10/16/07	QUAIL VALLEY	GREG HYNG

HAZEN + WILLIAMS

$V = 1.318\,(C)\,R^{.63}\,S^{.54}$

$= 1.318\,(150)\,(.33/4)^{.63}\,(.005)^{.54}$

$= 1.318\,(150)\,(.21)\,(.06)$

$= 2.49$ FPS

$C = 150$

$R = D/4$ (PIPE FULL)

S = SLOPE (0.5%)

PER PREL. ENGR. REPORT

$Q = A \times V$

$= \pi\left(\frac{.33}{4}\right)^2 \times 2.49$

$= .213$ CFS

PEAK = 95.5 GPM

= 137520 GPD

@ (2½ TIMES) = 38.2 GPM (AVERAGE DES FLOW

= 55,000 GPD

THIS CALCULATION IS BASED ON AN AVERAGE SLOPE OF 0.50% IN THE 4" SEWER LINE

10/17/07	QUAIL VALLEY	GREG HAUG

VARIABLE GRADE GRAVITY SEWERS

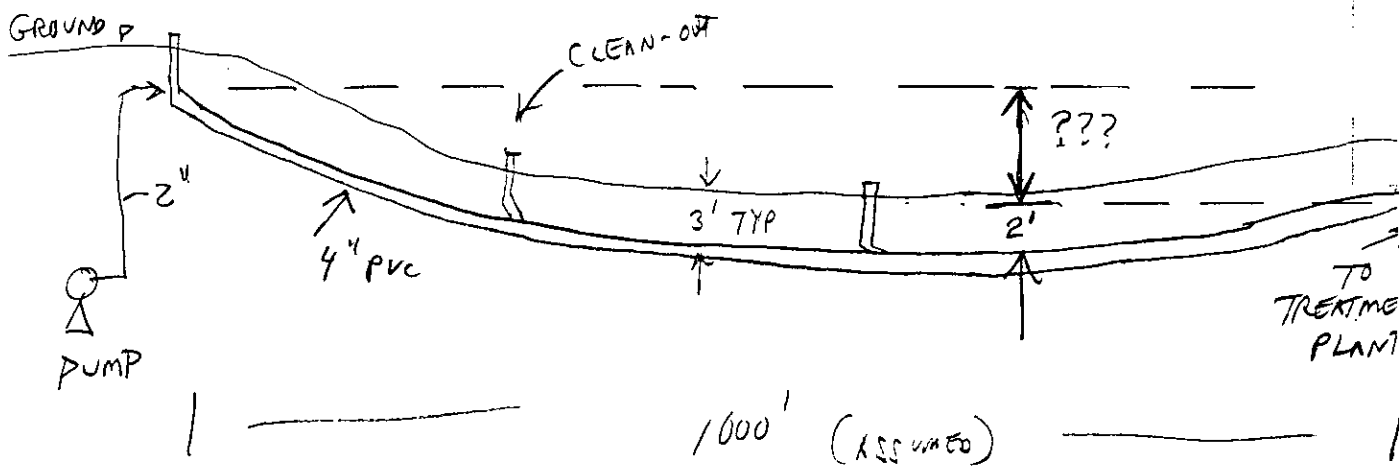
ASSUMPTIONS:

1) AS-BUILT PLAN WERE NOT AVAILABLE
2) VISUAL VIEW OF SURFACE LAYOUT INDICATES THAT 4" SEWER PIPE ON WEST SIDE OF LAKE COULD BE FLAT (OR EVEN NEGATIVE SLOPE) WITH WATER STANDING IN CLEANOUTS
3) WATER IS PUMPED UP TO HIGHEST INLET FROM PUMP STATION
4) HEAD PRESSURE PUSHES WATER THROUGH SYSTEM

CAPACITY CALCULATION

ASSUME: 2' ELEVATION FOR NEGATIVE SLOPE
4" PIPING
PVC PIPE

SOLVE FOR: AVAILABLE HEAD NEEDED (SEE SKETCH)



CAPACITY

USING MANNING'S EQN.

$$V = \frac{1.486}{N} R^{2/3} S^{1/2}$$

$$V = \frac{1.486}{.009} (.0825)^{2/3} \left(\frac{3.76}{1000}\right)^{1/2}$$

$$V = 165.11 (.188)(.06)$$

$$V = 1.9 \text{ FPS}$$

$$Q = VA$$

$$= (1.9)\left(\pi \frac{(.33)^2}{4}\right)$$

$$= (1.9)(.085)$$

$$= 0.16 \text{ CFS}$$

$$= 73 \text{ GPM}$$

$$= (105{,}120 \text{ GAL/DAY})$$

N FOR PVC = .009

$$R = D/4 = .33/4$$

$$= .0825$$

$$S = H_L/L$$

$L = 1000'$ (ASSUMED)

$$H_L = f \frac{L}{D} \frac{V^2}{2g}$$

$$H_L = .02\left(\frac{1000}{.33}\right) \frac{(2)^2}{64.4}$$

$$= 3.76'$$

$$N_R = \frac{DV}{\nu}$$

$$= \frac{(.33)(2)}{1.05 \times 10^{-5}}$$

$$= 6.3 \times 10^4$$

TO OVERCOME A NEGATIVE SLOPE THAT RESULTS IN PUSHING WATER 2' HIGHER THAN THE LOW POINT IN THE SEWER LINE, REQUIRES 3.76' OF HEAD (WATER BACKED UP IN SYSTEM) TO FLOW AT 73 GPM (105,000 GAL/DAY)

NOTE: THIS ASSUMES THE 4" PIPE IS NOT OBSTRUCTED WITH SOLIDS