

On-Site Training in Water Distribution System Flushing

Curriculum Introduction

Water Distribution System Flushing

“Most water systems experience problems with slow-moving or stagnant water in their distribution systems..... To minimize these types of problems, most water systems resort to flushing.” (McVay)

Water Distribution System Flushing

“Unfortunately, unless consideration is given to the methods used in the flushing process, flushing can actually cause additional problems and complaints and result in large distribution of lost water and ineffective use of limited personnel.”
(McVay)

Water Distribution System Flushing

- Low cost method of improving water quality in the distribution system
- Uni-Directional Flushing is a method of flushing where the operator controls the direction of flow in the system

Water Distribution System Flushing

- Ensures all sections of the system are flushed
- Ensures optimal flows and velocities are achieved throughout the flushing process

Water Distribution System Flushing

- Flushing has been discussed in the education sessions delivered to the province by the Operator Education, Training & Certification Section (OETC)
- Up to this point the OETC has not been providing on-site training in water distribution system flushing

Water Distribution System Flushing

- Section determined there was a definite need and interest in training in water system flushing
- Began work on developing the curriculum

Water Distribution System Flushing



- Historically on-site training is provided utilizing equipment in the Mobile Training Units (MTUs)

Water Distribution System Flushing

- Equipment used throughout the province is similar, for example:
 - Vacuum Regulators & Injectors
 - Chemical Feed Pumps
 - Control Valves
 - Fire Hydrants



Water Distribution System Flushing

- Typical on-site training session



Water Distribution System Flushing

- It is very difficult to provide flushing training in the MTUs
- Section altered its approach when developing this curriculum



Water Distribution System Flushing

- Section has always attempted to provide on-site training specific to the system
- Every system in the province has it's own characteristics
- Impossible to develop one flushing plan that applies to everyone

Water Distribution System Flushing



Water Distribution System Flushing



Water Distribution System Flushing

- The on-site training curriculum for flushing will assist in developing an individual flushing plan for every community that participates in the training

Water Distribution System Flushing

- The goal of this curriculum is to help the operators analyze their system components
- Determine a schedule of events to allow operators to flush their systems uni-directionally

Water Distribution System Flushing

- The steps we take in developing this plan are:
 - Obtain drawings of the water system
 - Number all valves & hydrants in system
 - Mark out water line size throughout system

Water Distribution System Flushing

- Steps continued...
 - Determine storage capability of tanks and/or lines
 - Determine velocities needed to flush each section
 - Test pressures at various points in the system

Water Distribution System Flushing

- Steps continued...
 - Mark tested pressures on drawings to depict pressure zones
 - Note high & low points in the system
 - Determine flushing sequence

System Drawings



- Show where the waterlines are in the system
- Easier to determine how and where to divert flows

Obtain System Drawings

- As-Built drawings are the best option
- The Limits of Servicing drawings could suffice for smaller communities
- Master Plans may not have all phases completed

Number Valves & Hydrants



Mark Out Line Size

- Depending on the size of the water line you will need a minimum flow to achieve flushing velocities
- For example a 150 mm water line will need flows around 26 L/s to achieve a flushing velocity of 1.5 m/s

Determining Storage Capability

- Flushing systems without adequate storage can lower system pressures dramatically
- Storage allows the water demands to be met without lowering pressures to the point of creating a vacuum
- Storage can be in actual storage facilities such as tanks or simply through lines in the system

Mark Required Flows on Drawings

- Marking out the required minimum flow for flushing a section allows easy access to these numbers
- Will not have to calculate or check a separate reference sheet for the information

Flow(lgmpand USgpm) and Velocity(fps) in Water Mains

Pipe Diameter (in.)

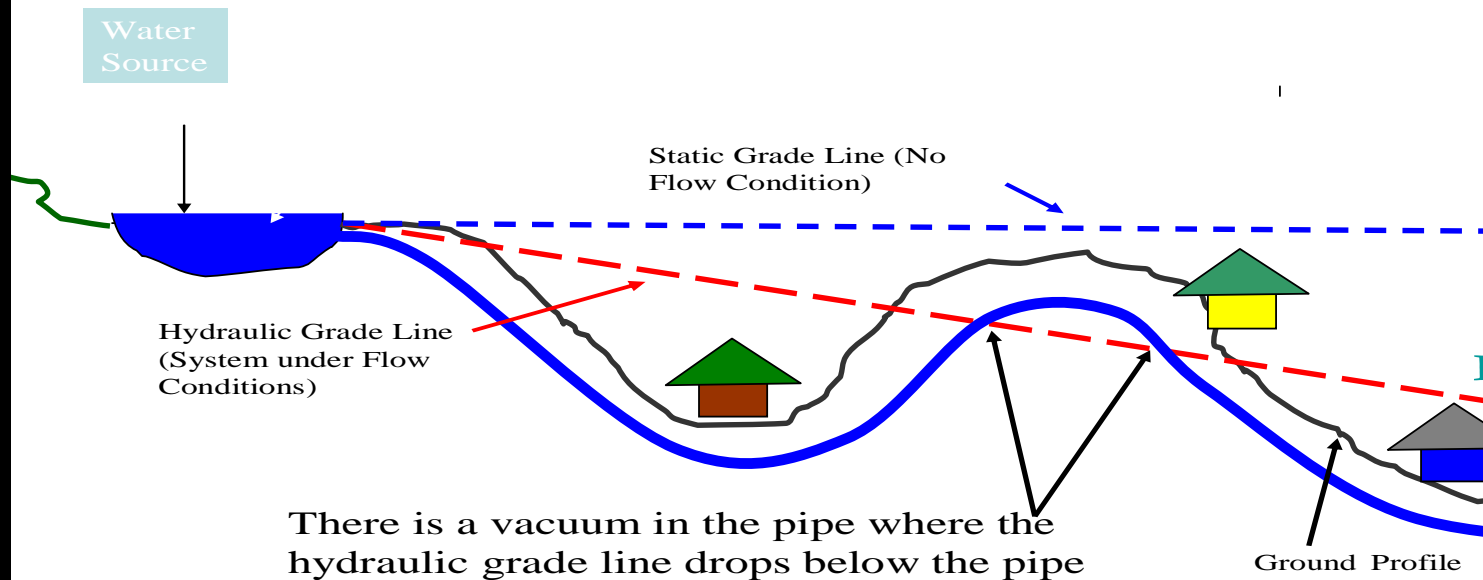
Flow USgpm	Flow lgpm	2	4	6	8	10	12	14	16	18	20
24	20	2.4									
36	30	3.7	0.9								
48	40	4.9	1.2	0.5							
60	50	6.1	1.5	0.7	0.4						
96	80	9.8	2.4	1.1	0.6	0.4					
120	100		3.1	1.4	0.8	0.5	0.3				
240	200		6.1	2.7	1.5	1.0	0.7	0.5			
360	300		9.2	4.1	2.3	1.5	1.0	0.7	0.6		
480	400			5.4	3.1	2.0	1.4	1.0	0.8	0.6	
600	500			6.8	3.8	2.4	1.7	1.2	1.0	0.8	0.6
720	600			8.2	4.6	2.9	2.0	1.5	1.1	0.9	0.7
840	700			9.5	5.4	3.4	2.4	1.7	1.3	1.1	0.9
960	800			10.9	6.1	3.9	2.7	2.0	1.5	1.2	1.0
1080	900				6.9	4.4	3.1	2.2	1.7	1.4	1.1
1200	1000				7.7	4.9	3.4	2.5	1.9	1.5	1.2
1320	1100				8.4	5.4	3.7	2.7	2.1	1.7	1.3
1440	1200				9.2	5.9	4.1	3.0	2.3	1.8	1.5
1560	1300				10.0	6.4	4.4	3.2	2.5	2.0	1.6
1680	1400					6.9	4.8	3.5	2.7	2.1	1.7
1800	1500					7.3	5.1	3.7	2.9	2.3	1.8
1920	1600					7.8	5.4	4.0	3.1	2.4	2.0
2040	1700					8.3	5.8	4.2	3.3	2.6	2.1
2160	1800					8.8	6.1	4.5	3.4	2.7	2.2
2280	1900					9.3	6.5	4.7	3.6	2.9	2.3
2400	2000					9.8	6.8	5.0	3.8	3.0	2.4
2520	2100					10.3	7.1	5.2	4.0	3.2	2.6
2640	2200						7.5	5.5	4.2	3.3	2.7
2760	2300						7.8	5.7	4.4	3.5	2.8
2880	2400						8.2	6.0	4.6	3.6	2.9
3000	2500						8.5	6.2	4.8	3.8	3.1
3120	2600						8.8	6.5	5.0	3.9	3.2
3240	2700						9.2	6.7	5.2	4.1	3.3
3360	2800						9.5	7.0	5.4	4.2	3.4
3480	2900						9.9	7.2	5.6	4.4	3.6
3600	3000						10.2	7.5	5.7	4.5	3.7

Testing Pressures

- Testing pressures in the system allows the operator to see how much the pressure will drop during a flushing exercise
- Procedures may have to be altered to prevent pressures from dropping below 20 psi

Hydraulic Grade Line

Negative Pressure in the System



Mark Tested Pressures on Drawings

- Pressures can be marked on drawings and pressure zones in the system can be identified
- It is likely that these pressure zones will follow the topography
- It is easy for operators flushing the system to see when they have begun flushing an area where they may have to monitor pressures more closely

Mark High & Low Points in System

- Allows the operator to easily identify where they will lose pressure during flushing
- Where there will be the most pressure during static situations

Determine Flushing Sequence

- Writing out a sequence of valves and hydrants to use allows the operator to be sure they are getting the most out of their flushing plan
- It also creates a set of instructions that can be followed repeatedly

Flushing Worksheets

- Using a worksheet provides the operators with a list of instructions as well as a checklist
- It also provides a written record of everything that was done during the flushing

FLUSHING WORKSHEET

TOWN OF _____

DATE _____

SECTION TO BE FLUSHED**VALVES TO CLOSE****VALVES CLOSED****HYD. / MINS FLUSHED****VALVES OPENED**☐☐**NOTES:** _____**SECTION TO BE FLUSHED****VALVES TO CLOSE****VALVES CLOSED****HYD. / MINS FLUSHED****VALVES OPENED**☐☐**NOTES:** _____**SECTION TO BE FLUSHED****VALVES TO CLOSE****VALVES CLOSED****HYD. / MINS FLUSHED****VALVES OPENED**☐☐**NOTES:** _____**SECTION TO BE FLUSHED****VALVES TO CLOSE****VALVES CLOSED****HYD. / MINS FLUSHED****VALVES OPENED**☐☐**NOTES:** _____**SECTION TO BE FLUSHED****VALVES TO CLOSE****VALVES CLOSED****HYD. / MINS FLUSHED****VALVES OPENED**☐☐

Verified by: _____

FLUSHING WORKSHEET

TOWN OF REIDVILLE

DATE _____

SECTION TO BE FLUSHED

VALVES TO CLOSE

VALVES CLOSED

NO. MINS FLUSHED

VALVES OPENED

CIRCULAR ROAD

V15

☐

H 13

☐

NOTES:

SECTION TO BE FLUSHED

VALVES TO CLOSE

VALVES CLOSED

NO. MINS FLUSHED

VALVES OPENED

COMMUNITY SQUARE

V18

☐

H 14

☐

NOTES:

SECTION TO BE FLUSHED

VALVES TO CLOSE

VALVES CLOSED

NO. MINS FLUSHED

VALVES OPENED

COMMUNITY SQUARE

V18, ~~V23~~☐

H 15

☐

NOTES:

SECTION TO BE FLUSHED

VALVES TO CLOSE

VALVES CLOSED

NO. MINS FLUSHED

VALVES OPENED

CIRCULAR ROAD

V16, V23

☐

H 16

☐

NOTES:

SECTION TO BE FLUSHED

VALVES TO CLOSE

VALVES CLOSED

NO. MINS FLUSHED

VALVES OPENED

REIDVILLE ROAD

V4, 17, 23

☐

H 16

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Verified by: _____

Flushing Equipment

- Flushing does not require a lot of equipment but there are tools available to make the job easier
- Some of these tools are available for demonstration in the MTUs during On-Site training in flushing

Flushing Tools

- Some of the tools in the MTUs are:
 - Diffusing equipment
 - Pitot gauges
 - Hydrant pumps



Flushing Tools

- More of the tools in the MTUs are:
 - Safety cones
 - Hydrant wrenches
 - Hydrant mounted pressure gauges

Traffic Awareness

- Curriculum will discuss traffic control measures
- Operating valves and hydrants may require operators to spend more time than usual on town roadways

Notifying the Public

- Towns can put announcements on local cable & radio stations
- Flyer notifications in mail boxes can alert residents to possible disruptions of service

Notifying the Public

- Sensitive areas have to be addressed to prevent users such as hospitals from having their supply compromised

Works Cited

McVay, R. (2009) . Distribution Detox. Water & Wastes Digest. 30-33.

Questions?