Bypass Pumping Considerations
Sewer System Rehabilitation – Trenchless Technologies

John Corkery
Municipal Sales Manager
Bypass Pumping Considerations

Outline

- Size and Flow Considerations
- Equipment Selection Guidelines
- Equipment Types/Applications
- Pumping Equipment – Accessories
- Case Study
Bypass Pumping Considerations

- Remember - Safety is always Job 1
- Safety Rules You Can Live With
- Learn who to prevent:
  - Property Damage
  - Injury
  - Death
• Rebuilding sewage infrastructure systems is a growing concern many municipalities - aging equipment
• Rehabilitation is often required to repair sewage lines

• Communities rely on trash-handling pumps to bypass sewage during line repairs
• Pumps and pumping systems have a critical role in assuring sewage continues to flow while necessary upgrades are made to the existing infrastructure
What is Bypass Pumping – Trenchless Technology

Bypass Pumps

Temporary Bypass Pipes

Work Area

Upstream Manhole

Downstream Manhole

FLOW

Temporary Plugs
Find out the size of the sewer line that must be bypassed. Once the size is determined, it is used to calculate the maximum flow the line can hold.

This also aids in selecting the correct mechanical plug to temporarily block the line so the corresponding section of the line can be repaired.
Bypass Pumping Considerations

Determine the flow Max and Min

The location of the project determines the amount of flow to bypass the sewage line repair. Industrial or Commercial area - non-peak times - lines will receive lower flow levels.

Over sizing the pump(s) can lead to other problems

The pumps should not be repeatedly cycling for short bursts of activity. Best to combine pumps to cover both the peak and low flow periods.

Accommodate added flow that might be brought on by a storm event.
Sewage flow pattern for a typical municipality
Estimating flows in gravity sewer systems

Slope = \( \frac{b}{a} \)

Normal Min Slope:
- 24"-36" - 2 feet per 1000 feet
- 0.20%
- 0.0020 ft/ft

Flow Velocity

Diameter
Estimating flows **partially filled** gravity systems

Slope = \( \frac{b}{a} \)

Typical slope:
- 24”-36” - 4 feet per 1000 feet
- 0.40%
- 0.0040 ft/ft

Flow Velocity

Diameter

Depth of flow
### ROUGH ESTIMATES (gpm) OF GRAVITY FLOWS IN TYPICAL-SIZED RCP PIPES WITHOUT SURCHARGE, FULL & INVERT

<table>
<thead>
<tr>
<th>RCP PIPE DIAMETER</th>
<th>Normal Minimum</th>
<th>Slope Encountered = 0.50% = 0.0050 ft/ft</th>
<th>(Q=5%)</th>
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<th>(Q=50%)</th>
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# EQUIPMENT SELECTION

## Estimating Flows

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<th>More Typical Slope Encountered</th>
<th>1.00% = 0.0100 ft/ft</th>
<th>0.40% = 0.0040 ft/ft</th>
<th>0.25% = 0.0025 ft/ft</th>
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<td>d/D=1/4 (Q=15%)</td>
<td>d/D=3/8 (Q=30%)</td>
<td>d/D=Half (Q=50%)</td>
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EQUIPMENT SELECTION

- Location
- Manhole/Chamber
- Suction Lift
- Surface mounted automatic self-priming, solids handling portable pump
- Submersible Electric Motor Pumps
- Hydraulically Driven submersible pumps
• Surcharge

• Variations in suction lift - level can get before impacting properties upstream

• Max suction lift – 20 ft
EQUIPMENT SELECTION

- Suction conditions - where to position pumps
- Access
- Air elimination
- Suction Gauges
Effect of Suction lift on Performance

Example:
10 foot suction lift
Flow 2150 gpm

25 foot suction lift
Flow 600 gpm
Discharge pressure – TDH
Manifold
Gates and Checks
Discharge gauges
Redundancy
- **Engine driven** surface-mounted, automatic self-priming, solids handling portable pump

- **Electric driven** surface-mounted, automatic self-priming, solids handling portable pump
TYPES - EQUIPMENT

- Electric Driven Submersible Pumps
- Hydraulic Driven Submersible Pumps
Surface-mounted, automatic self-priming, solids handling portable pump

- 6-Inch Suction
- 6-Inch Discharge
- Discharge up to 2000GPM
- Heads up to 300ft
Surface-mounted, automatic self-priming, solids handling portable pump

- 12-Inch Suction
- 12-Inch Discharge
- Discharge up to 5500GPM
- Heads up to 300ft
**TYPES - EQUIPMENT**

*Electric driven submersible pumps*

- 4 to 24 -Inch discharge size
- Discharge flows up to 10 MGD
- Heads up to 350ft
**Hydraulic driven submersible pumps**

- 4 to 6 -Inch discharge size
- Discharge flows up to 1800gpm
- Heads up to 80ft
APPLICATIONS

Surface-mounted, automatic self-priming, solids handling portable pump

- Self-powered
- Sound Attenuated
- Variable Speed
- Portable
- Reliable
- Accessible Maintenance
Applications

Submersible Electric Driven pump

- No suction issues
- VFD and complete AUTO Control
- Large sizes and capacities available
- Quiet
Submersible Electric Driven pump

- Transportable version with pipe or hose connection
- Free Standing
- Non Clog
Submersible Electric Driven pump

- Transportable version with pipe or hose connection
- Free Standing
- Non Clog
ACCESSORIES

Discharge Piping and Hoses

- HDPE Pipe
- Victaulic Fittings
- Bends
- Tees
- Air Release
ACCESSORIES

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- HDPE Pipe
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Discharge Piping and Hoses

- Hose
- Victaulic Fittings
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Discharge Piping and Hoses

- Hose
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Discharge Piping and Hoses

- Hose
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Temporary Power - Generators

- Sound Attenuated
- Day and auxiliary fuel tanks
- Redundancy
- Cabling
- Portable
TEMPORARY CONTROL SYSTEMS

- Float Switch
- Probes
- Transducer
- Direct-on-line
- Variable Frequency Drives
- Start-up
CASE STUDY

Submersible Self Priming Pumps

Application

Repair to a 24-inch gravity pipe at Pump Station.

Constraints

Bypass Manhole 31 ft Deep
Manhole Surcharge
Concerns with Plug Removal
Rags and Blockages
(3) Month Duration
To reduce suction lifts, pumps have to be lowered into the ground.
CASE STUDY

Submersible Self Priming Pumps
Submersible Self Priming Pumps

SELF Priming System
CASE STUDY

Submersible Self Priming Pumps

Note: Actual proposed bypass piping, fittings, Lengths, dimensions provided in body of report.

*Priming system to have connections to each Flygt Pump
Drawing not to scale
The plan is to have two (2) 70 hp Flygt Submersible Pumps to meet a peak flow of 11 MGD (around 7640gpm). A third Flygt submersible Pump will be on hand to act as backup if required.

These pumps come standard with a submersible motor which should provide an additional level of protection against any possible flooding in the work area.
Each of the above pumping units will come with its own Self Priming System Assembly. All three pumps will have individual suction piping with individual discharge piping out to a common manifold.

There will then be a common discharge pipe to handle the expected flow from two pumps running in parallel. In order to satisfy the Suction Lift constraints of the project as well as of the pumping units, the pumps will be located in the parking lot area at elevation 3.50 feet.
Summary

- Importance of Flow Calculation
- Wide Variety of Bypass pumps and accessories available
- Safety
Questions

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