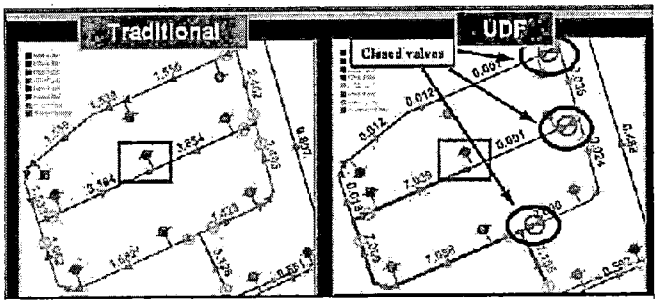
Punkin Water Association
Flushing Program

There are two types of flushing programs that have been successfully used by water system operators and they are targeted on very specific problems. These are: traditional or conventional flushing and unidirectional flushing (UDF). Both methods are appropriate for different uses. For the Punkin Water Association (PWA), given that they have experienced significant issues with brown or stained water from mineral deposits, it is recommended that a UDF flushing program be undertaken as soon as the current line size upgrades are complete and in service. Then, once the lines have been cleaned as well as can be, a conventional flushing approach can be organized taking different sections of the system and flushing on a more low impact basis monthly to maintain water clarity.

ESI notes with appreciation work presented in a paper by Robert D. McVay, PE, Florida Rural Water Association, which is the source for much of the flow and pressure detail information herein.

Figure 1

Differences Between Conventional and Unidirectional Flushing



Conventional Flushing	Unidirectional Flushing
< 2.5 fps velocity that reduces water age, raises disinfectant residual removes coloration	> 2.5 fps velocity that removes solid deposits and biofilm from pipelines

Flushing Procedures and Hydrant Maintenance, Texas Commission on Environmental Quality

Conventional flushing is primarily useful for reducing water age, raising disinfection residuals and removing coloration caused by iron problems. In a conventional flushing program only one flushing point is generally used at a time and water velocity is held to

below 2.5 feet per second. In general, conventional flushing is successful when about 3 pipelines of water volume is flushed from the main. The data in Table 1 below may be used to estimate this volume.

Table 1

Gallons of Water to Flush to Achieve Three (3) Volumes of Pipeline

	Feet of Pipeline				
Main Size dia"	100	200	300	400	500
2	50	100	150	200	250
3	110	220	330	440	550
4	200	400	600	800	1000
6	440	880	1320	1600	2200

A unidirectional flushing program is typically used to help remove solid deposits and biofilm from pipelines, reducing both undue chlorine demand, friction loss, and unpleasant color impacts. Once done, the system quality can then be maintained using the conventional method.

Determining Flow Velocities for Various Pipeline Sizes

Flow velocities for various pipeline sizes can be estimated for flushing purposes within reasonable accuracy in the field, without the use of meters or pitot tubes. Flow from a fire hydrant can be approximated by attaching a pressure gauge to the 2 ½ inch nozzle and flowing from the other nozzle. The table below will provide reasonable accuracy when using this method.

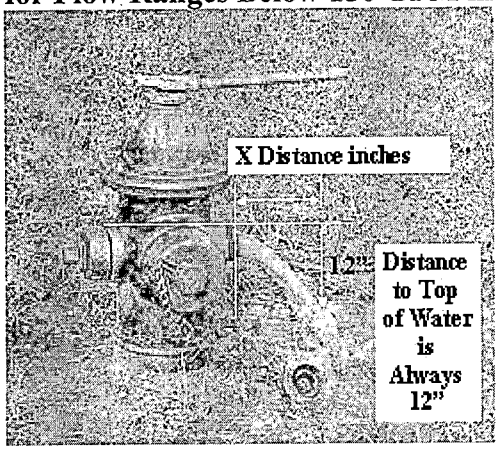
Table 2

Estimating Flow from a 2 1/2 " Fire Hydrant Nozzle with a Pressure Gauge on Opposite Nozzle in GPM

Pressure at Gauge	Approx. FH Flow	Pressure at Gauge	Approx. FH Flow
1	170	11	555
2	240	12	580
3	290	13	605
4	340	14	630
5	380	15	650
6	410	16	670
7	440	17	690
8	480	18	710
9	500	19	730
10	530	20	750

To measure smaller flows or for estimating flows from a 2" blow off the following table may be used. For conventional flushing do not exceed 3 feet per second to avoid stirring up deposits that can enter customer residences. **When flushing, always alert customers to avoid using water and not to do laundry on the day that flushing is being performed.** This will help reduce the amount of sediment entering residences. Generally, door hangers and personal notification are effective means to avoid these types of customer complaints.

Table 3
Estimating Flow from Blow Off Valves and Fire Hydrants for Flow Ranges Below 150 GPM in GPM



X	Flow 2"	Flow 2 ½ "
6	21	30
8	28	40
10	35	50
12	42	60
14	49	70
16	56	80
18	63	90
20	70	100
30	77	150

Hydraulic Handbook, Colt Industries

Determining How Long to Flush and How Many GPM are Needed to Achieve Desired Results

The above methods can be used to determine the flow rate from blow off valves or fire hydrants in gallons per minute (GPM) using simple field procedures. Now all that is left to do is to determine how long to flush to achieve the desired result. Flushing too long will waste valuable water and flushing at too high a rate will move sediment and rust and make problems worse. The following tables can be used together to estimate how long to flush to achieve the desired results.

Table 4
Determining the Flow Velocity Using Estimated GPM above

	Velocity in Pipeline	
Size of Main dia	3 fps	5fps
2	30	50
4	120	200
6	260	450
8	470	775
12	1,060	1,750
16	7,500	12,500

Determining How Long to Flush in minutes for Flow Velocity Estimated

Length	100'	200'	300'	400'	500'
Flush Vel.	Time for 3 Volumes of Pipeline (min.)				
3 fps	1:40	3:20	5:00	6:40	8:20
4fps	1:15	2:30	3:45	5:00	6:15
5fps	1:00	2:00	3:00	4:00	5:00

Conclusion

Although much of the Punkin Water distribution system is branched or dead end, and thus easy to isolate and flush, in the more developed areas such as The Lakes and Tuscan Hills/Highlands areas, some consideration must be given in how best to isolate sections of the system that can be effectively flushed depending on the location of valves and flush hydrants. Rather than try to map this out, given that some flexibility is necessary in determining which lines need flushing at a given time, ESI will be available to help PWA personnel in the field to assess the available valving and hydrants and lay out the best approach for a particular section of the system. To this end, ESI has provided PWA with a web-based map of their system pipes, valves and hydrants which can be accessed via smartphone to make this process simpler.