**Section 370.470 Force Mains**

a) Velocity and Diameter

At design pumping rates, a cleansing velocity of at least 2 feet per second should be maintained. Lower velocities may be permitted for very small installations. The minimum force main diameter for raw sewage shall be 4 inches except for grinder pump lift stations as allowed under Section 370.410(c)(3).

b) Air and Vacuum Relief Valve

An air relief valve shall be placed at high points in the force main to prevent air locking. Vacuum relief valves may be necessary to relieve negative pressure on force mains. Force main configuration and head conditions shall be evaluated as to the need for and placement of vacuum relief valves.

c) Termination

Force mains should enter the gravity sewer system at a point not more than 2 feet above the flow line of the receiving manhole.

d) Design Pressure

The force mains and fittings, including reaction blocking, shall be designed to withstand normal pressure and pressure surges (water hammer). The need for surge protection chambers shall be evaluated.

e) Special Construction

Force main construction near streams or water works structures and at water main crossings shall meet applicable provisions of Sections 370.125 and 370.126.

f) Design Friction Losses

1) Friction losses through force mains shall be based on the Hazen and Williams formula or other acceptable methods. When the Hazen and Williams formula is used, the value for "C" shall be 100 for unlined iron or steel pipe for design. For other smooth pipe materials such as polyvinyl chloride, polyethylene or lined ductile iron, a higher "C" value not to exceed 120 may be allowed for design.

2) When initially installed, force mains will have a significantly higher "C" factor. The effect of the higher "C" factor should be considered in calculating maximum power requirements and duty cycle time to prevent damage to the motor.

g) Identification

Where force mains are constructed of material which might cause the force main to be confused with potable water mains, the force main shall be appropriately identified.

h) Flexible Pipe Force Main Embedment

Embedment bedding (haunching and initial backfill as depicted in ASTM D2321-89, Figure (1)) shall be in accordance with Section 20-2.21 A and 20.2.21 B of Standard Specifications for Water and Sewer Main Construction in Illinois, 5th ed. (1996)(no later editions or amendments).

i) Leakage Testing

Leakage testing shall be specified, including testing methods and leakage limits.

(Source: Amended at 21 Ill. Reg. 12444, effective August 28, 1997)