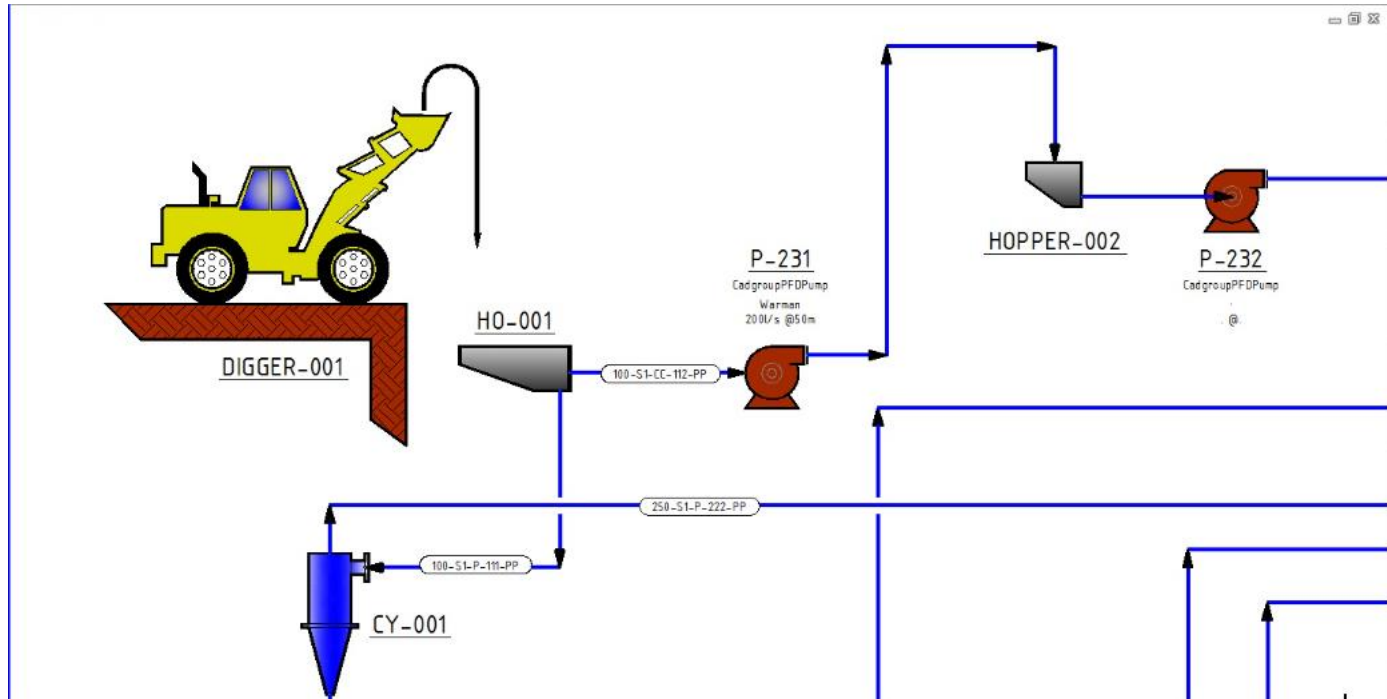


# Process Flow / Instrumentation Drawings – P&FD / P&ID



It's a detailed story told through *Symbology*

Version – 1.1, October 2020



American Water Works Association  
**Pacific Northwest** Section

Prepared by the Training Coordination  
Committee, PNWS-AWWA

# Acknowledgements:

**Author:**

**Butch Perry | KCWTD Infrastructure Coordinator  
(retired)**

**Today's Presenters:**

**Kenny Packard – HDR**

**Jeff Lundt – KCWTD (almost retired)**

## *Symbology*

*An 1877 dictionary defines the word as "the art of  
expressing through symbols."*

**Content & Goals:**

- To provide an understanding of what process flow and instrumentation drawings can tell us about how things work

# Outline:

## Workshop topics

### Understanding a P&ID Layout

- The difference between P&ID and PFD
- Symbology
- Equipment
- Piping that connects the equipment
- Lines and instruments used to monitor and control the process

# Symbols – They Tell a Story



Sign of power –  
worn by chiefs

Toki



Koru

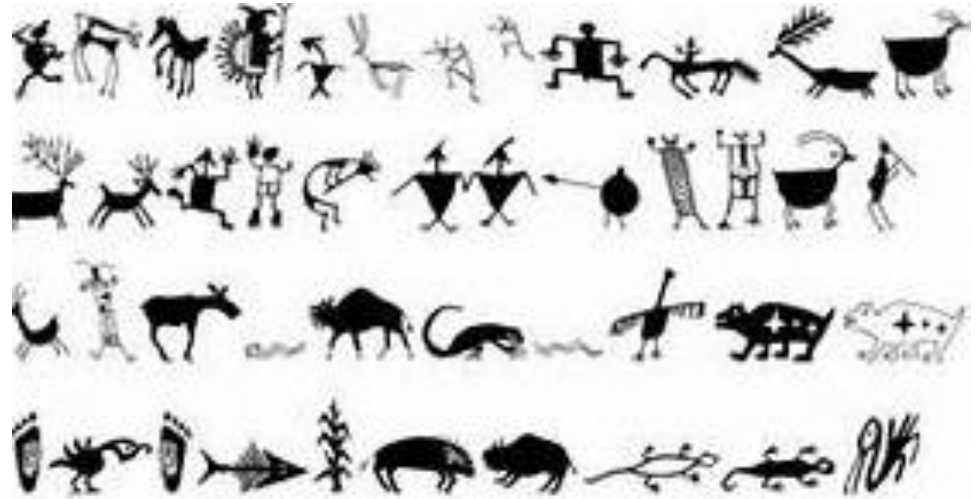
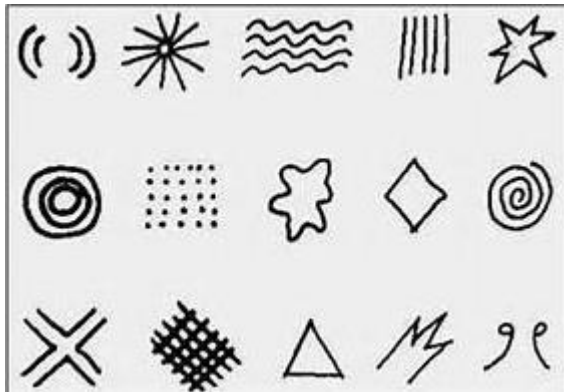
New life, growth,  
strength, and  
peace



Strength, good  
luck, and safe  
travel across  
water

Hei-Matu

# Symbols & Story Telling



# Evolution of Symbols



# The Basics

- There is a national standard for symbols
  - **AutoCAD P&ID ISA** – [International society of automation](#)
  - **AutoCAD P&ID PIP** – [Process Industry Practices](#)
  - **AutoCAD P&ID ISO** – [International Organization for Standardization](#)
- Plus many user (or designer) defined “unique” symbols
- Symbols change over time
  - Get the symbol guide for when the drawings were developed

# Where Can P&IDs Used?

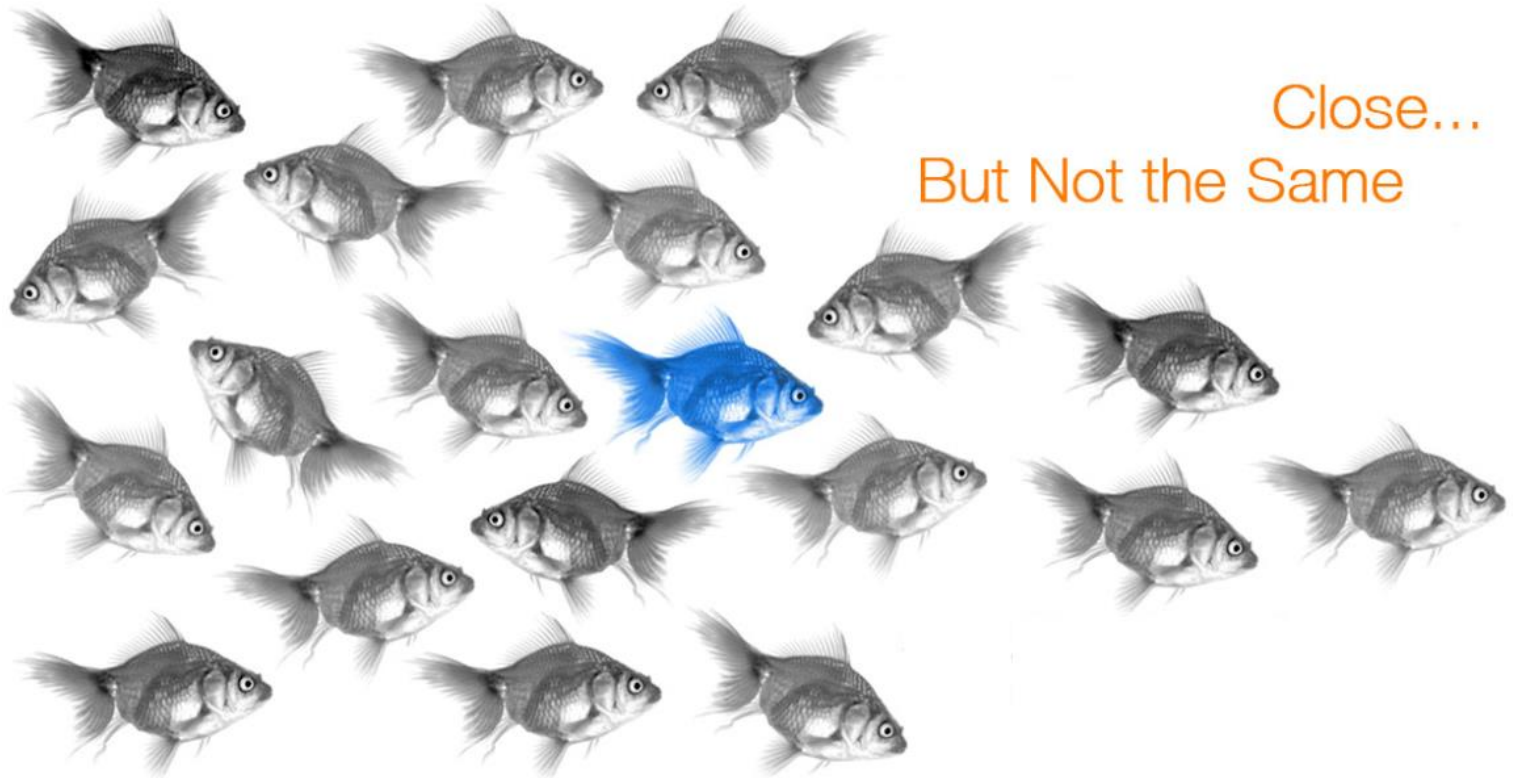
- Everywhere in our conveyance and treatment systems:
  - Operator training
  - Developing SOPs
  - Process troubleshooting
  - Distribution/conveyance information
  - Storage information



# Where Can P&IDs Used?

- Everywhere in our conveyance and treatment systems:
  - Chemical feed systems
  - Hazard monitoring – type and location
  - Sampling type and location
  - Security
  - Auxiliary services

# PFD / P&ID Differences



Close...  
But Not the Same

# The Process Flow Diagram

- Shows the flow of process or chemical materials and the equipment involved in the process.
- Shows the relationships between the major components in the system and doesn't show details.
- Sometimes used for visitor information and new employee training.

# A PFD should include:

- Process Piping



PRIMARY PROCESS FLOW

- Major equipment symbols, names and identification numbers



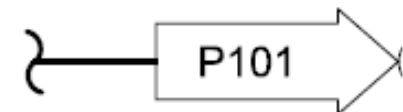
PUMP,  
PERISTALTIC

- Control, valves and valves that affect operation of the system



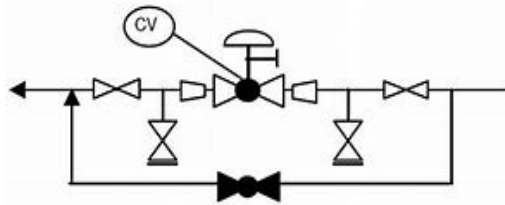
BUTTERFLY VALVE

- Interconnection with other systems



## A PFD should include:

- Major bypass and recirculation lines



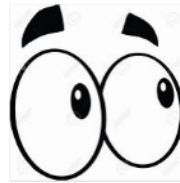
- Sometimes system ratings and operational values as minimum, normal and maximum flow, temperature and pressure
- Composition of fluids

# More Basics

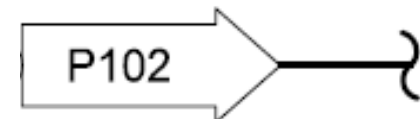
- Process always flows from left to right



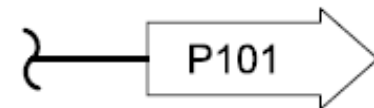
- The whole process doesn't always fit on one drawing

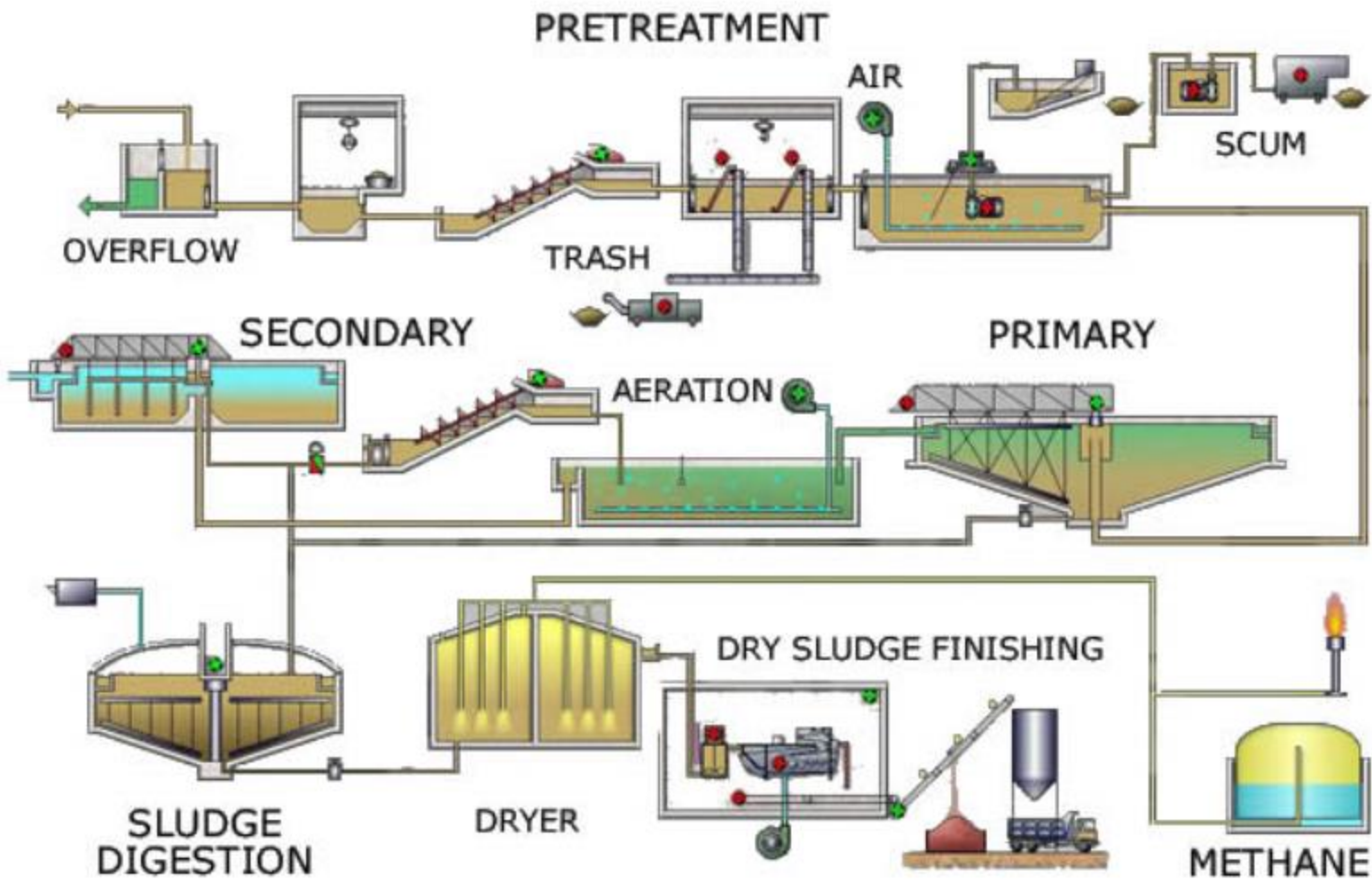


- Drawing numbers on the left side tells where the process is coming from

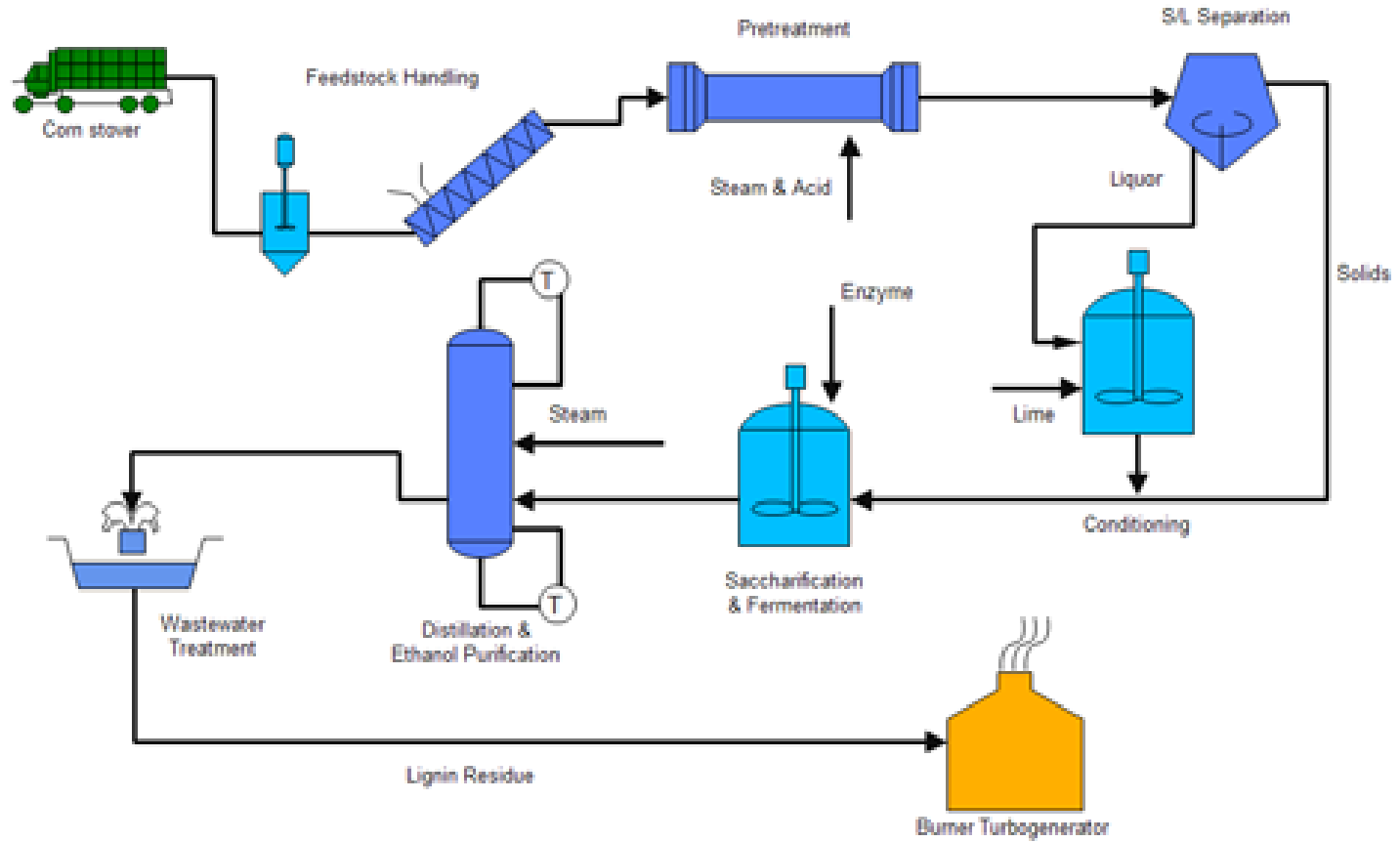


- Drawing number on the right side tells where the process is going to



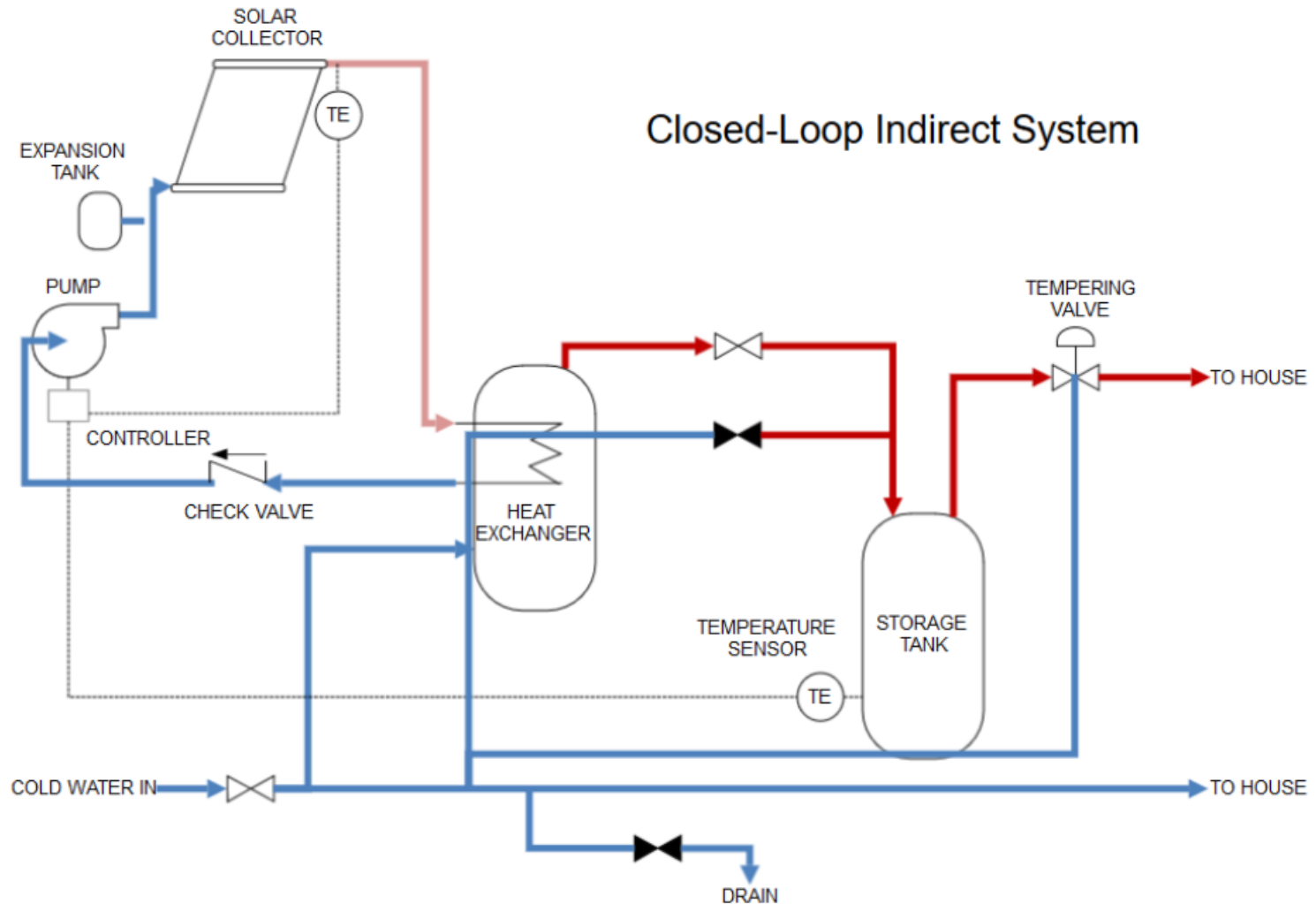


# Simple Process Flow

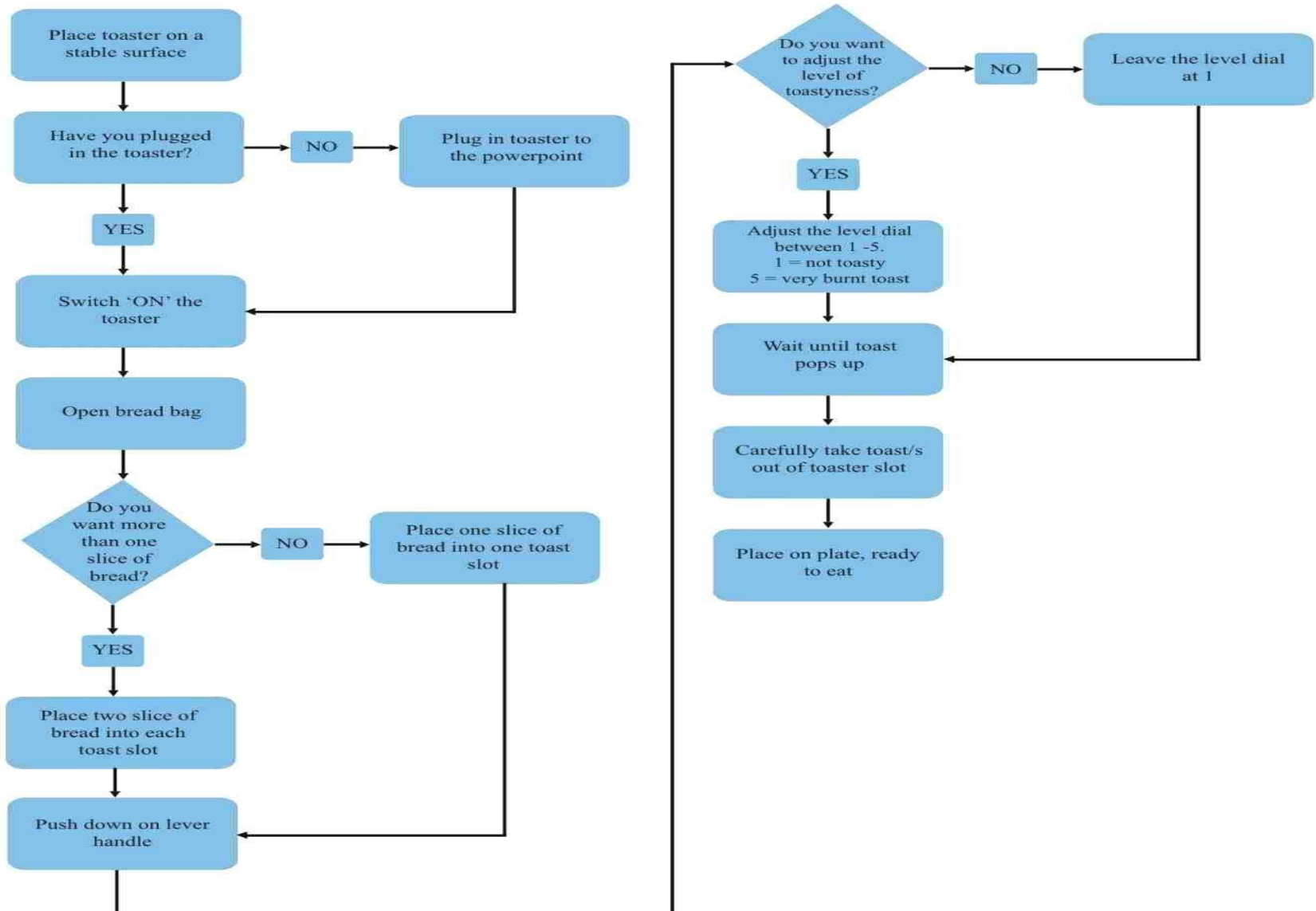




# Process Flow Diagram



# How To Make Toast



# The Process & Instrumentation Diagram

- Process & Instrumentation Diagram (P&ID) show what is in the PFD
  - **plus** the instrumentation to monitor the process
  - **plus** how it is controlled.
- A P&ID shows the relationships between the all components in the system and shows details.
- P&IDs are applied in programming, startup and trouble shooting.

# How A P&ID is Set Up

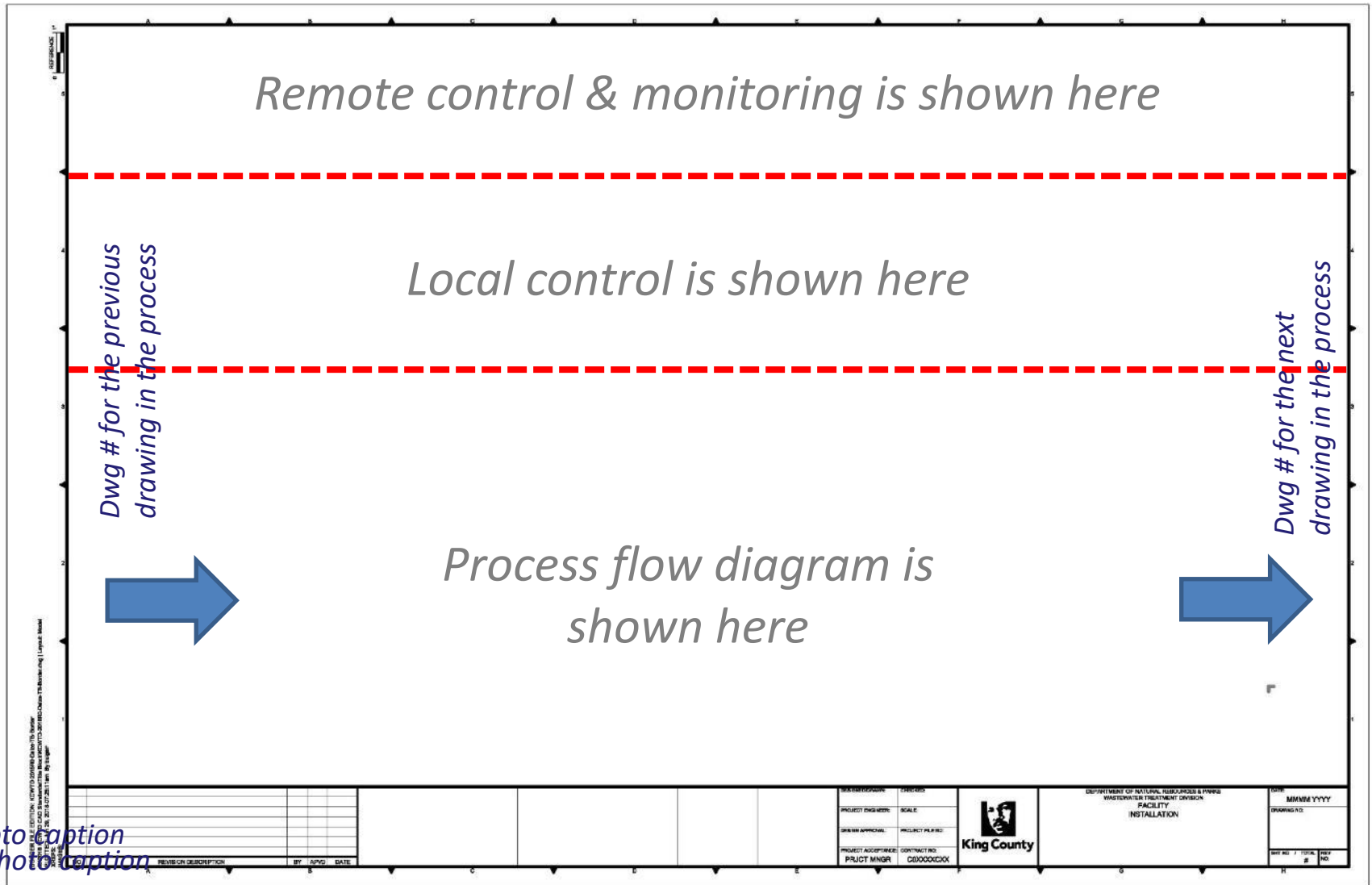


Photo Caption  
Photo Caption

# A P&ID Should Include:

- Instrumentation and designations
- Mechanical equipment with names & numbers
- All valves & their identifications
- Process piping, sizes & identification

# A P&ID Should Include:

- Miscellaneous – vents, drains, special fittings, sampling lines, reducers & increasers
- Permanent start-up & flush lines
- Flow directions

# A P&ID Should Also Include:

- Interconnections references
- Control inputs and outputs, interlocks Interfaces for class changes
- Quality level
- Annunciation inputs

# A P&ID Should Also Include:

- Computer control system input
- Vendor and contractor interfaces
- Identification of components and subsystems delivered by others
- Intended physical sequence of the equipment



# A P&ID Should Not Include:

- Equipment rating or capacity
- Manual switches and indicating lights
- Primary instrument tubing and valves

# A P&ID Should Not Include:

- Pressure temperature and flow data
- Elbows and similar standard fittings
- Extensive explanatory notes

# P&IDs Work With the Process Narratives

- Process narrative is the text description of the process, instrumentation, monitoring & control

- **Operating set points**
- **Decision trees**
- **Describes the process**

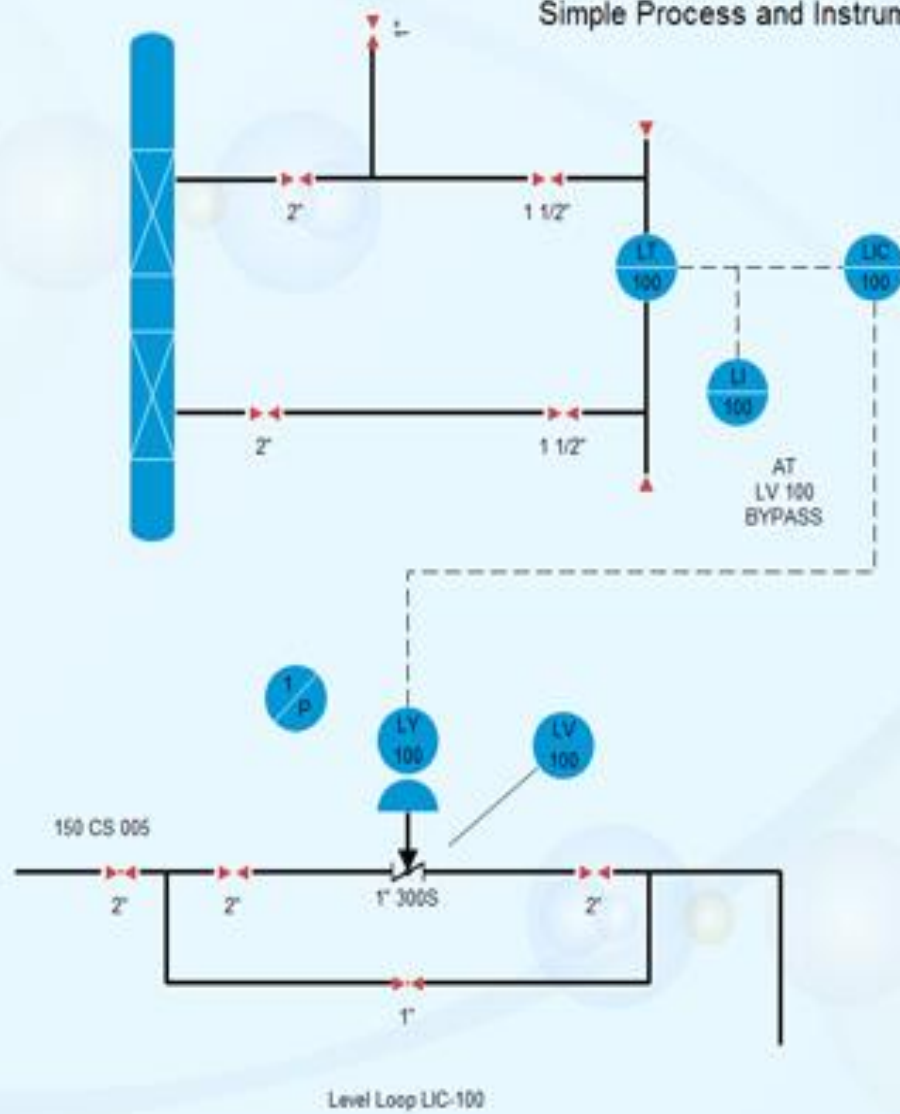
- **Describes the equipment**
- **Manual operation**
- **Automatic operation**

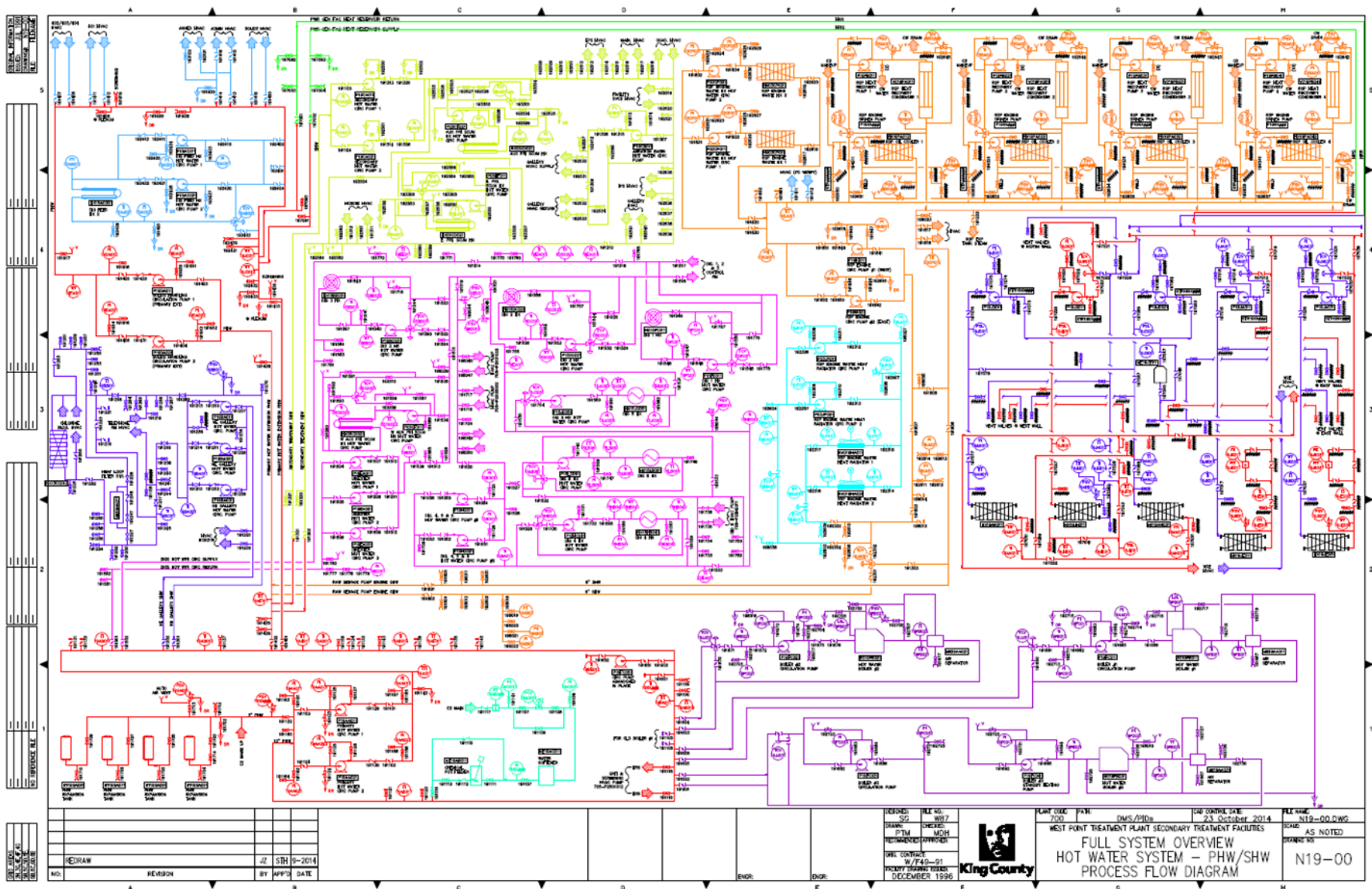
# Who Uses P&IDs?

***YOU DO!*** When:

- Planning a project
- Writing a job safety analysis (JSA)
- Lockout before a repair or maintenance
- Troubleshooting when problems arise
- Process hazard review
- Training new employees

### Simple Process and Instrument Diagram





Graphic from KCWTD

Color can help understanding

# What The Parts Tell Us – Title Block

ORIGINAL INFORMATION	ISSUED: AUG 1991	DRAWING#: N16-03	FILE: 11600P400.PID
----------------------	------------------	------------------	---------------------

PLANT CODE: 708	PATH: DMS/PIDS	CAD CONTROL DATE: 21 January 2015	FILE NAME: N16-03.DWG
WEST POINT TREATMENT PLANT SECONDARY TREATMENT FACILITIES			SCALE: NONE
DIGESTER 1 GAS SYSTEM			DRAWING NO: N16-03

NO:	REVISION	BY	APP'D	DATE
13	ADDED MISSING FA VALVES PER CWL 1178	JLR	BNS	JAN 15
12	INCORPORATED REVS FROM C00583C11 – CWL1137	SRK	JLR	JAN 11
11	ADD VALVE NUMBERS – CWL 1067	STH	STH	JUL 13
10	ADDED DUAL FLAME ARRESTOR PER T300337 – CWL 890	JLR	JLB	NOV 12

DESIGNED: DCS	FILE NO.: W87
DRAWN: LJL	CHECKED: RHS
RECOMMENDED:	APPROVED:
ORIG. CONTRACT: W/F57-91	
FACILITY DRAWING ISSUED: DECEMBER 1997	



*Images from KCWTD*

# Abbreviations

## FLOW STREAM IDENTIFICATION

AA	ADJ. LOW PRESSURE PROCESS	3A	AIR, INSTRUMENT
AP	AIR, HIGH PRESSURE PROCESS	JM	WATER, JACKET
AP	AIR, PURGE	L2R	LIQUE. OIL RETURN
AR	AIR RETURN	LOS	LIQUE. OIL SUPPLY
AS	AIR, STARTING	LOS1	LOX MAKE
ASD	DRAIN, AIR SEPARATOR	LOS2	LOX PRODUCT
ASP	AIR SUPPLY	LOS3	LOX ADDITION
BS	SLUDGE, BLENDING	LOS4	LOX TRANSFER
C1	WATER, POTABLE CITY	LOS5	LOX WITHDRAWAL
C2	WATER, NONPOTABLE CITY	LOS6	LOX PRESSURE BUILD
C3	PLANT EFFLUENT	LPO	POLYMER LIQUID
CDN	CENTRATE	LSD	LIQUID, LOW PRESSURE
CFE	CHLORINATED FINAL EFFLUENT	ML	MIXED LIQUOR
CL	CHLORINE DIOXIDATION	MSG	NEGOTIATED GAS, MEDIUM PRESSURE
CLG	CHLORINE GAS	N	NEUTER
LL	CHLORINE LIQUOR	NAHR	CHLORINE HYPOCHLORITE
LLS	CHLORINE SOLUTION	OA	AIR, OUTSIDE
CLV	CHLORINE VACUUM	O	OVERFLOW
CRN	DRAIN, CHEMICAL RESISTANT	P	PROGRAMME
CRV	VENT, CHEMICAL RESISTANT	PR	PUMPED DRAINAGE
CSC	CITY CHLORINE	PRD	PRIMARY EFFLUENT
DM	CITY WATER	PRM	WATER, PRIMARY LOOP HEATING
CWR	CHILLED WATER RETURN	POI	POLYMER SOLUTION (THICKENING)
CWS	CHILLED WATER SUPPLY	POD	POLYMER SOLUTION (HEATING)
DEA	DECA-ORINATED FINAL EFFLUENT	POV	POLYMER DRY
DH	WATER, DEIONIZED	PS	SLUDGE, PRIMARY
DIW	WATER, HOT POTABLE	PSG	SOLN. PRIMARY
DIP	DIGESTER OVERFLOW	PSK	PRIMARY SOLN UNDERFLOW
DR	DRAIN PROCESS	PWR	POWER
DS	SLUDGE, DIGESTED	RAS	SLUDGE, RETURN ACTIVATED
DSC	DIGESTED SLUDGE CLEANING	RD	DRAIN, ROOF
DSP	DIGESTED SLUDGE FLUSHING	RS	RAW SLAGGE
DUL	SLUDGE, DENOURED	RW	REUSE WATER
DUR	SLUDGE, RECYCLED DIGESTED	SA	AIR, SERVICE
DST	SLUDGE, TRANSFERRED DIGESTED	SAM	SAMPLE
DW	WATER, RECYCLED	SB	SODIUM BISULFITE
EA	AIR, EXHAUST	SCS	SODIUM SULFATE SOLUTION
EB	EMERGENCY BYPASS	SEC	SCREENING
EE	ENGINE EXHAUST	SDN	DRAIN, STORM
ED	VENT, EXHAUST GAS	SE	SECONDARY EFFLUENT
EGS	ENGINE GEN. SET GAS FUEL	SE	WATER, SECONDARY LOOP HEATING
FC	FERRIC CHLORIDE (SOLN)	SFC	STRAINED PRIMARY EFFLUENT
FD	DRAIN, FOUNDATION	SE	SOLIDS RETURN
FE	FINAL EFFLUENT	SS	SANITARY SEWER
FLT	TRENCHING, TILTRATE	SSC	SOLN. SECONDARY
GOR	GATE OPERATOR HYDRAULIC OIL RETURN	T	TELEPHONE
GOS	GATE OPERATOR HYDRAULIC OIL SUPPLY	TS	SLUDGE, THICKENED BLENDING

DG	DIGESTER GAS
DH	DOMESTIC HOT WATER
DIW	DEIONIZED WATER
DR	DRAIN
DS	DIGESTED SLUDGE
DSF	DIESEL FUEL

## ABBREVIATIONS & LETTER SYMBOLS

1-2	1-2 LEAD SELECT	LNR	LOWER
123	SELECT LIQUOR 3	MOD	MODULATE-CLOSE
1234	SELECT LIQUOR 4	MOR	MANUAL OFF-REMOTE
12345	SELECT LIQUOR 5	MSD	MASTER SHUT DOWN
AC	ALTERNATING CURRENT	MY	MANIPULATED VARIABLE
ADR	ADJUSTABLE SPEED	OC	OPEN-CLOSE
ALRY	ALKALINITY	OCA	OPEN-CLOSE-AUTO
AM	AUTO-MANUAL	OCN	OPEN-CLOSE-REMOTE
AS	ADJUSTABLE SPEED	OD	OIL
ASS	AUTO-START-STOP	ON	ON
BSN	REASON	ODD	ON-OFF
B-N-A	BYPASS NORMAL AUTO	ODA	ON-OFF-AUTO
B-N-A-R	BYPASS NORMAL AUTO REDUCULATE	ODR	ON-OFF-REMOTE
BEAR	BEARING	ORP	Oxidation-Reduction Potential
CA	CLOSE-AUTO	OSP	OPEN-STOP-CLOSE
CAL	CALIBRATION, CALIBRATE	OSR	OPEN-STOP-REVERSE
CL	CHLORINE (TYPICALLY USE STANDARD CHEMICAL ELEMENT ABBR)	OUT	OUT
COO	CHEMICAL OXYGEN DEMAND	OUT	OUT
COUPL	COUPLING	P	PERMITTION
CS	CONSTANT SPEED	PET	PLANT EMERGENCY TRIP
CST	CONTROL START	PH	HYDROGEN ION CONCENTRATION
CT	CLOSED TRIPPED	PLUG	PLUGGED
CTL	CONTROL POWER	PRD	PERCENT PURITY
DC	DIRECT CURRENT	PV	PROCESS VARIABLE
DESS	DESSALINATED OXYGEN	PMR	POWER
EAT	VOLTAGE TO CURRENT	RAS	RACIE
ENL	EMERGENCY STOP	REN	REAR
ES	EMERGENCY STOP	REAR	REAR
ETM	ELAPSED TIME METER	REMT	REMOTE
F/R	FORWARD-REVERSE	REV	REVERSE
FAB	FAIL	RES	RESET
FC	FAIL CLOSE	SECS	SECURE EVENT
FCLZ	FREE CHLORINE RESIDUAL	SEL 1	SELECTION 1
FZ	FAIL INDICATOR	SEL 2	SELECTION 2
FL	FAIL LAST POSITION	SEL 3	SELECTION 3
FLO	FLOOD (DRYWELL FLOOD)	SEL 4	SELECTION 4
FO	FAIL OPEN	SEL 5	SELECTION 5
FRW	FORWARD	SP	START POINT
FRT	FRONT	S/S	START-STOP
HPS	HYDROGEN SULFIDE	S/S/R	START-STOP-REVERSE
HR	HIGH	SS	SUPERHEATED SOLIDS
MA	MANUAL	STOP	STOP
MR	MEDIUM	START	START
NOA	NON-OFF-AUTO	START	START
ROR	REAR OFF-REMOTE	SURG	SURGE
NOV	NON-VOL	SYS	SYSTEM
E & C	INSTRUMENTATION & CONTROL	TCL	TOTAL CHLORINE RESIDUAL
I/C	CURRENT TO CURRENT	TEST	TEST
LP	CURRENT TO PNEUMATIC	TMC	THERMAL MASS FLOWMETER
DN	DOWN	TOA	TEST-OFF-AUTO
JOG	LOCAL	TOC	TOTAL ORGANIC CARBON
L/R	LOCAL-REMOTE	TOD	TOTAL OXYGEN DEMAND
LOC	LOCAL	TREBL	TREUBLE
LCL	LOWER EXPLOSIVE LIMIT	TREP	TRIPPED BREAKER
LOC	LOCKED GATE	TURB	TURBIDITY
LOL	LOW LOW	V/E	VOLTAGE TO CURRENT
LOLD	LOCAL OFF-REMOTE	WNO	WARNING
LOS	LOCKOUT STOP	+	PACKAGE SYSTEM
		++	SPECIFIED IN DIVISION 16 - ELECTRICAL

PIT	PRESSURE INDICATING XMITTER
PLC	PROGRAMMABLE LOGIC CNTRLER
PS	PRESSURE SWITCH
PSH	PRESSURE SWITCH HIGH
PSHH	PRESSURE SWITCH HIGH-HIGH
PSHL	PRESSURE SWITCH HIGH-LOW
PSL	PRESSURE SWITCH LOW
PSLL	PRESSURE SWITCH LOW-LOW

## EQUIPMENT TAG PREFIX

ACC	AREA CONTROL CENTER
ACP	AREA CONTROL PANEL
AD	AIR DRYER
ANN	ANNUNCIATOR
ASU	AIR SUPPLY UNIT
ATS	AUTOMATIC TRANSFER SWITCH
B	BLOWER
BAC	BACKFLOW PREVENTER
BAT	BATTERY
BGA	BASEBOARD ELECTRIC HEATER
BC	BATTERY CHARGER
BD	BOILER
BP	BUBBLER PANEL
BS	BAR SCREEN
C	CRANE
CC	CONDUIT BREAKER
CC	COOLING COILS
CCU	CATAO CONTROL UNIT
CEP	CENTRIFUGE
COLL	COLLECTOR
CON	CONVEYER
CPH	COMPRESSOR
CS	DOOR LEVELER
DPL	DISTRIBUTION PANEL BOARD 120 1/200 VOLTS
DPS	DISTRIBUTION PANEL BOARD 277 1/400 VOLTS
DT	DROP TRAP
EX	DIRECT EXPANSION COIL
E	ENGINE
ECP	ENVIRONMENTAL CONTROL PANEL
EF	EXHAUST FAN
EM	EMERGENCY GENERATOR
EL	ELEVATOR
ET	EXPANSION TANK
F	FAN
FA	FLAME ARRESTOR
FM	FUME HOOD
FI	FILTER
FP	VEHICLE CONTROL PANEL
FS	VEHICLE FUME EXHAUST SYSTEM
G	GENERATOR
GA	GAUGE
GDK	GEAR BOX
GDR	GRINDER
GT	GATE
H	HOIST
HC	HEATING COILS
HFP	HEAT PUMP

P	PUMP
PG	PRESSURE GAGE
PVL	PRESSURE VESSEL

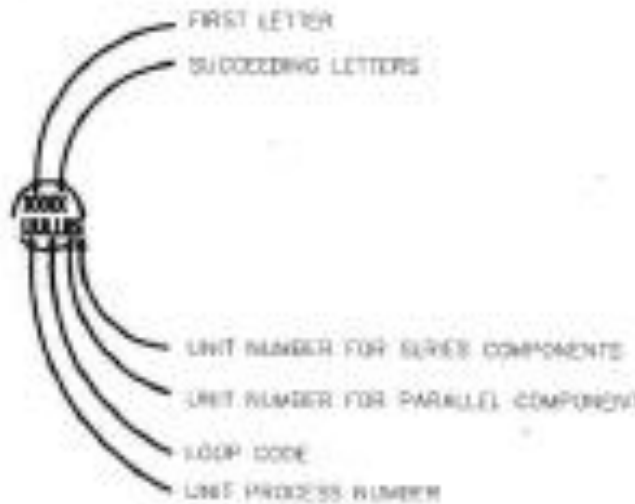
RSD	RAINFALL
RUF	ROLL-TYPE AIR FILTER
RD	ROLL UP DOOR
S4	SOUND ATTENUATOR
SAM	SAMPLE
SCL	STEAM CLEANER
SOP	SUBSTITUTION PANEL
SUP	SUPPLY FAN
SG	SLUDGE GATE
SSB	SANDBLAST Booth
SWB	SWITCHBOARD
SMR	SMOKE
T	TANK
TOU	CATAO TELEMETRY UNIT
TS	TRUCK SCALE
TW	TELEVISION MONITOR
UH	UNIT HEATER
UPS	UNIDENTIFIABLE POWER SUPPLY
US	UNIT SUBSTATION
VAF	VACUUM FILTER
VW	VEHICLE HOIST
VSD	VARIABLE SPEED DRIVE
WCC	WATER-COOLED CONDENSER
WCS	WASTE GAS BURNER
WFR	WASTE TRANSFORMER

THIS SET OF ABBREVIATIONS APPLIES TO THE DRAWINGS WITH THE FOLLOWING PREFIX LETTERS J AND N.			
PLANT TAG	PLANT GENERAL	USE PREFIX DATE: 27 NOVEMBER 2007	ISSUE NO: G40,024
WEST POINT TREATMENT PLANT SECONDARY TREATMENT FACILITIES LIQUIDS STREAM			ISSUE NO: NONE
ABBREVIATIONS I & C			G40



# Instrument Identification

## INSTRUMENT IDENTIFICATION EXAMPLE SYMBOLS



## GENERAL INSTRUMENT OR FUNCTION SYMBOLS

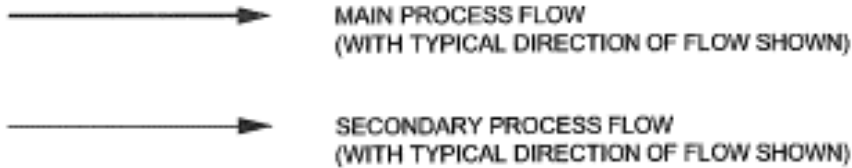
INSTRUMENTS      SHARED DISPLAY, SHARED CONTROL, ANNUNCIATOR      COMPUTER FUNCTION, DCS      PROGRAM LOGIC (PL)














## INSTRUMENT SOCIETY OF AMERICA TABLE

FIRST LETTER		SUCCEEDING LETTERS		
MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM	AUTO
B	BURNER FLAME		USER'S CHOICE	USER'S CHOICE
C	CONDUCTIVITY (ELECTRICAL)			CLOSED
D	DENSITY (MASS) OR SPECIFIC GRAVITY	DIFFERENTIAL		FAIL, ERROR ABNORMAL
E	VOLTAGE (EMF)		PRIMARY ELEMENT	
F	FLOW RATE	RATIO (FRACTION)		
G	GAUGING (DIMENSIONAL)		GLASS	READY
H	HAND (MANUALLY INITIATED)			HIGH
I	CURRENT (ELECTRICAL)		INDICATE	
J	POWER	SCAN		RUNNING, RUN
K	TIME OR TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION STOP
L	LEVEL		LIGHT (PILOT)	LOW, LOCAL
M	MOTOR OR MOISTURE	MOMENTARY		MID
N	EQUIPMENT			
O	USER'S CHOICE		ORIFICE (RESTRICTION)	OPEN
P	PRESSURE OR VACUUM		POINT (TEST CONNECTION)	
Q	QUANTITY	INTEGRATE OR TOTALIZE		
R	RADIATION		RECORD OR PRINT	REMOTE
S	SPEED OR FREQUENCY	SAFETY		SWITCH
T	TEMPERATURE			TRANSMIT
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION MULTIFUNCTION
V	VIBRATION			VALVE, DAMPER, OR LOUVER
W	TORQUE, WEIGHT, FORCE		WELL	
X	UNCLASSIFIED		PLC INPUT	UNCLASSIFIED
Y	EVENT			RELAY OR COMPUTER OR PLC OUTPUT
Z	POSITION			DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT

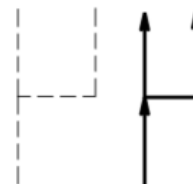
Images from KCWTD

# Line Legend

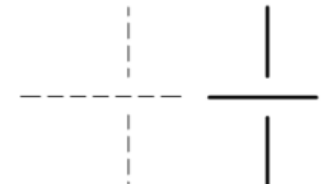


	PRIMARY PROCESS
	SECONDARY PROCESS
	ANALOG SIGNAL (4 TO 20 mA <sub>dc</sub> , ETC.)
	DISCRETE SIGNAL (ON/OFF, ETC.)
	MECHANICAL LINK
	SOFTWARE OR DATA LINK
	PNEUMATIC SIGNAL
	FILLED SYSTEM SIGNAL (CAPILLARY)
	HYDRAULIC SYSTEM SIGNAL
	GUIDED ELECTROMAGNETIC SIGNAL
	UNGUIDED ELECTROMAGNETIC SIGNAL
	EQUIPMENT POWER FEEDER
	PACKAGE SYSTEMS BREAK

CONNECTING LINES



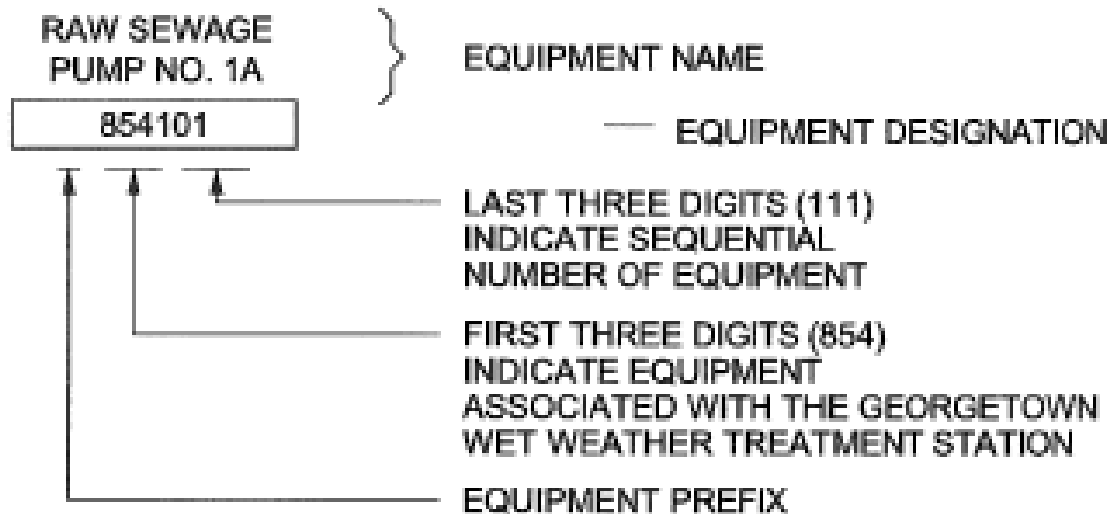
NON-CONNECTING LINES



# Tag Numbers

## EQUIPMENT IDENTIFICATION SYSTEM

EQUIPMENT IS CALLED OUT BY ITS PREFIX FOLLOWED BY A NUMBER, ENCLOSED AS SHOWN:



# Interface Symbols



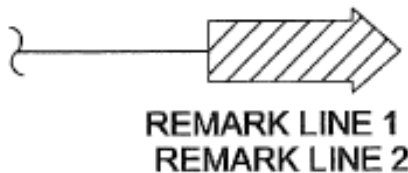
PROCESS/  
SIGNAL FLOW INTERFACE  
AA = CONNECTOR NUMBER  
P101 = DESTINATION DRAWING NO.



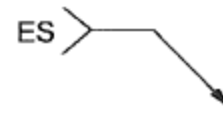
PROCESS/  
SIGNAL FLOW INTERFACE  
BB = CONNECTOR NUMBER  
P102 = SOURCE DRAWING NO.



FROM PROCESS EXTERNAL  
TO PROJECT

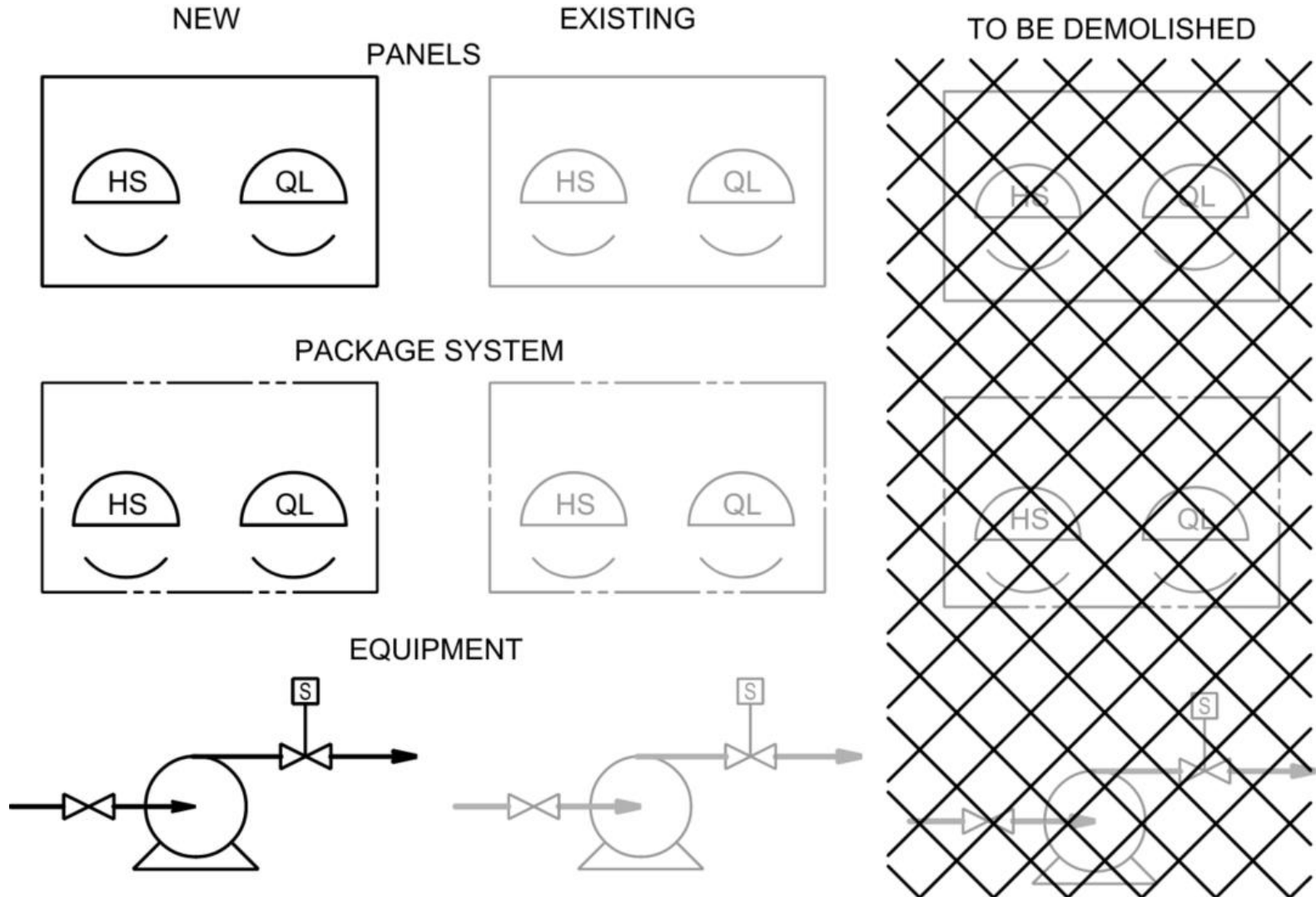


TO PROCESS EXTERNAL  
FROM PROJECT































ELECTRIC SUPPLY  
ES: DEFINES TYPE OF SUPPLY  
EXAMPLE:  
120=120VAC, SINGLE PHASE

# Construction Status



# Valve Symbols

	GATE		PRESSURE CONTROL REGULATED SIDE
	KNIFE GATE		BACK PRESSURE CONTROL VALVE
	BUTTERFLY		PRESSURE SAFETY (RELIEF)
	GLOBE		VACUUM RELIEF
	BALL		PRESSURE AND VACUUM RELIEF
	V-BALL		RUPTURE DISK
	DIAPHRAGM		RUPTURE DISK
	PINCH		AIR AND/OR VACUUM RELEASE
	NEEDLE		PRESSURE RELIEF PINCH
	PLUG		VACUUM RELIEF PINCH
	ECCENTRIC PLUG		THERMOSTATICALLY CONTROLLED VALVE
	BALL CHECK		3-WAY VALVE
	SWING CHECK		
	DUAL CHECK		
	BALANCING		
	BLAST GATE		

# Gate Symbols



SLUICE



BUTTERFLY



FLAP



FABRICATED SLIDE



SHEAR

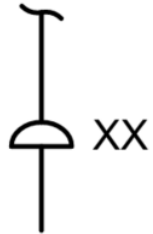


MUD VALVE



TELESCOPE VALVE

# Actuator Symbols



XX

PNEUMATIC DIAPHRAM  
SPRING-OPPOSED



XX

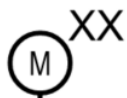
PNEUMATIC CYLINDER  
SINGLE OR DOUBLE ACTING  
ACTUATED BY ONE INPUT



MANUAL

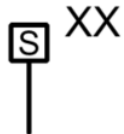


SPRING



XX

ELECTRIC MOTOR



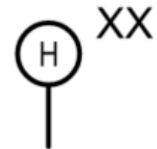
XX

SOLENOID



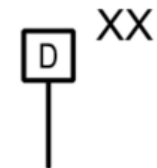
XX

ELECTROHYDRAULIC



XX

HYDRAULIC



XX

DIGITAL

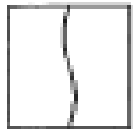
## NOTE:

ON LOSS OF PRIMARY POWER  
(PNEUMATIC, ELECTRICAL OR HYDRAULIC)

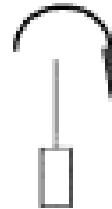
XX: FO = FAIL OPEN  
FC = FAIL CLOSED  
FL = FAIL TO LAST POSITION  
FI = FAIL INDETERMINATE



# Mechanical Equipment Symbols



HEATER



WEIR



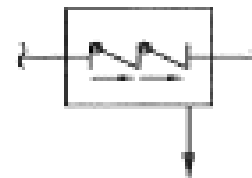
GENERATOR



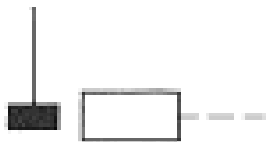
RECEIVER, PRESSURE VESSEL OR SCRUBBER



PUMP, CENTRIFUGAL



REDUCED PRESSURE BACKFLOW PREVENTER

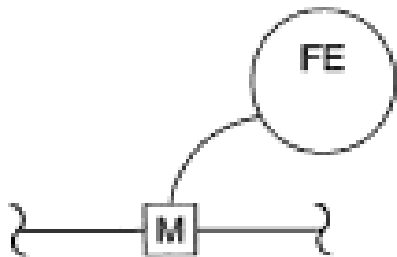


SPEED SENSOR (RPM)



SILENCER

# Primary Element Symbols



MAGNETIC FLOW TUBE



FLOAT SWITCH  
(HIGH WATER LEVEL)



ULTRASONIC LEVEL  
ELEMENT



BUBBLER



VARIABLE AREA  
FLOW INDICATOR  
(ROTAMETER)

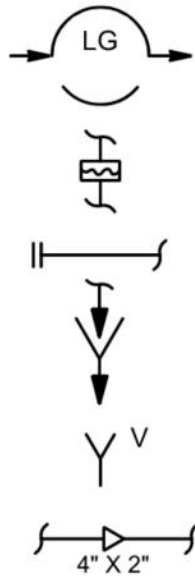


UTILITY METER



DIAPHRAGM SEAL

# Miscellaneous Symbols



SIGHT GLASS

DIAPHRAGM SEAL

BLIND FLANGE

AIR GAP

VENT TO ATMOSPHERE

PIPE REDUCER



IN-LINE STATIC MIXER



INLET GUIDE VANE



INLET SILENCER/FILTER



INLINE SILENCER



VENT SILENCER



FILTER



MULTIVANE LOUVER/DAMPEN



SINGLE VANE LOUVER/DAMPEN



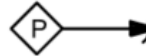
MIXER



ELECTRIC MOTOR



SAMPLE CONNECTION



FLUSHING CONNECTION  
PURGE OR FLUSHING DEVICE



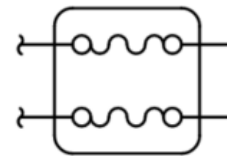
HOSE ADAPTOR - WITH CAP



SPIRAL TUBE EXCHANGER



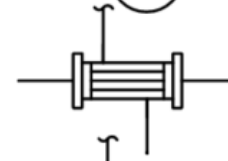
HEAT EXCHANGER



HEAT EXCHANGER, PLATE  
TYPE


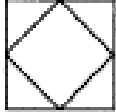
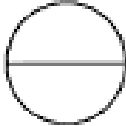
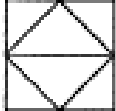
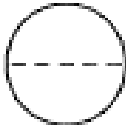
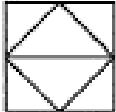

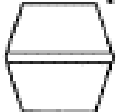
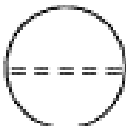
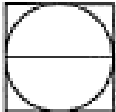
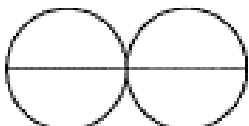


HEAT EXCHANGER,  
SPIRAL TYPE



HEAT EXCHANGER,  
STRAIGHT TUBE TYPE

# Functional Logic Diagrams

	FIELD DEVICE FOR DESCRIPTION SEE TABLE		PLC I/O
	PANEL FRONT DEVICE		PLC I/O AND ACCESSIBLE ON OIT AND SCADA
	INTERNAL PANEL DEVICE		PLC I/O AND ACCESSIBLE ON OIT
	AUXILIARY PANEL FRONT DEVICE		METROTEL I/O
	INTERNAL AUXILIARY PANEL DEVICE		VFD HUMAN INTERFACE MODULE OR MCC HUMAN MACHINE INTERFACE
	DEVICE INTEGRAL TO ONE PANEL MOUNTED DEVICE	* HIM	VFD HUMAN INTERFACE MODULE OR MCC HUMAN MACHINE INTERFACE
		HMI	MCC HUMAN MACHINE INTERFACE

# Header

## PLC INTERFACES

△ ANALOG INPUT

▲ DISCRETE INPUT

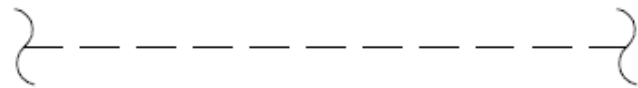
□ CABLE CONNECTION

▽ ANALOG OUTPUT

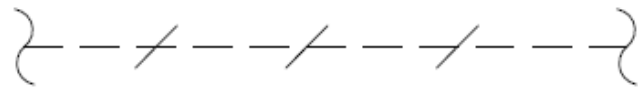
▼ DISCRETE OUTPUT

*(Analog = continuous)*

*(Discrete = on/off)*



ANALOG SIGNAL LINE



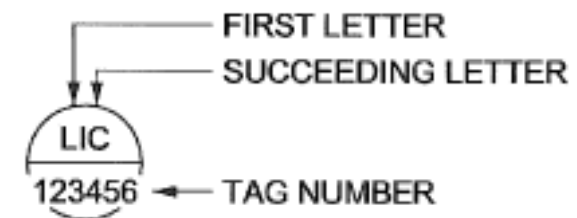
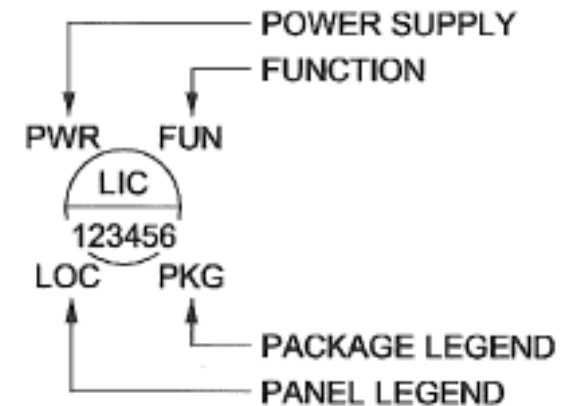
DISCRETE SIGNAL LINE



NETWORK CABLE

# Instrumentation Identification

FIRST LETTER		SUCCEEDING LETTERS		
MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS	ALARM	ALARM	AUTO
B	BURNER FLAME	USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	CONDUCTIVITY (ELECTRICAL)		CONTROL	CLOSED
D	DENSITY (MASS) OR SPECIFIC GRAVITY	DIFFERENTIAL		FAIL, ERROR ABNORMAL
E	VOLTAGE (EMF)	PRIMARY ELEMENT		
F	FLOW RATE	RATIO (FRACTION)		
G	GAUGING (DIMENSIONAL)	GLASS		READY
H	HAND (MANUALLY INITIATED)			HIGH
I	CURRENT (ELECTRICAL)	INDICATE		
J	POWER	SCAN		RUNNING, RUN
K	TIME OR TIME SCHEDULE	TIME RATE OF CHANGE	CONTROL STATION	STOP
L	LEVEL	LIGHT (PILOT)		LOW, LOCAL
M	MOTOR OR MOISTURE	MOMENTARY		MID
N	EQUIPMENT			
O	USER'S CHOICE	ORIFICE (RESTRICTION)		OPEN
P	PRESSURE OR VACUUM	POINT (TEST CONNECTION)		
Q	QUANTITY	INTEGRATE OR TOTALIZE		
R	RADIATION	RECORD OR PRINT		REMOTE
S	SPEED OR FREQUENCY	SAFETY	SWITCH	
T	TEMPERATURE		TRANSMIT	
U	MULTIVARIABLE	MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION		VALVE, DAMPER, OR LOUVER	
W	TORQUE, WEIGHT, FORCE	WELL		
X	UNCLASSIFIED	PLC INPUT	UNCLASSIFIED	
Y	EVENT		RELAY OR COMPUTER OR PLC OUTPUT	
Z	POSITION		DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT	



# Take a Break



## **An Example or Two**

***Carkeek Sodium Bisulfite System***

***Replacement***

***Alki CSO Treatment Plant Sodium***

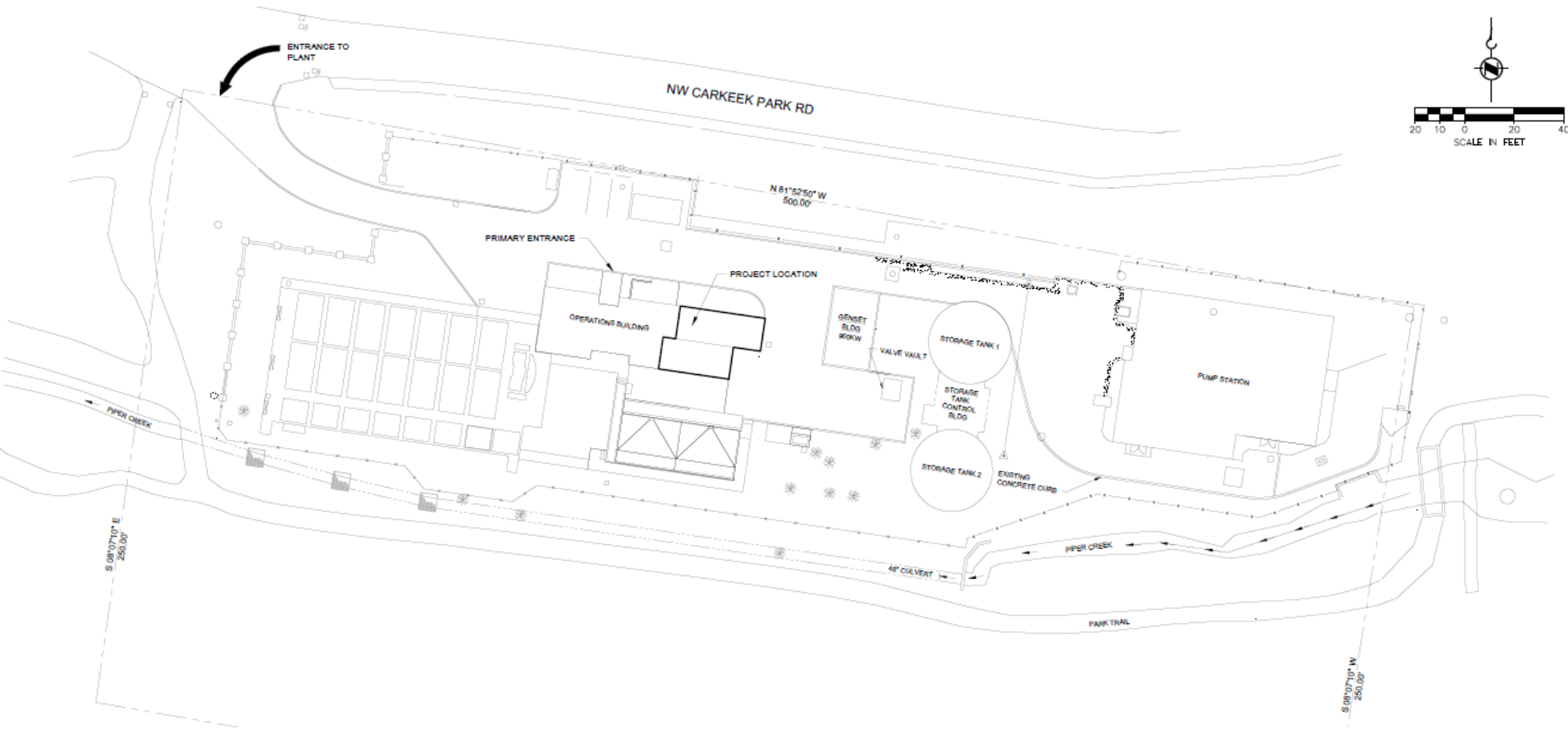
***Hypochlorite System***

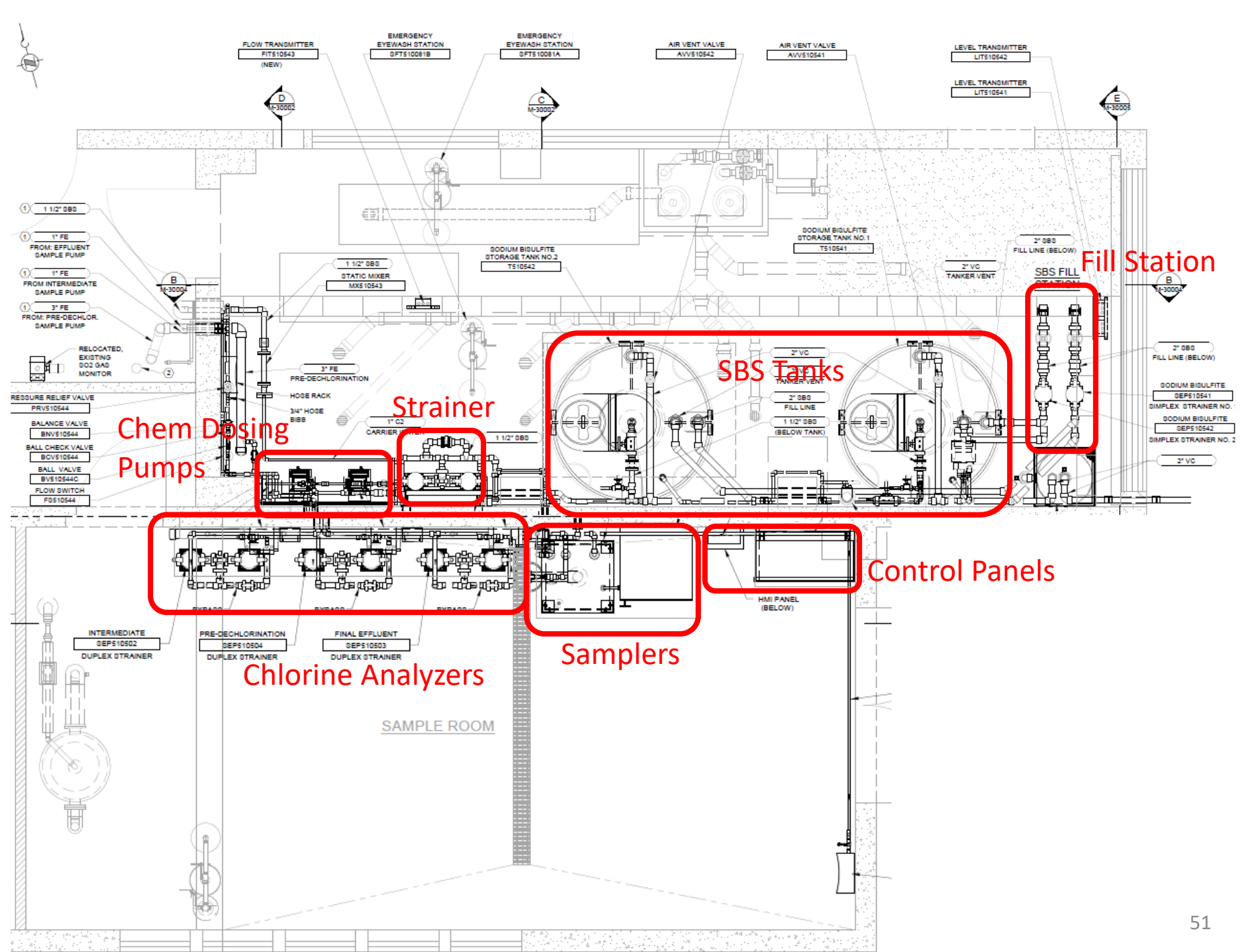


# Carkeek Wet Weather Treatment System – Sodium Bisulfite Dosing

Graphic from KCWTD







Chem Dosing  
Pumps

Strainer

SBS Tanks

Fill Station

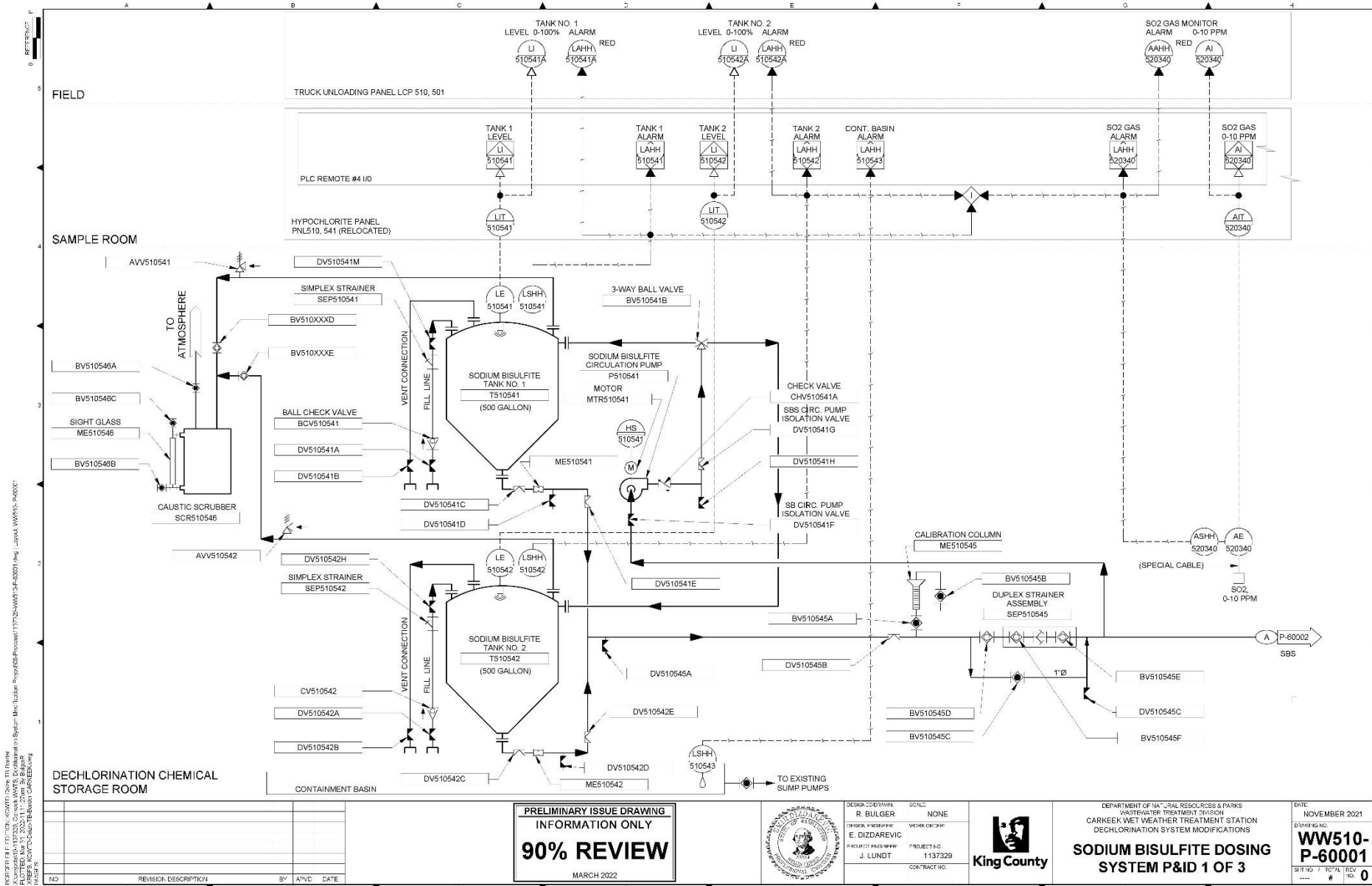
Control Panels

Chlorine Analyzers

Samplers

# SBS Storage & Strainer

Graphic from KCWTD

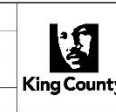


PROJECT: 11/13/2020 11:30 AM  
 DRAWING NO: 1137329  
 PROJECT NO: 1137329  
 PROJECT NAME: CARREEK WEATHER TREATMENT STATION DECHLORINATION SYSTEM MODIFICATIONS  
 PROJECT LOCATION: CARREEK WEATHER TREATMENT STATION  
 PROJECT OWNER: KING COUNTY  
 PROJECT MANAGER: J. LUNDT  
 PROJECT ENGINEER: E. DIDZAREVIC  
 PROJECT DESIGNER: R. BULGER

**PRELIMINARY ISSUE DRAWING**  
**INFORMATION ONLY**  
**90% REVIEW**  
 MARCH 2022



DESIGN: R. BULGER  
 CHECKED: E. DIDZAREVIC  
 APPROVED: J. LUNDT  
 SCALE: NONE  
 PROJECT NO: 1137329  
 CONTRACT NO:

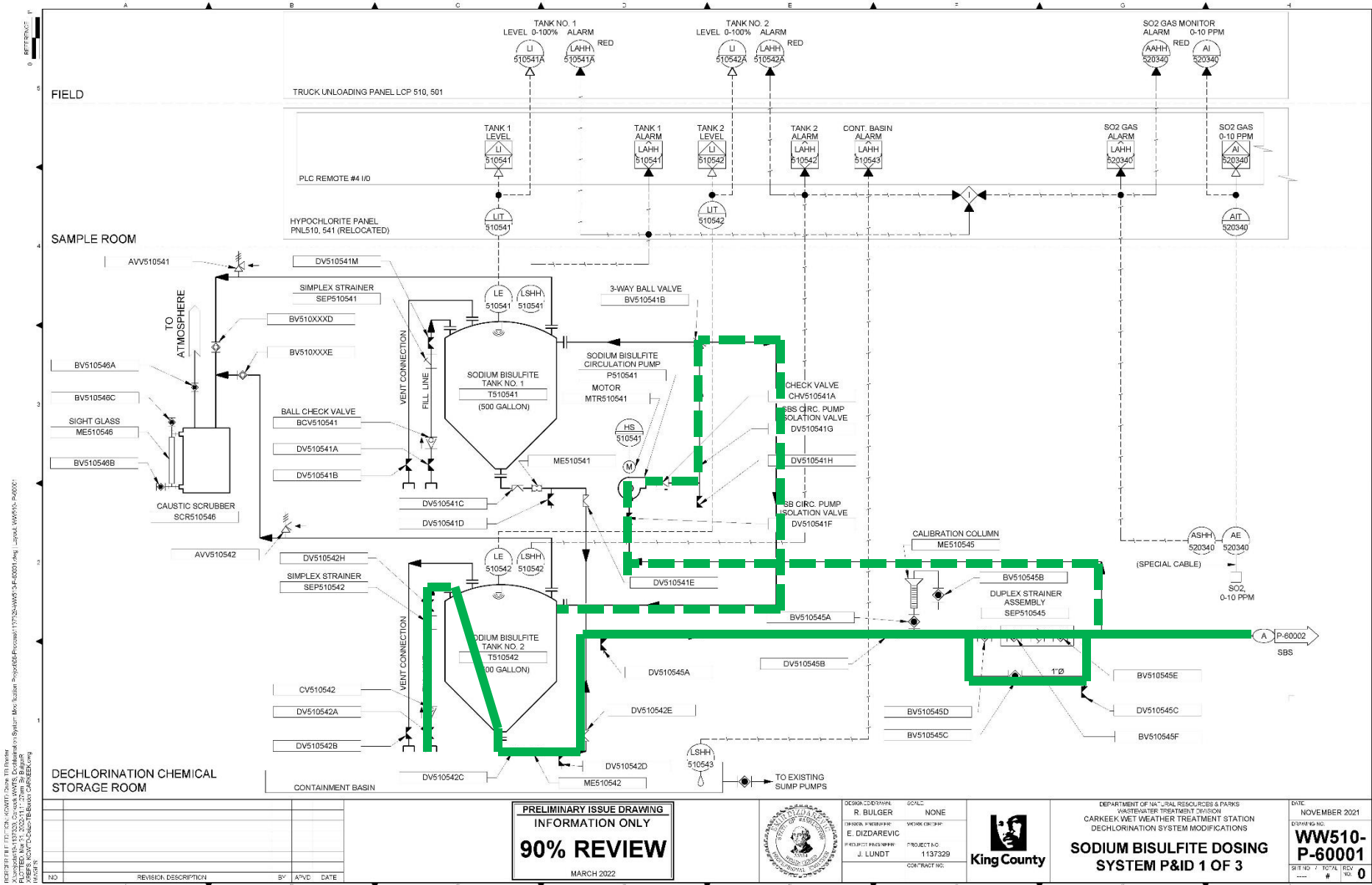


DEPARTMENT OF NATURAL RESOURCES & PARKS  
 WASTEWATER TREATMENT DIVISION  
 CARREEK WEATHER TREATMENT STATION  
 DECHLORINATION SYSTEM MODIFICATIONS  
**SODIUM BISULFITE DOSING SYSTEM P&ID 1 OF 3**

DATE: NOVEMBER 2021  
 DRAWING NO: **WW510-P-60001**  
 SHEET NO: 1 OF 3  
 TOTAL SHEETS: 3

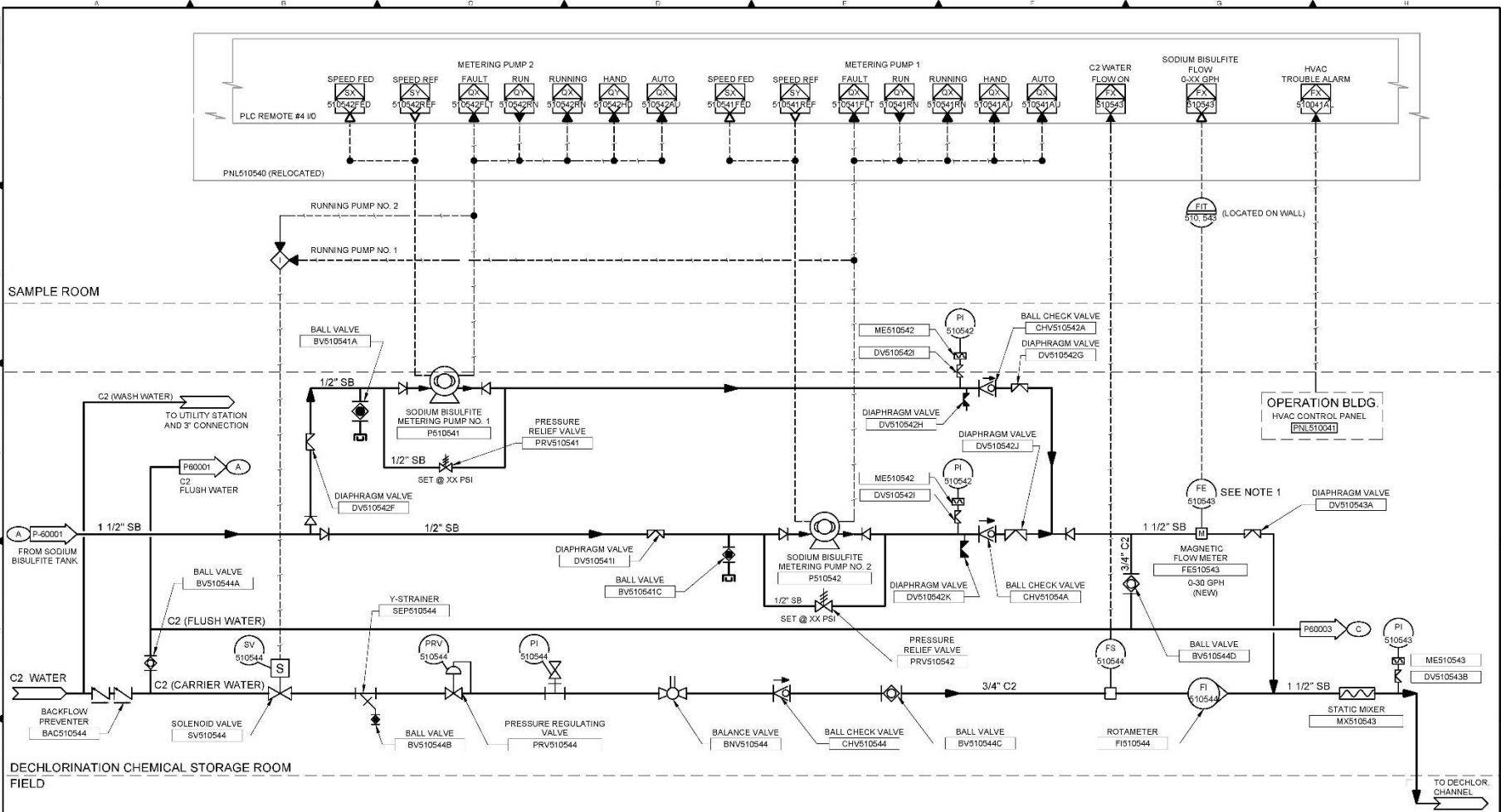
# SBS Storage & Strainer

Graphic from KCWTD



PROJECT: 1137329 - CARKEEK WEATHER TREATMENT STATION DECHLORINATION SYSTEM MODIFICATIONS  
 DRAWING NO.: WW510-P-60001  
 SHEET NO.: 1 OF 3  
 DATE: NOVEMBER 2021  
 PROJECT MANAGER: E. DIDZAREVIC  
 SUBMITTAL ENGINEER: J. LUNDT  
 DESIGN COORDINATOR: R. BULGER

# SBS Pumping



- NOTES:**
1. INSTALL WITH 5 PIPE DIAMETERS UPSTREAM AND 3 PIPE DIAMETERS DOWNSTREAM. STRAIGHT PIPE RUN REQUIRED.

SOURCE FILE: C:\WORK\042022\042022-001\042022-001.dwg  
 DATE: 10/18/2022 10:14:00 AM  
 USER: E. DICAREVIC  
 PLOT: 10/18/2022 10:14:00 AM  
 PLOTTER: HP DesignJet T1200

**PRELIMINARY ISSUE DRAWING**  
**INFORMATION ONLY**  
**90% REVIEW**  
 AUGUST 2022



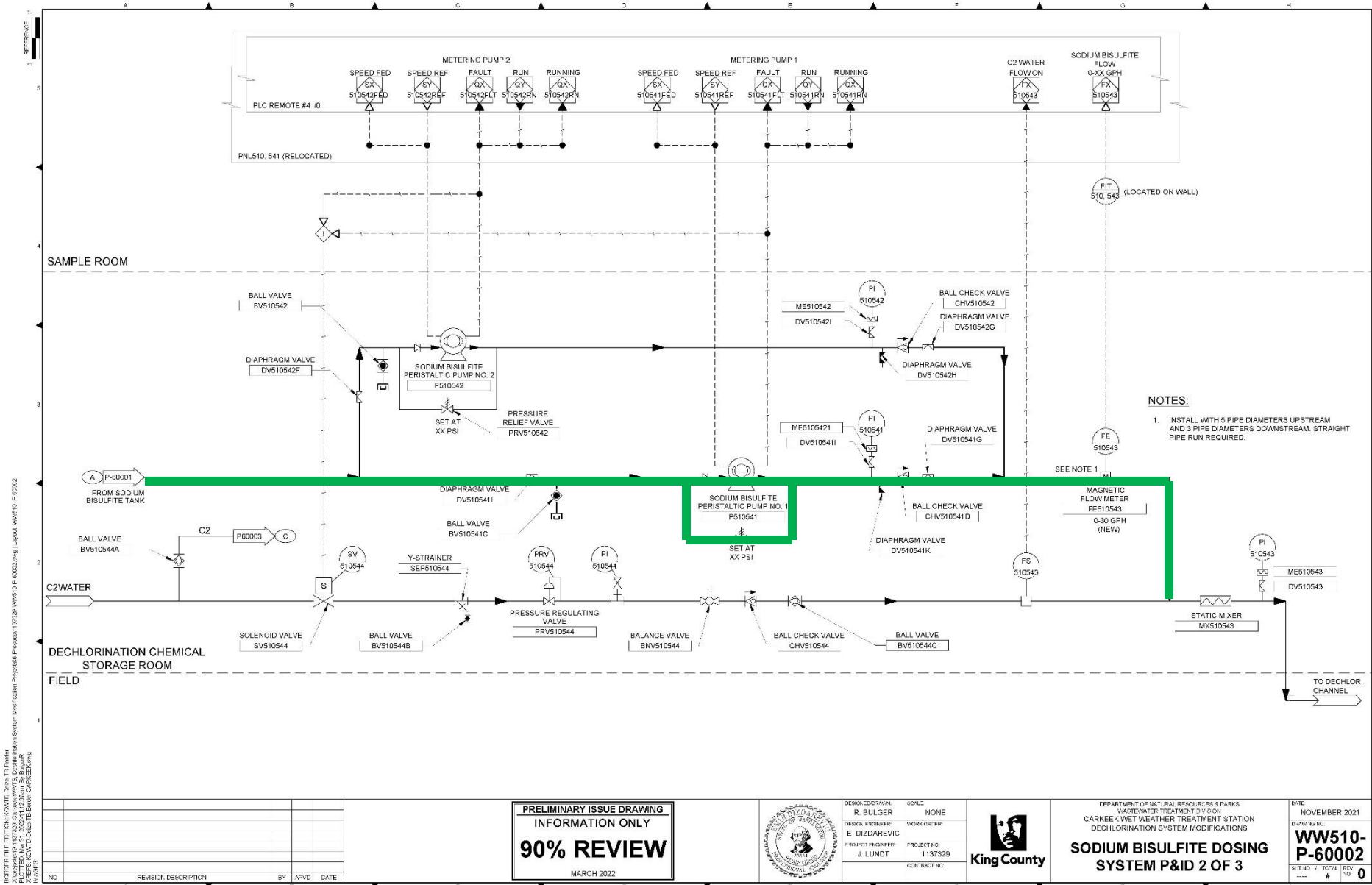
DESIGNER: R. BULGER  
 CHECKER: E. DICAREVIC  
 PROJECT NO.: 1137329  
 CONTRACT NO.:



DEPARTMENT OF NATURAL RESOURCES & PARKS  
 WASTEWATER TREATMENT DIVISION  
 CARKEEK WET WEATHER TREATMENT STATION  
 DECHLORINATION SYSTEM MODIFICATIONS  
**SODIUM BISULFITE DOSING**  
**SYSTEM P&ID 2 OF 3**

DATE: AUGUST 2022  
 DRAWING NO.: **WW510-P-60002**  
 SHEET NO.: 18 OF 120 REV: 0

# SBS Pumping



**PRELIMINARY ISSUE DRAWING**  
INFORMATION ONLY  
**90% REVIEW**  
MARCH 2022



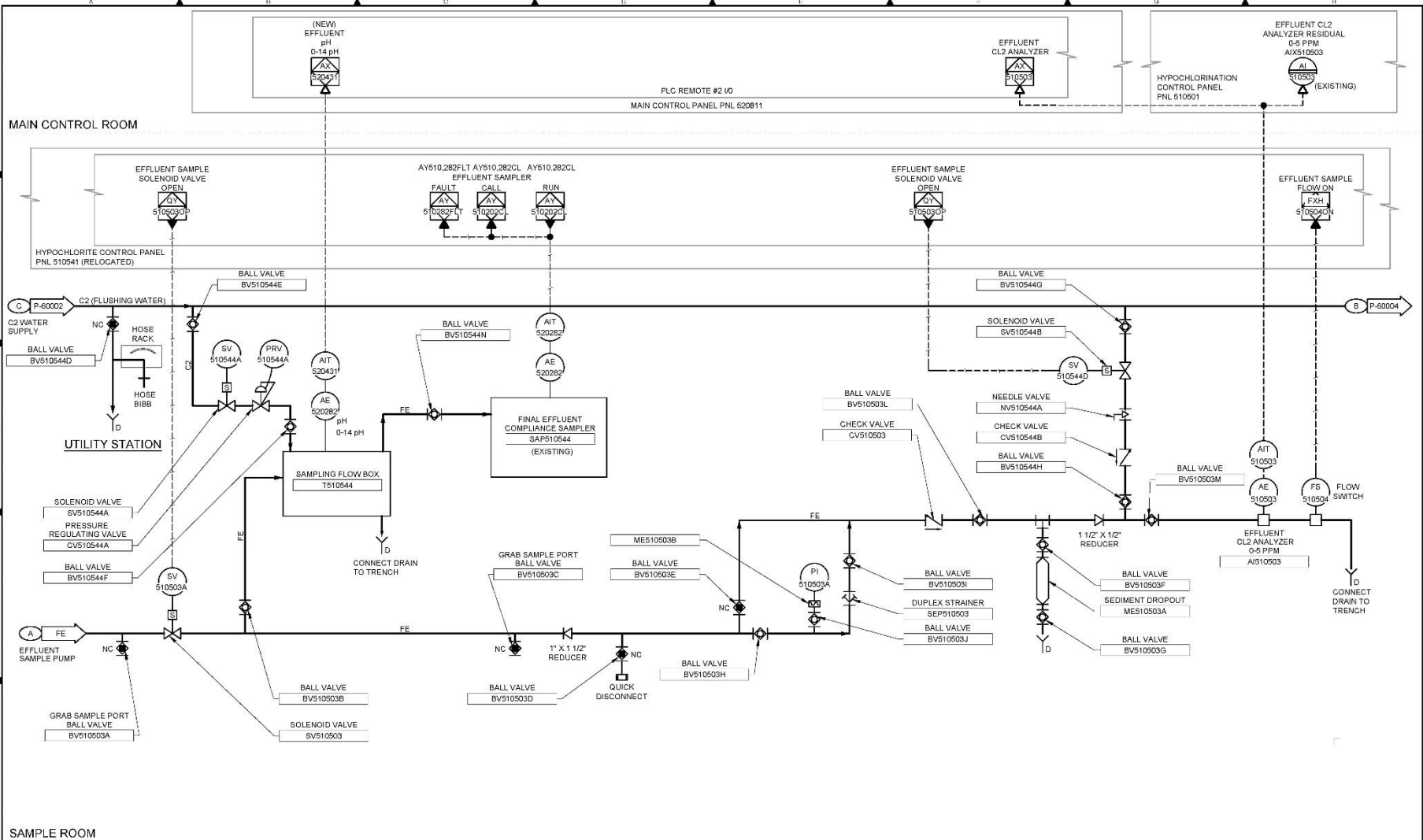
DESIGN COORDINATOR: R. BULGER  
DESIGNER: E. DIZDAREVIC  
PROJECT ENGINEER: J. LUNDT  
SCALE: NONE  
WORK ORDER NO.:  
PROJECT NO.: 1137329  
CONTRACT NO.:



DEPARTMENT OF NATURAL RESOURCES & PARKS  
WASTEWATER TREATMENT DIVISION  
CARKEEK WET WEATHER TREATMENT STATION  
DECHLORINATION SYSTEM MODIFICATIONS  
**SODIUM BISULFITE DOSING SYSTEM P&ID 2 OF 3**

DATE: NOVEMBER 2021  
DRAWING NO.: **WW510-P-60002**  
SHEET NO. 2 TOTAL SHEETS: 0

# Final Effluent Sampler & Analyzer



BOR:SER:FILE:0101-40V10:User:3-Book:1  
 PLOT FILE:AW1010\_202010171220:DWG:51137329:AW101015-F-60003:Rev1:Control:WWS-5-F-60035  
 System:Publication:Project:51137329:AW101015-F-60003:Rev1:Control:WWS-5-F-60035  
 All files to be saved under the folder name: 51137329

NO	REVISION	DESCRIPTION	BY	APP'D	DATE

**PRELIMINARY ISSUE DRAWING**  
**INFORMATION ONLY**  
**90% REVIEW**  
 AUGUST 2022



DESIGNER: R. BULGER  
 CHECKER: E. DIZDAREVIC  
 PROJECT ENG: E. SCHEY  
 SCALE: NONE  
 PROJECT NO: 1137329  
 CONTRACT NO:



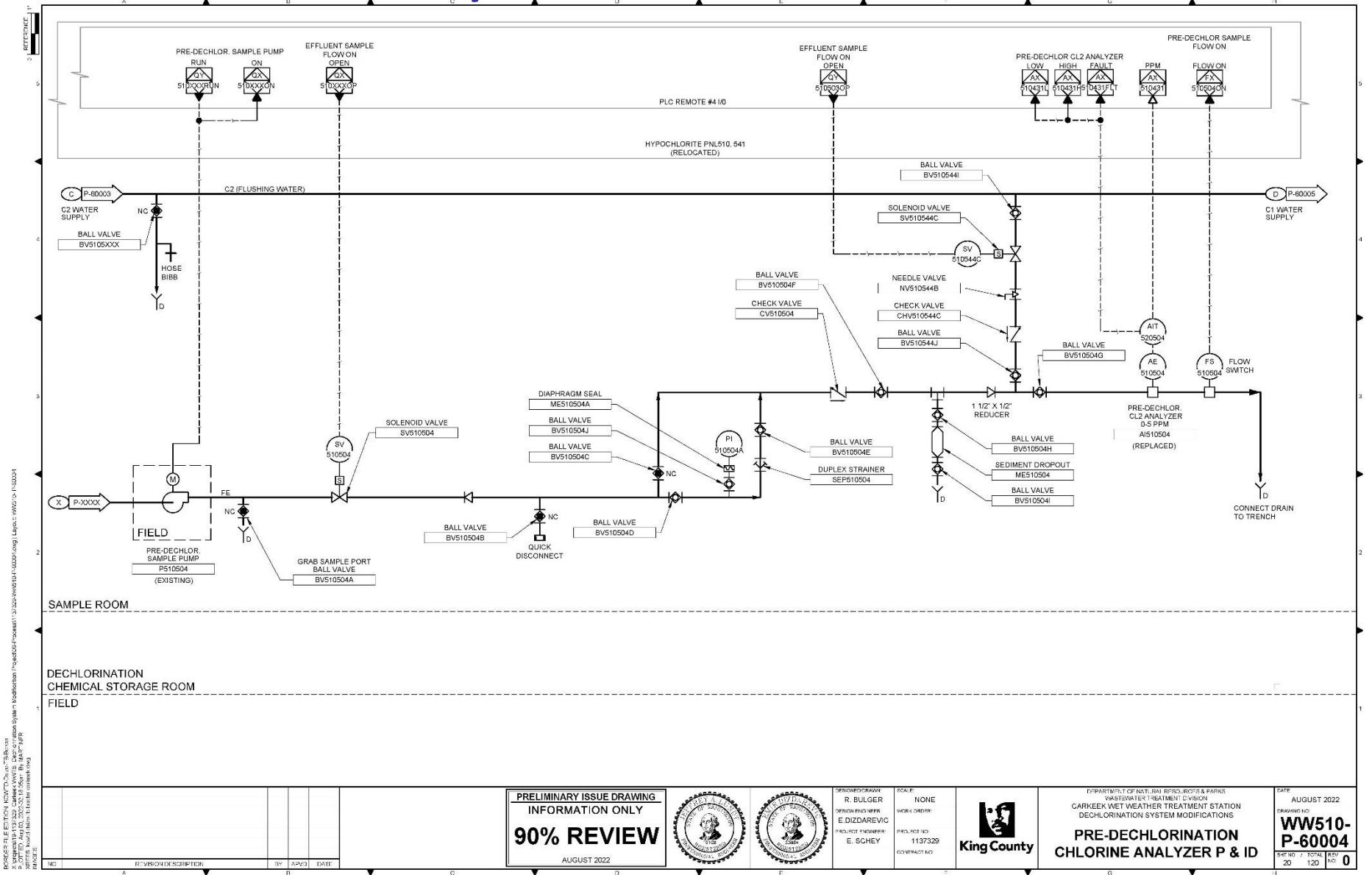
DEPARTMENT OF NATURAL RESOURCES & PARKS  
 WASTEWATER TREATMENT DIVISION  
 CARKEEK WET WEATHER TREATMENT STATION  
 DECHLORINATION SYSTEM MODIFICATIONS  
**EFFLUENT CHLORINE**  
**ANALYZER AND EFFLUENT**  
**SAMPLER P & ID**

DATE: AUGUST 2022  
 DRAWING NO: **WW510-P-60003**  
 SHEET NO: 18 OF 120 REV NO: 0



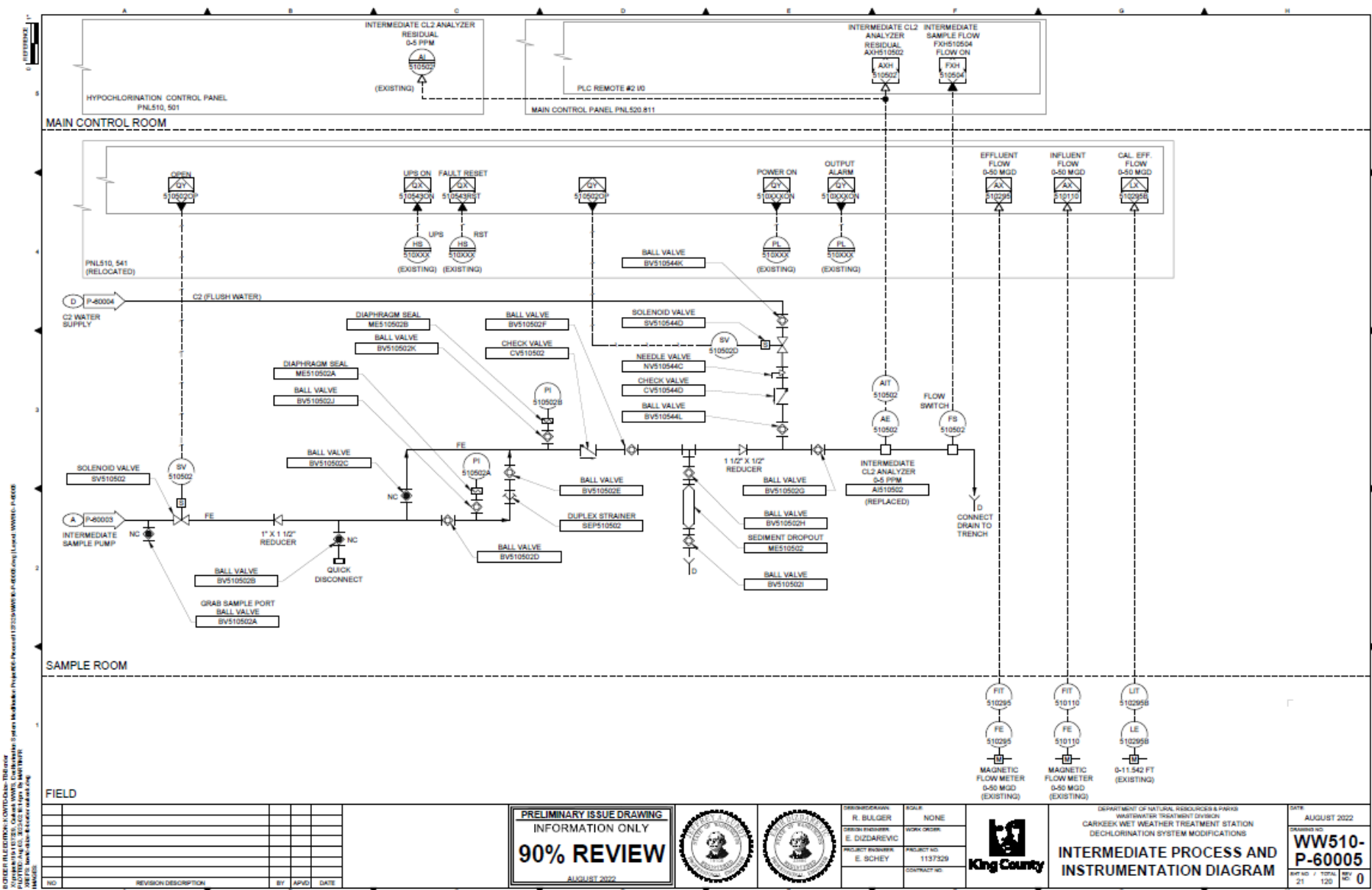


# Pre-Dechlor Analyzer





# Intermediate Chlorine Analyzer



PRELIMINARY ISSUE DRAWING  
 INFORMATION ONLY  
**90% REVIEW**  
 AUGUST 2022



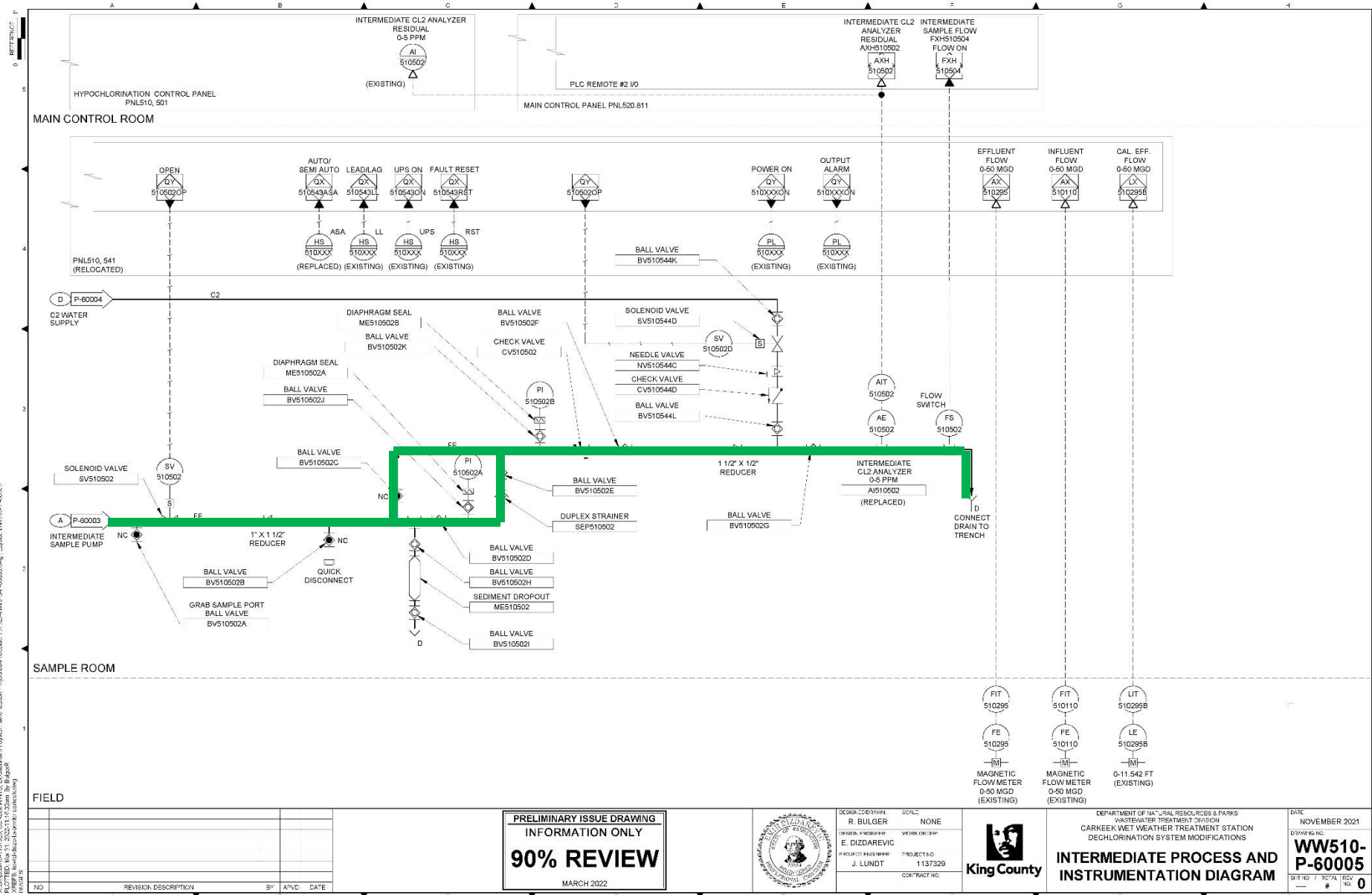
DESIGNED BY: R. BULGER	SCALE: NONE
DRAWN BY: E. DUGAREVIC	WORK ORDER: 1137329
CHECKED BY: E. SCHEY	PROJECT NO: 1137329
DATE: AUGUST 2022	CONTRACT NO: 1137329



DEPARTMENT OF NATURAL RESOURCES & PARKS  
 WASTEWATER TREATMENT DIVISION  
 CARKEEK WET WEATHER TREATMENT STATION  
 DECHLORINATION SYSTEM MODIFICATIONS  
**INTERMEDIATE PROCESS AND INSTRUMENTATION DIAGRAM**

DATE: AUGUST 2022
PROJECT NO: <b>WW510-P-60005</b>
REV NO: 21 / TOTAL: 120 / REV: 0

# Intermediate Chlorine Analyzer



10/23/2020 10:56:00 AM  
 PROJECT: 11/13/2020 11:00:00 AM  
 PLOTTER: 11/13/2020 11:00:00 AM  
 USER: j.lundt@kingcounty.gov  
 FILE: C:\Users\j.lundt\AppData\Local\Microsoft\Windows\CurrentVersion\PrinterConfig\1113224000\1113224000.dwg  
 PLOTTER: 11/13/2020 11:00:00 AM  
 USER: j.lundt@kingcounty.gov

**PRELIMINARY ISSUE DRAWING**  
**INFORMATION ONLY**  
**90% REVIEW**  
 MARCH 2022



DESIGN: R. BULGER  
 CHECKED: E. DIZDAREVIC  
 PROJECT NO: 1137329  
 CONTRACT NO:



DEPARTMENT OF NATURAL RESOURCES & PARKS  
 WASTEWATER TREATMENT DIVISION  
 CARKEEK WET WEATHER TREATMENT STATION  
 DECHLORINATION SYSTEM MODIFICATIONS  
**INTERMEDIATE PROCESS AND INSTRUMENTATION DIAGRAM**

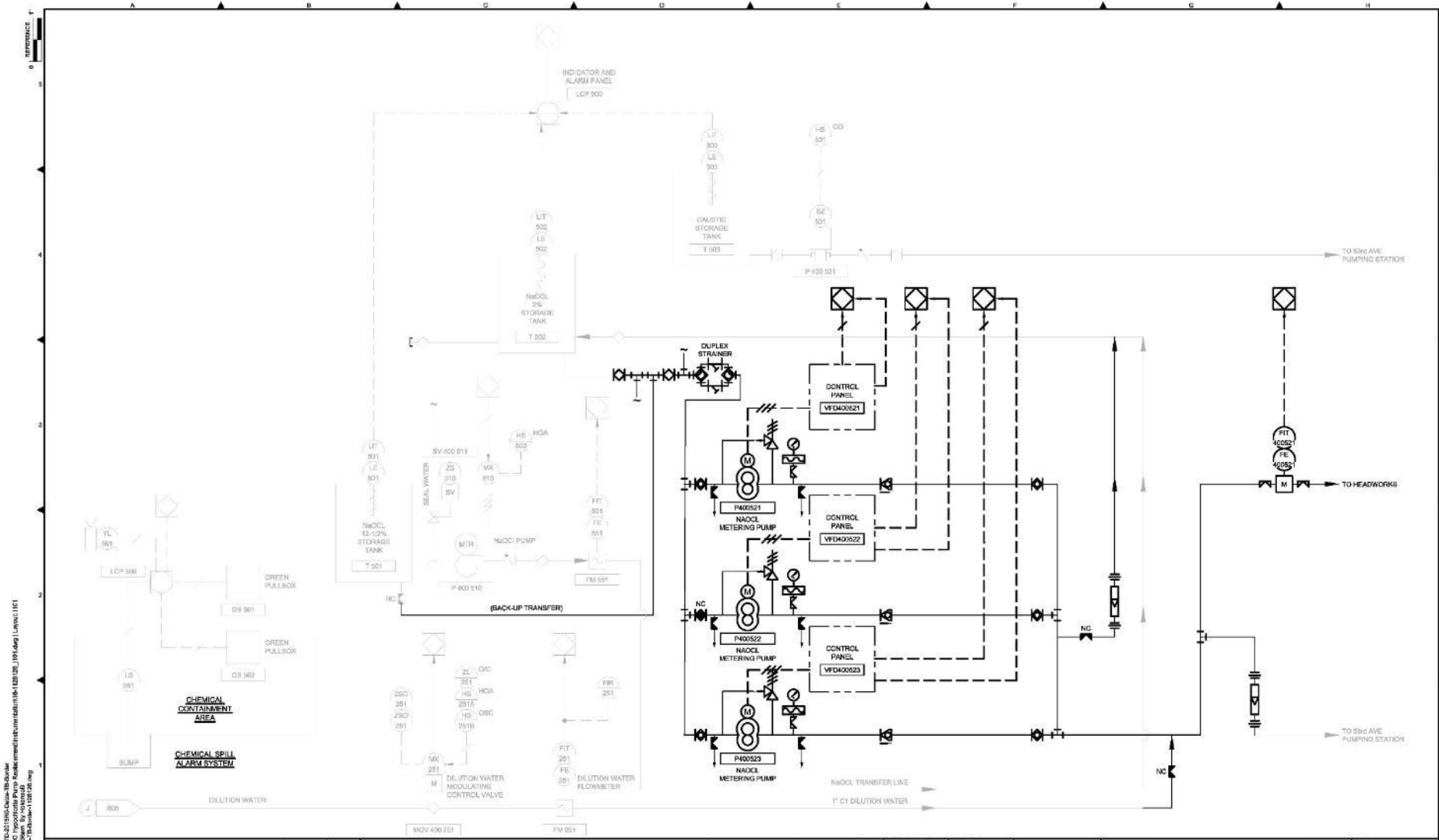
DATE: NOVEMBER 2021  
 DRAWING NO: **WW510-P-60005**  
 SHEET NO. 7 TOTAL SHEETS: 10

# Alki Wet Weather Treatment System Hypochlorite System

Aerial Photo from Google Maps



# Chemical Feed System P&ID



K:\WORK\PROJECTS\2016\1182126\Drawings\1182126\_101.dwg (10/14/20) [L:\1182126\_101.dwg] (11/22/20)  
 PLOT DATE: 11/22/20 11:06 AM BY: [redacted]  
 IMAGES: [redacted]

NO	REVISION DESCRIPTION	BY	APP'D	DATE



DESIGNED BY: B. HOKENSON  
 PROJECT ENGINEER: E. DIZDAREVIC  
 DESIGN APPROVAL: R. BROWNE  
 PROJECT ACCEPTANCE: S. MINGUS  
 CHECKED: R. WARD  
 SCALE: NO SCALE  
 FACILITY NUMBER: 400  
 CONTRACT NO: CD1184C17



DEPARTMENT OF NATURAL RESOURCES & PARKS  
 WASTEWATER TREATMENT DIVISION  
 ALKI WET WEATHER TREATMENT FACILITY  
 HYPOCHLORITE PUMP REPLACEMENT  
**CHEMICAL FEED SYSTEM**  
**P&ID**

DATE:	JULY 2017
PROJECT NUMBER:	16-1128126
DRAWING NO.:	1101
SHEET NO. / TOTAL:	28 / 40
REV. NO.:	0

# Chemical Feed System Schematic

Graphic from KCWTD

**GENERAL NOTES:**  
NOT USED

**KEY NOTES:**

CONTRACTOR TO COORDINATE WITH THE PROJECT REPRESENTATIVE TO MAINTAIN ONE EXISTING PUMP THROUGH THE INSTALLATION, TESTING, AND COMMISSIONING OF THE PROPOSED IMPROVEMENTS. REMOVE THE REMAINING PUMP AND ASSOCIATED PIPING UPON ACCEPTANCE OF THE PROPOSED IMPROVEMENTS.

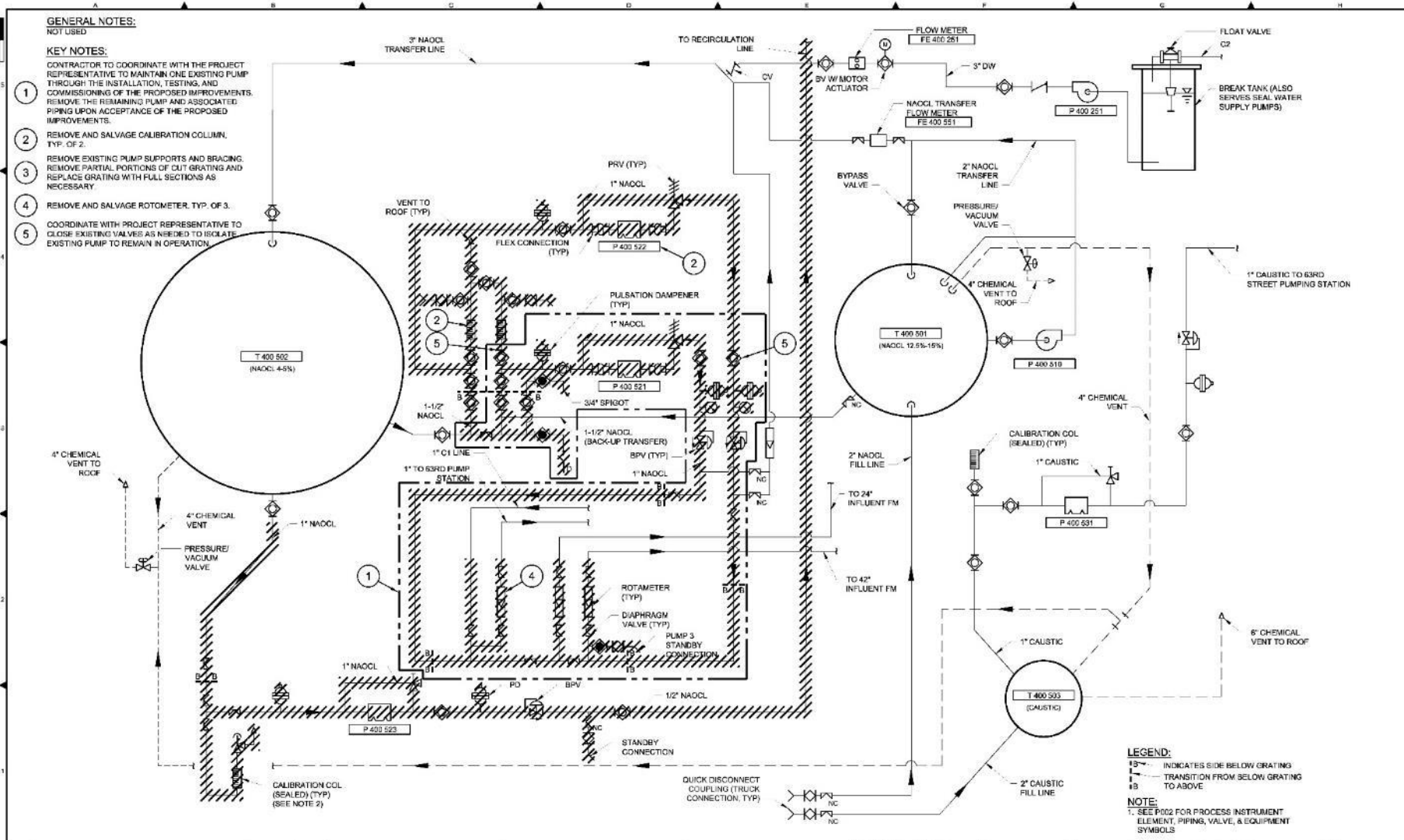
1 REMOVE AND SALVAGE CALIBRATION COLUMN, TYP. OF 2.

2 REMOVE EXISTING PUMP SUPPORTS AND BRACING. REMOVE PARTIAL PORTIONS OF CUT GRATING AND REPLACE GRATING WITH FULL SECTIONS AS NECESSARY.

3 REMOVE AND SALVAGE ROTAMETER, TYP. OF 3.

4 COORDINATE WITH PROJECT REPRESENTATIVE TO CLOSE EXISTING VALVES AS NEEDED TO ISOLATE EXISTING PUMP TO REMAIN IN OPERATION.

SOURCE: FILE:///C:/Users/kschwarz/Desktop/Projects/16-1128126-161128126-04011-04011.dwg (Lisp: D:\DWG) 16-1128126-161128126-04011-04011.dwg (Lisp: D:\DWG) 16-1128126-161128126-04011-04011.dwg (Lisp: D:\DWG) 16-1128126-161128126-04011-04011.dwg (Lisp: D:\DWG) 16-1128126-161128126-04011-04011.dwg (Lisp: D:\DWG)

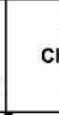


NO.	REVISION DESCRIPTION	BY	APP'D	DATE



DESIGNED BY: B. HOKENSON  
 PROJECT ENGINEER: J. PAULSON  
 CHECKED BY: R. BROWN  
 PROJECT SUPERVISOR: S. MINGUS

OWNER: R. WARD  
 SCALE: NO SCALE  
 FACILITY NUMBER: 400  
 CONTRACT NO.: C01184C17

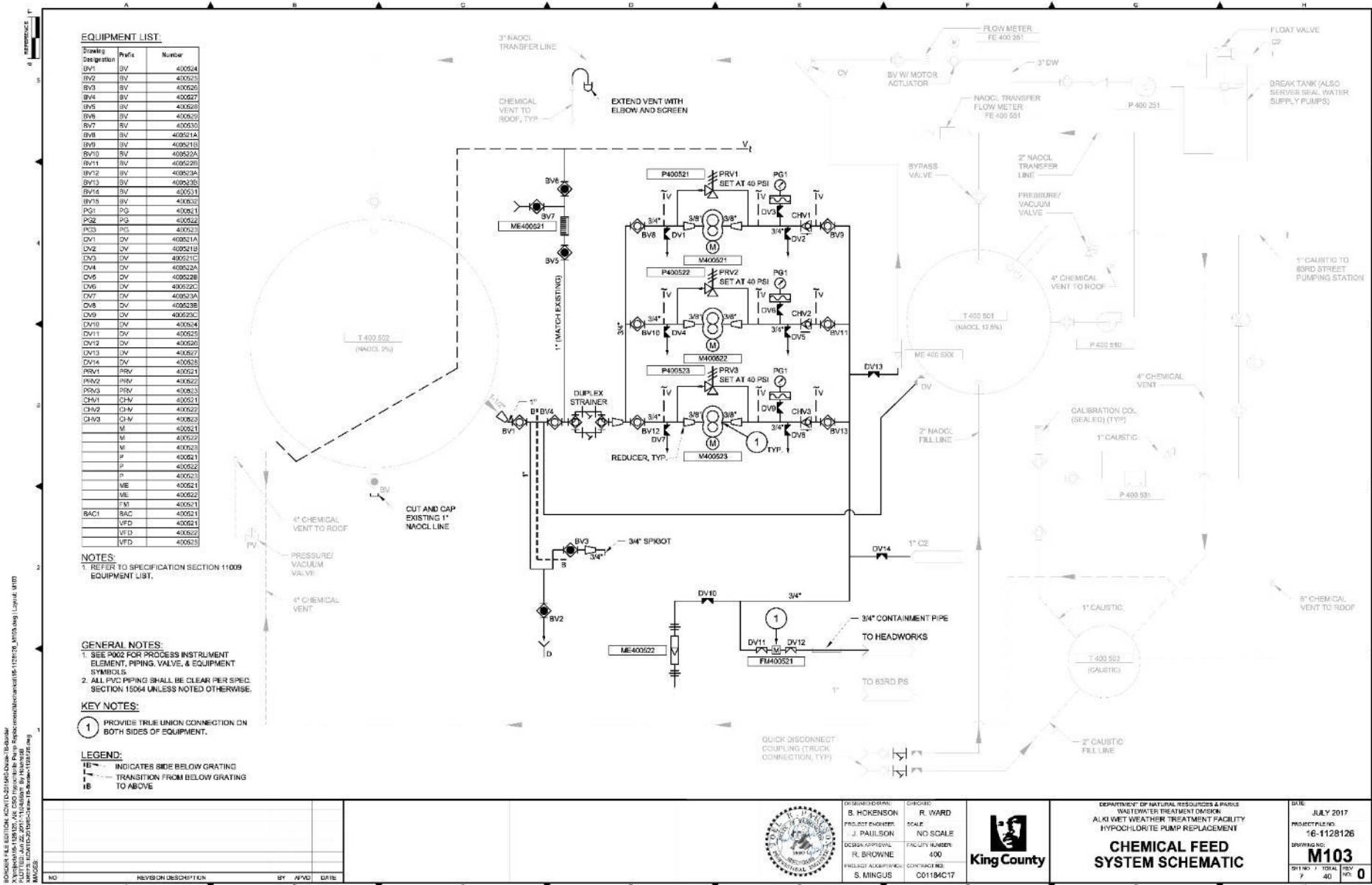


DEPARTMENT OF NATURAL RESOURCES & PARKS  
 WASTEWATER TREATMENT DIVISION  
 ALKI WET WEATHER TREATMENT FACILITY  
 HYPOCHLORITE PUMP REPLACEMENT  
**CHEMICAL STORAGE AND  
 FEED ROOM DEMO  
 SYSTEM SCHEMATIC**

DATE:	JULY 2017
PROJECT NUMBER:	16-1128126
DRAWING NO.:	<b>D-M101</b>
REV NO. / TOTAL	4 / 40
REV NO.	0



# Chemical Feed System Plans



**EQUIPMENT LIST:**

Drawing Designation	Qty's	Number
BV1	BV	400524
BV2	BV	400525
BV3	BV	400526
BV4	BV	400527
BV5	BV	400528
BV6	BV	400529
BV7	BV	400530
BV8	BV	400514
BV9	BV	400510
BV10	BV	40052A
BV11	BV	40052B
BV12	BV	40053A
BV13	BV	40053B
BV14	BV	400511
BV15	BV	400532
PG1	PG	400511
PG2	PG	400522
PG3	PG	400523
DV1	DV	40051A
DV2	DV	40051B
DV3	DV	40051C
DV4	DV	40052A
DV5	DV	40052B
DV6	DV	40052C
DV7	DV	40053A
DV8	DV	40053B
DV9	DV	40052C
DV10	DV	400504
DV11	DV	400525
DV12	DV	400526
DV13	DV	400527
DV14	DV	400528
PRV1	PRV	400521
PRV2	PRV	400522
PRV3	PRV	400523
CHV1	CHV	400521
CHV2	CHV	400522
CHV3	CHV	400523
M	M	400521
M	M	400522
M	M	400523
P	P	400521
P	P	400522
P	P	400523
ME	ME	400521
ME	ME	400522
ME	ME	400523
BAC1	BAC	400521
VFD	VFD	400521
VFD	VFD	400522
VFD	VFD	400523

**NOTES:**  
1. REFER TO SPECIFICATION SECTION 11009 EQUIPMENT LIST.

**GENERAL NOTES:**  
1. SEE P002 FOR PROCESS INSTRUMENT ELEMENT, PIPING, VALVE, & EQUIPMENT SYMBOLS.  
2. ALL PVC PIPING SHALL BE CLEAR PER SPEC SECTION 15064 UNLESS NOTED OTHERWISE.

**KEY NOTES:**  
1. PROVIDE TRUE UNION CONNECTION ON BOTH SIDES OF EQUIPMENT.

**LEGEND:**  
IB --- INDICATES SIDE BELOW GRATING  
I --- TRANSITION FROM BELOW GRATING TO ABOVE

SOURCE: FIELD DRAWING, KCWTD 02/01/2016, Drawn: [redacted], Checked: [redacted], Approved: [redacted], Date: [redacted], Project: [redacted], Revision: [redacted]

NO.	REVISION DESCRIPTION	BY	APPROVED	DATE

DESIGNED BY: B. HOKENSON  
PROJECT ENGINEER: J. PAULSON  
CHECKED BY: R. BROWNE  
PROJECT ADMIN: S. MINGUS

DRAWN BY: R. WARD  
SCALE: NO SCALE  
FACILITY NUMBER: 400  
CONTRACT NO: C01184C17



DEPARTMENT OF NATURAL RESOURCES & PARKS  
WASTEWATER TREATMENT DIVISION  
ALKI WET WEATHER TREATMENT FACILITY  
HYPOCHLORITE PUMP REPLACEMENT

**CHEMICAL FEED SYSTEM SCHEMATIC**

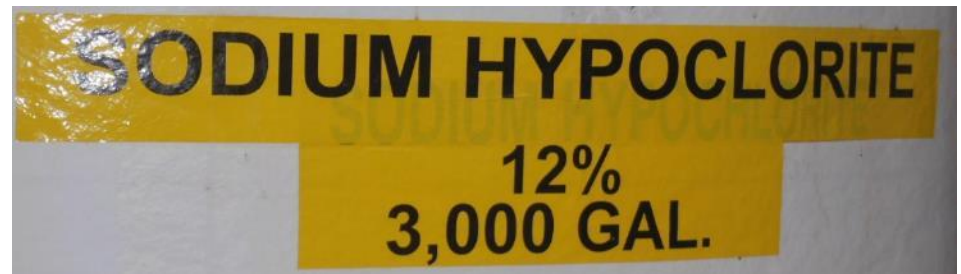
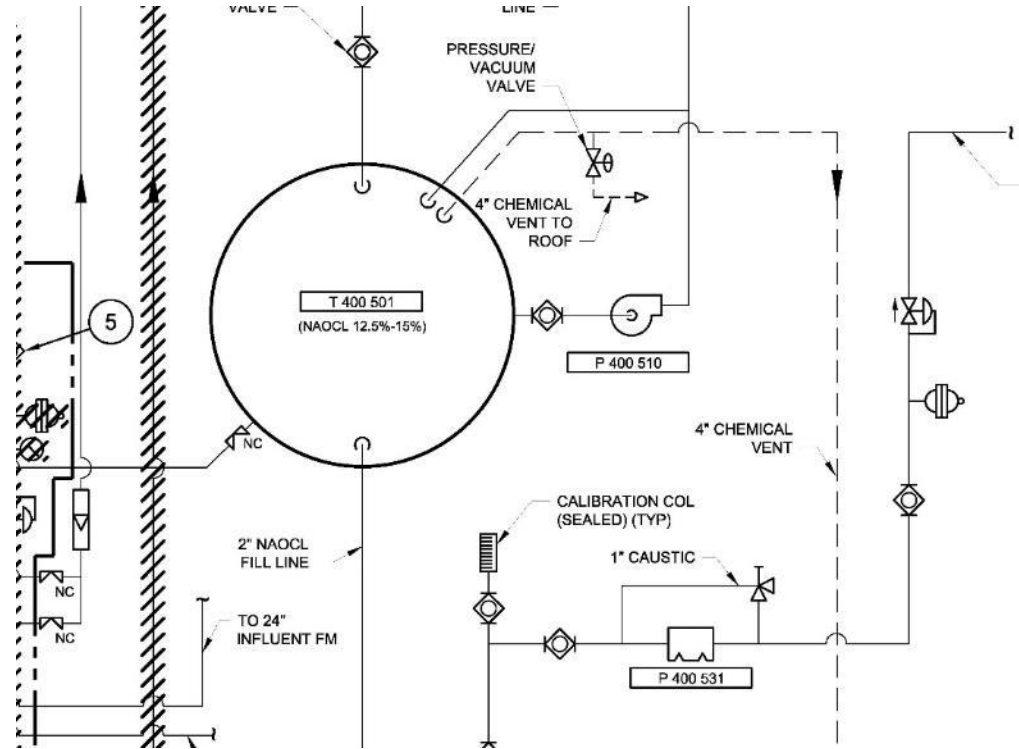
DATE: JULY 2017  
PROJECT NUMBER: 16-1128126  
DRAWING NO: **M103**  
SHEET 7 TOTAL: 40 REV: 0

# The Real Thing!



*Photos from KCWTD*

# Looking at Each Element - Tanks



*Concentrated hypo tank*

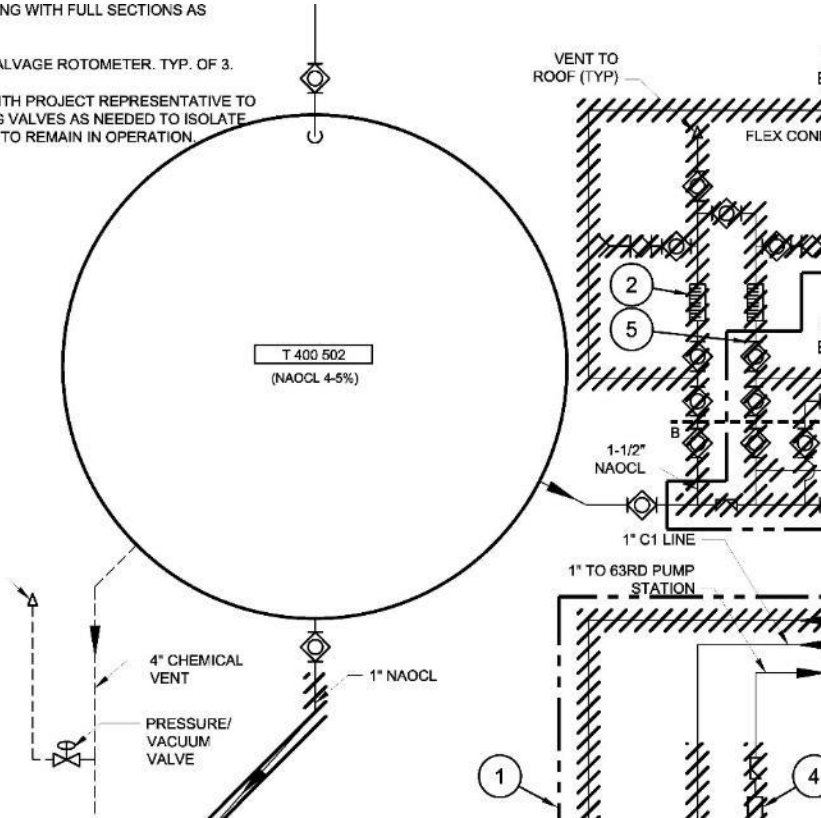
*Photos & graphics from KCWTD*

# Tanks

TING WITH FULL SECTIONS AS

SALVAGE ROTOMETER. TYP. OF 3.

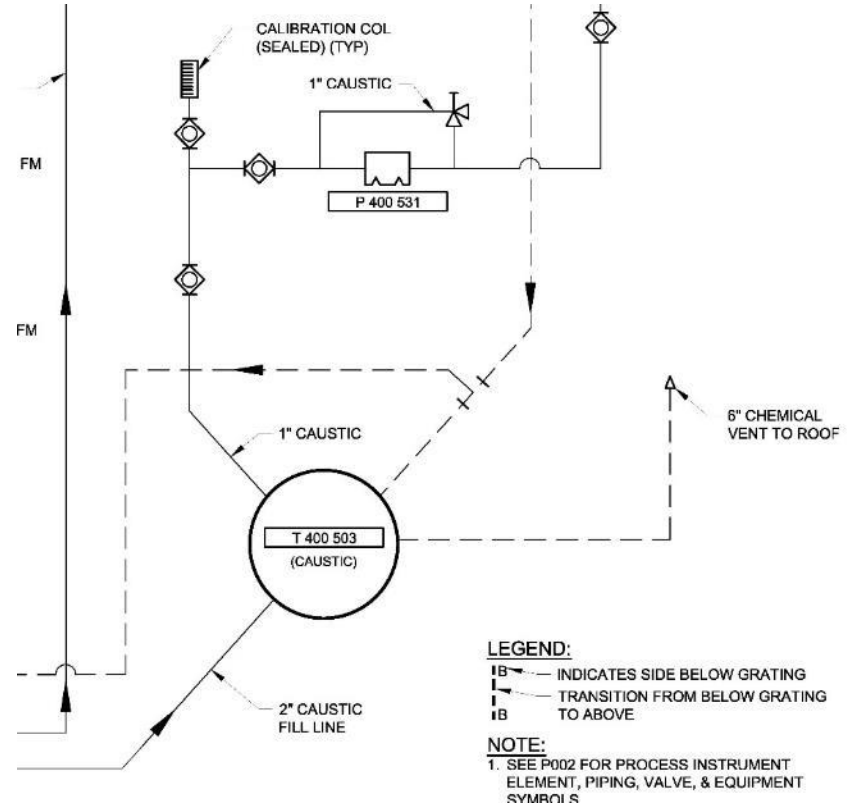
WITH PROJECT REPRESENTATIVE TO  
JG VALVES AS NEEDED TO ISOLATE  
P TO REMAIN IN OPERATION.



*Photos & graphics from KCWTD*

*Diluted hypo tank*

# Tanks



*Caustic tank*

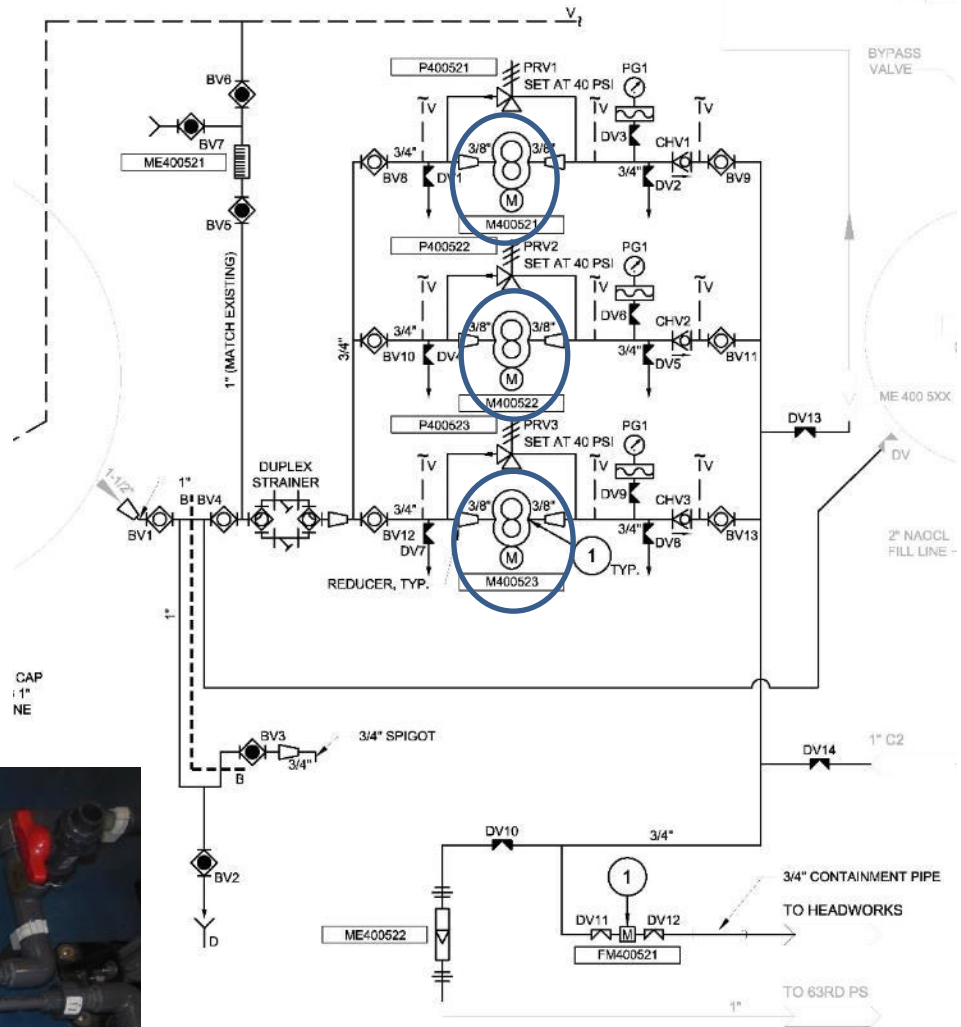
*Photos & graphics from KCWTD*

# Pumps



Photos & Graphics from KCWTD

Version - 1.1, October 2020



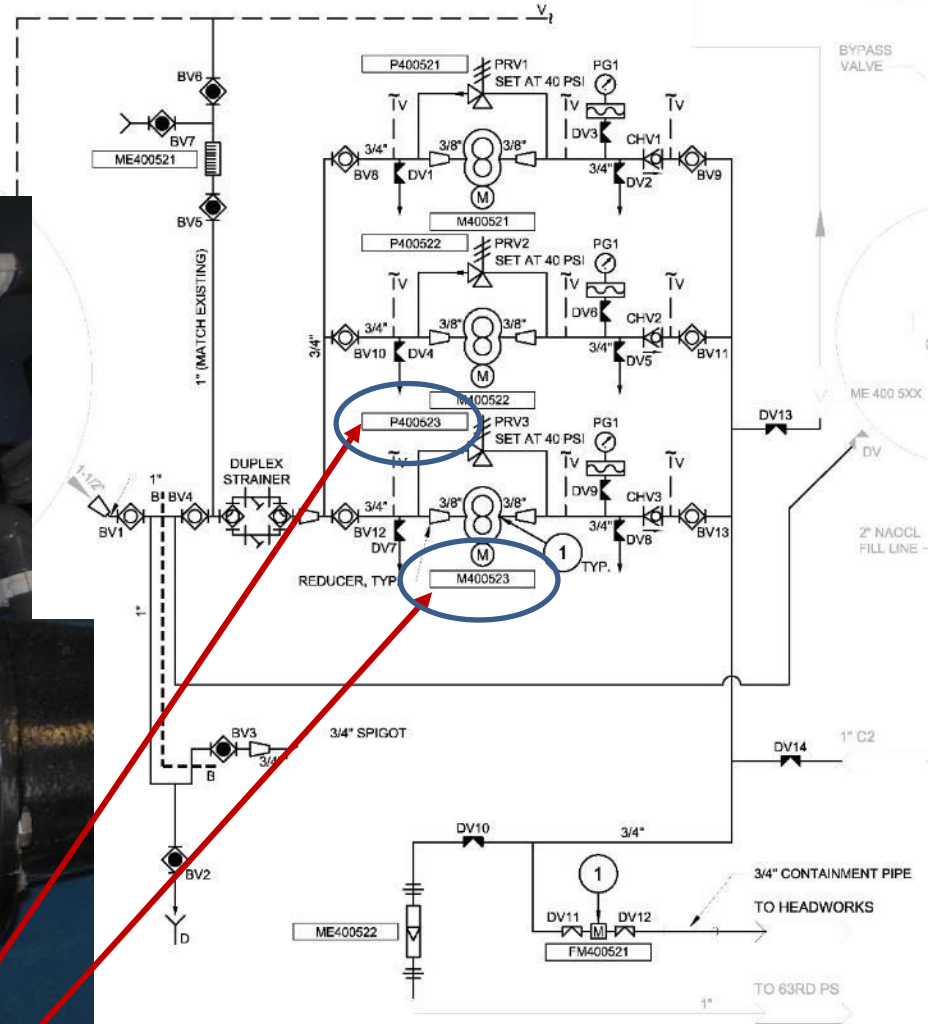
Process Flow / Instrumentation Drawings

## Hypochlorite Pumps

# Pumps



Photos & Graphics from KCWTD



Process Flow / Instrumentation Drawings

Hypochlorite Pumps

# Find the Valves

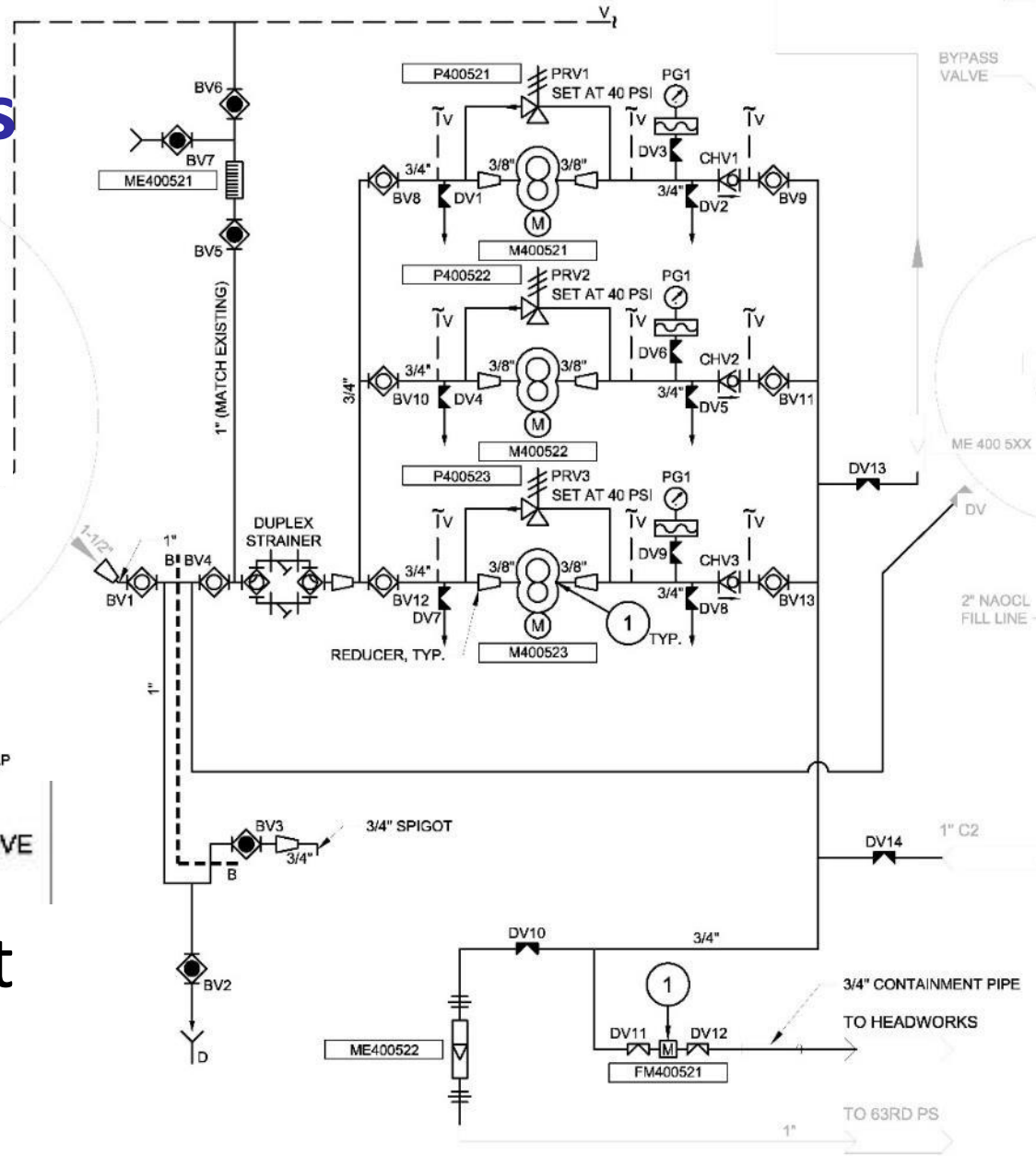
- Ball valves



- Diaphragm valves



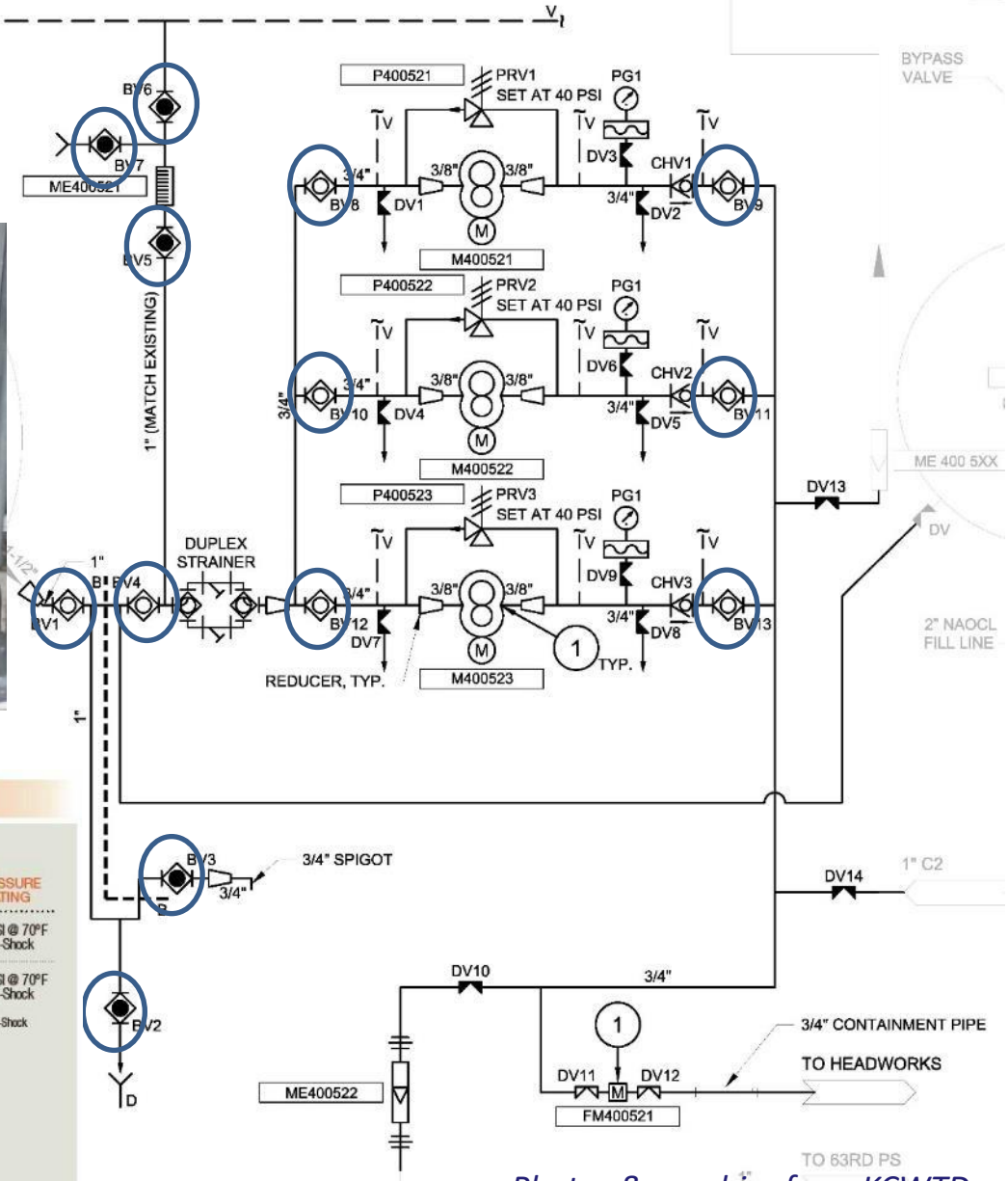
- Circle & count



Graphics from KCWTD

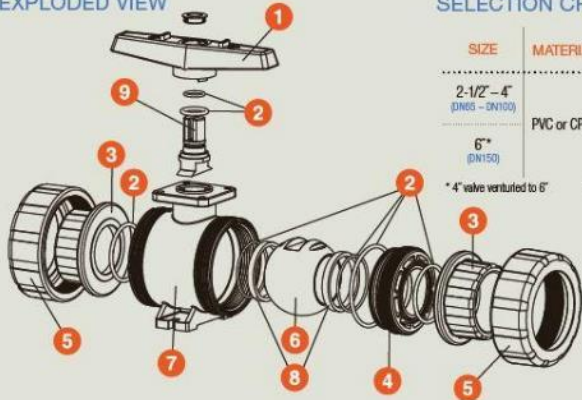


# Ball Valves



## TECHNICAL INFORMATION

### EXPLODED VIEW

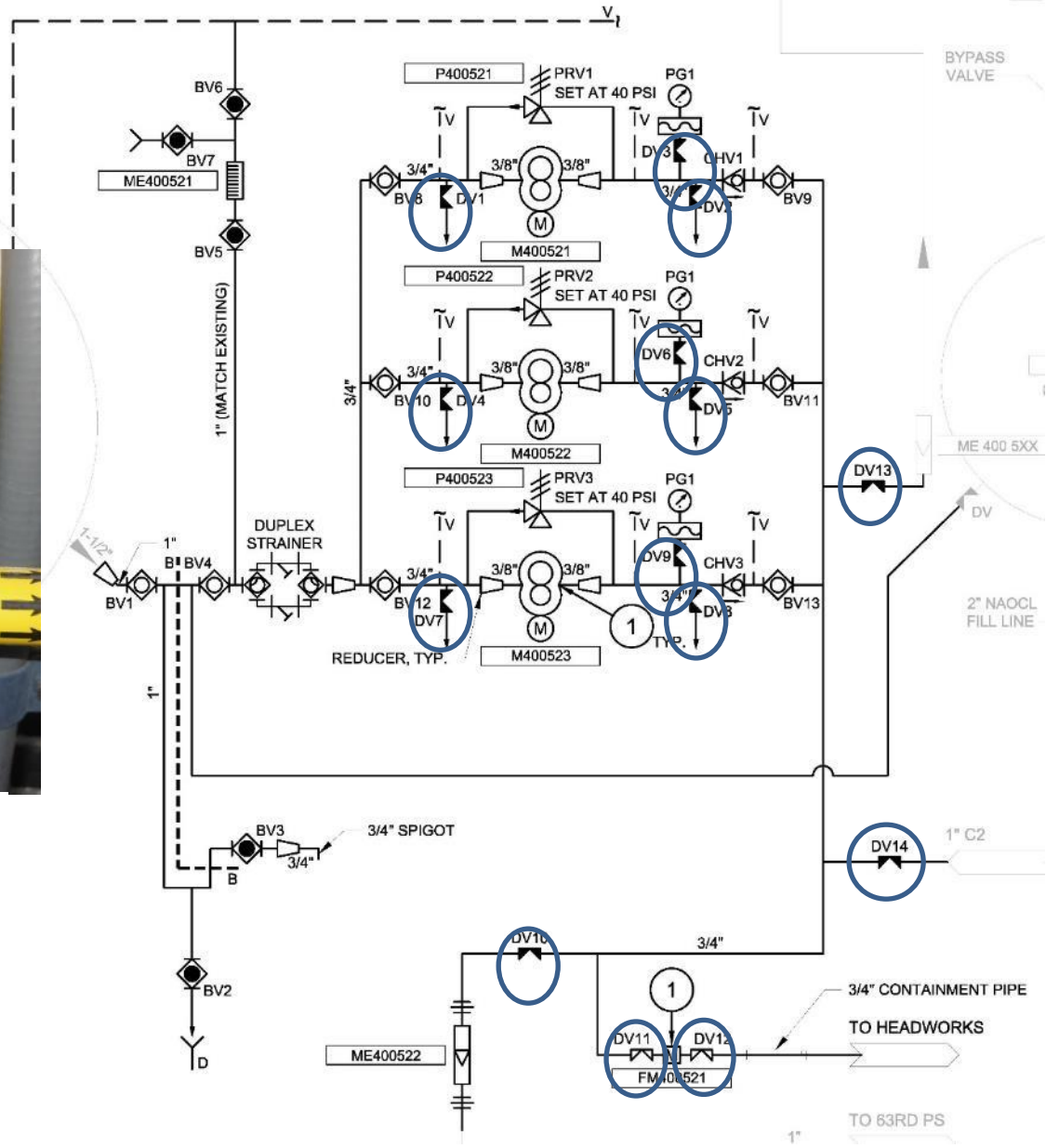
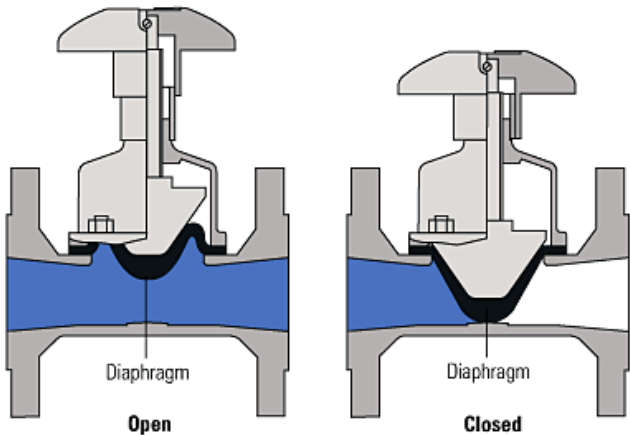


### SELECTION CHART

SIZE	MATERIAL	END CONNECTION	SEALS	PRESSURE RATING
2-1/2" - 4" (DN65 - DN100)	PVC or CPVC	Socket, Threaded or Flanged**	FPM or EPDM	235 PSI @ 70°F Non-Shock
6" (DN150)		Flanged		150 PSI @ 70°F Non-Shock

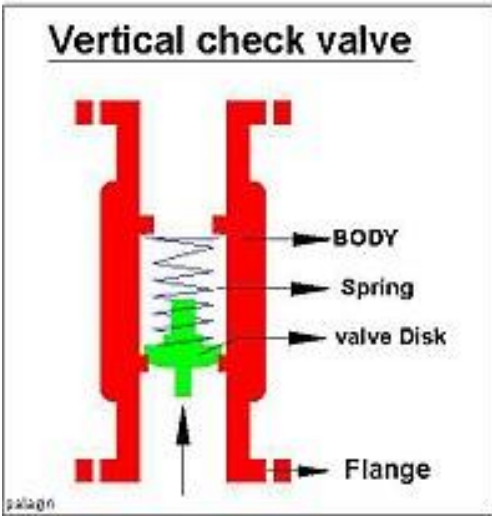
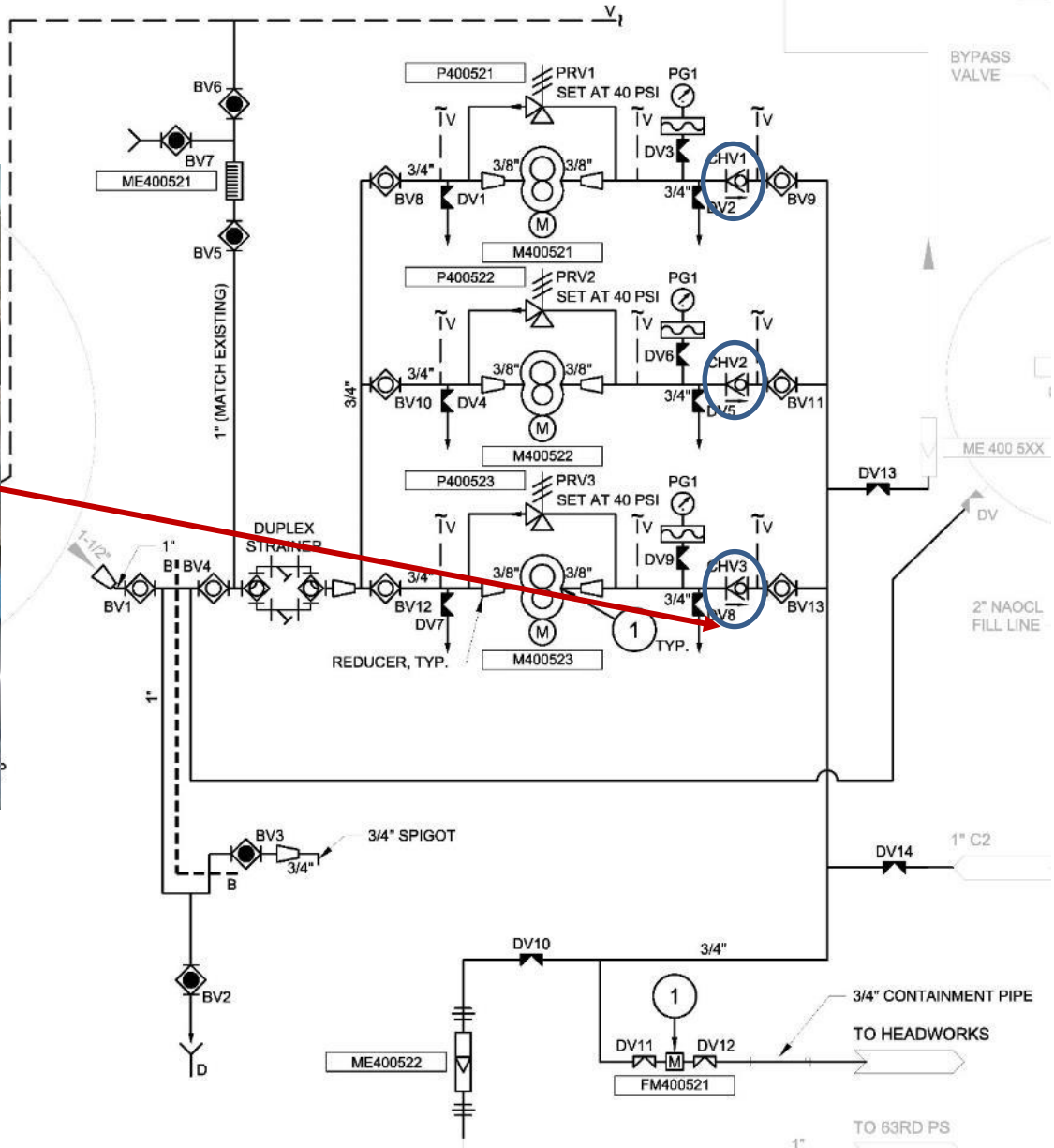
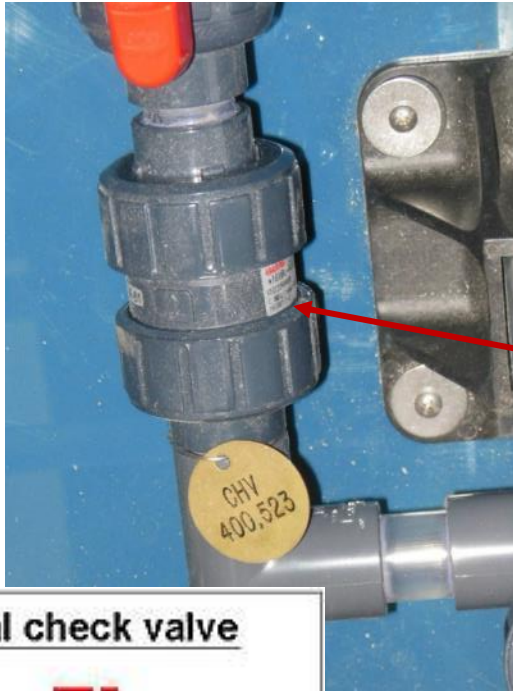
\* 4" valve venturited to 6"      \*\* All flanged valves are rated to 150 PSI @ 70°F Non-Shock

# Diaphragm Valves



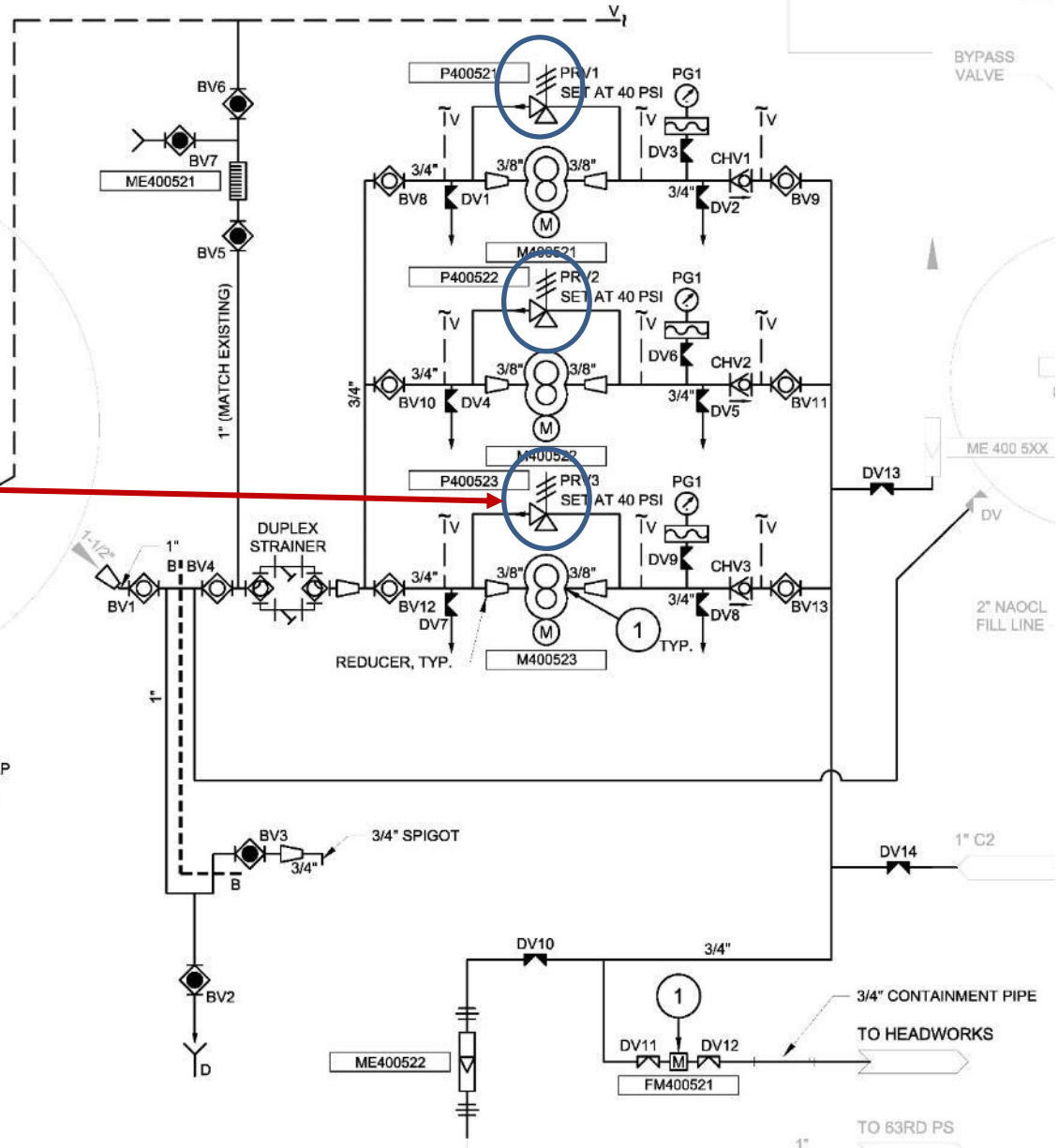
Photos & graphics from KCWTD & GlobalSpec

# Check Valves



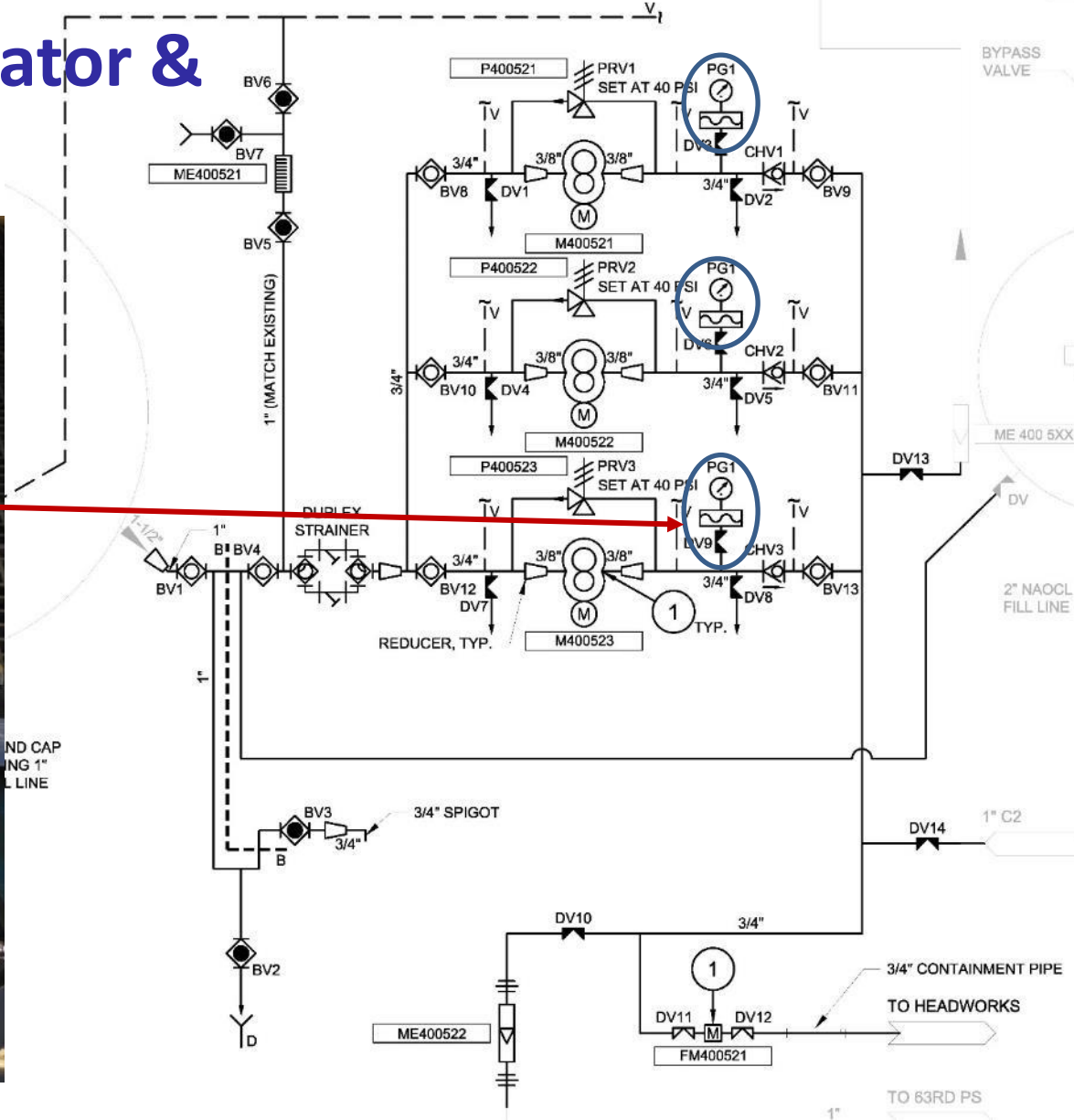
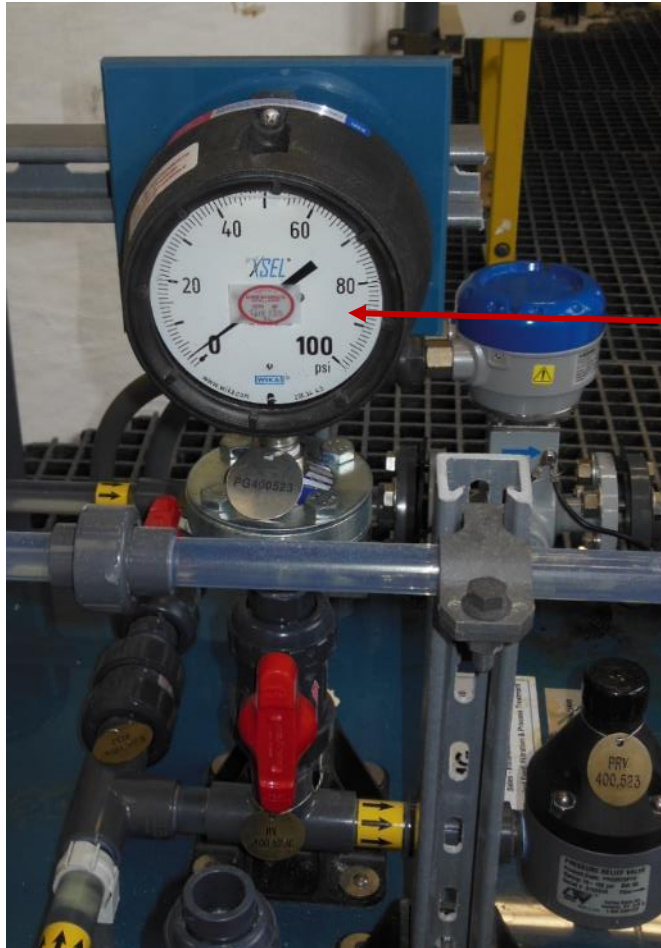
Photos & graphics from KCWTD & Wikipedia

# Pressure Relief Valves



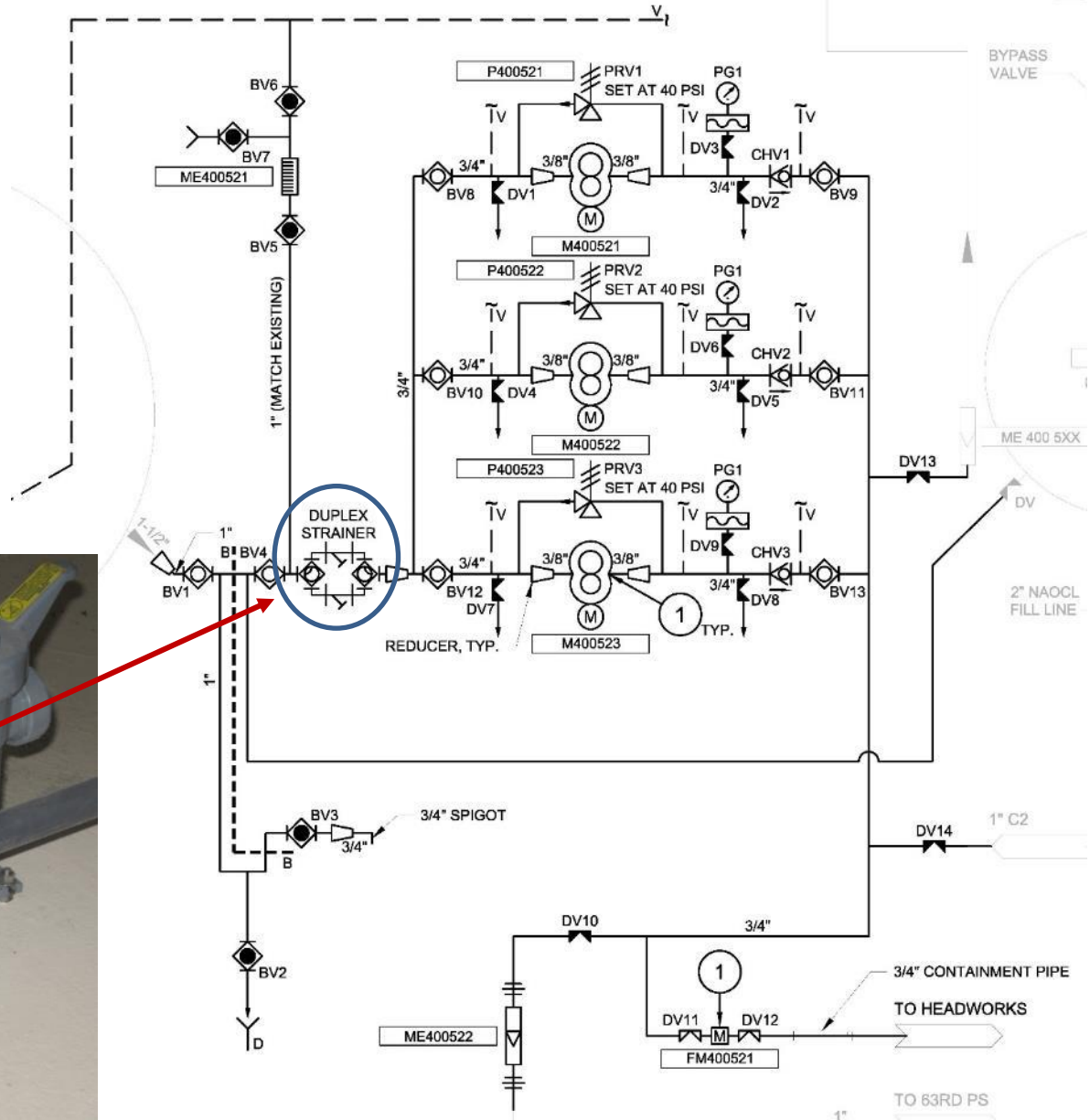
Photos & graphics from KCWTD

# Pressure Indicator & Diaphragm



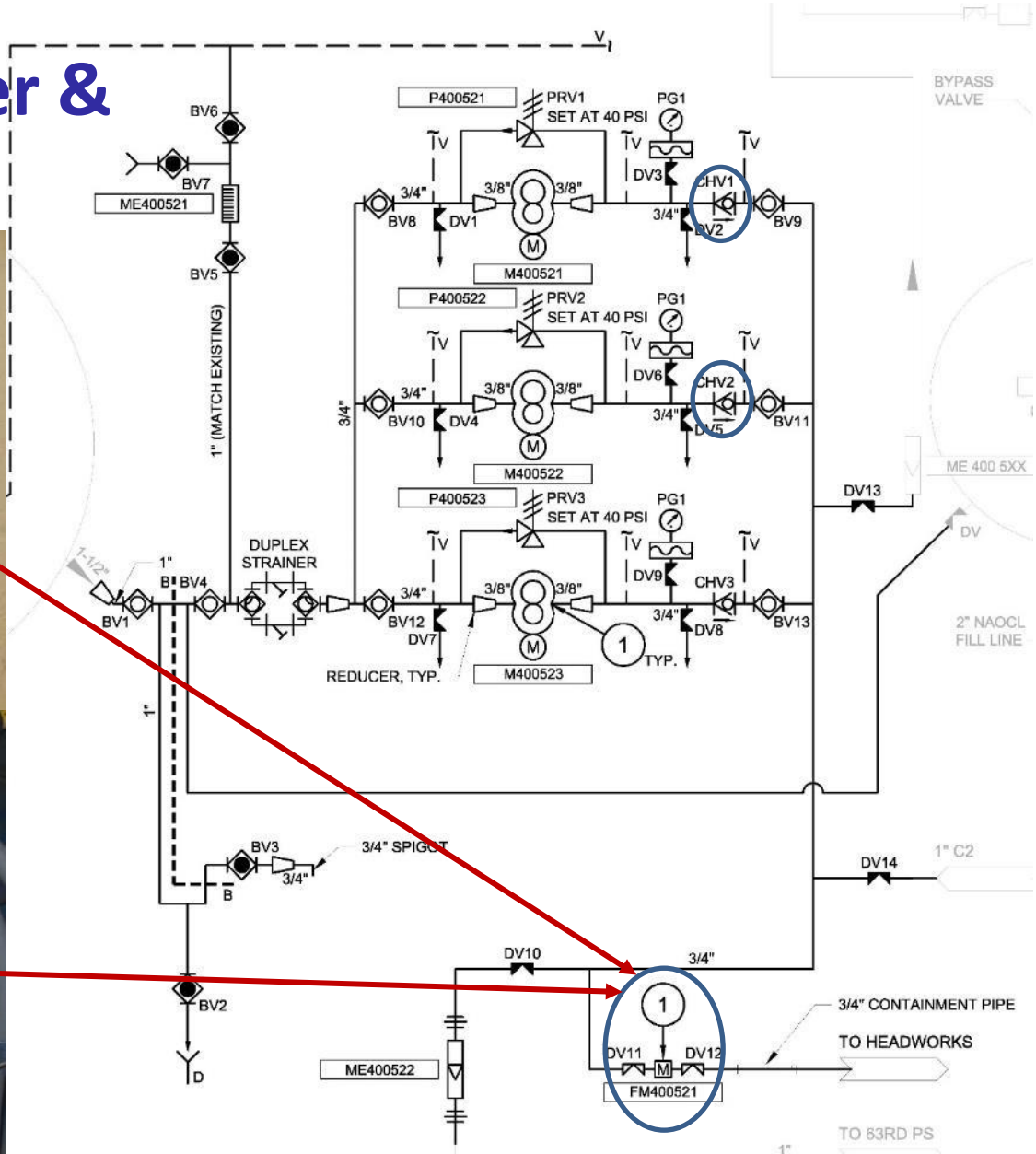
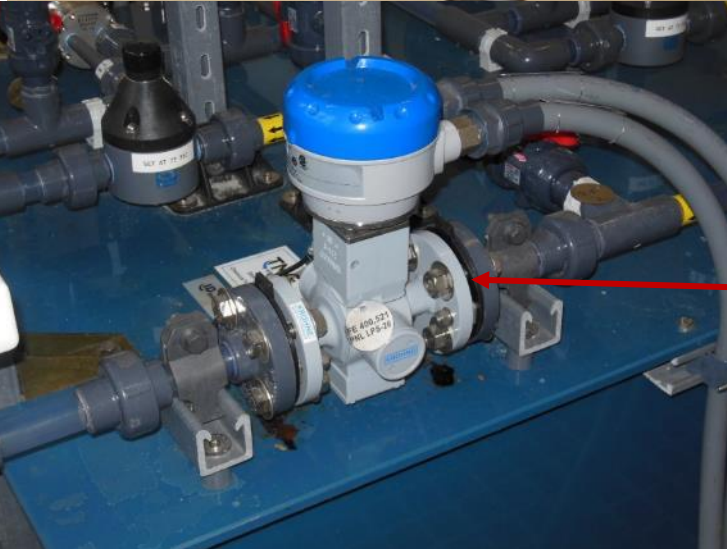
Photos & graphics from KCWTD

# Strainer



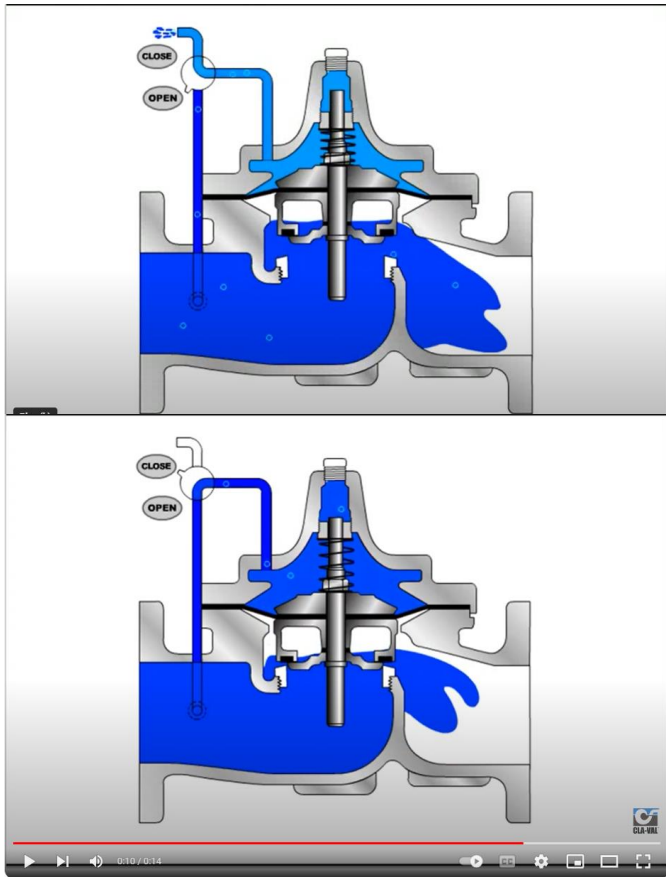
Photos & graphics from KCWTD

# Flow Transmitter & Indicator

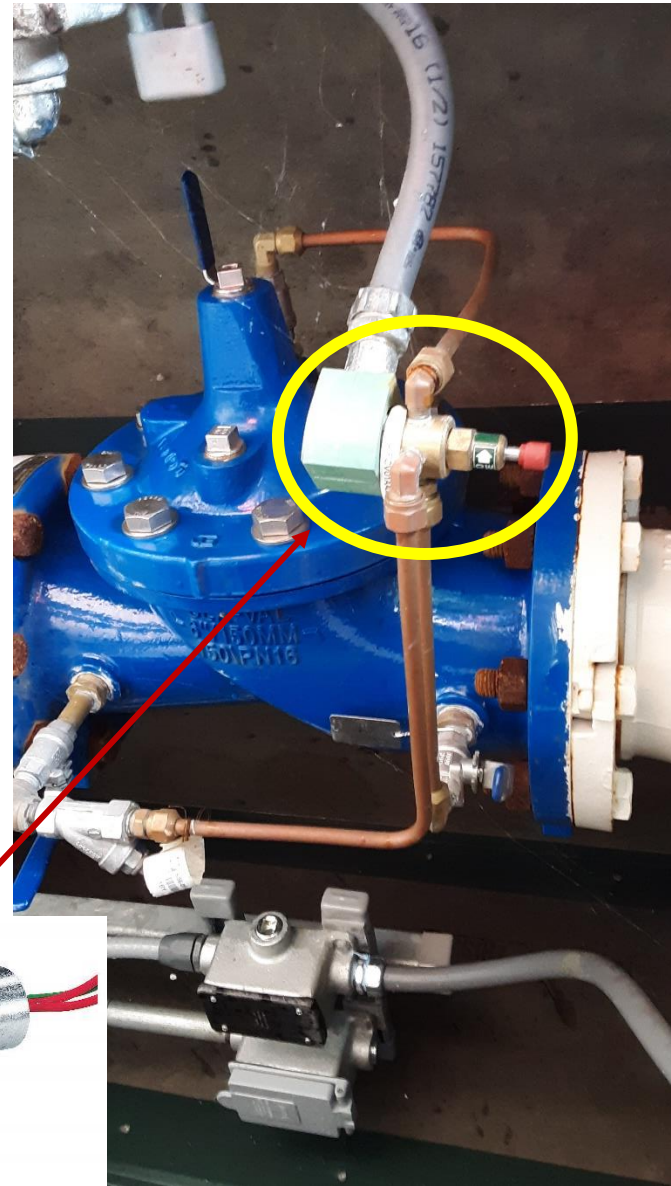


Photos & graphics from KCWTD

# Solenoid Valve



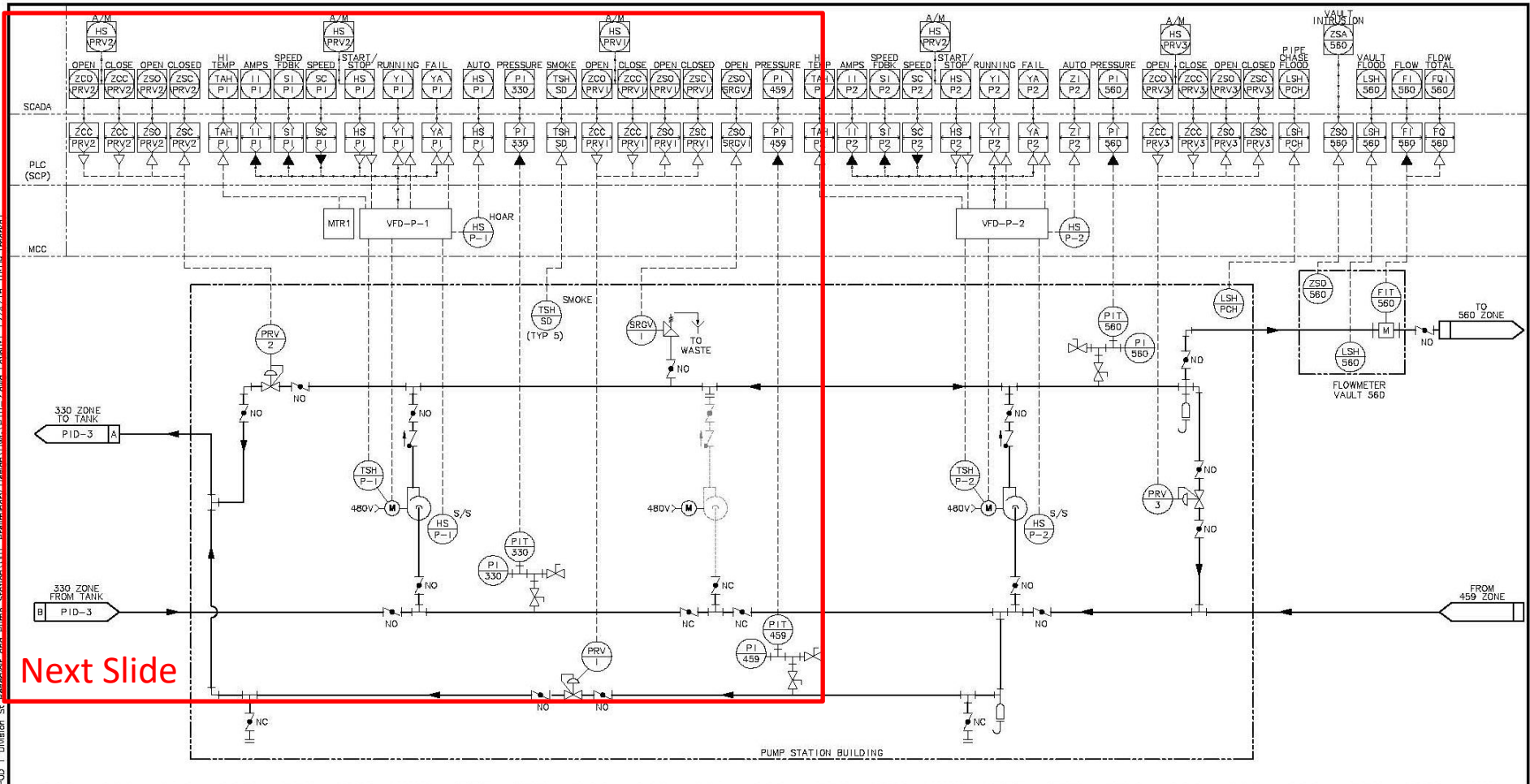
Images from Cla-Val via YouTube  
<https://www.youtube.com/watch?app=desktop&v=suAVORiXNsc>



Photos from KCWTD



W:\WF\143\_Murray\_Smith\_Assoc\085\_Skagit\_PUD\1\_Division\_Street\_Station\001\_Division\_Street\_Station\DWG\PID-2\_Pump\_Station\12.24.15\_10.00.dwg (Rev. 10.00)



Next Slide

- PRV-2**  
 PRESSURE REDUCING VALVE FROM 560 PZ TO 330 PZ
- P-1**  
 PORTABLE WATER PUMP 150HP
- PRV-1**  
 PRESSURE REDUCING VALVE FROM 459 PZ TO 330 PZ
- SRGV-1**  
 SURGE VALVE TO WASTE
- P-3**  
 (FUTURE) PORTABLE WATER PUMP 150HP
- P-2**  
 PORTABLE WATER PUMP 125HP
- PRV-3**  
 PRESSURE REDUCING VALVE FROM 560 PZ TO 459 PZ
- FI-560**  
 MAGNETIC FLOWMETER



**100% SUBMITTAL**

**MSA** Murray Smith & Associates, Inc.  
 Engineers/Planners  
 2707 Colby Avenue, Suite 1110 FEDERAL 425.252.2000  
 Everett, Washington 98201-3566 FAX 425.252.8388

NO.	REVISIONS	BY	DATE

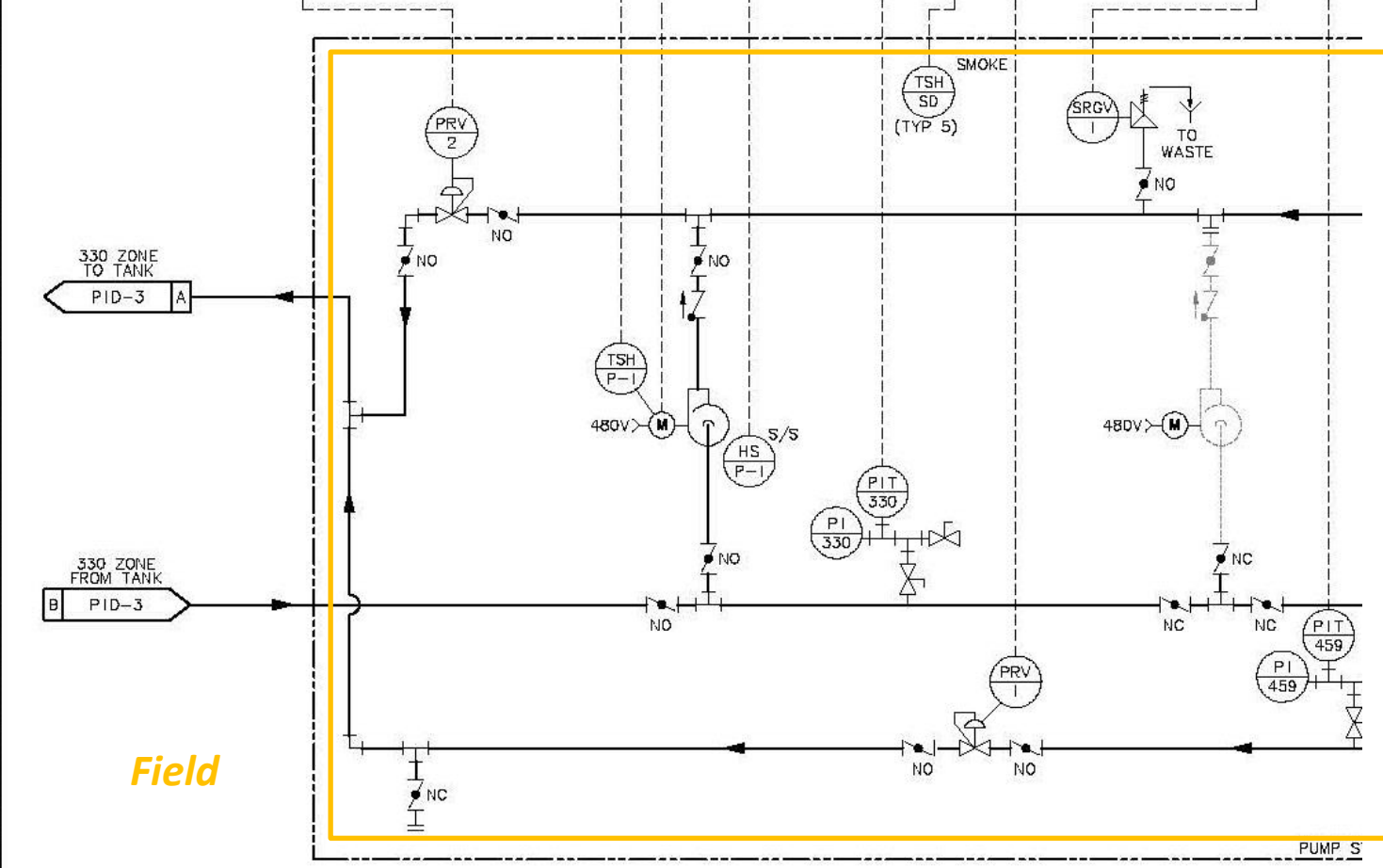
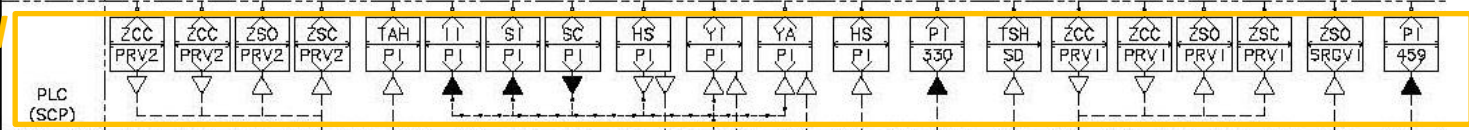
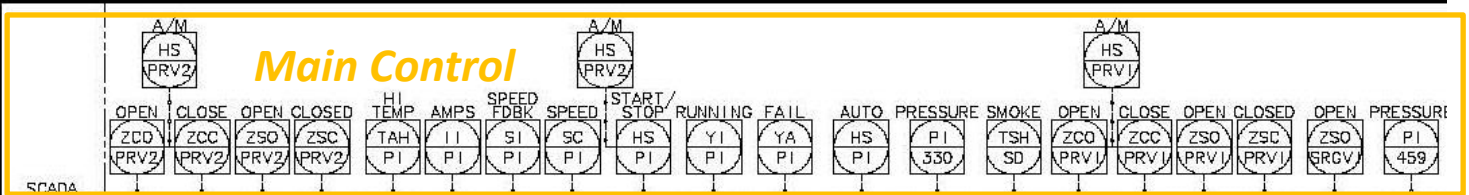


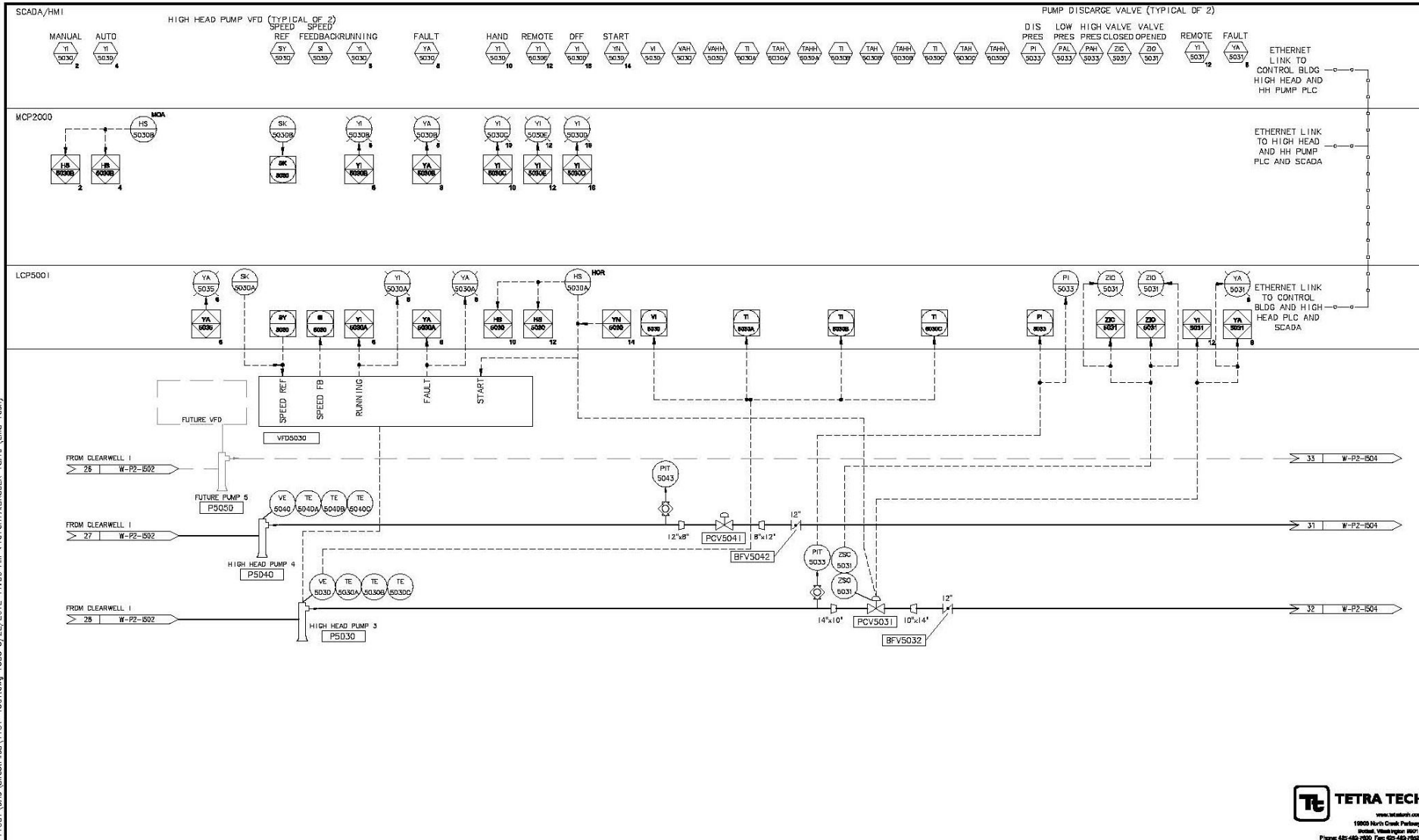
DATE PLOTTED: 07/03/24	SCALE: 1"=10'
DATE REVISION: 10/01/20	SCALE: 1"=10'

**Skagit PUD** PUBLIC UTILITY DISTRICT  
 NO. 1 of SKAGIT COUNTY  
 1415 Fremont Drive  
 P.O. BOX 5488  
 Mount Vernon, WA 98272  
 (509) 434-7704  
 www.skagit-pud.org

DIVISION STREET TANK AND BOOSTER PUMP STATION  
 PID-2  
 SCALE: NONE W.O. 15-1664 SHEET: 77 OF 78  
 I.S.O. 300X

PLC (Electrical Room)





P:\21885\135-21885-11001\CAD\SheetFiles\1101-1601.dwg 10/3/2020 11:00 AM VICTOR ABRUQUER 18 in (LMS Text)

NO.	DATE	BY	REVISION

**NOTICE**  
 0 1/8" = 1' (AS SHOWN)  
 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

BTY: DESIGNED  
 VCEI: CHECKED  
 DRAWN: USE  
 CHECKED: CHECKED

**MSA** Murray Smith & Associates, Inc.  
 Engineers/Planners  
 2290 Dulles Gateway, Suite 1100 | FORT MYERS, FL 33907  
 Leesville, Washington Street 9800 | PALM BEACH, FL 33480

PUBLIC UTILITY DISTRICT NO. 1  
 of *Whitehaven County*  
**WATER TREATMENT PLANT 2**  
**IMPROVEMENTS**  
**CIP NO. RW-1**

**HIGH HEAD PUMP STATION**

PROJECT NO.: 10-1129-250 SCALE: AS SHOWN DATE: APRIL 2012

SHEET  
**W-P2-I503**  
 45 of X

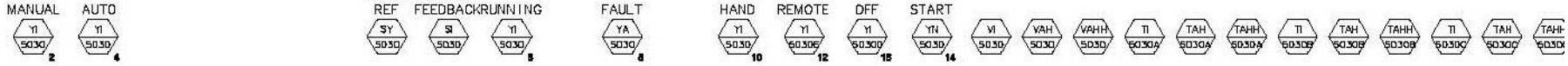


# Remote monitoring /

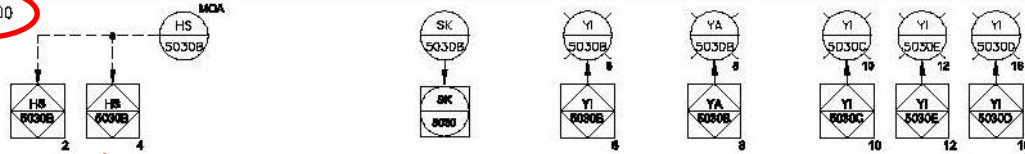
SCADA/HMI

# control

HIGH HEAD PUMP VFD (TYPICAL OF 2)



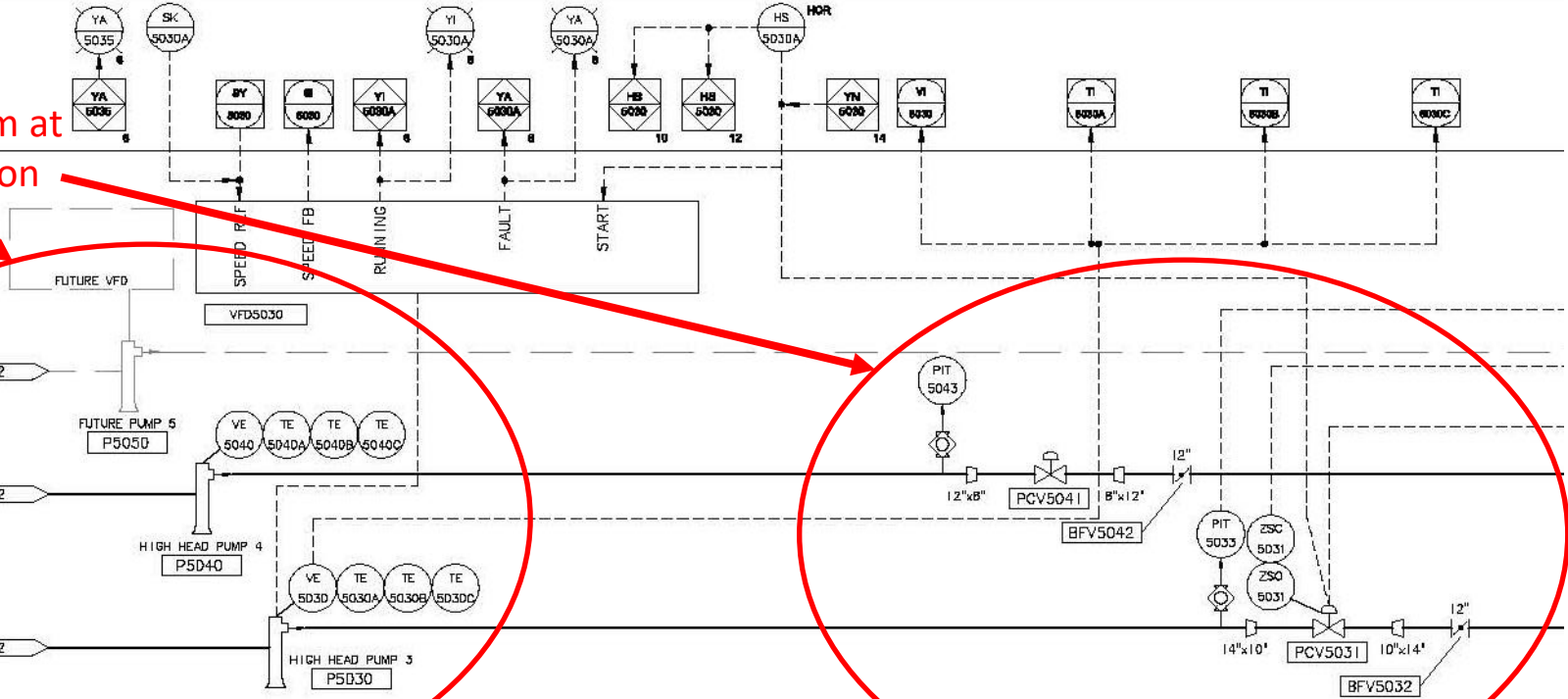
MCP2000



Electrical Rm at Pump Station

LCP5001

Pump Room at Pump Station



# Take a Break





## Pick from each section

- One from equipment
- Two from valves and gates
- One from pipeline devices
- One primary element
- Circle selected
- Focus on the Process Flow Diagram

# INSTRUMENT ELEMENT, PIPING, VALVE AND EQUIPMENT SYMBOLS LEGEND

PRIMARY ELEMENT <span style="float: right;">x1</span>	
	ORIFICE PLATE
	VENTURI OR FLOW TUBE
	NOZZLE FLOW
	PITOT TUBE
	PROPELLER OR TURBINE METER
	FLUME
	WEIR
	VARIABLE AREA FLOW INDICATOR (ROTAMETER)
	DIAPHRAGM SEAL
	IN-LINE ANNULAR SEAL
	FLOW ELEMENT INTEGRAL WITH TRANSMITTER (MASS FLOW, ETC)
	CAMERA (CCTV)
	MAGNETIC FLOWMETER
	SONIC FLOWMETER (DOPPLER OR TRANSIT TIME)
	POSITIVE DISPLACEMENT METER
	THERMAL FLOW ELEMENT
	VORTEX FLOW ELEMENT
	CORIOLIS FLOW ELEMENT
	FLOAT LEVEL ELEMENT
	ULTRASONIC FLOW ELEMENT
	RADAR OR ULTRASONIC LEVEL ELEMENT
	ANNUBAR
	BUBBLER LEVEL TUBE
	SUBMERSIBLE LEVEL TRANSMITTER
	COMPENSATED FLOW METER

PIPELINE DEVICES <span style="float: right;">x1</span>	
	TRAP
	SEDIMENT TRAP
	GAS DRIFT TRAP
	SEPARATOR/ DRYER
	PIPELINE FILTER
	RUPTURE DISK (VACUUM RELIEF)
	RUPTURE DISK (PRESSURE RELIEF)
	CONNECTION BETWEEN NEW AND EXISTING PIPING
	UNION
	QUICK CONNECTOR
	CAP OR PLUG
	BLIND FLANGE
	HOSE CONNECTION
	REDUCER
	TEE
	FLEX CONNECTION
	VENT TO ROOF
	VENT
	STEAM VENT
	AUTOMATIC VENT
	MANUAL VENT
	STRAINERS
	DRAIN
	DRAIN VALVE

	CALIBRATION CHAMBER
	PULSATION DAMPENER
	INJECTOR
	FLAME TRAP
	FLAME TRAP WITH THERMO SHUTOFF ASSEMBLY/FLAME CHECK
	SAMPLING AND FLUSHING CONNECTIONS
	SUCTION DIFFUSER
	TEMPERATURE WELL
	FLOW STRAIGHTENING VANES
	PRA
	AMMONIA UNION
	DAMPENER
	SIGHT GLASS
	REDUCED PRESSURE BACKFLOW PREVENTER
	FUEL PIPING LEAK DETECTOR ELEMENT
	FOOT VALVE
	AIR SEPARATOR
	SIGHT GLASS
	PRESSURE INDICATOR

NORMALLY OPEN	NORMALLY CLOSED	
		GATE VALVE
		PLUG VALVE
		BALL VALVE
		GLOBE VALVE
		NEEDLE VALVE
		KNIFE GATE VALVE
		DIAPHRAGM VALVE
		BUTTERFLY VALVE
		ANGLE VALVE
		THREE WAY VALVE
		FOUR WAY VALVE
		FLOAT VALVE
		PINCH VALVE
		BALANCING COCK
		THERMOSTATICALLY CONTROLLED VALVE
		DOUBLE LEAF CHECK VALVE
		CHECK VALVE
		BALL CHECK VALVE
		PUMP DISCHARGE VALVE
		GAUGE OR ROOT VALVE
		PRESSURE AND VACUUM RELIEF VALVE
		VACUUM RELIEF VALVE
		PRESSURE RELIEF VALVE
		IN-LINE SPRING LOADED RELIEF VALVE
		PRESSURE REGULATING VALVE (SELF-CONTAINED)
		BACK PRESSURE REGULATING VALVE (SELF-CONTAINED)


VALVES AND GATES <span style="float: right;">x2</span>	
	FUSIBLE LINK
	SOLENOID VALVE
	DIAPHRAGM OPERATED VALVE
	PRESSURE BALANCE OPERATED VALVE
	MOTOR OPERATED VALVE
	MOTOR OPERATED VALVE, MODULATING
NOTE: USE VALVE BODY SYMBOL TO MATCH TYPE OF VALVE.	
	PISTON OPERATED VALVE
	TELESCOPING VALVE
	MUD VALVE
SLIDE AND SLUICE GATES	
	FLAP GATE
	BUTTERFLY GATE
	STOP GATE (NORMALLY OPEN)
	STOP GATE (NORMALLY CLOSED)
	SLIDE GATE (NORMALLY OPEN)
	SLIDE GATE (NORMALLY CLOSED)
	SLUICE GATE (NORMALLY OPEN)
	SLUICE GATE (NORMALLY CLOSED)

PUMPS	
	PUMP, CENTRIFUGAL
	PUMP, DIAPHRAGM
	PUMP, GEAR
	PUMP, METERING
	PUMP, PERISTALTIC
	PUMP, PROGRESSING CAVITY
	PUMP, ROTARY LOBE
	PUMP, SUBMERSIBLE
	PUMP, VERTICAL
BLOWERS AND COMPRESSORS	
	BLOWER OR CENTRIFUGAL FAN
	BLOWER OR COMPRESSOR, LIQUID RING
	BLOWER OR COMPRESSOR, ROTARY LOBE
	COMPRESSOR, ROTARY SCREW
	COMPRESSOR, ROTARY SLIDING VANE
	COMPRESSOR, PISTON
MIXERS	
	MIXER
	MIXER, IN-LINE STATIC

EQUIPMENT <span style="float: right;">x1</span>	
SCREENINGS AND CONVEYORS	
	SCREEN
	SCREEN, ROTARY OVERFLOW
	CLASSIFIER OR GRIT WASHER
	CONVEYOR
	HYDROCYCLONE
VESSELS AND TANKS	
	RECEIVER OR PRESSURE VESSEL
	TANK, DOUBLE WALLED
	TANK, NON-PRESSURE TYPE
MOTORS AND POWER	
	VFD
	VSD
	SOLENOID
	MOTOR
	ENGINE
	EJECTOR, PNEUMATIC
	GENERATOR
	SPEED SENSOR (RPM)

HEAT EXCHANGERS	
	SHELL AND TUBE HEAT EXCHANGER
	HEAT EXCHANGER, PLATE TYPE
	HEAT EXCHANGER, SPIRAL TYPE
	HEAT EXCHANGER, STRAIGHT TUBE TYPE
	HEAT EXCHANGER, U-TUBE TYPE
HVAC RELATED	
	FAN, IN-LINE
	CHILLER
	FILTER OR FILTER-SILENCER, INLET AIR
	BOILER
MISCELLANEOUS	
	SLENDER
	GREASE FILTER/OILSEPARATOR
	BURNER, WASTE GAS
	HEAT TRACE
	GRINDER
	DIFFUSER HEADER
	SPRAY NOZZLES
	HOPPER


NO	REVISION DESCRIPTION	BY	APVD	DATE



City of Everett  
Public Works Department

DESIGNED BY: R E WARD  
PROJECT ENGINEER: R E WARD  
DESIGN APPROVAL: S. MINGUS

CHECKED: AS NOTED  
SCALE: ALL  
PROJECT ACCEPTANCE: C01184C17



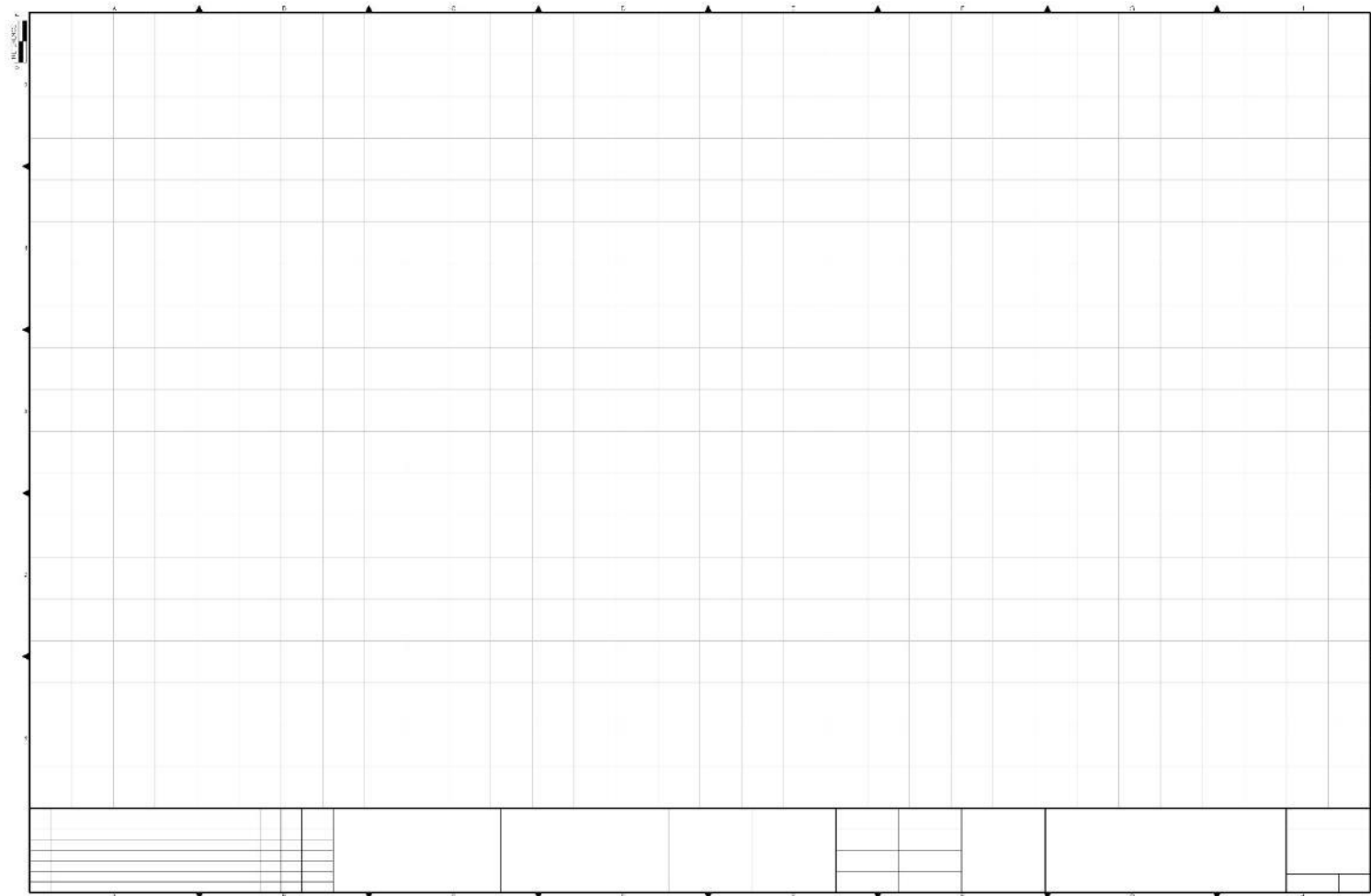
King County

DEPARTMENT OF NATURAL RESOURCES & PARKS WASTEWATER TREATMENT (4818) ALKI WET WEATHER TREATMENT FACILITY HYPOCHLORITE PUMP REPLACEMENT <b>PROCESS ELEMENT, PIPING, VALVE, &amp; EQUIPMENT SYMBOLS</b>	DATE: JULY 2017 PROJECT FILE NO: 16-1128126 DRAWING NO: <b>P002</b> SHEET NO: 22 TOTAL NO: 40
--	--



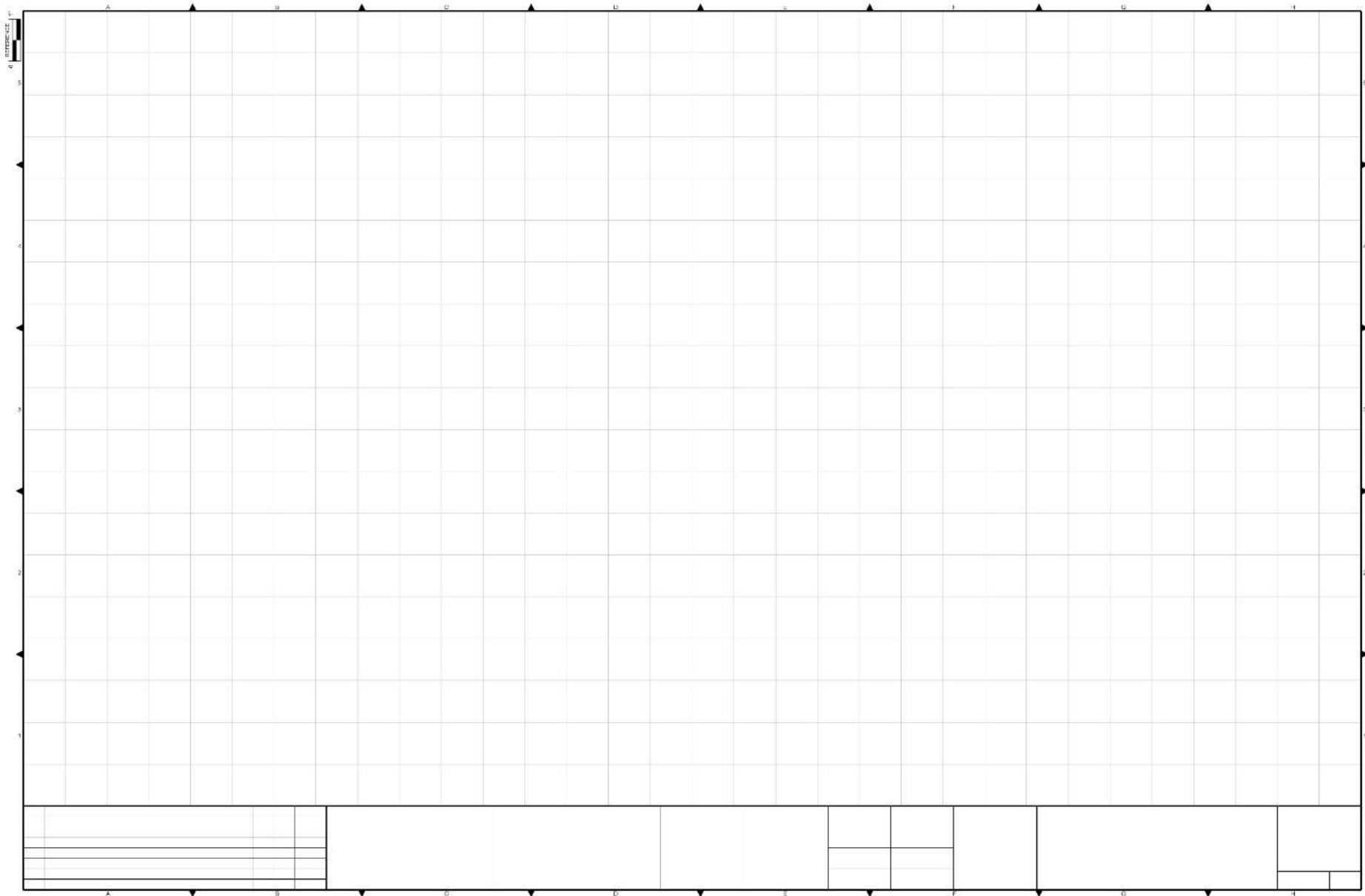
# Make up a P&ID

- Using the symbols selected



# Draw A Part of Your System

*Can you think of a part of your system  
and sketch it up?*



# Questions, Comments and Suggestions?

