



## Method of Determination:

3. ☒ Delivery System Diagram Attached (required). Indicate all major components and distances between components. Indicate weir size/pipe as applicable.
- ☐ Map Attached Showing Location(s) of point(s) of diversion and place(s) of use (required). Scale must be 1:24,000 or greater.
- ☒ Aerial Photo Attached (required for irrigation of 10+ acres).
- ☒ Photo of Diversion and System Attached

4.

| <u>Well or Diversion ID No.*</u> | <u>Motor Make</u> | <u>Hp</u> | <u>Motor Serial No.</u> | <u>Pump Make</u> | <u>Pump Serial No. or Discharge Size</u> |
|----------------------------------|-------------------|-----------|-------------------------|------------------|------------------------------------------|
| 25-91-E068 (6 in)                |                   | 7.5       |                         | Sta-rite         | 7.5Hp 75-K-6                             |
| 25-91-E067 (8 in)                |                   | 15        |                         | Berkeley         | 6S2BM6-15                                |
|                                  |                   |           |                         |                  |                                          |
|                                  |                   |           |                         |                  |                                          |

\*Code to correspond with No. on map and aerial photo

## D. FLOW MEASUREMENTS

1.

| <u>Measurement Equipment</u> | <u>Type</u> | <u>Make</u> | <u>Model No.</u> | <u>Serial No.</u> | <u>Size</u> | <u>Calib. Date</u> |
|------------------------------|-------------|-------------|------------------|-------------------|-------------|--------------------|
|                              |             |             |                  |                   |             |                    |
|                              |             |             |                  |                   |             |                    |

## 2. Measurements:

No measurements confirming historical operating conditions were made available to me.

In addition to the submittals provided by Rob Harris, I requested and received a copy of the May 12, 2006 field inspection and sanitary survey conducted by Public Health District 7 employee John Moss, on this system (PWS# ID 7100155). The pressure reading taken during that inspection confirms contemporary system operation is within the design range.

A flowmeter is visible in one of Mr. Moss' photos and he states that a flowmeter is installed but readings were not provided in his report or nor were they made available to me.

## E. FLOW CALCULATIONS

☒ Additional Computation Sheets Attached

## Measured Method:

No flow measurements were made. Pump curves, well logs and as-built drawings were used to estimate a combined flow from the two pumps. No system curve was provided.

Photos of the system show plumbing of the irrigation tap located upstream of the storage tanks. That placement allows for a domestic rate different from the irrigation rate.

Because each of the two wells is located within the circle of influence of the other, I believe that they operate as a small well field, that any two pumps would operate in parallel and that their pumping rates would be additive. This belief is contrary to Rob Harris' statements that the smaller pump was in place only to provide additional 'head' for the larger pump but was not intended to provide any additional rate.

Based on accepted equation for theoretical flow :  $Q = ((8.8) \times hp \times \text{efficiency}) / (\text{lift (ft)} + (\text{pressure (psi)} \times 2.31))$ , I estimated the flow from each well-pump pair. My estimates were based on 70% efficiency, 150 ft lift (I assumed drawdown similar to other wells in the vicinity) and 60 psi operational pressure quoted in the PHD7 inspection. With those parameter choices the total flow would be 0.48 cfs = (0.16 + 0.32)

In addition to my calculation, I requested a second opinion from Mat Weaver (State office - Staff Engineer) on the maximum flow possible in this system. Mat recognized that the max flow would occur at min pressure required for the storage tanks (38 psi). His computation is attached.

**F. VOLUME CALCULATIONS****1. Volume Calculations for Irrigation:**

Refer to Rob Harris' spreadsheet (exhibit K) for a listing of the total acres developed while the permit was active. In addition to the irrigation associated with above ground development, I am allowing an additional 0.5-acre for each lot that I recognized by Department stub-in guidance for domestic use. There were 4 lots stubbed-in but not built upon during the development period.

If 0.5 ac for each of 4 stub-in lots, total acres irrigated = 15.93 ac + 2 ac.

$$V_{I.R.} = (\text{Acres Irrigated}) \times (\text{Irrigation Requirement}) = (15.93 \text{ ac} + 2 \text{ ac}) \times 4 \text{ AF} = 71.72 \text{ AFA}$$

$$V_{D.R.} = [\text{Diversion Rate (cfs)}] \times (\text{Days in Irrigation season}) \times 1.9835 = .62 \times 214 \text{ days} \times 1.9835 = 263.17 \text{ AFA}$$

$$V = \text{Smaller of } V_{I.R.} \text{ and } V_{D.R.} = 71.72 \text{ AFA}$$

**2. Volume Calculations for Other Uses:**

Domestic use in 12 homes (internal) = 12 x 0.6 af = 7.2 AFA

**G. NARRATIVE/REMARKS/COMMENTS**

I reviewed the CAD drawings of the water system, and the other exhibits which were submitted by Mr. Rob Harris, attorney, on behalf of the Township Park Estates Water Association, Inc. and have determined that beneficial use had been established while this permit was in effect.

Two, adjacent, 8-inch diameter wells serve as the points-of-diversion for this subdivision. The wells were drilled by Denning Well Drilling in 1991 under drilling permits 25-91-E067 and 25-91-E068, but no initial well capacity determinations were listed.

The systems design engineer specified one, 15-hp pump but was silent about the size of the second pump. Copies of pump purchase and installation bids were provided to me, and they included both mixed pumps and twin pairs of pumps but no clear indication that any bid had been selected. I consulted Dennis Dunn of IDWRs Eastern Region office. He advised me to expect a mixed pump combination, with a combined flow limited by the capacity of the inside diameters of the well casings. Eventually, Rob Harris was able to provide the make, model, and size of the two initial pumps and I was able to solicit the necessary vintage pump curves from a pump supplier. I was not able to determine which pump was associated with which well. The two wells appear to operate as a well field.

A utility building encloses system components including a flowmeter and ten, 75-gallon storage tanks which provide additional capacity during peak demand. The wells were not screened and are apparently drawing a lot of sand. A sand filter was added to the system after the as-built drawings were issued. According to the Rob Harris, the pumps have also been replaced several times during the life of this system which complicated the search for the correct initial pumps and curves.

Twelve, single-family homes had been built or were stubbed-in by the proof due date. Guidance allowing for economy of scale is provided by the max instantaneous demand domestic curve. Only 0.16 cfs may be required and is also the max rate authorized under the permit for the domestic use.

Less irrigation was established during the development period than had been authorized by the permit. The spreadsheet submitted by Mr. Harris provides a good summary of the irrigated acres based on above-ground development. The Department's stub-in policy for domestic use does not exclude the possibility of additional 1/2 acre for each confirmed stub-in. Therefore, I am recommending an additional 2.0 acres of irrigation based on four confirmed stub-ins.

Have conditions of permit approval been met? ☒ Yes ☐ No

**H. RECOMMENDATIONS****1. Recommended Amounts**

| <u>BENEFICIAL USE</u> | <u>PERIOD OF USE</u> | <u>DIVERSION RATE</u> | <u>ANNUAL VOLUME</u> |
|-----------------------|----------------------|-----------------------|----------------------|
| IRRIGATION            | 04/01 to 11/01       | 0.36 CFS              | 71.72 AFA            |
| DOMESTIC              | 01/01 to 12/31       | 0.16 CFS              | 7.20 AFA             |
|                       | <u>Totals:</u>       | 0.52 CFS              | 78.92 AFA            |

**2. Recommended Amendments**

☐ Change P.D. as reflected above ☒ Add P.D. as reflected above ☐ None

☐ Change P.U. as reflected above ☐ Add P.U. as reflected above ☐ Other

**I. AUTHENTICATION**

Field Examiner's Name *Michael S. Bell* Date 11/12/2009

Reviewer \_\_\_\_\_ Date \_\_\_\_\_

## GROUNDWATER FLOWRATE THEORETICAL ANALYSIS

FILE: 25-7583

DATE: 29-Oct-09

BY: M. Weaver

THEORETICAL RATE OF FLOW:  $Q = \frac{(8.8) \times (HP) \times (EFF.)}{TDH}$

Q = Flowrate (CFS)  
HP = Total Brake Horsepower of pumping plant (including booster)  
Eff. = Pumping plant efficiency (assume 70% or 0.70)  
TDH = Total Dynamic Head = [Lift + (PSI x 2.31)]  
LIFT = Depth to water in FEET from land surface to pumping water level  
PSI = Pumping pressure measured in PSI near pump (if open discharge assume [0])

$$Q = \frac{8.8 \times (15) \times 0.70}{[(130) + (38 \times 2.31)]} = 0.42 \text{ cfs}$$

Denotes Cells Requiring Input

### LIFT FROM:

Measurement ☐

Owner ☐

Area Estimate ☐

Well Logs ☒

Booster (Y) ☐ (N) ☒

### PSI FROM:

Measurement ☐

Owner ☒

Estimate ☐

Owner Gage ☐

### NOTES ON PUMP:

Motor Make, Serial or ID

Pump Make, Serial or ID

Berkely 6S2BM, 15 hp

**REMARKS:** Pumping pressure obtained from construction plans which specify the operating pressure range of the well take matrix (x10) at 38-71 psi; assume operating pressure of 38 psi to estimate maximum diversion capacity.

Static water surface elevation is reported at 130 feet in the well, no draw-down is reported on the well logs. Therefore assume the elevation head is equal to 130 feet.

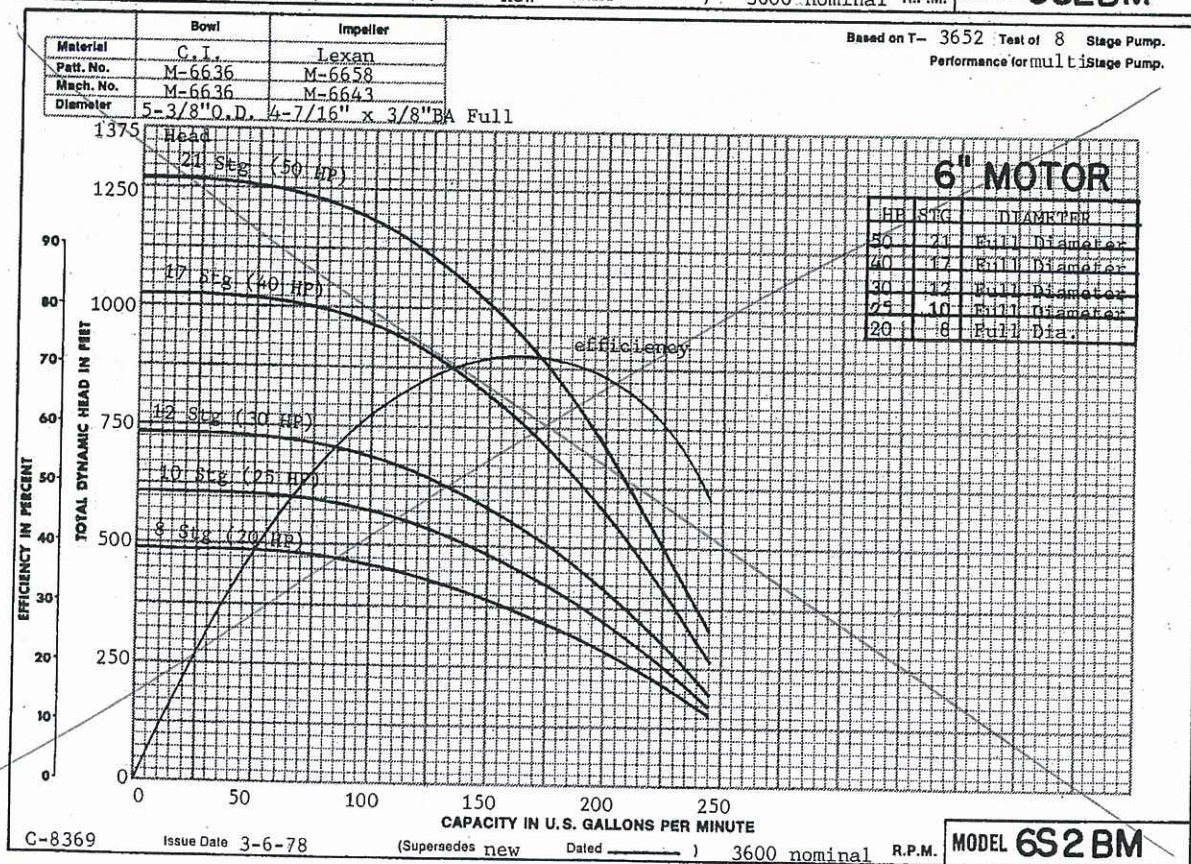
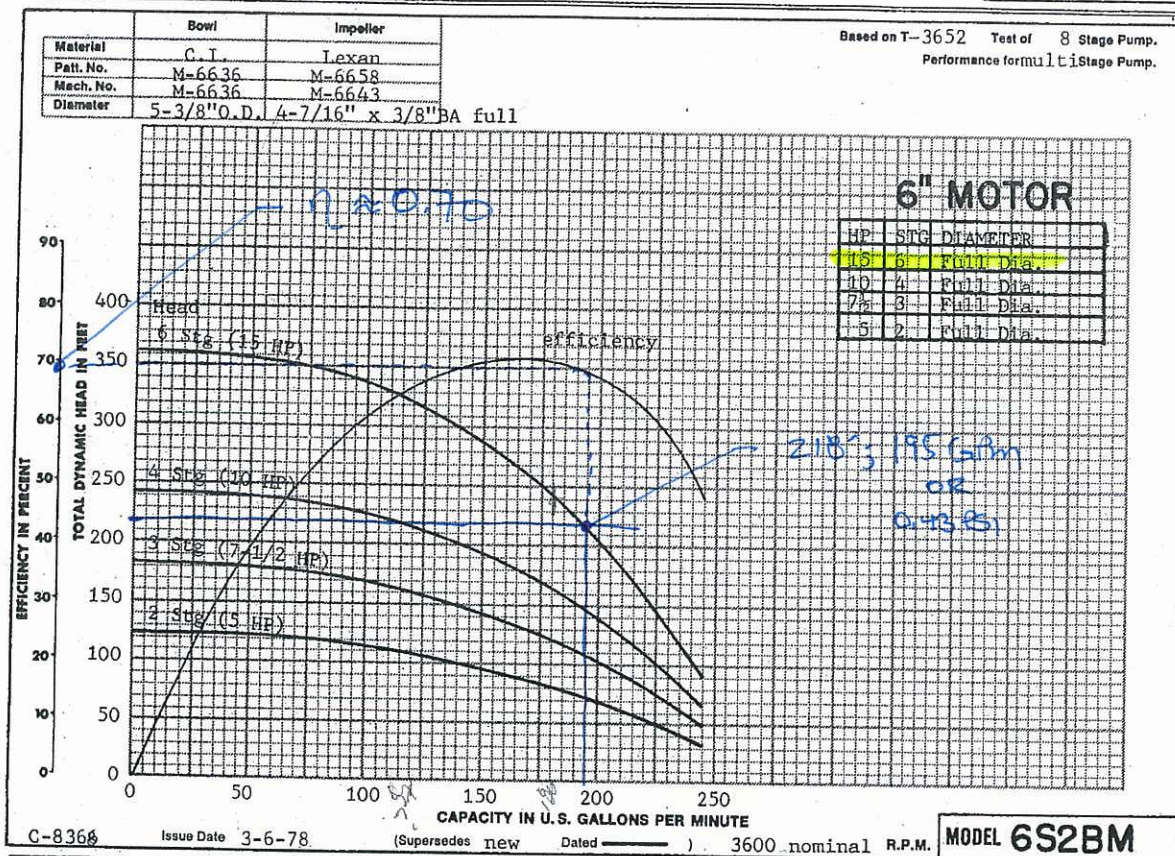
Utilizing a TDH of 218 feet the pump curves yield a flow rate of 0.43 cfs. Close agreement between two methods lends credibility to estimated value.

$$\begin{aligned}
 TCH &= \text{ELEV. H} + \text{PRESS H} + \text{FRIC. H} \\
 &= 130' + 2.31(38\text{PSI}) \\
 &= 218'
 \end{aligned}$$



**BERKELEY PUMP COMPANY**  
**SUBMERSIBLE TURBINE PUMPS**  
**6" AND 7" BOWLS**  
**PERFORMANCE CURVES**

|               |           |
|---------------|-----------|
| CURVE         | 2500      |
| DATE          | 5-1-79    |
| PAGE          | 3.01      |
| SUPERSEDES    |           |
| Curve 2500    | Page 3.01 |
| Dated 4-14-78 |           |



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- Q = Flowrate (CFS)  
HP = Total Brake Horsepower of pumping plant (including booster)  
Eff. = Pumping plant efficiency (assume 70% or 0.70)  
TDH = Total Dynamic Head = [Lift + (PSI x 2.31)]  
LIFT = Depth to water in FEET from land surface to pumping water level  
PSI = Pumping pressure measured in PSI near pump (if open discharge assume [0])

$$Q = \frac{8.8 \times (7.5) \times 0.70}{[(130) + (38 \times 2.31)]} = 0.21 \text{ cfs}$$

Denotes Cells Requiring Input

### LIFT FROM:

Measurement ☐  
Owner ☐  
Area Estimate ☐  
Well Logs ☒  
Booster (Y) ☐ (N) ☒

### PSI FROM:

Measurement ☐  
Owner ☒  
Estimate ☐  
Owner Gage ☐

### NOTES ON PUMP:

Motor Make, Serial or ID

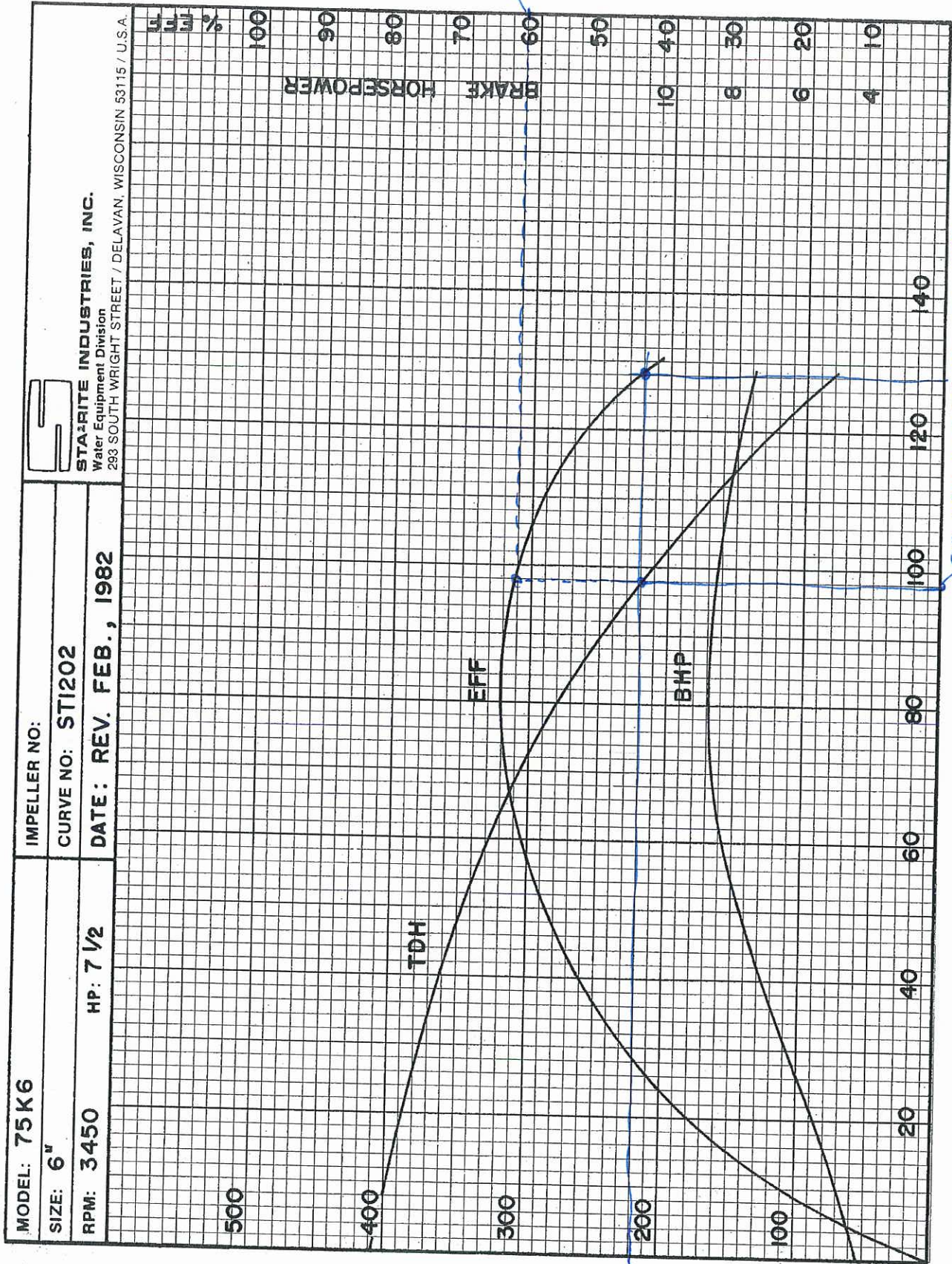
Pump Make, Serial or ID

StaRite Industries, 75K6, 7.5 hp

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Static water surface elevation is reported at 130 feet in the well, no draw-down is reported on the well logs. Therefore assume the elevation head is equal to 130 feet.

Utilizing a TDH of 218 feet the pump curve yield a flow rate of 0.21 cfs. Close agreement between two methods lends credibility to estimated value.



$\eta \approx 62\%$   
0.62

98 GPM x 0.2205 @ 218'

CAPACITY U.S. G.P.M.

TOTAL HEAD / FEET

Diam. =  inches (diameter of water system mainline)  
Diam. =  feet

Area =  SF (cross section area of mainline)

Q =  CFS (flowrate in mainline)

V =  FPS (velocity in mainline)

13.25 fps is pretty quick, maybe unreasonable so, however, it get's dumped immediately into a valve, flow meter, and sand filter system (lots of head loss) so it is probably only at that velocity for a short duration. At higher system pressures (>38 psi), that value is going to come down a bit as well, therefore, it seems okay.