# City of Nashua, New Hampshire

# WWTF Headworks Upgrade

**Presenters:**
**Noelle Osborne – Nashua WWTF**
**Andy Morrill – Wright-Pierce**

WRIGHT-PIERCE
Engineering a Better Environment
70 YEARS 1947 - 2017

**NEWEA Annual Conference**
**Session 18**
**January 24, 2017**

# Presentation Overview

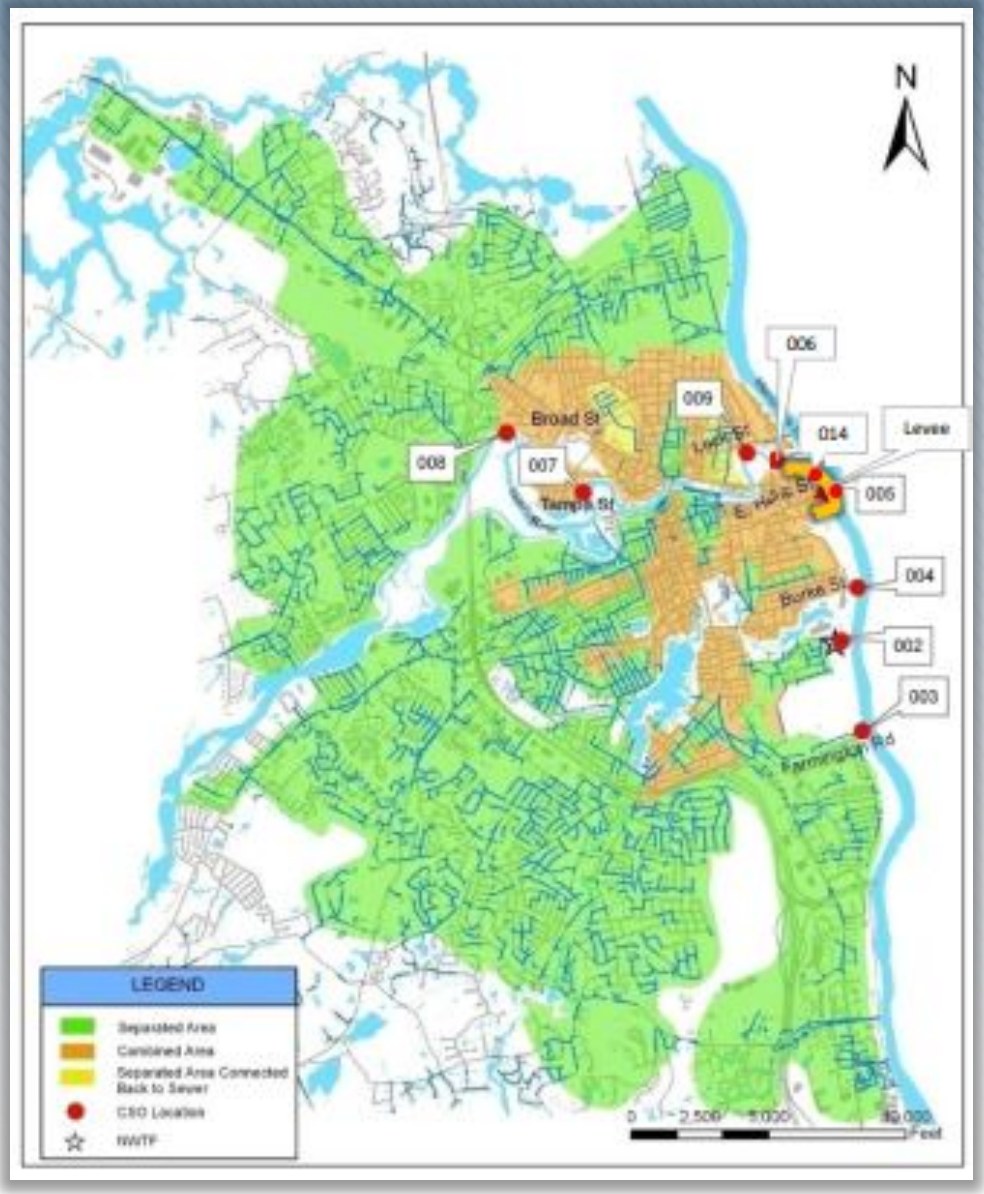
- ✓ Nashua WWTF Background
- ✓ Project Drivers
- ✓ Equipment Selections
- ✓ Operational Solutions
- ✓ Additional Improvements
- ✓ Project Overview/Status
- ✓ Q & A

# Nashua WWTF Background

- Population
  - 87,000
- Collection system
  - over 400 miles
  - combined
- Main WWTF
  - average daily flow 12 MGD
  - peak hourly flow 50 MGD
- Wet weather facility
  - peak hourly flow 60 MGD

# Nashua WWTF Background

- Collection System
  - Total - 420 miles
    - Combined - 100 miles
    - Separate Sanitary - 190 miles
    - Separate Storm - 130 miles
  - 13 Pump Stations
  - CSO Structures
    - Nashua River - 4
    - Merrimack River - 5
- Service Area
  - Nashua, NH
  - Hudson, NH
  - Merrimack, NH
  - Tyngsboro, MA



# Nashua WWTF Background

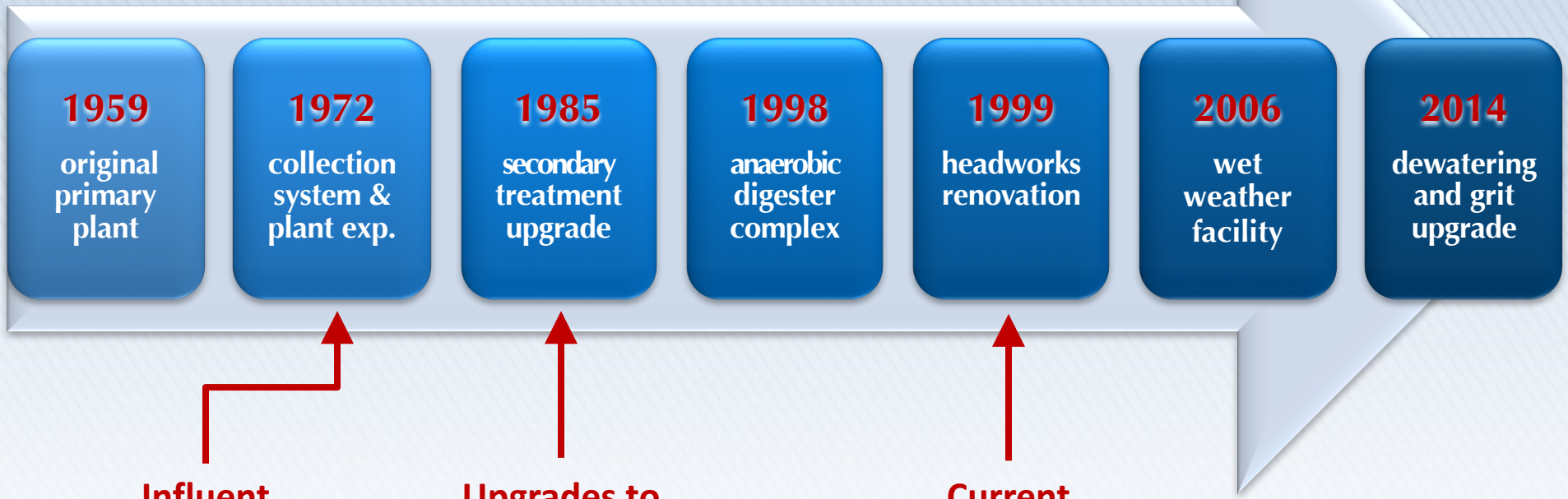
Nashua WWTF - 1965

# Nashua WWTF Background

## Nashua WWTF - 2002

# Nashua WWTF Background

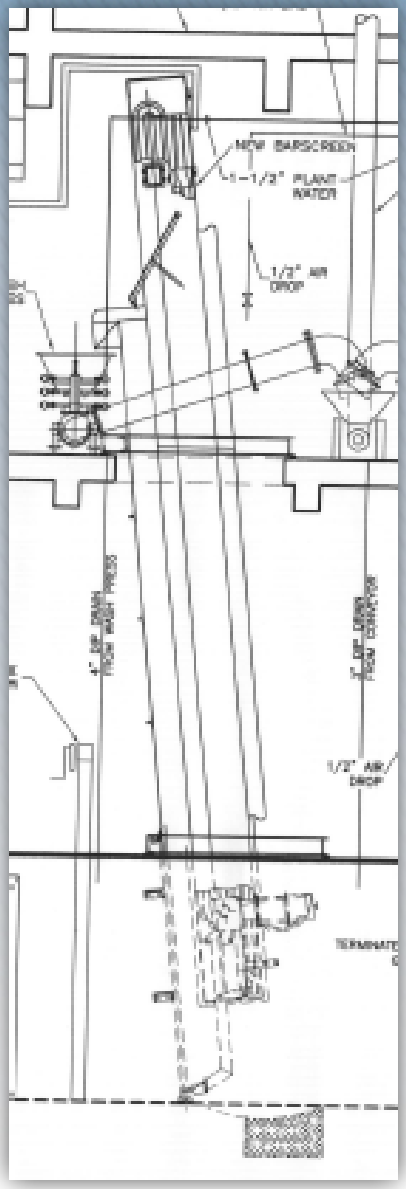
## Construction Projects



# Nashua WWTF Background

- Existing Screening Equipment
  - Two IDI Climber Screens
    - ¾-inch bar spacing
    - lift to second level – EL. 19.5
    - submerged operation - hydraulic drive
  - Two Lakeside Wash Presses
    - two-stage
  - Screw Conveyors
    - combined hopper to vertical screw

EL. 19.5



# Project Drivers

- Screening Equipment
  - Reached end of "**Useful Life**"
    - one screen offline prior to design
      - channel track repair
    - one screen offline during design
      - arm assembly replacement
    - one screen currently used during **"emergencies only"**
    - washpress frequently offline
      - bearing replacement

# Project Drivers

- Screenings Handling
  - vertical screw conveyor abandoned
  - discharge to small carts
  - carts hoisted to ground level
    - **labor and time intensive**
    - safety concerns


# Project Drivers

- Downstream Ragging
  - Grit Removal System
    - jammed shaftless screw conveyor
    - increased cleaning & maintenance
  - Digester Complex
    - decreased operational efficiency
    - added cost to remove matted rags

# Project Drivers

- Influent Flooding
  - Screen Room
    - high level of operator attention
    - additional cleaning & maintenance
    - collapsed HVAC ductwork

# Equipment Selections

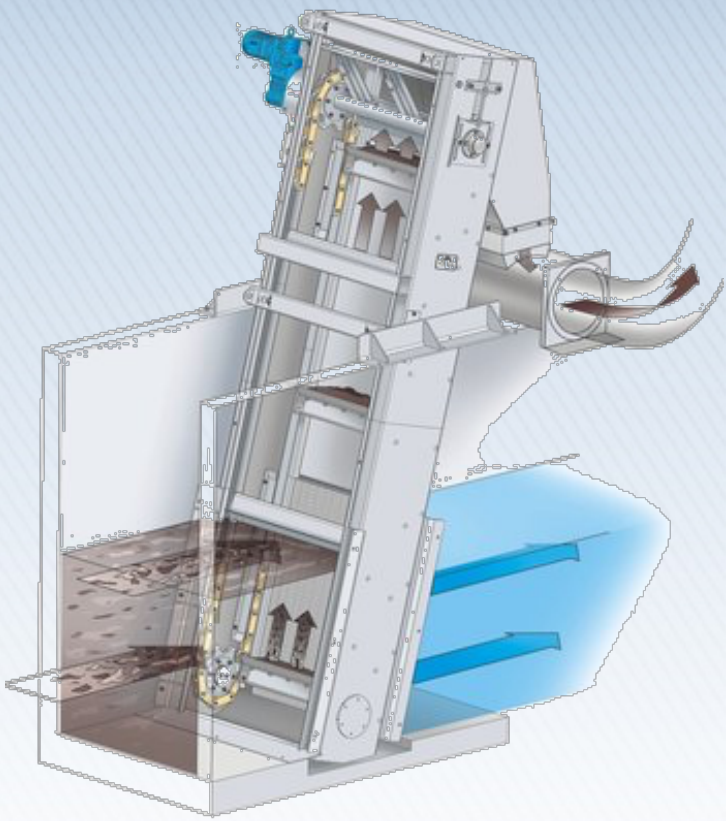
- **KEY GOALS**
  - increase mechanical reliability
  - increase screenings capture
  - effective screenings washing
    - reduce quantity & disposal costs
  - **automated** screenings conveying to ground level
  - upgrade ventilation and odor control as necessary
  - accomplish goals within available funding

# Equipment Selections

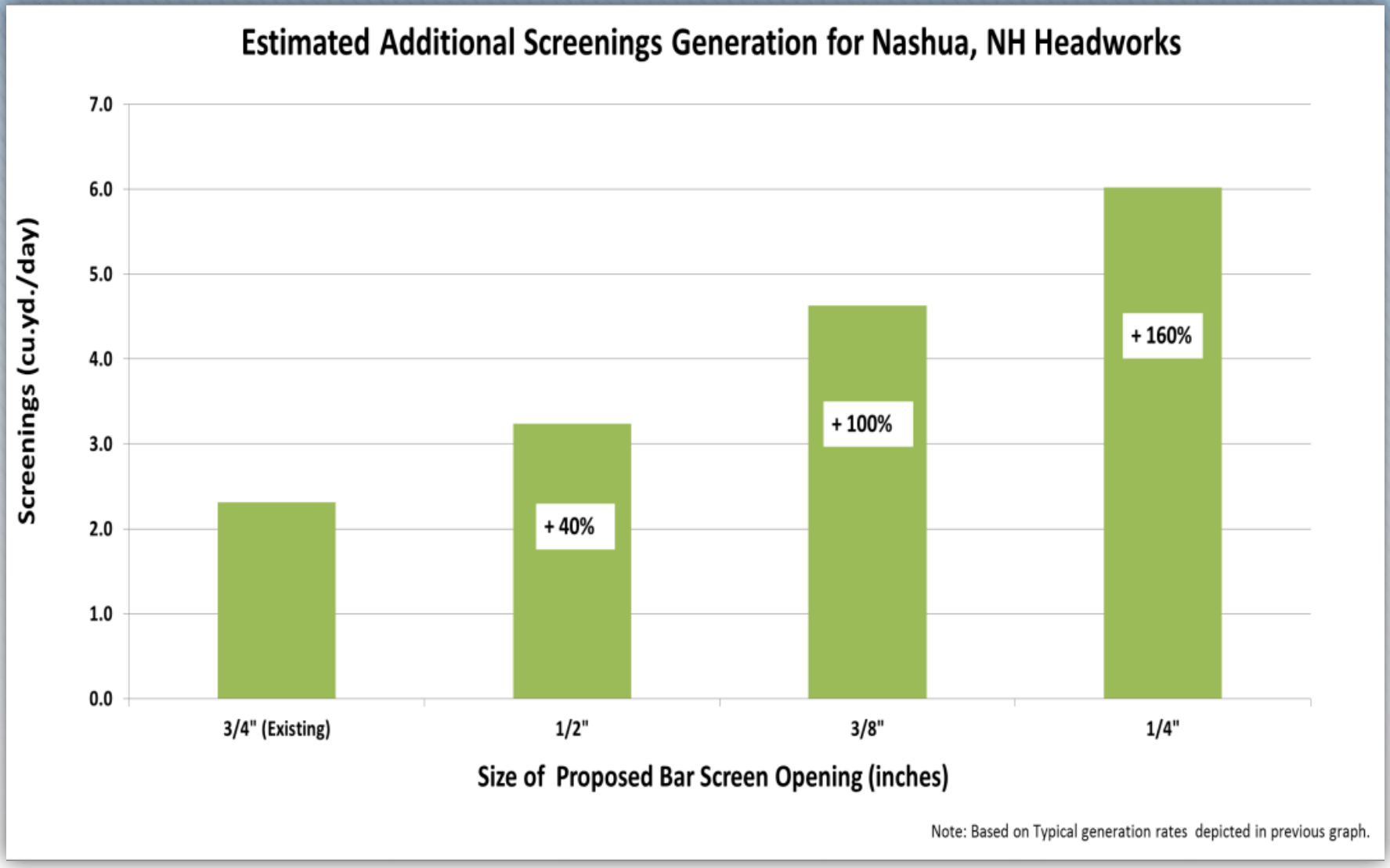
- Type of Screen
  - Climber
    - heavy duty provided rake-arm motor/drive above channel
    - requires substantial headroom space
    - limited screenings removal capacity
      - once per cycle

# Equipment Selections

- Type of Screen
  - Chain & Flight (Multi Rake)
    - front-raked & return
    - heavy-duty application
    - highest screenings removal
    - requires minimal headroom
    - least impact on hydraulic capacity with smaller bar spacing



# Equipment Selections



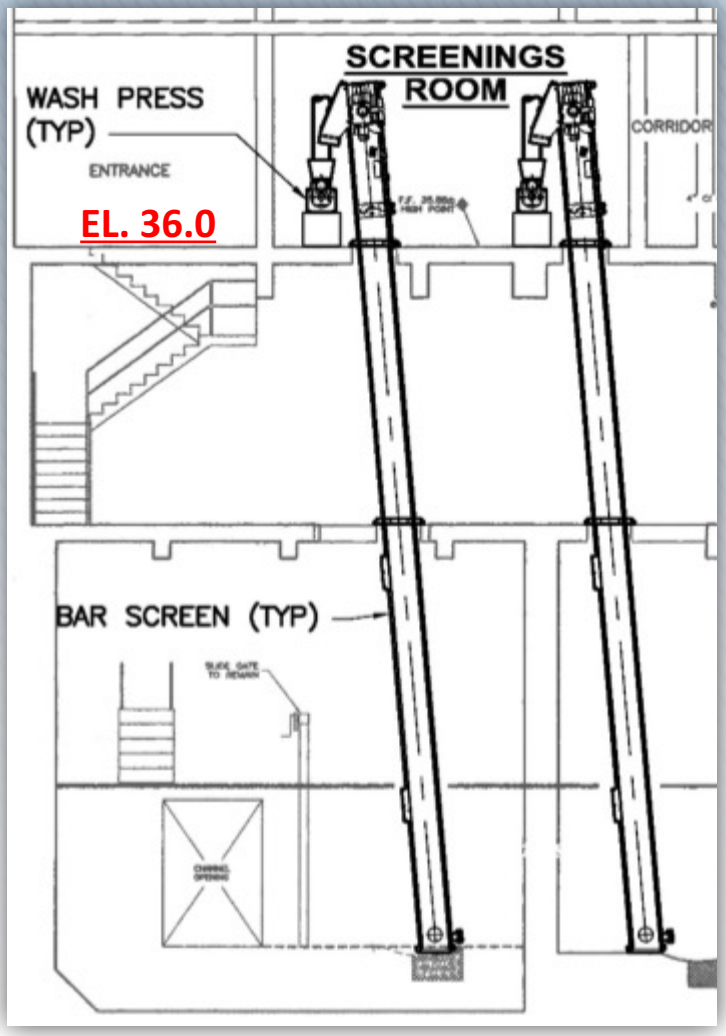
# Equipment Selections

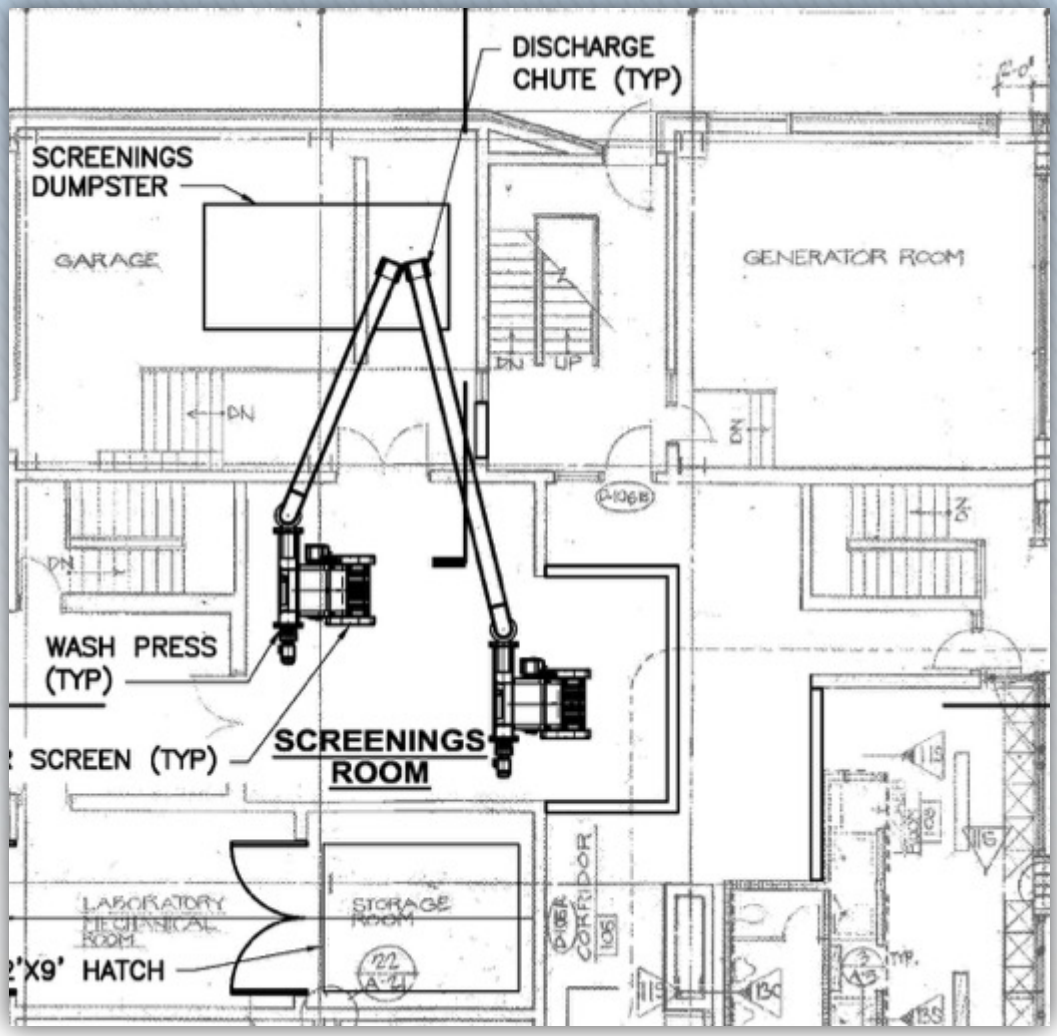
## Layout Alternatives

- Alternative 1 – Screens discharging at ground floor level (Elevation 36.0)
- Alternative 2 - Screens discharging to new mezzanine (Elevation 25.0)
- Alternative 3 - Screens discharging to screening room (Elevation 19.5)

# Equipment Selections

## Alternative 1 – Screens Discharge at EL. 36.0

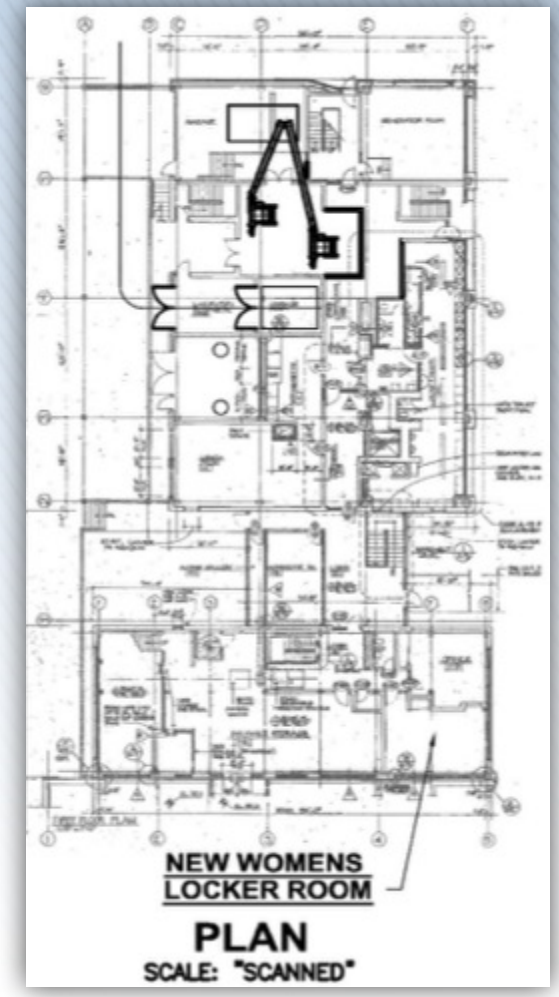


# Equipment Selections

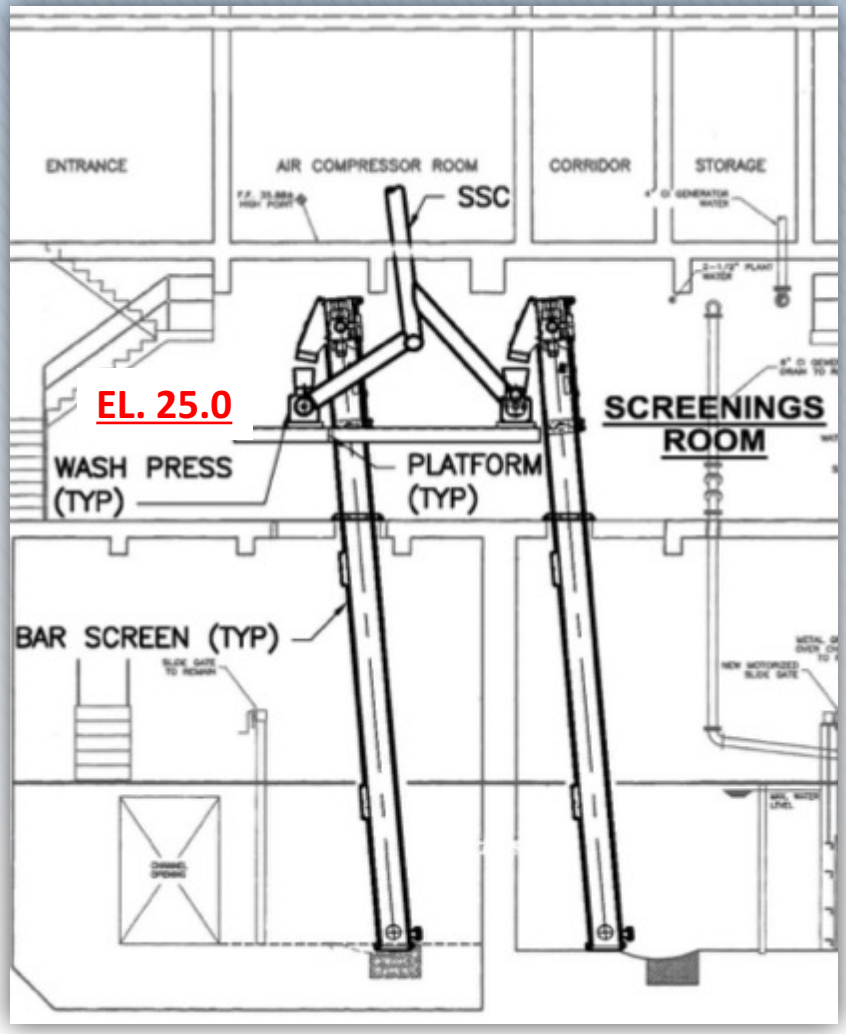
## Alternative 1 – Screens Discharge at EL. 36.0

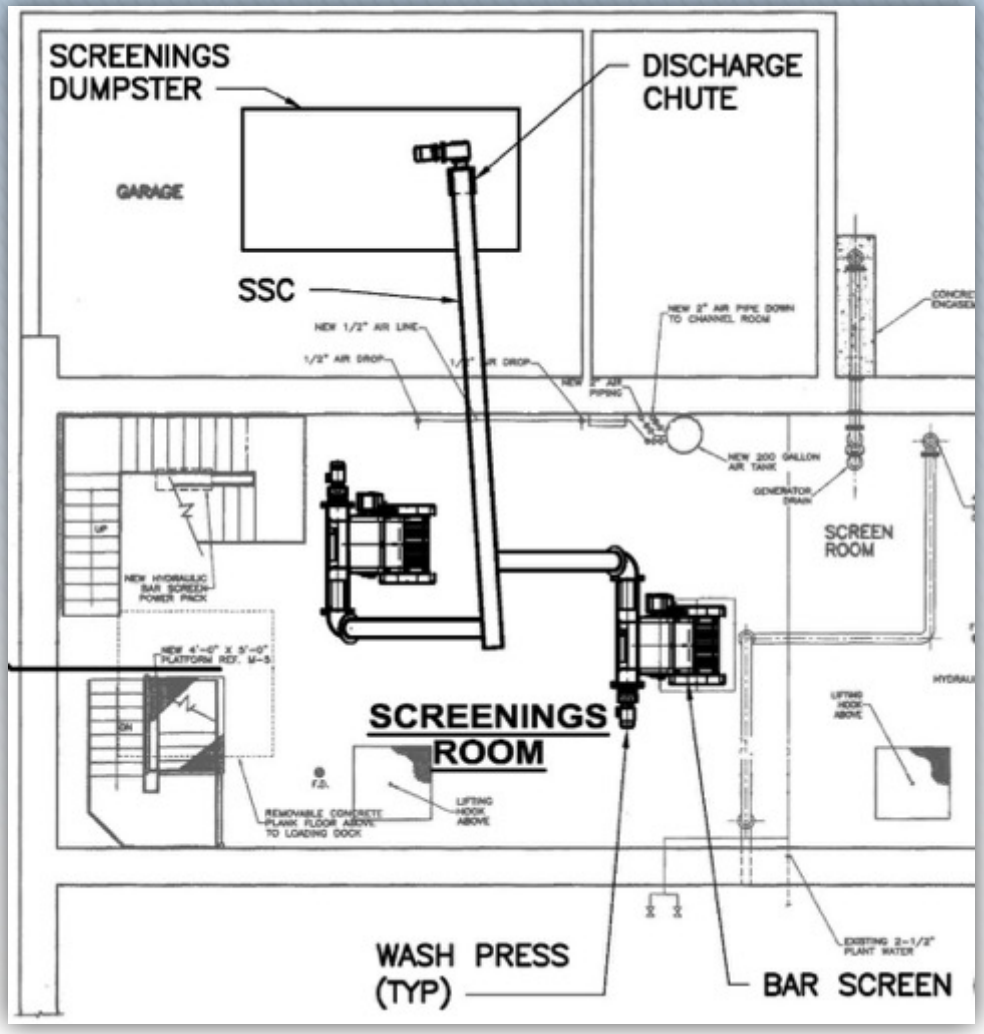
- Screens discharge to wash presses at EL. 36.0
  - must use chain and flight screens
- Wash presses discharge directly to screenings container
- Workable ground floor impacts
- Highest cost but within budget
- Best long-term solution



# Equipment Selections

## Alternative 2 – Screens Discharge at EL. 25.0

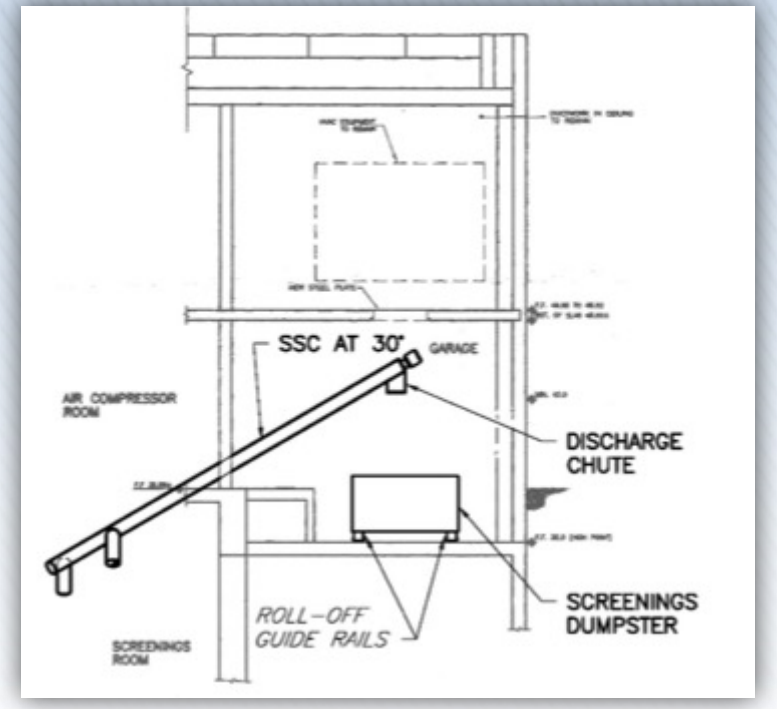


# Equipment Selections

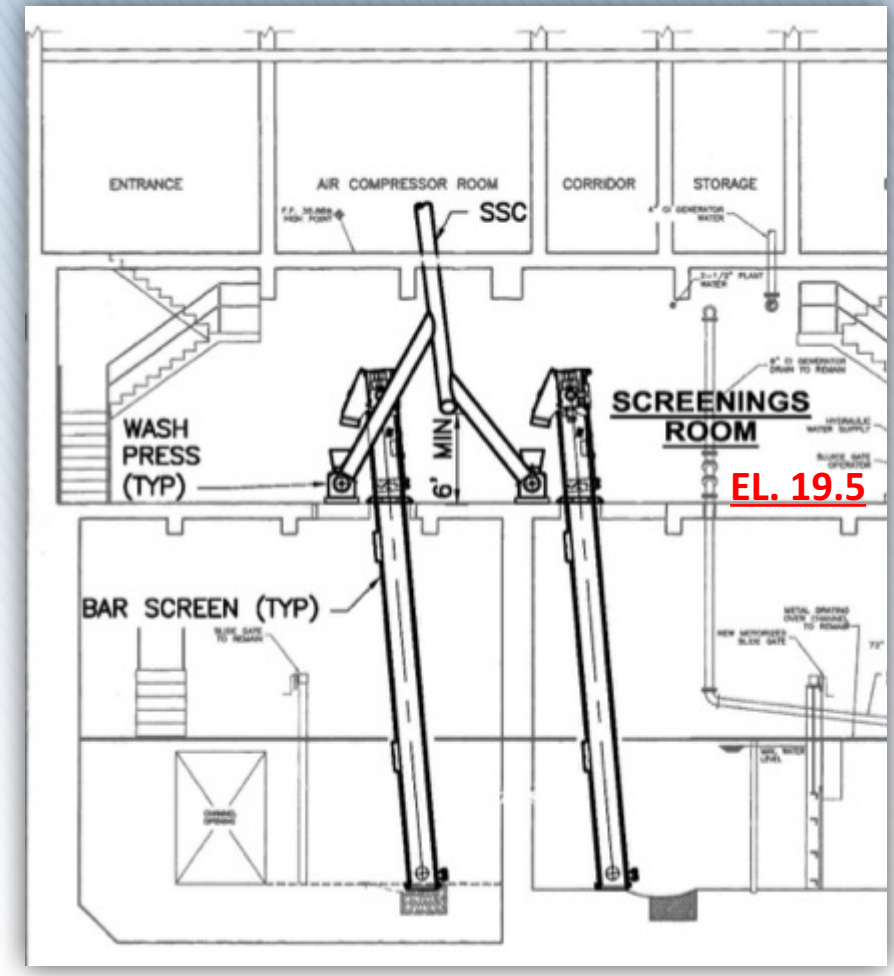
## Alternative 2 – Screens Discharge at EL. 25.0

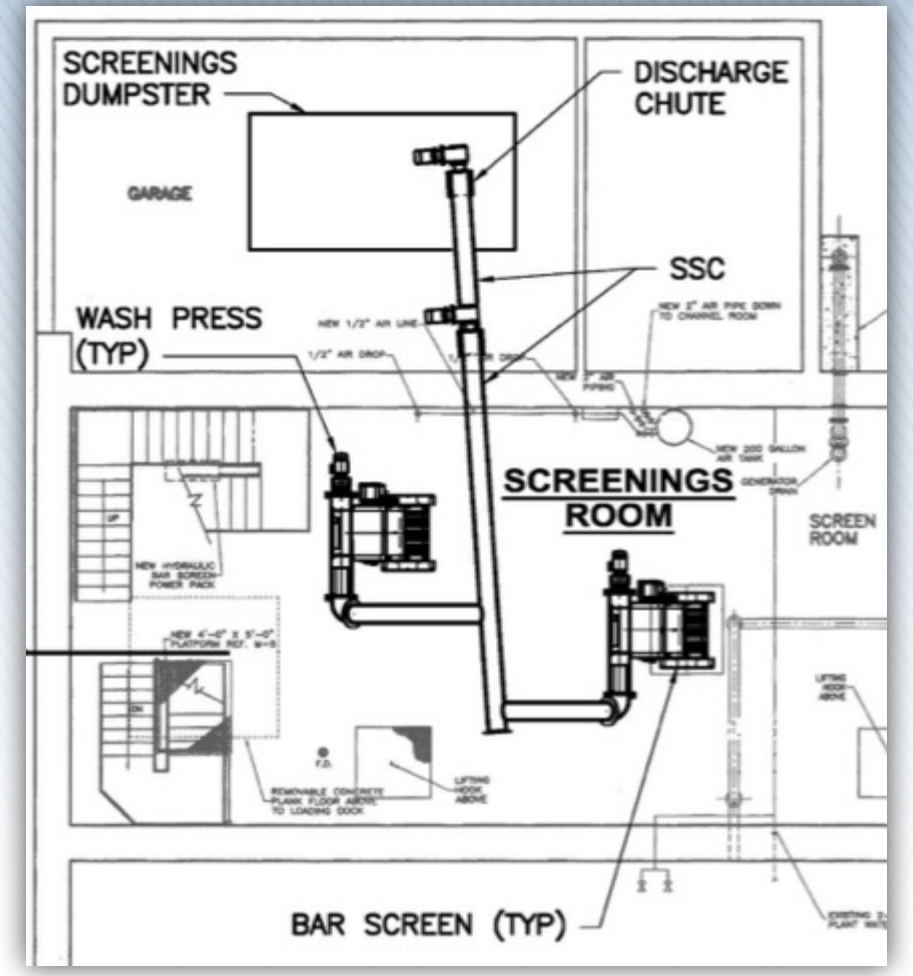
- Screens discharge to wash presses at EL. 25.0
  - must use chain and flight screens
- Wash presses discharge to 30-degree incline screw
- No ground floor impacts
- Moderate cost within budget



# Equipment Selections

## Alternative 3 – Screens Discharge at EL. 19.5

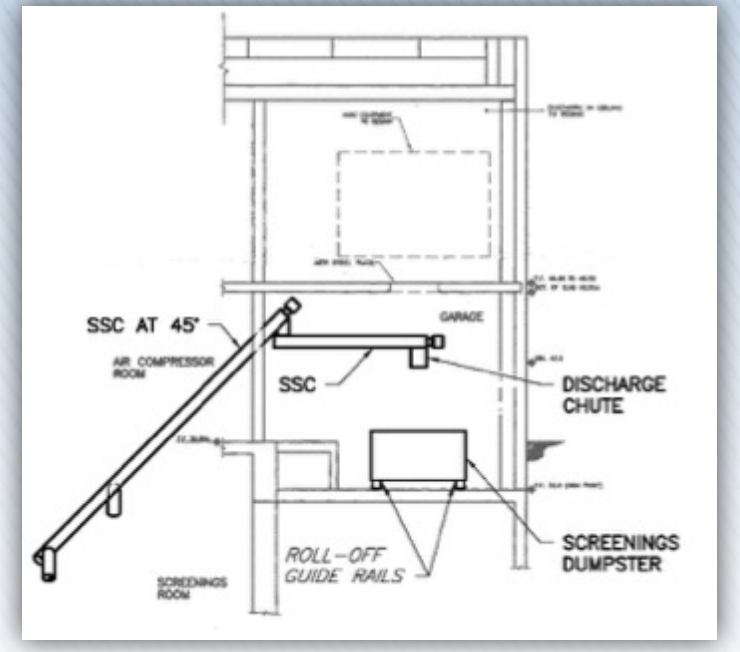


# Equipment Selections

## Alternative 3 – Screens Discharge at EL. 19.5

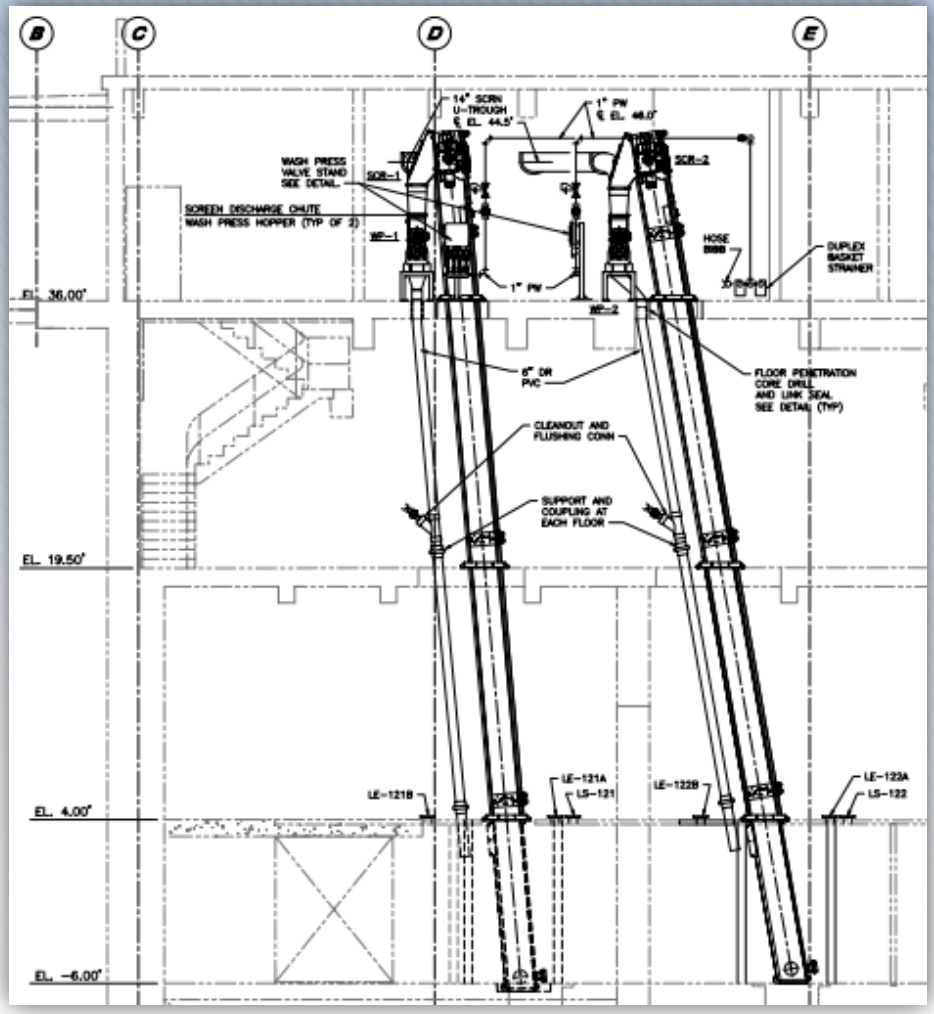
- Screens discharge to wash presses at EL. 19.5
  - chain and flight screens or climber
- Wash presses discharge to 45-degree incline screw
- Second horizontal screw
- No ground floor impacts
- Lowest capital cost within budget



# Equipment Selections

## Alternative 1 – Screens Discharge at EL. 36.0

- Huber Rake-Max Screens
  - 3/8” bar spacing
- Vulcan Wash Presses



# Equipment Selections

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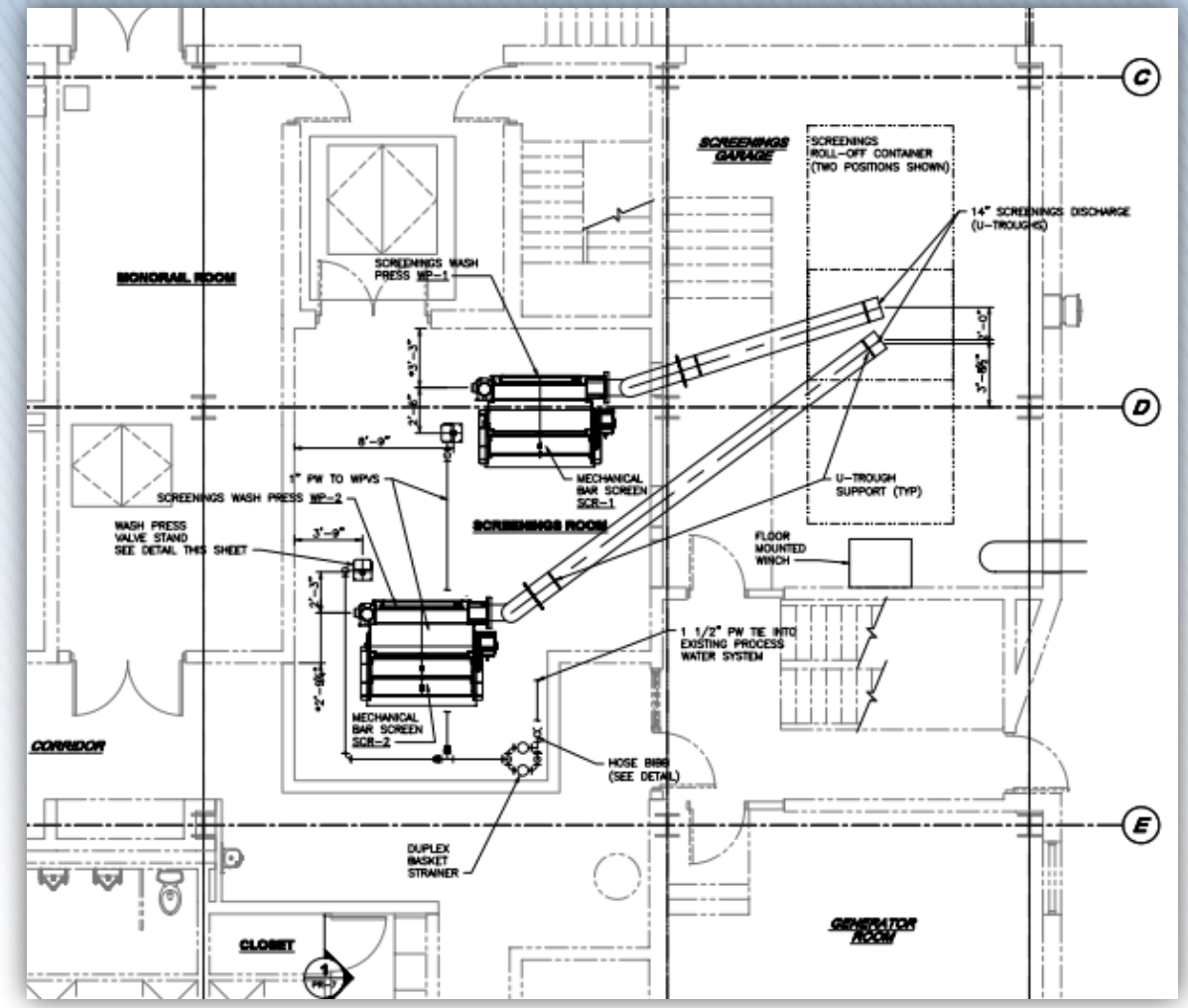


# Equipment Selections

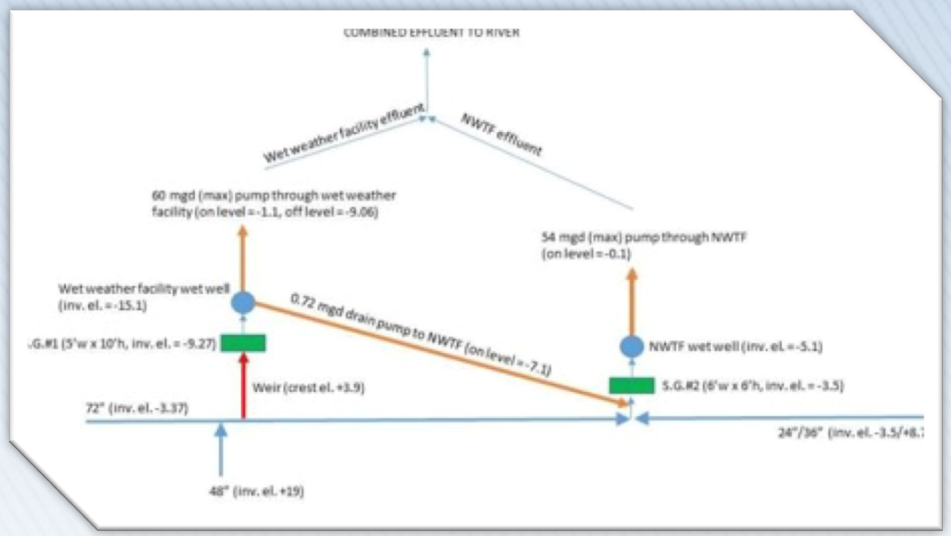
## Alternative 1 – Screens Discharge at EL. 36.0

# Equipment Selections

Alternative 1 – Screens Discharge at EL. 36.0

# Operational Solutions

- Hydraulic Modeling
  - existing conditions
    - flow to WWTF
      - theoretical
      - actual




  - proposed conditions
    - one & two screen operation
      - each screen - 60 MGD

# Operational Solutions

- SOP Review/Operator Input
  - influent gate
  - wet well levels
  - raw sewage pumps
  - secondary bypass

# Operational Solutions

- Automation of
  - third raw sewage pump & influent gate
    - third raw sewage pump
      - control via wet well level
    - influent gate control
      - **“storm event” virtual button**
      - gate to ready position
      - adjust influent gate to maintain
        - » wet well level - 8.0 feet
        - » influent flow - 50 MGD

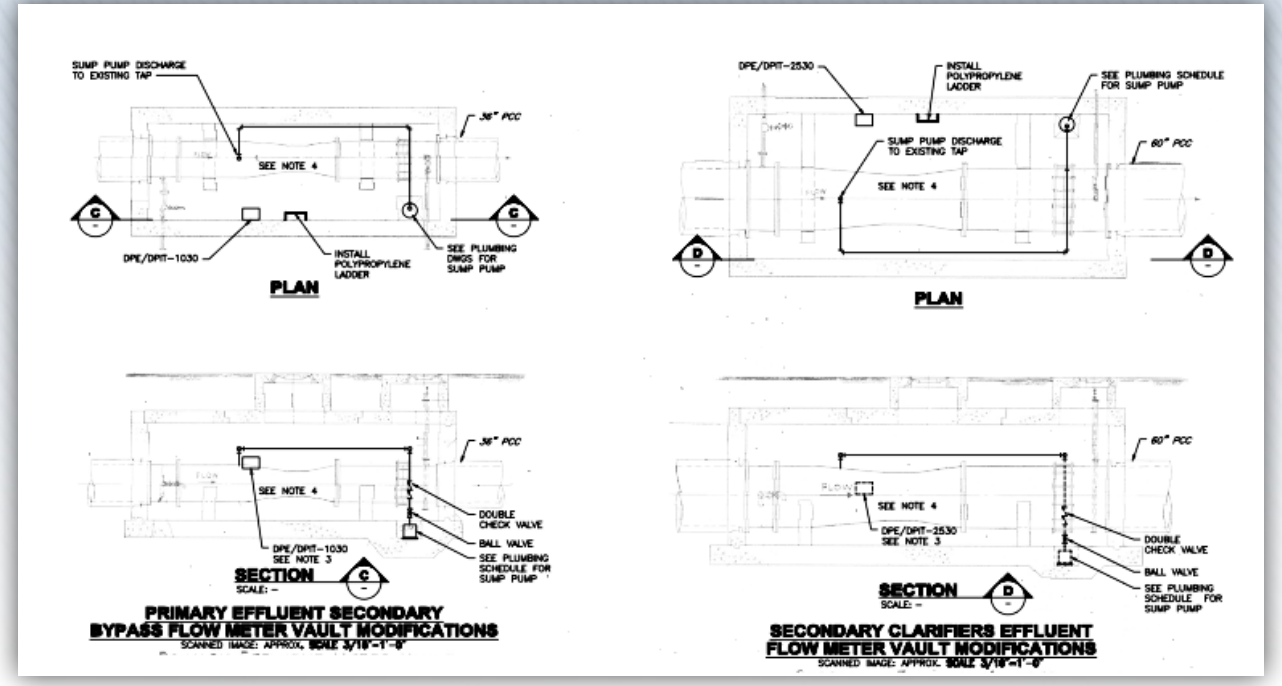
# Operational Solutions

- Automation of
  - secondary bypass gate operation
    - after third raw sewage pump started (~32 MGD)
    - **AND** wet well level 7.5-feet (rising)

| Storm Event Duration (hours) | Bypass Flow (MGD) | Secondary Flow (MGD) |
|---|---|---|
| ≤ 6 | 18 | 32 |
| 6 to 12 | 24 | 26 |
| ≥ 12 | 32 | 18 |

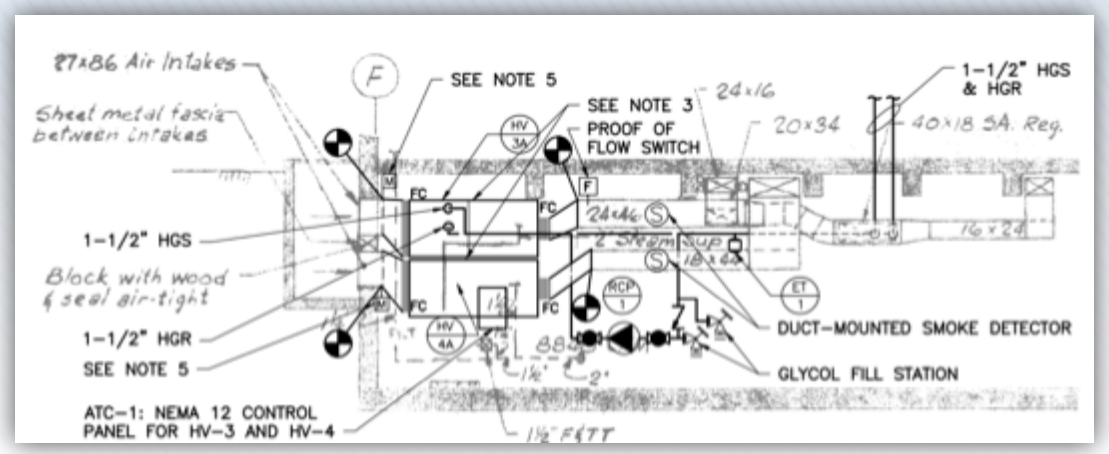
# Additional Improvements

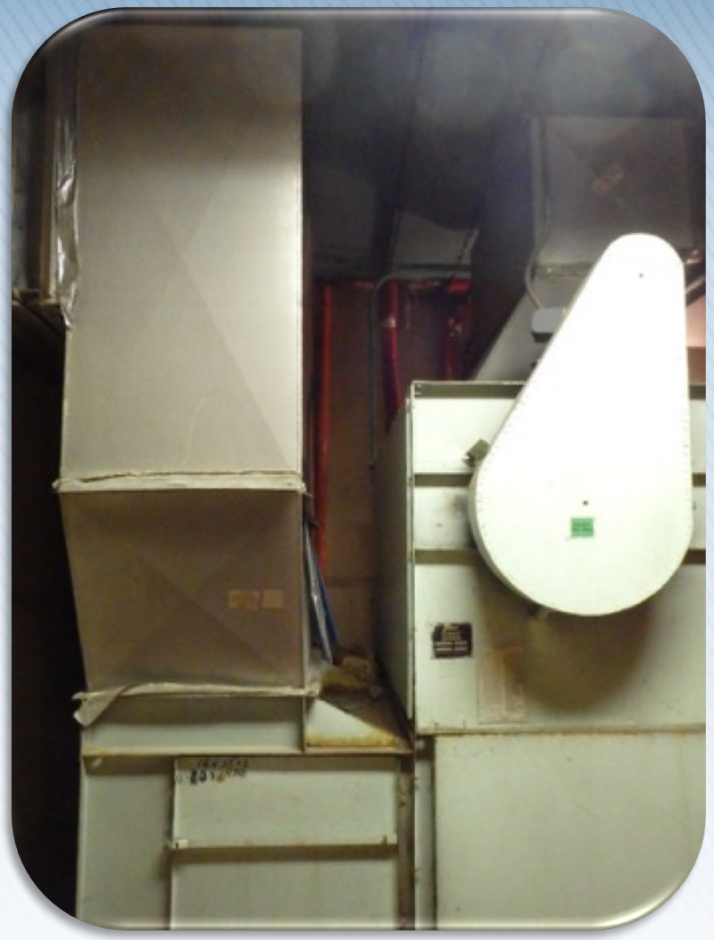
- Restore Existing Venturi Flow Meters
  - secondary effluent (60-inch)
  - secondary bypass (36-inch)



# Additional Improvements

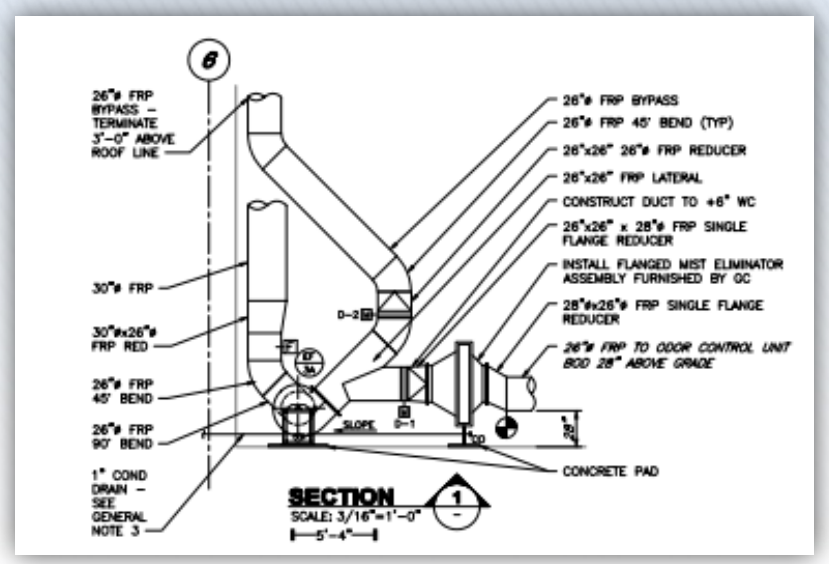
- Replace HVAC
  - wet well
  - dry well
  - ductwork



# Additional Improvements

- Replace
  - Aged MCCs
    - MCC-CB4
    - MCC-2
  - Wet Well Odor Control
    - fiberglass fan
    - new GAC
    - new bypass
    - new mist eliminator



# Project Overview/Status

Construction Cost: $2.85M

Engineering Cost: $0.65M

**Total Cost**: $3.50M

Currently 20% through Construction Budget

Substantial Completion: May 23, 2017

Final Completion: August 21, 2017

Currently 51% through Contract Time

# Questions

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