GREAT BASIN ENGINEERING INC

TERAKEE VILLAGE
APPROX. 900 SOUTH 4500 WEST
WEST WEBER, UTAH 84404
IRRIGATION WATER ANALYSIS
Project No. 16N719
3-29-2019

General Information:

The proposed Terakee Village site is located on the north side of 900 South Street about 2 to 3 blocks to the east of 4700 West Street in West Weber, Utah. As part of construction, an existing irrigation ditch will be piped. It is the understanding that a design flow rate of 3.0 cfs is to be used when sizing the new pipeline.

Irrigation water has historically entered the ditch in question from the north side of the property and flows to the south until it reaches a roadside ditch (to remain) on the north side of 900 South Street. The piped flows will also be directed to the south within the same alignment. The attached figure shows the project site and location of the irrigation water ditch that will be piped. Flow calculations have been provided for the pipe under the design flow requirement. (See attached figure and calculations).

Calculations:

To determine the pipe flow depths and expected velocity corresponding to the design flow rate of 3.0 cfs, Manning's Equation was used. It was calculated that the 18-inch (1.50 ft) diameter irrigation pipe will experience a depth of 0.8710 under the design flow rate. To verify this solution, equations for cross-sectional Area and wetted Perimeter were then used to generate A and P with the given depth, y. Geometry is used to find a cross-sectional "Area" and wetted "Perimeter" corresponding to this depth. Manning's Equation was then used (assuming a Manning's n of 0.013 for concrete pipe) by plugging in the known quantities. See attached calculations for a summary of the variables in Manning's Equation and results.

Velocities were then calculated as V=Q/A. A velocity of 2.82 fps was calculated, which corresponds to a depth of 0.8710 ft and flow rate of 3.00 cfs.

Conclusions:

The piped canal will accommodate the required flow rate and provide adequate velocities.

Great Basin Engineering, Inc.

Prepared by Ryan Bingham, P.E.

3/29/2019

Manning's Equation:

$$Q = \frac{\alpha}{n} \frac{A^{5/3}}{P^{2/3}} \sqrt{S}$$

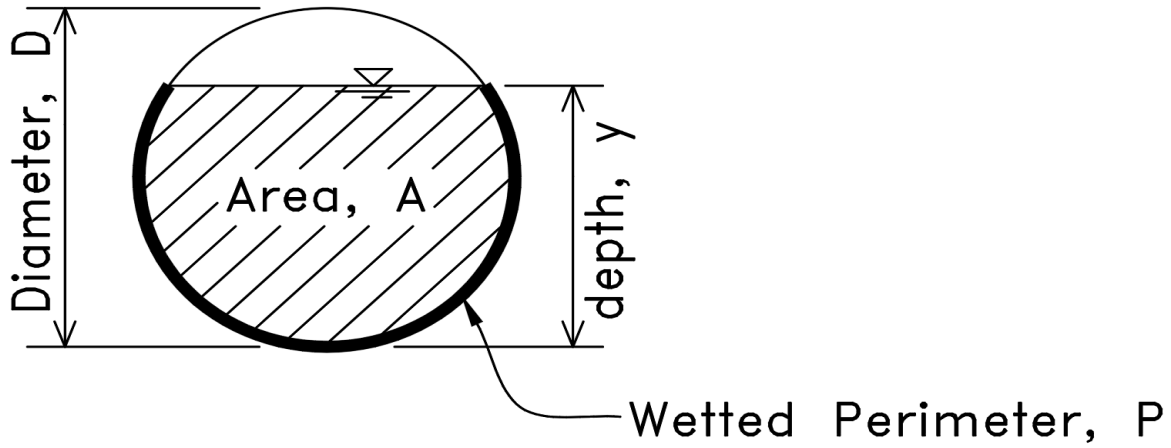
Variable	Representation
α	Manning's constant (1.4859)
n	Manning's roughness coefficient (0.011 for PVC)
A	Cross-sectional Area of flowing fluid (sf)
P	Wetted Perimeter of flowing fluid (ft)
S	Longitudinal slope of pipe (0.2% = 0.002 ft/ft)
Q	Flow Rate (cfs)

X-Sectional Area as a function of depth:

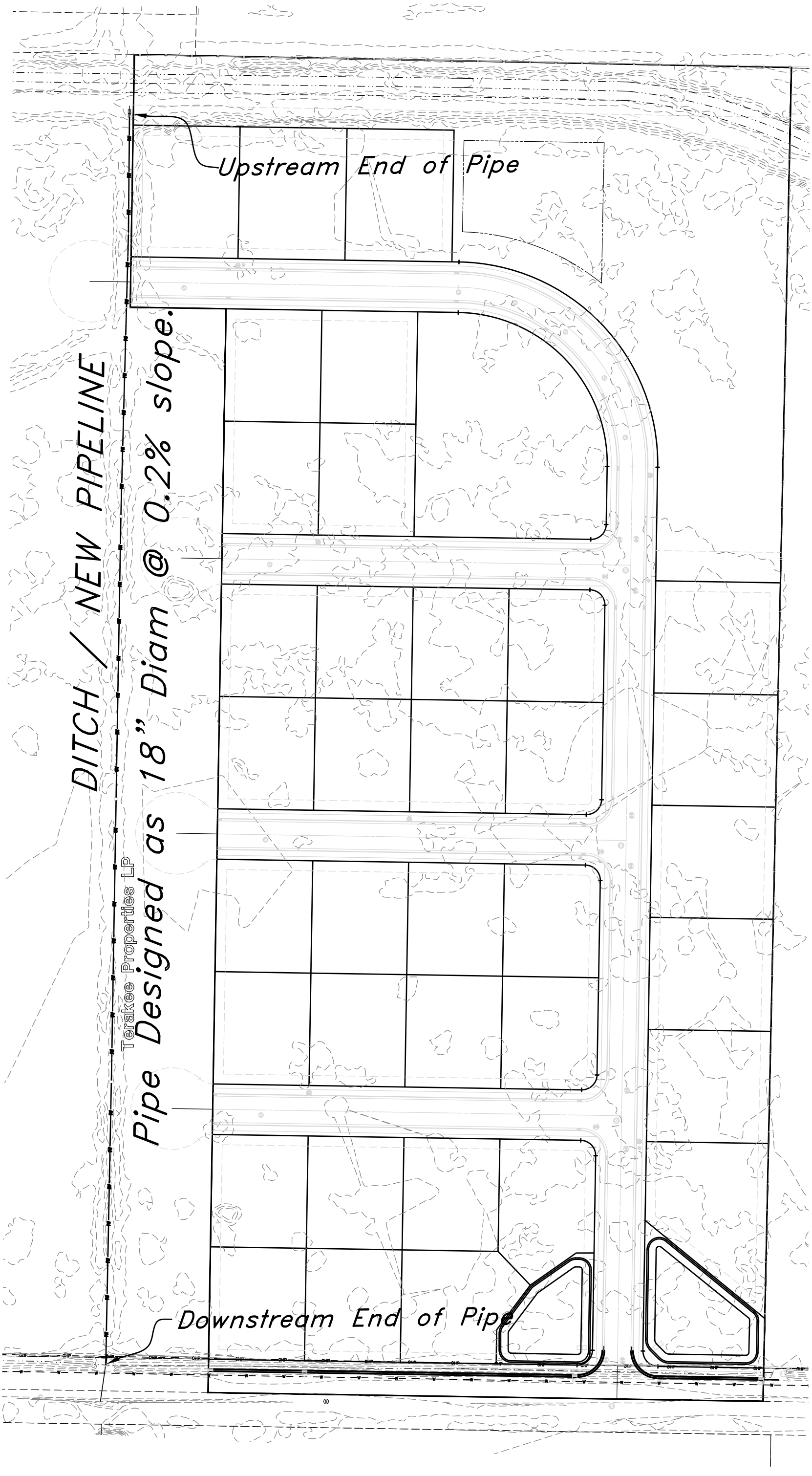
$$A = \left(y - \frac{D}{2}\right)\sqrt{yd - y^2} + \frac{D^2}{4}\left(\pi - \cos^{-1}\left(\frac{2y}{D} - 1\right)\right)$$

Wetted Perimeter as a function of depth:

$$P = D\left(\pi - \cos^{-1}\left(\frac{2y}{D} - 1\right)\right)$$



A PRUD Subdivision



Scale: NTS

SOLUTION

y =	0.87104	ft
α =	1.4859	
n =	0.013	
D =	1.5	ft
S =	0.002	ft/ft
A =	1.064342	sf
P =	2.599338	ft

Plugging these values into Manning's Equation, we arrive at the required 3.0 cfs

$$Q = \frac{\alpha}{n} \frac{A^{5/3}}{P^{2/3}} \sqrt{S}$$ = 3.00 cfs

Note: This yields a pipe velocity of V=Q/A= 2.82 fps