

Development of an Equation Independent of Manning's Coefficient n for Depth
Prediction in Partially-Filled Circular Culverts

by

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ABSTRACT

In the design of culverts for fish passage, knowing the water depth is important as it relates to roughness. Engineers currently select roughness coefficients, such as Manning's n , from a table that has been calculated from full flow conditions for culvert design. It is known from previous investigations that Manning's n varies with depth. According to Lang *et al.* (2004), flows at half depth or lower are the typical flows that fish will encounter. If the designer is using constant Manning's roughness coefficients for full flow, a substantial error in calculating water depth could result (Lang *et al.* 2004). The objective of this research is to develop an equation to predict water depth inside of partially filled circular culverts independently from the Manning's equation.

A new equation to predict depth (d) for a circular culvert, based on discharge (Q), slope (S), diameter (D), gravity (g), and absolute material roughness (K_s), has been developed. The new equation reduces the absolute mean error in calculating water depth by 37% compared to the previously published data. Data from five studies representing partially filled culvert conditions in concrete, clay, corrugated metal, PVC, and HDPE circular pipes with slopes and diameters ranging from 0.05 – 4% and 4 – 36 inches, respectively, were used in this study to establish the new equation.

The new equation allows for the explicit solution of depth while the Manning's equation requires an implicit solution. The iterative solver used (Excel Goal-Seek) did not find a viable solution for predicted depth using the Manning's equation in 29% of the cases reported in the literature. The new equation predicts depth more frequently and with greater accuracy than the Manning's equation for the data analyzed; and is therefore, a more consistent method when used to design and assess culverts for fish passage.

Dedication

To my family: Heather, Steven Jr., and Joseph.

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First and foremost I would like to thank my wife Heather, without her continued support, love, and encouragement this would not have been possible for me. Secondly, I would like to thank my two sons, Steven and Joseph, for understanding that I was not always available for playtime.

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1.0 Introduction

Throughout the United States, there are millions of miles of roads. Often these roads cross streams negatively affecting the aquatic ecology (Dryden and Jessop 1974). Engineers design and oversee the construction of culverts that facilitate stream flows beneath these roads. Historically, adverse impacts on fish and other aquatic organisms were not considered a significant design factor for culvert design (Richmond *et al.* 2007). Engineers unknowingly disrupted stream ecology or gave little regard to the disturbance that culverts create. Fish use streams for migration purposes, spawning, and feeding throughout their lives (Lang *et al.* 2004). It is now known that many of these culverts are barriers to fish passage because the hydraulic conditions of the culverts strongly influence passage success (Lang *et al.* 2004). Culvert design that minimizes the conditions which create barriers for fish passage has become an important ecological issue. The purpose of this research is to develop an equation to predict water depth in a circular culvert independent of the Manning's equation that will aid in the design of culverts to facilitate fish passage.

Richmond *et al.* (2007) state that according to the American Iron and Steel Institute (1993) “typically, studies of culvert flow have focused on bulk hydraulic properties pertinent to culvert performance such as head–discharge relationships, mean velocity, sediment and debris transport, and energy budgets.” One aspect of culvert design that is often overlooked is the hydraulic properties under partially filled flow conditions. Engineers currently select roughness coefficients from a table that has been calculated from full flow conditions for culvert design. Flows at half depth or lower are often the typical flows that fish will encounter during their migration. According to Lang

et al. (2004) roughness values change with depth and are expected to be much higher during typical fish migration flows resulting in lower occupied velocities. Webb *et al.* (1993) have shown that as velocity increases, drag on the fish increases creating hydraulic conditions that may lead to a fish passage barrier.

Lang *et al.* (2004) further states that table n (Manning's roughness coefficient n) values used in hydraulic modeling analysis for fish passage during the design phase of a culvert would introduce a substantial amount of conservatism; they conclude that "literature n -values tend to overestimate velocities, and underestimate water depth." They further state that "a need exists for developing roughness coefficients for various culvert materials at flows common to fish passage." This research seeks to improve upon the estimation of water depth in partially filled circular culverts.

2.0 Literature Review

2.1 Culverts as Ecological Impediment of Fish Passage

According to Kane and Wellen (1985), culverts are simple hydraulic structures designed for peak discharge that can cause serious problems for fish migration. Some of the problems or barriers encountered for migrating species through culverts are increased velocity, vertical barriers, and shallow water depths (Fitch 1995). Many fish, and more importantly juvenile fish, will not migrate upstream through culverts exhibiting increased water velocities (Barber and Downs 1996) whereas the proper design of a culvert will not produce water velocities that surpass the swimming abilities of fish (Behlke *et al.* 1991). Culvert design for fish passage must take into consideration the hydraulic conditions created by the culvert's size, slope, material, depth, and velocity (Bates 1994); however, culvert design criteria have been based on a limited number of studies (Kane and Wellen 1985).

Fish passage through culverts has been recognized as problem or concern for over a half century (McKinley and Webb 1956; Anderson and Bryant 1980). Since then, many remedies have been constructed or implemented to improve fish passage. According to Gebhards and Fisher (1972), some remedies implemented have been gradient choice, length of the culvert, baffles, multiple culverts, fishways, downstream controls, depth control, and decreased water velocity. According to Lang *et al.* (2004), water velocity and depth are the critical components in culvert design for fish passage and are currently calculated from full flow Manning's n values. Consequently, research is needed to determine water depths that allow fish passage independently from Manning's equation.

2.2 Manning's Roughness Coefficient

In the design of culverts and open channels, the Manning's Formula is the most widely accepted equation to calculate discharge or water depth (Equation 1; Chow 1959; Khan 1986).

$$\text{Equation (1):} \quad Q = \frac{1.486}{n} (R)^{\frac{2}{3}} (S)^{\frac{1}{2}} (A)$$

The variables in the formula are denoted as discharge (Q , ft³/s), cross-sectional area (A , ft²), hydraulic radius (R , ft) which is the ratio of cross-sectional area to wetted perimeter, slope (S , ft/ft) of the energy grade line, Manning's roughness coefficient n , and the numerical coefficient 1.486 is the conversion factor from metric to English standard units (Chow 1959).

2.3 Parameters Affecting Manning's Roughness Coefficient

There are geometric and hydraulic parameters that are understood to affect the value for Manning's roughness coefficient n for pipes designed at full flow (Lang *et al.* 2004; American Concrete Pipe Association 2007). Such geometric parameters include pipe diameter, pipe material, shape, seams or joints, corrugations and in situ conditions such as pipe slope. For instance, seams and joints that are not properly aligned and the number of joints could affect the roughness value (Pomeroy 1967, Mays 2005). Hydraulic parameters that affect Manning's roughness are velocity, flow rate, depth of flow, hydraulic radius, and slope of the energy grade line (Chow 1959; Khan 1986, Bloodgood and Bell 1961).

2.3.1 Geometric Parameters

The three most common materials used in culvert pipe are concrete (pre-cast, reinforced and non-reinforced), corrugated aluminum (CAP), and corrugated steel (CSP) (Normann 2005); but other materials are used as well, for example, vitrified clay (VCP), galvanized steel, and corrugated plastics (CPP), such as high density polyethylene (HDPE) (Ohio Department of Transportation 2007). According to Normann (2005) different materials have unique or distinct roughness properties but “culverts may also be lined with other materials to inhibit corrosion and abrasion, or to reduce hydraulic resistance”. The unique properties of materials that line culverts may also affect roughness values.

The culvert shape and slope can have numerous variations. The most common shapes include circular, box, arch, pipe arch, metal box, and elliptical (Normann 2005). This thesis investigates circular culvert pipe. Culvert diameters can range from four inches to several feet (Ead *et al.* 2002) and according to Straub and Morris (1951) the n value increases with an increase in pipe diameter of the same material.

2.3.2 Hydraulic Parameters

Manning’s roughness coefficient n is a function of velocity, which in turn is a function of the various hydraulic parameters found in the Manning’s equation (Chow 1959; Khan 1986). Velocity is a function of discharge, slope, and cross-sectional area (Chow 1959). The installed slope of a culvert may vary generally from zero to about five percent (Ead *et al.* 2002) affecting the velocity. The shape of the conduit will affect the depth of flow, cross-sectional area, and wetted perimeter causing the value of the

hydraulic radius to change. As discharge decreases, roughness becomes variable (Chow 1959).

2.4 Previous Investigations

There have been eight (known to the author) previous investigations of Manning's n under partial flow conditions for circular culvert or sewer pipe. A gap in the historical data from 1970 to 2009 was discovered while researching Manning's n for this literature review, which identifies a need for an updated study but limits the author to data and results which are forty years and older. The known investigations include Yarnell and Woodward (1920), Wilcox (1924), Camp (1946), Straub and Morris (1951), Cosens (1954), Neale and Price (1964), Pomeroy (1967), and Cox, Thornton and Beeby (2009). Reviews of these studies followed by a plot of their respective data or trend lines are presented. For all investigative graphs, the y-axis is the relative depth and the x-axis is the relative roughness. Relative depth (d/D) is the ratio of depth to diameter; whereas, the relative roughness (n/n_f) is the ratio of partial roughness to full flow roughness (n_f).

In recent years, pipe manufacturers have commissioned numerous studies but these data have not been published in journals or manuals. In an effort to obtain test data, manufacturers were contacted several times to request data, but no response was received. Since most research has focused on full flow conditions it is not likely that these experiments contain data on partial flows.

2.4.1 Yarnell and Woodward (1920)

Yarnell and Woodward (1920) produced a significant amount of data for culverts experiencing partial flow conditions (plotted as Figure 1, see Appendix A for Legend).

They performed their research on clay and concrete drain tile ranging in diameter from four to twelve inches with slopes from 0.05 to 1.5%. The data contain partial flow conditions ranging from approximately 25% capacity to full (100%) flow. They noted that velocity was not constant at half and at full flows. The hydraulic radius of circular culverts at full depth and half depth are equal. Because the hydraulic radius is the same at half and full flow, the only way to alter the velocity is through a change in the n value. It is important to note that this study was not based on Manning's roughness but on the Kutter n and the Chezy C .

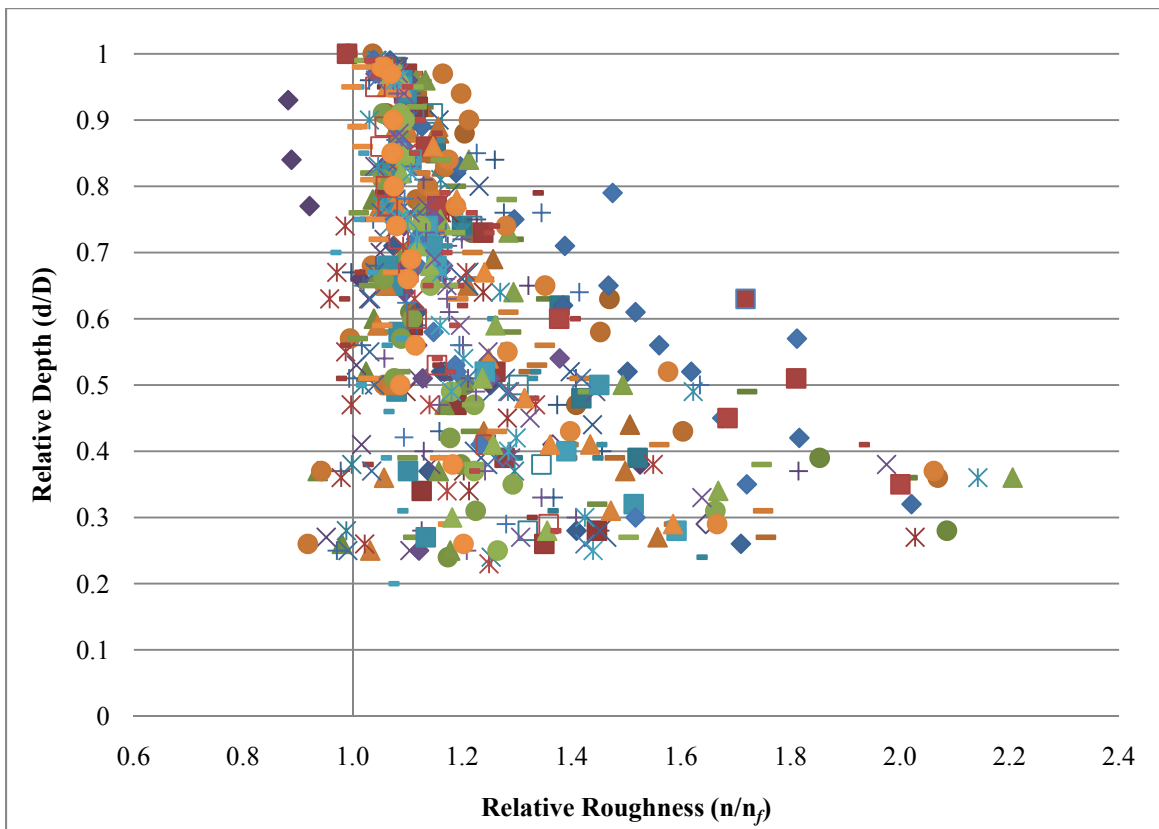


Figure 1: Experimental Data from Yarnell & Woodward (1920) (Legend in Appendix A). Decreasing Relative Depth increases the range in Relative Roughness values.

2.4.2 Wilcox (1924)

Wilcox (1924) examined eight inch asbestos concrete and vitrified clay pipe (VCP) with slopes from 0.5 to 4%. The pipes were analyzed at different discharges and depths of flow. It was found that the VCP had higher velocities than the asbestos cement under identical conditions. While Wilcox's primary finding was that material composition affects the n value under partial flow conditions, he also found that the velocity varied with depth indicating that relative roughness values become larger as depth is decreased. A plot of his data is shown in Figure 2.

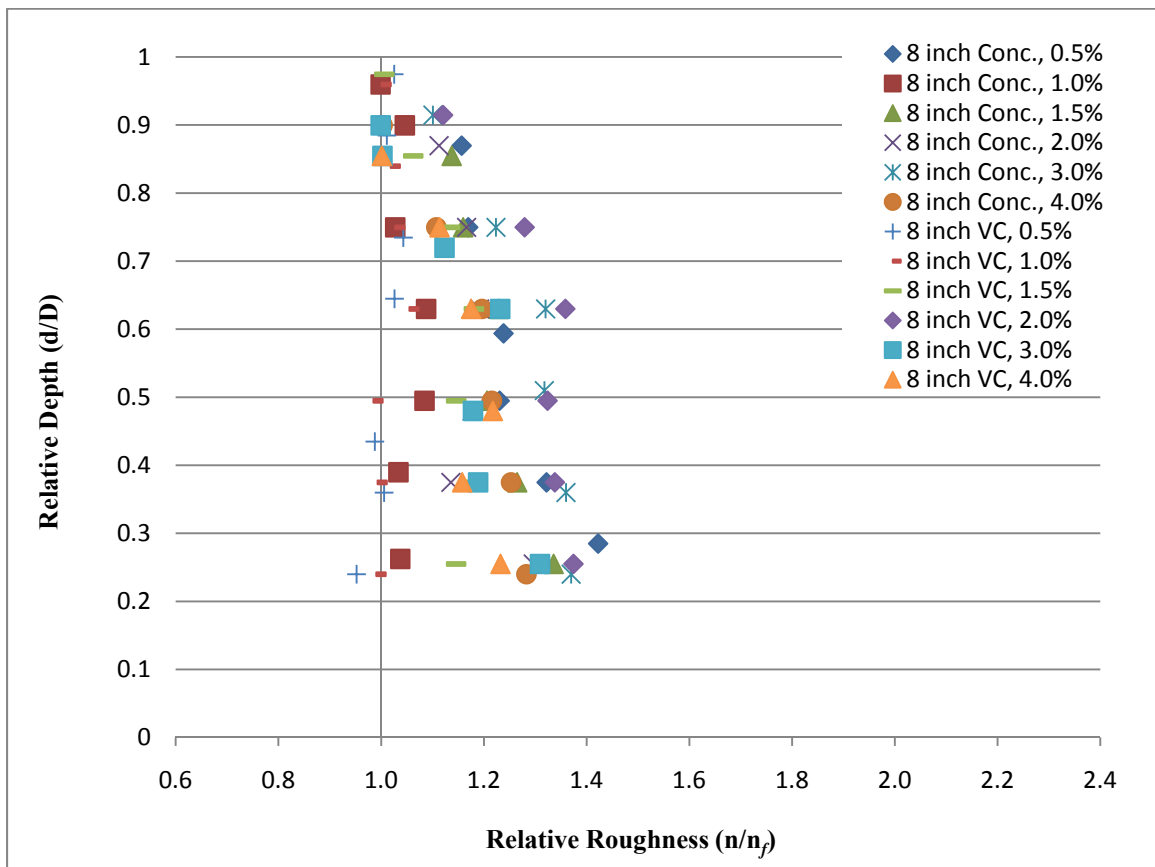


Figure 2: Experimental Data from Wilcox (1924). Data appear to have negative slope with decreasing relative depth, positive trend for 8 inch VC at 0.5% slope, no discernable trend for 8 inch concrete at 1.0% and VC at 1.0%.

2.4.3 Camp (1946)

Camp (1946) expanded the partial flow investigations of Wilcox (1924) and Yarnell and Woodward (1920) with research investigating circular sewer pipe designed to flow partially full. He emphasized that designers need quality estimates for flow and discharge fluctuations. Camp states “the hydraulic element graphs in common use have been prepared on the assumption that the roughness coefficient n does not change with the depth of flow in the conduit. It has been known for years that this assumption is erroneous, but it has been necessary to continue the use of the charts because of the lack of adequate data with which to correct them.” Camp further mentions that the works of Wilcox and Yarnell and Woodward contain data indicating pipes under partial flow exhibit Manning’s roughness values greater than at full flow. From this, Camp updated hydraulic element curves. His relative depth versus relative roughness curve is shown below as Figure 3. Camp’s curve suggests that culverts designed for partial flow using the manufacturers’ constant n have overestimated velocities.

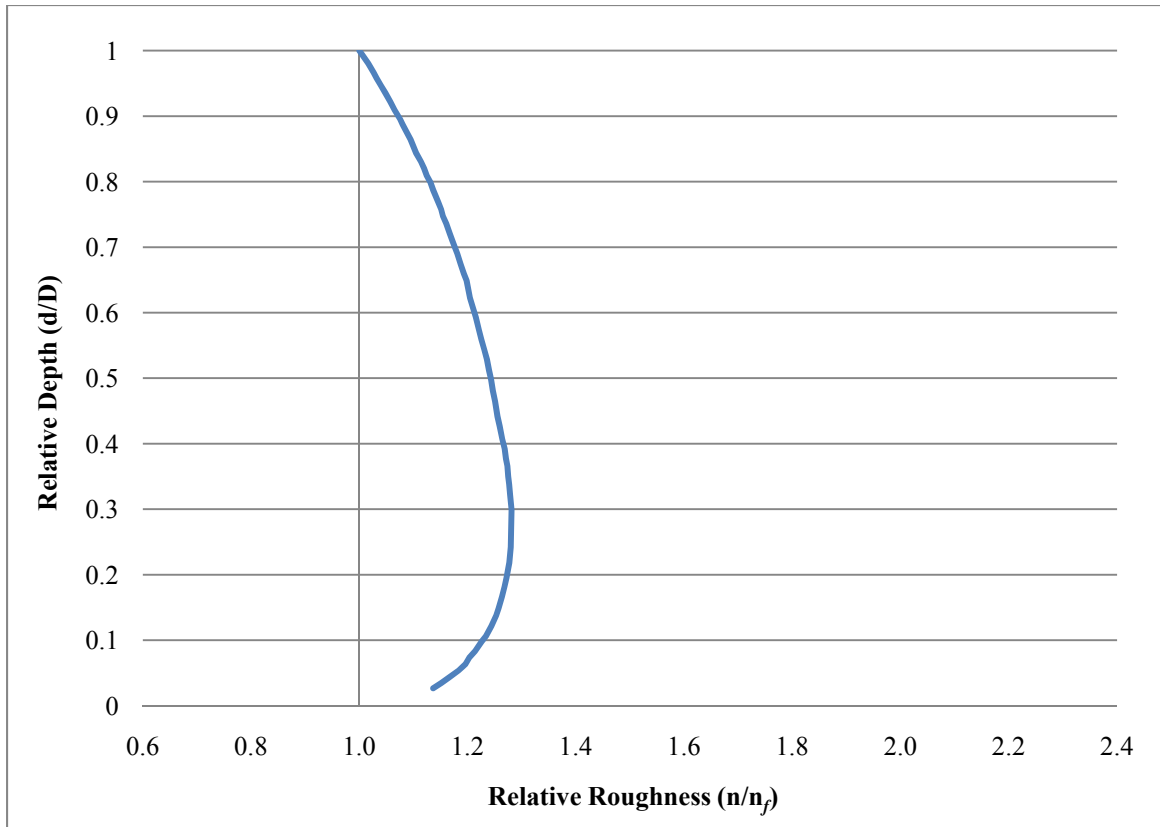


Figure 3: Hydraulic Elements Curve Developed by Camp (1946). Camp’s curve indicates that partial flow roughness is larger than full flow roughness.

2.4.4 Straub and Morris (1951)

Straub and Morris (1951) researched hydraulic data on culverts comprised of 18, 24, and 36 inch diameter concrete and corrugated steel with 0.2% slope. They observed that Manning’s n decreased as diameters increased for a relative depth, but that as the Reynolds number increased, so did n . From their data, seen in Figure 4, n appears to be independent of the relative depth counter to their conclusion in the text.

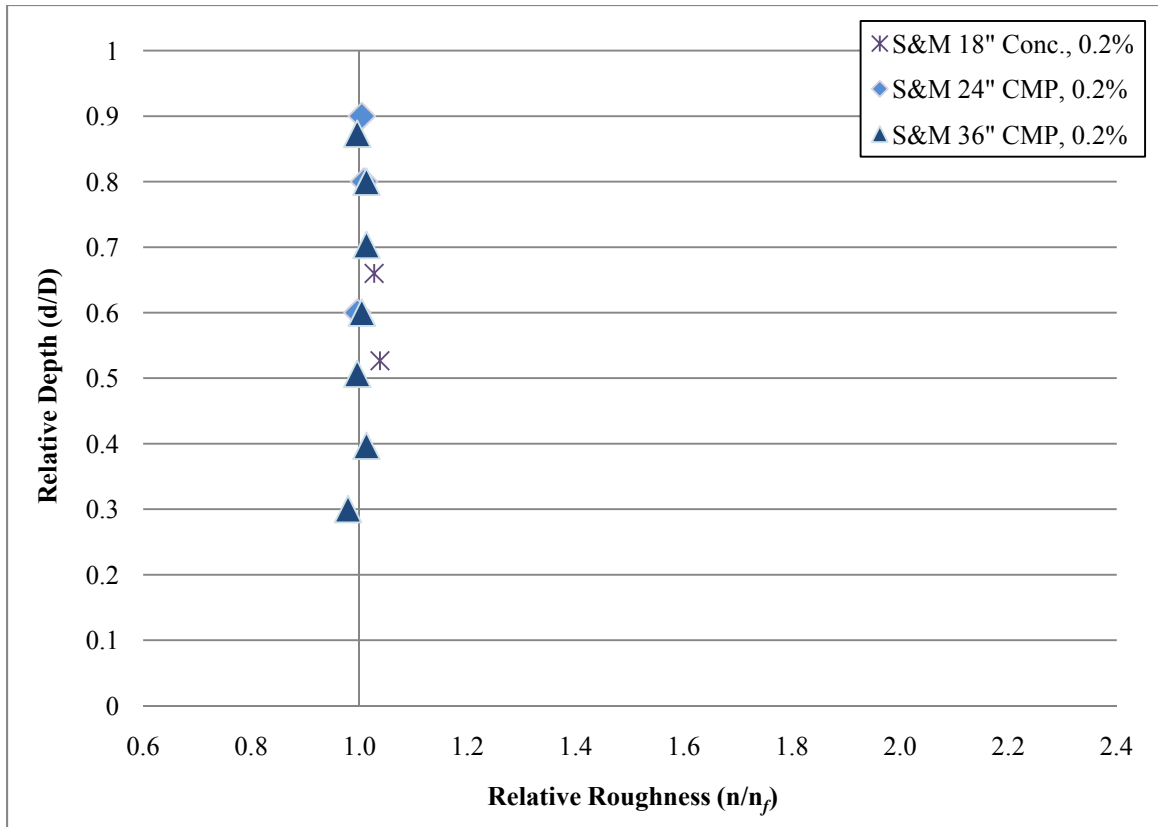


Figure 4: Experimental Data from Straub & Morris (1951). Decreasing Relative Depth does not vary Relative Roughness values.

2.4.5 Cosens (1954)

Cosens (1954) performed experiments using eight inch asbestos cement and vitrified clay pipe at slopes of 0.25 and 0.4%; he observed that the velocities at both half full and full were not equal for either material reinforcing the notion that Manning’s n changes with depth. In addition to concluding that the roughness coefficient changes with depth of flow, he also determined that as slope of the energy grade line increases, roughness increases. This implies that under partial flow conditions both the slope of the energy grade line and low flow depths create higher n values. Cosens’ experimental data is illustrated in Figure 5. According to Pomeroy (1967), Cosens data “are rather scattered, and appear to indicate that flows were not uniform through the test section.”

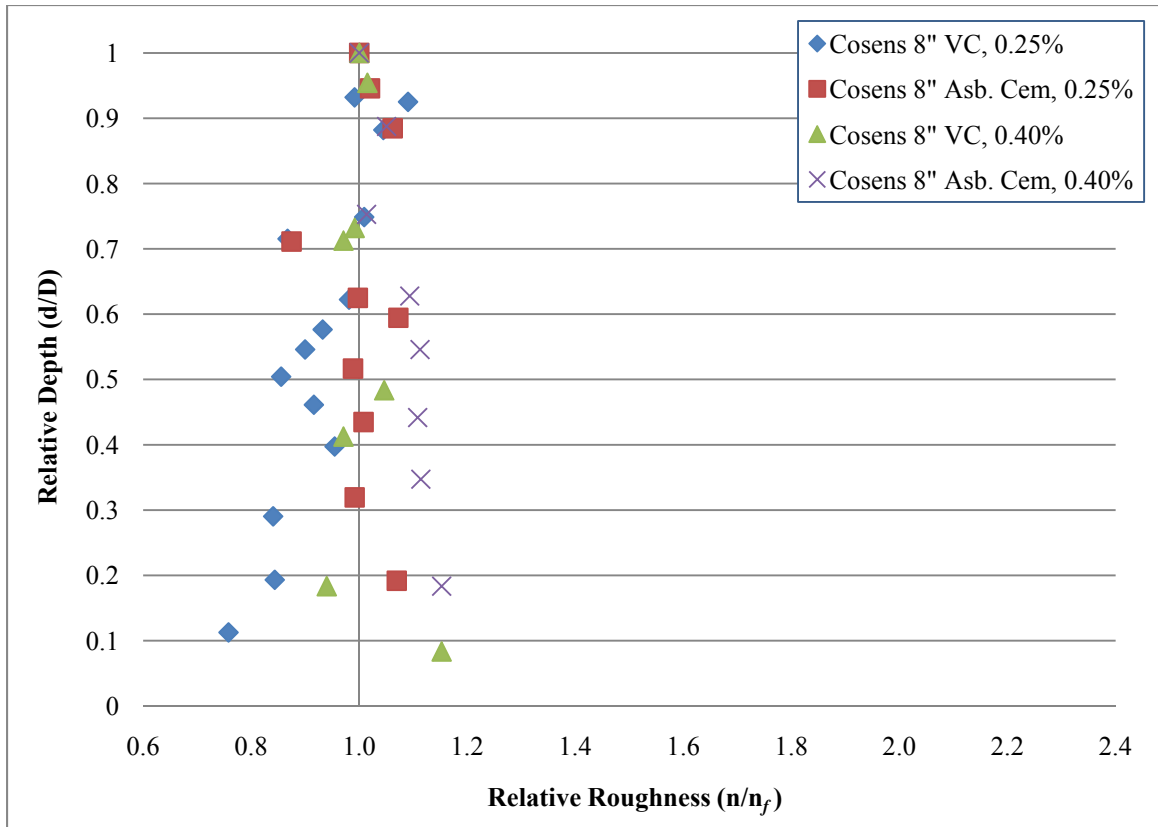


Figure 5: Experimental Data from Cosens (1954). Data appear scattered, as Relative Depth decreases Relative Roughness values do not appear to have a distinct correlation between them.

2.4.6 Neale and Price (1964)

Neale and Price (1964) experimented with eight and 12 inch polyvinyl chloride pipe (PVC) with slopes of 0.3, 0.6, and 1%, under both full and partially full flow conditions. Figure 6 illustrates that as relative depth decreases the relative roughness remains approximately constant and independent of the velocity. Another assertion was that the kinematic viscosity must be taken into account when calculating flow characteristics (Neale and Price 1964).

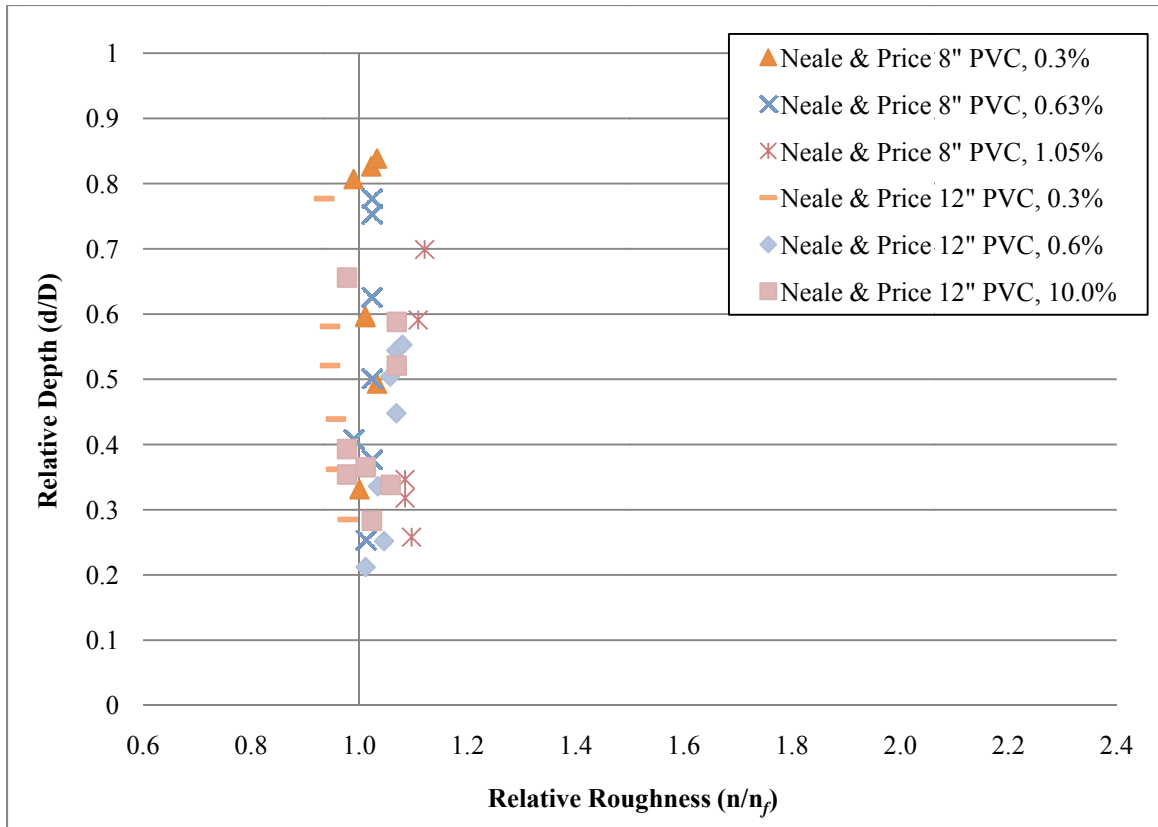


Figure 6: Experimental Data from Neale & Price (1964). Decreasing Relative Depth does not vary Relative Roughness values.

2.4.7 Pomeroy (1967)

Pomeroy (1967) examined the previous works of Wilcox, Yarnell and Woodward, Cosens, Straub and Morris, Neale and Price, and Bloodgood and Bell while researching sewers at various locations throughout the United States. The research was aimed to show that different design variables in the sewers have various hydraulic effects. He notes that velocities at low relative depths were ignored and not studied by previous research. Pomeroy asserts that “the n value is a coefficient in an empirical equation, and properly is defined as a mathematical function of the variables of the equation.” Pomeroy concludes that “the variation of n with depth should be taken into account...by correcting all n

values to a reference depth.” As a result, Pomeroy introduced a second curve to represent the variability of relative roughness which is shown in Figure 7.

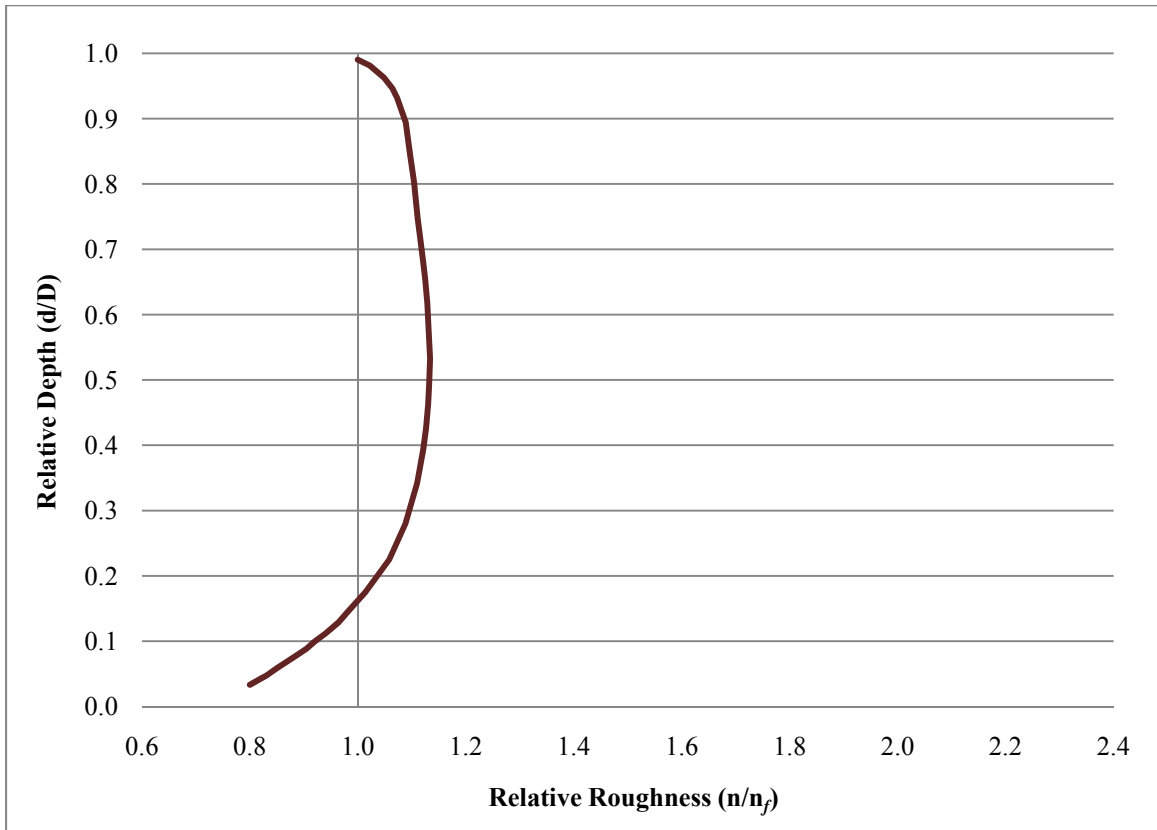


Figure 7: Hydraulic Elements Curve Developed by Pomeroy (1967). Pomeroy’s curve indicates that as relative depth decreases, the partial roughness is greater than the full flow roughness except for flows below 18% full.

2.4.8 Cox, Thornton, and Beeby (2009)

Cox *et al.* (2009) examined 36 inch HDPE pipe at slopes of 0.71%, 1.35%, and 1.97% and six different flow rates. The main purpose for the study was to determine a Manning’s coefficient value for HDPE pipe commissioned by the manufacturer. The report analyzes the data to determine an average Manning’s roughness of 0.0106 for discharges greater than 18 cfs and 0.0091 for 2 cfs in fully flowing culverts. It does not discuss how roughness varies with changes in water depth and provides no further

analysis or discussion. A plot of their data which appears to conform to Pomeroy's curve is shown in Figure 8.

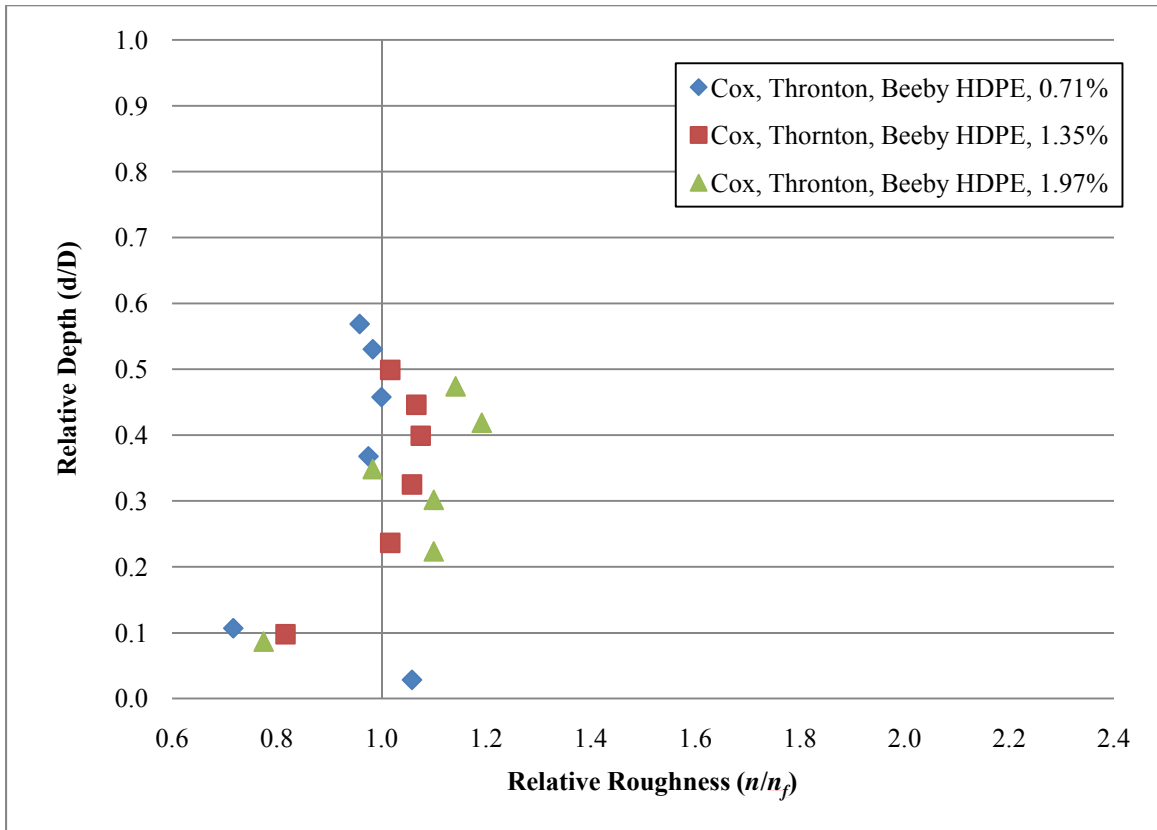


Figure 8: Experimental Data from Cox, Thornton, and Beeby (2009). Data appear to conform to Pomeroy's curve until half-depth is reached.

2.5 Examination of Investigator Data

The previous investigators collected 99% of their data at d/D values greater than 0.23 (see Figure 9). From the author's personal observations made at many culverts from May 2005 to May 2007 (approximately 2000 in total) located in northeastern Ohio, non-flood culvert flow depths were closer to a quarter full and below. The eight partial flow investigations therefore did not look at depths of flow which are more typical in culverts during non-flood stages in Ohio or similar areas.

Figure 9 shows the combined data from all the studies discussed above. Ninety-two percent of the data have a n/n_f value greater than one indicating that as depth decreases the roughness increases. Further analysis shows that as d/D decreases, the distribution of n/n_f appears to have an upper limit with a negative slope (shown on Figure 9), and the range of relative roughness values broadens; but this does not reveal why the variability in values exists. The largest distribution of n/n_f values (ranging from 0.8 to 2.3) occur at a relative depth of approximately 0.35.

Pomeroy's curve seems to be the most accurate for d/D values greater than 0.9 but Camp's curve fits the data best for $0.25 < d/D < 0.9$. It is not apparent from the data how either curve below was developed for d/D of 0.23.

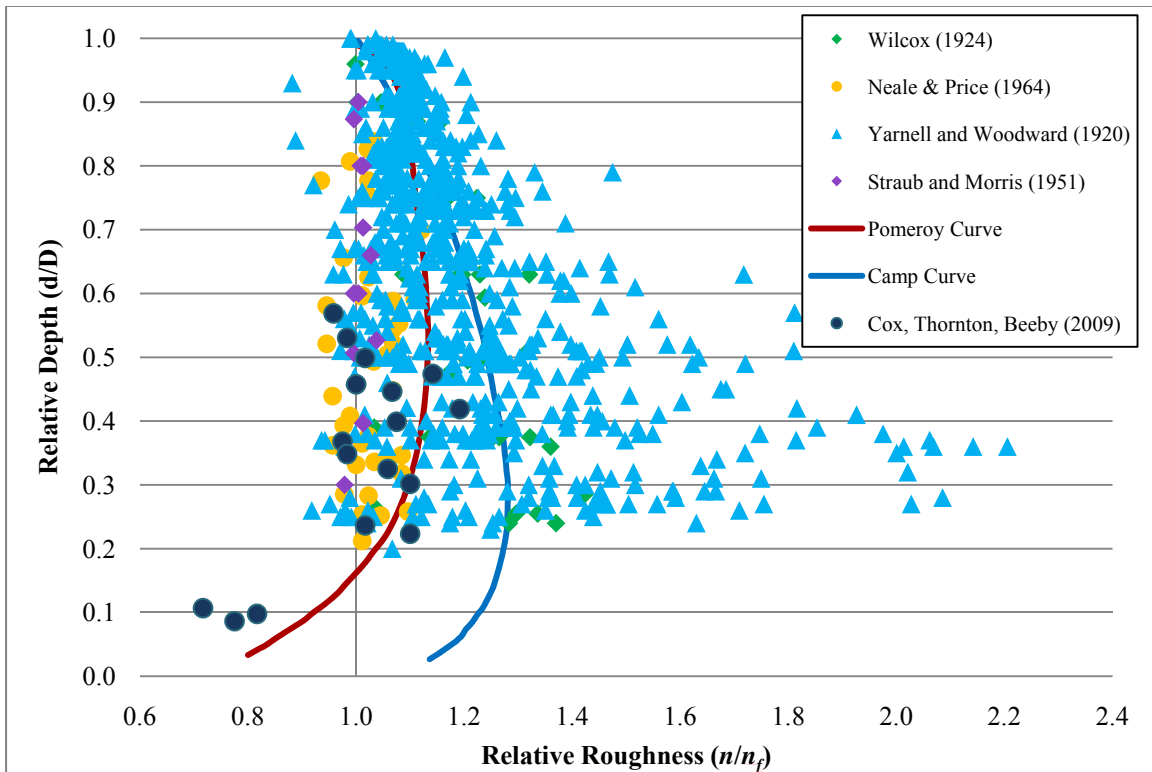


Figure 9: Combined Experimental Data. As Relative Depth decreases, measured values of partial depth roughness can be as much as 2.3 times full depth roughness.

The data were categorized into subgroups in an effort to clarify the discrepancies and identify any discernable trends. The data were grouped by investigator, material, diameter, and slope. The material data were grouped into clay, concrete, PVC, and corrugated metal graphs. The varying ranges of diameters were grouped into plots of four to six inch, eight to ten inch, twelve inch, and greater than twelve inch. The slope data were arranged by the following groups: $\leq 0.75\%$, $0.75\% < S \leq 1.5\%$, and $> 1.5\%$. Table 1 shows physical culvert parameters from each of the investigations for ease of reference. From these segregated data, no trends were apparent or the rationale for the spread in relative roughness as relative depth decreases.

Table 1: Physical Culvert Parameters from Experimental Investigations

Investigation	Slope(s) (%)	Diameter(s) (in.)	Material(s)
Woodward & Yarnell (1920)	0.05, 0.1, 0.2, 0.3, 0.5, 0.75, 1, 1.25, 1.5	4, 5, 6, 8, 10, 12	Concrete, Clay
Wilcox (1924)	0.5, 1, 1.5, 2, 3, 4	8	Concrete
Straub & Morris (1951)	0.2	18, 24, 36	Concrete, Corrugated Steel
Neale & Price (1964)	0.3, 0.6, 1	8, 12	PVC
Cox, Thornton, Beeby (2009)	0.71, 1.35, 1.97	36	HDPE

3.0 Methods

3.1 Manning's Roughness Variability

Pomeroy (1967) stated that Manning's n is a function of the parameters that comprise the Manning's equation and not a measure of roughness. Upon analysis of the Cosens data, the author agrees with Pomeroy statements that the Cosens data are scattered; therefore Cosens data were omitted from the data set used for further analysis in this thesis.

It is therefore hypothesized that Manning's roughness is a function of discharge (Q), depth (d), diameter (D), and slope (S). In order to prove that n/n_f is a function of d/D (relationship illustrated in Figure 9); the Manning's equation at full flow was introduced devoid of new variables or parameters. First, the Manning's equation for any data point was divided by its' full flow counterpart to derive an n/n_f term, as shown in Equation 2.

$$\text{Equation (2): } \frac{Q}{Q_f} = \left(\frac{n_f}{n}\right) \left(\frac{R}{R_f}\right)^{\left(\frac{2}{3}\right)} \left(\frac{A}{A_f}\right)$$

Next, using the properties of a circle and formulae for arc-sections from Khan (1986) (which can be seen in Table 2) the values for hydraulic radius and area were expressed as a function of the angle (θ) created between the concentric center of the pipe and the water surface (Figure 10).

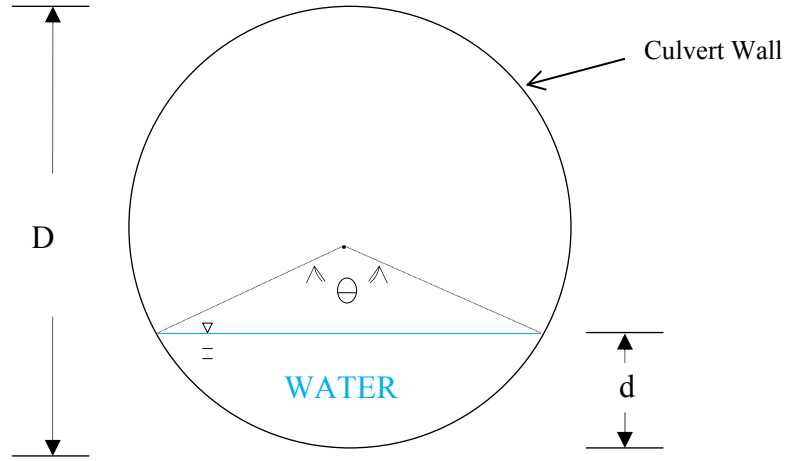


Figure 10: Defining Angle θ for a Circular Culvert Cross-Section (Khan 1986)

Table 2: Hydraulic Element Equations for Circular Cross-Sections Khan (1986)

	Area (A)	Wetted Perimeter (P)	Hydraulic Radius (R _h)
Partially Filled	$\frac{D^2}{8}(\theta - \sin \theta)$	$\frac{D}{2}\theta$	$\frac{D}{4\theta}(\theta - \sin \theta)$
Full	$\pi \frac{D^2}{4}$	$D\pi$	$\frac{D}{4}$

The angle (θ) is dependent only on the diameter of the culvert and the depth of water shown as Equation 3.

$$\text{Equation (3): } \theta = 2 \cos^{-1} \left(1 - 2 \frac{d}{D} \right)$$

Inserting the appropriate equations for hydraulic radius and area into Equation 2 yields a simplified equation (Equation 4, derivation shown in Appendix K) that expresses the relative roughness as a function of the relative depth and relative discharge (Q/Q_f).

$$\text{Equation (4): } \left(\frac{Q}{Q_f} \right) \left(\frac{n}{n_f} \right) = \left(1 - \frac{\sin \theta}{\theta} \right)^{\left(\frac{2}{3} \right)} \left(\frac{\theta - \sin \theta}{2\pi} \right)$$

When the data from previous investigations are plotted such that relative depth is a function of the product of the relative discharge and the relative Manning's n (Figure 11), rather than simply the Manning's n (Figure 9), the data appear less scattered and indicating a higher percentage of the variance is captured. A trend line (shown in pink) has been added showing the prediction from Equation 5.

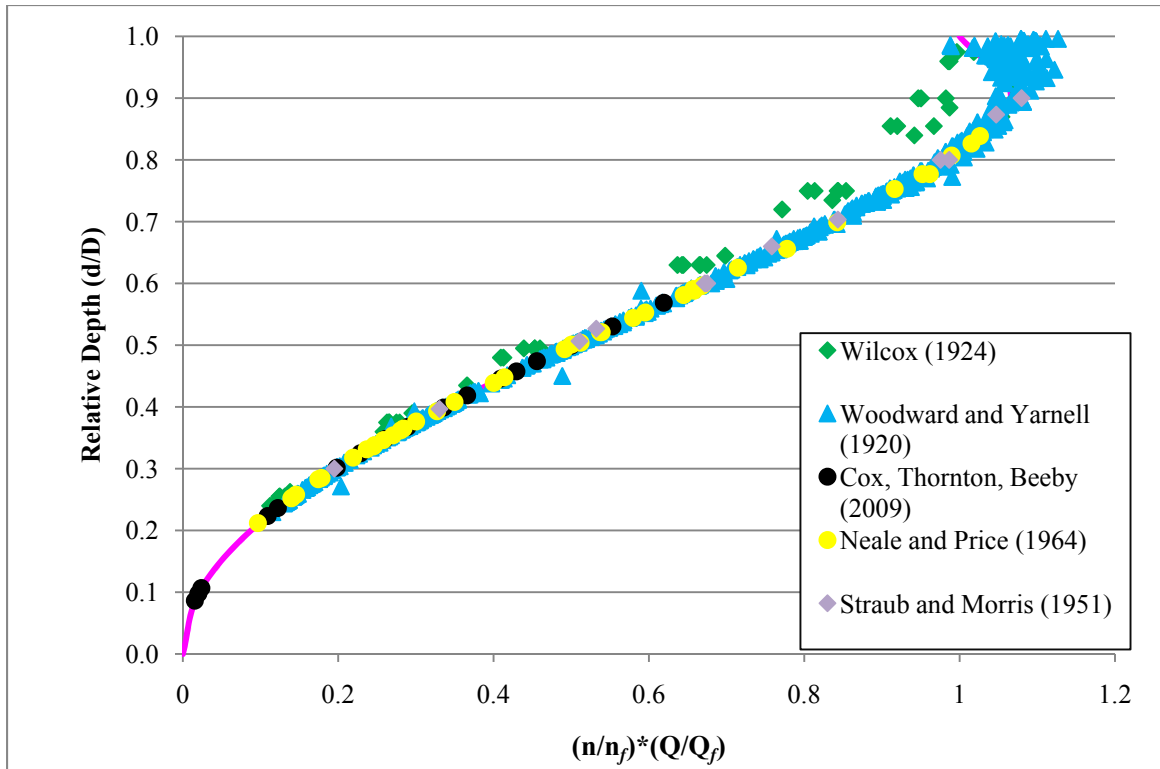


Figure 11: Reducing the Spread of Investigator Data. The data from the five partial flow investigations fit the trend-line from Equation 5 with minimal spread indicating that the variance in Manning's n is simply a function of both the relative depth and the relative discharge.

For a typical design problem two unknowns exist (depth and Manning's n) with only one equation (Equation 5). In order to rectify this problem a second equation is necessary. This equation would need to either relate Manning's n to depth or relate discharge to depth independently from Manning's n . The method used to solve the problem in this study was to develop an equation independent from Manning's equation.

3.2 Depth Equation

In order to accurately predict the depth, an equation relating depth and discharge was needed. In researching texts an independent equation from the Manning's equation for partially filled culverts was not found. Such an equation must be valid across all data sets therefore; the equation must be dimensionally homogeneous.

3.2.1 Equation Components

It is hypothesized that the water depth (d) in a culvert is a function of discharge (Q), slope (S), diameter (D), gravity (g), and a pipe roughness value. The absolute roughness coefficient (K_s) was included to account for material type because it is not dependent on flow depth. Instead, absolute roughness is only a function of material because when any material is viewed microscopically, projections can be seen (Khan 1986). Absolute roughness, which has units of length, is a measure of the height of these projections (Khan 1986). Absolute roughness differs from Manning's n (which has units of time/length^{1/3}) because K_s is a physically measurable constant; whereas, Manning's n is an empirical variable that accounts for other information in addition to roughness (Pomeroy 1967).

3.2.2 Equation Development

In order to reduce the number of independent variables (and therefore the complexity in determining the appropriate depth-discharge relation), the Buckingham Pi Theorem was utilized. According to Khan (1986), if there are x variables with y dimensions to a physical problem, then the quantities can be arranged into x minus y

dimensionless parameters representing the problem. The depth discharge relationship has six variables and two dimensions (length and time); therefore, there are four independent dimensionless parameters that define the system shown as π 's below (The derivation of the variables into dimensionless parameters is shown in Appendix J).

$$\pi_1 = \frac{Q}{\sqrt{gD^5}} \quad \pi_2 = S \quad \pi_3 = \frac{K_s}{D} \quad \pi_4 = \frac{d}{D}$$

The relative depth is therefore a function of three dimensionless parameters:

$$\frac{d}{D} = f\left(\frac{Q}{\sqrt{gD^5}}, \frac{K_s}{D}, S\right)$$

From these three dimensionless variables it was assumed that the equation followed a power law shown in Equation 5.

$$\text{Equation (5): } \frac{d}{D} = h \left[\frac{Q}{\sqrt{gD^5}} \right]^a \left[\frac{K_s}{D} \right]^b [S]^c + j$$

In order to solve for the exponents (a , b , c) and constants (h and j), each of the dimensionless variables was calculated. The data were then sorted by the three dimensionless variables. The first dimensionless variable was plotted against the observed d/D holding the other two variables constant to obtain exponent a . This process was then repeated for the second and third variables to obtain their exponents. The highest R^2 value of 0.95 occurred when a equaled 1, b equaled 1/6, c equaled -1/2, h equal to 0.32, and j equal to 0.2 (Figure 12). These exponents allow the equation to account for 95% of the variance associated within the data set.

Grouping of discharge, gravity, and diameter as π_1 has been previously performed by Vasconcelos and Wright (2005) as a non-dimensional flow rate (Q^*), shown as Equation 6. That term was substituted into the equation resulting in Equation 7.

$$\text{Equation (6): } Q^* = \frac{Q}{\sqrt{gD^5}}$$

$$\text{Equation (7): } \frac{d}{D} = (0.32) \left(\frac{Q^*}{\sqrt{S_o}} \right) \left(\frac{K_s}{D} \right)^{\frac{1}{6}}$$

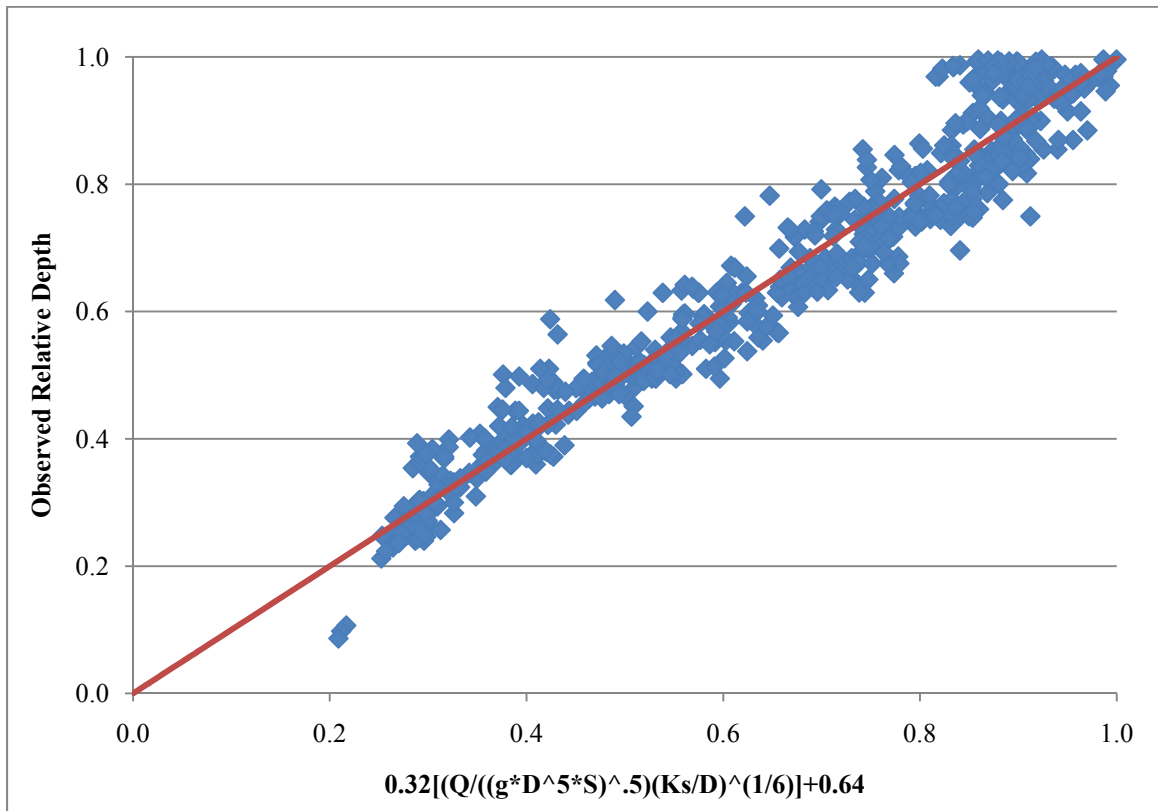


Figure 12: Exponent Development Graph for New Equation

3.2.3 Final Depth Equation

The best fit linear regression obtained from Figure 12 resulted in establishing the final Depth Predictor Equation (Equation 8).

$$\text{Equation (8): } d = .32D \left[\left(\frac{Q^*}{\sqrt{S_o}} \right) \left(\frac{K_s}{D} \right)^{\frac{1}{6}} + 0.64 \right]$$

3.3 Conversion of Chezy C to Manning's n

The Chezy C value, obtained from Yarnell and Woodward (1920), has been converted to Manning's n values using Equation 9 (Mays 2005); where (n) is Manning's roughness coefficient, (R) is the hydraulic radius, and (C) is the Chezy C .

$$\text{Equation (9):} \quad n = \frac{1.486}{C} (R)^{\frac{1}{6}}$$

3.4 Obtaining n Values for Manning's Equation

The predicted depth based on Manning's equation was accomplished using two versions of the roughness coefficient n - the manufacturers' suggested value for each material type and The Ohio Department of Transportations' (ODOT) Location and Design Volume 2 (2010) design value of 0.013. The manufacturers' roughness coefficient n values in the calculations were 0.011 for concrete from the American Concrete Pipe Institute (ACPA 2000), 0.013 for clay pipe from the National Clay Pipe Institute (NCPI 2006), 0.012 for PVC from Uni-Bell (Uni-Bell 2001), 0.024 for CMP from the National Corrugated Steel Pipe Institute (NCSPA 1999), and 0.012 for HDPE from ADS-Hancor (ADS-Hancor 2010).

3.5 Solving Manning's Equation

Excel's Goal-Seek function combined with the Macros written by Samuel R. Mangin (2010) (shown in Appendix I) were used to solve for the predicted water depth for each data point in the data set using Manning's equation.

3.6 Statistical Analysis for Significance

A test for significance compares observed data to predicted data (Moore and McCabe 2003). A measure of how well the observed data and the predicted data agree is expressed in terms of a probability (p-value) (Moore and McCabe 2003). The statement being tested is called the null hypothesis. The test of significance assesses the strength of evidence against the null hypothesis (Moore and McCabe 2003). When the p-value is less than α , the level of significance chosen, the alternative hypothesis is true (Moore and McCabe 2003).

The test of significance used in this thesis is paired student t -test. The null hypothesis considered is that Manning's equation and the newly developed equation have equal error when predicting the depth in partially-filled circular culverts. The alternative hypothesis is that the new equation and the Manning's equation do not equally predict depths.

Paired student t -tests were performed on the depth predictions calculated by the new equation and the Manning's equation. The threshold of 0.05(α) was set as the mark for statistical significance, and a 0.10 threshold for moderate statistical significance. Five hundred fourteen data points were analyzed for the Manning's equation that did not include the erroneous predictions (discussed in Section 4.3). A total of 722 data points were analyzed for the Manning's equation that had the 208 lines of the erroneous data's d/D set equal to one. The new equation had the identical data points tested for both versions of the Manning's equation, with and without the erroneous data.

4.0 Results and Discussion

Equation 8 was developed to predict depth in a circular culvert, similar to that of the Manning's equation. In order for this new equation to be an improvement on the Manning's equation it needs to have a greater predictive power for water depth. The dimensionless parameters that were developed through the Buckingham Pi Theorem to predict depth in Equation 8 were not surprising because of the similarities found in other equations. As previously stated, the Q^* term has been reported before by Vasconcelos and Wright (2005) as a non-dimensional flow rate. The absolute roughness term is one of the dimensionless terms in the Moody Diagram (Chow 1959) and the exponent of $1/6$ appears regularly in depth-discharge equations and in the Manning-Strickler Equation (Chanson 1999). The slope term to the $1/2$ power is also found in many fluid equations such as the Chezy Equation (Chow 1959).

The data evaluated for this study date from the 1920's through the late 2000's, and the methods of measurement have changed over time with technological advances in instrumentation. While all of the data is secondary data (not collected by the author), the data are believed to be valid. As illustrated in Figure 11, the observed data are consistent with the theoretical trend-line with very minimal spread and outliers. The data are from different decades, with different methods of measurement, spanning different materials, slopes, and diameters but still conform to the theory presented for Equation 4.

4.1 Determining Depth using Manning's Equation

For a given discharge (Q), Manning's roughness (n), slope (S), and diameter (D), a solution for depth (d) in a partially filled culvert cannot be found explicitly. A direct

solution for depth (d) is not possible because depth is embedded within theta (θ) which is embedded within the hydraulic radius (R_h) and area (A).

4.1.1 Manning's Equation with Manufacturer Suggested n -Value

The Manning's equation using manufacturer suggested n values erroneously predicted the culvert to be greater than full depth for 23.8%, 172 of the data points. These data were not plotted. The data that predicted a partial depth were graphed and are shown in Figure 13 (See Appendix C for data).

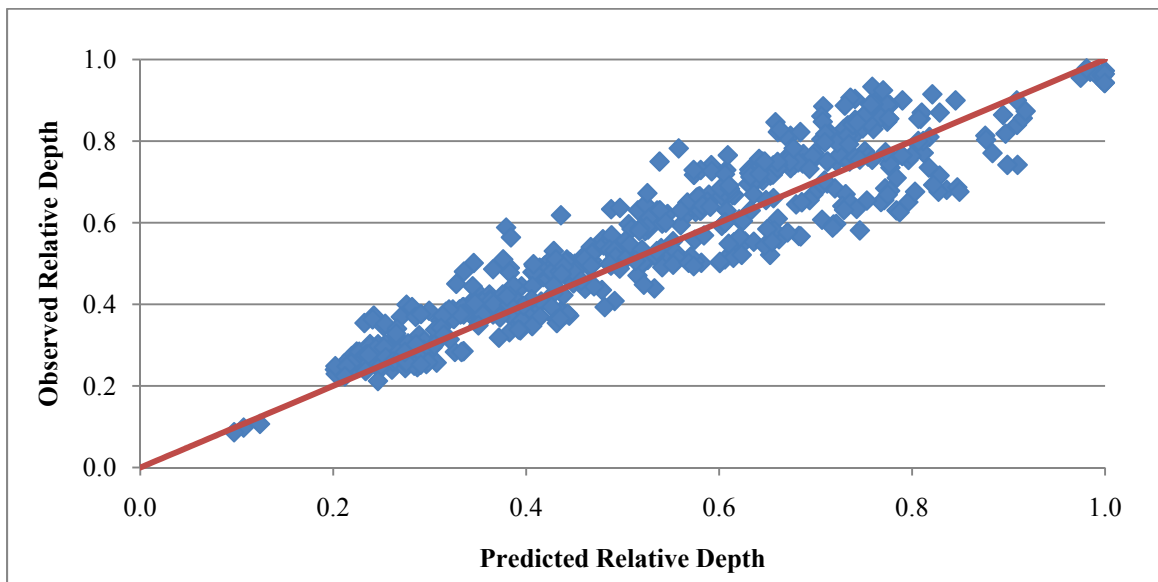


Figure 13: Depth Prediction (Manufacturer Suggested n Value). Cases in which greater than full depth was predicted are not plotted, representing 23.8% of the data set.

4.1.2 Manning's Equation ODOT Design n Value

The depth was determined utilizing the design n values from ODOT's Location and Design Volume 2 (2010). It was found that in 208 (28.8% of the data) Manning's equation erroneously predicted the depth to be greater than full. These data were not

plotted. The data points where a partial depth was predicted were graphed and are shown in Figure 14 (See Appendix D for data).

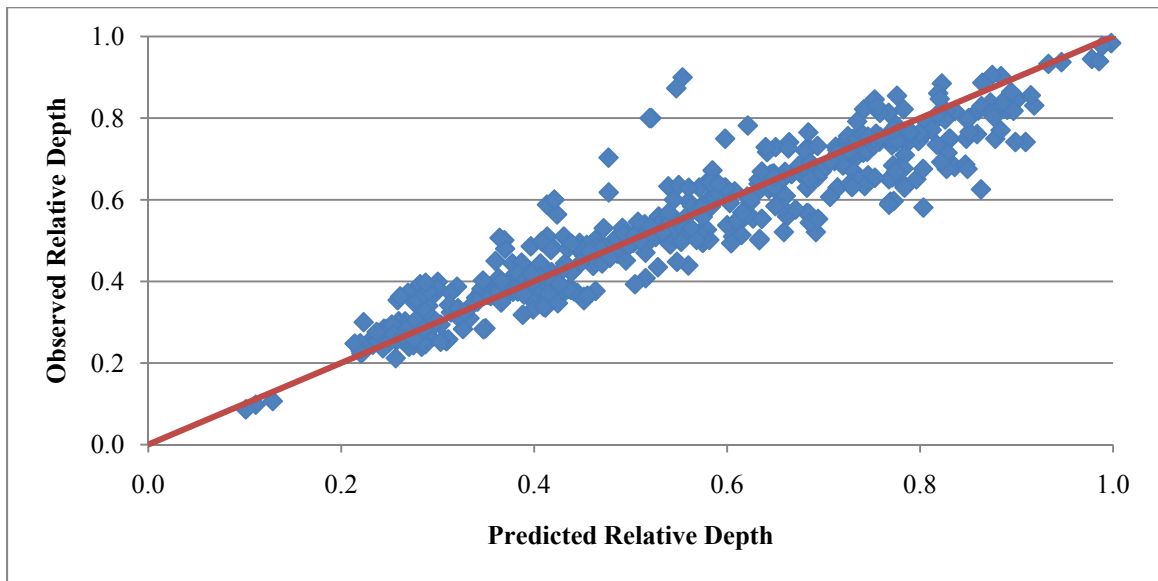


Figure 14: Depth Prediction (Design n Value 0.013). Cases in which greater than full depth was predicted are not plotted, representing 28.8% of the data set.

4.2 New Equation Prediction

The absolute roughness term varies by material (Chow 1959). The reported K_s values for concrete are 0.01-0.001 (Chow 1959), 0.0005 for clay (CPDA 1999), 0.0417 for CMP (Khan 1986), 0.000005 for PVC (Uni-Bell 2001), and 0.00005 for HDPE (PPI 2008). An average K_s value of 0.0055 was used for concrete in the Average K_s scenario; concrete K_s value of 0.01 and adjusted K_s values for PVC and HDPE were used in the “best fit” case.

It can be seen from Figure 15 that there are different lines for each material indicating that the published K_s values should be adjusted for partially filled culvert conditions. Due to these multiple lines, a power law regression has a slightly higher R^2 value equal to 0.90 than the linear regression (R^2 equal to 0.85).

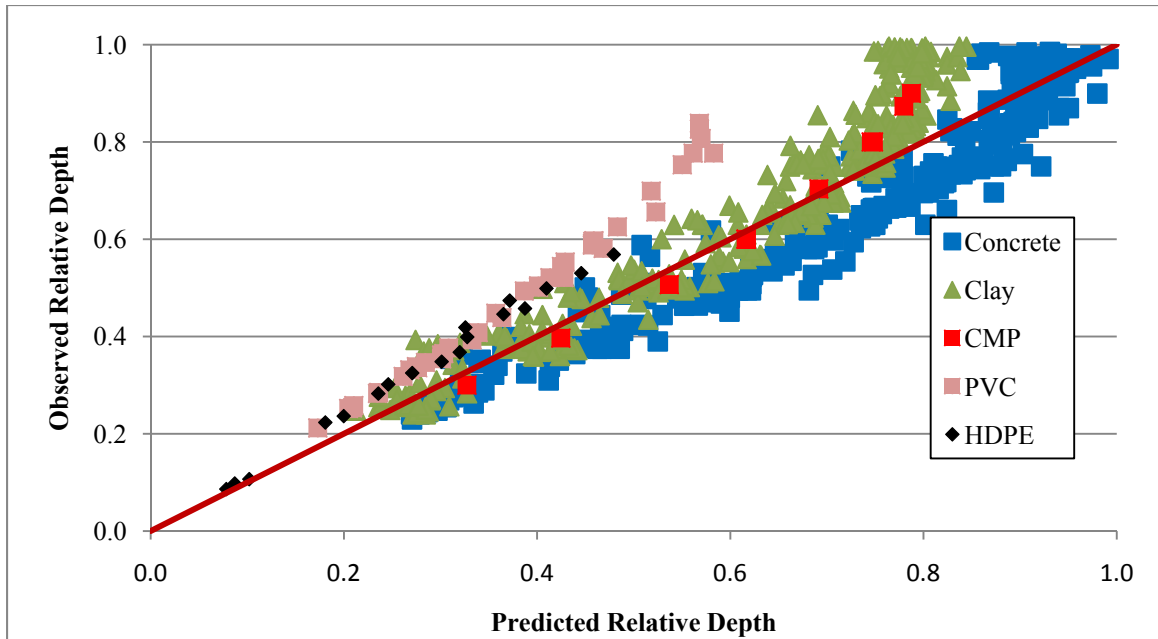


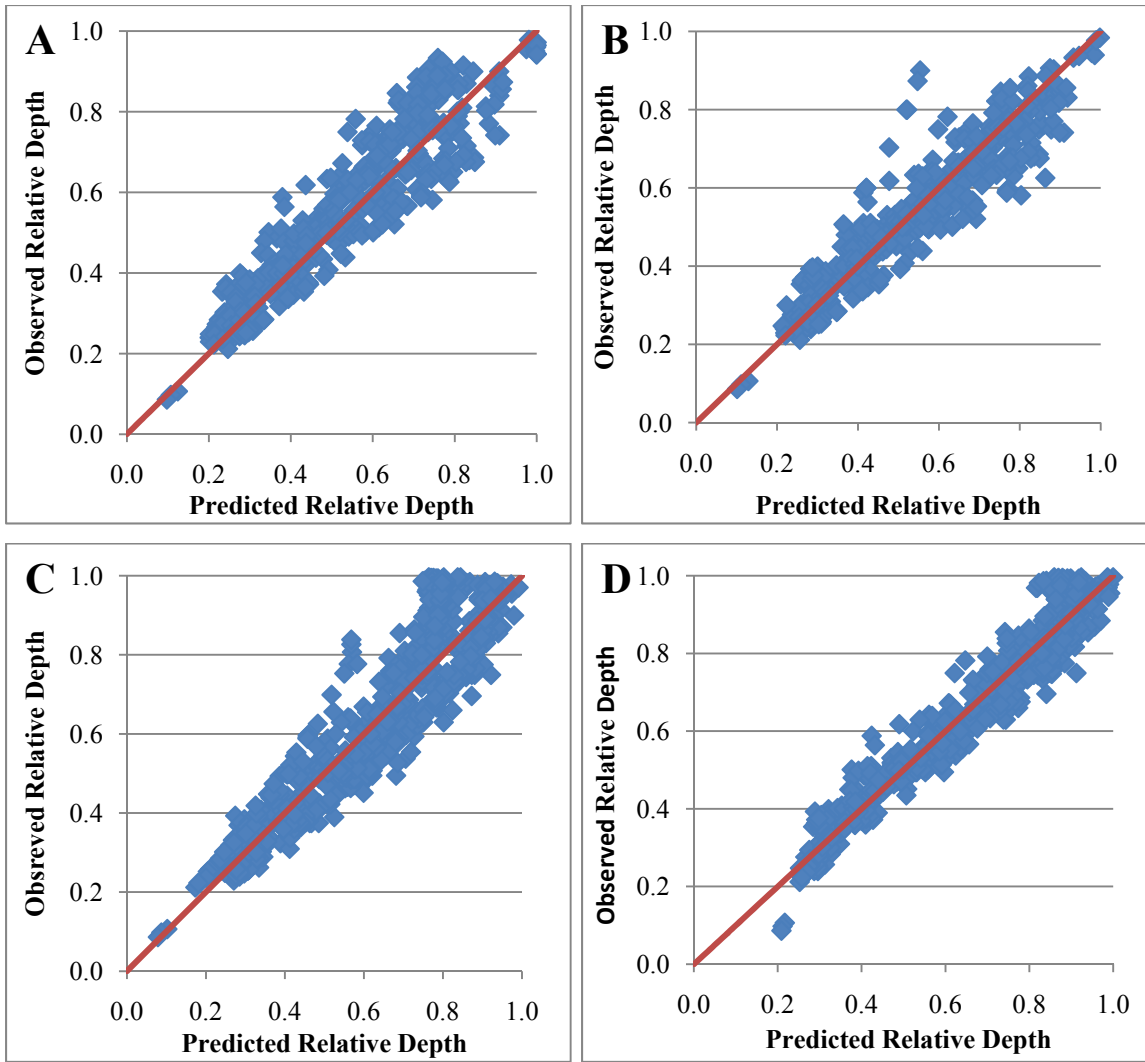
Figure 15: Depth Prediction New Equation (Average Ks Value). Multiples lines can be seen from grouping data by material. This indicates that the published relative roughness values are incorrect for partially filled circular culverts.

To further collapse the data and reduce the spread from the average Ks graph, adjusted Ks values for PVC and HDPE were used. Both of these materials' values were changed one order of magnitude larger, from 0.00005 for HDPE to 0.0005. Concrete's maximum Ks value of 0.01 was used. The data was then graphed and is shown in Figure 12 (See Appendix F for data).

4.3 Comparison of Equations

To allow the reader easier referencing and comparison, Figures 10-13 have been re-plotted as Figure 16. A comparison of the average of the absolute value of the percent error from the observed depth for the Manufacturers' Suggested *n* Values (see Appendix G for data), ODOT Design *n* Values, average Ks Equation (see Appendix H for data) did not indicate any significant difference (paired student t-test, $p < 0.05$) in the predictive

capacity of the three equations. However, the adjusted Ks version of the new equation performed significantly better than the other three. The following section compares the adjusted Ks Value equation to the best performing Manning's equation (ODOT Design n Values).



LEGEND		Mean % Error	Mean % Error		
A	Manufacturer n Value	11.7 (10.7)	C	Average Ks	11.3 (11.1, 11.6)
B	ODOT Design n Value	8.4 (10.9)	D	Adjusted Ks	6.9 (7.11, 7.4)

Figure 16: Depth Prediction Comparison. All four graphs show apparent outliers in the bottom left portion of the graph. Graph A and B appear to have greater spread than graph D. Graph C appears to have multiple lines of data. The data in the tables are represented in different colors. The black values are the mean percent error for the entire data set consisting of 722 data points. The purple values represent the mean percent error for comparison between 550 data points for the manufacturer suggested n value. The red values are the mean percent error for the 514 data points compared for the ODOT design n value.

The new equation allows for the explicit solution of depth while the Manning’s equation produces an implicit solution that is iterative. The iterative solver (Excel GoalSeek) did not find a viable solution for depth in 29% or 208 lines of data. The reason for this is that the solution began to converge to a relative depth greater than one – such a depth is not a physical possibility in the Manning’s equation, so a final solution was not produced. The solutions from Manning’s equation that erroneously predicted depths greater than full depth were not initially included in the analysis of error. The Manning’s equation prediction for depth had an average error of 10.9% compared to observed depths. The depth was also predicted using the same data points with the new equation having adjusted Ks values. The mean percent error was 7.4%. According to the paired student t-test shown as Table 3, the results were moderately significant with a probability of 0.078 ($0.05 < p < 0.10$); therefore, the null hypothesis was accepted (see Section 3.6).

Table 3: Paired t-Test: Paired Two Sample for Means, Manning’s ODOT Design *n* Value and Adjusted Ks Value Equation. Depths where Manning’s does not converge are not included.

	<i>Manning's Equation - ODOT Design n Values</i>	<i>New Equation - Adjusted Ks Values</i>
Mean % Error	10.85	7.38
Observations	514	514
P(T<=t) two-tail	0.078	

Upon further analysis, it is apparent that the iterative sequence utilized by the Goal-Seek function in Excel to numerically solve for depth is terminated when a value larger than full depth is reached. In an effort to account for the erroneous data, where the

observed depths were near full, a d/D value of 1 for the 208 lines was assumed and the data was statistically analyzed again (results shown in Table 4).

The new equation with the adjusted Ks values and the Manning’s equation with ODOT Design *n* Values were found to have mean percent errors of 6.9% and 8.4% respectively. From Table 4 the mean percent error for Manning’s equation decreased. This decrease was because the data initially not included in the analysis were from observations where the pipe was flowing near full depth (d/D greater than or equal to 0.9). The new equation predicted depth significantly better than the Manning’s equation when all data are included. Due to the p-value ($p = 4.66E-6$), the null hypothesis was rejected and statistically the predictions are not equivalent. The mean percent error is reduced 18% when utilizing the new equation. As illustrated in Figure 16, the spread for graph D is less than that of graph B indicating that the new equation is more precise for a 1:1 relationship between relative depth and relative roughness. Due to this information, it can be concluded that the new equation performs best as a depth predictor in partially filled circular culverts.

Table 4: Paired t-Test: Paired Two Sample for Means, Manning’s ODOT Design *n* Value and Adjusted Ks Value Equation. All Data included, Divergent Data now with d/D = 1

	<i>Manning's Equation - ODOT Design n Values</i>	<i>New Equation - Adjusted Ks Values</i>
Mean % Error	8.38	6.93
Observations	722	722
P(T<=t) two-tail	4.66E-06	

4.4 Manning's n Equivalence

To calculate an n value, the design engineer would solve the Manning's equation for roughness, Equation 1; but, two unknowns exist, n and depth (depth is embedded in the hydraulic radius and area). The goal of this research was to develop a new equation (Equation 8) to predict depth, but if the design engineer is more comfortable using Manning's equation, the new equation allows a solution for n in Equation 1 without the design engineer choosing full flow n values. By combining Equations 1 and 8, Equation 10 can be used to determine an appropriate n for partially filled culverts. Equation 10 is a function of theta (θ), which now takes the form shown in Equation 11.

$$\text{Equation (10): } n = \frac{1.486 \left[\left(\frac{D}{4\theta} \right) (\theta - \sin \theta) \right]^{\frac{2}{3}} \left[\frac{D^2}{8} (\theta - \sin \theta) \right] (S)^{\frac{1}{2}}}{Q}$$

Equation (11):

$$\theta = 2 \cos^{-1} \left[1 - 2 \left(0.32 \left(\left(\frac{Q_i^*}{\sqrt{S_o}} \right) \left(\frac{KS}{D} \right)^{\frac{1}{6}} + 0.64 \right) \right) \right]$$

5.0 Conclusion

In the design of a culvert for fish passage, knowing the depth is important because if the depth is too shallow a passage barrier is created. Also once discharge and depth are known, the velocity can be calculated which may also be a passage barrier. The current method for predicting depth, (Manning's equation with constant n), results in an average of 10.9% error between predicted and observed depths. If the designer is using roughness coefficients for full flow a substantial error in depth could result. However, guidelines currently do not exist for adjusting n values for partially filled culverts.

The equation developed in this thesis predicts depth independently from the Manning's equation and Manning's n . In comparison with predictions from the Manning's equation, the new equation with the Adjusted K_s values performs better. For instance, Manning's equation predicts water depth 70% of the time with a mean error of 10.9%, whereas the new equation predicts depths for the entire data set with a mean error of 6.9%.

This thesis has found that Manning's n does vary with depth. In fact, it varies with both relative depth and relative discharge. The new equation which is independent of Manning's n performs better than the Manning's equation. Based on this outcome a new equation for predicting Manning's n in partially filled culverts based on the new equation for depth prediction is proposed.

5.1 Recommendations for Future Research

A number of future research questions have emerged as a result of this study. Future research directions should focus on the addition of water properties that affect flow and the regression used to compare relative depth to relative roughness. It is possible that kinematic viscosity, a property of water based on temperature, should be included into the new equation; however, the existing data do not allow the investigation into that possibility. The viscosity of the water changes with temperature, possibly adding hydraulic roughness to the culvert when experiencing colder weather. In the future, adding this variable may improve predictive capabilities of depth in partially filled culverts. If viscosity is included in the Buckingham Pi Theorem, the fifth Pi would be the Reynolds Number. According to Chisholm and Tsang (1970) and mentioned by Straub and Morris (1951), Manning's n increases with the size of the conduit and that effect is more prominent for lower Reynolds numbers.

Another recommendation for future work is research into the effects of culvert aging on roughness. During the design life for a culvert, possible changes to the circumferential profile may result. According to Tullis *et al.* (2005), "hydraulic roughness is typically influenced by both the roughness of the pipe material and the pipe inside wall profile." Tullis *et al.* (2005) studied one type of HDPE, but the effect on roughness for other HDPE diameters and other materials such as CMP, may need further investigation. It is also known from Bland *et al.* (1978) that the effect of sliming on the walls due to age and water conditions, changes the roughness value. It is possible that current design practices are for the "best case scenario"; meaning that as culverts age, roughness values

increase resulting in higher depths and lower velocities. Further research is suggested for roughness variations due to age.

It is apparent from the investigative data that depths below 25% of the diameter were not researched. Data at these low flows is desirable. Data at low flow depths are important because these maybe the conditions typical that a fish will encounter during its life cycle; and therefore, needs to investigated.

In order to increase the predictive capacity of the new equation for future research, it is believed that a linear trend-line regression does not accurately portray the data for $d/D < 0.2$ and $d/D > 0.9$. It is theorized that the trend-line should appear more closely to what is shown in Figure 16.

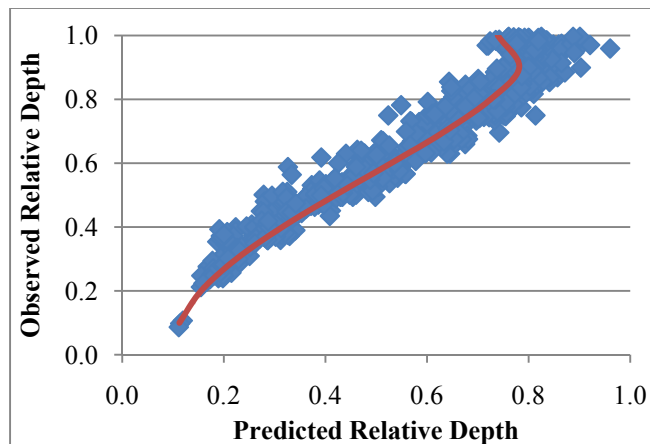


Figure 17: Depth Prediction Alternative Trend-line for New Equation
Trend-line based on Equation 5

The trend-line in Figure 16 incorporates hydraulic radius and area into the new equation thereby allowing the two ends of the curve to arc with the data. If such a trend-line exists, the depth predictive capacity of the new equation could further strengthen a 1:1 relationship between the measured depth and predicted depth. This needs to be investigated further.

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7.0 Appendices

Appendix A: Figure 1 Legend, Yarnell and Woodward Data Points

● YW 4" Clay, 0.05%	+ YW 4" Clay, 0.15%	- YW 4" Clay, 0.2%	- YW 4" Clay, 0.3%
◆ YW 4" Clay, 0.5%	■ YW 4" Clay, 0.75%	▲ YW 4" Clay, 1.0%	× YW 4" Clay, 1.25%
✕ YW 4" Clay, 1.5%	● YW 5" Clay, 0.05%	+ YW 5" Clay, 0.1%	- YW 5" Clay, 0.2%
- YW 5" Clay, 0.3%	◆ YW 5" Clay, 0.5%	■ YW 5" Clay, 0.75%	▲ YW 5" Clay, 1.0%
× YW 5" Clay, 1.25%	× YW 5" Clay, 1.5%	● YW 6" Clay, 0.05%	+ YW 6" Clay, 0.1%
- YW 6" Clay, 0.2%	- YW 6" Clay, 0.3%	◇ YW 6" Clay, 0.5%	□ YW 6" Clay, 0.75%
▲ YW 6" Clay, 1.0%	× YW 6" Clay, 1.25%	✕ YW 6" Clay, 1.5%	● YW 8" Clay, 0.05%
+ YW 8" Clay, 0.1%	- YW 8" Clay, 0.2%	- YW 8" Clay, 0.3%	◆ YW 8" Clay, 0.5%
■ YW 8" Clay, 0.75%	▲ YW 8" Clay, 1.0%	× YW 8" Clay, 1.25%	× YW 8" Clay, 1.5%
● YW 10" Clay, 0.05%	+ YW 10" Clay, 0.1%	- YW 10" Clay, 0.2%	- YW 10" Clay, 0.3%
◆ YW 10" Clay, 0.5%	■ YW 10" Clay, 0.75%	▲ YW 10" Clay, 1.0%	× YW 10" Clay, 1.25%
✕ YW 10" Clay, 1.5%	● YW 12" Clay, 0.05%	+ YW 12" Clay, 0.1%	- YW 12" Clay, 0.2%
- YW 12" Clay, 0.3%	◆ YW 12" Clay, 0.5%	■ YW 4" Conc., 0.05%	▲ YW 4" Conc., 0.1%
× YW 4" Conc., 0.2%	× YW 4" Conc., 0.3%	● YW 4" Conc., 0.5%	+ YW 4" Conc., 0.1%
- YW 4" Conc., 1.25%	- YW 4" Conc., 1.5%	◆ YW 5" Conc., 0.05%	■ YW 5" Conc., 0.1%
▲ YW 5" Conc., 0.2%	× YW 5" Conc., 0.3%	✕ YW 5" Conc., 0.5%	● YW 5" Conc., 0.75%
+ YW 5" Conc., 1.0%	- YW 5" Conc., 1.25%	- YW 5" Conc., 1.5%	◆ YW 6" Conc., 0.05%
■ YW 6" Conc., 0.1%	▲ YW 6" Conc., 0.2%	× YW 6" Conc., 0.3%	× YW 6" Conc., 0.5%
● YW 6" Conc., 0.75%	+ YW 6" Conc., 1.0%	- YW 8" Conc., 0.05%	- YW 8" Conc., 0.1%
◆ YW 8" Conc., 0.2%	■ YW 8" Conc., 0.3%	▲ YW 8" Conc., 0.5%	× YW 8" Conc., 0.75%
✕ YW 8" Conc., 1.0%	● YW 8" Conc., 1.25%	+ YW 8" Conc., 1.5%	- YW 10" Conc., 0.05%
- YW 10" Conc., 0.1%	◆ YW 10" Conc., 0.2%	□ YW 10" Conc., 0.3%	▲ YW 10" Conc., 0.5%
× YW 10" Conc., 0.75%	× YW 10" Conc., 1.0%	● YW 10" Conc., 1.25%	+ YW 10" Conc., 1.5%
- YW 12" Conc., 0.05%			

Appendix B: Investigator Data by Material

Material	Diameter (ϕ) [ft]	Slope (ft/ft)	Depth (d) [ft]	n	n_f	Investigator	Velocity (ft/s)	Hydraulic Radius	Discharge (Q) [cfs]
Concrete	0.667	0.0050	0.190	0.0141	0.0099	Wilcox	1.707	0.109	0.140
Concrete	0.667	0.0050	0.250	0.0131	0.0099	Wilcox	2.125	0.136	0.255
Concrete	0.667	0.0050	0.330	0.0122	0.0099	Wilcox	2.616	0.166	0.450
Concrete	0.667	0.0050	0.396	0.0123	0.0099	Wilcox	2.785	0.184	0.610
Concrete	0.667	0.0050	0.500	0.0116	0.0099	Wilcox	3.132	0.202	0.880
Concrete	0.667	0.0050	0.580	0.0115	0.0099	Wilcox	3.167	0.202	1.020
Concrete	0.667	0.0100	0.175	0.0117	0.0113	Wilcox	2.771	0.101	0.193
Concrete	0.667	0.0100	0.260	0.0116	0.0113	Wilcox	3.452	0.140	0.460
Concrete	0.667	0.0100	0.330	0.0122	0.0113	Wilcox	3.691	0.166	0.760
Concrete	0.667	0.0100	0.420	0.0122	0.0113	Wilcox	4.026	0.190	1.040
Concrete	0.667	0.0100	0.500	0.0116	0.0113	Wilcox	4.448	0.202	1.360
Concrete	0.667	0.0100	0.600	0.0118	0.0113	Wilcox	4.320	0.199	1.530
Concrete	0.667	0.0100	0.640	0.0112	0.0113	Wilcox	4.360	0.189	1.640
Concrete	0.667	0.0150	0.170	0.0136	0.0102	Wilcox	2.857	0.098	0.200
Concrete	0.667	0.0150	0.250	0.0129	0.0102	Wilcox	3.750	0.136	0.450
Concrete	0.667	0.0150	0.330	0.0123	0.0102	Wilcox	4.477	0.162	0.770
Concrete	0.667	0.0150	0.420	0.0125	0.0102	Wilcox	4.828	0.190	1.120
Concrete	0.667	0.0150	0.500	0.0118	0.0102	Wilcox	5.338	0.202	1.500
Concrete	0.667	0.0150	0.570	0.0116	0.0102	Wilcox	5.440	0.202	1.730
Concrete	0.667	0.0200	0.170	0.0136	0.0105	Wilcox	3.286	0.098	0.230
Concrete	0.667	0.0200	0.250	0.0119	0.0105	Wilcox	4.667	0.136	0.560
Concrete	0.667	0.0200	0.320	0.0123	0.0105	Wilcox	5.060	0.162	0.840
Concrete	0.667	0.0200	0.420	0.0125	0.0105	Wilcox	5.560	0.190	1.290
Concrete	0.667	0.0200	0.500	0.0122	0.0105	Wilcox	5.943	0.202	1.670
Concrete	0.667	0.0200	0.580	0.0117	0.0105	Wilcox	6.211	0.202	2.000
Concrete	0.667	0.0300	0.160	0.0147	0.0107	Wilcox	3.643	0.095	0.235
Concrete	0.667	0.0300	0.240	0.0146	0.0107	Wilcox	4.602	0.132	0.520
Concrete	0.667	0.0300	0.340	0.0141	0.0107	Wilcox	5.587	0.169	1.000
Concrete	0.667	0.0300	0.420	0.0141	0.0107	Wilcox	6.017	0.190	1.390
Concrete	0.667	0.0300	0.500	0.0131	0.0107	Wilcox	6.786	0.202	1.400
Concrete	0.667	0.0300	0.610	0.0118	0.0107	Wilcox	7.403	0.197	2.480
Concrete	0.667	0.0400	0.160	0.0156	0.0122	Wilcox	3.953	0.095	0.255
Concrete	0.667	0.0400	0.250	0.0153	0.0122	Wilcox	5.167	0.136	0.620
Concrete	0.667	0.0400	0.330	0.0148	0.0122	Wilcox	6.104	0.166	1.050
Concrete	0.667	0.0400	0.420	0.0146	0.0122	Wilcox	6.767	0.190	1.570
Concrete	0.667	0.0400	0.500	0.0135	0.0122	Wilcox	7.616	0.202	2.140
Concrete	0.667	0.0400	0.600	0.0122	0.0122	Wilcox	8.338	0.199	2.760
Concrete	0.333	0.0005	0.328	0.0125	0.0126	Yarnell	0.504	0.082	0.043
Concrete	0.333	0.0005	0.282	0.0143	0.0126	Yarnell	0.499	0.099	0.039
Concrete	0.333	0.0005	0.247	0.0145	0.0126	Yarnell	0.491	0.099	0.034
Concrete	0.333	0.0005	0.206	0.0217	0.0126	Yarnell	0.315	0.093	0.020
Concrete	0.333	0.0005	0.167	0.0228	0.0126	Yarnell	0.278	0.083	0.012
Concrete	0.333	0.0010	0.311	0.0124	0.0115	Yarnell	0.785	0.094	0.065
Concrete	0.333	0.0010	0.274	0.0139	0.0115	Yarnell	0.730	0.100	0.055
Concrete	0.333	0.0010	0.239	0.0147	0.0115	Yarnell	0.682	0.098	0.045
Concrete	0.333	0.0010	0.210	0.0148	0.0115	Yarnell	0.656	0.094	0.038
Concrete	0.333	0.0010	0.163	0.0171	0.0115	Yarnell	0.519	0.082	0.022
Concrete	0.333	0.0010	0.118	0.0253	0.0115	Yarnell	0.301	0.065	0.008
Concrete	0.333	0.0020	0.323	0.0134	0.0129	Yarnell	0.988	0.089	0.083
Concrete	0.333	0.0020	0.271	0.0134	0.0129	Yarnell	1.071	0.100	0.080

Material	Diameter (Φ) [ft]	Slope (ft/ft)	Depth (d) [ft]	n	n_f	Investigator	Velocity (ft/s)	Hydraulic Radius	Discharge (Q) [cfs]
Concrete	0.333	0.0020	0.243	0.0147	0.0129	Yarnell	0.968	0.099	0.065
Concrete	0.333	0.0020	0.215	0.0149	0.0129	Yarnell	0.927	0.095	0.054
Concrete	0.333	0.0020	0.162	0.0186	0.0129	Yarnell	0.673	0.081	0.028
Concrete	0.333	0.0020	0.124	0.0254	0.0129	Yarnell	0.434	0.067	0.013
Concrete	0.333	0.0030	0.323	0.0135	0.0129	Yarnell	1.204	0.089	0.101
Concrete	0.333	0.0030	0.295	0.0133	0.0129	Yarnell	1.300	0.098	0.104
Concrete	0.333	0.0030	0.271	0.0135	0.0129	Yarnell	1.298	0.100	0.097
Concrete	0.333	0.0030	0.243	0.0138	0.0129	Yarnell	1.263	0.099	0.085
Concrete	0.333	0.0030	0.211	0.0164	0.0129	Yarnell	1.028	0.094	0.059
Concrete	0.333	0.0030	0.160	0.0210	0.0129	Yarnell	0.727	0.081	0.030
Concrete	0.333	0.0050	0.315	0.0127	0.0118	Yarnell	1.697	0.093	0.142
Concrete	0.333	0.0050	0.276	0.0139	0.0118	Yarnell	1.627	0.100	0.124
Concrete	0.333	0.0050	0.243	0.0152	0.0118	Yarnell	1.484	0.099	0.100
Concrete	0.333	0.0050	0.212	0.0160	0.0118	Yarnell	1.364	0.094	0.079
Concrete	0.333	0.0050	0.170	0.0187	0.0118	Yarnell	1.081	0.084	0.048
Concrete	0.333	0.0050	0.121	0.0244	0.0118	Yarnell	0.706	0.066	0.020
Concrete	0.333	0.0125	0.301	0.0127	0.0115	Yarnell	2.771	0.097	0.225
Concrete	0.333	0.0125	0.287	0.0131	0.0115	Yarnell	2.709	0.099	0.212
Concrete	0.333	0.0125	0.242	0.0143	0.0115	Yarnell	2.478	0.099	0.166
Concrete	0.333	0.0125	0.204	0.0137	0.0115	Yarnell	2.492	0.093	0.138
Concrete	0.333	0.0125	0.196	0.0160	0.0115	Yarnell	1.918	0.079	0.076
Concrete	0.333	0.0125	0.133	0.0221	0.0115	Yarnell	1.293	0.071	0.042
Concrete	0.333	0.0150	0.314	0.0123	0.0115	Yarnell	3.056	0.093	0.254
Concrete	0.333	0.0150	0.302	0.0127	0.0114	Yarnell	3.018	0.097	0.246
Concrete	0.333	0.0150	0.274	0.0132	0.0114	Yarnell	2.965	0.100	0.224
Concrete	0.333	0.0150	0.255	0.0146	0.0114	Yarnell	2.684	0.100	0.189
Concrete	0.333	0.0150	0.224	0.0152	0.0114	Yarnell	2.449	0.096	0.151
Concrete	0.333	0.0150	0.159	0.0163	0.0114	Yarnell	2.088	0.080	0.085
Concrete	0.333	0.0150	0.123	0.0199	0.0114	Yarnell	1.511	0.067	0.044
Concrete	0.417	0.0005	0.396	0.0124	0.0115	Yarnell	0.640	0.117	0.084
Concrete	0.417	0.0005	0.308	0.0132	0.0115	Yarnell	0.627	0.124	0.067
Concrete	0.417	0.0005	0.221	0.0159	0.0115	Yarnell	0.475	0.108	0.035
Concrete	0.417	0.0010	0.405	0.0112	0.0106	Yarnell	0.980	0.113	0.131
Concrete	0.417	0.0010	0.293	0.0122	0.0106	Yarnell	0.954	0.123	0.097
Concrete	0.417	0.0010	0.206	0.0154	0.0106	Yarnell	0.671	0.103	0.045
Concrete	0.417	0.0010	0.134	0.0161	0.0106	Yarnell	0.521	0.075	0.020
Concrete	0.417	0.0020	0.393	0.0114	0.0105	Yarnell	1.400	0.118	0.184
Concrete	0.417	0.0020	0.317	0.0114	0.0105	Yarnell	1.459	0.125	0.161
Concrete	0.417	0.0020	0.233	0.0132	0.0105	Yarnell	1.150	0.108	0.085
Concrete	0.417	0.0020	0.171	0.0151	0.0105	Yarnell	0.890	0.091	0.047
Concrete	0.417	0.0020	0.126	0.0155	0.0105	Yarnell	0.740	0.072	0.026
Concrete	0.417	0.0030	0.310	0.0118	0.0104	Yarnell	1.719	0.125	0.185
Concrete	0.417	0.0030	0.209	0.0148	0.0104	Yarnell	1.218	0.104	0.083
Concrete	0.417	0.0050	0.398	0.0109	0.0101	Yarnell	2.307	0.116	0.305
Concrete	0.417	0.0050	0.278	0.0122	0.0101	Yarnell	2.107	0.121	0.202
Concrete	0.417	0.0050	0.193	0.0135	0.0101	Yarnell	1.668	0.099	0.102
Concrete	0.417	0.0050	0.159	0.0157	0.0101	Yarnell	1.310	0.086	0.062
Concrete	0.417	0.0075	0.393	0.0114	0.0105	Yarnell	2.711	0.118	0.356
Concrete	0.417	0.0075	0.196	0.0129	0.0105	Yarnell	2.154	0.100	0.135
Concrete	0.417	0.0075	0.146	0.0136	0.0105	Yarnell	1.767	0.081	0.075
Concrete	0.417	0.0075	0.126	0.0175	0.0105	Yarnell	1.270	0.072	0.044
Concrete	0.417	0.0100	0.404	0.0108	0.0103	Yarnell	3.218	0.113	0.428

Material	Diameter (Φ) [ft]	Slope (ft/ft)	Depth (d) [ft]	n	n_f	Investigator	Velocity (ft/s)	Hydraulic Radius	Discharge (Q) [cfs]
Concrete	0.417	0.0100	0.298	0.0123	0.0103	Yarnell	3.003	0.123	0.311
Concrete	0.417	0.0100	0.224	0.0108	0.0103	Yarnell	3.124	0.109	0.232
Concrete	0.417	0.0100	0.195	0.0119	0.0103	Yarnell	2.680	0.099	0.164
Concrete	0.417	0.0100	0.135	0.0138	0.0103	Yarnell	1.935	0.076	0.074
Concrete	0.417	0.0125	0.396	0.0113	0.0104	Yarnell	3.538	0.117	0.467
Concrete	0.417	0.0125	0.312	0.0123	0.0104	Yarnell	3.374	0.125	0.366
Concrete	0.417	0.0125	0.231	0.0110	0.0104	Yarnell	3.489	0.110	0.269
Concrete	0.417	0.0125	0.188	0.0110	0.0104	Yarnell	3.189	0.097	0.189
Concrete	0.417	0.0125	0.129	0.0113	0.0104	Yarnell	2.574	0.073	0.092
Concrete	0.417	0.0150	0.401	0.0111	0.0104	Yarnell	3.891	0.115	0.516
Concrete	0.417	0.0150	0.323	0.0112	0.0104	Yarnell	4.065	0.125	0.457
Concrete	0.417	0.0150	0.261	0.0124	0.0104	Yarnell	3.533	0.117	0.315
Concrete	0.417	0.0150	0.176	0.0131	0.0104	Yarnell	2.840	0.093	0.155
Concrete	0.500	0.0005	0.492	0.0123	0.0118	Yarnell	0.705	0.133	0.137
Concrete	0.500	0.0005	0.391	0.0174	0.0118	Yarnell	0.542	0.151	0.089
Concrete	0.500	0.0005	0.282	0.0214	0.0118	Yarnell	0.408	0.134	0.046
Concrete	0.500	0.0005	0.225	0.0198	0.0118	Yarnell	0.401	0.116	0.034
Concrete	0.500	0.0005	0.173	0.0203	0.0118	Yarnell	0.343	0.096	0.021
Concrete	0.500	0.0010	0.484	0.0111	0.0104	Yarnell	1.136	0.138	0.219
Concrete	0.500	0.0010	0.348	0.0120	0.0104	Yarnell	1.116	0.151	0.180
Concrete	0.500	0.0010	0.298	0.0143	0.0104	Yarnell	0.881	0.138	0.107
Concrete	0.500	0.0010	0.222	0.0175	0.0104	Yarnell	0.638	0.115	0.054
Concrete	0.500	0.0010	0.176	0.0207	0.0104	Yarnell	0.480	0.097	0.030
Concrete	0.500	0.0020	0.481	0.0113	0.0106	Yarnell	1.575	0.139	0.303
Concrete	0.500	0.0020	0.371	0.0123	0.0106	Yarnell	1.531	0.150	0.238
Concrete	0.500	0.0020	0.293	0.0133	0.0106	Yarnell	1.326	0.137	0.158
Concrete	0.500	0.0020	0.170	0.0176	0.0106	Yarnell	0.783	0.094	0.046
Concrete	0.500	0.0030	0.489	0.0108	0.0103	Yarnell	1.983	0.135	0.383
Concrete	0.500	0.0030	0.383	0.0117	0.0103	Yarnell	1.981	0.151	0.318
Concrete	0.500	0.0030	0.273	0.0128	0.0103	Yarnell	1.644	0.132	0.180
Concrete	0.500	0.0030	0.222	0.0136	0.0103	Yarnell	1.419	0.115	0.119
Concrete	0.500	0.0030	0.164	0.0169	0.0103	Yarnell	0.985	0.092	0.055
Concrete	0.500	0.0050	0.480	0.0125	0.0117	Yarnell	2.259	0.139	0.434
Concrete	0.500	0.0050	0.385	0.0123	0.0117	Yarnell	2.428	0.151	0.392
Concrete	0.500	0.0050	0.270	0.0140	0.0117	Yarnell	1.934	0.131	0.208
Concrete	0.500	0.0050	0.210	0.0151	0.0117	Yarnell	1.604	0.111	0.125
Concrete	0.500	0.0050	0.151	0.0166	0.0117	Yarnell	1.234	0.086	0.062
Concrete	0.500	0.0075	0.480	0.0113	0.0105	Yarnell	3.061	0.139	0.587
Concrete	0.500	0.0075	0.384	0.0125	0.0105	Yarnell	2.917	0.151	0.469
Concrete	0.500	0.0075	0.272	0.0135	0.0105	Yarnell	2.466	0.131	0.268
Concrete	0.500	0.0075	0.212	0.0147	0.0105	Yarnell	2.030	0.112	0.160
Concrete	0.500	0.0075	0.142	0.0176	0.0105	Yarnell	1.383	0.082	0.063
Concrete	0.500	0.0100	0.473	0.0124	0.0114	Yarnell	3.274	0.141	0.624
Concrete	0.500	0.0100	0.365	0.0133	0.0114	Yarnell	3.148	0.149	0.481
Concrete	0.500	0.0100	0.278	0.0136	0.0114	Yarnell	2.854	0.133	0.319
Concrete	0.500	0.0100	0.212	0.0138	0.0114	Yarnell	2.523	0.115	0.199
Concrete	0.500	0.0100	0.144	0.0146	0.0114	Yarnell	1.939	0.083	0.090
Concrete	0.667	0.0005	0.645	0.0116	0.0110	Yarnell	0.914	0.180	0.310
Concrete	0.667	0.0005	0.642	0.0117	0.0110	Yarnell	0.915	0.182	0.310
Concrete	0.667	0.0005	0.547	0.0120	0.0110	Yarnell	0.950	0.200	0.287
Concrete	0.667	0.0005	0.479	0.0137	0.0110	Yarnell	0.824	0.197	0.219
Concrete	0.667	0.0005	0.426	0.0131	0.0110	Yarnell	0.840	0.189	0.196

Material	Diameter (Φ) [ft]	Slope (ft/ft)	Depth (d) [ft]	n	n_f	Investigator	Velocity (ft/s)	Hydraulic Radius	Discharge (Q) [cfs]
Concrete	0.667	0.0005	0.319	0.0146	0.0110	Yarnell	0.676	0.161	0.111
Concrete	0.667	0.0005	0.258	0.0154	0.0110	Yarnell	0.582	0.139	0.072
Concrete	0.667	0.0010	0.654	0.0112	0.0109	Yarnell	1.305	0.172	0.444
Concrete	0.667	0.0010	0.625	0.0121	0.0109	Yarnell	1.276	0.189	0.426
Concrete	0.667	0.0010	0.554	0.0120	0.0109	Yarnell	1.342	0.200	0.410
Concrete	0.667	0.0010	0.481	0.0130	0.0109	Yarnell	1.227	0.197	0.328
Concrete	0.667	0.0010	0.428	0.0128	0.0109	Yarnell	1.212	0.190	0.284
Concrete	0.667	0.0010	0.311	0.0133	0.0109	Yarnell	1.036	0.159	0.164
Concrete	0.667	0.0010	0.253	0.0134	0.0109	Yarnell	0.937	0.137	0.113
Concrete	0.667	0.0010	0.177	0.0164	0.0109	Yarnell	0.628	0.103	0.046
Concrete	0.667	0.0020	0.648	0.0112	0.0107	Yarnell	1.882	0.178	0.637
Concrete	0.667	0.0020	0.640	0.0112	0.0107	Yarnell	1.923	0.183	0.650
Concrete	0.667	0.0020	0.565	0.0117	0.0107	Yarnell	1.940	0.199	0.604
Concrete	0.667	0.0020	0.496	0.0123	0.0107	Yarnell	1.850	0.199	0.509
Concrete	0.667	0.0020	0.448	0.0125	0.0107	Yarnell	1.778	0.193	0.439
Concrete	0.667	0.0020	0.335	0.0134	0.0107	Yarnell	1.503	0.166	0.262
Concrete	0.667	0.0030	0.643	0.0112	0.0106	Yarnell	2.325	0.181	0.787
Concrete	0.667	0.0030	0.623	0.0116	0.0106	Yarnell	2.324	0.189	0.775
Concrete	0.667	0.0030	0.553	0.0118	0.0106	Yarnell	2.371	0.200	0.724
Concrete	0.667	0.0030	0.489	0.0121	0.0106	Yarnell	2.295	0.198	0.622
Concrete	0.667	0.0030	0.445	0.0123	0.0106	Yarnell	2.221	0.193	0.544
Concrete	0.667	0.0030	0.341	0.0132	0.0106	Yarnell	1.884	0.168	0.335
Concrete	0.667	0.0030	0.262	0.0148	0.0106	Yarnell	1.492	0.141	0.189
Concrete	0.667	0.0030	0.182	0.0169	0.0106	Yarnell	1.075	0.105	0.082
Concrete	0.667	0.0050	0.647	0.0112	0.0107	Yarnell	2.979	0.179	1.105
Concrete	0.667	0.0050	0.628	0.0114	0.0107	Yarnell	3.035	0.188	1.016
Concrete	0.667	0.0050	0.623	0.0117	0.0107	Yarnell	2.978	0.189	0.993
Concrete	0.667	0.0050	0.566	0.0123	0.0107	Yarnell	2.924	0.199	0.911
Concrete	0.667	0.0050	0.512	0.0127	0.0107	Yarnell	2.825	0.200	0.803
Concrete	0.667	0.0050	0.443	0.0133	0.0107	Yarnell	2.642	0.192	0.644
Concrete	0.667	0.0050	0.318	0.0141	0.0107	Yarnell	2.216	0.161	0.361
Concrete	0.667	0.0050	0.270	0.0146	0.0107	Yarnell	1.983	0.144	0.261
Concrete	0.667	0.0050	0.189	0.0170	0.0107	Yarnell	1.411	0.109	0.114
Concrete	0.667	0.0075	0.647	0.0117	0.0111	Yarnell	3.508	0.179	1.190
Concrete	0.667	0.0075	0.633	0.0116	0.0111	Yarnell	3.652	0.186	1.228
Concrete	0.667	0.0075	0.546	0.0123	0.0111	Yarnell	3.603	0.200	1.088
Concrete	0.667	0.0075	0.495	0.0125	0.0111	Yarnell	3.517	0.199	0.966
Concrete	0.667	0.0075	0.442	0.0127	0.0111	Yarnell	3.375	0.192	0.820
Concrete	0.667	0.0075	0.335	0.0135	0.0111	Yarnell	2.896	0.166	0.504
Concrete	0.667	0.0075	0.260	0.0140	0.0111	Yarnell	2.476	0.140	0.310
Concrete	0.667	0.0075	0.170	0.0159	0.0111	Yarnell	1.743	0.099	0.122
Concrete	0.667	0.0100	0.645	0.0119	0.0113	Yarnell	4.007	0.180	1.358
Concrete	0.667	0.0100	0.642	0.0119	0.0113	Yarnell	4.030	0.182	1.363
Concrete	0.667	0.0100	0.559	0.0124	0.0113	Yarnell	4.114	0.200	1.268
Concrete	0.667	0.0100	0.464	0.0123	0.0113	Yarnell	4.082	0.195	1.047
Concrete	0.667	0.0100	0.415	0.0125	0.0113	Yarnell	3.886	0.187	0.879
Concrete	0.667	0.0100	0.309	0.0128	0.0113	Yarnell	3.388	0.158	0.532
Concrete	0.667	0.0100	0.225	0.0132	0.0113	Yarnell	2.820	0.125	0.290
Concrete	0.667	0.0100	0.153	0.0141	0.0113	Yarnell	2.136	0.091	0.128
Concrete	0.667	0.0125	0.642	0.0120	0.0113	Yarnell	4.470	0.182	1.512
Concrete	0.667	0.0125	0.600	0.0123	0.0113	Yarnell	4.569	0.195	1.488
Concrete	0.667	0.0125	0.593	0.0124	0.0113	Yarnell	4.553	0.196	1.470

Material	Diameter (Φ) [ft]	Slope (ft/ft)	Depth (d) [ft]	n	n_f	Investigator	Velocity (ft/s)	Hydraulic Radius	Discharge (Q) [cfs]
Concrete	0.667	0.0125	0.553	0.0124	0.0113	Yarnell	4.611	0.200	1.408
Concrete	0.667	0.0125	0.487	0.0127	0.0113	Yarnell	4.459	0.198	1.204
Concrete	0.667	0.0125	0.426	0.0129	0.0113	Yarnell	4.260	0.189	0.993
Concrete	0.667	0.0125	0.324	0.0133	0.0113	Yarnell	3.731	0.163	0.622
Concrete	0.667	0.0125	0.244	0.0138	0.0113	Yarnell	3.153	0.133	0.362
Concrete	0.667	0.0125	0.163	0.0143	0.0113	Yarnell	2.441	0.096	0.160
Concrete	0.667	0.0150	0.634	0.0121	0.0113	Yarnell	4.889	0.186	1.645
Concrete	0.667	0.0150	0.616	0.0122	0.0113	Yarnell	4.959	0.192	1.643
Concrete	0.667	0.0150	0.545	0.0125	0.0113	Yarnell	4.996	0.200	1.506
Concrete	0.667	0.0150	0.482	0.0128	0.0113	Yarnell	4.829	0.197	1.290
Concrete	0.667	0.0150	0.414	0.0133	0.0113	Yarnell	4.500	0.187	1.014
Concrete	0.667	0.0150	0.323	0.0138	0.0113	Yarnell	3.926	0.163	0.652
Concrete	0.667	0.0150	0.245	0.0140	0.0113	Yarnell	3.399	0.134	0.393
Concrete	0.667	0.0150	0.165	0.0137	0.0113	Yarnell	2.813	0.097	0.188
Concrete	0.833	0.0005	0.818	0.0136	0.0130	Yarnell	0.898	0.221	0.482
Concrete	0.833	0.0005	0.783	0.0131	0.0130	Yarnell	0.978	0.238	0.515
Concrete	0.833	0.0005	0.739	0.0130	0.0130	Yarnell	1.009	0.248	0.511
Concrete	0.833	0.0005	0.706	0.0132	0.0130	Yarnell	1.005	0.251	0.491
Concrete	0.833	0.0005	0.616	0.0131	0.0130	Yarnell	1.007	0.249	0.432
Concrete	0.833	0.0005	0.579	0.0125	0.0130	Yarnell	1.042	0.245	0.419
Concrete	0.833	0.0005	0.551	0.0134	0.0130	Yarnell	0.962	0.241	0.366
Concrete	0.833	0.0005	0.474	0.0141	0.0130	Yarnell	0.873	0.224	0.278
Concrete	0.833	0.0005	0.416	0.0131	0.0130	Yarnell	0.889	0.208	0.241
Concrete	0.833	0.0005	0.323	0.0137	0.0130	Yarnell	0.756	0.174	0.147
Concrete	0.833	0.0005	0.241	0.0139	0.0130	Yarnell	0.639	0.138	0.083
Concrete	0.833	0.0010	0.814	0.0129	0.0123	Yarnell	1.351	0.224	0.724
Concrete	0.833	0.0010	0.811	0.0125	0.0123	Yarnell	1.403	0.226	0.751
Concrete	0.833	0.0010	0.789	0.0122	0.0123	Yarnell	1.472	0.236	0.778
Concrete	0.833	0.0010	0.739	0.0124	0.0123	Yarnell	1.503	0.248	0.762
Concrete	0.833	0.0010	0.710	0.0125	0.0123	Yarnell	1.499	0.251	0.736
Concrete	0.833	0.0010	0.670	0.0127	0.0123	Yarnell	1.486	0.252	0.693
Concrete	0.833	0.0010	0.617	0.0128	0.0123	Yarnell	1.460	0.249	0.628
Concrete	0.833	0.0010	0.593	0.0128	0.0123	Yarnell	1.444	0.247	0.595
Concrete	0.833	0.0010	0.557	0.0132	0.0123	Yarnell	1.391	0.242	0.535
Concrete	0.833	0.0010	0.486	0.0129	0.0123	Yarnell	1.359	0.227	0.446
Concrete	0.833	0.0010	0.423	0.0126	0.0123	Yarnell	1.320	0.210	0.365
Concrete	0.833	0.0010	0.322	0.0142	0.0123	Yarnell	1.032	0.174	0.200
Concrete	0.833	0.0010	0.238	0.0144	0.0123	Yarnell	0.868	0.137	0.111
Concrete	0.833	0.0020	0.813	0.0118	0.0112	Yarnell	2.084	0.225	1.116
Concrete	0.833	0.0020	0.798	0.0122	0.0112	Yarnell	2.073	0.233	1.102
Concrete	0.833	0.0020	0.738	0.0121	0.0112	Yarnell	2.165	0.248	1.096
Concrete	0.833	0.0020	0.708	0.0122	0.0112	Yarnell	2.164	0.251	1.060
Concrete	0.833	0.0020	0.667	0.0122	0.0112	Yarnell	2.176	0.252	1.011
Concrete	0.833	0.0020	0.621	0.0121	0.0112	Yarnell	2.183	0.250	0.945
Concrete	0.833	0.0020	0.594	0.0125	0.0112	Yarnell	2.091	0.247	0.864
Concrete	0.833	0.0020	0.561	0.0126	0.0112	Yarnell	2.060	0.243	0.800
Concrete	0.833	0.0020	0.483	0.0129	0.0112	Yarnell	1.918	0.227	0.625
Concrete	0.833	0.0020	0.439	0.0133	0.0112	Yarnell	1.790	0.215	0.519
Concrete	0.833	0.0020	0.429	0.0134	0.0112	Yarnell	1.770	0.212	0.498
Concrete	0.833	0.0020	0.343	0.0139	0.0112	Yarnell	1.543	0.182	0.325
Concrete	0.833	0.0020	0.248	0.0170	0.0112	Yarnell	1.060	0.141	0.144
Concrete	0.833	0.0030	0.813	0.0121	0.0115	Yarnell	2.502	0.225	1.340

Material	Diameter (Φ) [ft]	Slope (ft/ft)	Depth (d) [ft]	n	n_f	Investigator	Velocity (ft/s)	Hydraulic Radius	Discharge (Q) [cfs]
Concrete	0.833	0.0030	0.810	0.0121	0.0115	Yarnell	2.502	0.227	1.338
Concrete	0.833	0.0030	0.790	0.0119	0.0115	Yarnell	2.609	0.236	1.380
Concrete	0.833	0.0030	0.740	0.0121	0.0115	Yarnell	2.651	0.247	1.345
Concrete	0.833	0.0030	0.715	0.0120	0.0115	Yarnell	2.689	0.250	1.328
Concrete	0.833	0.0030	0.663	0.0122	0.0115	Yarnell	2.676	0.252	1.236
Concrete	0.833	0.0030	0.636	0.0122	0.0115	Yarnell	2.661	0.251	1.180
Concrete	0.833	0.0030	0.598	0.0124	0.0115	Yarnell	2.584	0.247	1.086
Concrete	0.833	0.0030	0.554	0.0126	0.0115	Yarnell	2.505	0.241	0.959
Concrete	0.833	0.0030	0.498	0.0128	0.0115	Yarnell	2.393	0.230	0.809
Concrete	0.833	0.0030	0.436	0.0132	0.0115	Yarnell	2.205	0.214	0.633
Concrete	0.833	0.0030	0.339	0.0142	0.0115	Yarnell	1.828	0.180	0.379
Concrete	0.833	0.0030	0.243	0.0156	0.0115	Yarnell	1.407	0.139	0.185
Concrete	0.833	0.0050	0.805	0.0119	0.0112	Yarnell	3.308	0.229	1.765
Concrete	0.833	0.0050	0.804	0.0121	0.0112	Yarnell	3.253	0.230	1.735
Concrete	0.833	0.0050	0.789	0.0123	0.0112	Yarnell	3.282	0.236	1.735
Concrete	0.833	0.0050	0.741	0.0122	0.0112	Yarnell	3.407	0.247	1.730
Concrete	0.833	0.0050	0.704	0.0121	0.0112	Yarnell	3.451	0.251	1.683
Concrete	0.833	0.0050	0.678	0.0122	0.0112	Yarnell	3.446	0.252	1.625
Concrete	0.833	0.0050	0.623	0.0123	0.0112	Yarnell	3.408	0.250	1.480
Concrete	0.833	0.0050	0.586	0.0125	0.0112	Yarnell	3.303	0.246	1.345
Concrete	0.833	0.0050	0.562	0.0128	0.0112	Yarnell	3.209	0.243	1.248
Concrete	0.833	0.0050	0.492	0.0132	0.0112	Yarnell	2.980	0.229	0.993
Concrete	0.833	0.0050	0.420	0.0138	0.0112	Yarnell	2.680	0.209	0.735
Concrete	0.833	0.0050	0.338	0.0141	0.0112	Yarnell	2.388	0.180	0.493
Concrete	0.833	0.0050	0.231	0.0152	0.0112	Yarnell	1.810	0.133	0.222
Concrete	0.833	0.0075	0.806	0.0122	0.0114	Yarnell	3.962	0.229	2.115
Concrete	0.833	0.0075	0.800	0.0124	0.0114	Yarnell	3.927	0.232	2.090
Concrete	0.833	0.0075	0.779	0.0125	0.0114	Yarnell	3.972	0.239	2.085
Concrete	0.833	0.0075	0.726	0.0124	0.0114	Yarnell	4.112	0.249	2.056
Concrete	0.833	0.0075	0.718	0.0124	0.0114	Yarnell	4.125	0.250	2.044
Concrete	0.833	0.0075	0.627	0.0126	0.0114	Yarnell	4.050	0.250	1.770
Concrete	0.833	0.0075	0.570	0.0132	0.0114	Yarnell	3.828	0.244	1.512
Concrete	0.833	0.0075	0.541	0.0134	0.0114	Yarnell	3.706	0.239	1.380
Concrete	0.833	0.0075	0.487	0.0137	0.0114	Yarnell	3.512	0.228	1.156
Concrete	0.833	0.0075	0.408	0.0147	0.0114	Yarnell	3.045	0.205	0.804
Concrete	0.833	0.0075	0.323	0.0147	0.0114	Yarnell	2.729	0.174	0.531
Concrete	0.833	0.0075	0.224	0.0150	0.0114	Yarnell	2.211	0.130	0.260
Concrete	0.833	0.0100	0.792	0.0125	0.0115	Yarnell	4.542	0.235	2.406
Concrete	0.833	0.0100	0.791	0.0124	0.0115	Yarnell	4.574	0.235	2.421
Concrete	0.833	0.0100	0.681	0.0127	0.0115	Yarnell	4.663	0.252	2.208
Concrete	0.833	0.0100	0.624	0.0125	0.0115	Yarnell	4.727	0.250	2.056
Concrete	0.833	0.0100	0.618	0.0127	0.0115	Yarnell	4.655	0.249	2.005
Concrete	0.833	0.0100	0.595	0.0129	0.0115	Yarnell	4.552	0.247	1.884
Concrete	0.833	0.0100	0.553	0.0134	0.0115	Yarnell	4.308	0.241	1.645
Concrete	0.833	0.0100	0.489	0.0134	0.0115	Yarnell	4.157	0.228	1.375
Concrete	0.833	0.0100	0.405	0.0136	0.0115	Yarnell	3.795	0.204	0.993
Concrete	0.833	0.0100	0.327	0.0148	0.0115	Yarnell	3.156	0.176	0.624
Concrete	0.833	0.0100	0.207	0.0166	0.0115	Yarnell	2.203	0.121	0.232
Concrete	0.833	0.0125	0.810	0.0122	0.0116	Yarnell	5.055	0.227	2.704
Concrete	0.833	0.0125	0.809	0.0122	0.0116	Yarnell	5.092	0.227	2.722
Concrete	0.833	0.0125	0.805	0.0124	0.0116	Yarnell	5.040	0.229	2.689
Concrete	0.833	0.0125	0.742	0.0124	0.0116	Yarnell	5.272	0.247	2.680

Material	Diameter (Φ) [ft]	Slope (ft/ft)	Depth (d) [ft]	n	n_f	Investigator	Velocity (ft/s)	Hydraulic Radius	Discharge (Q) [cfs]
Concrete	0.833	0.0125	0.701	0.0124	0.0116	Yarnell	5.336	0.251	2.592
Concrete	0.833	0.0125	0.700	0.0124	0.0116	Yarnell	5.343	0.251	2.592
Concrete	0.833	0.0125	0.664	0.0124	0.0116	Yarnell	5.332	0.252	2.466
Concrete	0.833	0.0125	0.611	0.0125	0.0116	Yarnell	5.265	0.249	2.241
Concrete	0.833	0.0125	0.569	0.0128	0.0116	Yarnell	5.073	0.244	2.000
Concrete	0.833	0.0125	0.543	0.0127	0.0116	Yarnell	5.037	0.239	1.884
Concrete	0.833	0.0125	0.463	0.0129	0.0116	Yarnell	4.725	0.221	1.462
Concrete	0.833	0.0125	0.412	0.0126	0.0116	Yarnell	4.622	0.206	1.236
Concrete	0.833	0.0125	0.314	0.0137	0.0116	Yarnell	3.739	0.170	0.700
Concrete	0.833	0.0125	0.213	0.0139	0.0116	Yarnell	2.983	0.124	0.326
Concrete	0.833	0.0150	0.781	0.0128	0.0117	Yarnell	5.486	0.239	2.884
Concrete	0.833	0.0150	0.624	0.0128	0.0117	Yarnell	5.641	0.250	2.454
Concrete	0.833	0.0150	0.421	0.0128	0.0117	Yarnell	5.030	0.209	1.382
Concrete	1.000	0.0005	0.985	0.0114	0.0112	Yarnell	1.183	0.259	0.913
Concrete	1.000	0.0005	0.943	0.0122	0.0112	Yarnell	1.179	0.284	0.894
Concrete	1.000	0.0005	0.889	0.0125	0.0112	Yarnell	1.188	0.296	0.867
Concrete	1.000	0.0005	0.845	0.0123	0.0112	Yarnell	1.211	0.301	0.849
Concrete	1.000	0.0005	0.782	0.0130	0.0112	Yarnell	1.154	0.301	0.754
Concrete	1.000	0.0005	0.756	0.0135	0.0112	Yarnell	1.106	0.300	0.699
Concrete	1.000	0.0005	0.691	0.0130	0.0112	Yarnell	1.131	0.293	0.650
Concrete	1.000	0.0005	0.643	0.0126	0.0112	Yarnell	1.144	0.285	0.606
Concrete	1.000	0.0005	0.580	0.0132	0.0112	Yarnell	1.062	0.272	0.498
Concrete	1.000	0.0005	0.534	0.0128	0.0112	Yarnell	1.058	0.259	0.449
Concrete	1.000	0.0005	0.511	0.0131	0.0112	Yarnell	1.018	0.253	0.408
Concrete	1.000	0.0005	0.364	0.0136	0.0112	Yarnell	0.837	0.199	0.215
Concrete	1.000	0.0005	0.275	0.0152	0.0112	Yarnell	0.641	0.159	0.112
Concrete	1.500	0.0021	0.790	0.0109	0.0106	StraubMorris	3.238	0.390	3.060
Concrete	1.500	0.0021	0.990	0.0109	0.0106	StraubMorris	3.476	0.430	4.310
Clay	0.667	0.005	0.160	0.0095	0.0100	Wilcox	2.307	0.095	0.150
Clay	0.667	0.005	0.240	0.0100	0.0100	Wilcox	2.720	0.132	0.322
Clay	0.667	0.005	0.290	0.0099	0.0100	Wilcox	3.045	0.152	0.469
Clay	0.667	0.005	0.430	0.0102	0.0100	Wilcox	3.424	0.192	0.815
Clay	0.667	0.005	0.490	0.0104	0.0100	Wilcox	3.491	0.202	0.960
Clay	0.667	0.005	0.590	0.0101	0.0100	Wilcox	3.578	0.200	1.170
Clay	0.667	0.005	0.650	0.0102	0.0100	Wilcox	3.430	0.185	1.160
Clay	0.667	0.01	0.160	0.0103	0.0104	Wilcox	3.016	0.095	0.193
Clay	0.667	0.01	0.250	0.0103	0.0104	Wilcox	3.833	0.136	0.460
Clay	0.667	0.01	0.330	0.0102	0.0104	Wilcox	4.419	0.166	0.760
Clay	0.667	0.01	0.420	0.0109	0.0104	Wilcox	4.502	0.190	1.040
Clay	0.667	0.01	0.500	0.0106	0.0104	Wilcox	4.840	0.202	1.360
Clay	0.667	0.01	0.560	0.0105	0.0104	Wilcox	4.888	0.203	1.530
Clay	0.667	0.01	0.640	0.0104	0.0104	Wilcox	4.738	0.189	1.640
Clay	0.667	0.015	0.170	0.0113	0.0099	Wilcox	3.428	0.098	0.240
Clay	0.667	0.015	0.250	0.0116	0.0099	Wilcox	4.167	0.136	0.500
Clay	0.667	0.015	0.330	0.0113	0.0099	Wilcox	4.883	0.166	0.840
Clay	0.667	0.015	0.420	0.0116	0.0099	Wilcox	5.172	0.190	1.200
Clay	0.667	0.015	0.500	0.0112	0.0099	Wilcox	5.622	0.202	1.560
Clay	0.667	0.015	0.570	0.0105	0.0099	Wilcox	6.006	0.202	1.910
Clay	0.667	0.015	0.650	0.0099	0.0099	Wilcox	5.988	0.185	2.060
Clay	0.667	0.02	0.170	0.0126	0.0092	Wilcox	3.543	0.098	0.248
Clay	0.667	0.02	0.250	0.0123	0.0092	Wilcox	4.542	0.136	0.545
Clay	0.667	0.02	0.330	0.0122	0.0092	Wilcox	5.233	0.166	0.900

Material	Diameter (Φ) [ft]	Slope (ft/ft)	Depth (d) [ft]	n	n_f	Investigator	Velocity (ft/s)	Hydraulic Radius	Discharge (Q) [cfs]
Clay	0.667	0.02	0.420	0.0125	0.0092	Wilcox	5.560	0.190	1.290
Clay	0.667	0.02	0.500	0.0117	0.0092	Wilcox	6.157	0.202	1.730
Clay	0.667	0.02	0.610	0.0103	0.0092	Wilcox	6.925	0.197	2.320
Clay	0.667	0.03	0.170	0.0150	0.0115	Wilcox	3.643	0.098	0.255
Clay	0.667	0.03	0.250	0.0136	0.0115	Wilcox	5.000	0.136	0.600
Clay	0.667	0.03	0.320	0.0135	0.0115	Wilcox	5.663	0.162	0.940
Clay	0.667	0.03	0.420	0.0141	0.0115	Wilcox	6.034	0.190	1.400
Clay	0.667	0.03	0.480	0.0129	0.0115	Wilcox	6.840	0.199	1.840
Clay	0.667	0.03	0.570	0.0115	0.0115	Wilcox	7.734	0.202	2.440
Clay	0.667	0.03	0.600	0.0115	0.0115	Wilcox	7.673	0.199	2.540
Clay	0.667	0.04	0.170	0.0148	0.0120	Wilcox	4.286	0.098	0.300
Clay	0.667	0.04	0.250	0.0139	0.0120	Wilcox	5.667	0.136	0.680
Clay	0.667	0.04	0.320	0.0146	0.0120	Wilcox	6.061	0.162	1.000
Clay	0.667	0.04	0.420	0.0141	0.0120	Wilcox	6.983	0.190	1.620
Clay	0.667	0.04	0.500	0.0134	0.0120	Wilcox	7.679	0.202	2.150
Clay	0.667	0.04	0.570	0.0120	0.0120	Wilcox	8.549	0.202	2.710
Clay	0.333	0.0005	0.332	0.0113	0.0105	Yarnell	0.607	0.0935	0.055
Clay	0.333	0.0005	0.309	0.0111	0.0105	Yarnell	0.649	0.1007	0.056
Clay	0.333	0.0005	0.298	0.0126	0.0105	Yarnell	0.578	0.1023	0.049
Clay	0.333	0.0005	0.248	0.0127	0.0105	Yarnell	0.570	0.1018	0.040
Clay	0.333	0.0005	0.214	0.0154	0.0105	Yarnell	0.456	0.0965	0.027
Clay	0.333	0.0005	0.159	0.0147	0.0105	Yarnell	0.424	0.0813	0.018
Clay	0.333	0.0010	0.131	0.0188	0.0115	Yarnell	0.304	0.0708	0.010
Clay	0.333	0.0010	0.331	0.0125	0.0115	Yarnell	0.780	0.0940	0.070
Clay	0.333	0.0010	0.327	0.0119	0.0115	Yarnell	0.831	0.0958	0.074
Clay	0.333	0.0010	0.285	0.0145	0.0115	Yarnell	0.714	0.1032	0.058
Clay	0.333	0.0010	0.228	0.0115	0.0115	Yarnell	0.878	0.0992	0.057
Clay	0.333	0.0010	0.160	0.0158	0.0115	Yarnell	0.560	0.0817	0.024
Clay	0.333	0.0010	0.136	0.0168	0.0115	Yarnell	0.490	0.0728	0.017
Clay	0.333	0.0020	0.329	0.0129	0.0118	Yarnell	1.079	0.0950	0.097
Clay	0.333	0.0020	0.321	0.0123	0.0118	Yarnell	1.148	0.0979	0.102
Clay	0.333	0.0020	0.283	0.0126	0.0118	Yarnell	1.165	0.1033	0.094
Clay	0.333	0.0020	0.271	0.0126	0.0118	Yarnell	1.166	0.1034	0.090
Clay	0.333	0.0020	0.223	0.0126	0.0118	Yarnell	1.125	0.0983	0.071
Clay	0.333	0.0020	0.173	0.0145	0.0118	Yarnell	0.892	0.0859	0.041
Clay	0.333	0.0020	0.129	0.0191	0.0118	Yarnell	0.592	0.0700	0.019
Clay	0.333	0.0030	0.313	0.0125	0.0111	Yarnell	1.408	0.1000	0.123
Clay	0.333	0.0030	0.244	0.0143	0.0111	Yarnell	1.240	0.1013	0.086
Clay	0.333	0.0030	0.213	0.0150	0.0111	Yarnell	1.145	0.0963	0.069
Clay	0.333	0.0030	0.166	0.0190	0.0111	Yarnell	0.820	0.0837	0.036
Clay	0.333	0.0030	0.123	0.0223	0.0111	Yarnell	0.608	0.0675	0.018
Clay	0.333	0.0050	0.317	0.0126	0.0143	Yarnell	1.792	0.0990	0.158
Clay	0.333	0.0050	0.287	0.0127	0.0143	Yarnell	1.829	0.1032	0.149
Clay	0.333	0.0050	0.263	0.0131	0.0143	Yarnell	1.762	0.1031	0.133
Clay	0.333	0.0050	0.223	0.0145	0.0143	Yarnell	1.550	0.0983	0.099
Clay	0.333	0.0050	0.170	0.0179	0.0143	Yarnell	1.139	0.0850	0.052
Clay	0.333	0.0050	0.128	0.0218	0.0143	Yarnell	0.819	0.0696	0.026
Clay	0.333	0.0075	0.332	0.0124	0.0115	Yarnell	2.142	0.0935	0.193
Clay	0.333	0.0075	0.320	0.0128	0.0115	Yarnell	2.151	0.0982	0.191
Clay	0.333	0.0075	0.288	0.0132	0.0115	Yarnell	2.143	0.1031	0.176
Clay	0.333	0.0075	0.253	0.0138	0.0115	Yarnell	2.047	0.1023	0.148
Clay	0.333	0.0075	0.210	0.0158	0.0115	Yarnell	1.702	0.0954	0.100

Material	Diameter (Φ) [ft]	Slope (ft/ft)	Depth (d) [ft]	n	n_f	Investigator	Velocity (ft/s)	Hydraulic Radius	Discharge (Q) [cfs]
Clay	0.333	0.0075	0.164	0.0163	0.0115	Yarnell	1.508	0.0830	0.065
Clay	0.333	0.0075	0.134	0.0175	0.0115	Yarnell	1.279	0.0720	0.043
Clay	0.333	0.0125	0.331	0.0118	0.0108	Yarnell	2.932	0.0940	0.264
Clay	0.333	0.0125	0.304	0.0126	0.0108	Yarnell	2.888	0.1016	0.247
Clay	0.333	0.0125	0.270	0.0133	0.0108	Yarnell	2.749	0.1033	0.212
Clay	0.333	0.0125	0.254	0.0136	0.0108	Yarnell	2.638	0.1024	0.195
Clay	0.333	0.0125	0.177	0.0151	0.0108	Yarnell	2.161	0.0871	0.103
Clay	0.333	0.0125	0.148	0.0156	0.0108	Yarnell	1.941	0.0774	0.074
Clay	0.333	0.0150	0.329	0.0118	0.0108	Yarnell	3.218	0.0950	0.289
Clay	0.333	0.0150	0.313	0.0118	0.0108	Yarnell	3.328	0.1000	0.291
Clay	0.333	0.0150	0.298	0.0120	0.0108	Yarnell	3.338	0.1023	0.281
Clay	0.333	0.0150	0.257	0.0127	0.0108	Yarnell	3.150	0.1027	0.232
Clay	0.333	0.0150	0.228	0.0125	0.0108	Yarnell	3.132	0.0992	0.203
Clay	0.333	0.0150	0.168	0.0119	0.0108	Yarnell	2.957	0.0843	0.132
Clay	0.333	0.0150	0.126	0.0130	0.0108	Yarnell	2.353	0.0688	0.072
Clay	0.417	0.0010	0.406	0.0109	0.0101	Yarnell	1.035	0.1172	0.142
Clay	0.417	0.0010	0.402	0.0114	0.0101	Yarnell	1.003	0.1189	0.137
Clay	0.417	0.0010	0.350	0.0119	0.0101	Yarnell	0.999	0.1275	0.123
Clay	0.417	0.0010	0.314	0.0124	0.0101	Yarnell	0.960	0.1264	0.107
Clay	0.417	0.0010	0.273	0.0133	0.0101	Yarnell	0.866	0.1209	0.082
Clay	0.417	0.0010	0.215	0.0142	0.0101	Yarnell	0.746	0.1065	0.053
Clay	0.417	0.0010	0.155	0.0183	0.0101	Yarnell	0.497	0.0847	0.023
Clay	0.417	0.0010	0.116	0.0146	0.0101	Yarnell	0.531	0.0670	0.017
Clay	0.417	0.0020	0.411	0.0113	0.0106	Yarnell	1.386	0.1146	0.191
Clay	0.417	0.0020	0.410	0.0114	0.0106	Yarnell	1.378	0.1152	0.189
Clay	0.417	0.0020	0.348	0.0113	0.0106	Yarnell	1.491	0.1275	0.183
Clay	0.417	0.0020	0.315	0.0111	0.0106	Yarnell	1.515	0.1265	0.169
Clay	0.417	0.0020	0.279	0.0117	0.0106	Yarnell	1.405	0.1220	0.137
Clay	0.417	0.0020	0.212	0.0124	0.0106	Yarnell	1.200	0.1056	0.084
Clay	0.417	0.0020	0.164	0.0138	0.0106	Yarnell	0.961	0.0883	0.048
Clay	0.417	0.0020	0.129	0.0144	0.0106	Yarnell	0.807	0.0732	0.029
Clay	0.417	0.0030	0.399	0.0112	0.0102	Yarnell	1.775	0.1190	0.241
Clay	0.417	0.0030	0.392	0.0114	0.0102	Yarnell	1.765	0.1220	0.237
Clay	0.417	0.0030	0.352	0.0116	0.0102	Yarnell	1.784	0.1274	0.221
Clay	0.417	0.0030	0.321	0.0117	0.0102	Yarnell	1.761	0.1270	0.200
Clay	0.417	0.0030	0.273	0.0121	0.0102	Yarnell	1.645	0.1209	0.157
Clay	0.417	0.0030	0.219	0.0135	0.0102	Yarnell	1.368	0.1077	0.099
Clay	0.417	0.0030	0.165	0.0151	0.0102	Yarnell	1.078	0.0887	0.054
Clay	0.417	0.0030	0.115	0.0179	0.0102	Yarnell	0.751	0.0665	0.023
Clay	0.417	0.0050	0.397	0.0115	0.0104	Yarnell	2.237	0.1205	0.303
Clay	0.417	0.0050	0.377	0.0111	0.0104	Yarnell	2.367	0.1250	0.310
Clay	0.417	0.0050	0.347	0.0110	0.0104	Yarnell	2.421	0.1275	0.296
Clay	0.417	0.0050	0.298	0.0112	0.0104	Yarnell	2.347	0.1247	0.246
Clay	0.417	0.0050	0.254	0.0117	0.0104	Yarnell	2.162	0.1169	0.189
Clay	0.417	0.0050	0.220	0.0121	0.0104	Yarnell	1.973	0.1080	0.145
Clay	0.417	0.0050	0.154	0.0119	0.0104	Yarnell	1.705	0.0842	0.078
Clay	0.417	0.0050	0.118	0.0147	0.0104	Yarnell	1.194	0.0680	0.038
Clay	0.417	0.0100	0.402	0.0122	0.0112	Yarnell	2.945	0.1189	0.401
Clay	0.417	0.0100	0.383	0.0121	0.0112	Yarnell	3.063	0.1240	0.405
Clay	0.417	0.0100	0.326	0.0116	0.0112	Yarnell	3.247	0.1273	0.374
Clay	0.417	0.0150	0.394	0.0111	0.0101	Yarnell	4.030	0.1215	0.543
Clay	0.417	0.0150	0.343	0.0110	0.0101	Yarnell	4.190	0.1276	0.507

Material	Diameter (Φ) [ft]	Slope (ft/ft)	Depth (d) [ft]	n	n_f	Investigator	Velocity (ft/s)	Hydraulic Radius	Discharge (Q) [cfs]
Clay	0.417	0.0150	0.319	0.0110	0.0101	Yarnell	4.203	0.1269	0.474
Clay	0.417	0.0150	0.253	0.0108	0.0101	Yarnell	4.113	0.1167	0.358
Clay	0.417	0.0150	0.209	0.0103	0.0101	Yarnell	3.932	0.1046	0.270
Clay	0.417	0.0150	0.158	0.0101	0.0101	Yarnell	3.516	0.0859	0.167
Clay	0.417	0.0150	0.118	0.0100	0.0101	Yarnell	3.041	0.0680	0.097
Clay	0.500	0.0005	0.402	0.0122	0.0109	Yarnell	0.800	0.1573	0.140
Clay	0.500	0.0005	0.300	0.0158	0.0109	Yarnell	0.572	0.1412	0.072
Clay	0.500	0.0005	0.223	0.0175	0.0109	Yarnell	0.457	0.1170	0.040
Clay	0.500	0.0005	0.188	0.0225	0.0109	Yarnell	0.325	0.1031	0.023
Clay	0.500	0.0010	0.396	0.0150	0.0118	Yarnell	0.912	0.1569	0.158
Clay	0.500	0.0010	0.304	0.0132	0.0118	Yarnell	0.976	0.1422	0.126
Clay	0.500	0.0010	0.211	0.0136	0.0118	Yarnell	0.823	0.1163	0.071
Clay	0.500	0.0010	0.171	0.0161	0.0118	Yarnell	0.613	0.0958	0.037
Clay	0.500	0.0020	0.498	0.0108	0.0097	Yarnell	1.710	0.1465	0.356
Clay	0.500	0.0020	0.409	0.0130	0.0097	Yarnell	1.500	0.1576	0.268
Clay	0.500	0.0020	0.277	0.0112	0.0097	Yarnell	1.569	0.1350	0.180
Clay	0.500	0.0020	0.219	0.0120	0.0097	Yarnell	1.310	0.1144	0.109
Clay	0.500	0.0020	0.157	0.0129	0.0097	Yarnell	1.036	0.0893	0.056
Clay	0.500	0.0030	0.414	0.0119	0.0100	Yarnell	2.003	0.1577	0.362
Clay	0.500	0.0030	0.302	0.0129	0.0100	Yarnell	1.719	0.1417	0.219
Clay	0.500	0.0030	0.222	0.0122	0.0100	Yarnell	1.601	0.1167	0.138
Clay	0.500	0.0030	0.167	0.0145	0.0100	Yarnell	1.165	0.0939	0.069
Clay	0.500	0.0050	0.498	0.0110	0.0098	Yarnell	2.695	0.1465	0.554
Clay	0.500	0.0050	0.378	0.0113	0.0098	Yarnell	2.692	0.1552	0.444
Clay	0.500	0.0050	0.276	0.0114	0.0098	Yarnell	2.425	0.1347	0.277
Clay	0.500	0.0050	0.213	0.0133	0.0098	Yarnell	1.850	0.1133	0.151
Clay	0.500	0.0050	0.152	0.0161	0.0098	Yarnell	1.287	0.0870	0.066
Clay	0.500	0.0075	0.473	0.0110	0.0096	Yarnell	3.368	0.1534	0.680
Clay	0.500	0.0075	0.385	0.0117	0.0096	Yarnell	3.206	0.1560	0.539
Clay	0.500	0.0075	0.258	0.0125	0.0096	Yarnell	2.641	0.1292	0.277
Clay	0.500	0.0075	0.199	0.0129	0.0096	Yarnell	2.268	0.1077	0.169
Clay	0.500	0.0075	0.147	0.0126	0.0096	Yarnell	1.967	0.0846	0.097
Clay	0.667	0.0005	0.663	0.0124	0.0114	Yarnell	0.893	0.1911	0.326
Clay	0.667	0.0005	0.515	0.0136	0.0114	Yarnell	0.885	0.2067	0.254
Clay	0.667	0.0005	0.342	0.0138	0.0114	Yarnell	0.745	0.1711	0.137
Clay	0.667	0.0005	0.259	0.0137	0.0114	Yarnell	0.658	0.1406	0.084
Clay	0.667	0.0005	0.166	0.0134	0.0114	Yarnell	0.527	0.0978	0.036
Clay	0.667	0.0010	0.656	0.0126	0.0113	Yarnell	1.259	0.1944	0.457
Clay	0.667	0.0010	0.656	0.0123	0.0113	Yarnell	1.286	0.1944	0.467
Clay	0.667	0.0010	0.509	0.0128	0.0113	Yarnell	1.274	0.2001	0.374
Clay	0.667	0.0010	0.348	0.0134	0.0113	Yarnell	1.095	0.1730	0.206
Clay	0.667	0.0010	0.271	0.0128	0.0113	Yarnell	1.017	0.1456	0.138
Clay	0.667	0.0010	0.192	0.0128	0.0113	Yarnell	0.851	0.1106	0.072
Clay	0.667	0.0020	0.661	0.0120	0.0110	Yarnell	1.844	0.1924	0.672
Clay	0.667	0.0020	0.509	0.0131	0.0110	Yarnell	1.778	0.2061	0.522
Clay	0.667	0.0020	0.358	0.0145	0.0110	Yarnell	1.439	0.1760	0.281
Clay	0.667	0.0020	0.267	0.0158	0.0110	Yarnell	1.159	0.1439	0.154
Clay	0.667	0.0020	0.165	0.0179	0.0110	Yarnell	0.790	0.0973	0.054
Clay	0.667	0.0030	0.663	0.0126	0.0113	Yarnell	2.157	0.1915	0.787
Clay	0.667	0.0030	0.510	0.0131	0.0113	Yarnell	2.172	0.2062	0.639
Clay	0.667	0.0030	0.364	0.0151	0.0113	Yarnell	1.705	0.1778	0.339
Clay	0.667	0.0030	0.280	0.0158	0.0113	Yarnell	1.449	0.1490	0.205

Material	Diameter (Φ) [ft]	Slope (ft/ft)	Depth (d) [ft]	n	n_f	Investigator	Velocity (ft/s)	Hydraulic Radius	Discharge (Q) [cfs]
Clay	0.667	0.0030	0.196	0.0180	0.0113	Yarnell	1.057	0.1126	0.092
Clay	0.667	0.0075	0.662	0.0122	0.0111	Yarnell	3.522	0.1919	1.284
Clay	0.667	0.0075	0.642	0.0121	0.0111	Yarnell	3.623	0.1989	1.300
Clay	0.667	0.0075	0.503	0.0137	0.0111	Yarnell	3.270	0.2055	0.948
Clay	0.667	0.0075	0.356	0.0140	0.0111	Yarnell	2.889	0.1754	0.559
Clay	0.667	0.0075	0.270	0.0142	0.0111	Yarnell	2.513	0.1451	0.339
Clay	0.667	0.0075	0.180	0.0150	0.0111	Yarnell	1.915	0.1048	0.148
Clay	0.667	0.0100	0.661	0.0123	0.0111	Yarnell	4.021	0.1924	1.465
Clay	0.667	0.0100	0.657	0.0125	0.0111	Yarnell	3.982	0.1940	1.448
Clay	0.667	0.0100	0.473	0.0120	0.0111	Yarnell	4.267	0.2021	1.158
Clay	0.667	0.0100	0.325	0.0129	0.0111	Yarnell	3.471	0.1654	0.598
Clay	0.667	0.0100	0.250	0.0128	0.0111	Yarnell	3.089	0.1369	0.376
Clay	0.667	0.0100	0.173	0.0130	0.0111	Yarnell	2.483	0.1013	0.181
Clay	0.667	0.0125	0.490	0.0121	0.0114	Yarnell	4.778	0.2040	1.348
Clay	0.667	0.0125	0.346	0.0128	0.0114	Yarnell	4.031	0.1723	0.753
Clay	0.667	0.0125	0.260	0.0131	0.0114	Yarnell	3.453	0.1410	0.443
Clay	0.667	0.0125	0.173	0.0126	0.0114	Yarnell	2.869	0.1013	0.210
Clay	0.833	0.0005	0.821	0.0106	0.0100	Yarnell	1.168	0.2275	0.639
Clay	0.833	0.0005	0.812	0.0117	0.0100	Yarnell	1.079	0.2324	0.587
Clay	0.833	0.0005	0.783	0.0120	0.0100	Yarnell	1.080	0.2429	0.577
Clay	0.833	0.0005	0.749	0.0122	0.0100	Yarnell	1.088	0.2497	0.564
Clay	0.833	0.0005	0.697	0.0117	0.0100	Yarnell	1.141	0.2541	0.558
Clay	0.833	0.0005	0.666	0.0114	0.0100	Yarnell	1.174	0.2542	0.550
Clay	0.833	0.0005	0.626	0.0109	0.0100	Yarnell	1.217	0.2521	0.537
Clay	0.833	0.0005	0.567	0.0104	0.0100	Yarnell	1.259	0.2451	0.498
Clay	0.833	0.0005	0.546	0.0106	0.0100	Yarnell	1.214	0.2413	0.461
Clay	0.833	0.0005	0.473	0.0100	0.0100	Yarnell	1.239	0.2250	0.397
Clay	0.833	0.0005	0.421	0.0106	0.0100	Yarnell	1.111	0.2099	0.308
Clay	0.833	0.0005	0.310	0.0094	0.0100	Yarnell	1.079	0.1692	0.200
Clay	0.833	0.0005	0.214	0.0092	0.0100	Yarnell	0.906	0.1251	0.101
Clay	0.833	0.0010	0.782	0.0110	0.0100	Yarnell	1.661	0.2431	0.887
Clay	0.833	0.0010	0.723	0.0108	0.0100	Yarnell	1.752	0.2526	0.884
Clay	0.833	0.0010	0.681	0.0104	0.0100	Yarnell	1.822	0.2544	0.872
Clay	0.833	0.0010	0.625	0.0103	0.0100	Yarnell	1.817	0.2520	0.800
Clay	0.833	0.0010	0.572	0.0104	0.0100	Yarnell	1.780	0.2459	0.712
Clay	0.833	0.0010	0.542	0.0102	0.0100	Yarnell	1.792	0.2406	0.675
Clay	0.833	0.0010	0.466	0.0101	0.0100	Yarnell	1.710	0.2231	0.538
Clay	0.833	0.0010	0.425	0.0099	0.0100	Yarnell	1.686	0.2112	0.473
Clay	0.833	0.0010	0.313	0.0097	0.0100	Yarnell	1.486	0.1704	0.279
Clay	0.833	0.0010	0.205	0.0097	0.0100	Yarnell	1.188	0.1206	0.124
Clay	0.833	0.0020	0.823	0.0107	0.0101	Yarnell	2.318	0.2260	1.268
Clay	0.833	0.0020	0.797	0.0109	0.0101	Yarnell	2.350	0.2385	1.268
Clay	0.833	0.0020	0.778	0.0111	0.0101	Yarnell	2.353	0.2441	1.252
Clay	0.833	0.0020	0.694	0.0106	0.0101	Yarnell	2.525	0.2542	1.230
Clay	0.833	0.0020	0.667	0.0106	0.0101	Yarnell	2.521	0.2543	1.184
Clay	0.833	0.0020	0.623	0.0102	0.0101	Yarnell	2.595	0.2518	1.138
Clay	0.833	0.0020	0.563	0.0101	0.0101	Yarnell	2.566	0.2444	1.009
Clay	0.833	0.0020	0.525	0.0099	0.0101	Yarnell	2.585	0.2370	0.938
Clay	0.833	0.0020	0.472	0.0099	0.0101	Yarnell	2.493	0.2248	0.796
Clay	0.833	0.0020	0.428	0.0098	0.0101	Yarnell	2.416	0.2121	0.683
Clay	0.833	0.0020	0.318	0.0103	0.0101	Yarnell	2.004	0.1724	0.384
Clay	0.833	0.0020	0.203	0.0103	0.0101	Yarnell	1.567	0.1196	0.161

Material	Diameter (Φ) [ft]	Slope (ft/ft)	Depth (d) [ft]	n	n_f	Investigator	Velocity (ft/s)	Hydraulic Radius	Discharge (Q) [cfs]
Clay	0.833	0.0030	0.827	0.0108	0.0103	Yarnell	2.793	0.2232	1.530
Clay	0.833	0.0030	0.814	0.0109	0.0103	Yarnell	2.817	0.2314	1.535
Clay	0.833	0.0030	0.810	0.0110	0.0103	Yarnell	2.823	0.2334	1.535
Clay	0.833	0.0030	0.804	0.0111	0.0103	Yarnell	2.813	0.2360	1.525
Clay	0.833	0.0030	0.777	0.0115	0.0103	Yarnell	2.847	0.2444	1.514
Clay	0.833	0.0030	0.756	0.0112	0.0103	Yarnell	2.877	0.2485	1.502
Clay	0.833	0.0030	0.689	0.0106	0.0103	Yarnell	3.091	0.2543	1.496
Clay	0.833	0.0030	0.684	0.0106	0.0103	Yarnell	3.078	0.2544	1.480
Clay	0.833	0.0030	0.631	0.0104	0.0103	Yarnell	3.141	0.2525	1.396
Clay	0.833	0.0030	0.563	0.0104	0.0103	Yarnell	3.077	0.2444	1.210
Clay	0.833	0.0030	0.542	0.0106	0.0103	Yarnell	2.985	0.2406	1.124
Clay	0.833	0.0030	0.484	0.0109	0.0103	Yarnell	2.801	0.2278	0.923
Clay	0.833	0.0030	0.431	0.0112	0.0103	Yarnell	2.611	0.2130	0.745
Clay	0.833	0.0030	0.328	0.0113	0.0103	Yarnell	2.274	0.1765	0.454
Clay	0.833	0.0030	0.224	0.0114	0.0103	Yarnell	1.836	0.1301	0.217
Clay	0.833	0.0050	0.801	0.0110	0.0101	Yarnell	3.678	0.2371	1.990
Clay	0.833	0.0050	0.801	0.0111	0.0101	Yarnell	3.641	0.2371	1.970
Clay	0.833	0.0050	0.751	0.0111	0.0101	Yarnell	3.767	0.2494	1.958
Clay	0.833	0.0050	0.701	0.0108	0.0101	Yarnell	3.927	0.2540	1.930
Clay	0.833	0.0050	0.655	0.0108	0.0101	Yarnell	3.930	0.2542	1.840
Clay	0.833	0.0050	0.647	0.0107	0.0101	Yarnell	3.944	0.2536	1.798
Clay	0.833	0.0050	0.618	0.0110	0.0101	Yarnell	3.811	0.2512	1.658
Clay	0.833	0.0050	0.565	0.0111	0.0101	Yarnell	3.724	0.2448	1.470
Clay	0.833	0.0050	0.534	0.0110	0.0101	Yarnell	3.681	0.2389	1.363
Clay	0.833	0.0050	0.470	0.0113	0.0101	Yarnell	3.455	0.2242	1.098
Clay	0.833	0.0050	0.426	0.0114	0.0101	Yarnell	3.294	0.2115	0.926
Clay	0.833	0.0050	0.307	0.0102	0.0101	Yarnell	2.903	0.1679	0.531
Clay	0.833	0.0050	0.213	0.0113	0.0101	Yarnell	2.330	0.1246	0.257
Clay	0.833	0.0075	0.801	0.0112	0.0103	Yarnell	4.409	0.2371	2.385
Clay	0.833	0.0075	0.796	0.0111	0.0103	Yarnell	4.473	0.2388	2.412
Clay	0.833	0.0075	0.782	0.0113	0.0103	Yarnell	4.450	0.2431	2.376
Clay	0.833	0.0075	0.748	0.0112	0.0103	Yarnell	4.586	0.2498	2.376
Clay	0.833	0.0075	0.726	0.0111	0.0103	Yarnell	4.623	0.2524	2.340
Clay	0.833	0.0075	0.684	0.0110	0.0103	Yarnell	4.699	0.2544	2.259
Clay	0.833	0.0075	0.646	0.0110	0.0103	Yarnell	4.687	0.2536	2.133
Clay	0.833	0.0075	0.564	0.0110	0.0103	Yarnell	4.608	0.2446	1.815
Clay	0.833	0.0075	0.540	0.0110	0.0103	Yarnell	4.515	0.2401	1.693
Clay	0.833	0.0075	0.487	0.0111	0.0103	Yarnell	4.325	0.2286	1.435
Clay	0.833	0.0075	0.409	0.0111	0.0103	Yarnell	4.054	0.2060	1.082
Clay	0.833	0.0075	0.311	0.0113	0.0103	Yarnell	3.462	0.1696	0.644
Clay	0.833	0.0075	0.226	0.0117	0.0103	Yarnell	2.879	0.1311	0.345
Clay	0.833	0.0100	0.809	0.0111	0.0103	Yarnell	5.099	0.2338	2.772
Clay	0.833	0.0100	0.795	0.0112	0.0089	Yarnell	5.130	0.2391	2.765
Clay	0.833	0.0100	0.744	0.0113	0.0103	Yarnell	5.245	0.2505	2.707
Clay	0.833	0.0100	0.741	0.0111	0.0103	Yarnell	5.347	0.2508	2.751
Clay	0.833	0.0100	0.708	0.0111	0.0103	Yarnell	5.385	0.2537	2.670
Clay	0.833	0.0100	0.705	0.0111	0.0103	Yarnell	5.363	0.2538	2.649
Clay	0.833	0.0100	0.676	0.0110	0.0103	Yarnell	5.464	0.2545	2.598
Clay	0.833	0.0100	0.642	0.0108	0.0103	Yarnell	5.538	0.2534	2.505
Clay	0.833	0.0100	0.577	0.0108	0.0103	Yarnell	5.345	0.2466	2.196
Clay	0.833	0.0100	0.545	0.0109	0.0103	Yarnell	5.297	0.2411	2.008
Clay	0.833	0.0100	0.480	0.0107	0.0103	Yarnell	5.196	0.2291	1.733

Material	Diameter (φ) [ft]	Slope (ft/ft)	Depth (d) [ft]	n	n_f	Investigator	Velocity (ft/s)	Hydraulic Radius	Discharge (Q) [cfs]
Clay	0.833	0.0100	0.414	0.0110	0.0103	Yarnell	4.766	0.2077	1.292
Clay	0.833	0.0100	0.299	0.0109	0.0103	Yarnell	4.122	0.1645	0.727
Clay	0.833	0.0100	0.212	0.0106	0.0103	Yarnell	3.498	0.1241	0.383
Clay	0.833	0.0125	0.819	0.0109	0.0102	Yarnell	5.717	0.2288	3.122
Clay	0.833	0.0125	0.752	0.0113	0.0102	Yarnell	5.841	0.2492	3.038
Clay	0.833	0.0125	0.697	0.0110	0.0102	Yarnell	6.085	0.2541	2.975
Clay	0.833	0.0125	0.657	0.0109	0.0102	Yarnell	6.144	0.2541	2.843
Clay	0.833	0.0125	0.636	0.0108	0.0102	Yarnell	6.187	0.2529	2.772
Clay	0.833	0.0125	0.563	0.0107	0.0102	Yarnell	6.112	0.2444	2.403
Clay	0.833	0.0125	0.528	0.0106	0.0102	Yarnell	6.045	0.2376	2.208
Clay	0.833	0.0125	0.461	0.0106	0.0102	Yarnell	5.784	0.2218	1.795
Clay	0.833	0.0125	0.418	0.0106	0.0102	Yarnell	5.509	0.2090	1.512
Clay	0.833	0.0125	0.308	0.0106	0.0102	Yarnell	4.796	0.1683	0.880
Clay	0.833	0.0125	0.208	0.0101	0.0102	Yarnell	4.038	0.1221	0.430
Clay	0.833	0.0150	0.618	0.0111	0.0112	Yarnell	6.569	0.2512	2.858
Clay	0.833	0.0150	0.557	0.0109	0.0112	Yarnell	6.533	0.2433	2.538
Clay	0.833	0.0150	0.526	0.0107	0.0112	Yarnell	6.509	0.2372	2.367
Clay	0.833	0.0150	0.457	0.0111	0.0112	Yarnell	6.018	0.2206	1.848
Clay	0.833	0.0150	0.392	0.0112	0.0112	Yarnell	5.587	0.2003	1.412
Clay	0.833	0.0150	0.300	0.0110	0.0112	Yarnell	4.997	0.1650	0.885
Clay	0.833	0.0150	0.215	0.0115	0.0112	Yarnell	3.995	0.1256	0.446
Clay	1.000	0.0005	0.986	0.0111	0.0112	Yarnell	1.176	0.2464	0.897
Clay	1.000	0.0005	0.896	0.0119	0.0112	Yarnell	1.236	0.2922	0.901
Clay	1.000	0.0005	0.856	0.0122	0.0112	Yarnell	1.214	0.2975	0.854
Clay	1.000	0.0005	0.803	0.0119	0.0112	Yarnell	1.259	0.3000	0.838
Clay	1.000	0.0005	0.754	0.0127	0.0112	Yarnell	1.175	0.2985	0.736
Clay	1.000	0.0005	0.694	0.0125	0.0112	Yarnell	1.178	0.2924	0.676
Clay	1.000	0.0005	0.650	0.0119	0.0112	Yarnell	1.217	0.2857	0.650
Clay	1.000	0.0005	0.592	0.0125	0.0112	Yarnell	1.126	0.2738	0.539
Clay	1.000	0.0005	0.558	0.0122	0.0112	Yarnell	1.124	0.2654	0.501
Clay	1.000	0.0005	0.502	0.0121	0.0112	Yarnell	1.091	0.2493	0.426
Clay	1.000	0.0005	0.412	0.0132	0.0112	Yarnell	0.911	0.2181	0.275
CMP	2.000	0.0020	1.200	0.0240	0.0241	StraubMorris	1.879	0.5590	3.740
CMP	2.000	0.0020	1.600	0.0243	0.0241	StraubMorris	1.982	0.6180	5.430
CMP	2.000	0.0020	1.800	0.0242	0.0241	StraubMorris	1.970	0.6090	5.990
CMP	3.000	0.0018	0.900	0.0230	0.0235	StraubMorris	1.723	0.5100	3.050
CMP	3.000	0.0020	1.190	0.0238	0.0235	StraubMorris	2.034	0.6390	5.310
CMP	3.000	0.0020	1.520	0.0234	0.0235	StraubMorris	2.354	0.7540	8.450
CMP	3.000	0.0019	1.800	0.0236	0.0235	StraubMorris	2.430	0.8320	10.740
CMP	3.000	0.0022	2.110	0.0238	0.0235	StraubMorris	2.712	0.8900	14.430
CMP	3.000	0.0019	2.400	0.0238	0.0235	StraubMorris	2.555	0.9130	15.510
CMP	3.000	0.0020	2.620	0.0234	0.0235	StraubMorris	2.616	0.9060	17.110
PVC	0.667	0.0030	0.221	0.0092	0.0092	NealePrice	2.188	0.123	0.222
PVC	0.667	0.0030	0.329	0.0095	0.0092	NealePrice	2.593	0.167	0.449
PVC	0.667	0.0030	0.397	0.0093	0.0092	NealePrice	2.851	0.186	0.621
PVC	0.667	0.0030	0.398	0.0093	0.0092	NealePrice	2.848	0.186	0.624
PVC	0.667	0.0030	0.538	0.0091	0.0092	NealePrice	3.100	0.204	0.947
PVC	0.667	0.0030	0.551	0.0094	0.0092	NealePrice	3.012	0.205	0.941
PVC	0.667	0.0030	0.559	0.0095	0.0092	NealePrice	2.974	0.205	0.941
PVC	0.667	0.0063	0.272	0.0087	0.0088	NealePrice	3.744	0.145	0.505
PVC	0.667	0.0063	0.169	0.0089	0.0088	NealePrice	2.837	0.099	0.199
PVC	0.667	0.0063	0.251	0.0090	0.0088	NealePrice	3.460	0.136	0.421

Material	Diameter (φ) [ft]	Slope (ft/ft)	Depth (d) [ft]	n	n_f	Investigator	Velocity (ft/s)	Hydraulic Radius	Discharge (Q) [cfs]
PVC	0.667	0.0063	0.334	0.0090	0.0088	NealePrice	3.962	0.166	0.699
PVC	0.667	0.0063	0.417	0.0090	0.0088	NealePrice	4.309	0.189	0.999
PVC	0.667	0.0063	0.518	0.0090	0.0088	NealePrice	4.533	0.203	1.334
PVC	0.667	0.0063	0.502	0.0090	0.0088	NealePrice	4.502	0.201	1.283
PVC	0.667	0.0105	0.466	0.0093	0.0083	NealePrice	5.596	0.200	1.475
PVC	0.667	0.0105	0.172	0.0091	0.0083	NealePrice	3.616	0.100	0.260
PVC	0.667	0.0105	0.231	0.0090	0.0083	NealePrice	4.299	0.128	0.465
PVC	0.667	0.0105	0.394	0.0092	0.0083	NealePrice	5.353	0.184	1.160
PVC	0.667	0.0105	0.212	0.0090	0.0083	NealePrice	4.106	0.120	0.395
PVC	1.000	0.0030	0.285	0.0090	0.0092	NealePrice	2.728	0.166	0.512
PVC	1.000	0.0030	0.362	0.0088	0.0092	NealePrice	3.150	0.199	0.818
PVC	1.000	0.0030	0.439	0.0088	0.0092	NealePrice	3.476	0.230	1.176
PVC	1.000	0.0030	0.521	0.0087	0.0092	NealePrice	3.786	0.257	1.609
PVC	1.000	0.0030	0.581	0.0087	0.0092	NealePrice	3.971	0.277	1.915
PVC	1.000	0.0030	0.777	0.0086	0.0092	NealePrice	4.332	0.310	2.915
PVC	1.000	0.0060	0.212	0.0089	0.0088	NealePrice	3.199	0.123	0.398
PVC	1.000	0.0060	0.252	0.0092	0.0088	NealePrice	3.503	0.148	0.551
PVC	1.000	0.0060	0.336	0.0091	0.0088	NealePrice	4.177	0.190	0.980
PVC	1.000	0.0060	0.448	0.0094	0.0088	NealePrice	4.636	0.233	1.607
PVC	1.000	0.0060	0.504	0.0093	0.0088	NealePrice	4.979	0.255	2.012
PVC	1.000	0.0060	0.544	0.0094	0.0088	NealePrice	5.065	0.266	2.248
PVC	1.000	0.0060	0.553	0.0095	0.0088	NealePrice	5.045	0.269	2.286
PVC	1.000	0.0100	0.283	0.0089	0.0087	NealePrice	4.968	0.162	0.924
PVC	1.000	0.0100	0.338	0.0092	0.0087	NealePrice	5.315	0.189	1.254
PVC	1.000	0.0100	0.354	0.0085	0.0087	NealePrice	5.920	0.197	1.494
PVC	1.000	0.0100	0.365	0.0088	0.0087	NealePrice	5.763	0.199	1.515
PVC	1.000	0.0100	0.393	0.0085	0.0087	NealePrice	6.223	0.212	1.809
PVC	1.000	0.0100	0.521	0.0093	0.0087	NealePrice	6.491	0.259	2.747
PVC	1.000	0.0100	0.588	0.0093	0.0087	NealePrice	6.824	0.279	3.336
PVC	1.000	0.0100	0.656	0.0085	0.0087	NealePrice	7.760	0.296	4.321
HDPE	3.000	0.0071	0.320	0.0086	0.0120	CTB	5.000	0.201	2.000
HDPE	3.000	0.0071	0.085	0.0127	0.0120	CTB	6.130	0.490	10.010
HDPE	3.000	0.0071	1.103	0.0117	0.0120	CTB	7.660	0.606	18.030
HDPE	3.000	0.0071	1.373	0.0120	0.0120	CTB	8.290	0.708	26.060
HDPE	3.000	0.0071	1.591	0.0118	0.0120	CTB	8.990	0.780	34.130
HDPE	3.000	0.0071	1.706	0.0115	0.0120	CTB	9.480	0.812	39.260
HDPE	3.000	0.0135	0.293	0.0098	0.0120	CTB	5.730	0.185	2.030
HDPE	3.000	0.0135	0.709	0.0122	0.0120	CTB	7.920	0.419	10.050
HDPE	3.000	0.0135	0.975	0.0127	0.0120	CTB	9.090	0.547	18.030
HDPE	3.000	0.0135	1.197	0.0129	0.0120	CTB	9.960	0.642	26.030
HDPE	3.000	0.0135	1.338	0.0128	0.0120	CTB	10.560	0.693	32.070
HDPE	3.000	0.0135	1.497	0.0122	0.0120	CTB	11.710	0.753	40.020
HDPE	3.000	0.0197	0.259	0.0093	0.0120	CTB	6.780	0.166	2.000
HDPE	3.000	0.0197	0.670	0.0132	0.0120	CTB	8.540	0.397	10.010
HDPE	3.000	0.0197	0.905	0.0132	0.0120	CTB	10.170	0.516	18.100
HDPE	3.000	0.0197	1.045	0.0118	0.0120	CTB	12.260	0.578	26.740
HDPE	3.000	0.0197	1.256	0.0143	0.0120	CTB	11.100	0.664	31.090
HDPE	3.000	0.0197	1.422	0.0137	0.0120	CTB	12.260	0.723	40.070

Appendix C: Predicted Depth by Manning's (Manufacturer Suggested *n* Value)

Diameter (ft)	<i>n</i>	Slope (ft/ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.667	0.0110	0.0050	0.1401	0.1400	0.190	0.168	0.285	0.2515	Concrete	0.1963	3.31
0.667	0.0110	0.0050	0.2550	0.2550	0.250	0.228	0.375	0.3424	Concrete	0.2532	1.29
0.667	0.0110	0.0050	0.4503	0.4500	0.330	0.312	0.495	0.4675	Concrete	0.3316	0.48
0.667	0.0110	0.0050	0.6099	0.6100	0.396	0.374	0.594	0.5602	Concrete	0.3896	1.62
0.667	0.0110	0.0050	0.8800	0.8800	0.500	0.481	0.750	0.7216	Concrete	0.4907	1.86
0.667	0.0110	0.0050	1.0207	1.0200	0.580	0.553	0.870	0.8286	Concrete	0.5577	3.85
0.667	0.0110	0.0100	0.1934	0.1930	0.175	0.166	0.262	0.2484	Concrete	0.1944	11.08
0.667	0.0110	0.0100	0.4595	0.4600	0.260	0.260	0.390	0.3898	Concrete	0.2829	8.81
0.667	0.0110	0.0100	0.7603	0.7600	0.330	0.346	0.495	0.5186	Concrete	0.3636	10.17
0.667	0.0110	0.0100	1.0400	1.0400	0.420	0.422	0.630	0.6327	Concrete	0.4350	3.57
0.667	0.0110	0.0100	1.3599	1.3600	0.500	0.520	0.750	0.7790	Concrete	0.5266	5.32
0.667	0.0110	0.0100	1.5292	1.5300	0.600	0.606	0.900	0.9085	Concrete	0.6077	1.29
0.667	0.0110	0.0150	0.2001	0.2000	0.170	0.152	0.255	0.2283	Concrete	0.1817	6.91
0.667	0.0110	0.0150	0.4500	0.4500	0.250	0.231	0.375	0.3458	Concrete	0.2553	2.14
0.667	0.0110	0.0150	0.7708	0.7700	0.330	0.310	0.495	0.4644	Concrete	0.3296	0.12
0.667	0.0110	0.0150	1.1200	1.1200	0.420	0.388	0.630	0.5813	Concrete	0.4028	4.10
0.667	0.0110	0.0150	1.5001	1.5000	0.500	0.475	0.750	0.7126	Concrete	0.4850	3.00
0.667	0.0110	0.0150	1.7300	1.7300	0.570	0.540	0.855	0.8089	Concrete	0.5454	4.32
0.667	0.0110	0.0200	0.2301	0.2300	0.170	0.152	0.255	0.2278	Concrete	0.1815	6.74
0.667	0.0110	0.0200	0.5604	0.5600	0.250	0.240	0.375	0.3600	Concrete	0.2642	5.69
0.667	0.0110	0.0200	0.8400	0.8400	0.320	0.300	0.480	0.4493	Concrete	0.3202	0.06
0.667	0.0110	0.0200	1.2900	1.2900	0.420	0.387	0.630	0.5803	Concrete	0.4022	4.24
0.667	0.0110	0.0200	1.6704	1.6700	0.500	0.462	0.750	0.6929	Concrete	0.4727	5.46
0.667	0.0110	0.0200	2.0001	2.0000	0.580	0.540	0.870	0.8100	Concrete	0.5460	5.86
0.667	0.0110	0.0300	0.2357	0.2350	0.160	0.139	0.240	0.2084	Concrete	0.1693	5.83
0.667	0.0110	0.0300	0.5200	0.5200	0.240	0.207	0.360	0.3110	Concrete	0.2336	2.67
0.667	0.0110	0.0300	1.0000	1.0000	0.340	0.295	0.510	0.4422	Concrete	0.3157	7.14
0.667	0.0110	0.0300	1.3895	1.3900	0.420	0.357	0.630	0.5357	Concrete	0.3743	10.89
0.667	0.0110	0.0300	1.4005	1.4000	0.500	0.359	0.750	0.5383	Concrete	0.3759	24.82
0.667	0.0110	0.0300	2.4801	2.4800	0.610	0.548	0.915	0.8210	Concrete	0.5529	9.36
0.667	0.0110	0.0400	0.2551	0.2550	0.160	0.135	0.240	0.2018	Concrete	0.1652	3.25
0.667	0.0110	0.0400	0.6201	0.6200	0.250	0.211	0.375	0.3163	Concrete	0.2369	5.25
0.667	0.0110	0.0400	1.0500	1.0500	0.330	0.280	0.495	0.4194	Concrete	0.3014	8.66
0.667	0.0110	0.0400	1.5693	1.5700	0.420	0.353	0.630	0.5286	Concrete	0.3698	11.95
0.667	0.0110	0.0400	2.1401	2.1400	0.500	0.430	0.750	0.6452	Concrete	0.4428	11.43
0.667	0.0110	0.0400	2.7603	2.7600	0.600	0.527	0.900	0.7901	Concrete	0.5335	11.08
0.333	0.0110	0.0005	0.0387	0.0386	0.282	0.219	0.846	0.6585	Concrete	0.2255	20.05

Diameter (ft)	<i>n</i>	Slope (ft/ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.333	0.0110	0.0005	0.0331	0.0335	0.247	0.197	0.741	0.5919	Concrete	0.2046	17.15
0.333	0.0110	0.0005	0.0198	0.0196	0.206	0.145	0.618	0.4361	Concrete	0.1559	24.33
0.333	0.0110	0.0005	0.0129	0.0120	0.167	0.115	0.501	0.3457	Concrete	0.1276	23.61
0.333	0.0110	0.0010	0.0657	0.0650	0.311	0.253	0.933	0.7588	Concrete	0.2569	17.41
0.333	0.0110	0.0010	0.0551	0.0550	0.274	0.220	0.822	0.6609	Concrete	0.2262	17.43
0.333	0.0110	0.0010	0.0446	0.0450	0.239	0.191	0.717	0.5739	Concrete	0.1990	16.73
0.333	0.0110	0.0010	0.0375	0.0375	0.210	0.172	0.630	0.5159	Concrete	0.1808	13.88
0.333	0.0110	0.0010	0.0221	0.0218	0.163	0.128	0.489	0.3831	Concrete	0.1393	14.55
0.333	0.0110	0.0010	0.0084	0.0083	0.118	0.077	0.354	0.2324	Concrete	0.0921	21.92
0.333	0.0110	0.0020	0.0800	0.0800	0.271	0.225	0.813	0.6741	Concrete	0.2303	15.00
0.333	0.0110	0.0020	0.0643	0.0650	0.243	0.194	0.729	0.5810	Concrete	0.2012	17.20
0.333	0.0110	0.0020	0.0543	0.0544	0.215	0.175	0.645	0.5235	Concrete	0.1832	14.78
0.333	0.0110	0.0020	0.0287	0.0280	0.162	0.122	0.486	0.3658	Concrete	0.1339	17.37
0.333	0.0110	0.0020	0.0129	0.0127	0.124	0.081	0.372	0.2421	Concrete	0.0952	23.25
0.333	0.0110	0.0030	0.1046	0.1041	0.295	0.236	0.885	0.7079	Concrete	0.2409	18.33
0.333	0.0110	0.0030	0.0970	0.0969	0.271	0.223	0.813	0.6688	Concrete	0.2287	15.62
0.333	0.0110	0.0030	0.0843	0.0848	0.243	0.202	0.729	0.6074	Concrete	0.2095	13.79
0.333	0.0110	0.0030	0.0591	0.0591	0.211	0.163	0.633	0.4881	Concrete	0.1722	18.41
0.333	0.0110	0.0030	0.0299	0.0298	0.160	0.112	0.480	0.3356	Concrete	0.1244	22.24
0.333	0.0110	0.0050	0.1237	0.1235	0.276	0.221	0.828	0.6631	Concrete	0.2269	17.79
0.333	0.0110	0.0050	0.0996	0.0996	0.243	0.191	0.729	0.5736	Concrete	0.1989	18.14
0.333	0.0110	0.0050	0.0788	0.0788	0.212	0.166	0.636	0.4972	Concrete	0.1750	17.45
0.333	0.0110	0.0050	0.0479	0.0478	0.170	0.125	0.510	0.3762	Concrete	0.1371	19.33
0.333	0.0110	0.0050	0.0202	0.0200	0.121	0.080	0.363	0.2409	Concrete	0.0948	21.66
0.333	0.0110	0.0125	0.2260	0.2250	0.301	0.247	0.903	0.7409	Concrete	0.2512	16.53
0.333	0.0110	0.0125	0.2128	0.2124	0.287	0.235	0.861	0.7059	Concrete	0.2403	16.27
0.333	0.0110	0.0125	0.1656	0.1656	0.242	0.197	0.726	0.5924	Concrete	0.2048	15.38
0.333	0.0110	0.0125	0.1377	0.1377	0.204	0.176	0.612	0.5279	Concrete	0.1846	9.51
0.333	0.0110	0.0125	0.0768	0.0760	0.196	0.126	0.588	0.3793	Concrete	0.1381	29.54
0.333	0.0110	0.0125	0.0419	0.0416	0.133	0.092	0.399	0.2761	Concrete	0.1058	20.46
0.333	0.0110	0.0150	0.2456	0.2456	0.302	0.245	0.906	0.7361	Concrete	0.2498	17.30
0.333	0.0110	0.0150	0.2237	0.2236	0.274	0.228	0.822	0.6843	Concrete	0.2335	14.77
0.333	0.0110	0.0150	0.1893	0.1892	0.255	0.203	0.765	0.6090	Concrete	0.2100	17.65
0.333	0.0110	0.0150	0.1498	0.1506	0.224	0.175	0.672	0.5257	Concrete	0.1839	17.89
0.333	0.0110	0.0150	0.0857	0.0848	0.159	0.128	0.477	0.3832	Concrete	0.1393	12.39
0.333	0.0110	0.0150	0.0440	0.0438	0.123	0.090	0.369	0.2701	Concrete	0.1039	15.50
0.417	0.0110	0.0005	0.0669	0.0671	0.308	0.265	0.739	0.6366	Concrete	0.2733	11.28
0.417	0.0110	0.0005	0.0348	0.0346	0.221	0.179	0.530	0.4287	Concrete	0.1920	13.14
0.417	0.0110	0.0010	0.1296	0.1305	0.405	0.417	0.972	0.9998	Concrete	0.4154	2.56
0.417	0.0110	0.0010	0.0965	0.0969	0.293	0.269	0.703	0.6452	Concrete	0.2766	5.58

Diameter (ft)	<i>n</i>	Slope (ft/ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.417	0.0110	0.0010	0.0451	0.0448	0.206	0.170	0.494	0.4081	Concrete	0.1839	10.73
0.417	0.0110	0.0010	0.0198	0.0196	0.134	0.110	0.322	0.2652	Concrete	0.1280	4.49
0.417	0.0110	0.0020	0.1835	0.1840	0.393	0.417	0.943	0.9998	Concrete	0.4153	5.68
0.417	0.0110	0.0020	0.1605	0.1608	0.317	0.303	0.761	0.7283	Concrete	0.3091	2.48
0.417	0.0110	0.0020	0.0849	0.0848	0.233	0.200	0.559	0.4796	Concrete	0.2119	9.08
0.417	0.0110	0.0020	0.0468	0.0465	0.171	0.144	0.410	0.3455	Concrete	0.1594	6.79
0.417	0.0110	0.0020	0.0258	0.0256	0.126	0.106	0.302	0.2542	Concrete	0.1237	1.83
0.417	0.0110	0.0030	0.1846	0.1853	0.310	0.289	0.744	0.6931	Concrete	0.2954	4.72
0.417	0.0110	0.0030	0.0831	0.0828	0.209	0.176	0.502	0.4225	Concrete	0.1895	9.33
0.417	0.0110	0.0050	0.3062	0.3052	0.398	0.406	0.955	0.9748	Concrete	0.4055	1.90
0.417	0.0110	0.0050	0.2015	0.2020	0.278	0.257	0.667	0.6159	Concrete	0.2652	4.62
0.417	0.0110	0.0050	0.1028	0.1023	0.193	0.172	0.463	0.4127	Concrete	0.1857	3.79
0.417	0.0110	0.0050	0.0628	0.0622	0.159	0.132	0.382	0.3169	Concrete	0.1482	6.78
0.417	0.0110	0.0075	0.3569	0.3563	0.393	0.416	0.943	0.9994	Concrete	0.4152	5.64
0.417	0.0110	0.0075	0.1353	0.1349	0.196	0.179	0.470	0.4294	Concrete	0.1922	1.93
0.417	0.0110	0.0075	0.0754	0.0748	0.146	0.131	0.350	0.3138	Concrete	0.1470	0.69
0.417	0.0110	0.0075	0.0440	0.0439	0.126	0.099	0.302	0.2383	Concrete	0.1174	6.79
0.417	0.0110	0.0100	0.4284	0.4282	0.404	0.410	0.970	0.9847	Concrete	0.4094	1.34
0.417	0.0110	0.0100	0.3106	0.3105	0.298	0.272	0.715	0.6532	Concrete	0.2798	6.12
0.417	0.0110	0.0100	0.2318	0.2318	0.224	0.225	0.538	0.5400	Concrete	0.2355	5.13
0.417	0.0110	0.0100	0.1646	0.1644	0.195	0.184	0.468	0.4421	Concrete	0.1972	1.12
0.417	0.0110	0.0100	0.0743	0.0736	0.135	0.120	0.324	0.2891	Concrete	0.1373	1.74
0.417	0.0110	0.0125	0.4676	0.4669	0.396	0.415	0.950	0.9964	Concrete	0.4140	4.54
0.417	0.0110	0.0125	0.3662	0.3660	0.312	0.283	0.749	0.6786	Concrete	0.2897	7.15
0.417	0.0110	0.0125	0.2688	0.2688	0.231	0.230	0.554	0.5523	Concrete	0.2403	4.02
0.417	0.0110	0.0125	0.1892	0.1892	0.188	0.187	0.451	0.4491	Concrete	0.1999	6.34
0.417	0.0110	0.0125	0.0920	0.0920	0.129	0.127	0.310	0.3047	Concrete	0.1434	11.20
0.417	0.0110	0.0150	0.5166	0.5162	0.401	0.414	0.962	0.9934	Concrete	0.4128	2.95
0.417	0.0110	0.0150	0.4561	0.4565	0.323	0.313	0.775	0.7511	Concrete	0.3180	1.53
0.417	0.0110	0.0150	0.3146	0.3150	0.261	0.240	0.626	0.5757	Concrete	0.2494	4.43
0.417	0.0110	0.0150	0.1555	0.1548	0.176	0.160	0.422	0.3832	Concrete	0.1742	1.05
0.500	0.0110	0.0005	0.0889	0.0888	0.391	0.279	0.782	0.5581	Concrete	0.2911	25.55
0.500	0.0110	0.0005	0.0464	0.0463	0.282	0.192	0.564	0.3843	Concrete	0.2095	25.72
0.500	0.0110	0.0005	0.0344	0.0343	0.225	0.164	0.450	0.3276	Concrete	0.1829	18.72
0.500	0.0110	0.0005	0.0207	0.0206	0.173	0.126	0.346	0.2523	Concrete	0.1475	14.71
0.500	0.0110	0.0010	0.2190	0.2187	0.484	0.494	0.968	0.9885	Concrete	0.4931	1.88
0.500	0.0110	0.0010	0.1795	0.1795	0.348	0.356	0.696	0.7121	Concrete	0.3634	4.41
0.500	0.0110	0.0010	0.1071	0.1070	0.298	0.253	0.596	0.5063	Concrete	0.2667	10.49
0.500	0.0110	0.0010	0.0535	0.0535	0.222	0.172	0.444	0.3446	Concrete	0.1909	14.02
0.500	0.0110	0.0010	0.0296	0.0295	0.176	0.127	0.352	0.2540	Concrete	0.1483	15.72

Diameter (ft)	<i>n</i>	Slope (ft/ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.500	0.0110	0.0020	0.3035	0.3026	0.481	0.498	0.962	0.9970	Concrete	0.4971	3.34
0.500	0.0110	0.0020	0.2379	0.2378	0.371	0.339	0.742	0.6780	Concrete	0.3474	6.37
0.500	0.0110	0.0020	0.1578	0.1578	0.293	0.259	0.586	0.5189	Concrete	0.2727	6.94
0.500	0.0110	0.0020	0.0460	0.0459	0.170	0.133	0.340	0.2661	Concrete	0.1540	9.40
0.500	0.0110	0.0030	0.3833	0.3831	0.489	0.490	0.978	0.9809	Concrete	0.4896	0.11
0.500	0.0110	0.0030	0.3177	0.3177	0.383	0.362	0.766	0.7247	Concrete	0.3693	3.59
0.500	0.0110	0.0030	0.1797	0.1795	0.273	0.248	0.546	0.4970	Concrete	0.2624	3.89
0.500	0.0110	0.0030	0.1197	0.1190	0.222	0.198	0.444	0.3953	Concrete	0.2146	3.32
0.500	0.0110	0.0030	0.0560	0.0550	0.164	0.133	0.328	0.2654	Concrete	0.1537	6.30
0.500	0.0110	0.0050	0.3918	0.3915	0.385	0.349	0.770	0.6990	Concrete	0.3572	7.22
0.500	0.0110	0.0050	0.2084	0.2082	0.270	0.234	0.540	0.4670	Concrete	0.2483	8.03
0.500	0.0110	0.0050	0.1257	0.1250	0.210	0.177	0.420	0.3537	Concrete	0.1951	7.09
0.500	0.0110	0.0050	0.0625	0.0615	0.151	0.123	0.302	0.2466	Concrete	0.1448	4.08
0.500	0.0110	0.0075	0.5875	0.5874	0.480	0.499	0.960	0.9971	Concrete	0.4971	3.57
0.500	0.0110	0.0075	0.4693	0.4691	0.384	0.344	0.768	0.6874	Concrete	0.3518	8.39
0.500	0.0110	0.0075	0.2681	0.2680	0.272	0.240	0.544	0.4804	Concrete	0.2546	6.40
0.500	0.0110	0.0075	0.1608	0.1602	0.212	0.181	0.424	0.3620	Concrete	0.1990	6.13
0.500	0.0110	0.0075	0.0634	0.0633	0.142	0.112	0.284	0.2243	Concrete	0.1344	5.35
0.500	0.0110	0.0100	0.4807	0.4807	0.365	0.316	0.730	0.6313	Concrete	0.3254	10.84
0.500	0.0110	0.0100	0.3187	0.3186	0.278	0.244	0.556	0.4886	Concrete	0.2584	7.03
0.500	0.0110	0.0100	0.1992	0.1991	0.212	0.188	0.424	0.3758	Concrete	0.2055	3.06
0.500	0.0110	0.0100	0.0907	0.0904	0.144	0.125	0.288	0.2498	Concrete	0.1464	1.64
0.667	0.0110	0.0005	0.2878	0.2873	0.547	0.495	0.821	0.7428	Concrete	0.5037	7.92
0.667	0.0110	0.0005	0.2178	0.2187	0.479	0.404	0.719	0.6061	Concrete	0.4181	12.71
0.667	0.0110	0.0005	0.1957	0.1957	0.426	0.377	0.639	0.5658	Concrete	0.3929	7.77
0.667	0.0110	0.0005	0.1109	0.1105	0.319	0.271	0.479	0.4066	Concrete	0.2933	8.06
0.667	0.0110	0.0005	0.0725	0.0720	0.258	0.216	0.387	0.3241	Concrete	0.2416	6.35
0.667	0.0110	0.0010	0.4110	0.4104	0.554	0.499	0.831	0.7489	Concrete	0.5075	8.39
0.667	0.0110	0.0010	0.3275	0.3278	0.481	0.421	0.722	0.6314	Concrete	0.4340	9.78
0.667	0.0110	0.0010	0.2830	0.2839	0.428	0.383	0.642	0.5738	Concrete	0.3979	7.02
0.667	0.0110	0.0010	0.1646	0.1638	0.311	0.278	0.467	0.4176	Concrete	0.3002	3.48
0.667	0.0110	0.0010	0.1137	0.1130	0.253	0.228	0.380	0.3421	Concrete	0.2529	0.03
0.667	0.0110	0.0010	0.0469	0.0462	0.177	0.145	0.266	0.2177	Concrete	0.1751	1.09
0.667	0.0110	0.0020	0.6502	0.6496	0.640	0.665	0.960	0.9982	Concrete	0.6635	3.68
0.667	0.0110	0.0020	0.6035	0.6035	0.565	0.516	0.848	0.7744	Concrete	0.5234	7.35
0.667	0.0110	0.0020	0.5092	0.5090	0.496	0.450	0.744	0.6750	Concrete	0.4613	7.00
0.667	0.0110	0.0020	0.4387	0.4387	0.448	0.406	0.672	0.6089	Concrete	0.4199	6.27
0.667	0.0110	0.0020	0.2616	0.2616	0.335	0.297	0.503	0.4458	Concrete	0.3178	5.12
0.667	0.0110	0.0030	0.7872	0.7870	0.643	0.667	0.965	0.9998	Concrete	0.6645	3.35
0.667	0.0110	0.0030	0.7240	0.7240	0.553	0.507	0.830	0.7600	Concrete	0.5144	6.97

Diameter (ft)	<i>n</i>	Slope (ft/ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.667	0.0110	0.0030	0.6225	0.6224	0.489	0.449	0.734	0.6741	Concrete	0.4607	5.78
0.667	0.0110	0.0030	0.5440	0.5440	0.445	0.409	0.668	0.6139	Concrete	0.4230	4.94
0.667	0.0110	0.0030	0.3354	0.3354	0.341	0.305	0.512	0.4575	Concrete	0.3252	4.65
0.667	0.0110	0.0030	0.1894	0.1886	0.262	0.223	0.393	0.3351	Concrete	0.2486	5.13
0.667	0.0110	0.0030	0.0825	0.0824	0.182	0.146	0.273	0.2193	Concrete	0.1761	3.27
0.667	0.0110	0.0050	1.0168	1.0164	0.628	0.666	0.942	0.9997	Concrete	0.6645	5.81
0.667	0.0110	0.0050	0.9109	0.9108	0.566	0.495	0.849	0.7432	Concrete	0.5039	10.97
0.667	0.0110	0.0050	0.8028	0.8028	0.512	0.449	0.768	0.6736	Concrete	0.4604	10.08
0.667	0.0110	0.0050	0.6436	0.6440	0.443	0.387	0.665	0.5800	Concrete	0.4018	9.30
0.667	0.0110	0.0050	0.3616	0.3610	0.318	0.276	0.477	0.4136	Concrete	0.2976	6.40
0.667	0.0110	0.0050	0.2617	0.2608	0.270	0.232	0.405	0.3474	Concrete	0.2562	5.11
0.667	0.0110	0.0050	0.1141	0.1140	0.189	0.151	0.284	0.2270	Concrete	0.1809	4.30
0.667	0.0110	0.0075	1.0878	1.0880	0.546	0.485	0.819	0.7278	Concrete	0.4943	9.47
0.667	0.0110	0.0075	0.9662	0.9658	0.495	0.443	0.743	0.6651	Concrete	0.4551	8.06
0.667	0.0110	0.0075	0.8205	0.8204	0.442	0.397	0.663	0.5951	Concrete	0.4113	6.95
0.667	0.0110	0.0075	0.5043	0.5042	0.335	0.296	0.503	0.4447	Concrete	0.3171	5.34
0.667	0.0110	0.0075	0.3100	0.3096	0.260	0.228	0.390	0.3413	Concrete	0.2524	2.92
0.667	0.0110	0.0075	0.1215	0.1215	0.170	0.141	0.255	0.2118	Concrete	0.1713	0.79
0.667	0.0110	0.0100	1.2681	1.2680	0.559	0.489	0.839	0.7335	Concrete	0.4979	10.93
0.667	0.0110	0.0100	1.0471	1.0470	0.464	0.424	0.696	0.6362	Concrete	0.4370	5.82
0.667	0.0110	0.0100	0.8788	0.8788	0.415	0.378	0.623	0.5673	Concrete	0.3938	5.10
0.667	0.0110	0.0100	0.5318	0.5318	0.309	0.282	0.464	0.4227	Concrete	0.3033	1.83
0.667	0.0110	0.0100	0.2900	0.2899	0.225	0.204	0.338	0.3057	Concrete	0.2301	2.28
0.667	0.0110	0.0100	0.1284	0.1283	0.153	0.135	0.230	0.2027	Concrete	0.1656	8.26
0.667	0.0110	0.0125	1.4880	1.4880	0.600	0.510	0.900	0.7646	Concrete	0.5174	13.77
0.667	0.0110	0.0125	1.4700	1.4700	0.593	0.504	0.890	0.7564	Concrete	0.5122	13.62
0.667	0.0110	0.0125	1.4080	1.4080	0.553	0.486	0.830	0.7294	Concrete	0.4953	10.43
0.667	0.0110	0.0125	1.2038	1.2040	0.487	0.432	0.731	0.6486	Concrete	0.4447	8.68
0.667	0.0110	0.0125	0.9928	0.9928	0.426	0.381	0.639	0.5710	Concrete	0.3962	7.00
0.667	0.0110	0.0125	0.6225	0.6224	0.324	0.289	0.486	0.4336	Concrete	0.3102	4.27
0.667	0.0110	0.0125	0.3622	0.3620	0.244	0.216	0.366	0.3238	Concrete	0.2415	1.03
0.667	0.0110	0.0125	0.1605	0.1602	0.163	0.143	0.245	0.2142	Concrete	0.1728	6.03
0.667	0.0110	0.0150	1.6428	1.6425	0.616	0.513	0.924	0.7700	Concrete	0.5207	15.46
0.667	0.0110	0.0150	1.5060	1.5060	0.545	0.477	0.818	0.7155	Concrete	0.4866	10.71
0.667	0.0110	0.0150	1.2894	1.2900	0.482	0.426	0.723	0.6386	Concrete	0.4385	9.03
0.667	0.0110	0.0150	1.0139	1.0140	0.414	0.364	0.621	0.5466	Concrete	0.3809	8.00
0.667	0.0110	0.0150	0.6530	0.6524	0.323	0.282	0.485	0.4233	Concrete	0.3037	5.97
0.667	0.0110	0.0150	0.3930	0.3925	0.245	0.215	0.368	0.3222	Concrete	0.2405	1.84
0.667	0.0110	0.0150	0.1880	0.1879	0.165	0.148	0.248	0.2214	Concrete	0.1774	7.50
0.833	0.0110	0.0005	0.5114	0.5114	0.739	0.609	0.887	0.7304	Concrete	0.6199	16.12

Diameter (ft)	<i>n</i>	Slope (ft/ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.833	0.0110	0.0005	0.4914	0.4910	0.706	0.590	0.847	0.7075	Concrete	0.6020	14.73
0.833	0.0110	0.0005	0.4317	0.4324	0.616	0.536	0.739	0.6436	Concrete	0.5520	10.39
0.833	0.0110	0.0005	0.4189	0.4188	0.579	0.525	0.695	0.6304	Concrete	0.5417	6.45
0.833	0.0110	0.0005	0.3658	0.3660	0.551	0.481	0.661	0.5768	Concrete	0.4997	9.30
0.833	0.0110	0.0005	0.2782	0.2780	0.474	0.407	0.569	0.4886	Concrete	0.4307	9.13
0.833	0.0110	0.0005	0.2415	0.2408	0.416	0.375	0.499	0.4504	Concrete	0.4009	3.64
0.833	0.0110	0.0005	0.1470	0.1470	0.323	0.286	0.388	0.3437	Concrete	0.3174	1.75
0.833	0.0110	0.0005	0.0841	0.0832	0.241	0.215	0.289	0.2576	Concrete	0.2500	3.74
0.833	0.0110	0.0010	0.7619	0.7615	0.739	0.636	0.887	0.7635	Concrete	0.6458	12.61
0.833	0.0110	0.0010	0.7361	0.7360	0.710	0.618	0.852	0.7411	Concrete	0.6283	11.51
0.833	0.0110	0.0010	0.6930	0.6930	0.670	0.588	0.804	0.7060	Concrete	0.6008	10.33
0.833	0.0110	0.0010	0.6276	0.6278	0.617	0.547	0.740	0.6562	Concrete	0.5618	8.94
0.833	0.0110	0.0010	0.5954	0.5954	0.593	0.527	0.712	0.6326	Concrete	0.5434	8.37
0.833	0.0110	0.0010	0.5353	0.5354	0.557	0.491	0.668	0.5895	Concrete	0.5097	8.49
0.833	0.0110	0.0010	0.4462	0.4462	0.486	0.439	0.583	0.5264	Concrete	0.4603	5.29
0.833	0.0110	0.0010	0.3656	0.3650	0.423	0.390	0.508	0.4682	Concrete	0.4148	1.94
0.833	0.0110	0.0010	0.2002	0.1998	0.322	0.281	0.386	0.3368	Concrete	0.3120	3.11
0.833	0.0110	0.0010	0.1113	0.1110	0.238	0.208	0.286	0.2490	Concrete	0.2433	2.23
0.833	0.0110	0.0020	1.0961	1.0960	0.738	0.646	0.886	0.7756	Concrete	0.6553	11.21
0.833	0.0110	0.0020	1.0590	1.0600	0.708	0.627	0.850	0.7520	Concrete	0.6368	10.05
0.833	0.0110	0.0020	1.0105	1.0105	0.667	0.603	0.800	0.7232	Concrete	0.6143	7.90
0.833	0.0110	0.0020	0.9450	0.9448	0.621	0.572	0.745	0.6867	Concrete	0.5857	5.68
0.833	0.0110	0.0020	0.8641	0.8639	0.594	0.537	0.713	0.6440	Concrete	0.5523	7.02
0.833	0.0110	0.0020	0.7997	0.7996	0.561	0.509	0.673	0.6110	Concrete	0.5265	6.15
0.833	0.0110	0.0020	0.6252	0.6251	0.483	0.436	0.580	0.5234	Concrete	0.4580	5.18
0.833	0.0110	0.0020	0.5188	0.5188	0.439	0.391	0.527	0.4692	Concrete	0.4155	5.35
0.833	0.0110	0.0020	0.4982	0.4982	0.429	0.382	0.515	0.4584	Concrete	0.4071	5.10
0.833	0.0110	0.0020	0.3252	0.3250	0.343	0.302	0.412	0.3625	Concrete	0.3321	3.17
0.833	0.0110	0.0020	0.1438	0.1437	0.248	0.198	0.298	0.2380	Concrete	0.2347	5.36
0.833	0.0110	0.0030	1.3452	1.3450	0.740	0.648	0.888	0.7770	Concrete	0.6564	11.30
0.833	0.0110	0.0030	1.3280	1.3280	0.715	0.640	0.858	0.7679	Concrete	0.6493	9.20
0.833	0.0110	0.0030	1.2360	1.2360	0.663	0.602	0.796	0.7225	Concrete	0.6137	7.44
0.833	0.0110	0.0030	1.1806	1.1800	0.636	0.581	0.763	0.6970	Concrete	0.5938	6.63
0.833	0.0110	0.0030	1.0862	1.0860	0.598	0.547	0.718	0.6558	Concrete	0.5616	6.09
0.833	0.0110	0.0030	0.9587	0.9586	0.554	0.502	0.665	0.6025	Concrete	0.5198	6.17
0.833	0.0110	0.0030	0.8087	0.8092	0.498	0.451	0.598	0.5411	Concrete	0.4718	5.26
0.833	0.0110	0.0030	0.6332	0.6332	0.436	0.390	0.523	0.4682	Concrete	0.4148	4.86
0.833	0.0110	0.0030	0.3799	0.3791	0.339	0.295	0.407	0.3535	Concrete	0.3250	4.12
0.833	0.0110	0.0030	0.1853	0.1853	0.243	0.203	0.292	0.2442	Concrete	0.2395	1.43
0.833	0.0110	0.0050	1.7304	1.7300	0.741	0.645	0.889	0.7744	Concrete	0.6544	11.69

Diameter (ft)	<i>n</i>	Slope (ft/ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.833	0.0110	0.0050	1.6825	1.6825	0.704	0.629	0.845	0.7552	Concrete	0.6393	9.19
0.833	0.0110	0.0050	1.6250	1.6250	0.678	0.611	0.814	0.7332	Concrete	0.6221	8.24
0.833	0.0110	0.0050	1.4805	1.4800	0.623	0.568	0.748	0.6820	Concrete	0.5821	6.57
0.833	0.0110	0.0050	1.3452	1.3450	0.586	0.531	0.703	0.6371	Concrete	0.5469	6.67
0.833	0.0110	0.0050	1.2481	1.2480	0.562	0.505	0.674	0.6058	Concrete	0.5225	7.04
0.833	0.0110	0.0050	0.9930	0.9930	0.492	0.437	0.590	0.5249	Concrete	0.4591	6.68
0.833	0.0110	0.0050	0.7351	0.7345	0.420	0.367	0.504	0.4408	Concrete	0.3934	6.34
0.833	0.0110	0.0050	0.4941	0.4934	0.338	0.296	0.406	0.3549	Concrete	0.3261	3.51
0.833	0.0110	0.0050	0.2222	0.2222	0.231	0.196	0.277	0.2353	Concrete	0.2326	0.68
0.833	0.0110	0.0075	2.0565	2.0560	0.726	0.628	0.871	0.7538	Concrete	0.6383	12.09
0.833	0.0110	0.0075	2.0443	2.0440	0.718	0.625	0.862	0.7499	Concrete	0.6352	11.53
0.833	0.0110	0.0075	1.7701	1.7700	0.627	0.558	0.752	0.6701	Concrete	0.5728	8.65
0.833	0.0110	0.0075	1.5113	1.5120	0.570	0.501	0.684	0.6013	Concrete	0.5189	8.96
0.833	0.0110	0.0075	1.3795	1.3800	0.541	0.473	0.649	0.5671	Concrete	0.4922	9.02
0.833	0.0110	0.0075	1.1563	1.1560	0.487	0.424	0.584	0.5093	Concrete	0.4469	8.23
0.833	0.0110	0.0075	0.8044	0.8044	0.408	0.345	0.490	0.4140	Concrete	0.3724	8.73
0.833	0.0110	0.0075	0.5306	0.5306	0.323	0.276	0.388	0.3311	Concrete	0.3075	4.79
0.833	0.0110	0.0075	0.2600	0.2600	0.224	0.192	0.269	0.2300	Concrete	0.2284	1.96
0.833	0.0110	0.0100	2.2081	2.2080	0.681	0.592	0.817	0.7101	Concrete	0.6041	11.30
0.833	0.0110	0.0100	2.0560	2.0560	0.624	0.561	0.749	0.6730	Concrete	0.5750	7.85
0.833	0.0110	0.0100	2.0052	2.0050	0.618	0.551	0.742	0.6610	Concrete	0.5656	8.48
0.833	0.0110	0.0100	1.8836	1.8840	0.595	0.527	0.714	0.6328	Concrete	0.5435	8.65
0.833	0.0110	0.0100	1.6441	1.6450	0.553	0.482	0.664	0.5786	Concrete	0.5012	9.37
0.833	0.0110	0.0100	1.3751	1.3750	0.489	0.432	0.587	0.5183	Concrete	0.4540	7.16
0.833	0.0110	0.0100	0.9933	0.9930	0.405	0.358	0.486	0.4297	Concrete	0.3847	5.02
0.833	0.0110	0.0100	0.6238	0.6238	0.327	0.279	0.392	0.3342	Concrete	0.3100	5.20
0.833	0.0110	0.0100	0.2320	0.2318	0.207	0.169	0.248	0.2023	Concrete	0.2067	0.12
0.833	0.0110	0.0125	2.6800	2.6800	0.742	0.633	0.890	0.7601	Concrete	0.6431	13.32
0.833	0.0110	0.0125	2.5921	2.5920	0.701	0.616	0.841	0.7386	Concrete	0.6263	10.65
0.833	0.0110	0.0125	2.5921	2.5920	0.700	0.615	0.840	0.7386	Concrete	0.6263	10.52
0.833	0.0110	0.0125	2.4661	2.4660	0.664	0.591	0.797	0.7095	Concrete	0.6036	9.10
0.833	0.0110	0.0125	2.2418	2.2410	0.611	0.551	0.733	0.6610	Concrete	0.5656	7.43
0.833	0.0110	0.0125	2.0003	2.0000	0.569	0.509	0.683	0.6112	Concrete	0.5267	7.43
0.833	0.0110	0.0125	1.8841	1.8840	0.543	0.490	0.652	0.5878	Concrete	0.5084	6.38
0.833	0.0110	0.0125	1.4620	1.4620	0.463	0.419	0.556	0.5030	Concrete	0.4420	4.53
0.833	0.0110	0.0125	1.2360	1.2360	0.412	0.380	0.494	0.4564	Concrete	0.4056	1.56
0.833	0.0110	0.0125	0.7002	0.7000	0.314	0.279	0.377	0.3349	Concrete	0.3105	1.11
0.833	0.0110	0.0125	0.3262	0.3260	0.213	0.189	0.256	0.2267	Concrete	0.2258	6.03
0.833	0.0110	0.0150	2.4540	2.4540	0.624	0.551	0.749	0.6606	Concrete	0.5653	9.40
0.833	0.0110	0.0150	1.3820	1.3820	0.421	0.385	0.505	0.4618	Concrete	0.4098	2.67

Diameter (ft)	<i>n</i>	Slope (ft/ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
1.000	0.0110	0.0005	0.8680	0.8672	0.889	0.757	0.889	0.7573	Concrete	0.7691	13.48
1.000	0.0110	0.0005	0.8492	0.8492	0.845	0.743	0.845	0.7432	Concrete	0.7559	10.55
1.000	0.0110	0.0005	0.7540	0.7540	0.782	0.677	0.782	0.6772	Concrete	0.6940	11.26
1.000	0.0110	0.0005	0.6987	0.6986	0.756	0.641	0.756	0.6415	Concrete	0.6604	12.64
1.000	0.0110	0.0005	0.6494	0.6496	0.691	0.611	0.691	0.6106	Concrete	0.6314	8.63
1.000	0.0110	0.0005	0.6062	0.6062	0.643	0.584	0.643	0.5838	Concrete	0.6063	5.71
1.000	0.0110	0.0005	0.4983	0.4982	0.580	0.517	0.580	0.5172	Concrete	0.5438	6.25
1.000	0.0110	0.0005	0.4491	0.4485	0.534	0.486	0.534	0.4865	Concrete	0.5149	3.58
1.000	0.0110	0.0005	0.4083	0.4083	0.511	0.460	0.511	0.4605	Concrete	0.4905	4.01
1.000	0.0110	0.0005	0.2153	0.2152	0.364	0.325	0.364	0.3252	Concrete	0.3635	0.14
1.000	0.0110	0.0005	0.1128	0.1120	0.275	0.234	0.275	0.2337	Concrete	0.2776	0.95
1.500	0.0110	0.0021	3.0600	3.0600	0.790	0.783	0.527	0.5223	Concrete	0.8228	4.15
1.500	0.0110	0.0021	4.3100	4.3100	0.990	0.985	0.660	0.6564	Concrete	1.0116	2.18
0.667	0.0110	0.005	0.1508	0.1500	0.160	0.174	0.240	0.2610	Clay	0.2022	26.39
0.667	0.0110	0.005	0.3229	0.3220	0.240	0.259	0.360	0.3885	Clay	0.2821	17.54
0.667	0.0110	0.005	0.4690	0.4690	0.290	0.319	0.435	0.4786	Clay	0.3385	16.73
0.667	0.0110	0.005	0.8142	0.8150	0.430	0.453	0.645	0.6799	Clay	0.4645	8.03
0.667	0.0110	0.005	0.9599	0.9600	0.490	0.519	0.735	0.7776	Clay	0.5258	7.30
0.667	0.0110	0.01	0.1931	0.1930	0.160	0.166	0.240	0.2482	Clay	0.1943	21.42
0.667	0.0110	0.01	0.4603	0.4600	0.250	0.260	0.375	0.3902	Clay	0.2831	13.26
0.667	0.0110	0.01	0.7603	0.7600	0.330	0.346	0.495	0.5186	Clay	0.3636	10.17
0.667	0.0110	0.01	1.0400	1.0400	0.420	0.422	0.630	0.6327	Clay	0.4350	3.57
0.667	0.0110	0.01	1.3599	1.3600	0.500	0.520	0.750	0.7790	Clay	0.5266	5.32
0.667	0.0110	0.01	1.5293	1.5300	0.560	0.606	0.840	0.9088	Clay	0.6079	8.55
0.667	0.0110	0.015	0.2400	0.2400	0.170	0.167	0.255	0.2501	Clay	0.1954	14.95
0.667	0.0110	0.015	0.5001	0.5000	0.250	0.244	0.375	0.3658	Clay	0.2679	7.14
0.667	0.0110	0.015	0.8400	0.8400	0.330	0.326	0.495	0.4880	Clay	0.3444	4.36
0.667	0.0110	0.015	1.1997	1.2000	0.420	0.405	0.630	0.6078	Clay	0.4194	0.15
0.667	0.0110	0.015	1.5597	1.5600	0.500	0.490	0.750	0.7353	Clay	0.4992	0.15
0.667	0.0110	0.02	0.2480	0.2480	0.170	0.158	0.255	0.2365	Clay	0.1869	9.95
0.667	0.0110	0.02	0.5458	0.5450	0.250	0.237	0.375	0.3549	Clay	0.2611	4.43
0.667	0.0110	0.02	0.9007	0.9000	0.330	0.312	0.495	0.4675	Clay	0.3316	0.48
0.667	0.0110	0.02	1.2900	1.2900	0.420	0.387	0.630	0.5803	Clay	0.4022	4.24
0.667	0.0110	0.02	1.7301	1.7300	0.500	0.475	0.750	0.7119	Clay	0.4846	3.08
0.667	0.0110	0.03	0.2550	0.2550	0.170	0.145	0.255	0.2167	Clay	0.1745	2.67
0.667	0.0110	0.03	0.6002	0.6000	0.250	0.224	0.375	0.3352	Clay	0.2487	0.50
0.667	0.0110	0.03	0.9401	0.9400	0.320	0.285	0.480	0.4272	Clay	0.3063	4.28
0.667	0.0110	0.03	1.3995	1.4000	0.420	0.359	0.630	0.5381	Clay	0.3757	10.54
0.667	0.0110	0.03	1.8402	1.8400	0.480	0.428	0.720	0.6420	Clay	0.4408	8.16
0.667	0.0110	0.03	2.4400	2.4400	0.570	0.538	0.855	0.8066	Clay	0.5439	4.58

Diameter (ft)	<i>n</i>	Slope (ft/ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.667	0.0110	0.03	2.5406	2.5400	0.600	0.564	0.900	0.8451	Clay	0.5680	5.33
0.667	0.0110	0.04	0.3000	0.3000	0.170	0.146	0.255	0.2187	Clay	0.1758	3.41
0.667	0.0110	0.04	0.6803	0.6800	0.250	0.221	0.375	0.3320	Clay	0.2467	1.32
0.667	0.0110	0.04	1.0000	1.0000	0.320	0.272	0.480	0.4082	Clay	0.2944	7.99
0.667	0.0110	0.04	1.6195	1.6200	0.420	0.359	0.630	0.5388	Clay	0.3762	10.43
0.667	0.0110	0.04	2.1501	2.1500	0.500	0.432	0.750	0.6473	Clay	0.4441	11.17
0.667	0.0110	0.04	2.7102	2.7100	0.570	0.518	0.855	0.7764	Clay	0.5250	7.90
0.333	0.0130	0.0005	0.0403	0.0404	0.248	0.259	0.744	0.7765	Clay	0.2624	5.81
0.333	0.0130	0.0005	0.0273	0.0274	0.214	0.194	0.642	0.5829	Clay	0.2018	5.69
0.333	0.0130	0.0005	0.0177	0.0177	0.159	0.150	0.477	0.4499	Clay	0.1602	0.75
0.333	0.0130	0.0010	0.0104	0.0098	0.131	0.094	0.393	0.2818	Clay	0.1076	17.88
0.333	0.0130	0.0010	0.0570	0.0580	0.285	0.259	0.855	0.7761	Clay	0.2623	7.98
0.333	0.0130	0.0010	0.0567	0.0568	0.228	0.257	0.684	0.7721	Clay	0.2610	14.48
0.333	0.0130	0.0010	0.0236	0.0235	0.160	0.145	0.480	0.4348	Clay	0.1555	2.84
0.333	0.0130	0.0010	0.0170	0.0166	0.136	0.121	0.408	0.3631	Clay	0.1330	2.18
0.333	0.0130	0.0020	0.0895	0.0904	0.271	0.292	0.813	0.8759	Clay	0.2935	8.30
0.333	0.0130	0.0020	0.0709	0.0710	0.223	0.233	0.669	0.6978	Clay	0.2378	6.61
0.333	0.0130	0.0020	0.0414	0.0414	0.173	0.164	0.519	0.4922	Clay	0.1734	0.24
0.333	0.0130	0.0020	0.0189	0.0187	0.129	0.107	0.387	0.3201	Clay	0.1196	7.31
0.333	0.0130	0.0030	0.0862	0.0864	0.244	0.231	0.732	0.6937	Clay	0.2365	3.08
0.333	0.0130	0.0030	0.0684	0.0685	0.213	0.197	0.639	0.5909	Clay	0.2043	4.07
0.333	0.0130	0.0030	0.0364	0.0361	0.166	0.136	0.498	0.4076	Clay	0.1470	11.47
0.333	0.0130	0.0030	0.0185	0.0180	0.123	0.095	0.369	0.2855	Clay	0.1088	11.58
0.333	0.0130	0.0050	0.1326	0.1327	0.263	0.269	0.789	0.8071	Clay	0.2720	3.41
0.333	0.0130	0.0050	0.0986	0.0987	0.223	0.212	0.669	0.6359	Clay	0.2184	2.06
0.333	0.0130	0.0050	0.0519	0.0517	0.170	0.144	0.510	0.4308	Clay	0.1542	9.28
0.333	0.0130	0.0050	0.0263	0.0256	0.128	0.100	0.384	0.2995	Clay	0.1131	11.63
0.333	0.0130	0.0075	0.1751	0.1756	0.288	0.298	0.864	0.8943	Clay	0.2993	3.91
0.333	0.0130	0.0075	0.1481	0.1482	0.253	0.247	0.759	0.7410	Clay	0.2513	0.68
0.333	0.0130	0.0075	0.0994	0.0996	0.210	0.187	0.629	0.5602	Clay	0.1947	7.20
0.333	0.0130	0.0075	0.0657	0.0654	0.164	0.146	0.492	0.4389	Clay	0.1568	4.42
0.333	0.0130	0.0075	0.0426	0.0425	0.134	0.116	0.402	0.3469	Clay	0.1280	4.50
0.333	0.0130	0.0125	0.2124	0.2124	0.270	0.273	0.810	0.8181	Clay	0.2754	2.00
0.333	0.0130	0.0125	0.1953	0.1951	0.254	0.251	0.762	0.7544	Clay	0.2555	0.58
0.333	0.0130	0.0125	0.1033	0.1032	0.177	0.164	0.531	0.4915	Clay	0.1732	2.15
0.333	0.0130	0.0125	0.0738	0.0736	0.148	0.136	0.444	0.4065	Clay	0.1466	0.93
0.333	0.0130	0.0150	0.2311	0.2318	0.257	0.271	0.771	0.8120	Clay	0.2735	6.43
0.333	0.0130	0.0150	0.2023	0.2026	0.228	0.240	0.684	0.7201	Clay	0.2447	7.34
0.333	0.0130	0.0150	0.1323	0.1322	0.168	0.180	0.504	0.5395	Clay	0.1882	12.04
0.333	0.0130	0.0150	0.0721	0.0720	0.126	0.127	0.378	0.3818	Clay	0.1389	10.22

Diameter (ft)	<i>n</i>	Slope (ft/ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.417	0.0130	0.0010	0.1062	0.1065	0.314	0.332	0.754	0.7964	Clay	0.3358	6.93
0.417	0.0130	0.0010	0.0823	0.0824	0.273	0.270	0.655	0.6486	Clay	0.2780	1.82
0.417	0.0130	0.0010	0.0532	0.0532	0.215	0.205	0.516	0.4928	Clay	0.2170	0.94
0.417	0.0130	0.0010	0.0233	0.0231	0.155	0.131	0.372	0.3135	Clay	0.1469	5.25
0.417	0.0130	0.0010	0.0165	0.0165	0.116	0.110	0.278	0.2631	Clay	0.1272	9.64
0.417	0.0130	0.0020	0.1365	0.1371	0.279	0.305	0.670	0.7312	Clay	0.3103	11.21
0.417	0.0130	0.0020	0.0840	0.0840	0.212	0.219	0.509	0.5261	Clay	0.2300	8.50
0.417	0.0130	0.0020	0.0481	0.0481	0.164	0.160	0.394	0.3835	Clay	0.1743	6.25
0.417	0.0130	0.0020	0.0291	0.0291	0.129	0.123	0.310	0.2945	Clay	0.1394	8.09
0.417	0.0130	0.0030	0.1996	0.1998	0.321	0.368	0.770	0.8834	Clay	0.3698	15.21
0.417	0.0130	0.0030	0.1564	0.1566	0.273	0.289	0.655	0.6939	Clay	0.2957	8.30
0.417	0.0130	0.0030	0.0987	0.0987	0.219	0.214	0.526	0.5131	Clay	0.2250	2.73
0.417	0.0130	0.0030	0.0546	0.0544	0.165	0.153	0.396	0.3679	Clay	0.1682	1.91
0.417	0.0130	0.0030	0.0232	0.0231	0.115	0.099	0.276	0.2367	Clay	0.1168	1.60
0.417	0.0130	0.0050	0.2463	0.2464	0.298	0.345	0.715	0.8285	Clay	0.3483	16.90
0.417	0.0130	0.0050	0.1889	0.1892	0.254	0.275	0.610	0.6608	Clay	0.2827	11.32
0.417	0.0130	0.0050	0.1448	0.1448	0.220	0.231	0.528	0.5546	Clay	0.2412	9.64
0.417	0.0130	0.0050	0.0785	0.0784	0.154	0.163	0.370	0.3901	Clay	0.1768	14.83
0.417	0.0130	0.0050	0.0382	0.0381	0.118	0.111	0.283	0.2675	Clay	0.1289	9.22
0.417	0.0130	0.0150	0.3582	0.3582	0.253	0.294	0.607	0.7067	Clay	0.3007	18.85
0.417	0.0130	0.0150	0.2705	0.2704	0.209	0.242	0.502	0.5816	Clay	0.2517	20.45
0.417	0.0130	0.0150	0.1678	0.1674	0.158	0.183	0.379	0.4381	Clay	0.1956	23.81
0.417	0.0130	0.0150	0.0972	0.0969	0.118	0.136	0.283	0.3262	Clay	0.1519	28.70
0.500	0.0130	0.0005	0.0724	0.0724	0.300	0.272	0.600	0.5448	Clay	0.2848	5.05
0.500	0.0130	0.0005	0.0398	0.0397	0.223	0.193	0.446	0.3869	Clay	0.2107	5.50
0.500	0.0130	0.0005	0.0232	0.0225	0.188	0.146	0.376	0.2910	Clay	0.1657	11.86
0.500	0.0130	0.0010	0.1579	0.1578	0.396	0.367	0.792	0.7348	Clay	0.3740	5.56
0.500	0.0130	0.0010	0.1255	0.1255	0.304	0.310	0.608	0.6208	Clay	0.3205	5.43
0.500	0.0130	0.0010	0.0706	0.0706	0.211	0.219	0.422	0.4387	Clay	0.2350	11.39
0.500	0.0130	0.0010	0.0374	0.0372	0.171	0.156	0.342	0.3118	Clay	0.1754	2.59
0.500	0.0130	0.0020	0.2670	0.2680	0.409	0.448	0.818	0.8969	Clay	0.4501	10.05
0.500	0.0130	0.0020	0.1800	0.1801	0.277	0.313	0.554	0.6269	Clay	0.3234	16.73
0.500	0.0130	0.0020	0.1091	0.1090	0.219	0.231	0.438	0.4611	Clay	0.2456	12.12
0.500	0.0130	0.0020	0.0559	0.0559	0.157	0.160	0.314	0.3208	Clay	0.1797	14.46
0.500	0.0130	0.0030	0.2194	0.2194	0.302	0.312	0.604	0.6247	Clay	0.3223	6.73
0.500	0.0130	0.0030	0.1383	0.1382	0.222	0.235	0.444	0.4704	Clay	0.2499	12.57
0.500	0.0130	0.0050	0.2771	0.2771	0.276	0.308	0.552	0.6156	Clay	0.3181	15.24
0.500	0.0130	0.0050	0.1512	0.1512	0.213	0.214	0.426	0.4281	Clay	0.2301	8.01
0.500	0.0130	0.0050	0.0668	0.0664	0.152	0.139	0.304	0.2776	Clay	0.1594	4.89
0.500	0.0130	0.0075	0.2772	0.2771	0.258	0.271	0.516	0.5412	Clay	0.2831	9.74

Diameter (ft)	<i>n</i>	Slope (ft/ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.500	0.0130	0.0075	0.1692	0.1692	0.199	0.204	0.398	0.4073	Clay	0.2203	10.70
0.500	0.0130	0.0075	0.0969	0.0969	0.147	0.151	0.294	0.3029	Clay	0.1713	16.53
0.667	0.0130	0.0005	0.2547	0.2540	0.515	0.515	0.773	0.7725	Clay	0.5223	1.41
0.667	0.0130	0.0005	0.1370	0.1370	0.342	0.336	0.513	0.5042	Clay	0.3544	3.61
0.667	0.0130	0.0005	0.0847	0.0840	0.259	0.256	0.389	0.3846	Clay	0.2795	7.92
0.667	0.0130	0.0005	0.0367	0.0363	0.166	0.166	0.249	0.2490	Clay	0.1946	17.25
0.667	0.0130	0.0010	0.3732	0.3740	0.509	0.533	0.764	0.7994	Clay	0.5391	5.91
0.667	0.0130	0.0010	0.2054	0.2060	0.348	0.348	0.522	0.5220	Clay	0.3655	5.03
0.667	0.0130	0.0010	0.1380	0.1380	0.271	0.277	0.407	0.4156	Clay	0.2989	10.29
0.667	0.0130	0.0010	0.0720	0.0720	0.192	0.196	0.288	0.2941	Clay	0.2229	16.09
0.667	0.0130	0.0020	0.5214	0.5220	0.509	0.527	0.764	0.7899	Clay	0.5332	4.74
0.667	0.0130	0.0020	0.2806	0.2805	0.358	0.341	0.537	0.5113	Clay	0.3588	0.23
0.667	0.0130	0.0020	0.1547	0.1540	0.267	0.244	0.401	0.3662	Clay	0.2680	0.37
0.667	0.0130	0.0020	0.0542	0.0540	0.165	0.143	0.248	0.2139	Clay	0.1727	4.66
0.667	0.0130	0.0030	0.6384	0.6390	0.510	0.526	0.765	0.7896	Clay	0.5330	4.51
0.667	0.0130	0.0030	0.3394	0.3392	0.364	0.338	0.546	0.5076	Clay	0.3565	2.07
0.667	0.0130	0.0030	0.2062	0.2054	0.280	0.256	0.420	0.3834	Clay	0.2787	0.45
0.667	0.0130	0.0030	0.0924	0.0920	0.196	0.168	0.294	0.2525	Clay	0.1968	0.41
0.667	0.0130	0.0075	0.9480	0.9480	0.503	0.497	0.755	0.7459	Clay	0.5056	0.52
0.667	0.0130	0.0075	0.5590	0.5590	0.356	0.347	0.534	0.5201	Clay	0.3643	2.34
0.667	0.0130	0.0075	0.3393	0.3392	0.270	0.261	0.405	0.3917	Clay	0.2840	5.17
0.667	0.0130	0.0075	0.1485	0.1481	0.180	0.170	0.270	0.2545	Clay	0.1981	10.05
0.667	0.0130	0.0100	1.1572	1.1580	0.473	0.523	0.710	0.7841	Clay	0.5296	11.96
0.667	0.0130	0.0100	0.5980	0.5980	0.325	0.331	0.488	0.4970	Clay	0.3499	7.66
0.667	0.0130	0.0100	0.3761	0.3760	0.250	0.255	0.375	0.3831	Clay	0.2786	11.43
0.667	0.0130	0.0100	0.1817	0.1814	0.173	0.175	0.260	0.2621	Clay	0.2028	17.25
0.667	0.0130	0.0125	1.3475	1.3475	0.490	0.545	0.735	0.8174	Clay	0.5504	12.32
0.667	0.0130	0.0125	0.7525	0.7525	0.346	0.356	0.519	0.5334	Clay	0.3726	7.70
0.667	0.0130	0.0125	0.4426	0.4430	0.260	0.263	0.390	0.3939	Clay	0.2853	9.74
0.667	0.0130	0.0125	0.2097	0.2096	0.173	0.178	0.260	0.2663	Clay	0.2055	18.78
0.833	0.0130	0.0005	0.4981	0.4982	0.567	0.697	0.680	0.8359	Clay	0.7024	23.88
0.833	0.0130	0.0005	0.4609	0.4611	0.546	0.643	0.655	0.7712	Clay	0.6519	19.39
0.833	0.0130	0.0005	0.3967	0.3967	0.473	0.569	0.568	0.6827	Clay	0.5826	23.17
0.833	0.0130	0.0005	0.3078	0.3078	0.421	0.479	0.505	0.5748	Clay	0.4982	18.33
0.833	0.0130	0.0005	0.1998	0.1998	0.310	0.371	0.372	0.4447	Clay	0.3964	27.87
0.833	0.0130	0.0005	0.1005	0.1005	0.214	0.256	0.257	0.3073	Clay	0.2889	35.00
0.833	0.0130	0.0010	0.7119	0.7120	0.572	0.706	0.686	0.8469	Clay	0.7111	24.32
0.833	0.0130	0.0010	0.6739	0.6748	0.542	0.663	0.650	0.7961	Clay	0.6713	23.86
0.833	0.0130	0.0010	0.5378	0.5378	0.466	0.552	0.559	0.6621	Clay	0.5665	21.56
0.833	0.0130	0.0010	0.4726	0.4726	0.425	0.505	0.510	0.6061	Clay	0.5226	22.97

Diameter (ft)	<i>n</i>	Slope (ft/ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.833	0.0130	0.0010	0.2788	0.2788	0.313	0.368	0.376	0.4414	Clay	0.3938	25.81
0.833	0.0130	0.0010	0.1247	0.1240	0.205	0.239	0.246	0.2873	Clay	0.2732	33.28
0.833	0.0130	0.0020	1.0087	1.0090	0.563	0.708	0.676	0.8491	Clay	0.7128	26.61
0.833	0.0130	0.0020	0.9380	0.9380	0.525	0.653	0.630	0.7838	Clay	0.6617	26.04
0.833	0.0130	0.0020	0.7963	0.7964	0.472	0.570	0.566	0.6846	Clay	0.5841	23.74
0.833	0.0130	0.0020	0.6830	0.6832	0.428	0.512	0.514	0.6148	Clay	0.5295	23.71
0.833	0.0130	0.0020	0.3847	0.3841	0.318	0.363	0.382	0.4353	Clay	0.3891	22.34
0.833	0.0130	0.0020	0.1616	0.1614	0.203	0.229	0.244	0.2747	Clay	0.2634	29.77
0.833	0.0130	0.0030	1.2099	1.2100	0.563	0.690	0.676	0.8275	Clay	0.6959	23.60
0.833	0.0130	0.0030	1.1236	1.1240	0.542	0.640	0.650	0.7678	Clay	0.6492	19.78
0.833	0.0130	0.0030	0.9221	0.9227	0.484	0.548	0.581	0.6573	Clay	0.5627	16.27
0.833	0.0130	0.0030	0.7456	0.7450	0.431	0.476	0.517	0.5707	Clay	0.4950	14.84
0.833	0.0130	0.0030	0.4542	0.4542	0.328	0.355	0.394	0.4265	Clay	0.3822	16.51
0.833	0.0130	0.0030	0.2180	0.2173	0.224	0.241	0.269	0.2887	Clay	0.2743	22.47
0.833	0.0130	0.0050	1.6572	1.6575	0.618	0.758	0.742	0.9094	Clay	0.7599	22.97
0.833	0.0130	0.0050	1.4698	1.4700	0.565	0.648	0.678	0.7772	Clay	0.6565	16.20
0.833	0.0130	0.0050	1.3625	1.3625	0.534	0.606	0.641	0.7278	Clay	0.6178	15.70
0.833	0.0130	0.0050	1.0971	1.0980	0.470	0.518	0.564	0.6214	Clay	0.5346	13.75
0.833	0.0130	0.0050	0.9268	0.9261	0.426	0.464	0.511	0.5573	Clay	0.4845	13.74
0.833	0.0130	0.0050	0.5305	0.5306	0.307	0.336	0.368	0.4036	Clay	0.3642	18.64
0.833	0.0130	0.0050	0.2568	0.2568	0.213	0.230	0.256	0.2754	Clay	0.2640	23.92
0.833	0.0130	0.0075	1.6924	1.6925	0.540	0.614	0.648	0.7363	Clay	0.6245	15.65
0.833	0.0130	0.0075	1.4349	1.4350	0.487	0.542	0.584	0.6500	Clay	0.5570	14.37
0.833	0.0130	0.0075	1.0820	1.0820	0.409	0.451	0.491	0.5411	Clay	0.4718	15.36
0.833	0.0130	0.0075	0.6440	0.6440	0.311	0.335	0.373	0.4016	Clay	0.3627	16.62
0.833	0.0130	0.0075	0.3458	0.3449	0.226	0.241	0.271	0.2891	Clay	0.2747	21.55
0.833	0.0130	0.0100	2.1959	2.1960	0.577	0.685	0.692	0.8219	Clay	0.6915	19.84
0.833	0.0130	0.0100	2.0073	2.0075	0.545	0.628	0.654	0.7532	Clay	0.6377	17.01
0.833	0.0130	0.0100	1.7324	1.7325	0.480	0.559	0.576	0.6710	Clay	0.5734	19.46
0.833	0.0130	0.0100	1.2920	1.2920	0.414	0.460	0.497	0.5524	Clay	0.4806	16.10
0.833	0.0130	0.0100	0.7269	0.7270	0.299	0.331	0.359	0.3966	Clay	0.3588	20.00
0.833	0.0130	0.0100	0.3832	0.3831	0.212	0.236	0.254	0.2831	Clay	0.2700	27.34
0.833	0.0130	0.0125	2.4030	2.4030	0.563	0.669	0.676	0.8031	Clay	0.6768	20.21
0.833	0.0130	0.0125	2.2076	2.2080	0.528	0.619	0.634	0.7426	Clay	0.6295	19.22
0.833	0.0130	0.0125	1.7950	1.7950	0.461	0.530	0.553	0.6359	Clay	0.5460	18.44
0.833	0.0130	0.0125	1.5122	1.5120	0.418	0.474	0.502	0.5684	Clay	0.4932	17.99
0.833	0.0130	0.0125	0.8809	0.8804	0.308	0.345	0.370	0.4146	Clay	0.3728	21.05
0.833	0.0130	0.0125	0.4313	0.4303	0.208	0.237	0.250	0.2840	Clay	0.2707	30.15
0.833	0.0130	0.0150	2.8578	2.8580	0.618	0.749	0.742	0.8988	Clay	0.7517	21.63
0.833	0.0130	0.0150	2.5374	2.5380	0.557	0.646	0.668	0.7748	Clay	0.6547	17.54

Diameter (ft)	<i>n</i>	Slope (ft/ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.833	0.0130	0.0150	2.3668	2.3670	0.526	0.608	0.631	0.7295	Clay	0.6192	17.72
0.833	0.0130	0.0150	1.8480	1.8480	0.457	0.508	0.548	0.6099	Clay	0.5257	15.02
0.833	0.0130	0.0150	1.4120	1.4120	0.392	0.430	0.470	0.5154	Clay	0.4517	15.24
0.833	0.0130	0.0150	0.8853	0.8854	0.300	0.330	0.360	0.3954	Clay	0.3579	19.29
0.833	0.0130	0.0150	0.4462	0.4462	0.215	0.230	0.258	0.2759	Clay	0.2643	22.93
1.000	0.0130	0.0005	0.8537	0.8540	0.856	0.915	0.856	0.9148	Clay	0.9170	7.13
1.000	0.0130	0.0005	0.8379	0.8380	0.803	0.877	0.803	0.8767	Clay	0.8813	9.75
1.000	0.0130	0.0005	0.7360	0.7360	0.754	0.759	0.754	0.7587	Clay	0.7705	2.19
1.000	0.0130	0.0005	0.6761	0.6762	0.694	0.707	0.694	0.7075	Clay	0.7224	4.09
1.000	0.0130	0.0005	0.6489	0.6496	0.650	0.686	0.650	0.6857	Clay	0.7019	7.99
1.000	0.0130	0.0005	0.5390	0.5390	0.592	0.603	0.592	0.6028	Clay	0.6241	5.43
1.000	0.0130	0.0005	0.5006	0.5006	0.558	0.575	0.558	0.5748	Clay	0.5978	7.14
1.000	0.0130	0.0005	0.4262	0.4261	0.502	0.521	0.502	0.5206	Clay	0.5469	8.94
1.000	0.0130	0.0005	0.2754	0.2754	0.412	0.406	0.412	0.4057	Clay	0.4391	6.57
2.000	0.0240	0.0020	3.7400	3.7400	1.200	1.213	0.600	0.6063	CMP	1.2548	4.56
2.000	0.0240	0.0020	5.4294	5.4300	1.600	1.623	0.800	0.8115	CMP	1.6401	2.51
3.000	0.0240	0.0018	3.0502	3.0500	0.900	0.914	0.300	0.3047	CMP	1.0329	14.76
3.000	0.0240	0.0020	5.3100	5.3100	1.190	1.192	0.397	0.3973	CMP	1.2937	8.71
3.000	0.0240	0.0020	8.4501	8.4500	1.520	1.541	0.507	0.5136	CMP	1.6210	6.64
3.000	0.0240	0.0019	10.739	10.7400	1.800	1.818	0.600	0.6060	CMP	1.8813	4.52
3.000	0.0240	0.0022	14.430	14.4300	2.110	2.128	0.703	0.7093	CMP	2.1724	2.96
3.000	0.0240	0.0019	15.510	15.5100	2.400	2.419	0.800	0.8065	CMP	2.4459	1.91
3.000	0.0240	0.0020	17.109	17.1100	2.620	2.753	0.873	0.9178	CMP	2.7594	5.32
0.667	0.0120	0.0030	0.2227	0.2220	0.221	0.255	0.332	0.3827	PVC	0.2783	25.92
0.667	0.0120	0.0030	0.4492	0.4490	0.329	0.382	0.494	0.5737	PVC	0.3979	20.93
0.667	0.0120	0.0030	0.6208	0.6210	0.397	0.479	0.596	0.7187	PVC	0.4886	23.08
0.667	0.0120	0.0030	0.6238	0.6240	0.398	0.481	0.597	0.7215	PVC	0.4903	23.20
0.667	0.0120	0.0063	0.5050	0.5050	0.272	0.328	0.408	0.4918	PVC	0.3466	27.42
0.667	0.0120	0.0063	0.1990	0.1990	0.169	0.198	0.254	0.2966	PVC	0.2244	32.79
0.667	0.0120	0.0063	0.4210	0.4210	0.251	0.295	0.377	0.4431	PVC	0.3161	25.94
0.667	0.0120	0.0063	0.6992	0.6990	0.334	0.400	0.501	0.6007	PVC	0.4148	24.18
0.667	0.0120	0.0063	0.9990	0.9990	0.417	0.525	0.626	0.7871	PVC	0.5314	27.44
0.667	0.0120	0.0105	0.2600	0.2600	0.172	0.199	0.258	0.2984	PVC	0.2256	31.15
0.667	0.0120	0.0105	0.4650	0.4650	0.231	0.271	0.347	0.4063	PVC	0.2931	26.87
0.667	0.0120	0.0105	1.1597	1.1600	0.394	0.479	0.591	0.7178	PVC	0.4880	23.87
0.667	0.0120	0.0105	0.3950	0.3950	0.212	0.248	0.318	0.3718	PVC	0.2715	28.07
1.000	0.0120	0.0030	0.5119	0.5120	0.285	0.335	0.285	0.3351	PVC	0.3728	30.82
1.000	0.0120	0.0030	0.8179	0.8180	0.362	0.432	0.362	0.4318	PVC	0.4635	28.05
1.000	0.0120	0.0030	1.1760	1.1760	0.439	0.533	0.439	0.5330	PVC	0.5585	27.23
1.000	0.0120	0.0030	1.6089	1.6090	0.521	0.653	0.521	0.6529	PVC	0.6711	28.82

Diameter (ft)	<i>n</i>	Slope (ft/ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
1.000	0.0120	0.0030	1.9150	1.9150	0.581	0.746	0.581	0.7459	PVC	0.7584	30.54
1.000	0.0120	0.0060	0.3980	0.3980	0.212	0.246	0.212	0.2464	PVC	0.2896	36.58
1.000	0.0120	0.0060	0.5510	0.5510	0.252	0.291	0.252	0.2908	PVC	0.3312	31.42
1.000	0.0120	0.0060	0.9799	0.9800	0.336	0.394	0.336	0.3940	PVC	0.4281	27.42
1.000	0.0120	0.0060	1.6070	1.6070	0.448	0.522	0.448	0.5220	PVC	0.5483	22.39
1.000	0.0120	0.0060	2.0124	2.0120	0.504	0.601	0.504	0.6008	PVC	0.6222	23.46
1.000	0.0120	0.0060	2.2479	2.2480	0.544	0.647	0.544	0.6474	PVC	0.6660	22.42
1.000	0.0120	0.0060	2.2859	2.2860	0.553	0.655	0.553	0.6550	PVC	0.6731	21.73
1.000	0.0120	0.0100	0.9239	0.9240	0.283	0.333	0.283	0.3331	PVC	0.3709	31.07
1.000	0.0120	0.0100	1.2539	1.2540	0.338	0.392	0.338	0.3921	PVC	0.4263	26.14
1.000	0.0120	0.0100	1.4937	1.4940	0.354	0.432	0.354	0.4318	PVC	0.4636	30.96
1.000	0.0120	0.0100	1.5148	1.5150	0.365	0.435	0.365	0.4352	PVC	0.4668	27.89
1.000	0.0120	0.0100	1.8087	1.8090	0.393	0.481	0.393	0.4815	PVC	0.5102	29.82
1.000	0.0120	0.0100	2.7470	2.7470	0.521	0.623	0.521	0.6235	PVC	0.6435	23.51
1.000	0.0120	0.0100	3.3360	3.3360	0.588	0.718	0.588	0.7177	PVC	0.7320	24.48
3.000	0.0120	0.0071	1.9996	2.0000	0.320	0.373	0.107	0.1242	HDPE	0.5243	63.86
3.000	0.0120	0.0071	10.010	10.0100	0.848	0.823	0.283	0.2743	HDPE	0.9471	11.68
3.000	0.0120	0.0071	18.030	18.0300	1.103	1.119	0.368	0.3730	HDPE	1.2251	11.07
3.000	0.0120	0.0071	26.059	26.0600	1.373	1.371	0.458	0.4571	HDPE	1.4619	6.47
3.000	0.0120	0.0071	34.130	34.1300	1.591	1.606	0.530	0.5355	HDPE	1.6827	5.76
3.000	0.0120	0.0071	39.260	39.2600	1.706	1.753	0.569	0.5844	HDPE	1.8204	6.70
3.000	0.0120	0.0135	2.0292	2.0300	0.293	0.322	0.098	0.1072	HDPE	0.4766	62.67
3.000	0.0120	0.0135	10.050	10.0500	0.709	0.701	0.236	0.2337	HDPE	0.8327	17.44
3.000	0.0120	0.0135	18.030	18.0300	0.975	0.944	0.325	0.3147	HDPE	1.0610	8.82
3.000	0.0120	0.0135	26.030	26.0300	1.197	1.147	0.399	0.3823	HDPE	1.2514	4.54
3.000	0.0120	0.0135	32.070	32.0700	1.338	1.286	0.446	0.4287	HDPE	1.3820	3.29
3.000	0.0120	0.0135	40.020	40.0200	1.497	1.459	0.499	0.4863	HDPE	1.5441	3.15
3.000	0.0120	0.0197	2.0000	2.0000	0.259	0.292	0.086	0.0973	HDPE	0.4487	73.25
3.000	0.0120	0.0197	10.010	10.0100	0.670	0.637	0.223	0.2122	HDPE	0.7723	15.27
3.000	0.0120	0.0197	18.100	18.1000	0.905	0.858	0.302	0.2860	HDPE	0.9802	8.31
3.000	0.0120	0.0197	26.739	26.7400	1.045	1.052	0.348	0.3505	HDPE	1.1619	11.18
3.000	0.0120	0.0197	31.090	31.0900	1.256	1.140	0.419	0.3800	HDPE	1.2448	0.89
3.000	0.0120	0.0197	40.070	40.0700	1.422	1.311	0.474	0.4369	HDPE	1.4050	1.20

Appendix D: Predicted Depth by Manning's Equation (Design *n* Value)

Diameter (ft)	<i>n</i>	Slope (ft/ft)	depth (ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.667	0.0130	0.0050	0.183	0.1401	0.1400	0.190	0.183	0.285	0.2737	Concrete	0.1986	4.53
0.667	0.0130	0.0050	0.250	0.2557	0.2550	0.250	0.250	0.375	0.3748	Concrete	0.2586	3.43
0.667	0.0130	0.0050	0.344	0.4501	0.4500	0.330	0.344	0.495	0.5154	Concrete	0.3419	3.62
0.667	0.0130	0.0050	0.416	0.6098	0.6100	0.396	0.416	0.594	0.6240	Concrete	0.4064	2.63
0.667	0.0130	0.0050	0.566	0.8799	0.8800	0.500	0.566	0.750	0.8479	Concrete	0.5392	7.85
0.667	0.0130	0.0050	0.644	0.9143	1.0200	0.580	0.644	0.870	0.9652	Concrete	0.6088	4.97
0.667	0.0130	0.0100	0.180	0.1931	0.1930	0.175	0.180	0.262	0.2701	Concrete	0.1965	12.27
0.667	0.0130	0.0100	0.285	0.4600	0.4600	0.260	0.285	0.390	0.4275	Concrete	0.2898	11.48
0.667	0.0130	0.0100	0.383	0.7604	0.7600	0.330	0.383	0.495	0.5748	Concrete	0.3772	14.31
0.667	0.0130	0.0100	0.477	1.0400	1.0400	0.420	0.477	0.630	0.7145	Concrete	0.4601	9.54
0.667	0.0130	0.0100	0.636	1.2989	1.5300	0.600	0.636	0.900	0.9535	Concrete	0.6019	0.31
0.667	0.0130	0.0100	0.618	1.3000	1.6400	0.640	0.618	0.960	0.9259	Concrete	0.5855	8.51
0.667	0.0130	0.0150	0.166	0.2001	0.2000	0.170	0.166	0.255	0.2482	Concrete	0.1835	7.92
0.667	0.0130	0.0150	0.252	0.4500	0.4500	0.250	0.252	0.375	0.3780	Concrete	0.2605	4.19
0.667	0.0130	0.0150	0.341	0.7701	0.7700	0.330	0.341	0.495	0.5116	Concrete	0.3397	2.95
0.667	0.0130	0.0150	0.433	1.1197	1.1200	0.420	0.433	0.630	0.6496	Concrete	0.4216	0.38
0.667	0.0130	0.0150	0.554	1.4999	1.5000	0.500	0.554	0.750	0.8313	Concrete	0.5293	5.87
0.667	0.0130	0.0150	0.633	1.5925	1.7300	0.570	0.633	0.855	0.9486	Concrete	0.5989	5.08
0.667	0.0130	0.0200	0.165	0.2301	0.2300	0.170	0.165	0.255	0.2477	Concrete	0.1832	7.74
0.667	0.0130	0.0200	0.263	0.5606	0.5600	0.250	0.263	0.375	0.3939	Concrete	0.2699	7.96
0.667	0.0130	0.0200	0.330	0.8401	0.8400	0.320	0.330	0.480	0.4947	Concrete	0.3297	3.03
0.667	0.0130	0.0200	0.433	1.2897	1.2900	0.420	0.433	0.630	0.6485	Concrete	0.4209	0.22
0.667	0.0130	0.0200	0.533	1.6696	1.6700	0.500	0.533	0.750	0.7986	Concrete	0.5100	2.00
0.667	0.0130	0.0200	0.644	1.8286	2.0000	0.580	0.644	0.870	0.9652	Concrete	0.6088	4.97
0.667	0.0130	0.0300	0.151	0.2356	0.2350	0.160	0.151	0.240	0.2264	Concrete	0.1705	6.59
0.667	0.0130	0.0300	0.227	0.5210	0.5200	0.240	0.227	0.360	0.3398	Concrete	0.2378	0.92
0.667	0.0130	0.0300	0.325	1.0004	1.0000	0.340	0.325	0.510	0.4866	Concrete	0.3249	4.44
0.667	0.0130	0.0300	0.397	1.3891	1.3900	0.420	0.397	0.630	0.5948	Concrete	0.3891	7.36
0.667	0.0130	0.0300	0.399	1.4004	1.4000	0.500	0.399	0.750	0.5980	Concrete	0.3909	21.81
0.667	0.0130	0.0300	0.631	2.2528	2.4800	0.610	0.631	0.915	0.9466	Concrete	0.5977	2.01
0.667	0.0130	0.0400	0.146	0.2551	0.2550	0.160	0.146	0.240	0.2193	Concrete	0.1663	3.93
0.667	0.0130	0.0400	0.230	0.6201	0.6200	0.250	0.230	0.375	0.3453	Concrete	0.2410	3.58
0.667	0.0130	0.0400	0.307	1.0500	1.0500	0.330	0.307	0.495	0.4606	Concrete	0.3095	6.22
0.667	0.0130	0.0400	0.391	1.5700	1.5700	0.420	0.391	0.630	0.5866	Concrete	0.3842	8.52
0.667	0.0130	0.0400	0.487	2.1391	2.1400	0.500	0.487	0.750	0.7308	Concrete	0.4697	6.05
0.667	0.0130	0.0400	0.636	2.5978	2.7600	0.600	0.636	0.900	0.9535	Concrete	0.6019	0.31
0.333	0.0130	0.0005	0.333	0.0433	0.0426	0.328	0.333	0.984	0.9982	Concrete	0.3140	4.26
0.333	0.0130	0.0005	0.251	0.0390	0.0386	0.282	0.251	0.846	0.7529	Concrete	0.2413	14.42

Diameter (ft)	<i>n</i>	Slope (ft/ft)	depth (ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.333	0.0130	0.0005	0.221	0.0332	0.0335	0.247	0.221	0.741	0.6643	Concrete	0.2151	12.93
0.333	0.0130	0.0005	0.159	0.0196	0.0196	0.206	0.159	0.618	0.4773	Concrete	0.1596	22.52
0.333	0.0130	0.0005	0.123	0.0124	0.0120	0.167	0.123	0.501	0.3691	Concrete	0.1275	23.64
0.333	0.0130	0.0010	0.311	0.0647	0.0650	0.311	0.311	0.933	0.9330	Concrete	0.2947	5.24
0.333	0.0130	0.0010	0.247	0.0542	0.0550	0.274	0.247	0.822	0.7418	Concrete	0.2380	13.13
0.333	0.0130	0.0010	0.214	0.0446	0.0450	0.239	0.214	0.717	0.6414	Concrete	0.2083	12.87
0.333	0.0130	0.0010	0.190	0.0374	0.0375	0.210	0.190	0.630	0.5711	Concrete	0.1874	10.76
0.333	0.0130	0.0010	0.139	0.0219	0.0218	0.163	0.139	0.489	0.4169	Concrete	0.1417	13.07
0.333	0.0130	0.0010	0.086	0.0088	0.0083	0.118	0.086	0.354	0.2585	Concrete	0.0947	19.72
0.333	0.0130	0.0020	0.256	0.0796	0.0800	0.271	0.256	0.813	0.7675	Concrete	0.2456	9.36
0.333	0.0130	0.0020	0.217	0.0644	0.0650	0.243	0.217	0.729	0.6503	Concrete	0.2109	13.21
0.333	0.0130	0.0020	0.193	0.0542	0.0544	0.215	0.193	0.645	0.5800	Concrete	0.1900	11.61
0.333	0.0130	0.0020	0.132	0.0282	0.0280	0.162	0.132	0.486	0.3966	Concrete	0.1357	16.25
0.333	0.0130	0.0020	0.090	0.0135	0.0127	0.124	0.090	0.372	0.2693	Concrete	0.0979	21.02
0.333	0.0130	0.0030	0.333	0.1042	0.1014	0.323	0.333	0.969	1.0000	Concrete	0.3146	2.61
0.333	0.0130	0.0030	0.274	0.1045	0.1041	0.295	0.274	0.885	0.8225	Concrete	0.2619	11.21
0.333	0.0130	0.0030	0.253	0.0963	0.0969	0.271	0.253	0.813	0.7585	Concrete	0.2430	10.34
0.333	0.0130	0.0030	0.228	0.0846	0.0848	0.243	0.228	0.729	0.6836	Concrete	0.2208	9.15
0.333	0.0130	0.0030	0.180	0.0591	0.0591	0.211	0.180	0.633	0.5390	Concrete	0.1779	15.68
0.333	0.0130	0.0030	0.123	0.0304	0.0298	0.160	0.123	0.480	0.3699	Concrete	0.1278	20.15
0.333	0.0130	0.0050	0.326	0.1425	0.1415	0.315	0.326	0.945	0.9781	Concrete	0.3081	2.20
0.333	0.0130	0.0050	0.252	0.1237	0.1235	0.276	0.252	0.828	0.7555	Concrete	0.2421	12.29
0.333	0.0130	0.0050	0.213	0.0995	0.0996	0.243	0.213	0.729	0.6399	Concrete	0.2078	14.48
0.333	0.0130	0.0050	0.183	0.0788	0.0788	0.212	0.183	0.636	0.5499	Concrete	0.1811	14.57
0.333	0.0130	0.0050	0.138	0.0482	0.0478	0.170	0.138	0.510	0.4135	Concrete	0.1407	17.24
0.333	0.0130	0.0050	0.087	0.0201	0.0200	0.121	0.087	0.363	0.2612	Concrete	0.0955	21.05
0.333	0.0130	0.0125	0.295	0.2248	0.2250	0.301	0.295	0.903	0.8839	Concrete	0.2801	6.93
0.333	0.0130	0.0125	0.273	0.2125	0.2124	0.287	0.273	0.861	0.8188	Concrete	0.2608	9.11
0.333	0.0130	0.0125	0.221	0.1656	0.1656	0.242	0.221	0.726	0.6634	Concrete	0.2148	11.24
0.333	0.0130	0.0125	0.195	0.1377	0.1377	0.204	0.195	0.612	0.5856	Concrete	0.1917	6.02
0.333	0.0130	0.0125	0.138	0.0761	0.0760	0.196	0.138	0.588	0.4133	Concrete	0.1406	28.26
0.333	0.0130	0.0125	0.100	0.0417	0.0416	0.133	0.100	0.399	0.3001	Concrete	0.1071	19.50
0.333	0.0130	0.0150	0.312	0.2507	0.2544	0.314	0.312	0.942	0.9373	Concrete	0.2960	5.74
0.333	0.0130	0.0150	0.292	0.2448	0.2456	0.302	0.292	0.906	0.8748	Concrete	0.2774	8.13
0.333	0.0130	0.0150	0.261	0.2229	0.2236	0.274	0.261	0.822	0.7830	Concrete	0.2502	8.68
0.333	0.0130	0.0150	0.228	0.1893	0.1892	0.255	0.228	0.765	0.6842	Concrete	0.2209	13.36
0.333	0.0130	0.0150	0.195	0.1505	0.1506	0.224	0.195	0.672	0.5848	Concrete	0.1915	14.52
0.333	0.0130	0.0150	0.139	0.0849	0.0848	0.159	0.139	0.477	0.4175	Concrete	0.1419	10.78
0.333	0.0130	0.0150	0.099	0.0446	0.0438	0.123	0.099	0.369	0.2964	Concrete	0.1060	13.85
0.417	0.0130	0.0005	0.300	0.0671	0.0671	0.308	0.300	0.739	0.7210	Concrete	0.2898	5.90

Diameter (ft)	<i>n</i>	Slope (ft/ft)	depth (ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.417	0.0130	0.0005	0.197	0.0349	0.0346	0.221	0.197	0.530	0.4721	Concrete	0.1976	10.61
0.417	0.0130	0.0010	0.305	0.0968	0.0969	0.293	0.305	0.703	0.7329	Concrete	0.2942	0.42
0.417	0.0130	0.0010	0.186	0.0449	0.0448	0.206	0.186	0.494	0.4471	Concrete	0.1883	8.58
0.417	0.0130	0.0010	0.120	0.0198	0.0196	0.134	0.120	0.322	0.2883	Concrete	0.1295	3.39
0.417	0.0130	0.0020	0.389	0.1659	0.1840	0.393	0.389	0.943	0.9338	Concrete	0.3687	6.19
0.417	0.0130	0.0020	0.358	0.1602	0.1608	0.317	0.358	0.761	0.8591	Concrete	0.3410	7.56
0.417	0.0130	0.0020	0.220	0.0848	0.0848	0.233	0.220	0.559	0.5291	Concrete	0.2187	6.14
0.417	0.0130	0.0020	0.157	0.0467	0.0465	0.171	0.157	0.410	0.3772	Concrete	0.1624	5.02
0.417	0.0130	0.0020	0.115	0.0258	0.0256	0.126	0.115	0.302	0.2764	Concrete	0.1251	0.75
0.417	0.0130	0.0030	0.333	0.1843	0.1853	0.310	0.333	0.744	0.7984	Concrete	0.3185	2.74
0.417	0.0130	0.0030	0.193	0.0829	0.0828	0.209	0.193	0.502	0.4636	Concrete	0.1944	6.98
0.417	0.0130	0.0050	0.289	0.2019	0.2020	0.278	0.289	0.667	0.6938	Concrete	0.2797	0.63
0.417	0.0130	0.0050	0.188	0.1023	0.1023	0.193	0.188	0.463	0.4518	Concrete	0.1900	1.53
0.417	0.0130	0.0050	0.144	0.0626	0.0622	0.159	0.144	0.382	0.3454	Concrete	0.1506	5.26
0.417	0.0130	0.0075	0.389	0.3213	0.3563	0.393	0.389	0.943	0.9338	Concrete	0.3687	6.19
0.417	0.0130	0.0075	0.196	0.1345	0.1349	0.196	0.196	0.470	0.4704	Concrete	0.1969	0.48
0.417	0.0130	0.0075	0.142	0.0748	0.0748	0.146	0.142	0.350	0.3411	Concrete	0.1490	2.07
0.417	0.0130	0.0075	0.108	0.0441	0.0439	0.126	0.108	0.302	0.2596	Concrete	0.1188	5.69
0.417	0.0130	0.0100	0.390	0.3711	0.4282	0.404	0.390	0.970	0.9357	Concrete	0.3694	8.57
0.417	0.0130	0.0100	0.309	0.3102	0.3105	0.298	0.309	0.715	0.7412	Concrete	0.2973	0.24
0.417	0.0130	0.0100	0.250	0.2318	0.2318	0.224	0.250	0.538	0.6000	Concrete	0.2450	9.37
0.417	0.0130	0.0100	0.203	0.1645	0.1644	0.195	0.203	0.468	0.4862	Concrete	0.2028	4.00
0.417	0.0130	0.0100	0.131	0.0736	0.0736	0.135	0.131	0.324	0.3137	Concrete	0.1389	2.87
0.417	0.0130	0.0125	0.323	0.3656	0.3660	0.312	0.323	0.749	0.7764	Concrete	0.3103	0.53
0.417	0.0130	0.0125	0.256	0.2687	0.2688	0.231	0.256	0.554	0.6144	Concrete	0.2503	8.37
0.417	0.0130	0.0125	0.206	0.1896	0.1892	0.188	0.206	0.451	0.4951	Concrete	0.2061	9.63
0.417	0.0130	0.0125	0.139	0.0923	0.0920	0.129	0.139	0.310	0.3330	Concrete	0.1460	13.20
0.417	0.0130	0.0150	0.387	0.4542	0.5162	0.401	0.387	0.962	0.9287	Concrete	0.3668	8.53
0.417	0.0130	0.0150	0.391	0.4545	0.4565	0.323	0.391	0.775	0.9395	Concrete	0.3708	14.80
0.417	0.0130	0.0150	0.268	0.3150	0.3150	0.261	0.268	0.626	0.6434	Concrete	0.2611	0.02
0.417	0.0130	0.0150	0.174	0.1544	0.1548	0.176	0.174	0.422	0.4182	Concrete	0.1776	0.91
0.500	0.0130	0.0005	0.468	0.1349	0.1366	0.492	0.468	0.984	0.9355	Concrete	0.4432	9.93
0.500	0.0130	0.0005	0.311	0.0889	0.0888	0.391	0.311	0.782	0.6214	Concrete	0.3035	22.38
0.500	0.0130	0.0005	0.212	0.0469	0.0463	0.282	0.212	0.564	0.4238	Concrete	0.2156	23.55
0.500	0.0130	0.0005	0.180	0.0348	0.0343	0.225	0.180	0.450	0.3600	Concrete	0.1872	16.79
0.500	0.0130	0.0005	0.138	0.0210	0.0206	0.173	0.138	0.346	0.2769	Concrete	0.1503	13.14
0.500	0.0130	0.0010	0.467	0.1908	0.2187	0.484	0.467	0.968	0.9341	Concrete	0.4426	8.56
0.500	0.0130	0.0010	0.415	0.1793	0.1795	0.348	0.415	0.696	0.8294	Concrete	0.3960	13.79
0.500	0.0130	0.0010	0.280	0.1070	0.1070	0.298	0.280	0.596	0.5600	Concrete	0.2762	7.32
0.500	0.0130	0.0010	0.189	0.0537	0.0535	0.222	0.189	0.444	0.3774	Concrete	0.1950	12.17

Diameter (ft)	<i>n</i>	Slope (ft/ft)	depth (ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.500	0.0130	0.0010	0.140	0.0302	0.0295	0.176	0.140	0.352	0.2790	Concrete	0.1512	14.07
0.500	0.0130	0.0020	0.388	0.2374	0.2378	0.371	0.388	0.742	0.7752	Concrete	0.3719	0.24
0.500	0.0130	0.0020	0.288	0.1578	0.1578	0.293	0.288	0.586	0.5751	Concrete	0.2829	3.45
0.500	0.0130	0.0020	0.145	0.0461	0.0459	0.170	0.145	0.340	0.2904	Concrete	0.1563	8.06
0.500	0.0130	0.0030	0.426	0.3170	0.3177	0.383	0.426	0.766	0.8513	Concrete	0.4057	5.93
0.500	0.0130	0.0030	0.275	0.1795	0.1795	0.273	0.275	0.546	0.5491	Concrete	0.2713	0.61
0.500	0.0130	0.0030	0.216	0.1190	0.1190	0.222	0.216	0.444	0.4320	Concrete	0.2193	1.23
0.500	0.0130	0.0030	0.143	0.0551	0.0550	0.164	0.143	0.328	0.2867	Concrete	0.1546	5.70
0.500	0.0130	0.0050	0.468	0.4267	0.4335	0.480	0.468	0.960	0.9360	Concrete	0.4434	7.63
0.500	0.0130	0.0050	0.403	0.3906	0.3915	0.385	0.403	0.770	0.8060	Concrete	0.3856	0.16
0.500	0.0130	0.0050	0.257	0.2082	0.2082	0.270	0.257	0.540	0.5147	Concrete	0.2560	5.18
0.500	0.0130	0.0050	0.193	0.1254	0.1250	0.210	0.193	0.420	0.3863	Concrete	0.1990	5.26
0.500	0.0130	0.0050	0.133	0.0616	0.0615	0.151	0.133	0.302	0.2663	Concrete	0.1456	3.59
0.500	0.0130	0.0075	0.395	0.4688	0.4691	0.384	0.395	0.768	0.7897	Concrete	0.3783	1.47
0.500	0.0130	0.0075	0.265	0.2680	0.2680	0.272	0.265	0.544	0.5302	Concrete	0.2629	3.33
0.500	0.0130	0.0075	0.198	0.1605	0.1602	0.212	0.198	0.424	0.3957	Concrete	0.2031	4.18
0.500	0.0130	0.0075	0.122	0.0636	0.0633	0.142	0.122	0.284	0.2443	Concrete	0.1358	4.37
0.500	0.0130	0.0100	0.468	0.6035	0.6238	0.473	0.468	0.946	0.9365	Concrete	0.4436	6.21
0.500	0.0130	0.0100	0.356	0.4806	0.4807	0.365	0.356	0.730	0.7125	Concrete	0.3440	5.75
0.500	0.0130	0.0100	0.270	0.3186	0.3186	0.278	0.270	0.556	0.5397	Concrete	0.2671	3.90
0.500	0.0130	0.0100	0.206	0.1992	0.1991	0.212	0.206	0.424	0.4116	Concrete	0.2102	0.85
0.500	0.0130	0.0100	0.136	0.0906	0.0904	0.144	0.136	0.288	0.2718	Concrete	0.1480	2.78
0.667	0.0130	0.0005	0.622	0.2906	0.3096	0.645	0.622	0.968	0.9336	Concrete	0.5898	8.56
0.667	0.0130	0.0005	0.594	0.2866	0.2873	0.547	0.594	0.821	0.8905	Concrete	0.5642	3.14
0.667	0.0130	0.0005	0.454	0.2183	0.2187	0.479	0.454	0.719	0.6816	Concrete	0.4404	8.06
0.667	0.0130	0.0005	0.422	0.1965	0.1957	0.426	0.422	0.639	0.6326	Concrete	0.4113	3.45
0.667	0.0130	0.0005	0.297	0.1107	0.1105	0.319	0.297	0.479	0.4458	Concrete	0.3005	5.79
0.667	0.0130	0.0005	0.236	0.0723	0.0720	0.258	0.236	0.387	0.3534	Concrete	0.2457	4.75
0.667	0.0130	0.0010	0.615	0.4103	0.4440	0.654	0.615	0.981	0.9221	Concrete	0.5830	10.86
0.667	0.0130	0.0010	0.626	0.4110	0.4261	0.625	0.626	0.938	0.9387	Concrete	0.5928	5.16
0.667	0.0130	0.0010	0.612	0.4099	0.4104	0.554	0.612	0.831	0.9183	Concrete	0.5807	4.82
0.667	0.0130	0.0010	0.476	0.3283	0.3278	0.481	0.476	0.722	0.7143	Concrete	0.4597	4.42
0.667	0.0130	0.0010	0.428	0.2839	0.2839	0.428	0.428	0.642	0.6420	Concrete	0.4169	2.60
0.667	0.0130	0.0010	0.305	0.1638	0.1638	0.311	0.305	0.467	0.4575	Concrete	0.3074	1.15
0.667	0.0130	0.0010	0.248	0.1130	0.1130	0.253	0.248	0.380	0.3727	Concrete	0.2572	1.66
0.667	0.0130	0.0010	0.158	0.0468	0.0462	0.177	0.158	0.266	0.2363	Concrete	0.1763	0.39
0.667	0.0130	0.0020	0.618	0.5806	0.6496	0.640	0.618	0.960	0.9264	Concrete	0.5855	8.52
0.667	0.0130	0.0020	0.627	0.5812	0.6035	0.565	0.627	0.848	0.9407	Concrete	0.5940	5.13
0.667	0.0130	0.0020	0.514	0.5085	0.5090	0.496	0.514	0.744	0.7712	Concrete	0.4935	0.50
0.667	0.0130	0.0020	0.456	0.4387	0.4387	0.448	0.456	0.672	0.6840	Concrete	0.4418	1.39

Diameter (ft)	<i>n</i>	Slope (ft/ft)	depth (ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.667	0.0130	0.0020	0.327	0.2616	0.2616	0.335	0.327	0.503	0.4907	Concrete	0.3271	2.35
0.667	0.0130	0.0030	0.626	0.7118	0.7750	0.623	0.626	0.935	0.9392	Concrete	0.5931	4.80
0.667	0.0130	0.0030	0.630	0.7116	0.7240	0.553	0.630	0.830	0.9453	Concrete	0.5967	7.91
0.667	0.0130	0.0030	0.514	0.6223	0.6224	0.489	0.514	0.734	0.7708	Concrete	0.4932	0.87
0.667	0.0130	0.0030	0.460	0.5438	0.5440	0.445	0.460	0.668	0.6901	Concrete	0.4454	0.09
0.667	0.0130	0.0030	0.336	0.3354	0.3354	0.341	0.336	0.512	0.5040	Concrete	0.3351	1.74
0.667	0.0130	0.0030	0.244	0.1891	0.1886	0.262	0.244	0.393	0.3659	Concrete	0.2531	3.38
0.667	0.0130	0.0030	0.159	0.0826	0.0824	0.182	0.159	0.273	0.2385	Concrete	0.1776	2.40
0.667	0.0130	0.0050	0.625	0.9190	1.0164	0.628	0.625	0.942	0.9373	Concrete	0.5920	5.74
0.667	0.0130	0.0050	0.626	0.9190	0.9930	0.623	0.626	0.935	0.9392	Concrete	0.5931	4.80
0.667	0.0130	0.0050	0.600	0.9107	0.9108	0.566	0.600	0.849	0.9004	Concrete	0.5701	0.72
0.667	0.0130	0.0050	0.514	0.8028	0.8028	0.512	0.514	0.768	0.7703	Concrete	0.4929	3.73
0.667	0.0130	0.0050	0.432	0.6439	0.6440	0.443	0.432	0.665	0.6484	Concrete	0.4206	5.05
0.667	0.0130	0.0050	0.303	0.3612	0.3610	0.318	0.303	0.477	0.4539	Concrete	0.3053	3.99
0.667	0.0130	0.0050	0.253	0.2613	0.2608	0.270	0.253	0.405	0.3795	Concrete	0.2612	3.25
0.667	0.0130	0.0050	0.165	0.1143	0.1140	0.189	0.165	0.284	0.2470	Concrete	0.1827	3.35
0.667	0.0130	0.0075	0.625	1.1255	1.2280	0.633	0.625	0.950	0.9370	Concrete	0.5918	6.51
0.667	0.0130	0.0075	0.574	1.0876	1.0880	0.546	0.574	0.819	0.8604	Concrete	0.5463	0.06
0.667	0.0130	0.0075	0.505	0.9656	0.9658	0.495	0.505	0.743	0.7578	Concrete	0.4855	1.91
0.667	0.0130	0.0075	0.445	0.8204	0.8204	0.442	0.445	0.663	0.6668	Concrete	0.4316	2.36
0.667	0.0130	0.0075	0.326	0.5043	0.5042	0.335	0.326	0.503	0.4893	Concrete	0.3263	2.59
0.667	0.0130	0.0075	0.249	0.3099	0.3096	0.260	0.249	0.390	0.3730	Concrete	0.2573	1.02
0.667	0.0130	0.0075	0.153	0.1215	0.1215	0.170	0.153	0.255	0.2301	Concrete	0.1727	1.56
0.667	0.0130	0.0100	0.622	1.2994	1.3580	0.645	0.622	0.968	0.9336	Concrete	0.5898	8.56
0.667	0.0130	0.0100	0.582	1.2676	1.2680	0.559	0.582	0.839	0.8729	Concrete	0.5538	0.93
0.667	0.0130	0.0100	0.479	1.0464	1.0470	0.464	0.479	0.696	0.7188	Concrete	0.4624	0.35
0.667	0.0130	0.0100	0.422	0.8788	0.8788	0.415	0.422	0.623	0.6326	Concrete	0.4113	0.89
0.667	0.0130	0.0100	0.310	0.5318	0.5318	0.309	0.310	0.464	0.4644	Concrete	0.3115	0.82
0.667	0.0130	0.0100	0.222	0.2899	0.2899	0.225	0.222	0.338	0.3335	Concrete	0.2339	3.97
0.667	0.0130	0.0100	0.147	0.1285	0.1283	0.153	0.147	0.230	0.2202	Concrete	0.1668	8.99
0.667	0.0130	0.0125	0.630	1.4524	1.4880	0.600	0.630	0.900	0.9455	Concrete	0.5968	0.53
0.667	0.0130	0.0125	0.627	1.4529	1.4700	0.593	0.627	0.890	0.9412	Concrete	0.5943	0.21
0.667	0.0130	0.0125	0.576	1.4077	1.4080	0.553	0.576	0.830	0.8637	Concrete	0.5483	0.85
0.667	0.0130	0.0125	0.490	1.2040	1.2040	0.487	0.490	0.731	0.7357	Concrete	0.4724	2.99
0.667	0.0130	0.0125	0.425	0.9928	0.9928	0.426	0.425	0.639	0.6372	Concrete	0.4140	2.82
0.667	0.0130	0.0125	0.318	0.6224	0.6224	0.324	0.318	0.486	0.4767	Concrete	0.3189	1.58
0.667	0.0130	0.0125	0.236	0.3622	0.3620	0.244	0.236	0.366	0.3537	Concrete	0.2459	0.78
0.667	0.0130	0.0125	0.155	0.1605	0.1602	0.163	0.155	0.245	0.2327	Concrete	0.1742	6.87
0.667	0.0130	0.0150	0.624	1.5916	1.6450	0.634	0.624	0.951	0.9355	Concrete	0.5909	6.80
0.667	0.0130	0.0150	0.626	1.5917	1.6425	0.616	0.626	0.924	0.9390	Concrete	0.5930	3.74

Diameter (ft)	<i>n</i>	Slope (ft/ft)	depth (ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.667	0.0130	0.0150	0.557	1.5052	1.5060	0.545	0.557	0.818	0.8361	Concrete	0.5319	2.40
0.667	0.0130	0.0150	0.482	1.2900	1.2900	0.482	0.482	0.723	0.7225	Concrete	0.4646	3.61
0.667	0.0130	0.0150	0.405	1.0139	1.0140	0.414	0.405	0.621	0.6078	Concrete	0.3966	4.20
0.667	0.0130	0.0150	0.310	0.6527	0.6524	0.323	0.310	0.485	0.4649	Concrete	0.3119	3.45
0.667	0.0130	0.0150	0.235	0.3929	0.3925	0.245	0.235	0.368	0.3518	Concrete	0.2448	0.08
0.667	0.0130	0.0150	0.160	0.1880	0.1879	0.165	0.160	0.248	0.2407	Concrete	0.1789	8.43
0.833	0.0130	0.0005	0.833	#NUM!	0.4818	0.818	0.833	0.982	1.0000	Concrete	0.7864	3.86
0.833	0.0130	0.0005	0.821	0.5141	0.5150	0.783	0.821	0.940	0.9855	Concrete	0.7757	0.94
0.833	0.0130	0.0005	0.720	0.5108	0.5114	0.739	0.720	0.887	0.8645	Concrete	0.6860	7.17
0.833	0.0130	0.0005	0.684	0.4902	0.4910	0.706	0.684	0.847	0.8204	Concrete	0.6533	7.46
0.833	0.0130	0.0005	0.608	0.4324	0.4324	0.616	0.608	0.739	0.7299	Concrete	0.5862	4.84
0.833	0.0130	0.0005	0.593	0.4187	0.4188	0.579	0.593	0.695	0.7113	Concrete	0.5725	1.13
0.833	0.0130	0.0005	0.537	0.3659	0.3660	0.551	0.537	0.661	0.6444	Concrete	0.5229	5.11
0.833	0.0130	0.0005	0.450	0.2780	0.2780	0.474	0.450	0.569	0.5395	Concrete	0.4451	6.10
0.833	0.0130	0.0005	0.412	0.2401	0.2408	0.416	0.412	0.499	0.4942	Concrete	0.4115	1.07
0.833	0.0130	0.0005	0.313	0.1471	0.1470	0.323	0.313	0.388	0.3757	Concrete	0.3237	0.22
0.833	0.0130	0.0005	0.232	0.0833	0.0832	0.241	0.232	0.289	0.2790	Concrete	0.2520	4.57
0.833	0.0130	0.0010	0.824	0.7233	0.7240	0.814	0.824	0.977	0.9888	Concrete	0.7781	4.41
0.833	0.0130	0.0010	0.781	0.7452	0.7510	0.811	0.781	0.973	0.9378	Concrete	0.7403	8.72
0.833	0.0130	0.0010	0.781	0.7452	0.7780	0.789	0.781	0.947	0.9373	Concrete	0.7400	6.21
0.833	0.0130	0.0010	0.799	0.7426	0.7615	0.739	0.799	0.887	0.9583	Concrete	0.7555	2.24
0.833	0.0130	0.0010	0.744	0.7355	0.7360	0.710	0.744	0.852	0.8923	Concrete	0.7066	0.48
0.833	0.0130	0.0010	0.683	0.6928	0.6930	0.670	0.683	0.804	0.8197	Concrete	0.6528	2.57
0.833	0.0130	0.0010	0.622	0.6278	0.6278	0.617	0.622	0.740	0.7461	Concrete	0.5982	3.04
0.833	0.0130	0.0010	0.595	0.5954	0.5954	0.593	0.595	0.712	0.7144	Concrete	0.5748	3.08
0.833	0.0130	0.0010	0.550	0.5354	0.5354	0.557	0.550	0.668	0.6600	Concrete	0.5344	4.06
0.833	0.0130	0.0010	0.486	0.4454	0.4462	0.486	0.486	0.583	0.5832	Concrete	0.4775	1.75
0.833	0.0130	0.0010	0.430	0.3650	0.3650	0.423	0.430	0.508	0.5158	Concrete	0.4275	1.07
0.833	0.0130	0.0010	0.307	0.2000	0.1998	0.322	0.307	0.386	0.3679	Concrete	0.3179	1.26
0.833	0.0130	0.0010	0.226	0.1112	0.1110	0.238	0.226	0.286	0.2709	Concrete	0.2461	3.39
0.833	0.0130	0.0020	0.782	1.0538	1.0960	0.738	0.782	0.886	0.9387	Concrete	0.7410	0.41
0.833	0.0130	0.0020	0.784	1.0537	1.0600	0.708	0.784	0.850	0.9413	Concrete	0.7429	4.94
0.833	0.0130	0.0020	0.709	1.0099	1.0105	0.667	0.709	0.800	0.8505	Concrete	0.6756	1.29
0.833	0.0130	0.0020	0.658	0.9446	0.9448	0.621	0.658	0.745	0.7892	Concrete	0.6302	1.48
0.833	0.0130	0.0020	0.608	0.8637	0.8639	0.594	0.608	0.713	0.7291	Concrete	0.5856	1.41
0.833	0.0130	0.0020	0.572	0.7995	0.7996	0.561	0.572	0.673	0.6866	Concrete	0.5542	1.22
0.833	0.0130	0.0020	0.484	0.6251	0.6251	0.483	0.484	0.580	0.5804	Concrete	0.4754	1.57
0.833	0.0130	0.0020	0.431	0.5188	0.5188	0.439	0.431	0.527	0.5174	Concrete	0.4287	2.35
0.833	0.0130	0.0020	0.421	0.4982	0.4982	0.429	0.421	0.515	0.5050	Concrete	0.4196	2.20
0.833	0.0130	0.0020	0.331	0.3252	0.3250	0.343	0.331	0.412	0.3967	Concrete	0.3393	1.09

Diameter (ft)	<i>n</i>	Slope (ft/ft)	depth (ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.833	0.0130	0.0020	0.216	0.1441	0.1437	0.248	0.216	0.298	0.2591	Concrete	0.2373	4.31
0.833	0.0130	0.0030	0.778	1.2904	1.3400	0.813	0.778	0.976	0.9332	Concrete	0.7369	9.36
0.833	0.0130	0.0030	0.772	1.2894	1.3380	0.810	0.772	0.972	0.9265	Concrete	0.7319	9.64
0.833	0.0130	0.0030	0.782	1.2906	1.3800	0.790	0.782	0.948	0.9381	Concrete	0.7406	6.26
0.833	0.0130	0.0030	0.784	1.2906	1.3450	0.740	0.784	0.888	0.9413	Concrete	0.7429	0.39
0.833	0.0130	0.0030	0.786	1.2904	1.3280	0.715	0.786	0.858	0.9432	Concrete	0.7443	4.10
0.833	0.0130	0.0030	0.707	1.2352	1.2360	0.663	0.707	0.796	0.8489	Concrete	0.6744	1.73
0.833	0.0130	0.0030	0.671	1.1798	1.1800	0.636	0.671	0.763	0.8049	Concrete	0.6418	0.92
0.833	0.0130	0.0030	0.621	1.0860	1.0860	0.598	0.621	0.718	0.7452	Concrete	0.5976	0.07
0.833	0.0130	0.0030	0.563	0.9585	0.9586	0.554	0.563	0.665	0.6759	Concrete	0.5462	1.41
0.833	0.0130	0.0030	0.501	0.8092	0.8092	0.498	0.501	0.598	0.6015	Concrete	0.4911	1.39
0.833	0.0130	0.0030	0.430	0.6332	0.6332	0.436	0.430	0.523	0.5163	Concrete	0.4279	1.86
0.833	0.0130	0.0030	0.322	0.3795	0.3791	0.339	0.322	0.407	0.3865	Concrete	0.3317	2.16
0.833	0.0130	0.0030	0.221	0.1853	0.1853	0.243	0.221	0.292	0.2657	Concrete	0.2422	0.34
0.833	0.0130	0.0050	0.781	1.6662	1.7350	0.789	0.781	0.947	0.9373	Concrete	0.7400	6.21
0.833	0.0130	0.0050	0.785	1.6660	1.7300	0.741	0.785	0.889	0.9426	Concrete	0.7438	0.38
0.833	0.0130	0.0050	0.782	1.6662	1.6825	0.704	0.782	0.845	0.9387	Concrete	0.7410	5.26
0.833	0.0130	0.0050	0.727	1.6249	1.6250	0.678	0.727	0.814	0.8727	Concrete	0.6920	2.07
0.833	0.0130	0.0050	0.652	1.4799	1.4800	0.623	0.652	0.748	0.7822	Concrete	0.6250	0.32
0.833	0.0130	0.0050	0.600	1.3447	1.3450	0.586	0.600	0.703	0.7201	Concrete	0.5789	1.20
0.833	0.0130	0.0050	0.567	1.2480	1.2480	0.562	0.567	0.674	0.6801	Concrete	0.5493	2.25
0.833	0.0130	0.0050	0.485	0.9930	0.9930	0.492	0.485	0.590	0.5821	Concrete	0.4767	3.11
0.833	0.0130	0.0050	0.404	0.7347	0.7345	0.420	0.404	0.504	0.4848	Concrete	0.4046	3.67
0.833	0.0130	0.0050	0.323	0.4938	0.4934	0.338	0.323	0.406	0.3881	Concrete	0.3329	1.51
0.833	0.0130	0.0050	0.213	0.2222	0.2222	0.231	0.213	0.277	0.2559	Concrete	0.2349	1.70
0.833	0.0130	0.0075	0.780	2.0406	2.1150	0.806	0.780	0.967	0.9359	Concrete	0.7389	8.33
0.833	0.0130	0.0075	0.786	2.0403	2.0560	0.726	0.786	0.871	0.9432	Concrete	0.7443	2.53
0.833	0.0130	0.0075	0.783	2.0406	2.0440	0.718	0.783	0.862	0.9401	Concrete	0.7420	3.35
0.833	0.0130	0.0075	0.638	1.7698	1.7700	0.627	0.638	0.752	0.7652	Concrete	0.6124	2.33
0.833	0.0130	0.0075	0.562	1.5120	1.5120	0.570	0.562	0.684	0.6747	Concrete	0.5453	4.33
0.833	0.0130	0.0075	0.527	1.3798	1.3800	0.541	0.527	0.649	0.6326	Concrete	0.5141	4.97
0.833	0.0130	0.0075	0.470	1.1559	1.1560	0.487	0.470	0.584	0.5637	Concrete	0.4630	4.92
0.833	0.0130	0.0075	0.379	0.8044	0.8044	0.408	0.379	0.490	0.4546	Concrete	0.3822	6.33
0.833	0.0130	0.0075	0.301	0.5306	0.5306	0.323	0.301	0.388	0.3617	Concrete	0.3133	2.99
0.833	0.0130	0.0075	0.209	0.2610	0.2600	0.224	0.209	0.269	0.2505	Concrete	0.2309	3.10
0.833	0.0130	0.0100	0.781	2.3564	2.4210	0.791	0.781	0.949	0.9367	Concrete	0.7395	6.51
0.833	0.0130	0.0100	0.689	2.2079	2.2080	0.681	0.689	0.817	0.8270	Concrete	0.6582	3.35
0.833	0.0130	0.0100	0.641	2.0560	2.0560	0.624	0.641	0.749	0.7694	Concrete	0.6155	1.36
0.833	0.0130	0.0100	0.627	2.0049	2.0050	0.618	0.627	0.742	0.7524	Concrete	0.6029	2.45
0.833	0.0130	0.0100	0.596	1.8840	1.8840	0.595	0.596	0.714	0.7148	Concrete	0.5750	3.36

Diameter (ft)	<i>n</i>	Slope (ft/ft)	depth (ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.833	0.0130	0.0100	0.539	1.6447	1.6450	0.553	0.539	0.664	0.6466	Concrete	0.5245	5.15
0.833	0.0130	0.0100	0.479	1.3750	1.3750	0.489	0.479	0.587	0.5743	Concrete	0.4709	3.70
0.833	0.0130	0.0100	0.394	0.9932	0.9930	0.405	0.394	0.486	0.4723	Concrete	0.3953	2.39
0.833	0.0130	0.0100	0.304	0.6238	0.6238	0.327	0.304	0.392	0.3652	Concrete	0.3159	3.39
0.833	0.0130	0.0100	0.183	0.2320	0.2318	0.207	0.183	0.248	0.2197	Concrete	0.2081	0.54
0.833	0.0130	0.0125	0.779	2.6344	2.7040	0.810	0.779	0.972	0.9353	Concrete	0.7385	8.83
0.833	0.0130	0.0125	0.774	2.6329	2.6890	0.805	0.774	0.966	0.9290	Concrete	0.7338	8.85
0.833	0.0130	0.0125	0.794	2.6297	2.6800	0.742	0.794	0.890	0.9532	Concrete	0.7517	1.31
0.833	0.0130	0.0125	0.739	2.5919	2.5920	0.701	0.739	0.841	0.8864	Concrete	0.7022	0.17
0.833	0.0130	0.0125	0.739	2.5919	2.5920	0.700	0.739	0.840	0.8864	Concrete	0.7022	0.32
0.833	0.0130	0.0125	0.688	2.4658	2.4660	0.664	0.688	0.797	0.8260	Concrete	0.6574	0.99
0.833	0.0130	0.0125	0.627	2.2401	2.2410	0.611	0.627	0.733	0.7520	Concrete	0.6026	1.38
0.833	0.0130	0.0125	0.572	2.0000	2.0000	0.569	0.572	0.683	0.6870	Concrete	0.5544	2.57
0.833	0.0130	0.0125	0.548	1.8840	1.8840	0.543	0.548	0.652	0.6578	Concrete	0.5328	1.89
0.833	0.0130	0.0125	0.464	1.4620	1.4620	0.463	0.464	0.556	0.5565	Concrete	0.4577	1.14
0.833	0.0130	0.0125	0.419	1.2360	1.2360	0.412	0.419	0.494	0.5028	Concrete	0.4179	1.43
0.833	0.0130	0.0125	0.305	0.7002	0.7000	0.314	0.305	0.377	0.3660	Concrete	0.3165	0.80
0.833	0.0130	0.0125	0.205	0.3263	0.3260	0.213	0.205	0.256	0.2465	Concrete	0.2280	7.02
0.833	0.0130	0.0150	0.789	2.8844	2.8840	0.781	0.789	0.937	0.9466	Concrete	0.7468	4.38
0.833	0.0130	0.0150	0.627	2.4541	2.4540	0.624	0.627	0.749	0.7520	Concrete	0.6026	3.43
0.833	0.0130	0.0150	0.424	1.3820	1.3820	0.421	0.424	0.505	0.5089	Concrete	0.4224	0.34
1.000	0.0130	0.0005	0.902	0.8496	0.9125	0.985	0.902	0.985	0.9019	Concrete	0.8565	13.05
1.000	0.0130	0.0005	0.934	0.8567	0.8938	0.943	0.934	0.943	0.9336	Concrete	0.8846	6.19
1.000	0.0130	0.0005	0.942	0.8567	0.8672	0.889	0.942	0.889	0.9417	Concrete	0.8918	0.32
1.000	0.0130	0.0005	0.900	0.8491	0.8492	0.845	0.900	0.845	0.9004	Concrete	0.8551	1.20
1.000	0.0130	0.0005	0.775	0.7540	0.7540	0.782	0.775	0.782	0.7755	Concrete	0.7440	4.86
1.000	0.0130	0.0005	0.725	0.6976	0.6986	0.756	0.725	0.756	0.7252	Concrete	0.6993	7.50
1.000	0.0130	0.0005	0.686	0.6496	0.6496	0.691	0.686	0.691	0.6863	Concrete	0.6647	3.81
1.000	0.0130	0.0005	0.653	0.6062	0.6062	0.643	0.653	0.643	0.6528	Concrete	0.6349	1.26
1.000	0.0130	0.0005	0.573	0.4982	0.4982	0.580	0.573	0.580	0.5731	Concrete	0.5640	2.76
1.000	0.0130	0.0005	0.537	0.4485	0.4485	0.534	0.537	0.534	0.5369	Concrete	0.5318	0.41
1.000	0.0130	0.0005	0.507	0.4083	0.4083	0.511	0.507	0.511	0.5074	Concrete	0.5056	1.06
1.000	0.0130	0.0005	0.355	0.2152	0.2152	0.364	0.355	0.364	0.3551	Concrete	0.3702	1.69
1.000	0.0130	0.0005	0.254	0.1126	0.1120	0.275	0.254	0.275	0.2540	Concrete	0.2802	1.88
1.500	0.0130	0.0021	0.869	3.0600	3.0600	0.790	0.869	0.527	0.5790	Concrete	0.8540	8.10
1.500	0.0130	0.0021	1.119	4.3099	4.3100	0.990	1.119	0.660	0.7461	Concrete	1.0769	8.77
0.667	0.0130	0.005	0.189	0.1500	0.1500	0.160	0.189	0.240	0.2834	Clay	0.2043	27.71
0.667	0.0130	0.005	0.284	0.3220	0.3220	0.240	0.284	0.360	0.4251	Clay	0.2884	20.18
0.667	0.0130	0.005	0.352	0.4690	0.4690	0.290	0.352	0.435	0.5282	Clay	0.3496	20.54
0.667	0.0130	0.005	0.520	0.8143	0.8150	0.430	0.520	0.645	0.7795	Clay	0.4987	15.97

Diameter (ft)	<i>n</i>	Slope (ft/ft)	depth (ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.667	0.0130	0.005	0.626	0.9202	1.1700	0.590	0.626	0.885	0.9383	Clay	0.5929	0.48
0.667	0.0130	0.01	0.180	0.1932	0.1930	0.160	0.180	0.240	0.2702	Clay	0.1965	22.84
0.667	0.0130	0.01	0.285	0.4607	0.4600	0.250	0.285	0.375	0.4279	Clay	0.2901	16.03
0.667	0.0130	0.01	0.383	0.7604	0.7600	0.330	0.383	0.495	0.5748	Clay	0.3772	14.31
0.667	0.0130	0.01	0.477	1.0400	1.0400	0.420	0.477	0.630	0.7145	Clay	0.4601	9.54
0.667	0.0130	0.01	0.629	1.3012	1.5300	0.560	0.629	0.840	0.9424	Clay	0.5953	6.30
0.667	0.0130	0.01	0.618	1.3000	1.6400	0.640	0.618	0.960	0.9259	Clay	0.5855	8.51
0.667	0.0130	0.015	0.182	0.2407	0.2400	0.170	0.182	0.255	0.2726	Clay	0.1979	16.43
0.667	0.0130	0.015	0.267	0.5000	0.5000	0.250	0.267	0.375	0.4003	Clay	0.2737	9.47
0.667	0.0130	0.015	0.360	0.8410	0.8400	0.330	0.360	0.495	0.5395	Clay	0.3563	7.96
0.667	0.0130	0.015	0.455	1.1999	1.2000	0.420	0.455	0.630	0.6827	Clay	0.4412	5.05
0.667	0.0130	0.015	0.586	1.5598	1.5600	0.500	0.586	0.750	0.8779	Clay	0.5570	11.40
0.667	0.0130	0.015	0.633	1.5925	1.9100	0.570	0.633	0.855	0.9486	Clay	0.5989	5.08
0.667	0.0130	0.02	0.172	0.2483	0.2480	0.170	0.172	0.255	0.2574	Clay	0.1889	11.13
0.667	0.0130	0.02	0.259	0.5453	0.5450	0.250	0.259	0.375	0.3880	Clay	0.2664	6.56
0.667	0.0130	0.02	0.344	0.9002	0.9000	0.330	0.344	0.495	0.5154	Clay	0.3419	3.62
0.667	0.0130	0.02	0.433	1.2897	1.2900	0.420	0.433	0.630	0.6485	Clay	0.4209	0.22
0.667	0.0130	0.02	0.554	1.7299	1.7300	0.500	0.554	0.750	0.8301	Clay	0.5287	5.73
0.667	0.0130	0.02	0.631	1.8394	2.3200	0.610	0.631	0.915	0.9466	Clay	0.5977	2.01
0.667	0.0130	0.03	0.157	0.2550	0.2550	0.170	0.157	0.255	0.2356	Clay	0.1760	3.51
0.667	0.0130	0.03	0.244	0.6001	0.6000	0.250	0.244	0.375	0.3663	Clay	0.2535	1.41
0.667	0.0130	0.03	0.313	0.9401	0.9400	0.320	0.313	0.480	0.4695	Clay	0.3147	1.65
0.667	0.0130	0.03	0.399	1.3992	1.4000	0.420	0.399	0.630	0.5976	Clay	0.3907	6.97
0.667	0.0130	0.03	0.485	1.8403	1.8400	0.480	0.485	0.720	0.7268	Clay	0.4674	2.63
0.667	0.0130	0.03	0.633	2.2521	2.4400	0.570	0.633	0.855	0.9486	Clay	0.5989	5.08
0.667	0.0130	0.03	0.636	2.2497	2.5400	0.600	0.636	0.900	0.9535	Clay	0.6019	0.31
0.667	0.0130	0.04	0.159	0.3000	0.3000	0.170	0.159	0.255	0.2378	Clay	0.1773	4.28
0.667	0.0130	0.04	0.242	0.6803	0.6800	0.250	0.242	0.375	0.3627	Clay	0.2514	0.56
0.667	0.0130	0.04	0.299	1.0000	1.0000	0.320	0.299	0.480	0.4480	Clay	0.3020	5.62
0.667	0.0130	0.04	0.399	1.6191	1.6200	0.420	0.399	0.630	0.5985	Clay	0.3912	6.85
0.667	0.0130	0.04	0.489	2.1494	2.1500	0.500	0.489	0.750	0.7337	Clay	0.4715	5.71
0.667	0.0130	0.04	0.633	2.6005	2.7100	0.570	0.633	0.855	0.9486	Clay	0.5989	5.08
0.333	0.0130	0.0005	0.295	0.0450	0.0547	0.332	0.295	0.996	0.8864	Clay	0.2809	15.39
0.333	0.0130	0.0005	0.313	0.0458	0.0562	0.309	0.313	0.927	0.9392	Clay	0.2965	4.04
0.333	0.0130	0.0005	0.316	0.0457	0.0487	0.298	0.316	0.894	0.9476	Clay	0.2990	0.35
0.333	0.0130	0.0005	0.259	0.0403	0.0404	0.248	0.259	0.744	0.7765	Clay	0.2483	0.13
0.333	0.0130	0.0005	0.194	0.0273	0.0274	0.214	0.194	0.642	0.5829	Clay	0.1909	10.79
0.333	0.0130	0.0005	0.150	0.0177	0.0177	0.159	0.150	0.477	0.4499	Clay	0.1515	4.72
0.333	0.0130	0.0010	0.094	0.0104	0.0098	0.131	0.094	0.393	0.2818	Clay	0.1016	22.41
0.333	0.0130	0.0010	0.306	0.0645	0.0703	0.331	0.306	0.993	0.9175	Clay	0.2901	12.36

Diameter (ft)	<i>n</i>	Slope (ft/ft)	depth (ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.333	0.0130	0.0010	0.307	0.0646	0.0744	0.327	0.307	0.981	0.9221	Clay	0.2915	10.86
0.333	0.0130	0.0010	0.259	0.0570	0.0580	0.285	0.259	0.855	0.7761	Clay	0.2482	12.92
0.333	0.0130	0.0010	0.257	0.0567	0.0568	0.228	0.257	0.684	0.7721	Clay	0.2470	8.34
0.333	0.0130	0.0010	0.145	0.0236	0.0235	0.160	0.145	0.480	0.4348	Clay	0.1470	8.13
0.333	0.0130	0.0010	0.121	0.0170	0.0166	0.136	0.121	0.408	0.3631	Clay	0.1258	7.53
0.333	0.0130	0.0020	0.305	0.0912	0.0969	0.329	0.305	0.987	0.9146	Clay	0.2893	12.08
0.333	0.0130	0.0020	0.314	0.0915	0.0940	0.283	0.314	0.849	0.9415	Clay	0.2972	5.03
0.333	0.0130	0.0020	0.292	0.0895	0.0904	0.271	0.292	0.813	0.8759	Clay	0.2778	2.50
0.333	0.0130	0.0020	0.233	0.0709	0.0710	0.223	0.233	0.669	0.6978	Clay	0.2250	0.88
0.333	0.0130	0.0020	0.164	0.0414	0.0414	0.173	0.164	0.519	0.4922	Clay	0.1640	5.19
0.333	0.0130	0.0020	0.107	0.0189	0.0187	0.129	0.107	0.387	0.3201	Clay	0.1130	12.40
0.333	0.0130	0.0030	0.313	0.1121	0.1230	0.313	0.313	0.939	0.9378	Clay	0.2961	5.39
0.333	0.0130	0.0030	0.231	0.0862	0.0864	0.244	0.231	0.732	0.6937	Clay	0.2238	8.29
0.333	0.0130	0.0030	0.197	0.0684	0.0685	0.213	0.197	0.639	0.5909	Clay	0.1933	9.25
0.333	0.0130	0.0030	0.136	0.0364	0.0361	0.166	0.136	0.498	0.4076	Clay	0.1390	16.29
0.333	0.0130	0.0030	0.095	0.0185	0.0180	0.123	0.095	0.369	0.2855	Clay	0.1028	16.46
0.333	0.0130	0.0050	0.312	0.1447	0.1578	0.317	0.312	0.951	0.9355	Clay	0.2955	6.80
0.333	0.0130	0.0050	0.317	0.1446	0.1494	0.287	0.317	0.861	0.9500	Clay	0.2998	4.44
0.333	0.0130	0.0050	0.269	0.1326	0.1327	0.263	0.269	0.789	0.8071	Clay	0.2574	2.14
0.333	0.0130	0.0050	0.212	0.0986	0.0987	0.223	0.212	0.669	0.6359	Clay	0.2066	7.34
0.333	0.0130	0.0050	0.144	0.0519	0.0517	0.170	0.144	0.510	0.4308	Clay	0.1458	14.22
0.333	0.0130	0.0050	0.100	0.0263	0.0256	0.128	0.100	0.384	0.2995	Clay	0.1069	16.49
0.333	0.0130	0.0075	0.310	0.1772	0.1931	0.332	0.310	0.996	0.9295	Clay	0.2937	11.54
0.333	0.0130	0.0075	0.309	0.1771	0.1905	0.320	0.309	0.960	0.9264	Clay	0.2927	8.52
0.333	0.0130	0.0075	0.298	0.1751	0.1756	0.288	0.298	0.864	0.8943	Clay	0.2832	1.66
0.333	0.0130	0.0075	0.247	0.1481	0.1482	0.253	0.247	0.759	0.7410	Clay	0.2378	6.01
0.333	0.0130	0.0075	0.187	0.0994	0.0996	0.210	0.187	0.629	0.5602	Clay	0.1842	12.22
0.333	0.0130	0.0075	0.146	0.0657	0.0654	0.164	0.146	0.492	0.4389	Clay	0.1482	9.62
0.333	0.0130	0.0075	0.116	0.0426	0.0425	0.134	0.116	0.402	0.3469	Clay	0.1210	9.73
0.333	0.0130	0.0125	0.295	0.2248	0.2640	0.331	0.295	0.993	0.8838	Clay	0.2801	15.38
0.333	0.0130	0.0125	0.315	0.2288	0.2472	0.304	0.315	0.912	0.9439	Clay	0.2979	1.99
0.333	0.0130	0.0125	0.273	0.2124	0.2124	0.270	0.273	0.810	0.8181	Clay	0.2606	3.47
0.333	0.0130	0.0125	0.251	0.1953	0.1951	0.254	0.251	0.762	0.7544	Clay	0.2417	4.82
0.333	0.0130	0.0125	0.164	0.1033	0.1032	0.177	0.164	0.531	0.4915	Clay	0.1638	7.45
0.333	0.0130	0.0125	0.136	0.0738	0.0736	0.148	0.136	0.444	0.4065	Clay	0.1386	6.33
0.333	0.0130	0.0150	0.316	0.2505	0.2814	0.298	0.316	0.894	0.9476	Clay	0.2990	0.35
0.333	0.0130	0.0150	0.271	0.2311	0.2318	0.257	0.271	0.771	0.8120	Clay	0.2588	0.72
0.333	0.0130	0.0150	0.240	0.2023	0.2026	0.228	0.240	0.684	0.7201	Clay	0.2316	1.57
0.333	0.0130	0.0150	0.180	0.1323	0.1322	0.168	0.180	0.504	0.5395	Clay	0.1780	5.98
0.333	0.0130	0.0150	0.127	0.0721	0.0720	0.126	0.127	0.378	0.3818	Clay	0.1313	4.19

Diameter (ft)	<i>n</i>	Slope (ft/ft)	depth (ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.417	0.0130	0.0010	0.391	0.1174	0.1230	0.350	0.391	0.840	0.9383	Clay	0.3703	5.81
0.417	0.0130	0.0010	0.332	0.1062	0.1065	0.314	0.332	0.754	0.7964	Clay	0.3177	1.19
0.417	0.0130	0.0010	0.270	0.0823	0.0824	0.273	0.270	0.655	0.6486	Clay	0.2630	3.66
0.417	0.0130	0.0010	0.205	0.0532	0.0532	0.215	0.205	0.516	0.4928	Clay	0.2053	4.53
0.417	0.0130	0.0010	0.131	0.0233	0.0231	0.155	0.131	0.372	0.3135	Clay	0.1388	10.46
0.417	0.0130	0.0010	0.110	0.0165	0.0165	0.116	0.110	0.278	0.2631	Clay	0.1201	3.57
0.417	0.0130	0.0020	0.386	0.1658	0.1905	0.411	0.386	0.986	0.9272	Clay	0.3662	10.89
0.417	0.0130	0.0020	0.391	0.1660	0.1686	0.315	0.391	0.756	0.9383	Clay	0.3703	17.56
0.417	0.0130	0.0020	0.305	0.1365	0.1371	0.279	0.305	0.670	0.7312	Clay	0.2936	5.23
0.417	0.0130	0.0020	0.219	0.0840	0.0840	0.212	0.219	0.509	0.5261	Clay	0.2176	2.63
0.417	0.0130	0.0020	0.160	0.0481	0.0481	0.164	0.160	0.394	0.3835	Clay	0.1647	0.45
0.417	0.0130	0.0020	0.123	0.0291	0.0291	0.129	0.123	0.310	0.2945	Clay	0.1318	2.14
0.417	0.0130	0.0030	0.390	0.2033	0.2408	0.399	0.390	0.958	0.9361	Clay	0.3695	7.39
0.417	0.0130	0.0030	0.391	0.2033	0.2208	0.352	0.391	0.845	0.9384	Clay	0.3704	5.22
0.417	0.0130	0.0030	0.368	0.1996	0.1998	0.321	0.368	0.770	0.8834	Clay	0.3500	9.04
0.417	0.0130	0.0030	0.289	0.1564	0.1566	0.273	0.289	0.655	0.6939	Clay	0.2798	2.48
0.417	0.0130	0.0030	0.214	0.0987	0.0987	0.219	0.214	0.526	0.5131	Clay	0.2128	2.84
0.417	0.0130	0.0030	0.153	0.0546	0.0544	0.165	0.153	0.396	0.3679	Clay	0.1590	3.66
0.417	0.0130	0.0030	0.099	0.0232	0.0231	0.115	0.099	0.276	0.2367	Clay	0.1103	4.05
0.417	0.0130	0.0050	0.391	0.2624	0.3026	0.397	0.391	0.953	0.9373	Clay	0.3700	6.81
0.417	0.0130	0.0050	0.400	0.2614	0.3096	0.377	0.400	0.905	0.9591	Clay	0.3780	0.28
0.417	0.0130	0.0050	0.345	0.2463	0.2464	0.298	0.345	0.715	0.8285	Clay	0.3297	10.63
0.417	0.0130	0.0050	0.275	0.1889	0.1892	0.254	0.275	0.610	0.6608	Clay	0.2675	5.32
0.417	0.0130	0.0050	0.231	0.1448	0.1448	0.220	0.231	0.528	0.5546	Clay	0.2282	3.71
0.417	0.0130	0.0050	0.163	0.0785	0.0784	0.154	0.163	0.370	0.3901	Clay	0.1672	8.56
0.417	0.0130	0.0050	0.111	0.0382	0.0381	0.118	0.111	0.283	0.2675	Clay	0.1217	3.18
0.417	0.0130	0.0150	0.390	0.4545	0.5428	0.394	0.390	0.946	0.9361	Clay	0.3695	6.21
0.417	0.0130	0.0150	0.392	0.4545	0.4738	0.319	0.392	0.766	0.9407	Clay	0.3712	16.37
0.417	0.0130	0.0150	0.294	0.3582	0.3582	0.253	0.294	0.607	0.7067	Clay	0.2845	12.46
0.417	0.0130	0.0150	0.242	0.2705	0.2704	0.209	0.242	0.502	0.5816	Clay	0.2381	13.94
0.417	0.0130	0.0150	0.183	0.1678	0.1674	0.158	0.183	0.379	0.4381	Clay	0.1850	17.07
0.417	0.0130	0.0150	0.136	0.0972	0.0969	0.118	0.136	0.283	0.3262	Clay	0.1435	21.63
0.500	0.0130	0.0005	0.479	0.1345	0.1404	0.402	0.479	0.804	0.9581	Clay	0.4532	12.74
0.500	0.0130	0.0005	0.272	0.0724	0.0724	0.300	0.272	0.600	0.5448	Clay	0.2694	10.19
0.500	0.0130	0.0005	0.193	0.0398	0.0397	0.223	0.193	0.446	0.3869	Clay	0.1992	10.66
0.500	0.0130	0.0005	0.146	0.0232	0.0225	0.188	0.146	0.376	0.2910	Clay	0.1566	16.72
0.500	0.0130	0.0010	0.367	0.1579	0.1578	0.396	0.367	0.792	0.7348	Clay	0.3539	10.63
0.500	0.0130	0.0010	0.310	0.1255	0.1255	0.304	0.310	0.608	0.6208	Clay	0.3032	0.25
0.500	0.0130	0.0010	0.219	0.0706	0.0706	0.211	0.219	0.422	0.4387	Clay	0.2222	5.33
0.500	0.0130	0.0010	0.156	0.0374	0.0372	0.171	0.156	0.342	0.3118	Clay	0.1658	3.05

Diameter (ft)	<i>n</i>	Slope (ft/ft)	depth (ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.500	0.0130	0.0020	0.443	0.2655	0.3563	0.498	0.443	0.996	0.8864	Clay	0.4213	15.39
0.500	0.0130	0.0020	0.448	0.2670	0.2680	0.409	0.448	0.818	0.8969	Clay	0.4260	4.15
0.500	0.0130	0.0020	0.313	0.1800	0.1801	0.277	0.313	0.554	0.6269	Clay	0.3059	10.44
0.500	0.0130	0.0020	0.231	0.1091	0.1090	0.219	0.231	0.438	0.4611	Clay	0.2322	6.03
0.500	0.0130	0.0020	0.160	0.0559	0.0559	0.157	0.160	0.314	0.3208	Clay	0.1698	8.17
0.500	0.0130	0.0030	0.469	0.3305	0.3620	0.414	0.469	0.828	0.9386	Clay	0.4446	7.38
0.500	0.0130	0.0030	0.312	0.2194	0.2194	0.302	0.312	0.604	0.6247	Clay	0.3049	0.98
0.500	0.0130	0.0030	0.235	0.1383	0.1382	0.222	0.235	0.444	0.4704	Clay	0.2363	6.46
0.500	0.0130	0.0030	0.161	0.0686	0.0685	0.167	0.161	0.334	0.3210	Clay	0.1699	1.74
0.500	0.0130	0.0050	0.443	0.4198	0.5540	0.498	0.443	0.996	0.8864	Clay	0.4213	15.39
0.500	0.0130	0.0050	0.470	0.4267	0.4440	0.378	0.470	0.756	0.9404	Clay	0.4454	17.82
0.500	0.0130	0.0050	0.308	0.2771	0.2771	0.276	0.308	0.552	0.6156	Clay	0.3009	9.03
0.500	0.0130	0.0050	0.214	0.1512	0.1512	0.213	0.214	0.426	0.4281	Clay	0.2175	2.13
0.500	0.0130	0.0050	0.139	0.0668	0.0664	0.152	0.139	0.304	0.2776	Clay	0.1506	0.91
0.500	0.0130	0.0075	0.468	0.5226	0.6804	0.473	0.468	0.946	0.9365	Clay	0.4436	6.21
0.500	0.0130	0.0075	0.469	0.5226	0.5390	0.385	0.469	0.770	0.9382	Clay	0.4444	15.43
0.500	0.0130	0.0075	0.271	0.2772	0.2771	0.258	0.271	0.516	0.5412	Clay	0.2678	3.80
0.500	0.0130	0.0075	0.204	0.1692	0.1692	0.199	0.204	0.398	0.4073	Clay	0.2083	4.67
0.500	0.0130	0.0075	0.151	0.0969	0.0969	0.147	0.151	0.294	0.3029	Clay	0.1619	10.11
0.667	0.0130	0.0005	0.603	0.2885	0.3260	0.663	0.603	0.995	0.9044	Clay	0.5724	13.66
0.667	0.0130	0.0005	0.515	0.2547	0.2540	0.515	0.515	0.773	0.7725	Clay	0.4942	4.03
0.667	0.0130	0.0005	0.336	0.1370	0.1370	0.342	0.336	0.513	0.5042	Clay	0.3352	2.00
0.667	0.0130	0.0005	0.256	0.0847	0.0840	0.259	0.256	0.389	0.3846	Clay	0.2643	2.03
0.667	0.0130	0.0005	0.166	0.0367	0.0363	0.166	0.166	0.249	0.2490	Clay	0.1838	10.75
0.667	0.0130	0.0010	0.533	0.3732	0.3740	0.509	0.533	0.764	0.7994	Clay	0.5102	0.23
0.667	0.0130	0.0010	0.348	0.2054	0.2060	0.348	0.348	0.522	0.5220	Clay	0.3457	0.66
0.667	0.0130	0.0010	0.277	0.1380	0.1380	0.271	0.277	0.407	0.4156	Clay	0.2826	4.28
0.667	0.0130	0.0010	0.196	0.0720	0.0720	0.192	0.196	0.288	0.2941	Clay	0.2106	9.69
0.667	0.0130	0.0020	0.588	0.5705	0.6720	0.661	0.588	0.992	0.8824	Clay	0.5594	15.37
0.667	0.0130	0.0020	0.527	0.5214	0.5220	0.509	0.527	0.764	0.7899	Clay	0.5045	0.88
0.667	0.0130	0.0020	0.341	0.2806	0.2805	0.358	0.341	0.537	0.5113	Clay	0.3394	5.20
0.667	0.0130	0.0020	0.244	0.1547	0.1540	0.267	0.244	0.401	0.3662	Clay	0.2533	5.12
0.667	0.0130	0.0020	0.143	0.0542	0.0540	0.165	0.143	0.248	0.2139	Clay	0.1631	1.18
0.667	0.0130	0.0030	0.609	0.7089	0.7870	0.663	0.609	0.995	0.9134	Clay	0.5778	12.86
0.667	0.0130	0.0030	0.526	0.6384	0.6390	0.510	0.526	0.765	0.7896	Clay	0.5044	1.10
0.667	0.0130	0.0030	0.338	0.3394	0.3392	0.364	0.338	0.546	0.5076	Clay	0.3372	7.38
0.667	0.0130	0.0030	0.256	0.2062	0.2054	0.280	0.256	0.420	0.3834	Clay	0.2635	5.89
0.667	0.0130	0.0030	0.168	0.0924	0.0920	0.196	0.168	0.294	0.2525	Clay	0.1859	5.16
0.667	0.0130	0.0075	0.589	1.1057	1.2840	0.662	0.589	0.993	0.8840	Clay	0.5604	15.35
0.667	0.0130	0.0075	0.497	0.9480	0.9480	0.503	0.497	0.755	0.7459	Clay	0.4785	4.88

Diameter (ft)	<i>n</i>	Slope (ft/ft)	depth (ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.667	0.0130	0.0075	0.347	0.5590	0.5590	0.356	0.347	0.534	0.5201	Clay	0.3446	3.21
0.667	0.0130	0.0075	0.261	0.3393	0.3392	0.270	0.261	0.405	0.3917	Clay	0.2685	0.57
0.667	0.0130	0.0075	0.170	0.1485	0.1481	0.180	0.170	0.270	0.2545	Clay	0.1871	3.95
0.667	0.0130	0.0100	0.589	1.2763	1.4650	0.661	0.589	0.992	0.8834	Clay	0.5600	15.28
0.667	0.0130	0.0100	0.523	1.1572	1.1580	0.473	0.523	0.710	0.7841	Clay	0.5011	5.95
0.667	0.0130	0.0100	0.331	0.5980	0.5980	0.325	0.331	0.488	0.4970	Clay	0.3309	1.82
0.667	0.0130	0.0100	0.255	0.3761	0.3760	0.250	0.255	0.375	0.3831	Clay	0.2633	5.34
0.667	0.0130	0.0100	0.175	0.1817	0.1814	0.173	0.175	0.260	0.2621	Clay	0.1916	10.75
0.667	0.0130	0.0125	0.545	1.3475	1.3475	0.490	0.545	0.735	0.8174	Clay	0.5209	6.30
0.667	0.0130	0.0125	0.356	0.7525	0.7525	0.346	0.356	0.519	0.5334	Clay	0.3525	1.87
0.667	0.0130	0.0125	0.263	0.4426	0.4430	0.260	0.263	0.390	0.3939	Clay	0.2698	3.75
0.667	0.0130	0.0125	0.178	0.2097	0.2096	0.173	0.178	0.260	0.2663	Clay	0.1941	12.21
0.833	0.0130	0.0005	0.781	0.5269	0.5770	0.783	0.781	0.940	0.9373	Clay	0.7399	5.50
0.833	0.0130	0.0005	0.794	0.5260	0.5640	0.749	0.794	0.899	0.9527	Clay	0.7514	0.32
0.833	0.0130	0.0005	0.785	0.5268	0.5578	0.697	0.785	0.836	0.9419	Clay	0.7434	6.65
0.833	0.0130	0.0005	0.798	0.5251	0.5503	0.666	0.798	0.799	0.9582	Clay	0.7554	13.43
0.833	0.0130	0.0005	0.782	0.5269	0.5366	0.626	0.782	0.751	0.9389	Clay	0.7411	18.39
0.833	0.0130	0.0005	0.697	0.4981	0.4982	0.567	0.697	0.680	0.8359	Clay	0.6648	17.24
0.833	0.0130	0.0005	0.643	0.4609	0.4611	0.546	0.643	0.655	0.7712	Clay	0.6169	12.98
0.833	0.0130	0.0005	0.569	0.3967	0.3967	0.473	0.569	0.568	0.6827	Clay	0.5512	16.54
0.833	0.0130	0.0005	0.479	0.3078	0.3078	0.421	0.479	0.505	0.5748	Clay	0.4713	11.94
0.833	0.0130	0.0005	0.371	0.1998	0.1998	0.310	0.371	0.372	0.4447	Clay	0.3748	20.91
0.833	0.0130	0.0005	0.256	0.1005	0.1005	0.214	0.256	0.257	0.3073	Clay	0.2730	27.57
0.833	0.0130	0.0010	0.782	0.7452	0.8870	0.782	0.782	0.938	0.9381	Clay	0.7405	5.30
0.833	0.0130	0.0010	0.803	0.7412	0.8837	0.723	0.803	0.868	0.9630	Clay	0.7590	4.98
0.833	0.0130	0.0010	0.790	0.7446	0.7996	0.625	0.790	0.750	0.9482	Clay	0.7480	19.68
0.833	0.0130	0.0010	0.706	0.7119	0.7120	0.572	0.706	0.686	0.8469	Clay	0.6730	17.65
0.833	0.0130	0.0010	0.663	0.6739	0.6748	0.542	0.663	0.650	0.7961	Clay	0.6353	17.21
0.833	0.0130	0.0010	0.552	0.5378	0.5378	0.466	0.552	0.559	0.6621	Clay	0.5359	15.01
0.833	0.0130	0.0010	0.505	0.4726	0.4726	0.425	0.505	0.510	0.6061	Clay	0.4944	16.34
0.833	0.0130	0.0010	0.368	0.2788	0.2788	0.313	0.368	0.376	0.4414	Clay	0.3724	18.97
0.833	0.0130	0.0010	0.239	0.1247	0.1240	0.205	0.239	0.246	0.2873	Clay	0.2582	25.93
0.833	0.0130	0.0020	0.774	1.0531	1.2680	0.823	0.774	0.988	0.9283	Clay	0.7333	10.90
0.833	0.0130	0.0020	0.779	1.0537	1.2680	0.797	0.779	0.956	0.9349	Clay	0.7382	7.38
0.833	0.0130	0.0020	0.794	1.0521	1.1380	0.623	0.794	0.748	0.9525	Clay	0.7512	20.58
0.833	0.0130	0.0020	0.708	1.0087	1.0090	0.563	0.708	0.676	0.8491	Clay	0.6746	19.82
0.833	0.0130	0.0020	0.653	0.9380	0.9380	0.525	0.653	0.630	0.7838	Clay	0.6262	19.28
0.833	0.0130	0.0020	0.570	0.7963	0.7964	0.472	0.570	0.566	0.6846	Clay	0.5526	17.08
0.833	0.0130	0.0020	0.512	0.6830	0.6832	0.428	0.512	0.514	0.6148	Clay	0.5009	17.04
0.833	0.0130	0.0020	0.363	0.3847	0.3841	0.318	0.363	0.382	0.4353	Clay	0.3679	15.69

Diameter (ft)	<i>n</i>	Slope (ft/ft)	depth (ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.833	0.0130	0.0020	0.229	0.1616	0.1614	0.203	0.229	0.244	0.2747	Clay	0.2489	22.60
0.833	0.0130	0.0030	0.736	1.2674	1.5300	0.827	0.736	0.992	0.8832	Clay	0.6999	15.37
0.833	0.0130	0.0030	0.785	1.2905	1.5140	0.777	0.785	0.932	0.9417	Clay	0.7432	4.35
0.833	0.0130	0.0030	0.782	1.2906	1.4960	0.689	0.782	0.827	0.9384	Clay	0.7408	7.51
0.833	0.0130	0.0030	0.801	1.2849	1.3960	0.631	0.801	0.757	0.9610	Clay	0.7575	20.05
0.833	0.0130	0.0030	0.690	1.2099	1.2100	0.563	0.690	0.676	0.8275	Clay	0.6585	16.97
0.833	0.0130	0.0030	0.640	1.1236	1.1240	0.542	0.640	0.650	0.7678	Clay	0.6143	13.35
0.833	0.0130	0.0030	0.548	0.9221	0.9227	0.484	0.548	0.581	0.6573	Clay	0.5324	10.01
0.833	0.0130	0.0030	0.476	0.7456	0.7450	0.431	0.476	0.517	0.5707	Clay	0.4682	8.64
0.833	0.0130	0.0030	0.355	0.4542	0.4542	0.328	0.355	0.394	0.4265	Clay	0.3613	10.17
0.833	0.0130	0.0030	0.241	0.2180	0.2173	0.224	0.241	0.269	0.2887	Clay	0.2592	15.71
0.833	0.0130	0.0050	0.796	1.6622	1.9575	0.751	0.796	0.901	0.9553	Clay	0.7533	0.30
0.833	0.0130	0.0050	0.782	1.6662	1.9300	0.701	0.782	0.841	0.9390	Clay	0.7412	5.73
0.833	0.0130	0.0050	0.812	1.6456	1.7975	0.647	0.812	0.776	0.9743	Clay	0.7673	18.60
0.833	0.0130	0.0050	0.758	1.6572	1.6575	0.618	0.758	0.742	0.9094	Clay	0.7193	16.38
0.833	0.0130	0.0050	0.648	1.4698	1.4700	0.565	0.648	0.678	0.7772	Clay	0.6213	9.96
0.833	0.0130	0.0050	0.606	1.3625	1.3625	0.534	0.606	0.641	0.7278	Clay	0.5846	9.48
0.833	0.0130	0.0050	0.518	1.0971	1.0980	0.470	0.518	0.564	0.6214	Clay	0.5058	7.62
0.833	0.0130	0.0050	0.464	0.9268	0.9261	0.426	0.464	0.511	0.5573	Clay	0.4583	7.59
0.833	0.0130	0.0050	0.336	0.5305	0.5306	0.307	0.336	0.368	0.4036	Clay	0.3444	12.17
0.833	0.0130	0.0050	0.230	0.2568	0.2568	0.213	0.230	0.256	0.2754	Clay	0.2494	17.07
0.833	0.0130	0.0075	0.782	2.0407	2.3760	0.782	0.782	0.938	0.9381	Clay	0.7405	5.30
0.833	0.0130	0.0075	0.793	2.0378	2.3760	0.748	0.793	0.898	0.9515	Clay	0.7504	0.33
0.833	0.0130	0.0075	0.806	2.0255	2.3400	0.726	0.806	0.871	0.9670	Clay	0.7620	4.96
0.833	0.0130	0.0075	0.793	2.0376	2.2590	0.684	0.793	0.821	0.9519	Clay	0.7508	9.76
0.833	0.0130	0.0075	0.783	2.0407	2.1330	0.646	0.783	0.775	0.9395	Clay	0.7416	14.80
0.833	0.0130	0.0075	0.653	1.8146	1.8150	0.564	0.653	0.677	0.7831	Clay	0.6257	10.93
0.833	0.0130	0.0075	0.614	1.6924	1.6925	0.540	0.614	0.648	0.7363	Clay	0.5909	9.43
0.833	0.0130	0.0075	0.542	1.4349	1.4350	0.487	0.542	0.584	0.6500	Clay	0.5270	8.21
0.833	0.0130	0.0075	0.451	1.0820	1.0820	0.409	0.451	0.491	0.5411	Clay	0.4463	9.12
0.833	0.0130	0.0075	0.335	0.6440	0.6440	0.311	0.335	0.373	0.4016	Clay	0.3429	10.26
0.833	0.0130	0.0075	0.241	0.3458	0.3449	0.226	0.241	0.271	0.2891	Clay	0.2595	14.84
0.833	0.0130	0.0100	0.777	2.3558	2.7645	0.795	0.777	0.954	0.9325	Clay	0.7364	7.37
0.833	0.0130	0.0100	0.789	2.3552	2.7070	0.744	0.789	0.893	0.9464	Clay	0.7467	0.36
0.833	0.0130	0.0100	0.785	2.3561	2.7505	0.741	0.785	0.889	0.9426	Clay	0.7438	0.38
0.833	0.0130	0.0100	0.786	2.3560	2.6695	0.708	0.786	0.850	0.9431	Clay	0.7442	5.11
0.833	0.0130	0.0100	0.783	2.3564	2.6485	0.705	0.783	0.846	0.9391	Clay	0.7412	5.14
0.833	0.0130	0.0100	0.782	2.3564	2.5980	0.676	0.782	0.811	0.9383	Clay	0.7407	9.56
0.833	0.0130	0.0100	0.795	2.3518	2.5050	0.642	0.795	0.770	0.9536	Clay	0.7520	17.14
0.833	0.0130	0.0100	0.685	2.1959	2.1960	0.577	0.685	0.692	0.8219	Clay	0.6544	13.42

Diameter (ft)	<i>n</i>	Slope (ft/ft)	depth (ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
0.833	0.0130	0.0100	0.628	2.0073	2.0075	0.545	0.628	0.654	0.7532	Clay	0.6035	10.73
0.833	0.0130	0.0100	0.559	1.7324	1.7325	0.480	0.559	0.576	0.6710	Clay	0.5425	13.03
0.833	0.0130	0.0100	0.460	1.2920	1.2920	0.414	0.460	0.497	0.5524	Clay	0.4547	9.82
0.833	0.0130	0.0100	0.331	0.7269	0.7270	0.299	0.331	0.359	0.3966	Clay	0.3392	13.46
0.833	0.0130	0.0100	0.236	0.3832	0.3831	0.212	0.236	0.254	0.2831	Clay	0.2551	20.31
0.833	0.0130	0.0125	0.797	2.6272	3.0380	0.752	0.797	0.902	0.9565	Clay	0.7542	0.29
0.833	0.0130	0.0125	0.782	2.6345	2.9750	0.697	0.782	0.836	0.9389	Clay	0.7411	6.33
0.833	0.0130	0.0125	0.787	2.6336	2.8430	0.657	0.787	0.788	0.9448	Clay	0.7455	13.47
0.833	0.0130	0.0125	0.782	2.6345	2.7715	0.636	0.782	0.763	0.9383	Clay	0.7407	16.45
0.833	0.0130	0.0125	0.669	2.4030	2.4030	0.563	0.669	0.676	0.8031	Clay	0.6405	13.76
0.833	0.0130	0.0125	0.619	2.2076	2.2080	0.528	0.619	0.634	0.7426	Clay	0.5957	12.82
0.833	0.0130	0.0125	0.530	1.7950	1.7950	0.461	0.530	0.553	0.6359	Clay	0.5166	12.06
0.833	0.0130	0.0125	0.474	1.5122	1.5120	0.418	0.474	0.502	0.5684	Clay	0.4665	11.61
0.833	0.0130	0.0125	0.345	0.8809	0.8804	0.308	0.345	0.370	0.4146	Clay	0.3525	14.45
0.833	0.0130	0.0125	0.237	0.4313	0.4303	0.208	0.237	0.250	0.2840	Clay	0.2558	22.97
0.833	0.0130	0.0150	0.749	2.8578	2.8580	0.618	0.749	0.742	0.8988	Clay	0.7114	15.12
0.833	0.0130	0.0150	0.646	2.5374	2.5380	0.557	0.646	0.668	0.7748	Clay	0.6195	11.23
0.833	0.0130	0.0150	0.608	2.3668	2.3670	0.526	0.608	0.631	0.7295	Clay	0.5859	11.39
0.833	0.0130	0.0150	0.508	1.8480	1.8480	0.457	0.508	0.548	0.6099	Clay	0.4973	8.82
0.833	0.0130	0.0150	0.430	1.4120	1.4120	0.392	0.430	0.470	0.5154	Clay	0.4273	9.00
0.833	0.0130	0.0150	0.330	0.8853	0.8854	0.300	0.330	0.360	0.3954	Clay	0.3383	12.78
0.833	0.0130	0.0150	0.230	0.4462	0.4462	0.215	0.230	0.258	0.2759	Clay	0.2497	16.14
1.000	0.0130	0.0005	0.922	0.8552	0.8972	0.986	0.922	0.986	0.9215	Clay	0.8739	11.37
1.000	0.0130	0.0005	0.950	0.8559	0.9006	0.896	0.950	0.896	0.9498	Clay	0.8990	0.34
1.000	0.0130	0.0005	0.915	0.8537	0.8540	0.856	0.915	0.856	0.9148	Clay	0.8679	1.39
1.000	0.0130	0.0005	0.877	0.8379	0.8380	0.803	0.877	0.803	0.8767	Clay	0.8341	3.87
1.000	0.0130	0.0005	0.759	0.7360	0.7360	0.754	0.759	0.754	0.7587	Clay	0.7291	3.30
1.000	0.0130	0.0005	0.707	0.6761	0.6762	0.694	0.707	0.694	0.7075	Clay	0.6835	1.51
1.000	0.0130	0.0005	0.686	0.6489	0.6496	0.650	0.686	0.650	0.6857	Clay	0.6642	2.18
1.000	0.0130	0.0005	0.603	0.5390	0.5390	0.592	0.603	0.592	0.6028	Clay	0.5905	0.26
1.000	0.0130	0.0005	0.575	0.5006	0.5006	0.558	0.575	0.558	0.5748	Clay	0.5655	1.35
1.000	0.0130	0.0005	0.521	0.4262	0.4261	0.502	0.521	0.502	0.5206	Clay	0.5173	3.04
1.000	0.0130	0.0005	0.406	0.2754	0.2754	0.412	0.406	0.412	0.4057	Clay	0.4151	0.76
2.000	0.0130	0.0020	0.842	3.7400	3.7400	1.200	0.842	0.600	0.4210	CMP	0.8574	28.55
2.000	0.0130	0.0020	1.043	5.4299	5.4300	1.600	1.043	0.800	0.5216	CMP	1.0364	35.23
2.000	0.0130	0.0020	1.108	5.9906	5.9900	1.800	1.108	0.900	0.5538	CMP	1.0937	39.24
3.000	0.0130	0.0018	0.670	3.0501	3.0500	0.900	0.670	0.300	0.2233	CMP	0.7587	15.70
3.000	0.0130	0.0020	0.863	5.3102	5.3100	1.190	0.863	0.397	0.2875	CMP	0.9301	21.84
3.000	0.0130	0.0020	1.093	8.4501	8.4500	1.520	1.093	0.507	0.3642	CMP	1.1347	25.35
3.000	0.0130	0.0019	1.262	10.7400	10.7400	1.800	1.262	0.600	0.4208	CMP	1.2857	28.57

Diameter (ft)	<i>n</i>	Slope (ft/ft)	depth (ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
3.000	0.0130	0.0022	1.431	14.4300	14.4300	2.110	1.431	0.703	0.4771	CMP	1.4358	31.95
3.000	0.0130	0.0019	1.559	15.5098	15.5100	2.400	1.559	0.800	0.5197	CMP	1.5495	35.44
3.000	0.0130	0.0020	1.642	17.1102	17.1100	2.620	1.642	0.873	0.5473	CMP	1.6232	38.05
0.667	0.0130	0.0030	0.266	0.2220	0.2220	0.221	0.266	0.332	0.3990	PVC	0.2728	23.42
0.667	0.0130	0.0030	0.403	0.4493	0.4490	0.329	0.403	0.494	0.6042	PVC	0.3944	19.89
0.667	0.0130	0.0030	0.513	0.6210	0.6210	0.397	0.513	0.596	0.7693	PVC	0.4923	24.01
0.667	0.0130	0.0030	0.515	0.6240	0.6240	0.398	0.515	0.597	0.7727	PVC	0.4943	24.21
0.667	0.0130	0.0030	0.626	0.7118	0.9470	0.538	0.626	0.807	0.9386	PVC	0.5928	10.18
0.667	0.0130	0.0030	0.627	0.7118	0.9410	0.559	0.627	0.839	0.9412	PVC	0.5943	6.31
0.667	0.0130	0.0063	0.344	0.5049	0.5050	0.272	0.344	0.408	0.5156	PVC	0.3419	25.70
0.667	0.0130	0.0063	0.206	0.1989	0.1990	0.169	0.206	0.254	0.3091	PVC	0.2195	29.85
0.667	0.0130	0.0063	0.309	0.4209	0.4210	0.251	0.309	0.377	0.4636	PVC	0.3111	23.94
0.667	0.0130	0.0063	0.422	0.6987	0.6990	0.334	0.422	0.501	0.6334	PVC	0.4117	23.28
0.667	0.0130	0.0063	0.575	0.9989	0.9990	0.417	0.575	0.626	0.8631	PVC	0.5480	31.41
0.667	0.0130	0.0063	0.627	1.0315	1.3340	0.518	0.627	0.777	0.9402	PVC	0.5937	14.61
0.667	0.0130	0.0063	0.658	1.0051	1.2830	0.502	0.658	0.753	0.9864	PVC	0.6211	23.72
0.667	0.0130	0.0105	0.633	1.3305	1.4750	0.466	0.633	0.699	0.9491	PVC	0.5990	28.53
0.667	0.0130	0.0105	0.207	0.2599	0.2600	0.172	0.207	0.258	0.3110	PVC	0.2206	28.26
0.667	0.0130	0.0105	0.283	0.4649	0.4650	0.231	0.283	0.347	0.4246	PVC	0.2879	24.65
0.667	0.0130	0.0105	0.512	1.1600	1.1600	0.394	0.512	0.591	0.7682	PVC	0.4917	24.79
0.667	0.0130	0.0105	0.259	0.3949	0.3950	0.212	0.259	0.318	0.3882	PVC	0.2664	25.65
1.000	0.0130	0.0030	0.350	0.5118	0.5120	0.285	0.350	0.285	0.3495	PVC	0.3652	28.14
1.000	0.0130	0.0030	0.452	0.8177	0.8180	0.362	0.452	0.362	0.4516	PVC	0.4559	25.95
1.000	0.0130	0.0030	0.560	1.1759	1.1760	0.439	0.560	0.439	0.5599	PVC	0.5522	25.80
1.000	0.0130	0.0030	0.692	1.6090	1.6090	0.521	0.692	0.521	0.6920	PVC	0.6698	28.56
1.000	0.0130	0.0030	0.803	1.9150	1.9150	0.581	0.803	0.581	0.8034	PVC	0.7688	32.33
1.000	0.0130	0.0060	0.257	0.3978	0.3980	0.212	0.257	0.212	0.2565	PVC	0.2825	33.24
1.000	0.0130	0.0060	0.303	0.5508	0.5510	0.252	0.303	0.252	0.3030	PVC	0.3238	28.48
1.000	0.0130	0.0060	0.412	0.9797	0.9800	0.336	0.412	0.336	0.4116	PVC	0.4204	25.12
1.000	0.0130	0.0060	0.548	1.6070	1.6070	0.448	0.548	0.448	0.5481	PVC	0.5418	20.93
1.000	0.0130	0.0060	0.634	2.0120	2.0120	0.504	0.634	0.504	0.6337	PVC	0.6179	22.61
1.000	0.0130	0.0060	0.686	2.2475	2.2480	0.544	0.686	0.544	0.6856	PVC	0.6641	22.08
1.000	0.0130	0.0060	0.694	2.2854	2.2860	0.553	0.694	0.553	0.6943	PVC	0.6718	21.48
1.000	0.0130	0.0100	0.347	0.9235	0.9240	0.283	0.347	0.283	0.3474	PVC	0.3633	28.37
1.000	0.0130	0.0100	0.410	1.2537	1.2540	0.338	0.410	0.338	0.4097	PVC	0.4186	23.86
1.000	0.0130	0.0100	0.452	1.4932	1.4940	0.354	0.452	0.354	0.4516	PVC	0.4560	28.81
1.000	0.0130	0.0100	0.455	1.5145	1.5150	0.365	0.455	0.365	0.4553	PVC	0.4592	25.81
1.000	0.0130	0.0100	0.505	1.8085	1.8090	0.393	0.505	0.393	0.5045	PVC	0.5030	28.00
1.000	0.0130	0.0100	0.659	2.7468	2.7470	0.521	0.659	0.521	0.6589	PVC	0.6403	22.90
1.000	0.0130	0.0100	0.768	3.3359	3.3360	0.588	0.768	0.588	0.7679	PVC	0.7372	25.38

Diameter (ft)	<i>n</i>	Slope (ft/ft)	depth (ft)	Goal Seek Q	Discharge (Q) [cfs]	observed depth	depth predicted	d/D observed	d/D predicted	Material	depth adjusted	% error
1.000	0.0130	0.0100	0.941	3.8316	4.3210	0.656	0.941	0.656	0.9407	PVC	0.8909	35.81
3.000	0.0130	0.0071	0.387	2.0000	2.0000	0.320	0.387	0.107	0.1291	HDPE	0.5073	58.52
3.000	0.0130	0.0071	0.857	10.0101	10.0100	0.085	0.857	0.028	0.2857	HDPE	0.9253	991.16
3.000	0.0130	0.0071	1.168	18.0296	18.0300	1.103	1.168	0.368	0.3895	HDPE	1.2021	8.98
3.000	0.0130	0.0071	1.436	26.0599	26.0600	1.373	1.436	0.458	0.4785	HDPE	1.4397	4.86
3.000	0.0130	0.0071	1.688	34.1300	34.1300	1.591	1.688	0.530	0.5626	HDPE	1.6640	4.59
3.000	0.0130	0.0071	1.847	39.2598	39.2600	1.706	1.847	0.569	0.6157	HDPE	1.8058	5.85
3.000	0.0130	0.0135	0.334	2.0299	2.0300	0.293	0.334	0.098	0.1114	HDPE	0.4602	57.07
3.000	0.0130	0.0135	0.730	10.0500	10.0500	0.709	0.730	0.236	0.2432	HDPE	0.8119	14.51
3.000	0.0130	0.0135	0.985	18.0300	18.0300	0.975	0.985	0.325	0.3282	HDPE	1.0385	6.51
3.000	0.0130	0.0135	1.198	26.0299	26.0300	1.197	1.198	0.399	0.3993	HDPE	1.2284	2.62
3.000	0.0130	0.0135	1.345	32.0697	32.0700	1.338	1.345	0.446	0.4484	HDPE	1.3593	1.59
3.000	0.0130	0.0135	1.529	40.0200	40.0200	1.497	1.529	0.499	0.5097	HDPE	1.5229	1.73
3.000	0.0130	0.0197	0.303	1.9995	2.0000	0.259	0.303	0.086	0.1011	HDPE	0.4327	67.05
3.000	0.0130	0.0197	0.663	10.0101	10.0100	0.670	0.663	0.223	0.2208	HDPE	0.7521	12.26
3.000	0.0130	0.0197	0.894	18.1003	18.1000	0.905	0.894	0.302	0.2981	HDPE	0.9582	5.88
3.000	0.0130	0.0197	1.097	26.7396	26.7400	1.045	1.097	0.348	0.3658	HDPE	1.1390	8.99
3.000	0.0130	0.0197	1.191	31.0904	31.0900	1.256	1.191	0.419	0.3969	HDPE	1.2218	2.72
3.000	0.0130	0.0197	1.371	40.0701	40.0700	1.422	1.371	0.474	0.4571	HDPE	1.3824	2.78

Appendix E: Predicted Depth by New Equation (Average Ks)

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	Material	depth adjusted Power	% error Power - Average Ks
0.1400	0.667	0.0055	0.0050	0.4318	0.285	0.190	0.4318	Concrete	0.225944	18.92
0.2550	0.667	0.0055	0.0050	0.7865	0.375	0.250	0.7865	Concrete	0.308521	23.41
0.4500	0.667	0.0055	0.0050	1.3880	0.495	0.330	1.3880	Concrete	0.41441	25.58
0.6100	0.667	0.0055	0.0050	1.8815	0.594	0.396	1.8815	Concrete	0.485362	22.57
0.8800	0.667	0.0055	0.0050	2.7143	0.750	0.500	2.7143	Concrete	0.587145	17.43
1.0200	0.667	0.0055	0.0050	3.1462	0.870	0.580	3.1462	Concrete	0.633949	9.30
0.1930	0.667	0.0055	0.0100	0.4209	0.262	0.175	0.4209	Concrete	0.222967	27.41
0.4600	0.667	0.0055	0.0100	1.0033	0.390	0.260	1.0033	Concrete	0.350104	34.66
0.7600	0.667	0.0055	0.0100	1.6576	0.495	0.330	1.6576	Concrete	0.45444	37.71
1.0400	0.667	0.0055	0.0100	2.2683	0.630	0.420	2.2683	Concrete	0.534863	27.35
1.3600	0.667	0.0055	0.0100	2.9662	0.750	0.500	2.9662	Concrete	0.614848	22.97
1.5300	0.667	0.0055	0.0100	3.3370	0.900	0.600	3.3370	Concrete	0.653644	8.94
1.6400	0.667	0.0055	0.0100	3.5769	0.960	0.640	3.5769	Concrete	0.67765	5.88
0.2000	0.667	0.0055	0.0150	0.3562	0.255	0.170	0.3562	Concrete	0.204428	20.25
0.4500	0.667	0.0055	0.0150	0.8014	0.375	0.250	0.8014	Concrete	0.311529	24.61
0.7700	0.667	0.0055	0.0150	1.3712	0.495	0.330	1.3712	Concrete	0.4118	24.79
1.1200	0.667	0.0055	0.0150	1.9945	0.630	0.420	1.9945	Concrete	0.500292	19.12
1.5000	0.667	0.0055	0.0150	2.6712	0.750	0.500	2.6712	Concrete	0.582283	16.46
1.7300	0.667	0.0055	0.0150	3.0808	0.855	0.570	3.0808	Concrete	0.627075	10.01
0.2300	0.667	0.0055	0.0200	0.3547	0.255	0.170	0.3547	Concrete	0.203995	20.00
0.5600	0.667	0.0055	0.0200	0.8637	0.375	0.250	0.8637	Concrete	0.323881	29.55
0.8400	0.667	0.0055	0.0200	1.2955	0.480	0.320	1.2955	Concrete	0.39982	24.94
1.2900	0.667	0.0055	0.0200	1.9895	0.630	0.420	1.9895	Concrete	0.499635	18.96
1.6700	0.667	0.0055	0.0200	2.5755	0.750	0.500	2.5755	Concrete	0.571351	14.27
2.0000	0.667	0.0055	0.0200	3.0845	0.870	0.580	3.0845	Concrete	0.627461	8.18
0.2350	0.667	0.0055	0.0300	0.2959	0.240	0.160	0.2959	Concrete	0.185666	16.04
0.5200	0.667	0.0055	0.0300	0.6548	0.360	0.240	0.6548	Concrete	0.280495	16.87
1.0000	0.667	0.0055	0.0300	1.2592	0.510	0.340	1.2592	Concrete	0.393969	15.87
1.3900	0.667	0.0055	0.0300	1.7503	0.630	0.420	1.7503	Concrete	0.467475	11.30
1.4000	0.667	0.0055	0.0300	1.7629	0.750	0.500	1.7629	Concrete	0.469219	6.16
2.4800	0.667	0.0055	0.0300	3.1229	0.915	0.610	3.1229	Concrete	0.631509	3.53
0.2550	0.667	0.0055	0.0400	0.2781	0.240	0.160	0.2781	Concrete	0.179766	12.35
0.6200	0.667	0.0055	0.0400	0.6761	0.375	0.250	0.6761	Concrete	0.285205	14.08
1.0500	0.667	0.0055	0.0400	1.1451	0.495	0.330	1.1451	Concrete	0.374988	13.63
1.5700	0.667	0.0055	0.0400	1.7121	0.630	0.420	1.7121	Concrete	0.462146	10.03
2.1400	0.667	0.0055	0.0400	2.3337	0.750	0.500	2.3337	Concrete	0.542824	8.56
2.7600	0.667	0.0055	0.0400	3.0099	0.900	0.600	3.0099	Concrete	0.619529	3.25
0.0426	0.333	0.0055	0.0005	2.6419	0.984	0.328	2.6419	Concrete	0.289331	11.79
0.0386	0.333	0.0055	0.0005	2.3938	0.846	0.282	2.3938	Concrete	0.274884	2.52
0.0335	0.333	0.0055	0.0005	2.0775	0.741	0.247	2.0775	Concrete	0.255375	3.39
0.0196	0.333	0.0055	0.0005	1.2155	0.618	0.206	1.2155	Concrete	0.193306	6.16

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	Material	depth adjusted Power	% error Power - Average Ks
0.0120	0.333	0.0055	0.0005	0.7442	0.501	0.167	0.7442	Concrete	0.149814	10.29
0.0650	0.333	0.0055	0.0010	2.8504	0.933	0.311	2.8504	Concrete	0.300977	3.22
0.0550	0.333	0.0055	0.0010	2.4119	0.822	0.274	2.4119	Concrete	0.275958	0.71
0.0450	0.333	0.0055	0.0010	1.9733	0.717	0.239	1.9733	Concrete	0.248639	4.03
0.0375	0.333	0.0055	0.0010	1.6445	0.630	0.210	1.6445	Concrete	0.226169	7.70
0.0218	0.333	0.0055	0.0010	0.9560	0.489	0.163	0.9560	Concrete	0.170629	4.68
0.0083	0.333	0.0055	0.0010	0.3640	0.354	0.118	0.3640	Concrete	0.10332	12.44
0.0832	0.333	0.0055	0.0020	2.5799	0.969	0.323	2.5799	Concrete	0.285783	11.52
0.0800	0.333	0.0055	0.0020	2.4807	0.813	0.271	2.4807	Concrete	0.280019	3.33
0.0650	0.333	0.0055	0.0020	2.0155	0.729	0.243	2.0155	Concrete	0.251386	3.45
0.0544	0.333	0.0055	0.0020	1.6868	0.645	0.215	1.6868	Concrete	0.229179	6.60
0.0280	0.333	0.0055	0.0020	0.8682	0.486	0.162	0.8682	Concrete	0.162305	0.19
0.0127	0.333	0.0055	0.0020	0.3938	0.372	0.124	0.3938	Concrete	0.107636	13.20
0.1014	0.333	0.0055	0.0030	2.5673	0.969	0.323	2.5673	Concrete	0.285055	11.75
0.1041	0.333	0.0055	0.0030	2.6356	0.885	0.295	2.6356	Concrete	0.288974	2.04
0.0969	0.333	0.0055	0.0030	2.4533	0.813	0.271	2.4533	Concrete	0.278412	2.73
0.0848	0.333	0.0055	0.0030	2.1470	0.729	0.243	2.1470	Concrete	0.259773	6.90
0.0591	0.333	0.0055	0.0030	1.4963	0.633	0.211	1.4963	Concrete	0.215344	2.06
0.0298	0.333	0.0055	0.0030	0.7545	0.480	0.160	0.7545	Concrete	0.150886	5.70
0.1415	0.333	0.0055	0.0050	2.7750	0.945	0.315	2.7750	Concrete	0.296815	5.77
0.1235	0.333	0.0055	0.0050	2.4220	0.828	0.276	2.4220	Concrete	0.276559	0.20
0.0996	0.333	0.0055	0.0050	1.9533	0.729	0.243	1.9533	Concrete	0.247322	1.78
0.0788	0.333	0.0055	0.0050	1.5454	0.636	0.212	1.5454	Concrete	0.218984	3.29
0.0478	0.333	0.0055	0.0050	0.9374	0.510	0.170	0.9374	Concrete	0.1689	0.65
0.0200	0.333	0.0055	0.0050	0.3922	0.363	0.121	0.3922	Concrete	0.107412	11.23
0.2250	0.333	0.0055	0.0125	2.7907	0.903	0.301	2.7907	Concrete	0.297688	1.10
0.2124	0.333	0.0055	0.0125	2.6345	0.861	0.287	2.6345	Concrete	0.288908	0.66
0.1656	0.333	0.0055	0.0125	2.0540	0.726	0.242	2.0540	Concrete	0.253866	4.90
0.1377	0.333	0.0055	0.0125	1.7079	0.612	0.204	1.7079	Concrete	0.230663	13.07
0.0760	0.333	0.0055	0.0125	0.9426	0.588	0.196	0.9426	Concrete	0.169389	13.58
0.0416	0.333	0.0055	0.0125	0.5160	0.399	0.133	0.5160	Concrete	0.123857	6.87
0.2544	0.333	0.0055	0.0150	2.8805	0.942	0.314	2.8805	Concrete	0.302622	3.62
0.2456	0.333	0.0055	0.0150	2.7808	0.906	0.302	2.7808	Concrete	0.297138	1.61
0.2236	0.333	0.0055	0.0150	2.5317	0.822	0.274	2.5317	Concrete	0.282999	3.28
0.1892	0.333	0.0055	0.0150	2.1422	0.765	0.255	2.1422	Concrete	0.259475	1.75
0.1506	0.333	0.0055	0.0150	1.7052	0.672	0.224	1.7052	Concrete	0.23047	2.89
0.0848	0.333	0.0055	0.0150	0.9602	0.477	0.159	0.9602	Concrete	0.171016	7.56
0.0438	0.333	0.0055	0.0150	0.4959	0.369	0.123	0.4959	Concrete	0.121334	1.35
0.0844	0.417	0.0055	0.0005	2.8868	0.950	0.396	2.8868	Concrete	0.378712	4.37
0.0671	0.417	0.0055	0.0005	2.2951	0.739	0.308	2.2951	Concrete	0.336168	9.15
0.0346	0.417	0.0055	0.0005	1.1835	0.530	0.221	1.1835	Concrete	0.2383	7.83
0.1305	0.417	0.0055	0.0010	3.1563	0.972	0.405	3.1563	Concrete	0.396681	2.05
0.0969	0.417	0.0055	0.0010	2.3436	0.703	0.293	2.3436	Concrete	0.339842	15.99
0.0448	0.417	0.0055	0.0010	1.0835	0.494	0.206	1.0835	Concrete	0.227626	10.50
0.0196	0.417	0.0055	0.0010	0.4740	0.322	0.134	0.4740	Concrete	0.148153	10.56
0.1840	0.417	0.0055	0.0020	3.1468	0.943	0.393	3.1468	Concrete	0.396061	0.78

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	Material	depth adjusted Power	% error Power - Average Ks
0.1608	0.417	0.0055	0.0020	2.7500	0.761	0.317	2.7500	Concrete	0.369279	16.49
0.0848	0.417	0.0055	0.0020	1.4503	0.559	0.233	1.4503	Concrete	0.264845	13.67
0.0465	0.417	0.0055	0.0020	0.7952	0.410	0.171	0.7952	Concrete	0.193835	13.35
0.0256	0.417	0.0055	0.0020	0.4378	0.302	0.126	0.4378	Concrete	0.142158	12.82
0.1853	0.417	0.0055	0.0030	2.5875	0.744	0.310	2.5875	Concrete	0.357776	15.41
0.0828	0.417	0.0055	0.0030	1.1562	0.502	0.209	1.1562	Concrete	0.235433	12.65
0.3052	0.417	0.0055	0.0050	3.3011	0.955	0.398	3.3011	Concrete	0.406038	2.02
0.2020	0.417	0.0055	0.0050	2.1849	0.667	0.278	2.1849	Concrete	0.327684	17.87
0.1023	0.417	0.0055	0.0050	1.1065	0.463	0.193	1.1065	Concrete	0.23012	19.23
0.0622	0.417	0.0055	0.0050	0.6728	0.382	0.159	0.6728	Concrete	0.177705	11.76
0.3563	0.417	0.0055	0.0075	3.1467	0.943	0.393	3.1467	Concrete	0.396053	0.78
0.1349	0.417	0.0055	0.0075	1.1914	0.470	0.196	1.1914	Concrete	0.239126	22.00
0.0748	0.417	0.0055	0.0075	0.6606	0.350	0.146	0.6606	Concrete	0.176026	20.57
0.0439	0.417	0.0055	0.0075	0.3877	0.302	0.126	0.3877	Concrete	0.133458	5.92
0.4282	0.417	0.0055	0.0100	3.2750	0.970	0.404	3.2750	Concrete	0.404364	0.09
0.3105	0.417	0.0055	0.0100	2.3748	0.715	0.298	2.3748	Concrete	0.342183	14.83
0.2318	0.417	0.0055	0.0100	1.7729	0.538	0.224	1.7729	Concrete	0.293974	31.24
0.1644	0.417	0.0055	0.0100	1.2574	0.468	0.195	1.2574	Concrete	0.24592	26.11
0.0736	0.417	0.0055	0.0100	0.5629	0.324	0.135	0.5629	Concrete	0.161985	19.99
0.4669	0.417	0.0055	0.0125	3.1940	0.950	0.396	3.1940	Concrete	0.399136	0.79
0.3660	0.417	0.0055	0.0125	2.5038	0.749	0.312	2.5038	Concrete	0.351713	12.73
0.2688	0.417	0.0055	0.0125	1.8388	0.554	0.231	1.8388	Concrete	0.299604	29.70
0.1892	0.417	0.0055	0.0125	1.2943	0.451	0.188	1.2943	Concrete	0.249643	32.79
0.0920	0.417	0.0055	0.0125	0.6294	0.310	0.129	0.6294	Concrete	0.171651	33.06
0.5162	0.417	0.0055	0.0150	3.2236	0.962	0.401	3.2236	Concrete	0.401053	0.01
0.4565	0.417	0.0055	0.0150	2.8508	0.775	0.323	2.8508	Concrete	0.376246	16.48
0.3150	0.417	0.0055	0.0150	1.9671	0.626	0.261	1.9671	Concrete	0.310288	18.88
0.1548	0.417	0.0055	0.0150	0.9667	0.422	0.176	0.9667	Concrete	0.214525	21.89
0.1366	0.500	0.0055	0.0005	2.8733	0.984	0.492	2.8733	Concrete	0.453346	7.86
0.0888	0.500	0.0055	0.0005	1.8679	0.782	0.391	1.8679	Concrete	0.362463	7.30
0.0463	0.500	0.0055	0.0005	0.9739	0.564	0.282	0.9739	Concrete	0.258424	8.36
0.0343	0.500	0.0055	0.0005	0.7215	0.450	0.225	0.7215	Concrete	0.221131	1.72
0.0206	0.500	0.0055	0.0005	0.4333	0.346	0.173	0.4333	Concrete	0.169675	1.92
0.2187	0.500	0.0055	0.0010	3.2528	0.968	0.484	3.2528	Concrete	0.483529	0.10
0.1795	0.500	0.0055	0.0010	2.6698	0.696	0.348	2.6698	Concrete	0.436372	25.39
0.1070	0.500	0.0055	0.0010	1.5915	0.596	0.298	1.5915	Concrete	0.333531	11.92
0.0535	0.500	0.0055	0.0010	0.7957	0.444	0.222	0.7957	Concrete	0.232675	4.81
0.0295	0.500	0.0055	0.0010	0.4388	0.352	0.176	0.4388	Concrete	0.170783	2.96
0.3026	0.500	0.0055	0.0020	3.1825	0.962	0.481	3.1825	Concrete	0.478068	0.61
0.2378	0.500	0.0055	0.0020	2.5010	0.742	0.371	2.5010	Concrete	0.421813	13.70
0.1578	0.500	0.0055	0.0020	1.6596	0.586	0.293	1.6596	Concrete	0.340875	16.34
0.0459	0.500	0.0055	0.0020	0.4827	0.340	0.170	0.4827	Concrete	0.179469	5.57
0.3831	0.500	0.0055	0.0030	3.2898	0.978	0.489	3.2898	Concrete	0.486373	0.54
0.3177	0.500	0.0055	0.0030	2.7282	0.766	0.383	2.7282	Concrete	0.441303	15.22
0.1795	0.500	0.0055	0.0030	1.5414	0.546	0.273	1.5414	Concrete	0.328039	20.16
0.1190	0.500	0.0055	0.0030	1.0219	0.444	0.222	1.0219	Concrete	0.264963	19.35

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	Material	depth adjusted Power	% error Power - Average Ks
0.0550	0.500	0.0055	0.0030	0.4723	0.328	0.164	0.4723	Concrete	0.177442	8.20
0.4335	0.500	0.0055	0.0050	2.8835	0.960	0.480	2.8835	Concrete	0.454181	5.38
0.3915	0.500	0.0055	0.0050	2.6041	0.770	0.385	2.6041	Concrete	0.430762	11.89
0.2082	0.500	0.0055	0.0050	1.3849	0.540	0.270	1.3849	Concrete	0.310287	14.92
0.1250	0.500	0.0055	0.0050	0.8315	0.420	0.210	0.8315	Concrete	0.238044	13.35
0.0615	0.500	0.0055	0.0050	0.4091	0.302	0.151	0.4091	Concrete	0.164677	9.06
0.5874	0.500	0.0055	0.0075	3.1902	0.960	0.480	3.1902	Concrete	0.478669	0.28
0.4691	0.500	0.0055	0.0075	2.5477	0.768	0.384	2.5477	Concrete	0.425889	10.91
0.2680	0.500	0.0055	0.0075	1.4555	0.544	0.272	1.4555	Concrete	0.318412	17.06
0.1602	0.500	0.0055	0.0075	0.8701	0.424	0.212	0.8701	Concrete	0.243723	14.96
0.0633	0.500	0.0055	0.0075	0.3438	0.284	0.142	0.3438	Concrete	0.150454	5.95
0.6238	0.500	0.0055	0.0100	2.9340	0.946	0.473	2.9340	Concrete	0.458297	3.11
0.4807	0.500	0.0055	0.0100	2.2609	0.730	0.365	2.2609	Concrete	0.400271	9.66
0.3186	0.500	0.0055	0.0100	1.4985	0.556	0.278	1.4985	Concrete	0.323264	16.28
0.1991	0.500	0.0055	0.0100	0.9365	0.424	0.212	0.9365	Concrete	0.253214	19.44
0.0904	0.500	0.0055	0.0100	0.4252	0.288	0.144	0.4252	Concrete	0.168016	16.68
0.3096	0.667	0.0055	0.0005	3.0239	0.968	0.645	3.0239	Concrete	0.620714	3.77
0.3096	0.667	0.0055	0.0005	3.0239	0.963	0.642	3.0239	Concrete	0.620714	3.32
0.2873	0.667	0.0055	0.0005	2.8061	0.821	0.547	2.8061	Concrete	0.597071	9.15
0.2187	0.667	0.0055	0.0005	2.1360	0.719	0.479	2.1360	Concrete	0.518169	8.18
0.1957	0.667	0.0055	0.0005	1.9114	0.639	0.426	1.9114	Concrete	0.489105	14.81
0.1105	0.667	0.0055	0.0005	1.0793	0.479	0.319	1.0793	Concrete	0.363452	13.93
0.0720	0.667	0.0055	0.0005	0.7032	0.387	0.258	0.7032	Concrete	0.290941	12.77
0.4440	0.667	0.0055	0.0010	3.0664	0.981	0.654	3.0664	Concrete	0.625235	4.40
0.4261	0.667	0.0055	0.0010	2.9428	0.938	0.625	2.9428	Concrete	0.612011	2.08
0.4104	0.667	0.0055	0.0010	2.8343	0.831	0.554	2.8343	Concrete	0.60019	8.34
0.3278	0.667	0.0055	0.0010	2.2639	0.722	0.481	2.2639	Concrete	0.534056	11.03
0.2839	0.667	0.0055	0.0010	1.9607	0.642	0.428	1.9607	Concrete	0.495618	15.80
0.1638	0.667	0.0055	0.0010	1.1313	0.467	0.311	1.1313	Concrete	0.372446	19.76
0.1130	0.667	0.0055	0.0010	0.7804	0.380	0.253	0.7804	Concrete	0.307116	21.39
0.0462	0.667	0.0055	0.0010	0.3191	0.266	0.177	0.3191	Concrete	0.192979	9.03
0.6373	0.667	0.0055	0.0020	3.1122	0.972	0.648	3.1122	Concrete	0.630074	2.77
0.6496	0.667	0.0055	0.0020	3.1723	0.960	0.640	3.1723	Concrete	0.636363	0.57
0.6035	0.667	0.0055	0.0020	2.9472	0.848	0.565	2.9472	Concrete	0.612487	8.40
0.5090	0.667	0.0055	0.0020	2.4857	0.744	0.496	2.4857	Concrete	0.560628	13.03
0.4387	0.667	0.0055	0.0020	2.1424	0.672	0.448	2.1424	Concrete	0.518969	15.84
0.2616	0.667	0.0055	0.0020	1.2775	0.503	0.335	1.2775	Concrete	0.396733	18.43
0.7870	0.667	0.0055	0.0030	3.1380	0.965	0.643	3.1380	Concrete	0.632782	1.59
0.7750	0.667	0.0055	0.0030	3.0902	0.935	0.623	3.0902	Concrete	0.627752	0.76
0.7240	0.667	0.0055	0.0030	2.8868	0.830	0.553	2.8868	Concrete	0.60594	9.57
0.6224	0.667	0.0055	0.0030	2.4817	0.734	0.489	2.4817	Concrete	0.560163	14.55
0.5440	0.667	0.0055	0.0030	2.1691	0.668	0.445	2.1691	Concrete	0.522323	17.38
0.3354	0.667	0.0055	0.0030	1.3374	0.512	0.341	1.3374	Concrete	0.40628	19.14
0.1886	0.667	0.0055	0.0030	0.7520	0.393	0.262	0.7520	Concrete	0.301259	14.98
0.0824	0.667	0.0055	0.0030	0.3286	0.273	0.182	0.3286	Concrete	0.195938	7.66
1.1050	0.667	0.0055	0.0050	3.4129	0.971	0.647	3.4129	Concrete	0.660993	2.16

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	Material	depth adjusted Power	% error Power - Average Ks
1.0164	0.667	0.0055	0.0050	3.1392	0.942	0.628	3.1392	Concrete	0.632908	0.78
0.9930	0.667	0.0055	0.0050	3.0670	0.935	0.623	3.0670	Concrete	0.625296	0.37
0.9108	0.667	0.0055	0.0050	2.8131	0.849	0.566	2.8131	Concrete	0.597848	5.63
0.8028	0.667	0.0055	0.0050	2.4795	0.768	0.512	2.4795	Concrete	0.559904	9.36
0.6440	0.667	0.0055	0.0050	1.9891	0.665	0.443	1.9891	Concrete	0.499329	12.72
0.3610	0.667	0.0055	0.0050	1.1150	0.477	0.318	1.1150	Concrete	0.369654	16.24
0.2608	0.667	0.0055	0.0050	0.8055	0.405	0.270	0.8055	Concrete	0.312207	15.63
0.1140	0.667	0.0055	0.0050	0.3521	0.284	0.189	0.3521	Concrete	0.203111	7.47
1.1900	0.667	0.0055	0.0075	3.0010	0.971	0.647	3.0010	Concrete	0.618269	4.44
1.2280	0.667	0.0055	0.0075	3.0968	0.950	0.633	3.0968	Concrete	0.628448	0.72
1.0880	0.667	0.0055	0.0075	2.7437	0.819	0.546	2.7437	Concrete	0.590146	8.09
0.9658	0.667	0.0055	0.0075	2.4356	0.743	0.495	2.4356	Concrete	0.554727	12.07
0.8204	0.667	0.0055	0.0075	2.0689	0.663	0.442	2.0689	Concrete	0.509644	15.30
0.5042	0.667	0.0055	0.0075	1.2715	0.503	0.335	1.2715	Concrete	0.395761	18.14
0.3096	0.667	0.0055	0.0075	0.7808	0.390	0.260	0.7808	Concrete	0.307186	18.15
0.1215	0.667	0.0055	0.0075	0.3064	0.255	0.170	0.3064	Concrete	0.188959	11.15
1.3580	0.667	0.0055	0.0100	2.9658	0.968	0.645	2.9658	Concrete	0.614496	4.73
1.3630	0.667	0.0055	0.0100	2.9767	0.963	0.642	2.9767	Concrete	0.615671	4.10
1.2680	0.667	0.0055	0.0100	2.7693	0.839	0.559	2.7693	Concrete	0.592991	6.08
1.0470	0.667	0.0055	0.0100	2.2866	0.696	0.464	2.2866	Concrete	0.536834	15.70
0.8788	0.667	0.0055	0.0100	1.9193	0.623	0.415	1.9193	Concrete	0.49015	18.11
0.5318	0.667	0.0055	0.0100	1.1614	0.464	0.309	1.1614	Concrete	0.377576	22.19
0.2899	0.667	0.0055	0.0100	0.6331	0.338	0.225	0.6331	Concrete	0.275496	22.44
0.1283	0.667	0.0055	0.0100	0.2802	0.230	0.153	0.2802	Concrete	0.180385	17.90
1.5120	0.667	0.0055	0.0125	2.9535	0.963	0.642	2.9535	Concrete	0.613172	4.49
1.4880	0.667	0.0055	0.0125	2.9067	0.900	0.600	2.9067	Concrete	0.608097	1.35
1.4700	0.667	0.0055	0.0125	2.8715	0.890	0.593	2.8715	Concrete	0.604264	1.90
1.4080	0.667	0.0055	0.0125	2.7504	0.830	0.553	2.7504	Concrete	0.590887	6.85
1.2040	0.667	0.0055	0.0125	2.3519	0.731	0.487	2.3519	Concrete	0.544742	11.86
0.9928	0.667	0.0055	0.0125	1.9393	0.639	0.426	1.9393	Concrete	0.492805	15.68
0.6224	0.667	0.0055	0.0125	1.2158	0.486	0.324	1.2158	Concrete	0.386656	19.34
0.3620	0.667	0.0055	0.0125	0.7071	0.366	0.244	0.7071	Concrete	0.291779	19.58
0.1602	0.667	0.0055	0.0125	0.3129	0.245	0.163	0.3129	Concrete	0.191041	17.20
1.6450	0.667	0.0055	0.0150	2.9334	0.951	0.634	2.9334	Concrete	0.610993	3.63
1.6425	0.667	0.0055	0.0150	2.9289	0.924	0.616	2.9289	Concrete	0.61051	0.89
1.5060	0.667	0.0055	0.0150	2.6855	0.818	0.545	2.6855	Concrete	0.583604	7.08
1.2900	0.667	0.0055	0.0150	2.3003	0.723	0.482	2.3003	Concrete	0.538505	11.72
1.0140	0.667	0.0055	0.0150	1.8082	0.621	0.414	1.8082	Concrete	0.475198	14.78
0.6524	0.667	0.0055	0.0150	1.1634	0.485	0.323	1.1634	Concrete	0.377901	17.00
0.3925	0.667	0.0055	0.0150	0.6999	0.368	0.245	0.6999	Concrete	0.290227	18.46
0.1879	0.667	0.0055	0.0150	0.3351	0.248	0.165	0.3351	Concrete	0.197944	19.97
0.4818	0.833	0.0055	0.0005	2.5954	0.982	0.818	2.5954	Concrete	0.716683	12.39
0.5150	0.833	0.0055	0.0005	2.7742	0.940	0.783	2.7742	Concrete	0.741928	5.25
0.5114	0.833	0.0055	0.0005	2.7548	0.887	0.739	2.7548	Concrete	0.739229	0.03
0.4910	0.833	0.0055	0.0005	2.6449	0.847	0.706	2.6449	Concrete	0.72376	2.52
0.4324	0.833	0.0055	0.0005	2.3293	0.739	0.616	2.3293	Concrete	0.677517	9.99

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	Material	depth adjusted Power	% error Power - Average Ks
0.4188	0.833	0.0055	0.0005	2.2560	0.695	0.579	2.2560	Concrete	0.666362	15.09
0.3660	0.833	0.0055	0.0005	1.9716	0.661	0.551	1.9716	Concrete	0.621307	12.76
0.2780	0.833	0.0055	0.0005	1.4975	0.569	0.474	1.4975	Concrete	0.538591	13.63
0.2408	0.833	0.0055	0.0005	1.2971	0.499	0.416	1.2971	Concrete	0.49986	20.16
0.1470	0.833	0.0055	0.0005	0.7919	0.388	0.323	0.7919	Concrete	0.386811	19.76
0.0832	0.833	0.0055	0.0005	0.4482	0.289	0.241	0.4482	Concrete	0.287794	19.42
0.7240	0.833	0.0055	0.0010	2.7578	0.977	0.814	2.7578	Concrete	0.739638	9.14
0.7510	0.833	0.0055	0.0010	2.8606	0.973	0.811	2.8606	Concrete	0.753842	7.05
0.7780	0.833	0.0055	0.0010	2.9635	0.947	0.789	2.9635	Concrete	0.767802	2.69
0.7615	0.833	0.0055	0.0010	2.9006	0.887	0.739	2.9006	Concrete	0.759299	2.75
0.7360	0.833	0.0055	0.0010	2.8035	0.852	0.710	2.8035	Concrete	0.745982	5.07
0.6930	0.833	0.0055	0.0010	2.6397	0.804	0.670	2.6397	Concrete	0.723013	7.91
0.6278	0.833	0.0055	0.0010	2.3913	0.740	0.617	2.3913	Concrete	0.686836	11.32
0.5954	0.833	0.0055	0.0010	2.2679	0.712	0.593	2.2679	Concrete	0.668187	12.68
0.5354	0.833	0.0055	0.0010	2.0394	0.668	0.557	2.0394	Concrete	0.632315	13.52
0.4462	0.833	0.0055	0.0010	1.6996	0.583	0.486	1.6996	Concrete	0.575196	18.35
0.3650	0.833	0.0055	0.0010	1.3903	0.508	0.423	1.3903	Concrete	0.518199	22.51
0.1998	0.833	0.0055	0.0010	0.7611	0.386	0.322	0.7611	Concrete	0.378917	17.68
0.1110	0.833	0.0055	0.0010	0.4228	0.286	0.238	0.4228	Concrete	0.27921	17.31
1.1160	0.833	0.0055	0.0020	3.0059	0.976	0.813	3.0059	Concrete	0.773489	4.86
1.1020	0.833	0.0055	0.0020	2.9681	0.958	0.798	2.9681	Concrete	0.768433	3.71
1.0960	0.833	0.0055	0.0020	2.9520	0.886	0.738	2.9520	Concrete	0.766256	3.83
1.0600	0.833	0.0055	0.0020	2.8550	0.850	0.708	2.8550	Concrete	0.753076	6.37
1.0105	0.833	0.0055	0.0020	2.7217	0.800	0.667	2.7217	Concrete	0.734597	10.13
0.9448	0.833	0.0055	0.0020	2.5447	0.745	0.621	2.5447	Concrete	0.709384	14.23
0.8639	0.833	0.0055	0.0020	2.3268	0.713	0.594	2.3268	Concrete	0.677151	14.00
0.7996	0.833	0.0055	0.0020	2.1537	0.673	0.561	2.1537	Concrete	0.650482	15.95
0.6251	0.833	0.0055	0.0020	1.6837	0.580	0.483	1.6837	Concrete	0.572385	18.51
0.5188	0.833	0.0055	0.0020	1.3973	0.527	0.439	1.3973	Concrete	0.519559	18.35
0.4982	0.833	0.0055	0.0020	1.3419	0.515	0.429	1.3419	Concrete	0.508738	18.59
0.3250	0.833	0.0055	0.0020	0.8754	0.412	0.343	0.8754	Concrete	0.407489	18.80
0.1437	0.833	0.0055	0.0020	0.3870	0.298	0.248	0.3870	Concrete	0.266681	7.53
1.3400	0.833	0.0055	0.0030	2.9469	0.976	0.813	2.9469	Concrete	0.765568	5.83
1.3380	0.833	0.0055	0.0030	2.9425	0.972	0.810	2.9425	Concrete	0.764974	5.56
1.3800	0.833	0.0055	0.0030	3.0348	0.948	0.790	3.0348	Concrete	0.777356	1.60
1.3450	0.833	0.0055	0.0030	2.9579	0.888	0.740	2.9579	Concrete	0.767051	3.66
1.3280	0.833	0.0055	0.0030	2.9205	0.858	0.715	2.9205	Concrete	0.761999	6.57
1.2360	0.833	0.0055	0.0030	2.7182	0.796	0.663	2.7182	Concrete	0.734102	10.72
1.1800	0.833	0.0055	0.0030	2.5950	0.763	0.636	2.5950	Concrete	0.716631	12.68
1.0860	0.833	0.0055	0.0030	2.3883	0.718	0.598	2.3883	Concrete	0.686383	14.78
0.9586	0.833	0.0055	0.0030	2.1081	0.665	0.554	2.1081	Concrete	0.6433	16.12
0.8092	0.833	0.0055	0.0030	1.7796	0.598	0.498	1.7796	Concrete	0.589098	18.29
0.6332	0.833	0.0055	0.0030	1.3925	0.523	0.436	1.3925	Concrete	0.518625	18.95
0.3791	0.833	0.0055	0.0030	0.8337	0.407	0.339	0.8337	Concrete	0.397297	17.20
0.1853	0.833	0.0055	0.0030	0.4075	0.292	0.243	0.4075	Concrete	0.273914	12.72
1.7650	0.833	0.0055	0.0050	3.0066	0.966	0.805	3.0066	Concrete	0.773591	3.90

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	Material	depth adjusted Power	% error Power - Average Ks
1.7350	0.833	0.0055	0.0050	2.9555	0.965	0.804	2.9555	Concrete	0.766732	4.64
1.7350	0.833	0.0055	0.0050	2.9555	0.947	0.789	2.9555	Concrete	0.766732	2.82
1.7300	0.833	0.0055	0.0050	2.9470	0.889	0.741	2.9470	Concrete	0.765584	3.32
1.6825	0.833	0.0055	0.0050	2.8661	0.845	0.704	2.8661	Concrete	0.75459	7.19
1.6250	0.833	0.0055	0.0050	2.7681	0.814	0.678	2.7681	Concrete	0.741082	9.30
1.4800	0.833	0.0055	0.0050	2.5211	0.748	0.623	2.5211	Concrete	0.705958	13.32
1.3450	0.833	0.0055	0.0050	2.2912	0.703	0.586	2.2912	Concrete	0.671736	14.63
1.2480	0.833	0.0055	0.0050	2.1259	0.674	0.562	2.1259	Concrete	0.646117	14.97
0.9930	0.833	0.0055	0.0050	1.6915	0.590	0.492	1.6915	Concrete	0.573777	16.62
0.7345	0.833	0.0055	0.0050	1.2512	0.504	0.420	1.2512	Concrete	0.490581	16.80
0.4934	0.833	0.0055	0.0050	0.8405	0.406	0.338	0.8405	Concrete	0.398974	18.04
0.2222	0.833	0.0055	0.0050	0.3785	0.277	0.231	0.3785	Concrete	0.26361	14.12
2.1150	0.833	0.0055	0.0075	2.9417	0.967	0.806	2.9417	Concrete	0.764868	5.10
2.0900	0.833	0.0055	0.0075	2.9069	0.960	0.800	2.9069	Concrete	0.760158	4.98
2.0850	0.833	0.0055	0.0075	2.9000	0.935	0.779	2.9000	Concrete	0.759213	2.54
2.0560	0.833	0.0055	0.0075	2.8596	0.871	0.726	2.8596	Concrete	0.753709	3.82
2.0440	0.833	0.0055	0.0075	2.8429	0.862	0.718	2.8429	Concrete	0.75142	4.65
1.7700	0.833	0.0055	0.0075	2.4618	0.752	0.627	2.4618	Concrete	0.697285	11.21
1.5120	0.833	0.0055	0.0075	2.1030	0.684	0.570	2.1030	Concrete	0.642488	12.72
1.3800	0.833	0.0055	0.0075	1.9194	0.649	0.541	1.9194	Concrete	0.61271	13.26
1.1560	0.833	0.0055	0.0075	1.6078	0.584	0.487	1.6078	Concrete	0.558849	14.75
0.8044	0.833	0.0055	0.0075	1.1188	0.490	0.408	1.1188	Concrete	0.462893	13.45
0.5306	0.833	0.0055	0.0075	0.7380	0.388	0.323	0.7380	Concrete	0.37291	15.45
0.2600	0.833	0.0055	0.0075	0.3616	0.269	0.224	0.3616	Concrete	0.257434	14.93
2.4060	0.833	0.0055	0.0100	2.8981	0.950	0.792	2.8981	Concrete	0.758959	4.17
2.4210	0.833	0.0055	0.0100	2.9162	0.949	0.791	2.9162	Concrete	0.761413	3.74
2.2080	0.833	0.0055	0.0100	2.6596	0.817	0.681	2.6596	Concrete	0.725843	6.58
2.0560	0.833	0.0055	0.0100	2.4765	0.749	0.624	2.4765	Concrete	0.69944	12.09
2.0050	0.833	0.0055	0.0100	2.4151	0.742	0.618	2.4151	Concrete	0.690373	11.71
1.8840	0.833	0.0055	0.0100	2.2693	0.714	0.595	2.2693	Concrete	0.668405	12.34
1.6450	0.833	0.0055	0.0100	1.9815	0.664	0.553	1.9815	Concrete	0.622921	12.64
1.3750	0.833	0.0055	0.0100	1.6562	0.587	0.489	1.6562	Concrete	0.567523	16.06
0.9930	0.833	0.0055	0.0100	1.1961	0.486	0.405	1.1961	Concrete	0.479237	18.33
0.6238	0.833	0.0055	0.0100	0.7514	0.392	0.327	0.7514	Concrete	0.37641	15.11
0.2318	0.833	0.0055	0.0100	0.2792	0.248	0.207	0.2792	Concrete	0.225067	8.73
2.7040	0.833	0.0055	0.0125	2.9132	0.972	0.810	2.9132	Concrete	0.76101	6.05
2.7220	0.833	0.0055	0.0125	2.9326	0.971	0.809	2.9326	Concrete	0.763637	5.61
2.6890	0.833	0.0055	0.0125	2.8970	0.966	0.805	2.8970	Concrete	0.758814	5.74
2.6800	0.833	0.0055	0.0125	2.8873	0.890	0.742	2.8873	Concrete	0.757493	2.09
2.5920	0.833	0.0055	0.0125	2.7925	0.841	0.701	2.7925	Concrete	0.744468	6.20
2.5920	0.833	0.0055	0.0125	2.7925	0.840	0.700	2.7925	Concrete	0.744468	6.35
2.4660	0.833	0.0055	0.0125	2.6568	0.797	0.664	2.6568	Concrete	0.725443	9.25
2.2410	0.833	0.0055	0.0125	2.4144	0.733	0.611	2.4144	Concrete	0.690267	12.97
2.0000	0.833	0.0055	0.0125	2.1547	0.683	0.569	2.1547	Concrete	0.650651	14.35
1.8840	0.833	0.0055	0.0125	2.0298	0.652	0.543	2.0298	Concrete	0.630765	16.16
1.4620	0.833	0.0055	0.0125	1.5751	0.556	0.463	1.5751	Concrete	0.552908	19.42

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	Material	depth adjusted Power	% error Power - Average Ks
1.2360	0.833	0.0055	0.0125	1.3316	0.494	0.412	1.3316	Concrete	0.506718	22.99
0.7000	0.833	0.0055	0.0125	0.7542	0.377	0.314	0.7542	Concrete	0.37713	20.11
0.3260	0.833	0.0055	0.0125	0.3512	0.256	0.213	0.3512	Concrete	0.253559	19.04
2.8840	0.833	0.0055	0.0150	2.8364	0.937	0.781	2.8364	Concrete	0.750521	3.90
2.4540	0.833	0.0055	0.0150	2.4135	0.749	0.624	2.4135	Concrete	0.690137	10.60
1.3820	0.833	0.0055	0.0150	1.3592	0.505	0.421	1.3592	Concrete	0.512141	21.65
0.9125	1.000	0.0055	0.0005	3.0228	0.985	0.985	3.0228	Concrete	0.93091	5.49
0.8938	1.000	0.0055	0.0005	2.9609	0.943	0.943	2.9609	Concrete	0.92095	2.34
0.8672	1.000	0.0055	0.0005	2.8728	0.889	0.889	2.8728	Concrete	0.906608	1.98
0.8492	1.000	0.0055	0.0005	2.8132	0.845	0.845	2.8132	Concrete	0.896783	6.13
0.7540	1.000	0.0055	0.0005	2.4978	0.782	0.782	2.4978	Concrete	0.843065	7.81
0.6986	1.000	0.0055	0.0005	2.3143	0.756	0.756	2.3143	Concrete	0.810295	7.18
0.6496	1.000	0.0055	0.0005	2.1519	0.691	0.691	2.1519	Concrete	0.780254	12.92
0.6062	1.000	0.0055	0.0005	2.0082	0.643	0.643	2.0082	Concrete	0.752723	17.06
0.4982	1.000	0.0055	0.0005	1.6504	0.580	0.580	1.6504	Concrete	0.679779	17.20
0.4485	1.000	0.0055	0.0005	1.4857	0.534	0.534	1.4857	Concrete	0.643661	20.54
0.4083	1.000	0.0055	0.0005	1.3526	0.511	0.511	1.3526	Concrete	0.613014	19.96
0.2152	1.000	0.0055	0.0005	0.7129	0.364	0.364	0.7129	Concrete	0.439519	20.75
0.1120	1.000	0.0055	0.0005	0.3710	0.275	0.275	0.3710	Concrete	0.313066	13.84
3.0600	1.500	0.0055	0.0021	1.6777	0.527	0.790	1.6777	Concrete	1.028385	30.18
4.3100	1.500	0.0055	0.0021	2.3916	0.660	0.990	2.3916	Concrete	1.236383	24.89
0.1500	0.667	0.0005	0.005	0.3094	0.240	0.160	0.3094	Clay	0.190017	18.76
0.3220	0.667	0.0005	0.005	0.6642	0.360	0.240	0.6642	Clay	0.282582	17.74
0.4690	0.667	0.0005	0.005	0.9674	0.435	0.290	0.9674	Clay	0.343548	18.46
0.8150	0.667	0.0005	0.005	1.6811	0.645	0.430	1.6811	Clay	0.457783	6.46
0.9600	0.667	0.0005	0.005	1.9802	0.735	0.490	1.9802	Clay	0.498428	1.72
1.1700	0.667	0.0005	0.005	2.4134	0.885	0.590	2.4134	Clay	0.552377	6.38
1.1600	0.667	0.0005	0.005	2.3928	0.975	0.650	2.3928	Clay	0.549919	15.40
0.1930	0.667	0.0005	0.01	0.2815	0.240	0.160	0.2815	Clay	0.180912	13.07
0.4600	0.667	0.0005	0.01	0.6710	0.375	0.250	0.6710	Clay	0.284068	13.63
0.7600	0.667	0.0005	0.01	1.1085	0.495	0.330	1.1085	Clay	0.368725	11.73
1.0400	0.667	0.0005	0.01	1.5169	0.630	0.420	1.5169	Clay	0.433979	3.33
1.3600	0.667	0.0005	0.01	1.9837	0.750	0.500	1.9837	Clay	0.498877	0.22
1.5300	0.667	0.0005	0.01	2.2316	0.840	0.560	2.2316	Clay	0.530356	5.29
1.6400	0.667	0.0005	0.01	2.3921	0.960	0.640	2.3921	Clay	0.549834	14.09
0.2400	0.667	0.0005	0.015	0.2858	0.255	0.170	0.2858	Clay	0.182348	7.26
0.5000	0.667	0.0005	0.015	0.5955	0.375	0.250	0.5955	Clay	0.26699	6.80
0.8400	0.667	0.0005	0.015	1.0004	0.495	0.330	1.0004	Clay	0.349578	5.93
1.2000	0.667	0.0005	0.015	1.4291	0.630	0.420	1.4291	Clay	0.420741	0.18
1.5600	0.667	0.0005	0.015	1.8579	0.750	0.500	1.8579	Clay	0.48218	3.56
1.9100	0.667	0.0005	0.015	2.2747	0.855	0.570	2.2747	Clay	0.535646	6.03
2.0600	0.667	0.0005	0.015	2.4533	0.975	0.650	2.4533	Clay	0.557102	14.29
0.2480	0.667	0.0005	0.02	0.2558	0.255	0.170	0.2558	Clay	0.172126	1.25
0.5450	0.667	0.0005	0.02	0.5621	0.375	0.250	0.5621	Clay	0.259111	3.64
0.9000	0.667	0.0005	0.02	0.9282	0.495	0.330	0.9282	Clay	0.336246	1.89
1.2900	0.667	0.0005	0.02	1.3305	0.630	0.420	1.3305	Clay	0.405396	3.48

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	Material	depth adjusted Power	% error Power - Average Ks
1.7300	0.667	0.0005	0.02	1.7843	0.750	0.500	1.7843	Clay	0.472164	5.57
2.3200	0.667	0.0005	0.02	2.3928	0.915	0.610	2.3928	Clay	0.549919	9.85
0.2550	0.667	0.0005	0.03	0.2147	0.255	0.170	0.2147	Clay	0.157176	7.54
0.6000	0.667	0.0005	0.03	0.5053	0.375	0.250	0.5053	Clay	0.245153	1.94
0.9400	0.667	0.0005	0.03	0.7916	0.480	0.320	0.7916	Clay	0.309548	3.27
1.4000	0.667	0.0005	0.03	1.1790	0.630	0.420	1.1790	Clay	0.380716	9.35
1.8400	0.667	0.0005	0.03	1.5495	0.720	0.480	1.5495	Clay	0.438794	8.58
2.4400	0.667	0.0005	0.03	2.0548	0.855	0.570	2.0548	Clay	0.508086	10.86
2.5400	0.667	0.0005	0.03	2.1390	0.900	0.600	2.1390	Clay	0.518799	13.53
0.3000	0.667	0.0005	0.04	0.2188	0.255	0.170	0.2188	Clay	0.158708	6.64
0.6800	0.667	0.0005	0.04	0.4959	0.375	0.250	0.4959	Clay	0.242786	2.89
1.0000	0.667	0.0005	0.04	0.7293	0.480	0.320	0.7293	Clay	0.296644	7.30
1.6200	0.667	0.0005	0.04	1.1815	0.630	0.420	1.1815	Clay	0.381135	9.25
2.1500	0.667	0.0005	0.04	1.5680	0.750	0.500	1.5680	Clay	0.441506	11.70
2.7100	0.667	0.0005	0.04	1.9764	0.855	0.570	1.9764	Clay	0.497924	12.64
0.0547	0.333	0.0005	0.0005	2.2686	0.996	0.332	2.2686	Clay	0.267318	19.48
0.0562	0.333	0.0005	0.0005	2.3308	0.927	0.309	2.3308	Clay	0.271101	12.26
0.0487	0.333	0.0005	0.0005	2.0198	0.894	0.298	2.0198	Clay	0.25166	15.55
0.0404	0.333	0.0005	0.0005	1.6755	0.744	0.248	1.6755	Clay	0.22838	7.91
0.0274	0.333	0.0005	0.0005	1.1364	0.642	0.214	1.1364	Clay	0.186662	12.77
0.0177	0.333	0.0005	0.0005	0.7341	0.477	0.159	0.7341	Clay	0.148753	6.44
0.0098	0.333	0.0005	0.0010	0.2874	0.393	0.131	0.2874	Clay	0.091389	30.24
0.0703	0.333	0.0005	0.0010	2.0616	0.993	0.331	2.0616	Clay	0.254357	23.15
0.0744	0.333	0.0005	0.0010	2.1819	0.981	0.327	2.1819	Clay	0.261959	19.89
0.0580	0.333	0.0005	0.0010	1.7009	0.855	0.285	1.7009	Clay	0.230172	19.24
0.0568	0.333	0.0005	0.0010	1.6657	0.684	0.228	1.6657	Clay	0.227685	0.14
0.0235	0.333	0.0005	0.0010	0.6892	0.480	0.160	0.6892	Clay	0.143953	10.03
0.0166	0.333	0.0005	0.0010	0.4868	0.408	0.136	0.4868	Clay	0.12017	11.64
0.0969	0.333	0.0005	0.0020	2.0094	0.987	0.329	2.0094	Clay	0.250988	23.71
0.1019	0.333	0.0005	0.0020	2.1131	0.963	0.321	2.1131	Clay	0.257635	19.74
0.0940	0.333	0.0005	0.0020	1.9493	0.849	0.283	1.9493	Clay	0.247058	12.70
0.0904	0.333	0.0005	0.0020	1.8746	0.813	0.271	1.8746	Clay	0.242096	10.67
0.0710	0.333	0.0005	0.0020	1.4723	0.669	0.223	1.4723	Clay	0.213544	4.24
0.0414	0.333	0.0005	0.0020	0.8585	0.519	0.173	0.8585	Clay	0.161358	6.73
0.0187	0.333	0.0005	0.0020	0.3878	0.387	0.129	0.3878	Clay	0.106778	17.23
0.1230	0.333	0.0005	0.0030	2.0826	0.939	0.313	2.0826	Clay	0.255696	18.31
0.0864	0.333	0.0005	0.0030	1.4629	0.732	0.244	1.4629	Clay	0.212832	12.77
0.0685	0.333	0.0005	0.0030	1.1598	0.639	0.213	1.1598	Clay	0.188651	11.43
0.0361	0.333	0.0005	0.0030	0.6112	0.498	0.166	0.6112	Clay	0.135252	18.52
0.0180	0.333	0.0005	0.0030	0.3048	0.369	0.123	0.3048	Clay	0.094218	23.40
0.1578	0.333	0.0005	0.0050	2.0696	0.951	0.317	2.0696	Clay	0.254865	19.60
0.1494	0.333	0.0005	0.0050	1.9594	0.861	0.287	1.9594	Clay	0.247724	13.68
0.1327	0.333	0.0005	0.0050	1.7404	0.789	0.263	1.7404	Clay	0.23293	11.43
0.0987	0.333	0.0005	0.0050	1.2945	0.669	0.223	1.2945	Clay	0.199729	10.44
0.0517	0.333	0.0005	0.0050	0.6781	0.510	0.170	0.6781	Clay	0.142742	16.03
0.0256	0.333	0.0005	0.0050	0.3357	0.384	0.128	0.3357	Clay	0.099077	22.60

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	Material	depth adjusted Power	% error Power - Average Ks
0.1931	0.333	0.0005	0.0075	2.0678	0.996	0.332	2.0678	Clay	0.254752	23.27
0.1905	0.333	0.0005	0.0075	2.0400	0.960	0.320	2.0400	Clay	0.252964	20.95
0.1756	0.333	0.0005	0.0075	1.8804	0.864	0.288	1.8804	Clay	0.242485	15.80
0.1482	0.333	0.0005	0.0075	1.5870	0.759	0.253	1.5870	Clay	0.222029	12.24
0.0996	0.333	0.0005	0.0075	1.0666	0.629	0.210	1.0666	Clay	0.180613	13.91
0.0654	0.333	0.0005	0.0075	0.7003	0.492	0.164	0.7003	Clay	0.14516	11.49
0.0425	0.333	0.0005	0.0075	0.4551	0.402	0.134	0.4551	Clay	0.116038	13.40
0.2640	0.333	0.0005	0.0125	2.1898	0.993	0.331	2.1898	Clay	0.262453	20.71
0.2472	0.333	0.0005	0.0125	2.0505	0.912	0.304	2.0505	Clay	0.25364	16.57
0.2124	0.333	0.0005	0.0125	1.7618	0.810	0.270	1.7618	Clay	0.234415	13.18
0.1951	0.333	0.0005	0.0125	1.6183	0.762	0.254	1.6183	Clay	0.224294	11.70
0.1032	0.333	0.0005	0.0125	0.8560	0.531	0.177	0.8560	Clay	0.161115	8.97
0.0736	0.333	0.0005	0.0125	0.6105	0.444	0.148	0.6105	Clay	0.135167	8.67
0.2890	0.333	0.0005	0.0150	2.1883	0.987	0.329	2.1883	Clay	0.26236	20.26
0.2907	0.333	0.0005	0.0150	2.2012	0.939	0.313	2.2012	Clay	0.263161	15.92
0.2814	0.333	0.0005	0.0150	2.1308	0.894	0.298	2.1308	Clay	0.258753	13.17
0.2318	0.333	0.0005	0.0150	1.7552	0.771	0.257	1.7552	Clay	0.233958	8.97
0.2026	0.333	0.0005	0.0150	1.5341	0.684	0.228	1.5341	Clay	0.218153	4.32
0.1322	0.333	0.0005	0.0150	1.0010	0.504	0.168	1.0010	Clay	0.17476	4.02
0.0720	0.333	0.0005	0.0150	0.5452	0.378	0.126	0.5452	Clay	0.127452	1.15
0.1415	0.417	0.0005	0.0010	2.2887	0.974	0.406	2.2887	Clay	0.335681	17.32
0.1366	0.417	0.0005	0.0010	2.2094	0.965	0.402	2.2094	Clay	0.329591	18.01
0.1230	0.417	0.0005	0.0010	1.9895	0.840	0.350	1.9895	Clay	0.312115	10.82
0.1065	0.417	0.0005	0.0010	1.7226	0.754	0.314	1.7226	Clay	0.289612	7.77
0.0824	0.417	0.0005	0.0010	1.3328	0.655	0.273	1.3328	Clay	0.253473	7.15
0.0532	0.417	0.0005	0.0010	0.8605	0.516	0.215	0.8605	Clay	0.201939	6.08
0.0231	0.417	0.0005	0.0010	0.3736	0.372	0.155	0.3736	Clay	0.13092	15.54
0.0165	0.417	0.0005	0.0010	0.2669	0.278	0.116	0.2669	Clay	0.109924	5.24
0.1905	0.417	0.0005	0.0020	2.1788	0.986	0.411	2.1788	Clay	0.327206	20.39
0.1892	0.417	0.0005	0.0020	2.1639	0.984	0.410	2.1639	Clay	0.326044	20.48
0.1827	0.417	0.0005	0.0020	2.0896	0.835	0.348	2.0896	Clay	0.320176	8.00
0.1686	0.417	0.0005	0.0020	1.9283	0.756	0.315	1.9283	Clay	0.307092	2.51
0.1371	0.417	0.0005	0.0020	1.5680	0.670	0.279	1.5680	Clay	0.275808	1.14
0.0840	0.417	0.0005	0.0020	0.9607	0.509	0.212	0.9607	Clay	0.213835	0.87
0.0481	0.417	0.0005	0.0020	0.5501	0.394	0.164	0.5501	Clay	0.160063	2.40
0.0291	0.417	0.0005	0.0020	0.3328	0.310	0.129	0.3328	Clay	0.123284	4.43
0.2408	0.417	0.0005	0.0030	2.2487	0.958	0.399	2.2487	Clay	0.332619	16.64
0.2370	0.417	0.0005	0.0030	2.2132	0.941	0.392	2.2132	Clay	0.329881	15.85
0.2208	0.417	0.0005	0.0030	2.0619	0.845	0.352	2.0619	Clay	0.317968	9.67
0.1998	0.417	0.0005	0.0030	1.8658	0.770	0.321	1.8658	Clay	0.301881	5.96
0.1566	0.417	0.0005	0.0030	1.4624	0.655	0.273	1.4624	Clay	0.265993	2.57
0.0987	0.417	0.0005	0.0030	0.9217	0.526	0.219	0.9217	Clay	0.209278	4.44
0.0544	0.417	0.0005	0.0030	0.5080	0.396	0.165	0.5080	Clay	0.153575	6.92
0.0231	0.417	0.0005	0.0030	0.2157	0.276	0.115	0.2157	Clay	0.098418	14.42
0.3026	0.417	0.0005	0.0050	2.1888	0.953	0.397	2.1888	Clay	0.327991	17.38
0.3096	0.417	0.0005	0.0050	2.2395	0.905	0.377	2.2395	Clay	0.331911	11.96

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	Material	depth adjusted Power	% error Power - Average Ks
0.2958	0.417	0.0005	0.0050	2.1397	0.833	0.347	2.1397	Clay	0.324141	6.59
0.2464	0.417	0.0005	0.0050	1.7823	0.715	0.298	1.7823	Clay	0.294787	1.08
0.1892	0.417	0.0005	0.0050	1.3686	0.610	0.254	1.3686	Clay	0.256987	1.18
0.1448	0.417	0.0005	0.0050	1.0474	0.528	0.220	1.0474	Clay	0.223651	1.66
0.0784	0.417	0.0005	0.0050	0.5671	0.370	0.154	0.5671	Clay	0.16261	5.59
0.0381	0.417	0.0005	0.0050	0.2756	0.283	0.118	0.2756	Clay	0.111774	5.28
0.4009	0.417	0.0005	0.0100	2.0505	0.965	0.402	2.0505	Clay	0.317056	21.13
0.4051	0.417	0.0005	0.0100	2.0720	0.919	0.383	2.0720	Clay	0.318777	16.77
0.3740	0.417	0.0005	0.0100	1.9129	0.782	0.326	1.9129	Clay	0.305819	6.19
0.5428	0.417	0.0005	0.0150	2.2669	0.946	0.394	2.2669	Clay	0.334013	15.23
0.5066	0.417	0.0005	0.0150	2.1157	0.823	0.343	2.1157	Clay	0.322249	6.05
0.4738	0.417	0.0005	0.0150	1.9787	0.766	0.319	1.9787	Clay	0.311236	2.43
0.3582	0.417	0.0005	0.0150	1.4959	0.607	0.253	1.4959	Clay	0.269145	6.38
0.2704	0.417	0.0005	0.0150	1.1293	0.502	0.209	1.1293	Clay	0.232566	11.28
0.1674	0.417	0.0005	0.0150	0.6991	0.379	0.158	0.6991	Clay	0.181284	14.74
0.0969	0.417	0.0005	0.0150	0.4047	0.283	0.118	0.4047	Clay	0.136463	15.65
0.1404	0.500	0.0005	0.0005	1.9750	0.804	0.402	1.9750	Clay	0.373119	7.18
0.0724	0.500	0.0005	0.0005	1.0184	0.600	0.300	1.0184	Clay	0.264499	11.83
0.0397	0.500	0.0005	0.0005	0.5585	0.446	0.223	0.5585	Clay	0.19358	13.19
0.0225	0.500	0.0005	0.0005	0.3165	0.376	0.188	0.3165	Clay	0.144128	23.34
0.1578	0.500	0.0005	0.0010	1.5696	0.792	0.396	1.5696	Clay	0.331142	16.38
0.1255	0.500	0.0005	0.0010	1.2483	0.608	0.304	1.2483	Clay	0.293997	3.29
0.0706	0.500	0.0005	0.0010	0.7022	0.422	0.211	0.7022	Clay	0.218048	3.34
0.0372	0.500	0.0005	0.0010	0.3700	0.342	0.171	0.3700	Clay	0.156313	8.59
0.3563	0.500	0.0005	0.0020	2.5060	0.996	0.498	2.5060	Clay	0.422253	15.21
0.2680	0.500	0.0005	0.0020	1.8850	0.818	0.409	1.8850	Clay	0.364184	10.96
0.1801	0.500	0.0005	0.0020	1.2667	0.554	0.277	1.2667	Clay	0.29624	6.95
0.1090	0.500	0.0005	0.0020	0.7666	0.438	0.219	0.7666	Clay	0.228217	4.21
0.0559	0.500	0.0005	0.0020	0.3932	0.314	0.157	0.3932	Clay	0.161319	2.75
0.3620	0.500	0.0005	0.0030	2.0789	0.828	0.414	2.0789	Clay	0.38319	7.44
0.2194	0.500	0.0005	0.0030	1.2600	0.604	0.302	1.2600	Clay	0.295418	2.18
0.1382	0.500	0.0005	0.0030	0.7937	0.444	0.222	0.7937	Clay	0.232359	4.67
0.0685	0.500	0.0005	0.0030	0.3934	0.334	0.167	0.3934	Clay	0.161364	3.37
0.5540	0.500	0.0005	0.0050	2.4644	0.996	0.498	2.4644	Clay	0.418594	15.94
0.4440	0.500	0.0005	0.0050	1.9751	0.756	0.378	1.9751	Clay	0.373126	1.29
0.2771	0.500	0.0005	0.0050	1.2326	0.552	0.276	1.2326	Clay	0.292072	5.82
0.1512	0.500	0.0005	0.0050	0.6726	0.426	0.213	0.6726	Clay	0.213215	0.10
0.0664	0.500	0.0005	0.0050	0.2954	0.304	0.152	0.2954	Clay	0.139045	8.52
0.6804	0.500	0.0005	0.0075	2.4712	0.946	0.473	2.4712	Clay	0.4192	11.37
0.5390	0.500	0.0005	0.0075	1.9577	0.770	0.385	1.9577	Clay	0.371416	3.53
0.2771	0.500	0.0005	0.0075	1.0064	0.516	0.258	1.0064	Clay	0.262875	1.89
0.1692	0.500	0.0005	0.0075	0.6145	0.398	0.199	0.6145	Clay	0.203448	2.24
0.0969	0.500	0.0005	0.0075	0.3519	0.294	0.147	0.3519	Clay	0.152298	3.60
0.3260	0.667	0.0005	0.0005	2.1293	0.995	0.663	2.1293	Clay	0.517325	21.97
0.2540	0.667	0.0005	0.0005	1.6591	0.773	0.515	1.6591	Clay	0.45442	11.76
0.1370	0.667	0.0005	0.0005	0.8948	0.513	0.342	0.8948	Clay	0.329741	3.58

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	Material	depth adjusted Power	% error Power - Average Ks
0.0840	0.667	0.0005	0.0005	0.5487	0.389	0.259	0.5487	Clay	0.255746	1.26
0.0363	0.667	0.0005	0.0005	0.2371	0.249	0.166	0.2371	Clay	0.165393	0.37
0.4570	0.667	0.0005	0.0010	2.1107	0.984	0.656	2.1107	Clay	0.514968	21.50
0.4670	0.667	0.0005	0.0010	2.1569	0.984	0.656	2.1569	Clay	0.520792	20.61
0.3740	0.667	0.0005	0.0010	1.7274	0.764	0.509	1.7274	Clay	0.464046	8.83
0.2060	0.667	0.0005	0.0010	0.9514	0.522	0.348	0.9514	Clay	0.340414	2.18
0.1380	0.667	0.0005	0.0010	0.6374	0.407	0.271	0.6374	Clay	0.276453	2.01
0.0720	0.667	0.0005	0.0010	0.3325	0.288	0.192	0.3325	Clay	0.197169	2.69
0.6720	0.667	0.0005	0.0020	2.1947	0.992	0.661	2.1947	Clay	0.525509	20.50
0.5220	0.667	0.0005	0.0020	1.7048	0.764	0.509	1.7048	Clay	0.460884	9.45
0.2805	0.667	0.0005	0.0020	0.9161	0.537	0.358	0.9161	Clay	0.333782	6.76
0.1540	0.667	0.0005	0.0020	0.5029	0.401	0.267	0.5029	Clay	0.244443	8.45
0.0540	0.667	0.0005	0.0020	0.1764	0.248	0.165	0.1764	Clay	0.141821	14.05
0.7870	0.667	0.0005	0.0030	2.0986	0.995	0.663	2.0986	Clay	0.513429	22.56
0.6390	0.667	0.0005	0.0030	1.7039	0.765	0.510	1.7039	Clay	0.460765	9.65
0.3392	0.667	0.0005	0.0030	0.9045	0.546	0.364	0.9045	Clay	0.331584	8.91
0.2054	0.667	0.0005	0.0030	0.5477	0.420	0.280	0.5477	Clay	0.255516	8.74
0.0920	0.667	0.0005	0.0030	0.2453	0.294	0.196	0.2453	Clay	0.168349	14.11
1.2840	0.667	0.0005	0.0075	2.1654	0.993	0.662	2.1654	Clay	0.521863	21.17
1.3000	0.667	0.0005	0.0075	2.1924	0.963	0.642	2.1924	Clay	0.525231	18.19
0.9480	0.667	0.0005	0.0075	1.5988	0.755	0.503	1.5988	Clay	0.445768	11.38
0.5590	0.667	0.0005	0.0075	0.9427	0.534	0.356	0.9427	Clay	0.338795	4.83
0.3392	0.667	0.0005	0.0075	0.5721	0.405	0.270	0.5721	Clay	0.261354	3.20
0.1481	0.667	0.0005	0.0075	0.2498	0.270	0.180	0.2498	Clay	0.169926	5.60
1.4650	0.667	0.0005	0.0100	2.1397	0.992	0.661	2.1397	Clay	0.518629	21.54
1.4475	0.667	0.0005	0.0100	2.1141	0.986	0.657	2.1141	Clay	0.515401	21.55
1.1580	0.667	0.0005	0.0100	1.6913	0.710	0.473	1.6913	Clay	0.458987	2.96
0.5980	0.667	0.0005	0.0100	0.8734	0.488	0.325	0.8734	Clay	0.325612	0.19
0.3760	0.667	0.0005	0.0100	0.5492	0.375	0.250	0.5492	Clay	0.255867	2.35
0.1814	0.667	0.0005	0.0100	0.2649	0.260	0.173	0.2649	Clay	0.175213	1.28
1.3475	0.667	0.0005	0.0125	1.7603	0.735	0.490	1.7603	Clay	0.468621	4.36
0.7525	0.667	0.0005	0.0125	0.9830	0.519	0.346	0.9830	Clay	0.34624	0.07
0.4430	0.667	0.0005	0.0125	0.5787	0.390	0.260	0.5787	Clay	0.262929	1.13
0.2096	0.667	0.0005	0.0125	0.2738	0.260	0.173	0.2738	Clay	0.178236	3.03
0.6386	0.833	0.0005	0.0005	2.3005	0.985	0.821	2.3005	Clay	0.673163	18.01
0.5874	0.833	0.0005	0.0005	2.1161	0.974	0.812	2.1161	Clay	0.644563	20.62
0.5770	0.833	0.0005	0.0005	2.0786	0.940	0.783	2.0786	Clay	0.638609	18.44
0.5640	0.833	0.0005	0.0005	2.0318	0.899	0.749	2.0318	Clay	0.631093	15.74
0.5578	0.833	0.0005	0.0005	2.0095	0.836	0.697	2.0095	Clay	0.627479	9.97
0.5503	0.833	0.0005	0.0005	1.9824	0.799	0.666	1.9824	Clay	0.623082	6.44
0.5366	0.833	0.0005	0.0005	1.9331	0.751	0.626	1.9331	Clay	0.614975	1.76
0.4982	0.833	0.0005	0.0005	1.7948	0.680	0.567	1.7948	Clay	0.591705	4.36
0.4611	0.833	0.0005	0.0005	1.6611	0.655	0.546	1.6611	Clay	0.568389	4.10
0.3967	0.833	0.0005	0.0005	1.4291	0.568	0.473	1.4291	Clay	0.52566	11.13
0.3078	0.833	0.0005	0.0005	1.1088	0.505	0.421	1.1088	Clay	0.460744	9.44
0.1998	0.833	0.0005	0.0005	0.7198	0.372	0.310	0.7198	Clay	0.368098	18.74

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	Material	depth adjusted Power	% error Power - Average Ks
0.1005	0.833	0.0005	0.0005	0.3620	0.257	0.214	0.3620	Clay	0.25759	20.37
0.8870	0.833	0.0005	0.0010	2.2595	0.938	0.782	2.2595	Clay	0.666895	14.72
0.8837	0.833	0.0005	0.0010	2.2511	0.868	0.723	2.2511	Clay	0.665605	7.94
0.8722	0.833	0.0005	0.0010	2.2218	0.817	0.681	2.2218	Clay	0.661091	2.92
0.7996	0.833	0.0005	0.0010	2.0368	0.750	0.625	2.0368	Clay	0.631908	1.11
0.7120	0.833	0.0005	0.0010	1.8137	0.686	0.572	1.8137	Clay	0.594942	4.01
0.6748	0.833	0.0005	0.0010	1.7189	0.650	0.542	1.7189	Clay	0.578586	6.75
0.5378	0.833	0.0005	0.0010	1.3700	0.559	0.466	1.3700	Clay	0.514244	10.35
0.4726	0.833	0.0005	0.0010	1.2039	0.510	0.425	1.2039	Clay	0.480851	13.14
0.2788	0.833	0.0005	0.0010	0.7102	0.376	0.313	0.7102	Clay	0.365545	16.79
0.1240	0.833	0.0005	0.0010	0.3159	0.246	0.205	0.3159	Clay	0.239963	17.06
1.2680	0.833	0.0005	0.0020	2.2840	0.988	0.823	2.2840	Clay	0.67064	18.51
1.2680	0.833	0.0005	0.0020	2.2840	0.956	0.797	2.2840	Clay	0.67064	15.85
1.2520	0.833	0.0005	0.0020	2.2551	0.934	0.778	2.2551	Clay	0.66623	14.37
1.2300	0.833	0.0005	0.0020	2.2155	0.833	0.694	2.2155	Clay	0.660122	4.88
1.1840	0.833	0.0005	0.0020	2.1327	0.800	0.667	2.1327	Clay	0.64718	2.97
1.1380	0.833	0.0005	0.0020	2.0498	0.748	0.623	2.0498	Clay	0.633993	1.76
1.0090	0.833	0.0005	0.0020	1.8174	0.676	0.563	1.8174	Clay	0.59558	5.79
0.9380	0.833	0.0005	0.0020	1.6896	0.630	0.525	1.6896	Clay	0.573427	9.22
0.7964	0.833	0.0005	0.0020	1.4345	0.566	0.472	1.4345	Clay	0.526692	11.59
0.6832	0.833	0.0005	0.0020	1.2306	0.514	0.428	1.2306	Clay	0.48637	13.64
0.3841	0.833	0.0005	0.0020	0.6919	0.382	0.318	0.6919	Clay	0.36061	13.40
0.1614	0.833	0.0005	0.0020	0.2907	0.244	0.203	0.2907	Clay	0.22984	13.22
1.5300	0.833	0.0005	0.0030	2.2502	0.992	0.827	2.2502	Clay	0.665467	19.53
1.5350	0.833	0.0005	0.0030	2.2575	0.977	0.814	2.2575	Clay	0.666596	18.11
1.5350	0.833	0.0005	0.0030	2.2575	0.972	0.810	2.2575	Clay	0.666596	17.70
1.5250	0.833	0.0005	0.0030	2.2428	0.965	0.804	2.2428	Clay	0.664336	17.37
1.5140	0.833	0.0005	0.0030	2.2266	0.932	0.777	2.2266	Clay	0.661842	14.82
1.5020	0.833	0.0005	0.0030	2.2090	0.907	0.756	2.2090	Clay	0.659112	12.82
1.4960	0.833	0.0005	0.0030	2.2002	0.827	0.689	2.2002	Clay	0.657743	4.54
1.4800	0.833	0.0005	0.0030	2.1766	0.821	0.684	2.1766	Clay	0.654079	4.37
1.3960	0.833	0.0005	0.0030	2.0531	0.757	0.631	2.0531	Clay	0.634523	0.56
1.2100	0.833	0.0005	0.0030	1.7795	0.676	0.563	1.7795	Clay	0.589096	4.64
1.1240	0.833	0.0005	0.0030	1.6531	0.650	0.542	1.6531	Clay	0.56696	4.61
0.9227	0.833	0.0005	0.0030	1.3570	0.581	0.484	1.3570	Clay	0.511715	5.73
0.7450	0.833	0.0005	0.0030	1.0957	0.517	0.431	1.0957	Clay	0.457893	6.24
0.4542	0.833	0.0005	0.0030	0.6680	0.394	0.328	0.6680	Clay	0.354094	7.96
0.2173	0.833	0.0005	0.0030	0.3196	0.269	0.224	0.3196	Clay	0.241425	7.78
1.9900	0.833	0.0005	0.0050	2.2670	0.961	0.801	2.2670	Clay	0.668049	16.60
1.9700	0.833	0.0005	0.0050	2.2442	0.961	0.801	2.2442	Clay	0.664552	17.03
1.9575	0.833	0.0005	0.0050	2.2300	0.901	0.751	2.2300	Clay	0.662358	11.80
1.9300	0.833	0.0005	0.0050	2.1987	0.841	0.701	2.1987	Clay	0.657508	6.20
1.8400	0.833	0.0005	0.0050	2.0961	0.786	0.655	2.0961	Clay	0.641397	2.08
1.7975	0.833	0.0005	0.0050	2.0477	0.776	0.647	2.0477	Clay	0.633657	2.06
1.6575	0.833	0.0005	0.0050	1.8882	0.742	0.618	1.8882	Clay	0.607519	1.70
1.4700	0.833	0.0005	0.0050	1.6746	0.678	0.565	1.6746	Clay	0.570789	1.02

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	Material	depth adjusted Power	% error Power - Average Ks
1.3625	0.833	0.0005	0.0050	1.5522	0.641	0.534	1.5522	Clay	0.548709	2.75
1.0980	0.833	0.0005	0.0050	1.2508	0.564	0.470	1.2508	Clay	0.490509	4.36
0.9261	0.833	0.0005	0.0050	1.0550	0.511	0.426	1.0550	Clay	0.448986	5.40
0.5306	0.833	0.0005	0.0050	0.6045	0.368	0.307	0.6045	Clay	0.336179	9.50
0.2568	0.833	0.0005	0.0050	0.2925	0.256	0.213	0.2925	Clay	0.230589	8.26
2.3850	0.833	0.0005	0.0075	2.2184	0.961	0.801	2.2184	Clay	0.660571	17.53
2.4120	0.833	0.0005	0.0075	2.2435	0.955	0.796	2.2435	Clay	0.664445	16.53
2.3760	0.833	0.0005	0.0075	2.2100	0.938	0.782	2.2100	Clay	0.659275	15.69
2.3760	0.833	0.0005	0.0075	2.2100	0.898	0.748	2.2100	Clay	0.659275	11.86
2.3400	0.833	0.0005	0.0075	2.1766	0.871	0.726	2.1766	Clay	0.654066	9.91
2.2590	0.833	0.0005	0.0075	2.1012	0.821	0.684	2.1012	Clay	0.642205	6.11
2.1330	0.833	0.0005	0.0075	1.9840	0.775	0.646	1.9840	Clay	0.623334	3.51
1.8150	0.833	0.0005	0.0075	1.6882	0.677	0.564	1.6882	Clay	0.573193	1.63
1.6925	0.833	0.0005	0.0075	1.5743	0.648	0.540	1.5743	Clay	0.552758	2.36
1.4350	0.833	0.0005	0.0075	1.3348	0.584	0.487	1.3348	Clay	0.50734	4.18
1.0820	0.833	0.0005	0.0075	1.0064	0.491	0.409	1.0064	Clay	0.438122	7.12
0.6440	0.833	0.0005	0.0075	0.5990	0.373	0.311	0.5990	Clay	0.334603	7.59
0.3449	0.833	0.0005	0.0075	0.3208	0.271	0.226	0.3208	Clay	0.241906	7.04
2.7715	0.833	0.0005	0.0100	2.2325	0.971	0.809	2.2325	Clay	0.662753	18.08
2.7645	0.833	0.0005	0.0100	2.2269	0.954	0.795	2.2269	Clay	0.661883	16.74
2.7070	0.833	0.0005	0.0100	2.1806	0.893	0.744	2.1806	Clay	0.654695	12.00
2.7505	0.833	0.0005	0.0100	2.2156	0.889	0.741	2.2156	Clay	0.660139	10.91
2.6695	0.833	0.0005	0.0100	2.1504	0.850	0.708	2.1504	Clay	0.649968	8.20
2.6485	0.833	0.0005	0.0100	2.1335	0.846	0.705	2.1335	Clay	0.647306	8.18
2.5980	0.833	0.0005	0.0100	2.0928	0.811	0.676	2.0928	Clay	0.640865	5.20
2.5050	0.833	0.0005	0.0100	2.0179	0.770	0.642	2.0179	Clay	0.628843	2.05
2.1960	0.833	0.0005	0.0100	1.7690	0.692	0.577	1.7690	Clay	0.587272	1.78
2.0075	0.833	0.0005	0.0100	1.6171	0.654	0.545	1.6171	Clay	0.56052	2.85
1.7325	0.833	0.0005	0.0100	1.3956	0.576	0.480	1.3956	Clay	0.519221	8.17
1.2920	0.833	0.0005	0.0100	1.0408	0.497	0.414	1.0408	Clay	0.445823	7.69
0.7270	0.833	0.0005	0.0100	0.5856	0.359	0.299	0.5856	Clay	0.330696	10.60
0.3831	0.833	0.0005	0.0100	0.3086	0.254	0.212	0.3086	Clay	0.237078	11.83
3.1220	0.833	0.0005	0.0125	2.2494	0.983	0.819	2.2494	Clay	0.665345	18.76
3.0380	0.833	0.0005	0.0125	2.1889	0.902	0.752	2.1889	Clay	0.655984	12.77
2.9750	0.833	0.0005	0.0125	2.1435	0.836	0.697	2.1435	Clay	0.648882	6.90
2.8430	0.833	0.0005	0.0125	2.0484	0.788	0.657	2.0484	Clay	0.633762	3.54
2.7715	0.833	0.0005	0.0125	1.9968	0.763	0.636	1.9968	Clay	0.625431	1.66
2.4030	0.833	0.0005	0.0125	1.7313	0.676	0.563	1.7313	Clay	0.580752	3.15
2.2080	0.833	0.0005	0.0125	1.5909	0.634	0.528	1.5909	Clay	0.555772	5.26
1.7950	0.833	0.0005	0.0125	1.2933	0.553	0.461	1.2933	Clay	0.499086	8.26
1.5120	0.833	0.0005	0.0125	1.0894	0.502	0.418	1.0894	Clay	0.456527	9.22
0.8804	0.833	0.0005	0.0125	0.6343	0.370	0.308	0.6343	Clay	0.344707	11.92
0.4303	0.833	0.0005	0.0125	0.3100	0.250	0.208	0.3100	Clay	0.237647	14.25
2.8580	0.833	0.0005	0.0150	1.8798	0.742	0.618	1.8798	Clay	0.606102	1.93
2.5380	0.833	0.0005	0.0150	1.6693	0.668	0.557	1.6693	Clay	0.569843	2.31
2.3670	0.833	0.0005	0.0150	1.5568	0.631	0.526	1.5568	Clay	0.549563	4.48

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	Material	depth adjusted Power	% error Power - Average Ks
1.8480	0.833	0.0005	0.0150	1.2155	0.548	0.457	1.2155	Clay	0.483252	5.74
1.4120	0.833	0.0005	0.0150	0.9287	0.470	0.392	0.9287	Clay	0.420205	7.20
0.8854	0.833	0.0005	0.0150	0.5823	0.360	0.300	0.5823	Clay	0.329732	9.91
0.4462	0.833	0.0005	0.0150	0.2935	0.258	0.215	0.2935	Clay	0.230968	7.43
0.8972	1.000	0.0005	0.0005	1.9876	0.986	0.986	1.9876	Clay	0.748719	24.07
0.9006	1.000	0.0005	0.0005	1.9952	0.896	0.896	1.9952	Clay	0.750191	16.27
0.8540	1.000	0.0005	0.0005	1.8919	0.856	0.856	1.8919	Clay	0.729768	14.75
0.8380	1.000	0.0005	0.0005	1.8565	0.803	0.803	1.8565	Clay	0.722633	10.01
0.7360	1.000	0.0005	0.0005	1.6305	0.754	0.754	1.6305	Clay	0.675516	10.41
0.6762	1.000	0.0005	0.0005	1.4980	0.694	0.694	1.4980	Clay	0.646423	6.86
0.6496	1.000	0.0005	0.0005	1.4391	0.650	0.650	1.4391	Clay	0.633085	2.60
0.5390	1.000	0.0005	0.0005	1.1941	0.592	0.592	1.1941	Clay	0.574583	2.94
0.5006	1.000	0.0005	0.0005	1.1090	0.558	0.558	1.1090	Clay	0.55294	0.91
0.4261	1.000	0.0005	0.0005	0.9440	0.502	0.502	0.9440	Clay	0.508539	1.30
0.2754	1.000	0.0005	0.0005	0.6101	0.412	0.412	0.6101	Clay	0.405372	1.61
3.7400	2.000	0.0417	0.0020	1.3674	0.600	1.200	1.3674	CMP	1.233006	2.75
5.4300	2.000	0.0417	0.0020	1.9853	0.800	1.600	1.9853	CMP	1.496534	6.47
5.9900	2.000	0.0417	0.0020	2.1901	0.900	1.800	2.1901	CMP	1.574822	12.51
3.0500	3.000	0.0417	0.0018	0.4043	0.300	0.900	0.4043	CMP	0.982113	9.12
5.3100	3.000	0.0417	0.0020	0.6669	0.397	1.190	0.6669	CMP	1.273641	7.03
8.4500	3.000	0.0417	0.0020	1.0479	0.507	1.520	1.0479	CMP	1.61067	5.97
10.7400	3.000	0.0417	0.0019	1.3665	0.600	1.800	1.3665	CMP	1.848832	2.71
14.4300	3.000	0.0417	0.0022	1.7062	0.703	2.110	1.7062	CMP	2.074873	1.66
15.5100	3.000	0.0417	0.0019	1.9734	0.800	2.400	1.9734	CMP	2.23776	6.76
17.1100	3.000	0.0417	0.0020	2.1489	0.873	2.620	2.1489	CMP	2.339019	10.72
0.2220	0.667	5E-06	0.0030	0.2755	0.332	0.221	0.2755	PVC	0.17881	19.09
0.4490	0.667	5E-06	0.0030	0.5572	0.494	0.329	0.5572	PVC	0.257812	21.64
0.6210	0.667	5E-06	0.0030	0.7707	0.596	0.397	0.7707	PVC	0.305121	23.14
0.6240	0.667	5E-06	0.0030	0.7744	0.597	0.398	0.7744	PVC	0.305886	23.14
0.9470	0.667	5E-06	0.0030	1.1753	0.807	0.538	1.1753	PVC	0.379905	29.39
0.9410	0.667	5E-06	0.0030	1.1678	0.827	0.551	1.1678	PVC	0.378653	31.28
0.9410	0.667	5E-06	0.0030	1.1678	0.839	0.559	1.1678	PVC	0.378653	32.26
0.5050	0.667	5E-06	0.0063	0.4325	0.408	0.272	0.4325	PVC	0.226009	16.91
0.1990	0.667	5E-06	0.0063	0.1704	0.254	0.169	0.1704	PVC	0.139322	17.56
0.4210	0.667	5E-06	0.0063	0.3605	0.377	0.251	0.3605	PVC	0.205627	18.08
0.6990	0.667	5E-06	0.0063	0.5986	0.501	0.334	0.5986	PVC	0.267591	19.88
0.9990	0.667	5E-06	0.0063	0.8555	0.626	0.417	0.8555	PVC	0.322136	22.75
1.3340	0.667	5E-06	0.0063	1.1424	0.777	0.518	1.1424	PVC	0.374355	27.73
1.2830	0.667	5E-06	0.0063	1.0988	0.753	0.502	1.0988	PVC	0.36685	26.92
1.4750	0.667	5E-06	0.0105	0.9785	0.699	0.466	0.9785	PVC	0.345404	25.88
0.2600	0.667	5E-06	0.0105	0.1725	0.258	0.172	0.1725	PVC	0.140191	18.49
0.4650	0.667	5E-06	0.0105	0.3085	0.347	0.231	0.3085	PVC	0.189619	17.91
1.1600	0.667	5E-06	0.0105	0.7695	0.591	0.394	0.7695	PVC	0.304878	22.62
0.3950	0.667	5E-06	0.0105	0.2620	0.318	0.212	0.2620	PVC	0.17421	17.83
0.5120	1.000	5E-06	0.0030	0.2155	0.285	0.285	0.2155	PVC	0.236088	17.16
0.8180	1.000	5E-06	0.0030	0.3443	0.362	0.362	0.3443	PVC	0.30115	16.81

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	Material	depth adjusted Power	% error Power - Average Ks
1.1760	1.000	5E-06	0.0030	0.4950	0.439	0.439	0.4950	PVC	0.363651	17.16
1.6090	1.000	5E-06	0.0030	0.6773	0.521	0.521	0.6773	PVC	0.42797	17.86
1.9150	1.000	5E-06	0.0030	0.8061	0.581	0.581	0.8061	PVC	0.468484	19.37
2.9150	1.000	5E-06	0.0030	1.2270	0.777	0.777	1.2270	PVC	0.582757	25.00
0.3980	1.000	5E-06	0.0060	0.1185	0.212	0.212	0.1185	PVC	0.173003	18.39
0.5510	1.000	5E-06	0.0060	0.1640	0.252	0.252	0.1640	PVC	0.204854	18.71
0.9800	1.000	5E-06	0.0060	0.2917	0.336	0.336	0.2917	PVC	0.276285	17.77
1.6070	1.000	5E-06	0.0060	0.4783	0.448	0.448	0.4783	PVC	0.357224	20.26
2.0120	1.000	5E-06	0.0060	0.5989	0.504	0.504	0.5989	PVC	0.401467	20.34
2.2480	1.000	5E-06	0.0060	0.6691	0.544	0.544	0.6691	PVC	0.425278	21.82
2.2860	1.000	5E-06	0.0060	0.6804	0.553	0.553	0.6804	PVC	0.428998	22.42
0.9240	1.000	5E-06	0.0100	0.2130	0.283	0.283	0.2130	PVC	0.234669	17.08
1.2540	1.000	5E-06	0.0100	0.2891	0.338	0.338	0.2891	PVC	0.275015	18.63
1.4940	1.000	5E-06	0.0100	0.3444	0.354	0.354	0.3444	PVC	0.301207	14.91
1.5150	1.000	5E-06	0.0100	0.3493	0.365	0.365	0.3493	PVC	0.303399	16.88
1.8090	1.000	5E-06	0.0100	0.4171	0.393	0.393	0.4171	PVC	0.332682	15.35
2.7470	1.000	5E-06	0.0100	0.6333	0.521	0.521	0.6333	PVC	0.413311	20.67
3.3360	1.000	5E-06	0.0100	0.7691	0.588	0.588	0.7691	PVC	0.4572	22.24
4.3210	1.000	5E-06	0.0100	0.9962	0.656	0.656	0.9962	PVC	0.522969	20.28
2.0000	3.000	5E-05	0.0071	0.0429	0.107	0.320	0.0429	HDPE	0.306227	4.30
10.0100	3.000	5E-05	0.0071	0.2147	0.028	0.848	0.2147	HDPE	0.706942	16.63
18.0300	3.000	5E-05	0.0071	0.3868	0.368	1.103	0.3868	HDPE	0.959728	12.99
26.0600	3.000	5E-05	0.0071	0.5591	0.458	1.373	0.5591	HDPE	1.162136	15.36
34.1300	3.000	5E-05	0.0071	0.7322	0.530	1.591	0.7322	HDPE	1.336973	15.97
39.2600	3.000	5E-05	0.0071	0.8422	0.569	1.706	0.8422	HDPE	1.437856	15.72
2.0300	3.000	5E-05	0.0135	0.0316	0.098	0.293	0.0316	HDPE	0.261164	10.87
10.0500	3.000	5E-05	0.0135	0.1564	0.236	0.709	0.1564	HDPE	0.599506	15.44
18.0300	3.000	5E-05	0.0135	0.2805	0.325	0.975	0.2805	HDPE	0.812191	16.70
26.0300	3.000	5E-05	0.0135	0.4050	0.399	1.197	0.4050	HDPE	0.982895	17.89
32.0700	3.000	5E-05	0.0135	0.4989	0.446	1.338	0.4989	HDPE	1.095436	18.13
40.0200	3.000	5E-05	0.0135	0.6226	0.499	1.497	0.6226	HDPE	1.228999	17.90
2.0000	3.000	5E-05	0.0197	0.0258	0.086	0.259	0.0258	HDPE	0.23492	9.30
10.0100	3.000	5E-05	0.0197	0.1289	0.223	0.670	0.1289	HDPE	0.542326	19.06
18.1000	3.000	5E-05	0.0197	0.2331	0.302	0.905	0.2331	HDPE	0.737733	18.48
26.7400	3.000	5E-05	0.0197	0.3444	0.348	1.045	0.3444	HDPE	0.903536	13.54
31.0900	3.000	5E-05	0.0197	0.4004	0.419	1.256	0.4004	HDPE	0.977128	22.20
40.0700	3.000	5E-05	0.0197	0.5161	0.474	1.422	0.5161	HDPE	1.114807	21.60

Appendix F: Predicted Depth by New Equation (Best Fit)

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	depth adjusted	% error	Material
0.1400	0.667	0.001	0.0050	0.3250	0.285	0.190	0.3250	0.2006	5.59	Concrete
0.2550	0.667	0.001	0.0050	0.5920	0.375	0.250	0.5920	0.2577	3.08	Concrete
0.4500	0.667	0.001	0.0050	1.0447	0.495	0.330	1.0447	0.3545	7.41	Concrete
0.6100	0.667	0.001	0.0050	1.4162	0.594	0.396	1.4162	0.4339	9.56	Concrete
0.8800	0.667	0.001	0.0050	2.0430	0.750	0.500	2.0430	0.5679	13.57	Concrete
1.0200	0.667	0.001	0.0050	2.3680	0.870	0.580	2.3680	0.6374	9.89	Concrete
0.1930	0.667	0.001	0.0100	0.3168	0.262	0.175	0.3168	0.1989	13.64	Concrete
0.4600	0.667	0.001	0.0100	0.7551	0.390	0.260	0.7551	0.2926	12.52	Concrete
0.7600	0.667	0.001	0.0100	1.2476	0.495	0.330	1.2476	0.3978	20.56	Concrete
1.0400	0.667	0.001	0.0100	1.7073	0.630	0.420	1.7073	0.4961	18.12	Concrete
1.3600	0.667	0.001	0.0100	2.2326	0.750	0.500	2.2326	0.6084	21.68	Concrete
1.5300	0.667	0.001	0.0100	2.5117	0.900	0.600	2.5117	0.6681	11.34	Concrete
1.6400	0.667	0.001	0.0100	2.6923	0.960	0.640	2.6923	0.7067	10.42	Concrete
0.2000	0.667	0.001	0.0150	0.2681	0.255	0.170	0.2681	0.1884	10.85	Concrete
0.4500	0.667	0.001	0.0150	0.6032	0.375	0.250	0.6032	0.2601	4.03	Concrete
0.7700	0.667	0.001	0.0150	1.0321	0.495	0.330	1.0321	0.3518	6.60	Concrete
1.1200	0.667	0.001	0.0150	1.5012	0.630	0.420	1.5012	0.4521	7.63	Concrete
1.5000	0.667	0.001	0.0150	2.0106	0.750	0.500	2.0106	0.5609	12.19	Concrete
1.7300	0.667	0.001	0.0150	2.3189	0.855	0.570	2.3189	0.6268	9.97	Concrete
0.2300	0.667	0.001	0.0200	0.2670	0.255	0.170	0.2670	0.1882	10.71	Concrete
0.5600	0.667	0.001	0.0200	0.6500	0.375	0.250	0.6500	0.2701	8.04	Concrete
0.8400	0.667	0.001	0.0200	0.9751	0.480	0.320	0.9751	0.3396	6.12	Concrete
1.2900	0.667	0.001	0.0200	1.4974	0.630	0.420	1.4974	0.4512	7.44	Concrete
1.6700	0.667	0.001	0.0200	1.9385	0.750	0.500	1.9385	0.5455	9.11	Concrete
2.0000	0.667	0.001	0.0200	2.3216	0.870	0.580	2.3216	0.6274	8.18	Concrete
0.2350	0.667	0.001	0.0300	0.2227	0.240	0.160	0.2227	0.1787	11.72	Concrete
0.5200	0.667	0.001	0.0300	0.4929	0.360	0.240	0.4929	0.2365	1.46	Concrete
1.0000	0.667	0.001	0.0300	0.9478	0.510	0.340	0.9478	0.3337	1.84	Concrete
1.3900	0.667	0.001	0.0300	1.3174	0.630	0.420	1.3174	0.4128	1.72	Concrete
1.4000	0.667	0.001	0.0300	1.3269	0.750	0.500	1.3269	0.4148	17.04	Concrete
2.4800	0.667	0.001	0.0300	2.3505	0.915	0.610	2.3505	0.6336	3.87	Concrete
0.2550	0.667	0.001	0.0400	0.2093	0.240	0.160	0.2093	0.1759	9.92	Concrete
0.6200	0.667	0.001	0.0400	0.5089	0.375	0.250	0.5089	0.2399	4.03	Concrete
1.0500	0.667	0.001	0.0400	0.8618	0.495	0.330	0.8618	0.3154	4.43	Concrete
1.5700	0.667	0.001	0.0400	1.2887	0.630	0.420	1.2887	0.4066	3.19	Concrete
2.1400	0.667	0.001	0.0400	1.7565	0.750	0.500	1.7565	0.5066	1.33	Concrete
2.7600	0.667	0.001	0.0400	2.2654	0.900	0.600	2.2654	0.6154	2.57	Concrete
0.0426	0.333	0.001	0.0005	1.9885	0.984	0.328	1.9885	0.2780	15.25	Concrete
0.0386	0.333	0.001	0.0005	1.8018	0.846	0.282	1.8018	0.2580	8.50	Concrete
0.0335	0.333	0.001	0.0005	1.5637	0.741	0.247	1.5637	0.2326	5.83	Concrete
0.0196	0.333	0.001	0.0005	0.9149	0.618	0.206	0.9149	0.1633	20.74	Concrete
0.0120	0.333	0.001	0.0005	0.5601	0.501	0.167	0.5601	0.1254	24.93	Concrete

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	depth adjusted	% error	Material
0.0650	0.333	0.001	0.0010	2.1454	0.933	0.311	2.1454	0.2947	5.23	Concrete
0.0550	0.333	0.001	0.0010	1.8154	0.822	0.274	1.8154	0.2595	5.30	Concrete
0.0450	0.333	0.001	0.0010	1.4853	0.717	0.239	1.4853	0.2242	6.19	Concrete
0.0375	0.333	0.001	0.0010	1.2377	0.630	0.210	1.2377	0.1978	5.83	Concrete
0.0218	0.333	0.001	0.0010	0.7195	0.489	0.163	0.7195	0.1424	12.64	Concrete
0.0083	0.333	0.001	0.0010	0.2740	0.354	0.118	0.2740	0.0948	19.66	Concrete
0.0832	0.333	0.001	0.0020	1.9418	0.969	0.323	1.9418	0.2730	15.49	Concrete
0.0800	0.333	0.001	0.0020	1.8671	0.813	0.271	1.8671	0.2650	2.21	Concrete
0.0650	0.333	0.001	0.0020	1.5170	0.729	0.243	1.5170	0.2276	6.34	Concrete
0.0544	0.333	0.001	0.0020	1.2696	0.645	0.215	1.2696	0.2012	6.43	Concrete
0.0280	0.333	0.001	0.0020	0.6535	0.486	0.162	0.6535	0.1353	16.45	Concrete
0.0127	0.333	0.001	0.0020	0.2964	0.372	0.124	0.2964	0.0972	21.61	Concrete
0.1014	0.333	0.001	0.0030	1.9323	0.969	0.323	1.9323	0.2720	15.80	Concrete
0.1041	0.333	0.001	0.0030	1.9838	0.885	0.295	1.9838	0.2775	5.94	Concrete
0.0969	0.333	0.001	0.0030	1.8465	0.813	0.271	1.8465	0.2628	3.02	Concrete
0.0848	0.333	0.001	0.0030	1.6160	0.729	0.243	1.6160	0.2382	1.99	Concrete
0.0591	0.333	0.001	0.0030	1.1262	0.633	0.211	1.1262	0.1859	11.92	Concrete
0.0298	0.333	0.001	0.0030	0.5679	0.480	0.160	0.5679	0.1262	21.12	Concrete
0.1415	0.333	0.001	0.0050	2.0887	0.945	0.315	2.0887	0.2887	8.36	Concrete
0.1235	0.333	0.001	0.0050	1.8230	0.828	0.276	1.8230	0.2603	5.69	Concrete
0.0996	0.333	0.001	0.0050	1.4702	0.729	0.243	1.4702	0.2226	8.40	Concrete
0.0788	0.333	0.001	0.0050	1.1632	0.636	0.212	1.1632	0.1898	10.47	Concrete
0.0478	0.333	0.001	0.0050	0.7056	0.510	0.170	0.7056	0.1409	17.11	Concrete
0.0200	0.333	0.001	0.0050	0.2952	0.363	0.121	0.2952	0.0971	19.77	Concrete
0.2250	0.333	0.001	0.0125	2.1005	0.903	0.301	2.1005	0.2899	3.68	Concrete
0.2124	0.333	0.001	0.0125	1.9829	0.861	0.287	1.9829	0.2774	3.35	Concrete
0.1656	0.333	0.001	0.0125	1.5460	0.726	0.242	1.5460	0.2307	4.67	Concrete
0.1377	0.333	0.001	0.0125	1.2855	0.612	0.204	1.2855	0.2029	0.55	Concrete
0.0760	0.333	0.001	0.0125	0.7095	0.588	0.196	0.7095	0.1413	27.89	Concrete
0.0416	0.333	0.001	0.0125	0.3884	0.399	0.133	0.3884	0.1070	19.53	Concrete
0.2544	0.333	0.001	0.0150	2.1680	0.942	0.314	2.1680	0.2972	5.37	Concrete
0.2456	0.333	0.001	0.0150	2.0931	0.906	0.302	2.0931	0.2891	4.26	Concrete
0.2236	0.333	0.001	0.0150	1.9056	0.822	0.274	1.9056	0.2691	1.78	Concrete
0.1892	0.333	0.001	0.0150	1.6124	0.765	0.255	1.6124	0.2378	6.75	Concrete
0.1506	0.333	0.001	0.0150	1.2834	0.672	0.224	1.2834	0.2026	9.53	Concrete
0.0848	0.333	0.001	0.0150	0.7227	0.477	0.159	0.7227	0.1427	10.23	Concrete
0.0438	0.333	0.001	0.0150	0.3733	0.369	0.123	0.3733	0.1054	14.30	Concrete
0.0844	0.417	0.001	0.0005	2.1728	0.950	0.396	2.1728	0.3721	6.04	Concrete
0.0671	0.417	0.001	0.0005	1.7275	0.739	0.308	1.7275	0.3126	1.50	Concrete
0.0346	0.417	0.001	0.0005	0.8908	0.530	0.221	0.8908	0.2009	9.11	Concrete
0.1305	0.417	0.001	0.0010	2.3756	0.972	0.405	2.3756	0.3992	1.44	Concrete
0.0969	0.417	0.001	0.0010	1.7640	0.703	0.293	1.7640	0.3175	8.36	Concrete
0.0448	0.417	0.001	0.0010	0.8155	0.494	0.206	0.8155	0.1908	7.37	Concrete
0.0196	0.417	0.001	0.0010	0.3568	0.322	0.134	0.3568	0.1296	3.31	Concrete
0.1840	0.417	0.001	0.0020	2.3685	0.943	0.393	2.3685	0.3982	1.33	Concrete
0.1608	0.417	0.001	0.0020	2.0699	0.761	0.317	2.0699	0.3583	13.04	Concrete

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	depth adjusted	% error	Material
0.0848	0.417	0.001	0.0020	1.0916	0.559	0.233	1.0916	0.2277	2.28	Concrete
0.0465	0.417	0.001	0.0020	0.5986	0.410	0.171	0.5986	0.1618	5.35	Concrete
0.0256	0.417	0.001	0.0020	0.3295	0.302	0.126	0.3295	0.1259	0.06	Concrete
0.1853	0.417	0.001	0.0030	1.9475	0.744	0.310	1.9475	0.3420	10.32	Concrete
0.0828	0.417	0.001	0.0030	0.8702	0.502	0.209	0.8702	0.1981	5.20	Concrete
0.3052	0.417	0.001	0.0050	2.4847	0.955	0.398	2.4847	0.4137	3.95	Concrete
0.2020	0.417	0.001	0.0050	1.6445	0.667	0.278	1.6445	0.3015	8.46	Concrete
0.1023	0.417	0.001	0.0050	0.8328	0.463	0.193	0.8328	0.1931	0.07	Concrete
0.0622	0.417	0.001	0.0050	0.5064	0.382	0.159	0.5064	0.1495	5.95	Concrete
0.3563	0.417	0.001	0.0075	2.3684	0.943	0.393	2.3684	0.3982	1.32	Concrete
0.1349	0.417	0.001	0.0075	0.8967	0.470	0.196	0.8967	0.2017	2.89	Concrete
0.0748	0.417	0.001	0.0075	0.4972	0.350	0.146	0.4972	0.1483	1.59	Concrete
0.0439	0.417	0.001	0.0075	0.2918	0.302	0.126	0.2918	0.1209	4.06	Concrete
0.4282	0.417	0.001	0.0100	2.4650	0.970	0.404	2.4650	0.4111	1.76	Concrete
0.3105	0.417	0.001	0.0100	1.7874	0.715	0.298	1.7874	0.3206	7.59	Concrete
0.2318	0.417	0.001	0.0100	1.3344	0.538	0.224	1.3344	0.2601	16.12	Concrete
0.1644	0.417	0.001	0.0100	0.9464	0.468	0.195	0.9464	0.2083	6.82	Concrete
0.0736	0.417	0.001	0.0100	0.4237	0.324	0.135	0.4237	0.1385	2.59	Concrete
0.4669	0.417	0.001	0.0125	2.4040	0.950	0.396	2.4040	0.4030	1.76	Concrete
0.3660	0.417	0.001	0.0125	1.8845	0.749	0.312	1.8845	0.3336	6.92	Concrete
0.2688	0.417	0.001	0.0125	1.3840	0.554	0.231	1.3840	0.2667	15.47	Concrete
0.1892	0.417	0.001	0.0125	0.9742	0.451	0.188	0.9742	0.2120	12.77	Concrete
0.0920	0.417	0.001	0.0125	0.4737	0.310	0.129	0.4737	0.1452	12.54	Concrete
0.5162	0.417	0.001	0.0150	2.4263	0.962	0.401	2.4263	0.4059	1.23	Concrete
0.4565	0.417	0.001	0.0150	2.1457	0.775	0.323	2.1457	0.3685	14.07	Concrete
0.3150	0.417	0.001	0.0150	1.4806	0.626	0.261	1.4806	0.2796	7.14	Concrete
0.1548	0.417	0.001	0.0150	0.7276	0.422	0.176	0.7276	0.1791	1.75	Concrete
0.1366	0.500	0.001	0.0005	2.1627	0.984	0.492	2.1627	0.4449	9.58	Concrete
0.0888	0.500	0.001	0.0005	1.4059	0.782	0.391	1.4059	0.3236	17.24	Concrete
0.0463	0.500	0.001	0.0005	0.7330	0.564	0.282	0.7330	0.2158	23.49	Concrete
0.0343	0.500	0.001	0.0005	0.5430	0.450	0.225	0.5430	0.1853	17.63	Concrete
0.0206	0.500	0.001	0.0005	0.3261	0.346	0.173	0.3261	0.1506	12.97	Concrete
0.2187	0.500	0.001	0.0010	2.4483	0.968	0.484	2.4483	0.4906	1.37	Concrete
0.1795	0.500	0.001	0.0010	2.0095	0.696	0.348	2.0095	0.4203	20.78	Concrete
0.1070	0.500	0.001	0.0010	1.1979	0.596	0.298	1.1979	0.2903	2.60	Concrete
0.0535	0.500	0.001	0.0010	0.5989	0.444	0.222	0.5989	0.1943	12.49	Concrete
0.0295	0.500	0.001	0.0010	0.3303	0.352	0.176	0.3303	0.1512	14.08	Concrete
0.3026	0.500	0.001	0.0020	2.3954	0.962	0.481	2.3954	0.4822	0.24	Concrete
0.2378	0.500	0.001	0.0020	1.8824	0.742	0.371	1.8824	0.4000	7.81	Concrete
0.1578	0.500	0.001	0.0020	1.2491	0.586	0.293	1.2491	0.2985	1.87	Concrete
0.0459	0.500	0.001	0.0020	0.3633	0.340	0.170	0.3633	0.1565	7.93	Concrete
0.3831	0.500	0.001	0.0030	2.4761	0.978	0.489	2.4761	0.4951	1.25	Concrete
0.3177	0.500	0.001	0.0030	2.0534	0.766	0.383	2.0534	0.4274	11.58	Concrete
0.1795	0.500	0.001	0.0030	1.1602	0.546	0.273	1.1602	0.2842	4.11	Concrete
0.1190	0.500	0.001	0.0030	0.7691	0.444	0.222	0.7691	0.2216	0.20	Concrete
0.0550	0.500	0.001	0.0030	0.3555	0.328	0.164	0.3555	0.1553	5.33	Concrete

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	depth adjusted	% error	Material
0.4335	0.500	0.001	0.0050	2.1703	0.960	0.480	2.1703	0.4461	7.06	Concrete
0.3915	0.500	0.001	0.0050	1.9601	0.770	0.385	1.9601	0.4124	7.12	Concrete
0.2082	0.500	0.001	0.0050	1.0424	0.540	0.270	1.0424	0.2653	1.73	Concrete
0.1250	0.500	0.001	0.0050	0.6258	0.420	0.210	0.6258	0.1986	5.43	Concrete
0.0615	0.500	0.001	0.0050	0.3079	0.302	0.151	0.3079	0.1476	2.22	Concrete
0.5874	0.500	0.001	0.0075	2.4012	0.960	0.480	2.4012	0.4831	0.64	Concrete
0.4691	0.500	0.001	0.0075	1.9176	0.768	0.384	1.9176	0.4056	5.62	Concrete
0.2680	0.500	0.001	0.0075	1.0955	0.544	0.272	1.0955	0.2739	0.68	Concrete
0.1602	0.500	0.001	0.0075	0.6549	0.424	0.212	0.6549	0.2032	4.13	Concrete
0.0633	0.500	0.001	0.0075	0.2588	0.284	0.142	0.2588	0.1398	1.57	Concrete
0.6238	0.500	0.001	0.0100	2.2083	0.946	0.473	2.2083	0.4522	4.40	Concrete
0.4807	0.500	0.001	0.0100	1.7017	0.730	0.365	1.7017	0.3710	1.65	Concrete
0.3186	0.500	0.001	0.0100	1.1279	0.556	0.278	1.1279	0.2790	0.38	Concrete
0.1991	0.500	0.001	0.0100	0.7048	0.424	0.212	0.7048	0.2113	0.35	Concrete
0.0904	0.500	0.001	0.0100	0.3200	0.288	0.144	0.3200	0.1496	3.88	Concrete
0.3096	0.667	0.001	0.0005	2.2760	0.968	0.645	2.2760	0.6174	4.28	Concrete
0.3096	0.667	0.001	0.0005	2.2760	0.963	0.642	2.2760	0.6174	3.84	Concrete
0.2873	0.667	0.001	0.0005	2.1120	0.821	0.547	2.1120	0.5823	6.46	Concrete
0.2187	0.667	0.001	0.0005	1.6077	0.719	0.479	1.6077	0.4746	0.92	Concrete
0.1957	0.667	0.001	0.0005	1.4387	0.639	0.426	1.4387	0.4385	2.92	Concrete
0.1105	0.667	0.001	0.0005	0.8123	0.479	0.319	0.8123	0.3046	4.50	Concrete
0.0720	0.667	0.001	0.0005	0.5293	0.387	0.258	0.5293	0.2442	5.36	Concrete
0.4440	0.667	0.001	0.0010	2.3080	0.981	0.654	2.3080	0.6242	4.56	Concrete
0.4261	0.667	0.001	0.0010	2.2149	0.938	0.625	2.2149	0.6043	3.31	Concrete
0.4104	0.667	0.001	0.0010	2.1333	0.831	0.554	2.1333	0.5869	5.94	Concrete
0.3278	0.667	0.001	0.0010	1.7040	0.722	0.481	1.7040	0.4951	2.94	Concrete
0.2839	0.667	0.001	0.0010	1.4758	0.642	0.428	1.4758	0.4464	4.30	Concrete
0.1638	0.667	0.001	0.0010	0.8515	0.467	0.311	0.8515	0.3130	0.64	Concrete
0.1130	0.667	0.001	0.0010	0.5874	0.380	0.253	0.5874	0.2566	1.41	Concrete
0.0462	0.667	0.001	0.0010	0.2402	0.266	0.177	0.2402	0.1824	3.04	Concrete
0.6373	0.667	0.001	0.0020	2.3425	0.972	0.648	2.3425	0.6316	2.53	Concrete
0.6496	0.667	0.001	0.0020	2.3877	0.960	0.640	2.3877	0.6412	0.19	Concrete
0.6035	0.667	0.001	0.0020	2.2183	0.848	0.565	2.2183	0.6050	7.09	Concrete
0.5090	0.667	0.001	0.0020	1.8709	0.744	0.496	1.8709	0.5308	7.02	Concrete
0.4387	0.667	0.001	0.0020	1.6125	0.672	0.448	1.6125	0.4756	6.16	Concrete
0.2616	0.667	0.001	0.0020	0.9616	0.503	0.335	0.9616	0.3365	0.45	Concrete
0.7870	0.667	0.001	0.0030	2.3619	0.965	0.643	2.3619	0.6357	1.13	Concrete
0.7750	0.667	0.001	0.0030	2.3259	0.935	0.623	2.3259	0.6280	0.81	Concrete
0.7240	0.667	0.001	0.0030	2.1728	0.830	0.553	2.1728	0.5953	7.65	Concrete
0.6224	0.667	0.001	0.0030	1.8679	0.734	0.489	1.8679	0.5302	8.42	Concrete
0.5440	0.667	0.001	0.0030	1.6326	0.668	0.445	1.6326	0.4799	7.84	Concrete
0.3354	0.667	0.001	0.0030	1.0066	0.512	0.341	1.0066	0.3461	1.51	Concrete
0.1886	0.667	0.001	0.0030	0.5660	0.393	0.262	0.5660	0.2520	3.81	Concrete
0.0824	0.667	0.001	0.0030	0.2473	0.273	0.182	0.2473	0.1839	1.05	Concrete
1.1050	0.667	0.001	0.0050	2.5688	0.971	0.647	2.5688	0.6799	5.09	Concrete
1.0164	0.667	0.001	0.0050	2.3628	0.942	0.628	2.3628	0.6359	1.26	Concrete

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	depth adjusted	% error	Material
0.9930	0.667	0.001	0.0050	2.3084	0.935	0.623	2.3084	0.6243	0.21	Concrete
0.9108	0.667	0.001	0.0050	2.1173	0.849	0.566	2.1173	0.5835	3.09	Concrete
0.8028	0.667	0.001	0.0050	1.8663	0.768	0.512	1.8663	0.5298	3.48	Concrete
0.6440	0.667	0.001	0.0050	1.4971	0.665	0.443	1.4971	0.4509	1.79	Concrete
0.3610	0.667	0.001	0.0050	0.8392	0.477	0.318	0.8392	0.3104	2.40	Concrete
0.2608	0.667	0.001	0.0050	0.6063	0.405	0.270	0.6063	0.2606	3.48	Concrete
0.1140	0.667	0.001	0.0050	0.2650	0.284	0.189	0.2650	0.1877	0.69	Concrete
1.1900	0.667	0.001	0.0075	2.2587	0.971	0.647	2.2587	0.6137	5.15	Concrete
1.2280	0.667	0.001	0.0075	2.3309	0.950	0.633	2.3309	0.6291	0.62	Concrete
1.0880	0.667	0.001	0.0075	2.0651	0.819	0.546	2.0651	0.5723	4.82	Concrete
0.9658	0.667	0.001	0.0075	1.8332	0.743	0.495	1.8332	0.5228	5.61	Concrete
0.8204	0.667	0.001	0.0075	1.5572	0.663	0.442	1.5572	0.4638	4.93	Concrete
0.5042	0.667	0.001	0.0075	0.9570	0.503	0.335	0.9570	0.3356	0.16	Concrete
0.3096	0.667	0.001	0.0075	0.5877	0.390	0.260	0.5877	0.2566	1.30	Concrete
0.1215	0.667	0.001	0.0075	0.2306	0.255	0.170	0.2306	0.1803	6.08	Concrete
1.3580	0.667	0.001	0.0100	2.2323	0.968	0.645	2.2323	0.6080	5.73	Concrete
1.3630	0.667	0.001	0.0100	2.2405	0.963	0.642	2.2405	0.6098	5.02	Concrete
1.2680	0.667	0.001	0.0100	2.0843	0.839	0.559	2.0843	0.5764	3.12	Concrete
1.0470	0.667	0.001	0.0100	1.7211	0.696	0.464	1.7211	0.4988	7.50	Concrete
0.8788	0.667	0.001	0.0100	1.4446	0.623	0.415	1.4446	0.4397	5.96	Concrete
0.5318	0.667	0.001	0.0100	0.8742	0.464	0.309	0.8742	0.3178	2.86	Concrete
0.2899	0.667	0.001	0.0100	0.4765	0.338	0.225	0.4765	0.2329	3.51	Concrete
0.1283	0.667	0.001	0.0100	0.2109	0.230	0.153	0.2109	0.1761	15.12	Concrete
1.5120	0.667	0.001	0.0125	2.2230	0.963	0.642	2.2230	0.6061	5.60	Concrete
1.4880	0.667	0.001	0.0125	2.1878	0.900	0.600	2.1878	0.5985	0.25	Concrete
1.4700	0.667	0.001	0.0125	2.1613	0.890	0.593	2.1613	0.5929	0.02	Concrete
1.4080	0.667	0.001	0.0125	2.0701	0.830	0.553	2.0701	0.5734	3.69	Concrete
1.2040	0.667	0.001	0.0125	1.7702	0.731	0.487	1.7702	0.5093	4.58	Concrete
0.9928	0.667	0.001	0.0125	1.4597	0.639	0.426	1.4597	0.4430	3.98	Concrete
0.6224	0.667	0.001	0.0125	0.9151	0.486	0.324	0.9151	0.3266	0.80	Concrete
0.3620	0.667	0.001	0.0125	0.5322	0.366	0.244	0.5322	0.2448	0.32	Concrete
0.1602	0.667	0.001	0.0125	0.2355	0.245	0.163	0.2355	0.1814	11.28	Concrete
1.6450	0.667	0.001	0.0150	2.2079	0.951	0.634	2.2079	0.6028	4.92	Concrete
1.6425	0.667	0.001	0.0150	2.2045	0.924	0.616	2.2045	0.6021	2.26	Concrete
1.5060	0.667	0.001	0.0150	2.0213	0.818	0.545	2.0213	0.5630	3.29	Concrete
1.2900	0.667	0.001	0.0150	1.7314	0.723	0.482	1.7314	0.5010	3.94	Concrete
1.0140	0.667	0.001	0.0150	1.3610	0.621	0.414	1.3610	0.4219	1.90	Concrete
0.6524	0.667	0.001	0.0150	0.8756	0.485	0.323	0.8756	0.3182	1.50	Concrete
0.3925	0.667	0.001	0.0150	0.5268	0.368	0.245	0.5268	0.2436	0.56	Concrete
0.1879	0.667	0.001	0.0150	0.2522	0.248	0.165	0.2522	0.1850	12.09	Concrete
0.4818	0.833	0.001	0.0005	1.9535	0.982	0.818	1.9535	0.6856	16.19	Concrete
0.5150	0.833	0.001	0.0005	2.0881	0.940	0.783	2.0881	0.7215	7.85	Concrete
0.5114	0.833	0.001	0.0005	2.0735	0.887	0.739	2.0735	0.7176	2.89	Concrete
0.4910	0.833	0.001	0.0005	1.9908	0.847	0.706	1.9908	0.6955	1.48	Concrete
0.4324	0.833	0.001	0.0005	1.7532	0.739	0.616	1.7532	0.6321	2.61	Concrete
0.4188	0.833	0.001	0.0005	1.6980	0.695	0.579	1.6980	0.6173	6.62	Concrete

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	depth adjusted	% error	Material
0.3660	0.833	0.001	0.0005	1.4840	0.661	0.551	1.4840	0.5602	1.66	Concrete
0.2780	0.833	0.001	0.0005	1.1272	0.569	0.474	1.1272	0.4649	1.92	Concrete
0.2408	0.833	0.001	0.0005	0.9763	0.499	0.416	0.9763	0.4246	2.07	Concrete
0.1470	0.833	0.001	0.0005	0.5960	0.388	0.323	0.5960	0.3230	0.01	Concrete
0.0832	0.833	0.001	0.0005	0.3373	0.289	0.241	0.3373	0.2539	5.37	Concrete
0.7240	0.833	0.001	0.0010	2.0757	0.977	0.814	2.0757	0.7182	11.77	Concrete
0.7510	0.833	0.001	0.0010	2.1531	0.973	0.811	2.1531	0.7389	8.89	Concrete
0.7780	0.833	0.001	0.0010	2.2305	0.947	0.789	2.2305	0.7596	3.73	Concrete
0.7615	0.833	0.001	0.0010	2.1832	0.887	0.739	2.1832	0.7469	1.07	Concrete
0.7360	0.833	0.001	0.0010	2.1101	0.852	0.710	2.1101	0.7274	2.45	Concrete
0.6930	0.833	0.001	0.0010	1.9868	0.804	0.670	1.9868	0.6945	3.65	Concrete
0.6278	0.833	0.001	0.0010	1.7999	0.740	0.617	1.7999	0.6446	4.47	Concrete
0.5954	0.833	0.001	0.0010	1.7070	0.712	0.593	1.7070	0.6197	4.51	Concrete
0.5354	0.833	0.001	0.0010	1.5350	0.668	0.557	1.5350	0.5738	3.02	Concrete
0.4462	0.833	0.001	0.0010	1.2792	0.583	0.486	1.2792	0.5055	4.01	Concrete
0.3650	0.833	0.001	0.0010	1.0464	0.508	0.423	1.0464	0.4433	4.80	Concrete
0.1998	0.833	0.001	0.0010	0.5728	0.386	0.322	0.5728	0.3168	1.61	Concrete
0.1110	0.833	0.001	0.0010	0.3182	0.286	0.238	0.3182	0.2488	4.55	Concrete
1.1160	0.833	0.001	0.0020	2.2624	0.976	0.813	2.2624	0.7681	5.52	Concrete
1.1020	0.833	0.001	0.0020	2.2340	0.958	0.798	2.2340	0.7605	4.70	Concrete
1.0960	0.833	0.001	0.0020	2.2219	0.886	0.738	2.2219	0.7573	2.61	Concrete
1.0600	0.833	0.001	0.0020	2.1489	0.850	0.708	2.1489	0.7378	4.20	Concrete
1.0105	0.833	0.001	0.0020	2.0485	0.800	0.667	2.0485	0.7110	6.59	Concrete
0.9448	0.833	0.001	0.0020	1.9154	0.745	0.621	1.9154	0.6754	8.76	Concrete
0.8639	0.833	0.001	0.0020	1.7513	0.713	0.594	1.7513	0.6316	6.33	Concrete
0.7996	0.833	0.001	0.0020	1.6210	0.673	0.561	1.6210	0.5968	6.38	Concrete
0.6251	0.833	0.001	0.0020	1.2672	0.580	0.483	1.2672	0.5023	3.99	Concrete
0.5188	0.833	0.001	0.0020	1.0517	0.527	0.439	1.0517	0.4447	1.31	Concrete
0.4982	0.833	0.001	0.0020	1.0100	0.515	0.429	1.0100	0.4336	1.07	Concrete
0.3250	0.833	0.001	0.0020	0.6589	0.412	0.343	0.6589	0.3398	0.93	Concrete
0.1437	0.833	0.001	0.0020	0.2913	0.298	0.248	0.2913	0.2416	2.56	Concrete
1.3400	0.833	0.001	0.0030	2.2180	0.976	0.813	2.2180	0.7562	6.98	Concrete
1.3380	0.833	0.001	0.0030	2.2147	0.972	0.810	2.2147	0.7553	6.75	Concrete
1.3800	0.833	0.001	0.0030	2.2842	0.948	0.790	2.2842	0.7739	2.04	Concrete
1.3450	0.833	0.001	0.0030	2.2263	0.888	0.740	2.2263	0.7584	2.49	Concrete
1.3280	0.833	0.001	0.0030	2.1982	0.858	0.715	2.1982	0.7509	5.03	Concrete
1.2360	0.833	0.001	0.0030	2.0459	0.796	0.663	2.0459	0.7103	7.13	Concrete
1.1800	0.833	0.001	0.0030	1.9532	0.763	0.636	1.9532	0.6855	7.78	Concrete
1.0860	0.833	0.001	0.0030	1.7976	0.718	0.598	1.7976	0.6439	7.68	Concrete
0.9586	0.833	0.001	0.0030	1.5867	0.665	0.554	1.5867	0.5876	6.07	Concrete
0.8092	0.833	0.001	0.0030	1.3394	0.598	0.498	1.3394	0.5216	4.73	Concrete
0.6332	0.833	0.001	0.0030	1.0481	0.523	0.436	1.0481	0.4438	1.78	Concrete
0.3791	0.833	0.001	0.0030	0.6275	0.407	0.339	0.6275	0.3314	2.23	Concrete
0.1853	0.833	0.001	0.0030	0.3067	0.292	0.243	0.3067	0.2458	1.13	Concrete
1.7650	0.833	0.001	0.0050	2.2630	0.966	0.805	2.2630	0.7682	4.57	Concrete
1.7350	0.833	0.001	0.0050	2.2245	0.965	0.804	2.2245	0.7580	5.73	Concrete

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	depth adjusted	% error	Material
1.7350	0.833	0.001	0.0050	2.2245	0.947	0.789	2.2245	0.7580	3.93	Concrete
1.7300	0.833	0.001	0.0050	2.2181	0.889	0.741	2.2181	0.7563	2.06	Concrete
1.6825	0.833	0.001	0.0050	2.1572	0.845	0.704	2.1572	0.7400	5.11	Concrete
1.6250	0.833	0.001	0.0050	2.0835	0.814	0.678	2.0835	0.7203	6.24	Concrete
1.4800	0.833	0.001	0.0050	1.8976	0.748	0.623	1.8976	0.6706	7.65	Concrete
1.3450	0.833	0.001	0.0050	1.7245	0.703	0.586	1.7245	0.6244	6.56	Concrete
1.2480	0.833	0.001	0.0050	1.6001	0.674	0.562	1.6001	0.5912	5.20	Concrete
0.9930	0.833	0.001	0.0050	1.2732	0.590	0.492	1.2732	0.5039	2.41	Concrete
0.7345	0.833	0.001	0.0050	0.9417	0.504	0.420	0.9417	0.4154	1.11	Concrete
0.4934	0.833	0.001	0.0050	0.6326	0.406	0.338	0.6326	0.3328	1.54	Concrete
0.2222	0.833	0.001	0.0050	0.2849	0.277	0.231	0.2849	0.2399	3.86	Concrete
2.1150	0.833	0.001	0.0075	2.2141	0.967	0.806	2.2141	0.7552	6.30	Concrete
2.0900	0.833	0.001	0.0075	2.1880	0.960	0.800	2.1880	0.7482	6.47	Concrete
2.0850	0.833	0.001	0.0075	2.1827	0.935	0.779	2.1827	0.7468	4.13	Concrete
2.0560	0.833	0.001	0.0075	2.1524	0.871	0.726	2.1524	0.7387	1.75	Concrete
2.0440	0.833	0.001	0.0075	2.1398	0.862	0.718	2.1398	0.7353	2.42	Concrete
1.7700	0.833	0.001	0.0075	1.8530	0.752	0.627	1.8530	0.6587	5.06	Concrete
1.5120	0.833	0.001	0.0075	1.5829	0.684	0.570	1.5829	0.5866	2.91	Concrete
1.3800	0.833	0.001	0.0075	1.4447	0.649	0.541	1.4447	0.5497	1.61	Concrete
1.1560	0.833	0.001	0.0075	1.2102	0.584	0.487	1.2102	0.4871	0.01	Concrete
0.8044	0.833	0.001	0.0075	0.8421	0.490	0.408	0.8421	0.3887	4.72	Concrete
0.5306	0.833	0.001	0.0075	0.5555	0.388	0.323	0.5555	0.3122	3.35	Concrete
0.2600	0.833	0.001	0.0075	0.2722	0.269	0.224	0.2722	0.2365	5.59	Concrete
2.4060	0.833	0.001	0.0100	2.1813	0.950	0.792	2.1813	0.7464	5.75	Concrete
2.4210	0.833	0.001	0.0100	2.1949	0.949	0.791	2.1949	0.7501	5.18	Concrete
2.2080	0.833	0.001	0.0100	2.0018	0.817	0.681	2.0018	0.6985	2.57	Concrete
2.0560	0.833	0.001	0.0100	1.8640	0.749	0.624	1.8640	0.6617	6.04	Concrete
2.0050	0.833	0.001	0.0100	1.8178	0.742	0.618	1.8178	0.6493	5.07	Concrete
1.8840	0.833	0.001	0.0100	1.7081	0.714	0.595	1.7081	0.6200	4.21	Concrete
1.6450	0.833	0.001	0.0100	1.4914	0.664	0.553	1.4914	0.5622	1.66	Concrete
1.3750	0.833	0.001	0.0100	1.2466	0.587	0.489	1.2466	0.4968	1.59	Concrete
0.9930	0.833	0.001	0.0100	0.9003	0.486	0.405	0.9003	0.4043	0.18	Concrete
0.6238	0.833	0.001	0.0100	0.5655	0.392	0.327	0.5655	0.3149	3.71	Concrete
0.2318	0.833	0.001	0.0100	0.2102	0.248	0.207	0.2102	0.2200	6.26	Concrete
2.7040	0.833	0.001	0.0125	2.1927	0.972	0.810	2.1927	0.7495	7.47	Concrete
2.7220	0.833	0.001	0.0125	2.2073	0.971	0.809	2.2073	0.7534	6.88	Concrete
2.6890	0.833	0.001	0.0125	2.1805	0.966	0.805	2.1805	0.7462	7.30	Concrete
2.6800	0.833	0.001	0.0125	2.1732	0.890	0.742	2.1732	0.7443	0.31	Concrete
2.5920	0.833	0.001	0.0125	2.1019	0.841	0.701	2.1019	0.7252	3.45	Concrete
2.5920	0.833	0.001	0.0125	2.1019	0.840	0.700	2.1019	0.7252	3.60	Concrete
2.4660	0.833	0.001	0.0125	1.9997	0.797	0.664	1.9997	0.6979	5.11	Concrete
2.2410	0.833	0.001	0.0125	1.8172	0.733	0.611	1.8172	0.6492	6.25	Concrete
2.0000	0.833	0.001	0.0125	1.6218	0.683	0.569	1.6218	0.5970	4.92	Concrete
1.8840	0.833	0.001	0.0125	1.5277	0.652	0.543	1.5277	0.5719	5.32	Concrete
1.4620	0.833	0.001	0.0125	1.1855	0.556	0.463	1.1855	0.4805	3.77	Concrete
1.2360	0.833	0.001	0.0125	1.0023	0.494	0.412	1.0023	0.4315	4.74	Concrete

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	depth adjusted	% error	Material
0.7000	0.833	0.001	0.0125	0.5676	0.377	0.314	0.5676	0.3154	0.46	Concrete
0.3260	0.833	0.001	0.0125	0.2644	0.256	0.213	0.2644	0.2344	10.06	Concrete
2.8840	0.833	0.001	0.0150	2.1349	0.937	0.781	2.1349	0.7340	6.01	Concrete
2.4540	0.833	0.001	0.0150	1.8166	0.749	0.624	1.8166	0.6490	4.01	Concrete
1.3820	0.833	0.001	0.0150	1.0230	0.505	0.421	1.0230	0.4371	3.82	Concrete
0.9125	1.000	0.001	0.0005	2.2752	0.985	0.985	2.2752	0.9258	6.01	Concrete
0.8938	1.000	0.001	0.0005	2.2286	0.943	0.943	2.2286	0.9109	3.41	Concrete
0.8672	1.000	0.001	0.0005	2.1623	0.889	0.889	2.1623	0.8896	0.07	Concrete
0.8492	1.000	0.001	0.0005	2.1174	0.845	0.845	2.1174	0.8752	3.58	Concrete
0.7540	1.000	0.001	0.0005	1.8800	0.782	0.782	1.8800	0.7991	2.19	Concrete
0.6986	1.000	0.001	0.0005	1.7419	0.756	0.756	1.7419	0.7549	0.15	Concrete
0.6496	1.000	0.001	0.0005	1.6197	0.691	0.691	1.6197	0.7157	3.58	Concrete
0.6062	1.000	0.001	0.0005	1.5115	0.643	0.643	1.5115	0.6810	5.91	Concrete
0.4982	1.000	0.001	0.0005	1.2422	0.580	0.580	1.2422	0.5947	2.54	Concrete
0.4485	1.000	0.001	0.0005	1.1183	0.534	0.534	1.1183	0.5550	3.93	Concrete
0.4083	1.000	0.001	0.0005	1.0180	0.511	0.511	1.0180	0.5229	2.33	Concrete
0.2152	1.000	0.001	0.0005	0.5366	0.364	0.364	0.5366	0.3686	1.26	Concrete
0.1120	1.000	0.001	0.0005	0.2793	0.275	0.275	0.2793	0.2861	4.04	Concrete
3.0600	1.500	0.001	0.0021	1.2627	0.527	0.790	1.2627	0.9020	14.17	Concrete
4.3100	1.500	0.001	0.0021	1.8001	0.660	0.990	1.8001	1.1603	17.20	Concrete
0.1500	0.667	0.0005	0.005	0.3094	0.240	0.160	0.3094	0.1973	23.30	Clay
0.3220	0.667	0.0005	0.005	0.6642	0.360	0.240	0.6642	0.2731	13.80	Clay
0.4690	0.667	0.0005	0.005	0.9674	0.435	0.290	0.9674	0.3379	16.53	Clay
0.8150	0.667	0.0005	0.005	1.6811	0.645	0.430	1.6811	0.4905	14.07	Clay
0.9600	0.667	0.0005	0.005	1.9802	0.735	0.490	1.9802	0.5545	13.15	Clay
1.1700	0.667	0.0005	0.005	2.4134	0.885	0.590	2.4134	0.6471	9.67	Clay
1.1600	0.667	0.0005	0.005	2.3928	0.975	0.650	2.3928	0.6426	1.13	Clay
0.1930	0.667	0.0005	0.01	0.2815	0.240	0.160	0.2815	0.1913	19.57	Clay
0.4600	0.667	0.0005	0.01	0.6710	0.375	0.250	0.6710	0.2746	9.83	Clay
0.7600	0.667	0.0005	0.01	1.1085	0.495	0.330	1.1085	0.3681	11.55	Clay
1.0400	0.667	0.0005	0.01	1.5169	0.630	0.420	1.5169	0.4554	8.43	Clay
1.3600	0.667	0.0005	0.01	1.9837	0.750	0.500	1.9837	0.5552	11.04	Clay
1.5300	0.667	0.0005	0.01	2.2316	0.840	0.560	2.2316	0.6082	8.61	Clay
1.6400	0.667	0.0005	0.01	2.3921	0.960	0.640	2.3921	0.6425	0.39	Clay
0.2400	0.667	0.0005	0.015	0.2858	0.255	0.170	0.2858	0.1922	13.08	Clay
0.5000	0.667	0.0005	0.015	0.5955	0.375	0.250	0.5955	0.2584	3.37	Clay
0.8400	0.667	0.0005	0.015	1.0004	0.495	0.330	1.0004	0.3450	4.54	Clay
1.2000	0.667	0.0005	0.015	1.4291	0.630	0.420	1.4291	0.4366	3.96	Clay
1.5600	0.667	0.0005	0.015	1.8579	0.750	0.500	1.8579	0.5283	5.66	Clay
1.9100	0.667	0.0005	0.015	2.2747	0.855	0.570	2.2747	0.6174	8.32	Clay
2.0600	0.667	0.0005	0.015	2.4533	0.975	0.650	2.4533	0.6556	0.86	Clay
0.2480	0.667	0.0005	0.02	0.2558	0.255	0.170	0.2558	0.1858	9.30	Clay
0.5450	0.667	0.0005	0.02	0.5621	0.375	0.250	0.5621	0.2513	0.52	Clay
0.9000	0.667	0.0005	0.02	0.9282	0.495	0.330	0.9282	0.3296	0.13	Clay
1.2900	0.667	0.0005	0.02	1.3305	0.630	0.420	1.3305	0.4156	1.06	Clay
1.7300	0.667	0.0005	0.02	1.7843	0.750	0.500	1.7843	0.5126	2.51	Clay

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	depth adjusted	% error	Material
2.3200	0.667	0.0005	0.02	2.3928	0.915	0.610	2.3928	0.6426	5.35	Clay
0.2550	0.667	0.0005	0.03	0.2147	0.255	0.170	0.2147	0.1770	4.14	Clay
0.6000	0.667	0.0005	0.03	0.5053	0.375	0.250	0.5053	0.2391	4.34	Clay
0.9400	0.667	0.0005	0.03	0.7916	0.480	0.320	0.7916	0.3004	6.14	Clay
1.4000	0.667	0.0005	0.03	1.1790	0.630	0.420	1.1790	0.3832	8.77	Clay
1.8400	0.667	0.0005	0.03	1.5495	0.720	0.480	1.5495	0.4624	3.67	Clay
2.4400	0.667	0.0005	0.03	2.0548	0.855	0.570	2.0548	0.5704	0.07	Clay
2.5400	0.667	0.0005	0.03	2.1390	0.900	0.600	2.1390	0.5884	1.94	Clay
0.3000	0.667	0.0005	0.04	0.2188	0.255	0.170	0.2188	0.1779	4.65	Clay
0.6800	0.667	0.0005	0.04	0.4959	0.375	0.250	0.4959	0.2371	5.14	Clay
1.0000	0.667	0.0005	0.04	0.7293	0.480	0.320	0.7293	0.2870	10.30	Clay
1.6200	0.667	0.0005	0.04	1.1815	0.630	0.420	1.1815	0.3837	8.64	Clay
2.1500	0.667	0.0005	0.04	1.5680	0.750	0.500	1.5680	0.4663	6.73	Clay
2.7100	0.667	0.0005	0.04	1.9764	0.855	0.570	1.9764	0.5536	2.87	Clay
0.0547	0.333	0.0005	0.0005	2.2686	0.996	0.332	2.2686	0.3079	7.26	Clay
0.0562	0.333	0.0005	0.0005	2.3308	0.927	0.309	2.3308	0.3145	1.79	Clay
0.0487	0.333	0.0005	0.0005	2.0198	0.894	0.298	2.0198	0.2813	5.60	Clay
0.0404	0.333	0.0005	0.0005	1.6755	0.744	0.248	1.6755	0.2445	1.40	Clay
0.0274	0.333	0.0005	0.0005	1.1364	0.642	0.214	1.1364	0.1869	12.65	Clay
0.0177	0.333	0.0005	0.0005	0.7341	0.477	0.159	0.7341	0.1440	9.46	Clay
0.0098	0.333	0.0005	0.0010	0.2874	0.393	0.131	0.2874	0.0962	26.54	Clay
0.0703	0.333	0.0005	0.0010	2.0616	0.993	0.331	2.0616	0.2858	13.66	Clay
0.0744	0.333	0.0005	0.0010	2.1819	0.981	0.327	2.1819	0.2986	8.68	Clay
0.0580	0.333	0.0005	0.0010	1.7009	0.855	0.285	1.7009	0.2472	13.25	Clay
0.0568	0.333	0.0005	0.0010	1.6657	0.684	0.228	1.6657	0.2435	6.79	Clay
0.0235	0.333	0.0005	0.0010	0.6892	0.480	0.160	0.6892	0.1392	13.03	Clay
0.0166	0.333	0.0005	0.0010	0.4868	0.408	0.136	0.4868	0.1175	13.57	Clay
0.0969	0.333	0.0005	0.0020	2.0094	0.987	0.329	2.0094	0.2802	14.83	Clay
0.1019	0.333	0.0005	0.0020	2.1131	0.963	0.321	2.1131	0.2913	9.26	Clay
0.0940	0.333	0.0005	0.0020	1.9493	0.849	0.283	1.9493	0.2738	3.26	Clay
0.0904	0.333	0.0005	0.0020	1.8746	0.813	0.271	1.8746	0.2658	1.92	Clay
0.0710	0.333	0.0005	0.0020	1.4723	0.669	0.223	1.4723	0.2228	0.08	Clay
0.0414	0.333	0.0005	0.0020	0.8585	0.519	0.173	0.8585	0.1573	9.10	Clay
0.0187	0.333	0.0005	0.0020	0.3878	0.387	0.129	0.3878	0.1070	17.08	Clay
0.1230	0.333	0.0005	0.0030	2.0826	0.939	0.313	2.0826	0.2880	7.98	Clay
0.0864	0.333	0.0005	0.0030	1.4629	0.732	0.244	1.4629	0.2218	9.09	Clay
0.0685	0.333	0.0005	0.0030	1.1598	0.639	0.213	1.1598	0.1894	11.06	Clay
0.0361	0.333	0.0005	0.0030	0.6112	0.498	0.166	0.6112	0.1308	21.18	Clay
0.0180	0.333	0.0005	0.0030	0.3048	0.369	0.123	0.3048	0.0981	20.25	Clay
0.1578	0.333	0.0005	0.0050	2.0696	0.951	0.317	2.0696	0.2866	9.58	Clay
0.1494	0.333	0.0005	0.0050	1.9594	0.861	0.287	1.9594	0.2749	4.23	Clay
0.1327	0.333	0.0005	0.0050	1.7404	0.789	0.263	1.7404	0.2515	4.39	Clay
0.0987	0.333	0.0005	0.0050	1.2945	0.669	0.223	1.2945	0.2038	8.60	Clay
0.0517	0.333	0.0005	0.0050	0.6781	0.510	0.170	0.6781	0.1380	18.84	Clay
0.0256	0.333	0.0005	0.0050	0.3357	0.384	0.128	0.3357	0.1014	20.78	Clay
0.1931	0.333	0.0005	0.0075	2.0678	0.996	0.332	2.0678	0.2864	13.72	Clay

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	depth adjusted	% error	Material
0.1905	0.333	0.0005	0.0075	2.0400	0.960	0.320	2.0400	0.2835	11.42	Clay
0.1756	0.333	0.0005	0.0075	1.8804	0.864	0.288	1.8804	0.2664	7.49	Clay
0.1482	0.333	0.0005	0.0075	1.5870	0.759	0.253	1.5870	0.2351	7.08	Clay
0.0996	0.333	0.0005	0.0075	1.0666	0.629	0.210	1.0666	0.1795	14.45	Clay
0.0654	0.333	0.0005	0.0075	0.7003	0.492	0.164	0.7003	0.1404	14.42	Clay
0.0425	0.333	0.0005	0.0075	0.4551	0.402	0.134	0.4551	0.1142	14.81	Clay
0.2640	0.333	0.0005	0.0125	2.1898	0.993	0.331	2.1898	0.2995	9.52	Clay
0.2472	0.333	0.0005	0.0125	2.0505	0.912	0.304	2.0505	0.2846	6.38	Clay
0.2124	0.333	0.0005	0.0125	1.7618	0.810	0.270	1.7618	0.2538	6.02	Clay
0.1951	0.333	0.0005	0.0125	1.6183	0.762	0.254	1.6183	0.2384	6.13	Clay
0.1032	0.333	0.0005	0.0125	0.8560	0.531	0.177	0.8560	0.1570	11.31	Clay
0.0736	0.333	0.0005	0.0125	0.6105	0.444	0.148	0.6105	0.1308	11.65	Clay
0.2890	0.333	0.0005	0.0150	2.1883	0.987	0.329	2.1883	0.2993	9.02	Clay
0.2907	0.333	0.0005	0.0150	2.2012	0.939	0.313	2.2012	0.3007	3.93	Clay
0.2814	0.333	0.0005	0.0150	2.1308	0.894	0.298	2.1308	0.2932	1.62	Clay
0.2318	0.333	0.0005	0.0150	1.7552	0.771	0.257	1.7552	0.2530	1.54	Clay
0.2026	0.333	0.0005	0.0150	1.5341	0.684	0.228	1.5341	0.2294	0.63	Clay
0.1322	0.333	0.0005	0.0150	1.0010	0.504	0.168	1.0010	0.1725	2.66	Clay
0.0720	0.333	0.0005	0.0150	0.5452	0.378	0.126	0.5452	0.1238	1.76	Clay
0.1415	0.417	0.0005	0.0010	2.2887	0.974	0.406	2.2887	0.3876	4.54	Clay
0.1366	0.417	0.0005	0.0010	2.2094	0.965	0.402	2.2094	0.3770	6.23	Clay
0.1230	0.417	0.0005	0.0010	1.9895	0.840	0.350	1.9895	0.3476	0.69	Clay
0.1065	0.417	0.0005	0.0010	1.7226	0.754	0.314	1.7226	0.3120	0.65	Clay
0.0824	0.417	0.0005	0.0010	1.3328	0.655	0.273	1.3328	0.2599	4.80	Clay
0.0532	0.417	0.0005	0.0010	0.8605	0.516	0.215	0.8605	0.1968	8.45	Clay
0.0231	0.417	0.0005	0.0010	0.3736	0.372	0.155	0.3736	0.1318	14.96	Clay
0.0165	0.417	0.0005	0.0010	0.2669	0.278	0.116	0.2669	0.1176	1.34	Clay
0.1905	0.417	0.0005	0.0020	2.1788	0.986	0.411	2.1788	0.3729	9.28	Clay
0.1892	0.417	0.0005	0.0020	2.1639	0.984	0.410	2.1639	0.3709	9.54	Clay
0.1827	0.417	0.0005	0.0020	2.0896	0.835	0.348	2.0896	0.3610	3.72	Clay
0.1686	0.417	0.0005	0.0020	1.9283	0.756	0.315	1.9283	0.3394	7.75	Clay
0.1371	0.417	0.0005	0.0020	1.5680	0.670	0.279	1.5680	0.2913	4.41	Clay
0.0840	0.417	0.0005	0.0020	0.9607	0.509	0.212	0.9607	0.2102	0.84	Clay
0.0481	0.417	0.0005	0.0020	0.5501	0.394	0.164	0.5501	0.1554	5.26	Clay
0.0291	0.417	0.0005	0.0020	0.3328	0.310	0.129	0.3328	0.1264	2.04	Clay
0.2408	0.417	0.0005	0.0030	2.2487	0.958	0.399	2.2487	0.3822	4.21	Clay
0.2370	0.417	0.0005	0.0030	2.2132	0.941	0.392	2.2132	0.3775	3.71	Clay
0.2208	0.417	0.0005	0.0030	2.0619	0.845	0.352	2.0619	0.3573	1.50	Clay
0.1998	0.417	0.0005	0.0030	1.8658	0.770	0.321	1.8658	0.3311	3.14	Clay
0.1566	0.417	0.0005	0.0030	1.4624	0.655	0.273	1.4624	0.2772	1.54	Clay
0.0987	0.417	0.0005	0.0030	0.9217	0.526	0.219	0.9217	0.2050	6.39	Clay
0.0544	0.417	0.0005	0.0030	0.5080	0.396	0.165	0.5080	0.1498	9.24	Clay
0.0231	0.417	0.0005	0.0030	0.2157	0.276	0.115	0.2157	0.1107	3.72	Clay
0.3026	0.417	0.0005	0.0050	2.1888	0.953	0.397	2.1888	0.3742	5.74	Clay
0.3096	0.417	0.0005	0.0050	2.2395	0.905	0.377	2.2395	0.3810	1.06	Clay
0.2958	0.417	0.0005	0.0050	2.1397	0.833	0.347	2.1397	0.3677	5.95	Clay

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	depth adjusted	% error	Material
0.2464	0.417	0.0005	0.0050	1.7823	0.715	0.298	1.7823	0.3199	7.36	Clay
0.1892	0.417	0.0005	0.0050	1.3686	0.610	0.254	1.3686	0.2647	4.20	Clay
0.1448	0.417	0.0005	0.0050	1.0474	0.528	0.220	1.0474	0.2218	0.81	Clay
0.0784	0.417	0.0005	0.0050	0.5671	0.370	0.154	0.5671	0.1576	2.37	Clay
0.0381	0.417	0.0005	0.0050	0.2756	0.283	0.118	0.2756	0.1187	0.61	Clay
0.4009	0.417	0.0005	0.0100	2.0505	0.965	0.402	2.0505	0.3557	11.51	Clay
0.4051	0.417	0.0005	0.0100	2.0720	0.919	0.383	2.0720	0.3586	6.37	Clay
0.3740	0.417	0.0005	0.0100	1.9129	0.782	0.326	1.9129	0.3374	3.49	Clay
0.5428	0.417	0.0005	0.0150	2.2669	0.946	0.394	2.2669	0.3846	2.38	Clay
0.5066	0.417	0.0005	0.0150	2.1157	0.823	0.343	2.1157	0.3644	6.25	Clay
0.4738	0.417	0.0005	0.0150	1.9787	0.766	0.319	1.9787	0.3462	8.51	Clay
0.3582	0.417	0.0005	0.0150	1.4959	0.607	0.253	1.4959	0.2817	11.34	Clay
0.2704	0.417	0.0005	0.0150	1.1293	0.502	0.209	1.1293	0.2327	11.35	Clay
0.1674	0.417	0.0005	0.0150	0.6991	0.379	0.158	0.6991	0.1753	10.93	Clay
0.0969	0.417	0.0005	0.0150	0.4047	0.283	0.118	0.4047	0.1360	15.22	Clay
0.1404	0.500	0.0005	0.0005	1.9750	0.804	0.402	1.9750	0.4148	3.18	Clay
0.0724	0.500	0.0005	0.0005	1.0184	0.600	0.300	1.0184	0.2615	12.83	Clay
0.0397	0.500	0.0005	0.0005	0.5585	0.446	0.223	0.5585	0.1878	15.79	Clay
0.0225	0.500	0.0005	0.0005	0.3165	0.376	0.188	0.3165	0.1490	20.73	Clay
0.1578	0.500	0.0005	0.0010	1.5696	0.792	0.396	1.5696	0.3498	11.66	Clay
0.1255	0.500	0.0005	0.0010	1.2483	0.608	0.304	1.2483	0.2983	1.86	Clay
0.0706	0.500	0.0005	0.0010	0.7022	0.422	0.211	0.7022	0.2108	0.08	Clay
0.0372	0.500	0.0005	0.0010	0.3700	0.342	0.171	0.3700	0.1576	7.84	Clay
0.3563	0.500	0.0005	0.0020	2.5060	0.996	0.498	2.5060	0.4999	0.38	Clay
0.2680	0.500	0.0005	0.0020	1.8850	0.818	0.409	1.8850	0.4004	2.11	Clay
0.1801	0.500	0.0005	0.0020	1.2667	0.554	0.277	1.2667	0.3013	8.77	Clay
0.1090	0.500	0.0005	0.0020	0.7666	0.438	0.219	0.7666	0.2212	0.98	Clay
0.0559	0.500	0.0005	0.0020	0.3932	0.314	0.157	0.3932	0.1613	2.74	Clay
0.3620	0.500	0.0005	0.0030	2.0789	0.828	0.414	2.0789	0.4314	4.21	Clay
0.2194	0.500	0.0005	0.0030	1.2600	0.604	0.302	1.2600	0.3002	0.59	Clay
0.1382	0.500	0.0005	0.0030	0.7937	0.444	0.222	0.7937	0.2255	1.57	Clay
0.0685	0.500	0.0005	0.0030	0.3934	0.334	0.167	0.3934	0.1613	3.39	Clay
0.5540	0.500	0.0005	0.0050	2.4644	0.996	0.498	2.4644	0.4932	0.96	Clay
0.4440	0.500	0.0005	0.0050	1.9751	0.756	0.378	1.9751	0.4148	9.74	Clay
0.2771	0.500	0.0005	0.0050	1.2326	0.552	0.276	1.2326	0.2958	7.18	Clay
0.1512	0.500	0.0005	0.0050	0.6726	0.426	0.213	0.6726	0.2061	3.25	Clay
0.0664	0.500	0.0005	0.0050	0.2954	0.304	0.152	0.2954	0.1456	4.19	Clay
0.6804	0.500	0.0005	0.0075	2.4712	0.946	0.473	2.4712	0.4943	4.51	Clay
0.5390	0.500	0.0005	0.0075	1.9577	0.770	0.385	1.9577	0.4120	7.02	Clay
0.2771	0.500	0.0005	0.0075	1.0064	0.516	0.258	1.0064	0.2596	0.61	Clay
0.1692	0.500	0.0005	0.0075	0.6145	0.398	0.199	0.6145	0.1968	1.12	Clay
0.0969	0.500	0.0005	0.0075	0.3519	0.294	0.147	0.3519	0.1547	5.24	Clay
0.3260	0.667	0.0005	0.0005	2.1293	0.995	0.663	2.1293	0.5860	11.61	Clay
0.2540	0.667	0.0005	0.0005	1.6591	0.773	0.515	1.6591	0.4856	5.72	Clay
0.1370	0.667	0.0005	0.0005	0.8948	0.513	0.342	0.8948	0.3223	5.77	Clay
0.0840	0.667	0.0005	0.0005	0.5487	0.389	0.259	0.5487	0.2483	4.13	Clay

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	depth adjusted	% error	Material
0.0363	0.667	0.0005	0.0005	0.2371	0.249	0.166	0.2371	0.1817	9.47	Clay
0.4570	0.667	0.0005	0.0010	2.1107	0.984	0.656	2.1107	0.5821	11.27	Clay
0.4670	0.667	0.0005	0.0010	2.1569	0.984	0.656	2.1569	0.5919	9.77	Clay
0.3740	0.667	0.0005	0.0010	1.7274	0.764	0.509	1.7274	0.5001	1.74	Clay
0.2060	0.667	0.0005	0.0010	0.9514	0.522	0.348	0.9514	0.3344	3.92	Clay
0.1380	0.667	0.0005	0.0010	0.6374	0.407	0.271	0.6374	0.2673	1.38	Clay
0.0720	0.667	0.0005	0.0010	0.3325	0.288	0.192	0.3325	0.2021	5.27	Clay
0.6720	0.667	0.0005	0.0020	2.1947	0.992	0.661	2.1947	0.6000	9.23	Clay
0.5220	0.667	0.0005	0.0020	1.7048	0.764	0.509	1.7048	0.4953	2.69	Clay
0.2805	0.667	0.0005	0.0020	0.9161	0.537	0.358	0.9161	0.3268	8.71	Clay
0.1540	0.667	0.0005	0.0020	0.5029	0.401	0.267	0.5029	0.2385	10.66	Clay
0.0540	0.667	0.0005	0.0020	0.1764	0.248	0.165	0.1764	0.1687	2.27	Clay
0.7870	0.667	0.0005	0.0030	2.0986	0.995	0.663	2.0986	0.5795	12.60	Clay
0.6390	0.667	0.0005	0.0030	1.7039	0.765	0.510	1.7039	0.4951	2.91	Clay
0.3392	0.667	0.0005	0.0030	0.9045	0.546	0.364	0.9045	0.3243	10.90	Clay
0.2054	0.667	0.0005	0.0030	0.5477	0.420	0.280	0.5477	0.2481	11.39	Clay
0.0920	0.667	0.0005	0.0030	0.2453	0.294	0.196	0.2453	0.1835	6.39	Clay
1.2840	0.667	0.0005	0.0075	2.1654	0.993	0.662	2.1654	0.5937	10.31	Clay
1.3000	0.667	0.0005	0.0075	2.1924	0.963	0.642	2.1924	0.5995	6.62	Clay
0.9480	0.667	0.0005	0.0075	1.5988	0.755	0.503	1.5988	0.4727	6.03	Clay
0.5590	0.667	0.0005	0.0075	0.9427	0.534	0.356	0.9427	0.3325	6.60	Clay
0.3392	0.667	0.0005	0.0075	0.5721	0.405	0.270	0.5721	0.2533	6.19	Clay
0.1481	0.667	0.0005	0.0075	0.2498	0.270	0.180	0.2498	0.1844	2.46	Clay
1.4650	0.667	0.0005	0.0100	2.1397	0.992	0.661	2.1397	0.5882	11.01	Clay
1.4475	0.667	0.0005	0.0100	2.1141	0.986	0.657	2.1141	0.5828	11.30	Clay
1.1580	0.667	0.0005	0.0100	1.6913	0.710	0.473	1.6913	0.4924	4.11	Clay
0.5980	0.667	0.0005	0.0100	0.8734	0.488	0.325	0.8734	0.3177	2.25	Clay
0.3760	0.667	0.0005	0.0100	0.5492	0.375	0.250	0.5492	0.2484	0.64	Clay
0.1814	0.667	0.0005	0.0100	0.2649	0.260	0.173	0.2649	0.1877	8.48	Clay
1.3475	0.667	0.0005	0.0125	1.7603	0.735	0.490	1.7603	0.5072	3.51	Clay
0.7525	0.667	0.0005	0.0125	0.9830	0.519	0.346	0.9830	0.3411	1.41	Clay
0.4430	0.667	0.0005	0.0125	0.5787	0.390	0.260	0.5787	0.2547	2.03	Clay
0.2096	0.667	0.0005	0.0125	0.2738	0.260	0.173	0.2738	0.1896	9.58	Clay
0.6386	0.833	0.0005	0.0005	2.3005	0.985	0.821	2.3005	0.7783	5.20	Clay
0.5874	0.833	0.0005	0.0005	2.1161	0.974	0.812	2.1161	0.7290	10.22	Clay
0.5770	0.833	0.0005	0.0005	2.0786	0.940	0.783	2.0786	0.7190	8.17	Clay
0.5640	0.833	0.0005	0.0005	2.0318	0.899	0.749	2.0318	0.7065	5.68	Clay
0.5578	0.833	0.0005	0.0005	2.0095	0.836	0.697	2.0095	0.7005	0.51	Clay
0.5503	0.833	0.0005	0.0005	1.9824	0.799	0.666	1.9824	0.6933	4.10	Clay
0.5366	0.833	0.0005	0.0005	1.9331	0.751	0.626	1.9331	0.6801	8.65	Clay
0.4982	0.833	0.0005	0.0005	1.7948	0.680	0.567	1.7948	0.6432	13.44	Clay
0.4611	0.833	0.0005	0.0005	1.6611	0.655	0.546	1.6611	0.6075	11.26	Clay
0.3967	0.833	0.0005	0.0005	1.4291	0.568	0.473	1.4291	0.5455	15.33	Clay
0.3078	0.833	0.0005	0.0005	1.1088	0.505	0.421	1.1088	0.4600	9.26	Clay
0.1998	0.833	0.0005	0.0005	0.7198	0.372	0.310	0.7198	0.3561	14.86	Clay
0.1005	0.833	0.0005	0.0005	0.3620	0.257	0.214	0.3620	0.2605	21.74	Clay

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	depth adjusted	% error	Material
0.8870	0.833	0.0005	0.0010	2.2595	0.938	0.782	2.2595	0.7673	1.88	Clay
0.8837	0.833	0.0005	0.0010	2.2511	0.868	0.723	2.2511	0.7651	5.82	Clay
0.8722	0.833	0.0005	0.0010	2.2218	0.817	0.681	2.2218	0.7572	11.19	Clay
0.7996	0.833	0.0005	0.0010	2.0368	0.750	0.625	2.0368	0.7078	13.25	Clay
0.7120	0.833	0.0005	0.0010	1.8137	0.686	0.572	1.8137	0.6482	13.33	Clay
0.6748	0.833	0.0005	0.0010	1.7189	0.650	0.542	1.7189	0.6229	14.93	Clay
0.5378	0.833	0.0005	0.0010	1.3700	0.559	0.466	1.3700	0.5297	13.67	Clay
0.4726	0.833	0.0005	0.0010	1.2039	0.510	0.425	1.2039	0.4854	14.20	Clay
0.2788	0.833	0.0005	0.0010	0.7102	0.376	0.313	0.7102	0.3535	12.94	Clay
0.1240	0.833	0.0005	0.0010	0.3159	0.246	0.205	0.3159	0.2482	21.07	Clay
1.2680	0.833	0.0005	0.0020	2.2840	0.988	0.823	2.2840	0.7738	5.97	Clay
1.2680	0.833	0.0005	0.0020	2.2840	0.956	0.797	2.2840	0.7738	2.91	Clay
1.2520	0.833	0.0005	0.0020	2.2551	0.934	0.778	2.2551	0.7661	1.52	Clay
1.2300	0.833	0.0005	0.0020	2.2155	0.833	0.694	2.2155	0.7556	8.87	Clay
1.1840	0.833	0.0005	0.0020	2.1327	0.800	0.667	2.1327	0.7334	9.96	Clay
1.1380	0.833	0.0005	0.0020	2.0498	0.748	0.623	2.0498	0.7113	14.17	Clay
1.0090	0.833	0.0005	0.0020	1.8174	0.676	0.563	1.8174	0.6492	15.32	Clay
0.9380	0.833	0.0005	0.0020	1.6896	0.630	0.525	1.6896	0.6151	17.16	Clay
0.7964	0.833	0.0005	0.0020	1.4345	0.566	0.472	1.4345	0.5470	15.88	Clay
0.6832	0.833	0.0005	0.0020	1.2306	0.514	0.428	1.2306	0.4925	15.07	Clay
0.3841	0.833	0.0005	0.0020	0.6919	0.382	0.318	0.6919	0.3486	9.63	Clay
0.1614	0.833	0.0005	0.0020	0.2907	0.244	0.203	0.2907	0.2415	18.96	Clay
1.5300	0.833	0.0005	0.0030	2.2502	0.992	0.827	2.2502	0.7648	7.52	Clay
1.5350	0.833	0.0005	0.0030	2.2575	0.977	0.814	2.2575	0.7668	5.80	Clay
1.5350	0.833	0.0005	0.0030	2.2575	0.972	0.810	2.2575	0.7668	5.34	Clay
1.5250	0.833	0.0005	0.0030	2.2428	0.965	0.804	2.2428	0.7629	5.12	Clay
1.5140	0.833	0.0005	0.0030	2.2266	0.932	0.777	2.2266	0.7585	2.38	Clay
1.5020	0.833	0.0005	0.0030	2.2090	0.907	0.756	2.2090	0.7538	0.29	Clay
1.4960	0.833	0.0005	0.0030	2.2002	0.827	0.689	2.2002	0.7515	9.07	Clay
1.4800	0.833	0.0005	0.0030	2.1766	0.821	0.684	2.1766	0.7452	8.94	Clay
1.3960	0.833	0.0005	0.0030	2.0531	0.757	0.631	2.0531	0.7122	12.87	Clay
1.2100	0.833	0.0005	0.0030	1.7795	0.676	0.563	1.7795	0.6391	13.52	Clay
1.1240	0.833	0.0005	0.0030	1.6531	0.650	0.542	1.6531	0.6053	11.69	Clay
0.9227	0.833	0.0005	0.0030	1.3570	0.581	0.484	1.3570	0.5263	8.73	Clay
0.7450	0.833	0.0005	0.0030	1.0957	0.517	0.431	1.0957	0.4565	5.91	Clay
0.4542	0.833	0.0005	0.0030	0.6680	0.394	0.328	0.6680	0.3422	4.34	Clay
0.2173	0.833	0.0005	0.0030	0.3196	0.269	0.224	0.3196	0.2492	11.24	Clay
1.9900	0.833	0.0005	0.0050	2.2670	0.961	0.801	2.2670	0.7693	3.96	Clay
1.9700	0.833	0.0005	0.0050	2.2442	0.961	0.801	2.2442	0.7632	4.72	Clay
1.9575	0.833	0.0005	0.0050	2.2300	0.901	0.751	2.2300	0.7594	1.12	Clay
1.9300	0.833	0.0005	0.0050	2.1987	0.841	0.701	2.1987	0.7511	7.14	Clay
1.8400	0.833	0.0005	0.0050	2.0961	0.786	0.655	2.0961	0.7237	10.48	Clay
1.7975	0.833	0.0005	0.0050	2.0477	0.776	0.647	2.0477	0.7107	9.85	Clay
1.6575	0.833	0.0005	0.0050	1.8882	0.742	0.618	1.8882	0.6681	8.11	Clay
1.4700	0.833	0.0005	0.0050	1.6746	0.678	0.565	1.6746	0.6111	8.16	Clay
1.3625	0.833	0.0005	0.0050	1.5522	0.641	0.534	1.5522	0.5784	8.31	Clay

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	depth adjusted	% error	Material
1.0980	0.833	0.0005	0.0050	1.2508	0.564	0.470	1.2508	0.4979	5.94	Clay
0.9261	0.833	0.0005	0.0050	1.0550	0.511	0.426	1.0550	0.4456	4.60	Clay
0.5306	0.833	0.0005	0.0050	0.6045	0.368	0.307	0.6045	0.3253	5.95	Clay
0.2568	0.833	0.0005	0.0050	0.2925	0.256	0.213	0.2925	0.2420	13.60	Clay
2.3850	0.833	0.0005	0.0075	2.2184	0.961	0.801	2.2184	0.7563	5.58	Clay
2.4120	0.833	0.0005	0.0075	2.2435	0.955	0.796	2.2435	0.7630	4.14	Clay
2.3760	0.833	0.0005	0.0075	2.2100	0.938	0.782	2.2100	0.7541	3.57	Clay
2.3760	0.833	0.0005	0.0075	2.2100	0.898	0.748	2.2100	0.7541	0.82	Clay
2.3400	0.833	0.0005	0.0075	2.1766	0.871	0.726	2.1766	0.7452	2.64	Clay
2.2590	0.833	0.0005	0.0075	2.1012	0.821	0.684	2.1012	0.7250	6.00	Clay
2.1330	0.833	0.0005	0.0075	1.9840	0.775	0.646	1.9840	0.6937	7.39	Clay
1.8150	0.833	0.0005	0.0075	1.6882	0.677	0.564	1.6882	0.6147	8.99	Clay
1.6925	0.833	0.0005	0.0075	1.5743	0.648	0.540	1.5743	0.5843	8.20	Clay
1.4350	0.833	0.0005	0.0075	1.3348	0.584	0.487	1.3348	0.5203	6.84	Clay
1.0820	0.833	0.0005	0.0075	1.0064	0.491	0.409	1.0064	0.4326	5.78	Clay
0.6440	0.833	0.0005	0.0075	0.5990	0.373	0.311	0.5990	0.3238	4.12	Clay
0.3449	0.833	0.0005	0.0075	0.3208	0.271	0.226	0.3208	0.2495	10.41	Clay
2.7715	0.833	0.0005	0.0100	2.2325	0.971	0.809	2.2325	0.7601	6.04	Clay
2.7645	0.833	0.0005	0.0100	2.2269	0.954	0.795	2.2269	0.7586	4.58	Clay
2.7070	0.833	0.0005	0.0100	2.1806	0.893	0.744	2.1806	0.7462	0.30	Clay
2.7505	0.833	0.0005	0.0100	2.2156	0.889	0.741	2.2156	0.7556	1.97	Clay
2.6695	0.833	0.0005	0.0100	2.1504	0.850	0.708	2.1504	0.7382	4.26	Clay
2.6485	0.833	0.0005	0.0100	2.1335	0.846	0.705	2.1335	0.7336	4.06	Clay
2.5980	0.833	0.0005	0.0100	2.0928	0.811	0.676	2.0928	0.7228	6.92	Clay
2.5050	0.833	0.0005	0.0100	2.0179	0.770	0.642	2.0179	0.7028	9.47	Clay
2.1960	0.833	0.0005	0.0100	1.7690	0.692	0.577	1.7690	0.6363	10.28	Clay
2.0075	0.833	0.0005	0.0100	1.6171	0.654	0.545	1.6171	0.5957	9.31	Clay
1.7325	0.833	0.0005	0.0100	1.3956	0.576	0.480	1.3956	0.5366	11.79	Clay
1.2920	0.833	0.0005	0.0100	1.0408	0.497	0.414	1.0408	0.4418	6.72	Clay
0.7270	0.833	0.0005	0.0100	0.5856	0.359	0.299	0.5856	0.3202	7.11	Clay
0.3831	0.833	0.0005	0.0100	0.3086	0.254	0.212	0.3086	0.2463	16.16	Clay
3.1220	0.833	0.0005	0.0125	2.2494	0.983	0.819	2.2494	0.7646	6.64	Clay
3.0380	0.833	0.0005	0.0125	2.1889	0.902	0.752	2.1889	0.7484	0.47	Clay
2.9750	0.833	0.0005	0.0125	2.1435	0.836	0.697	2.1435	0.7363	5.64	Clay
2.8430	0.833	0.0005	0.0125	2.0484	0.788	0.657	2.0484	0.7109	8.21	Clay
2.7715	0.833	0.0005	0.0125	1.9968	0.763	0.636	1.9968	0.6972	9.62	Clay
2.4030	0.833	0.0005	0.0125	1.7313	0.676	0.563	1.7313	0.6262	11.23	Clay
2.2080	0.833	0.0005	0.0125	1.5909	0.634	0.528	1.5909	0.5887	11.50	Clay
1.7950	0.833	0.0005	0.0125	1.2933	0.553	0.461	1.2933	0.5092	10.47	Clay
1.5120	0.833	0.0005	0.0125	1.0894	0.502	0.418	1.0894	0.4548	8.80	Clay
0.8804	0.833	0.0005	0.0125	0.6343	0.370	0.308	0.6343	0.3333	8.20	Clay
0.4303	0.833	0.0005	0.0125	0.3100	0.250	0.208	0.3100	0.2466	18.58	Clay
2.8580	0.833	0.0005	0.0150	1.8798	0.742	0.618	1.8798	0.6659	7.75	Clay
2.5380	0.833	0.0005	0.0150	1.6693	0.668	0.557	1.6693	0.6097	9.46	Clay
2.3670	0.833	0.0005	0.0150	1.5568	0.631	0.526	1.5568	0.5796	10.20	Clay
1.8480	0.833	0.0005	0.0150	1.2155	0.548	0.457	1.2155	0.4885	6.88	Clay

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	depth adjusted	% error	Material
1.4120	0.833	0.0005	0.0150	0.9287	0.470	0.392	0.9287	0.4119	5.07	Clay
0.8854	0.833	0.0005	0.0150	0.5823	0.360	0.300	0.5823	0.3194	6.46	Clay
0.4462	0.833	0.0005	0.0150	0.2935	0.258	0.215	0.2935	0.2422	12.66	Clay
0.8972	1.000	0.0005	0.0005	1.9876	0.986	0.986	1.9876	0.8336	15.45	Clay
0.9006	1.000	0.0005	0.0005	1.9952	0.896	0.896	1.9952	0.8361	6.69	Clay
0.8540	1.000	0.0005	0.0005	1.8919	0.856	0.856	1.8919	0.8030	6.20	Clay
0.8380	1.000	0.0005	0.0005	1.8565	0.803	0.803	1.8565	0.7916	1.42	Clay
0.7360	1.000	0.0005	0.0005	1.6305	0.754	0.754	1.6305	0.7192	4.62	Clay
0.6762	1.000	0.0005	0.0005	1.4980	0.694	0.694	1.4980	0.6767	2.49	Clay
0.6496	1.000	0.0005	0.0005	1.4391	0.650	0.650	1.4391	0.6578	1.21	Clay
0.5390	1.000	0.0005	0.0005	1.1941	0.592	0.592	1.1941	0.5793	2.14	Clay
0.5006	1.000	0.0005	0.0005	1.1090	0.558	0.558	1.1090	0.5520	1.07	Clay
0.4261	1.000	0.0005	0.0005	0.9440	0.502	0.502	0.9440	0.4991	0.57	Clay
0.2754	1.000	0.0005	0.0005	0.6101	0.412	0.412	0.6101	0.3921	4.82	Clay
3.7400	2.000	0.0417	0.0020	1.3674	0.600	1.200	1.3674	1.2697	5.81	CMP
5.4300	2.000	0.0417	0.0020	1.9853	0.800	1.600	1.9853	1.6658	4.11	CMP
5.9900	2.000	0.0417	0.0020	2.1901	0.900	1.800	2.1901	1.7970	0.16	CMP
3.0500	3.000	0.0417	0.0018	0.4043	0.300	0.900	0.4043	0.9786	8.73	CMP
5.3100	3.000	0.0417	0.0020	0.6669	0.397	1.190	0.6669	1.2310	3.45	CMP
8.4500	3.000	0.0417	0.0020	1.0479	0.507	1.520	1.0479	1.5973	5.09	CMP
10.7400	3.000	0.0417	0.0019	1.3665	0.600	1.800	1.3665	1.9037	5.76	CMP
14.4300	3.000	0.0417	0.0022	1.7062	0.703	2.110	1.7062	2.2303	5.70	CMP
15.5100	3.000	0.0417	0.0019	1.9734	0.800	2.400	1.9734	2.4872	3.63	CMP
17.1100	3.000	0.0417	0.0020	2.1489	0.873	2.620	2.1489	2.6559	1.37	CMP
0.2220	0.667	0.00005	0.0030	0.4044	0.332	0.221	0.4044	0.2175	1.60	PVC
0.4490	0.667	0.00005	0.0030	0.8179	0.494	0.329	0.8179	0.3058	7.04	PVC
0.6210	0.667	0.00005	0.0030	1.1312	0.596	0.397	1.1312	0.3728	6.10	PVC
0.6240	0.667	0.00005	0.0030	1.1367	0.597	0.398	1.1367	0.3739	6.05	PVC
0.9470	0.667	0.00005	0.0030	1.7251	0.807	0.538	1.7251	0.4997	7.13	PVC
0.9410	0.667	0.00005	0.0030	1.7141	0.827	0.551	1.7141	0.4973	9.74	PVC
0.9410	0.667	0.00005	0.0030	1.7141	0.839	0.559	1.7141	0.4973	11.03	PVC
0.5050	0.667	0.00005	0.0063	0.6348	0.408	0.272	0.6348	0.2667	1.95	PVC
0.1990	0.667	0.00005	0.0063	0.2501	0.254	0.169	0.2501	0.1845	9.18	PVC
0.4210	0.667	0.00005	0.0063	0.5292	0.377	0.251	0.5292	0.2441	2.73	PVC
0.6990	0.667	0.00005	0.0063	0.8787	0.501	0.334	0.8787	0.3188	4.55	PVC
0.9990	0.667	0.00005	0.0063	1.2558	0.626	0.417	1.2558	0.3994	4.23	PVC
1.3340	0.667	0.00005	0.0063	1.6769	0.777	0.518	1.6769	0.4894	5.53	PVC
1.2830	0.667	0.00005	0.0063	1.6128	0.753	0.502	1.6128	0.4757	5.25	PVC
1.4750	0.667	0.00005	0.0105	1.4362	0.699	0.466	1.4362	0.4379	6.02	PVC
0.2600	0.667	0.00005	0.0105	0.2532	0.258	0.172	0.2532	0.1852	7.65	PVC
0.4650	0.667	0.00005	0.0105	0.4528	0.347	0.231	0.4528	0.2278	1.38	PVC
1.1600	0.667	0.00005	0.0105	1.1295	0.591	0.394	1.1295	0.3724	5.48	PVC
0.3950	0.667	0.00005	0.0105	0.3846	0.318	0.212	0.3846	0.2132	0.59	PVC
0.5120	1.000	0.00005	0.0030	0.3163	0.285	0.285	0.3163	0.2980	4.56	PVC
0.8180	1.000	0.00005	0.0030	0.5054	0.362	0.362	0.5054	0.3586	0.95	PVC
1.1760	1.000	0.00005	0.0030	0.7266	0.439	0.439	0.7266	0.4295	2.17	PVC

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted	depth adjusted	% error	Material
1.6090	1.000	0.00005	0.0030	0.9941	0.521	0.521	0.9941	0.5152	1.11	PVC
1.9150	1.000	0.00005	0.0030	1.1832	0.581	0.581	1.1832	0.5758	0.89	PVC
2.9150	1.000	0.00005	0.0030	1.8010	0.777	0.777	1.8010	0.7738	0.41	PVC
0.3980	1.000	0.00005	0.0060	0.1739	0.212	0.212	0.1739	0.2523	19.02	PVC
0.5510	1.000	0.00005	0.0060	0.2407	0.252	0.252	0.2407	0.2738	8.63	PVC
0.9800	1.000	0.00005	0.0060	0.4281	0.336	0.336	0.4281	0.3338	0.65	PVC
1.6070	1.000	0.00005	0.0060	0.7021	0.448	0.448	0.7021	0.4216	5.89	PVC
2.0120	1.000	0.00005	0.0060	0.8790	0.504	0.504	0.8790	0.4783	5.10	PVC
2.2480	1.000	0.00005	0.0060	0.9821	0.544	0.544	0.9821	0.5114	6.00	PVC
2.2860	1.000	0.00005	0.0060	0.9987	0.553	0.553	0.9987	0.5167	6.57	PVC
0.9240	1.000	0.00005	0.0100	0.3127	0.283	0.283	0.3127	0.2968	4.88	PVC
1.2540	1.000	0.00005	0.0100	0.4244	0.338	0.338	0.4244	0.3326	1.60	PVC
1.4940	1.000	0.00005	0.0100	0.5056	0.354	0.354	0.5056	0.3586	1.31	PVC
1.5150	1.000	0.00005	0.0100	0.5127	0.365	0.365	0.5127	0.3609	1.12	PVC
1.8090	1.000	0.00005	0.0100	0.6122	0.393	0.393	0.6122	0.3928	0.05	PVC
2.7470	1.000	0.00005	0.0100	0.9296	0.521	0.521	0.9296	0.4945	5.08	PVC
3.3360	1.000	0.00005	0.0100	1.1289	0.588	0.588	1.1289	0.5584	5.03	PVC
4.3210	1.000	0.00005	0.0100	1.4622	0.656	0.656	1.4622	0.6652	1.41	PVC
2.0000	3.000	0.0005	0.0071	0.0630	0.107	0.320	0.0630	0.6504	103.24	HDPE
10.0100	3.000	0.0005	0.0071	0.3152	0.028	0.848	0.3152	0.8929	5.29	HDPE
18.0300	3.000	0.0005	0.0071	0.5677	0.368	1.103	0.5677	1.1357	2.96	HDPE
26.0600	3.000	0.0005	0.0071	0.8206	0.458	1.373	0.8206	1.3788	0.42	HDPE
34.1300	3.000	0.0005	0.0071	1.0747	0.530	1.591	1.0747	1.6231	2.02	HDPE
39.2600	3.000	0.0005	0.0071	1.2362	0.569	1.706	1.2362	1.7784	4.25	HDPE
2.0300	3.000	0.0005	0.0135	0.0464	0.098	0.293	0.0464	0.6344	116.51	HDPE
10.0500	3.000	0.0005	0.0135	0.2295	0.236	0.709	0.2295	0.8105	14.31	HDPE
18.0300	3.000	0.0005	0.0135	0.4117	0.325	0.975	0.4117	0.9857	1.09	HDPE
26.0300	3.000	0.0005	0.0135	0.5944	0.399	1.197	0.5944	1.1613	2.98	HDPE
32.0700	3.000	0.0005	0.0135	0.7323	0.446	1.338	0.7323	1.2939	3.29	HDPE
40.0200	3.000	0.0005	0.0135	0.9139	0.499	1.497	0.9139	1.4685	1.90	HDPE
2.0000	3.000	0.0005	0.0197	0.0378	0.086	0.259	0.0378	0.6262	141.76	HDPE
10.0100	3.000	0.0005	0.0197	0.1892	0.223	0.670	0.1892	0.7717	15.19	HDPE
18.1000	3.000	0.0005	0.0197	0.3422	0.302	0.905	0.3422	0.9188	1.52	HDPE
26.7400	3.000	0.0005	0.0197	0.5055	0.348	1.045	0.5055	1.0758	2.95	HDPE
31.0900	3.000	0.0005	0.0197	0.5877	0.419	1.256	0.5877	1.1549	8.05	HDPE
40.0700	3.000	0.0005	0.0197	0.7575	0.474	1.422	0.7575	1.3181	7.31	HDPE

Appendix G: Comparison between Manufacturer and New Equation (Average and Best Fit)

Material	depth adjusted	% error - Manufacturer	% error Power - Average Ks	% error - Best Fit
Concrete	0.1963	3.31	18.92	5.59
Concrete	0.2532	1.29	23.41	3.08
Concrete	0.3316	0.48	25.58	7.41
Concrete	0.3896	1.62	22.57	9.56
Concrete	0.4907	1.86	17.43	13.57
Concrete	0.5577	3.85	9.30	9.89
Concrete	0.1944	11.08	27.41	13.64
Concrete	0.2829	8.81	34.66	12.52
Concrete	0.3636	10.17	37.71	20.56
Concrete	0.4350	3.57	27.35	18.12
Concrete	0.5266	5.32	22.97	21.68
Concrete	0.6077	1.29	8.94	11.34
Concrete	0.1817	6.91	20.25	10.85
Concrete	0.2553	2.14	24.61	4.03
Concrete	0.3296	0.12	24.79	6.60
Concrete	0.4028	4.10	19.12	7.63
Concrete	0.4850	3.00	16.46	12.19
Concrete	0.5454	4.32	10.01	9.97
Concrete	0.1815	6.74	20.00	10.71
Concrete	0.2642	5.69	29.55	8.04
Concrete	0.3202	0.06	24.94	6.12
Concrete	0.4022	4.24	18.96	7.44
Concrete	0.4727	5.46	14.27	9.11
Concrete	0.5460	5.86	8.18	8.18
Concrete	0.1693	5.83	16.04	11.72
Concrete	0.2336	2.67	16.87	1.46
Concrete	0.3157	7.14	15.87	1.84
Concrete	0.3743	10.89	11.30	1.72
Concrete	0.3759	24.82	6.16	17.04
Concrete	0.5529	9.36	3.53	3.87
Concrete	0.1652	3.25	12.35	9.92
Concrete	0.2369	5.25	14.08	4.03
Concrete	0.3014	8.66	13.63	4.43
Concrete	0.3698	11.95	10.03	3.19
Concrete	0.4428	11.43	8.56	1.33
Concrete	0.5335	11.08	3.25	2.57

Material	depth adjusted	% error - Manufacturer	% error Power - Average Ks	% error - Best Fit
Concrete	0.2255	20.05	2.52	8.50
Concrete	0.2046	17.15	3.39	5.83
Concrete	0.1559	24.33	6.16	20.74
Concrete	0.1276	23.61	10.29	24.93
Concrete	0.2569	17.41	3.22	5.23
Concrete	0.2262	17.43	0.71	5.30
Concrete	0.1990	16.73	4.03	6.19
Concrete	0.1808	13.88	7.70	5.83
Concrete	0.1393	14.55	4.68	12.64
Concrete	0.0921	21.92	12.44	19.66
Concrete	0.2303	15.00	3.33	2.21
Concrete	0.2012	17.20	3.45	6.34
Concrete	0.1832	14.78	6.60	6.43
Concrete	0.1339	17.37	0.19	16.45
Concrete	0.0952	23.25	13.20	21.61
Concrete	0.2409	18.33	2.04	5.94
Concrete	0.2287	15.62	2.73	3.02
Concrete	0.2095	13.79	6.90	1.99
Concrete	0.1722	18.41	2.06	11.92
Concrete	0.1244	22.24	5.70	21.12
Concrete	0.2269	17.79	0.20	5.69
Concrete	0.1989	18.14	1.78	8.40
Concrete	0.1750	17.45	3.29	10.47
Concrete	0.1371	19.33	0.65	17.11
Concrete	0.0948	21.66	11.23	19.77
Concrete	0.2512	16.53	1.10	3.68
Concrete	0.2403	16.27	0.66	3.35
Concrete	0.2048	15.38	4.90	4.67
Concrete	0.1846	9.51	13.07	0.55
Concrete	0.1381	29.54	13.58	27.89
Concrete	0.1058	20.46	6.87	19.53
Concrete	0.2498	17.30	1.61	4.26
Concrete	0.2335	14.77	3.28	1.78
Concrete	0.2100	17.65	1.75	6.75
Concrete	0.1839	17.89	2.89	9.53
Concrete	0.1393	12.39	7.56	10.23
Concrete	0.1039	15.50	1.35	14.30
Concrete	0.2733	11.28	9.15	1.50
Concrete	0.1920	13.14	7.83	9.11
Concrete	0.4154	2.56	2.05	1.44

Material	depth adjusted	% error - Manufacturer	% error Power - Average Ks	% error - Best Fit
Concrete	0.2766	5.58	15.99	8.36
Concrete	0.1839	10.73	10.50	7.37
Concrete	0.1280	4.49	10.56	3.31
Concrete	0.4153	5.68	0.78	1.33
Concrete	0.3091	2.48	16.49	13.04
Concrete	0.2119	9.08	13.67	2.28
Concrete	0.1594	6.79	13.35	5.35
Concrete	0.1237	1.83	12.82	0.06
Concrete	0.2954	4.72	15.41	10.32
Concrete	0.1895	9.33	12.65	5.20
Concrete	0.4055	1.90	2.02	3.95
Concrete	0.2652	4.62	17.87	8.46
Concrete	0.1857	3.79	19.23	0.07
Concrete	0.1482	6.78	11.76	5.95
Concrete	0.4152	5.64	0.78	1.32
Concrete	0.1922	1.93	22.00	2.89
Concrete	0.1470	0.69	20.57	1.59
Concrete	0.1174	6.79	5.92	4.06
Concrete	0.4094	1.34	0.09	1.76
Concrete	0.2798	6.12	14.83	7.59
Concrete	0.2355	5.13	31.24	16.12
Concrete	0.1972	1.12	26.11	6.82
Concrete	0.1373	1.74	19.99	2.59
Concrete	0.4140	4.54	0.79	1.76
Concrete	0.2897	7.15	12.73	6.92
Concrete	0.2403	4.02	29.70	15.47
Concrete	0.1999	6.34	32.79	12.77
Concrete	0.1434	11.20	33.06	12.54
Concrete	0.4128	2.95	0.01	1.23
Concrete	0.3180	1.53	16.48	14.07
Concrete	0.2494	4.43	18.88	7.14
Concrete	0.1742	1.05	21.89	1.75
Concrete	0.2911	25.55	7.30	17.24
Concrete	0.2095	25.72	8.36	23.49
Concrete	0.1829	18.72	1.72	17.63
Concrete	0.1475	14.71	1.92	12.97
Concrete	0.4931	1.88	0.10	1.37
Concrete	0.3634	4.41	25.39	20.78
Concrete	0.2667	10.49	11.92	2.60
Concrete	0.1909	14.02	4.81	12.49

Material	depth adjusted	% error - Manufacturer	% error Power - Average Ks	% error - Best Fit
Concrete	0.1483	15.72	2.96	14.08
Concrete	0.4971	3.34	0.61	0.24
Concrete	0.3474	6.37	13.70	7.81
Concrete	0.2727	6.94	16.34	1.87
Concrete	0.1540	9.40	5.57	7.93
Concrete	0.4896	0.11	0.54	1.25
Concrete	0.3693	3.59	15.22	11.58
Concrete	0.2624	3.89	20.16	4.11
Concrete	0.2146	3.32	19.35	0.20
Concrete	0.1537	6.30	8.20	5.33
Concrete	0.3572	7.22	11.89	7.12
Concrete	0.2483	8.03	14.92	1.73
Concrete	0.1951	7.09	13.35	5.43
Concrete	0.1448	4.08	9.06	2.22
Concrete	0.4971	3.57	0.28	0.64
Concrete	0.3518	8.39	10.91	5.62
Concrete	0.2546	6.40	17.06	0.68
Concrete	0.1990	6.13	14.96	4.13
Concrete	0.1344	5.35	5.95	1.57
Concrete	0.3254	10.84	9.66	1.65
Concrete	0.2584	7.03	16.28	0.38
Concrete	0.2055	3.06	19.44	0.35
Concrete	0.1464	1.64	16.68	3.88
Concrete	0.5037	7.92	9.15	6.46
Concrete	0.4181	12.71	8.18	0.92
Concrete	0.3929	7.77	14.81	2.92
Concrete	0.2933	8.06	13.93	4.50
Concrete	0.2416	6.35	12.77	5.36
Concrete	0.5075	8.39	8.34	5.94
Concrete	0.4340	9.78	11.03	2.94
Concrete	0.3979	7.02	15.80	4.30
Concrete	0.3002	3.48	19.76	0.64
Concrete	0.2529	0.03	21.39	1.41
Concrete	0.1751	1.09	9.03	3.04
Concrete	0.6635	3.68	0.57	0.19
Concrete	0.5234	7.35	8.40	7.09
Concrete	0.4613	7.00	13.03	7.02
Concrete	0.4199	6.27	15.84	6.16
Concrete	0.3178	5.12	18.43	0.45
Concrete	0.6645	3.35	1.59	1.13

Material	depth adjusted	% error - Manufacturer	% error Power - Average Ks	% error - Best Fit
Concrete	0.5144	6.97	9.57	7.65
Concrete	0.4607	5.78	14.55	8.42
Concrete	0.4230	4.94	17.38	7.84
Concrete	0.3252	4.65	19.14	1.51
Concrete	0.2486	5.13	14.98	3.81
Concrete	0.1761	3.27	7.66	1.05
Concrete	0.6645	5.81	0.78	1.26
Concrete	0.5039	10.97	5.63	3.09
Concrete	0.4604	10.08	9.36	3.48
Concrete	0.4018	9.30	12.72	1.79
Concrete	0.2976	6.40	16.24	2.40
Concrete	0.2562	5.11	15.63	3.48
Concrete	0.1809	4.30	7.47	0.69
Concrete	0.4943	9.47	8.09	4.82
Concrete	0.4551	8.06	12.07	5.61
Concrete	0.4113	6.95	15.30	4.93
Concrete	0.3171	5.34	18.14	0.16
Concrete	0.2524	2.92	18.15	1.30
Concrete	0.1713	0.79	11.15	6.08
Concrete	0.4979	10.93	6.08	3.12
Concrete	0.4370	5.82	15.70	7.50
Concrete	0.3938	5.10	18.11	5.96
Concrete	0.3033	1.83	22.19	2.86
Concrete	0.2301	2.28	22.44	3.51
Concrete	0.1656	8.26	17.90	15.12
Concrete	0.5174	13.77	1.35	0.25
Concrete	0.5122	13.62	1.90	0.02
Concrete	0.4953	10.43	6.85	3.69
Concrete	0.4447	8.68	11.86	4.58
Concrete	0.3962	7.00	15.68	3.98
Concrete	0.3102	4.27	19.34	0.80
Concrete	0.2415	1.03	19.58	0.32
Concrete	0.1728	6.03	17.20	11.28
Concrete	0.5207	15.46	0.89	2.26
Concrete	0.4866	10.71	7.08	3.29
Concrete	0.4385	9.03	11.72	3.94
Concrete	0.3809	8.00	14.78	1.90
Concrete	0.3037	5.97	17.00	1.50
Concrete	0.2405	1.84	18.46	0.56
Concrete	0.1774	7.50	19.97	12.09

Material	depth adjusted	% error - Manufacturer	% error Power - Average Ks	% error - Best Fit
Concrete	0.6199	16.12	0.03	2.89
Concrete	0.6020	14.73	2.52	1.48
Concrete	0.5520	10.39	9.99	2.61
Concrete	0.5417	6.45	15.09	6.62
Concrete	0.4997	9.30	12.76	1.66
Concrete	0.4307	9.13	13.63	1.92
Concrete	0.4009	3.64	20.16	2.07
Concrete	0.3174	1.75	19.76	0.01
Concrete	0.2500	3.74	19.42	5.37
Concrete	0.6458	12.61	2.75	1.07
Concrete	0.6283	11.51	5.07	2.45
Concrete	0.6008	10.33	7.91	3.65
Concrete	0.5618	8.94	11.32	4.47
Concrete	0.5434	8.37	12.68	4.51
Concrete	0.5097	8.49	13.52	3.02
Concrete	0.4603	5.29	18.35	4.01
Concrete	0.4148	1.94	22.51	4.80
Concrete	0.3120	3.11	17.68	1.61
Concrete	0.2433	2.23	17.31	4.55
Concrete	0.6553	11.21	3.83	2.61
Concrete	0.6368	10.05	6.37	4.20
Concrete	0.6143	7.90	10.13	6.59
Concrete	0.5857	5.68	14.23	8.76
Concrete	0.5523	7.02	14.00	6.33
Concrete	0.5265	6.15	15.95	6.38
Concrete	0.4580	5.18	18.51	3.99
Concrete	0.4155	5.35	18.35	1.31
Concrete	0.4071	5.10	18.59	1.07
Concrete	0.3321	3.17	18.80	0.93
Concrete	0.2347	5.36	7.53	2.56
Concrete	0.6564	11.30	3.66	2.49
Concrete	0.6493	9.20	6.57	5.03
Concrete	0.6137	7.44	10.72	7.13
Concrete	0.5938	6.63	12.68	7.78
Concrete	0.5616	6.09	14.78	7.68
Concrete	0.5198	6.17	16.12	6.07
Concrete	0.4718	5.26	18.29	4.73
Concrete	0.4148	4.86	18.95	1.78
Concrete	0.3250	4.12	17.20	2.23
Concrete	0.2395	1.43	12.72	1.13

Material	depth adjusted	% error - Manufacturer	% error Power - Average Ks	% error - Best Fit
Concrete	0.6544	11.69	3.32	2.06
Concrete	0.6393	9.19	7.19	5.11
Concrete	0.6221	8.24	9.30	6.24
Concrete	0.5821	6.57	13.32	7.65
Concrete	0.5469	6.67	14.63	6.56
Concrete	0.5225	7.04	14.97	5.20
Concrete	0.4591	6.68	16.62	2.41
Concrete	0.3934	6.34	16.80	1.11
Concrete	0.3261	3.51	18.04	1.54
Concrete	0.2326	0.68	14.12	3.86
Concrete	0.6383	12.09	3.82	1.75
Concrete	0.6352	11.53	4.65	2.42
Concrete	0.5728	8.65	11.21	5.06
Concrete	0.5189	8.96	12.72	2.91
Concrete	0.4922	9.02	13.26	1.61
Concrete	0.4469	8.23	14.75	0.01
Concrete	0.3724	8.73	13.45	4.72
Concrete	0.3075	4.79	15.45	3.35
Concrete	0.2284	1.96	14.93	5.59
Concrete	0.6041	11.30	6.58	2.57
Concrete	0.5750	7.85	12.09	6.04
Concrete	0.5656	8.48	11.71	5.07
Concrete	0.5435	8.65	12.34	4.21
Concrete	0.5012	9.37	12.64	1.66
Concrete	0.4540	7.16	16.06	1.59
Concrete	0.3847	5.02	18.33	0.18
Concrete	0.3100	5.20	15.11	3.71
Concrete	0.2067	0.12	8.73	6.26
Concrete	0.6431	13.32	2.09	0.31
Concrete	0.6263	10.65	6.20	3.45
Concrete	0.6263	10.52	6.35	3.60
Concrete	0.6036	9.10	9.25	5.11
Concrete	0.5656	7.43	12.97	6.25
Concrete	0.5267	7.43	14.35	4.92
Concrete	0.5084	6.38	16.16	5.32
Concrete	0.4420	4.53	19.42	3.77
Concrete	0.4056	1.56	22.99	4.74
Concrete	0.3105	1.11	20.11	0.46
Concrete	0.2258	6.03	19.04	10.06
Concrete	0.5653	9.40	10.60	4.01

Material	depth adjusted	% error - Manufacturer	% error Power - Average Ks	% error - Best Fit
Concrete	0.4098	2.67	21.65	3.82
Concrete	0.7691	13.48	1.98	0.07
Concrete	0.7559	10.55	6.13	3.58
Concrete	0.6940	11.26	7.81	2.19
Concrete	0.6604	12.64	7.18	0.15
Concrete	0.6314	8.63	12.92	3.58
Concrete	0.6063	5.71	17.06	5.91
Concrete	0.5438	6.25	17.20	2.54
Concrete	0.5149	3.58	20.54	3.93
Concrete	0.4905	4.01	19.96	2.33
Concrete	0.3635	0.14	20.75	1.26
Concrete	0.2776	0.95	13.84	4.04
Concrete	0.8228	4.15	30.18	14.17
Concrete	1.0116	2.18	24.89	17.20
Clay	0.2022	26.39	18.76	23.30
Clay	0.2821	17.54	17.74	13.80
Clay	0.3385	16.73	18.46	16.53
Clay	0.4645	8.03	6.46	14.07
Clay	0.5258	7.30	1.72	13.15
Clay	0.1943	21.42	13.07	19.57
Clay	0.2831	13.26	13.63	9.83
Clay	0.3636	10.17	11.73	11.55
Clay	0.4350	3.57	3.33	8.43
Clay	0.5266	5.32	0.22	11.04
Clay	0.6079	8.55	5.29	8.61
Clay	0.1954	14.95	7.26	13.08
Clay	0.2679	7.14	6.80	3.37
Clay	0.3444	4.36	5.93	4.54
Clay	0.4194	0.15	0.18	3.96
Clay	0.4992	0.15	3.56	5.66
Clay	0.1869	9.95	1.25	9.30
Clay	0.2611	4.43	3.64	0.52
Clay	0.3316	0.48	1.89	0.13
Clay	0.4022	4.24	3.48	1.06
Clay	0.4846	3.08	5.57	2.51
Clay	0.1745	2.67	7.54	4.14
Clay	0.2487	0.50	1.94	4.34
Clay	0.3063	4.28	3.27	6.14
Clay	0.3757	10.54	9.35	8.77
Clay	0.4408	8.16	8.58	3.67

Material	depth adjusted	% error - Manufacturer	% error Power - Average Ks	% error - Best Fit
Clay	0.5439	4.58	10.86	0.07
Clay	0.5680	5.33	13.53	1.94
Clay	0.1758	3.41	6.64	4.65
Clay	0.2467	1.32	2.89	5.14
Clay	0.2944	7.99	7.30	10.30
Clay	0.3762	10.43	9.25	8.64
Clay	0.4441	11.17	11.70	6.73
Clay	0.5250	7.90	12.64	2.87
Clay	0.2624	5.81	7.91	1.40
Clay	0.2018	5.69	12.77	12.65
Clay	0.1602	0.75	6.44	9.46
Clay	0.1076	17.88	30.24	26.54
Clay	0.2623	7.98	19.24	13.25
Clay	0.2610	14.48	0.14	6.79
Clay	0.1555	2.84	10.03	13.03
Clay	0.1330	2.18	11.64	13.57
Clay	0.2935	8.30	10.67	1.92
Clay	0.2378	6.61	4.24	0.08
Clay	0.1734	0.24	6.73	9.10
Clay	0.1196	7.31	17.23	17.08
Clay	0.2365	3.08	12.77	9.09
Clay	0.2043	4.07	11.43	11.06
Clay	0.1470	11.47	18.52	21.18
Clay	0.1088	11.58	23.40	20.25
Clay	0.2720	3.41	11.43	4.39
Clay	0.2184	2.06	10.44	8.60
Clay	0.1542	9.28	16.03	18.84
Clay	0.1131	11.63	22.60	20.78
Clay	0.2993	3.91	15.80	7.49
Clay	0.2513	0.68	12.24	7.08
Clay	0.1947	7.20	13.91	14.45
Clay	0.1568	4.42	11.49	14.42
Clay	0.1280	4.50	13.40	14.81
Clay	0.2754	2.00	13.18	6.02
Clay	0.2555	0.58	11.70	6.13
Clay	0.1732	2.15	8.97	11.31
Clay	0.1466	0.93	8.67	11.65
Clay	0.2735	6.43	8.97	1.54
Clay	0.2447	7.34	4.32	0.63
Clay	0.1882	12.04	4.02	2.66

Material	depth adjusted	% error - Manufacturer	% error Power - Average Ks	% error - Best Fit
Clay	0.1389	10.22	1.15	1.76
Clay	0.3358	6.93	7.77	0.65
Clay	0.2780	1.82	7.15	4.80
Clay	0.2170	0.94	6.08	8.45
Clay	0.1469	5.25	15.54	14.96
Clay	0.1272	9.64	5.24	1.34
Clay	0.3103	11.21	1.14	4.41
Clay	0.2300	8.50	0.87	0.84
Clay	0.1743	6.25	2.40	5.26
Clay	0.1394	8.09	4.43	2.04
Clay	0.3698	15.21	5.96	3.14
Clay	0.2957	8.30	2.57	1.54
Clay	0.2250	2.73	4.44	6.39
Clay	0.1682	1.91	6.92	9.24
Clay	0.1168	1.60	14.42	3.72
Clay	0.3483	16.90	1.08	7.36
Clay	0.2827	11.32	1.18	4.20
Clay	0.2412	9.64	1.66	0.81
Clay	0.1768	14.83	5.59	2.37
Clay	0.1289	9.22	5.28	0.61
Clay	0.3007	18.85	6.38	11.34
Clay	0.2517	20.45	11.28	11.35
Clay	0.1956	23.81	14.74	10.93
Clay	0.1519	28.70	15.65	15.22
Clay	0.2848	5.05	11.83	12.83
Clay	0.2107	5.50	13.19	15.79
Clay	0.1657	11.86	23.34	20.73
Clay	0.3740	5.56	16.38	11.66
Clay	0.3205	5.43	3.29	1.86
Clay	0.2350	11.39	3.34	0.08
Clay	0.1754	2.59	8.59	7.84
Clay	0.4501	10.05	10.96	2.11
Clay	0.3234	16.73	6.95	8.77
Clay	0.2456	12.12	4.21	0.98
Clay	0.1797	14.46	2.75	2.74
Clay	0.3223	6.73	2.18	0.59
Clay	0.2499	12.57	4.67	1.57
Clay	0.3181	15.24	5.82	7.18
Clay	0.2301	8.01	0.10	3.25
Clay	0.1594	4.89	8.52	4.19

Material	depth adjusted	% error - Manufacturer	% error Power - Average Ks	% error - Best Fit
Clay	0.2831	9.74	1.89	0.61
Clay	0.2203	10.70	2.24	1.12
Clay	0.1713	16.53	3.60	5.24
Clay	0.5223	1.41	11.76	5.72
Clay	0.3544	3.61	3.58	5.77
Clay	0.2795	7.92	1.26	4.13
Clay	0.1946	17.25	0.37	9.47
Clay	0.5391	5.91	8.83	1.74
Clay	0.3655	5.03	2.18	3.92
Clay	0.2989	10.29	2.01	1.38
Clay	0.2229	16.09	2.69	5.27
Clay	0.5332	4.74	9.45	2.69
Clay	0.3588	0.23	6.76	8.71
Clay	0.2680	0.37	8.45	10.66
Clay	0.1727	4.66	14.05	2.27
Clay	0.5330	4.51	9.65	2.91
Clay	0.3565	2.07	8.91	10.90
Clay	0.2787	0.45	8.74	11.39
Clay	0.1968	0.41	14.11	6.39
Clay	0.5056	0.52	11.38	6.03
Clay	0.3643	2.34	4.83	6.60
Clay	0.2840	5.17	3.20	6.19
Clay	0.1981	10.05	5.60	2.46
Clay	0.5296	11.96	2.96	4.11
Clay	0.3499	7.66	0.19	2.25
Clay	0.2786	11.43	2.35	0.64
Clay	0.2028	17.25	1.28	8.48
Clay	0.5504	12.32	4.36	3.51
Clay	0.3726	7.70	0.07	1.41
Clay	0.2853	9.74	1.13	2.03
Clay	0.2055	18.78	3.03	9.58
Clay	0.7024	23.88	4.36	13.44
Clay	0.6519	19.39	4.10	11.26
Clay	0.5826	23.17	11.13	15.33
Clay	0.4982	18.33	9.44	9.26
Clay	0.3964	27.87	18.74	14.86
Clay	0.2889	35.00	20.37	21.74
Clay	0.7111	24.32	4.01	13.33
Clay	0.6713	23.86	6.75	14.93
Clay	0.5665	21.56	10.35	13.67

Material	depth adjusted	% error - Manufacturer	% error Power - Average Ks	% error - Best Fit
Clay	0.5226	22.97	13.14	14.20
Clay	0.3938	25.81	16.79	12.94
Clay	0.2732	33.28	17.06	21.07
Clay	0.7128	26.61	5.79	15.32
Clay	0.6617	26.04	9.22	17.16
Clay	0.5841	23.74	11.59	15.88
Clay	0.5295	23.71	13.64	15.07
Clay	0.3891	22.34	13.40	9.63
Clay	0.2634	29.77	13.22	18.96
Clay	0.6959	23.60	4.64	13.52
Clay	0.6492	19.78	4.61	11.69
Clay	0.5627	16.27	5.73	8.73
Clay	0.4950	14.84	6.24	5.91
Clay	0.3822	16.51	7.96	4.34
Clay	0.2743	22.47	7.78	11.24
Clay	0.7599	22.97	1.70	8.11
Clay	0.6565	16.20	1.02	8.16
Clay	0.6178	15.70	2.75	8.31
Clay	0.5346	13.75	4.36	5.94
Clay	0.4845	13.74	5.40	4.60
Clay	0.3642	18.64	9.50	5.95
Clay	0.2640	23.92	8.26	13.60
Clay	0.6245	15.65	2.36	8.20
Clay	0.5570	14.37	4.18	6.84
Clay	0.4718	15.36	7.12	5.78
Clay	0.3627	16.62	7.59	4.12
Clay	0.2747	21.55	7.04	10.41
Clay	0.6915	19.84	1.78	10.28
Clay	0.6377	17.01	2.85	9.31
Clay	0.5734	19.46	8.17	11.79
Clay	0.4806	16.10	7.69	6.72
Clay	0.3588	20.00	10.60	7.11
Clay	0.2700	27.34	11.83	16.16
Clay	0.6768	20.21	3.15	11.23
Clay	0.6295	19.22	5.26	11.50
Clay	0.5460	18.44	8.26	10.47
Clay	0.4932	17.99	9.22	8.80
Clay	0.3728	21.05	11.92	8.20
Clay	0.2707	30.15	14.25	18.58
Clay	0.7517	21.63	1.93	7.75

Material	depth adjusted	% error - Manufacturer	% error Power - Average Ks	% error - Best Fit
Clay	0.6547	17.54	2.31	9.46
Clay	0.6192	17.72	4.48	10.20
Clay	0.5257	15.02	5.74	6.88
Clay	0.4517	15.24	7.20	5.07
Clay	0.3579	19.29	9.91	6.46
Clay	0.2643	22.93	7.43	12.66
Clay	0.9170	7.13	14.75	6.20
Clay	0.8813	9.75	10.01	1.42
Clay	0.7705	2.19	10.41	4.62
Clay	0.7224	4.09	6.86	2.49
Clay	0.7019	7.99	2.60	1.21
Clay	0.6241	5.43	2.94	2.14
Clay	0.5978	7.14	0.91	1.07
Clay	0.5469	8.94	1.30	0.57
Clay	0.4391	6.57	1.61	4.82
CMP	1.2548	4.56	2.75	5.81
CMP	1.6401	2.51	6.47	4.11
CMP	1.0329	14.76	9.12	8.73
CMP	1.2937	8.71	7.03	3.45
CMP	1.6210	6.64	5.97	5.09
CMP	1.8813	4.52	2.71	5.76
CMP	2.1724	2.96	1.66	5.70
CMP	2.4459	1.91	6.76	3.63
CMP	2.7594	5.32	10.72	1.37
PVC	0.2783	25.92	19.09	1.60
PVC	0.3979	20.93	21.64	7.04
PVC	0.4886	23.08	23.14	6.10
PVC	0.4903	23.20	23.14	6.05
PVC	0.3466	27.42	16.91	1.95
PVC	0.2244	32.79	17.56	9.18
PVC	0.3161	25.94	18.08	2.73
PVC	0.4148	24.18	19.88	4.55
PVC	0.5314	27.44	22.75	4.23
PVC	0.2256	31.15	18.49	7.65
PVC	0.2931	26.87	17.91	1.38
PVC	0.4880	23.87	22.62	5.48
PVC	0.2715	28.07	17.83	0.59
PVC	0.3728	30.82	17.16	4.56
PVC	0.4635	28.05	16.81	0.95
PVC	0.5585	27.23	17.16	2.17

Material	depth adjusted	% error - Manufacturer	% error Power - Average Ks	% error - Best Fit
PVC	0.6711	28.82	17.86	1.11
PVC	0.7584	30.54	19.37	0.89
PVC	0.2896	36.58	18.39	19.02
PVC	0.3312	31.42	18.71	8.63
PVC	0.4281	27.42	17.77	0.65
PVC	0.5483	22.39	20.26	5.89
PVC	0.6222	23.46	20.34	5.10
PVC	0.6660	22.42	21.82	6.00
PVC	0.6731	21.73	22.42	6.57
PVC	0.3709	31.07	17.08	4.88
PVC	0.4263	26.14	18.63	1.60
PVC	0.4636	30.96	14.91	1.31
PVC	0.4668	27.89	16.88	1.12
PVC	0.5102	29.82	15.35	0.05
PVC	0.6435	23.51	20.67	5.08
PVC	0.7320	24.48	22.24	5.03
HDPE	0.5243	63.86	4.30	103.24
HDPE	0.9471	11.68	16.63	5.29
HDPE	1.2251	11.07	12.99	2.96
HDPE	1.4619	6.47	15.36	0.42
HDPE	1.6827	5.76	15.97	2.02
HDPE	1.8204	6.70	15.72	4.25
HDPE	0.4766	62.67	10.87	116.51
HDPE	0.8327	17.44	15.44	14.31
HDPE	1.0610	8.82	16.70	1.09
HDPE	1.2514	4.54	17.89	2.98
HDPE	1.3820	3.29	18.13	3.29
HDPE	1.5441	3.15	17.90	1.90
HDPE	0.4487	73.25	9.30	141.76
HDPE	0.7723	15.27	19.06	15.19
HDPE	0.9802	8.31	18.48	1.52
HDPE	1.1619	11.18	13.54	2.95
HDPE	1.2448	0.89	22.20	8.05
HDPE	1.4050	1.20	21.60	7.31
	Average Error	10.69	11.14	7.11

Appendix H: Comparison between Design and New Equation (Average and Best Fit)

Material	depth adjusted	% error - Design Value	% error Power - Average Ks	% error - Best Fit
Concrete	0.2002	5.38	18.92	5.59
Concrete	0.2590	3.59	23.41	3.08
Concrete	0.3407	3.24	25.58	7.41
Concrete	0.4039	1.99	22.57	9.56
Concrete	0.5340	6.81	17.43	13.57
Concrete	0.1981	13.22	27.41	13.64
Concrete	0.2896	11.40	34.66	12.52
Concrete	0.3753	13.71	37.71	20.56
Concrete	0.4565	8.68	27.35	18.12
Concrete	0.1854	9.05	20.25	10.85
Concrete	0.2609	4.35	24.61	4.03
Concrete	0.3385	2.58	24.79	6.60
Concrete	0.4187	0.30	19.12	7.63
Concrete	0.5243	4.87	16.46	12.19
Concrete	0.1851	8.88	20.00	10.71
Concrete	0.2701	8.04	29.55	8.04
Concrete	0.3287	2.72	24.94	6.12
Concrete	0.4181	0.46	18.96	7.44
Concrete	0.5054	1.08	14.27	9.11
Concrete	0.1727	7.95	16.04	11.72
Concrete	0.2386	0.57	16.87	1.46
Concrete	0.3240	4.70	15.87	1.84
Concrete	0.3869	7.89	11.30	1.72
Concrete	0.3887	22.26	6.16	17.04
Concrete	0.1686	5.35	12.35	9.92
Concrete	0.2418	3.28	14.08	4.03
Concrete	0.3089	6.40	13.63	4.43
Concrete	0.3821	9.02	10.03	3.19
Concrete	0.4659	6.81	8.56	1.33
Concrete	0.3105	5.33	11.79	15.25
Concrete	0.2393	15.15	2.52	8.50
Concrete	0.2135	13.54	3.39	5.83
Concrete	0.1592	22.71	6.16	20.74
Concrete	0.1278	23.49	10.29	24.93
Concrete	0.2916	6.24	3.22	5.23
Concrete	0.2361	13.84	0.71	5.30

Material	depth adjusted	% error - Design Value	% error Power - Average Ks	% error - Best Fit
Concrete	0.2069	13.44	4.03	6.19
Concrete	0.1864	11.22	7.70	5.83
Concrete	0.1417	13.10	4.68	12.64
Concrete	0.0956	18.96	12.44	19.66
Concrete	0.2435	10.14	3.33	2.21
Concrete	0.2095	13.80	3.45	6.34
Concrete	0.1890	12.08	6.60	6.43
Concrete	0.1357	16.21	0.19	16.45
Concrete	0.0988	20.35	13.20	21.61
Concrete	0.2595	12.04	2.04	5.94
Concrete	0.2409	11.11	2.73	3.02
Concrete	0.2192	9.81	6.90	1.99
Concrete	0.1771	16.05	2.06	11.92
Concrete	0.1280	20.00	5.70	21.12
Concrete	0.3047	3.27	5.77	8.36
Concrete	0.2400	13.03	0.20	5.69
Concrete	0.2065	15.04	1.78	8.40
Concrete	0.1803	14.96	3.29	10.47
Concrete	0.1407	17.25	0.65	17.11
Concrete	0.0964	20.32	11.23	19.77
Concrete	0.2773	7.87	1.10	3.68
Concrete	0.2584	9.96	0.66	3.35
Concrete	0.2133	11.86	4.90	4.67
Concrete	0.1907	6.53	13.07	0.55
Concrete	0.1406	28.27	13.58	27.89
Concrete	0.1077	19.01	6.87	19.53
Concrete	0.2747	9.04	1.61	4.26
Concrete	0.2480	9.48	3.28	1.78
Concrete	0.2193	14.00	1.75	6.75
Concrete	0.1904	14.98	2.89	9.53
Concrete	0.1418	10.80	7.56	10.23
Concrete	0.1066	13.30	1.35	14.30
Concrete	0.2875	6.65	9.15	1.50
Concrete	0.1971	10.81	7.83	9.11
Concrete	0.2918	0.39	15.99	8.36
Concrete	0.1881	8.71	10.50	7.37
Concrete	0.1304	2.71	10.56	3.31
Concrete	0.3376	6.51	16.49	13.04
Concrete	0.2178	6.52	13.67	2.28

Material	depth adjusted	% error - Design Value	% error Power - Average Ks	% error - Best Fit
Concrete	0.1627	4.88	13.35	5.35
Concrete	0.1260	0.03	12.82	0.06
Concrete	0.3156	1.81	15.41	10.32
Concrete	0.1940	7.17	12.65	5.20
Concrete	0.2776	0.13	17.87	8.46
Concrete	0.1897	1.69	19.23	0.07
Concrete	0.1511	4.96	11.76	5.95
Concrete	0.1965	0.26	22.00	2.89
Concrete	0.1495	2.42	20.57	1.59
Concrete	0.1200	4.80	5.92	4.06
Concrete	0.2948	1.06	14.83	7.59
Concrete	0.2436	8.74	31.24	16.12
Concrete	0.2022	3.71	26.11	6.82
Concrete	0.1396	3.40	19.99	2.59
Concrete	0.3076	1.40	12.73	6.92
Concrete	0.2488	7.71	29.70	15.47
Concrete	0.2055	9.29	32.79	12.77
Concrete	0.1466	13.64	33.06	12.54
Concrete	0.2593	0.64	18.88	7.14
Concrete	0.1775	0.87	21.89	1.75
Concrete	0.3016	22.86	7.30	17.24
Concrete	0.2155	23.59	8.36	23.49
Concrete	0.1877	16.59	1.72	17.63
Concrete	0.1515	12.45	1.92	12.97
Concrete	0.3923	12.72	25.39	20.78
Concrete	0.2749	7.77	11.92	2.60
Concrete	0.1953	12.04	4.81	12.49
Concrete	0.1524	13.41	2.96	14.08
Concrete	0.3686	0.64	13.70	7.81
Concrete	0.2814	3.95	16.34	1.87
Concrete	0.1574	7.44	5.57	7.93
Concrete	0.4018	4.91	15.22	11.58
Concrete	0.2701	1.06	20.16	4.11
Concrete	0.2191	1.32	19.35	0.20
Concrete	0.1557	5.03	8.20	5.33
Concrete	0.3821	0.76	11.89	7.12
Concrete	0.2551	5.52	14.92	1.73
Concrete	0.1992	5.16	13.35	5.43
Concrete	0.1469	2.75	9.06	2.22

Material	depth adjusted	% error - Design Value	% error Power - Average Ks	% error - Best Fit
Concrete	0.3750	2.35	10.91	5.62
Concrete	0.2619	3.72	17.06	0.68
Concrete	0.2033	4.12	14.96	4.13
Concrete	0.1373	3.33	5.95	1.57
Concrete	0.3413	6.49	9.66	1.65
Concrete	0.2660	4.32	16.28	0.38
Concrete	0.2102	0.86	19.44	0.35
Concrete	0.1492	3.64	16.68	3.88
Concrete	0.5585	2.10	9.15	6.46
Concrete	0.4371	8.74	8.18	0.92
Concrete	0.4087	4.07	14.81	2.92
Concrete	0.3001	5.93	13.93	4.50
Concrete	0.2464	4.49	12.77	5.36
Concrete	0.5747	3.73	8.34	5.94
Concrete	0.4561	5.17	11.03	2.94
Concrete	0.4141	3.24	15.80	4.30
Concrete	0.3069	1.33	19.76	0.64
Concrete	0.2576	1.83	21.39	1.41
Concrete	0.1784	0.77	9.03	3.04
Concrete	0.4892	1.37	13.03	7.02
Concrete	0.4385	2.12	15.84	6.16
Concrete	0.3262	2.63	18.43	0.45
Concrete	0.4890	0.01	14.55	8.42
Concrete	0.4421	0.65	17.38	7.84
Concrete	0.3339	2.07	19.14	1.51
Concrete	0.2537	3.18	14.98	3.81
Concrete	0.1797	1.28	7.66	1.05
Concrete	0.5643	0.30	5.63	3.09
Concrete	0.4886	4.56	9.36	3.48
Concrete	0.4178	5.68	12.72	1.79
Concrete	0.3048	4.15	16.24	2.40
Concrete	0.2616	3.12	15.63	3.48
Concrete	0.1846	2.32	7.47	0.69
Concrete	0.5410	0.92	8.09	4.82
Concrete	0.4814	2.74	12.07	5.61
Concrete	0.4285	3.05	15.30	4.93
Concrete	0.3254	2.87	18.14	0.16
Concrete	0.2578	0.85	18.15	1.30
Concrete	0.1748	2.82	11.15	6.08

Material	depth adjusted	% error - Design Value	% error Power - Average Ks	% error - Best Fit
Concrete	0.5483	1.92	6.08	3.12
Concrete	0.4587	1.14	15.70	7.50
Concrete	0.4087	1.52	18.11	5.96
Concrete	0.3109	0.61	22.19	2.86
Concrete	0.2348	4.38	22.44	3.51
Concrete	0.1690	10.47	17.90	15.12
Concrete	0.5429	1.82	6.85	3.69
Concrete	0.4686	3.78	11.86	4.58
Concrete	0.4113	3.45	15.68	3.98
Concrete	0.3181	1.82	19.34	0.80
Concrete	0.2466	1.05	19.58	0.32
Concrete	0.1763	8.16	17.20	11.28
Concrete	0.5269	3.32	7.08	3.29
Concrete	0.4609	4.38	11.72	3.94
Concrete	0.3943	4.77	14.78	1.90
Concrete	0.3112	3.65	17.00	1.50
Concrete	0.2455	0.20	18.46	0.56
Concrete	0.1809	9.65	19.97	12.09
Concrete	0.7671	2.03	5.25	7.85
Concrete	0.6792	8.09	0.03	2.89
Concrete	0.6472	8.32	2.52	1.48
Concrete	0.5815	5.61	9.99	2.61
Concrete	0.5680	1.90	15.09	6.62
Concrete	0.5194	5.74	12.76	1.66
Concrete	0.4432	6.50	13.63	1.92
Concrete	0.4103	1.37	20.16	2.07
Concrete	0.3242	0.38	19.76	0.01
Concrete	0.2540	5.37	19.42	5.37
Concrete	0.7695	5.46	9.14	11.77
Concrete	0.6994	1.49	5.07	2.45
Concrete	0.6467	3.48	7.91	3.65
Concrete	0.5932	3.85	11.32	4.47
Concrete	0.5702	3.84	12.68	4.51
Concrete	0.5307	4.72	13.52	3.02
Concrete	0.4749	2.28	18.35	4.01
Concrete	0.4260	0.70	22.51	4.80
Concrete	0.3186	1.07	17.68	1.61
Concrete	0.2481	4.25	17.31	4.55
Concrete	0.6691	0.31	10.13	6.59

Material	depth adjusted	% error - Design Value	% error Power - Average Ks	% error - Best Fit
Concrete	0.6246	0.58	14.23	8.76
Concrete	0.5809	2.20	14.00	6.33
Concrete	0.5501	1.95	15.95	6.38
Concrete	0.4729	2.10	18.51	3.99
Concrete	0.4271	2.71	18.35	1.31
Concrete	0.4182	2.53	18.59	1.07
Concrete	0.3395	1.03	18.80	0.93
Concrete	0.2395	3.41	7.53	2.56
Concrete	0.6679	0.74	10.72	7.13
Concrete	0.6360	0.00	12.68	7.78
Concrete	0.5926	0.90	14.78	7.68
Concrete	0.5423	2.12	16.12	6.07
Concrete	0.4882	1.96	18.29	4.73
Concrete	0.4263	2.22	18.95	1.78
Concrete	0.3320	2.06	17.20	2.23
Concrete	0.2443	0.54	12.72	1.13
Concrete	0.6852	1.06	9.30	6.24
Concrete	0.6195	0.56	13.32	7.65
Concrete	0.5743	1.99	14.63	6.56
Concrete	0.5453	2.97	14.97	5.20
Concrete	0.4741	3.63	16.62	2.41
Concrete	0.4035	3.94	16.80	1.11
Concrete	0.3332	1.41	18.04	1.54
Concrete	0.2372	2.69	14.12	3.86
Concrete	0.6071	3.17	11.21	5.06
Concrete	0.5414	5.02	12.72	2.91
Concrete	0.5108	5.58	13.26	1.61
Concrete	0.4608	5.39	14.75	0.01
Concrete	0.3815	6.49	13.45	4.72
Concrete	0.3141	2.77	15.45	3.35
Concrete	0.2333	4.16	14.93	5.59
Concrete	0.6520	4.26	6.58	2.57
Concrete	0.6102	2.22	12.09	6.04
Concrete	0.5978	3.27	11.71	5.07
Concrete	0.5705	4.12	12.34	4.21
Concrete	0.5210	5.79	12.64	1.66
Concrete	0.4685	4.20	16.06	1.59
Concrete	0.3944	2.62	18.33	0.18
Concrete	0.3166	3.18	15.11	3.71

Material	depth adjusted	% error - Design Value	% error Power - Average Ks	% error - Best Fit
Concrete	0.2109	1.90	8.73	6.26
Concrete	0.6951	0.83	6.20	3.45
Concrete	0.6951	0.69	6.35	3.60
Concrete	0.6513	1.92	9.25	5.11
Concrete	0.5975	2.21	12.97	6.25
Concrete	0.5503	3.29	14.35	4.92
Concrete	0.5291	2.56	16.16	5.32
Concrete	0.4555	1.61	19.42	3.77
Concrete	0.4165	1.09	22.99	4.74
Concrete	0.3172	1.00	20.11	0.46
Concrete	0.2304	8.16	19.04	10.06
Concrete	0.7389	5.40	3.90	6.01
Concrete	0.5975	4.24	10.60	4.01
Concrete	0.4210	0.01	21.65	3.82
Concrete	0.8464	0.17	6.13	3.58
Concrete	0.7375	5.69	7.81	2.19
Concrete	0.6937	8.24	7.18	0.15
Concrete	0.6598	4.52	12.92	3.58
Concrete	0.6306	1.93	17.06	5.91
Concrete	0.5611	3.26	17.20	2.54
Concrete	0.5295	0.84	20.54	3.93
Concrete	0.5039	1.40	19.96	2.33
Concrete	0.3711	1.96	20.75	1.26
Concrete	0.2830	2.89	13.84	4.04
Concrete	0.8494	7.52	30.18	14.17
Concrete	1.0679	7.87	24.89	17.20
Clay	0.2058	28.65	18.76	23.30
Clay	0.2882	20.10	17.74	13.80
Clay	0.3482	20.06	18.46	16.53
Clay	0.4943	14.95	6.46	14.07
Clay	0.1982	23.87	13.07	19.57
Clay	0.2899	15.95	13.63	9.83
Clay	0.3753	13.71	11.73	11.55
Clay	0.4565	8.68	3.33	8.43
Clay	0.1996	17.39	7.26	13.08
Clay	0.2738	9.52	6.80	3.37
Clay	0.3547	7.49	5.93	4.54
Clay	0.4380	4.28	0.18	3.96
Clay	0.5514	10.29	3.56	5.66

Material	depth adjusted	% error - Design Value	% error Power - Average Ks	% error - Best Fit
Clay	0.1907	12.20	1.25	9.30
Clay	0.2667	6.67	3.64	0.52
Clay	0.3407	3.24	1.89	0.13
Clay	0.4181	0.46	3.48	1.06
Clay	0.5237	4.73	5.57	2.51
Clay	0.1780	4.73	7.54	4.14
Clay	0.2540	1.62	1.94	4.34
Clay	0.3140	1.87	3.27	6.14
Clay	0.3885	7.50	9.35	8.77
Clay	0.4636	3.41	8.58	3.67
Clay	0.1793	5.49	6.64	4.65
Clay	0.2520	0.78	2.89	5.14
Clay	0.3016	5.77	7.30	10.30
Clay	0.3890	7.38	9.25	8.64
Clay	0.4676	6.48	11.70	6.73
Clay	0.2461	0.75	7.91	1.40
Clay	0.1899	11.26	12.77	12.65
Clay	0.1513	4.87	6.44	9.46
Clay	0.1024	21.83	30.24	26.54
Clay	0.2460	13.68	19.24	13.25
Clay	0.2449	7.40	0.14	6.79
Clay	0.1469	8.22	10.03	13.03
Clay	0.1260	7.33	11.64	13.57
Clay	0.2750	1.48	10.67	1.92
Clay	0.2233	0.11	4.24	0.08
Clay	0.1635	5.48	6.73	9.10
Clay	0.1135	11.99	17.23	17.08
Clay	0.2221	8.98	12.77	9.09
Clay	0.1922	9.75	11.43	11.06
Clay	0.1390	16.29	18.52	21.18
Clay	0.1035	15.86	23.40	20.25
Clay	0.2550	3.03	11.43	4.39
Clay	0.2053	7.94	10.44	8.60
Clay	0.1457	14.29	16.03	18.84
Clay	0.1075	15.98	22.60	20.78
Clay	0.2804	2.65	15.80	7.49
Clay	0.2358	6.79	12.24	7.08
Clay	0.1833	12.64	13.91	14.45
Clay	0.1481	9.72	11.49	14.42

Material	depth adjusted	% error - Design Value	% error Power - Average Ks	% error - Best Fit
Clay	0.1213	9.45	13.40	14.81
Clay	0.2582	4.36	13.18	6.02
Clay	0.2397	5.63	11.70	6.13
Clay	0.1633	7.73	8.97	11.31
Clay	0.1386	6.32	8.67	11.65
Clay	0.2565	0.21	8.97	1.54
Clay	0.2297	0.76	4.32	0.63
Clay	0.1773	5.52	4.02	2.66
Clay	0.1315	4.33	1.15	1.76
Clay	0.3149	0.28	7.77	0.65
Clay	0.2612	4.31	7.15	4.80
Clay	0.2046	4.82	6.08	8.45
Clay	0.1395	9.99	15.54	14.96
Clay	0.1212	4.51	5.24	1.34
Clay	0.2912	4.38	1.14	4.41
Clay	0.2167	2.23	0.87	0.84
Clay	0.1649	0.57	2.40	5.26
Clay	0.1326	2.80	4.43	2.04
Clay	0.3465	7.94	5.96	3.14
Clay	0.2777	1.70	2.57	1.54
Clay	0.2120	3.19	4.44	6.39
Clay	0.1593	3.47	6.92	9.24
Clay	0.1116	2.93	14.42	3.72
Clay	0.3266	9.59	1.08	7.36
Clay	0.2657	4.59	1.18	4.20
Clay	0.2271	3.22	1.66	0.81
Clay	0.1673	8.66	5.59	2.37
Clay	0.1228	4.07	5.28	0.61
Clay	0.2823	11.59	6.38	11.34
Clay	0.2369	13.33	11.28	11.35
Clay	0.1848	16.94	14.74	10.93
Clay	0.1441	22.16	15.65	15.22
Clay	0.2682	10.59	11.83	12.83
Clay	0.1994	10.57	13.19	15.79
Clay	0.1576	16.16	23.34	20.73
Clay	0.3510	11.36	16.38	11.66
Clay	0.3014	0.87	3.29	1.86
Clay	0.2220	5.21	3.34	0.08
Clay	0.1667	2.54	8.59	7.84

Material	depth adjusted	% error - Design Value	% error Power - Average Ks	% error - Best Fit
Clay	0.4217	3.10	10.96	2.11
Clay	0.3040	9.74	6.95	8.77
Clay	0.2318	5.82	4.21	0.98
Clay	0.1706	8.67	2.75	2.74
Clay	0.3030	0.34	2.18	0.59
Clay	0.2358	6.22	4.67	1.57
Clay	0.1707	2.22	3.37	3.39
Clay	0.2991	8.36	5.82	7.18
Clay	0.2174	2.06	0.10	3.25
Clay	0.1518	0.13	8.52	4.19
Clay	0.2666	3.35	1.89	0.61
Clay	0.2083	4.68	2.24	1.12
Clay	0.1628	10.76	3.60	5.24
Clay	0.4899	4.87	11.76	5.72
Clay	0.3340	2.33	3.58	5.77
Clay	0.2646	2.14	1.26	4.13
Clay	0.1858	11.90	0.37	9.47
Clay	0.5056	0.68	8.83	1.74
Clay	0.3444	1.04	2.18	3.92
Clay	0.2825	4.26	2.01	1.38
Clay	0.2120	10.41	2.69	5.27
Clay	0.5000	1.76	9.45	2.69
Clay	0.3382	5.54	6.76	8.71
Clay	0.2539	4.92	8.45	10.66
Clay	0.1654	0.23	14.05	2.27
Clay	0.4999	1.98	9.65	2.91
Clay	0.3360	7.69	8.91	10.90
Clay	0.2638	5.78	8.74	11.39
Clay	0.1878	4.20	14.11	6.39
Clay	0.4745	5.67	11.38	6.03
Clay	0.3433	3.57	4.83	6.60
Clay	0.2687	0.49	3.20	6.19
Clay	0.1889	4.97	5.60	2.46
Clay	0.4967	5.01	2.96	4.11
Clay	0.3299	1.50	0.19	2.25
Clay	0.2637	5.47	2.35	0.64
Clay	0.1934	11.77	1.28	8.48
Clay	0.5160	5.31	4.36	3.51
Clay	0.3510	1.45	0.07	1.41

Material	depth adjusted	% error - Design Value	% error Power - Average Ks	% error - Best Fit
Clay	0.2699	3.83	1.13	2.03
Clay	0.1958	13.19	3.03	9.58
Clay	0.6584	16.13	4.36	13.44
Clay	0.6115	12.00	4.10	11.26
Clay	0.5472	15.68	11.13	15.33
Clay	0.4688	11.36	9.44	9.26
Clay	0.3743	20.75	18.74	14.86
Clay	0.2745	28.28	20.37	21.74
Clay	0.6665	16.52	4.01	13.33
Clay	0.6296	16.16	6.75	14.93
Clay	0.5322	14.21	10.35	13.67
Clay	0.4915	15.65	13.14	14.20
Clay	0.3719	18.82	16.79	12.94
Clay	0.2600	26.82	17.06	21.07
Clay	0.6681	18.67	5.79	15.32
Clay	0.6207	18.22	9.22	17.16
Clay	0.5486	16.22	11.59	15.88
Clay	0.4979	16.33	13.64	15.07
Clay	0.3675	15.57	13.40	9.63
Clay	0.2509	23.59	13.22	18.96
Clay	0.6524	15.87	4.64	13.52
Clay	0.6090	12.37	4.61	11.69
Clay	0.5288	9.25	5.73	8.73
Clay	0.4658	8.08	6.24	5.91
Clay	0.3611	10.09	7.96	4.34
Clay	0.2610	16.52	7.78	11.24
Clay	0.7118	15.19	1.70	8.11
Clay	0.6158	9.00	1.02	8.16
Clay	0.5799	8.60	2.75	8.31
Clay	0.5027	6.95	4.36	5.94
Clay	0.4561	7.08	5.40	4.60
Clay	0.3445	12.20	9.50	5.95
Clay	0.2514	18.01	8.26	13.60
Clay	0.6201	9.95	1.63	8.99
Clay	0.5861	8.54	2.36	8.20
Clay	0.5234	7.48	4.18	6.84
Clay	0.4443	8.64	7.12	5.78
Clay	0.3430	10.30	7.59	4.12
Clay	0.2613	15.63	7.04	10.41

Material	depth adjusted	% error - Design Value	% error Power - Average Ks	% error - Best Fit
Clay	0.6483	12.36	1.78	10.28
Clay	0.5984	9.80	2.85	9.31
Clay	0.5387	12.22	8.17	11.79
Clay	0.4525	9.31	7.69	6.72
Clay	0.3394	13.52	10.60	7.11
Clay	0.2569	21.20	11.83	16.16
Clay	0.6347	12.73	3.15	11.23
Clay	0.5907	11.88	5.26	11.50
Clay	0.5132	11.33	8.26	10.47
Clay	0.4642	11.05	9.22	8.80
Clay	0.3525	14.43	11.92	8.20
Clay	0.2576	23.87	14.25	18.58
Clay	0.7042	13.94	1.93	7.75
Clay	0.6141	10.26	2.31	9.46
Clay	0.5812	10.49	4.48	10.20
Clay	0.4943	8.17	5.74	6.88
Clay	0.4257	8.60	7.20	5.07
Clay	0.3386	12.85	9.91	6.46
Clay	0.2517	17.07	7.43	12.66
Clay	0.8589	0.34	14.75	6.20
Clay	0.8258	2.83	10.01	1.42
Clay	0.7229	4.12	10.41	4.62
Clay	0.6782	2.27	6.86	2.49
Clay	0.6593	1.42	2.60	1.21
Clay	0.5870	0.84	2.94	2.14
Clay	0.5626	0.82	0.91	1.07
Clay	0.5153	2.65	1.30	0.57
Clay	0.4152	0.77	1.61	4.82
CMP	0.8570	28.58	2.75	5.81
CMP	1.0324	35.47	6.47	4.11
CMP	1.0886	39.52	12.51	0.16
CMP	0.7686	14.60	9.12	8.73
CMP	0.9366	21.29	7.03	3.45
CMP	1.1372	25.19	5.97	5.09
CMP	1.2851	28.61	2.71	5.76
CMP	1.4323	32.12	1.66	5.70
CMP	1.5437	35.68	6.76	3.63
CMP	1.6159	38.33	10.72	1.37
PVC	0.2729	23.48	19.09	1.60

Material	depth adjusted	% error - Design Value	% error Power - Average Ks	% error - Best Fit
PVC	0.3921	19.19	21.64	7.04
PVC	0.4881	22.94	23.14	6.10
PVC	0.4900	23.13	23.14	6.05
PVC	0.3406	25.24	16.91	1.95
PVC	0.2206	30.56	17.56	9.18
PVC	0.3105	23.69	18.08	2.73
PVC	0.4091	22.48	19.88	4.55
PVC	0.5426	30.12	22.75	4.23
PVC	0.2218	28.94	18.49	7.65
PVC	0.2878	24.58	17.91	1.38
PVC	0.4874	23.72	22.62	5.48
PVC	0.2666	25.77	17.83	0.59
PVC	0.3663	28.51	17.16	4.56
PVC	0.4552	25.75	16.81	0.95
PVC	0.5496	25.19	17.16	2.17
PVC	0.6648	27.59	17.86	1.11
PVC	0.7618	31.13	19.37	0.89
PVC	0.2852	34.53	18.39	19.02
PVC	0.3257	29.24	18.71	8.63
PVC	0.4204	25.11	17.77	0.65
PVC	0.5393	20.38	20.26	5.89
PVC	0.6140	21.82	20.34	5.10
PVC	0.6592	21.18	21.82	6.00
PVC	0.6668	20.57	22.42	6.57
PVC	0.3644	28.76	17.08	4.88
PVC	0.4187	23.86	18.63	1.60
PVC	0.4552	28.60	14.91	1.31
PVC	0.4584	25.59	16.88	1.12
PVC	0.5013	27.57	15.35	0.05
PVC	0.6359	22.05	20.67	5.08
PVC	0.7309	24.30	22.24	5.03
HDPE	0.5223	63.21	4.30	103.24
HDPE	0.9319	998.99	16.63	5.29
HDPE	1.2032	9.08	12.99	2.96
HDPE	1.4361	4.59	15.36	0.42
HDPE	1.6558	4.07	15.97	2.02
HDPE	1.7948	5.20	15.72	4.25
HDPE	0.4762	62.52	10.87	116.51
HDPE	0.8208	15.77	15.44	14.31

Material	depth adjusted	% error - Design Value	% error Power - Average Ks	% error - Best Fit
HDPE	1.0429	6.96	16.70	1.09
HDPE	1.2290	2.67	17.89	2.98
HDPE	1.3573	1.44	18.13	3.29
HDPE	1.5176	1.37	17.90	1.90
HDPE	0.4492	73.42	9.30	141.76
HDPE	0.7623	13.77	19.06	15.19
HDPE	0.9642	6.54	18.48	1.52
HDPE	1.1414	9.22	13.54	2.95
HDPE	1.2225	2.66	22.20	8.05
HDPE	1.3799	2.96	21.60	7.31
	Average Error	10.85	11.62	7.38

Appendix I: Goal Seek Macros Program

```

Sub multiGoal()
  Dim i As Integer
  'Change the value for i below for the rows, this would be
  'row 2 to row 723.
  For i = 2 To 723
    'Change the (i,7) to (i,"COLUMN W/FORMULA") and then change
    '("F" & "" & i) to blank column for result like "DK"
    'Ok = Cells(i, 7).GoalSeek(goal:=0.25, ChangingCell:=Range("F" & "" & i))
    'Ok = Cells(i, 7).GoalSeek(goal:=Cells(i, 11), ChangingCell:=Range("F" & "" & i))
    Ok = Range("G" & i).GoalSeek(goal:=Range("K" & i), ChangingCell:=Range("F" &
i))
  If Ok <> True Then
    MsgBox ("GoalSeek() for row " & i & " did not complete successfully!")
  End If
  Next i
End Sub

```

Discharge (Q)	Diameter (ft)	Ks	Slope (ft/ft)	Goal Seek Depth	d/D observed	observed depth	d/D predicted
0.14	0.667	0.001	0.005	=A2/(D2^0.5*E2^0.5*B2^2.5)*(C2/B2)^(1/6)	0.284857571214393	0.19	=F2

Appendix J: Buckingham Pi Theorem Derivation

$$\pi_1 = QDg = (L^3T^{-1})^a(L)^b(LT^{-2}) = L^0T^0$$

$$L: 3a + b + 1 = 0$$

$$-6b + b + 1 = 0$$

$$b = \frac{1}{5}$$

$$T: -a - 2 = 0$$

$$a = -2$$

$$\therefore \pi_1 = \frac{Q}{\sqrt{gD^5}}$$

$$\pi_2 = QDS = (L^3T^{-1})^a(L)^b(L^0) = L^0T^0$$

$$L: 3a + b = 0$$

$$b = 0$$

$$T: -a = 0$$

$$\therefore \pi_2 = S$$

$$\pi_3 = QDK_s = (L^3T^{-1})^a(L)^b(L) = L^0T^0$$

$$L: 3a + b + 1 = 0$$

$$b + 1 = 0$$

$$b = -1$$

$$T: -a = 0$$

$$\therefore \pi_3 = \frac{K_s}{D}$$

$$\pi_4 = QDd = (L^3T^{-1})^a(L)^b(L) = L^0T^0$$

$$L: 3a + b + 1 = 0$$

$$b + 1 = 0$$

$$b = -1$$

$$T: -a = 0$$

$$\therefore \pi_4 = \frac{d}{D}$$

Appendix K: Derivation of Equation 4

Step 1: Divide Partial Manning's by Full Manning's (The slopes and constants cancel)

$$\text{Step 1: } \frac{Q}{Q_f} = \left(\frac{n_f}{n}\right) \left(\frac{R}{R_f}\right)^{\left(\frac{2}{3}\right)} \left(\frac{A}{A_f}\right)$$

Step 2: Insert Equations from Table 2 for Hydraulic Radius and Area (Full and Partial)

$$\text{Step 2: } \frac{Q}{Q_f} = \left(\frac{n_f}{n}\right) \left[\frac{\frac{D}{4\theta}(\theta - \sin \theta)}{\frac{D}{4}} \right]^{\left(\frac{2}{3}\right)} \left[\frac{\frac{D^2}{8}(\theta - \sin \theta)}{\frac{\pi D^2}{4}} \right]$$

Step 3: Simplify

$$\text{Step 3: } \left(\frac{Q}{Q_f}\right) \left(\frac{n}{n_f}\right) = \left[\frac{(\theta - \sin \theta)}{\theta} \right]^{\left(\frac{2}{3}\right)} \left[\frac{(\theta - \sin \theta)}{2\pi} \right]$$

Step 4: Simplify

$$\text{Step 4: } \left(\frac{Q}{Q_f}\right) \left(\frac{n}{n_f}\right) = \left(1 - \frac{\sin \theta}{\theta}\right)^{\left(\frac{2}{3}\right)} \left(\frac{\theta - \sin \theta}{2\pi}\right)$$