# Distribution System Flushing:

Conventional, Unidirectional, and No Discharge Methods

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Why Have a Distribution System Flushing Program?

- Water Quality
  - Scour pipe surfaces
    - Remove sediment, biofilm, scale, etc.
  - Remove stagnant water
    - Reduce water age, increase disinfectant residual, etc.
  - Address aesthetic issues



#### Why Have a Distribution System Flushing Program?

- System maintenance
  - Exercise valves/hydrants
  - Improves the carrying capacity of pipes
  - Allows operators to assess available water pressure and available flow



Master meter vault



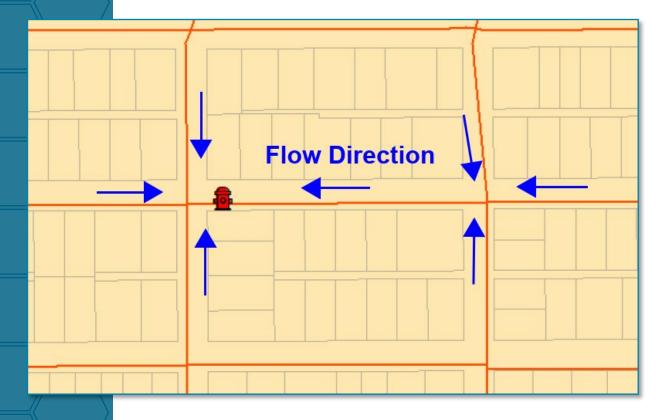
Hydrant pressure transducer





# **Conventional Flushing**

 Conventional flushing – opening hydrants and using the available flow rate without manipulating system valves

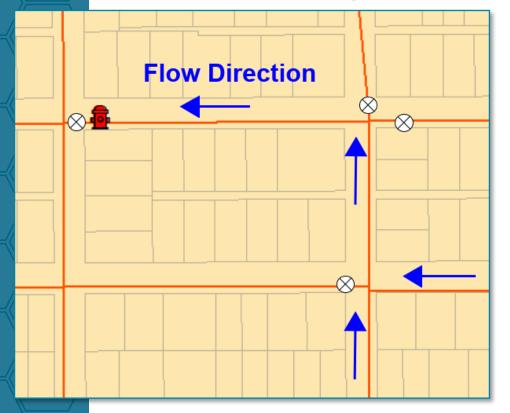


- Open hydrants in targeted areas, generally, one hydrant at a time
- Water comes from all directions in the distribution system to the open hydrant



# **Unidirectional Flushing**

- Flushing systematically from water sources to the edges of the distribution system
- Strategically opening and closing valves to force flow from targeted directions

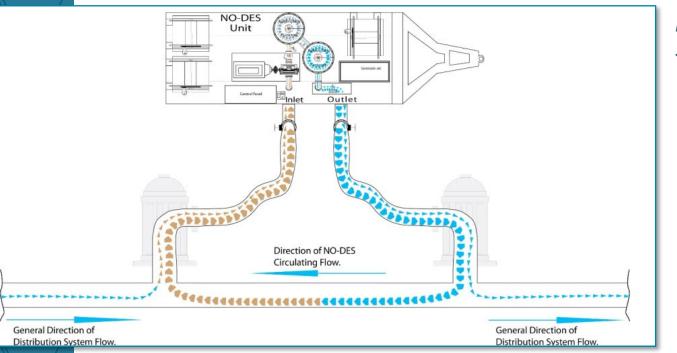


• Isolating an alignment to achieve the velocity criteria for pipe scouring



# No-Discharge Flushing

- Distribution system flushing is crucial to the maintenance of a distribution system but has its challenges
- Specialized equipment allows flushing without discharging water from the distribution system



NO-DES Flushing System (2020)



Why use a Hydraulic Model to Develop a Flushing Program?

- Where can velocity criteria be achieved with conventional flushing?
- Where is unidirectional flushing needed to achieve flushing velocity?
- Improve efficiency flush longer alignments from one hydrant.

Unidirectional flushing alters the system configuration which can lead to unusual system conditions

#### **Distribution System Pressure**

- Under 30 psi
- 30 to 40 psi
- 40 to 80 psi
- 80 to 100 psi
- Over 100 psi

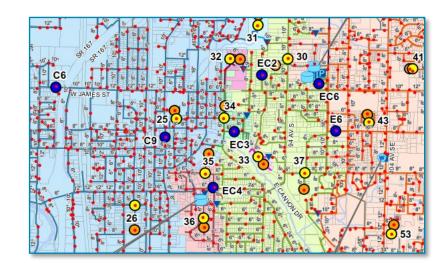
#### Flushing Velocity Achieved

- Pipes Not Targeted for Flushing
  - Less than 3 ft/s
  - 3 ft/s to 8 ft/s
    - Greater than 8 ft/s

## Flushing Program Development

Develop and/or calibrate a hydraulic model of the distribution system Collaboration between utility operators and engineers

#### Document and analyze utility assets



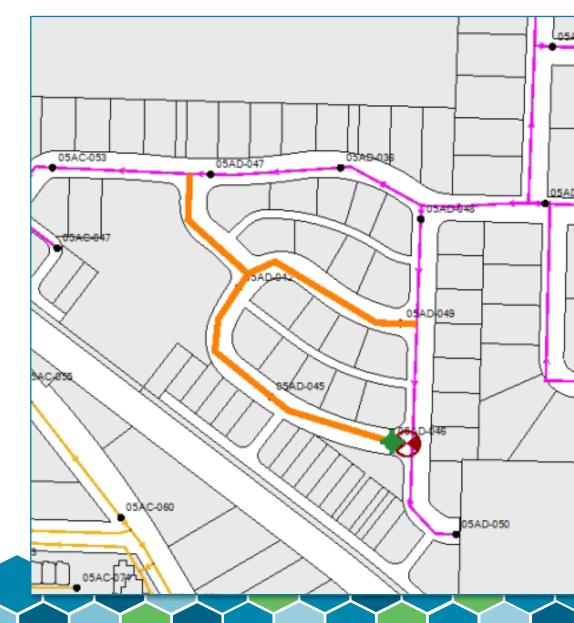
#### Flushing Parameters/Criteria

#### co•Velocity criteria

- Minimum acceptable system pressures during flushing
  E6
  A3
  - 20 psi? Or maintain a higher level of service as system flushing is a non-emergency event
- Hydrant emitter coefficient
  - Diffuser(s) to be used
    - Establish a realistic flow rate from individual hydrants

# Flushing Program Development

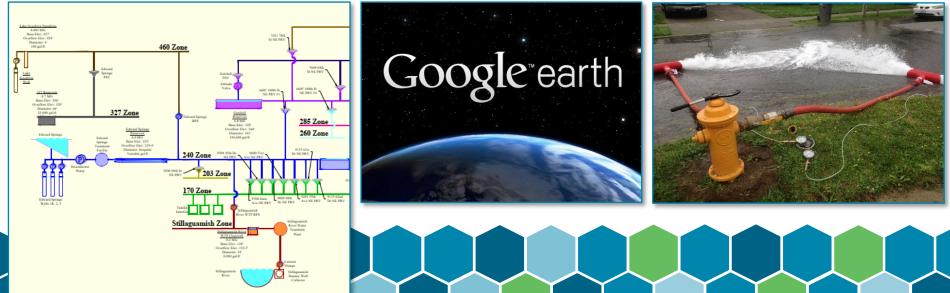
- A well-calibrated hydraulic model that accurately represents the water system is required
  - Distribution system mains
  - Hydrant locations
  - System valves



## Flushing Program Development

- Begin in the pressure zone nearest to the utility's water sources
- Identify potential flushing locations
- Vet the location using digital tools and utility operator input





#### Flushing Program Development

Determine subsequent flushing events efficiently, targeting the most distribution main possible

Determine flushing locations that can target multiple areas

Identify and eliminate redundant flushing events that target the same areas



### **Developing Functional Deliverables**

# Modeling software can create a set of field-flushing reports

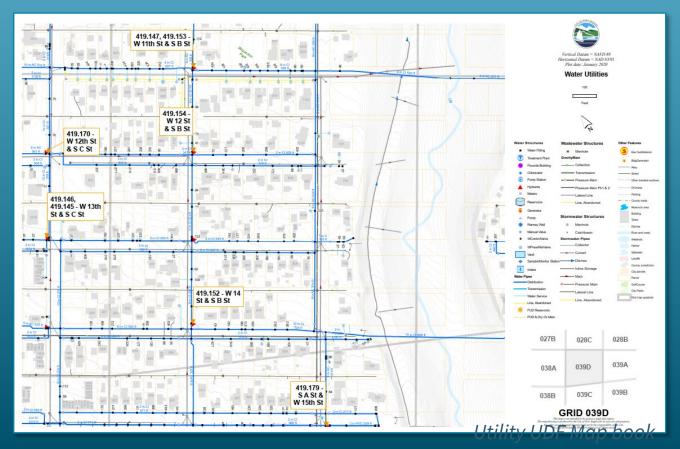
Fire Hydrant		Notes	Pressure (psi) Static, Dynamic	Measured Flow (gpm)	Predicted Pressure (psi	Predicted Flow ) (gpm)
05BD-029					38.1	0 925.90
Valve	Operation	Notes		Flushing	Minimum	Recommended
05BD-026	Close			Time (min)	0.8	1.7
				Volume (gal)	783.4	1,566.9
				Start Time		
				End Time		
				Operator		
				Date		
				Date		
				Water Quali	ty Ini	tial Final
				Clear		
				Colored		
				Chlorine Resid	lual	
				Turbidity		
Pipe Run to be Cleaned						
P-1150						
Notes						

Bentley Systems field-flushing report

#### **Developing Functional Deliverables**

Using GIS software field-flushing reports can be incorporated into utility map books

Utility symbology and asset IDs can be used



### **Tracking Progress**

Developing a flushing program creates a sequential list of flushing events

Identifies valves that need to be closed for each flushing event Identifies which valves need to be reopened after each flushing event

Should a valve be reopened at the end of the day?

Fire Hydrant		Notes		
05DA-053				
Valve	Operation		Notes	
05DC-036	Reopen			
05DB-021	Reopen			
05DC-001	Reopen			
05DD-025	Reopen			
05DA-002	Close			
05DA-041	Close			
	L			

### Troubleshooting/Concerns

#### Large diameter mains are difficult to flush

Small diameter mains that exceed the utility's velocity constraint

#### Low-pressure areas

# Areas that rely on sensitive facilities

#### Drainage issues



