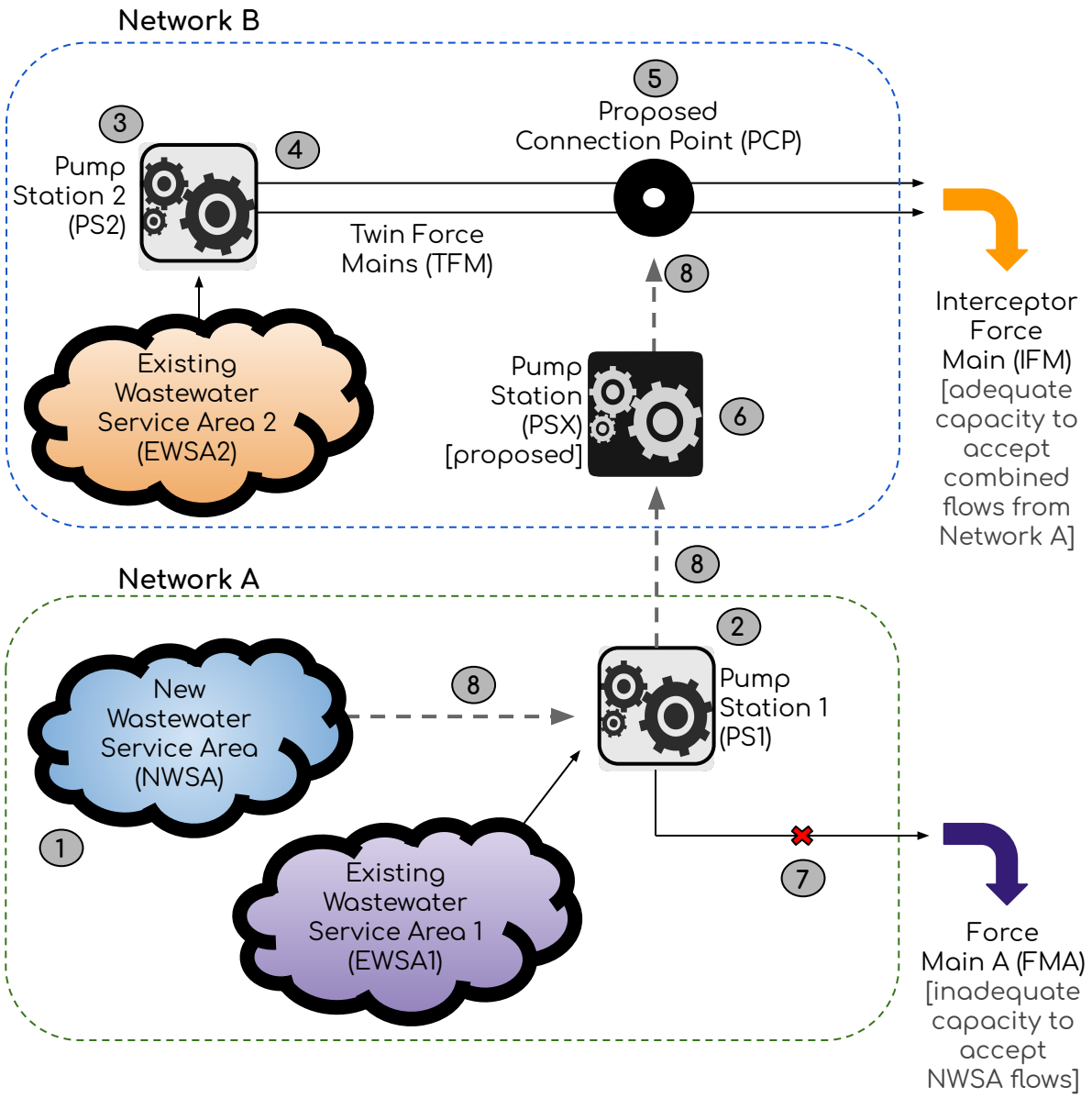
Resolve System Capacity Issue by Redirecting Flow Traffic to New Network



1. Determine system loading from NWSA by analyzing wastewater user data logs. Determine combined flows from NWSA and EWSA1.
2. Analyze pump curves at PS1 to determine if there is adequate capacity to accept and redirect combined flows to proposed PSX.
3. Analyze flow data from PS2 SCADA system to determine remaining capacity in the TFM; if there is adequate capacity, the TFM can accept combined flows from PSX.
4. Collect discharge pressure data at PS2 from SCADA system to set baseline for Step 5.
5. Calculate theoretical pressure conditions at PCP in the TFM using Hazen-Williams and Darcy Weisbach equations.
6. Design PSX (see page 2):
   - a. Size the pumps to (1) handle all flow loading conditions from PS1 as determined in Step 1, and (2) have adequate power to overcome theoretical pressure at PCP in the TFM as determined in Step 5.
   - b. Implement variable frequency drives (VFDs) in PSX to scale discharge flow rates into the TFM to maintain ideal system conditions (ie. pipe velocities and pressures).
7. Abandon connection to FMA.
8. Connect Network A to Network B by establishing connections between NWSA, PS1, PSX, and the TFM.

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Calculations Required for Step 6a, Designing Pump Station 'PSX'

1. Calculations to Determine Suction & Discharge Heads (Energy) in Pump

Run Total Minor Head Loss calculations for both sides of pump

Suction

Discharge

Total Minor Losses (hf)

Suction Minor Losses

Discharge Minor Losses

Total Minor Losses

Static Head (elevation)

Total Dynamic Head (TDH)

Y-axis

All flow Rates, gpm (i_0 to i_9)

X-axis

Hazen-Williams Equation
[calculate for all pipe lengths, materials, and flow rates]

$h_f = 0.002083*L(100/C)^{1.85}*(q^{1.85}/d^{4.8655})$

C = roughness value of pipe material

L = length of pipe

d = inside pipe diameter, ft

q = flow, gpm

Darcy-Weisbach Equation
[calculate for each pipe fitting in system at all flow rates]

$h_f = K*(V^2/2g)$

k = friction coefficient

v = velocity in pipe, fps

g = acceleration due to gravity, ft/s^2

Minor head loss calculations **must** be performed for all flow conditions

Flow rates, q (gpm), in iterations from i_0 = 0 to i_9 = Peak Hourly Flow (PHF). Extrapolate for i_1 through i_8

Flow velocities, V (fps), in iterations from i_0 = 0 to i_9 = Peak Hourly Flow (PHF). Extrapolate for i_1 through i_8

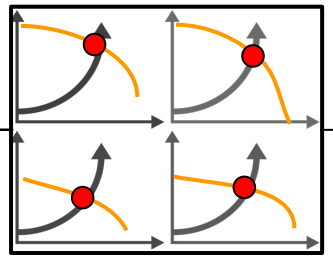
2. Graph Design Point

Plot Hydraulic System Curve

Plot Pump Curve: Impeller n

Plot Pump Curve: Impeller n+1

Plot Pump Curve: Impeller n+1



Analyze graph and select pump with impeller that is most central in flow range

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