"Getting the Grit Out!"

At

Manchester NH's WWTP

Grit System Upgrade Project

Fred McNeill, Chief Engineer - City of Manchester's Environmental Protection Division

and

Steve Calabro, Associate - Stantec




CITY OF MANCHESTER
ENVIRONMENTAL PROTECTION DIVISION
DEPARTMENT OF PUBLIC WORKS

Stantec

Manchester Grit System Upgrade

Presentation Outline

- ✓ Manchester's Wastewater System overview
- ✓ Highlights of the design and constructed facility
- ✓ Issues during construction and startup
- ✓ Adjustments made to improve operations
- ✓ Lessons Learned

CITY OF MANCHESTER
ENVIRONMENTAL PROTECTION DIVISION
DEPARTMENT OF PUBLIC WORKS

Stantec

Manchester Wastewater System
Overview

- 385 Miles of sewers for Wastewater Collection
- 12 Pump stations
- 43 MGD Wastewater Treatment Plant

Approximately 50% of the collection system is combined (sanitary and storm water flows)

CITY OF MANCHESTER
ENVIRONMENTAL PROTECTION DIVISION
DEPARTMENT OF PUBLIC WORKS

Stantec

CITY OF Manchester NH

WWTP Overview

CITY OF MANCHESTER ENVIRONMENTAL PROTECTION DIVISION DEPARTMENT OF PUBLIC WORKS

Stantec

Grit System Upgrade Partners

EPD Team (Manchester's Environmental Protection Division)

Design Team

Stantec – Lead, with Brown & Caldwell, TF Moran

Construction Team

Keymont Construction – Prime with Ewing Electric, EII controls, John Egan Painting Co.

Major Equipment Suppliers

> JDV grit screws
> Gorman Rupp grit pumps
> Wemco hydrocyclones and classifiers
> Sanitaire air diffusers
> UltraFlote tank covers

CITY OF MANCHESTER
ENVIRONMENTAL PROTECTION DIVISION
DEPARTMENT OF PUBLIC WORKS

Manchester Grit System Upgrade

Highlights of the design and constructed facility

- ✓ Existing grit facility description
- ✓ *Facilities Plan as a starting point*
- ✓ *Existing vs new approach for grit removal*
- ✓ *Grit System Design Parameters*
- ✓ *Review of Major Equipment in the final design*

Stantec

Problems Caused by Grit at the Manchester WWTP

- *Large quantities of grit that occur from a combined system during a rainfall event make it difficult to keep grit removal equipment running properly.*
- *Grit causes premature wear of pumps and related equipment.*
- *Grit in the biological treatment system decreases removal rates by increasing the quantity of inorganic material.*
- **Ultimately grit ends up in the WWTP sludge incinerator where it decreased burning efficiencies.**

CITY OF MANCHESTER ENVIRONMENTAL PROTECTION DIVISION DEPARTMENT OF PUBLIC WORKS

Stantec

Manchester Grit System Upgrade

Existing Grit Facility /Approach

- Four aerated grit tanks constructed in 1976
- Modified in 1993.
- Used chain & bucket bottom scraper and elevator system.
- Maintenance issues:
  - Tension adjustments
  - Uneven skid shoe wear
  - Chain stretch

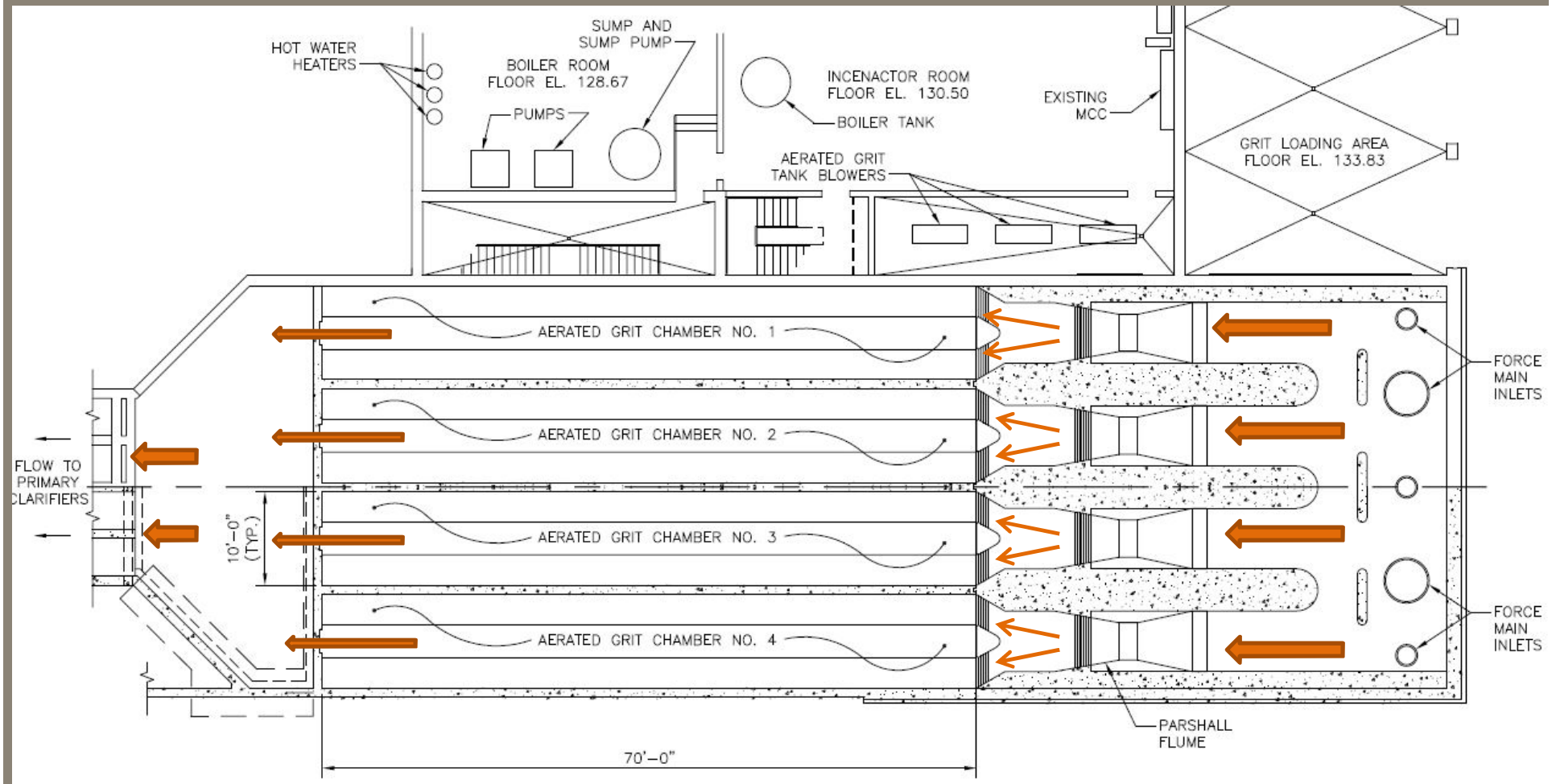
Frequent Operator Attention….

Only very course grit removal…

Stantec

Manchester Grit System Upgrade

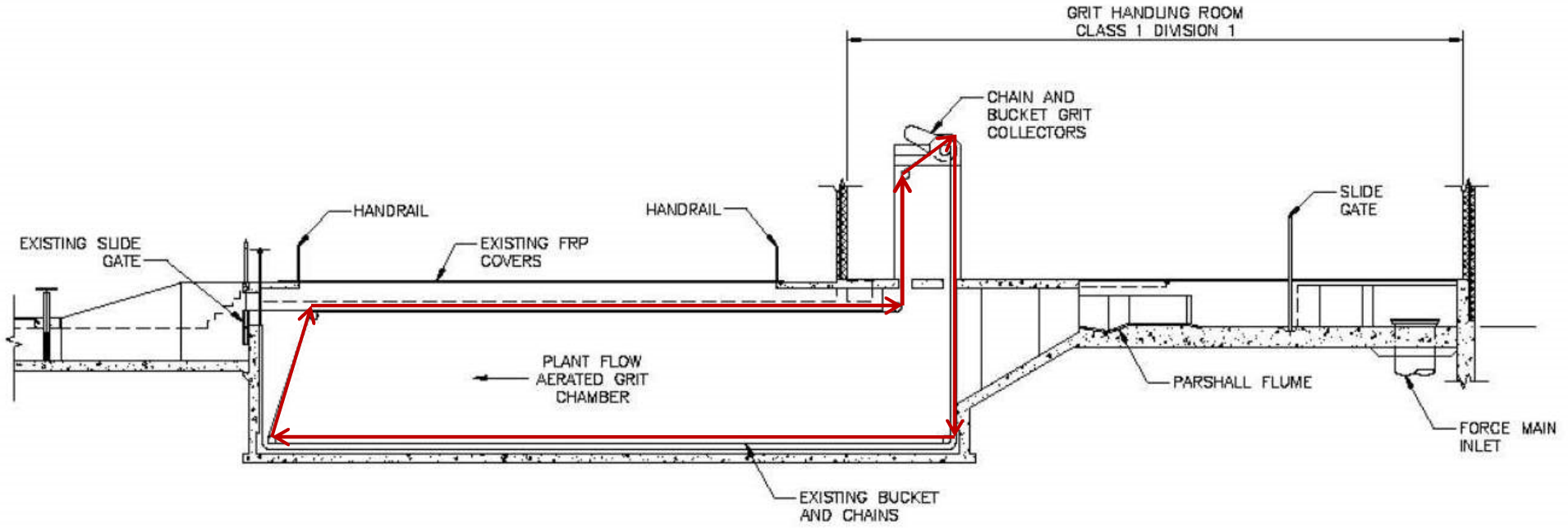
Existing approach for grit removal



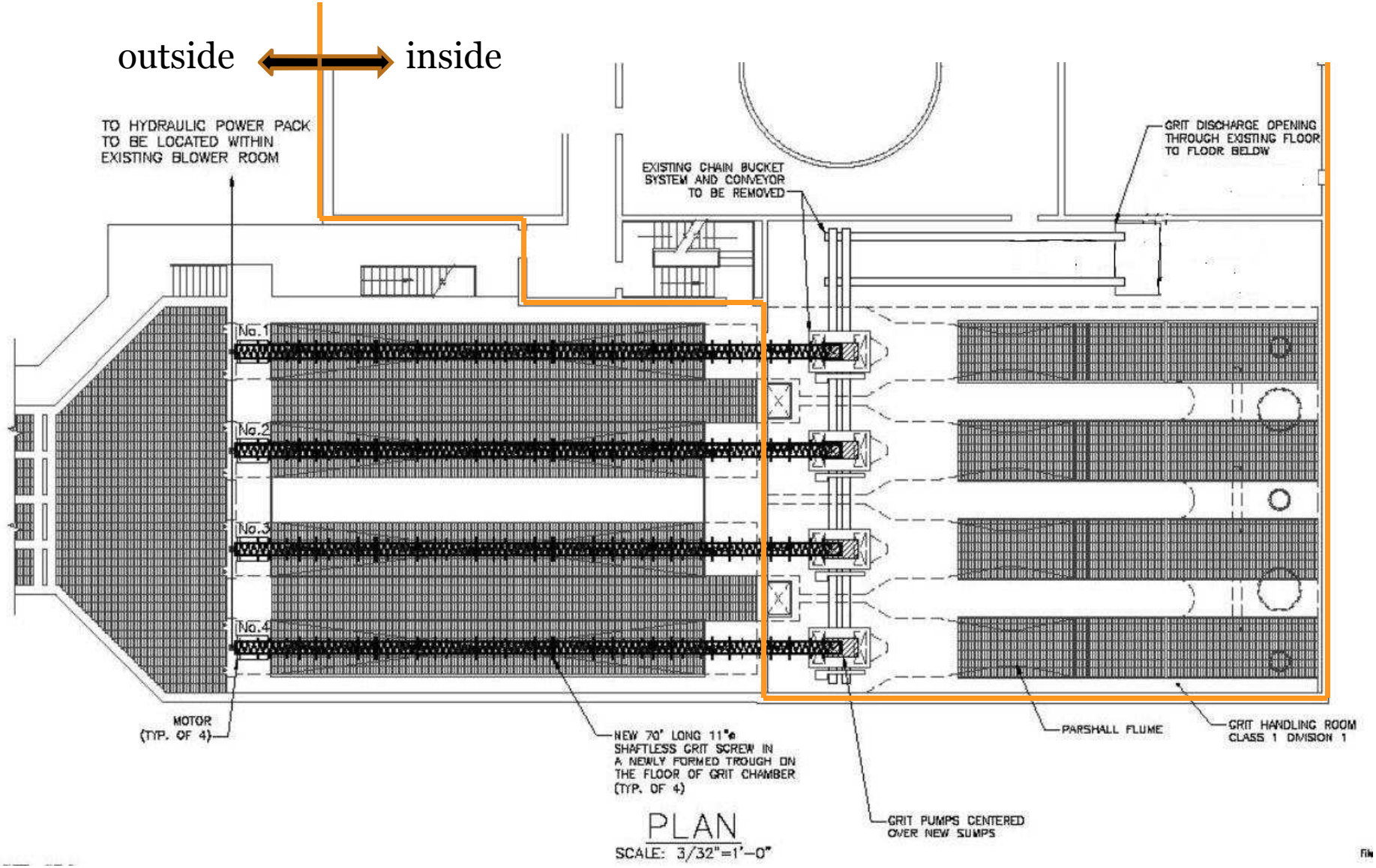
Stantec

Manchester Grit System Upgrade

Existing approach for grit removal



Stantec


outside
inside
TO HYDRAULIC POWER PACK TO BE LOCATED WITHIN EXISTING BLOWER ROOM
EXISTING CHAIN BUCKET SYSTEM AND CONVEYOR TO BE REMOVED
GRIT DISCHARGE OPENING THROUGH EXISTING FLOOR TO FLOOR BELOW
No.1
No.2
No.3
No.4
MOTOR (TYP. OF 4)
NEW 70' LONG 11"ø SHAFTLESS GRIT SCREW IN A NEWLY FORMED TROUGH ON THE FLOOR OF GRIT CHAMBER (TYP. OF 4)
GRIT PUMPS CENTERED OVER NEW SUMPS
PARSHALL FLUME
GRIT HANDLING ROOM CLASS 1 DIVISION 1
PLAN
SCALE: 3/32"=1'-0"

Stantec

Original Aerated Grit Tank Chain and bucket system

Stantec

Manchester Grit System Upgrade

Existing Facilities Plan as a starting point

Facilities plan recommended:

- *Replace the grit system equipment in-kind.*
- *Estimated cost of $5.6 Million.*
- *A grit classification study was completed but did not identify any unusual conditions.*

Stantec

Manchester Grit System Upgrade

Project Goals/Objectives

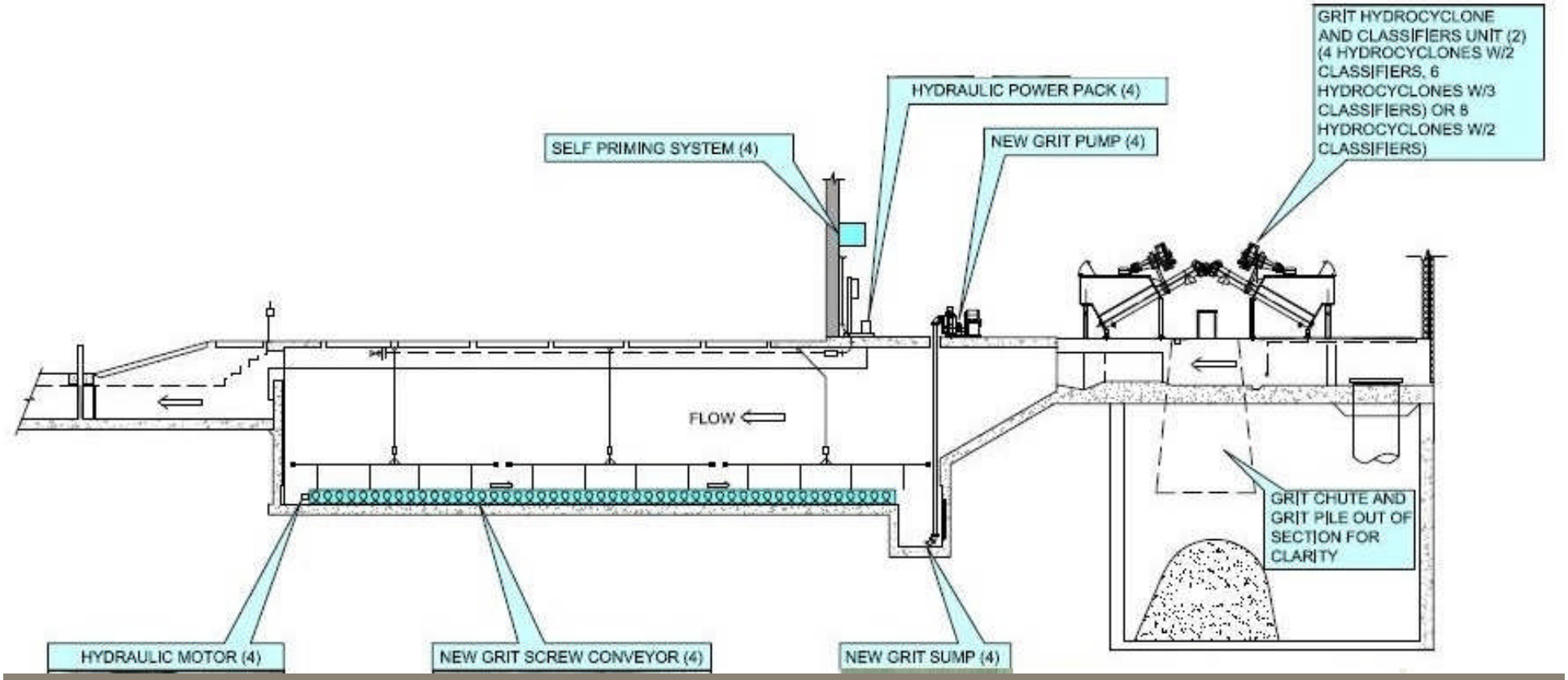
- ✓ *Install a grit collection and removal system that:*
  - *> Minimizes confined space entry .*
  - *> Reduces O&M requirements.*
- ✓ *System should provide at least the same or better grit removal efficiency.*
- ✓ *System should be designed to accommodate peak projected flow conditions.*

Consider a New Approach……

Stantec

Manchester Grit System Upgrade

New approach for grit removal



Stantec

Manchester Grit System Upgrade

Description of the final design

- ✓Submerged hydraulically driven grit screws to convey grit along the existing grit tank invert to a newly constructed grit sump.
- ✓Self-priming grit pumps to move grit from the sump out of the grit tank for processing.
- ✓Hyrdocylones and grit classifiers for grit washing and dewatering.
- ✓New course bubble diffusers and upgrades to the existing blowers.

Stantec

Manchester Grit System Upgrade

Description of the final design (continued)

- ✓ New transverse baffles added in each tank.
- ✓ New covers over the aerated grit tanks that can be easily removed .
- ✓ New fiberglass Parshall flumes with ultrasonic level/flow meters.
- ✓ New electrical equipment and instrumentation with pre-programmed modes of operation controlled by SCADA.

Stantec

Manchester Grit System Upgrade

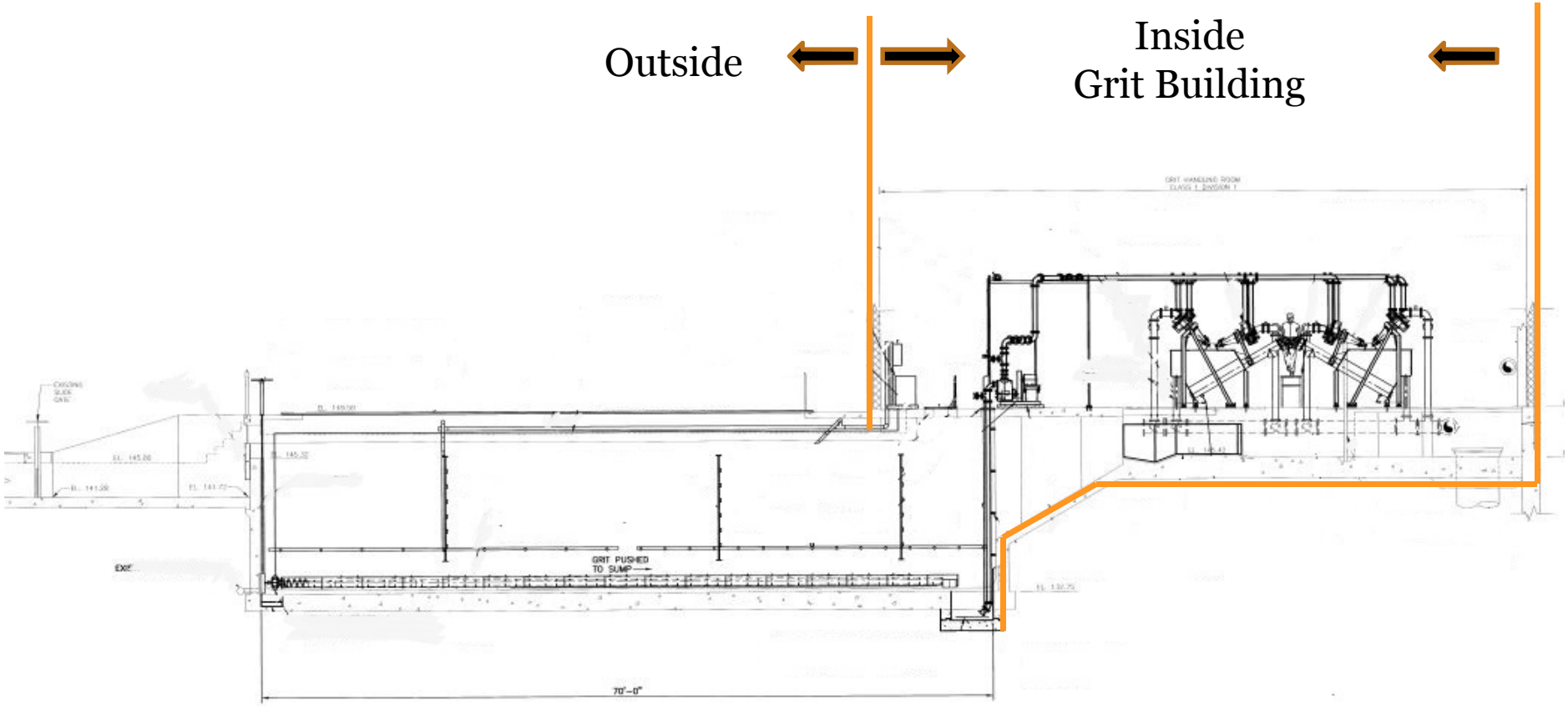
Design Parameters

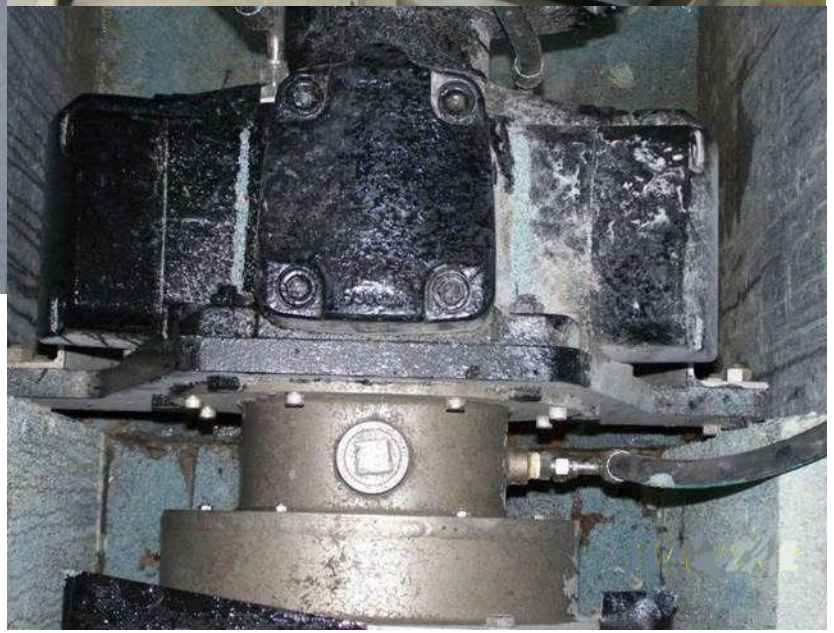
Criteria	Design Basis	
Manchester WWTF- Assumptions	**Peak**	**Average**
➢ Influent Flow	85 MGD	32.1 MGD
➢ Aerated Grit Chambers Operating	4 of 4	3 of 4
Grit – Total Production	**Peak**	**Avg.**
➢ Dewatered Grit Volume	1275 ft^3/day (53 ft^3/hr)	19.3 ft^3/day
➢ Dewatered Grit Weight(2)	70 tons/day (2.9 tons/hr)	1.1 tons/day
➢ Time to fill 30 Cu yard Dumpster	0.6 days (15 hours)	42 days
➢ Time to fill 30 Cu Yd Dumpster		2.8 days

Review of Major Equipment

- Submerged Grit Screws
- Grit Pumps
- Hydrocyclones and Grit Washers

Stantec


Outside
Inside
Grit Building
GRIT PUSHED
TO SUMP
70'-0"



- Shaftless Grit Screw
- Hydraulic Motor
- Hydraulic Power Pack

Stantec

Grit Pumps

- Gorman Rupp Self-Priming Pumps
- Four pumps total
- Pumps fitted for grit service
- 350 gpm at ____ TDH

Stantec

Hydrocyclone and Grit Classifier Units

- 2 - Classifiers
- 8 – Hydrocyclones

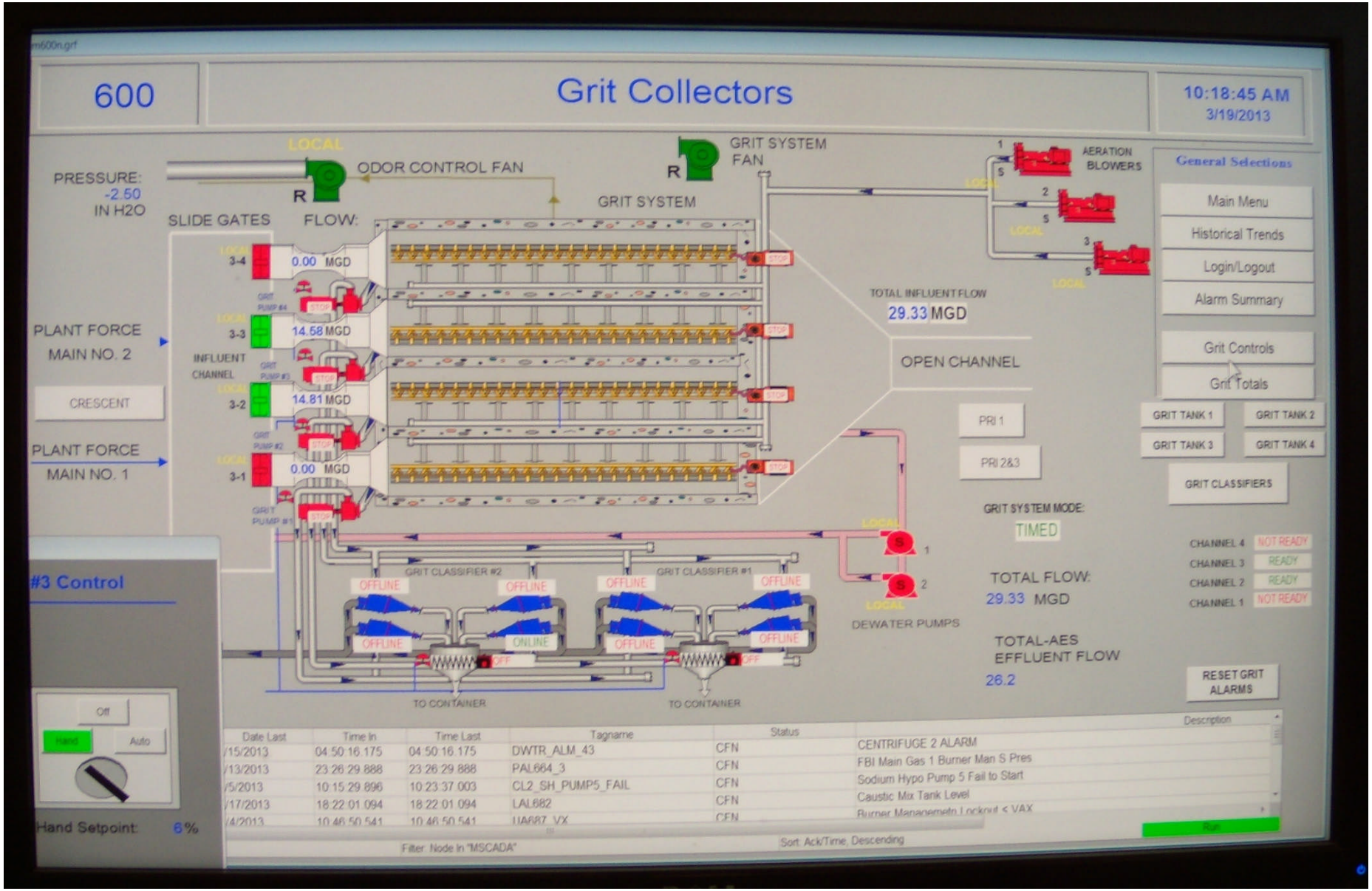
1 hydrocyclone on each classier for each of the 4 grit tanks for full redundancy

Stantec

Aerated Grit Tank Baffles

- Intended to prevent short circuiting of suspended Grit

Stantec



Grit System SCADA Screen

Stantec

Manchester Grit System Upgrade

Issues during construction and startup

- *How many grit tanks must remain in service?*

  …..Spring high flows a concern….

- *Equipment lead times*

- *Experiencing the grit wave during construction*

Stantec

The Grit Wave

Grit builds up in the system very quickly as flows increase due to storm events.

Stantec

Manchester Grit System Upgrade

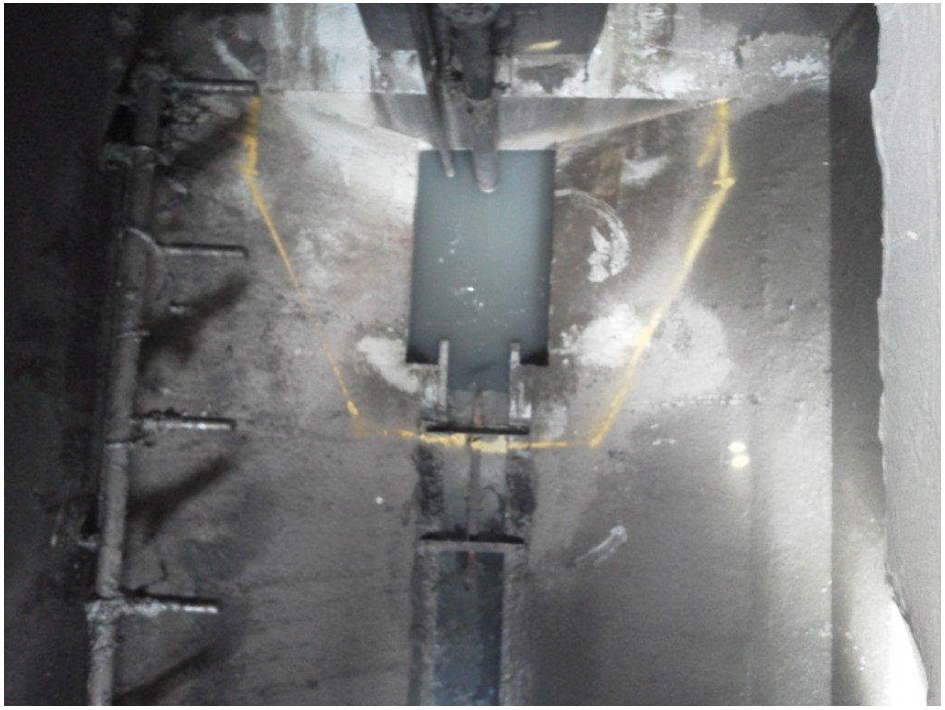
Lessons Leaned / Adjustments made

- *Adjusted equipment operating set-points.*
- *Added fluidizing water flow indicator.*
- *Added hydrocyclone clogging alarms.*
- *Replaced grit pump suction elbow with Tee.*
- *Added Grit Sump Baffle/Cover.*

Stantec

Grit Sump Cover

Prevents the wave of grit from inundating the grit sump at the start of a storm event.



Stantec

How does the System Operate?

Four Modes of Operation Available using SCADA:

Mode 1: Manual Startup and Shutdown Control
(Operator initiated)

Mode 2: Time Based System Automatic Start-Stop
(with Storm flow override).

Mode 3: Flow Rate Automatic Start-Stop

Mode 4: Total Flow Based Automatic Stop-Start

Not all modes must be used – some experimentation is required to determine which mode works best for certain conditions and possibly times of the year

Manchester Grit System Upgrade

Project Summary

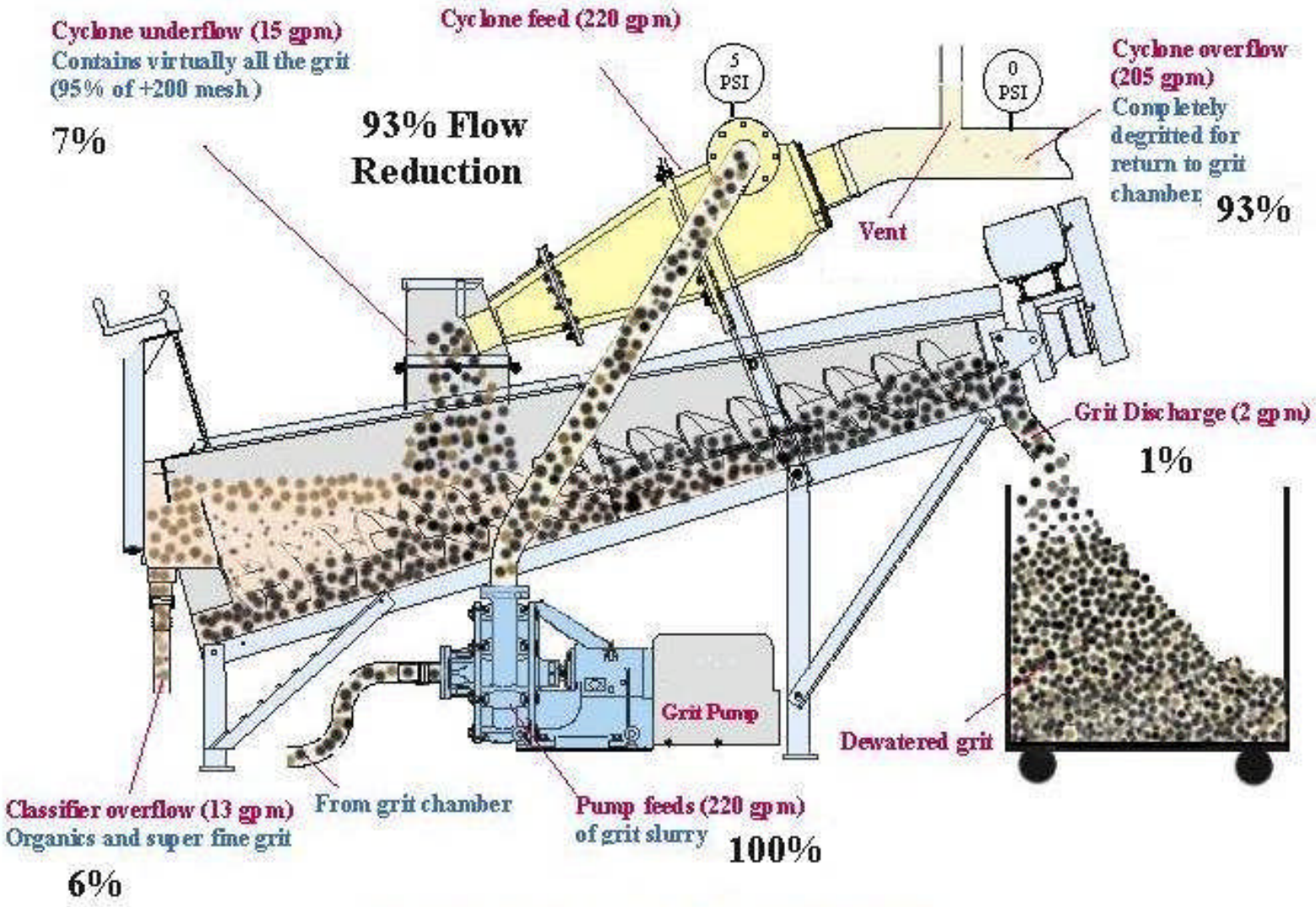
Project Cost	• Final cost at 3.85M vs 5.0 M budget
Grit Removal	• Improved grit removal vs old system
O & M	• Significant O&M still required
Peak Grit Event	• Peak grit events can be handled

Stantec

Questions/ Open Discussion

Thank You For Your Time

Cyclone & Grit Classifier Process



HOW IT WORKS—MASS BALANCE

Stantec