | 2.17 | 878.16 | 2.34 | 1195.11 | 2.49 | 1574.14 |
| .0040 | 250.0 | 1.45 | 184.94 | 1.66 | 262.91 | 1.87 | 424.21 | 2.05 | 635.37 | 2.23 | 901.30 | 2.40 | 1226.56 | 2.56 | 1615.54 |
| .0042 | 238.1 | 1.48 | 189.56 | 1.71 | 269.52 | 1.91 | 434.85 | 2.10 | 651.29 | 2.28 | 923.86 | 2.46 | 1257.24 | 2.62 | 1655.91 |
| .0044 | 227.3 | 1.64 | 209.27 | 1.75 | 275.97 | 1.96 | 445.24 | 2.15 | 666.84 | 2.34 | 945.89 | 2.52 | 1287.20 | 2.68 | 1695.34 |
| .0046 | 217.4 | 1.67 | 214.06 | 1.79 | 282.28 | 2.00 | 455.40 | 2.20 | 682.04 | 2.39 | 967.42 | 2.57 | 1316.48 | 2.74 | 1733.88 |
| .0048 | 208.3 | 1.71 | 218.74 | 1.83 | 288.45 | 2.05 | 465.35 | 2.25 | 696.91 | 2.44 | 988.50 | 2.63 | 1345.14 | 2.80 | 1771.60 |
| .0050 | 200.0 | 1.75 | 223.33 | 1.86 | 294.50 | 2.09 | 475.08 | 2.30 | 711.48 | 2.50 | 1009.14 | 2.68 | 1373.20 | 2.86 | 1808.53 |
| .0055 | 181.8 | 1.83 | 234.42 | 1.96 | 309.11 | 2.19 | 498.61 | 2.41 | 746.67 | 2.62 | 1059.00 | 2.82 | 1441.00 | 3.00 | 1897.77 |
| .0060 | 166.7 | 1.92 | 245.01 | 2.05 | 323.06 | 2.29 | 521.09 | 2.52 | 780.29 | 2.74 | 1106.65 | 2.94 | 1505.79 | 3.14 | 1983.04 |
| .0065 | 153.8 | 1.99 | 255.17 | 2.13 | 336.45 | 2.39 | 542.65 | 2.62 | 812.54 | 2.85 | 1152.35 | 3.06 | 1567.93 | 3.27 | 2064.82 |
| .0070 | 142.9 | 2.07 | 264.95 | 2.21 | 349.33 | 2.48 | 563.40 | 2.72 | 843.58 | 2.96 | 1196.33 | 3.18 | 1627.72 | 3.39 | 2143.52 |
| .0075 | 133.3 | 2.14 | 274.39 | 2.29 | 361.76 | 2.57 | 583.42 | 2.82 | 873.53 | 3.06 | 1238.76 | 3.29 | 1685.42 | 3.51 | 2219.46 |
| .0080 | 125.0 | 2.22 | 283.51 | 2.37 | 373.79 | 2.65 | 602.79 | 2.92 | 902.49 | 3.17 | 1279.81 | 3.40 | 1741.22 | 3.63 | 2292.91 |
| .0085 | 117.6 | 2.29 | 292.36 | 2.44 | 385.44 | 2.73 | 621.56 | 3.01 | 930.57 | 3.26 | 1319.59 | 3.51 | 1795.31 | 3.74 | 2364.09 |
| .0090 | 111.1 | 2.35 | 300.95 | 2.51 | 396.76 | 2.81 | 639.78 | 3.09 | 957.83 | 3.36 | 1358.22 | 3.61 | 1847.83 | 3.85 | 2433.22 |
| .0095 | 105.3 | 2.42 | 309.30 | 2.58 | 407.76 | 2.89 | 657.51 | 3.18 | 984.34 | 3.45 | 1395.79 | 3.71 | 1898.91 | 3.96 | 2500.45 |
| .0100 | 100.0 | 2.48 | 317.44 | 2.65 | 418.48 | 2.97 | 674.77 | 3.26 | 1010.17 | 3.54 | 1432.38 | 3.81 | 1948.67 | 4.06 | 2565.93 |
| .0110 | 90.9 | 2.60 | 333.13 | 2.78 | 439.15 | 3.11 | 708.06 | 3.42 | 1059.95 | 3.72 | 1502.92 | 4.00 | 2044.58 | 4.26 | 2692.16 |
| .0120 | 83.3 | 2.72 | 348.12 | 2.91 | 458.90 | 3.25 | 739.86 | 3.58 | 1107.52 | 3.88 | 1570.33 | 4.17 | 2136.23 | 4.45 | 2812.78 |
| .0130 | 76.9 | 2.83 | 362.50 | 3.03 | 477.84 | 3.39 | 770.37 | 3.72 | 1153.15 | 4.04 | 1634.98 | 4.35 | 2224.13 | 4.64 | 2928.47 |
| .0140 | 71.4 | 2.94 | 376.33 | 3.14 | 496.06 | 3.52 | 799.72 | 3.87 | 1197.05 | 4.20 | 1697.19 | 4.51 | 2308.71 | 4.81 | 3039.79 |
| .0150 | 66.7 | 3.05 | 389.68 | 3.25 | 513.65 | 3.64 | 828.05 | 4.00 | 1239.42 | 4.35 | 1757.21 | 4.67 | 2390.33 | 4.98 | 3147.20 |
| .0160 | 62.5 | 3.15 | 402.60 | 3.36 | 530.66 | 3.76 | 855.44 | 4.14 | 1280.39 | 4.49 | 1815.27 | 4.83 | 2469.27 | 5.15 | 3251.09 |
| .0170 | 58.8 | 3.24 | 415.11 | 3.46 | 547.15 | 3.88 | 881.99 | 4.26 | 1320.11 | 4.63 | 1871.54 | 4.97 | 2545.77 | 5.31 | 3351.78 |
| .0180 | 55.6 | 3.34 | 427.27 | 3.57 | 563.16 | 3.99 | 907.78 | 4.39 | 1358.67 | 4.76 | 1926.18 | 5.12 | 2620.06 | 5.46 | 3449.55 |
| .0190 | 52.6 | 3.43 | 439.09 | 3.66 | 578.73 | 4.10 | 932.85 | 4.51 | 1396.17 | 4.90 | 1979.33 | 5.26 | 2692.32 | 5.61 | 3544.65 |
| .0200 | 50.0 | 3.52 | 450.60 | 3.76 | 593.89 | 4.21 | 957.28 | 4.63 | 1432.71 | 5.02 | 2031.09 | 5.40 | 2762.69 | 5.76 | 3637.27 |
| .0220 | 45.5 | 3.70 | 472.79 | 3.95 | 623.13 | 4.42 | 1004.36 | 4.86 | 1503.13 | 5.27 | 2130.87 | 5.66 | 2898.36 | 6.04 | 3815.81 |
| .0240 | 41.7 | 3.86 | 494.00 | 4.12 | 651.06 | 4.61 | 1049.35 | 5.07 | 1570.41 | 5.51 | 2226.21 | 5.92 | 3027.98 | 6.31 | 3986.41 |
| .0260 | 38.5 | 4.02 | 514.34 | 4.29 | 677.86 | 4.80 | 1092.50 | 5.28 | 1634.95 | 5.73 | 2317.65 | 6.16 | 3152.31 | 6.57 | 4150.04 |
| .0280 | 35.7 | 4.17 | 533.91 | 4.45 | 703.64 | 4.99 | 1134.02 | 5.48 | 1697.05 | 5.95 | 2405.64 | 6.39 | 3271.94 | 6.82 | 4307.49 |
| .0300 | 33.3 | 4.32 | 552.79 | 4.61 | 728.52 | 5.16 | 1174.08 | 5.68 | 1756.97 | 6.16 | 2490.54 | 6.62 | 3387.38 | 7.06 | 4459.41 |
| .0320 | 31.2 | 4.46 | 571.06 | 4.76 | 752.58 | 5.33 | 1212.83 | 5.86 | 1814.93 | 6.36 | 2572.66 | 6.84 | 3499.02 | 7.29 | 4606.34 |
| .0340 | 29.4 | 4.60 | 588.76 | 4.91 | 775.90 | 5.50 | 1250.39 | 6.04 | 1871.10 | 6.56 | 2652.25 | 7.05 | 3607.23 | 7.52 | 4748.76 |
| .0360 | 27.8 | 4.74 | 605.95 | 5.06 | 798.54 | 5.66 | 1286.85 | 6.22 | 1925.64 | 6.75 | 2729.53 | 7.25 | 3712.31 | 7.74 | 4887.04 |
| .0380 | 26.3 | 4.87 | 622.67 | 5.20 | 820.56 | 5.81 | 1322.32 | 6.39 | 1978.69 | 6.94 | 2804.69 | 7.45 | 3814.50 | 7.95 | 5021.53 |
| .0400 | 25.0 | 4.99 | 638.96 | 5.33 | 842.02 | 5.97 | 1356.87 | 6.56 | 2030.36 | 7.12 | 2877.90 | 7.65 | 3914.03 | 8.16 | 5152.53 |
| .0420 | 23.8 | 5.12 | 654.84 | 5.46 | 862.94 | 6.11 | 1390.56 | 6.72 | 2080.75 | 7.29 | 2949.30 | 7.84 | 4011.11 | 8.36 | 5280.29 |
| .0440 | 22.7 | 5.24 | 670.35 | 5.59 | 883.37 | 6.26 | 1423.46 | 6.88 | 2129.96 | 7.47 | 3019.02 | 8.02 | 4105.90 | 8.56 | 5405.05 |
| .0460 | 21.7 | 5.36 | 685.51 | 5.72 | 903.34 | 6.40 | 1455.62 | 7.04 | 2178.06 | 7.63 | 3087.18 | 8.20 | 4198.57 | 8.75 | 5527.00 |
| .0480 | 20.8 | 5.47 | 700.34 | 5.84 | 922.88 | 6.54 | 1487.09 | 7.19 | 2225.12 | 7.80 | 3153.87 | 8.38 | 4289.24 | 8.94 | 5646.33 |
| .0500 | 20.0 | 5.59 | 714.87 | 5.96 | 942.02 | 6.67 | 1517.91 | 7.34 | 2271.22 | 7.96 | 3219.18 | 8.55 | 4378.04 | 9.12 | 5763.20 |
| .0550 | 18.2 | 5.86 | 749.97 | 6.26 | 988.25 | 7.00 | 1592.37 | 7.70 | 2382.58 | 8.35 | 3376.96 | 8.97 | 4592.56 | 9.57 | 6045.52 |
| .0600 | 16.7 | 6.12 | 783.50 | 6.54 | 1032.43 | 7.31 | 1663.51 | 8.04 | 2488.98 | 8.72 | 3527.72 | 9.37 | 4797.53 | 10.00 | 6315.29 |
| .0650 | 15.4 | 6.38 | 815.67 | 6.80 | 1074.80 | 7.61 | 1731.75 | 8.37 | 2591.03 | 9.08 | 3672.32 | 9.76 | 4994.13 | 10.41 | 6574.02 |
| .0700 | 14.3 | 6.62 | 846.62 | 7.06 | 1115.57 | 7.90 | 1797.40 | 8.69 | 2689.23 | 9.43 | 3811.46 | 10.13 | 5183.30 | 10.80 | 6822.99 |
| .0750 | 13.3 | 6.85 | 876.49 | 7.31 | 1154.91 | 8.18 | 1860.76 | 8.99 | 2783.98 | 9.76 | 3945.71 | 10.49 | 5365.83 | 11.18 | 7063.21 |
| .0800 | 12.5 | 7.08 | 905.37 | 7.55 | 1192.95 | 8.45 | 1922.03 | 9.29 | 2875.63 | 10.08 | 4075.56 | 10.83 | 5542.37 | 11.55 | 7295.55 |
| .0850 | 11.8 | 7.30 | 933.37 | 7.79 | 1229.83 | 8.71 | 1981.42 | 9.58 | 2964.45 | 10.39 | 4201.41 | 11.16 | 5713.48 | 11.90 | 7520.74 |
| .0900 | 11.1 | 7.51 | 960.55 | 8.01 | 1265.64 | 8.97 | 2039.08 | 9.85 | 3050.69 | 10.69 | 4323.61 | 11.49 | 5879.62 | 12.25 | 7739.39 |
| .0950 | 10.5 | 7.71 | 986.99 | 8.23 | 1300.47 | 9.21 | 2095.17 | 10.13 | 3134.58 | 10.99 | 4442.46 | 11.80 | 6041.21 | 12.59 | 7952.06 |

**TABLE 28 PIPE FLOWING FULL**

$k_s$ = 1.5mm for velocities less than or equal to 1.0m/s
$k_s$ = 0.6mm for velocities greater than 1.0m/s less than or equal to 1.5m/s
$k_s$ = 0.3mm for velocities greater than 1.5m/s

**100mm to 400mm Nominal Bore**

| Nominal Bore mm | | 100 | | 150 | | 200 | | 225 | | 300 | | 375 | | 400 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hydraulic Gradient | 1 in | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s |
| .0010 | 1000.0 | 0.21 | 1.62 | 0.27 | 4.82 | 0.33 | 10.42 | 0.36 | 14.27 | 0.43 | 30.70 | 0.50 | 55.54 | 0.52 | 65.91 |
| .0011 | 909.1 | 0.22 | 1.70 | 0.29 | 5.06 | 0.35 | 10.93 | 0.38 | 14.97 | 0.46 | 32.22 | 0.53 | 58.28 | 0.55 | 69.16 |
| .0012 | 833.3 | 0.23 | 1.78 | 0.30 | 5.29 | 0.36 | 11.43 | 0.39 | 15.65 | 0.48 | 33.67 | 0.55 | 60.90 | 0.58 | 72.27 |
| .0013 | 769.2 | 0.24 | 1.85 | 0.31 | 5.51 | 0.38 | 11.90 | 0.41 | 16.30 | 0.50 | 35.06 | 0.57 | 63.41 | 0.60 | 75.25 |
| .0014 | 714.3 | 0.24 | 1.92 | 0.32 | 5.72 | 0.39 | 12.36 | 0.43 | 16.92 | 0.51 | 36.40 | 0.60 | 65.83 | 0.62 | 78.12 |
| .0015 | 666.7 | 0.25 | 1.99 | 0.34 | 5.93 | 0.41 | 12.80 | 0.44 | 17.52 | 0.53 | 37.69 | 0.62 | 68.16 | 0.64 | 80.89 |
| .0016 | 625.0 | 0.26 | 2.06 | 0.35 | 6.12 | 0.42 | 13.22 | 0.46 | 18.10 | 0.55 | 38.94 | 0.64 | 70.42 | 0.66 | 83.56 |
| .0017 | 588.2 | 0.27 | 2.12 | 0.36 | 6.32 | 0.43 | 13.63 | 0.47 | 18.67 | 0.57 | 40.15 | 0.66 | 72.61 | 0.69 | 86.16 |
| .0018 | 555.6 | 0.28 | 2.19 | 0.37 | 6.50 | 0.45 | 14.03 | 0.48 | 19.22 | 0.58 | 41.33 | 0.68 | 74.73 | 0.71 | 88.68 |
| .0019 | 526.3 | 0.29 | 2.25 | 0.38 | 6.68 | 0.46 | 14.42 | 0.50 | 19.75 | 0.60 | 42.47 | 0.70 | 76.80 | 0.73 | 91.13 |
| .0020 | 500.0 | 0.29 | 2.31 | 0.39 | 6.86 | 0.47 | 14.80 | 0.51 | 20.27 | 0.62 | 43.58 | 0.71 | 78.81 | 0.74 | 93.51 |
| .0022 | 454.5 | 0.31 | 2.42 | 0.41 | 7.20 | 0.49 | 15.53 | 0.53 | 21.27 | 0.65 | 45.73 | 0.75 | 82.68 | 0.78 | 98.11 |
| .0024 | 416.7 | 0.32 | 2.53 | 0.43 | 7.52 | 0.52 | 16.23 | 0.56 | 22.22 | 0.68 | 47.78 | 0.78 | 86.39 | 0.82 | 102.51 |
| .0026 | 384.6 | 0.34 | 2.64 | 0.44 | 7.83 | 0.54 | 16.90 | 0.58 | 23.14 | 0.70 | 49.75 | 0.81 | 89.94 | 0.85 | 106.72 |
| .0028 | 357.1 | 0.35 | 2.74 | 0.46 | 8.13 | 0.56 | 17.55 | 0.60 | 24.02 | 0.73 | 51.64 | 0.85 | 93.36 | 0.88 | 110.78 |
| .0030 | 333.3 | 0.36 | 2.84 | 0.48 | 8.42 | 0.58 | 18.17 | 0.63 | 24.87 | 0.76 | 53.47 | 0.88 | 96.66 | 0.91 | 114.69 |
| .0032 | 312.5 | 0.37 | 2.93 | 0.49 | 8.70 | 0.60 | 18.77 | 0.65 | 25.70 | 0.78 | 55.24 | 0.90 | 99.85 | 0.94 | 118.48 |
| .0034 | 294.1 | 0.38 | 3.02 | 0.51 | 8.97 | 0.62 | 19.35 | 0.67 | 26.49 | 0.81 | 56.95 | 0.93 | 102.95 | 0.97 | 122.15 |
| .0036 | 277.8 | 0.40 | 3.11 | 0.52 | 9.24 | 0.63 | 19.92 | 0.69 | 27.27 | 0.83 | 58.61 | 0.96 | 105.95 | 1.13 | 141.44 |
| .0038 | 263.2 | 0.41 | 3.20 | 0.54 | 9.49 | 0.65 | 20.47 | 0.70 | 28.02 | 0.85 | 60.23 | 0.99 | 108.87 | 1.16 | 145.36 |
| .0040 | 250.0 | 0.42 | 3.28 | 0.55 | 9.74 | 0.67 | 21.01 | 0.72 | 28.76 | 0.87 | 61.81 | 1.14 | 125.85 | 1.19 | 149.19 |
| .0042 | 238.1 | 0.43 | 3.36 | 0.57 | 9.98 | 0.69 | 21.53 | 0.74 | 29.47 | 0.90 | 63.34 | 1.17 | 128.99 | 1.22 | 152.91 |
| .0044 | 227.3 | 0.44 | 3.44 | 0.58 | 10.22 | 0.70 | 22.04 | 0.76 | 30.17 | 0.92 | 64.84 | 1.20 | 132.06 | 1.25 | 156.55 |
| .0046 | 217.4 | 0.45 | 3.52 | 0.59 | 10.45 | 0.72 | 22.54 | 0.78 | 30.85 | 0.94 | 66.31 | 1.22 | 135.07 | 1.27 | 160.11 |
| .0048 | 208.3 | 0.46 | 3.60 | 0.60 | 10.68 | 0.73 | 23.03 | 0.79 | 31.52 | 0.96 | 67.74 | 1.25 | 138.00 | 1.30 | 163.59 |
| .0050 | 200.0 | 0.47 | 3.67 | 0.62 | 10.90 | 0.75 | 23.51 | 0.81 | 32.18 | 0.98 | 69.15 | 1.28 | 140.88 | 1.33 | 167.00 |
| .0055 | 181.8 | 0.49 | 3.86 | 0.65 | 11.44 | 0.79 | 24.67 | 0.85 | 33.76 | 1.16 | 82.06 | 1.34 | 147.83 | 1.39 | 175.24 |
| .0060 | 166.7 | 0.51 | 4.03 | 0.68 | 11.95 | 0.82 | 25.77 | 0.89 | 35.27 | 1.21 | 85.75 | 1.40 | 154.48 | 1.46 | 183.11 |
| .0065 | 153.8 | 0.53 | 4.20 | 0.70 | 12.45 | 0.85 | 26.83 | 0.92 | 36.72 | 1.26 | 89.29 | 1.46 | 160.85 | 1.64 | 206.02 |
| .0070 | 142.9 | 0.55 | 4.36 | 0.73 | 12.92 | 0.89 | 27.85 | 0.96 | 38.12 | 1.31 | 92.70 | 1.63 | 180.55 | 1.70 | 213.92 |
| .0075 | 133.3 | 0.57 | 4.51 | 0.76 | 13.38 | 0.92 | 28.84 | 0.99 | 39.46 | 1.36 | 95.99 | 1.69 | 186.99 | 1.76 | 221.55 |
| .0080 | 125.0 | 0.59 | 4.66 | 0.78 | 13.82 | 0.95 | 29.79 | 1.17 | 46.37 | 1.40 | 99.17 | 1.75 | 193.22 | 1.82 | 228.93 |
| .0085 | 117.6 | 0.61 | 4.80 | 0.81 | 14.25 | 0.98 | 30.71 | 1.20 | 47.81 | 1.45 | 102.25 | 1.80 | 199.26 | 1.88 | 236.08 |
| .0090 | 111.1 | 0.63 | 4.95 | 0.83 | 14.66 | 1.15 | 36.03 | 1.24 | 49.21 | 1.49 | 105.25 | 1.86 | 205.12 | 1.93 | 243.02 |
| .0095 | 105.3 | 0.65 | 5.08 | 0.85 | 15.07 | 1.18 | 37.03 | 1.27 | 50.58 | 1.66 | 117.24 | 1.91 | 210.82 | 1.99 | 249.77 |
| .0100 | 100.0 | 0.66 | 5.22 | 0.87 | 15.46 | 1.21 | 38.00 | 1.31 | 51.91 | 1.70 | 120.34 | 1.96 | 216.38 | 2.04 | 256.35 |
| .0110 | 90.9 | 0.70 | 5.47 | 0.92 | 16.22 | 1.27 | 39.88 | 1.37 | 54.47 | 1.79 | 126.30 | 2.06 | 227.09 | 2.14 | 269.03 |
| .0120 | 83.3 | 0.73 | 5.72 | 0.96 | 16.95 | 1.33 | 41.67 | 1.43 | 56.91 | 1.87 | 132.01 | 2.15 | 237.32 | 2.24 | 281.15 |
| .0130 | 76.9 | 0.76 | 5.95 | 1.00 | 17.64 | 1.38 | 43.39 | 1.49 | 59.26 | 1.94 | 137.47 | 2.24 | 247.13 | 2.33 | 292.77 |
| .0140 | 71.4 | 0.79 | 6.18 | 1.19 | 21.02 | 1.43 | 45.05 | 1.68 | 66.92 | 2.02 | 142.74 | 2.32 | 256.58 | 2.42 | 303.95 |
| .0150 | 66.7 | 0.81 | 6.40 | 1.23 | 21.76 | 1.48 | 46.65 | 1.74 | 69.30 | 2.09 | 147.81 | 2.41 | 265.69 | 2.50 | 314.74 |
| .0160 | 62.5 | 0.84 | 6.61 | 1.27 | 22.48 | 1.67 | 52.49 | 1.80 | 71.61 | 2.16 | 152.72 | 2.49 | 274.50 | 2.59 | 325.18 |
| .0170 | 58.8 | 0.87 | 6.81 | 1.31 | 23.18 | 1.72 | 54.13 | 1.86 | 73.85 | 2.23 | 157.49 | 2.56 | 283.05 | 2.67 | 335.29 |
| .0180 | 55.6 | 0.89 | 7.01 | 1.35 | 23.86 | 1.77 | 55.73 | 1.91 | 76.02 | 2.29 | 162.11 | 2.64 | 291.34 | 2.75 | 345.12 |
| .0190 | 52.6 | 0.92 | 7.21 | 1.39 | 24.52 | 1.82 | 57.28 | 1.97 | 78.14 | 2.36 | 166.60 | 2.71 | 299.41 | 2.82 | 354.67 |
| .0200 | 50.0 | 0.94 | 7.39 | 1.42 | 25.17 | 1.87 | 58.79 | 2.02 | 80.19 | 2.42 | 170.98 | 2.78 | 307.27 | 2.90 | 363.98 |
| .0220 | 45.5 | 0.99 | 7.76 | 1.49 | 26.41 | 1.96 | 61.70 | 2.12 | 84.16 | 2.54 | 179.42 | 2.92 | 322.42 | 3.04 | 381.91 |
| .0240 | 41.7 | 1.20 | 9.39 | 1.71 | 30.17 | 2.05 | 64.48 | 2.21 | 87.95 | 2.65 | 187.49 | 3.05 | 336.89 | 3.18 | 399.05 |
| .0260 | 38.5 | 1.25 | 9.78 | 1.78 | 31.43 | 2.14 | 67.15 | 2.30 | 91.59 | 2.76 | 195.23 | 3.18 | 350.78 | 3.31 | 415.49 |
| .0280 | 35.7 | 1.29 | 10.15 | 1.85 | 32.63 | 2.22 | 69.72 | 2.39 | 95.09 | 2.87 | 202.67 | 3.30 | 364.14 | 3.43 | 431.31 |
| .0300 | 33.3 | 1.34 | 10.51 | 1.91 | 33.79 | 2.30 | 72.20 | 2.48 | 98.46 | 2.97 | 209.86 | 3.41 | 377.03 | 3.55 | 446.58 |
| .0320 | 31.2 | 1.38 | 10.86 | 1.98 | 34.92 | 2.37 | 74.59 | 2.56 | 101.73 | 3.07 | 216.80 | 3.53 | 389.50 | 3.67 | 461.34 |
| .0340 | 29.4 | 1.43 | 11.20 | 2.04 | 36.01 | 2.45 | 76.92 | 2.64 | 104.89 | 3.16 | 223.54 | 3.64 | 401.58 | 3.79 | 475.65 |
| .0360 | 27.8 | 1.47 | 11.53 | 2.10 | 37.06 | 2.52 | 79.17 | 2.72 | 107.97 | 3.25 | 230.08 | 3.74 | 413.32 | 3.90 | 489.55 |
| .0380 | 26.3 | 1.66 | 13.03 | 2.16 | 38.09 | 2.59 | 81.36 | 2.79 | 110.96 | 3.34 | 236.44 | 3.85 | 424.73 | 4.00 | 503.06 |
| .0400 | 25.0 | 1.70 | 13.37 | 2.21 | 39.10 | 2.66 | 83.50 | 2.86 | 113.87 | 3.43 | 242.63 | 3.95 | 435.84 | 4.11 | 516.22 |
| .0420 | 23.8 | 1.75 | 13.71 | 2.27 | 40.07 | 2.72 | 85.59 | 2.94 | 116.71 | 3.52 | 248.67 | 4.04 | 446.69 | 4.21 | 529.06 |
| .0440 | 22.7 | 1.79 | 14.04 | 2.32 | 41.03 | 2.79 | 87.62 | 3.01 | 119.48 | 3.60 | 254.57 | 4.14 | 457.27 | 4.31 | 541.60 |
| .0460 | 21.7 | 1.83 | 14.36 | 2.37 | 41.96 | 2.85 | 89.61 | 3.07 | 122.19 | 3.68 | 260.34 | 4.23 | 467.62 | 4.41 | 553.85 |
| .0480 | 20.8 | 1.87 | 14.67 | 2.43 | 42.87 | 2.91 | 91.56 | 3.14 | 124.85 | 3.76 | 265.98 | 4.33 | 477.75 | 4.50 | 565.84 |
| .0500 | 20.0 | 1.91 | 14.98 | 2.48 | 43.77 | 2.98 | 93.46 | 3.21 | 127.44 | 3.84 | 271.51 | 4.42 | 487.67 | 4.60 | 577.58 |
| .0550 | 18.2 | 2.00 | 15.72 | 2.60 | 45.93 | 3.12 | 98.07 | 3.36 | 133.72 | 4.03 | 284.86 | 4.63 | 511.62 | 4.82 | 605.95 |
| .0600 | 16.7 | 2.09 | 16.43 | 2.72 | 47.99 | 3.26 | 102.47 | 3.51 | 139.72 | 4.21 | 297.62 | 4.84 | 534.52 | 5.04 | 633.06 |
| .0650 | 15.4 | 2.18 | 17.11 | 2.83 | 49.97 | 3.40 | 106.69 | 3.66 | 145.47 | 4.38 | 309.86 | 5.04 | 556.48 | 5.24 | 659.06 |
| .0700 | 14.3 | 2.26 | 17.76 | 2.94 | 51.88 | 3.53 | 110.75 | 3.80 | 151.00 | 4.55 | 321.63 | 5.23 | 577.60 | 5.44 | 684.08 |
| .0750 | 13.3 | 2.34 | 18.39 | 3.04 | 53.72 | 3.65 | 114.67 | 3.93 | 156.34 | 4.71 | 332.99 | 5.41 | 597.99 | 5.64 | 708.22 |
| .0800 | 12.5 | 2.42 | 19.00 | 3.14 | 55.50 | 3.77 | 118.46 | 4.06 | 161.51 | 4.87 | 343.98 | 5.59 | 617.71 | 5.82 | 731.56 |
| .0850 | 11.8 | 2.49 | 19.59 | 3.24 | 57.22 | 3.89 | 122.13 | 4.19 | 166.51 | 5.02 | 354.63 | 5.77 | 636.82 | 6.00 | 754.19 |
| .0900 | 11.1 | 2.57 | 20.17 | 3.33 | 58.89 | 4.00 | 125.70 | 4.31 | 171.37 | 5.16 | 364.97 | 5.93 | 655.37 | 6.18 | 776.17 |
| .0950 | 10.5 | 2.64 | 20.73 | 3.42 | 60.52 | 4.11 | 129.17 | 4.43 | 176.10 | 5.31 | 375.03 | 6.10 | 673.42 | 6.35 | 797.54 |

**TABLE 28**
*(continued)*

**PIPE FLOWING FULL**

$k_s$ = 1.5mm for velocities less than or equal to 1.0m/s
$k_s$ = 0.6mm for velocities greater than 1.0m/s less than or equal to 1.5m/s
$k_s$ = 0.3mm for velocities greater than 1.5m/s

**450mm to 1000mm Nominal Bore**

| Nominal Bore mm | | 450 | | 500 | | 600 | | 700 | | 800 | | 900 | | 1000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hydraulic Gradient | 1 in | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s |
| .0010 | 1000.0 | 0.57 | 90.06 | 0.61 | 119.04 | 0.68 | 192.80 | 0.75 | 289.66 | 0.82 | 411.96 | 0.88 | 561.88 | 0.94 | 741.52 |
| .0011 | 909.1 | 0.59 | 94.50 | 0.64 | 124.91 | 0.72 | 202.29 | 0.79 | 303.91 | 0.86 | 432.21 | 0.93 | 589.49 | 0.99 | 777.93 |
| .0012 | 833.3 | 0.62 | 98.75 | 0.66 | 130.51 | 0.75 | 211.35 | 0.83 | 317.52 | 0.90 | 451.55 | 0.97 | 615.86 | 1.15 | 901.93 |
| .0013 | 769.2 | 0.65 | 102.82 | 0.69 | 135.89 | 0.78 | 220.05 | 0.86 | 330.57 | 0.94 | 470.11 | 1.12 | 712.45 | 1.20 | 939.20 |
| .0014 | 714.3 | 0.67 | 106.73 | 0.72 | 141.06 | 0.81 | 228.42 | 0.89 | 343.14 | 0.97 | 487.97 | 1.16 | 739.67 | 1.24 | 975.07 |
| .0015 | 666.7 | 0.69 | 110.51 | 0.74 | 146.05 | 0.84 | 236.49 | 0.92 | 355.26 | 1.12 | 562.29 | 1.20 | 765.94 | 1.29 | 1009.67 |
| .0016 | 625.0 | 0.72 | 114.16 | 0.77 | 150.88 | 0.86 | 244.30 | 0.95 | 366.99 | 1.16 | 580.96 | 1.24 | 791.35 | 1.33 | 1043.15 |
| .0017 | 588.2 | 0.74 | 117.71 | 0.79 | 155.56 | 0.89 | 251.87 | 0.98 | 378.35 | 1.19 | 599.05 | 1.28 | 815.98 | 1.37 | 1075.59 |
| .0018 | 555.6 | 0.76 | 121.14 | 0.82 | 160.10 | 0.92 | 259.22 | 1.13 | 434.25 | 1.23 | 616.62 | 1.32 | 839.89 | 1.41 | 1107.09 |
| .0019 | 526.3 | 0.78 | 124.49 | 0.84 | 164.52 | 0.94 | 266.37 | 1.16 | 446.29 | 1.26 | 633.71 | 1.36 | 863.15 | 1.45 | 1137.73 |
| .0020 | 500.0 | 0.80 | 127.75 | 0.86 | 168.82 | 0.97 | 273.34 | 1.19 | 458.03 | 1.29 | 650.35 | 1.39 | 885.80 | 1.49 | 1167.57 |
| .0022 | 454.5 | 0.84 | 134.03 | 0.90 | 177.12 | 1.13 | 320.55 | 1.25 | 480.64 | 1.36 | 682.44 | 1.46 | 929.47 | 1.67 | 1312.63 |
| .0024 | 416.7 | 0.88 | 140.03 | 0.94 | 185.05 | 1.18 | 334.98 | 1.31 | 502.25 | 1.42 | 713.10 | 1.64 | 1041.39 | 1.75 | 1371.92 |
| .0026 | 384.6 | 0.92 | 145.79 | 0.98 | 192.65 | 1.23 | 348.81 | 1.36 | 522.98 | 1.48 | 742.51 | 1.70 | 1084.59 | 1.82 | 1428.79 |
| .0028 | 357.1 | 0.95 | 151.32 | 1.14 | 224.18 | 1.28 | 362.13 | 1.41 | 542.93 | 1.65 | 827.39 | 1.77 | 1126.17 | 1.89 | 1483.51 |
| .0030 | 333.3 | 0.99 | 156.67 | 1.18 | 232.14 | 1.33 | 374.98 | 1.46 | 562.18 | 1.70 | 856.89 | 1.83 | 1166.29 | 1.96 | 1536.32 |
| .0032 | 312.5 | 1.14 | 181.75 | 1.22 | 239.85 | 1.37 | 387.41 | 1.62 | 624.11 | 1.76 | 885.43 | 1.89 | 1205.09 | 2.02 | 1587.39 |
| .0034 | 294.1 | 1.18 | 187.41 | 1.26 | 247.31 | 1.41 | 399.45 | 1.67 | 643.63 | 1.82 | 913.09 | 1.95 | 1242.71 | 2.08 | 1636.90 |
| .0036 | 277.8 | 1.21 | 192.90 | 1.30 | 254.56 | 1.45 | 411.15 | 1.72 | 662.59 | 1.87 | 939.95 | 2.01 | 1279.23 | 2.15 | 1684.97 |
| .0038 | 263.2 | 1.25 | 198.25 | 1.33 | 261.61 | 1.49 | 422.53 | 1.77 | 681.02 | 1.92 | 966.08 | 2.07 | 1314.75 | 2.20 | 1731.73 |
| .0040 | 250.0 | 1.28 | 203.46 | 1.37 | 268.48 | 1.65 | 466.67 | 1.82 | 698.98 | 1.97 | 991.52 | 2.12 | 1349.36 | 2.26 | 1777.27 |
| .0042 | 238.1 | 1.31 | 208.54 | 1.40 | 275.18 | 1.69 | 478.38 | 1.86 | 716.50 | 2.02 | 1016.34 | 2.17 | 1383.10 | 2.32 | 1821.69 |
| .0044 | 227.3 | 1.34 | 213.50 | 1.43 | 281.72 | 1.73 | 489.82 | 1.91 | 733.60 | 2.07 | 1040.58 | 2.23 | 1416.06 | 2.37 | 1865.06 |
| .0046 | 217.4 | 1.37 | 218.35 | 1.47 | 288.11 | 1.77 | 500.99 | 1.95 | 750.32 | 2.12 | 1064.27 | 2.28 | 1448.27 | 2.43 | 1907.46 |
| .0048 | 208.3 | 1.40 | 223.09 | 1.50 | 294.37 | 1.81 | 511.93 | 1.99 | 766.68 | 2.16 | 1087.46 | 2.33 | 1479.80 | 2.48 | 1948.95 |
| .0050 | 200.0 | 1.43 | 227.74 | 1.65 | 323.98 | 1.85 | 522.64 | 2.03 | 782.70 | 2.21 | 1110.16 | 2.37 | 1510.67 | 2.53 | 1989.59 |
| .0055 | 181.8 | 1.62 | 257.88 | 1.73 | 340.05 | 1.94 | 548.52 | 2.13 | 821.42 | 2.32 | 1165.02 | 2.49 | 1585.26 | 2.66 | 2087.76 |
| .0060 | 166.7 | 1.69 | 269.54 | 1.81 | 355.40 | 2.03 | 573.25 | 2.23 | 858.41 | 2.42 | 1217.44 | 2.60 | 1656.53 | 2.78 | 2181.56 |
| .0065 | 153.8 | 1.77 | 280.72 | 1.89 | 370.13 | 2.11 | 596.97 | 2.32 | 893.89 | 2.52 | 1267.71 | 2.71 | 1724.89 | 2.89 | 2271.53 |
| .0070 | 142.9 | 1.83 | 291.47 | 1.96 | 384.30 | 2.19 | 619.80 | 2.41 | 928.03 | 2.62 | 1316.09 | 2.81 | 1790.67 | 3.00 | 2358.11 |
| .0075 | 133.3 | 1.90 | 301.85 | 2.03 | 397.98 | 2.27 | 641.83 | 2.50 | 960.98 | 2.71 | 1362.78 | 2.91 | 1854.15 | 3.11 | 2441.65 |
| .0080 | 125.0 | 1.96 | 311.90 | 2.09 | 411.21 | 2.35 | 663.13 | 2.58 | 992.84 | 2.80 | 1407.93 | 3.01 | 1915.54 | 3.21 | 2522.45 |
| .0085 | 117.6 | 2.02 | 321.63 | 2.16 | 424.03 | 2.42 | 683.78 | 2.66 | 1023.73 | 2.89 | 1451.69 | 3.10 | 1975.04 | 3.31 | 2600.76 |
| .0090 | 111.1 | 2.08 | 331.08 | 2.22 | 436.48 | 2.49 | 703.83 | 2.74 | 1053.72 | 2.97 | 1494.19 | 3.20 | 2032.82 | 3.41 | 2676.81 |
| .0095 | 105.3 | 2.14 | 340.27 | 2.28 | 448.58 | 2.56 | 723.33 | 2.81 | 1082.89 | 3.05 | 1535.52 | 3.28 | 2089.02 | 3.50 | 2750.77 |
| .0100 | 100.0 | 2.20 | 349.22 | 2.34 | 460.38 | 2.63 | 742.33 | 2.89 | 1111.30 | 3.13 | 1575.78 | 3.37 | 2143.75 | 3.59 | 2822.81 |
| .0110 | 90.9 | 2.30 | 366.48 | 2.46 | 483.11 | 2.75 | 778.94 | 3.03 | 1166.06 | 3.29 | 1653.38 | 3.54 | 2249.27 | 3.77 | 2961.67 |
| .0120 | 83.3 | 2.41 | 382.97 | 2.57 | 504.84 | 2.88 | 813.93 | 3.17 | 1218.40 | 3.44 | 1727.53 | 3.69 | 2350.09 | 3.94 | 3094.37 |
| .0130 | 76.9 | 2.51 | 398.79 | 2.68 | 525.67 | 3.00 | 847.49 | 3.30 | 1268.59 | 3.58 | 1798.66 | 3.85 | 2446.79 | 4.10 | 3221.64 |
| .0140 | 71.4 | 2.60 | 414.01 | 2.78 | 545.73 | 3.11 | 879.78 | 3.42 | 1316.89 | 3.71 | 1867.09 | 3.99 | 2539.84 | 4.26 | 3344.10 |
| .0150 | 66.7 | 2.70 | 428.70 | 2.88 | 565.07 | 3.22 | 910.94 | 3.54 | 1363.50 | 3.85 | 1933.13 | 4.13 | 2629.63 | 4.41 | 3462.27 |
| .0160 | 62.5 | 2.78 | 442.90 | 2.97 | 583.79 | 3.33 | 941.08 | 3.66 | 1408.57 | 3.97 | 1997.00 | 4.27 | 2716.46 | 4.55 | 3576.56 |
| .0170 | 58.8 | 2.87 | 456.67 | 3.07 | 601.92 | 3.43 | 970.29 | 3.77 | 1452.26 | 4.10 | 2058.90 | 4.40 | 2800.63 | 4.69 | 3687.33 |
| .0180 | 55.6 | 2.96 | 470.04 | 3.16 | 619.53 | 3.53 | 998.65 | 3.88 | 1494.69 | 4.22 | 2119.01 | 4.53 | 2882.36 | 4.83 | 3794.89 |
| .0190 | 52.6 | 3.04 | 483.04 | 3.24 | 636.66 | 3.63 | 1026.24 | 3.99 | 1535.95 | 4.33 | 2177.48 | 4.66 | 2961.85 | 4.96 | 3899.50 |
| .0200 | 50.0 | 3.12 | 495.71 | 3.33 | 653.35 | 3.72 | 1053.11 | 4.10 | 1576.13 | 4.45 | 2234.42 | 4.78 | 3039.27 | 5.09 | 4001.40 |
| .0220 | 45.5 | 3.27 | 520.12 | 3.49 | 685.51 | 3.91 | 1104.91 | 4.30 | 1653.60 | 4.66 | 2344.19 | 5.01 | 3188.51 | 5.34 | 4197.81 |
| .0240 | 41.7 | 3.42 | 543.45 | 3.65 | 716.24 | 4.08 | 1154.40 | 4.49 | 1727.63 | 4.87 | 2449.07 | 5.24 | 3331.11 | 5.58 | 4385.49 |
| .0260 | 38.5 | 3.56 | 565.83 | 3.80 | 745.72 | 4.25 | 1201.87 | 4.67 | 1798.63 | 5.07 | 2549.67 | 5.45 | 3467.89 | 5.81 | 4565.50 |
| .0280 | 35.7 | 3.69 | 587.36 | 3.94 | 774.08 | 4.41 | 1247.55 | 4.85 | 1866.94 | 5.26 | 2646.47 | 5.66 | 3599.50 | 6.03 | 4738.71 |
| .0300 | 33.3 | 3.82 | 608.13 | 4.08 | 801.45 | 4.57 | 1291.62 | 5.02 | 1932.86 | 5.45 | 2739.87 | 5.86 | 3726.49 | 6.25 | 4905.84 |
| .0320 | 31.2 | 3.95 | 628.23 | 4.22 | 827.92 | 4.72 | 1334.25 | 5.19 | 1996.62 | 5.63 | 2830.21 | 6.05 | 3849.31 | 6.45 | 5067.49 |
| .0340 | 29.4 | 4.07 | 647.70 | 4.35 | 853.57 | 4.87 | 1375.56 | 5.35 | 2058.41 | 5.80 | 2917.77 | 6.24 | 3968.35 | 6.65 | 5224.16 |
| .0360 | 27.8 | 4.19 | 666.62 | 4.47 | 878.48 | 5.01 | 1415.68 | 5.50 | 2118.41 | 5.97 | 3002.78 | 6.42 | 4083.94 | 6.85 | 5376.28 |
| .0380 | 26.3 | 4.31 | 685.01 | 4.60 | 902.71 | 5.14 | 1454.70 | 5.66 | 2176.77 | 6.14 | 3085.47 | 6.60 | 4196.37 | 7.03 | 5524.24 |
| .0400 | 25.0 | 4.42 | 702.92 | 4.72 | 926.31 | 5.28 | 1492.71 | 5.80 | 2233.61 | 6.30 | 3166.01 | 6.77 | 4305.87 | 7.22 | 5668.35 |
| .0420 | 23.8 | 4.53 | 720.40 | 4.83 | 949.33 | 5.41 | 1529.77 | 5.95 | 2289.05 | 6.45 | 3244.56 | 6.94 | 4412.66 | 7.40 | 5808.90 |
| .0440 | 22.7 | 4.64 | 737.46 | 4.95 | 971.80 | 5.54 | 1565.97 | 6.09 | 2343.19 | 6.61 | 3321.26 | 7.10 | 4516.95 | 7.57 | 5946.15 |
| .0460 | 21.7 | 4.74 | 754.13 | 5.06 | 993.77 | 5.66 | 1601.35 | 6.23 | 2396.10 | 6.76 | 3396.24 | 7.26 | 4618.89 | 7.74 | 6080.31 |
| .0480 | 20.8 | 4.84 | 770.45 | 5.17 | 1015.27 | 5.79 | 1635.97 | 6.36 | 2447.88 | 6.90 | 3469.60 | 7.42 | 4718.63 | 7.91 | 6211.58 |
| .0500 | 20.0 | 4.94 | 786.44 | 5.28 | 1036.32 | 5.91 | 1669.87 | 6.49 | 2498.59 | 7.05 | 3541.45 | 7.57 | 4816.32 | 8.07 | 6340.15 |
| .0550 | 18.2 | 5.19 | 825.05 | 5.54 | 1087.18 | 6.20 | 1751.78 | 6.81 | 2621.10 | 7.39 | 3715.03 | 7.94 | 5052.32 | 8.47 | 6650.74 |
| .0600 | 16.7 | 5.42 | 861.94 | 5.78 | 1135.78 | 6.47 | 1830.05 | 7.11 | 2738.15 | 7.72 | 3880.88 | 8.30 | 5277.81 | 8.85 | 6947.51 |
| .0650 | 15.4 | 5.64 | 897.33 | 6.02 | 1182.39 | 6.74 | 1905.11 | 7.41 | 2850.42 | 8.04 | 4039.96 | 8.64 | 5494.09 | 9.21 | 7232.15 |
| .0700 | 14.3 | 5.86 | 931.38 | 6.25 | 1227.25 | 6.99 | 1977.34 | 7.69 | 2958.45 | 8.34 | 4193.03 | 8.96 | 5702.20 | 9.56 | 7506.04 |
| .0750 | 13.3 | 6.06 | 964.23 | 6.47 | 1270.52 | 7.24 | 2047.04 | 7.96 | 3062.69 | 8.64 | 4340.72 | 9.28 | 5903.01 | 9.89 | 7770.31 |
| .0800 | 12.5 | 6.26 | 996.01 | 6.68 | 1312.38 | 7.48 | 2114.45 | 8.22 | 3163.51 | 8.92 | 4483.57 | 9.58 | 6097.22 | 10.22 | 8025.91 |
| .0850 | 11.8 | 6.46 | 1026.80 | 6.89 | 1352.95 | 7.71 | 2179.78 | 8.47 | 3261.22 | 9.20 | 4622.01 | 9.88 | 6285.45 | 10.53 | 8273.64 |
| .0900 | 11.1 | 6.64 | 1056.71 | 7.09 | 1392.34 | 7.93 | 2243.22 | 8.72 | 3356.10 | 9.46 | 4756.45 | 10.17 | 6468.23 | 10.84 | 8514.19 |
| .0950 | 10.5 | 6.83 | 1085.79 | 7.29 | 1430.65 | 8.15 | 2304.92 | 8.96 | 3448.38 | 9.72 | 4887.20 | 10.45 | 6645.99 | 11.14 | 8748.14 |

| Nominal Bore mm | | 100 | | 150 | | 200 | | 225 | | 300 | | 375 | | 400 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hydraulic Gradient | 1 in | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s |
| .0010 | 1000.0 | 0.25 | 1.97 | 0.33 | 5.85 | 0.40 | 12.58 | 0.43 | 17.21 | 0.52 | 36.91 | 0.60 | 66.59 | 0.63 | 78.97 |
| .0011 | 909.1 | 0.26 | 2.08 | 0.35 | 6.15 | 0.42 | 13.23 | 0.45 | 18.09 | 0.55 | 38.79 | 0.63 | 69.96 | 0.66 | 82.96 |
| .0012 | 833.3 | 0.28 | 2.17 | 0.36 | 6.44 | 0.44 | 13.85 | 0.48 | 18.93 | 0.57 | 40.58 | 0.66 | 73.18 | 0.69 | 86.77 |
| .0013 | 769.2 | 0.29 | 2.27 | 0.38 | 6.71 | 0.46 | 14.44 | 0.50 | 19.74 | 0.60 | 42.30 | 0.69 | 76.27 | 0.72 | 90.43 |
| .0014 | 714.3 | 0.30 | 2.36 | 0.39 | 6.98 | 0.48 | 15.01 | 0.52 | 20.51 | 0.62 | 43.95 | 0.72 | 79.25 | 0.75 | 93.95 |
| .0015 | 666.7 | 0.31 | 2.45 | 0.41 | 7.24 | 0.50 | 15.56 | 0.53 | 21.26 | 0.64 | 45.55 | 0.74 | 82.12 | 0.77 | 97.35 |
| .0016 | 625.0 | 0.32 | 2.53 | 0.42 | 7.49 | 0.51 | 16.09 | 0.55 | 21.99 | 0.67 | 47.10 | 0.77 | 84.89 | 0.80 | 100.64 |
| .0017 | 588.2 | 0.33 | 2.62 | 0.44 | 7.73 | 0.53 | 16.60 | 0.57 | 22.69 | 0.69 | 48.59 | 0.79 | 87.58 | 0.83 | 103.83 |
| .0018 | 555.6 | 0.34 | 2.70 | 0.45 | 7.96 | 0.54 | 17.10 | 0.59 | 23.38 | 0.71 | 50.05 | 0.82 | 90.20 | 0.85 | 106.93 |
| .0019 | 526.3 | 0.35 | 2.77 | 0.46 | 8.19 | 0.56 | 17.59 | 0.60 | 24.04 | 0.73 | 51.47 | 0.84 | 92.74 | 0.87 | 109.94 |
| .0020 | 500.0 | 0.36 | 2.85 | 0.48 | 8.41 | 0.58 | 18.07 | 0.62 | 24.69 | 0.75 | 52.84 | 0.86 | 95.22 | 0.90 | 112.87 |
| .0022 | 454.5 | 0.38 | 3.00 | 0.50 | 8.84 | 0.60 | 18.98 | 0.65 | 25.94 | 0.79 | 55.50 | 0.91 | 99.99 | 0.94 | 118.53 |
| .0024 | 416.7 | 0.40 | 3.14 | 0.52 | 9.25 | 0.63 | 19.86 | 0.68 | 27.13 | 0.82 | 58.05 | 0.95 | 104.56 | 0.99 | 123.93 |
| .0026 | 384.6 | 0.42 | 3.27 | 0.55 | 9.64 | 0.66 | 20.70 | 0.71 | 28.28 | 0.86 | 60.49 | 0.99 | 108.94 | 1.03 | 129.12 |
| .0028 | 357.1 | 0.43 | 3.40 | 0.57 | 10.02 | 0.68 | 21.51 | 0.74 | 29.38 | 0.89 | 62.83 | 1.02 | 113.15 | 1.07 | 134.11 |
| .0030 | 333.3 | 0.45 | 3.53 | 0.59 | 10.39 | 0.71 | 22.29 | 0.77 | 30.44 | 0.92 | 65.10 | 1.06 | 117.22 | 1.11 | 138.93 |
| .0032 | 312.5 | 0.46 | 3.65 | 0.61 | 10.74 | 0.73 | 23.04 | 0.79 | 31.47 | 0.95 | 67.29 | 1.10 | 121.15 | 1.14 | 143.59 |
| .0034 | 294.1 | 0.48 | 3.76 | 0.63 | 11.08 | 0.76 | 23.77 | 0.82 | 32.47 | 0.98 | 69.41 | 1.13 | 124.97 | 1.18 | 148.10 |
| .0036 | 277.8 | 0.49 | 3.88 | 0.65 | 11.42 | 0.78 | 24.48 | 0.84 | 33.44 | 1.01 | 71.48 | 1.17 | 128.67 | 1.21 | 152.49 |
| .0038 | 263.2 | 0.51 | 3.99 | 0.66 | 11.74 | 0.80 | 25.17 | 0.86 | 34.38 | 1.04 | 73.48 | 1.20 | 132.27 | 1.25 | 156.76 |
| .0040 | 250.0 | 0.52 | 4.10 | 0.68 | 12.06 | 0.82 | 25.85 | 0.89 | 35.30 | 1.07 | 75.44 | 1.23 | 135.78 | 1.28 | 160.91 |
| .0042 | 238.1 | 0.54 | 4.20 | 0.70 | 12.36 | 0.84 | 26.51 | 0.91 | 36.19 | 1.09 | 77.34 | 1.26 | 139.21 | 1.31 | 164.96 |
| .0044 | 227.3 | 0.55 | 4.31 | 0.72 | 12.67 | 0.86 | 27.15 | 0.93 | 37.07 | 1.12 | 79.21 | 1.29 | 142.55 | 1.34 | 168.92 |
| .0046 | 217.4 | 0.56 | 4.41 | 0.73 | 12.96 | 0.88 | 27.77 | 0.95 | 37.92 | 1.15 | 81.03 | 1.32 | 145.82 | 1.38 | 172.79 |
| .0048 | 208.3 | 0.57 | 4.51 | 0.75 | 13.25 | 0.90 | 28.39 | 0.97 | 38.76 | 1.17 | 82.81 | 1.35 | 149.01 | 1.41 | 176.58 |
| .0050 | 200.0 | 0.59 | 4.60 | 0.77 | 13.53 | 0.92 | 28.99 | 1.00 | 39.58 | 1.20 | 84.55 | 1.38 | 152.14 | 1.43 | 180.29 |
| .0055 | 181.8 | 0.62 | 4.84 | 0.80 | 14.21 | 0.97 | 30.44 | 1.05 | 41.56 | 1.26 | 88.77 | 1.45 | 159.71 | 1.51 | 189.25 |
| .0060 | 166.7 | 0.64 | 5.06 | 0.84 | 14.86 | 1.01 | 31.83 | 1.09 | 43.45 | 1.31 | 92.79 | 1.51 | 166.94 | 1.57 | 197.81 |
| .0065 | 153.8 | 0.67 | 5.27 | 0.88 | 15.49 | 1.06 | 33.16 | 1.14 | 45.27 | 1.37 | 96.66 | 1.57 | 173.88 | 1.64 | 206.02 |
| .0070 | 142.9 | 0.70 | 5.48 | 0.91 | 16.09 | 1.10 | 34.44 | 1.18 | 47.01 | 1.42 | 100.38 | 1.63 | 180.55 | 1.70 | 213.92 |
| .0075 | 133.3 | 0.72 | 5.68 | 0.94 | 16.67 | 1.14 | 35.68 | 1.22 | 48.70 | 1.47 | 103.96 | 1.69 | 186.99 | 1.76 | 221.55 |
| .0080 | 125.0 | 0.75 | 5.87 | 0.97 | 17.23 | 1.17 | 36.88 | 1.27 | 50.33 | 1.52 | 107.44 | 1.75 | 193.22 | 1.82 | 228.93 |
| .0085 | 117.6 | 0.77 | 6.06 | 1.01 | 17.77 | 1.21 | 38.04 | 1.31 | 51.91 | 1.57 | 110.80 | 1.80 | 199.26 | 1.88 | 236.08 |
| .0090 | 111.1 | 0.79 | 6.24 | 1.04 | 18.30 | 1.25 | 39.16 | 1.34 | 53.45 | 1.61 | 114.07 | 1.86 | 205.12 | 1.93 | 243.02 |
| .0095 | 105.3 | 0.82 | 6.41 | 1.06 | 18.81 | 1.28 | 40.26 | 1.38 | 54.94 | 1.66 | 117.24 | 1.91 | 210.82 | 1.99 | 249.77 |
| .0100 | 100.0 | 0.84 | 6.59 | 1.09 | 19.31 | 1.32 | 41.33 | 1.42 | 56.39 | 1.70 | 120.34 | 1.96 | 216.38 | 2.04 | 256.35 |
| .0110 | 90.9 | 0.88 | 6.92 | 1.15 | 20.28 | 1.38 | 43.38 | 1.49 | 59.20 | 1.79 | 126.30 | 2.06 | 227.09 | 2.14 | 269.03 |
| .0120 | 83.3 | 0.92 | 7.23 | 1.20 | 21.20 | 1.44 | 45.35 | 1.56 | 61.88 | 1.87 | 132.01 | 2.15 | 237.32 | 2.24 | 281.15 |
| .0130 | 76.9 | 0.96 | 7.54 | 1.25 | 22.08 | 1.50 | 47.23 | 1.62 | 64.45 | 1.94 | 137.47 | 2.24 | 247.13 | 2.33 | 292.77 |
| .0140 | 71.4 | 1.00 | 7.83 | 1.30 | 22.93 | 1.56 | 49.05 | 1.68 | 66.92 | 2.02 | 142.74 | 2.32 | 256.58 | 2.42 | 303.95 |
| .0150 | 66.7 | 1.03 | 8.11 | 1.34 | 23.76 | 1.62 | 50.80 | 1.74 | 69.30 | 2.09 | 147.81 | 2.41 | 265.69 | 2.50 | 314.74 |
| .0160 | 62.5 | 1.07 | 8.38 | 1.39 | 24.55 | 1.67 | 52.49 | 1.80 | 71.61 | 2.16 | 152.72 | 2.49 | 274.50 | 2.59 | 325.18 |
| .0170 | 58.8 | 1.10 | 8.65 | 1.43 | 25.32 | 1.72 | 54.13 | 1.86 | 73.85 | 2.23 | 157.49 | 2.56 | 283.05 | 2.67 | 335.29 |
| .0180 | 55.6 | 1.13 | 8.90 | 1.48 | 26.07 | 1.77 | 55.73 | 1.91 | 76.02 | 2.29 | 162.11 | 2.64 | 291.34 | 2.75 | 345.12 |
| .0190 | 52.6 | 1.17 | 9.15 | 1.52 | 26.80 | 1.82 | 57.28 | 1.97 | 78.14 | 2.36 | 166.60 | 2.71 | 299.41 | 2.82 | 354.67 |
| .0200 | 50.0 | 1.20 | 9.39 | 1.56 | 27.50 | 1.87 | 58.79 | 2.02 | 80.19 | 2.42 | 170.98 | 2.78 | 307.27 | 2.90 | 363.98 |
| .0220 | 45.5 | 1.26 | 9.86 | 1.63 | 28.87 | 1.96 | 61.70 | 2.12 | 84.16 | 2.54 | 179.42 | 2.92 | 322.42 | 3.04 | 381.91 |
| .0240 | 41.7 | 1.31 | 10.31 | 1.71 | 30.17 | 2.05 | 64.48 | 2.21 | 87.95 | 2.65 | 187.49 | 3.05 | 336.89 | 3.18 | 399.05 |
| .0260 | 38.5 | 1.37 | 10.74 | 1.78 | 31.43 | 2.14 | 67.15 | 2.30 | 91.59 | 2.76 | 195.23 | 3.18 | 350.78 | 3.31 | 415.49 |
| .0280 | 35.7 | 1.42 | 11.15 | 1.85 | 32.63 | 2.22 | 69.72 | 2.39 | 95.09 | 2.87 | 202.67 | 3.30 | 364.14 | 3.43 | 431.31 |
| .0300 | 33.3 | 1.47 | 11.55 | 1.91 | 33.79 | 2.30 | 72.20 | 2.48 | 98.46 | 2.97 | 209.86 | 3.41 | 377.03 | 3.55 | 446.58 |
| .0320 | 31.2 | 1.52 | 11.94 | 1.98 | 34.92 | 2.37 | 74.59 | 2.56 | 101.73 | 3.07 | 216.80 | 3.53 | 389.50 | 3.67 | 461.34 |
| .0340 | 29.4 | 1.57 | 12.31 | 2.04 | 36.01 | 2.45 | 76.92 | 2.64 | 104.89 | 3.16 | 223.54 | 3.64 | 401.58 | 3.79 | 475.65 |
| .0360 | 27.8 | 1.61 | 12.68 | 2.10 | 37.06 | 2.52 | 79.17 | 2.72 | 107.97 | 3.25 | 230.08 | 3.74 | 413.32 | 3.90 | 489.55 |
| .0380 | 26.3 | 1.66 | 13.03 | 2.16 | 38.09 | 2.59 | 81.36 | 2.79 | 110.96 | 3.34 | 236.44 | 3.85 | 424.73 | 4.00 | 503.06 |
| .0400 | 25.0 | 1.70 | 13.37 | 2.21 | 39.10 | 2.66 | 83.50 | 2.86 | 113.87 | 3.43 | 242.63 | 3.95 | 435.84 | 4.11 | 516.22 |
| .0420 | 23.8 | 1.75 | 13.71 | 2.27 | 40.07 | 2.72 | 85.59 | 2.94 | 116.71 | 3.52 | 248.67 | 4.04 | 446.69 | 4.21 | 529.06 |
| .0440 | 22.7 | 1.79 | 14.04 | 2.32 | 41.03 | 2.79 | 87.62 | 3.01 | 119.48 | 3.60 | 254.57 | 4.14 | 457.27 | 4.31 | 541.60 |
| .0460 | 21.7 | 1.83 | 14.36 | 2.37 | 41.96 | 2.85 | 89.61 | 3.07 | 122.19 | 3.68 | 260.34 | 4.23 | 467.62 | 4.41 | 553.85 |
| .0480 | 20.8 | 1.87 | 14.67 | 2.43 | 42.87 | 2.91 | 91.56 | 3.14 | 124.85 | 3.76 | 265.98 | 4.33 | 477.75 | 4.50 | 565.84 |
| .0500 | 20.0 | 1.91 | 14.98 | 2.48 | 43.77 | 2.98 | 93.46 | 3.21 | 127.44 | 3.84 | 271.51 | 4.42 | 487.67 | 4.60 | 577.58 |
| .0550 | 18.2 | 2.00 | 15.72 | 2.60 | 45.93 | 3.12 | 98.07 | 3.36 | 133.72 | 4.03 | 284.86 | 4.63 | 511.62 | 4.82 | 605.95 |
| .0600 | 16.7 | 2.09 | 16.43 | 2.72 | 47.99 | 3.26 | 102.47 | 3.51 | 139.72 | 4.21 | 297.62 | 4.84 | 534.52 | 5.04 | 633.06 |
| .0650 | 15.4 | 2.18 | 17.11 | 2.83 | 49.97 | 3.40 | 106.69 | 3.66 | 145.47 | 4.38 | 309.86 | 5.04 | 556.48 | 5.24 | 659.06 |
| .0700 | 14.3 | 2.26 | 17.76 | 2.94 | 51.88 | 3.53 | 110.75 | 3.80 | 151.00 | 4.55 | 321.63 | 5.23 | 577.60 | 5.44 | 684.08 |
| .0750 | 13.3 | 2.34 | 18.39 | 3.04 | 53.72 | 3.65 | 114.67 | 3.93 | 156.34 | 4.71 | 332.99 | 5.41 | 597.99 | 5.64 | 708.22 |
| .0800 | 12.5 | 2.42 | 19.00 | 3.14 | 55.50 | 3.77 | 118.46 | 4.06 | 161.51 | 4.87 | 343.98 | 5.59 | 617.71 | 5.82 | 731.56 |
| .0850 | 11.8 | 2.49 | 19.59 | 3.24 | 57.22 | 3.89 | 122.13 | 4.19 | 166.51 | 5.02 | 354.63 | 5.77 | 636.82 | 6.00 | 754.19 |
| .0900 | 11.1 | 2.57 | 20.17 | 3.33 | 58.89 | 4.00 | 125.70 | 4.31 | 171.37 | 5.16 | 364.97 | 5.93 | 655.37 | 6.18 | 776.17 |
| .0950 | 10.5 | 2.64 | 20.73 | 3.42 | 60.52 | 4.11 | 129.17 | 4.43 | 176.10 | 5.31 | 375.03 | 6.10 | 673.42 | 6.35 | 797.54 |

**TABLE 29** *(continued)* **PIPE FLOWING FULL** $k_s$ = 0.3mm **450mm to 1000mm Nominal Bore**

| Nominal Bore mm | | 450 | | 500 | | 600 | | 700 | | 800 | | 900 | | 1000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hydraulic Gradient | 1 in | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s |
| .0010 | 1000.0 | 0.68 | 107.75 | 0.72 | 142.24 | 0.81 | 229.85 | 0.90 | 344.67 | 0.97 | 489.39 | 1.05 | 666.53 | 1.12 | 878.49 |
| .0011 | 909.1 | 0.71 | 113.18 | 0.76 | 149.40 | 0.85 | 241.39 | 0.94 | 361.94 | 1.02 | 513.87 | 1.10 | 699.82 | 1.17 | 922.31 |
| .0012 | 833.3 | 0.74 | 118.38 | 0.80 | 156.24 | 0.89 | 252.41 | 0.98 | 378.44 | 1.07 | 537.26 | 1.15 | 731.64 | 1.23 | 964.19 |
| .0013 | 769.2 | 0.78 | 123.36 | 0.83 | 162.81 | 0.93 | 263.00 | 1.02 | 394.27 | 1.11 | 559.70 | 1.20 | 762.15 | 1.28 | 1004.37 |
| .0014 | 714.3 | 0.81 | 128.15 | 0.86 | 169.13 | 0.97 | 273.18 | 1.06 | 409.51 | 1.16 | 581.30 | 1.24 | 791.52 | 1.33 | 1043.03 |
| .0015 | 666.7 | 0.83 | 132.78 | 0.89 | 175.23 | 1.00 | 283.01 | 1.10 | 424.22 | 1.20 | 602.14 | 1.29 | 819.87 | 1.38 | 1080.34 |
| .0016 | 625.0 | 0.86 | 137.26 | 0.92 | 181.13 | 1.03 | 292.51 | 1.14 | 438.44 | 1.24 | 622.30 | 1.33 | 847.28 | 1.42 | 1116.42 |
| .0017 | 588.2 | 0.89 | 141.60 | 0.95 | 186.85 | 1.07 | 301.73 | 1.18 | 452.23 | 1.28 | 641.84 | 1.37 | 873.86 | 1.47 | 1151.40 |
| .0018 | 555.6 | 0.92 | 145.82 | 0.98 | 192.40 | 1.10 | 310.68 | 1.21 | 465.62 | 1.31 | 660.82 | 1.41 | 899.66 | 1.51 | 1185.37 |
| .0019 | 526.3 | 0.94 | 149.92 | 1.01 | 197.80 | 1.13 | 319.38 | 1.24 | 478.64 | 1.35 | 679.27 | 1.45 | 924.76 | 1.55 | 1218.41 |
| .0020 | 500.0 | 0.97 | 153.91 | 1.03 | 203.07 | 1.16 | 327.86 | 1.28 | 491.33 | 1.39 | 697.25 | 1.49 | 949.21 | 1.59 | 1250.59 |
| .0022 | 454.5 | 1.02 | 161.61 | 1.09 | 213.22 | 1.22 | 344.21 | 1.34 | 515.79 | 1.46 | 731.91 | 1.57 | 996.35 | 1.67 | 1312.63 |
| .0024 | 416.7 | 1.06 | 168.97 | 1.14 | 222.91 | 1.27 | 359.84 | 1.40 | 539.16 | 1.52 | 765.04 | 1.64 | 1041.39 | 1.75 | 1371.92 |
| .0026 | 384.6 | 1.11 | 176.03 | 1.18 | 232.22 | 1.33 | 374.82 | 1.46 | 561.58 | 1.59 | 796.81 | 1.70 | 1084.59 | 1.82 | 1428.79 |
| .0028 | 357.1 | 1.15 | 182.83 | 1.23 | 241.17 | 1.38 | 389.24 | 1.52 | 583.15 | 1.65 | 827.39 | 1.77 | 1126.17 | 1.89 | 1483.51 |
| .0030 | 333.3 | 1.19 | 189.39 | 1.27 | 249.81 | 1.43 | 403.16 | 1.57 | 603.97 | 1.70 | 856.89 | 1.83 | 1166.29 | 1.96 | 1536.32 |
| .0032 | 312.5 | 1.23 | 195.73 | 1.31 | 258.16 | 1.47 | 416.62 | 1.62 | 624.11 | 1.76 | 885.43 | 1.89 | 1205.09 | 2.02 | 1587.39 |
| .0034 | 294.1 | 1.27 | 201.88 | 1.36 | 266.26 | 1.52 | 429.67 | 1.67 | 643.63 | 1.82 | 913.09 | 1.95 | 1242.71 | 2.08 | 1636.90 |
| .0036 | 277.8 | 1.31 | 207.85 | 1.40 | 274.13 | 1.56 | 442.34 | 1.72 | 662.59 | 1.87 | 939.95 | 2.01 | 1279.23 | 2.15 | 1684.97 |
| .0038 | 263.2 | 1.34 | 213.65 | 1.44 | 281.78 | 1.61 | 454.67 | 1.77 | 681.02 | 1.92 | 966.08 | 2.07 | 1314.75 | 2.20 | 1731.73 |
| .0040 | 250.0 | 1.38 | 219.31 | 1.47 | 289.23 | 1.65 | 466.67 | 1.82 | 698.98 | 1.97 | 991.52 | 2.12 | 1349.36 | 2.26 | 1777.27 |
| .0042 | 238.1 | 1.41 | 224.83 | 1.51 | 296.50 | 1.69 | 478.38 | 1.86 | 716.50 | 2.02 | 1016.34 | 2.17 | 1383.10 | 2.32 | 1821.69 |
| .0044 | 227.3 | 1.45 | 230.22 | 1.55 | 303.60 | 1.73 | 489.82 | 1.91 | 733.60 | 2.07 | 1040.58 | 2.23 | 1416.06 | 2.37 | 1865.06 |
| .0046 | 217.4 | 1.48 | 235.48 | 1.58 | 310.54 | 1.77 | 500.99 | 1.95 | 750.32 | 2.12 | 1064.27 | 2.28 | 1448.27 | 2.43 | 1907.46 |
| .0048 | 208.3 | 1.51 | 240.64 | 1.62 | 317.33 | 1.81 | 511.93 | 1.99 | 766.68 | 2.16 | 1087.46 | 2.33 | 1479.80 | 2.48 | 1948.95 |
| .0050 | 200.0 | 1.54 | 245.69 | 1.65 | 323.98 | 1.85 | 522.64 | 2.03 | 782.70 | 2.21 | 1110.16 | 2.37 | 1510.67 | 2.53 | 1989.59 |
| .0055 | 181.8 | 1.62 | 257.88 | 1.73 | 340.05 | 1.94 | 548.52 | 2.13 | 821.42 | 2.32 | 1165.02 | 2.49 | 1585.26 | 2.66 | 2087.76 |
| .0060 | 166.7 | 1.69 | 269.54 | 1.81 | 355.40 | 2.03 | 573.25 | 2.23 | 858.41 | 2.42 | 1217.44 | 2.60 | 1656.53 | 2.78 | 2181.56 |
| .0065 | 153.8 | 1.77 | 280.72 | 1.89 | 370.13 | 2.11 | 596.97 | 2.32 | 893.89 | 2.52 | 1267.71 | 2.71 | 1724.89 | 2.89 | 2271.53 |
| .0070 | 142.9 | 1.83 | 291.47 | 1.96 | 384.30 | 2.19 | 619.80 | 2.41 | 928.03 | 2.62 | 1316.09 | 2.81 | 1790.67 | 3.00 | 2358.11 |
| .0075 | 133.3 | 1.90 | 301.85 | 2.03 | 397.98 | 2.27 | 641.83 | 2.50 | 960.98 | 2.71 | 1362.78 | 2.91 | 1854.15 | 3.11 | 2441.65 |
| .0080 | 125.0 | 1.96 | 311.90 | 2.09 | 411.21 | 2.35 | 663.13 | 2.58 | 992.84 | 2.80 | 1407.93 | 3.01 | 1915.54 | 3.21 | 2522.45 |
| .0085 | 117.6 | 2.02 | 321.63 | 2.16 | 424.03 | 2.42 | 683.78 | 2.66 | 1023.73 | 2.89 | 1451.69 | 3.10 | 1975.04 | 3.31 | 2600.76 |
| .0090 | 111.1 | 2.08 | 331.08 | 2.22 | 436.48 | 2.49 | 703.83 | 2.74 | 1053.72 | 2.97 | 1494.19 | 3.20 | 2032.82 | 3.41 | 2676.81 |
| .0095 | 105.3 | 2.14 | 340.27 | 2.28 | 448.58 | 2.56 | 723.33 | 2.81 | 1082.89 | 3.05 | 1535.52 | 3.28 | 2089.02 | 3.50 | 2750.77 |
| .0100 | 100.0 | 2.20 | 349.22 | 2.34 | 460.38 | 2.63 | 742.33 | 2.89 | 1111.30 | 3.13 | 1575.78 | 3.37 | 2143.75 | 3.59 | 2822.81 |
| .0110 | 90.9 | 2.30 | 366.48 | 2.46 | 483.11 | 2.75 | 778.94 | 3.03 | 1166.06 | 3.29 | 1653.38 | 3.54 | 2249.27 | 3.77 | 2961.67 |
| .0120 | 83.3 | 2.41 | 382.97 | 2.57 | 504.84 | 2.88 | 813.93 | 3.17 | 1218.40 | 3.44 | 1727.53 | 3.69 | 2350.09 | 3.94 | 3094.37 |
| .0130 | 76.9 | 2.51 | 398.79 | 2.68 | 525.67 | 3.00 | 847.49 | 3.30 | 1268.59 | 3.58 | 1798.66 | 3.85 | 2446.79 | 4.10 | 3221.64 |
| .0140 | 71.4 | 2.60 | 414.01 | 2.78 | 545.73 | 3.11 | 879.78 | 3.42 | 1316.89 | 3.71 | 1867.09 | 3.99 | 2539.84 | 4.26 | 3344.10 |
| .0150 | 66.7 | 2.70 | 428.70 | 2.88 | 565.07 | 3.22 | 910.94 | 3.54 | 1363.50 | 3.85 | 1933.13 | 4.13 | 2629.63 | 4.41 | 3462.27 |
| .0160 | 62.5 | 2.78 | 442.90 | 2.97 | 583.79 | 3.33 | 941.08 | 3.66 | 1408.57 | 3.97 | 1997.00 | 4.27 | 2716.46 | 4.55 | 3576.56 |
| .0170 | 58.8 | 2.87 | 456.67 | 3.07 | 601.92 | 3.43 | 970.29 | 3.77 | 1452.26 | 4.10 | 2058.90 | 4.40 | 2800.63 | 4.69 | 3687.33 |
| .0180 | 55.6 | 2.96 | 470.04 | 3.16 | 619.53 | 3.53 | 998.65 | 3.88 | 1494.69 | 4.22 | 2119.01 | 4.53 | 2882.36 | 4.83 | 3794.89 |
| .0190 | 52.6 | 3.04 | 483.04 | 3.24 | 636.66 | 3.63 | 1026.24 | 3.99 | 1535.95 | 4.33 | 2177.48 | 4.66 | 2961.85 | 4.96 | 3899.50 |
| .0200 | 50.0 | 3.12 | 495.71 | 3.33 | 653.35 | 3.72 | 1053.11 | 4.10 | 1576.13 | 4.45 | 2234.42 | 4.78 | 3039.27 | 5.09 | 4001.40 |
| .0220 | 45.5 | 3.27 | 520.12 | 3.49 | 685.51 | 3.91 | 1104.91 | 4.30 | 1653.60 | 4.66 | 2344.19 | 5.01 | 3188.51 | 5.34 | 4197.81 |
| .0240 | 41.7 | 3.42 | 543.45 | 3.65 | 716.24 | 4.08 | 1154.40 | 4.49 | 1727.63 | 4.87 | 2449.07 | 5.24 | 3331.11 | 5.58 | 4385.49 |
| .0260 | 38.5 | 3.56 | 565.83 | 3.80 | 745.72 | 4.25 | 1201.87 | 4.67 | 1798.63 | 5.07 | 2549.67 | 5.45 | 3467.89 | 5.81 | 4565.50 |
| .0280 | 35.7 | 3.69 | 587.36 | 3.94 | 774.08 | 4.41 | 1247.55 | 4.85 | 1866.94 | 5.26 | 2646.47 | 5.66 | 3599.50 | 6.03 | 4738.71 |
| .0300 | 33.3 | 3.82 | 608.13 | 4.08 | 801.45 | 4.57 | 1291.62 | 5.02 | 1932.86 | 5.45 | 2739.87 | 5.86 | 3726.49 | 6.25 | 4905.84 |
| .0320 | 31.2 | 3.95 | 628.23 | 4.22 | 827.92 | 4.72 | 1334.25 | 5.19 | 1996.62 | 5.63 | 2830.21 | 6.05 | 3849.31 | 6.45 | 5067.49 |
| .0340 | 29.4 | 4.07 | 647.70 | 4.35 | 853.57 | 4.87 | 1375.56 | 5.35 | 2058.41 | 5.80 | 2917.77 | 6.24 | 3968.35 | 6.65 | 5224.16 |
| .0360 | 27.8 | 4.19 | 666.62 | 4.47 | 878.48 | 5.01 | 1415.68 | 5.50 | 2118.41 | 5.97 | 3002.78 | 6.42 | 4083.94 | 6.85 | 5376.28 |
| .0380 | 26.3 | 4.31 | 685.01 | 4.60 | 902.71 | 5.14 | 1454.70 | 5.66 | 2176.77 | 6.14 | 3085.47 | 6.60 | 4196.37 | 7.03 | 5524.24 |
| .0400 | 25.0 | 4.42 | 702.92 | 4.72 | 926.31 | 5.28 | 1492.71 | 5.80 | 2233.61 | 6.30 | 3166.01 | 6.77 | 4305.87 | 7.22 | 5668.35 |
| .0420 | 23.8 | 4.53 | 720.40 | 4.83 | 949.33 | 5.41 | 1529.77 | 5.95 | 2289.05 | 6.45 | 3244.56 | 6.94 | 4412.66 | 7.40 | 5808.90 |
| .0440 | 22.7 | 4.64 | 737.46 | 4.95 | 971.80 | 5.54 | 1565.97 | 6.09 | 2343.19 | 6.61 | 3321.26 | 7.10 | 4516.95 | 7.57 | 5946.15 |
| .0460 | 21.7 | 4.74 | 754.13 | 5.06 | 993.77 | 5.66 | 1601.35 | 6.23 | 2396.10 | 6.76 | 3396.24 | 7.26 | 4618.89 | 7.74 | 6080.31 |
| .0480 | 20.8 | 4.84 | 770.45 | 5.17 | 1015.27 | 5.79 | 1635.97 | 6.36 | 2447.88 | 6.90 | 3469.60 | 7.42 | 4718.63 | 7.91 | 6211.58 |
| .0500 | 20.0 | 4.94 | 786.44 | 5.28 | 1036.32 | 5.91 | 1669.87 | 6.49 | 2498.59 | 7.05 | 3541.45 | 7.57 | 4816.32 | 8.07 | 6340.15 |
| .0550 | 18.2 | 5.19 | 825.05 | 5.54 | 1087.18 | 6.20 | 1751.78 | 6.81 | 2621.10 | 7.39 | 3715.03 | 7.94 | 5052.32 | 8.47 | 6650.74 |
| .0600 | 16.7 | 5.42 | 861.94 | 5.78 | 1135.78 | 6.47 | 1830.05 | 7.11 | 2738.15 | 7.72 | 3880.88 | 8.30 | 5277.81 | 8.85 | 6947.51 |
| .0650 | 15.4 | 5.64 | 897.33 | 6.02 | 1182.39 | 6.74 | 1905.11 | 7.41 | 2850.42 | 8.04 | 4039.96 | 8.64 | 5494.09 | 9.21 | 7232.15 |
| .0700 | 14.3 | 5.86 | 931.38 | 6.25 | 1227.25 | 6.99 | 1977.34 | 7.69 | 2958.45 | 8.34 | 4193.03 | 8.96 | 5702.20 | 9.56 | 7506.04 |
| .0750 | 13.3 | 6.06 | 964.23 | 6.47 | 1270.52 | 7.24 | 2047.04 | 7.96 | 3062.69 | 8.64 | 4340.72 | 9.28 | 5903.01 | 9.89 | 7770.31 |
| .0800 | 12.5 | 6.26 | 996.01 | 6.68 | 1312.38 | 7.48 | 2114.45 | 8.22 | 3163.51 | 8.92 | 4483.57 | 9.58 | 6097.22 | 10.22 | 8025.91 |
| .0850 | 11.8 | 6.46 | 1026.80 | 6.89 | 1352.95 | 7.71 | 2179.78 | 8.47 | 3261.22 | 9.20 | 4622.01 | 9.88 | 6285.45 | 10.53 | 8273.64 |
| .0900 | 11.1 | 6.64 | 1056.71 | 7.09 | 1392.34 | 7.93 | 2243.22 | 8.72 | 3356.10 | 9.46 | 4756.45 | 10.17 | 6468.23 | 10.84 | 8514.19 |
| .0950 | 10.5 | 6.83 | 1085.79 | 7.29 | 1430.65 | 8.15 | 2304.92 | 8.96 | 3448.38 | 9.72 | 4887.20 | 10.45 | 6645.99 | 11.14 | 8748.14 |

| Nominal Bore mm | | 100 | | 150 | | 200 | | 225 | | 300 | | 375 | | 400 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hydraulic Gradient | 1 in | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s |
| .0010 | 1000.0 | 0.23 | 1.84 | 0.31 | 5.45 | 0.37 | 11.74 | 0.40 | 16.06 | 0.49 | 34.45 | 0.56 | 62.19 | 0.59 | 73.75 |
| .0011 | 909.1 | 0.25 | 1.93 | 0.32 | 5.73 | 0.39 | 12.33 | 0.42 | 16.87 | 0.51 | 36.18 | 0.59 | 65.29 | 0.62 | 77.43 |
| .0012 | 833.3 | 0.26 | 2.02 | 0.34 | 5.99 | 0.41 | 12.90 | 0.44 | 17.64 | 0.54 | 37.83 | 0.62 | 68.26 | 0.64 | 80.95 |
| .0013 | 769.2 | 0.27 | 2.11 | 0.35 | 6.24 | 0.43 | 13.44 | 0.46 | 18.38 | 0.56 | 39.41 | 0.64 | 71.11 | 0.67 | 84.32 |
| .0014 | 714.3 | 0.28 | 2.19 | 0.37 | 6.49 | 0.44 | 13.96 | 0.48 | 19.09 | 0.58 | 40.93 | 0.67 | 73.84 | 0.70 | 87.57 |
| .0015 | 666.7 | 0.29 | 2.27 | 0.38 | 6.72 | 0.46 | 14.46 | 0.50 | 19.78 | 0.60 | 42.40 | 0.69 | 76.49 | 0.72 | 90.70 |
| .0016 | 625.0 | 0.30 | 2.35 | 0.39 | 6.95 | 0.48 | 14.95 | 0.51 | 20.44 | 0.62 | 43.82 | 0.72 | 79.04 | 0.75 | 93.73 |
| .0017 | 588.2 | 0.31 | 2.43 | 0.41 | 7.17 | 0.49 | 15.42 | 0.53 | 21.09 | 0.64 | 45.20 | 0.74 | 81.52 | 0.77 | 96.66 |
| .0018 | 555.6 | 0.32 | 2.50 | 0.42 | 7.39 | 0.51 | 15.88 | 0.55 | 21.71 | 0.66 | 46.53 | 0.76 | 83.93 | 0.79 | 99.51 |
| .0019 | 526.3 | 0.33 | 2.57 | 0.43 | 7.59 | 0.52 | 16.33 | 0.56 | 22.32 | 0.68 | 47.83 | 0.78 | 86.27 | 0.81 | 102.29 |
| .0020 | 500.0 | 0.34 | 2.64 | 0.44 | 7.80 | 0.53 | 16.76 | 0.58 | 22.92 | 0.69 | 49.10 | 0.80 | 88.55 | 0.84 | 104.99 |
| .0022 | 454.5 | 0.35 | 2.77 | 0.46 | 8.19 | 0.56 | 17.60 | 0.61 | 24.06 | 0.73 | 51.54 | 0.84 | 92.94 | 0.88 | 110.19 |
| .0024 | 416.7 | 0.37 | 2.90 | 0.48 | 8.56 | 0.59 | 18.40 | 0.63 | 25.15 | 0.76 | 53.88 | 0.88 | 97.14 | 0.92 | 115.17 |
| .0026 | 384.6 | 0.38 | 3.02 | 0.50 | 8.92 | 0.61 | 19.17 | 0.66 | 26.20 | 0.79 | 56.12 | 0.92 | 101.17 | 0.95 | 119.94 |
| .0028 | 357.1 | 0.40 | 3.14 | 0.52 | 9.27 | 0.63 | 19.91 | 0.68 | 27.21 | 0.82 | 58.27 | 0.95 | 105.04 | 0.99 | 124.53 |
| .0030 | 333.3 | 0.41 | 3.25 | 0.54 | 9.60 | 0.66 | 20.62 | 0.71 | 28.18 | 0.85 | 60.35 | 0.98 | 108.78 | 1.03 | 128.97 |
| .0032 | 312.5 | 0.43 | 3.36 | 0.56 | 9.92 | 0.68 | 21.31 | 0.73 | 29.13 | 0.88 | 62.36 | 1.02 | 112.40 | 1.06 | 133.25 |
| .0034 | 294.1 | 0.44 | 3.47 | 0.58 | 10.24 | 0.70 | 21.98 | 0.76 | 30.04 | 0.91 | 64.31 | 1.05 | 115.91 | 1.09 | 137.41 |
| .0036 | 277.8 | 0.45 | 3.57 | 0.60 | 10.54 | 0.72 | 22.63 | 0.78 | 30.92 | 0.94 | 66.20 | 1.08 | 119.31 | 1.13 | 141.44 |
| .0038 | 263.2 | 0.47 | 3.67 | 0.61 | 10.83 | 0.74 | 23.26 | 0.80 | 31.79 | 0.96 | 68.04 | 1.11 | 122.62 | 1.16 | 145.36 |
| .0040 | 250.0 | 0.48 | 3.77 | 0.63 | 11.12 | 0.76 | 23.88 | 0.82 | 32.63 | 0.99 | 69.83 | 1.14 | 125.85 | 1.19 | 149.19 |
| .0042 | 238.1 | 0.49 | 3.87 | 0.65 | 11.40 | 0.78 | 24.48 | 0.84 | 33.44 | 1.01 | 71.58 | 1.17 | 128.99 | 1.22 | 152.91 |
| .0044 | 227.3 | 0.50 | 3.96 | 0.66 | 11.68 | 0.80 | 25.06 | 0.86 | 34.24 | 1.04 | 73.29 | 1.20 | 132.06 | 1.25 | 156.55 |
| .0046 | 217.4 | 0.52 | 4.05 | 0.68 | 11.94 | 0.82 | 25.64 | 0.88 | 35.03 | 1.06 | 74.96 | 1.22 | 135.07 | 1.27 | 160.11 |
| .0048 | 208.3 | 0.53 | 4.14 | 0.69 | 12.20 | 0.83 | 26.20 | 0.90 | 35.79 | 1.08 | 76.59 | 1.25 | 138.00 | 1.30 | 163.59 |
| .0050 | 200.0 | 0.54 | 4.23 | 0.71 | 12.46 | 0.85 | 26.75 | 0.92 | 36.54 | 1.11 | 78.19 | 1.28 | 140.88 | 1.33 | 167.00 |
| .0055 | 181.8 | 0.57 | 4.44 | 0.74 | 13.08 | 0.89 | 28.07 | 0.96 | 38.35 | 1.16 | 82.06 | 1.34 | 147.83 | 1.39 | 175.24 |
| .0060 | 166.7 | 0.59 | 4.64 | 0.77 | 13.67 | 0.93 | 29.34 | 1.01 | 40.08 | 1.21 | 85.75 | 1.40 | 154.48 | 1.46 | 183.11 |
| .0065 | 153.8 | 0.62 | 4.84 | 0.81 | 14.24 | 0.97 | 30.56 | 1.05 | 41.74 | 1.26 | 89.29 | 1.46 | 160.85 | 1.52 | 190.66 |
| .0070 | 142.9 | 0.64 | 5.02 | 0.84 | 14.79 | 1.01 | 31.73 | 1.09 | 43.34 | 1.31 | 92.70 | 1.51 | 166.98 | 1.58 | 197.93 |
| .0075 | 133.3 | 0.66 | 5.20 | 0.87 | 15.32 | 1.05 | 32.85 | 1.13 | 44.88 | 1.36 | 95.99 | 1.57 | 172.90 | 1.63 | 204.94 |
| .0080 | 125.0 | 0.68 | 5.38 | 0.90 | 15.83 | 1.08 | 33.95 | 1.17 | 46.37 | 1.40 | 99.17 | 1.62 | 178.62 | 1.68 | 211.72 |
| .0085 | 117.6 | 0.71 | 5.55 | 0.92 | 16.32 | 1.11 | 35.00 | 1.20 | 47.81 | 1.45 | 102.25 | 1.67 | 184.16 | 1.74 | 218.29 |
| .0090 | 111.1 | 0.73 | 5.71 | 0.95 | 16.80 | 1.15 | 36.03 | 1.24 | 49.21 | 1.49 | 105.25 | 1.72 | 189.55 | 1.79 | 224.67 |
| .0095 | 105.3 | 0.75 | 5.87 | 0.98 | 17.27 | 1.18 | 37.03 | 1.27 | 50.58 | 1.53 | 108.16 | 1.76 | 194.79 | 1.84 | 230.88 |
| .0100 | 100.0 | 0.77 | 6.02 | 1.00 | 17.72 | 1.21 | 38.00 | 1.31 | 51.91 | 1.57 | 110.99 | 1.81 | 199.89 | 1.89 | 236.92 |
| .0110 | 90.9 | 0.81 | 6.32 | 1.05 | 18.60 | 1.27 | 39.88 | 1.37 | 54.47 | 1.65 | 116.46 | 1.90 | 209.72 | 1.98 | 248.57 |
| .0120 | 83.3 | 0.84 | 6.61 | 1.10 | 19.44 | 1.33 | 41.67 | 1.43 | 56.91 | 1.72 | 121.68 | 1.98 | 219.12 | 2.07 | 259.71 |
| .0130 | 76.9 | 0.88 | 6.88 | 1.15 | 20.24 | 1.38 | 43.39 | 1.49 | 59.26 | 1.79 | 126.69 | 2.07 | 228.13 | 2.15 | 270.39 |
| .0140 | 71.4 | 0.91 | 7.15 | 1.19 | 21.02 | 1.43 | 45.05 | 1.55 | 61.52 | 1.86 | 131.51 | 2.14 | 236.80 | 2.23 | 280.66 |
| .0150 | 66.7 | 0.94 | 7.40 | 1.23 | 21.76 | 1.48 | 46.65 | 1.60 | 63.70 | 1.93 | 136.17 | 2.22 | 245.17 | 2.31 | 290.58 |
| .0160 | 62.5 | 0.97 | 7.65 | 1.27 | 22.48 | 1.53 | 48.19 | 1.66 | 65.81 | 1.99 | 140.67 | 2.29 | 253.27 | 2.39 | 300.17 |
| .0170 | 58.8 | 1.00 | 7.89 | 1.31 | 23.18 | 1.58 | 49.69 | 1.71 | 67.85 | 2.05 | 145.03 | 2.36 | 261.11 | 2.46 | 309.46 |
| .0180 | 55.6 | 1.03 | 8.12 | 1.35 | 23.86 | 1.63 | 51.14 | 1.76 | 69.83 | 2.11 | 149.26 | 2.43 | 268.73 | 2.53 | 318.49 |
| .0190 | 52.6 | 1.06 | 8.34 | 1.39 | 24.52 | 1.67 | 52.56 | 1.80 | 71.76 | 2.17 | 153.38 | 2.50 | 276.13 | 2.60 | 327.26 |
| .0200 | 50.0 | 1.09 | 8.56 | 1.42 | 25.17 | 1.72 | 53.93 | 1.85 | 73.64 | 2.23 | 157.39 | 2.57 | 283.35 | 2.67 | 335.81 |
| .0220 | 45.5 | 1.14 | 8.99 | 1.49 | 26.41 | 1.80 | 56.59 | 1.94 | 77.26 | 2.34 | 165.12 | 2.69 | 297.26 | 2.80 | 352.29 |
| .0240 | 41.7 | 1.20 | 9.39 | 1.56 | 27.59 | 1.88 | 59.12 | 2.03 | 80.73 | 2.44 | 172.51 | 2.81 | 310.55 | 2.93 | 368.04 |
| .0260 | 38.5 | 1.25 | 9.78 | 1.63 | 28.73 | 1.96 | 61.56 | 2.11 | 84.05 | 2.54 | 179.60 | 2.93 | 323.30 | 3.05 | 383.15 |
| .0280 | 35.7 | 1.29 | 10.15 | 1.69 | 29.83 | 2.03 | 63.90 | 2.19 | 87.24 | 2.64 | 186.42 | 3.04 | 335.56 | 3.16 | 397.68 |
| .0300 | 33.3 | 1.34 | 10.51 | 1.75 | 30.88 | 2.11 | 66.16 | 2.27 | 90.32 | 2.73 | 193.00 | 3.15 | 347.40 | 3.28 | 411.70 |
| .0320 | 31.2 | 1.38 | 10.86 | 1.81 | 31.90 | 2.18 | 68.34 | 2.35 | 93.30 | 2.82 | 199.36 | 3.25 | 358.84 | 3.38 | 425.27 |
| .0340 | 29.4 | 1.43 | 11.20 | 1.86 | 32.89 | 2.24 | 70.46 | 2.42 | 96.19 | 2.91 | 205.53 | 3.35 | 369.94 | 3.49 | 438.41 |
| .0360 | 27.8 | 1.47 | 11.53 | 1.92 | 33.85 | 2.31 | 72.51 | 2.49 | 99.00 | 2.99 | 211.52 | 3.45 | 380.71 | 3.59 | 451.17 |
| .0380 | 26.3 | 1.51 | 11.85 | 1.97 | 34.79 | 2.37 | 74.51 | 2.56 | 101.73 | 3.07 | 217.34 | 3.54 | 391.19 | 3.69 | 463.59 |
| .0400 | 25.0 | 1.55 | 12.16 | 2.02 | 35.70 | 2.43 | 76.46 | 2.63 | 104.39 | 3.15 | 223.01 | 3.63 | 401.39 | 3.79 | 475.68 |
| .0420 | 23.8 | 1.59 | 12.46 | 2.07 | 36.59 | 2.49 | 78.36 | 2.69 | 106.98 | 3.23 | 228.55 | 3.72 | 411.35 | 3.88 | 487.47 |
| .0440 | 22.7 | 1.62 | 12.76 | 2.12 | 37.45 | 2.55 | 80.22 | 2.75 | 109.51 | 3.31 | 233.95 | 3.81 | 421.06 | 3.97 | 498.99 |
| .0460 | 21.7 | 1.66 | 13.05 | 2.17 | 38.30 | 2.61 | 82.03 | 2.82 | 111.98 | 3.38 | 239.23 | 3.90 | 430.56 | 4.06 | 510.25 |
| .0480 | 20.8 | 1.70 | 13.33 | 2.21 | 39.13 | 2.67 | 83.80 | 2.88 | 114.40 | 3.46 | 244.40 | 3.98 | 439.86 | 4.15 | 521.26 |
| .0500 | 20.0 | 1.73 | 13.61 | 2.26 | 39.94 | 2.72 | 85.54 | 2.94 | 116.78 | 3.53 | 249.46 | 4.06 | 448.96 | 4.23 | 532.05 |
| .0550 | 18.2 | 1.82 | 14.28 | 2.37 | 41.90 | 2.86 | 89.74 | 3.08 | 122.50 | 3.70 | 261.69 | 4.26 | 470.96 | 4.44 | 558.11 |
| .0600 | 16.7 | 1.90 | 14.92 | 2.48 | 43.78 | 2.98 | 93.75 | 3.22 | 127.98 | 3.87 | 273.37 | 4.45 | 491.97 | 4.64 | 583.01 |
| .0650 | 15.4 | 1.98 | 15.53 | 2.58 | 45.58 | 3.11 | 97.60 | 3.35 | 133.23 | 4.03 | 284.58 | 4.64 | 512.13 | 4.83 | 606.89 |
| .0700 | 14.3 | 2.05 | 16.12 | 2.68 | 47.31 | 3.22 | 101.30 | 3.48 | 138.28 | 4.18 | 295.36 | 4.81 | 531.52 | 5.01 | 629.87 |
| .0750 | 13.3 | 2.13 | 16.69 | 2.77 | 48.98 | 3.34 | 104.87 | 3.60 | 143.15 | 4.33 | 305.76 | 4.98 | 550.24 | 5.19 | 652.05 |
| .0800 | 12.5 | 2.20 | 17.24 | 2.86 | 50.59 | 3.45 | 108.32 | 3.72 | 147.87 | 4.47 | 315.82 | 5.15 | 568.34 | 5.36 | 673.49 |
| .0850 | 11.8 | 2.26 | 17.78 | 2.95 | 52.16 | 3.55 | 111.67 | 3.83 | 152.44 | 4.61 | 325.58 | 5.30 | 585.88 | 5.52 | 694.28 |
| .0900 | 11.1 | 2.33 | 18.30 | 3.04 | 53.68 | 3.66 | 114.92 | 3.95 | 156.87 | 4.74 | 335.05 | 5.46 | 602.91 | 5.69 | 714.46 |
| .0950 | 10.5 | 2.39 | 18.80 | 3.12 | 55.15 | 3.76 | 118.09 | 4.05 | 161.19 | 4.87 | 344.26 | 5.61 | 619.48 | 5.84 | 734.09 |

TABLE 30 **PIPE FLOWING FULL** $k_s = 0.6$mm **450mm to 1000mm Nominal Bore**
*(continued)*

| Nominal Bore mm | | 450 | | 500 | | 600 | | 700 | | 800 | | 900 | | 1000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hydraulic Gradient | 1 in | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s |
| .0010 | 1000.0 | 0.63 | 100.66 | 0.68 | 132.91 | 0.76 | 214.87 | 0.84 | 322.34 | 0.91 | 457.85 | 0.98 | 623.79 | 1.05 | 822.41 |
| .0011 | 909.1 | 0.66 | 105.67 | 0.71 | 139.52 | 0.80 | 225.54 | 0.88 | 338.33 | 0.96 | 480.53 | 1.03 | 654.66 | 1.10 | 863.08 |
| .0012 | 833.3 | 0.69 | 110.46 | 0.74 | 145.84 | 0.83 | 235.74 | 0.92 | 353.60 | 1.00 | 502.20 | 1.08 | 684.15 | 1.15 | 901.93 |
| .0013 | 769.2 | 0.72 | 115.06 | 0.77 | 151.90 | 0.87 | 245.52 | 0.96 | 368.25 | 1.04 | 522.99 | 1.12 | 712.45 | 1.20 | 939.20 |
| .0014 | 714.3 | 0.75 | 119.48 | 0.80 | 157.74 | 0.90 | 254.93 | 0.99 | 382.35 | 1.08 | 542.99 | 1.16 | 739.67 | 1.24 | 975.07 |
| .0015 | 666.7 | 0.78 | 123.75 | 0.83 | 163.36 | 0.93 | 264.01 | 1.03 | 395.95 | 1.12 | 562.29 | 1.20 | 765.94 | 1.29 | 1009.67 |
| .0016 | 625.0 | 0.80 | 127.88 | 0.86 | 168.81 | 0.96 | 272.79 | 1.06 | 409.11 | 1.16 | 580.96 | 1.24 | 791.35 | 1.33 | 1043.15 |
| .0017 | 588.2 | 0.83 | 131.88 | 0.89 | 174.09 | 0.99 | 281.31 | 1.10 | 421.86 | 1.19 | 599.05 | 1.28 | 815.98 | 1.37 | 1075.59 |
| .0018 | 555.6 | 0.85 | 135.77 | 0.91 | 179.21 | 1.02 | 289.58 | 1.13 | 434.25 | 1.23 | 616.62 | 1.32 | 839.89 | 1.41 | 1107.09 |
| .0019 | 526.3 | 0.88 | 139.54 | 0.94 | 184.19 | 1.05 | 297.62 | 1.16 | 446.29 | 1.26 | 633.71 | 1.36 | 863.15 | 1.45 | 1137.73 |
| .0020 | 500.0 | 0.90 | 143.23 | 0.96 | 189.05 | 1.08 | 305.45 | 1.19 | 458.03 | 1.29 | 650.35 | 1.39 | 885.80 | 1.49 | 1167.57 |
| .0022 | 454.5 | 0.95 | 150.32 | 1.01 | 198.41 | 1.13 | 320.55 | 1.25 | 480.64 | 1.36 | 682.44 | 1.46 | 929.47 | 1.56 | 1225.10 |
| .0024 | 416.7 | 0.99 | 157.10 | 1.06 | 207.35 | 1.18 | 334.98 | 1.31 | 502.25 | 1.42 | 713.10 | 1.53 | 971.20 | 1.63 | 1280.07 |
| .0026 | 384.6 | 1.03 | 163.61 | 1.10 | 215.92 | 1.23 | 348.81 | 1.36 | 522.98 | 1.48 | 742.51 | 1.59 | 1011.23 | 1.70 | 1332.79 |
| .0028 | 357.1 | 1.07 | 169.87 | 1.14 | 224.18 | 1.28 | 362.13 | 1.41 | 542.93 | 1.53 | 770.80 | 1.65 | 1049.74 | 1.76 | 1383.53 |
| .0030 | 333.3 | 1.11 | 175.90 | 1.18 | 232.14 | 1.33 | 374.98 | 1.46 | 562.18 | 1.59 | 798.11 | 1.71 | 1086.90 | 1.82 | 1432.48 |
| .0032 | 312.5 | 1.14 | 181.75 | 1.22 | 239.85 | 1.37 | 387.41 | 1.51 | 580.79 | 1.64 | 824.52 | 1.77 | 1122.85 | 1.88 | 1479.83 |
| .0034 | 294.1 | 1.18 | 187.41 | 1.26 | 247.31 | 1.41 | 399.45 | 1.56 | 598.83 | 1.69 | 850.11 | 1.82 | 1157.68 | 1.94 | 1525.72 |
| .0036 | 277.8 | 1.21 | 192.90 | 1.30 | 254.56 | 1.45 | 411.15 | 1.60 | 616.35 | 1.74 | 874.97 | 1.87 | 1191.51 | 2.00 | 1570.28 |
| .0038 | 263.2 | 1.25 | 198.25 | 1.33 | 261.61 | 1.49 | 422.53 | 1.65 | 633.39 | 1.79 | 899.14 | 1.92 | 1224.41 | 2.05 | 1613.62 |
| .0040 | 250.0 | 1.28 | 203.46 | 1.37 | 268.48 | 1.53 | 433.61 | 1.69 | 649.99 | 1.84 | 922.68 | 1.98 | 1256.46 | 2.11 | 1655.83 |
| .0042 | 238.1 | 1.31 | 208.54 | 1.40 | 275.18 | 1.57 | 444.41 | 1.73 | 666.18 | 1.88 | 945.65 | 2.02 | 1287.71 | 2.16 | 1697.00 |
| .0044 | 227.3 | 1.34 | 213.50 | 1.43 | 281.72 | 1.61 | 454.97 | 1.77 | 681.98 | 1.93 | 968.07 | 2.07 | 1318.23 | 2.21 | 1737.21 |
| .0046 | 217.4 | 1.37 | 218.35 | 1.47 | 288.11 | 1.65 | 465.28 | 1.81 | 697.43 | 1.97 | 989.99 | 2.12 | 1348.06 | 2.26 | 1776.51 |
| .0048 | 208.3 | 1.40 | 223.09 | 1.50 | 294.37 | 1.68 | 475.38 | 1.85 | 712.55 | 2.01 | 1011.44 | 2.16 | 1377.26 | 2.31 | 1814.96 |
| .0050 | 200.0 | 1.43 | 227.74 | 1.53 | 300.50 | 1.72 | 485.26 | 1.89 | 727.36 | 2.05 | 1032.45 | 2.21 | 1405.85 | 2.36 | 1852.62 |
| .0055 | 181.8 | 1.50 | 238.96 | 1.61 | 315.30 | 1.80 | 509.15 | 1.98 | 763.13 | 2.15 | 1083.19 | 2.32 | 1474.91 | 2.47 | 1943.60 |
| .0060 | 166.7 | 1.57 | 249.69 | 1.68 | 329.45 | 1.88 | 531.97 | 2.07 | 797.31 | 2.25 | 1131.68 | 2.42 | 1540.91 | 2.59 | 2030.53 |
| .0065 | 153.8 | 1.63 | 259.98 | 1.75 | 343.01 | 1.96 | 553.85 | 2.16 | 830.10 | 2.34 | 1178.19 | 2.52 | 1604.21 | 2.69 | 2113.92 |
| .0070 | 142.9 | 1.70 | 269.88 | 1.81 | 356.07 | 2.03 | 574.92 | 2.24 | 861.64 | 2.43 | 1222.94 | 2.62 | 1665.11 | 2.79 | 2194.15 |
| .0075 | 133.3 | 1.76 | 279.43 | 1.88 | 368.66 | 2.11 | 595.24 | 2.32 | 892.08 | 2.52 | 1266.12 | 2.71 | 1723.88 | 2.89 | 2271.56 |
| .0080 | 125.0 | 1.82 | 288.67 | 1.94 | 380.85 | 2.17 | 614.89 | 2.39 | 921.52 | 2.60 | 1307.89 | 2.80 | 1780.72 | 2.99 | 2346.44 |
| .0085 | 117.6 | 1.87 | 297.63 | 2.00 | 392.66 | 2.24 | 633.94 | 2.47 | 950.05 | 2.68 | 1348.36 | 2.89 | 1835.82 | 3.08 | 2419.01 |
| .0090 | 111.1 | 1.93 | 306.32 | 2.06 | 404.12 | 2.31 | 652.44 | 2.54 | 977.76 | 2.76 | 1387.67 | 2.97 | 1889.31 | 3.17 | 2489.47 |
| .0095 | 105.3 | 1.98 | 314.78 | 2.11 | 415.27 | 2.37 | 670.43 | 2.61 | 1004.71 | 2.84 | 1425.90 | 3.05 | 1941.34 | 3.26 | 2558.01 |
| .0100 | 100.0 | 2.03 | 323.01 | 2.17 | 426.14 | 2.43 | 687.96 | 2.68 | 1030.96 | 2.91 | 1463.13 | 3.13 | 1992.01 | 3.34 | 2624.76 |
| .0110 | 90.9 | 2.13 | 338.89 | 2.28 | 447.07 | 2.55 | 721.74 | 2.81 | 1081.55 | 3.05 | 1534.90 | 3.28 | 2089.70 | 3.51 | 2753.44 |
| .0120 | 83.3 | 2.23 | 354.06 | 2.38 | 467.08 | 2.67 | 754.01 | 2.94 | 1129.89 | 3.19 | 1603.48 | 3.43 | 2183.04 | 3.66 | 2876.39 |
| .0130 | 76.9 | 2.32 | 368.62 | 2.48 | 486.27 | 2.78 | 784.97 | 3.06 | 1176.26 | 3.32 | 1669.26 | 3.57 | 2272.56 | 3.81 | 2994.32 |
| .0140 | 71.4 | 2.41 | 382.62 | 2.57 | 504.73 | 2.88 | 814.76 | 3.17 | 1220.88 | 3.45 | 1732.55 | 3.71 | 2358.70 | 3.96 | 3107.79 |
| .0150 | 66.7 | 2.49 | 396.13 | 2.66 | 522.55 | 2.98 | 843.50 | 3.28 | 1263.93 | 3.57 | 1793.63 | 3.84 | 2441.82 | 4.10 | 3217.28 |
| .0160 | 62.5 | 2.57 | 409.20 | 2.75 | 539.78 | 3.08 | 871.30 | 3.39 | 1305.57 | 3.69 | 1852.69 | 3.96 | 2522.21 | 4.23 | 3323.17 |
| .0170 | 58.8 | 2.65 | 421.86 | 2.83 | 556.48 | 3.18 | 898.25 | 3.50 | 1345.92 | 3.80 | 1909.94 | 4.09 | 2600.13 | 4.36 | 3425.81 |
| .0180 | 55.6 | 2.73 | 434.16 | 2.92 | 572.70 | 3.27 | 924.41 | 3.60 | 1385.11 | 3.91 | 1965.53 | 4.21 | 2675.78 | 4.49 | 3525.46 |
| .0190 | 52.6 | 2.81 | 446.12 | 3.00 | 588.47 | 3.36 | 949.85 | 3.70 | 1423.22 | 4.02 | 2019.59 | 4.32 | 2749.36 | 4.61 | 3622.39 |
| .0200 | 50.0 | 2.88 | 457.77 | 3.08 | 603.84 | 3.45 | 974.64 | 3.79 | 1460.34 | 4.12 | 2072.25 | 4.43 | 2821.03 | 4.73 | 3716.80 |
| .0220 | 45.5 | 3.02 | 480.23 | 3.23 | 633.45 | 3.62 | 1022.41 | 3.98 | 1531.90 | 4.32 | 2173.76 | 4.65 | 2959.19 | 4.96 | 3898.78 |
| .0240 | 41.7 | 3.15 | 501.69 | 3.37 | 661.75 | 3.78 | 1068.06 | 4.16 | 1600.27 | 4.52 | 2270.75 | 4.86 | 3091.19 | 5.19 | 4072.67 |
| .0260 | 38.5 | 3.28 | 522.27 | 3.51 | 688.89 | 3.93 | 1111.85 | 4.33 | 1665.85 | 4.70 | 2363.78 | 5.06 | 3217.80 | 5.40 | 4239.45 |
| .0280 | 35.7 | 3.41 | 542.07 | 3.64 | 715.00 | 4.08 | 1153.98 | 4.49 | 1728.95 | 4.88 | 2453.30 | 5.25 | 3339.63 | 5.60 | 4399.93 |
| .0300 | 33.3 | 3.53 | 561.18 | 3.77 | 740.20 | 4.23 | 1194.63 | 4.65 | 1789.83 | 5.05 | 2539.67 | 5.43 | 3457.18 | 5.80 | 4554.77 |
| .0320 | 31.2 | 3.64 | 579.67 | 3.89 | 764.57 | 4.36 | 1233.94 | 4.80 | 1848.72 | 5.22 | 2623.20 | 5.61 | 3570.88 | 5.99 | 4704.53 |
| .0340 | 29.4 | 3.76 | 597.58 | 4.01 | 788.19 | 4.50 | 1272.05 | 4.95 | 1905.79 | 5.38 | 2704.17 | 5.79 | 3681.07 | 6.17 | 4849.68 |
| .0360 | 27.8 | 3.87 | 614.97 | 4.13 | 811.13 | 4.63 | 1309.05 | 5.10 | 1961.21 | 5.54 | 2782.78 | 5.95 | 3788.06 | 6.35 | 4990.63 |
| .0380 | 26.3 | 3.97 | 631.89 | 4.24 | 833.43 | 4.76 | 1345.04 | 5.24 | 2015.11 | 5.69 | 2859.24 | 6.12 | 3892.13 | 6.53 | 5127.71 |
| .0400 | 25.0 | 4.08 | 648.36 | 4.36 | 855.16 | 4.88 | 1380.09 | 5.37 | 2067.61 | 5.84 | 2933.72 | 6.28 | 3993.49 | 6.70 | 5261.22 |
| .0420 | 23.8 | 4.18 | 664.43 | 4.46 | 876.35 | 5.00 | 1414.28 | 5.51 | 2118.81 | 5.98 | 3006.35 | 6.43 | 4092.34 | 6.86 | 5391.44 |
| .0440 | 22.7 | 4.28 | 680.13 | 4.57 | 897.04 | 5.12 | 1447.66 | 5.64 | 2168.81 | 6.12 | 3077.28 | 6.58 | 4188.87 | 7.03 | 5518.59 |
| .0460 | 21.7 | 4.37 | 695.47 | 4.67 | 917.27 | 5.24 | 1480.29 | 5.76 | 2217.68 | 6.26 | 3146.61 | 6.73 | 4283.23 | 7.18 | 5642.89 |
| .0480 | 20.8 | 4.47 | 710.47 | 4.77 | 937.06 | 5.35 | 1512.22 | 5.89 | 2265.50 | 6.39 | 3214.45 | 6.88 | 4375.56 | 7.34 | 5764.51 |
| .0500 | 20.0 | 4.56 | 725.17 | 4.87 | 956.45 | 5.46 | 1543.49 | 6.01 | 2312.34 | 6.53 | 3280.89 | 7.02 | 4465.98 | 7.49 | 5883.62 |
| .0550 | 18.2 | 4.78 | 760.68 | 5.11 | 1003.27 | 5.73 | 1619.03 | 6.30 | 2425.48 | 6.85 | 3441.39 | 7.36 | 4684.43 | 7.86 | 6171.37 |
| .0600 | 16.7 | 5.00 | 794.62 | 5.34 | 1048.01 | 5.98 | 1691.21 | 6.58 | 2533.59 | 7.15 | 3594.76 | 7.69 | 4893.16 | 8.21 | 6446.31 |
| .0650 | 15.4 | 5.20 | 827.16 | 5.56 | 1090.93 | 6.23 | 1760.44 | 6.85 | 2637.28 | 7.44 | 3741.85 | 8.01 | 5093.35 | 8.54 | 6710.02 |
| .0700 | 14.3 | 5.40 | 858.47 | 5.77 | 1132.22 | 6.46 | 1827.06 | 7.11 | 2737.06 | 7.73 | 3883.39 | 8.31 | 5285.98 | 8.87 | 6963.76 |
| .0750 | 13.3 | 5.59 | 888.69 | 5.97 | 1172.06 | 6.69 | 1891.33 | 7.36 | 2833.33 | 8.00 | 4019.95 | 8.60 | 5471.85 | 9.18 | 7208.60 |
| .0800 | 12.5 | 5.77 | 917.91 | 6.17 | 1210.60 | 6.91 | 1953.50 | 7.60 | 2926.44 | 8.26 | 4152.04 | 8.88 | 5651.61 | 9.48 | 7445.40 |
| .0850 | 11.8 | 5.95 | 946.24 | 6.36 | 1247.95 | 7.12 | 2013.75 | 7.84 | 3016.68 | 8.51 | 4280.06 | 9.16 | 5825.85 | 9.77 | 7674.91 |
| .0900 | 11.1 | 6.12 | 973.74 | 6.54 | 1284.21 | 7.33 | 2072.26 | 8.07 | 3104.31 | 8.76 | 4404.36 | 9.42 | 5995.03 | 10.06 | 7897.76 |
| .0950 | 10.5 | 6.29 | 1000.49 | 6.72 | 1319.48 | 7.53 | 2129.16 | 8.29 | 3189.53 | 9.00 | 4525.26 | 9.68 | 6159.57 | 10.33 | 8114.50 |

| Nominal Bore mm | | 100 | | 150 | | 200 | | 225 | | 300 | | 375 | | 400 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hydraulic Gradient | 1 in | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s |
| .0010 | 1000.0 | 0.21 | 1.62 | 0.27 | 4.82 | 0.33 | 10.42 | 0.36 | 14.27 | 0.43 | 30.70 | 0.50 | 55.54 | 0.52 | 65.91 |
| .0011 | 909.1 | 0.22 | 1.70 | 0.29 | 5.06 | 0.35 | 10.93 | 0.38 | 14.97 | 0.46 | 32.22 | 0.53 | 58.28 | 0.55 | 69.16 |
| .0012 | 833.3 | 0.23 | 1.78 | 0.30 | 5.29 | 0.36 | 11.43 | 0.39 | 15.65 | 0.48 | 33.67 | 0.55 | 60.90 | 0.58 | 72.27 |
| .0013 | 769.2 | 0.24 | 1.85 | 0.31 | 5.51 | 0.38 | 11.90 | 0.41 | 16.30 | 0.50 | 35.06 | 0.57 | 63.41 | 0.60 | 75.25 |
| .0014 | 714.3 | 0.24 | 1.92 | 0.32 | 5.72 | 0.39 | 12.36 | 0.43 | 16.92 | 0.51 | 36.40 | 0.60 | 65.83 | 0.62 | 78.12 |
| .0015 | 666.7 | 0.25 | 1.99 | 0.34 | 5.93 | 0.41 | 12.80 | 0.44 | 17.52 | 0.53 | 37.69 | 0.62 | 68.16 | 0.64 | 80.89 |
| .0016 | 625.0 | 0.26 | 2.06 | 0.35 | 6.12 | 0.42 | 13.22 | 0.46 | 18.10 | 0.55 | 38.94 | 0.64 | 70.42 | 0.66 | 83.56 |
| .0017 | 588.2 | 0.27 | 2.12 | 0.36 | 6.32 | 0.43 | 13.63 | 0.47 | 18.67 | 0.57 | 40.15 | 0.66 | 72.61 | 0.69 | 86.16 |
| .0018 | 555.6 | 0.28 | 2.19 | 0.37 | 6.50 | 0.45 | 14.03 | 0.48 | 19.22 | 0.58 | 41.33 | 0.68 | 74.73 | 0.71 | 88.68 |
| .0019 | 526.3 | 0.29 | 2.25 | 0.38 | 6.68 | 0.46 | 14.42 | 0.50 | 19.75 | 0.60 | 42.47 | 0.70 | 76.80 | 0.73 | 91.13 |
| .0020 | 500.0 | 0.29 | 2.31 | 0.39 | 6.86 | 0.47 | 14.80 | 0.51 | 20.27 | 0.62 | 43.58 | 0.71 | 78.81 | 0.74 | 93.51 |
| .0022 | 454.5 | 0.31 | 2.42 | 0.41 | 7.20 | 0.49 | 15.53 | 0.53 | 21.27 | 0.65 | 45.73 | 0.75 | 82.68 | 0.78 | 98.11 |
| .0024 | 416.7 | 0.32 | 2.53 | 0.43 | 7.52 | 0.52 | 16.23 | 0.56 | 22.22 | 0.68 | 47.78 | 0.78 | 86.39 | 0.82 | 102.51 |
| .0026 | 384.6 | 0.34 | 2.64 | 0.44 | 7.83 | 0.54 | 16.90 | 0.58 | 23.14 | 0.70 | 49.75 | 0.81 | 89.94 | 0.85 | 106.72 |
| .0028 | 357.1 | 0.35 | 2.74 | 0.46 | 8.13 | 0.56 | 17.55 | 0.60 | 24.02 | 0.73 | 51.64 | 0.85 | 93.36 | 0.88 | 110.78 |
| .0030 | 333.3 | 0.36 | 2.84 | 0.48 | 8.42 | 0.58 | 18.17 | 0.63 | 24.87 | 0.76 | 53.47 | 0.88 | 96.66 | 0.91 | 114.69 |
| .0032 | 312.5 | 0.37 | 2.93 | 0.49 | 8.70 | 0.60 | 18.77 | 0.65 | 25.70 | 0.78 | 55.24 | 0.90 | 99.85 | 0.94 | 118.48 |
| .0034 | 294.1 | 0.38 | 3.02 | 0.51 | 8.97 | 0.62 | 19.35 | 0.67 | 26.49 | 0.81 | 56.95 | 0.93 | 102.95 | 0.97 | 122.15 |
| .0036 | 277.8 | 0.40 | 3.11 | 0.52 | 9.24 | 0.63 | 19.92 | 0.69 | 27.27 | 0.83 | 58.61 | 0.96 | 105.95 | 1.00 | 125.71 |
| .0038 | 263.2 | 0.41 | 3.20 | 0.54 | 9.49 | 0.65 | 20.47 | 0.70 | 28.02 | 0.85 | 60.23 | 0.99 | 108.87 | 1.03 | 129.18 |
| .0040 | 250.0 | 0.42 | 3.28 | 0.55 | 9.74 | 0.67 | 21.01 | 0.72 | 28.76 | 0.87 | 61.81 | 1.01 | 111.72 | 1.05 | 132.55 |
| .0042 | 238.1 | 0.43 | 3.36 | 0.57 | 9.98 | 0.69 | 21.53 | 0.74 | 29.47 | 0.90 | 63.34 | 1.04 | 114.49 | 1.08 | 135.84 |
| .0044 | 227.3 | 0.44 | 3.44 | 0.58 | 10.22 | 0.70 | 22.04 | 0.76 | 30.17 | 0.92 | 64.84 | 1.06 | 117.20 | 1.11 | 139.06 |
| .0046 | 217.4 | 0.45 | 3.52 | 0.59 | 10.45 | 0.72 | 22.54 | 0.78 | 30.85 | 0.94 | 66.31 | 1.09 | 119.85 | 1.13 | 142.20 |
| .0048 | 208.3 | 0.46 | 3.60 | 0.60 | 10.68 | 0.73 | 23.03 | 0.79 | 31.52 | 0.96 | 67.74 | 1.11 | 122.44 | 1.16 | 145.27 |
| .0050 | 200.0 | 0.47 | 3.67 | 0.62 | 10.90 | 0.75 | 23.51 | 0.81 | 32.18 | 0.98 | 69.15 | 1.13 | 124.98 | 1.18 | 148.28 |
| .0055 | 181.8 | 0.49 | 3.86 | 0.65 | 11.44 | 0.79 | 24.67 | 0.85 | 33.76 | 1.03 | 72.54 | 1.19 | 131.11 | 1.24 | 155.56 |
| .0060 | 166.7 | 0.51 | 4.03 | 0.68 | 11.95 | 0.82 | 25.77 | 0.89 | 35.27 | 1.07 | 75.79 | 1.24 | 136.97 | 1.29 | 162.51 |
| .0065 | 153.8 | 0.53 | 4.20 | 0.70 | 12.45 | 0.85 | 26.83 | 0.92 | 36.72 | 1.12 | 78.90 | 1.29 | 142.59 | 1.35 | 169.17 |
| .0070 | 142.9 | 0.55 | 4.36 | 0.73 | 12.92 | 0.89 | 27.85 | 0.96 | 38.12 | 1.16 | 81.90 | 1.34 | 148.00 | 1.40 | 175.59 |
| .0075 | 133.3 | 0.57 | 4.51 | 0.76 | 13.38 | 0.92 | 28.84 | 0.99 | 39.46 | 1.20 | 84.78 | 1.39 | 153.22 | 1.45 | 181.78 |
| .0080 | 125.0 | 0.59 | 4.66 | 0.78 | 13.82 | 0.95 | 29.79 | 1.03 | 40.76 | 1.24 | 87.58 | 1.43 | 158.26 | 1.49 | 187.76 |
| .0085 | 117.6 | 0.61 | 4.80 | 0.81 | 14.25 | 0.98 | 30.71 | 1.06 | 42.03 | 1.28 | 90.29 | 1.48 | 163.15 | 1.54 | 193.57 |
| .0090 | 111.1 | 0.63 | 4.95 | 0.83 | 14.66 | 1.01 | 31.61 | 1.09 | 43.25 | 1.31 | 92.92 | 1.52 | 167.90 | 1.59 | 199.20 |
| .0095 | 105.3 | 0.65 | 5.08 | 0.85 | 15.07 | 1.03 | 32.48 | 1.12 | 44.44 | 1.35 | 95.47 | 1.56 | 172.52 | 1.63 | 204.68 |
| .0100 | 100.0 | 0.66 | 5.22 | 0.87 | 15.46 | 1.06 | 33.32 | 1.15 | 45.60 | 1.39 | 97.97 | 1.60 | 177.02 | 1.67 | 210.01 |
| .0110 | 90.9 | 0.70 | 5.47 | 0.92 | 16.22 | 1.11 | 34.96 | 1.20 | 47.84 | 1.45 | 102.77 | 1.68 | 185.69 | 1.75 | 220.30 |
| .0120 | 83.3 | 0.73 | 5.72 | 0.96 | 16.95 | 1.16 | 36.52 | 1.26 | 49.98 | 1.52 | 107.36 | 1.76 | 193.98 | 1.83 | 230.13 |
| .0130 | 76.9 | 0.76 | 5.95 | 1.00 | 17.64 | 1.21 | 38.02 | 1.31 | 52.03 | 1.58 | 111.76 | 1.83 | 201.93 | 1.91 | 239.56 |
| .0140 | 71.4 | 0.79 | 6.18 | 1.04 | 18.31 | 1.26 | 39.46 | 1.36 | 54.00 | 1.64 | 115.99 | 1.90 | 209.58 | 1.98 | 248.63 |
| .0150 | 66.7 | 0.81 | 6.40 | 1.07 | 18.96 | 1.30 | 40.86 | 1.41 | 55.91 | 1.70 | 120.08 | 1.96 | 216.96 | 2.05 | 257.38 |
| .0160 | 62.5 | 0.84 | 6.61 | 1.11 | 19.59 | 1.34 | 42.20 | 1.45 | 57.75 | 1.75 | 124.03 | 2.03 | 224.09 | 2.12 | 265.85 |
| .0170 | 58.8 | 0.87 | 6.81 | 1.14 | 20.19 | 1.38 | 43.51 | 1.50 | 59.53 | 1.81 | 127.86 | 2.09 | 231.01 | 2.18 | 274.05 |
| .0180 | 55.6 | 0.89 | 7.01 | 1.18 | 20.78 | 1.43 | 44.77 | 1.54 | 61.27 | 1.86 | 131.58 | 2.15 | 237.73 | 2.24 | 282.02 |
| .0190 | 52.6 | 0.92 | 7.21 | 1.21 | 21.35 | 1.46 | 46.01 | 1.58 | 62.95 | 1.91 | 135.20 | 2.21 | 244.26 | 2.31 | 289.77 |
| .0200 | 50.0 | 0.94 | 7.39 | 1.24 | 21.91 | 1.50 | 47.21 | 1.62 | 64.59 | 1.96 | 138.72 | 2.27 | 250.62 | 2.37 | 297.32 |
| .0220 | 45.5 | 0.99 | 7.76 | 1.30 | 22.99 | 1.58 | 49.52 | 1.70 | 67.76 | 2.06 | 145.51 | 2.38 | 262.89 | 2.48 | 311.87 |
| .0240 | 41.7 | 1.03 | 8.10 | 1.36 | 24.01 | 1.65 | 51.73 | 1.78 | 70.78 | 2.15 | 152.00 | 2.49 | 274.61 | 2.59 | 325.77 |
| .0260 | 38.5 | 1.07 | 8.44 | 1.41 | 25.00 | 1.71 | 53.85 | 1.85 | 73.68 | 2.24 | 158.22 | 2.59 | 285.85 | 2.70 | 339.10 |
| .0280 | 35.7 | 1.12 | 8.76 | 1.47 | 25.94 | 1.78 | 55.89 | 1.92 | 76.47 | 2.32 | 164.21 | 2.69 | 296.66 | 2.80 | 351.93 |
| .0300 | 33.3 | 1.15 | 9.07 | 1.52 | 26.86 | 1.84 | 57.86 | 1.99 | 79.16 | 2.40 | 169.99 | 2.78 | 307.10 | 2.90 | 364.31 |
| .0320 | 31.2 | 1.19 | 9.37 | 1.57 | 27.74 | 1.90 | 59.76 | 2.06 | 81.77 | 2.48 | 175.58 | 2.87 | 317.19 | 2.99 | 376.28 |
| .0340 | 29.4 | 1.23 | 9.66 | 1.62 | 28.60 | 1.96 | 61.61 | 2.12 | 84.29 | 2.56 | 181.00 | 2.96 | 326.97 | 3.09 | 387.89 |
| .0360 | 27.8 | 1.27 | 9.94 | 1.67 | 29.43 | 2.02 | 63.40 | 2.18 | 86.74 | 2.63 | 186.26 | 3.05 | 336.47 | 3.18 | 399.15 |
| .0380 | 26.3 | 1.30 | 10.21 | 1.71 | 30.24 | 2.07 | 65.14 | 2.24 | 89.12 | 2.71 | 191.37 | 3.13 | 345.71 | 3.26 | 410.11 |
| .0400 | 25.0 | 1.33 | 10.48 | 1.76 | 31.03 | 2.13 | 66.84 | 2.30 | 91.45 | 2.78 | 196.36 | 3.21 | 354.71 | 3.35 | 420.79 |
| .0420 | 23.8 | 1.37 | 10.74 | 1.80 | 31.80 | 2.18 | 68.49 | 2.36 | 93.71 | 2.85 | 201.21 | 3.29 | 363.48 | 3.43 | 431.20 |
| .0440 | 22.7 | 1.40 | 10.99 | 1.84 | 32.55 | 2.23 | 70.11 | 2.41 | 95.92 | 2.91 | 205.96 | 3.37 | 372.05 | 3.51 | 441.36 |
| .0460 | 21.7 | 1.43 | 11.24 | 1.88 | 33.28 | 2.28 | 71.69 | 2.47 | 98.08 | 2.98 | 210.60 | 3.44 | 380.43 | 3.59 | 451.30 |
| .0480 | 20.8 | 1.46 | 11.48 | 1.92 | 34.00 | 2.33 | 73.23 | 2.52 | 100.20 | 3.04 | 215.14 | 3.52 | 388.63 | 3.67 | 461.02 |
| .0500 | 20.0 | 1.49 | 11.72 | 1.96 | 34.71 | 2.38 | 74.75 | 2.57 | 102.27 | 3.11 | 219.58 | 3.59 | 396.66 | 3.74 | 470.54 |
| .0550 | 18.2 | 1.57 | 12.29 | 2.06 | 36.40 | 2.50 | 78.41 | 2.70 | 107.27 | 3.26 | 230.32 | 3.77 | 416.05 | 3.93 | 493.55 |
| .0600 | 16.7 | 1.64 | 12.84 | 2.15 | 38.03 | 2.61 | 81.90 | 2.82 | 112.05 | 3.40 | 240.58 | 3.93 | 434.58 | 4.10 | 515.53 |
| .0650 | 15.4 | 1.70 | 13.37 | 2.24 | 39.59 | 2.71 | 85.25 | 2.93 | 116.64 | 3.54 | 250.42 | 4.10 | 452.35 | 4.27 | 536.61 |
| .0700 | 14.3 | 1.77 | 13.88 | 2.32 | 41.08 | 2.82 | 88.48 | 3.04 | 121.05 | 3.68 | 259.89 | 4.25 | 469.45 | 4.43 | 556.89 |
| .0750 | 13.3 | 1.83 | 14.36 | 2.41 | 42.53 | 2.92 | 91.59 | 3.15 | 125.31 | 3.81 | 269.03 | 4.40 | 485.95 | 4.59 | 576.47 |
| .0800 | 12.5 | 1.89 | 14.84 | 2.49 | 43.93 | 3.01 | 94.60 | 3.26 | 129.42 | 3.93 | 277.87 | 4.54 | 501.91 | 4.74 | 595.40 |
| .0850 | 11.8 | 1.95 | 15.29 | 2.56 | 45.28 | 3.10 | 97.52 | 3.36 | 133.41 | 4.05 | 286.43 | 4.68 | 517.38 | 4.88 | 613.75 |
| .0900 | 11.1 | 2.00 | 15.74 | 2.64 | 46.60 | 3.19 | 100.35 | 3.45 | 137.29 | 4.17 | 294.75 | 4.82 | 532.40 | 5.03 | 631.56 |
| .0950 | 10.5 | 2.06 | 16.17 | 2.71 | 47.88 | 3.28 | 103.11 | 3.55 | 141.06 | 4.28 | 302.84 | 4.95 | 547.01 | 5.16 | 648.89 |

**TABLE 31** *(continued)* **PIPE FLOWING FULL** $k_s = 1.5mm$ **450mm to 1000mm Nominal Bore**

| Nominal Bore mm | | 450 | | 500 | | 600 | | 700 | | 800 | | 900 | | 1000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hydraulic Gradient | 1 in | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s | velocity m/s | discharge l/s |
| .0010 | 1000.0 | 0.57 | 90.06 | 0.61 | 119.04 | 0.68 | 192.80 | 0.75 | 289.66 | 0.82 | 411.96 | 0.88 | 561.88 | 0.94 | 741.52 |
| .0011 | 909.1 | 0.59 | 94.50 | 0.64 | 124.91 | 0.72 | 202.29 | 0.79 | 303.91 | 0.86 | 432.21 | 0.93 | 589.49 | 0.99 | 777.93 |
| .0012 | 833.3 | 0.62 | 98.75 | 0.66 | 130.51 | 0.75 | 211.35 | 0.83 | 317.52 | 0.90 | 451.55 | 0.97 | 615.86 | 1.03 | 812.73 |
| .0013 | 769.2 | 0.65 | 102.82 | 0.69 | 135.89 | 0.78 | 220.05 | 0.86 | 330.57 | 0.94 | 470.11 | 1.01 | 641.16 | 1.08 | 846.10 |
| .0014 | 714.3 | 0.67 | 106.73 | 0.72 | 141.06 | 0.81 | 228.42 | 0.89 | 343.14 | 0.97 | 487.97 | 1.05 | 665.51 | 1.12 | 878.22 |
| .0015 | 666.7 | 0.69 | 110.51 | 0.74 | 146.05 | 0.84 | 236.49 | 0.92 | 355.26 | 1.01 | 505.20 | 1.08 | 689.00 | 1.16 | 909.20 |
| .0016 | 625.0 | 0.72 | 114.16 | 0.77 | 150.88 | 0.86 | 244.30 | 0.95 | 366.99 | 1.04 | 521.86 | 1.12 | 711.71 | 1.20 | 939.17 |
| .0017 | 588.2 | 0.74 | 117.71 | 0.79 | 155.56 | 0.89 | 251.87 | 0.98 | 378.35 | 1.07 | 538.02 | 1.15 | 733.73 | 1.23 | 968.22 |
| .0018 | 555.6 | 0.76 | 121.14 | 0.82 | 160.10 | 0.92 | 259.22 | 1.01 | 389.38 | 1.10 | 553.70 | 1.19 | 755.12 | 1.27 | 996.42 |
| .0019 | 526.3 | 0.78 | 124.49 | 0.84 | 164.52 | 0.94 | 266.37 | 1.04 | 400.12 | 1.13 | 568.95 | 1.22 | 775.91 | 1.30 | 1023.86 |
| .0020 | 500.0 | 0.80 | 127.75 | 0.86 | 168.82 | 0.97 | 273.34 | 1.07 | 410.57 | 1.16 | 583.81 | 1.25 | 796.16 | 1.34 | 1050.58 |
| .0022 | 454.5 | 0.84 | 134.03 | 0.90 | 177.12 | 1.01 | 286.76 | 1.12 | 430.72 | 1.22 | 612.45 | 1.31 | 835.21 | 1.40 | 1102.08 |
| .0024 | 416.7 | 0.88 | 140.03 | 0.94 | 185.05 | 1.06 | 299.58 | 1.17 | 449.97 | 1.27 | 639.82 | 1.37 | 872.51 | 1.47 | 1151.29 |
| .0026 | 384.6 | 0.92 | 145.79 | 0.98 | 192.65 | 1.10 | 311.88 | 1.22 | 468.44 | 1.33 | 666.06 | 1.43 | 908.30 | 1.53 | 1198.49 |
| .0028 | 357.1 | 0.95 | 151.32 | 1.02 | 199.97 | 1.14 | 323.72 | 1.26 | 486.21 | 1.38 | 691.32 | 1.48 | 942.73 | 1.58 | 1243.91 |
| .0030 | 333.3 | 0.99 | 156.67 | 1.05 | 207.02 | 1.19 | 335.14 | 1.31 | 503.35 | 1.42 | 715.69 | 1.53 | 975.95 | 1.64 | 1287.74 |
| .0032 | 312.5 | 1.02 | 161.84 | 1.09 | 213.85 | 1.22 | 346.19 | 1.35 | 519.94 | 1.47 | 739.26 | 1.58 | 1008.08 | 1.69 | 1330.12 |
| .0034 | 294.1 | 1.05 | 166.85 | 1.12 | 220.47 | 1.26 | 356.89 | 1.39 | 536.01 | 1.52 | 762.10 | 1.63 | 1039.22 | 1.75 | 1371.20 |
| .0036 | 277.8 | 1.08 | 171.71 | 1.16 | 226.89 | 1.30 | 367.29 | 1.43 | 551.61 | 1.56 | 784.28 | 1.68 | 1069.46 | 1.80 | 1411.09 |
| .0038 | 263.2 | 1.11 | 176.44 | 1.19 | 233.14 | 1.33 | 377.40 | 1.47 | 566.79 | 1.60 | 805.86 | 1.73 | 1098.87 | 1.85 | 1449.89 |
| .0040 | 250.0 | 1.14 | 181.05 | 1.22 | 239.23 | 1.37 | 387.25 | 1.51 | 581.58 | 1.65 | 826.87 | 1.77 | 1127.51 | 1.89 | 1487.67 |
| .0042 | 238.1 | 1.17 | 185.54 | 1.25 | 245.17 | 1.40 | 396.85 | 1.55 | 596.00 | 1.69 | 847.36 | 1.82 | 1155.45 | 1.94 | 1524.53 |
| .0044 | 227.3 | 1.19 | 189.93 | 1.28 | 250.96 | 1.44 | 406.23 | 1.59 | 610.07 | 1.73 | 867.38 | 1.86 | 1182.73 | 1.99 | 1560.52 |
| .0046 | 217.4 | 1.22 | 194.22 | 1.31 | 256.63 | 1.47 | 415.40 | 1.62 | 623.84 | 1.76 | 886.94 | 1.90 | 1209.40 | 2.03 | 1595.69 |
| .0048 | 208.3 | 1.25 | 198.42 | 1.34 | 262.18 | 1.50 | 424.37 | 1.66 | 637.30 | 1.80 | 906.08 | 1.94 | 1235.49 | 2.08 | 1630.12 |
| .0050 | 200.0 | 1.27 | 202.53 | 1.36 | 267.61 | 1.53 | 433.15 | 1.69 | 650.49 | 1.84 | 924.82 | 1.98 | 1261.05 | 2.12 | 1663.83 |
| .0055 | 181.8 | 1.34 | 212.46 | 1.43 | 280.72 | 1.61 | 454.38 | 1.77 | 682.36 | 1.93 | 970.11 | 2.08 | 1322.78 | 2.22 | 1745.27 |
| .0060 | 166.7 | 1.40 | 221.95 | 1.49 | 293.26 | 1.68 | 474.66 | 1.85 | 712.80 | 2.02 | 1013.38 | 2.17 | 1381.77 | 2.32 | 1823.08 |
| .0065 | 153.8 | 1.45 | 231.05 | 1.55 | 305.28 | 1.75 | 494.11 | 1.93 | 742.00 | 2.10 | 1054.88 | 2.26 | 1438.35 | 2.42 | 1897.72 |
| .0070 | 142.9 | 1.51 | 239.81 | 1.61 | 316.85 | 1.81 | 512.82 | 2.00 | 770.10 | 2.18 | 1094.82 | 2.35 | 1492.79 | 2.51 | 1969.53 |
| .0075 | 133.3 | 1.56 | 248.26 | 1.67 | 328.01 | 1.88 | 530.88 | 2.07 | 797.21 | 2.25 | 1133.35 | 2.43 | 1545.32 | 2.60 | 2038.82 |
| .0080 | 125.0 | 1.61 | 256.43 | 1.73 | 338.81 | 1.94 | 548.35 | 2.14 | 823.43 | 2.33 | 1170.62 | 2.51 | 1596.13 | 2.68 | 2105.84 |
| .0085 | 117.6 | 1.66 | 264.36 | 1.78 | 349.27 | 2.00 | 565.28 | 2.21 | 848.84 | 2.40 | 1206.74 | 2.59 | 1645.37 | 2.76 | 2170.80 |
| .0090 | 111.1 | 1.71 | 272.05 | 1.83 | 359.43 | 2.06 | 581.72 | 2.27 | 873.52 | 2.47 | 1241.81 | 2.66 | 1693.18 | 2.84 | 2233.87 |
| .0095 | 105.3 | 1.76 | 279.53 | 1.88 | 369.31 | 2.11 | 597.70 | 2.33 | 897.52 | 2.54 | 1275.92 | 2.73 | 1739.68 | 2.92 | 2295.22 |
| .0100 | 100.0 | 1.80 | 286.82 | 1.93 | 378.94 | 2.17 | 613.27 | 2.39 | 920.89 | 2.60 | 1309.15 | 2.81 | 1784.98 | 3.00 | 2354.96 |
| .0110 | 90.9 | 1.89 | 300.86 | 2.02 | 397.49 | 2.28 | 643.29 | 2.51 | 965.95 | 2.73 | 1373.20 | 2.94 | 1872.29 | 3.15 | 2470.14 |
| .0120 | 83.3 | 1.98 | 314.28 | 2.11 | 415.22 | 2.38 | 671.97 | 2.62 | 1009.01 | 2.85 | 1434.39 | 3.07 | 1955.71 | 3.29 | 2580.19 |
| .0130 | 76.9 | 2.06 | 327.15 | 2.20 | 432.22 | 2.47 | 699.48 | 2.73 | 1050.30 | 2.97 | 1493.08 | 3.20 | 2035.72 | 3.42 | 2685.74 |
| .0140 | 71.4 | 2.13 | 339.54 | 2.28 | 448.58 | 2.57 | 725.95 | 2.83 | 1090.04 | 3.08 | 1549.56 | 3.32 | 2112.72 | 3.55 | 2787.30 |
| .0150 | 66.7 | 2.21 | 351.49 | 2.37 | 464.37 | 2.66 | 751.49 | 2.93 | 1128.38 | 3.19 | 1604.06 | 3.44 | 2187.00 | 3.67 | 2885.30 |
| .0160 | 62.5 | 2.28 | 363.05 | 2.44 | 479.63 | 2.75 | 776.19 | 3.03 | 1165.46 | 3.30 | 1656.76 | 3.55 | 2258.85 | 3.79 | 2980.08 |
| .0170 | 58.8 | 2.35 | 374.25 | 2.52 | 494.43 | 2.83 | 800.13 | 3.12 | 1201.40 | 3.40 | 1707.84 | 3.66 | 2328.49 | 3.91 | 3071.94 |
| .0180 | 55.6 | 2.42 | 385.13 | 2.59 | 508.80 | 2.91 | 823.37 | 3.21 | 1236.30 | 3.50 | 1757.45 | 3.77 | 2396.11 | 4.02 | 3161.14 |
| .0190 | 52.6 | 2.49 | 395.71 | 2.66 | 522.78 | 2.99 | 845.98 | 3.30 | 1270.24 | 3.59 | 1805.69 | 3.87 | 2461.88 | 4.14 | 3247.89 |
| .0200 | 50.0 | 2.55 | 406.01 | 2.73 | 536.39 | 3.07 | 868.01 | 3.39 | 1303.30 | 3.69 | 1852.67 | 3.97 | 2525.93 | 4.24 | 3332.39 |
| .0220 | 45.5 | 2.68 | 425.88 | 2.87 | 562.63 | 3.22 | 910.46 | 3.55 | 1367.03 | 3.87 | 1943.25 | 4.16 | 2649.41 | 4.45 | 3495.27 |
| .0240 | 41.7 | 2.80 | 444.86 | 2.99 | 587.70 | 3.36 | 951.02 | 3.71 | 1427.92 | 4.04 | 2029.79 | 4.35 | 2767.39 | 4.65 | 3650.91 |
| .0260 | 38.5 | 2.91 | 463.06 | 3.12 | 611.74 | 3.50 | 989.92 | 3.86 | 1486.32 | 4.20 | 2112.80 | 4.53 | 2880.55 | 4.84 | 3800.18 |
| .0280 | 35.7 | 3.02 | 480.58 | 3.23 | 634.88 | 3.63 | 1027.35 | 4.01 | 1542.52 | 4.36 | 2192.67 | 4.70 | 2989.43 | 5.02 | 3943.81 |
| .0300 | 33.3 | 3.13 | 497.48 | 3.35 | 657.21 | 3.76 | 1063.47 | 4.15 | 1596.74 | 4.52 | 2269.74 | 4.86 | 3094.49 | 5.20 | 4082.40 |
| .0320 | 31.2 | 3.23 | 513.83 | 3.46 | 678.80 | 3.88 | 1098.40 | 4.29 | 1649.18 | 4.66 | 2344.28 | 5.02 | 3196.10 | 5.37 | 4216.44 |
| .0340 | 29.4 | 3.33 | 529.67 | 3.56 | 699.72 | 4.00 | 1132.26 | 4.42 | 1700.01 | 4.81 | 2416.52 | 5.18 | 3294.58 | 5.53 | 4346.36 |
| .0360 | 27.8 | 3.43 | 545.05 | 3.67 | 720.05 | 4.12 | 1165.14 | 4.55 | 1749.36 | 4.95 | 2486.67 | 5.33 | 3390.21 | 5.69 | 4472.50 |
| .0380 | 26.3 | 3.52 | 560.02 | 3.77 | 739.81 | 4.23 | 1197.11 | 4.67 | 1797.36 | 5.08 | 2554.89 | 5.48 | 3483.22 | 5.85 | 4595.19 |
| .0400 | 25.0 | 3.61 | 574.59 | 3.87 | 759.06 | 4.34 | 1228.26 | 4.79 | 1844.11 | 5.21 | 2621.34 | 5.62 | 3573.81 | 6.00 | 4714.69 |
| .0420 | 23.8 | 3.70 | 588.80 | 3.96 | 777.83 | 4.45 | 1258.63 | 4.91 | 1889.71 | 5.34 | 2686.15 | 5.76 | 3662.16 | 6.15 | 4831.24 |
| .0440 | 22.7 | 3.79 | 602.68 | 4.05 | 796.17 | 4.56 | 1288.29 | 5.03 | 1934.24 | 5.47 | 2749.44 | 5.89 | 3748.43 | 6.30 | 4945.04 |
| .0460 | 21.7 | 3.87 | 616.25 | 4.15 | 814.09 | 4.66 | 1317.28 | 5.14 | 1977.76 | 5.59 | 2811.30 | 6.02 | 3832.76 | 6.44 | 5056.29 |
| .0480 | 20.8 | 3.96 | 629.52 | 4.24 | 831.62 | 4.76 | 1345.65 | 5.25 | 2020.35 | 5.71 | 2871.83 | 6.15 | 3915.28 | 6.58 | 5165.14 |
| .0500 | 20.0 | 4.04 | 642.52 | 4.32 | 848.79 | 4.86 | 1373.43 | 5.36 | 2062.06 | 5.83 | 2931.11 | 6.28 | 3996.09 | 6.71 | 5271.75 |
| .0550 | 18.2 | 4.24 | 673.93 | 4.53 | 890.28 | 5.09 | 1440.55 | 5.62 | 2162.82 | 6.12 | 3074.32 | 6.59 | 4191.33 | 7.04 | 5529.29 |
| .0600 | 16.7 | 4.43 | 703.94 | 4.74 | 929.92 | 5.32 | 1504.69 | 5.87 | 2259.10 | 6.39 | 3211.16 | 6.88 | 4377.87 | 7.35 | 5775.37 |
| .0650 | 15.4 | 4.61 | 732.73 | 4.93 | 967.94 | 5.54 | 1566.20 | 6.11 | 2351.44 | 6.65 | 3342.41 | 7.16 | 4556.79 | 7.65 | 6011.39 |
| .0700 | 14.3 | 4.78 | 760.42 | 5.12 | 1004.53 | 5.75 | 1625.38 | 6.34 | 2440.29 | 6.90 | 3468.70 | 7.43 | 4728.95 | 7.94 | 6238.50 |
| .0750 | 13.3 | 4.95 | 787.14 | 5.30 | 1039.83 | 5.95 | 1682.49 | 6.56 | 2526.02 | 7.14 | 3590.55 | 7.69 | 4895.07 | 8.22 | 6457.62 |
| .0800 | 12.5 | 5.11 | 812.99 | 5.47 | 1073.97 | 6.15 | 1737.73 | 6.78 | 2608.94 | 7.38 | 3708.40 | 7.95 | 5055.73 | 8.49 | 6669.56 |
| .0850 | 11.8 | 5.27 | 838.04 | 5.64 | 1107.06 | 6.34 | 1791.26 | 6.99 | 2689.31 | 7.60 | 3822.63 | 8.19 | 5211.45 | 8.75 | 6874.98 |
| .0900 | 11.1 | 5.42 | 862.37 | 5.80 | 1139.19 | 6.52 | 1843.24 | 7.19 | 2767.34 | 7.83 | 3933.54 | 8.43 | 5362.65 | 9.01 | 7074.43 |
| .0950 | 10.5 | 5.57 | 886.02 | 5.96 | 1170.43 | 6.70 | 1893.80 | 7.39 | 2843.24 | 8.04 | 4041.42 | 8.66 | 5509.70 | 9.25 | 7268.42 |

## Table 32. Proportional Velocities and Discharges in pipes running part full

| Proportional Depth | Proportion of full-bore values | |
|---|---|---|
| | Velocity | Discharge |
| 0.02 | 0.128 | 0.001 |
| 0.04 | 0.213 | 0.003 |
| 0.06 | 0.283 | 0.007 |
| 0.08 | 0.345 | 0.013 |
| 0.10 | 0.400 | 0.021 |
| 0.12 | 0.450 | 0.031 |
| 0.14 | 0.496 | 0.042 |
| 0.16 | 0.539 | 0.056 |
| 0.18 | 0.580 | 0.071 |
| 0.20 | 0.618 | 0.088 |
| 0.22 | 0.654 | 0.107 |
| 0.24 | 0.688 | 0.127 |
| 0.26 | 0.720 | 0.149 |
| 0.28 | 0.750 | 0.172 |
| 0.30 | 0.779 | 0.197 |
| 0.35 | 0.846 | 0.264 |
| 0.40 | 0.904 | 0.338 |
| 0.45 | 0.955 | 0.417 |
| 0.50 | 1.000 | 0.500 |
| 0.55 | 1.038 | 0.585 |
| 0.60 | 1.071 | 0.671 |
| 0.65 | 1.097 | 0.755 |
| 0.70 | 1.117 | 0.835 |
| 0.75 | 1.130 | 0.909 |
| 0.80 | 1.136 | 0.974 |
| 0.85 | 1.134 | 1.027 |
| 0.90 | 1.121 | 1.063 |
| 0.95 | 1.092 | 1.072 |

The values in this table have been extracted from Tables 35 and 36 of Hydraulics Research. Tables for the Hydraulic Design of Pipes and Sewers, Fifth Edition, H.M.S.O. 1990.

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