Environmental Resources Management

101 SW Main Street
Suite 804
Portland, OR 97214
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(503) 488-5142 (fax)
www.erm.com

7 February 2011

Mr. Matt McClincy
Oregon Department of Environmental Quality
Northwest Region
2020 Southwest 4th Avenue, Suite 400
Portland, Oregon 97201-4987

Subject: Arkema Portland Groundwater Source Control Measure Groundwater Extraction and Treatment System Pre-Final Design
ECSI No. 398

Dear Matt:

On behalf of Legacy Site Services, LLC (LSS), ERM-West, Inc. (ERM) is submitting the attached Pre-Final Design drawings and specifications for the Groundwater Source Control Measure Groundwater Extraction and Treatment (GWET) System at the Arkema, Inc. site in Portland, Oregon. These documents are being submitted for review by the Oregon Department of Environmental Quality in accordance with Order on Consent No. LQVC-NWR-08-04 dated 31 October 2008, and the *Groundwater Source Control Measure Design and Implementation Work Plan* dated June 2009.

Design drawings are included as **Attachment A** and specifications are included as **Attachment B**. As per discussion with the ODEQ, the supporting project plans documents such as the Health and Safety Plan, Communication Plans Construction, GWET System Shut Down Hydraulic Evaluation, and GWET System Operation Description will be submitted under a separate cover during the early part of the week of 14 February 2011.

If you have any questions, please contact me at (503) 488-5014 or Todd Slater (LSS) at (610) 594-4430.

Sincerely,

Brendan Robinson, P.E.
Project Manager

BAR/ssh/114849
Attachments

cc: Todd Slater, LSS
Tom Gainer, ODEQ
Henning Larsen, ODEQ
Sean Sheldrake, EPA
Larry Patterson
Steve Parkinson, Groff Murphy
Karen Traeger, LSS
David Livermore, Integral

Attachment A
Drawings

GROUNDWATER SOURCE CONTROL MEASURE - GROUNDWATER EXTRACTION AND TREATMENT SYSTEM FOR

ARKEMA, INC.
PORTLAND, OREGON

FEBRUARY 2011

ISSUED FOR REVIEW & COMMENT PURPOSES
-NOT FOR CONSTRUCTION-

PREPARED FOR:

LEGACY SITE SERVICES, LLC
468 THOMAS JONES WAY
EXTON, PENNSYLVANIA 19341

PREPARED BY:

Environmental Resources Management, Inc.
ERM-West, Inc.
101 SW Main Street, Suite 804
Portland, Oregon 97204

ERIK IPSEN P.E.
Oregon Professional Engineer License No. 71118 PE

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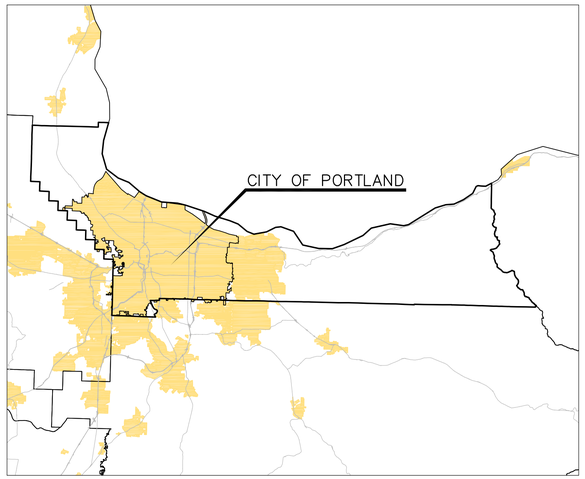

MULTNOMAH COUNTY
OREGON

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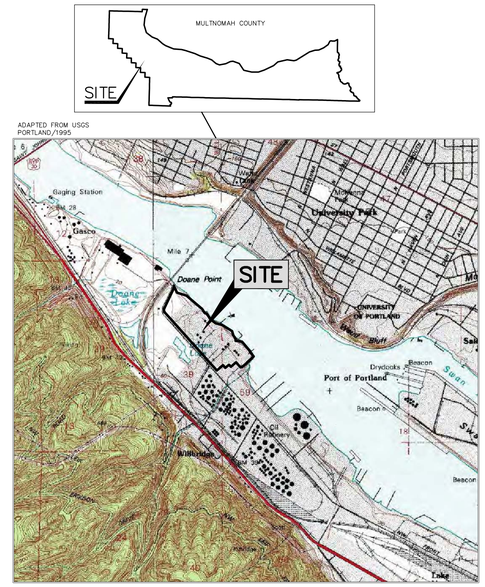

SECTION 59
T.1N / R.1E
CITY OF PORTLAND, MULTNANOMAH COUNTY, OREGON

SITE LOCATION MAP

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SCALE (IN FEET)

SITE VICINITY MAP

0 500 1000
SCALE (IN FEET)

GENERAL NOTES

1. SCALES ARE AS NOTED ON EACH DRAWING.

2. THE GENERAL NOTES AND LEGEND ON THIS SHEET APPLY TO ALL DRAWINGS, UNLESS OTHERWISE NOTED.

3. GROUND SURFACE ELEVATIONS SHOWN ARE BASED ON A LIDAR SURVEY PERFORMED BY I–TEN ASSOCIATES IN 2001 AND A BATHY METRIC SURVEY PERFORMED BY DAVID EVANS AND ASSOCIATES IN 2004. ELEVATIONS SHOWN ARE IN FEET ABOVE MEAN SEA LEVEL (AMSL), NAVD 88. HORIZONTAL CONTROL IS BASED ON OREGON STATE PLANE COORDINATE SYSTEM, NAD 83.

4. EXISTING CONTOUR LINES ARE SHOWN AT 2–FOOT INTERVALS, UNLESS OTHERWISE NOTED.

5. CONTRACTOR SHALL ENSURE THAT CONSTRUCTION ACTIVITIES DO NOT INTERFERE WITH SITE ACTIVITIES AT ANY TIME.

6. CONTRACTOR SHALL COMPLY WITH ALL REQUIREMENTS OF SITE HEALTH AND SAFETY THROUGHOUT CONSTRUCTION.

7. IN THE EVENT THAT THE DRAWINGS AND TECHNICAL SPECIFICATIONS CONFLICT, THE DRAWINGS SHALL TAKE PRECEDENCE OVER THE SPECIFICATIONS.

8. BENCHMARKS, MONUMENTS, AND PROPERTY MARKERS SHALL BE PROTECTED AT ALL TIMES AND SHALL NOT BE DISTURBED BY CONSTRUCTION ACTIVITIES.

9. CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING THE OREGON UTILITY NOTIFICATION CENTER AT 1–800–332–2344 THREE DAYS PRIOR TO THE START OF ANY EXCAVATION WORK.

10. CONTRACTOR SHALL CONTRACT AN APPROVED PRIVATE UTILITY LOCATOR FOR MARKOUT OF OWNER UTILITIES.

11. THE 100–YEAR FLOODPLAIN DELINEATION (ELEVATION 31 FEET AMSL) WAS OBTAINED FROM FLOOD INSURANCE RATE MAP 41018300B0E, CITY OF PORTLAND, OREGON, DATED OCTOBER 19, 2004.

LIST OF DRAWINGS

SHEET NO.	TITLE
	COVER SHEET
G1	SITE LOCATION, LEGEND, AND LIST OF DRAWINGS
G2	EXISTING SITE CONDITIONS
G3	PROPOSED SITE PLAN
G4	GWET SYSTEM BUILDING AREA
GA1	PRETREATMENT BUILDING AND EQUIPMENT LAYOUT
GA2	BIO-REACTOR BUILDING AND EQUIPMENT LAYOUT
GA3	ELEVATION VIEW "A" LOOKING NORTHWEST
GA4	ELEVATION VIEW "B" LOOKING NORTHEAST
PFD-01	GWET SYSTEM PROCESS FLOW DIAGRAM
PID-00	STANDARD P&ID SYMBOL, LEGEND
PID-01	RECOVERY WELLS
PID-02	PRETREATMENT SYSTEM 1 OF 2
PID-03	PRETREATMENT SYSTEM 2 OF 2
PID-04	BIO-REACTOR SYSTEM
PID-05	CARBON SYSTEM
PID-06	PRETREATMENT SLUDGE SYSTEM
PID-07	BIO-REACTOR SLUDGE SYSTEM
PID-08	COMPRESSED AIR AND SERVICE WATER
S1	CONCRETE FOUNDATIONS, FOOTINGS, & PIERS
S2	EQUIPMENT PAD PLANS & DETAILS
S3	TRENCH & SUMPS PLAN & DETAILS
S4	MISCELLANEOUS DETAILS
U1	UTILITY PIPING LAYOUT
U2	UTILITY PIPING ENLARGED PLAN AND DETAILS
U3	UTILITY TRENCH DETAILS
U4	MISCELLANEOUS DETAILS
M1	HVAC PLAN, ELEVATIONS, AND DETAILS
E1	ELECTRICAL LIGHTING AND RECEPTACLE LAYOUT
E2	ELECTRICAL WIRING DIAGRAM, PANEL BOARD SCHEDULES & DETAILS
E3	ELECTRICAL GROUNDING AND WIRING SCHEDULE
INST1	CONTROL PANEL ELEVATIONS AND DETAILS
4	EROSION AND SEDIMENT CONTROL PLAN
7	EROSION AND SEDIMENT CONTROL DETAILS

LEGEND

- MONITORING WELL LOCATION
- MONITORING WELL TO BE ABANDONED
- BORING LOCATION
- GWBW/UTILITY INTERSECTION
- HYDRANT
- GROUND SURFACE CONTOUR (2 ft. INTERVAL)
- TOP OF RIVER BANK (APPROX. 35 FT. AMSL)
- FLOODPLAIN BOUNDARY (APPROX. 31 FT. AMSL)
- EDGE OF WATER (15.93 FT. AMSL ON 5/3/06)
- SF — SF — SILT FENCE
- LOD — LIMIT OF DISTURBANCE
- X — X — X — EXISTING CHAIN LINK FENCE
- X — X — X — PROPOSED CHAIN LINK FENCE
- PARCEL/PROPERTY BOUNDARY
- SMALL DEBRIS/FRAGMENTS/FILL
- HISTORICAL BORING REFUSAL/LARGE DEBRIS
- TEST TRENCH (PREVIOUSLY EXCAVATED BY OTHERS)
- CLEARANCE TRENCH
- SD — SD — INDUSTRIAL STORMWATER DRAIN
- DS — DS — DS — DOMESTIC SEWER
- W — W — W — CITY WATER LINE
- RW — RW — RW — RIVER WATER LINE
- S — S — S — STEAM LINE
- DW — DW — DW — DOMESTIC WATER LINE
- E — E — E — OVERHEAD ELECTRIC/UTILITY LINE
- B — B — B — BRINE LINE
- RAILROAD TRACK
- INGRESS/EGRESS ROUTE

ABBREVIATIONS

℄	CENTERLINE
NOM	NOMINAL
DIA.	DIAMETER
R.O.W.	RIGHT OF WAY
EX	EXISTING
N.I.C.	NOT IN CONTRACT
TYP	TYPICAL
WSE	WATER SURFACE ELEVATION
INV	INVERT
STL	STEEL
MIN	MINIMUM
DWG	DRAWING
ELEV	ELEVATION
GAL	GALLONS
CY	CUBIC YARDS

602
4

SHEET NUMBER WHERE DETAIL IS LOCATED
DETAIL DESIGNATION
SHEET(S) NUMBER WHERE DETAIL IS IDENTIFIED

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GWET SYSTEM
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SITE LOCATION, LEGEND, AND LIST OF DRAWINGS

SCALE	PROJECT NUMBER	SHEET	REV.
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DATE 11/30/2010			

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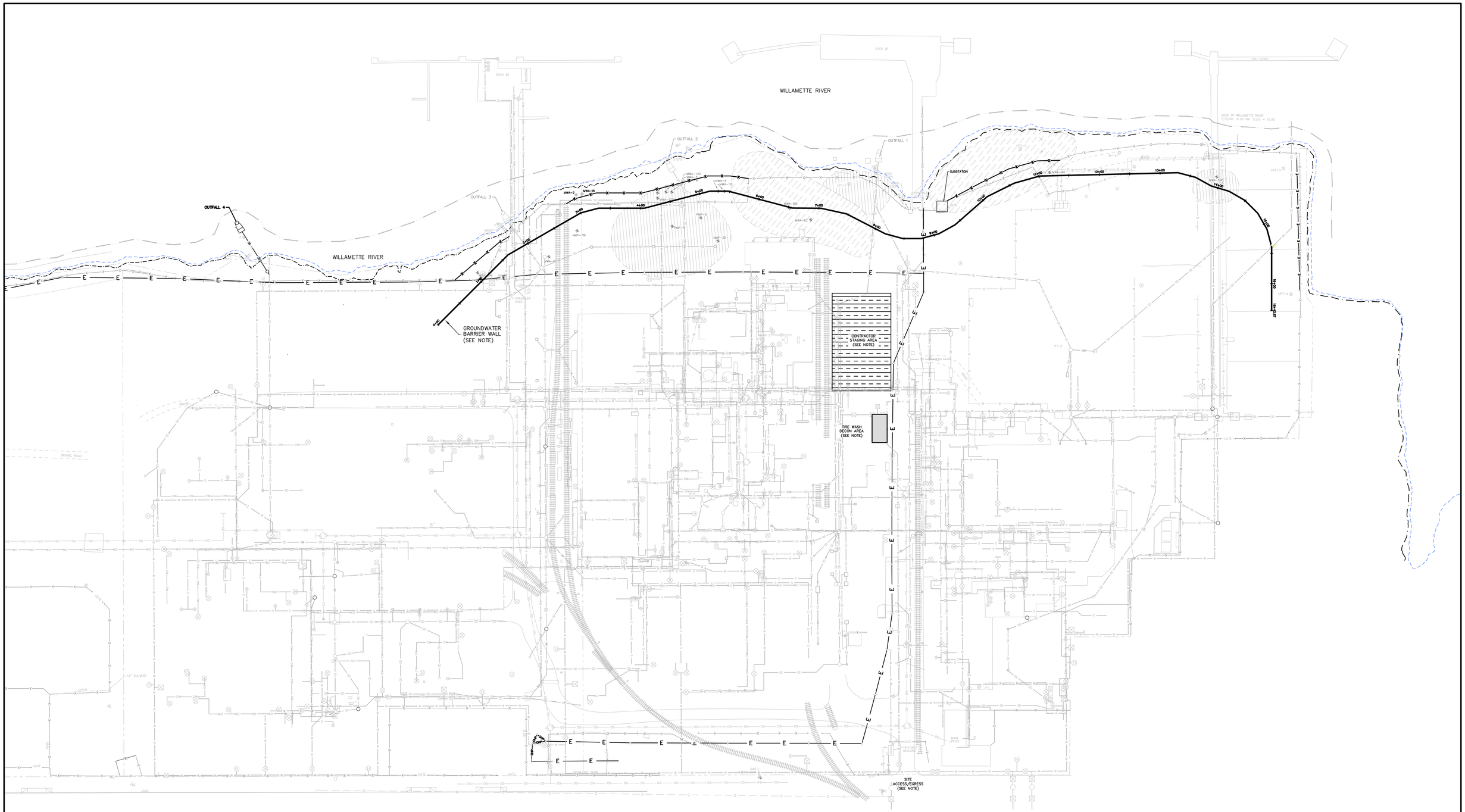

LEGEND

- MONITORING WELL LOCATION
- MONITORING WELL TO BE ABANDONED (SEE NOTE 6)
- BORING LOCATION
- GROUND SURFACE CONTOUR (2 ft. INTERVAL)
- TOP OF RIVER BANK (APPROX. 35 FT. AMSL)
- FLOODPLAIN BOUNDARY (APPROX. 31 FT. AMSL)
- EDGE OF WATER (15.93 FT. AMSL ON 5/3/06)
- CHAIN LINK FENCE
- PROPOSED CHAIN LINK FENCE
- PARCEL/PROPERTY BOUNDARY
- SMALL DEBRIS/FRAGMENTS/FILL
- HISTORICAL BORING REFUSAL/LARGE DEBRIS
- INDUSTRIAL STORMWATER DRAIN
- DOMESTIC SEWER
- CITY WATER LINE
- RIVER WATER LINE
- STEAM LINE
- DOMESTIC WATER LINE
- OVERHEAD ELECTRIC/UTILITY LINE
- BRINE LINE
- RAILROAD TRACK

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NOTE:
THE GWBW (GROUNDWATER BARRIER WALL) WILL BE CONSTRUCTED BEFORE THE GWET SYSTEM. NOTE THAT GWET SYSTEM CONSTRUCTION IS SCHEDULED TO ACTUALLY START BEFORE GWBW CONSTRUCTION IS FULLY COMPLETE IN ORDER TO MINIMIZE THE DELAY BETWEEN WALL INSTALLATION AND GWET SYSTEM STARTUP. THE STAGING AREA AND TRUCK WASH WILL BE AVAILABLE FOR BOTH THE GRBW AND GWET SYSTEM CONSTRUCTION.

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EXISTING SITE CONDITIONS

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WILLAMETTE RIVER

RECOVERY WELL PIPING AND ELECTRIC (SEE SHEET U2)

OUTFALL 4

WILLAMETTE RIVER

GWET SYSTEM (SEE SHEET G4)

NEW FIRE HYDRANT

CONTRACTOR STAGING AREA (SEE NOTE)

TIRE WASH DECON AREA (SEE NOTE)

NEW OVERHEAD ELECTRICAL AND PHONE SERVICE

NEW 2"ø GAS LINE

NEW 8"ø WATER LINE

ELECTRICAL SERVICE TIE IN

TIE NEW 8" WATER INTO EXISTING 10" ON SITE WATER LINE

TIE NEW 2" GAS LINE INTO EXISTING ON SITE GAS LINE

SITE ACCESS/EGRESS (SEE NOTE)

N.W. FRONT AVENUE

N.W. FRONT AVENUE

EXISTING CITY WATER MAIN

LEGEND

- MONITORING WELL LOCATION
- MONITORING WELL TO BE ABANDONED
- BORING LOCATION
- GROUND SURFACE CONTOUR (2 ft. INTERVAL)
- TOP OF RIVER BANK (APPROX. 35 FT. AMSL)
- FLOODPLAIN BOUNDARY (APPROX. 31 FT. AMSL)
- EDGE OF WATER (15.93 FT. AMSL ON 5/3/06)
- CHAIN LINK FENCE
- PROPOSED CHAIN LINK FENCE
- PARCEL/PROPERTY BOUNDARY
- SMALL DEBRIS/FRAGMENTS/FILL
- HISTORICAL BORING REFUSAL/LARGE DEBRIS

REVISIONS TO BE MADE ON THE CADD FILE ONLY

- INDUSTRIAL STORMWATER DRAIN
- DOMESTIC SEWER
- CITY WATER LINE – CURRENTLY LIVE
- CITY WATER LINE – NOT IN USE
- NEW CITY WATER LINE
- RIVER WATER LINE
- STEAM LINE
- DOMESTIC WATER LINE
- EXISTING OVERHEAD ELECTRIC/PHONE LINE
- NEW OVERHEAD ELECTRIC/PHONE LINE
- NEW GAS SUPPLY
- RAILROAD TRACK

- SHALLOW ZONE RECOVERY WELL
- INTERMEDIATE ZONE RECOVERY WELL
- PIEZOMETER WELL

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PROPOSED SITE PLAN

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WILLAMETTE RIVER

TREATED EFFLUENT DISCHARGE TO OUTFALL 004

NORTH

AIR COMPRESSOR

40' ±

40.27"

6" PVC SCH80 DISCHARGE PIPE

7627177.66E/ 702754.23N

7627236.70E/ 702684.54N

30'±

GWET SYSTEM BUILDING (SEE SHEETS GA1–GA4)

MWA–63

MWA–14I

MWA–5A

MWA–6C

RW–7

1+00

0+00

GROUNDWATER BARRIER WALL

PROPOSED SECURITY FENCE (SEE SHEET 7)

RW–6i

RECOVERY WELL PIPING AND ELECTRIC (SEE SHEET U2)

RW–5

PA–17i

PA–27d

PA–03

PA–10i

PA– 4

PA–18d

ELECTRICAL TRANSFORMER

PARKING AREA

WATER METER AND BACKFLOW PREVENTER

NATURAL GAS METER/REGULATOR

HYDRANT

GATE

APPROXIMATE EDGE OF EXISTING ROADWAY

GATE

GRAVEL

SPRINKLER SHED

NEW OVERHEAD ELECTRICAL AND PHONE SERVICE

NEW 8" WATER LINE

NEW 2" GAS LINE

LEGEND

- MONITORING WELL LOCATION
- MONITORING WELL TO BE ABANDONED (SEE NOTE 6)
- BORING LOCATION
- GROUND SURFACE CONTOUR (2 ft. INTERVAL)
- TOP OF RIVER BANK (APPROX. 35 FT. AMSL)
- FLOODPLAIN BOUNDARY (APPROX. 31 FT. AMSL)
- EDGE OF WATER (15.93 FT. AMSL ON 5/3/06)
- CHAIN LINK FENCE
- PROPOSED CHAIN LINK FENCE
- PARCEL/PROPERTY BOUNDARY
- SMALL DEBRIS/FRAGMENTS/FILL
- HISTORICAL BORING REFUSAL/LARGE DEBRIS
- INDUSTRIAL STORMWATER DRAIN
- DOMESTIC SEWER
- CITY WATER LINE – CURRENTLY LIVE
- CITY WATER LINE – NOT IN USE
- NEW CITY WATER LINE
- RIVER WATER LINE
- STEAM LINE
- DOMESTIC WATER LINE
- EXISTING OVERHEAD ELECTRIC/PHONE LINE
- NEW OVERHEAD ELECTRIC/PHONE LINE
- NEW GAS SUPPLY
- RAILROAD TRACK
- SHALLOW ZONE RECOVERY WELL
- INTERMEDIATE ZONE RECOVERY WELL
- PIEZOMETER WELL

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GWET SYSTEM BUILDING AREA

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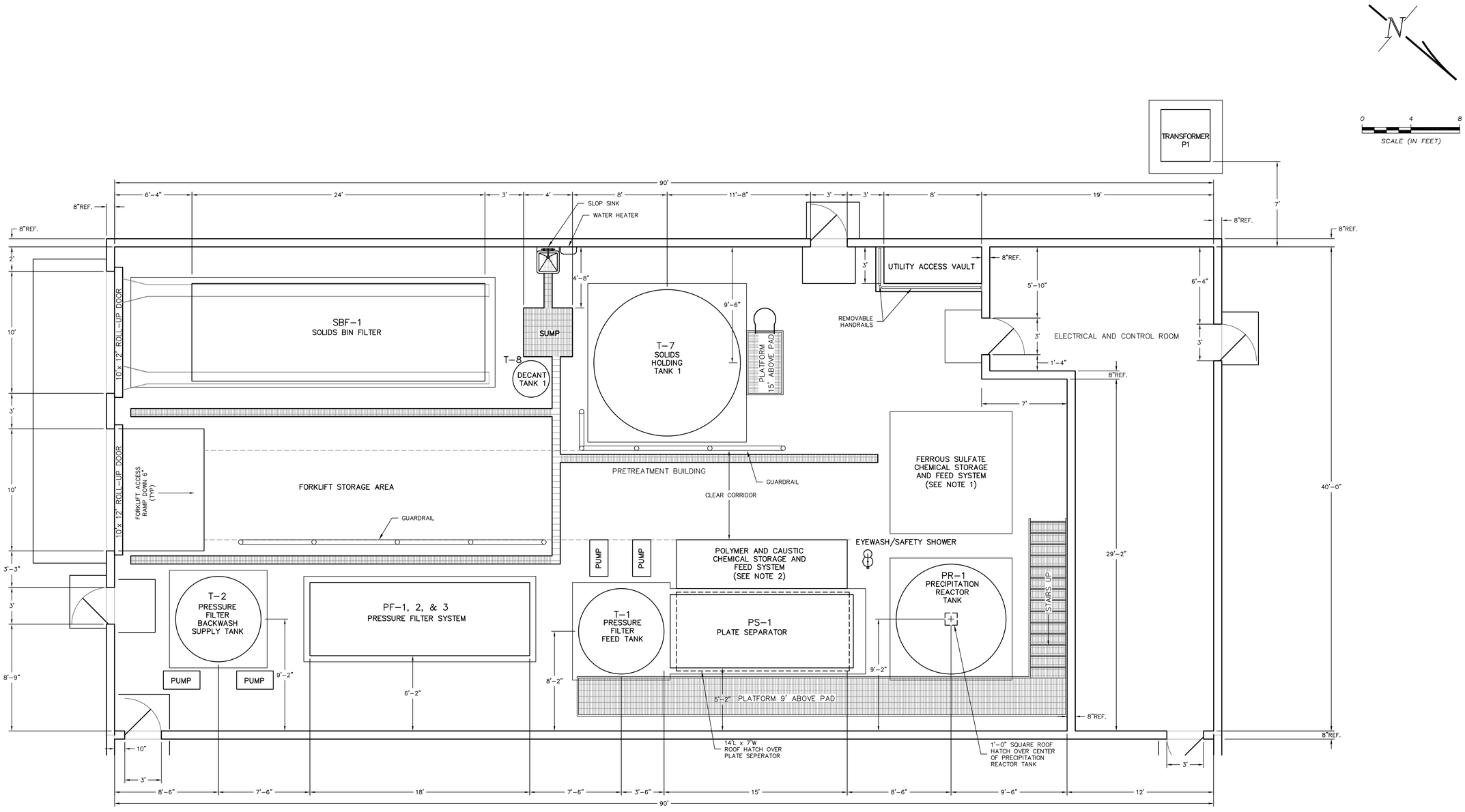

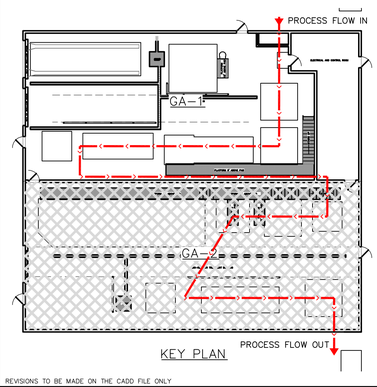

KEY PLAN

NOTES:

1. THE AREA CAN ACCOMMODATE FOUR 330-GALLON TOTES WITH CHEMICAL FEED PUMPS.

2. THE AREA CAN ACCOMMODATE TWO 330-GALLON CAUSTIC TOTES AND TWO POLYMER 55-GALLON POLYMER DRUMS.

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PRETREATMENT BUILDING AND EQUIPMENT LAYOUT

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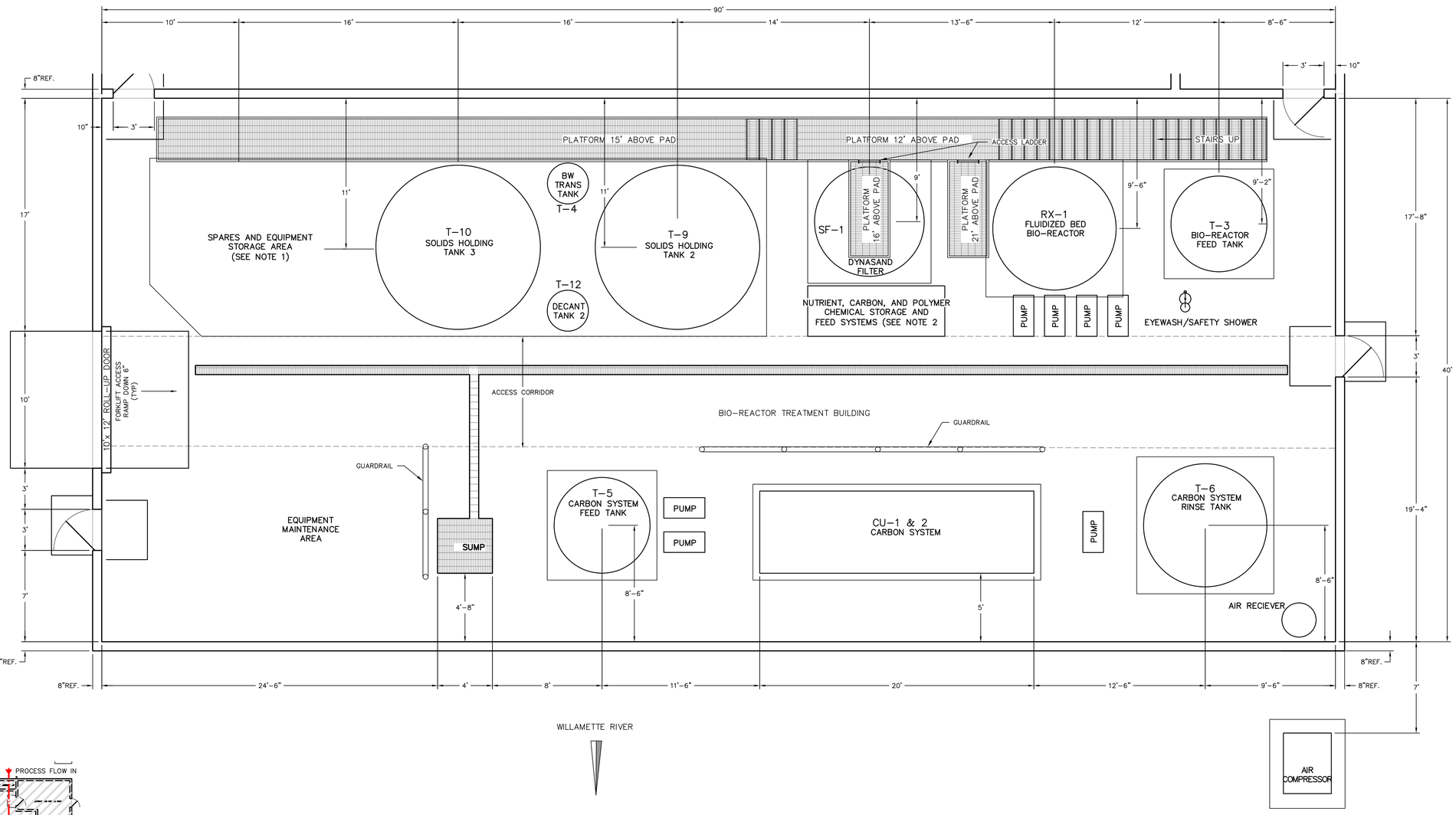

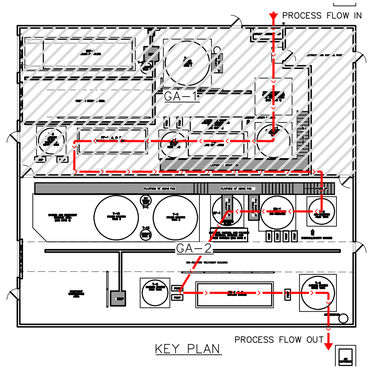

KEY PLAN

NOTES:

1. THE PROPOSED BIO-SOLIDS DISPOSAL METHOD IS REMOVAL BY A VACUUM TRUCK WITH OFF-SITE DISPOSAL. IF THE BIO-SOLIDS VOLUME INCREASES OR ADDITIONAL DEWATERNG IS REQUIRED, A SLUDGE THICKENER COULD BE ADDED.

2. AREA SET ASIDE FOR TWO 330-GALLON CARBON SOURCE TOTES, TWO 55-GALLON NUTRIENT DRUMS, AND TWO 55-GALLON POLYMER DRUMS.

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BIO-REACTOR BUILDING AND EQUIPMENT LAYOUT

SCALE	PROJECT NUMBER	SHEET	REV.
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DATE 11/30/2010			

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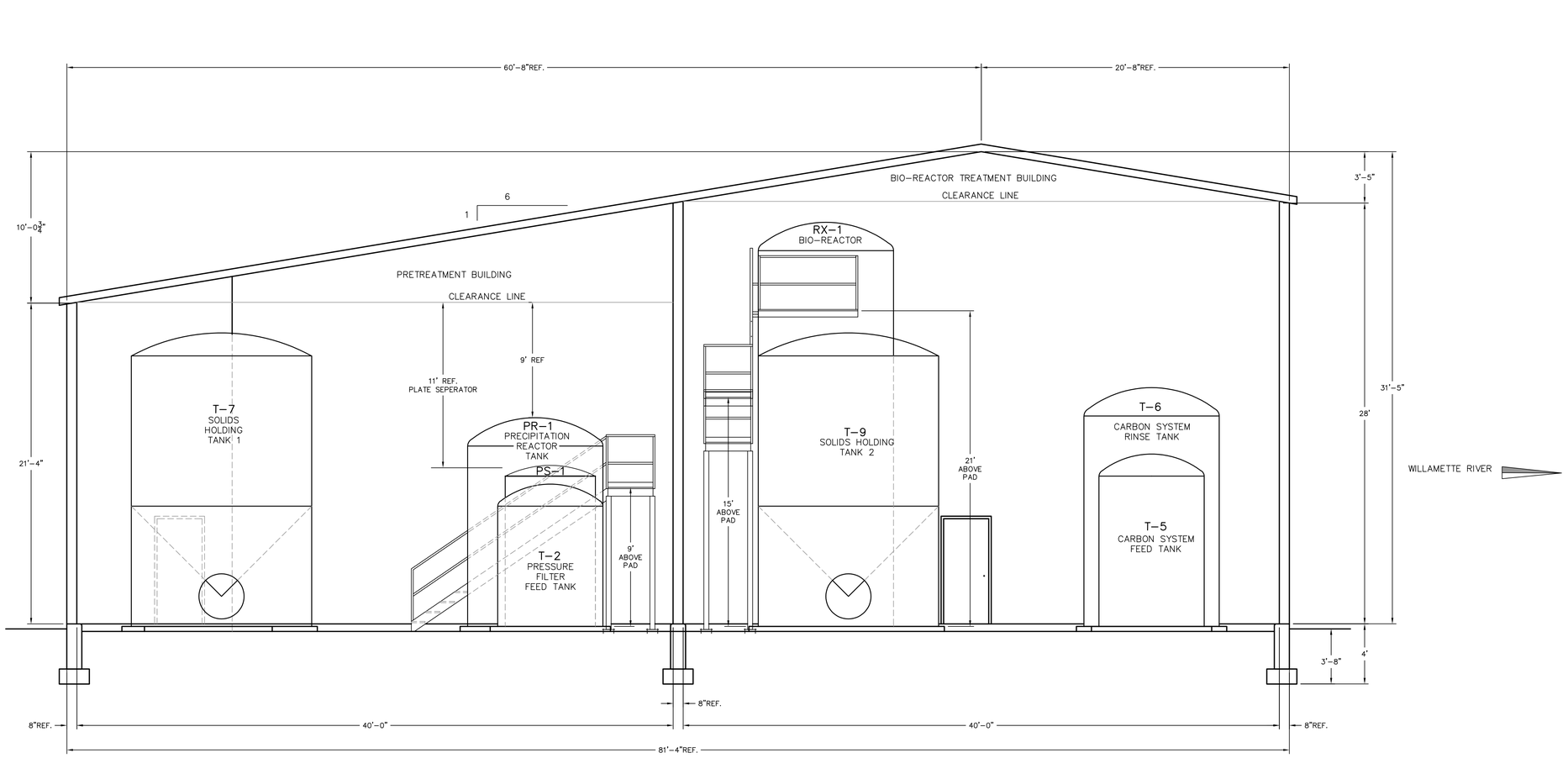

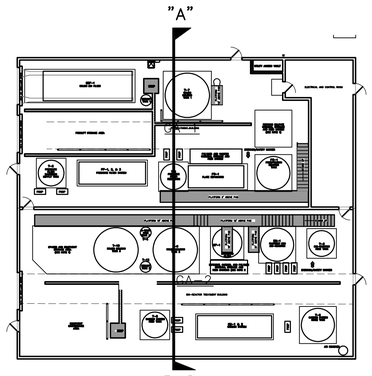

KEY PLAN

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ELEVATION VIEW "A" LOOKING NORTHWEST

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	GA3	0
DATE 11/30/2010			

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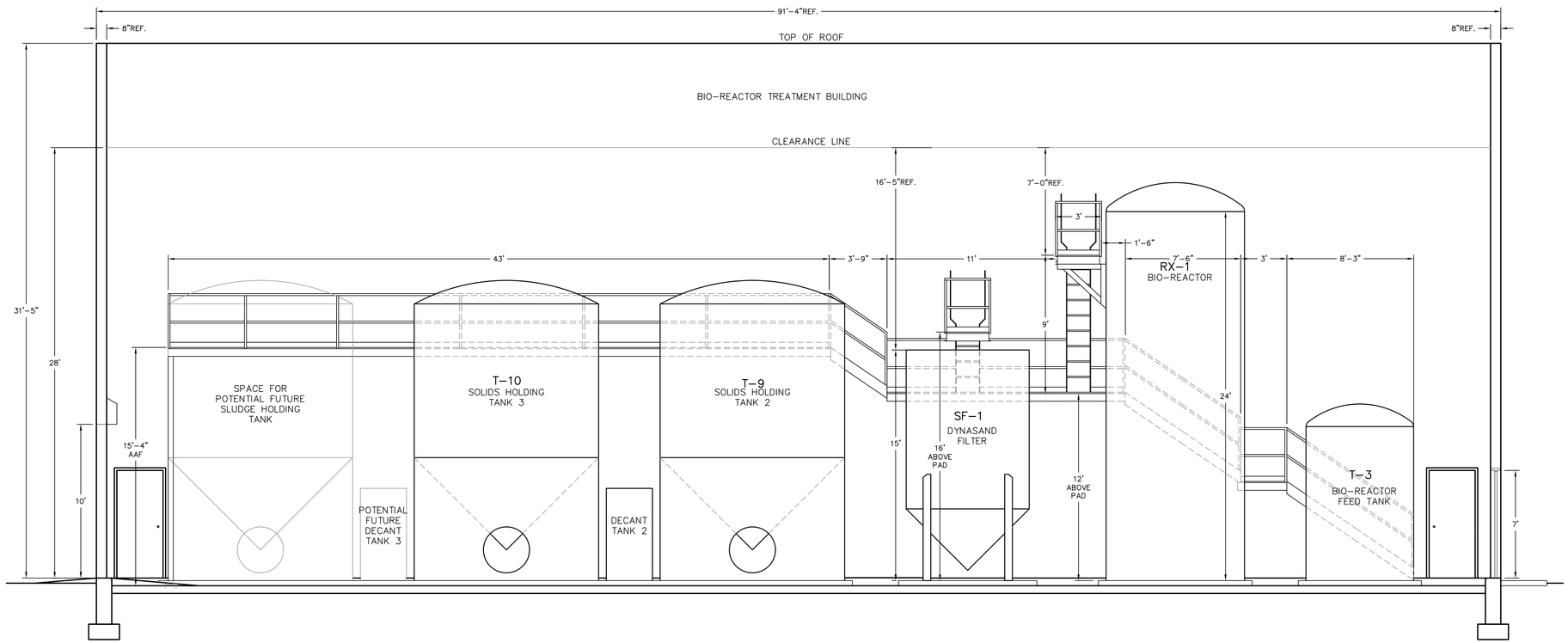

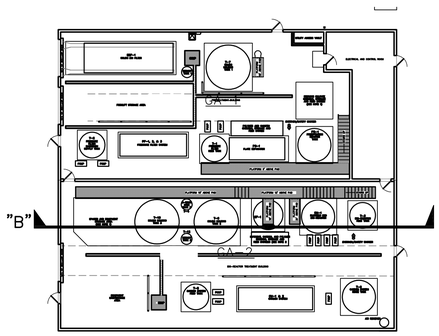

KEY PLAN

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ELEVATION VIEW "B" LOOKING NORTHEAST

SCALE	PROJECT NUMBER	SHEET	REV.
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DATE 11/30/2010			

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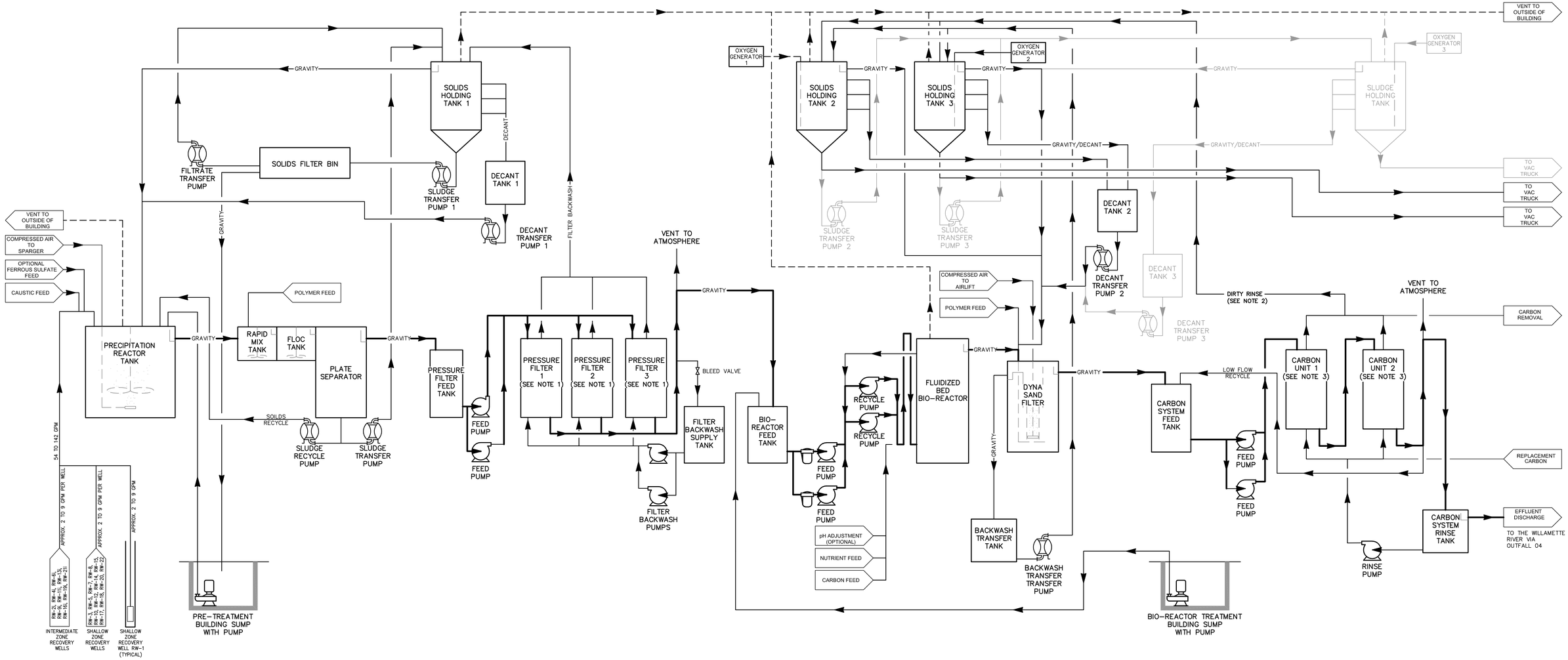

LEGEND

- AIR POWERED PUMP
- ELECTRICALLY POWERED CENTRIFUGLE PUMP
- SUMP PUMP
- INLINE STRAINER
- GRAY SHADE INDICATES POTENTIAL FUTURE EQUIPMENT AND ASSOCIATED PIPING

NOTES:

1. TWO FILTER UNITS IN OPERATION WITH ONE UNIT IN BACKWASH/STANDBY.
2. AFTER PLACEMENT OF NEW CARBON IN THE CARBON UNITS, THEY ARE RINSED TO REMOVE FINES
3. THE CARBON UNITS ARE OPERATED IN SERIES (PRIMARY UNIT DISCHARGING TO THE SECONDARY UNIT DISCHARGING TO THE OUTFALL)

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GROUNDWATER SOURCE CONTROL MEASURE

ARKEMA, INC.
PORTLAND, OREGON

GWET SYSTEM PROCESS FLOW DIAGRAM

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	PFD-01	0
DATE 11/10/2010			

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P & ID VALVE AND PIPING SYMBOLS

- GATE
- GLOBE
- BALL
- BUTTERFLY
- DIAPHRAGM
- VALVE WITH TAPPED DRAIN
- SWING CHECK VALVE
- BALL CHECK VALVE
- SPRING CHECK VALVE
- THREE WAY BALL VALVE
- FOUR WAY BALL VALVE
- NEEDLE
- PINCH
- KNIFE
- PLUG
- PRESSURE SAFETY OR RELIEF VALVE (PSV)
- FUSIBLE LINK VALVE
- SPRING OPERATED SELF CLOSING HAND VALVE
- HOSE BIB
- UNION OR RESTRICTION ORIFICE
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER
- AIR/GAS QUICK CONNECT
- ONE WAY HOSE COUPLING
- TWO WAY HOSE COUPLING
- SP 02 — SPECIALTY ITEM
- AR — AIR RELEASE

- THREADED CONNECTION
- FLANGED CONNECTION
- WELDED CONNECTION
- SANITARY CONNECTION
- COMPRESSION CONNECTION
- BLIND FLANGE
- FLEXIBLE CONNECTION
- HOSE CONNECTION
- PIPE CAP
- DRAIN LEG
- DRAIN
- EXPANSION JOINT
- EDUCTOR /EJECTOR
- STRAINER (Y TYPE)
- STRAINER (SINGLE BASKET)
- STRAINER (DOUBLE BASKET)
- FILTER OR SPECIAL STRAINER
- STRAINER (CONE TYPE)
- T — INDUSTRIAL STEAM TRAP
- T1 — SIP TRAP
- T2 — PURE STEAM DRIP LEG TRAP
- MT — AIR MOISTURE TRAP
- SIGHT LEVEL GLASS
- FIGURE 8 SPECTACLE BLIND
- FLUSH BOTTOM VALVE
- KW — HEATER, ELECTRIC
- M — MOTOR
- FLAME ARRESTOR
- RAIN HOOD
- PULSATION DAMPENER

- ROTA-METER
- SIGHT FLOW INDICATOR
- DIAPHRAM ACTUATOR
- ROTORY ACTUATOR
- S — SOLENOID
- PISTON ACTUATOR
- PRESSURE REGULATTING
- BACKFLOW PREVENTOR

- RUPTURE DISC
- VACUUM SAFETY RUPTURE DISC
- LOAD CELL
- TEMPERATURE SENSOR W/O THERMOWELL
- TEMPERATURE SENSOR WITH THERMOWELL
- ORIFICE PLATE
- SANITARY DIAPHRAGM SEAL
- CHEMICAL SEAL
- FI — FLOW INDICATOR
- F — AIR FILTER
- P — STEAM PURIFIER
- FW — WATER FILTER
- BACKFLOW PREVENTER
- HU- — MIXING HOSE UNIT STEAM & COLD WATER
- EWES- — EYE WASH & SAFETY SHOWER
- VB- — VACUUM BREAKER
- JACKETED VALVE
- CSO — CAR SEAL OPEN
- CSC — CAR SEAL CLOSED
- TANK LIGHT
- L — AIR LUBRICATOR
- F — CARTRIDGE FILTER

CONTROL VALVE OPERATORS AND VALVES

- SELF-CONTAINED BACK PRESSURE REGULATING VALVE
- NO INDICATION — MANUAL
- CH — CHAIN
- MODULATING
- DISCRETE (OPEN/CLOSE)
- POSITION SWITCH
- SELF-CONTAINED TEMPERATURE REGULATOR
- SELF CONTAINED PRESSURE REDUCING AND / OR REGULATING VALVE

- S — 2-WAY SOLENOID VALVE
- S — 3-WAY SOLENOID VALVE
- S — 4 WAY SOLENOID VALVE (SHOWN DEENERGIZED)
- FC — FAIL POSITION
  - FC FAIL CLOSED
  - FO FAIL OPEN
  - FP FAIL IN POSITION
- S, F — SOLENOID VALVE (FAIL POSITION SHOWN)
- M — MOTOR OPERATED VALVE
- MODULATING WITH POSITIONER

INSTRUMENT LINE SYMBOLS

- DIRECT CONNECTION OR MECHANICAL LINK TO INSTRUMENT
- INTERLOCK
- INSTRUMENT AIR SUPPLY
- SIGNAL LINE (ELECTRICAL)
- SIGNAL LINE (PNEUMATIC)
- CAPILLARY LINE TO INSTRUMENT
- HYDRAULIC SIGNAL LINE
- ULTRA SONIC
- COMPUTER SOFTWARE LINK
- LOCALLY MOUNTED INSTRUMENT
- FRONT OF MAIN PANEL INSTRUMENT
- FRONT OF LOCAL PANEL INSTRUMENT
- REAR OF MAIN PANEL INSTRUMENT
- REAR OF LOCAL PANEL INSTRUMENT
- SOFTWARE FUNCTION
- INSTRUMENT FUNCTION ON SHARED DEVICE
- COMBINATION INSTRUMENTS
- INDICATOR LIGHT
- PORTABLE INSTRUMENT OR INSTRUMENT SHOWN ON ANOTHER DRAWING
- AI — ANALOG INPUT SIGNAL TO COMPUTER SYSTEM
- AO — ANALOG OUTPUT SIGNAL FROM COMPUTER SYSTEM
- DI — DISCRETE INPUT SIGNAL TO COMPUTER SYSTEM
- DO — DISCRETE OUTPUT SIGNAL FROM COMPUTER SYSTEM

SANITARY PROCESS VALVES

- Y BODY
- 2-WAY SHUTOFF
- 3-WAY
- 3-WAY DIVERTER
- 4-WAY VALVE
- 45° — TANK OUTLET VALVES
- 90°

PROCESS LINE IDENTIFICATION

- MAIN FLOW
- SECONDARY FLOW & RECYCLE
- DIRECTION OF FLOW
- ALTERNATE FLOW
- HEAT TRACED LINE (E ----- ELECTRICAL / S ----- STEAM)
- INSULATED LINE
- OUT OF FUNCTION/DETAILED ON ANOTHER DRAWING
- REMOVABLE
- PACKAGE BOUNDARY
- EXISTING
- POC — POINT OF CONNECTION
- INDICATES LINE INTERRUPTED IN P & I DWG FOR CLARITY
- PIPE, MATERIAL CONTINUATION FLAG BETWEEN DRAWINGS

INSTRUMENT IDENTIFICATION

PROCUREMENT — (#) — SEE NOTES ON P&IDs FOR EXPLAINATION OF #s 1 ,2, & 3

LIC 0001A — SPECIAL FUNCTION OR ANALYZER TYPE; XXXYYY — LOCATION CODE

LIC-0001 A
- INSTRUMENT NUMBER
- SUFFIX TO PREVENT DUPLICATION (IF NECESSARY)
- INSTRUMENT LOOP NUMBER
- MEASURED VARIABLE AND INSTRUMENT FUNCTION

XXXYYY — LOCATION CODE
- LOCATION NUMBER
- LOCATION TYPE IDENTIFIER
  - LP# LOCAL PANEL
  - MP# MAIN PANEL
  - OIT OPERATOR INTERFACE TERMINAL
  - MCC MOTOR CONTROL CENTER
  - ANN ANNUNCIATOR
  - XJR MULTIPOINT SCANNING RECORDER

IDENTIFICATION LETTERS FOR INSTRUMENTS

	FIRST LETTER		SUCCEEDING-LETTERS	
	MEASURED OR INITIATING VARIABLE	MODIFIER	FUNCTION	MODIFIER
A	ANALYSIS		ALARM	
B	BURNER , COMBUSTION			
C			CONTROL, CLOSED	
D		DIFFERENTIAL	DEVICE	
E	VOLTAGE		ELEMENT	
F	FLOW RATE	RATIO (FRACTION)		
G			GLASS , VIEWING DEVICE	
H	HAND			HIGH
I	CURRENT (ELECTRICAL)		INDICATE	
J	POWER	SCAN		
K	TIME , TIME SCHEDULE	TIME RATE OF CHANGE	CONTROL STATION	
L	LEVEL		LIGHT	LOW
M		MOMENTARY		MIDDLE , INTERMEDIATE
N				
O			ORIFICE , RESTRICTION, OPEN	
P	PRESSURE , VACUUM		POINT (TEST) CONNECTION	
Q	QUANTITY	INTEGRATE , TOTALIZE		
R			RECORD	
S	SPEED, SOLENOID, FREQUENCY	SAFETY	SWITCH	
T	TEMPERATURE		TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION , MECHANICAL ANALYSIS, VISCOSITY		VALVE , DAMPER , LOUVER	
W	WEIGHT , FORCE		WELL	
X	USER SPECIFIED (INDICATION)	X AXIS		
Y	EVENT , STATE OR PRESENCE	Y AXIS	RELAY , COMPUTE CONVERT	
Z	POSITION , DIMENSION	Z AXIS	DRIVER , ACTUATOR , UNCLASSIFIED FINAL CONTROL ELEMENT	

DESCRIPTION OF ANALYZER TYPES

- V = VISCOSITY
- D = DENSITY
- LEL = LOWER EXPLOSIVE LIMIT
- M = MOISTURE
- COND = CONDENSATE
- T = TURBIDITY
- ORP = OXIDATION REDUCTION POTENTIAL
- DO = DISSOLVED OXYGEN
- PH = pH
- OD = OPTICAL DENSITY (UV)

SPECIAL FUNCTIONS

- ΣΣ — ADD
- AVG — AVERAGE
- ± — BIAS
- ÷ — DIVIDE
- f(x) — CHARACTERIZE
- < — LOW SELECTOR
- > — HIGH SELECTOR
- A/D — ANALOG/DIGITAL
- X^n — RAISE TO POWER
- D — DERIVATIVE OR RATE
- I/D — INVERSE DERIVATIVE
- √ — SQUARE ROOT
- 1:3 — GAIN
- REV — REVERSE
- X — MULTIPLY
- ∫ — INTEGRATE
- 1: 1 — BOOST
- I-0 — ON-OFF
- △ — DIFFERENCE
- E/P — FOR INPUT/OUTPUT OF THE FOLLOWING:

INPUT/OUTPUT DESIGNATION SIGNAL

- E — VOLTAGE
- I — CURRENT
- H — HYDRAULIC
- O — ELECTROMAGNETIC SONIC SIGNAL OR LIGHT BEAM
- P — PNEUMATIC
- R — RESISTANCE

NOT ALL SYMBOLS SHOWN ON THIS SHEET ARE USED ON THE P&IDs THAT FOLLOW

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GWET SYSTEM
ARKEMA, INC.
PORTLAND, OREGON

STANDARD P&ID SYMBOL LEGEND

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	PID-00	0
DATE 11/10/2010			

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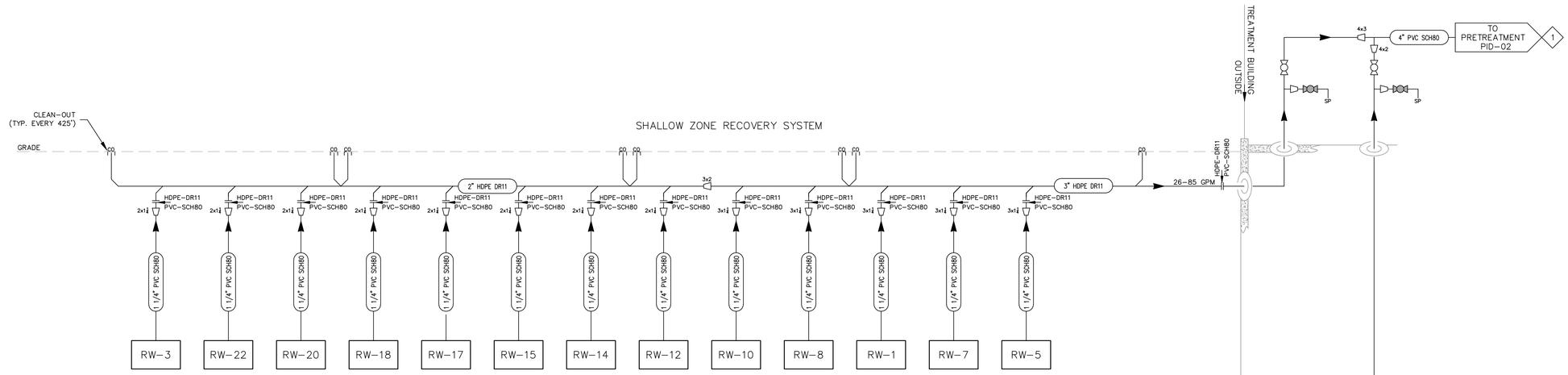

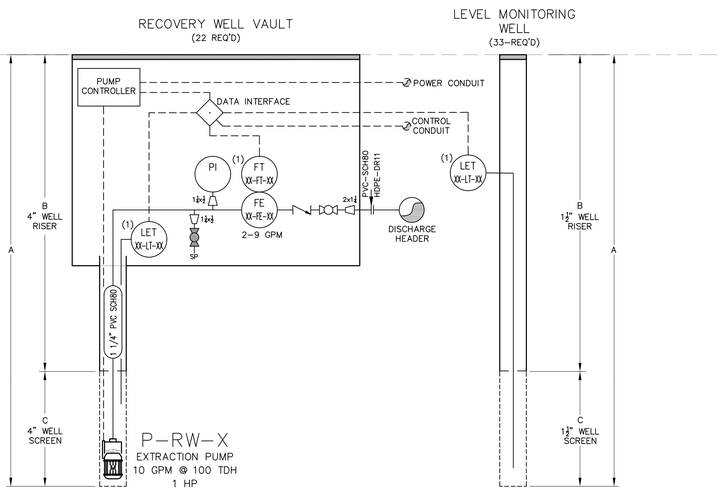

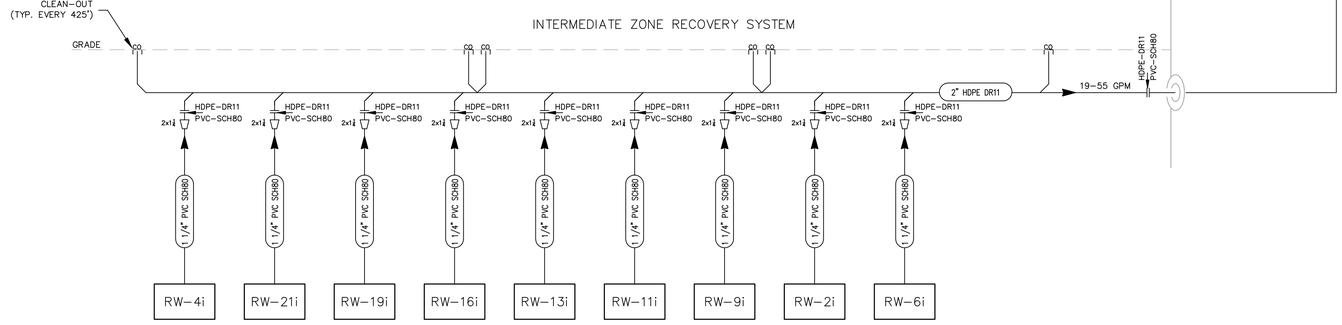

RECOVERY AND LEVEL MONITORING WELL DEPTHS				
TYPE OF WELL	"A" FEET	"B" FEET	"C" FEET	TOTAL
SHALLOW RECOVERY WELL	35	25-30	5-10	13
INTERMEDIATE RECOVERY WELL	45	35-40	5-10	9
SHALLOW LEVEL MONITORING WELL	35	30	5	20
INTERMEDIATE LEVEL MONITORING WELL	45	40	5	15
DEEP LEVEL MONITORING WELL	50	50	5	9
			TOTAL WELLS	55

Well and Corresponding Instrument Tag Number

Recovery Well	Flow Meter	Level Transmitter	Water Level Monitoring	Level Transmitter	Water Level Monitoring	Level Transmitter
RW-3	01-FT-01	01-LT-01	PA-8	0-LT-01	PA-6	0-LT-23
RW-22	01-FT-02	01-LT-02	PA-9	0-LT-02	MWA-89	0-LT-24
RW-20	01-FT-03	01-LT-03	PA-15i	0-LT-03	PA-12i	0-LT-25
RW-18	01-FT-04	01-LT-04	PA-16i	0-LT-04	MWA-86i	0-LT-26
RW-17	01-FT-05	01-LT-05	PA-25d	0-LT-05	PA-20d	0-LT-27
RW-15	01-FT-06	01-LT-06	PA-26d	0-LT-06	PA-21d	0-LT-28
RW-14	01-FT-07	01-LT-07	MWA-47	0-LT-07	MWA-2	0-LT-29
RW-12	01-FT-08	01-LT-08	PA-7	0-LT-08	PA-5	0-LT-30
RW-10	01-FT-09	01-LT-09	MWA-50i	0-LT-09	MWA-8i	0-LT-31
RW-8	01-FT-10	01-LT-10	PA-14i	0-LT-10	PA-11i	0-LT-32
RW-1	01-FT-11	01-LT-11	PA-23d	0-LT-11	PA-19d	0-LT-33
RW-7	01-FT-12	01-LT-12	PA-24d	0-LT-12		
RW-5	01-FT-13	01-LT-13	MWA-46	0-LT-13		
RW-4i	01-FT-14	01-LT-14	MWA-49i	0-LT-14		
RW-21i	01-FT-15	01-LT-15	PA-13i	0-LT-15		
RW-19i	01-FT-16	01-LT-16	MWA-55d	0-LT-16		
RW-16i	01-FT-17	01-LT-17	PA-22d	0-LT-17		
RW-13i	01-FT-18	01-LT-18	PA-25i	0-LT-18		
RW-11i	01-FT-19	01-LT-19	PA-24i	0-LT-19		
RW-9i	01-FT-20	01-LT-20	PA-23i	0-LT-20		
RW-2i	01-FT-21	01-LT-21	PA-22i	0-LT-21		
RW-6i	01-FT-22	01-LT-22	PA-21i	0-LT-22		

NOTES:

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3. AN INSTRUMENT IDENTIFIED BY A 3 IS PROVIDED BY BIO-REACTOR VENDOR PROVIDER
4. SEE DRAWING PID-00 FOR STANDARD P&ID SYMBOL LEGEND

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GWET SYSTEM
ARKEMA, INC.
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RECOVERY WELLS P&ID

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	PID-01	A
DATE 11/10/2010			

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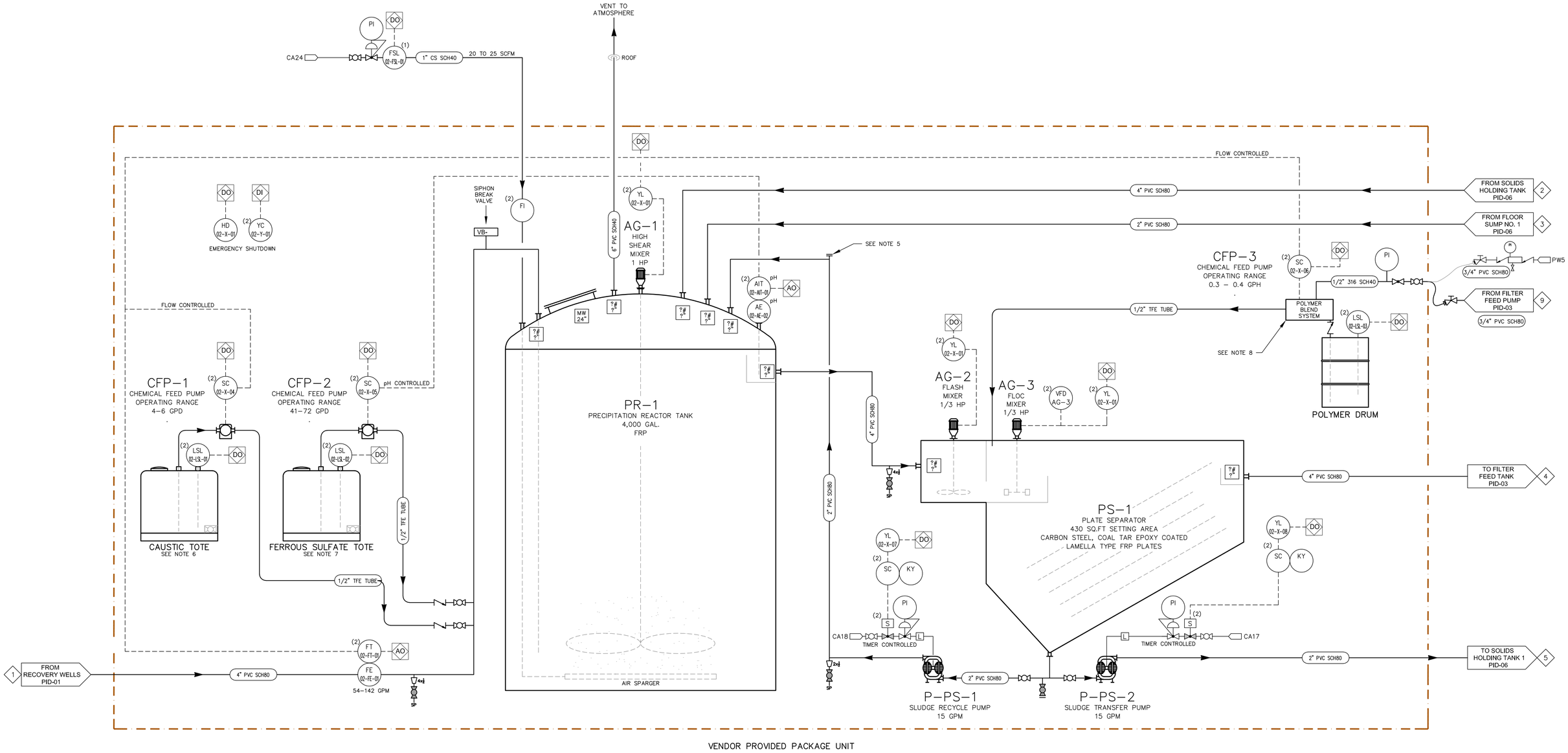

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4. SEE DRAWING PID-00 FOR STANDARD P&ID SYMBOL LEGEND.
5. CLEAN-OUTS TO BE PROVIDED IN SOLIDS HANDLING PIPING AT EACH 90° CHANGE IN DIRECTION.
6. CAUSTIC SOLUTION OF 20% WITH FEED PUMP RANGE OF 1 TO 50 GPD.
7. FERROUS SULFATE SOLUTION (5% AS Fe) WITH FEED PUMP RANGE OF 3 TO 150 GPD
8. POLYMER FEED PUMP RANGE OF 0.1 TO 5 GPD WITH A WATER FLOW RATE OF 10 TO 120 GPH.

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PRE-TREATMENT P&ID 1 OF 2

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	PID-02	0
DATE 11/10/2010			

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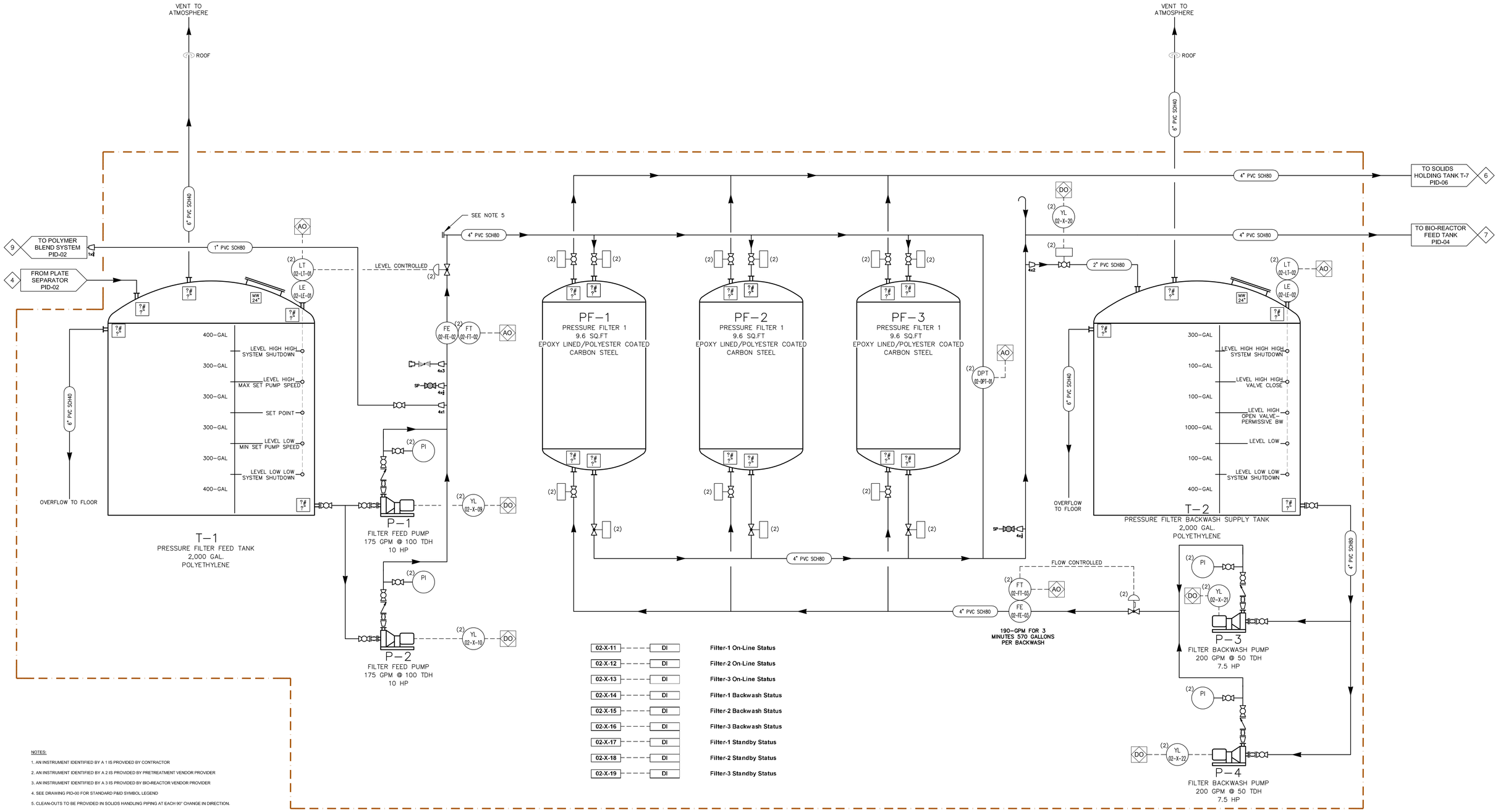

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5. CLEAN-OUTS TO BE PROVIDED IN SOLIDS HANDLING PIPING AT EACH 90° CHANGE IN DIRECTION.

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PRE-TREATMENT P&ID 2 OF 2

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	PID-03	0
DATE 11/10/2010			

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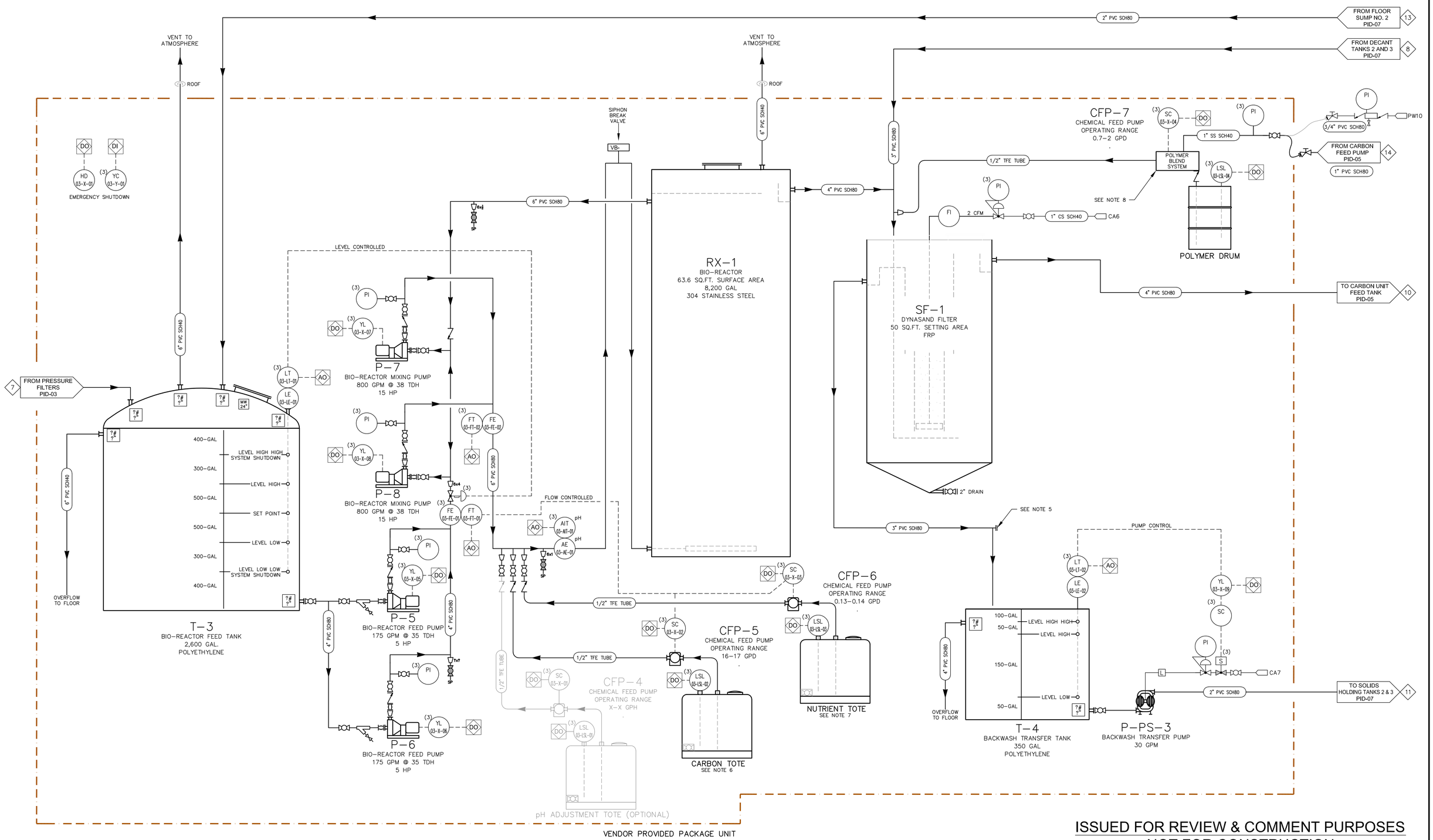

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4. SEE DRAWING PID-00 FOR STANDARD P&ID SYMBOL LEGEND
5. CLEAN-OUTS TO BE PROVIDED IN SOLIDS HANDLING PIPING AT EACH 90° CHANGE IN DIRECTION.
6. CARBON SOLUTION WITH FEED PUMP RANGE OF 1 TO 50 GPD.
7. DIPOTASSIUM PHOSPHATE (50% AS FE) WITH FEED PUMP RANGE OF 0.02 TO 1 GPD.
8. POLYMER FEED PUMP RANGE OF 0.1 TO 5 GPD WITH A WATER FLOW RATE OF 10 TO 60 GPH.

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BIO-REACTOR P&ID

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	PID-04	0
DATE 11/10/2010			

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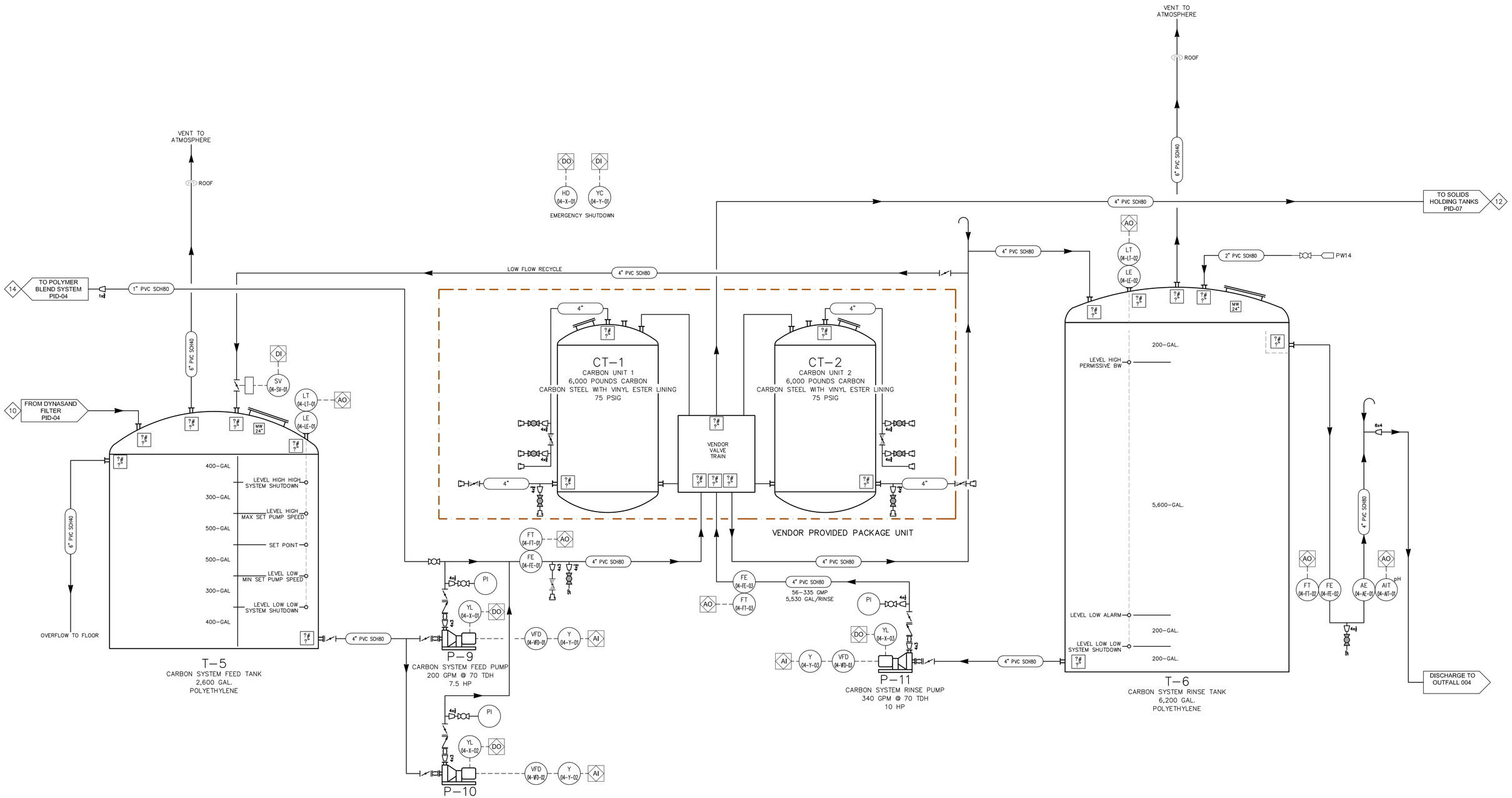

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PORTLAND, OREGON

CARBON SYSTEM P&ID

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	PID-05	0
DATE 11/10/2010			

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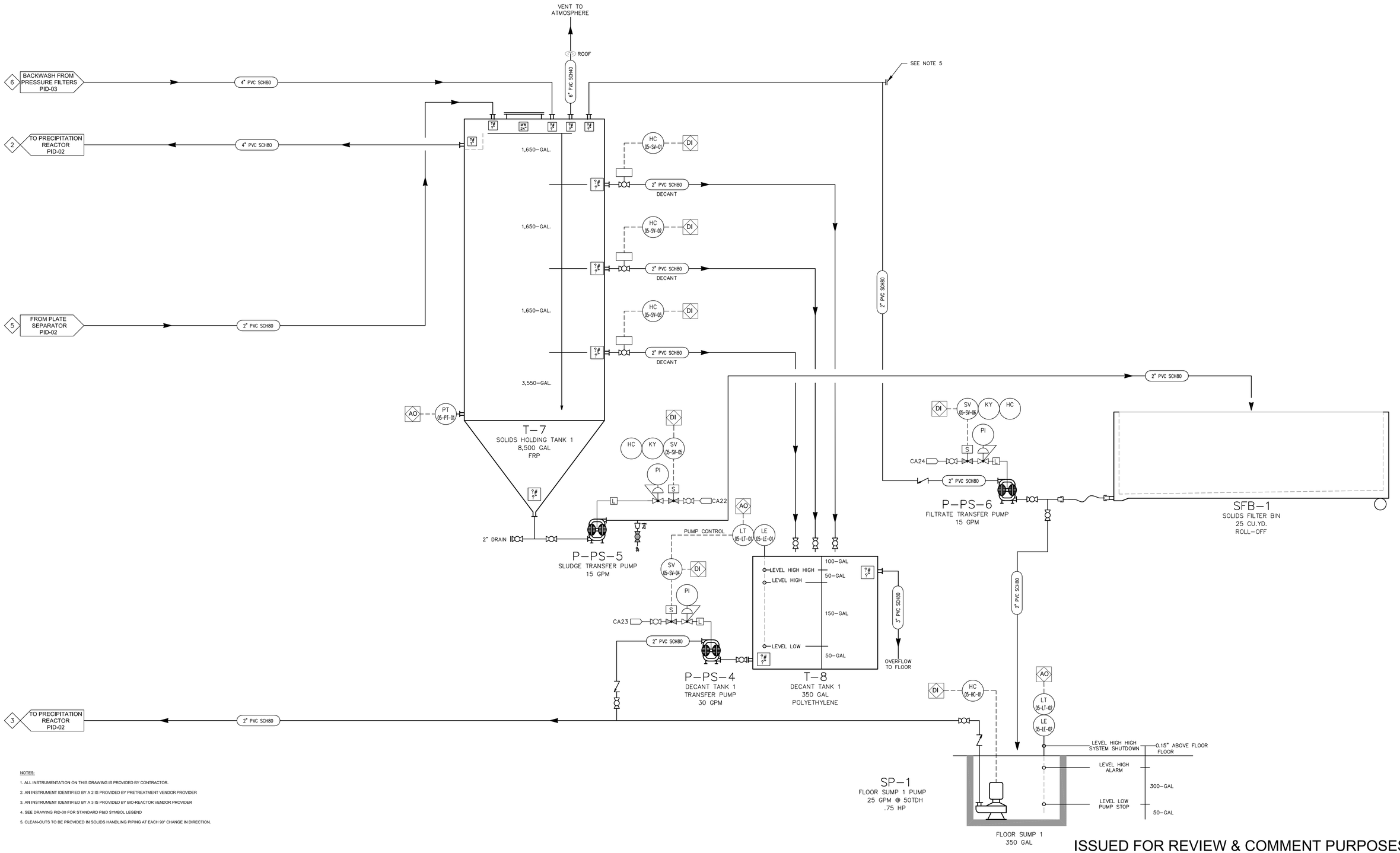

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5. CLEAN-OUTS TO BE PROVIDED IN SOLIDS HANDLING PIPING AT EACH 90° CHANGE IN DIRECTION.

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PRETREATMENT SLUDGE SYSTEM P&ID

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	PID-06	0
DATE 11/10/2010			

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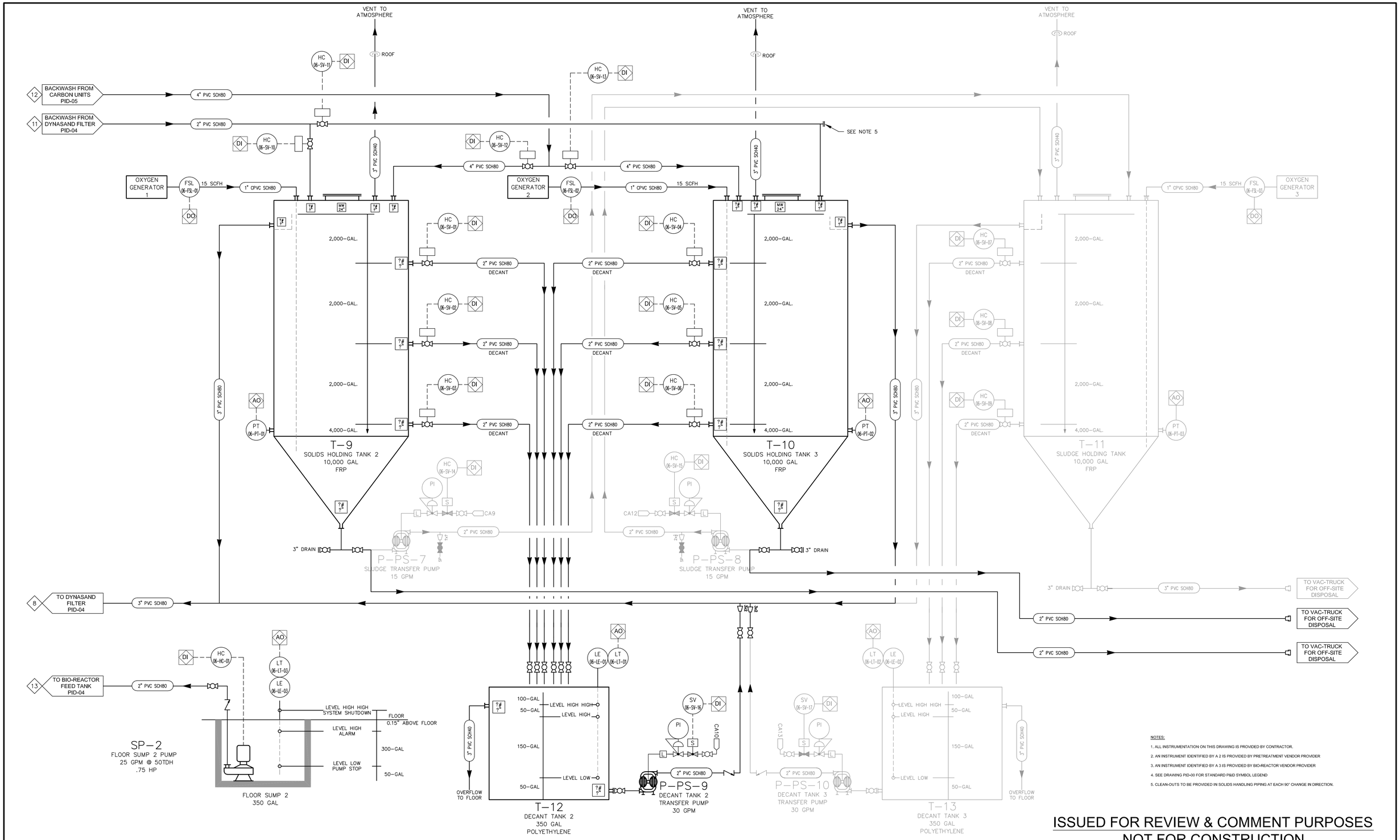

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REV.	DATE	DESCRIPTION	BY	CHK
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GROUNDWATER SOURCE CONTROL MEASURE
GWET SYSTEM
ARKEMA, INC.
PORTLAND, OREGON

BIO-REACTOR SLUDGE SYSTEM P&ID

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	PID-07	0
DATE 11/10/2010			

REVISIONS TO BE MADE ON THE CADD FILE ONLY

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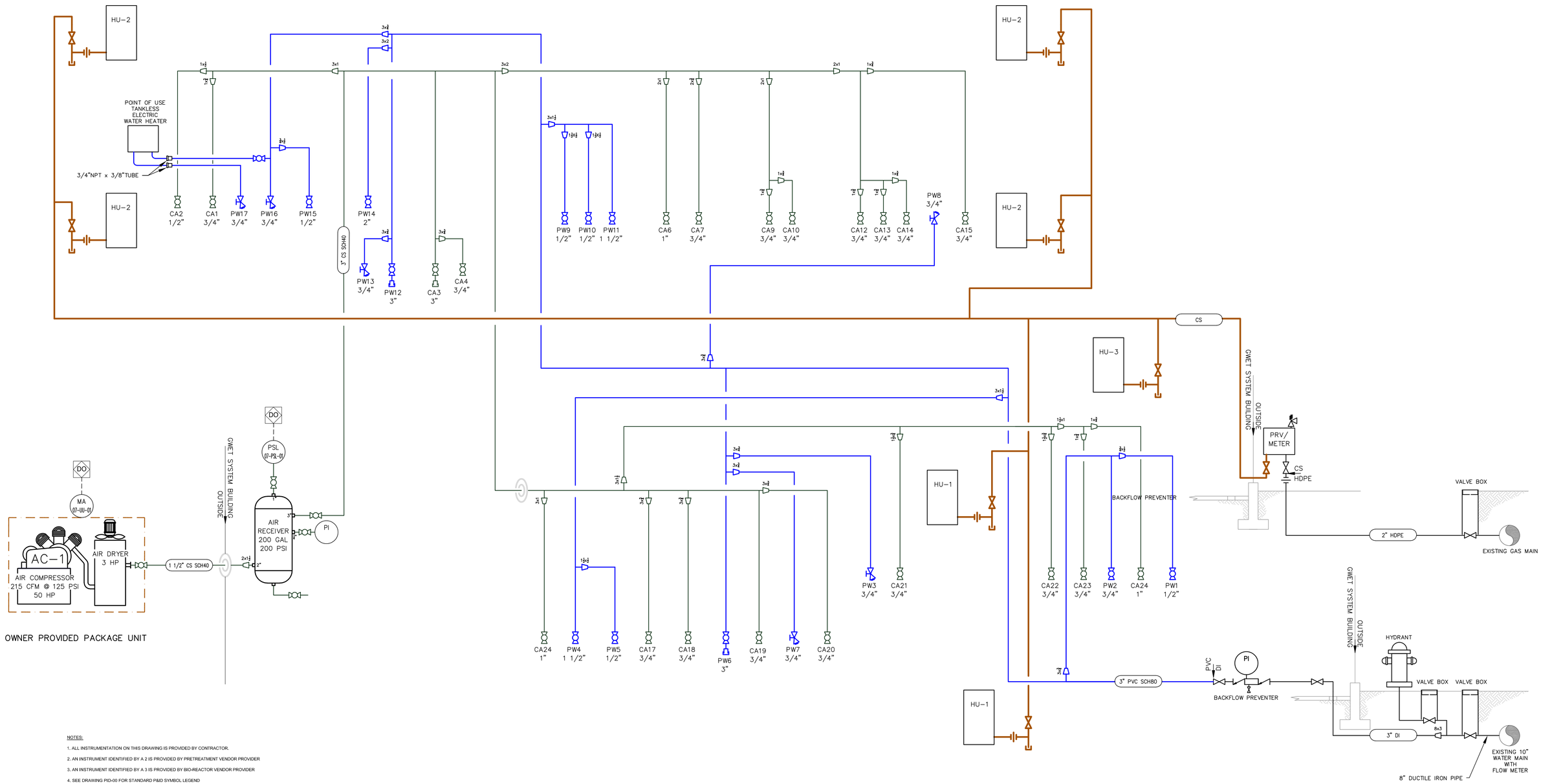

NOTES:

1. ALL INSTRUMENTATION ON THIS DRAWING IS PROVIDED BY CONTRACTOR.
2. AN INSTRUMENT IDENTIFIED BY A 2 IS PROVIDED BY PRETREATMENT VENDOR PROVIDER
3. AN INSTRUMENT IDENTIFIED BY A 3 IS PROVIDED BY BIO-REACTOR VENDOR PROVIDER
4. SEE DRAWING PID-00 FOR STANDARD P&ID SYMBOL LEGEND

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GROUNDWATER SOURCE CONTROL MEASURE
GWET SYSTEM
ARKEMA, INC.
PORTLAND, OREGON

COMPRESSED AIR & PROCESS WATER P&ID

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	PID-08	0
DATE 11/10/2010			

REVISIONS TO BE MADE ON THE CADD FILE ONLY

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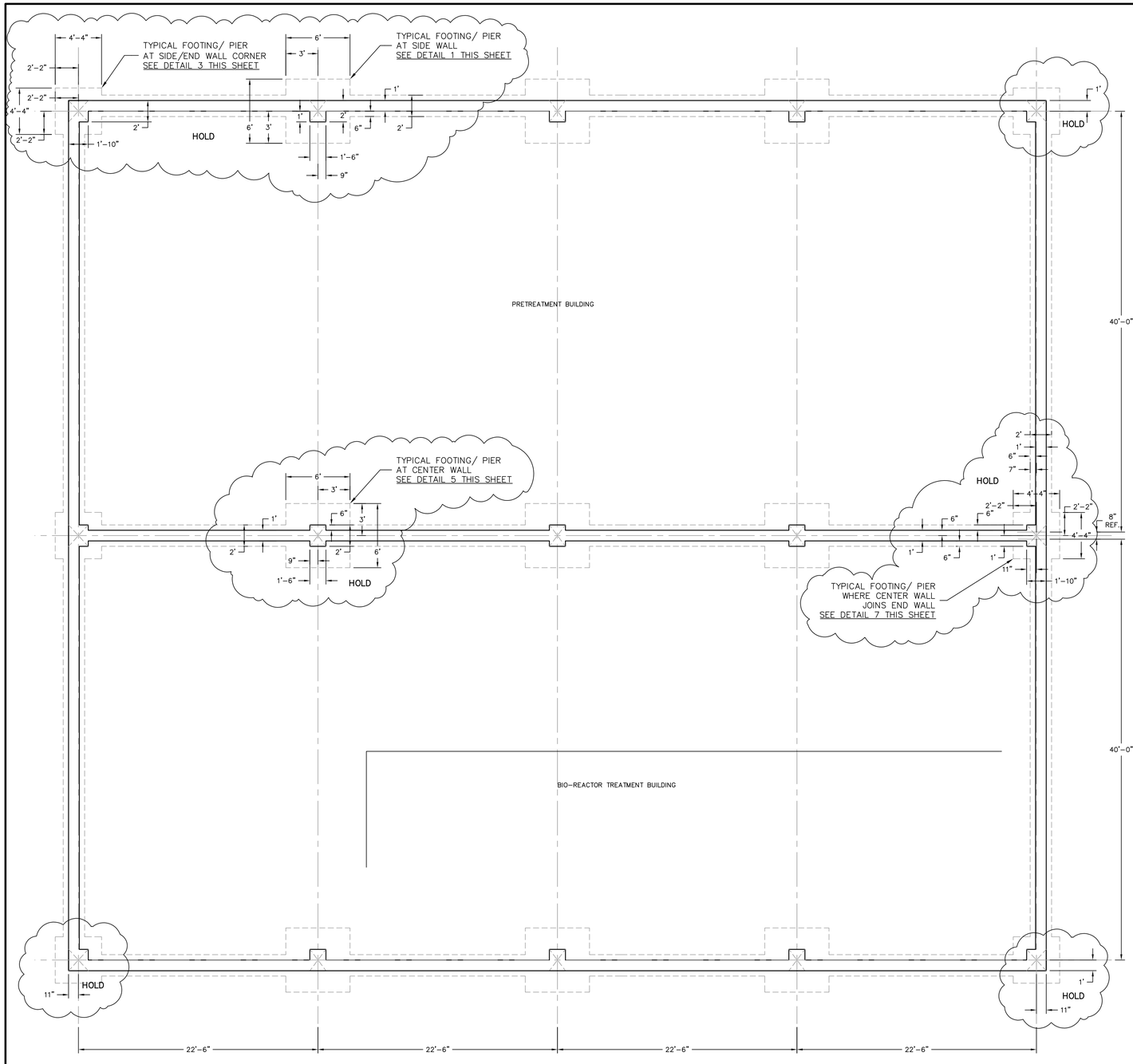
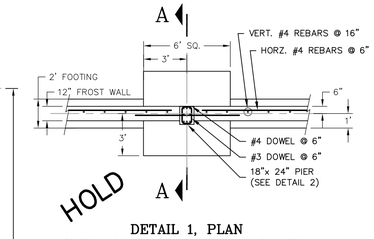
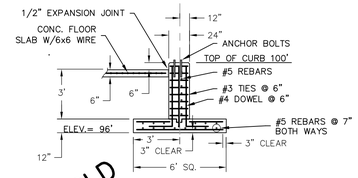




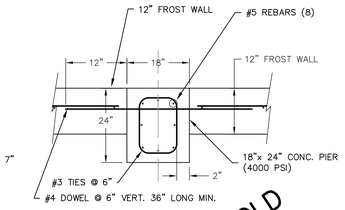
DETAIL 1, PLAN
SIDEWALL COLUMN PIER & FOOTING

SCALE: NONE



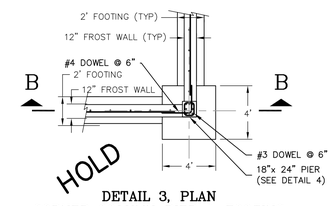
SECTION A–A
SIDEWALL COLUMN
FOOTING DETAIL

SCALE: NONE



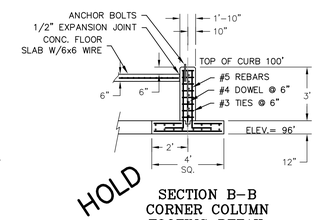
DETAIL 2
SIDEWALL COLUMN PIER

SCALE: NONE



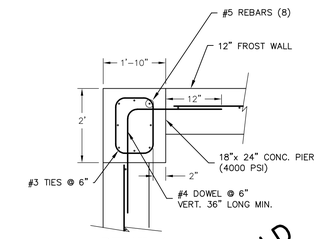
DETAIL 3, PLAN
CORNER COLUMN PIER & FOOTING

SCALE: NONE



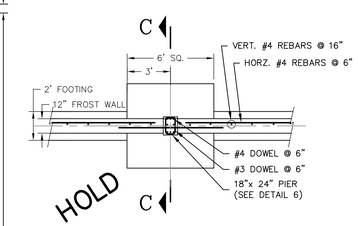
SECTION B–B
CORNER COLUMN
FOOTING DETAIL

SCALE: NONE



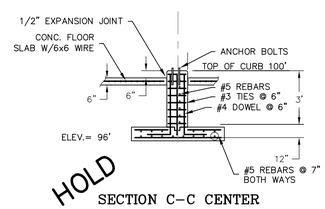
DETAIL 4
CORNER COLUMN PIER

SCALE: NONE



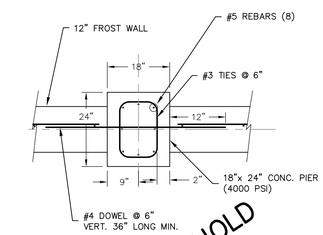
DETAIL 5, PLAN
CENTER WALL COLUMN PIER & FOOTING

SCALE: NONE



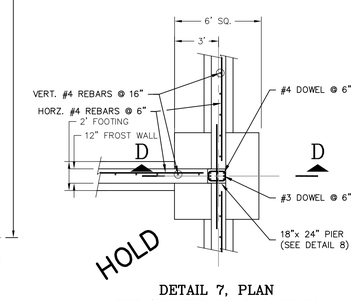
SECTION C–C CENTER
WALL COLUMN FOOTING
DETAIL

SCALE: NONE



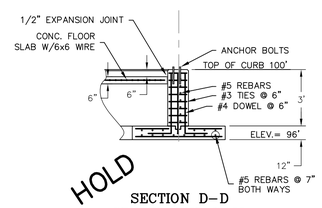
DETAIL 6
CENTER WALL COLUMN PIER

SCALE: NONE



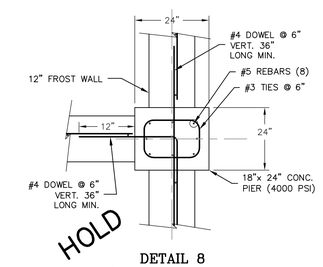
DETAIL 7, PLAN
END/CENTER WALL COLUMN
PIER & FOOTING

SCALE: NONE



SECTION D–D
CENTER/END WALL
COLUMN FOOTING DETAIL

SCALE: NONE



DETAIL 8
CENTER/END WALL COLUMN PIER

SCALE: NONE

NOTES:

1. THIS DRAWING IS BASED ON PRELIMINARY REACTIONS AND ARE NOT FOR CONSTRUCTION.

2. TO BE REVISED AS PER FINAL SIGNED AND SEALED REACTIONS PROVIDED BY BUILDING VENDOR.

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WILLAMETTE RIVER

N

0 4 8
SCALE (IN FEET)

REVISIONS TO BE MADE ON THE CADD FILE ONLY

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GROUNDWATER SOURCE CONTROL MEASURE
GWET SYSTEM
ARKEMA, INC.
PORTLAND, OREGON

CONCRETE FOUNDATIONS, FOOTINGS, AND PIERS

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	S1	0
DATE 11/30/2010			

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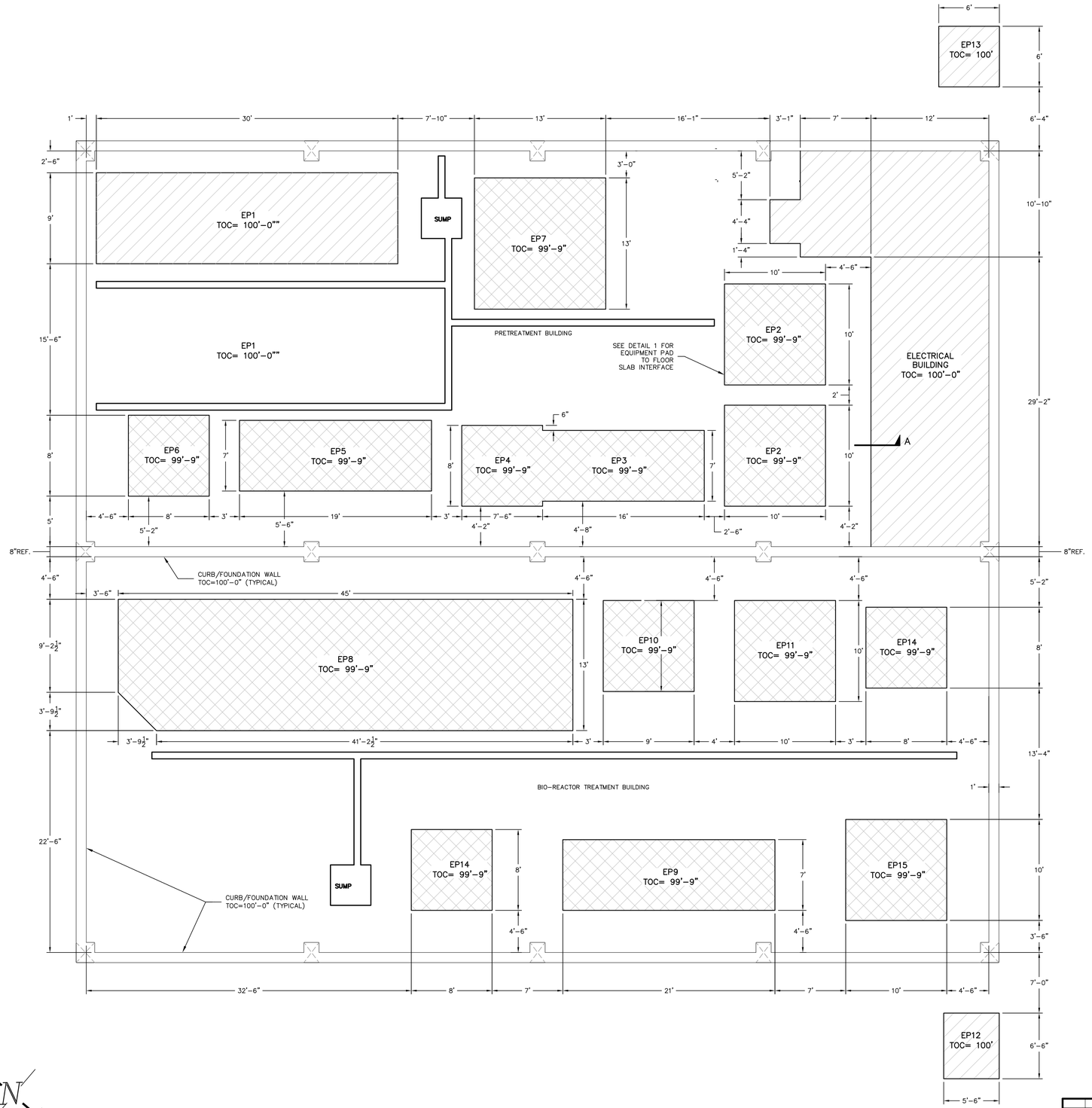
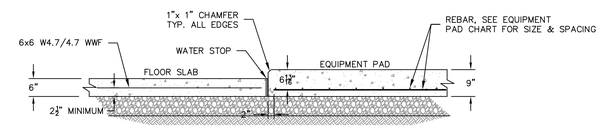
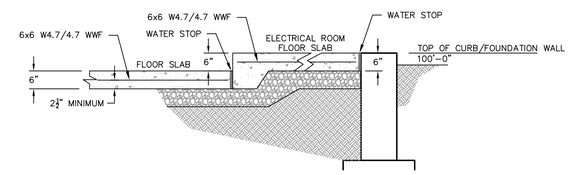


TAG #	PAD #	Concrete Pad/Slab	Load (#/SF)	Slab Thickness (in)	Width (ft)	Length (ft)	Rebar #	Rebar Spacing Short Way (in)	Rebar Spacing Long Way (in)	Depth of Rebar (in)
N/A	N/A	Floor Slab	1500	6	Varies	Varies	6x6 W4.7/4.7	6x6 Wire Mesh	6x6 Wire Mesh	4
SBF-1	EP1	Solids Filter Bin	500	9	9	30	4	9	12	6.81
PR-1	EP2	Precipitation Reactor Tank	700	9	10	10	4	9	9	6.81
PS-1	EP3	Plate Separaor Unit	500	9	7	16	4	9	12	6.81
T-1	EP4	Pressure Filter Feed Tank	600	9	7.5	8	4	9	9	6.81
PF-1 to 3	EP5	Pressure Filter System	500	9	7	19	4	9	12	6.81
T-2	EP6	PF Backwash Supply Tank	500	9	8	8	4	9	9	6.81
T-7	EP7	Solids Holding Tank 1	900	9	13	13	4	9	9	6.81
T-9 to 11	EP8	Solids & Sludge Holding Tanks	900	9	13	45	4	9	12	6.81
CU-1 & 2	EP9	Carbon System	700	9	7	21	4	9	12	6.81
SF-1	EP10	Dynasand Filter Tank	1100	9	9	9	4	9	9	6.81
RX-1	EP11	Bio-reactor Tank	1300	9	10	10	4	9	9	6.81
AC-1	EP12	Air Compressor Unit	50	9	5.5	6.5	4	9	9	6.81
T-1	EP13	Pad Mounted Transformer	50	9	6	6	6x6 W2.9/2.9	6x6 W2.9/2.9	6x6 W2.9/2.9	6.81
T-3 & T-5	EP14	Feed Tanks	700	9	8	8	6x6 W2.9/2.10	6x6 W2.9/2.9	6x6 W2.9/2.9	6.81
T-6	EP15	Carbon System Rinse Tank	1000	9	10	10	4	9	9	6.81

EQUIPMENT PAD CHART



DETAIL 1
EQUIPMENT PAD TO FLOOR SLAB
TYPICAL FOR ALL



SECTION A
PROCESS FLOOR TO ELECTRICAL ROOM
DETAIL

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REV.	DATE	DESCRIPTION	BY	CHK
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GWET SYSTEM
ARKEMA, INC.
PORTLAND, OREGON

EQUIPMENT PAD PLANS & DETAILS

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	S2	0
DATE 11/30/2010			

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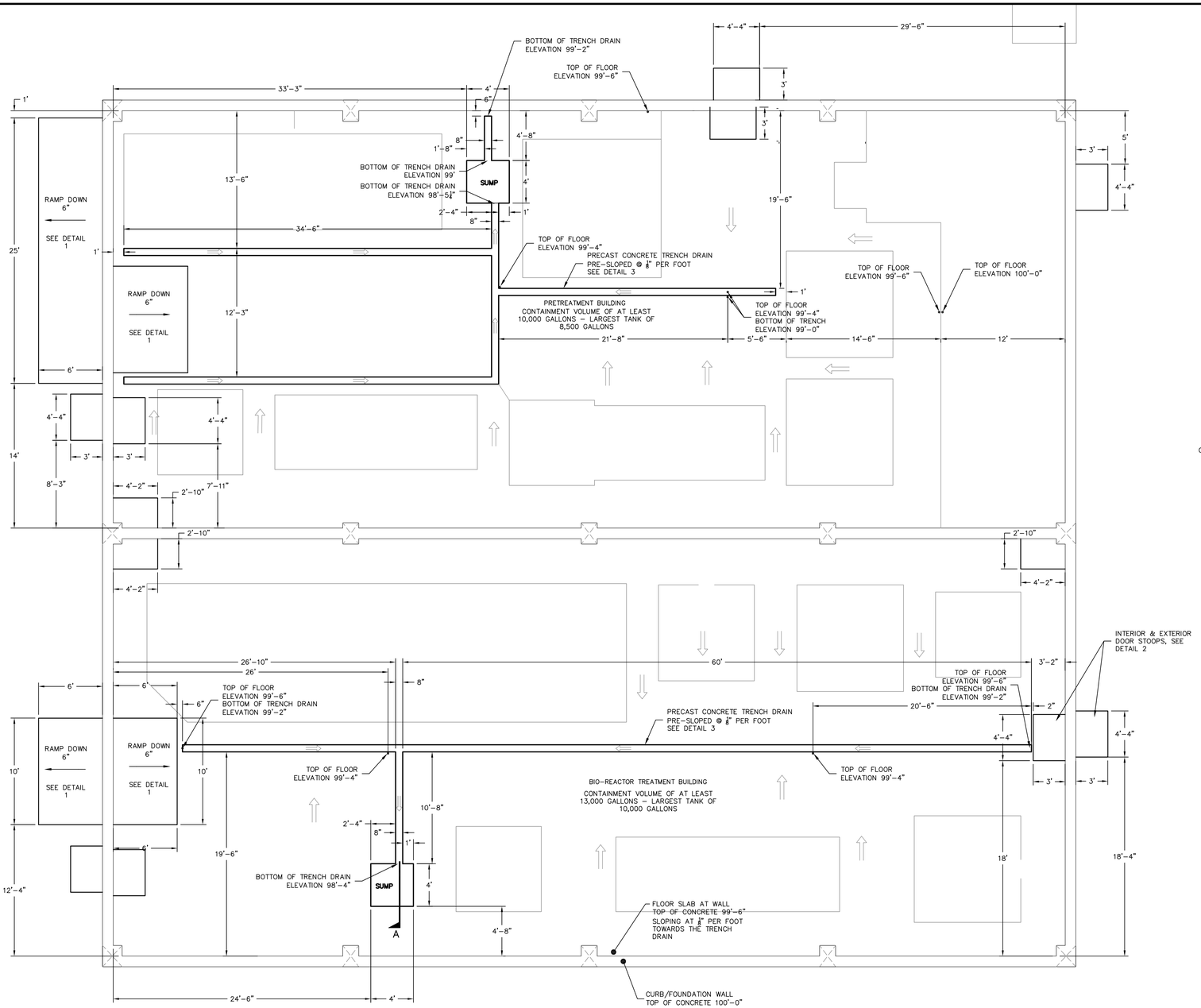
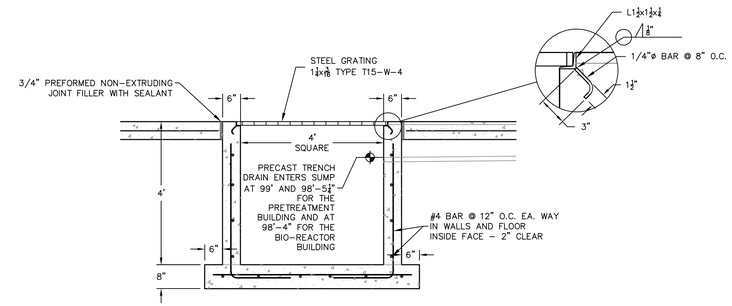
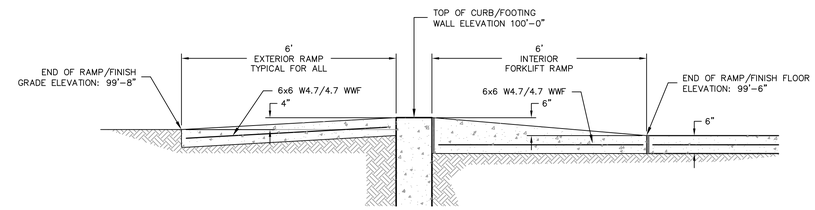


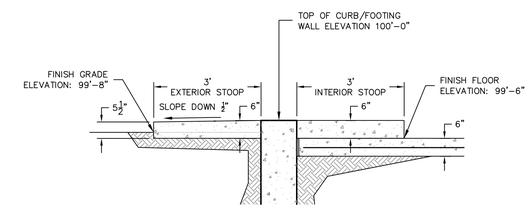
PLAN
TRENCHES, SUMPS & STOOPS



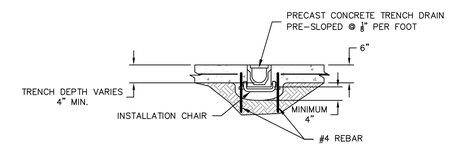
SECTION A
TYPICAL FLOOR SUMP
SCALE: ½"= 1'-0"



DETAIL 1
RAMP DETAIL
SCALE: ½"= 1'-0"



DETAIL 2
TYPICAL DOOR STOOP
SCALE: ½"= 1'-0"



DETAIL 3
TYPICAL TRENCH DETAIL
SCALE: ½"= 1'-0"

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GROUNDWATER SOURCE CONTROL MEASURE
GWET SYSTEM
ARKEMA, INC.
PORTLAND, OREGON

TRENCHES & SUMPS PLANS & DETAILS

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	S3	0
DATE 11/30/2010			

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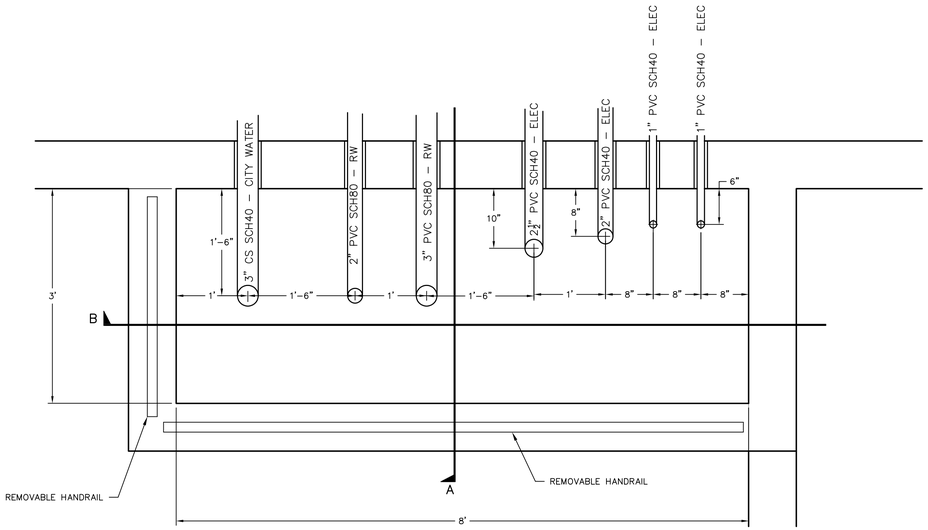
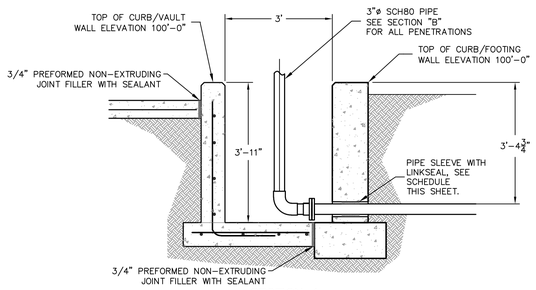
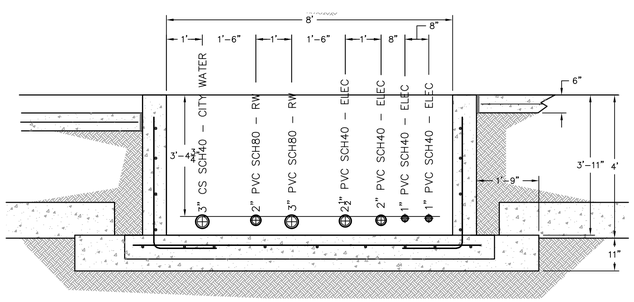


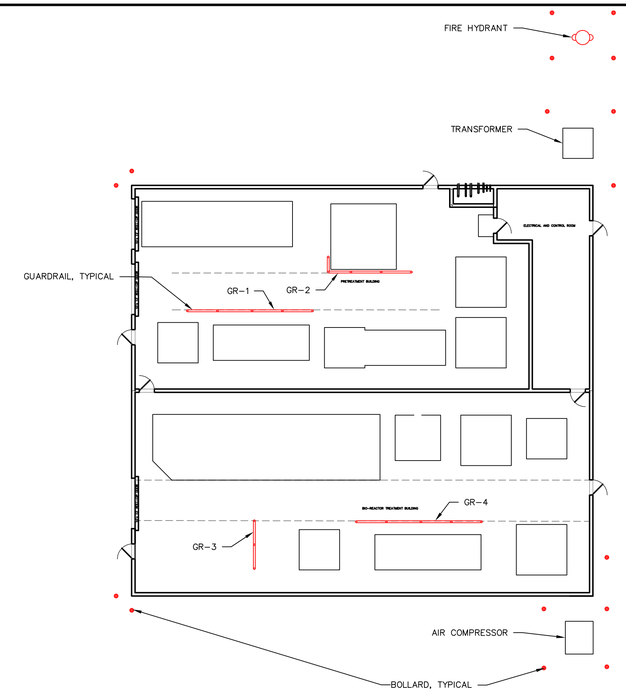
PLAN
UTILITY VAULT
SCALE: 1"= 1'–0"



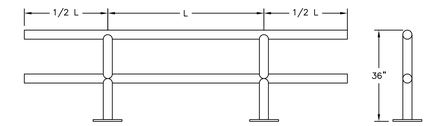
SECTION A
UTILITY VAULT
SCALE: 1/2"= 1'–0"



SECTION B
UTILITY VAULT



GUARDRAIL AND BOLLAND PLAN
SCALE: NONE

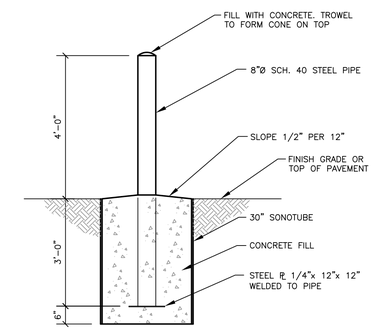


Ideal Shield 4 expansion anchor bolts per support
two line with base plate
ASTM A53, Grade B, Type E or S, Schedule 40
Polyethylene Thermoplastic (HDPE) tubes having ultra-violet resistance and anti static properties, nominal thickness 0.250 inches. Color shall be OSHA yellow unless otherwise noted.

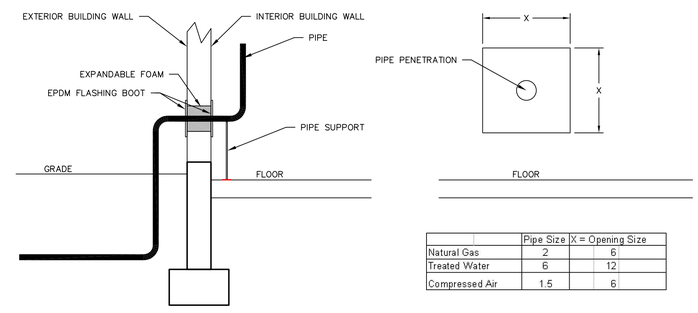
Expansion Anchors: Threaded stud type with two independent expansion anchor wedges per Fed. Spec. FF-S-325, Group II, Type 4, Class 1 for concrete expansion anchors. Stud, wedges, washer and nut shall be zinc-plated steel.
a. Hilti Fastening Systems, "Kwick Bolt".
b. Molly Fastener Group, Parabolt".
c. Red Head, Phillips Anchors, "Wedge Anchors".

GR	Length, ft	Sections	Leg Length, ff
1	24	2	none
2	16	2	4
3	8	1	none
4	16	2	none

GUARDRAIL DETAILS
SCALE: NONE



BOLLARD DETAIL
SCALE: 1/2"= 1'–0"



	Pipe Size	X = Opening Size
Natural Gas	2	6
Treated Water	6	12
Compressed Air	1.5	6

WALL PENETRATION DETAIL
SCALE: 1/2"= 1'–0"

SLEEVE AND LINKSEAL SCHEDULE

Item	Pipe Size (in)	Schedule	Pipe O.D. (in)	Manufacturer
RW	3	80	3.5	Link-Seal
RW	2	80	2.375	Link-Seal
RW	3	40	3.5	Link-Seal
Elect	2.5	40	2.875	Link-Seal
Elect	2	40	2.375	Link-Seal
Elect	1	40	1.315	Link-Seal

Sleeve Model #	Sleeve Length in inches = x	Sleeve Material	Link Seal Material
LS-300-CS-5-x	6	HDPE	EPDM
LS-300-CS-4-x	6	HDPE	EPDM
LS-300-CS-5-x	6	HDPE	EPDM
LS-200-CS-4-x	6	HDPE	EPDM
LS-300-CS-4-x	6	HDPE	EPDM
LS-300-CS-3-x	6	HDPE	EPDM

Note:
Splay forces are to be evaluated by Contractor based on proximity of footing.

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GWET SYSTEM
ARKEMA, INC.
PORTLAND, OREGON

MISCELLANEOUS DETAILS

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	S4	0
DATE 11/30/2010			

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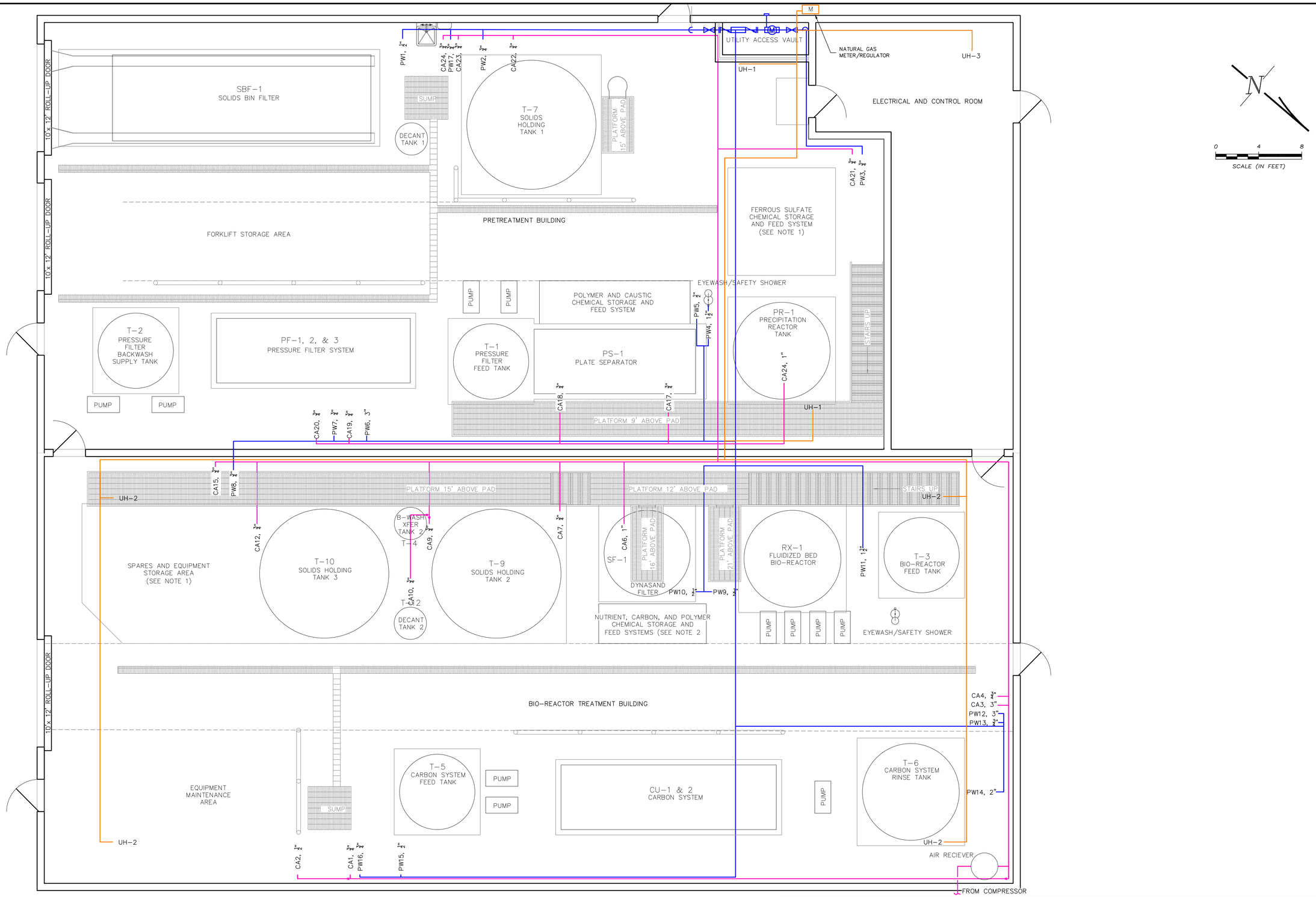

WILLAMETTE RIVER

COMPRESSED AIR — CA1, 3"

PROCESS WATER — PW1, 3"

NATURAL GAS — PIPING RO BE SIZED BY CONTRACTOR

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GWET SYSTEM
ARKEMA, INC.
PORTLAND, OREGON

UTILITY PIPING LAYOUT

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	U1	0
DATE 11/30/2010			

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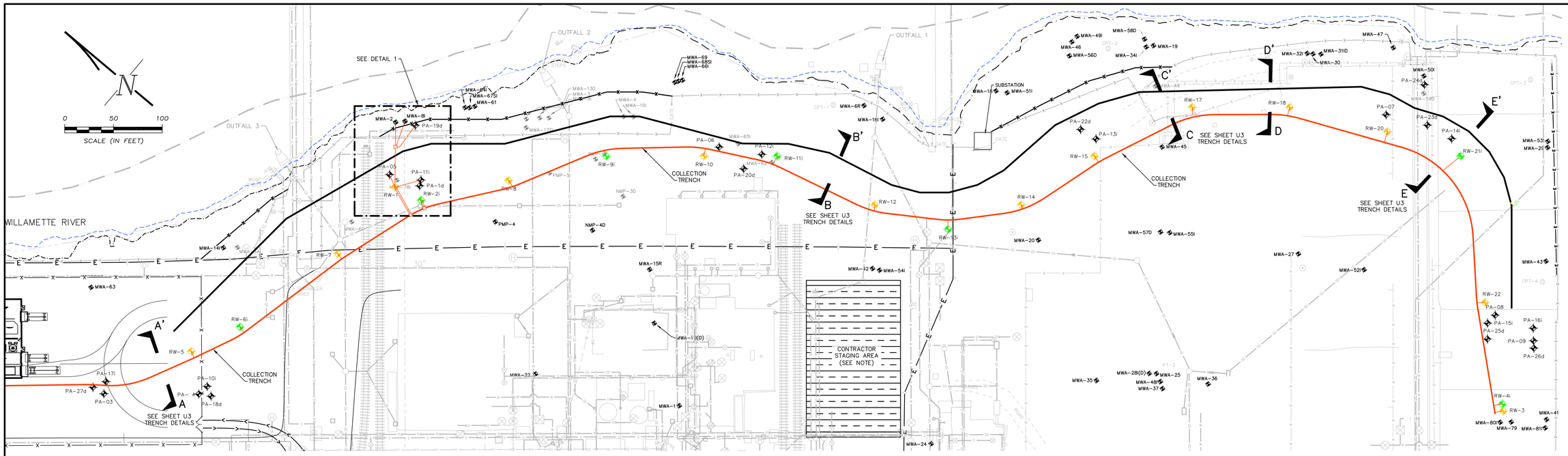
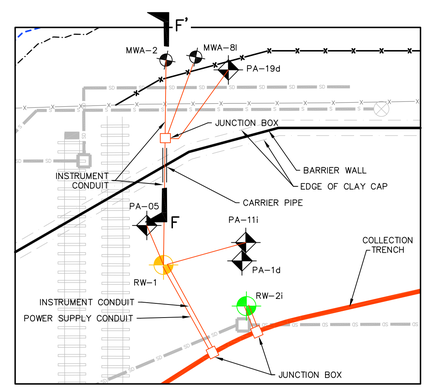
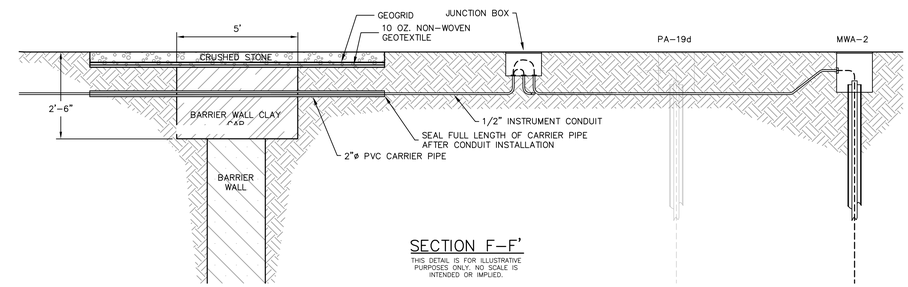


SITE UTILITY PIPING PLAN



DETAIL 1
NOT TO SCALE



SECTION F–F'
THIS DETAIL IS FOR ILLUSTRATIVE PURPOSES ONLY. NO SCALE IS INTENDED OR IMPLIED.

Water Level Monitoring Locations

Identified junction points for noted water level monitoring (i.e. RW 1 recieves 5 water level transmitter signals)

RW 1	RW 2i	RW 3	RW-4i	RW 5	RW 6i	RW 7	RW 8	RW 9i	RW 10	RW 11i	RW 12	RW 13i	RW 14	RW 15	RW 16i	RW 17	RW 18	RW 19i	RW 20	RW 21i	RW 22	Monitoring Point
1																						MWA-2
														1								MWA-45
														1								MWA-46
																			1			MWA-47
														1								MWA-49i
																			1			MWA-50i
														1								MWA-56d
									1													MWA-66i
									1													MWA-69
1																						MWA-8i
				1																		PA-10i
1																						PA-11i
									1													PA-12i
														1								PA-13i
																			1			PA-14i
																					1	PA-15i
				1																	1	PA-16i
				1																		PA-17i
																						PA-18d
1																						PA-19d
									1													PA-20d
														1								PA-22d
																			1			PA-23d
																			1			PA-24d
																					1	PA-25d
																					1	PA-26d
				1																		PA-27d
				1																		PA-3
				1																		PA-4
1																						PA-5
									1													PA-6
									1													PA-7
																					1	PA-8
																					1	PA-9
1																						RW 1
	1																					RW 2i
		1																				RW 3
			1																			RW-4i
				1																		RW 5
					1																	RW 6i
						1																RW 7
							1															RW 8
								1														RW 9i
									1													RW 10
										1												RW 11i
											1											RW 12
												1										RW 13i
													1									RW 14
														1								RW 15
															1							RW 16i
																1						RW 17
																	1					RW 18
																		1				RW 19i
																			1			RW 20
																				1		RW 21i
																					1	RW 22
6	1	1	1	7	1	1	1	1	7	1	1	1	1	7	1	1	1	1	6	1	7	56

REVISIONS TO BE MADE ON THE CADD FILE ONLY

Shallow Well Pump		Intermediate Well Pump				
Well #	Wire Size	Well #	Wire Size	Conduit Route	Power Conduit Size	I&C Conduit Size
RW-5	2 #12, #10 Gnd	RW-6	2 #12, #10 Gnd	JB in GWET to RW-12	2.5"	2"
RW-7	2 #12, #10 Gnd	RW-2	2 #10, #10 Gnd	RW-12 to RW-17	2"	2"
RW-1	2 #12, #10 Gnd	RW-9	2 #8, #10 Gnd	RW-17 to RW-18	1.5"	1"
RW-8	2 #10, #10 Gnd	RW-11	2 #8, #10 Gnd	RW-18 to RW-3	1"	1"
RW-10	2 #8, #10 Gnd	RW-13	2 #8, #10 Gnd			
RW-12	2 #8, #10 Gnd	RW-16	2 #6, #10 Gnd	WWTP to RW-13	2"	1"
RW-14	2 #6, #10 Gnd	RW-19	2 #6, #10 Gnd	RW-13 to RW-21	2"	1"
RW-15	2 #6, #10 Gnd	RW-21	2 #6, #10 Gnd	RW-21 to RW-4	1"	1"
RW-17	2 #6, #10 Gnd	RW-4	2 #4, #10 Gnd			
RW-18	2 #6, #10 Gnd					
RW-20	2 #6, #10 Gnd					
RW-22	2 #4, #10 Gnd					
RW-3	2 #4, #10 Gnd					

Notes:

I&C wire is 18AWG 2-conductor stranded copper shielded with drain wire.

One wire run from vault-to-vault for motor control and data

One wire run from vault-to-vault plus additional wire runs to each piezometers location in groups of eight to each vault

LEGEND

- MONITORING WELL LOCATION
- SHALLOW ZONE RECOVERY WELL
- INTERMEDIATE ZONE RECOVERY WELL
- PIEZOMETER WELL

NOTE: SEE SHEET U3 TRENCH DETAILS

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GWET SYSTEM
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PORTLAND, OREGON

UTILITY PIPING ENLARGED PLAN AND DETAILS

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	U2	0
DATE 11/30/2010			

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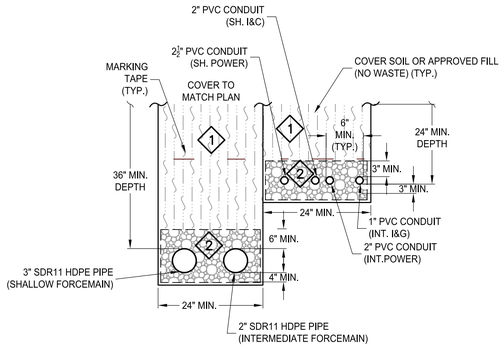
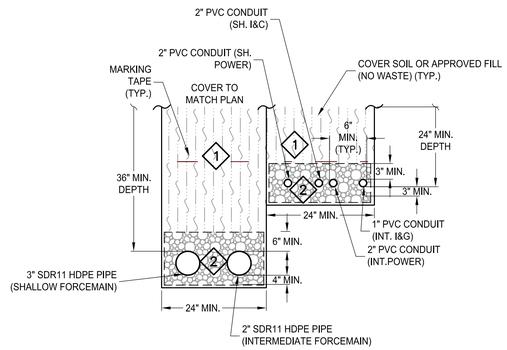


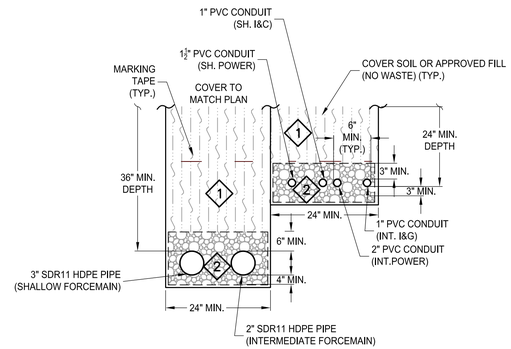
COLLECTION TRENCH DETAIL A-A'

N.T.S.



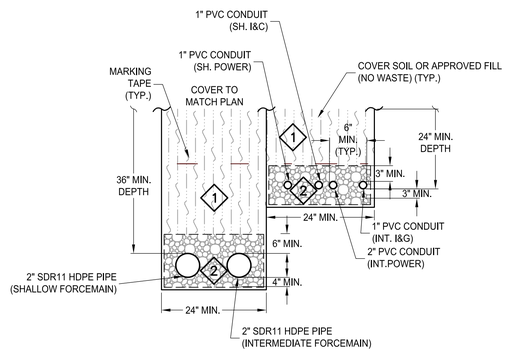
COLLECTION TRENCH DETAIL B-B'

N.T.S.



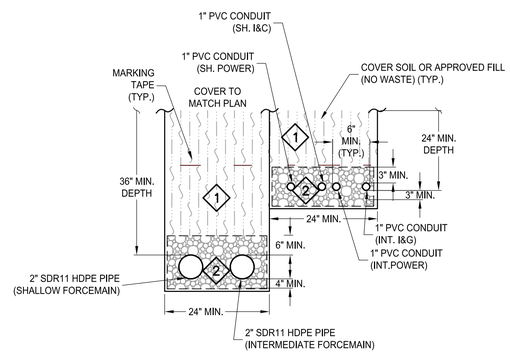
COLLECTION TRENCH DETAIL C-C'

N.T.S.



COLLECTION TRENCH DETAIL D-D'

N.T.S.



COLLECTION TRENCH DETAIL E-E'

N.T.S.

NOTES:
SH. = SHALLOW
INT. = INTERMEDIATE

1 COMMON FILL

2 ¾" COARSE AGGREGATE STONE SURROUNDED BY TYPE 1 GEOTEXTILE

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PORTLAND, OREGON

UTILITY TRENCH DETAILS

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	U3	0

DATE 11/30/2010

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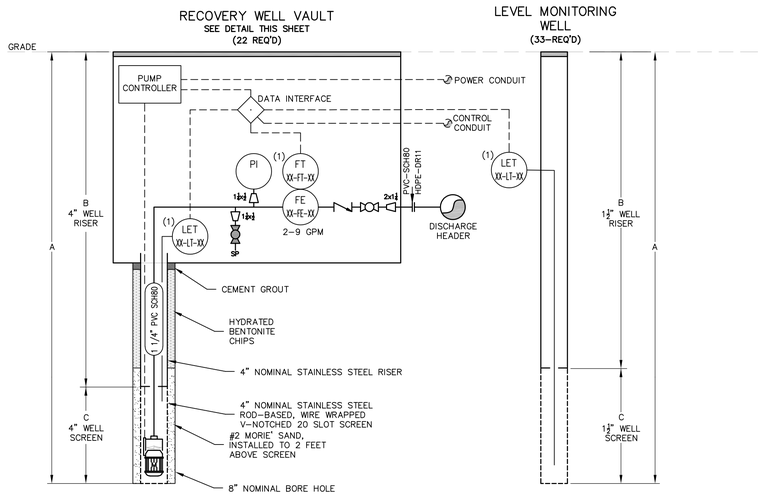
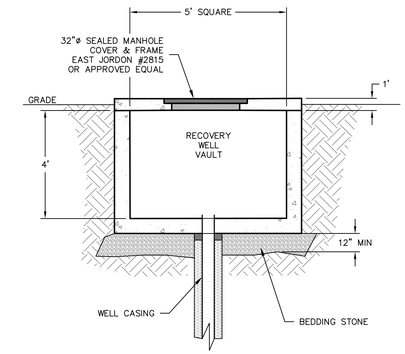
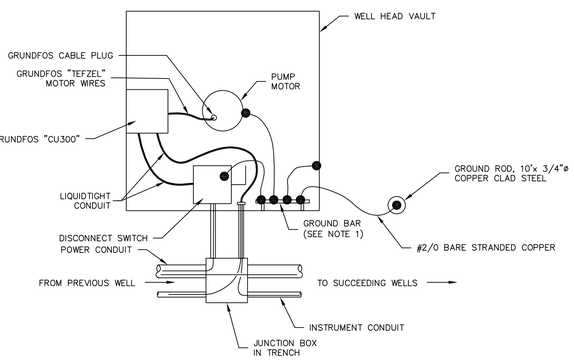


RECOVERY WELL DETAIL
NOT TO SCALE



RECOVERY WELL VAULT DETAIL
NOT TO SCALE



WELL PUMP POWER & INSTR. WIRING (TYP)
NOT TO SCALE

NOTES:

1. PROVIDE COPPER GROUND BAR 2"x ¼" THK., LENGTH AS REQUIRED, SPACED APPROXIMATELY 1" FROM VAULT WALL.

2. PROVIDE CONNECTIONS FROM WELL CASING, PUMP MOTOR GROUND (IN DISCONNECT SWITCH), GRUNDOS "CU300", WELL COVER SUPPORT FRAME AND DOORS TO GROUND BAR USING BARE STRANDED AWG #2 COPPER.

3. PROVIDE WELDED CONNECTIONS TO WELL CASING, WELL COVER SUPPORT FRAME AND DOORS, GROUND BAR, AND GROUND ROD

RECOVERY AND LEVEL MONITORING WELL DEPTHS				
TYPE OF WELL	'A' FEET	'B' FEET	'C' FEET	TOTAL
SHALLOW RECOVERY WELL	35	25-30	5-10	13
INTERMEDIATE RECOVERY WELL	45	35-40	5-10	9
SHALLOW LEVEL MONITORING WELL	35	30	5	20
INTERMEDIATE LEVEL MONITORING WELL	45	40	5	15
DEEP LEVEL MONITORING WELL	50	50	5	9
			TOTAL WELLS	55

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GROUNDWATER SOURCE CONTROL MEASURE
GWET SYSTEM
ARKEMA, INC.
PORTLAND, OREGON

MISCELLANEOUS DETAILS

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	U4	0
DATE 11/30/2010			

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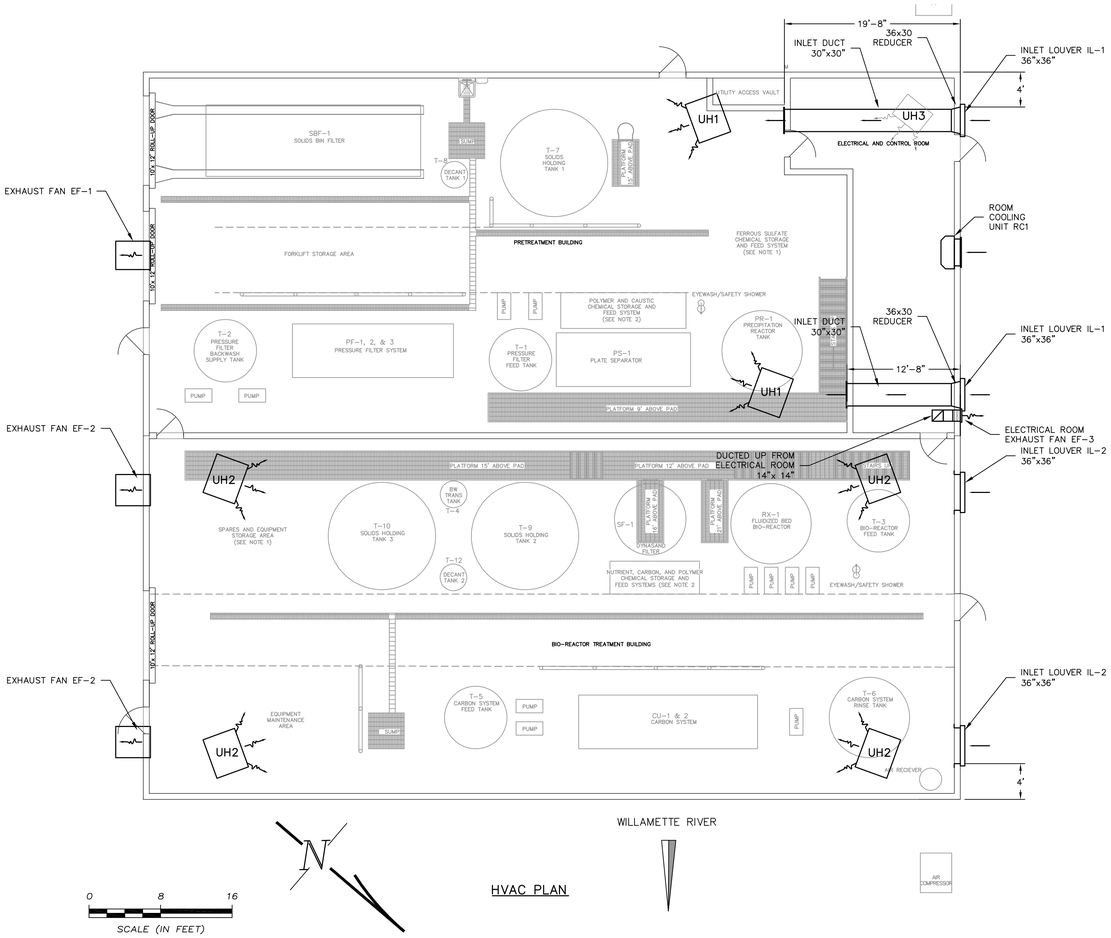
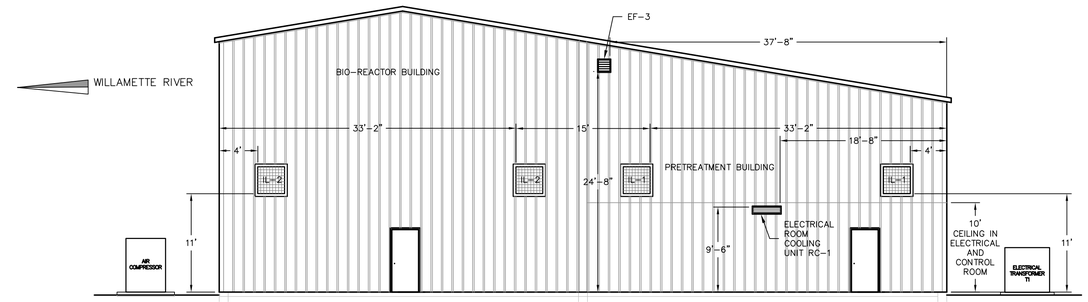
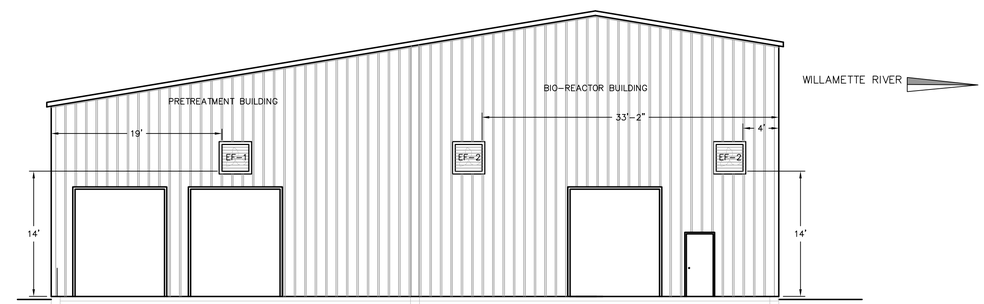


HVAC PLAN



ELEVATION VIEW
LOOKING SOUTHEAST
SCALE: 1/8" = 1'-0:



ELEVATION VIEW
LOOKING NORTHWEST
SCALE: 1/8" = 1'-0:

Ventilation - Pretreatment Room

Sidewall Mounted Exhaust Fan with Gravity Damper and Weather Hood - EF1

		Comments	
Manufacturer	Greenheck		
Model	SBE-1H30-7		
Type	Belt Driven Side Mounted		
Qty	1		
Design Ps in. wg	0.25		
Required CFM/Unit	7421		
Rated CFM/Unit	7779		
Propeller Diameter (in)	30		
Panel Length (in)	38		
Hp	3/4		
Sones	19.1	70.56	dBA
rpm	827		

Intake Louvers - IL-1

Manufacturer	Greenheck
Model	EDJ-430
Type	Extruded Aluminum Frame
Qty	2
CFM	3710
Length (in)	30
Width (in)	30
Max Loss (in. w	0.08

Ventilation - Bio-Reactor Room

Wall Mounted Exhaust Fan with Gravity Damper and Weatherhood - EF-2

		Comments	
Manufacturer	Greenheck		
Model	SBE-1H30-5		
Type	Belt Driven Side Mounted		
Qty	2		
Design Ps in. wg	0.25		
Required CFM/Unit	5348		
Rated CFM/Unit	6145		
Propeller Diameter (in)	30		
Panel Length (in)	38		
Hp	1/2		
Sones	15.5	67.54	dBA
rpm	631		

Intake Louvers - IL-2

Manufacturer	Greenheck
Model	EDJ-430
Type	Extruded Aluminum Frame
Qty	2
CFM	6145
Length (in)	36
Width (in)	36
Max Loss (in. w	0.08

Ventilation - Electrical Room

Wall Mounted Exhaust Fan with Gravity Damper and Weatherhood - EF-3

		Comments	
Manufacturer	Greenheck		
Model	S1E-12-432-D	Intake via duct work to pretreatment room.	
Type	Direct Drive Side Mounted		
Qty	1		
Design Ps in. wg	0.25		
Required CFM/Unit	988		
Rated CFM/Unit	1042		
Propeller Diameter (in)	12		
Panel Length (in)	18		
Hp	1/8		
Sones	7.5	57.07	dBA
rpm	1550		

Intake Louvers

Manufacturer	NA
Model	NA
Type	NA
Qty	NA
CFM	NA
Length (in)	NA
Width (in)	NA
Max Loss (in. w	NA

Gas Heaters

Room	UH2 Bio-Reactor Room	UH1 Pretreatment Room	UH3 Electrical Room	Comments
Manufactuer	Dayton	Dayton	Dayton	
Heater Model	4LX65	4LX67	4LX55	
Source	Grainger	Grainger	Grainger	
Fuel Type	LP	LP	LP	
F.L.A @ 115V	12.5	12.5	7.8	
Motor HP	(2) 1/3	(2) 1/3	1/4	
H (in)	34	34	33.75	
W (in)	55.25	55.25	25.25	
D (in)	44.75	44.75	43.5	
CFM	5600	5800	2400	
Qty.	4	2	1	
Voltage	120/1/60	120/1/60	120/1/60	
Gas Inlet Size (in)	3/4	3/4	1/2	
BTU/hr In	350000	400000	150000	
BTU/hr Out	280000	324000	121500	
Safety Factor	1	1	1.25	
Btu/hr Required	947000	575000	122000	
Btu/hr Provided	1120000	648000	121500	

Air Conditioning

Room	Pretreatment Room	Bio-Reactor Room	RC1 Electrical Room	Comments
Manufactuer	NA	NA	Frigidaire	It is assumed that ventilation will be supplied within the open space above the electrical room. That ventilation is anticipated to tied into the Pretreatment Room such that it will remove the majority of the heat gain, and the size of the AC unit is bei
Model	NA	NA	4YG99	
Source	NA	NA	Grainger	
Amps	NA	NA	6	
H (in)	NA	NA	14.5	
W (in)	NA	NA	24	
D (in)	NA	NA	18.5	
CFM	NA	NA	265	
Qty.	NA	NA	1	
Voltage	NA	NA	230/208	
Radiant Heat (BTU/hr)	NA	NA	9400	
Design BTU/hr*	NA	NA	9400	
Btu/hr Provided	NA	NA	12000	

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GROUNDWATER SOURCE CONTROL MEASURE
GWET SYSTEM
ARKEMA, INC.
PORTLAND, OREGON

HVAC PLAN, ELEVATIONS, AND DETAILS

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	M1	0
DATE 11/30/2010			

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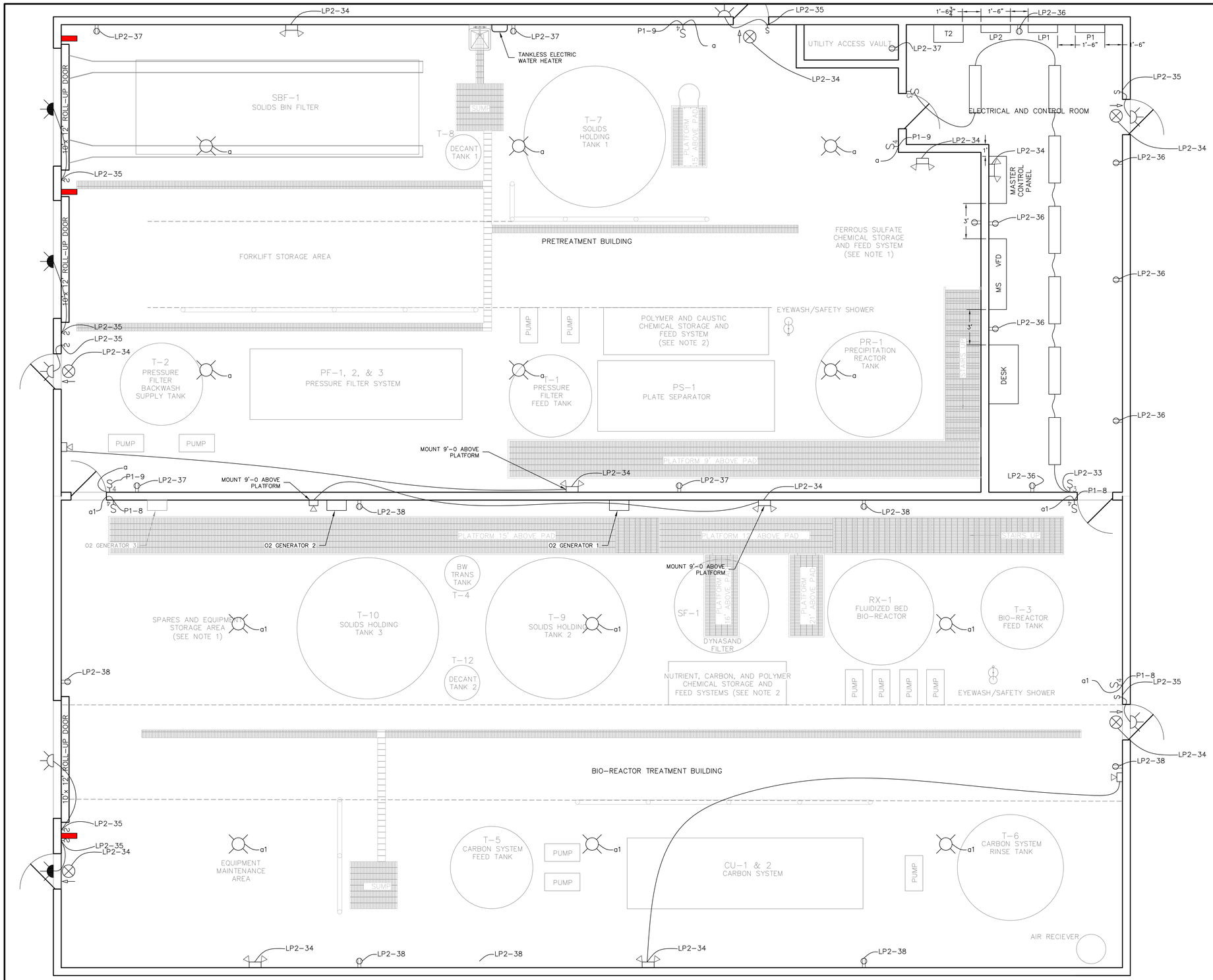

LEGEND

P1	Panelboard, three phase 4- wire, 480/277 VAC, 400 amp main circuit breaker – 35K AIC (verify with Utility), copper bus, with ground bar, 42 single pole spaces, NEMA 1 surface mount enclosure, service entrance rated; Provide breakers as noted on Single-Line Diagram
LP1/2	Panelboard, single phase 3- wire, 120/240 VAC, 225 amp main circuit breaker, copper bus with ground bar, 42 single-pole spaces, NEMA 1 surface mount enclosure, provide breakers as indicated on panelboard schedules
T1	Transformer, pad-mount, Size and voltage as noted on Single-Line Diagram.
T2	Transformer, Dry Type, 100 KVA Single Phase, 480 V. primary 120/240 V. secondary, 150 deg. C rise, Floor mounted.
DS	Disconnect Switch-non-fused, 3-pole, 30 amp 240 VAC, NEMA 4X enclosure, with ground block; Provide mounting brackets as required.
	Light Fixture-Metal Halide, 400 watt , 277 VAC, Pulse Start Ballast/Lamp, sealed die-cast aluminum housing with clear acrylic prismatic reflector, with 41000 Lumen lamp-adjustable lamp position, 100W. quartz standby, ceiling mount.
	Light Fixture-fluorescent, recessed lay-in, 1'x4'., (2) F32T8/CW lamps, rapid start electronic ballast, 120 volt, acrylic diffuser in hinged door, with clips for mounting in T-bar grid.
	Light Fixture-fluorescent, 26 watt CFL, wall mount, polycarbonate front, bronze finish,120 VAC, with photoelectric control, UL wet location listed; -20 degrees F. starting; Provide mounting accessories, mtg. ht.: 8'-0" above door sill
	Light Fixture-fluorescent, 42 watt CFL, 120 volt, with photoelectric control, weather tight die-cast aluminum housing with tempered glass lens & wire guard, UL wet location listed, with bracket for adjustable mounting above roll-up door.
	Exit Light, wall mounted white thermoplastic housing with chevrons, 120 VAC, with nickel cadmium battery, charger & test switch, LED illumination; install 8 ft AFF; provide chevrons as indicated.
	Emergency Lighting Unit, wall mounted white thermoplastic housing, (2) 12 volt 9 watt lamps, 120 VAC, with nickel cadmium battery, charger & test switch; install 8 ft. AFF; provide connection to remote lamp heads where indicated.
	Remote Lamp Head, 12 volt 12 watt halogen lamp, white thermoplastic housing, wedge base round head, with compatible mounting plate; install 9 ft. AFF; provide connection to emergency lighting unit where indicated.
	Garage Door Operator, trolley opener, medium duty for standard lift sectional doors, 1/2 HP 120 VAC motor with instant reverse & internal automatic reset thermal overload, dual L-rail track with trolley chain, NEMA 1 operator/motor control enclosure, with 3-button station: OPEN-STOP-CLOSE, with options: solenoid brake, trolley auto-reconnect, sensing edge, photo safety sensor; install per manufacturer recommendations; install 3-button station on inside wall 54" AFF; verify operator is compatible with supplied door.
WR	Welding Receptacle, 30Amp 250 VAC single-phase, NEMA L6-30 configuration, Spring-Loaded Flip Seal Cover weather resistant, wall mount to a FD corrosion resistant box with stainless steel hardware.
	Duplex Receptacle, 20 amp 125 VAC, 2-pole 3-wire grounding, NEMA 5-20R, provide cover and outlet box. WP = Weatherproof GFI = Ground Fault Circuit Interrupter
S_{3a}	Toggle Switch, single pole-on/off, 20 amp 120/277 VAC, with ground screw, brown toggle; provide wall box & corrosion-resistant wall plate. S_{3a} = 3-way, letter indicates type fixture controlled by switch
LP2-34	"Homerun" circuit to indicated panelboard
VFD	Variable Frequency Drive, Allen-Bradley PowerFlex 4M, 7.5HP 460 Volt 3-phase, with provision for low voltage control wiring via a single DeviceNet cable. (Cable to consist of a shielded jacket with five conductors for connecting the three drives in series, and terminates at the MCS and at the last drive)
MS	Motor Starter, NEMA Size 0, 2-Pole 240 VAC, with 120 VAC coil for separate control, with non-fusible disconnect switch, thermal overload relay & heater for 1/3 HP 240 VAC motor, with (2) aux N.O. contacts, NEMA 1 enclosure with Hand-Off-Auto switch & red "ON" pilot light on cover.

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PORTLAND, OREGON

ELECTRICAL LIGHTING AND RECEPTACLE LAYOUT

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	E1	0
DATE 11/30/2010			

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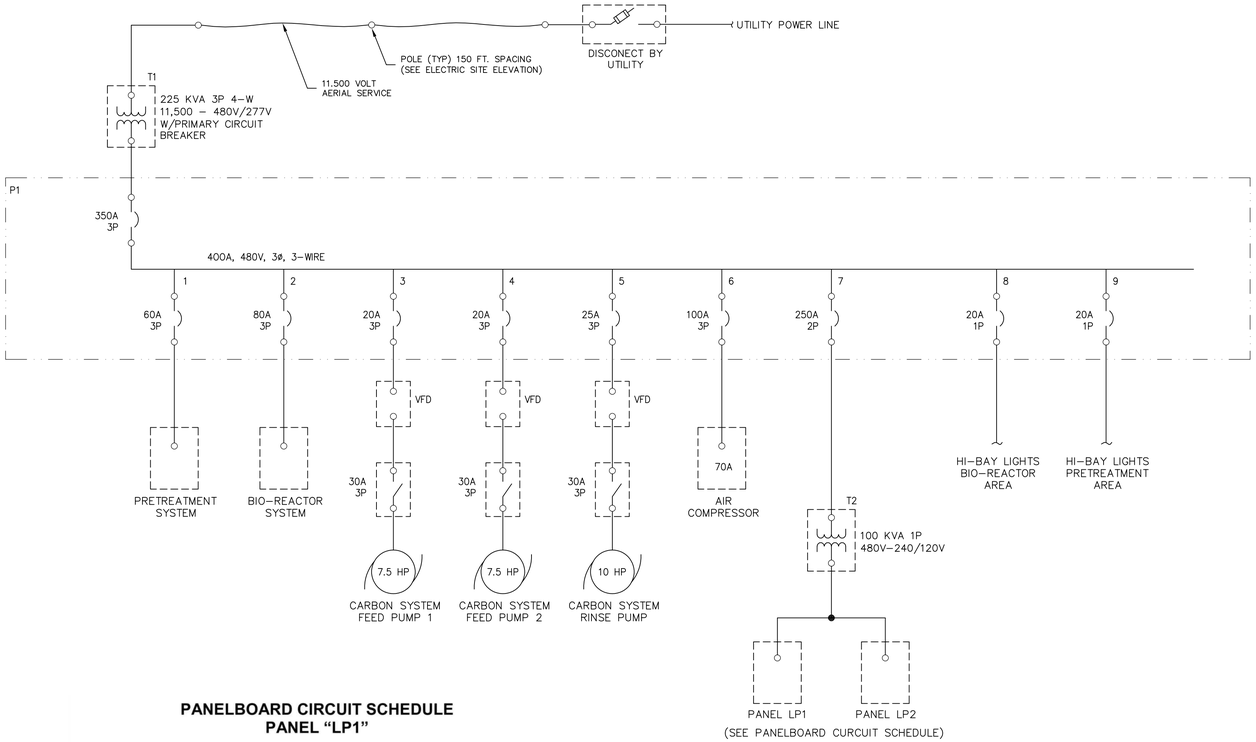
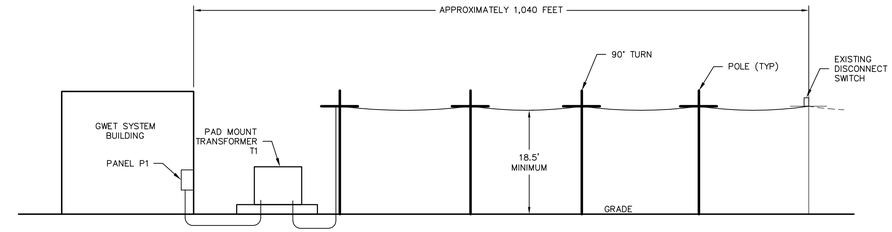




ELECTRIC SITE ELEVATION
NOT TO SCALE

NOTES:

1. ALL EQUIPMENT, INCLUDING INSTALLATION, FROM EXISTING UTILITY DISCONNECT SWITCH TO THE GWET SYSTEM BUILDING TO BE PROVIDED BY CONTRACTOR, IN ACCORDANCE WITH UTILITY'S LATEST ELECTRIC SERVICE REQUIREMENTS.

2. PROVIDE 15KV 3-PHASE DISCONNECT. CONSULT WITH UTILITY FOR AVAILABLE FAULT CURRENT.

3. TYPE OF AERIAL SERVICE CONDUCTORS TO BE AS REQUIRED BY THE UTILITY.

4. PROVIDE CONCRETE PAD FOR TRANSFORMER WITH PROVISION FOR CONTAINMENT IF REQUIRED BY LOCAL CODES AND/OR THE UTILITY. SERVICE FROM POLE DISCONNECT TO TRANSFORMER PRIMARY TO BE PER UTILITY REQUIREMENTS.

5. POLES TO BE SPACES ON 150 FT. (APPROX) CENTERS. CONSULT WITH UTILITY FOR POLE DETAILS AND INSTALLATION.

6. PROVIDE A 3" RGC CONDUIT UNDERGROUND FROM TRANSFORMER TO POWER PANEL P1. INSTALL (3) 350 MCM & #10 GND, TYPE THHW, 600 V CABLE.

PANELBOARD CIRCUIT SCHEDULE
PANEL "LP1"

240/120 VOLTS
1 PHASE, 3 WIRE
SURFACE MOUNTED
WITH GROUND BUS

AMPERE MAIN LUGS
225 AMPERE MAIN BREAKER
AMPERES SYM. INTERRUPTING

CKT NO.	DESCRIPTION	BKR. SIZE	VA	VA	BKR. SIZE	DESCRIPTION	CKT NO.
1	WELL PUMP	15 /			15 /	WELL PUMP	2
3	RW-1	/ 2			/ 2	RW-3	4
5	WELL PUMP	15 /			15 /	WELL PUMP	6
7	RW-5	/ 2			/ 2	RW-7	8
9	WELL PUMP	15 /			15 /	WELL PUMP	10
11	RW-8	/ 2			/ 2	RW-10	12
13	WELL PUMP	15 /			15 /	WELL PUMP	14
15	RW-12	/ 2			/ 2	RW-14	16
17	WELL PUMP	15 /			15 /	WELL PUMP	18
19	RW-15	/ 2			/ 2	RW-17	20
21	WELL PUMP	15 /			15 /	WELL PUMP	22
23	RW-18	/ 2			/ 2	RW-20	24
25	WELL PUMP	15 /					26
27	RW-22	/ 2					28
29	EXH FAN #1 PRETREAT RM	25 / 1			30 /	WELDING	30
31	EXH FAN #1 BIO-REACT RM	20 / 1			/ 2	RECEPTACLES	32
33	EXH FAN #2 BIO-REACT RM	20 / 1			25 / 1	(2) GAS HTRS BIO-REACT RM	34
35	CARBON SYSTEM	20 / 1			25 / 1	(2) GAS HTRS PRETREAT RM	36
37	OVER HEAD DOOR OP #1	20 / 1			15/1	HEATER – CONTROL RM	38
39	OVER HEAD DOOR OP #2	20 / 1			20 /	TANKLESS	40
41	OVER HEAD DOOR OP #3	20 / 1			/ 2	WATER HEATER	42

PANELBOARD CIRCUIT SCHEDULE
PANEL "LP2"

240/120 VOLTS
1 PHASE, 3 WIRE
SURFACE MOUNTED
WITH GROUND BUS

AMPERE MAIN LUGS
225 AMPERE MAIN BREAKER
AMPERES SYM. INTERRUPTING

CKT NO.	DESCRIPTION	BKR. SIZE	VA	V A	BKR. SIZE	DESCRIPTION	CK T NO.
1	WELL PUMP	15 /			15 /	WELL PUMP	2
3	RW-2	/ 2			/ 2	RW-4	4
5	WELL PUMP	15 /			15 /	WELL PUMP	6
7	RW-6	/ 2			/ 2	RW-9	8
9	WELL PUMP	15 /			15 /	WELL PUMP	10
11	RW-11	/ 2			/ 2	RW-13	12
13	WELL PUMP	15 /			15 /	WELL PUMP	14
15	RW-16	/ 2			/ 2	RW-19	16
17	WELL PUMP	15 /			25 / 1	(2) GAS HTRS BIO-REACT RM	18
19	RW-21	/ 2					20
21							22
23	ELECT/CONTROL RM	15 /			15 /	SUMP	24
25	AC UNIT	/ 2			/ 2	PUMP #1	26
27	O_2 GENERATOR 1	15 /			15 /	SUMP	28
29	CONTROL	/ 2			/ 2	PUMP #2	30
31							32
33	LIGHTING-CONTROL RM	20 / 1			20 / 1	EMERG. LIGHT/EXIT LIGHT	34
35	OUTSIDE DOOR LIGHTS	20 / 1			20 / 1	RECEPTS-CONTROL RM	36
37	RECEPTS-PRE TREAT	20 / 1			20 / 1	RECEPTS-BIO REACT.	38
39	O_2 GENERATOR 2	15 /			15 /	O_2 GENERATOR 3	40
41	CONTROL	/ 2			/ 2	CONTROL	42

WELL PUMPS WIRING SCHEDULE

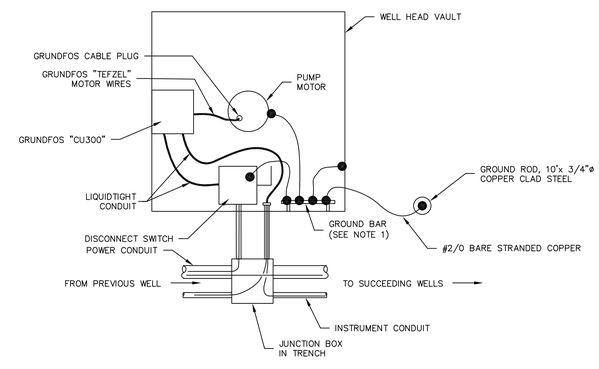
Power

Shallow Well Pump	Wire Size	Intermediate Well Pump	Wire Size
RW-5	2 #12, #10 Gnd	RW-6	2 #12, #10 Gnd
RW-7	2 #12, #10 Gnd	RW-2	2 #10, #10 Gnd
RW-1	2 #12, #10 Gnd	RW-9	2 #8, #10 Gnd
RW-8	2 #10, #10 Gnd	RW-11	2 #8, #10 Gnd
RW-10	2 #8, #10 Gnd	RW-13	2 #8, #10 Gnd
RW-12	2 #8, #10 Gnd	RW-16	2 #6, #10 Gnd
RW-14	2 #6, #10 Gnd	RW-19	2 #6, #10 Gnd
RW-15	2 #6, #10 Gnd	RW-21	2 #6, #10 Gnd
RW-17	2 #6, #10 Gnd	RW-4	2 #4, #10 Gnd
RW-18	2 #6, #10 Gnd		
RW-20	2 #6, #10 Gnd		
RW-22	2 #4, #10 Gnd		
RW-3	2 #4, #10 Gnd		

Notes:
1.) Indicated wire sizes are continuous lengths from well pump disconnect/control in WWTP to disconnect switch in respective well head.
2.) Conduit in trench sized as follows:
Shallow Well Pumps:
Junction Box in WWTP to RW-12: 2 ½"
RW-12 to RW-17: 2"
RW-17 to RW-18: 1 ½"
RW-18 to RW-3: 1"
Intermediate Well Pumps:
Junction Box in WWTP to RW-13 2"
RW-13 to RW-21 1 ½"
RW-21 to RW-4 1"
3.) Provide junction boxes in trench conduit for respective circuits to well pumps.
4.) Trench conduit type: PVC Sch. 40; Wiring type: copper, 600V type THHW
5.) Specified wire sizes are based on pump data supplied by "Grundfos"
6.) Refer to Installation and Operating Instructions supplied with pumps.

Instrumentation/Control

1.) Provide (1) 4-conductor #18, 300 V. shielded cable from Master Control Panel in WWTP to closest Well (RW 5) of the Shallow Well Pumps. Provide same for closest well (RW 6) of the Intermediate Well Pumps.
2.) Connections in each well vault to be continuous to succeeding well vaults.
3.) Refer to Instrumentation/Control Wiring Diagrams for connections.



WELL PUMP POWER & INSTR. WIRING (TYP)
NOT TO SCALE

NOTES:

1. PROVIDE COPPER GROUND BAR 2"x ¼" THK., LENGTH AS REQUIRED, SPACED APPROXIMATELY 1" FROM VAULT WALL.

2. PROVIDE CONNECTIONS FROM WELL CASING, PUMP MOTOR GROUND (IN DISCONNECT SWITCH), GRUNDOS "CU300", WELL COVER SUPPORT FRAME AND DOORS TO GROUND BAR USING BARE STRANDED AWG #2 COPPER.

3. PROVIDE WELDED CONNECTIONS TO WELL CASING, WELL COVER SUPPORT FRAME AND DOORS, GROUND BAR, AND GROUND ROD

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GWET SYSTEM
ARKEMA, INC.
PORTLAND, OREGON

ELECTRICAL SCHEMATIC

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	E2	0
DATE 11/30/2010			

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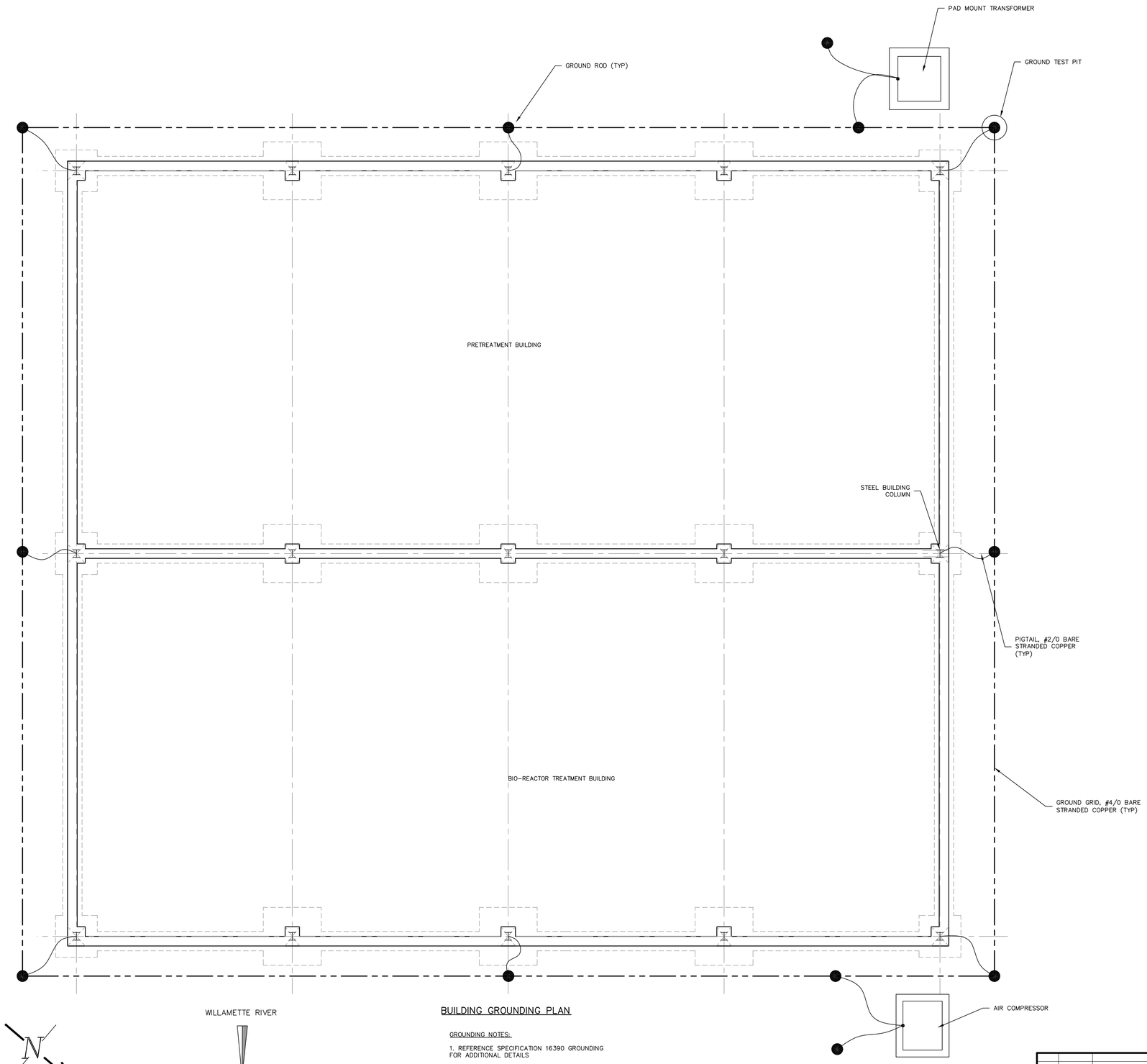

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BUILDING GROUNDING PLAN

GROUNDING NOTES:

1. REFERENCE SPECIFICATION 16390 GROUNDING FOR ADDITIONAL DETAILS

2. INSTALL GROUND GRID 30" BELOW FINISHED GRADE, 24" FROM BUILDING FOUNDATION.

GWET SYSTEM BUILDING WIRING SCHEDULE

Equipment	Location	Termination	Wiring Type	Signal	Remarks
Pad Mount Transf. T1	Outdoor GWTP	Panelboard P1	A	Power	480 VAC
PreTreat. Sys. Panel	Control Rm.	Panelboard P1	B	Power	480 VAC
Bioreactor. Sys. Panel	Control Rm.	Panelboard P1	C	Power	480 VAC
Carbon Sys. Panel	Control Rm.	Panelboard LP1	J	Power	120 VAC
Carbon Sys Feed Pump #1VFD	Control Rm.	Panelboard P1	D	Power	480 VAC
Carbon Sys Feed Pump #1	Bioreactor Area	VFD	D	Power	Via Local Disc. Sw.
Carbon Sys Feed Pump #2 VFD	Control Rm.	Panelboard P1	D	Power	480 VAC
Carbon Sys Feed Pump #2	Bioreactor Area	VFD	D	Power	Via Local Disc. Sw.
Carbon Sys Rinse Pump VFD	Control Rm.	Panelboard P1	D	Power	480 VAC
Carbon Sys Rinse Pump	Bioreactor Area	VFD	D	Power	Via Local Disc. Sw.
A/C Unit	Control Rm.	Panelboard LP2	I	Power	240 VAC
Oxygen Gen. Control Panel #1	Control Rm.	Panelboard LP2	I	Power	240 VAC
Oxygen Gen. Control Panel #2	Control Rm.	Panelboard LP2	I	Power	240 VAC
Oxygen Gen. Control Panel #3	Control Rm.	Panelboard LP2	I	Power	240 VAC
Sump Pump #1 Motor Starter	MCS	Panelboard LP2	I	Power	240 VAC
Sump Pump #1	PreTreat Area	MCS	I	Power	Via Local Disc. Sw.
Sump Pump #2 Motor Starter	MCS	Panelboard LP2	I	Power	240 VAC
Sump Pump #2	Bioreactor. Area	MCS	I	Power	Via Local Disc. Sw.
Air Compressor	Outdoor GWTP	Panelboard P1	E	Power	480 VAC
Transf. T2	Control Rm.	Panelboard P1	F	Power	480 VAC
Panelboard LP1	Control Rm.	Transf. T2	G	Power	240/120 VAC
Panelboard LP2	Control Rm.	Transf. T2	G	Power	240/120 VAC
Lighting	Bioreactor Area	Panelboard P1	I	Lighting	277 VAC
Lighting	PreTreat Area	Panelboard P1	I	Lighting	277 VAC
Lighting	Control Rm.	Panelboard LP2	I	Lighting	120 VAC
Lighting	Outside Doors	PanelboardLP2	I	Lighting	120 VAC
Lighting-Emerg. & Exit	All Areas	Panelboard LP2	I	Lighting	120 VAC
Convenience Recepts.	All Areas	Panelboard LP2	I	Power	120 VAC
Overhead Door Operators	Bioreactor. & PreTreat.	Panelboard LP1	I	Power	120 VAC (each circuit)
Welding Recepts.	Bioreactor & PreTreat.	Panelboard LP1	H	Power	240 VAC (each circuit)
Gas Heaters (2)	Bioreactor Area	Panelboard LP1	H	Power	120 VAC (each area)
Gas Heaters (2)	PreTreat. Area	Panelboard LP1	H	Power	120 VAC (each area)
Gas Heaters (2)	Bioreactor Area	Panelboard LP2	H	Power	120 VAC (each area)
Tankless Water Heater	PreTreat Area	Panelboard LP1	I	Power	240 VAC
Exh. Fan #1	Bioreactor Area	Panelboard LP1	I	Power	120 VAC
Exh. Fan #2	Bioreactor Area	Panelboard LP1	I	Power	120 VAC
Exh. Fan	PreTreat Area	Panelboard LP1	H	Power	120 VAC
Heater	Control Rm.	Panelboard LP1	I	Power	120 VAC

Notes:

1. Wiring Terminations:
   MCS = Motor Control Starters Panel
   VFD = Variable Frequency Drive
   LP1 = Lighting Panel #1
   LP2 – Lighting Panel #2
   P1 – Power Panel P1

2. Wiring Types:
   A = (4) #500 MCM, #1/0 Gnd
   B = (3) #6, #10 Gnd.
   C = (3) #4, #8 Gnd.
   D = (3) #12, #12 Gnd..
   E = (3) #3, #8 Gnd..
   F = (2) #4/0), #2 Gnd.
   G = (3) #4/0, #2 Gnd. (to each panel)
   H = (2) #10, #12 Gnd.
   I = (2) #12, #12 Gnd.
   J = (2) #6, #10 Gnd.

3. To reduce the quantity of conduits, "like" circuits may be routed in a common conduit. Refer to the NEC for allowable wire current carrying capacity.

4. Conduit sizing to be as required by the NEC.

5. Verify all wiring with Vendor supplied drawings

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GWET SYSTEM
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PORTLAND, OREGON

ELECTRICAL GROUNDING AND WIRING SCHEDULE

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0114849	E3	0
DATE 11/30/2010			

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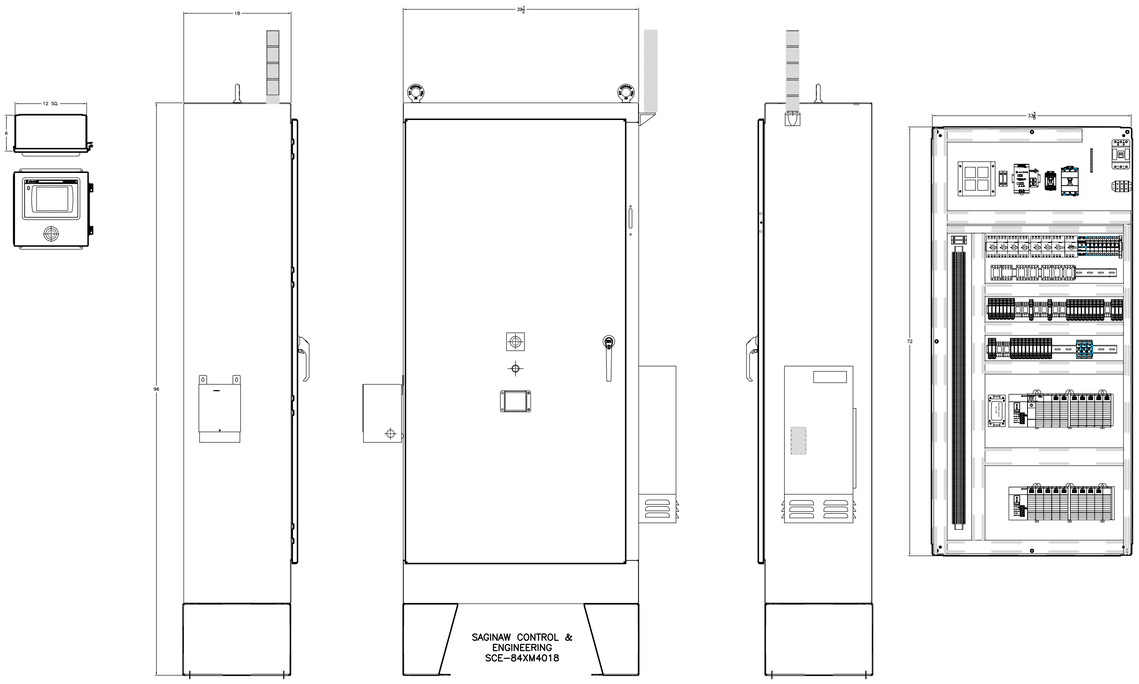

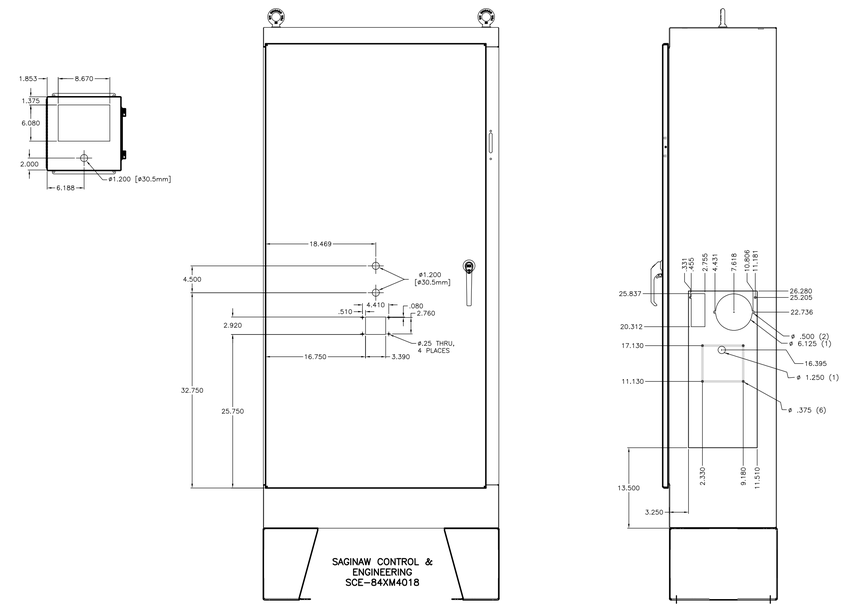

CONTROL PANEL ELEVATIONS ARE PRELIMINARY AND PANEL DESIGN NEEDS TO BE CONDUCTED TO FINALIZE THE COMPONENTS, LOCATION, AND SIZE

The Control Panel will be PLC based and will consist of all components necessary to fabricate the system as noted on the drawings and specifications. The Control Panel will consist of the following as a minimum:

(1) Control enclosure, NEMA 12, 72"H x 30"W x 18"D
(1) Main disconnect, 120V, 40A, 1-pole
(5) Circuit breakers, 120V, 1-pole, for PLC and control power
(1) Surge protector, 120V
(1) DC power supply for PLC control
(1) DC power supply for Device Net
(1) ESTOP (emergency stop)
(1) Programmable logic controller, Allen Bradley 1769-L35E
(2) Power supply, Allen Bradley, 1769-PA4
(4) Discrete input cards, Allen Bradley, 1769-IQ16
(3) Discrete output cards, Allen Bradley, 1769-OW16
(5) Analog input cards, Spectrum, 1769sc-IF8U
(1) Device Net module, Allen Bradley, 1769-SDN
(1) Modbus module Prosoft MVI69-MCM
(1) Ethernet switch, 4-port
(1) Lot of control relays, wire, terminals, terminal markers, din, etc.
(1) Electrical schematics and UL 508A listing

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PANEL ELEVATIONS AND DETAILS

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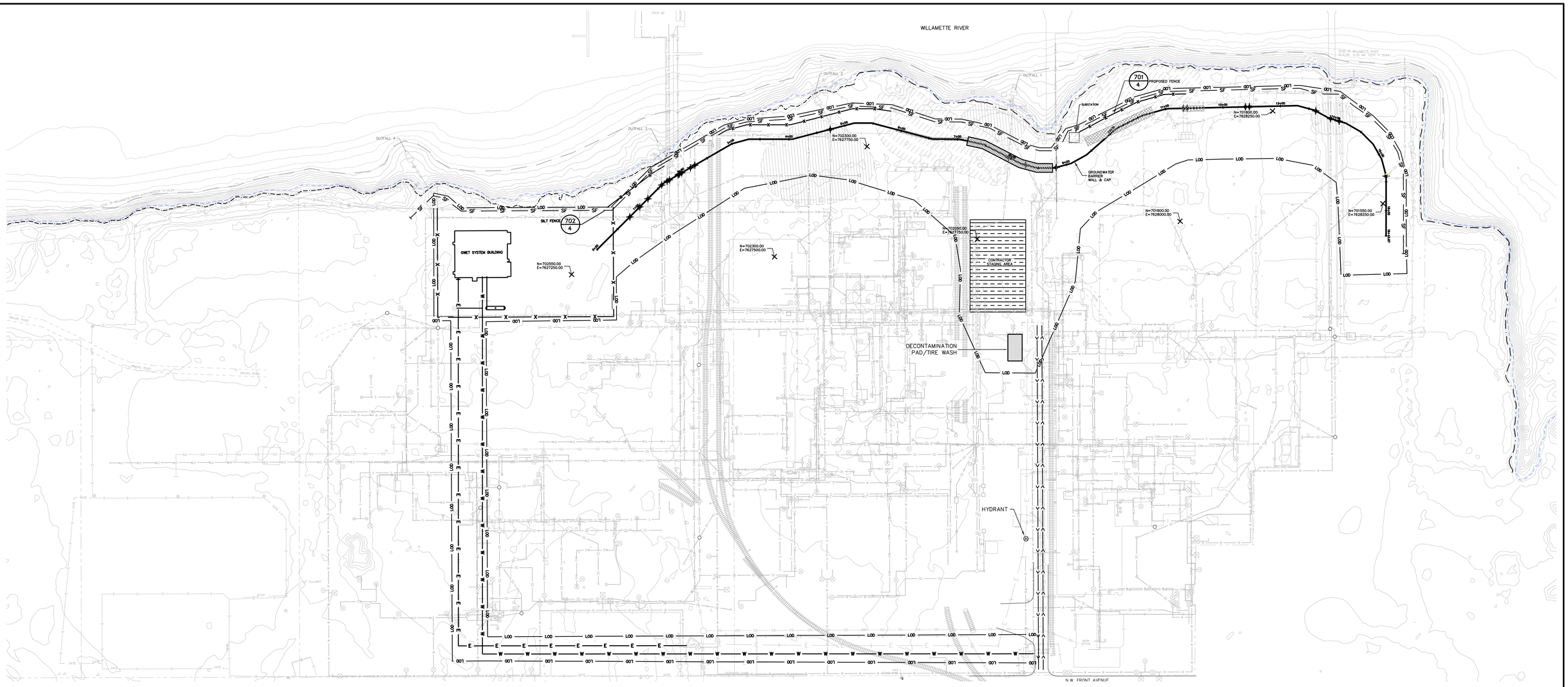

LEGEND

- GWBW/UTILITY INTERSECTION
- HYDRANT
- GROUND SURFACE CONTOUR (2 ft. INTERVAL)
- TOP OF RIVER BANK (APPROX. 35 FT. AMSL)
- FLOODPLAIN BOUNDARY (APPROX. 31 FT. AMSL)
- EDGE OF WATER (15.93 FT. AMSL ON 5/3/06)
- SILT FENCE
- LIMIT OF DISTURBANCE
- EXISTING CHAIN LINK FENCE
- PROPOSED CHAIN LINK FENCE
- PARCEL/PROPERTY BOUNDARY
- SMALL DEBRIS/FRAGMENTS/FILL
- HISTORICAL BORING REFUSAL/LARGE DEBRIS
- TEST TRENCH (PREVIOUSLY EXCAVATED BY OTHERS)
- CLEARANCE TRENCH
- INDUSTRIAL STORMWATER DRAIN
- DOMESTIC SEWER
- CITY WATER LINE
- RIVER WATER LINE
- STEAM LINE
- DOMESTIC WATER LINE
- OVERHEAD ELECTRIC/UTILITY LINE
- BRINE LINE
- RAILROAD TRACK
- INGRESS/EGRESS ROUTE

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NOTES:

1. FOR GRAPHICAL PURPOSES, THE SILT FENCE AND LIMIT OF DISTURBANCE ARE SHOWN SEPARATELY. DURING CONSTRUCTION ACTIVITIES, THE SILT FENCE WILL SERVE AS THE LIMIT OF DISTURBANCE.

2. CONTRACTOR SHALL MONITOR THE EXISTING STORMWATER OUTFALLS AND OTHER POTENTIAL CONDUITS ENCOUNTERED AND TERMINATED DURING GROUNDWATER BARRIER WALL CONSTRUCTION TO ENSURE THAT A RELEASE OF SLURRY OR OTHER MATERIAL DOES NOT OCCUR.

3. EROSION CONTROL DEVICES SHALL BE MAINTAINED UNTIL PERMANENT COVER IS ESTABLISHED AND APPROVED BY THE ENGINEER. UPON ESTABLISHMENT OF PERMANENT COVER THE CONTRACTOR SHALL REMOVE THE EROSION CONTROLS.

4. THE CONTRACTOR MAY SUBMIT AN ALTERNATIVE LOCATION(S) FOR THE THE STAGING AREA FOR REVIEW AND APPROVAL BY THE ENGINEER. IF THE STAGING AREA IS RE-LOCATED, THE LIMIT OF DISTURBANCE WILL ALSO BE ADJUSTED, ACCORDINGLY.

5. NEITHER SLURRY OR SEDIMENT-LADEN SURFACE WATER SHALL BE PERMITTED TO FLOW BEYOND THE SILT FENCE (LIMIT OF DISTURBANCE) LOCATED ALONG THE CREST OF THE RIVER BANK. THE CONTRACTOR SHALL ROUTINELY MONITOR THE CONDITIONS AND ACTIVITIES TO ENSURE THAT THE SILT FENCE AND OTHER CONTROLS ARE IN PROPER WORKING ORDER. REPAIRS OF THE EROSION CONTROLS SHALL BE PERFORMED IMMEDIATELY UPON INSPECTION.

6. PERMANENT STORMWATER BEST MANAGEMENT PRACTICES (BMPs) ARE PRESENTED ON OTHER DRAWINGS. THE BMPs WILL BE CONSTRUCTED BY OTHERS PRIOR TO IMPLEMENTATION OF THE GROUNDWATER BARRIER WALL ACTIVITIES PRESENTED ON THESE DRAWINGS. CONTRACTOR SHALL PROTECT THESE FEATURES AND ENSURE THAT CONSTRUCTION ACTIVITIES DO NOT INTERFERE WITH OR IMPEDE THIER OPERATION.

7. DISTURBED AREAS SHALL BE SURFACED WITH CLEAN CRUSHED STONE, MEETING THE REQUIREMENTS OF SECTION 02232 OF THE TECHNICAL SPECIFICATIONS, LEVELED WITH THE EXISTING SURROUNDING GRADE.

CITY OF PORTLAND EROSION AND SEDIMENT CONTROL NOTES:

1. APPROVAL OF THIS EROSION, SEDIMENT AND POLLUTION CONTROL PLAN (ESPCP) DOES NOT CONSTITUTE AN APPROVAL OF PERMANENT ROAD OR DRAINAGE DESIGN (E.G., SIZE AND LOCATION OF ROADS, PIPES, RESTRICTORS, CHANNELS, RETENTION FACILITIES, UTILITIES, ETC.).

2. THE IMPLEMENTATION OF THIS ESPCP AND THE CONSTRUCTION, MAINTENANCE, REPLACEMENT, AND UPGRADING OF THESE ESPCP FACILITIES IS THE RESPONSIBILITY OF THE CONTRACTOR UNTIL ALL CONSTRUCTION IS COMPLETED AND APPROVED AND VEGETATION/LANDSCAPING IS ESTABLISHED.

3. THE BOUNDARIES OF THE CLEARING LIMITS SHOWN ON THIS PLAN SHALL BE CLEARLY FLAGGED IN THE FIELD PRIOR TO CONSTRUCTION. DURING THE CONSTRUCTION PERIOD, NO DISTURBANCE BEYOND THE FLAGGED CLEARING LIMITS SHALL BE PERMITTED. THE FLAGGING SHALL BE MAINTAINED BY THE CONTRACTOR FOR THE DURATION OF CONSTRUCTION.

4. THE ESPCP FACILITIES SHOWN ON THIS PLAN MUST BE CONSTRUCTED IN CONJUNCTION WITH ALL CLEARING AND GRADING ACTIVITIES, AND IN SUCH A MANNER AS TO INSURE THAT SEDIMENT, SLURRY, AND SEDIMENT LADEN WATER DO NOT ENTER THE DRAINAGE SYSTEM, ROADWAYS, OR VIOLATE APPLICABLE WATER STANDARDS.

5. THE ESPCP FACILITIES SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE ESPCP FACILITIES SHALL BE UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS AND TO ENSURE THAT SEDIMENT, SLURRY, AND SEDIMENT-LADEN WATER DO NOT LEAVE THE SITE.

6. THE ESPCP FACILITIES SHALL BE INSPECTED DAILY BY THE CONTRACTOR AND MAINTAINED AS NECESSARY TO ENSURE THEIR CONTINUED FUNCTIONING.

7. THE ESPCP FACILITIES ON INACTIVE SITES SHALL BE INSPECTED AND MAINTAINED A MINIMUM OF ONCE A MONTH OR WITHIN THE 24 HOURS FOLLOWING A STORM EVENT.

8. STABILIZED CONSTRUCTION ENTRANCES SHALL BE INSTALLED AT THE BEGINNING OF CONSTRUCTION AND MAINTAINED FOR THE DURATION OF THE PROJECT. ADDITIONAL MEASURES MAY BE REQUIRED TO INSURE THAT ALL PAVED AREAS ARE KEPT CLEAN FOR THE DURATION OF THE PROJECT.

SEQUENCE OF CONSTRUCTION:

THE FEATURES PRESENTED ON THESE DRAWINGS SHALL BE CONSTRUCTED ACCORDING TO THE SEQUENCE PRESENTED BELOW, UNLESS OTHERWISE APPROVED BY THE ENGINEER.

1. INSTALL DECONTAMINATION PAD/TIRE WASH AND SILT FENCE.

2. EXCAVATE AND BACKFILL CLEARANCE TRENCH AND SEGREGATE LARGE DEBRIS.

3. IDENTIFY, CUT, AND CAP OR PLUG UTILITIES INTERSECTING GROUNDWATER BARRIER WALL ALIGNMENT.

4. INSTALL GROUNDWATER BARRIER WALL.

5. TRANSPORTATION AND DISPOSAL OF EXCESS SPOILS AND LARGE DEBRIS.

6. INSTALL GROUNDWATER EXTRACTION AND TREATMENT (GWET) SYSTEM BUILDING AND UTILITIES.

7. STABILIZE DISTURBED AREAS/RESTORE SITE.

8. FOLLOWING STABILIZATION OF ALL DISTURBED AREAS, ALL EROSION AND SEDIMENT CONTROL DEVICES SHALL BE REMOVED, AS APPROVED BY THE ENGINEER.

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SCALE (IN FEET)

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1	01/14/11	REV BLDG LABLE & DELETED WL	LAG	BR
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EROSION AND SEDIMENT CONTROL PLAN

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0116759	4	1
DATE 07/20/2010			

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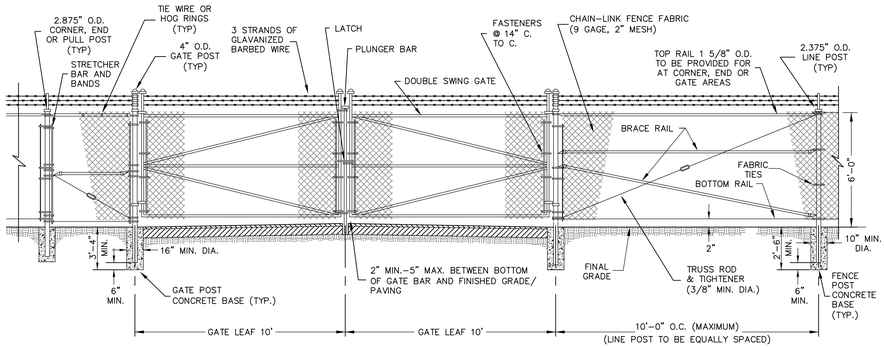
GATE POST SCHEDULE	
GATE LEAF WIDTH (NOMINAL)	OUTSIDE DIMENSION (NOMINAL)
6' OR LESS	2.875" O.D. 2.5" SQ.
MORE THAN 6' TO 13'	4.0" O.D.
MORE THAN 13' TO 18'	6.625" O.D.
MORE THAN 18'	8.625" O.D.



SECURITY FENCE WITH VEHICLE GATE DETAIL

N.T.S.

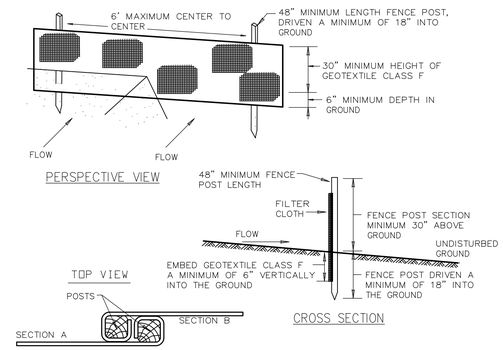
NOTES:

1. FENCE-CHAIN LINK FENCE SHALL INCLUDE 3-STRAND BARBED WIRE ON SINGLE OUTRIGGER.
2. THE CONTRACTOR SHALL HAVE THE OPTION OF NOT USING CONCRETE FENCE POST FOUNDATIONS IN TEMPORARY FENCING. ALL MODIFICATIONS SHALL BE APPROVED BY THE ENGINEER.
3. WIRE TIES, RAILS, POSTS, AND BRACES SHALL BE CONSTRUCTED ON THE SECURE SIDE OF THE FENCE ALIGNMENT. CHAIN-LINK FABRIC SHALL BE PLACED ON THE OPPOSITE SIDE OF THE SECURE AREA.
4. C-SECTION POSTS SHALL BE INSTALLED SO THAT THE VOID INSIDE THE POST IS COMPLETELY FILLED WITH CONCRETE UP TO THE TOP OF THE FOUNDATION.
5. SWING GATES SHALL BE CONSTRUCTED WITH DROP RODS, PADLOCKS, LATCH ASSEMBLY, AND GATE KEEPERS, EXCEPT AS NOTED.
6. ALL GATE FRAMES SHALL BE A MINIMUM 1.90" NOMINAL (ROUND) OR 2.00" NOMINAL (SQUARE). GATE FRAMES SHALL BE OF WELDED CONSTRUCTION OR SHALL BE ASSEMBLED USING HEAVY FITTINGS. AT CONTRACTOR'S OPTION, A WELDED HORIZONTAL BRACE MAY BE USED IN LIEU OF TRUSS RODS TO BRACE ALL WELDED GATE FRAMES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROPER RIGID CONSTRUCTION OF ALL GATES SUPPLIED.
7. STEEL POSTS SHALL BE IN ACCORDANCE WITH THE SCHEDULE ON THIS DRAWING.
8. GATE POSTS SHALL BE IN ACCORDANCE WITH THE SCHEDULE ON THIS DRAWING.

701 / 3,4 SECURITY FENCE WITH VEHICLE GATE DETAIL

SCALE: NONE

STEEL POST SCHEDULE	
USE AND SECTION	MINIMUM OUTSIDE DIMENSIONS (NOMINAL)
	FABRIC 72" TO 96"
CORNER, END & PULL POSTS	
TUBULAR - ROUND	2.875" O.D.
TUBULAR - SQUARE	2.50" SQ.
C-SECTION (ROLL-FORMED)	3.50"x3.50"
LINE POSTS	
TUBULAR - ROUND	2.375" O.D.
H-SECTION	2.25" x 1.70"
C-SECTION (ROLL-FORMED)	2.25" x 1.70"
TOP, BOTTOM & BRACE RAILS	
TUBULAR - ROUND	1.66" O.D.
TUBULAR - SQUARE	1.50" O.D.
H-SECTION	1.625" x 1.50"
C-SECTION (ROLL-FORMED)	1.625" x 1.25"



JOINING TWO ADJACENT SILT FENCE SECTIONS

CONSTRUCTION SPECIFICATIONS

1. THE FILTER FABRIC SHALL BE PURCHASED IN A CONTINUOUS ROLL CUT TO THE LENGTH OF THE BARRIER TO AVOID USE OF JOINTS. WHEN JOINTS ARE NECESSARY, FILTER CLOTH SHALL BE SPLICED TOGETHER ONLY AT A SUPPORT POST, WITH A MINIMUM 6-INCH OVERLAP, AND BOTH ENDS SECURELY FASTENED TO THE POST, OR OVERLAP 2 INCH X 2 INCH POSTS AND ATTACH AS SHOWN ON DETAIL.

2. THE FILTER FABRIC FENCE SHALL BE INSTALLED TO FOLLOW THE CONTOURS WHERE FEASIBLE. THE FENCE POSTS SHALL BE SPACED A MAXIMUM OF 6 FEET APART AND DRIVEN SECURELY INTO THE GROUND A MINIMUM OF 18 INCHES.

3. THE FILTER FABRIC SHALL HAVE A MINIMUM VERTICAL BURIAL OF 6 INCHES. ALL EXCAVATED MATERIAL FROM FILTER FABRIC FENCE INSTALLATION, SHALL BE BACKFILLED AND COMPACTED, ALONG THE ENTIRE DISTURBED AREA.

4. STANDARD OR HEAVY DUTY FILTER FABRIC FENCE SHALL HAVE MANUFACTURED STITCHED LOOPS FOR 2 INCH X 2 INCH POST INSTALLATION. STITCHED LOOPS SHALL BE INSTALLED ON THE UP HILL SIDE OF THE SLOPED AREA.

5. FILTER FABRIC FENCES SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFUL PURPOSE, BUT NOT BEFORE THE UPSLOPE AREA HAS BEEN PERMANENTLY PROTECTED AND STABILIZED.

6. FILTER FABRIC FENCES SHALL BE INSPECTED BY CONTRACTOR IMMEDIATELY AFTER EACH RAINFALL AND AT LEAST DAILY DURING PROLONGED RAINFALL. ANY REQUIRED REPAIRS SHALL BE MADE IMMEDIATELY.

702 / 4 SILT FENCE DETAIL

SCALE: NONE

REV.	DATE	DESCRIPTION	BY	CHK
1	01/14/11	REVISED SHEET TITLE	LAG	BR
0	01/05/11	ISSUED FOR CLIENT REVIEW	LAG	BR

DRAWN BY RMK | CADD Review TGE | CHECKED BY SL-ANN

ERM www.erm.com

Environmental Resources Management, Inc.

SEAL

GROUNDWATER SOURCE CONTROL MEASURE

ARKEMA, INC.
PORTLAND, OREGON

EROSION AND SEDIMENT CONTROL DETAILS

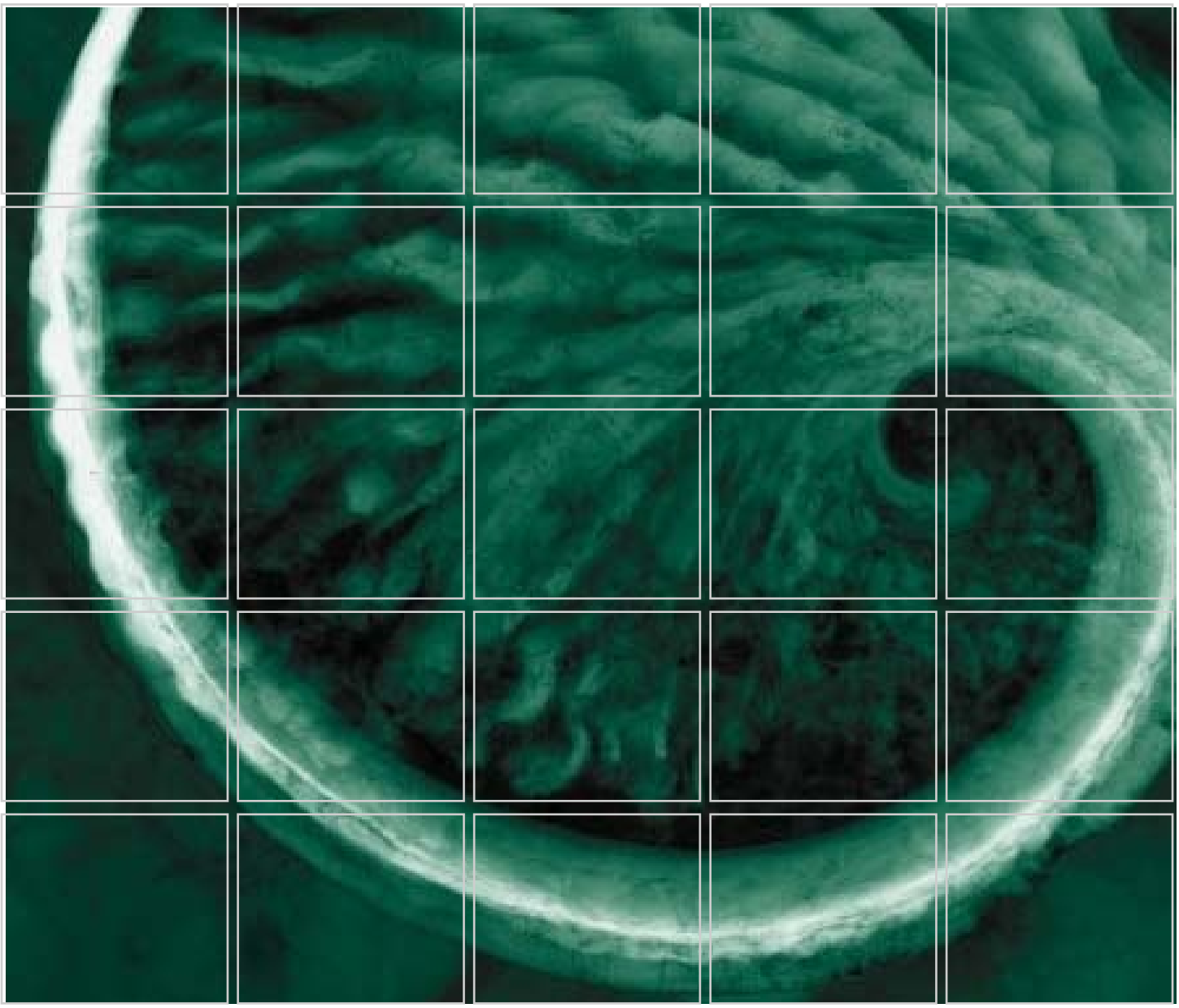
SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0116759	7	1
DATE 07/20/2010			

REVISIONS TO BE MADE ON THE CADD FILE ONLY

R:\Cadd\CINA-DVARKEMA\0116759\0093838-SHT-6.DWG, SHT-7, 1/13/2011 7:40:11 AM, RMK - HOLLAND

[See enclosed Drawings Package]

Attachment B
Specifications



Technical Specifications

Groundwater Source Control Measure
Groundwater Extraction and Treatment System
Former Arkema Facility
Portland, Oregon

February 2011

Prepared for:
Legacy Site Services LLC

www.erm.com

ERM

Delivering sustainable solutions in a more competitive world

Legacy Site Services LLC

Technical Specifications: *Groundwater Source Control Measure, Groundwater Extraction and Treatment System, Former Arkema Facility, Portland, Oregon*

February 2011

Project No. 0114849

DRAFT

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PART 1 - GENERAL

1.01 DEFINITIONS

A. Whenever the following terms are used in these Specifications, it is understood that they represent the following:

1. OWNER:
Arkema, Inc.
6400 Northwest Front Avenue
Portland, Oregon 97210

2. OWNER'S AGENT
Legacy Site Services, LLC
468 Thomas Jones Way
Suite 150
Exton, Pennsylvania, 19341

3. ENGINEER:
ERM-West, Inc.
101 SW Main Street, Suite 804
Portland, Oregon 97213
(503) 488-5282

4. CONTRACTOR:
The individual, firm, partnership, or corporation which is determined to be the successful Bidder and will be contracted by the OWNER or OWNER's AGENT.

5 SUBCONTRACTOR:
The individual, firm, partnership, or corporation which is contracted by the CONTRACTOR to assist the CONTRACTOR with project implementation, or the individual, firm, partnership, or corporation which is contracted by the OWNER or OWNER'S AGENT to assist the OWNER or OWNER'S AGENT with project implementation.

During implementation of the project, the OWNER or OWNER'S AGENT reserves the right to select a Representative to serve the role as ENGINEER, as referenced throughout these Technical Specifications. If the Representative is different than the ENGINEER listed above, the Representative would fulfill all requirements of the ENGINEER as noted in these Technical Specifications.

1.02 SITE CONDITIONS

A. General

There will be no payment for any extras as a consequence of the CONTRACTOR's misunderstanding the descriptions contained in the Contract, Specifications and Drawings. The CONTRACTOR shall inspect the Site and request answers to all questions that relate to the Work, its execution, and other details prior to submitting a Bid.

B. Site Access and Work Areas

Drawings, as referenced in these Specifications, depict the location of the Site and describe the types of access roads that lead to the Site. It is the CONTRACTOR's sole responsibility to use and maintain present access beyond the location depicted on the Drawings. Any access roadways, storage areas, Work areas or other areas that the CONTRACTOR must use are the CONTRACTOR's sole responsibility to keep passable at all times at its cost. The CONTRACTOR shall understand that certain access roadways must be used by the OWNER'S AGENT to maintain access to Work areas; the CONTRACTOR shall cooperate with others in the establishment and maintenance of these common access roadways. Further, access to the Site by the CONTRACTOR through areas other than the dedicated points as indicated on the Drawings is prohibited, unless otherwise previously approved by the OWNER'S AGENT.

C. Site Conditions

The Site is a former chemical facility that has been decommissioned and currently is not actively used for any industrial purposes. Drawings, as referenced in these Specifications, depict the location of various Site features, including an office building, groundwater monitoring and extraction wells, electric utility substation, docks, and other features that may affect the Work. It is the CONTRACTOR's sole responsibility to keep these areas protected and passable at all times at no additional cost to the OWNER'S AGENT.

D. Security

The OWNER'S AGENT has instituted security measures for the facility including perimeter chain-link fence and locking gates. The CONTRACTOR shall comply with all site security measures and procedures during work.

E. Night and Sunday Work

Unless otherwise specifically authorized by ENGINEER or OWNER'S AGENT, no Work shall be done between the hours of 6:00 p.m. and 7:00 a.m. or on Sunday, except as necessary for the proper care of and protection of Work already performed. If it shall become necessary to perform Work at night or on Sunday, the ENGINEER or OWNER'S AGENT shall be informed at least forty-eight (48) hours in advance of the beginning of performance of such Work. Only such Work shall be done at night as can be done satisfactorily and in a safe first-class manner. Good lighting and all other necessary facilities for carrying out and inspecting the Work shall be provided and maintained by the CONTRACTOR at all points where such Work is being done. Amount of lighting required shall be approved by the ENGINEER or OWNER'S AGENT.

F. Work in Bad Weather

During freezing, stormy or inclement weather, no Work shall be done except such as can be done satisfactorily and in a manner to secure safe first-class construction throughout. Material backfill and compaction shall not be undertaken during freezing, heavy precipitation, or otherwise inclement weather, as determined by the ENGINEER or OWNER'S AGENT.

1.03 CODES AND STANDARDS

The Work shall conform to all local, state and federal codes, comply with standards referenced in these Specifications, and adhere to regulatory requirements presented in Section 01060-REGULATORY REQUIREMENTS AND RESPONSIBILITY TO THE PUBLIC, which are described elsewhere in these Specifications. The latest issue shall be used unless specifically noted otherwise.

1.04 SCOPE OF WORK

A. The Scope-of-Work shall include, but not be limited to, furnishing all labor, materials, methods, services, tools, machinery and equipment necessary for the construction of the Work as specified in these Specifications and the following Drawings:

SHEET NO.	TITLE
	COVER SHEET
G1	SITE LOCATION, LEGEND, AND LIST OF DRAWINGS
G2	EXISTING SITE CONDITIONS
G3	PROPOSED SITE PLAN
G4	GWET SYSTEM BUILDING AREA

GA1	PRETREATMENT BUILDING AND EQUIPMENT LAYOUT
GA2	BIO-REACTOR BUILDING AND EQUIPMENT LAYOUT
GA3	ELEVATION VIEW "A" LOOKING NORTHEAST
GA4	ELEVATION VIEW "B" LOOKING NORTHEAST
PDF-01	PROCESS FLOW DIAGRAM
PID-00	STANDARD P&ID SYMBOL, LEGEND
PID-01	RECOVERY WELLS
PID-02	PRETREATMENT SYSTEM 1 OF 2
PID-03	PRETREATMENT SYSTEM 2 OF 2
PID-04	BIO-REACTOR SYSTEM
PID-05	CARBON SYSTEM
PID-06	PRETREATMENT SLUDGE SYSTEM
PID-07	BIO-REACTOR SLUDGE SYSTEM
PID-08	COMPRESSED AIR AND SERVICE WATER
S1	CONCRETE FOUNDATIONS
S2	EQUIPMENT PAD PLANS & DETAILS
S3	TRENCH DRAIN & SUMP DETAILS
U1	UTILITY PIPING PLAN
U2	UTILITY PIPING ENLARGED PLAN AND DETAILS
U3	UTILITY TRENCH DETAILS
M1	HVAC
E1	ELECTRICAL LAYOUT
E2	ELECTRIC WIRING DIAGRAM, PANELBOARD SCHEDULES AND SITE DETAILS
E3	ELECTRICAL GROUNDING AND ELECTRICAL CONTROL ROOM EQUIPMENT PLANS
INST1	CONTROL PANEL
4	EROSION AND SEDIMENT CONTROL PLAN
7	EROSION AND SEDIMENT CONTROL DETAILS

B. The CONTRACTOR shall supply all necessary materials except those specifically designated as furnished by the OWNER, the ENGINEER or OWNER'S AGENT, or furnished by others.

C. Work by Others includes.

1. The installation of the GW SCM Groundwater Barrier Wall.

2. Submitting the application for the natural gas, electrical and phone services.

D. The Work covered under this Contract shall include, but is not limited to, the following items:

1. Preparing any additional drawings required to obtain construction permits and obtaining the permits.

2. Mobilization/demobilization.

3. Furnishing temporary field offices, along with temporary electrical power, telephone communications, separate men and women sanitary facilities, and potable water, as needed.

4. Preparing the Site for Work, including but not limited to, staging and stockpile area, health and safety provisions, installation of erosion and sediment controls, coordination with utility authorities for disconnection and/or temporary rerouting of utilities, removal of segments of the perimeter security fence, installation of a temporary security fence, and other preparatory work.

5. Survey and layout of the GWET System Building.

6. Excavation of the trench's and GWET System building foundation and management of the materials, including, backfilling and compacting, and/or transportation for on site placement.

8. Preparation of the working surface for the construction of the GWET System building.

9. Obtaining and installation of the GWET System as noted on the drawings and specification, including but not limited to:
    - Recovery well system with recovery wells, vaults, pumps, piping, control, electrical, and instrumentation.
    - The piezometers down well instrumentation and conduit and wiring from the piezometers to the recovery wells.
    - The piping, electrical, and instrumentation from the recovery well to the GWET System.
    - The GWET System including all concrete, structural, building, treatment equipment, packaged or loose equipment, piping, HVAC, electrical, PLC, PLC programming, and instrumentation.
    - The GWET System sewer discharge to the existing outfall.
    - The GWET System utilities including: potable water and tap to 10-inch existing OWNER line; natural and tap to existing line; electrical including poles, cable, and transformer; and phone services.
    - The GWETS System perimeter fencing system.

- The GWET System check-out and startup assistance.

10. Management, transportation, and placement of excess spoils from excavation activities.

11. Maintaining continuous operation of affected utilities for duration of work activities, including temporary rerouting of utility services, as required.

12. Health and safety activities and nuisance (i.e. dust and odor) control, including air monitoring and suppression.

13. Site restoration, including grading, placement of crushed stone, and installation of a permanent chain link fence.

14. Protection of the Willamette River, the electric substation, all existing groundwater monitoring and extraction wells, and other structures and Site features.

15. Miscellaneous site work, including site cleanup, site restoration, and permanent stabilization of all areas disturbed during construction.

16. Other Work indicated within these Contract Documents, or as otherwise required for complete and installation of GWET System.

1.05 QUALITY ASSURANCE:

A. All work shall be in accordance with Section 01400 – QUALITY CONTROL.

B. The CONTRACTOR warrants in presenting a Bid that all Work will be performed to the highest standards. The CONTRACTOR further warrants that defects that are the result of the CONTRACTOR's methods, workmanship, or protection of Work will be corrected, removed, and/or replaced at the CONTRACTOR's expense immediately. Further, the CONTRACTOR shall warrant all Work and repairs for one year after the completion and acceptance of the Work or repairs.

1.06 COOPERATION

A. There may be other Engineers and/or Contractors, OWNER personnel and/or Regulators present at the Site. The CONTRACTOR shall make every effort reasonably possible to cooperate with all authorized outside personnel. Any disputes shall be settled by and at the sole discretion of the OWNER'S AGENT.

B. All construction activities shall be carried out in such a manner that there shall be absolutely no possibility of interruption of any operations occurring in the remaining portions of the facility.

C. The ENGINEER or OWNER'S AGENT may conduct intermittent quality control air and odor monitoring during work. The CONTRACTOR shall be responsible for conducting any required actions based upon the results of either the CONTRACTOR or the ENGINEER or OWNER'S AGENT'S sampling and monitoring activities.

1.07 CARE AND STORAGE OF MATERIALS

A. The CONTRACTOR shall unload, inspect, and store all equipment and material items delivered, to the project site for its Work, including items supplied by the OWNER, the ENGINEER or OWNER'S AGENT, or furnished by others. Materials shall be stored on-site only in areas designated by the ENGINEER or OWNER'S AGENT for that purpose.

B. The CONTRACTOR shall replace, at its sole expense, all OWNER, ENGINEER or OWNER'S AGENT, furnished by others, and/or CONTRACTOR-furnished materials damaged by the CONTRACTOR or the CONTRACTOR's Subcontractors during unloading and storage, damaged by weather, or other related causes.

C. Special attention shall be paid to instructions issued by the manufacturer for handling and storage of materials and/or equipment. These instructions shall be followed in every respect.

D. The CONTRACTOR shall be solely responsible for all security of equipment and material items delivered to the Site for its Work, including items supplied by the OWNER, the ENGINEER or OWNER'S AGENT, or furnished by others. Replacement of any equipment or material shall be at the sole expense of the CONTRACTOR.

E. The CONTRACTOR shall exercise care in the handling, moving, storing, and transporting of the equipment. The integrity of the equipment shall not be compromised at any time. The CONTRACTOR shall be responsible for any damage to the equipment and shall repair or replace, at the OWNER' AGENT discretion, the damaged equipment at no additional cost to the OWNER, ENGINEER or OWNER'S AGENT.

1.08 CONTRACTOR'S RESPONSIBILITIES AND WORK

A. The CONTRACTOR shall furnish all construction equipment, machines, tools, materials, field sanitary facilities, temporary features and controls,

protection of Work, other services, supplies, labor, and supervision that are necessary to complete the Work and requirements as described or implied in these Specifications and Drawings.

B. The CONTRACTOR shall provide all transportation for the items included in this Section from its headquarters or other locations to and from the Site.

C. The CONTRACTOR shall furnish all housing, travel, required training, personal safety equipment, and related allowances required by its employees to meet the minimum standards of the OWNER or OWNER'S AGENT and the Site Health and Safety Plan. No housing facilities shall be permitted on the Site.

D. Neither the CONTRACTOR nor any of its employees shall drive or park any vehicle anywhere on the Site, except at such locations as shown or as specifically approved by the OWNER'S AGENT.

E. The CONTRACTOR shall comply with all site security measures and procedures for the duration of work activities.

F. The CONTRACTOR shall provide sufficient workers and supervisory personnel to maintain Work progress so that the various areas of Work will be completed in accordance with the schedule or sequence defined elsewhere in these Specifications. If, in the opinion of the OWNER'S AGENT, the Work is behind schedule or is improperly staffed, the OWNER'S AGENT will direct the CONTRACTOR to increase its complement of supervisors, workmen, or equipment so as to comply with the schedule. The CONTRACTOR shall discharge any such directives promptly and without expectation of additional compensation. If the CONTRACTOR fails to discharge any of these directives, the ENGINEER or OWNER'S AGENT may arrange for such directives to be discharged at the sole cost of the CONTRACTOR.

G. The CONTRACTOR shall make all overtime, premium, and incentive payments to the CONTRACTOR's employees that may be required to complete the Work in accordance with the schedule. No exceptions shall be allowed for lack of performance, late material deliveries, or interference with other contractors possibly employed at the Site or with the OWNER's authorized personnel.

H. There is no applicable sales tax in the state of Oregon; therefore the CONTRACTOR should not include sales tax in its Bid.

I. The CONTRACTOR shall obtain any state, county, or local building permits required in the performance of its Work, except as provided by the

ENGINEER or OWNER'S AGENT as listed in Technical Specification 01060 Regulatory Requirements and Responsibility to the Public.

J. Prior to a Contract award any questions or assistance the CONTRACTOR may request shall be directed to the ENGINEER or OWNER'S AGENT.

K. By submitting a Bid for the Work, the CONTRACTOR acknowledges to be entirely familiar with the requirements prescribed by the State of Oregon that relate to the Work, with regulations prescribed by the United States Environmental Protection Agency (USEPA), with the rules and regulations of OSHA, and with local conditions, including weather, availability of supplies, and logistics. The CONTRACTOR further acknowledges itself to be entirely qualified to perform the Work described by these Specifications and the Drawings.

L. The CONTRACTOR shall maintain the site of its activities free of refuse and debris at all times at their expense. The CONTRACTOR shall, promptly comply with any directives from the OWNER, or it's AGENT, regarding housekeeping. The CONTRACTOR shall provide the appropriate containers at convenient locations for the disposal of disposable personnel protection equipment and other items of trash. Upon completion of the Work and before final payment, the CONTRACTOR shall completely remove all tools, equipment, supplies, materials, structures, and debris from the Site and leave the premises clean. Debris shall be removed to disposal locations, off the Site that are selected by the CONTRACTOR, and are permitted to receive the debris to be disposed, and prior approved by the ENGINEER or OWNER'S AGENT. Refuse shall be accumulated for a minimum of weekly disposal.

M. The CONTRACTOR shall be responsible for all engineering and corresponding support required to perform the scope of work established in the Contract Documents, including but not limited to design and/or verification of shoring, bracing, demonstration of equivalent materials, or other such matters that require engineering expertise.

N. Safety

1. It is the CONTRACTOR's responsibility to perform all Work in a safe manner, and meet all applicable federal, state and local laws and those requirements imposed by the OWNER or OWNER'S AGENT. The CONTRACTOR shall submit a Site Health and Safety Plan (HASP) to the ENGINEER or OWNER'S AGENT for review. The plan shall meet, or exceed, all requirements specified in the Contract Documents and federal, state, and local regulations.

2. All employees and subcontractors working on site that will be performing intrusive activities, and who may be exposed to hazardous substances, health hazards, or safety hazards and their supervisors and management responsible for the Site will receive training meeting the requirements of 29 CFR 1910.120.

O. Environmental Protection

All Work to be performed by the CONTRACTOR as a part of this project is regulated by the Oregon Department of Environmental Quality (ODEQ). By acceptance of the terms of the Contract, the CONTRACTOR acknowledges that it is familiar with the rules and regulations of the ODEQ. The CONTRACTOR further acknowledges familiarity with, and accepts as a condition of this Contract, all of the terms, stipulations, and commitments pertaining to the Work. Questions concerning the permits or regulations shall be referred to the ENGINEER or OWNER'S AGENT; the ENGINEER or OWNER'S AGENT'S decision in all cases shall be final.

P. Project Offices

The CONTRACTOR shall provide a temporary project field office at the site if office space is deemed necessary. The CONTRACTOR may utilize the utilities available at the site, including electric, water, and telecommunications.

Q. Utilities

1. Electrical Power

Electrical power is available on site; however, the CONTRACTOR is responsible for all coordination with the OWNER'S AGENT and power company, as well as establishing all connections to the source. If connected to the existing power source on site, the OWNER'S AGENT will be responsible for the cost of usage.

2. Telecommunications

Telecommunications (telephone, data) service is available at the site; however, the CONTRACTOR shall be responsible for establishing all connections to the service.

3. Water Supply

Water service is available on site; however, the CONTRACTOR is responsible for all coordination with the OWNER'S AGENT and

water company, as well as establishing all connections to the source. If connected to the existing water supply source on site, the OWNER'S AGENT will be responsible for the cost of usage. The CONTRACTOR shall be responsible for determining if the available water service is sufficient for the work activities.

4. Sanitary Facilities

Limited sanitary facilities are available within the office building. Chemical-type sanitary facilities shall be provided near the points of Work for CONTRACTOR personnel on the project if deemed necessary. Separate sanitary facilities are required for men and women, and shall be cleaned daily and adequately serviced.

1.09 TERMS AND CONDITIONS

If the Technical Specifications conflict with the OWNER'S or OWNER'S AGENT'S Terms and Conditions, the Terms and Conditions shall supersede the Technical Specifications.

1.10 CLEAN FUELS AND EQUIPMENT TECHNOLOGIES

A. CONTRACTOR, including all Subcontractors, shall follow federal, state, and local equipment and vehicle idling regulations and shall comply with a five (5) minute maximum idling time, whichever is more restrictive. Additionally, no unattended idling shall occur. Exceptions to these requirements shall be allowed for weather, safety concerns, and where implementation may actually slow work and/or increase emissions.

B. The CONTRACTOR shall use clean technologies and/or fuels on all diesel equipment to the extent practicable and/or feasible. The preference is for clean diesel technologies, but alternate fuels, such as biodiesel or natural gas powered vehicles, can also be considered. These alternate fuels shall be used where they are available and within a reasonable distance to the Site. For equipment retrofits, the CONTRACTOR shall employ the Best Available Control Technology (BACT) on off-road and on-road diesel powered equipment used at the Site. Examples of clean diesel technologies include diesel particulate filters and diesel oxidation catalysis. For alternative fuel usage, the CONTRACTOR shall use at least a B20 blend (i.e., 20 percent biodiesel and 80 percent petro-diesel) or higher in the equipment engines used at the Site.

C. The CONTRACTOR shall provide a discussion of the proposed clean fuel and equipment technologies in their bid.

PART 2 - PRODUCTS

2.01 REGISTERED TRADE NAMES

A. Products are referenced and specified throughout these Specifications by registered trade names. This does not constitute a recommendation of these products to the exclusion of other products. Equivalent products may be used upon receiving approval of the, the ENGINEER or OWNER'S AGENT.

B. The reference to registered trade names establishes a standard of required function, dimension, appearance and quality of the required equipment, materials or products.

PART 3 - EXECUTION

(not used)

END OF SECTION

01014 – Work Sequence

PART 1 - GENERAL

1.01 CONSTRUCTION SCHEDULE

A. A Construction Schedule shall be submitted with the Bid for approval. The schedule shall include sequence and dates of construction operations for all major stages of Work, order and delivery of materials and equipment, and estimated milestones for substantial and final completion. The Construction Schedule shall be subject to review and acceptance by the ENGINEER or OWNER'S AGENT. The Construction Schedule shall incorporate and meet, at a minimum, Project Milestones as identified in these Specifications and Drawings. The CONTRACTOR can provide alternates to the Construction Schedule in order to expedite the overall project schedule. Any alternates must be approved in writing by the ENGINEER or OWNER'S AGENT prior to formal acceptance as part of the Construction Schedule. Revisions to the Construction Sequence by the CONTRACTOR shall not be made until approved by the ENGINEER or OWNER'S AGENT. Changes in the approved schedule shall not be allowed without written approval. If the construction progress does not adhere to the schedule as approved or revised, measures shall be taken by CONTRACTOR to make up for the lost time to assure completion of the Work in accordance with the schedule. The schedule shall be created using Microsoft Project or Primavera, and shall include all appropriate task designations (Predecessor, Successor, Lag, Lead, Slack, Resources, etc.).

B. Certain aspects of the construction are weather dependent. The ENGINEER or OWNER'S AGENT may, therefore, suspend operations at any time, when in its sole judgment, the conditions are unsuitable for the proper performance of the Work. No measures, aside from those provided elsewhere in the Construction Documents, shall be provided for such suspension of Work or costs associated with them. The CONTRACTOR shall account for typical delays in the schedule associated with normal levels of inclement weather as determined by the average monthly precipitation and temperatures for the period of times specified in the proffered construction schedule.

C. The Contractor shall be responsible for meeting the schedule established for equipment delivery. If, at anytime during implementation of the Work, the OWNER, ENGINEER or OWNER'S AGENT, or CONTRACTOR determines that the Work is behind schedule, the CONTRACTOR shall make every reasonable effort; i.e., additional manpower, equipment, or work hours, to make-up the lost time.

1.02 WEATHER

A. The CONTRACTOR shall take all necessary precautions to prepare for adverse weather so that the Work may be properly performed and be satisfactory in all respects. When required, protection shall be provided by use of tarpaulins, shelters, silt fencing, straw bales, or other approved means. During cold weather, materials shall be preheated, if required, and the materials and structure into which they are to be incorporated shall be kept sufficiently warm so that a proper bond shall take place and a proper curing, aging, or drying shall result. Heating shall be by a method approved by the ENGINEER or OWNER'S AGENT and shall result in a moist or a dry atmosphere according to the particular requirements of the Work being protected. Ingredients for concrete and mortar shall be sufficiently heated so that the mixture shall be warm throughout when used. The ENGINEER or OWNER'S AGENT may suspend operations at any time when, in its sole judgment, the conditions are unsuitable or the proper precautions are not being taken.

B. Delays to the schedule caused by adverse weather conditions shall be identified as a request for schedule extension submitted by the CONTRACTOR to the ENGINEER or OWNER'S AGENT within one (1) day of the termination of the event. Adverse weather for which no extension of time is required shall not necessitate such a request and shall be deemed the responsibility of the CONTRACTOR to make-up the scheduled time to compensate for any lost time. No time extensions will be awarded without proper and timely notification to the ENGINEER or OWNER'S AGENT. Time extensions will be awarded by OWNER or OWNER'S AGENT at its sole discretion based on a comparison with the prior average conditions in the vicinity of the site as defined in Part 1.01 of this Section; the CONTRACTOR shall anticipate and initially factor into its schedule normally-occurring weather conditions, for which no time extensions shall be awarded. The methodology for determination of variations from the average shall be determined by the OWNER and ENGINEER or OWNER'S AGENT. Weather delays may be made up through extended Work times with the approval of the OWNER or OWNER'S AGENT. The CONTRACTOR shall receive no additional financial compensation as a result of adverse weather conditions.

1.03 PROGRESS REPORTS

A. The CONTRACTOR shall submit to the ENGINEER or OWNER'S AGENT every two (2) weeks following written issuance of a Notice to Proceed, or more frequently if requested by the OWNER, ENGINEER or OWNER'S AGENT, a report, in form and substance satisfactory to the OWNER, or its AGENT, stating the progress being made in fulfillment of this Contract, and indicating the progress to date with respect to the

Construction Schedule. Included with the report shall be an updated schedule indicating scheduled durations, scheduled start dates, scheduled completion dates, actual durations, actual start dates and actual completion dates of construction activities identified in the initial approved Construction Schedule. If the Schedule indicates that the CONTRACTOR is behind schedule, a written plan indicating the corrective measures to be implemented to make up lost time shall be submitted with the updated Schedule.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

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01040 – Control and Inspection

PART 1 - GENERAL

1.01 ENGINEER'S AUTHORITY

A. The OWNER'S AGENT may appoint a Representative during the life of the Contract as specified in Section 01010 – SUMMARY OF WORK, who will observe the Work in progress on behalf of the OWNER'S AGENT. The Representative shall have authority to: (1) act on behalf of the OWNER'S AGENT to the extent expressly provided in the Contract or otherwise in writing; (2) stop the Work whenever such stoppage may be necessary, in its sole discretion, to prevent improper execution of the Work, or otherwise to protect the interests of the OWNER'S AGENT; (3) determine the amount, quality, acceptability and fitness of all Work, materials and equipment required by the Contract; and, (4) decide all questions which arise in relation to the Work, the execution thereof, and the fulfillment of the Contract Documents.

B. The OWNER'S AGENT shall be the sole judge of the intent and meaning of the Contract, and the ENGINEER or OWNER'S AGENT shall be the sole judge of the intent and meaning of the Specifications and Drawings, and its decisions thereon, and its interpretation thereof shall be final, conclusive and binding on all parties.

C. The CONTRACTOR shall proceed without delay to perform the Work as directed, instructed, determined or decided by the ENGINEER or OWNER'S AGENT and shall comply with such directions, instructions, determinations or decisions.

D. Any doubts to the meaning of, or any obscurity as to the working of the Contract, Specifications, and Drawings shall be explained, and all directions and explanations requisite or necessary to complete, explain, or make definite any of the provisions of the Contract, Specifications or Drawings and to give them due effect shall be given by the ENGINEER or OWNER'S AGENT.

1.02 INSPECTORS

A. Inspectors employed by the ENGINEER or OWNER'S AGENT shall be authorized to inspect all Work performed and all materials and/or equipment furnished. Such inspection may extend to all or any part of the Work and to the preparation or manufacture of the materials to be used. In case of a dispute arising between the CONTRACTOR and the Inspector as to materials furnished or the manner of performing the Work, the Inspector shall have the authority to reject materials or suspend the Work until the question at issue can be referred to and decided by the ENGINEER or OWNER'S AGENT. The Inspector shall not be

authorized to revoke, alter, enlarge, relax, or release any requirements of the Contract, Specifications or Drawings, nor to approve or accept any portion of the Work, nor to issue instructions contrary to the Contract, Specifications, and Drawings. The Inspector shall in no case act as foreman or perform other duties for the CONTRACTOR, or interfere with the management of the Work by the CONTRACTOR. Any advice which the Inspector gives the CONTRACTOR shall in no way be construed as binding on the ENGINEER, OWNER'S AGENT, or the OWNER in any way or releasing the CONTRACTOR from the fulfillment of the terms of the Contract.

1.03 INSPECTION

A. The CONTRACTOR shall, at the CONTRACTOR's expense when requested, provide the ENGINEER or OWNER'S AGENT with ladders, lights, tools, labor, samples and other facilities as may be necessary for inspecting material and Work.

B. Imperfect materials or defective Work which may be detected, shall be replaced or corrected immediately on the requirement of the ENGINEER or OWNER'S AGENT not withstanding that it may have been previously overlooked and included in a partial payment. Materials condemned or rejected by the ENGINEER or OWNER'S AGENT shall be marked and shall, on its demand, be removed at once to a satisfactory distance from the Work. If not removed within twenty-four (24) hours after receipt of written notice from the ENGINEER or OWNER'S AGENT, it may be removed by the ENGINEER or OWNER'S AGENT and the cost of removal shall be charged to the CONTRACTOR and deducted from any payment due or which may become due to it.

C. If Work to be done away from the construction site is to be inspected on behalf of the ENGINEER or OWNER'S AGENT during its fabrication, manufacture, excavation, processing, or testing, or before shipment, the CONTRACTOR shall give notice to the ENGINEER or OWNER'S AGENT of the place and time where such fabrication, manufacture, excavation, processing, testing, or shipping is to be done. Such notices shall be in writing and delivered to the ENGINEER or OWNER'S AGENT ten (10) days prior to initiation of such activity so that the necessary arrangements for the inspection can be made.

1.04 CONTRACTOR'S EQUIPMENT AND WORK FORCE

A. All machinery and equipment to be used shall be of sufficient size and in proper operating condition to accomplish the Work as described herein and shall be such as to produce a satisfactory quality of Work. A competent foreman or Superintendent shall be present at all times during the progress of the Work with authority to act for the CONTRACTOR and coordinate with the ENGINEER or OWNER'S AGENT. A workforce of sufficient size with the required experience and ability shall be employed at all times to assure that the Work is executed in a satisfactory and workmanlike manner.

B. Unless otherwise expressly provided, the means and the methods of construction are at the option of the CONTRACTOR. Only adequate and safe procedures, methods, structures and equipment shall be used. The ENGINEER or OWNER'S AGENT'S approval, or failure to exercise its right thereon, shall not relieve the CONTRACTOR of obligations to accomplish the result intended by the Contract, nor shall such create a cause of action for damages or extras.

C. If the ENGINEER or OWNER'S AGENT at any time gives notice, in writing, to the CONTRACTOR that an employee is, in its opinion, incompetent, unfaithful, disorderly, discourteous, careless, unobservant of instructions, or in any way a detriment to the satisfactory progress of the Work, such employee shall be immediately removed from and not again allowed upon the Site. Likewise, equipment and machinery deemed inadequate and unsatisfactory shall be removed from the Site when such written notice is received by the CONTRACTOR.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

END OF SECTION

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01050 – Field Engineering

PART 1 - GENERAL

1.01 DESCRIPTION

Primary Line and Grade Measurements

A. Baselines and benchmarks have been established by the ENGINEER or OWNER'S AGENT by means of suitable marks as provided on the Drawings. All points must be carefully preserved and, if destroyed by the CONTRACTOR, the cost of replacing the points will be charged against the CONTRACTOR.

B. The CONTRACTOR shall employ a competent surveyor registered in the State of Oregon and require said surveyor to establish all lines, elevations, reference marks, batterboards, etc. needed by the CONTRACTOR, ENGINEER, or OWNER'S AGENT during the progress of the Work, and from time to time to verify such marks by instrument or other appropriate means.

C. Surveyor shall provide survey control for each stage of construction, and provide survey "As-Built" documentation for various components of construction. The Surveyor shall furnish all labor, materials, tools, supervision, transportation, and equipment necessary to perform the project surveying Work as specified herein for the GWET System and associated Work, as shown on the Drawings.

1.02 QUALIFICATIONS

A. The CONTRACTOR shall employ the services of a competent Surveyor registered in the State of Oregon acceptable to the OWNER, OWNER'S AGENT and/or ENGINEER.

B. The surveyor, in the opinion of the ENGINEER or OWNER'S AGENT, shall have a proven record of successful performance on projects of similar magnitude. Prior to acceptance by the OWNER, OWNER'S AGENT and/or ENGINEER, the surveyor will be required to submit a Survey Plan describing qualifications of the survey crew chief, other key personnel, instrumentation to be used, accuracy and precision required, type of grid system to be used, and a description of the other survey points required to establish grades, layout, quantities, and required "As-Builts" and certifications. The Plan must also provide the Surveyor's commitment to meet the project schedule and provide the required "As-Built" documentation as expeditiously as possible, and in accordance with the requirements imposed by the project schedule.

1.03 SURVEY REQUIREMENTS

A. The Surveyor shall locate survey control points prior to starting site Work. The ENGINEER or OWNER'S AGENT shall be promptly notified in writing of any discrepancies discovered before or during construction. The survey data are to include NAVD88 and Oregon State Plane North (NAD 83/91).

B. The Surveyor shall maintain lines and levels, layout, and locate the Work utilizing recognized engineering survey practices. A complete and accurate log of control and survey Work must be maintained. The Surveyor shall establish, at a minimum, a 50-foot by 50-foot (ft) survey grid for construction and "As-Built" documentation. The spacing of the grid shall be reduced in areas of steep slopes, grade change, ditches, impoundments, and other structuring to assure adequate control and accurate "As-Builts". The plan grid shall be approved by the ENGINEER or OWNER'S AGENT. The Surveyor shall provide, at a minimum, a detailed survey for the following components:

1. The excavation extents of the trenching, including the lateral limits and depths.

2. The top of finished floor and perimeter curb elevations for the building.

3. The building layout including the building corners coordinates and elevation.

4. The location of all utilities (elevations and horizontal alignment) including: recovery well vaults; piping, electrical, and instrumentation from the vaults to the building; potable water line; electrical/phone including pole locations; gas line including storage tank; and discharge sewer to outfall. Elevations and horizontal alignment at a minimum of 25 foot intervals and at each bend.

5. All other items that the CONTRACTOR requires to complete the Work and establish quantities for payment.

6. All other reasonable items requested by the ENGINEER or OWNER'S AGENT.

C. The detailed topographic survey shall extend to a minimum of 100 ft in all directions beyond the limits of disturbance or Ordinary High Water, which ever is lesser.

D. All locations/stations should be surveyed to include both horizontal coordinates (accuracy 0.1 ft) and vertical elevation (accuracy 0.01 ft).

1.04 CONTRACTOR ENGINEERING REQUIREMENTS

The CONTRACTOR shall provide all necessary engineering, support and coordination necessary to perform the scope of work. These services include, but are not limited to, all work associated with obtaining permits, preparing shop drawings and submittals, providing engineering and licensed certification (P.E. stamp) for alternate designs, performing quality control, conducting monitoring and maintenance activities, performing inspections, and any other required activities.

1.05 CONSTRUCTION TOLERANCES

A. Construction tolerances shall be as provided in the various Sections of these Specifications, and as given below.

B. All minimum thicknesses specified within these Contract Documents shall be met with no exception. The construction tolerances on final contours shall be within two tenths of one foot below to five tenths of one foot above (-0.2 to +0.5) the specified grades as they appear on the Drawings, or as otherwise approved by the ENGINEER or OWNER'S AGENT. No additional payments for actual thicknesses of specified soil layers greater than that required will be approved.

C. No surveying will be allowed between one hour before sunset and one hour after sunrise, unless approved by the ENGINEER or OWNER'S AGENT.

D. The ENGINEER or OWNER'S AGENT shall be permitted at all times to check the lines, elevations, reference marks, batterboards, etc. set by the CONTRACTOR, who will correct any errors in lines, elevations, reference marks, batterboards, etc. disclosed by such check. Such a check will not be construed to be an approval of the CONTRACTOR's work and shall not relieve or diminish in any way the responsibility of the CONTRACTOR for the accurate and satisfactory construction and completion of the entire Work. In order to verify the construction, the ENGINEER or OWNER'S AGENT shall be supplied with survey information at the time of surveying.

E. The CONTRACTOR shall be aware of the surveying activities and shall account for them in the construction schedule.

1.06 RECORD DOCUMENTATION

At the completion of the Work the CONTRACTOR shall have its Surveyor prepare "As-Built" drawings showing the location of all Work installed, including that Work installed by the OWNER or OWNER'S AGENT (if any) and submit the "As-Built" drawings to the ENGINEER or OWNER'S AGENT for review. "As-Built" drawings shall also be provided to the ENGINEER or OWNER'S AGENT in electronic format (AutoCAD). "As-Built" drawings shall include the various Work components discussed herein. Certification of the "As-Built" drawings by the registered Surveyor is required. Submittals of these "As-Built" drawings shall conform to requirements of Section 01300 – SUBMITTALS.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

END OF SECTION

01060 – Regulatory Requirements and Responsibility to the Public

01060
REGULATORY REQUIREMENTS
AND
RESPONSIBILITY TO THE PUBLIC

PART 1 - GENERAL

1.01 REGULATIONS

A. The Work shall be performed in accordance with all applicable federal, state, county, and municipal regulations.

B. The CONTRACTOR shall give all necessary notices, obtain all permits, and pay all fees and other costs in connection with the Work, file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having jurisdiction, unless previously obtained by the ENGINEER or OWNER'S AGENT. The CONTRACTOR shall obtain all required Certificates of Inspection and approval for the Work and deliver these documents to the ENGINEER or OWNER'S AGENT, except as noted.

1. The ENGINEER or OWNER'S AGENT will obtain the following permits
   a. NPDES 1200C Construction Stormwater General Permit.
   b. Electrical Permit

C. The CONTRACTOR shall include in the Work, without extra cost to the OWNER, labor, materials, services and drawings required to comply with all applicable laws, ordinances, rules and regulations, whether or not shown in the Contract, Specifications, or Drawings.

D. The CONTRACTOR shall become familiar with all federal, state, local and municipal laws, ordinances, rules and regulations which in any manner affect those engaged or employed in the Work, or the materials or equipment used in or upon the Work, or in any way affect the Work, and no pleas of misunderstanding will be considered on account of the ignorance thereof. If the CONTRACTOR discovers any provision in the Contract, Specifications, or Drawings which is contrary to, or inconsistent with, any such law, ordinance, rule or regulation, he shall forthwith report it to the ENGINEER or OWNER'S AGENT in writing.

E. For the security and safety of persons in or adjacent to construction operations, OWNER's or OWNER'S AGENT's security and safety standards and the "Manual of Accident Prevention in Construction" of the National Safety Council shall be followed as applicable, specifically or with similarity of operation, or as in the opinion of the governing jurisdictions may be necessary for protection.

1.02 RESPONSIBILITY TO THE PUBLIC

A. Traffic

1. Construction operations shall be programmed and conducted to maintain adequate roadway and pedestrian traffic within and adjacent to the Site, including, but not limited to, the following for the Contract duration: flagmen and watchmen; furnishing, erecting and proper maintenance, removal and disposal of traffic controls.

2. Pedestrian access to abutting properties and vehicular access for ambulances, police and fire or other emergency equipment shall be maintained at all times. When vehicular access is temporarily curtailed, it shall be the CONTRACTOR'S responsibility to give adequate notice to affected parties including, but not limited to the police department having jurisdiction for the Site, fire department and emergency ambulance services prior to impairing access, and to provide means of temporary access when and if required.

3. When traffic is interrupted, every effort shall be exercised to restore normal traffic as soon as practicable.

4. Furnishing, erecting, proper maintenance, relocation, removal, replacement, and/or disposal of necessary signs, barricades, cones, warning lights, and other traffic controls shall be in accordance with local requirements and ordinances.

5. The CONTRACTOR shall conduct all operations in a manner which complies with all applicable laws and ordinances, and which will in no way discredit the OWNER or OWNER'S AGENT at any time.

6 Construction operations shall be programmed and conducted not to impede the daily operations of the OWNER or OWNER'S AGENT.

7. CONTRACTOR shall obtain local permits for interrupting traffic; retain local police to direct traffic if required by local regulations

and permit, and to pay for the police without extra cost to the OWNER.

B. Sanitary Provision

1. The CONTRACTOR shall provide adequate sanitary facilities, per local and federal regulations, for the use of those employed on the Work. Such facilities shall include, but not be limited to restrooms and washrooms. The CONTRACTOR shall provide segregated facilities for male employees, female employees, other site personnel, and visitors. Such facilities shall be made available when the first employees arrive on site for the Work, shall be properly secluded from public observation, and shall be constructed and maintained during the progress of the Work in suitable numbers and at such points and in such manner as may be required or approved.

2. The CONTRACTOR shall maintain the facilities in a satisfactory and sanitary condition at all times and shall enforce their use. The CONTRACTOR shall rigorously prohibit the committing of nuisances on the site of the Work or on adjacent property.

C. Protection of Property

1. All property along the line of the Work, or which is in the vicinity of, or is in any way affected by the Work, shall be protected and preserved from damage by the CONTRACTOR. Trees, fences, water or gas pipes, sewers, drains, conduits, poles or wires for electrical purposes, or other structures shall not be involved without consent of the persons owning or controlling them, and in crossing or working near them, they shall be sustained securely in place and shall be so treated as to render their condition as efficient and permanent as before.

2. Property damaged shall be immediately repaired and restored at the expense of the CONTRACTOR, or if required, the CONTRACTOR shall make the necessary repairs. In case of failure on the part of the CONTRACTOR to restore such property as it deems necessary, the ENGINEER or OWNER'S AGENT shall have repairs made and any cost thereof shall be deducted from payments due, or which may become due to the

CONTRACTOR under this Contract.

a. Existing Underground Utilities

The CONTRACTOR shall be responsible for determining the exact location of each utility within any area of excavation. Additionally, in accordance with state regulations, "Oregon Utility Notification Center" (1-800-332-2344) shall be contacted three (3) working days prior to any excavation. The CONTRACTOR shall also arrange to have a private utility locator investigate the proposed excavation areas to identify potential utilities and other subsurface obstructions prior to any excavation. Care shall be exercised during such location work to avoid damaging and/or disrupting the affected utility. The CONTRACTOR shall be responsible for repairing, at its expense, damage or damages to any utility caused by its work occurring during the period of construction or within the period covered by its guarantee bond, unless otherwise designated on the Drawings for removal or abandonment.

With the exception of the utilities identified for removal or relocation on the Drawings, all underground and overhead utilities in actual line and/or grade of a proposed structure or excavation, requiring adjustment to permit proper installations, shall be adjusted by others during the construction operation without charge to the OWNER'S AGENT. When excavating in close proximity of a utility or structure, the ENGINEER or OWNER'S AGENT, shall be notified thereof sufficiently in advance so that the OWNER'S AGENT may accomplish any special protective measure deemed necessary. Construction operations shall be so conducted as to facilitate access to utility structures by the ENGINEER or its agents or the OWNER'S AGENT.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

01060
REGULATORY REQUIREMENTS
AND
RESPONSIBILITY TO THE PUBLIC

(not used)

END OF SECTION

01200 – Project Meetings

PART 1 - GENERAL

1.01 DESCRIPTION

A. Pre-Construction Conference

1. Before issuance of the Notice to Proceed, a Pre-Construction Conference will be held to discuss items of significance, including

   a. construction schedule;
   b. work sequence;
   c. responsible personnel;
   d. construction quality control;
   e. procedures for handling shop drawings, schedules, "as-built" drawings, and other submissions;
   f. processing Applications for Payment;
   g. procedures for field decisions and Site Work Order Requests;
   h. preparation of record documents;
   i. applicable safety, health, environmental, security, fire protection, and operating requirements of the facility;
   j. use of premises;
   k. office, work, and storage areas;
   l. equipment and product deliveries;
   m. housekeeping; and
   n. working hours.

2. Among those present at the Pre-Construction Conference shall be the OWNER'S AGENT, the ENGINEER, the CONTRACTOR and CONTRACTOR's Superintendent and major Subcontractors. All CONTRACTOR's employees and subcontractor may attend, at the CONTRACTOR's discretion.

3. The ENGINEER or OWNER'S AGENT will arrange for and organize the Pre-Construction Conference.

B. Progress Meetings

1. During the course of the Contract, progress meetings will be organized and conducted by the ENGINEER or OWNER'S AGENT to discuss the progress of the Contract at a frequency of at least every week, or more frequently at the discretion of the ENGINEER or OWNER'S AGENT. The CONTRACTOR, its Superintendent, dedicated Safety Officer, and the Construction Quality Control (CQC) Manager shall attend these meetings. The CONTRACTOR shall be fully responsible for any and all of the

subcontractors and shall be responsible for subcontractor attendance and/or input into the meetings. The ENGINEER will take the minutes of the progress meetings and a copy will be furnished to the CONTRACTOR, OWNER, and OWNER'S AGENT. These meetings may, at the ENGINEER or OWNER'S AGENT'S discretion, be increased if progress is not satisfactory or if coordination problems should arise.

2. The construction schedule, as submitted under Section 01014 - WORK SEQUENCE, shall be updated for each progress meeting. The updated schedule shall be furnished to the ENGINEER or OWNER'S AGENT listing all parts of Work and providing the planned start and completion date for each part of Work. The schedule completion date shall conform to the contract completion date.

3. A special meeting shall be held when and if a problem or deficiency is present or likely to occur. The attendees at this meeting shall be specific to the incident. The purpose of the meeting shall be to define and resolve the problem or Work deficiency.

C. Weekly Progress Schedule

The CONTRACTOR's Site Superintendent shall submit on a weekly basis to the ENGINEER or OWNER'S AGENT a schedule of anticipated Work for the following week. This schedule shall be submitted by 12 p.m. (noon) on each Friday, and shall be updated as necessary if the CONTRACTOR's anticipated Work is altered.

D. Health and Safety Meetings

1. ALL SITE PERSONNEL SHALL attend a mandatory health and safety briefing prior to commencing field activities

2. A safety tailgate meeting shall be held on a daily basis prior to commencement of work for that day. At the meeting, activities scheduled for the day, safety procedures that will be followed for each activity to prevent injury and property damage, and site controls shall be discussed.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

END OF SECTION

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01300 – Submittals

PART 1 - GENERAL

1.01 DESCRIPTION

A. Materials, equipment, workmanship, design and arrangement of all Work performed under this Contract shall be subject to the approval of the ENGINEER or OWNER'S AGENT.

B. Work Included:

1. Procedures for submittal to the ENGINEER or OWNER'S AGENT, a List of Submittals, certificates and affidavits, samples for testing, material test results, Shop Drawings, operation and maintenance literature, and other miscellaneous data for approval.

2. Procedures for turnover of the CONTRACTOR-prepared As-Built drawings and/or Record Documents.

C. The CONTRACTOR is required to review all submittals and certify the completeness, accuracy, and content prior to submitting to the ENGINEER or OWNER'S AGENT.

PART 2 - PRODUCTS

2.01 LIST OF SUBMITTALS

A. Within ten (10) calendar days after the Contract is awarded, the CONTRACTOR shall furnish the ENGINEER or OWNER'S AGENT with a List of Submittals.

B. The List of Submittals shall indicate all products which the CONTRACTOR believes will be incorporated in the Work. Omission from this list of any equipment, material, or product required by the Specifications shall not relieve the CONTRACTOR of the Contract requirements for providing the equipment, materials, or products and completing the associated Work as specified. Each such omission discovered by the ENGINEER or OWNER'S AGENT shall be brought to the CONTRACTOR's attention for the purpose of revising the List of Submittals. The ENGINEER or OWNER'S AGENT reserves the right to make any revisions to the List of Submittals after award of the Contract, as necessary.

C. For each entry of the List of Submittals, reference to the Specifications shall be made, along with an indication of the type of submittal(s) which the CONTRACTOR plans to make to the ENGINEER or OWNER'S AGENT. More than one type of submittal may be required. The ENGINEER or OWNER'S AGENT shall approve the types of submissions offered, or request additional or alternative submissions. Types of submissions are listed below:

1. Sample for testing, approval or filing,
2. Chain of Custody,
3. Sampling and analytical methods used,
4. Testing and sample analysis results,
5. Certificates and Accompanying Affidavit,
6. Shop Drawings,
7. Equipment Data Sheets,
8. Equipment system operation and maintenance manuals, and
9. Miscellaneous Data.

D. For each item on the List of Submittals, the CONTRACTOR shall indicate the proposed source of supply or manufacturer for that entry.

E. The ENGINEER or OWNER'S AGENT will review the CONTRACTOR's proposed source of supply or manufacturer for each entry and note any exceptions taken, and then return the List of Submittals to the CONTRACTOR within fourteen (14) calendar days.

F. The following conditions apply concerning exceptions:

1. No reference to a particular source of supply or manufacturer in the Contract Documents shall relieve the CONTRACTOR of the obligation to fulfill, all requirements of the Specifications.

2. No exception to a particular manufacturer shall be construed by the CONTRACTOR as obligating the ENGINEER or OWNER'S AGENT to approve a Shop Drawing for a product from that manufacturer.

3. Subsequent to rejection of a particular source of supply or manufacturer, the CONTRACTOR shall submit to the ENGINEER or OWNER'S AGENT for approval a different source of supply or manufacturer for that product within seven (7) calendar days after notification of such rejection. The entire List of Submittals shall be resubmitted.

4. As an alternative to rejecting a particular source of supply for equipment, materials, or products, the ENGINEER or OWNER'S

AGENT reserves the option to alter the type of submittal required for that product.

2.02 SAMPLES

A. If the ENGINEER or OWNER'S AGENT so requires, either prior to or after commencement of the Work, the CONTRACTOR shall submit samples of materials for such special tests, or for file purposes, as the ENGINEER or OWNER'S AGENT deems necessary to demonstrate that they conform to the Specifications. Such samples shall be furnished, taken, stored, packed and shipped by the CONTRACTOR as directed.

B. All samples shall be packed so as to reach their destination in good condition, and shall be labeled to indicate the material represented, the name of the Work and location for which the material is intended, and the name of the CONTRACTOR submitting the sample. To ensure consideration of samples, the CONTRACTOR shall notify the ENGINEER or OWNER'S AGENT by letter that the samples have been shipped and shall properly describe the same in the letter; the letter shall have a copy of the Chain of Custody attached. The Letter of Notification and Chain of Custody shall be enclosed with the samples.

C. The CONTRACTOR shall submit data and samples, or place its orders sufficiently early to permit consideration, inspection, testing, and approval before the materials and equipment are needed for incorporation into the Work. The consequences of CONTRACTOR failure to do so shall be the CONTRACTOR's sole responsibility.

D. In order to demonstrate the proficiency of workmen or to facilitate the choice among several textures, type finishes, surfaces, etc., the CONTRACTOR shall provide such samples of workmanship as may be required.

E. When required, the CONTRACTOR shall furnish to the ENGINEER or OWNER'S AGENT triplicate sworn copies of manufacturer's shop or mill tests or reports from independent testing laboratories relative to the materials, equipment performance ratings, and concrete data.

F. The cost of samples, sample testing, and analysis associated with the approval of proposed materials and/or methods shall be borne in their entirety by the CONTRACTOR.

2.03 CERTIFICATES, AFFIDAVITS, AND WARRANTIES

A. Where specified in the Specifications that a certificate, affidavit, or warranty be submitted to the ENGINEER or OWNER'S AGENT for a particular material, product or product component, such submittals shall

be made in accordance with the following:

1. Equipment, Materials, and Products: A Certificate of Compliance shall indicate that the equipment, material, product, or product component complies with the requirements of the Specifications, and it shall be accompanied by test results and/or other technical data substantiating such compliance. The certificate shall be supplied by the material supplier or product component manufacturer.

2. Installation: A Certificate of Compliance shall indicate that the equipment or system has been properly installed in compliance with manufacturer's instructions and is ready to be operated. The certificate shall be supplied by the equipment or system manufacturer or manufacturer's representative.

3. Equipment, materials, products and their installation shall be warranted in accordance with these Construction Documents. All warranties shall be submitted for review prior to delivery of the equipment, materials or products to the Site and must be acceptable to the OWNER or OWNER'S AGENT. Limited warranties shall not be acceptable to the OWNER or OWNER'S AGENT unless specifically agreed to by the OWNER or OWNER'S AGENT in writing.

B. Each certificate shall include a signed sworn statement by an official of the company originating the certificate attesting to the truth and accuracy of all information contained in the certificate. If such attestation of truth and accuracy cannot be included in the certificate itself, it must be provided as an affidavit accompanying the certificate.

2.04 SHOP DRAWINGS

A. Five (5) copies of each Shop Drawing, certified correct for construction, shall be submitted for the review of the ENGINEER or OWNER'S AGENT as soon as possible after approval of the List of Submittals and with due regard to the sequence in which such information will be required. This includes, but is not limited to: silt fence material; backfill materials; concrete mix; reinforcing steel; structural steel including grating and handrail; building structure including all components; package equipment systems; equipment including pumps, tanks, and non-package items; piping systems including valves; electrical and grounding systems including light fixtures, transformers, power panels, breakers, and disconnect switches; heating, ventilation, and air conditioning include ductwork and controls; instruments; PLC including panel and programming; fence including gates; details of any deviation which the

CONTRACTOR proposes from the details as indicated on the Drawings and Construction Sequence; and any details not specifically indicated on the Drawings. It is the CONTRACTOR's responsibility to provide finished Shop Drawings for approval, based on field measurements of actual conditions, indicating how he proposes to install the Work and the equipment, materials, and products being furnished under the Contract. Copies of project Drawings will not be accepted for submission as Shop Drawings.

B. Shop Drawings shall be submitted in proper sequence with due regard to the time required for the reviewing, approving and transmittal.

C. The CONTRACTOR may submit manufacturer's literature as a substitute for, or supplement to, the Shop Drawings, provided the literature is explicit with regard to details of the items to be furnished. Samples and/or visual representation of the material shall accompany product data whenever available. Drawings, specifications and manufacturers literature shall bear the name and address of the manufacturer or fabricator, and be clear, detailed, and complete. Catalog numbers of materials or equipment will not suffice.

D. Shop Drawing submissions shall be made to the ENGINEER or OWNER'S AGENT by the CONTRACTOR only. Any data prepared by Subcontractors and Suppliers shall he submitted through the CONTRACTOR upon review by the CONTRACTOR.

E. All Shop Drawings covering related items, of equipment material, and products or integrated systems of equipment, material, and products shall be submitted at the same time so that their complete installation can be adequately reviewed. No partial submissions will be considered when it is necessary to meet the material delivery times required by the Contract, the ENGINEER or OWNER'S AGENT may approve partial submissions when accompanied by sufficient data to allow the ENGINEER or OWNER'S AGENT to determine the effect on the final design of other facilities being furnished under this Contract.

F. Shop Drawings shall be submitted to the ENGINEER or OWNER'S AGENT which have been checked and stamped with the approval of the CONTRACTOR. The CONTRACTOR's stamp shall include, but not be limited to, the submittal date, contract number, project name, submittal number, corresponding specification and paragraph number and CONTRACTOR's company name, signature and a notation that the Shop Drawing had been reviewed by the CONTRACTOR and is in conformance with the referenced specification section. Two (2) copies of the Shop Drawings and data submitted by the CONTRACTOR for approval shall be returned by the ENGINEER or OWNER'S AGENT to

the CONTRACTOR with comments such as, “No Exceptions Noted”, “Exceptions Noted”, or “Returned for Resubmission”. The CONTRACTOR shall correct the original drawings and data, if required, and resubmit five (5) copies of the revised Shop Drawings and data. Two (2) copies of such revisions, reviewed by the ENGINEER and OWNER, or its AGENT, shall be returned to the CONTRACTOR.

1. All Shop Drawings shall be numbered in chronological order utilizing 001, 002, etc. as the format.

2. All Shop Drawings, when practical, shall be limited in size to 22” x 34”, and have borderlines set back ½” on top, bottom, and right-hand side of the sheet. When the scale, to which the drawings must be made for clarity, and the size of the equipment assembly of arrangement, make it impractical to prepare the drawings in 22” x 34” format, larger sheet sizes may be used.

3. The CONTRACTOR shall revise its original Shop Drawings to reflect any and all changes made to the equipment, materials, or products in the field during construction. When the equipment, materials or products have been finally accepted, the CONTRACTOR shall submit five (5) copies of any Shop Drawing or data which have been so corrected. These copies shall be added by the ENGINEER or OWNER’S AGENT to the bound sets or data submitted as specified below.

G. At the time of each submission, the CONTRACTOR shall, in writing, notify the ENGINEER or OWNER’S AGENT of any deviation that the Shop Drawings have from the requirements of these Specifications. Failure to note deviations shall not excuse the CONTRACTOR from complying with the requirements of the Specifications.

H. No equipment, materials, or products for which Shop Drawings have been submitted for approval shall be delivered to the project site or incorporated into the Work until the CONTRACTOR has received copies of such reviewed drawings or until the ENGINEER or OWNER’S AGENT has authorized CONTRACTOR in writing to do so.

I. The review of the CONTRACTOR’s submitted data by the ENGINEER or OWNER’S AGENT is for general conformance only. Although the ENGINEER or OWNER’S AGENT may review submitted data in detail, such review is an effort to discover errors and omissions in the CONTRACTOR’s submissions and to assist the CONTRACTOR in coordinating and expediting its Work. It shall in no way relieve the CONTRACTOR of its obligation and responsibility to coordinate the Work or to relieve it of its responsibility in fulfilling the purpose and

intent of the Contract.

J. Once submitted, all Shop Drawings become the property of the OWNER and OWNER'S AGENT.

2.05 CONSTRUCTION "AS-BUILT" DRAWINGS

A. The CONTRACTOR shall maintain at the Site a complete set of project Drawings as issued with the Construction Documents. Project Drawings shall be updated by the CONTRACTOR to show any and all deviations made by it during construction. These drawings shall be labeled 'AS-BUILT" with 1/2" high block letters, and submitted to the ENGINEER or OWNER'S AGENT at the completion of the project within seven (7) days after issuance of a Certificate of Substantial Completion by the ENGINEER or OWNER'S AGENT. All such revisions shall be marked every week to keep the Drawings set current during the construction process and prior to any item becoming inaccessible for an "As-Built" drawing to be performed.

B. The CONTRACTOR's set of project Drawings showing changes made during construction shall be available to the ENGINEER or OWNER'S AGENT throughout the construction period, and shall be delivered to the ENGINEER or OWNER'S AGENT according to the requirements of Paragraph 2.05 A, above.

C. Electronic format drawings shall be in AutoCAD format.

2.06 MISCELLANEOUS DATA

Any other submittal required by these Specifications, but not directly addressed under this Section, shall be submitted in accordance with the requirements for Shop Drawings.

PART 3 - EXECUTION

3.01 GENERAL

During the Pre-Construction Conference, procedures for handling Shop Drawings and other submissions shall be established.

3.02 ALTERNATIVES TO SPECIFIED PRODUCTS

A. The Specifications may indicate the name of a manufacturer, a trade name, or a material to be used in the Contract. Reference made to a particular product of the manufacturer is made to identify a particular design,

quality, construction arrangement, or style.

B. Where the CONTRACTOR proposes to use a substitute product for that specified, it shall submit to the ENGINEER or OWNER'S AGENT, for approval, complete information on such substitute product including all necessary redesign of the structure, equipment, or any other part of these Specifications requiring modification as a result of the use of the requested substitute. All such redesign and all new drawings and detailing required as a result thereof shall be prepared by the CONTRACTOR at its own expense, including regulatory permit acquisition for the modifications. Requests for additional money for such substitution will not be considered. Cost savings as a result of such substitutions will be passed onto to OWNER'S AGENT.

C. If the CONTRACTOR proposes to provide products as "equals" to those specified, it shall be its responsibility to furnish complete, specific detailed information to the ENGINEER or OWNER'S AGENT for approval from the manufacturer or supplier of the product proposed to be provided in which the requirements of these Specifications are shown to be met. This shall consist of a point-by-point comparison of the Specification requirements which the product proposed to be provided. In the event the Specifications mention a manufacturer, a point-by-point comparison of the product specified and that proposed to be provided shall be furnished by the CONTRACTOR. The burden of responsibility in furnishing this information is with the CONTRACTOR. If incomplete or irrelevant data is submitted as evidence of compliance with this subparagraph, the request for approval to provide this specific substitute shall not be considered. The request for approval by the CONTRACTOR to the ENGINEER or OWNER'S AGENT for a substitute product shall also be in accordance with Section 01400 – QUALITY CONTROL.

END OF SECTION

01400 – Quality Control

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included

1. Where applicable in the Contract Documents, the minimum acceptable quality of equipment, materials, and workmanship has been defined either by a manufacturer's name and product identification, or by reference to recognized industry standards. Standards, testing protocol, inspection procedures, and additional requirements are referenced in these Contract Documents.

2. To ensure that the necessary materials and equipment are furnished, procedures are established herein to allow the CONTRACTOR to obtain approval by the ENGINEER or OWNER'S AGENT for Work which will be in complete accordance with the Contract Documents; and for substitutions to be reviewed by the ENGINEER or OWNER'S AGENT, or accepted thereby if sufficient data for unqualified approval are submitted by the CONTRACTOR.

3. For products which do not differ significantly from those specified in the referencing Section, or are, in the CONTRACTOR's judgment, of equal or higher quality, the submission of the Materials List as specified in Section 01300 - SUBMITTALS and its approval by the ENGINEER or OWNER'S AGENT, shall provide the basis for quality control. Actual quality control during manufacture shall be maintained by the approval of the Shop Drawings and by the final submissions of the manufacturer's Certificates of Compliance, and the Testing and Inspection Services; specified herein.

4. If the CONTRACTOR proposes to provide products as "equals" to those specified in the referencing Section on which the design is based, it shall be its responsibility to furnish complete, specific, detailed information to the ENGINEER or OWNER'S AGENT for approval, in which the requirements of the Contract Documents are shown to be met.

   a. These data shall be prepared or approved by the manufacturer of the proposed product, and shall include a point-by-point comparison between the features of the proposed product and the corresponding features of the product specified in the Contract Documents as the one on which the design is based. The features of the product

specified shall be those of the manufacturer's model specified (including all standard catalog features and any specified options) which were published on the date of the Invitation for Bids.

b. If applicable, the CONTRACTOR shall also furnish a description of the changes in structures and other equipment which will have to be made because of the proposed substitution.

c. The burden of responsibility for furnishing these data, documentation, engineering, and certifications for substitute products is with the CONTRACTOR.

d. A request to furnish the substitute product shall not be considered if incomplete or irrelevant data are submitted as evidence of compliance with the requirements.

1.02 QUALITY CONTROL

A. Qualification of Manufacturer/Installer

1. The manufacturer/installer shall be regularly engaged in the business of manufacturing material, installing and/or equipment of the type required by the referencing Section.

2. The manufacturer/installer shall be one of those specified by name in the referencing Section, or must be specifically approved by the ENGINEER or OWNER'S AGENT.

a. Requests for approval of a manufacturer/installer not named in the referencing Section shall be submitted to the ENGINEER or OWNER'S AGENT, accompanied by the following information:

1) List of at least five (5) installations of material and/or equipment of comparable size and capacity, and operating under anticipated service conditions; showing location, installation date, model, capacity, and service.

2) If the manufacturer/installer cannot list five (5) installations; list all those which have been made, if fewer than five (5).

3) Complete literature, technical, and performance data describing the proposed equipment.

4) The manufacturer's standard installation, operating, and maintenance instruction bulletins for the proposed equipment.

b. The ENGINEER or OWNER'S AGENT shall notify the CONTRACTOR, in writing, that the manufacturer selected by the CONTRACTOR is approved; or shall request further data to justify the selection. Upon the approval of the manufacturer, the CONTRACTOR shall update the Materials List and submit this to the ENGINEER or OWNER'S AGENT.

c. If the ENGINEER or OWNER'S AGENT requests additional data on the actual performance of the equipment or system, the CONTRACTOR shall submit evidence that the equipment or system proposed has been installed and has been in operation for a period prior to the date of Invitation for Bids, and that at least two (2) years of such service are considered satisfactory by the operating superintendents of the facilities in which installed. The service and operating conditions for the equipment or system shall be as similar to those described in these Contract Documents, as is practical.

1) The ENGINEER or OWNER'S AGENT shall review the experience record of the equipment or system proposed to be installed by the CONTRACTOR, and shall advise the CONTRACTOR, in writing, as to whether or not it appears to be suitable for installation under this Contract.

d. If acceptable evidence of satisfactory experience with the proposed material and/or equipment cannot be furnished, but the CONTRACTOR still elects to provide it, the ENGINEER or OWNER'S AGENT may accept the installation, but to protect the OWNER's and OWNER'S AGENT's interest in the event that the material and/or equipment does not meet the intended use requirements the CONTRACTOR may be required to submit a separate/additional bond or deposit in the amount of the portion of the total Contract price represented by the material and installation cost, including overhead profit of

the material and/or equipment being proposed. The period of time for which the bond or deposit shall remain in effect shall be two (2) years after final acceptance of the Work. The bond or deposit shall be used by the OWNER or OWNER'S AGENT to pay for its costs to replace the material and/or equipment with that of an alternative manufacturer or supplier, if the material and/or equipment when installed does not perform in accordance with the intended use, in the sole judgment of the OWNER or OWNER'S AGENT.

1) The original material and/or equipment which has been replaced shall become the property of the CONTRACTOR, who shall promptly remove it from the site.

2) The CONTRACTOR shall be given reasonable opportunity to modify the equipment furnished, if necessary, so that it will be acceptable to the OWNER, ENGINEER, or OWNER'S AGENT. Continuous operation in accordance with time for such modifications shall be maintained.

3) The decision of the OWNER or OWNER'S AGENT with respect to replacing unsatisfactory equipment shall be final.

e. Neither approval by the ENGINEER or OWNER'S AGENT of the CONTRACTOR's selection of a particular manufacturer or system supplier, nor accepting the CONTRACTOR's selection together with the posting of a bond or deposit in lieu of satisfactory evidence of experience, shall obligate the ENGINEER or OWNER'S AGENT to approve details on the Working Drawing submissions from that manufacturer which are not in conformance with the requirements of the Contract Documents.

f. Neither approval by the ENGINEER or OWNER'S AGENT of the CONTRACTOR's selection of a particular manufacturer, equipment supplier, or installer, nor accepting the CONTRACTOR's selection together with the posting of a bond or deposit in lieu of satisfactory evidence of experience, shall relieve the CONTRACTOR of its obligations to fulfill all requirements of the Contract

Documents.

3. When so specified in the referencing Section, the manufacturer of the equipment or supplier of the system shall furnish, as requested by the ENGINEER or OWNER'S AGENT, and at no additional cost to the OWNER or OWNER'S AGENT, the services of a qualified Technical Agent to advise the ENGINEER or OWNER'S AGENT and the CONTRACTOR in the installation and operation of the equipment or system, and to certify to the ENGINEER or OWNER'S AGENT, in writing, that the equipment or system is properly installed and ready to be operated.

B. Installation Requirements

1. The CONTRACTOR shall provide at least one person who shall be present at all times during the installation of the items of equipment furnished under the referencing Section who is thoroughly familiar with the type of materials being installed and with the manufacturer's recommended methods of installation and operation, and who shall direct all the Work performed on the equipment item being installed, at no additional cost to the OWNER's AGENT.

2. Applicable personnel certifications required by the manufacturer and other regulatory requirements, shall be furnished by the CONTRACTOR in accordance with Section 01300-SUBMITTALS.

3. The person providing the above service need not be an authorized representative of the manufacturer except when the warranty of the manufacturer shall be voided if not installed by an authorized representative. The Certificate of Compliance required by Section 01300-SUBMITTALS must be issued by the manufacturer of the equipment or supplier of the system.

C. Codes and Standards

1. Equipment and installation shall comply with all pertinent federal, state and local codes and regulations.

2. Materials, equipment, and installation shall comply with:

a. The minimum standards of the governmental agency or industry standardizing organization publishing standards applicable to such Work.

b. The requirements of specific standards listed in the referencing Section.

c. Where the standards of several organizations (including the manufacturer's own published standards) are applicable to the same Work, the Work may be done in accordance with any such other standards that require an equal or higher quality construction for the specified service than those listed in the referencing Section. The selection of such an alternate standard to the one specified shall be subject to the approval of the ENGINEER or OWNER'S AGENT.

3. Where any provisions of pertinent codes or standards are in conflict with the requirements of the Contract Documents, the provisions requiring greater safety or operability, or higher quality construction for the specified service shall govern, unless specific exemptions to such provisions are made in the referencing Section. The final determination shall be made by the ENGINEER or OWNER'S AGENT.

4. If the mandatory standards of governmental agencies are revised subsequent to the date of issue of the Invitation to Bid, but are made applicable to the Work under this Contract, the CONTRACTOR shall advise the ENGINEER or OWNER'S AGENT as to the additional cost or reduction in costs required to comply with such revisions, and a Change Order will be issued to cover such costs or the CONTRACTOR issue a credit in the event the change required by the governmental agency results in a cost reduction. The cost of rework required for Work not complying with such revised regulations, but installed after the effective date of such code revisions, will be at the CONTRACTOR's expense.

5. The CONTRACTOR shall document construction and installation activities. At a minimum, installation records shall contain the minimum information: time, place, installer, personnel, equipment used or required, testing performed, test locations, results of testing, installation percent completed, duration, conflicts, resolution to conflicts, safety requirements/actions, site conditions, weather, and all other information required to document the proper installation and certification.

D. At the discretion of the ENGINEER or OWNER'S AGENT, the CONTRACTOR shall make available any materials related to the Work, including but not limited to soils, granular materials, clay, mix reagents, or soil-mix backfill, for confirmation quality control sampling by the

ENGINEER or OWNER'S AGENT.

PART 2 - PRODUCTS

2.01 DESIGN

A. The design of certain items at the site, as shown in the Contract Documents, is based on the performance and dimensions of specific equipment items as furnished by particular manufacturers.

1. When the performance or dimensions of such items are proprietary, and furnished only by one particular manufacturer, the referencing Section will state the design is based on a particular model of that manufacturer.

a. The CONTRACTOR may furnish and install corresponding products produced by an alternate manufacturer; either one named as an alternate in the referencing Section, or any other one selected by the CONTRACTOR and approved or accepted by the ENGINEER or OWNER'S AGENT on the basis of the information supplied as requested in Part I of this Section.

b. The CONTRACTOR shall furnish the ENGINEER or OWNER'S AGENT with those data on the particular model of the alternate manufacturer which are required to demonstrate that the proposed equipment or system is at least equivalent in performance in the specified service to the equipment or system on which the design is based. The ENGINEER's or OWNER'S AGENT'S evaluation will include a determination of the ability of the proposed equipment to meet the requirements of these Drawings, and a comparison of the costs of Operation and Maintenance. If the CONTRACTOR proposes a modification to the Contract Price due to the substitute equipment, this will also be evaluated by the ENGINEER or OWNER'S AGENT.

c. Approval by the ENGINEER or OWNER'S AGENT of the proposed substitution will not be capriciously withheld.

d. The design of the facilities associated with the equipment or system for which a substitution is proposed may be affected by such substitution. The size of the building or supporting structure, the size and arrangement of piping and wiring, the specification for associated equipment, the

necessary controls, and the service requirements will have to be reconsidered by the CONTRACTOR. The CONTRACTOR shall be completely responsible for the necessary engineering, redesign and certification of all facilities affected by the substitution, and shall prepare the revisions to the Drawings required by such substitution. These revisions shall be submitted to the ENGINEER or OWNER'S AGENT for approval, in accordance with the provisions in Section 01300 – SUBMITTALS, including the specific notice as to the details in which the substitute design differs from the requirements of the Contract Documents. All such redesign and all new drawings and detailing required as a result thereof shall be prepared by the CONTRACTOR, or its Subcontractors, at its own expense. Requests for additional payment for such substitution will not be considered unless made a part of the final request for approval of the substitution itself.

2.02 MATERIALS

A. All materials, including those not specifically described or specified, but required for a complete and proper installation of Work shall be new, first quality of their respective kinds, and subject to the approval of the ENGINEER or OWNER'S AGENT.

B. All materials shall be in accordance with details and samples as specified in the referencing Section; and submitted and approved in accordance with Section 01300-SUBMITTALS.

2.03 INTERCHANGEABILITY

A. All products of the same size and type and performing the same function shall be, insofar as practical, the products of one manufacturer.

1. Details in the Shop Drawing submissions of the several equipment manufacturers shall be coordinated so that items such as lubricating fittings, for example, are identical on all equipment items requiring the same grade of lubricant.

PART 3 - EXECUTION

3.01 INSTALLATION CONDITIONS

A. Inspection

1. Prior to any Work on a specific equipment unit or material installation, the CONTRACTOR shall carefully inspect the existing and previously installed Work, and verify that all Work is in such a condition that the installation of new Work may properly commence and be carried out to a proper and timely completion.

2. The CONTRACTOR shall verify that each item of Work shall be installed in accordance with all pertinent codes and regulations, the approved design, and the referenced standards.

3. The ENGINEER or OWNER'S AGENT shall periodically inspect the Work to provide quality assurance in accordance with these Contract Documents.

B. Discrepancies

1. In the event of discrepancies, the CONTRACTOR shall immediately notify the ENGINEER or OWNER'S AGENT, in writing, of such conditions.

2. The CONTRACTOR shall not proceed with installation in areas of discrepancy until such discrepancies have been corrected in a manner acceptable to the ENGINEER or OWNER'S AGENT.

3. For any unexpected features arising during the progress of Work and not fully covered herein, the Specifications shall be interpreted by the ENGINEER, its AGENT, or OWNER'S AGENT to require first-class workmanship and materials, and such interpretation shall be accepted by the CONTRACTOR.

3.02 INSTALLATION

A. The CONTRACTOR shall install each equipment item in strict accordance with the manufacturer's instructions, unless specifically directed otherwise by the ENGINEER or OWNER'S AGENT. The CONTRACTOR shall not void the manufacturer's guarantee.

B. In the event of discrepancies between the Contract Documents and the equipment manufacturer's formal installation instructions, as submitted for the actual units supplied, the CONTRACTOR shall notify the ENGINEER or OWNER'S AGENT, in writing, of such discrepancies. The CONTRACTOR shall obtain the equipment manufacturer's approval in writing for any changes required to suit the site conditions, and so advise the ENGINEER or OWNER'S AGENT.

END OF SECTION

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01430 – Environmental Protection

PART 1 - GENERAL

1.01 DESCRIPTION

The CONTRACTOR shall perform all Work in such manner as to minimize the polluting of air, water, or land, and shall, within reasonable limits, control noise and minimize the generation and disposal of solid waste materials, as well as other pollutants. Disposal of waste materials shall comply with all applicable federal, state, county, and environmental regulations.

1.02 PRE-CONSTRUCTION WALK-THROUGH

Prior to the start of any on-site construction activities, the CONTRACTOR and the ENGINEER or OWNER'S AGENT shall make a joint condition survey of the Site after which the CONTRACTOR shall prepare a brief report indicating on a layout plan the condition of structures, fences, equipment, stored product and materials, and items near the Work areas and access route(s) as applicable. This report will be signed by both the ENGINEER or OWNER'S AGENT, and the CONTRACTOR upon mutual agreement as to its accuracy and completeness.

1.03 PROTECTION OF LAND AREAS AND UTILITIES

A. Except for any Work, or storage area and access routes specifically assigned for the use of the CONTRACTOR, the land areas outside the limits of disturbance performed shall be preserved in their present condition.

B. The CONTRACTOR shall confine its construction activities to areas defined for Work on the Drawings or specifically assigned for its use within the designated disturbed area. Storage and related areas and access required temporarily by the CONTRACTOR in the performance of the Work shall be coordinated with the ENGINEER or OWNER'S AGENT.

C. The Work includes excavation and other activities near, and at, the location of utilities, both subsurface and overhead. For any utility designated on the Drawings for abandonment, the CONTRACTOR shall confirm, via inspection and confirmation from the ENGINEER and the OWNER'S AGENT, that the particular utility is not being used. For all active utilities, the CONTRACTOR shall perform all work in accordance with any requirements stipulated by each specific utility. Work shall also be conducted in accordance with all local and state requirements.

D. It is the responsibility of the CONTRACTOR to contact the specific utility when working near utility poles. The CONTRACTOR shall coordinate with the utility to ensure adequate, temporary support and protection of the utility poles when working near the poles. The CONTRACTOR shall also coordinate with the utility for any temporary re-routing of the utility or shielding of the utility during the Work.

1.04 PROTECTION OF SURROUNDING AREAS

A. Except for trees, shrubs and other vegetation marked on the Drawings to be removed; the CONTRACTOR shall not deface, injure or destroy trees, shrubs, or vegetation nor remove or cut them without special authority. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorages.

B. The CONTRACTOR shall not damage or compromise the integrity of any infrastructure, equipment, materials, or other items not designated for removal or any Work. Any damage to items within or outside the Work area that are not designated for dismantling shall be restored or replaced in kind at no additional cost to the OWNER'S AGENT.

1.05 PROTECTION OF WATER RESOURCES

A. The CONTRACTOR shall control the disposal of fuels, oils, bitumens, calcium chloride, acids, alkalies, or other harmful materials, both on and off-site, and shall comply with applicable federal, state, and local laws concerning the pollution of rivers and streams. Special measures shall be taken to prevent chemicals, fuels, oils, greases, bituminous materials, from entering public waters.

B. Decontamination water or fluids shall be contained and disposed at an appropriate facility in accordance with all federal, state and local requirements.

C. Water accumulating within any excavation containing potentially impacted materials shall be removed/dewatered in accordance with these Specifications. Water shall be disposed in accordance with Section 01500 – TEMPORARY FACILITIES AND CONTROLS.

1.06 WASTE DISPOSAL

A. The CONTRACTOR shall place all general debris and waste; i.e., paper, trash, etc., in a storage container provided by the CONTRACTOR for subsequent disposal by the CONTRACTOR. Soil, sediment, contact water or demolition debris is not considered general debris, but rather, waste that shall be managed as required in the Contract Documents, including Section 02250 – TRANSPORTATION AND DISPOSAL OF MATERIALS. If any waste material is dumped in unauthorized areas, the CONTRACTOR shall remove the material and restore the area to the condition of the adjacent undisturbed areas. Where directed, ground and/or floor areas contaminated by CONTRACTOR operations shall be excavated and/or cleaned, disposed as approved, and replaced with suitable fill material at no additional expense to the OWNER'S AGENT.

B. No material shall be burned on the project site. It shall be the responsibility of the CONTRACTOR to provide disposal of all waste materials in accordance with all federal, state and local regulations.

1.07 DUST CONTROL

A. The CONTRACTOR shall maintain all excavations, stockpiles, access roads, waste areas, off-site roadways and all other work areas free from excess dust to such reasonable degree as to avoid causing a hazard or nuisance to others, in accordance with the dust monitoring requirements of the site specific Health and Safety Plan, and Contaminated Material Management Plan.

B. Approved temporary methods for dust control consist of sprinkling of water or a dilute solution of water with a biodegradable surfactant (less than 0.05 percent). Chemical treatment, tents, windscreens, or similar methods will be considered for dust control. Approval of such temporary methods must be granted by the ENGINEER or OWNER'S AGENT prior to initiation.

C. Dust control shall be performed as the Work proceeds and whenever a dust nuisance, hazard, or exceedance of predefined action levels occurs, or as otherwise directed by the ENGINEER or OWNER'S AGENT.

1.08 CORRECTIVE ACTION

The CONTRACTOR shall, upon receipt of a notice in writing from the ENGINEER or OWNER'S AGENT of any non-compliance with the foregoing provisions, take immediate corrective action in accordance with any and all federal, state, or local laws. If the CONTRACTOR fails or refuses to comply promptly, the ENGINEER or OWNER'S AGENT may issue an order stopping all

or part of the work until satisfactory corrective action has been taken.

1.09 POST-CONSTRUCTION CLEANUP OR OBLITERATION

The CONTRACTOR shall, unless otherwise instructed in writing by the ENGINEER or OWNER'S AGENT, obliterate all signs of temporary construction facilities such as temporary access roads, Work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the Work. Any disturbed soil areas shall be graded and filled and the entire area stabilized with aggregate or seeded with permanent vegetation, as indicated on the Drawings.

1.10 EROSION CONTROL

A. Surface drainage from cuts and fills, within the construction limits, whether or not completed, and from excavated areas shall be graded to control erosion within acceptable limits in accordance with the Erosion and Sediment Control Plan and requirements of the 1200C National Pollutant Discharge Elimination System Construction Stormwater General Permit.

B. Temporary control measures shall be provided and maintained throughout construction. Such measures shall include, but not be limited to silt fence, straw bales, drainage swales, and stabilized construction entrance(s). No additional payment will be considered or approved for repair or maintenance of the erosion control measures or for erosion repair.

C. The area of bare soil, exposed at any one time by construction operations shall be minimized to the satisfaction of the ENGINEER or OWNER'S AGENT.

1.11 SITE ROADWAYS, ENTRANCE TO SITE AND PUBLIC ROADS

A. During the construction activities, the CONTRACTOR shall maintain the site roadways and entrance(s) to public roads.

B. The CONTRACTOR shall be responsible for any activities that may result in materials deposited on public roadways, including removal and repair. This includes all work activities being conducted by the CONTRACTOR and his SUBCONTRACTORS.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

END OF SECTION

01500 – Temporary Facilities and Controls

PART 1 - GENERAL

1.01 FIELD CONDITIONS AND MEASUREMENTS

A. The CONTRACTOR shall base all measurements, both horizontal and vertical, from established benchmarks and monuments. The CONTRACTOR shall be responsible for field verification of all dimensions and conditions at the Site. The ENGINEER or OWNER'S AGENT shall provide to the CONTRACTOR both coordinates and elevations for monuments as shown on the Drawings.

B. Should the CONTRACTOR discover any discrepancy between actual conditions and those indicated, which prevent following good practice or the intent of the Specifications and Drawings, the CONTRACTOR shall notify the ENGINEER or OWNER'S AGENT, request clarification and instructions, and shall not proceed with Work until the CONTRACTOR has received the same from the ENGINEER or OWNER'S AGENT; provided that such wait does not unduly delay the progress of the Work.

C. No claims shall be made for extra payment or extensions of the Contract completion time if the CONTRACTOR fails to notify the ENGINEER or OWNER'S AGENT of any discrepancy before proceeding with that aspect of that Work.

1.02 SUBMITTALS

Submittals will be in accordance with Section 01300 – SUBMITTALS and the Construction Quality Assurance/Quality Control (CQA/QC) Plan.

1.03 ACCESS AND DRAINAGE

A. The CONTRACTOR shall keep all natural drainage and water courses unobstructed or provide equal courses effectively placed, and prevent accumulations of surface water. The CONTRACTOR shall construct, grade, and stabilize access roads and provide temporary mobilization, parking, storage and staging areas for its use during construction within the areas shown on the Drawings.

B. Access roads and mobilization, parking, and storage areas shall be maintained in a stable and smooth condition throughout the life of the Contract.

1.04 TEMPORARY SANITARY FACILITIES

The CONTRACTOR shall furnish and maintain the necessary temporary self-contained chemical type sanitary facilities in accordance with all applicable regulations. They shall be located near the points of Work and shall be cleaned daily and adequately serviced. The use of these facilities shall be available for the CONTRACTOR's employees as well as the OWNER'S AGENT and ENGINEER representatives and other project personnel on the Site. Separate sanitary facilities are required for men and women; these facilities must be clearly marked and reasonably maintained in a sanitary condition.

1.05 CONTRACTOR STORAGE AREA

A storage area shall be designated by the ENGINEER or OWNER'S AGENT on the project site for use by the CONTRACTOR for storage of materials, tools, equipment, office and other items necessary for construction. The exact limits of the storage area will be designated in the field by the ENGINEER or OWNER'S AGENT. The CONTRACTOR shall be fully responsible for the preparation of this area, its maintenance, and its security including fencing, watchmen, and other means of security. Under no circumstances will the OWNER, OWNER'S AGENT, or ENGINEER be responsible for the security of any property belonging to the CONTRACTOR, its Subcontractors or any of its Work forces. The CONTRACTOR shall, upon completion of the project, return the storage area(s) to the original condition. All disturbed areas shall be repaired and covered with surface materials that match the existing adjacent materials; i.e., concrete, topsoil and grass, asphalt, etc.

1.06 STAGING AREAS, STORAGE AND FIELD OFFICES

A. The CONTRACTOR may, during the course of this project, stage construction, store materials, or erect temporary field offices only within the Limits of Disturbance shown on the Drawings or as otherwise approved by the ENGINEER or OWNER'S AGENT.

B. The requirements the staging areas, storage and field office(s) shall be

1. Office: Weather tight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture drawing rack, and drawing display table.

2. Provide space for Project meetings, with table and chairs to accommodate 8 persons.

3. Locate offices and sheds as directed by ENGINEER or OWNER'S AGENT.

4. Storage Areas And Sheds: Size to storage requirements for products of individual Sections, allowing for access and orderly provision for maintenance and for inspection of products to requirements of Section 01600.

5. Preparation: Fill and grade sites for temporary structures sloped for drainage away from buildings and Work.

6. Installation:
   a. Install office spaces ready for occupancy no later than 3 days after the start of mobilization.

7. Maintenance And Cleaning:
   a. Weekly janitorial services for offices; periodic cleaning and maintenance for office and storage areas.
   b. Maintain approach walks free of mud, water, and snow.

8. Removal: At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

1.07 HANDLING AND DISPOSAL OF SITE WATER

A. The CONTRACTOR shall furnish all labor, materials, and equipment necessary for the proper handling, collection, and disposal of water accumulated that is generated from stormwater, groundwater, dust control operations, or otherwise.

B. Any stormwater or other ponded water encountered within the areas of excavation or disturbance with potentially impacted material exposed during construction activities shall be collected and managed in accordance with these Specifications and the Contaminated Material Management Plan.

C. All waste fluids generated by the CONTRACTOR from decontamination activities, or otherwise, shall be properly contained, managed, and disposed of in accordance with these specifications and the Contaminated Material Management Plan.

D. The CONTRACTOR shall take the necessary measures; i.e., divert runoff from the work area, to minimize the quantity of water generated for disposal.

1.08 TRUCKING

A. All trucks bringing to or removing from the Site, soil, loose materials or debris shall be loaded in a manner so as to prevent the dropping of materials on public or private off-site streets or roadways.

B. At all points where trucks leave the project site and enter adjacent paved roadways, the CONTRACTOR shall provide and maintain a crew or other means necessary to prevent any mud or loose material from being carried onto such adjacent paved roadways.

C. Soil, loose materials or debris deposited on the roadways due to contract activities shall be removed daily.

1.09 EQUIPMENT DECONTAMINATION

A. The CONTRACTOR shall decontaminate any equipment or materials that have contacted potentially hazardous substances (if any) prior to leaving the area. Decontamination activities shall be performed in a designated location over a contained area such that all materials and contact water are properly contained. All decontaminated residual materials and contact water shall be tested and properly disposed in accordance with Part 1.07 of this Section.

B. The CONTRACTOR shall provide all wash water required for the decontamination of equipment and personnel.

C. Personnel decontamination procedures shall be followed by the CONTRACTOR as specified in the CONTRACTOR's Health and Safety Plan.

D. Any solids and soils/sediments generated from the decontamination activities shall be considered impacted and disposed in accordance with Section 02250 – TRANSPORTATION AND DISPOSAL OF MATERIALS.

1.10 SECURITY

A. Security for the purpose of this project will be defined as precautionary measures to ensure that equipment, tools, and materials are safe from vandalism, theft, or damage. The CONTRACTOR is responsible for the security of all equipment used and/or stored on the Site.

B. The right of access to this Work area, whether it is in preparation or progress, shall be extended to the OWNER, OWNER'S AGENT and ENGINEER, as well as local authorities.

C. The entrance of persons and vehicles into the Site shall only be permitted for authorized persons with proper identification.

D. A list of authorized persons shall be maintained, and a copy submitted to the ENGINEER or OWNER'S AGENT upon request.

E. CONTRACTOR is responsible for security of work progress and equipment until acceptance of work by the ENGINEER, OWNER'S AGENT and OWNER.

1.11 EROSION AND SEDIMENT CONTROL MEASURES

A. Adequate control of erosion and sediment of both a temporary and permanent nature on areas disturbed by the Work shall be provided under this Specification and/or subject to the approval of the ENGINEER or OWNER'S AGENT. During the pre-construction walk-through, the CONTRACTOR and the ENGINEER or OWNER'S AGENT shall review the Erosion and Sediment Control Plan and details and shall determine additional specific sediment and erosion control requirements. All erosion and sediment control measures shall be provided and maintained until the Site is fully stabilized, as approved by the ENGINEER. Maintenance includes, but is not limited to, the clearing and removal of sediment accumulation in the ditches and silt fence; repair of any damaged or fallen erosion and sediment control components; and all other activities required to ensure proper performance of erosion and sediment control measures.

B. Erosion control shall comply with all applicable State of Oregon regulations.

1.12 TEMPORARY ELECTRICITY

C. Contractor shall arrange for temporary construction power from the local utility company.

D. Available Power Service Characteristics: Contractor shall determine the available power supply characteristics in the immediate site area from the local utility company.

E. Provide power outlets, with branch wiring and distribution boxes as required for construction operations. Provide flexible power cords as required for portable construction tools and equipment.

F. Provide feeder switch at source distribution equipment.

G. Permanent convenience receptacles may be utilized during construction.

H. Provide distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting, to the extent required for construction.

1.13 TEMPORARY TELEPHONE SERVICE

I. Provide, maintain, and pay for telephone service to field office at time of project mobilization.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

END OF SECTION

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01600 – Material and Equipment

PART 1 - GENERAL

1.01 EQUIPMENT AND PRODUCTS SPECIFIED

A. In various detailed Sections of these Specifications, certain items of equipment, materials, or products are specified by proprietary name or trade name and shall be used without exception. It is to be understood that these items are to be furnished by the CONTRACTOR as indicated in this Section and no substitutes will be allowed.

B. In the various detailed Sections of these Specifications where any item of equipment or product is specified by proprietary name or trade name, with the addition of such expressions as "or equal", it is to be understood that equal quality equipment or products of either a manufacturer named or a manufacturer not named which meet the detailed requirements of the Specifications are subject to the approval of the ENGINEER or OWNER'S AGENT as to the equality thereof and in accordance with Section 01400 - QUALITY CONTROL.

1.02 STORAGE AND MAINTENANCE OF EQUIPMENT

A. All equipment, materials, and products provided and Work performed under this Contract shall be protected from damage before and after installation. The CONTRACTOR shall be responsible for Work, equipment, materials, and products until inspected, tested, and finally accepted in accordance with this Section, the Contract Documents and all applicable warranties.

B. During construction, and at the end of each working day or other period, the open ends of Work shall be effectively closed with temporary covers or plugs to prevent the entry of foreign material.

C. Where permanent equipment called for under this Contract is installed before the erection of adequate protective structures, the CONTRACTOR without additional compensation therefore, shall provide approved, effective, and durable covers for fully protecting such equipment against damage from the elements or from any other causes.

D. All machinery, equipment, piping, and accessories and appurtenances shall be adequately supported and safeguarded against all damage or injury during performance of Work under this Contract. The CONTRACTOR shall be responsible for all damage or injury resulting from its operations and shall repair such damage immediately and to the satisfaction of the ENGINEER or OWNER'S AGENT.

E. The CONTRACTOR shall store and protect equipment, materials, and products in accordance with the manufacturer's recommendations and the requirements specified in these Specifications and shall submit the manufacturer's storage and maintenance instructions to the ENGINEER or OWNER'S AGENT prior to delivery.

F. The CONTRACTOR shall make all arrangements and provisions necessary for the storage of equipment, materials, and products. All excavated material, construction equipment, and materials and equipment to be incorporated into the Work shall be placed so as not to injure any part of the Work or existing facilities, and so that free access can be achieved at all times to all parts of the Work and to all public utility installations in the vicinity of the Work. Equipment, materials, and products shall be kept neatly and compactly stored in locations that will cause a minimum of inconvenience to other contractors, public travel, adjoining owners, tenants, occupants, and the ENGINEER or OWNER'S AGENT'S personnel.

G. Areas available on the project site for storage of equipment, materials, and products shall be as shown, specified, or designated and approved by the ENGINEER or OWNER'S AGENT. All equipment, materials, and products must be consigned to the CONTRACTOR directly. No delivery of equipment, materials, and products will be accepted by the ENGINEER or OWNER'S AGENT, and all expenses incurred by the ENGINEER or OWNER'S AGENT in handling equipment, materials, and products which have been consigned or directed to the ENGINEER or OWNER'S AGENT will be charged to the CONTRACTOR.

H. Equipment, materials, and products which are to become the property of the OWNER and OWNER'S AGENT shall be stored to facilitate their inspection and ensure preservation of the quality and fitness of the Work, including proper protection against damage by freezing and moisture. They shall be placed inside storage areas, unless otherwise shown, specified, or acceptable to the ENGINEER or OWNER'S AGENT.

I. CONTRACTOR shall be fully responsible for loss or damage to stored equipment, materials, and products.

J. Any equipment, materials, or products which, in the opinion of the ENGINEER or OWNER'S AGENT, have been damaged due to improper storage and/or handling and is unfit for its specified or intended use shall be properly removed from the site or Work. The CONTRACTOR shall receive no compensation for the damaged equipment, material, or product or its removal or replacement.

K. All materials delivered and stored on-site shall bear the manufacturer's trade names, labels, stamps, or other suitable identification clearly marked in a conspicuous place.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

END OF SECTION

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01700 – Contract Closeout

PART 1 - GENERAL

1.01 DESCRIPTION

A. Clean-Up

Upon completion of the Work and before a Certificate of Substantial Completion is issued by the ENGINEER or OWNER'S AGENT to the CONTRACTOR, the Work site, storage areas, and other areas occupied by the CONTRACTOR during construction shall be cleaned, and all surplus and discarded materials, false Work, and rubbish placed thereon by the CONTRACTOR shall be removed by the CONTRACTOR. No separate payment will be made for clean-up as all such costs shall be included in the Bid.

B. Warranties and Guarantees

All Warranties and Guarantees shall be submitted to the ENGINEER or OWNER'S AGENT prior to the performance of Work or the delivery of materials to the Site. These Warranties and Guarantees will be referred to the OWNER or OWNER'S AGENT for review and approval of the Terms and Conditions. Upon completion of the Work and before a Certificate of Substantial Completion is issued by the ENGINEER or OWNER'S AGENT to the CONTRACTOR, all final Warranties and Guarantees shall be submitted to the ENGINEER or OWNER'S AGENT.

C. Record Documentation and "As-Built" Drawings

1. Upon Completion of the Work and before a Certificate of Substantial Completion is issued by the ENGINEER or OWNER'S AGENT to the CONTRACTOR, all "As-Built" documentation shall be completed and submitted to the ENGINEER or OWNER'S AGENT.

2. Project record documents include, but are not limited to the following:

   a. Drawings;
   b. Specifications;
   c. Addenda;
   d. Site Work Orders, field orders, and other modifications to the Contract,
   e. Approved Shop Drawings;
   f. Product data and samples;
   g. Warranties and Guarantees;

h. "As-Built" documentation;
i. Operation and Maintenance Manuals; and,
j. Other approved documents submitted by the CONTRACTOR in compliance with these Specifications.

3. CONTRACTOR shall maintain, at the Site, one set of the following record documents; and record actual revisions to the Work.

   a. Contract Drawings;
   b. Specifications;
   c. Addenda;
   d. Change Orders and other Modifications to the Contract;
   e. Operation and Maintenance Manuals; and,
   f. Reviewed Shop Drawings, product data, and samples.

4. CONTRACTOR shall store Record Documents separately from documents used for construction.

5. CONTRACTOR shall record information concurrent with construction progress.

6. Specifications: CONTRACTOR shall legibly mark and record at each product section the description of actual products installed, including the following:

   a. Manufacturer's name and product model and number;
   b. Product substitutions or alternates utilized; and,
   c. Changes made by Addenda and modifications.

7. Record Documents and Shop Drawings: CONTRACTOR shall legibly mark each item to record actual construction, including:

   a. Field changes of dimension and detail.
   b. Details not included on the Drawings.

8. CONTRACTOR shall submit the documents to the ENGINEER or OWNER'S AGENT with the claim for final Application of Payment.

9. CONTRACTOR shall maintain a daily log of Work performed/completed.

10. CONTRACTOR shall maintain a workers log.

1.02 CLOSEOUT PROCEDURES

A. When the CONTRACTOR considers that the Work is substantially complete, it shall submit a written request that certifies that the Contract Documents have been reviewed, the Work has been inspected, and that Work is complete in accordance with the Contract Documents and is ready for the ENGINEER's or OWNER'S AGENT'S final inspection.

B. CONTRACTOR shall provide to the ENGINEER or OWNER'S AGENT "As-Built" documentation, all submittals in accordance with Section 01300 - SUBMITTALS of the Technical Specifications, Warranties and Guarantees, and other submittals required by these Specifications or governing authorities prior to, or concurrent with the request for Certification of Substantial Completion.

C. ENGINEER or OWNER'S AGENT shall, within a reasonable time after receipt of a written request from the CONTRACTOR, conduct an inspection to determine the status of completion. If ENGINEER or OWNER'S AGENT, determines that the Work is not complete, it shall notify CONTRACTOR in writing giving the reasons thereof. The CONTRACTOR shall remedy the deficiencies noted and submit a certification to the ENGINEER or OWNER'S AGENT for re-inspection.

D. The CONTRACTOR shall submit project Record Documents to the ENGINEER or OWNER'S AGENT with the claim for final Application for Payment.

E. Evidence of payment and release of liens shall be provided by the CONTRACTOR in accordance with the requirements provided in the Contract Documents, and is required prior to final payment.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

END OF SECTION

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01740 – Warranties and Bonds

PART 1- GENERAL

1.01 PROJECT MAINTENANCE AND WARRANTY

A. Maintain in good repair the improvements covered by these Drawings and Specifications during the life of the Contract.

B. Indemnify the OWNER and OWNER'S AGENT against any repairs which may become necessary to any part of the work performed and to items of equipment and systems procured of or furnished under this Contract, arising from defective workmanship or materials used therein, for a period of one (1) year after acceptance from the final date of final resolution of the OWNER'S AGENT accepting work.

C. The CONTRACTOR shall not be obligated to make replacements which become necessary because of ordinary wear and tear, or as a result of improper operation or maintenance, or to perform any work which is normally performed by a maintenance crew during operation.

D. In the event of multiple failures of major consequences prior to the expiration of the one-year warranty described above, the affected construction of installation shall be removed/disassembled, inspected, and repaired, modified or replaced as necessary to prevent further occurrences. All related components which may have been damaged or rendered non-serviceable as a consequence of the failure shall be replaced. A new twelve (12) month warranty against defective or deficient design, workmanship, and materials shall commence on the day that the item is reassembled and placed back into operation. As used herein, multiple failures shall be interpreted to mean two (2) or more successive failures of the same kind in the same item or failures of the same kind in two (2) or more items. Major failures may include but are not limited to, piping system failure (including valves), tank failure, mechanical equipment failure (include pumps, HVAC system components. package systems), electrical equipment, instrumentation equipment (including PLC components and interlocks), or other deficiencies that would cause any part of the GWET System to not comply with the requirements herein; or other occurrences that would result in any portion of the project to not comply with these Technical Specifications or Drawings. Should multiple failures occur in a given time, all products of the same size and type shall be disassembled, inspected, modified, or replaced, as necessary, and rewarranted for one year.

E. The CONTRACTOR shall, at his own expense, furnish all labor, materials, tools, and equipment required and shall make such repairs and removals or shall perform such work or reconstruction as may be made necessary by any structural or functional defect or failure resulting from

neglect, faulty workmanship, or faulty materials, in any part of the Work performed. Such repair shall also include refilling of trenches, excavations or embankments which show settlement or erosion after backfilling or placement.

F. Except as noted on the Drawings or as specified, all structures such as embankments and fences shall be returned to their original condition prior to the completion of the Contract. Any and all damage to any facility not designated for removal, resulting from the CONTRACTOR's operations, shall be promptly repaired by the CONTRACTOR at no cost to the OWNER or OWNER'S AGENT.

G. In the event the CONTRACTOR fails to proceed to remedy the defects of which he has been notified within fifteen (15) days of the date of such notice, the OWNER/OWNER'S AGENT reserves the right to cause the required materials to be procured and the work to be done, as described in the Drawings and Specifications, and to hold the CONTRACTOR and the sureties on his bond liable for the cost and expense thereof.

H. Notice to the CONTRACTOR for repairs and reconstruction will be made in the form of a registered letter addressed to the CONTRACTOR at the contract-designated office.

I. Neither the foregoing paragraphs nor any provision in the Contract Documents, nor any special guarantee time limit implies any limitation of the CONTRACTOR's liability with the law of the State of Oregon.

1. Upon completion of the Work and before a Certificate of Substantial Completion is issued by the ENGINEER or OWNER'S AGENT to the CONTRACTOR, the Work site, storage areas, and other areas occupied by the CONTRACTOR during construction shall be cleaned, and all surplus and discarded materials, false Work, and rubbish placed thereon by the CONTRACTOR shall be removed by the CONTRACTOR. No separate payment will be made for clean-up as all such costs shall be included in the Bid.

1.02 PERFORMANCE CRITERIA

A. A description of the work for GWET System installation is provided in 01010 Summary of Work.

B. Constituents of potential concern (COPCs) present in groundwater, and water quality parameters that may affect the design of the GWET system, are presented in Table 1. While actual influent concentrations will likely vary, the influent groundwater concentrations presented in Table 1 are considered to be conservative estimates.

C. Treated groundwater will be discharged to the Willamette River through an existing stormwater outfall. The presumed effluent quality objectives (EQOs for the treated groundwater are summarized in Table 2. Based on comparison of estimated influent concentrations to the EQOs and pending further negotiations with ODEQ, the proposed GWET system design parameters are summarized in Table 3.

D. The CONTRACTOR shall provide a performance guarantee that the GWET System will produce an acceptable effluent as defined in Table 2.

PART 2- PRODUCTS

(not used)

PART 3- EXECUTION

(not used)

END OF SECTION

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Table 1
Estimated Range of Influent Concentrations for GWET System Design
Groundwater Source Control Measure
Arkema Inc.
Portland, Oregon

Data Source	Groundwater Treatability Study[1]	Site-Wide Groundwater Sampling[2]				Recovery Well Pumping Tests[3]				Estimated Influent Concentration
Parameter	Blended	Average	Maximum	No. of Samples	No. of Detections	Average	Maximum	No. of Samples	No. of Detections	
VOCs (ug/L)										
Benzene	ND (6.4)	1.04	16.6	33	10	1.22	2.69	12	1	3
Chlorobenzene	1,700	948	12,500	33	30	80.5	286	12	6	2,000
Chloroform	9.9	298	9,800	33	17	NA	ND (5)	12	0	300
SVOCs (ug/L)										
Benzo(a)Anthracene	ND (1.7)	NA				NA				ND (1.7)
Benzo(a)Pyrene	ND (1.3)	NA				NA				ND (1.3)
Benzo(k)Fluoranthene	ND (0.46)	NA				NA				ND (0.46)
2-Chlorophenol	43	NA				NA				50
Chrysene	ND (1.0)	NA				NA				ND (1.0)
Dibenzo(a,h)Anthracene	ND (1.4)	NA				NA				ND (1.4)
Fluoranthene	ND (5.0)	NA				NA				ND (5.0)
Hexachlorobenzene	ND (2.1)	NA				NA				ND (2.1)
Pentachlorophenol	ND (20)	NA				NA				ND (20)
Pesticides (ug/L)										
Aldrin	ND (0.0059)	NA	ND (0.05)	36	0	NA				ND (0.0059)
Chlordane	ND (0.14)	NA	ND (0.5)	36	0	NA				ND (0.14)
DDD	0.027 COL	0.09	0.599	36	17	NA	ND (0.1)	12	0	0.1
DDE	ND (0.0075)	0.06	0.553	36	10	NA	ND (0.1)	12	0	0.1
DDT	0.015 COL	1.3	30.8	36	23	NA	ND (0.1)	12	0	1
Metals, total (ug/L)[4]										
Arsenic	ND (4.4)	NA	ND (3)	1	0	NA				10
Cadmium	5.6	NA	0.367 J	1	1	NA				5
Chromium, total	ND (2.6)	NA				NA				100
Chromium, hexavalent	ND (4.4)	98	1,100	30	15	NA				100
Copper	ND (4.5)	NA	ND (2)	1	0	NA				5
Iron	140,000	NA	205	1	1	NA				2,000
Lead	ND (2.6)	NA	ND (7)	1	0	NA				ND (2.6)
Manganese	NA	NA	641	1	1	NA				500
Nickel	ND (7.8)	NA	5.41 J	1	1	NA				5
Silver	ND (2.8)	NA				NA				ND (2.8)
Zinc	63	NA	2.25 J	1	1	NA				50
Metals, dissolved (ug/L)[4]										
Arsenic	ND (4.4)	45.4	892	31	17	13.2	51.9	12	9	10
Cadmium	4	NA	ND (0.7)	2	0	NA				5
Chromium, total	ND (2.6)	36.4	388	19	9	NA				100
Chromium, hexavalent	ND (4.4)	NA				NA				100
Copper	ND (4.5)	2.54	2.85 J	2	2	NA				5
Iron	110,000	1,637	17,800	31	28	500	1,940	12	9	2,000
Lead	ND (2.6)	NA	ND (7)	2	0	NA				ND (2.6)
Manganese	NA	471	4,190	21	20	616	2,090	12	12	500
Nickel	ND (7.8)	3.44	4.95 J	2	1	NA				5

Table 1
Estimated Range of Influent Concentrations for GWET System Design
Groundwater Source Control Measure
Arkema Inc.
Portland, Oregon

Data Source	Groundwater Treatability Study[1]	Site-Wide Groundwater Sampling[2]				Recovery Well Pumping Tests[3]				Estimated Influent Concentration
Parameter	Blended	Average	Maximum	No. of Samples	No. of Detections	Average	Maximum	No. of Samples	No. of Detections	
Silver	ND (2.8)	NA				NA				ND (2.8)
Zinc	49	2.86	4.72 J	2	1	NA				50
Inorganics (mg/L)										
Chlorate	45.5	NA				NA				50
Perchlorate	3.2 Q	5.2	119	40	15	NA	ND (0.68)	6	0	5
Chloride	1,600 Q	3,251	39,400	40	40	294	860	12	12	2,500
pH (s.u.)	6.54	6.15	5.02 - 9.71	20	20	NA				6.5
Other Parameters (mg/L)										
Alkalinity	200	NA				NA				200
Calcium	73	NA				NA				75
Nitrate as N	ND (0.21) G	NA				NA				2.5
Nitrogen, Ammonium	5.2	NA				NA				5
Nitrogen, Total Kjeldahl	6.1	NA				NA				5
Phosphate, Total as P	0.18	NA				NA				0.2
Sulfate	1,300 Q	NA				NA				1,000
Total Organic Carbon	10	NA				NA				10
Total Suspended Solids	220 Q	NA				NA				100
Total Volatile Solids	48 Q	NA				NA				25

Notes

(1) - Based on analytical results for groundwater samples collected from on-site monitoring wells for the groundwater treatability study during 2007. Blended sample represents composite samples from MWA-5, MWA-14i, MWA-34i, MWA-43, MWA-44, MWA-52i, MWA-66i, and MWA-68si).

(2) - Based on analytical results for groundwater samples collected from on-site monitoring wells during site-wide groundwater samplings event in 2007 and 2009 (except for total metals and pH, which are based on 2009 event only and dissolved chromium, total, which is based on 2007 event only). Hexavalent chromium, total concentrations based on 2007 and 2009 events.

(3) - Based on analytical results for groundwater samples collected from proposed recovery wells during pumping tests in 2009.

(4) - Dissolved metal concentration may exceed total metal concentration based on data set used to estimate influent concentration.

When necessary, average concentrations calculated assuming concentrations equal to one half of laboratory method detection limit and/or reporting limit for non-detect values.

Non-detect (ND) values reported with laboratory method detection limits (groundwater treatability study and site-wide groundwater sampling) or reporting limit (recovery well pumping tests).

mg/L = milligrams per liter
ug/L = micrograms per liter
s.u. = standard units
NA = data not available
J = Estimated result. Result is less than laboratory method detection limit.

COL = More than 40% RPD between primary and confirmation column results. The lower of the two results is reported.
Q = Elevated reporting limit. The reporting limit is elevated due to high analyte levels.
G = Elevated reporting limit. The reporting limit is elevated due to matrix interference.
V = Elevated reporting limit. The reporting limit is elevated due to limited sample volume.

Table 2
Effluent Quality Objectives for GWET System Design
Groundwater Source Control Measure
Arkema Inc.
Portland, Oregon

Parameter	ODEQ MQL[1]	Estimated Influent Concentration	Effluent Quality Objective	Comments
VOCs (ug/L)[2]				
Benzene	0.5	3	<0.7	Based on LPGAC vendor information
Chlorobenzene	0.5	2,000	<200	Based on LPGAC vendor information; however, FBR treatability study effluent data suggests removal to <130 ug/L
Chloroform	0.5	300	<30	Based on LPGAC vendor information
SVOCs (ug/L)[2]				
Benzo(a)Anthracene	1	ND (1.7)	No design criteria	No design criteria, not detected in influent[5]
Benzo(a)Pyrene	1	ND (1.3)	No design criteria	No design criteria, not detected in influent[5]
Benzo(k)Fluoranthene	1	ND (0.46)	No design criteria	No design criteria, not detected in influent at concentration above MQL
2-Chlorophenol	1	50	<5	Based on LPGAC vendor information
Chrysene	1	ND (1.0)	No design critera	No design criteria, not detected in influent at concentration above MQL
Dibenzo(a)Anthracene	1	ND (1.4)	No design critera	No design criteria, not detected in influent[5]
Fluoranthene	2	ND (5.0)	No design critera	No design criteria, not detected in influent[5]
Hexachlorobenzene	1	ND (2.1)	No design critera	No design criteria, not detected in influent[5]
Pentachlorophenol	2	ND (20)	No design critera	No design criteria, not detected in influent[5]
Pesticides (ug/L)[2]				
Aldrin	0.01	ND (0.0059)	No design criteria	No design criteria, not detected in influent at concentration above MQL
Chlordane	0.1	ND (0.14)	No design criteria	No design criteria, not detected in influent[5]
DDD	0.05	0.1	<0.05	Based on LPGAC vendor information
DDE	0.05	0.1	<0.05	Based on LPGAC vendor information
DDT	0.05	1	<0.05	Based on LPGAC vendor information
Metals (ug/L)[3]				
Arsenic	0.05	10	<10	Based on FBR treatability study effluent
Cadmium	0.1	5	No design criteria	No design criteria, naturally-occurring, incidental removal expected[5]
Chromium, total	10	100	No design criteria	No design criteria, incidental removal expected[6]
Chromium, hexavalent	0.9	100	<16	Based on FBR treatability study effluent
Copper	10	5	No design criteria	No design criteria, naturally-occurring, incidental removal expected[5]
Iron	100	2,000	No design criteria	No design criteria, naturally-occurring, incidental removal expected
Lead	5	ND (2.6)	No design criteria	No design criteria, naturally-occurring, incidental removal expected[5]
Manganese	2	500	No design criteria	No design criteria, naturally-occurring, incidental removal expected
Nickel	10	5	No design criteria	No design criteria, naturally-occurring, incidental removal expected[5]
Silver	1	ND (2.8)	No design criteria	No design criteria, naturally-occurring, incidental removal expected
Zinc	5	50	No design criteria	No design criteria, naturally-occurring, incidental removal expected

Table 2
Effluent Quality Objectives for GWET System Design
Groundwater Source Control Measure
Arkema Inc.
Portland, Oregon

Parameter	ODEQ MQL[1]	Estimated Influent Concentration	Effluent Quality Objective	Comments
Inorganics (mg/L)[4]				
Chlorate	NA	50	<0.015	Based on FBR treatability study effluent
Perchlorate	0.004	5	<0.015	Based on FBR treatability study effluent
Chloride	1	2,500	No design criteria	No treatment
pH (s.u.)	NA	6.5	6.5 to 8.5	Based on FBR treatability study effluent
Other Parameters (mg/L)[4]				
Alkalinity	1	200	No design criteria	No design criteria, naturally-occurring
Calcium	NA	75	No design criteria	No design criteria, naturally-occurring
Nitrate as N	0.1	2.5	<10	Total nitrogen based on FBR treatability study effluent
Nitrogen, Ammonium	1	5		
Nitrogen, Total Kjeldahl	NA	5		
Phosphate, Total as P	0.01	0.2	<1	Total phosphorus based on FBR treatability study effluent
Sulfate	NA	1,000	No design criteria	No treatment
Total Organic Carbon	NA	10	<10	Based on FBR treatability study effluent
Total Suspended Solids	NA	100	<25	Based on FBR treatability study effluent
Total Volatile Solids	NA	25	<25	Based on FBR treatability study effluent

Notes
(1) - Method Quantitation Limit (MQL) based on values published by Oregon Deparment of Environmental Quality (ODEQ) in guidance dated 16
(2) - Estimated effluent concentrations based on approximately 90% removal efficiency for liquid-phase granular activated carbon (LPGAC).
(3) - Estimated effluent concentrations assume iron co-precipitation with clarifier and optional solids filtration.
(4) - Estimated effluent concentrations based on documented performance of fluidized bed reactor.
(5) - Not detected in FBR treatability study effluent above MQL.
(6) - Assumes that majority of chromium present as hexavalent chromium, and total chromium concentrations will be reduced via removal of hexavalent chromium.
Non-detect (ND) values reported with laboratory method detection limits.
FBR = fluidized bed reactor
GWET = groundwater extraction and treatment
LPGAC = liquid-phase granular activated carbon
mg/L = milligrams per liter
ug/L = micrograms per liter
s.u. = standard units
NA = data not available

Table 3
NDPES Permit Effluent Discharge Limits
Performance Monitoring Plan
Groundwater Source Control Measure
Arkema Inc.
Portland, Oregon

Parameter	MQL	Effluent Quality Objective
VOCs (ug/L)[1]		
Benzene	0.5	<0.7
Chlorobenzene	0.5	<200
Chloroform	0.5	<30
SVOCs (ug/L)[1]		
2-Chlorophenol	1	<5
Pesticides (ug/L)[1]		
DDD	0.05	<0.05
DDE	0.05	<0.05
DDT	0.05	<0.05
Metals (ug/L)[2]		
Arsenic	0.05	<10
Chromium, hexavalent	0.9	<16
Inorganics (mg/L)[3]		
Chlorate	NA	<0.015
Perchlorate	0.004	<0.015
pH (s.u.)	NA	5.5 to 9.0
Other Parameters (mg/L)[3]		
Nitrate as N	0.1	<10
Nitrogen, Ammonium	1	
Nitrogen, Total Kjeldahl	NA	
Phosphate, Total as P	0.01	<1
Total Organic Carbon	NA	<10
Total Suspended Solids	NA	<25
Total Volatile Solids	NA	<25

Notes

(1) - Estimated effluent concentrations based on approximately 90% removal efficiency for liquid-phase granular activated carbon (LPGAC).

(2) - Estimated effluent concentrations assume iron co-precipitation with clarifier and optional solids filtration.

(3) - Estimated effluent concentrations based on documented performance of fluidized bed reactor.

MDL = Method Detection Limit
mg/L = milligrams per liter
ug/L = micrograms per liter
s.u. = standard units
NA = data not available
VOC = Volatile Organic Compounds
SVOC = Semi-Volatile Organic Compounds
ODEQ = Oregon Department of Environmental Qu
DDD = dichloro diphenyl dichloroethane
DDE = dichloro diphenyl dichloroethylene
DDT = dichloro diphenyl trichloroethane

Division 2 – Site Work

02110 - Site Clearing

02110
SITE CLEARING

PART 1 – GENERAL

1.01 DESCRIPTION

A. The Work covered by this Section consists of furnishing all equipment, tools, and labor necessary for clearing and grubbing of trees, brush, vegetation, and perishable material of whatever nature; Site preparation activities; removing existing structures, including concrete pads, footing, foundations, abandoned utilities, railroad tracks, and other features; temporarily re-routing the overhead power line; capping and abandoning the designated subsurface utilities; and, preparing the Site for Work. All Work shall be performed in accordance with the limits set forth in the Drawings.

B. Clearing of vegetation shall only occur to the extent that it is necessary to perform the Work. All materials that are cleared and/or removed shall be managed on site in accordance with the Contaminated Material Management Plan.

1.02 MATERIALS OWNERSHIP

A. Except for materials to be stockpiled for later reuse, CONTRACTOR shall place materials in designated on site storage areas in accordance with the Contaminated Material Management Plan and these specifications.

1.03 SUBMITTALS

A. In accordance with the provisions of these Contract Documents.

1.04 QUALITY ASSURANCE

A. All materials procedures, operations, and methods shall be in strict conformance with the Drawings and Specifications, and shall be subjected to strict quality control monitoring as detailed in these Contract Documents and the Construction Quality Assurance/Quality Control (CQA/QC) Plan.

B. The CONTRACTOR shall comply with all requirements of the Oregon Department of Environmental Quality (ODEQ), and other federal, state, and local regulatory agencies controlling environmental reviews and safety during construction.

PART 2 – PRODUCTS

(not used)

PART 3 – EXECUTION

3.01 PREPARATION

A. The CONTRACTOR shall protect and maintain benchmarks and survey control points from disturbance during construction.

B. The CONTRACTOR shall retain the services of a private utility locator for utility clearance at the Site prior to initiation of any ground disturbance at the Site including clearing, grading, and grubbing. Identified active utilities shall be clearly identified with marking paint on the ground surface. Private utility clearance shall be used as an aid to identify active private utilities located at the Site and shall not be used as a comprehensive survey of private site utilities. CONTRACTOR shall be responsible for supplemental means of utility identification and shall proceed with caution when performing the Work in a manner that will allow field identification of utilities not previously marked.

C. Provide erosion control measures to prevent soil erosion and discharge of soil/sediment-bearing water runoff or airborne dust to adjacent properties and the Willamette River in accordance with Division 01430 Section 1.10 of these Technical Specification, the Erosion and Sediment Control Plan and requirements of the 1200C National Pollutant Discharge Elimination System Construction General Permit.

D. Protect existing vegetation and structures to remain against damage.

3.02 SURFACE DEBRIS

A. Prior to issuance of a Notice-to-Proceed, the OWNER'S AGENT will salvage any desired materials from the work areas, and so inform the CONTRACTOR.

B. All unsalvaged surface debris, rubble, and other deleterious materials of a manmade nature that may be encountered within the limits of disturbance shall be managed on site in accordance with the Contaminated Material Management Plan.

3.03 CLEARING AND GRUBBING

A. Clearing and grubbing shall be performed within the limits of disturbance as indicated on the Drawings and only in those areas that require construction activity, such as excavation, filling, removal activities, and

construction access. Clearing and grubbing shall be performed in such a fashion as to minimize as much as possible the overall disturbance to the Site.

B. In the areas to be cleared and grubbed, all trees, stumps, roots, brush, and other vegetation and objectionable organic material shall be removed. Material to be grubbed shall be removed to a depth of not less than 6 inches below the surface elevation of the ground.

C. All trees, logs, brush, crops, grasses, and debris of all kinds, both standing and fallen, shall be cleared, grubbed, and disposed in accordance with Part 3.06 of this Section without damage to adjoining property.

D. Areas outside of the limits of clearing shall be protected from damage and no equipment or materials shall be stored or Work performed in those areas. Wherever possible, equipment and materials shall be stored in an area of the site with a stabilized surface as indicated on the Drawings.

3.04 REMOVAL OF EXISTING STRUCTURES

A. The CONTRACTOR shall remove segments of railroad track, as necessary, to facilitate installation of the extraction well system piping and electrical conduits.

B. The CONTRACTOR shall remove sections of asphalt or concrete pavement, as necessary, to facilitate installation of the GWET System Building. Saw cutting, or other approved method, shall be used to achieve a neat and uniform section for removal.

3.05 UTILITY ABANDONMENT

A. The CONTRACTOR shall cut and cap and/or plug (isolate) all subsurface utilities intersecting the GWET System construction. The segment of the pipeline intersecting the associated work shall be cut and removed to construction. The remaining ends of the upgradient and downgradient segments of the pipe shall be capped and/or plugged to form a water tight seal prohibiting future flow into the pipe ends. These utilities include unused process lines, storm sewer drains, water lines, steam, and other pipelines. Known utilities within the vicinity of the proposed groundwater barrier wall are depicted on the Drawings.

B. Utility pipes designated for removal shall be tapped and the contents inspected prior to cutting and removing the segment of pipe. If liquids are present, the CONTRACTOR shall drain the pipe to facilitate abandonment. The CONTRACTOR shall capture and store all recovered

liquids in an appropriate container for subsequent characterization and disposal.

C. Releases to the subsurface or surrounding work area of liquids recovered from the piping will be immediately remediated by the CONTRACTOR. Release will be remediated by the CONTRACTOR with no additional cost to the OWNER'S AGENT.

D. Pipe tapping and dismantlement will be performed with non-sparking methods and equipment to prevent explosion and fire. Pipe tapping, drainage, and dismantlement will be preformed in accordance with protocols prepared by the CONTRACTOR and approved by the ENGINEER.

E. Dismantling and removal of piping shall be conducted in a manner as to prevent the migration of dust, fluids, contaminants, and debris outside of the work area.

F. The utilities shall be abandoned in a manner that prohibits backfill from entering the conduits during GWET System construction.

3.06 DISPOSAL OF MATERIALS

A. General refuse and construction debris that accumulates during the course of construction shall be disposed in separate containers supplied by the CONTRACTOR. Refuse shall be accumulated and disposed periodically.

END OF SECTION

02201 – Earthwork

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work covered by this Section consists of furnishing all materials, labor, tools, equipment and transportation necessary for all construction as it pertains to the excavating, handling, stockpiling, backfilling, compacting and grading of earthwork. The Work includes all hauling, stockpiling, covering, wetting or drying, dewatering, conditioning, compacting and other operations pertaining thereto for constructing and preparing the earthwork complete in accordance with these Specifications and Drawings, or as directed by the ENGINEER or OWNER'S AGENT.

B. The Work shall include, but not be limited to, the following activities:

1. Construction of earthen berms, ditches and/or swales, and other measures for management of surface water flow;
2. Hauling, conditioning, stockpiling, and management of soils removed for installation of the clearance trench and GWET System building foundation;
3. Excavations and backfilling of soils or trench spoils associated with any portion of the Work required herein, including the clearance trench;
4. Furnishing, preparing, hauling, testing, placing, and compacting structural fill;
5. Furnishing, preparing, hauling, testing, placing, and compacting backfill material;
6. Site grading;
7. Stockpiling and managing materials throughout Work;
8. Dust control; and,
9. Dewatering, transportation, and off-site disposal or treatment and discharge of any accumulated stormwater runoff and groundwater within excavations.

C. No soils shall be removed from the Site unless otherwise instructed or approved by the ENGINEER or OWNER'S AGENT.

D. All soil types shall consist of materials approved by the ENGINEER or OWNER'S AGENT from off-site sources or from on site excavation, as approved for reuse. During construction, the construction area shall be well drained. No materials shall be backfilled when either the material or the surfaces on which it is to be placed are frozen, subject to standing water, or excessively wet or soft, unless otherwise specified by the

ENGINEER or OWNER'S AGENT. When the Work is interrupted by heavy precipitation or freezing temperatures, fill operations shall not be resumed until the ENGINEER or OWNER'S AGENT determines that the moisture content, density and integrity of the previously-placed soils are as specified.

E. All soils shall be removed to the limits and depths as specified on the Drawings and Specifications.

1.02 DEFINITIONS

A. "Common Fill" includes all soils utilized as supplemental fill to backfill excavations or construct earthen berms, as required.

B. "Trench Spoils" includes all excavated materials generated from the excavation of trenches.

C. "Impacted Spoils" includes those soils existing within the extent of the GWET System, or elsewhere that are observed to be contaminated, as determined by the ENGINEER or OWNER'S AGENT.

D. "Obstructive Debris" includes those materials encountered during the Work that would interfere or obstruct the installation of the GWET System.

1.03 REFERENCES

A. Oregon Department of Transportation General Specifications

B. ASTM D-422 Particle-Size Analysis of Soils

C. ASTM D-698 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5 Pound Rammer and 12-inch Drop

D. ASTM D-2216 Standard Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures

E. ASTM D-2487 Classification of Soils for Engineering Purposes

F. ASTM D-6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

G. ASTM D-4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

H. ASTM D-2974 Organic Content of Soils

I. ASTM D-1556 Test Method for Density of Soil In Place by Sand-Cone Method

J. ASTM D-1557 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 Pound Rammer and 18-Inch Drop

K. ASTM D-5084 Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

L. EPA 9095-A Paint Filter Liquids Test

1.04 QUALITY ASSURANCE

A. All materials, procedures, operations, and methods shall be in strict conformance with the Drawings and Specifications, and shall be subject to strict quality control monitoring as detailed herein and in the Construction Quality Assurance/Quality Control (CQA/QC) Plan. The backfilled soils shall conform exactly to the Drawings and Specifications, except as otherwise authorized in writing by the ENGINEER or OWNER'S AGENT.

B. The CONTRACTOR shall comprehend and anticipate construction quality assurance activities by the ENGINEER or OWNER'S AGENT, or others, and account for these activities in the installation schedule.

1.05 SUBMITTALS

A. The CONTRACTOR shall submit to the ENGINEER or OWNER'S AGENT for review a Work Plan proposing methods of excavation, separation of materials (i.e., obstructive debris from trench spoils), backfilling and compaction, proper staging, conditioning, dewatering, and sequencing for the various portions of the Work. Review shall be for method only. The CONTRACTOR shall remain fully responsible for the adequacy and safety of the methods proposed.

B. The CONTRACTOR shall submit to the ENGINEER or OWNER'S AGENT a stockpiling and staging plan for all Work, including soils, trench spoils, obstructive debris, and other materials prior to the commencement of earthwork activities. The plan shall indicate the location and contents of each stockpile. Generalized locations for soil stockpiles are as designated on the Drawings; the final stockpiling plan is subject to the approval of the ENGINEER or OWNER'S AGENT.

C. All imported soils shall be procured from a commercial soil borrow site.

D. The CONTRACTOR shall submit the location of all off-site borrow sources and the results of the tests listed below to the ENGINEER or

OWNER'S AGENT no less than two (2) weeks prior to the anticipated placement of any soil materials.

1.06 SOIL TESTING

A. Prior to the general placement of the fill, and during such placement, the ENGINEER or OWNER'S AGENT shall select areas within the limits of the fill for testing the degree of compaction obtained. The CONTRACTOR shall be responsible for the cost of all quality control testing. The CONTRACTOR shall cooperate fully to allow the ENGINEER or OWNER'S AGENT to perform supplemental quality assurance testing.

B. Payment for any in-place quality assurance testing verification will be made by the OWNER or OWNER'S AGENT. If the results are unsatisfactory, all costs involved in correcting deficiencies in compacted materials to the satisfaction of the ENGINEER or OWNER'S AGENT and any additional costs for retesting will be borne by the CONTRACTOR.

PART 2 – MATERIALS

2.01 COMMON FILL SOILS

Common fill soils shall consist of mineral soil substantially free from organic materials, loam, wood, trash, and other objectionable materials which may be compressible or which cannot be properly compacted. Common fill soils shall not contain stones larger than two (2) inches in largest diameter and shall be classified according to the Unified Soil Classification System (USCS) as SM, SC, SC-SM, ML-CL, ML, or CL. Common fill soils shall have a maximum plasticity index of 40. Common fill soils shall not contain granite blocks, broken concrete, masonry, rubble, or other similar materials. It shall have physical properties such that it can readily spread and be compacted during filling. Snow, ice, and frozen soil shall not be permitted. Common fill soils shall be used as backfill for trench excavated areas. Common fill soils shall be procured from a commercial soil borrow site.

PART 3 – EXECUTION

3.01 GENERAL

A. Prior to earthwork activities, the Site shall be prepared in accordance with Section 02110 – SITE CLEARING.

B. Wet, soft, frozen or otherwise unsuitable subgrade, shall be allowed to dry, prior to any grading or backfilling activities, and as approved by the ENGINEER or OWNER'S AGENT. If a firm subgrade foundation is not achieved, the subbase soils shall be excavated and backfilled with structural fill soils so that fill materials will ultimately be placed on a firm foundation.

C. All excavations shall be cut accurately within the lines and limits shown on the Drawings or otherwise as directed by the ENGINEER or OWNER'S AGENT. All roots, stumps, rock and foreign matter in the sides and bottom of excavations shall be removed. Excavations and filling shall conform to the slope, grade, and shape of the section shown. Care shall be taken not to excavate below the grades indicated, unless otherwise approved by the ENGINEER or OWNER'S AGENT. Excessive excavation shall be backfilled to grade with suitable fill material as directed by the ENGINEER or OWNER'S AGENT with no additional cost to the OWNER/OWNER'S AGENT. Any required shoring activities shall be conducted in accordance with local, state and federal codes, and as approved by the ENGINEER or OWNER'S AGENT. All trenches and structures excavated under this Section shall be maintained until final acceptance of the Work.

D. Neighboring on-site and off-site structures, utilities, roadways, sidewalks, the Willamette River, and other facilities shall be protected from damage caused by settlement, lateral movement, undermining, wash-out and other hazards created by the earthwork operations or delivery of fill materials.

The CONTRACTOR shall be responsible for retaining engineering services required to perform the scope of work established in the Contract Documents, including, but not limited to, engineered shoring, bracing, and support; or, other such matters that require engineering expertise. Associated drawings and calculations shall be prepared and sealed by an Oregon Professional Engineer retained by the CONTRACTOR (herein referred to as CONTRACTOR's Engineer).

E. Pumping and Drainage

1. At all times during construction, and up to the point of actual turnover to OWNER'S AGENT, the CONTRACTOR shall provide and maintain proper equipment and facilities to prevent all surface-water from entering excavations, and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill soils to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. Where required, design of an appropriate dewatering system

will be the responsibility of the CONTRACTOR, submitted to the ENGINEER or OWNER'S AGENT for review prior to commencing Work.

2. Dewatering shall be conducted in such a manner as to remove all water associated with the naturally occurring groundwater table and surface water runoff that has entered the depressed areas.

3. Water entering the limits of the work area from surface runoff shall be re-directed, via berms or ditches, around the perimeter of the excavation, and discharged to stable ground such that no erosion occurs at the point of discharge.

4. Groundwater, or surface water that enters an excavation, shall not be discharged, or permitted to flow, off-site. These fluids that are collected during dewatering operations shall be contained. If the fluids are not re-used in the GWET System construction, they shall be tested and disposed in accordance with these Specifications, or as approved by the ENGINEER or OWNER'S AGENT.

5. Removal of dewatering equipment shall be accomplished after the system is no longer required; the material and equipment constituting the system shall be removed by the CONTRACTOR.

6. All precautions necessary to preclude the accidental discharge of fuel, oil, etc., shall be taken in order to prevent adverse effects on surface water or groundwater quality.

7. Prior to backfilling, the areas to be backfilled shall be fully excavated as required and rough graded in accordance with the Contract Documents. Wherever directed by the ENGINEER or OWNER'S AGENT, any soft boggy, organic, or otherwise unsuitable material shall be excavated so that backfill material will be placed on a firm foundation. The use of explosives shall not be permitted in the performance of site excavation.

8. The CONTRACTOR shall be responsible for maintaining a dry excavation at all times and shall be responsible for providing the necessary equipment to maintain dry excavations. The CONTRACTOR is advised that any water removed from excavations shall be managed as contaminated water, unless otherwise approved by the ENGINEER or OWNER'S AGENT.

9. Groundwater, or surface water that enters an excavation, shall not be discharged, or permitted to flow, off-site. These fluids that are collected during dewatering operations shall be contained. If the

fluids are not re-used in the GWET System construction, they shall be tested and disposed off-site at an approved facility.

F. If the moisture content of any fill material is outside the accepted range to be returned to the excavation, the soil shall be wetted or dried, as appropriate.

1. Fill material that is too wet to permit compaction shall be removed and stockpiled, or spread and allowed to dry. Drying may be assessed by disking, harrowing, or pulverizing until moisture content is reduced to a satisfactory level.

2. Fill material that is too dry shall be wetted uniformly so as to prevent free water appearing on the surface during or subsequent to compaction operations.

G. Any delays in progress due to the necessary wetting or drying of soil are the responsibility of the CONTRACTOR.

H. Soils placed in fill areas shall be graded to smooth true lines, strictly conforming to grades indicated on the Drawings, or otherwise approved by the ENGINEER or OWNER'S AGENT.

I. The CONTRACTOR shall subcontract a Professional Land Surveyor registered in the State of Oregon to certify that all soil material has been placed to the lines, grades, and elevations presented on the Drawings. The CONTRACTOR may use in-house personnel for the certifications, provided the certification is performed by a surveyor registered in the State of Oregon.

J. Fill materials shall be placed in such a manner as to facilitate drainage at all times. Ponding of surface-water runoff shall not be permitted.

K. If compaction or other tests indicate that any portion of the Work does not meet the specified requirements, then the CONTRACTOR shall remove that section, replace and recompact at no additional cost to the OWNER or OWNER'S AGENT. Determinations of the extent of removal and the acceptability of the in-place fill materials shall be made by the ENGINEER or OWNER'S AGENT.

L. If significant precipitation causes wet conditions, placement and compaction activities shall be terminated until the conditions have dried sufficiently to continue according to the ENGINEER or OWNER'S AGENT.

M. Equipment or vehicles shall not be allowed to travel in a single track or form ruts. Any ruts or irregularities formed shall be scarified and re-compacted by the CONTRACTOR at its expense as required and directed by the ENGINEER or OWNER'S AGENT.

N. Prior to backfilling fill materials, the areas shall be prepared in accordance with the Specifications. The existing soils shall be proof-rolled to achieve a compact, uniform grade, and the surface shall be free of stones, roots, or other debris.

O. Inspection

1. Prior to implementing any of the Work in this Section, the CONTRACTOR shall carefully inspect the installed Work of all other Sections and verify that all Work is complete to the point where the Work of this Section may properly commence without adverse impact.

2. If the CONTRACTOR has any concerns regarding the installed Work of other Sections, CONTRACTOR shall notify the ENGINEER or OWNER'S AGENT in writing. Failure to notify the ENGINEER or OWNER'S AGENT prior to conducting Work within this or other Sections will be construed as CONTRACTOR's acceptance of the related Work of all other applied Sections.

P. The CONTRACTOR shall protect on-going and completed work from precipitation, excessive heat, freezing, and other elements to avoid compromising the integrity of prior Work. Prior Work affected by such conditions shall be repaired by the CONTRACTOR at no additional cost to the OWNER or OWNER'S AGENT.

Q. The CONTRACTOR shall provide erosion-control measures to prevent erosion or displacement of soils, or other Work materials, and discharge of sediment-laden runoff or airborne dust to adjacent properties or water bodies.

3.02 EXCAVATION

A. A trench shall be excavated in the location depicted on the Drawings to facilitate installation of the GWET System utilities and building foundation. Trenches shall have a minimum bottom width of three feet.

B. Excavation shall be made to the depths shown on the Drawings. Care shall be exercised when removing soil as to prevent over-excavation.

C. All excavation activities shall be conducted in compliance with all applicable OSHA regulations. All excavations shall be conducted in a safe and stable manner. The slopes of the excavation shall be stable at all times. The CONTRACTOR is responsible for the design and installation of temporary shoring, if required.

D. If unsuitable subgrade materials are uncovered during excavation or otherwise, it shall be removed, stockpiled for conditioning, disposal, replaced, compacted, and graded with structural fill, as required and approved by the ENGINEER or OWNER'S AGENT.

E. Excavation of materials shall be accomplished using properly sized hydraulic excavators or equivalent. The equipment will operate so as to eliminate the potential for spreading contamination onto uncontaminated areas or surfaces.

E. Obstructive debris encountered during trench excavation and the GWET System utilities and building foundation shall be segregated and stockpiled on site in accordance with the CMMP.

H. Impacted spoils encountered during trench excavation and the GWET System utilities and building foundation shall be segregated and stockpiled on site in accordance with the CMMP. Impacted spoils included those materials that exhibit visual gross contamination, as determined by the ENGINEER or OWNER'S AGENT. The CONTRACTOR shall stage impacted spoils on minimum 30-mil PVC geomembrane.

3.03 APPROVAL OF SUBGRADE

A. CONTRACTOR shall notify ENGINEER or OWNER'S AGENT when excavations have reached required subgrade, or when the waste materials have been removed, to the extent practical, from a specific location.

B. If ENGINEER or OWNER'S AGENT determines that unsatisfactory soil materials are present, the CONTRACTOR shall continue excavation and replace with acceptable backfill material, as directed.

C. Where accessibility permits; i.e., all locations except on side slopes equivalent to three (3) horizontal to one (1) vertical or steeper, proof-roll subgrade, including all waste materials, with heavy loaded tandem to identify soft pockets and areas of excess yielding, otherwise, compact subgrade by other methods approved by ENGINEER or OWNER'S AGENT.

D. CONTRACTOR shall reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the ENGINEER or OWNER'S AGENT.

3.04 BACKFILLING

A. With the exception of large debris and impacted soils, as determined by the ENGINEER or OWNER'S AGENT, trench spoils removed during trench excavation shall be placed back in the excavation and compacted. It is the CONTRACTOR's responsibility to compact the trench spoils to the extent necessary, to ensure that sloughing, sliding, or buckling will not occur during subsequent groundwater barrier wall installation through the backfill.

B. Final grade shall be backfilled to the contours and elevations indicated on the Drawings, or as directed by the ENGINEER or OWNER'S AGENT. Grading and placement of the various materials shall be in conformity with the tolerances specified in this Specification.

3.05 RECOVERY WELL INSTALLATION

A. Recovery wells will be installed as indicated on the Drawings, and in accordance with the construction methods presented in the Performance Monitoring Plan, and with approval of the ENGINEER and OWNER'S AGENT.

B. Wells be constructed in accordance federal, state, and local regulations, including Oregon Administrative Rules (OARs) 690-200 and 690-240.

3.06 PIEZOMETER INSTALLATION

A. Piezometers will be installed as indicated on the Drawings, and in accordance with the construction methods presented in the Performance Monitoring Plan, and with approval of the ENGINEER and OWNER'S AGENT.

B. Wells be constructed in accordance federal, state, and local regulations, including Oregon Administrative Rules (OARs) 690-200 and 690-240.

3.07 EXCESS MATERIALS

A. All general waste or debris shall be containerized on-site and periodically disposed off-site in accordance with these Specifications.

B. Suitable materials, as determined by tests discussed in these Specifications, shall be classified and stockpiled in approved areas for immediate or future use.

C. Stockpiles shall be graded to drain; no surface-water ponding is permitted on stockpiles. Stockpiles shall be covered with plastic sheeting or other material to preserve the soil integrity. Proper erosion controls; i.e., silt fence, shall be installed at the perimeter of the stockpile.

D. Obstructive debris, impacted spoils, and other unsuitable material that are not replaced as backfill shall be stockpiled on a minimum 30-mil geomembrane that is continuously seamed. The material shall also be covered to provide a protective envelope to prevent contact with any precipitation or surface water runoff. These materials shall be disposed on-site, as approved by the ENGINEER or OWNER'S AGENT, and in accordance with the CMMP. All activities shall comply with the Contaminated Material Management Plan.

3.08 GRADING

A. Uneven areas and low spots which may develop in the backfilling operations shall be eliminated via minor excavations or placement of appropriate fill materials. Levels, profiles and contours of the final site configuration shall be maintained as established on the Drawings.

B. The areas to be backfilled shall be uniformly graded to within the limits of grading under this Section. A smooth finished surface shall result within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades to the satisfaction of the ENGINEER or OWNER'S AGENT.

C. Constructed slopes shall be blended into existing undisturbed areas gradually in order to provide neat, clean transition zones. Feathering of constructed slopes into existing grades shall be accomplished to promote natural drainage and to eliminate possible surface-water ponding.

D. The right is reserved by the ENGINEER or OWNER'S AGENT to make minor adjustments or revisions in lines or grades if found necessary as the Work progresses, due to discrepancies on the Drawings or in order to obtain satisfactory construction. Any suspected discrepancies shall be reported to the ENGINEER or OWNER'S AGENT as soon as detected.

3.09 CRITERIA AND TOLERANCES

A. Compaction and moisture criteria and tolerances are discussed in Part 3.05 of this Section.

C. In recognition of the moisture-density relationship of soils, the ENGINEER or OWNER'S AGENT may direct that the compaction and moisture content tolerances be modified if required by variabilities in the soils. This decision, if required, will be based on the ENGINEER or OWNER'S AGENT interpretation of the laboratory analysis for each soil.

D. No additional payment shall be made for quantities of soils placed in excess of that amount required to achieve the minimum specified thickness.

3.10 FIELD QUALITY CONTROL

A. The CONTRACTOR shall test the in-place density and moisture content of the structural fill soils by nuclear methods in accordance with ASTM D-6938, and these Specifications. The testing shall be conducted at a frequency not less than three tests per lift per area of interest. Every 25th nuclear density test shall be verified in accordance with ASTM D-1556 and ASTM D-2216. All test locations shall be recorded and provided on the "As-Built" Drawings.

B. The CONTRACTOR shall provide a minimum of 24 hours notice to the ENGINEER or OWNER'S AGENT when each compacted lift is ready for testing.

C. The CONTRACTOR shall provide access and repair any damage to subgrade caused by correctly performed tests, and cooperate in other ways necessary to permit the ENGINEER or OWNER'S AGENT to conduct testing when and where he/she desires and as expeditiously as possible.

D. Fill material shall not be placed over a lift which has not been tested and accepted by the ENGINEER or OWNER'S AGENT.

E. All placement operations shall comply with all requirements of these Specifications.

END OF SECTION

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02232 – Granular Materials

PART 1 - GENERAL

1.01 DESCRIPTION

Work covered by this Section consists of furnishing all labor, materials, tools, equipment and incidentals necessary for obtaining and placing the granular components as indicated on the Drawings and specified herein.

1.02 DEFINITIONS

"Dense-Graded Aggregate (DGA)" includes all aggregate utilized for stabilization of disturbed areas and construction of access roads, if necessary.

1.03 REFERENCES

A. AASHTO T 27 Sieve Analysis of Fine and Coarse Aggregates

B. 2005 Oregon Department of Environmental Quality Erosion and Sediment Control Manual

C. 2008 Oregon Standard Specifications for Construction, Volume 2

1.04 QUALITY ASSURANCE

All materials, procedures, operations, and methods shall be in strict conformance with the Drawings and these Specifications, and shall be subject to strict quality control monitoring as detailed herein and in the Construction Quality Assurance/Quality Control (CQA/QC) Plan. The placed granular materials shall conform exactly to the Drawings and these Specifications, except as otherwise authorized in writing by the ENGINEER or OWNER'S AGENT.

1.05 SUBMITTALS

A. The CONTRACTOR shall submit the location of all borrow pits to the ENGINEER or OWNER'S AGENT no less than two weeks prior to the anticipated placement of any granular materials.

B. The CONTRACTOR shall submit a 50-pound sample from each of the suppliers proposed to furnish the required quantity of granular materials. The samples shall be submitted to the ENGINEER or OWNER'S AGENT no less than two weeks prior to the anticipated placement of any granular materials.

C. Dense-Graded Aggregate

1. The CONTRACTOR shall submit the results of the particle-size analysis for dense-graded aggregate conducted in accordance with AASHTO T 27 for every 1,000 cubic yards of materials imported to the Site.

2. The test results shall verify that the material meets the technical requirements of these Specifications. The test results shall be submitted to the ENGINEER or OWNER'S AGENT no less than one week prior to the anticipated placement of granular materials.

1.06 DELIVERY

The CONTRACTOR shall notify the ENGINEER or OWNER'S AGENT one (1) week in advance of delivery of all granular materials. The CONTRACTOR shall stockpile granular materials only at a location approved by the OWNER and/or ENGINEER or OWNER'S AGENT.

PART 2- MATERIALS

2.01 GRANULAR MATERIALS

A. Dense-Graded Aggregate

1. Aggregate shall consist of hard, strong, durable particles that are free of any materials, roots, trees, stumps, concrete, construction debris, other organic matter, and deleterious materials.

2. The aggregate shall meet the gradation requirements set forth by the Oregon Standard Specifications for Construction for ¾-inch dense-graded aggregate as given below and as determined by AASHTO T 27.

Percent Passing (by weight)

Sieve Size	**1 1/2" – 0**
1"	100
¾"	90-100
½"	-
3/8"	55-75
¼"	40-60
No. 10	*

* Of the fraction passing the ¼-inch sieve, 40% to 60% shall pass the No. 10 sieve

PART 3 - EXECUTION

3.01 INSPECTION

A. The CONTRACTOR shall verify that finished grades, slopes, and elevations are level with the existing grades and conform to the specified requirements. Misgraded Work shall be corrected at no additional cost to the OWNER or OWNER'S AGENT. CONTRACTOR shall notify the ENGINEER or OWNER'S AGENT immediately if a specified grade, slope or elevation appears inconsistent with the others specified.

B. At the beginning of each day's Work, the ENGINEER or OWNER'S AGENT will inspect the previously placed granular materials and institute whatever corrective action, if any, that the ENGINEER or OWNER'S AGENT deems appropriate, at no extra cost to the OWNER or OWNER'S AGENT, unless the action requested is clearly beyond the scope of this Contract. This may include, but is not limited to the removal of unsuitable granular materials.

3.02 PLACEMENT OF GRANULAR MATERIALS

A. Dense-graded aggregate shall be used to stabilize access and on-site roadways, as necessary. Any additional roadways required to ensure access to all areas of the Work shall be constructed as deemed necessary by the CONTRACTOR.

B. Granular materials shall be placed, not dumped, to the limits and grades shown on the Drawings.

C. Material shall be spread and graded in one lift to the thickness shown on the Drawings and compacted with a steel roller.

3.03 CRITERIA AND TOLERANCES

A. Final grades shall be within two tenths of one (0.2) foot below to five tenths of one (0.5) foot above (-0.2 to +0.5) the grades and contours indicated on the Drawings, or as dictated by changed field conditions, and approval by the ENGINEER or OWNER'S AGENT. Regardless of the final grade tolerances, the thickness of the granular materials shall meet the minimum thickness as stated in each application.

B. No additional payment will be made for quantities of soils placed in excess of that amount required to achieve the minimum specified thickness.

3.04 FIELD QUALITY CONTROL

A. The ENGINEER or OWNER'S AGENT will perform thickness measurements in the field to determine compliance with these Specifications.

B. CONTRACTOR shall comply with all quality assurance requirements specified herein.

END OF SECTION

02250 – Transportation and Disposal of Materials

PART 1 - GENERAL

1.01 DESCRIPTION

The CONTRACTOR shall furnish all labor, materials, tools, and equipment, required to transport all concrete/asphalt debris, piping, spoils, liquids, and other waste materials for recycling and/or disposal as specified in these Contract Documents and the Contaminated Material Management Plan.

1.02 REGULATORY REQUIREMENTS

A. The concrete/asphalt debris, piping, spoils, liquids, and other waste materials removed during the Work shall be properly segregated, characterized recycled and/or disposed in accordance with these Specifications and all federal, state, and local regulations.

B. The CONTRACTOR shall comply with all applicable regulatory requirements and all federal, state, or local laws, codes, and ordinances which govern the transportation and disposal of material to be removed from the Site.

C. The CONTRACTOR shall obtain any and all permits required for transport and disposal and comply with all applicable requirements.

1.03 TRANSPORTATION

A. The CONTRACTOR shall be responsible for transporting concrete/asphalt debris, piping, spoils, liquids, and other waste materials to the appropriate off-site facility for recycling or disposal.

B. If off-site recycling or disposal is required by the ENGINEER or OWNER'S AGENT the CONTRACTOR shall be responsible for all sampling and testing required by the off-site recycling or disposal facility.

C. The CONTRACTOR shall provide all necessary traffic controls at the ingress and egress location along Northwest Front Avenue, such as flagmen, during trucking operations, or as otherwise directed by the ENGINEER or OWNER'S AGENT.

D. No queuing of trucks shall be permitted on Northwest Front Avenue. Any queuing of trucks that occurs on-site shall not interfere with daily traffic.

1.04 SUBMITTALS

A. In accordance with Section 01300 – SUBMITTALS and the Construction Quality Assurance/Quality Control (CQA/QC) Plan.

B. The CONTRACTOR shall submit written documentation certifying that the recycling or disposal facility is in compliance with all regulations and permits, and is willing to accept the material. A copy of the most recent inspection report shall be submitted to the ENGINEER or OWNER'S AGENT verifying that the facilities have no violations or other environmental conditions that affect the satisfactory operation of the facility.

C. If off-site recycling or disposal is required by the ENGINEER or OWNER'S AGENT the CONTRACTOR shall submit copies of results of any tests performed at the disposal facility by the disposal facility prior to waste acceptance. The CONTRACTOR shall be responsible for performing any tests required by the receiving facility for the disposal of materials.

D. The CONTRACTOR shall prepare and submit to the ENGINEER or OWNER'S AGENT information regarding transporting materials from the Site, including type of trucks and/or trailers, method of transportation, the transport route to the facility, the anticipated number of trips, and the proposed types and locations of necessary traffic control devices to be used by the CONTRACTOR. The CONTRACTOR shall also list all federal, state, and local regulations that must be complied with and all permits that must be obtained.

E. The CONTRACTOR shall not commence with the removal of concrete/asphalt debris, piping, spoils, liquids, and other waste materials from the Site until the ENGINEER or OWNER'S AGENT has approved the submitted information.

F. The CONTRACTOR shall submit copies of weigh tickets or other receipts provided by the disposal facility to the ENGINEER or OWNER'S AGENT as evidence of the arrival and disposal of the material at the disposal site, including any salvaging, recycling, or recovery. The documentation submitted to the ENGINEER or OWNER'S AGENT shall, at a minimum, identify the origin of the material, the quantity of the material (tons, cubic yards, units, etc.), the identification of the transport vehicle, the type of material, and the date the material was disposed at the facility.

1.05 DISPOSAL FACILITIES

A. The OWNER and OWNER'S AGENT reserve the right to direct the CONTRACTOR to dispose material at a facility identified by the OWNER'S AGENT.

B. Unless directed by the OWNER'S AGENT to dispose material at a particular facility, the CONTRACTOR shall be responsible for locating disposal facilities; e.g., solid waste disposal facility, hazardous waste disposal facility, etc., which shall accept all materials removed from the Site to be disposed, including materials generated from site clearing and grubbing or other activities performed within the areas of Work, as applicable.

C. The disposal facilities shall be approved by the ENGINEER or OWNER'S AGENT. The disposal facility shall be in compliance with all current federal and state regulations governing construction and operation of an appropriate waste disposal facility.

1.06 ALTERNATE DISPOSAL FACILITY

A. In the event that the identified and approved facilities cease to accept the stated materials or the facility ceases operations or the OWNER'S AGENT rejects the facility, it is the CONTRACTOR's responsibility to locate an alternate approved and permitted facility for accepting materials. The CONTRACTOR is responsible for making the necessary arrangements to utilize the facility and the alternate facility must be approved in writing by the OWNER'S AGENT in the same manner and with the same requirements as the original facility before the concrete/asphalt debris, spoils, waste materials, impacted water, or other materials, are removed from the Site.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

3.01 GENERAL

A. No vehicle shall leave the Site unless it is in a clean condition, free of loose dirt or loose material on tailgates, axles, wheels, etc.

B. No vehicle shall leave the Site with concrete/asphalt debris, piping, spoils, liquids, or other waste materials, unless the materials are secure and tightly covered/tarped or contained so that no material, dust, or water is

able to drop off, blow off, or leak out. Trucks shall be lined at the discretion of the ENGINEER or OWNER'S AGENT.

C. Loading and transportation of concrete/asphalt debris, piping, spoils, liquids, and other waste materials shall be conducted in a manner as to eliminate all dust.

D. All personnel, equipment, and trucks shall enter and exit the Site from Northwest Front Avenue. Prior to exiting the Site all decontamination requirements of these Specifications and the Site Health and Safety Plan shall be met.

E. In the event that the materials being transported are dropped or spilled from the truck during transportation, the CONTRACTOR shall take the following steps.

1. If contents are spilled on-site, the CONTRACTOR shall immediately notify the ENGINEER or OWNER'S AGENT. The CONTRACTOR is responsible for immediate removal of the waste materials and cleaning the area to the satisfaction of the ENGINEER or OWNER'S AGENT.

2. If contents are spilled off-site, the CONTRACTOR shall immediately notify the ENGINEER, OWNER'S AGENT, OWNER, and the appropriate authorities; i.e., local fire and police departments, Oregon Department of Environmental Quality project manager, and Oregon Emergency Response System, if necessary. The appropriate clean up activities shall be coordinated without delay with these authorities.

3. The CONTRACTOR shall bear full responsibility for any required clean up of all spilled material. All clean up and remediation activities associated with spilled materials shall be performed at no extra cost to the OWNER or OWNER'S AGENT.

F. The CONTRACTOR shall be responsible for managing, handling, conditioning, transporting, and disposing of all material that is designated to be removed from the Site.

G. No material shall exit the Site unless it has been analyzed and documented (e.g., manifest), as necessary.

H. No material, except dewatering and decontamination liquids, shall exit the Site that fails the Paint Filter Liquid Test, EPA Method 9095A.

3.02 TRANSPORTATION LOG

The CONTRACTOR shall maintain at the Site a log of vehicles leaving the Site with waste materials. The log shall indicate the vehicle identification number, date and time of departure, contents of the truck, and approximate volume or quantity of material carried.

END OF SECTION

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02290 – Soil Erosion and Sediment Control

PART 1- GENERAL

1.01 DESCRIPTION

A. The Work covered by this Section consists of furnishing all materials, equipment, tools and labor to construct, maintain, and remove soil erosion and sediment control systems.

B. The Work to be performed includes, but is not limited to the installation or construction of silt fence, storm drain inlet protection, and any other controls necessary as specified herein, shown on the Drawings, or required to eliminate the potential for sediment-laden surface water to flow beyond the limits of disturbance.

1.02 REFERENCES

A. 2005 Oregon Department of Environmental Quality Erosion and Sediment Control Manual

B. 2008 Portland Erosion and Sediment Control Manual

1.03 QUALITY ASSURANCE

A. All materials, procedures, operations, and methods shall be in strict conformance with the Drawings and these Specifications, and shall be subject to strict quality control monitoring as detailed herein. The installed erosion and sediment controls shall conform exactly to the Drawings and these Specifications, except as otherwise authorized in writing by the ENGINEER or OWNER'S AGENT.

B. The CONTRACTOR shall comprehend and anticipate quality assurance activities and account for these activities in the installation schedule.

C. The CONTRACTOR shall periodically inspect and maintain proper erosion and sediment control measures throughout the duration of the project, including weekends and holidays. All erosion and sediment controls shall be maintained as necessary for rainfalls one-half inch (1/2") or greater.

1.04 SUBMITTALS

Product data shall be submitted as indicated in these Contract Documents.

PART 2 - PRODUCTS

2.01 SOIL EROSION AND SEDIMENT CONTROL MATERIALS

Silt Fence: The CONTRACTOR shall supply silt fence to control surface-water runoff and sediment in locations indicated on the Drawings. As specified in the Portland Erosion and Sediment Control Manual, silt fence material shall be heavy-duty fabric and shall retain 85 percent of the soil by weight. The fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 to 120 degrees Fahrenheit.

The CONTRACTOR shall submit the manufacturer's product data to the ENGINEER or OWNER'S AGENT for approval.

PART 3 - EXECUTION

3.01 TRANSPORTATION, HANDLING AND STORAGE

Materials shall be handled in such a manner as to prevent damage to the material. Materials shall not be dropped or dragged over the ground. Any materials damaged shall be replaced at no expense to the OWNER or OWNER'S AGENT.

3.02 EROSION AND SEDIMENT CONTROL STRUCTURES

Silt Fence: The CONTRACTOR shall install silt fence in accordance with the Specifications and installation instructions provided by the manufacturer, as shown on the Drawings, or as directed by the ENGINEER or OWNER'S AGENT. Presiding authority shall be as follows, in descending order: ENGINEER or OWNER'S AGENT direction, Drawings, Specifications, manufacturer's installation instructions. The CONTRACTOR shall maintain the silt fence until permanent cover is established, and the entire Site is stabilized, as approved by the ENGINEER or OWNER'S AGENT.

END OF SECTION

02585 – Utility Poles

PART 1 - GENERAL

1.01 SUMMARY

A. The Work covered by this Section consists of installing utility poles for overhead electrical supply as shown on the Drawings.

B. The Work includes, but is not limited to, installing new utility poles, crossarms, and appurtenances within the locations as shown on the Drawings.

C. Related Sections:
Section 16000 – Electrical Work – General Requirements

1.02 REFERENCES

A. American National Standards Institute:
ANSI C135.30 - Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction.
ANSI C135.4 - Zinc-Coated Ferrous Eyebolts and Nuts for Overhead Line Construction.
ANSI C135.5 - Zinc-Coated Ferrous Eyenuts and Eyebolts for Overhead Line Construction.
ANSI C135.6 - Zinc-Coated Ferrous Crossarm Braces for Overhead Line Construction.
ANSI O5.1 - Wood Poles, Specifications and Dimensions.

B. American Society for Testing and Materials:
ASTM A475 - Standard Specification for Zinc-Coated Steel Wire Strand.
ASTM A675/A675M - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
ASTM D390 - Standard Specification for Coal-Tar Creosote for the Preservative Treatment of Piles, Poles, and Timbers for Marine, Land, and Fresh Water Use.

C. American Wood-Preservers' Association:
AWPA C4 - Poles - Preservative Treatment by Pressure Processes.
AWPA C25 - Sawn Crossarms - Preservative Treatment by Pressure Processes.

D. Institute of Electrical and Electronics Engineers:
IEEE C2 - National Electrical Safety Code.
IEEE C135.1 - Standard for Zinc-Coated Steel Bolts and Nuts for Overhead Line Construction.

IEEE C135.2 - Standard for Threaded Zinc-Coated Ferrous Strand-Eye Anchor Rods and Nuts for Overhead Line Construction.

E. Underwriters Laboratories Inc.:
UL 96 - Lightning Protection Components.

1.03 SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate pole locations and details of pole line construction.

C. Product Data: Submit data showing materials and construction of hardware.

1.04 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of poles, guys, anchors, and required horizontal and vertical clearances.

Operation and Maintenance Data: Submittals for Project Closeout.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with local, state, federal, and Portland General Electric, and other applicable standards.

B. Perform Work in accordance with IEEE C2, applicable loading conditions, Grade B construction

1.06 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum three (3) years experience.

1.07 PRE-INSTALLATION MEETINGS

A. Section 01300 - Administrative Requirements: Pre-installation meeting.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Section 16010 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Protect poles from damage and decay by stacking to allow free circulation of air. Maintain 1 foot minimum spacing between bottom pole and ground or ground vegetation. Do not store poles above decayed or decaying wood.

C. Stack poles stored for more than two weeks on creosoted or decay-resistant skids arranged to support poles without noticeable pole distortion.

D. Handle treated poles with tools to not produce indentations greater than 1 inch deep. Do not drag treated poles along ground. Do not apply tools to section of treated poles between 1 foot above and 2 feet below ground line.

PART 2 - PRODUCTS

2.01 POLES

A. Wood Poles: ANSI O5.1, treated Douglas fir poles of minimum length and class indicated.

B. Select poles for straightness and minimum sweeps and short crooks.

C. Preservative: ASTM D390.

D. Apply preservative to AWPA C4 with minimum net retention of 12 pounds per cubic foot obtain complete sapwood penetration.

2.02 CROSSARMS

A. Crossarms and Timbers: Straight-grained Douglas fir free of twists to within 0.1 inch per foot (1 percent) of length, with bends and twists in only one direction.

B. Preservative: ASTM D390.

C. Apply preservative to crossarms to AWPA C25 with minimum net retention of 8 pounds per cubic foot.

D. Crossarm Dimensions: 4.25 x 5.25 inches x 9 feet

2.03. POLE HARDWARE

A. Crossarm Braces: ANSI C135.6, structural steel galvanized to ASTM A675/A675M.

B. Miscellaneous Pole Hardware: Hot-dipped galvanized after fabrication.

C. Angle Braces: 60 inch span x 18 inches, drop-formed in one piece from 1-3/4 x 1-3/4 inch angle.

D. Flat Braces: 1/4 x 1-1/4 inch.

E. Eye Bolts and Nuts: ANSI C135.4.

F. Anchor Rods and Nuts: IEEE C135.2.

G. Bolts and Nuts: IEEE C135.1.

H. Eyenuts and Eyelets: ANSI C135.5.

I. Ground Rods: ANSI C135.30.

PART 3 - EXECUTION

3.01. PREPARATION

A. Plug unused holes in poles using treated wood dowel pins. Treat field-cut gains and field-bored holes with preservative.

B. Cut gains on face of pole, with gained surfaces in parallel planes.

C. Shorten poles when required by cutting from top end. Apply hot preservative to shortened end of pole.

3.02. EXISTING WORK

A. Remove abandoned poles and hardware.

B. Extend existing pole line installations using materials and methods [compatible with existing installations, or] as specified.

C. Repair existing poles and hardware to remain. Remove abandoned crossarms and hardware from existing poles to remain.

3.03. INSTALLATION

A. The depth and size of holes shall be in accordance with Utility requirements.

B. Dig setting holes large enough to permit use of tampers to full depth. Place earth in maximum 6 inch layers and pack to 95 percent density.

C. Set poles in straight line. Place curved poles with curvature in line with lead pole. Maintain even grade.

D. Set poles plumb. Rake poles located at corners, angles, and dead ends so poles are plumb after line installation.

E. Do not install poles along edge of cuts and embankments or where soil is in danger of washing out.

F. Set crossarms at right angles to line for straight runs; and to bisect angle of turns in line direction.

G. Install two braces for each crossarm.

H. Install anchor rods, guy strands, and accessories.

I. Install [ground rods] [butt plates] and ground wire.

J. Identify each pole using aluminum marker stamped with characters 2.5 inches high minimum. Locate for maximum visibility from roadway and fasten with aluminum nails.

3.04. FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Field test at least one anchor of each capacity installed to rated holding power.

END OF SECTION

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02831 – Chain Link Fences and Gates

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work covered by this Section consists of installing a permanent, 6-foot high chain link security fence with three strands of barbed wire as shown on the Drawings.

B. The Work includes, but is not limited to, installing new fence posts, and appurtenances within the locations as shown on the Drawings.

C. During Work, the perimeter of the entire Site shall be secure with existing fence and/or temporary fence at all times; barricades, building walls, and other temporary measures may be considered.

1.02 REFERENCES

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred in the text by the basic designation only.

B. Federal Specifications (Fed. Spec.):

RR-F-191K/GEN	Fencing, Wire and Post Metal (and Gates, Chain Link Fence Fabric, and Accessories) (General Specification)
RR-F-19 1/1d	Fencing, Wire and Post, Metal (Chain-Link Fence Fabric) (Detail Specification)
BR-F- 19 1/2d	Fencing, Wire and Post, Metal (Chain-Link Fence Gates) (Detail Specification)
RR-F-19 1/3d	Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces) (Detail Specification)
RR-F- 19 1/4d	Fencing, Wire and Post, Metal (Chain-Link Fence Accessories) (Detail Specification)

C. American Society for Testing and Materials (ASTM) Publications:

ASTM A 123	Zinc (Hot Galvanized) Coatings of Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strips.
ASTM F 567	Installation of Chain-Link Fence.
ASTM A 120	Pipe, Steel, Black and Hot-dipped Zinc-coated (Galvanized) welded and Seamless, for Ordinary Uses.
ASTM C 94	Ready-mixed Concrete.

ASTM B 429	Framework.
ASTM A 569	Steel Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality.
ASTM A 570	Steel, Sheet & Strip, Carbon, Hot-Rolled Structural Quality.

D. Underwriters Laboratories (UL) Inc. Publication:

UL 467	Grounding and Bonding Equipment

1.03 QUALITY CONTROL

A. In accordance with Section 01400 – QUALITY CONTROL.

B. Installation of the chain link fence shall be accomplished by an installation contractor, approved by the manufacturer, having a minimum of three (3) years experience in the satisfactory performance of similar work.

1.04 SUBMITTALS

A. In accordance with Section 01300 – SUBMITTALS.

B. Specific work history of the chain link fence installer shall be provided.

C. The CONTRACTOR'S submittals shall include a plan layout; spacing of components; and a schedule of components.

D. The CONTRACTOR shall submit manufacturer's installation instructions to the ENGINEER or OWNER'S AGENT a minimum of two (2) weeks prior to fence installation.

PART 2 - PRODUCTS

2.01 GENERAL

A. All new materials shall conform to Fed. Spec. RR-F-191 and detailed specifications forming the various parts thereto. Chain link security fence shall be constructed at the locations and alignment shown on the Drawings. All chain link security fence materials shall be the standard product of one manufacturer who is regularly engaged in the manufacture of chain link security fencing. Products which differ only in nonessential details from those specified herein will be acceptable. Drawings shall be submitted for any deviations to the ENGINEER or OWNER'S AGENT or its authorized

representative.

B. Delivery, Storage and Protection: Materials shall be delivered to the Site in an undamaged condition. Materials shall be carefully stored off the ground to provide proper protection against oxidation caused by ground contact.

C. Storage and Protection of Existing Fence Materials: Materials obtained through the removal of existing chain link fence(s) to be reused shall be stored and protected as stated in paragraph B above. All materials stored for reuse shall be cleaned and recoated as necessary in accordance with the following specifications at the discretion of the ENGINEER or OWNER'S AGENT prior to storage.

D. Temporary Fence: The temporary fence shall be 6-foot high, chain link fence that provides continuous security when abutted to the existing fence or other structures. The post shall be secured, i.e., in concrete or other means approved by the ENGINEER or OWNER'S AGENT.

2.02 POSTS, RAILS, AND BRACES

A. Fed. Spec. RR-F- 191/3 galvanized steel, 1.8 ounce per square foot, except as modified herein.

B. Post Braces and Truss Rods: For each gate, corner, pull or end post. Truss rods shall be provided with turnbuckles or other equivalent provisions for adjustment. Truss rods shall be 3/8 inch diameter.

C. Intermediate Posts: C-section line posts of the same dimension as H-post, 0.120 inch wall thickness, and fabricated from steel conforming to ASTM A570, Grade 33 may be furnished in lieu of H- or round posts.

D. Posts, Braces, Rails, and Gate Frames: Steel pipe manufactured from steel conforming to ASTM A 569, cold-rolled. Steel pipe shall be of the same external dimension and minimum wall thickness as Class 1 - steel pipe as listed in Fed. Spec. RR-F-191/3. Post, brace, nail and gate frame sizes shall be as indicated on the Drawings.

E. Barbed Wire Support Arms: All posts shall be provided with pressed copper-bearing galvanized steel extension arms. All end posts shall be provided with heavy malleable iron extension arms. All extension arms shall be heavily coated with zinc by the hot-dip process. Each extension arm shall be sized to carry three strands of 12-1/2 GA, 4 PT, Class III barbed wire at an angle of 45 degrees, the upper strand 12 inches out from the fence line and 12 inches above the top of the fabric. Arms shall be the type that allow top rail to pass through their bases to form a continuous

brace. Barbed wire arms shall be of sufficient strength to withstand a weight of 250 pounds applied at the outer or the top strand of barbed wire.

F. Barbed Wire: Barbed wire shall be of the four-point pattern, composed of three strands of No. 12-1/2 gauge copper-bearing steel wire, Class III with large hard temper barbs spaced a maximum of 5 inches apart, and shall be heavily galvanized by the hot-dip process.

2.03 CHAIN-LINK FABRIC

A. Fed. Spec. RR-F-191/1; Type I, 1.2 ounces per square foot coating, or Type II, 0.40 ounce per square foot coating, and shall be 9-gauge wire woven in a 2-inch mesh. Fabric width shall be as indicated.

B. Attach fabric by method standard with the manufacturer, except that welding will not be permitted.

2.05 CONCRETE

A. ASTM C 94, using 3/4 inch maximum-size aggregate, and having minimum compressive strength of 3,000 psi at 28 days.

2.06 COMPONENTS

A. Top, bottom, and upright gate frame members shall be minimum 1 5/8-inch O.D. steel pipe.

B. Fence fabric shall be 1.75-inch diamond mesh, galvanized steel wire, interwoven 9-gauge thick with top selvage twisted tight and bottom selvage knuckle and closed.

C. Caps shall be galvanized steel sized to post dimension.

D. All sleeves, bands, clips, rail bends, tensions, bars, fasteners and fittings shall be galvanized steel.

E. Tension Wire shall have a minimum tensile strength of 75,000 psi, zinc-coated for use with zinc-coated fabric and aluminum coated for use with aluminum-coated fabric. Minimum weight of aluminum coating shall be 0.40 ounce of aluminum per square foot of wire.

F. Tie Wire shall be nine gauge galvanized steel wire for attaching fabric to rails, braces, and intermediate posts.

G. Hog Rings shall be nine gauge (minimum) galvanized steel wire for attaching fabric to bottom reinforcing wires.

H. Padlocks shall be Fed. Spec. FF-P-101, type EPB, 1-3/4-inch size, with chain. All padlocks shall be keyed alike.

2.07 FINISHES

A. Frame components shall be galvanized at a rate of 1.8 ounces per square foot in accordance with ASTM A 123.

PART 3 – EXECUTION

3.01 INSTALLATION

A. CONTRACTOR shall install framework, fabric, gates, and accessories in accordance with ASTM F 567 and as shown on the Drawings.

B. The fence shall be installed on previously prepared surfaces to line and grade indicated. Fence installation shall be as specified and in accordance with the fence manufacturer's written installation instructions.

C. Excavation for concrete-embedded items shall be of the dimensions indicated. Post holes shall be cleared of loose materials. Spoil material shall be spread where directed by the ENGINEER or OWNER'S AGENT. The ground surface irregularities, along the fence line and in areas not being altered by area grading, shall be eliminated to the extent necessary to maintain a 2-inch clearance between the bottom of the fabric and finish grade.

D. CONTRACTOR shall provide 6-foot nominal height fence with line posts not exceeding 10 feet, center-to-center.

E. All posts shall be set plumb and in alignment in concrete floorings with top of footing a minimum of two inches above finished grade. Posts shall be set in concrete a minimum of 40 inches and top of concrete shall be sloped for water runoff. Concrete shall be thoroughly compacted as to be free of voids and finished in a dome. Concrete shall cure 3 days prior to installation of fabric. Straight runs between braced posts shall not exceed 500 feet.

F. Each gate and corner post shall be braced back to adjacent line post with horizontal brace and rail and diagonal truss rods.

G. Contractor shall furnish center and bottom brace rails on corner posts and gate leaves.

H. Tension wire shall be used to secure the top of the fence except at gate locations, end posts, and corners.

I. Bottom tension wire shall be installed before installing chain-link fabric and shall be pulled taut.

J. Post caps shall be of the design as required to accommodate the top rail. Post caps shall be installed as recommended by the manufacturer.

K. Supporting arms shall be of the design as required to accommodate the top rail. Supporting arms shall be installed as recommended by the manufacturer.

L. Top rail shall be installed at all gate locations, end posts, and corners only before installing chain-link fabric and shall pass through intermediate post caps. Expansion coupling shall be provided and spaced a maximum of 100 feet on center.

M. Fabric shall be placed two inches above finished grade and mechanically pulled taut and secured to the top rail or tension wire and bottom wire close to both sides of each post and at intervals of not more than 24 inches on center. Fabric shall be secured to line posts using ties at the top and bottom at intervals of not more than 15 inches. Fabric shall be secured to end, corner, pull, and gate posts for the full length by integrally weaving to fastening loops or by using stretcher bars and bands. Fabric shall be twisted and barbed on the top selvage and knuckled on the bottom selvage.

N. Padlocks shall be furnished for gate openings and shall have chains that are securely attached to the gate or gate posts. Padlocks shall be keyed alike and five keys shall be provided by the CONTRACTOR to the ENGINEER or OWNER’S AGENT.

O. Barbed Wire: Each extension arm shall carry three strands of barbed wire at an angle of 45 degrees, the upper strand 12 inches out from the fence line and 12 inches above the top of the fabric. Install three strands on the extension arms at the top of the fence and over gates. The extension arms shall be installed so that they are pointing to the exterior of the perimeter created by the fence.

3.02 TEMPORARY CHAIN LINK SECURITY FENCE

A. Temporary, 6-foot high chain link security fence shall be provided, as necessary, to ensure a continuous, secure perimeter exists around the entire Site at all times.

B. The temporary fence shall be securely connected to the existing fence so that the existing and temporary fences form a continuous barrier.

3.03 RELOCATION OF EXISTING CHAIN LINK SECURITY FENCE AND GATES

A. The removal of existing fence designated for relocation or temporary removal shall be in accordance with the requirements hereinbefore specified for removal thereof. All fence materials to be reinstalled in the Work shall be jointly inspected by the CONTRACTOR and the ENGINEER or OWNER'S AGENT prior to dismantling or removal by the CONTRACTOR. An agreement briefly setting forth the current condition of the fence and gates to be reinstalled shall be prepared by the CONTRACTOR and signed by the CONTRACTOR and the ENGINEER or OWNER'S AGENT after the pre-construction walk-through.

B. Reinstallation shall be as specified under paragraph 3.01 of this Section. The CONTRACTOR shall supply such new parts conforming to the requirements of this Section as are necessary to complete the installation of the relocated fences and gates.

3.04 GROUNDING

A. Fence fabric shall be grounded at each site of every gate, at points 150 feet each side of overhead power-transmission lines, at intervals of every 1,000 to 1,500 feet of length when fences are located in isolated places, and every 500 to 750 feet when in close proximity (100 feet or less) to public roads, highways, and buildings. Fence shall be grounded at locations where the fence alignment changes more than 15 degrees.

B. Each fence post to be grounded shall be connected to a ground electrode consisting of a 3/4-inch diameter copper-dad steel ground rod 10 feet long, driven not less than 11 feet into the ground with rod located at the fence line or as near the fence line as is practical. Ground rods shall conform to UL 467. Connection of fence post to ground electrode shall be made below grade with not less than No. 4 AWG stranded-copper wire with TW insulation by approved clamp-type fitting of copper on fence post and ground electrode. Each gate panel shall be bonded with a flexible bond strap to its gate post.

END OF SECTION

02901 – Miscellaneous Work and Site Cleanup

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. CONTRACTOR shall furnish all labor, materials, equipment, and incidentals required to perform miscellaneous Work not specified in other Sections, but necessary for the proper completion of the Work as shown on the Drawings.

B. When applicable, the CONTRACTOR shall perform the Work in accordance with other Sections of these Specifications. When no applicable specification exists, the CONTRACTOR shall perform the Work in accordance with established industry practice and/or as directed by the ENGINEER or OWNER'S AGENT.

C. The Work of this Section includes, but is not limited to, the following:

1. Cleanup.

2. Incidental work.

3. Restoration of disturbed areas.

4. Restoring easement and right-of-ways.

5. Temporary facilities.

6. Protection of existing equipment, underground and aboveground utilities, including significant gas supply lines, monitoring wells, materials and structures that are designated to remain.

7. Restoration of electrical lines temporarily removed for work.

PART 2 - PRODUCTS

2.01 MATERIALS

Materials required for this section shall be the same quality of materials that are to be restored. Where possible, the CONTRACTOR may use existing materials that are removed subject to the approval of the ENGINEER or OWNER'S AGENT.

PART 3 - EXECUTION

3.01 CLEANUP

A. The CONTRACTOR shall remove all construction material, waste, buildings, equipment and other debris remaining on the project, except as otherwise specified, as a result of construction operations and shall restore the site of the Work to a neat and orderly condition.

B. During the course of the Work, the CONTRACTOR shall keep the site of operations in as clean and neat a condition as is possible. CONTRACTOR shall dispose of all residuals resulting from the Work that are not otherwise re-used or replaced.

C. At the completion of the Work, the CONTRACTOR shall:

1. Remove waste materials, rubbish, tools, equipment, machinery, and surplus materials.

2. Remove grease, dust, stains, labels, and other deleterious or foreign materials from the Site.

3. Repair, patch, and touch up marred or otherwise damaged surfaces.

4. Prior to transferring the completed project, conduct an inspection of surfaces, and all Work areas, to verify that the entire Site is in an orderly condition.

D. In order to prevent environmental pollution arising from the construction activities related to the performance of this project, the CONTRACTOR and Subcontractors shall comply with all applicable federal, state and local laws and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and elsewhere in these Specifications.

E. The CONTRACTOR is advised that the disposal of excess excavated material in wetlands, stream corridors, and floodplains is strictly prohibited. Any violation of this restriction by the CONTRACTOR, or any Subcontractor or employee, will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. Therefore, the CONTRACTOR will be required to remove the fill and restore the area impacted without additional cost to the OWNER/OWNER'S AGENT.

3.02 INCIDENTAL WORK

CONTRACTOR shall perform all incidental work not otherwise specified, but necessary to the proper completion of the Work as specified and as shown on the Drawings.

3.03 RESTORATION OF DISTURBED AREAS

The CONTRACTOR shall be responsible for restoring and stabilizing all disturbed areas prior to demobilizing from the site. Stabilization and restoration shall be conducted in accordance with the Drawings and Technical Specifications and shall ensure that sediment laden surface water will not enter drainageways, streams, rivers or other conveyance systems.

3.04 RESTORING EASEMENTS AND RIGHT-OF-WAYS

Existing vegetated surfaces damaged by construction shall be replaced. The CONTRACTOR shall restore the areas with an equivalent depth and quality of loam, seed and fertilizer as necessary to produce a stand of grass at least equal to that existing prior to construction. These areas shall be maintained and re-seeded, if necessary, until the Work has been completed and accepted. Any additional Work required to restore property to the original condition shall be performed by the CONTRACTOR.

3.05 PROTECTION OF EXISTING UNDERGROUND AND ABOVEGROUND UTILITIES AND OTHER INFRASTRUCTURE

A. Utilities (telephone, sewer, culverts, etc.) and other infrastructure may exist within, or adjacent to, the project area. These items shall be maintained and protected at all times. Locations of these items may or may not be shown on the Drawings. Prior to starting work the CONTRACTOR shall be responsible for identifying these items and providing proper protection; barricades, such that the integrity is not compromised nor the daily operations of the facilities affected. Any damage to such facilities as a direct result of CONTRACTOR operations will be the sole responsibility of the CONTRACTOR to repair and/or replace at no cost to the OWNER/ OWNER'S AGENT.

B. The CONTRACTOR shall cooperate with the OWNER/ OWNER'S AGENT, and other organizations; i.e., utility companies, and shall not allow plant or utility service to be disrupted or relocated without the permission of the ENGINEER or OWNER'S AGENT and the written permission of the utility owner.

C. In the event that an existing structure or utility not already identified for relocation must be relocated in order to avoid a conflict with the Work, the CONTRACTOR shall notify the ENGINEER, OWNER'S AGENT and the OWNER promptly.

END OF SECTION

Division 3 – Concrete

03210 – Reinforcing Steel

SECTION 03210
REINFORCING STEEL

PART 1 - GENERAL

1.01 GENERAL

A. CONTRACTOR shall provide all materials, labor and equipment necessary to furnish and install all required steel reinforcement and welded wire fabric for all structural concrete work.

1.02 RELATED WORK SPECIFIED ELSEWHERE

SECTION 03300 – Cast-in-place Concrete

1.03 SUBMITTALS

A. CONTRACTOR shall furnish the following prior to the placement of any steel reinforcement:

1. Drawings showing all steel placements

2. Bending Lists

3. Drawings showing locations of all splices and splicing method

1.04 APPLICABLE CODES AND STANDARDS

A. American Concrete Institute (ACI)

1. ACI-301 -- Specifications for Structural Concrete for Buildings

2. ACI-315 -- Details and Detailing of Concrete Reinforcement.

3. ACI-318 -- Building Code Requirements for Reinforced Concrete Structures.

B. Concrete Reinforcing Steel Institute (CRSI) - Manual of Standard Practice

C. American Society for Testing and Materials (ASTM)

1. ASTM-A-185 -- Specification for Steel Welded Wire Fabric, Plain for Concrete Reinforcement.

2. ASTM-A-615 -- Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

3. ASTM-82 -- Specification for Steel Wire, Plain, for Concrete Reinforcement.

PART 2 - PRODUCTS

2.01 REINFORCING BARS

A. Deformed Bars, Grade 60, meeting ASTM A 615. No re-rolled or high carbon steel bars will be permitted in the work.

2.02 STEEL WIRE

A. ASTM A82, plain, cold drawn steel.

2.03 WELDED WIRE FABRIC

A. All welded wire fabric (WWF) shall be mesh fabrication, which meets the requirements of ASTM A 185; and shall be supplied in flat sheets.

2.04 REINFORCEMENT SUPPORTS

A. Provide supports for reinforcements including bolsters, chairs and spacers. Bar supports for surfaces exposed to view after form stripping shall be small concrete blocks made of the same color and strength concrete being placed around them. Use concrete supports for reinforcing in concrete placed on grade.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Conform to ACI-318-89, (use most recent revision) "Building Code for Reinforced Concrete" in placing reinforcing bars. All bars shall be bent cold.

3.02 PLACEMENT OF STEEL

A. Clean reinforcement of any loose mill scale, rust, oil, earth and other contaminants.

B. Positioning, spacing, splicing: conform to ACI 318.

C. Set wire ties so that ends are directed into concrete, not toward exposed concrete surface.

3.03 INSPECTION

A. Notify the ENGINEER when reinforcing is in place and ready for inspection. Sufficient time shall be allowed for inspection prior to placement of concrete.

*** * END OF SECTION * ***

03300 – Cast-in-Place Concrete

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

A. General

1. Concrete work shall conform to all requirements of ACI 301-84 "Specifications for Structural Concrete for Buildings", except as modified by the supplemental requirements below:

2. The CONTRACTOR shall furnish all labor, equipment, supplies and material required to complete the construction and testing where required of all concrete footings, slabs, manholes, valve pits, tanks, vaults, concrete equipment pads and other structures as shown on the Drawings.

3. All access hatches, man ways, risers, ladder rungs, pipe sleeves and other fabrications shall be included in the construction of the various concrete units and shall be as shown on the Drawings.

1.02 QUALITY ASSURANCE

A. Codes and Standards

1. Comply with the latest editions of the following codes, specifications and standards except where requirements that are more stringent are specified herein or shown on the drawing.
   a. ACI 318 "Building Code Requirements for Reinforced Concrete".
   b. ACI 305 R "Hot Weather Concreting".
   c. ACI 306 R "Cold Weather Concreting".
   d. ACI 211 "Recommended Practice for Selecting Proportions for Concrete".
   e. ACI 347 "Recommended Practice for Concrete Form Work".
   f. ACI 350 “Environmental Engineering Concrete Structures”.
   g. Concrete Reinforcing Steel Institute (CRSI), “Manual of Standard Practice”

B. Use adequate numbers of skilled workmen thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

C. Quality Control: Do not begin placement of concrete until mix designs have been reviewed and approved by the ENGINEER and all governmental agencies having jurisdiction, and until copies are at the job site, the batch plant, and the building department.

D. Concrete Testing Service: Engage a testing laboratory acceptable to ENGINEER to compressive strength and other material evaluation tests.

E. Materials and installed work may require testing and re-testing at anytime during progress of work. Tests, including re-testing of rejected materials for installed work, shall be done at Contractor's expense.

F. CONTRACTOR shall keep a record at the job site showing time and place of each pour of concrete together with transit-mix delivery slip certifying contents of pour.

1. These records shall be made available to the ENGINEER for his inspection upon request.

2. Upon completion of this portion of the work, CONTRACTOR shall deliver the record and delivery slips to the ENGINEER.

1.03 SUBMITTALS

A. The CONTRACTOR shall submit the following (30) days prior to any concrete work:

1. Shop Drawings for reinforcing.

3. Name and qualifications of batching plant.

4. Mix design as per section 1.02

B. CONTRACTOR shall submit laboratory test results for compressive strength as specified.

PART 2 - PRODUCTS

2.01 FORM WORK

A. All form work shall be designed, constructed, erected, used and removed in accordance with the recommendations, guidelines and requirements of ACI 347 and SP4 and shall consist of "new and undamaged", Class I plywood complying with US Product Standard PS-1 "B-B (Concrete Form) Plywood, lumber, metal or other material approved by the Engineer. Form lumber shall be dressed on four (4) sides and only selected boards shall be used for forms in contact with concrete.

B. Form coating compounds shall be commercial products designed expressly to prevent adhesion of concrete and shall not stain or adversely affect the concrete surfaces.

C. Form Ties

1. Form ties should be of such type, that after forms are stripped, the ties can be broken back a minimum of 2 inches from the surface of concrete; or after bolts are removed, the position of tie remaining in the concrete shall be no closer than 2" to the face of concrete and shall be water tight.

2. The assembly shall provide cone-shaped depressions of the forms at the surface at least 1 inch in diameter and 1 1/2 inches deep to allow filling and patching.

3. The spacing of form ties and hangers shall be in accordance with manufacturer's recommendations.

2.02 WATER

A. Water shall be clear and free from injurious amounts of oils, acids, alkalis, organic materials or other deleterious substances. If there is any question as to the suitability of the water, another source shall be used or it shall be tested in accordance with AASHTO: T26.

2.03 CURING COMPOUND

A. Curing compound when used shall be a liquid membrane forming curing compound such as "Super Pliocure"; the Euclid Chemical Corp., "Master Seal 66"; Master Builders, or equal. Curing compounds shall not be used on surfaces where additional finishes or coatings are required.

2.04 GROUT

A. Non-shrink grout used for filling snap tie holes, joints in precast structures, around pipe penetrations, and wherever else shown shall consist of Type I or Type II Portland Cement and fine sand and shall contain a compound that will eliminate shrinkage. Acceptable products include SET non-Shrink Grout by Master Builders, Crystex by L&M Construction Chemicals, non-shrink grout by SIKA Chemical Corp., or approved equal.

2.05 BONDING AGENT

A. Supply bonding agents as manufactured by Sika Chemical Corporation, W.R. Grace, or equal. Particular product used shall meet requirements of pot life, set time, vertical or horizontal application, etc. required by application. Furnish manufacturer's application information.

2.06 CEMENT

A. Portland Cement ASTM C150 Type II. Unless other types are required by these specifications, or are authorized in writing, Type II Cement should be used. Only one brand of cement shall be used for exposed concrete surfaces of any individual structure.

B. For all hydraulic and below grade structures, Type II cement shall be used. Alternatively, at the Contractor's option, substituting, by weight, of Type cement by Pozzolan (ASTM C618) so that the total C3A content of the resulting cement is not greater than 5%. Pozzolan shall not exceed 25% by weight of the total cement and Pozzolan mixture. The mixture shall be made at the batching plant only.

2.07 AGGREGATES

A. All aggregates shall conform to ASTM C33, except Section 5.2 therein which does not apply.

B. Fine aggregates shall be capable of developing 100% of the compressive strength of Ottawa sand when tested in accordance with ASTM C87. They should not contain more than 3% clay.

C. Coarse aggregates should be size 467, No. 57 or No. 67, as described in ASTM C33, and should conform to all quality noted therein. The nominal maximum size of coarse aggregates should not be larger than 1/5 the narrowest dimension between sides of the form, one third of the depth of slabs, or 3/4 of the minimum clear spacing between reinforcing bars. These limitations may be waived if, in the judgment of the Engineer, workability and methods of consolidation are such that concrete can be placed without honeycombs and voids.

2.08 ADMIXTURES

A. Pozzolan to be used in combination with cement as specified above for all hydraulic structures, shall be Class C or Class F fly ash conforming to ASTM C618-84. Before a Class C or Class F Pozzolan is accepted by the ENGINEER, the supplier shall submit the last 20 ASTM C 618 analyses.

B. Air Entraining Admixture to be used in all concrete. Admixture shall meet the requirements of ASTM C 260 and shall contain no chlorides.

C. Water Reducing Admixture conforming to ASTM C 494, Type A (normal) or Type D (retarding), to be an integral part of the design mix and shall contain not more than 1% chloride ions. The admixture shall be used in the proportion recommended by the manufacturer.

D. Upon written permission from the ENGINEER, "Super Plasticizer" meeting ASTM C 494, Type F or Type G, and containing no chlorides may be used for selected applications.

E. The use of admixtures to accelerate hardening or for waterproofing shall not be permitted.

2.09 WATER STOPS

A. The CONTRACTOR shall furnish labor, material, and equipment required to install water stops in all construction joints and as shown on the Drawings.

B. Provide serrated center bulb type water stop, extruded from elastomeric plastic compound whose basic resin shall be virgin PVC. Size of water stop shall be as shown on the Drawings. Water stop shall have a constant thickness from the edge of the bulb to the edge of the water stop. The thickness next to the center bulb shall be a minimum of 3/8" and the water stop shall weigh a minimum of 120#/100 LF, for 6" size. Water stop shall meet the requirements of the U.S. Army Corp. of Engineers Standard CRD-C572.

C. Submit a sample of the proposed water stop for the ENGINEER'S approval.

2.10 JOINT FILLERS & SEALERS

A. Gun Grade Sealants for Caulked Joints

1. Sealants shall be self-leveling (S/L) for horizontal and sloping joints with a slope less than 2%. Non-sag sealants (N/S) shall be used for steeper sloped joints, vertical joints, and overhead joints.

2. Primer shall be as recommended by the sealant manufacturer.

3. Non-Submerged Sealants
   a. Joints 1 inch or less in width shall be filled with SIKA FLEX 1a, ISOFLEX 2000, PRC 150, PRC 250 or equal.
   b. Joints greater than 1 inch wide shall use PRC 210(N/S), PRC 220(S/L), PRC 270; or equal.

4. Submerged Sealants
   a. SIKA FLEX 1A or 427, Isoflex 908 or 814 or PRC 210, 220, or 270.

B. Pre-molded joint filler shall be softer grade of cellular rubber conforming to ASTM D1056 or bituminous type conforming to D994, D1751, and D1752.

C. Field molded joint filler shall be asphalt filler conforming to AST D1190.

D. Preformed control joint shall be one-piece flexible PVC such as Kold-Seal Zip-Per Strip by Vinylex Corp., or a one-piece steel strip with preformed groove such as Keyed Kold Retained KAP by Burke Concrete Industries, Inc.

2.11 WALL SLEEVES

A. Wall sleeves shall be coated steel or stainless steel with integral welded water stop.

PART 3 - EXECUTION

3.01 CONCRETE MIX DESIGN

A. Mix Proportioning: All materials used should be proportioned to produce a well graded mixture of high density and maximum workability, with a specified 28 day compressive

strength of 4,000 psi. The concrete should be portioned in accordance with ACI 211.1, subject to the following special requirements:

1. Type of cement: see Section 2.06.

2. Maximum water-cement ratio: 0.45. If pozzolan is used in concrete, the maximum water-cement plus pozzolan ratio should be 0.45.

3. Minimum cement content:

Coarse Aggregate #	lb /cyd.
#467 (1 1/2")	517
#57 (1") or #67 (3/4")	564

Concrete mixes with less cement than shown above may be used when it is demonstrated to the Engineer that the proposed mixes will produce concrete that will have acceptable durability and impermeability.

4. Air content (as determined in accordance with ASTM C231 or C173):
   5 1/2% ± 1% for coarse aggregate size #467
   6% ± 1% for coarse aggregate size #57 or 67

5. Slump (as determined in accordance with ASTM C143):
   1" minimum
   3" maximum for footings and walls
   4" maximum for slabs, beams, columns.

B. Approval of Proportions: The CONTRACTOR should furnish for approval mix proportions prepared by a testing laboratory approved by the ENGINEER.

3.02 CERTIFICATION

A. Furnish a delivery ticket with the information contained in Section 15.1 to 15.2.8 of ASTM C96 before unloading at job site. In addition, record the type, brand, and amount of any fly ash used plus the reading of the mix truck revolution counter.

3.03 DELIVERY AND MIXING

A. Concrete shall be discharged at the job within 1-1/2 hours of adding the cement to water or aggregates, except for approved adjustments to this time due to the additions of admixtures or weather conditions.

B. Ready-mixed concrete conforming to ASTM C-94 as modified herein shall be used.

C. The plant shall be adequately equipped for the accurate proportioning and proper mixing and delivery of the concrete including accurate water measurements and controls.

D. Cement and aggregates (fine and coarse) shall be weighed separately, (except cement in standard bags). Admixtures shall be added separately in solution form and shall be uniformly distributed throughout the batch.

3.04 RETEMPERING

A. The retempering of concrete or mortar in which the cement has partially hydrated will not be permitted.

3.05 FORMWORK

A. Formwork shall be designed and constructed so that all components and members of the structure will be cast to correct dimensions, shape, alignment, elevation and position. Formwork shall also be designed to be erected, supported, braced and maintained so that it will safely support all vertical and lateral loads that might be applied until such loads can be supported by the concrete structure.

B. All corners and edges shall be constructed with a 3/4" chamfer whether or not shown on the Drawings.

C. Form/Construction Tolerances: Variation in alignment, grade and dimensions of the structures from the established alignment, grade and dimensions shown on the Drawings shall be within the tolerances specified in the following table except in areas where equipment requires more stringent tolerances:

1. Variation from the plumb:
   a. In the lines and surfaces of columns, posts, piers, walls and arises:
      In 10 ft. . . . . 1/4 in.
      but not more than. . . . 1 in.
   b. For exposed corner columns, posts, joint grooves and other conspicuous lines:
      In any bay or 20 ft maximum. . . 1/4 in.
      In 40 ft or more. . . . 1/2 in.

2. Variation from the level or from the elevations indicated on the Drawings:
   a. In floors, ceilings, beam soffits, and in arises:
      In 10 ft. . . . . 1/4 in.
      In any bay or 20 ft maximum. . . 3/8 in
      In 40 ft or more. . . . 3/4 in.
   b. For exposed lintels, sills, and other conspicuous lines:
      In any bay or 20 ft maximum. . . 1/4 in.
      In 40 ft or more. . . . 1/2 in.

3. Variation of the linear building lines from established position in plan and related position of columns, walls, and partitions: 1/2 in.

4. Variation in the sizes and locations of sleeves, floor openings, and wall openings:

. . . . . 1/4 in.

5. Variation in cross sectional dimensions of columns and beams and in the thickness of slabs and walls:
   Minus . . . . . 1/4 in.
   Plus. . . . . 1/2 in.

6. Footings:
   a. Variation of dimensions in Plan:
      Minus . . . . . 1/4 in.
      Plus . . . . . 2 in.
   b. Misplacement or eccentricity:
      2 percent of the footing width in the direction of misplacement but not more than 2 in.

7. Footings and base slabs reduction in thickness:
   Minus . . . . . 5 percent of specified thickness

8. Variation in steps:
   a. In a single step:
      Riser . . . . . 1/8 in.
      Tread . . . . . 1/4 in.
   b. In two consecutive steps
      Riser . . . . . 1/16 in.
      Tread . . . . . 1/8 in.

D. Form Surface Preparation

1. Wood Forms: All form surfaces shall be coated with an effective release agent prior to placing reinforcement.

2. Steel Forms: Coat steel forms with a non-staining, rust preventative form oil. Rust stained steel formwork is not acceptable.

3.06 PLACING CONCRETE

A. After completion of form erection and reinforcement placement, notify other trades whose work is in any way connected with or influenced by concreting. Allow those trades reasonable time to complete their portion of the work before placing concrete.

B. Do not place concrete until reinforcement, conduits, outlet boxes, anchors, sleeves, hangers, bolts and other embedded materials are securely and properly fastened in their correct positions.

C. Notify ENGINEER at least one full working day in advance of concreting to allow time for inspection. Obtain the ENGINEER'S approval of reinforcing steel before placing any concrete.

D. Conform to recommendations of ACI 304 and ACI 318 and as herein specified.

E. Place concrete as soon as possible after leaving mixer. Do not allow concrete to fall more than 5 feet to avoid segregation of ingredients.

F. Use of aluminum pipe or other aluminum conveying devices will not be permitted

G. Pumping of concrete will be permitted only with the ENGINEER'S approval.

H. Placing in Forms: Deposit concrete in layers not exceeding 24". Where several layers are required, place each layer while preceding layer is still plastic to avoid cold joints.

I. Premolded gaskets to be lubricated with lanolin-based material or other manufacturer recommended paste. Gaskets shall be securely in place when sections are joined.

J. Consolidate concrete with mechanical vibrators with minimum frequency of 8000 VPM. Provide at least one standby vibrator in operable condition. Do not use vibrators to horizontally transport concrete inside of forms. The arrangement of forms and windows shall be such that the vibrator operator can visually observe the concrete being consolidated or the CONTRACTOR may have a person observing the consolidation at all times who will advise the vibrator operator of any changes needed in his operation. Do not permit segregation of aggregate.

K. Cold Weather Placement

1. The CONTRACTOR shall have equipment and materials readily available to take protective measures for maintaining the specified temperature of freshly placed concrete.

2. Do not place concrete when ambient temperature is below 40 deg. F or approaching 40 deg. F and falling, without special precautions as listed in ACI 306R-78 and specified below.

3. The CONTRACTOR shall submit his detailed plan for cold weather placing, curing and protection to the Engineer prior to any concrete work to be placed or cured at temperatures below 40 deg. F.

4. When air temperatures are expected to be 40 deg. F or below, heat water and aggregate to maintain a concrete temperature between 50 deg. F and 80 deg. F at the point of placement. The temperature of concrete shall not be permitted to fall below 50 deg. F during curing period, and the Contractor shall provide insulation, tents, temporary heat, or take other approved measures to accomplish this. The heating methods shall

not subject concrete surfaces to such excessive heat concentration as may cause rapid drying.

5. When temporary enclosures to protect the concrete are to be heated, the heating methods shall not subject concrete surfaces to excessive heat such that rapid drying would occur. The CONTRACTOR shall continuously operate heaters, under manned supervision, and provide adequate fire protection. When heating is discontinued, the drop in temperature of concrete shall not exceed 40°F in 24 hours.

6. Do not use calcium chloride, salt or any other chloride-containing admixture for freeze protection under any circumstances.

7. The CONTRACTOR shall take all due care to ensure attainment of adequate strength before removing forms during cold weather conditions.

J. Hot Weather Placement

1. The CONTRACTOR shall provide equipment for cooling concrete aggregates and water, and shall adjust the mix to retard the setting time of the concrete when directed.

2. Conform to ACI 305 R-77 and as herein specified, if air temperature rises above 85 deg. F.

3. Sunshades and windbreaks shall be provided when required by weather conditions to maintain the temperature between 50-80 deg. F and to minimize excessive drying. Sunshades and windbreaks shall be left in place for at least 7 days. When fly ash is used, the protection time shall be increased to 12 days.

4. Curing of concrete should be started as soon as finishing has been completed and/or water sheen has disappeared. If liquid membrane curing is used, the compound should be white pigment.

3.07 APPLICATION OF EPOXY GROUT

A. Safety Note: Epoxy material will cause severe dermatitis if allowed to contact skin or eyes. Provide protective measures and follow precautions as recommended by the manufacturer.

B. Preparation and Mixing: Prepare surfaces to receive epoxy grout, mix and apply epoxy grout, all in strict accordance with the manufacturer's printed instructions.

C. Placement of Grout: After materials and equipment to be grouted are properly aligned, epoxy grout shall be placed continuously and rapidly to eliminate all voids.

D. Protection of Work: Materials and equipment grouted shall not be disturbed for 24 hours after grout has set.

3.08 PROTECTION OF CONCRETE

A. The CONTRACTOR shall provide all protection against flooding, freezing, heat, premature drying, etc. by the application of preventive measures such as dewatering, heaters, water spray for curing, insulation, tarpaulins, and all else necessary or directed to insure proper curing of poured in place concrete.

B. The CONTRACTOR shall protect all concrete from any damage until final acceptance of the work.

3.09 DEFECTIVE CONCRETE

A. The following concrete will be deemed defective, and shall be removed promptly from the job site at the CONTRACTOR'S expense.

1. Concrete that is not formed as indicated, is not true to intended alignment, is not plumb or level where so intended, or is not true to intended grades and levels.

2. Concrete that has voids or honeycombs that have been cut, resurfaced, or filled, unless with the approval of the ENGINEER.

3. Concrete that has sawdust, shavings, wood or embedded debris.

4. Concrete that has been damaged by freezing or by alternate freezing and thawing.

5. Concrete that does not otherwise conform fully to the provisions of the Contract Documents.

3.10 CONCRETE FINISHING

A. Finish of Formed Surfaces

1. Rough form finish applies to all surfaces below a point one foot below grade. These surfaces shall be left with texture imparted by the forms after removal, except for repairs of defective concrete and filling of tie holes. All fins shall be chopped off or rubbed off and irregularities shall be corrected.

2. Smooth form finish applies to all interior formed surfaces of tanks, as well as all exposed surfaces above finished grade, and to at least one foot below grade except where otherwise specified.

3. Smooth rubbed finish shall be produced on newly hardened concrete no later than the day following form removal. Surfaces shall be wetted and rubbed with carborundum brick or other abrasive until uniform color and texture are produced. No cement grout shall be used other than the cement paste drawn from the concrete itself by the rubbing process.

B. Finish of Unformed Surfaces: Top of walls or buttresses and similar unformed surfaces shall be struck smooth after concrete is placed and shall be floated to texture reasonably consistent with that of formed surfaces. Final treatment on formed surfaces shall continue uniformly across unformed surfaces.

C. Finish of Slabs

1. Steel Trowel Finish: Finish by screeding and floating to the elevations shown. Begin power float operation when surface water has disappeared and/or concrete has stiffened to permit power floating. Check level surface, slope floor to drains if required. Re-float after leveling. Begin final troweling when a ringing sound is produced when trowel is moved over concrete. Finish by hand areas too small or inaccessible for power unit.

2. Wood Float Finish: Slabs shall be finished by screeding with straight edges. Slab will be wood floated to compact and seal surface.

3. Underside of Elevated Slabs: If forms are to be removed, all projections shall be removed and honey combs and rock pockets repaired.

4. Exterior Broom Finish: Applied broom finish to exterior platforms, aprons, steps, ramps, slabs, and sills by drawing a fiber bristle broom across the slab perpendicular to traffic route, immediately after trowel finishing.

3.11 CURING

A. Concrete shall be cured for a period of not less than 7 days.

B. Curing should commence immediately following initial set or completion of surface finishing. Methods of curing include leaving the forms in place, sprinkling and ponding. All water retaining structures shall be water cured only. If membrane-curing compound is used, all finishing operations, except grinding, chipping and sandblasting, should be completed prior to application of the membrane.

C. The CONTRACTOR shall have on hand all equipment and materials needed for adequate curing and protection of poured concrete.

D. Horizontal construction joints shall be cured with a minimum of two inches of sand, and shall be kept completely saturated. These joints shall be cleaned and allowed to dry for 12 hours immediately prior to placing of the following lift.

E. Slabs

1. Protect surface by ponding or sprinkling; or

2. Cover with burlap mats kept sufficiently wet; or

3. Cover with 1-inch layer of wet sand or sawdust kept sufficiently wet.

3.12 PATCHING AND REPAIRS

A. Fill tie holes with non-shrink non-metallic grout.

B. Honeycombed Areas

1. Honeycombed sections result from improper placement and inadequate vibration. Their patching may be permitted by the ENGINEER depending on his examination of the extent and depth of the defective concrete and its location. If patching is allowed, all unsound material must be chipped out back to sound and solid concrete and inspected prior to filling and patching operations. Patch with non-shrink non-metallic grout after applying bonding agent to the solid concrete.

3.13 WALL SLEEVES

A. Install wall sleeves or 'pipe sleeves' in locations as shown on the Drawings.

B. Sleeves should not be in contact with reinforcing steel. Provide a minimum 2 1/2" spacing between sleeves and between sleeves and reinforcing steel.

C. Size sleeves to accommodate O.D. of pipe sizes shown on the Drawings.

3.14 TESTING

A. Slump:

1. According to ASTM C143: one test for each load of concrete, and one test for each set of compressive strength cylinders.

B. Concrete Test Evaluation

1. During construction, 7-day compressive strength should be used to supplement the 28-day tests by comparing the average relative 7 and 28-day strengths as determined by the Laboratory.

2. At least two (2) test cylinders shall be cast for testing at each age during each concreting operation, for every 20 cubic yards of concrete or fraction thereof.

3. All test cylinders should be cured under Laboratory conditions, except that the ENGINEER may require an equal number of field control cylinders cured under field conditions.

**** END OF SECTION * ***

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03400 – Pre-cast Concrete

SECTION 03400
PRE-CAST CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

A. The CONTRACTOR shall furnish all labor, materials, and equipment to install the pre-cast concrete manholes, chambers, etc., and access risers as shown on the Drawings as required for a complete and operable installation. Precast concrete units include, and are not limited to the following:

1. Wellhead Chambers

1.02 QUALITY ASSURANCE

A. Standards

1. Building code requirements for reinforced concrete: ACI 318-89, including all referenced standards and specifications.

2. AASHTO: Standard Specifications for Highway and Bridges.

3. Oregon Department of Transportation Standard Specifications for Highway and Bridges.

B. Design Loads - Precast Tanks, Manholes & Sumps:

1. Dead Load
   a. Concrete - 150 pcf
   b. Earth cover - 130 pcf

2. Lateral Earth Pressure on Walls:
   a. Equivalent fluid pressure above water table = 65 lbs. per cubic foot
   b. Equivalent fluid pressure below water table = 90 lbs. per cubic foot
   c. Surcharge on walls = 4 feet of earth

3. Live Load - AASHTO HS 20-44

1.03 SUBMITTALS

A. Shop Drawings/Project Data: Submit manufacturer's shop drawing and project data for items ordered including installation instructions.

PART 2 - PRODUCTS

2.01 BEDDING MATERIAL

A. Gravel - Clean, crushed stone, 3/4 inch sized or as required by the Oregon DOT Standard Specifications for Highway and Bridges.

B. Topping - Quarry processed "screenings".

2.02 PRE-CAST CONCRETE UNITS

A. Concrete shall reach a compressive strength of 4000 psi at 28 days, minimum 3000 psi at time of delivery.

B. Reinforcement:

1. Bars - ASTM A615-75, grade 60

2. Welded Wire Fabric - ASTM A-185

C. Joint Seal: 1-1/4 in. diameter or shaped to fit joint casting, shall be neoprene, butyl rubber or equivalent, suitable for high strength sewage. A compatible liquid joint sealer shall be provided to lubricate pre-molded gasket.

D. Riser: Provide manufacturer's cylindrical or rectangular risers as shown on Drawings.

E. Wellhead Chambers: Where indicated on Contract Drawings, the Contractor shall furnish rectangular sections of dimensions shown on drawings, which will rest on a precast base section. Chamber to extend to grade with a man way opening sized as shown on the Drawings.

F. The Exterior of all pre-cast concrete units shall be coated with one coat of Carboline “Super Service Black.” Total dry film thickness shall be 14 mils or approved equal.

2.03 PIPE SLEEVES

A. For pipes 4" diameter or smaller, provide bitumastic coated steel or stainless steel with integral welded water stop. Size to accommodate O.D. of pipe plus "link seal" mechanical unit.

2.04 MANHOLE/CHAMBER STEPS

A. Manhole steps shall be of the design known as the safety steps. The steps shall be twelve inches (12") wide and the legs at least twelve inches (12") long. The steps shall be fabricated of extruded aluminum alloy 6061-T6 ASTM C478, drop front design. The steps shall be located to provide a continuous ladder with steps equally spaced vertically in the assembled manhole at 12", plus or minus 3/4". The steps shall be able to withstand a force of 350 pounds applied at any place and direction on the step.

PART 3 – EXECUTION

3.01 MANUFACTURE

A. Access hatches (see Section 05500 Metal Fabrications) to be cast into top slab as shown on the Drawings, as directed by contractor.

B. Manhole steps to be cast into walls, level, straight and in precise alignment between cast sections as required. Provide ladder extensions as per OSHA requirements.

C. Wall sleeves cast at locations and elevations indicated on the drawings. Sleeves shall not be in contact with reinforcement.

D. Rubber pipe gaskets shall be cast into manhole sections at locations and elevations indicated.

3.02 EXCAVATION AND BACKFILL

A. Comply with requirements of Section 02200. Excavate a minimum of 1 ft. larger than tank.

3.03 BEDDING

A. Sub-base to be firm and leveled.

B. Place a minimum of 9", of ¾” crushed stone or as per the requirements of the Oregon DOT Standard Specifications for Highway and Bridges, and compact with vibratory equipment or other means acceptable to the Engineer.

3.04 JOINTS

A. Concrete joints to be smooth and free of voids.

B. Pre-molded gasket to be lubricated and joint surfaces coated with liquid joint sealer prior to assembly.

C. After tanks have been set in excavation, apply non-shrink, nonmetallic grout to the inside and outside of all joints.

3.05 TESTING

A. After hydraulic structures are installed, backfilled, and all coatings applied, structures shall be tested for water tightness.

B. Plug all wall penetrations, and fill tank to within 3" of top.

C. Tanks shall pass if leakage is less than 4.5 gallons in 24 hrs.

D. If leakage is greater than 4.5 gallons, repairs shall be made and the structure retested at the Contractor's expense.

*** * END OF SECTION * ***

Division 5 – Metal Fabrications

05500 – Metal Fabrications

SECTION 05500
METAL FABRICATIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The CONTRACTOR shall provide all labor, material and equipment to furnish and install the fabrications and items specified herein.

B. The work specified in this section includes but is not limited to stairs, ladders, screen boxes, gratings, anchors, inserts and fasteners, gate and handrail.

C. All grating shall be aluminum. Where handrails mount on grating, similar materials must be used including bolts and other fasteners. Support brackets, where unprotected, must also be of similar material to that which it supports. Any interfaces between dissimilar metals shall be insulated using plastic bushings around bolts and plastic sheeting between flat surfaces.

D. Related Work Specified Elsewhere

SECTION 03300 – Cast-In-Place Concrete
SECTION 03400 – Pre-cast Concrete
SECTION 15001 – Pipe, Fittings, and Accessories

1.02 STANDARDS

A. Comply with all governing codes, such as OSHA, and with the requirements of ANSI A 14.3 and the AWS "Structural Welding Code".

1.03 SUBMITTALS

A. Shop Drawings: Show details of construction, gauges, jointing, installation, fastening and supports. Shop drawings for stairs, hatches, handrail, manhole covers and frames, and ladders shall contain design, type of metal and load assumptions.

B. Catalog Cuts: Submit catalog cuts of manufactured components or systems.

C. Coating types, methods, systems.

D. Samples: Submit samples of materials or assemblies, as requested, and color chip samples.

E. All hatches, frames and hardware shall be as shown on shop drawings and approved before fabrication is commenced.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete masonry, in ample time to not delay work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. If bolts and nuts become dry or rusty, clean and relubricate before use.

1. Do not store materials on structure in a manner that might cause distortion or damage to member or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.01 STRUCTURAL STEEL

The steel materials considered in these specifications are covered by the following standards:

Product	Standard
Structural Steel Shapes, Plates and Bars	ASTM A 36
Stainless Structural Steel	ASTM 304, ASTM 316
Cold-Formed Steel Tubing	ASTM A 500, Grade B
CHot-Formed Steel Tubing	ASTM A 501
Steel Pipe	ASTM A 53, Type E or S, Grade B; or ASTM A 501
Steel Castings	ASTM A 27, Grade 65-35 medium strength carbon steel
Steel Products	ASTM A 386, Zinc Coating (Hot-Dip) on assembled steel products
Headed Stud-Type Shear Connectors	ASTM A 108, Grade 1015 or 1020, cold finished carbon steel with dimensions complying with AISC Specifications
Anchor Bolts	ASTM A 320, 304 Stainless steel bolts
Unfinished Threaded Fasteners	ASTM A 307, Grade A, regular low-carbon steel bolts and nuts.
High-Strength Threaded Fasteners	ASTM A 490
Electrodes for Welding	AWS Code
Structural Steel Primer Paint	SSPC- Paint 13

2.02 STRUCTURAL ALUMINUM

The aluminum alloy materials considered in these specifications are covered by the following ASTM Specifications:

Product	ASTM Specification No.
Sheet and Plate	B209-62 (6061-T6)
Drawn Seamless Tubes	B210-62 (6061-T6, 6062-T6, 6063-T6)
Bars, Rods and Wires	B211-62 (6061-T6)
Extruded Bars, Rods	B221-62 (6061-T6, 6062-T6, and Shapes 6063-T5 and T6)
Extruded Tubes	B235-62 (6061-T6, 6062-T6, 6063-T5 and T6)
Pipe	B241-62 (6061-T6, 6062-T6, 6063-T5 and T6)
Forgings	B247-62 (6061-T6)
Standard Structural Shapes	B308-62 (6061-T6 and 6062-T6)
Railings and Handrails	ASTM E985

2.03 ACCESS HATCHES, MANHOLE COVERS AND FRAMES

A. Access Hatches

1. For OFF-STREET locations - Access doors shall be "THG-H20" (WATERTIGHT, ODORTIGHT and GASTIGHT) as manufactured by the Thompson Fabricating LLC, Tarrant, AL, or approved equal. Door leaf shall be 1/4" aluminum diamond pattern plate to withstand a live load AASHO-H20 Load as shown on the Contract Drawings. Channel frame shall be 1/4" aluminum with an anchor flange around the perimeter. Doors shall be equipped with heavy forged brass hinges, stainless steel pins, spring operators for easy operation, and an automatic hold-open arm with release handle. A snap lock with removable handle shall be provided. Hardware shall be stainless steel and factory finish shall be a mill finish with bituminous coating applied to exterior of the frame. Installation shall be in accordance with manufacturer's instructions. Manufacturer shall guarantee against defects in material or workmanship for a period of five years.

B. Manhole Covers and Frames

1. Manholes covers and frames shall be provided for all ON-STREET locations.

2. Manhole frames and covers manufactured by Olympic Foundry, Portland, Oregon, for use with valve boxes, cleanouts, chambers, and manholes.

3. Water tight manhole covers shall be provided for all pre-cast concrete well chambers as detailed on the Contract Drawings.

4. Minimum diameter shall be 30” for access ways unless otherwise specified on the Contract Drawings.

2.04 OPEN GRATING

A. All open grating shall be rated for minimum 100-lb/ft2 live load. Grating shall be P-19-4, Type F, swaged aluminum grating with serrated finish as manufactured by Harsco Industrial IKG, or approved equal. Maximum deflection shall not exceed 1/4" over entire span.

B. All open grading hardware shall be 304 stainless steel.

2.05 GRATING FOR STAIRWAY TREADS AND LANDINGS

A. Aluminum: Borden Grating, Type F., as manufactured by Borden Metal Products, Elizabeth, NJ or approved equal.

B. All open grating hardware shall be stainless steel, type 304.

2.06 ANCHORS, INSERTS, AND FASTENERS

A. Submerged use is defined as any connection to concrete below a point 18 inches above the maximum level in a liquid holding structure.

B. Anchor Bolts, submerged use: Type 316 stainless steel of size as shown.

C. Machine Anchor Bolts: Furnish stainless steel bolts or studs required by equipment manufacturer.

D. Wedge Anchors for concrete: Shall not be used for submerged usage as defined above. Where use is permissible, provide anchors as manufactured by ITT Phillips, Hilti, Wej-it or equal.

E. Expansion Anchors for concrete: Shall not be used except in dry areas where there is no concern for future corrosion. Provide anchors as manufactured by ITT Phillips, Hilti or equal.

F. Adhesive Anchors for concrete: Shall be used for submerged applications as defined above. Provide adhesive anchors with Type 316 stainless steel stud or anchor rod as manufactured by Parabond, Molly Division, HBP, Hilti, Inc. or equal.

G. Machine Bolts, Inserts and Fasteners:

1. Permanently embedded in concrete shall be type 316 stainless steel.

2. Located in wet well floors, areas subject to drainage, leakage and trenches shall be type 316 stainless steel.

3. Located in areas where drainage, leakage, and wash down are not likely, may be ASTM A 153, galvanized steel.

2.07 COATINGS AND FINISHES

A. Steel

1. Finish: Black, except where indicated to be galvanized.
2. Paint thickness shall be a minimum of 1.5 mills
3. As Specified: Galvanizing, Hot-dipped.

B. Aluminum

1. General: Coal tar epoxy or Bitumastic, Cielcote or equal.

   a) Bituminous Paint used shall meet the requirements of United States Military Specification MIL-P-6883 or equal.

   b) Aluminum grating does not require a coating.

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2.08 RAILINGS AND HANDRAILS

A. Provide railing and handrail assemblies that meet the following requirement for structural performance:

1. Handrails shall 1.66" OD aluminum 3'-6" high able to withstand a concentrated load of 200 lbs. applied at any point in any direction.

2. Uniform load of 50 lb. per linear foot applied simultaneously in both vertical and horizontal directions. Concentrated and uniform loads need not be assumed to act concurrently.

3. Construct railings and handrails in accordance with ASTM E985.

2.09 GATES AND GATE POSTS

A. Gates shall be of sufficient size to maintain the clear opening as shown on Drawings, with braced cantilevered frame.

B. Gates shall be as indicated on the Drawings as to type and location(s). Gates shall be sufficiently braced with pipe or galvanized steel tension bars. Frames minimum 2 in. galvanized steel pipe. Gates shall not sag, bend or flex while traveling throughout the

required range of movement and shall provide for attachment of fabric, hardware and accessories.

C. Gateposts shall be minimum 4 in. O.D., hot-dipped galvanized steel pipe of sufficient length to allow for installation a minimum of 4 ft. below finished grade level.

PART 3 - EXECUTION

3.01 COATINGS

A. Aluminum:

1. Heavy coating coal tar epoxy or Bitumastic neatly applied only to required surfaces, in strict accordance with manufacturer's latest printed requirements.

2. Field touch-up galvanized surfaces with brush-on cold application galvanizing, in strict accordance with manufacturer's latest printed requirements.

B. Steel [need to define kind of finish and color]:

1. ASTM A 386, Zinc Coating (Hot-Dip) on assembled steel products.

2. Structural Steel Primer Paint: SSPC- Paint 13.

3. Field touch-up galvanized surfaces with brush-on cold application galvanizing, in strict accordance with manufacturer's latest printed requirements.

3.02 STAIRS

A. Stairs shall be of open riser construction, unless otherwise shown.

B. Stairways shall conform to all OSHA and other applicable codes. Stairways shall be capable of supporting a moving concentrated load of 1,000 lbs.

C. Stair treads and landings shall be aluminum grating.

3.03 LADDERS

A. Fabricate ladders, with dimensions, details and anchorages as shown on the drawings. Conform to ANSI A 14.3, except where otherwise specified.

B. Provide continuous structural steel flat bar side rails, spaced 12" apart, unless otherwise shown. Provide 3/4" diameter solid structural steel bar rungs, spaced 12" O.C. Fit rungs in center of side rails, plug weld and grind smooth on outer rail faces.

C. Provide non-slip surface at the top of each rung, either by coating the rung with aluminum oxide granules set in epoxy adhesive, or by using a manufactured rung with an aluminum oxide grout filler strip.

3.04 GRATINGS

A. Ensure that gratings furnished correspond to existing structural supports.

B. Provide and install aluminum floor gratings of dimensions shown on drawings.

C. Provide and install all frames, seat angles, fasteners and other required accessories. Size support angles to provide a minimum of 1-inch (1") for all main bearing bars. Band all cutouts and edges.

3.05 ACCESS HATCHES, MANHOLE COVERS AND FRAMES

A. Install hatches in accordance with the manufacturer's printed installation instructions as approved by the Engineer.

B. Frames for hatches shall be provided and properly cast in place during construction. Frames for hatches in precast lids shall be furnished to supplier of lid for proper inclusion in precast work.

C. Provide suitable drainage for runoff from access hatch channel frames.

3.06 VALVE KEYS

A. Two (2) welded steel valve keys of each type shall be manufactured and supplied for use on valves located within valve boxes in order to fully operate valves. Separate style keys may be necessary for different valves. Keys shall be of suitable design including proper length, key end to fit valve operator and 18" minimum handles.

3.07 VALVE BOX AND COVERS

A. Provide valve boxes and covers in the locations and to grade as indicated on the Drawings.

3.08 EQUIPMENT SUPPORT STRUCTURES

A. Where certain equipment requires metal support framing, such framing shall be either constructed at the site and equipment mounted upon it after proper anchorage or supports shall be manufactured with the equipment and installed as a complete unit.

B. All bolting, welding, etc., whether field or shop prepared shall be neat and professional and shall be in accordance with shop drawings as approved.

3.09 FABRICATION

C. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications.

D. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.

E. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of member exposed in final structure free of marking, burrs, and other defects.

F. Bolt field connections, except where welded connections or other connections are indicated.

1. Provide high-strength threaded fasteners for all bolted connections, except where unfinished bolts are indicated.

G. High-Strength Bolted Constructions: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts."

H. Steel Framings: Select members that are true and straight for fabrication of steel framing. Straighten as required to provide uniform, square, and true members in completed wall framing.

I. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.

J. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members that are not under stress, as acceptable to Engineer. Finish gas-cut sections equal to sheared appearance when permitted.

3.10 STRUCTURAL STEEL

A. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.

B. General: Shop-paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel that is partially exposed on exposed portions and initial 2 inches of embedded areas only.

C. Do not paint surfaces to be welded or high-strengthen bolted with friction-type connections.

D. Apply 2 coats of paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

E. Surface Preparation: After inspection and before shipping, clean steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:

1. SP-6 “Commercial Blast Cleaning”.

F. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer’s instructions and at a rate to provide dry film thickness of not less than 1.5 mils. Use painting methods that result in full coverage of joints, corners, edges, and exposed surfaces.

G. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

1. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

3.11 STRUCTURAL ALUMINUM

A. All welding (shop and/or field) shall be as follows:

1. All dirt, grease, forming or machining lubricants, or any organic materials shall be removed from the areas to be welded by cleaning with a suitable solvent or by vapor degreasing. Additional operations to remove the oxide coating just prior to welding are required when the inert gas tungsten arc welding method is used. This method may be done by etching or by scratch brushing. Suitable edge preparation to assure 100% penetration in butt welds shall be used.

2. Oxygen cutting shall not be used. Sawing, chipping, machining, shearing or arc cutting may be used.

3. The welding may be done in the inert-gas welding process; either by consumable metal (MIG welding) or tungsten (TIG welding). Parts may also be welded by resistance. No welding process that requires the use of a welding flux shall be used. The filler metal shall be aluminum alloy 5556, 5356 or 4043. Other filler metal alloys may be used if they are capable of meeting the qualification test requirements, and result in welds having resistance to corrosion equal to or greater than welds made with filler alloys 5556, 5356, or 4043. Preheating for welding is permissible provided the temperature does not exceed 400âF for a total time of 30 minutes. Portions of joints

that have been rejected on inspection because of defects may be repaired only by welding. The defective area shall be removed by chipping or machining. Flame cutting shall not be used. Before welding, the joint shall be inspected to assure that the entire defective weld has been removed and that the joint is accessible so that the welding operator can obtain full penetration through the joint.

B. Welding procedures and operators shall be qualified for welding above mentioned aluminum alloys. At the option of the Engineer, the Contractors may be required to conform to the method described in ASME Boiler and Pressure Vessel Code, Section IX, "Welding Qualifications", Part B, 1962, for qualifying his welders.

C. Stainless steel bolts are to be used for bolting all aluminum. All bolting shall use the proper flat washers and lock washers which are also to be stainless steel.

D. Aluminum surfaces placed in contact with steel shall be given one coat of zinc chromate primer in accordance with United States Military Spec. MIL-P-735, or one coat of a suitable non-hardening joint compound capable of excluding moisture from the joint. Zinc Chromate paint shall be allowed to dry hard before assembly of the parts. The adjoining steel surface shall be painted with red lead conforming to Federal Spec. II-P-86, followed by one coat of paint consisting of two (2) pounds of aluminum paste pigment (ASTM Spec. D962-49, Type II, Class B), per gallon of varnish, that meets Fed. Spec. TT-V-81, Type II.

E. Aluminum surfaces in contact with stainless steel or aluminized, hot-dipped galvanized or electro-galvanized steel placed in contact with aluminum need not be painted.

F. Aluminum surfaces to be placed in contact with wood, concrete, or masonry construction, and aluminum to be embedded in concrete, shall be given a heavy coat of an alkali-resistant bituminous paint before installation. The paint shall be applied as it is received from the manufacturer without the addition of any thinner.

G. Adequate shoring and protection shall be provided to prevent distortion and other damage during storage at the job site. The structural aluminum shall be stored on timber and not laid in mud or cinders or otherwise handled to damage it.

H. All aluminum shall be erected plumb and level. Temporary bracing required for proper alignment and stability during erection shall be provided. Temporary bracing and/or shoring shall remain during erection and as long thereafter as required for safety.

I. Field errors and adjustments shall not be corrected without approval of the ENGINEER. Indiscriminate cutting and slotting of holes will not be allowed.

*** * END OF SECTION * ***

Division 11 – Miscellaneous Equipment

11201 – Safety Equipment

SECTION 11201
SAFETY EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. CONTRACTOR shall provide all labor, materials, equipment and incidentals, as shown, specified and required to provide as a minimum a degree of safety for all personnel coming in contact with the chemicals specified hereinafter.

B. The following types of safety equipment shall be furnished under this Section:

1. Deluge Shower & Eye Wash

2. Fire Extinguisher

3. Miscellaneous Safety Equipment

1.02 QUALITY ASSURANCE

A. Quality Source Control:

1. Furnish all equipment by one manufacturer, unless otherwise accepted by ENGINEER.

B. Reference Standards: Comply with applicable provisions and recommendations, unless otherwise shown or specified.

1. Occupational Safety and Health Act (OSHA) of 1971

2. ANSI Z87.1 of 1989

3. ANSI Z358.1 of 1981

1.03 SUBMITTALS

A. Shop Drawings: Submit for approval manufacturer's detailed data sheets.

PART 2 - PRODUCTS

2.01 PERSONAL PROTECTION EQUIPMENT

A. Deluge Shower & Eye Wash Unit:

1. Quantity: 2

2. Description: Shower features pull rod, stanchion, floor flange, ABS bowl face/eye wash, and galvanized steel interconnecting pipe.

3. Eye wash and shower unit shall meet requirements of ANSI Z358.1-1998.

4. Product and Manufacturer:
   a. Model OA-28909 by Lab Safety Supply, Inc., or approved equal.

2.02 OTHER SAFETY EQUIPMENT

A. Fire Extinguisher:

1. Quantity: 3

2. Description: Tri-class (A-B-C) Dry chemical type fire extinguishers, 20-pound capacity each, (UL rating 1OA; 6OBC) with wall mounting brackets. Extinguishers shall be installed in each process room and the electrical control room. Contractor shall meet with the local fire inspector who shall specify the exact number and locations of the fire extinguishers.

3. Product and Manufacturer: Extinguishers shall be Sentry type as manufactured by Ansul, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install safety equipment so specified and in accordance with the manufacturer's instructions. Wall mounted units shall be positioned plumb and true and securely mounted and anchored in place with proper clips, brackets and bolts for the type of mounting required. Location shall be as directed by the ENGINEER.

*** * END OF SECTION * ***

11901 – Pretreatment System

SECTION 11901
PRETREATMENT SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. CONTRACTOR shall provide all labor, materials, equipment and incidentals, as shown, specified and required to provide a Pretreatment System specified hereinafter.

B. CONTRACTOR shall obtain the Pretreatment System from a vendor that has demonstrated experienced in the technology specified.

C. A request for quotation (dated September 2010) was issued to bidders. The request for quotation is included as Attachment PS-RFQ. The updates to the RFQ are:
   1. Process Flow Diagram update (see attached Drawing package, Sheet PFD-01); and
   2. Effluent Quality Objectives (see Table 2 in 01740 Warranties and Bonds)

D. Additions to the RFQ are noted below.

   1. Providing two installed filter feed pumps.
   2. Providing two installed filter backwash pumps.
   3. Providing three pressure filters.
   4. Design based on seismic loadings applicable in Seismic Zone 3.

E. A review of submitted bids was conducted. Unipure was selected as the preferred Vendor based upon both cost and technical considerations. CONTRACTOR may propose a Pretreatment System from an alternative Vendor that meets the treatment objectives as specified herein, with approval from the ENGINEER and OWNER'S AGENT.

F. CONTRACTOR is responsible for providing a complete and functional Pretreatment System. Equipment, materials, and labor not provided by the Pretreatment System vendor shall be provided by the CONTRACTOR.

1.02 QUALITY ASSURANCE

A. Quality Source Control:

   1. Furnish all equipment per the request for quotation and the applicable Pretreatment System components as shown in engineered design drawings (Attachment A), unless otherwise accepted by Engineer.

   2. Equipment shall be of the same manufacturer for each equipment and instrumentation type as noted in the drawings and specifications.

B. Reference Standards:

3. Comply with applicable provisions and per the request for quotation, the engineered design drawings, and standards reference by manufacturer/equipment vendor, unless otherwise shown or specified.

1.03 SUBMITTALS

A. Fabrication/Shop Drawings: Submit per the attached RFQ. CONTRACTOR shall provide a schedule for submitting fabrication/shop drawings to OWNER'S AGENT and ENGINEER as part of the proposal. OWNER'S AGENT and ENGINEER must approve the drawings before fabrication commences. As such, CONTRACTOR shall provide a total of 30 calendar days for the OWNER'S AGENT and ENGINEER to review the drawings, request clarification and/or revisions, review the CONTRACTOR'S responses and revised drawings, and issue approval. CONTRACTOR shall assume participation in a conference call with the OWNER'S AGENT and ENGINEER to discuss their comments and the CONTRACTOR'S responses and revisions within the above 30 calendar days.

B. Operation and Maintenance Manual as As-Built Drawings: Submit per the attached RFQ. CONTRACTOR shall provide a draft manual to the OWNER'S AGENT and ENGINEER for review and approval prior to commencing system start up. As such, CONTRACTOR shall provide a total of 30 calendar days for the OWNER'S AGENT and ENGINEER to review the manual and as-built drawings, request clarification and/or revisions, review the CONTRACTOR'S responses and revised manual and drawings, and issue approval. CONTRACTOR shall assume participate in a conference call with the OWNER'S AGENT and ENGINEER to discuss their comments and the CONTRACTOR'S responses and revisions within the above 30 calendar days.

PART 2 - PRODUCTS

2.01 PRETREATMENT SYSTEM

A. Provide as noted in the request for quotation, updates, and additions listed above in Sections 1.01C and 1.01D.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation of the Pretreatment System will be in accordance with the manufacturer/equipment vendor instructions, engineered design drawings, and any specification recommended by the CONTRACTOR and approved by the ENGINEER and OWNER'S AGENT.

B. CONTRACTOR is responsible for providing a complete and functional Pretreatment System per the attached RFQ, design drawings and specifications, and vendor's/manufacturer's specifications. CONTRACTOR shall verify that all equipment, associated controls, and interlocks function per the design and that the treatment system is achieving the required discharge limits. Field/start up testing to verify this shall be proposed and conducted by the CONTRACTOR to the satisfaction of the OWNER'S AGENT and ENGINEER, and the project shall not be complete until such testing verifies that the system functions as designed and achieves the discharge limits. CONTRACTOR shall correct any deficiencies identified during the field/start up testing at no additional cost to the OWNER

C. CONTRACTOR shall provide start up, operation, and maintenance training to the OWNER'S AGENT and ENGINEER, and such training shall include an overview of the operation and maintenance manual to understand the key features of the system operation and maintenance, walkthrough of the system to see and understand how the key features function and how maintenance is to be performed, hands-on startup, hands-on shut down, and health and safety considerations.

*** * END OF SECTION * ***

REQUEST FOR QUOTATION
Metals Precipitation System
Groundwater Extraction and Treatment System
Groundwater Source Control Measure
Arkema, Inc. Facility – Portland, Oregon
September 2010

1.0 INTRODUCTION

On behalf of Legacy Site Services, LLC (LSS), agent for Arkema Inc. (Arkema), ERM-West, Inc. (ERM) is requesting a quotation from treatment equipment vendors for a metals precipitation system as part of a groundwater extraction and treatment (GWET) system currently planned to be installed at the Portland, Oregon facility (the "Site"). The system will be used to remove metals from groundwater to achieve effluent quality objectives (EQOs) set forth by the Oregon Department of Environmental Quality (ODEQ). This document outlines the treatment process, groundwater treatability study results, metals precipitation system description and specifications, influent groundwater characteristics, performance criteria, and quotation requirements.

2.0 PROCESS OVERVIEW

Groundwater at the Site contains volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, metals, and other inorganics (i.e., chlorate and perchlorate) at concentrations exceeding EQOs. A preliminary process flow diagram for the GWET system is included as Figure 1.

The recommended GWET system consists of the following components:

- A total of 22 recovery wells, each equipped with a pump;
- Precipitation reactor with aeration and pH adjustment via sodium hydroxide to remove metals potentially present at concentrations exceeding their EQOs in groundwater, and is to include the option for ferrous sulfate or ferrous chloride addition to enhance metals removal via iron co-precipitation;
- Solids handling system (i.e., clarifier with polymer feed, sludge holding tank, filter press, optional post-clarifier solids filtration unit, and associated equipment) to dewater and prepare precipitated solids for off-site transportation and disposal;
- A pH adjustment tank to neutralize the groundwater pH prior to anaerobic biological treatment;

- Fluidized bed reactor (FBR) to anaerobically biodegrade chlorate, perchlorate, and potentially biodegradable organics present in groundwater, with the option of utilizing either a packed bed reactor (PBR) or EHC®/sand reactor in the event they are determined to be more cost effective than a FBR;
- Post-FBR sand filter to remove biomass potentially carried over into the FBR effluent;
- Two liquid-phase granular activated carbon (LPGAC) units in series to remove VOCs, SVOCs, and pesticides from groundwater; and
- Discharge to the Willamette River through an existing stormwater outfall.

Vendors are requested to provide a quotation for the metals precipitation system, including the precipitation reactor and associated solids handling system.

3.0 GROUNDWATER TREATABILITY STUDY

A bench-scale groundwater treatability study was conducted between April 2007 and February 2008 to evaluate the potential effectiveness of various treatment technologies for groundwater at the Site. Results of the treatability study were used as a basis for the preliminary GWET system design, and are summarized as follows:

- Iron was the only metal of interest present at measurable concentrations in the blended groundwater sample collected for treatability testing (at a concentration of 140 milligrams per liter [mg/L]), and testing efforts evaluated removal of iron. The observed concentration of iron may be anomalous, resulting from sample container corrosion. Chemical precipitation consisting of aeration with sodium hydroxide (NaOH) to adjust the pH to 8.0 standard units (SU) followed by the addition of an anionic polymer and polishing filtration (25-micron) was able to effectively reduce the concentration of iron to less than its draft discharge limit of 0.3 milligrams per liter (mg/L). Based on these results, iron co-precipitation was selected as the initial treatment step of the groundwater treatment system. However, iron co-precipitation is expected to be effective for treatment of a number of metals, including arsenic, hexavalent chromium, and others periodically detected in groundwater samples collected at the Site. Although polishing filtration was required to achieve the draft discharge limit for iron during the bench-scale treatability study, filtration may not be required for the full-scale GWET system. Specifically, the bench-scale testing relied upon manual decanting of the treated effluent from jar testing, while the full-scale system will include an engineered clarifier system for removal of fine solids. The equipment vendor shall recommend whether a post-clarifier solids filter is

required to achieve applicable EQOs and meet performance objectives for metals removal.

- Titration tests indicated that the volume of NaOH required to achieve a pH of 8.0 SU ranged from $3x10^{-5}$ gallons (NaOH, 20 percent weight by volume) to $5x10^{-4}$ gallons (NaOH, 40 percent weight by volume) per gallon of groundwater. The dosage required depended on the age of the groundwater sample. Lower volumes of NaOH were required to achieve the target pH during the initial stages of the treatability study, suggesting that NaOH feed rates for the GWET system will be on the low end of this observed range.
- The polymer dosage that effectively coagulated the precipitated solids and enhanced their settlement in the clarifier was $2x10^{-4}$ gallons (CSC Technology 4816P, 0.1 percent) per gallon of groundwater.
- Iron co-precipitation using a supplemental iron source was initially planned to be evaluated as a means to remove iron and other metals present at concentrations above their potential EQOs. However, sufficient iron was present in the treatability study sample so that an additional source of iron was not needed for the co-precipitation process. Additionally, no conclusions could be drawn for other metals, as they were present at relatively low concentrations in the treatability study sample relative to their potential EQOs based on information provided by ODEQ. The concentration of iron present in groundwater pumped from the recovery wells appears to be significantly lower in samples collected from monitoring wells compared to iron in the treatability study sample, and the equipment vendor shall recommend whether a supplemental iron source is required for the GWET system to provide high enough iron concentrations for sufficient iron co-precipitation to achieve applicable EQOs for other metals. If an additional iron source (e.g., ferrous sulfate) is necessary, the equipment vendor shall provide the ability to add ferrous sulfate (or other recommended source of iron) to the precipitation reactor and specify the supporting feed system with corresponding controls.

Electronic copies of the bench-scale treatability study report (Adventus, April 2008) and draft preliminary design report (ERM, May 2010; excluding appendices), which provide additional information on the design basis for the GWET system, are provided for reference purposes.

4.0 METALS PRECIPITATION SYSTEM DESCRIPTION

Iron co-precipitation will be used to remove metals present in groundwater at concentrations exceeding the EQOs, or at levels that may affect the downstream

anaerobic biological treatment process. Based on the treatability studies, the metals precipitation system will consist of the following:

- A precipitation reactor (vertical tank equipped with a mixer) where influent groundwater is equalized, mixed with a supplemental iron source, if required, and sodium hydroxide to raise the pH to between 7.5 and 8.5 SU (pending vendor recommendation), aerated using an air injection blower to oxidize the iron and enhance its precipitation and the removal of other metals, and mixed with recycled sludge from the clarifier as necessary to enhance its performance;
- An iron source feed tank and metering pump to feed ferrous sulfate (or other iron source) to the precipitation reactor, if required;
- A sodium hydroxide feed tank and metering pump to feed sodium hydroxide to the precipitation reactor;
- A parallel-plate type of clarifier equipped with a rapid mix tank where polymer is added to enable floc formation and enhance settling characteristics, a flocculator to further enhance floc formation, a settling chamber, and an overflow weir where the clarified effluent leaves the clarifier;
- A polymer storage tank, polymer blending unit, and polymer metering pump to feed the anionic polymer to the clarifier's rapid mix tank;
- A diaphragm pump to pump settled solids/sludge from the bottom of the clarifier to the sludge holding tank/thickener, and a portion recycled back to the chemical precipitation reactor;
- A sludge holding tank/thickener with mixer/scraper to concentrate the solids, with the supernatant pumped to the precipitation reactor;
- A diaphragm pump to transfer sludge from the sludge holding tank/thickener to the filter press;
- A filter aid addition system for lime or diatomaceous earth, if needed;
- A filter press to dewater the sludge, where the dewatered sludge is placed into a roll-off container for transportation and off-site disposal, with the filtrate pumped to the precipitation reactor; and
- A post-clarifier solids filtration unit to remove solids in the clarifier effluent to achieve applicable EQOs for metals removal, if necessary.

As discussed in Section 3.0, iron co-precipitation was initially considered as an enhancement to chemical precipitation to more effectively remove other metals

besides iron. However, sufficient iron was present in the treatability study sample such that an additional source of iron was not necessary to effect the iron co-precipitation process. Pending recommendations from the equipment vendor selected to provide the metals precipitation system, a supplemental iron source is assumed to be required for the GWET system to provide high enough iron concentrations for sufficient iron co-precipitation to achieve applicable EQOs for other metals.

While full-scale iron co-precipitation and clarification is anticipated to reduce the concentrations of metals in groundwater, a post-clarifier solids filtration unit may be necessary to remove solids in the clarifier effluent to achieve applicable EQOs for these metals. Particulates bearing metals in the clarifier effluent could potentially be redissolved in the strong reducing conditions in the FBR and pass through the post-FBR solids filter.

5.0 SPECIFICATIONS

The iron co-precipitation equipment will be provided by the vendor as a package treatment system with associated controls. The vendor will be responsible for treatment equipment design, fabrication, delivery, and operator training, as well as process performance to meet specified EQOs for the Site. Equipment bidding is being completed in parallel with design of the GWET system so that the selected treatment system can be incorporated directly into the design, and the design and implementation schedule for the GWET system will be expedited. Specifications for the metals precipitation system are summarized as follows:

1. **Expected Flow Rate Range**: Flow rate range of 54 to 142 gpm with an average predicted pumping rate of 109 gpm. The flow rate will be adjusted periodically within the specified range to account for site-specific hydrogeologic conditions.

2. **System Configuration**: One covered precipitation reactor with air vent, followed by clarifier with sludge holding tank/thickener and a filter press. Treatment building structural requirements (e.g., winch/lift system for removal and maintenance of mixers and clarifier plates, elevated platform for filter press to allow for disposal container access, fork lift or vacuum truck access) shall be specified by Vendor. Vendor shall also recommend optimal equipment sizing (i.e., dimensions and volumes), types (e.g., cylindrical, inclined plate, cone-bottom, plate-and-frame, etc.), and arrangement (e.g., layout of the equipment to optimize space requirements while enabling access for operation and maintenance).

3. **Air Feed**: Vendor shall recommend and provide feed system for ambient air to precipitation reactor. Vendor shall specify blower size, type, and motor horsepower rating, inlet air filter size and type, as well as proposed method of controlling air feed rate and distribution in precipitation reactor. Vendor shall also specify size and type of air vent for covered precipitation reactor.

4. **Chemical Feed**: Vendor shall recommend and provide feed systems (i.e., feed tanks, feed pumps, piping, and controls) for supplemental iron source (if necessary), NaOH, polymer, and filter aid (if necessary). If the supplemental iron source is not necessary, the vendor shall design the system to enable supplemental iron source addition (e.g., space for tank and feed pump, location for injection into the tank). Vendor shall specify chemical storage tank volumes, feed pump size, type, and motor horsepower rating, as well as proposed method of controlling chemical feed rates (e.g., flow control valves vs. adjustable rate feed pumps). Vendor shall also specify whether chemical feed tanks and/or piping require heat trace and insulation to prevent clogging/fouling of feed systems.

5. **Mixers**: Vendor is to equip precipitation reactor, clarifier rapid mix and flocculation tanks, and sludge holding tank/thickener with mechanical mixers/flocculators/scrapers. Vendor shall recommend optimal mixer size, type, motor horsepower rating, and installation (e.g., vertical, angled).

6. **Sludge Pumps**: Vendor is to equip clarifier and sludge holding tank/thickener with sludge pumps. Vendor shall recommend optimal pump size, type, and motor horsepower or pneumatic pressure rating. Vendor shall also specify proposed method of controlling pumping and recycle rates.

7. **Tank Connections**: Vendor shall specify the number, location, size, and type of inlet and outlet connections for the precipitation reactor, clarifier, sludge holding tank/thickener, and filter press.

8. **Post-Clarifier Solids Filtration Unit (optional):** If recommended, Vendor shall specify the size and type of post-clarifier solids filtration unit to remove residual solids from the clarifier effluent to achieve applicable EQOs for metals. Additionally, Vendor shall provide specifications for any ancillary equipment required to support solids filtration process (e.g., post-clarifier effluent holding tank, transfer pump, and corresponding controls).

9. **Operation**: 24 hours per day, 7 days per week. Fully automated system that minimizes operator intervention.

10. **Controls**: Vendor shall recommend and provide instrumentation and controls for optimal performance of the metals precipitation system, and provide specifications for recommended instrumentation and controls.

11. **Control Panel**: The control panel enclosure shall be NEMA Type 4X. The control panel must be equipped with operating controls/switches, indicator lights, operating data displays, and/or visual indicator lights to denote each alarm condition (e.g., high tank level, high discharge pressure, etc.) [HMI is acceptable]. The control panel must be equipped to relay each alarm signal from the metals precipitation system to a Master Control Panel for the overall GWET system to shut down the groundwater recovery pumps, notify the operator that the metals precipitation system has shut down, and identify the specific alarm condition that caused the shut down. The control panel must be equipped with interlock(s) to shut down the metals precipitation system in the event of an alarm condition for the overall GWET system and to allow for remote starting of the metals precipitation system (via Master Control Panel). As an added option, Vendor shall also recommend a remote monitoring and control system to access the control panel for the metals precipitation system via the Master Control Panel using a secure, password-protected internet site. All instrumentation, indicator lights, switches, and other items mounted on the control panel must be clearly labeled. Any panel tags to be engraved type, black background with white lettering. The control panel is to be mounted on the metals precipitation system skid, tested and verified by Vendor before shipping, and not disconnected prior to shipping. If control panel is disconnected from metals precipitation system skid prior to shipping for any reason, testing and verification is to be repeated by Vendor upon reconnection at Site. Control wire and electric junction boxes with HOA switches for motors must be mounted at the metals precipitation system.

12. **Electrical Power**: 480 VAC, 3-phase and 120 VAC, 1-Phase electric power sources are available. Any 120 VAC uses on metals precipitation system will be distributed through a main circuit breaker (sized by Vendor) and individual fused power distribution terminals mounted in the metals precipitation system control panel.

13. **Materials of Construction**: Materials of construction selected by the Vendor for the metals precipitation system must be compatible with the groundwater characteristics, constituents present in groundwater, and

chemicals to be used in the treatment process. Any PVC pipe or fittings shall be of Schedule 80 construction with flanged or union connections to facilitate O&M activities.

14. **Fabrication Drawings**: Vendor is required to provide PFD, P&ID, equipment arrangements, elevation, electrical (control panel and electric distribution), control logic/ladder diagrams, and other fabrication drawings, design specifications, and control narrative for the metals precipitation system to LSS for review, use in preparing the design package for the GWET system, and final approval prior to fabrication. All drawings to be submitted in AutoCAD format so that they can be incorporated into the overall GWET design package. Additional information to be provided shall include the required footprint of the system and ceiling height, equipment weight empty and full of water, recommended mounting/securing of the equipment (e.g., concrete floor, pedestal, concrete strength recommendation, bolt sizes, etc.), and whether the equipment will be delivered in pieces. If delivered in pieces, assembly specifications/instructions shall be provided. Vendor shall also provide a proposed schedule for delivery of fabrication drawings.

15. **Operation & Maintenance Manual**: Vendor must provide five hard copies and one electronic copy of an operation and maintenance (O&M) manual for the metals precipitation system including, but not limited to, startup and shutdown procedures; emergency shutdown procedure, if different; operating procedures; alarm settings and procedures for adjusting settings; maintenance/cleaning requirements, procedures, and frequency; equipment and components list; troubleshooting guidance; as-built engineering drawings of the system and controls; manufacturer's equipment information and O&M manuals for individual components; and list of equipment provided and replacement parts.

16. **Location**: The metals precipitation system will be located inside a building where the temperature will be maintained at 45°F and greater throughout the year, so no freeze protection will be required. However, some supplemental heating may be required for chemical feed systems (e.g., caustic) to reduce potential for clogging/fouling of feed systems.

The vendor is encouraged to propose an alternative treatment process if it will more reliably and consistently achieve the EQOs and/or be more cost effective considering capital, operating, and maintenance costs. Alternative processes will

be considered and evaluated based on vendor recommendations during the bidding process.

6.0 INFLUENT GROUNDWATER CHARACTERISTICS

Constituents of potential concern (COPCs) present in groundwater, and water quality parameters that may affect the design of the GWET system, are presented in Table 1. While actual influent concentrations will likely vary, the influent groundwater concentrations presented in Table 1 are considered to be conservative estimates. Based on actual operating experience from other GWET systems, actual influent concentrations are expected to decrease over time. However, sporadic increases in concentrations could occur in the short term due to areas of groundwater containing constituents at higher concentrations being pulled toward the recovery wells and/or more groundwater being pumped from areas with COPCs at higher concentrations. The conservative estimates of influent concentrations included in Table 1 provide some additional level of assurance that the GWET system will be able to effectively treat the groundwater if higher constituent concentrations are encountered.

7.0 PERFORMANCE CRITERIA

Treated groundwater will be discharged to the Willamette River through an existing stormwater outfall. The presumed EQOs for the treated groundwater are summarized in Table 2. Based on comparison of estimated influent concentrations to the EQOs and pending further negotiations with ODEQ, the proposed GWET system design parameters are summarized in Table 3. The COPCs in groundwater that will be included in the permit for discharge of treated effluent and their respective EQOs are currently being discussed between LSS and ODEQ.

8.0 QUOTATION REQUIREMENTS

The quotation **MUST** include the following items:

1. Price for the metals precipitation system per the above specifications, excluding the supplemental iron feed system and post-clarifier solids filtration unit (including five O&M manuals). If multiple configurations that will satisfy the performance criteria are available, please provide pricing for all such configurations.
2. Add-on cost for supplemental iron feed system for the precipitation reactor, including supporting feed tank, feed pump, and corresponding controls.

3. Estimated removal efficiencies for metals listed on Table 2, with and without post-clarifier solids filtration unit.
4. Add-on cost for post-clarifier solids filtration unit to remove solids in the clarifier effluent to achieve applicable EQOs for these metals, including any ancillary equipment (e.g., post-clarifier effluent holding tank, transfer pump, and corresponding controls).
5. Add-on cost for remote monitoring and control system to access the control panel for the metals precipitation system via the Master Control Panel using a secure, password-protected internet site.
6. Price for shipping the metals precipitation system to Portland, Oregon.
7. Unit prices for start-up and training services provided by vendor.
8. Unit price for additional O&M support during two years of operation.
9. List of, and unit price for recommended spare parts.
10. Literature and typical schematics for the recommended system.
11. Manufacturer/vendor recommendations for improving system performance and/or reducing cost.
12. Vendor to indicate the maximum flow rate the system will be able to effectively treat, if higher than the upper end of the specified flow rate range.
13. Applicable equipment warranties and performance guarantee in terms of equipment operation, fabrication quality, and achieving the EQOs, Associated conditions and/or assumptions that affect the warranties and performance guarantee shall also be provided.
14. Schedule for developing design drawings and equipment design information; estimated time for LSS to review and approve drawings and equipment design information; fabrication; and delivery schedule. Include a list of drawings to be provided. LSS also reserves the right to visit the fabrication facility to inspect the metals precipitation system prior to shipping to the Site.
15. Key vendor assumptions for proposing the recommended metals precipitation system; developing the pricing, schedule, and performance guarantee; and key conditions affecting the manufacturer's warranty and performance guarantee.
16. Alternative processes will be considered and evaluated based on vendor feedback during the bidding process, and recommendations for improving metals precipitation system design, performance, operation,

and maintenance are welcome. Separate cost additions/deductions and rationale are to be provided for all recommended improvements.

9.0 ESTIMATED PROJECT SCHEDULE

Design activities have been initiated for the GWET system, with a proposed delivery date for the pre-final design to regulatory agencies in December 2010. The proposed schedule for the GWET system design and implementation is presented in the Groundwater Source Control Measure Schedule as Figure 2. Based on expected agency review timeframes, ERM anticipates that the final design for the GWET system will be completed during Spring 2011 and approved during Summer 2011. Construction contractor bidding and equipment procurement activities are planned to be completed concurrent with agency review and approval of the final design, with contracts awarded during Summer 2011. Construction of the GWET system is slated to occur during Summer 2011 through Spring 2012, with startup activities scheduled for Spring/Summer 2012. This overall project schedule is subject to change based on agency review times and comments.

10.0 QUOTATION DUE DATE AND SUBMITTAL

The quotation must be submitted to the following by 8 October 2010 at 5:00 PM (electronic mail acceptable):

Mr. Chris Underwood
Environmental Resources Management
350 Eagleview Blvd., Suite 200
Exton, Pennsylvania 19341
Phone: 610-524-3605
E-Mail: christopher.underwood@erm.com

ERM will review the quotation and contact you with any questions and/or requested changes to the quotation. If you have any questions regarding this request for quotation, technical or otherwise, please submit questions in writing (again, electronic mail is acceptable) to Mr. Underwood. ERM will accept such questions until 1 October 2010 at 5:00 PM. ERM appreciates your effort in preparing this quotation and looks forward to reviewing your submittal.

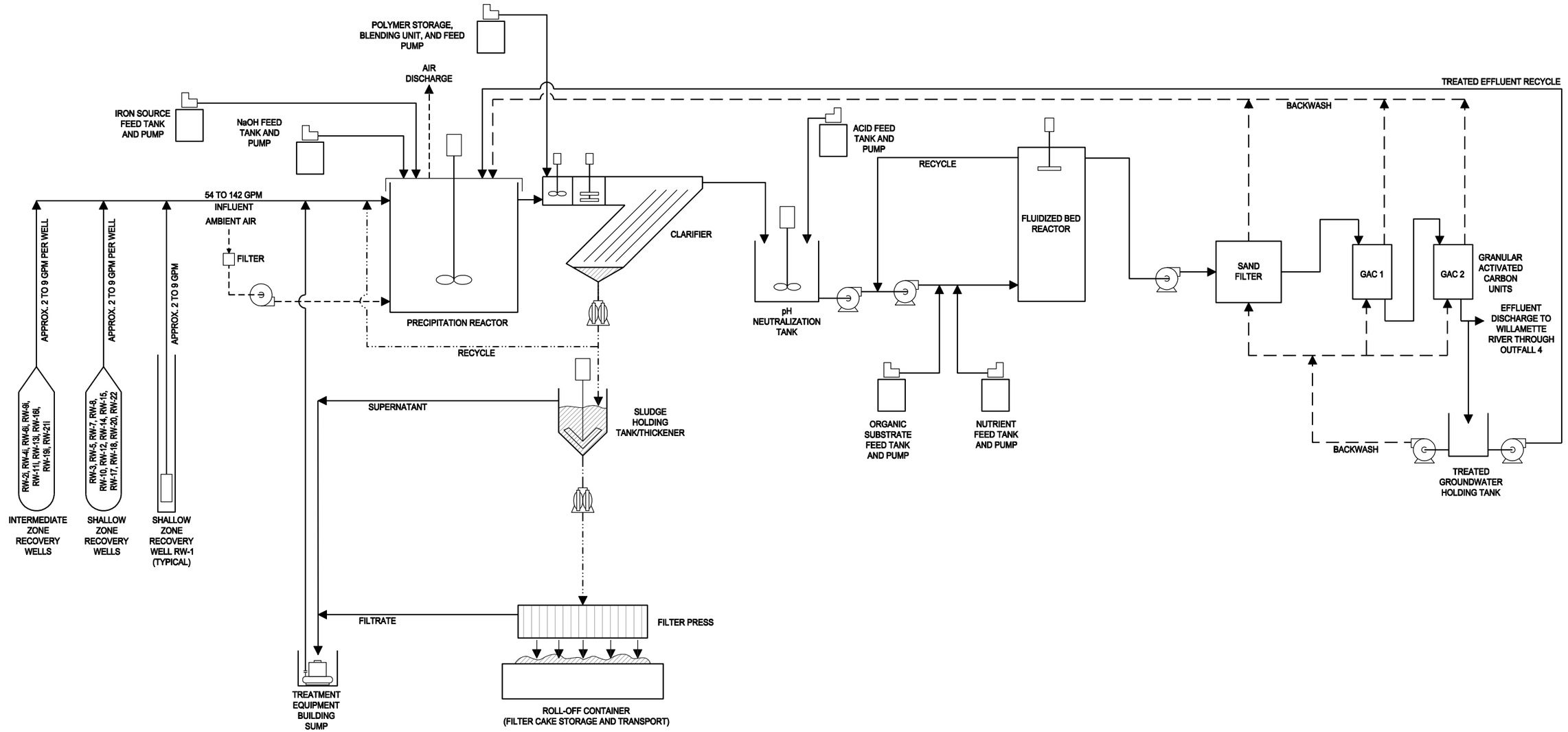


Figure 1

Preliminary GWET System Process Flow Diagram
Preliminary Design Report
Groundwater Source Control Measure
Arkema, Inc.
Portland, Oregon

ERM 5/10

CAD File: G:\CAD\Drawings\Arkema-Portland\0093634\K201.dwg
Drawn By: MLB
Date: 9/27/2010
Project No. 0114849

Table 1
Estimated Range of Influent Concentrations for GWET System Design
Groundwater Source Control Measure
Arkema Inc.
Portland, Oregon

Data Source	Groundwater Treatability Study[1]	Site-Wide Groundwater Sampling[2]				Recovery Well Pumping Tests[3]				Estimated Influent Concentration
Parameter	Blended	Average	Maximum	No. of Samples	No. of Detections	Average	Maximum	No. of Samples	No. of Detections	
VOCs (ug/L)										
Benzene	ND (6.4)	1.04	16.6	33	10	1.22	2.69	12	1	3
Chlorobenzene	1,700	948	12,500	33	30	80.5	286	12	6	2,000
Chloroform	9.9	298	9,800	33	17	NA	ND (5)	12	0	300
SVOCs (ug/L)										
Benzo(a)Anthracene	ND (1.7)	NA				NA				ND (1.7)
Benzo(a)Pyrene	ND (1.3)	NA				NA				ND (1.3)
Benzo(k)Fluoranthene	ND (0.46)	NA				NA				ND (0.46)
2-Chlorophenol	43	NA				NA				50
Chrysene	ND (1.0)	NA				NA				ND (1.0)
Dibenzo(a,h)Anthracene	ND (1.4)	NA				NA				ND (1.4)
Fluoranthene	ND (5.0)	NA				NA				ND (5.0)
Hexachlorobenzene	ND (2.1)	NA				NA				ND (2.1)
Pentachlorophenol	ND (20)	NA				NA				ND (20)
Pesticides (ug/L)										
Aldrin	ND (0.0059)	NA	ND (0.05)	36	0	NA				ND (0.0059)
Chlordane	ND (0.14)	NA	ND (0.5)	36	0	NA				ND (0.14)
DDD	0.027 COL	0.09	0.599	36	17	NA	ND (0.1)	12	0	0.1
DDE	ND (0.0075)	0.06	0.553	36	10	NA	ND (0.1)	12	0	0.1
DDT	0.015 COL	1.3	30.8	36	23	NA	ND (0.1)	12	0	1
Metals, total (ug/L)[4]										
Arsenic	ND (4.4)	NA	ND (3)	1	0	NA				10
Cadmium	5.6	NA	0.367 J	1	1	NA				5
Chromium, total	ND (2.6)	NA				NA				100
Chromium, hexavalent	ND (4.4)	98	1,100	30	15	NA				100
Copper	ND (4.5)	NA	ND (2)	1	0	NA				5
Iron	140,000	NA	205	1	1	NA				2,000
Lead	ND (2.6)	NA	ND (7)	1	0	NA				ND (2.6)
Manganese	NA	NA	641	1	1	NA				500
Nickel	ND (7.8)	NA	5.41 J	1	1	NA				5
Silver	ND (2.8)	NA				NA				ND (2.8)
Zinc	63	NA	2.25 J	1	1	NA				50
Metals, dissolved (ug/L)[4]										
Arsenic	ND (4.4)	45.4	892	31	17	13.2	51.9	12	9	10
Cadmium	4	NA	ND (0.7)	2	0	NA				5
Chromium, total	ND (2.6)	36.4	388	19	9	NA				100
Chromium, hexavalent	ND (4.4)	NA				NA				100
Copper	ND (4.5)	2.54	2.85 J	2	2	NA				5
Iron	110,000	1,637	17,800	31	28	500	1,940	12	9	2,000
Lead	ND (2.6)	NA	ND (7)	2	0	NA				ND (2.6)
Manganese	NA	471	4,190	21	20	616	2,090	12	12	500
Nickel	ND (7.8)	3.44	4.95 J	2	1	NA				5
Silver	ND (2.8)	NA				NA				ND (2.8)
Zinc	49	2.86	4.72 J	2	1	NA				50
Inorganics (mg/L)										
Chlorate	45.5	NA				NA				50
Perchlorate	3.2 Q	5.2	119	40	15	NA	ND (0.68)	6	0	5
Chloride	1,600 Q	3,251	39,400	40	40	294	860	12	12	2,500
pH (s.u.)	6.54	6.15	5.02 - 9.71	20	20	NA				6.5
Other Parameters (mg/L)										
Alkalinity	200	NA				NA				200
Calcium	73	NA				NA				75
Nitrate as N	ND (0.21) G	NA				NA				2.5
Nitrogen, Ammonium	5.2	NA				NA				5
Nitrogen, Total Kjeldahl	6.1	NA				NA				5
Phosphate, Total as P	0.18	NA				NA				0.2
Sulfate	1,300 Q	NA				NA				1,000
Total Organic Carbon	10	NA				NA				10
Total Suspended Solids	220 Q	NA				NA				100
Total Volatile Solids	48 Q	NA				NA				25

Notes

(1) - Based on analytical results for groundwater samples collected from on-site monitoring wells for the groundwater treatability study during 2007. Blended sample represents composite samples from MWA-5, MWA-14i, MWA-34i, MWA-43, MWA-44, MWA-52i, MWA-66i, and MWA-68si).

(2) - Based on analytical results for groundwater samples collected from on-site monitoring wells during site-wide groundwater samplings event in 2007 and 2009 (except for total metals and pH, which are based on 2009 event only and dissolved chromium, total, which is based on 2007 event only). Hexavalent chromium, total concentrations based on 2007 and 2009 events.

(3) - Based on analytical results for groundwater samples collected from proposed recovery wells during pumping tests in 2009.

(4) - Dissolved metal concentration may exceed total metal concentration based on data set used to estimate influent concentration.

When necessary, average concentrations calculated assuming concentrations equal to one half of laboratory method detection limit and/or reporting limit for non-detect values.

Non-detect (ND) values reported with laboratory method detection limits (groundwater treatability study and site-wide groundwater sampling) or reporting limit (recovery well pumping tests).

mg/L = milligrams per liter
ug/L = micrograms per liter
s.u. = standard units
NA = data not available
J = Estimated result. Result is less than laboratory method detection limit.

COL = More than 40% RPD between primary and confirmation column results. The lower of the two results is reported.
Q = Elevated reporting limit. The reporting limit is elevated due to high analyte levels.
G = Elevated reporting limit. The reporting limit is elevated due to matrix interference.
V = Elevated reporting limit. The reporting limit is elevated due to limited sample volume.

Table 2
Effluent Quality Objectives for GWET System Design
Groundwater Source Control Measure
Arkema Inc.
Portland, Oregon

Parameter	ODEQ MQL[1]	Estimated Influent Concentration	Effluent Quality Objective	Comments
VOCs (ug/L)[2]				
Benzene	0.5	3	<0.7	Based on LPGAC vendor information
Chlorobenzene	0.5	2,000	<200	Based on LPGAC vendor information; however, FBR treatability study effluent data suggests removal to <130 ug/L
Chloroform	0.5	300	<30	Based on LPGAC vendor information
SVOCs (ug/L)[2]				
Benzo(a)Anthracene	1	ND (1.7)	No design criteria	No design criteria, not detected in influent[5]
Benzo(a)Pyrene	1	ND (1.3)	No design criteria	No design criteria, not detected in influent[5]
Benzo(k)Fluoranthene	1	ND (0.46)	No design criteria	No design criteria, not detected in influent at concentration above MQL
2-Chlorophenol	1	50	<5	Based on LPGAC vendor information
Chrysene	1	ND (1.0)	No design critera	No design criteria, not detected in influent at concentration above MQL
Dibenzo(a)Anthracene	1	ND (1.4)	No design critera	No design criteria, not detected in influent[5]
Fluoranthene	2	ND (5.0)	No design critera	No design criteria, not detected in influent[5]
Hexachlorobenzene	1	ND (2.1)	No design critera	No design criteria, not detected in influent[5]
Pentachlorophenol	2	ND (20)	No design critera	No design criteria, not detected in influent[5]
Pesticides (ug/L)[2]				
Aldrin	0.01	ND (0.0059)	No design criteria	No design criteria, not detected in influent at concentration above MQL
Chlordane	0.1	ND (0.14)	No design criteria	No design criteria, not detected in influent[5]
DDD	0.01	0.1	<0.01	Based on LPGAC vendor information
DDE	0.01	0.1	<0.01	Based on LPGAC vendor information
DDT	0.01	1	<0.1	Based on LPGAC vendor information
Metals (ug/L)[3]				
Arsenic	0.05	10	<10	Based on FBR treatability study effluent
Cadmium	0.1	5	No design criteria	No design criteria, naturally-occurring, incidental removal expected[5]
Chromium, total	10	100	No design criteria	No design criteria, incidental removal expected[6]
Chromium, hexavalent	10	100	<10	Based on FBR treatability study effluent
Copper	10	5	No design criteria	No design criteria, naturally-occurring, incidental removal expected[5]
Iron	100	2,000	No design criteria	No design criteria, naturally-occurring, incidental removal expected
Lead	5	ND (2.6)	No design criteria	No design criteria, naturally-occurring, incidental removal expected[5]
Manganese	2	500	No design criteria	No design criteria, naturally-occurring, incidental removal expected
Nickel	10	5	No design criteria	No design criteria, naturally-occurring, incidental removal expected[5]
Silver	1	ND (2.8)	No design criteria	No design criteria, naturally-occurring, incidental removal expected
Zinc	5	50	No design criteria	No design criteria, naturally-occurring, incidental removal expected
Inorganics (mg/L)[4]				
Chlorate	NA	50	<0.015	Based on FBR treatability study effluent
Perchlorate	0.004	5	<0.015	Based on FBR treatability study effluent
Chloride	1	2,500	No design criteria	No treatment
pH (s.u.)	NA	6.5	6.5 to 8.5	Based on FBR treatability study effluent
Other Parameters (mg/L)[4]				
Alkalinity	1	200	No design criteria	No design criteria, naturally-occurring
Calcium	NA	75	No design criteria	No design criteria, naturally-occurring
Nitrate as N	0.1	2.5	<10	Total nitrogen based on FBR treatability study effluent
Nitrogen, Ammonium	1	5		
Nitrogen, Total Kjeldahl	NA	5		
Phosphate, Total as P	0.01	0.2	<1	Total phosphorus based on FBR treatability study effluent
Sulfate	NA	1,000	No design criteria	No treatment
Total Organic Carbon	NA	10	<10	Based on FBR treatability study effluent
Total Suspended Solids	NA	100	<25	Based on FBR treatability study effluent
Total Volatile Solids	NA	25	<25	Based on FBR treatability study effluent

Notes
(1) - Method Quantitation Limit (MQL) based on values published by Oregon Deparment of Environmental Quality (ODEQ) in guidance dated 16 November 2007.
(2) - Estimated effluent concentrations based on approximately 90% removal efficiency for liquid-phase granular activated carbon (LPGAC).
(3) - Estimated effluent concentrations assume iron co-precipitation with clarifier and optional solids filtration.
(4) - Estimated effluent concentrations based on documented performance of fluidized bed reactor.
(5) - Not detected in FBR treatability study effluent above MQL.
(6) - Assumes that majority of chromium present as hexavalent chromium, and total chromium concentrations will be reduced via removal of hexavalent chromium.
Non-detect (ND) values reported with laboratory method detection limits.
FBR = fluidized bed reactor
GWET = groundwater extraction and treatment
LPGAC = liquid-phase granular activated carbon
mg/L = milligrams per liter
ug/L = micrograms per liter
s.u. = standard units
NA = data not available

Table 3
Preliminary GWET System Design Parameters
Groundwater Source Control Measure
Arkema Inc.
Portland, Oregon

Parameter	Estimated Influent Concentration	Effluent Quality Objective
VOCs (ug/L)[2]		
Benzene	3	<0.7
Chlorobenzene	2,000	<200
Chloroform	300	<30
SVOCs (ug/L)[2]		
2-Chlorophenol	50	<5
Pesticides (ug/L)[2]		
DDD	0.1	<0.01
DDE	0.1	<0.01
DDT	1	<0.1
Metals (ug/L)[3]		
Arsenic	10	<10
Chromium, hexavalent	100	<10
Inorganics (mg/L)[4]		
Chlorate	50	<0.015
Perchlorate	5	<0.015
pH (s.u.)	6.5	6.5 to 8.5
Other Parameters (mg/L)[4]		
Nitrate as N	2.5	<10, Total as N
Nitrogen, Ammonium	5	
Nitrogen, Total Kjeldahl	5	
Phosphate, Total as P	0.2	<1
Total Organic Carbon	10	<10
Total Suspended Solids	100	<25
Total Volatile Solids	25	<25

Notes
mg/L = milligrams per liter
ug/L = micrograms per liter
s.u. = standard units

11902 – Bio-Reactor System

SECTION 11902
BIO-REACTOR SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. CONTRACTOR shall provide all labor, materials, equipment and incidentals, as shown, specified and required to provide a Bio-reactor System specified hereinafter.

B. CONTRACTOR shall obtain the Bio-reactor System from a vendor that has demonstrated experienced in the technology specified.

C. A request for quotation (dated September 2010) was issued to bidders. The request for quotation is included as Attachment BRS-RFQ. The updates to the RFQ are:
   1. Process Flow Diagram update (see attached Drawing package, Sheet PFD-01); and
   2. Effluent Quality Objectives (see Table 2 in 01740 Warranties and Bonds.

D. Additions to the RFQ are noted below:

   1. Providing two installed bio-reactor feed pumps.
   2. Providing two installed bio-reactor recycle pumps.
   3. Design based on seismic loadings applicable in Seismic Zone 3.

E. A review of the bids was conducted with the preferred Vendor Envirogen based upon both cost and technical considerations. CONTRACTOR may propose a Bio-Reactor System from an alternative Vendor that meets the treatment objectives as specified herein, with approval from the ENGINEER and OWNER'S AGENT.

F. CONTRACTOR is responsible for providing a complete and functional Bio-reactor System. Equipment, materials, and labor not provided by the Bio-reactor System vendor shall be provided by the CONTRACTOR.

1.02 QUALITY ASSURANCE

A. Quality Source Control:

   1. Furnish all equipment per the requested for quotation and the applicable Bio-Reactor System components as shown in engineered design drawings (Attachment A), unless otherwise accepted by ENGINEER or OWNER'S AGENT.

   2. Equipment shall be of the same manufacturer for each equipment and instrumentation type as noted in the drawings and specifications.

B. Reference Standards:

1. Comply with applicable provisions and per the requested for quotation, the engineered design drawings, and standards reference by manufacturer/equipment vendor, unless otherwise shown or specified.

1.03 SUBMITTALS

A. Fabrication/Shop Drawings: Submit per the attached RFQ. CONTRACTOR shall provide a schedule for submitting fabrication/shop drawings to OWNER'S AGENT and ENGINEER as part of the proposal. OWNER'S AGENT and ENGINEER must approve the drawings before fabrication commences. As such, CONTRACTOR shall provide a total of 30 calendar days for the OWNER'S AGENT and ENGINEER to review the drawings, request clarification and/or revisions, review the CONTRACTOR'S responses and revised drawings, and issue approval. CONTRACTOR shall assume participation in a conference call with the OWNER'S AGENT and ENGINEER to discuss their comments and the CONTRACTOR'S responses and revisions within the above 30 calendar days.

B. Operation and Maintenance Manual as As-Built Drawings: Submit per the attached RFQ. CONTRACTOR shall provide a draft manual to the OWNER'S AGENT and ENGINEER for review and approval prior to commencing system start up. As such, CONTRACTOR shall provide a total of 30 calendar days for the OWNER'S AGENT and ENGINEER to review the manual and as-built drawings, request clarification and/or revisions, review the CONTRACTOR'S responses and revised manual and drawings, and issue approval. CONTRACTOR shall assume participate in a conference call with the OWNER'S AGENT and ENGINEER to discuss their comments and the CONTRACTOR'S responses and revisions within the above 30 calendar days.

PART 2 - PRODUCTS

2.01 BIO-REACTOR SYSTEM

A. Provide as noted in the request for quotation, updates, and additions listed above in Sections 1.01C and 1.01D.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation of the Bio-Reactor System will be in accordance with the manufacturer/equipment vendor instructions, engineered design drawings, and any

specification recommended by the CONTRACTOR and approved by the ENGINEER and OWNER'S AGENT.

B. CONTRACTOR is responsible for providing a complete and functional Bio-Reactor System per the attached RFQ, design drawings and specifications, and vendor's/manufacturer's specifications. CONTRACTOR shall verify that all equipment, associated controls, and interlocks function per the design and that the treatment system is achieving the required discharge limits. Field/start up testing to verify this shall be proposed and conducted by the CONTRACTOR to the satisfaction of the OWNER'S AGENT and ENGINEER, and the project shall not be complete until such testing verifies that the system functions as designed and achieves the discharge limits. CONTRACTOR shall correct any deficiencies identified during the field/start up testing at no additional cost to the OWNER'S AGENT.

C. CONTRACTOR shall provide start up, operation, and maintenance training to the OWNER'S AGENT and ENGINEER, and such training shall include an overview of the operation and maintenance manual to understand the key features of the system operation and maintenance, walkthrough of the system to see and understand how the key features function and how maintenance is to be performed, hands-on startup, hands-on shut down, and health and safety considerations.

*** * END OF SECTION * ***

REQUEST FOR QUOTATION
Anaerobic Bioreactor System
Groundwater Extraction and Treatment System
Groundwater Source Control Measure
Arkema, Inc. Facility – Portland, Oregon
September 2010

1.0 INTRODUCTION

On behalf of Legacy Site Services, LLC (LSS), agent for Arkema Inc. (Arkema), ERM-West, Inc. (ERM) is requesting a quotation from treatment equipment vendors for an anaerobic bioreactor system as part of a groundwater extraction and treatment (GWET) system currently planned to be installed at the Portland, Oregon facility (the "Site"). The system will be used to remove chlorate and perchlorate from groundwater to achieve effluent quality objectives (EQOs) set forth by the Oregon Department of Environmental Quality (ODEQ). This document outlines the treatment process, groundwater treatability study results, anaerobic bioreactor system description and specifications, influent groundwater characteristics, performance criteria, and quotation requirements.

2.0 PROCESS OVERVIEW

Groundwater at the Site contains volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, metals, and other inorganics (i.e., chlorate and perchlorate) at concentrations exceeding EQOs. A preliminary process flow diagram for the GWET system is included as Figure 1.

The recommended GWET system consists of the following components:

- A total of 22 recovery wells, each equipped with a pump;
- Precipitation reactor with aeration and pH adjustment via sodium hydroxide to remove metals potentially present at concentrations exceeding their EQOs in groundwater, and is to include the option for ferrous sulfate or ferrous chloride addition to enhance metals removal via iron co-precipitation;
- Solids handling system (i.e., clarifier with polymer feed, sludge holding tank, filter press, optional post-clarifier solids filtration unit, and associated equipment) to dewater and prepare precipitated solids for off-site transportation and disposal;
- A pH neutralization tank to adjust the groundwater pH prior to anaerobic biological treatment;

- Fluidized bed reactor (FBR) to anaerobically biodegrade chlorate, perchlorate, and potentially biodegradable organics present in groundwater, with the option of utilizing either a packed bed reactor (PBR) or EHC®/sand reactor in the event they are determined to be more cost effective than a FBR;
- Post-FBR sand filter to remove biosolids potentially carried over into the FBR effluent;
- Two liquid-phase granular activated carbon (LPGAC) units in series to remove VOCs, SVOCs, and pesticides from groundwater; and
- Discharge to the Willamette River through an existing stormwater outfall.

Vendors are requested to provide a quotation for the anaerobic bioreactor system, including the pH neutralization tank and biosolids filter.

3.0 GROUNDWATER TREATABILITY STUDY

A bench-scale groundwater treatability study was conducted between April 2007 and February 2008 to evaluate the potential effectiveness of various treatment technologies for groundwater at the Site. Results of the treatability study were used as a basis for the preliminary GWET system design, and are summarized as follows:

- Both FBRs and PBRs were effective at reducing the concentrations of chlorate and perchlorate to below laboratory detection limits with a hydraulic residence time of approximately 3 hours at an approximate temperature of 20°C. These treatments were effective at both low (i.e., 1,600 milligram per liter [mg/L]) and high (i.e., 8,000 mg/L) chloride concentrations. A single FBR with sand as the reactor media was effective at treating chlorate and perchlorate. LPGAC may be considered as an alternate reactor media based on documented performance of existing FBRs for similar groundwater treatment applications. A single PBR filled with Adventus' proprietary biological treatment media, AQUAMEND®, was also effective at treating chlorate and perchlorate.
- High fructose corn syrup (HFCS) was used as the organic carbon source for the FBR and PBR during the treatability study. A feed rate of 1.6×10^{-4} gallons of HFCS per gallon of groundwater was estimated for a full-scale treatment system based on the results of the treatability study.
- Ammonium phosphate was used as the nutrient source for the FBR and PBR during the treatability study, with target feed concentrations of 1 mg/L of phosphate-P and 10 mg/L ammonium-N.

Electronic copies of the bench-scale treatability study report (Adventus, April 2008) and draft preliminary design report (ERM, May 2010; excluding appendices), which provide additional information on the design basis for the GWET system, are provided for reference purposes.

4.0 ANAEROBIC BIOREACTOR SYSTEM DESCRIPTION

An anaerobic bioreactor system will be used to remove chlorate and perchlorate present in groundwater at concentrations exceeding the EQOs. Based on the treatability studies and vendor feedback, the anaerobic bioreactor system will consist of the following:

- A pH neutralization tank, or direct in-line acid feed system pending vendor recommendations, to adjust the groundwater pH prior to anaerobic biological treatment;
- Fluidized bed reactor (FBR) to anaerobically biodegrade chlorate, perchlorate, and potentially biodegradable organics present in groundwater, with the option of utilizing either a packed bed reactor (PBR) or EHC®/sand reactor in the event they are determined to be more cost effective than a FBR; and
- Post-FBR sand filter, or alternative filter type (e.g., backwashable cartridge filter) pending vendor recommendations, to remove biosolids potentially carried over into the FBR effluent;

Effluent from the metals precipitation system (pH approximately 7.5 to 8.5 standard units [SU]) will be discharged to the pH neutralization tank where an acid will be added to lower the groundwater pH to a neutral level for the anaerobic treatment process (estimated 7.0 to 7.5 SU, target pH to be recommended by Vendor). An acid feed tank and chemical feed pump will be used to feed the acid to the pH neutralization tank. A pump shall be provided to pump effluent from the pH neutralization tank to the anaerobic bioreactor. Alternatively, direct feed of the acid into the anaerobic bioreactor influent line will also be considered for this application based on vendor recommendations.

Based on the treatability study results, anaerobic biological treatment was shown to be effective at removing chlorate and perchlorate from site groundwater. Based on available information and published data, an FBR is the presumptive anaerobic biological treatment process considered for this design. The FBR process consists of pumping groundwater up through a vertical column filled with a biological growth media, either sand or LPGAC, to fluidize the media. The groundwater volume being fed to the reactor is made up of influent

groundwater and a large portion of recycle from the FBR effluent. Microorganisms grow on the media surface, and fluidization of the media increases the contact between the microorganisms and the constituents of concern (i.e., chlorate and perchlorate) thus enhancing the biodegradation of these constituents. A significant portion of the fluidization flow rate is FBR effluent recycle, and this recycle increases the total hydraulic residence time in the reactor and improves the FBR treatment performance. An organic carbon source and nutrients are added to enhance the treatment performance. A biosolids separation device is included at the top of the reactor vessel to remove biosolids from the fluidized media, which increases the density of the media and enables it drop back into the reactor rather than be discharged out the top of the reactor.

The FBR for this application includes the following:

- A fluidization pump, to pump effluent from the neutralization tank and FBR recycle up through the column at a rate sufficient to fluidize the media;
- An organic carbon feed tank and feed pump to provide the organic carbon needed by the microorganisms to grow and biodegrade the chlorate and perchlorate;
- A nutrient feed tank and feed pump to provide the phosphorus and nitrogen (e.g. ammonium phosphate, as per the treatability study) needed by the microorganisms to optimally grow and biodegrade the chlorate and perchlorate; and
- An FBR filled with sand and/or LPGAC, to serve as the fluidization media, and equipped with a biosolids separation device, recycle discharge to divert some effluent back through the FBR, and effluent discharge with pump.

Alternatively, the treatability study results indicated that a PBR and EHC®/sand reactor were effective at removing chlorate and perchlorate from groundwater, and these technologies will also be considered for this application based on vendor recommendations.

Effluent from the anaerobic bioreactor contains biosolids that need to be filtered to reduce the concentration of total suspended solids (TSS) to below the EQO for TSS, and to prevent plugging of the downstream LPGAC units and potential additional biological growth. A sand filter is currently proposed for this application. The sand filter will require backwashing to remove the solids, with the backwash water will be discharged to the chemical precipitation reactor. Alternative filter types (e.g., backwashable cartridge filter) will also be considered for this application based on vendor recommendations.

5.0 SPECIFICATIONS

The anaerobic bioreactor and ancillary equipment (e.g., pH neutralization tank, biosolids filter) will be provided by the vendor as a package treatment system with associated controls. The vendor will be responsible for treatment equipment design, fabrication, delivery, and operator training, as well as process performance to meet specified EQOs for the Site at expected operating temperatures. Equipment bidding is being completed in parallel with design of the GWET system so that the selected treatment system can be incorporated directly into the design, and the design and implementation schedule for the GWET system will be expedited. Specifications for the anaerobic bioreactor system are summarized as follows:

1. **Expected Flow Rate Range**: Flow rate range of 54 to 142 gpm with an average predicted pumping rate of 109 gpm. The flow rate will be adjusted periodically within the specified range to account for site-specific hydrogeologic conditions.

2. **System Configuration**: Anaerobic bioreactor system with pH neutralization tank and biosolids filter, including acid, organic substrate, and nutrient feed systems. Treatment building structural requirements (e.g., winch/lift system for removal and maintenance of mixer, fork lift or vacuum truck access) shall be specified by Vendor. Vendor shall also recommend optimal equipment sizing (i.e., dimensions and volumes), types, and arrangement (e.g., layout of the equipment to optimize space requirements while enabling access for operation and maintenance).

3. **pH Neutralization Tank**: Vendor shall recommend and provide the complete pH neutralization system including acid feed tank, feed pump, piping, and controls. The preferred acid for neutralization, target pH range for anaerobic treatment process, and estimated acid feed rate shall be recommended by the Vendor. Vendor shall specify acid storage tank volume, feed pump size, type, and motor horsepower rating, as well as proposed method of controlling chemical feed rates (e.g., flow control valve vs. adjustable rate feed pump, pH feedback loop). Vendor is to equip the tank with a mechanical mixer, and shall recommend optimal mixer size, type, motor horsepower rating, and installation (e.g., vertical vs. angled). Vendor is to also include an effluent pump for the tank, and shall recommend optimal pump size, type, and motor horsepower rating. Alternatively, the Vendor may also propose an in-line acid feed system with specifications if confident that this method will perform

equally. Vendor shall also specify whether acid feed tank and/or piping requires heat trace and insulation to prevent freezing.

4. **Substrate and Nutrient Feed**: Vendor shall recommend and provide cost-effective organic substrate and nutrient sources for the anaerobic bioreactor system and provide associated feed systems (i.e., feed tanks, feed pumps, piping, and controls). Vendor shall specify and provide storage tank volumes, feed pump size, type, and motor horsepower rating, as well as proposed method of controlling chemical feed rates (e.g., flow control valves vs. adjustable rate feed pumps). Vendor shall provide estimated organic substrate and nutrient feed rates, and also specify whether feed tanks and/or piping require heat trace and insulation to prevent clogging/fouling of feed systems.

5. **Anaerobic Bioreactor**: Vendor shall recommend preferred configuration (e.g., FBR, PBR) and reactor volume, and provide specifications for bioreactor unit, including recycle pump, biosolids separation system, and effluent pump with associated controls. Vendor shall recommend optimal pump sizes, types, and motor horsepower rating. Vendor shall also specify proposed method of controlling pumping and recycle rates, and feed, recycle, and effluent pump configuration shall be designed to balance flows and reduce potential for process upset.

6. **Biosolids Filter:** Vendor shall specify the size and type of sand filter to remove biosolids from the bioreactor effluent to achieve applicable EQOs, and shall provide specifications for corresponding controls. If recommended, the Vendor may also propose a different type of biosolids filter (e.g., backwashable cartridge filter) with specifications.

7. **Tank Connections**: Vendor shall specify the number, location, size, and type of inlet and outlet connections for the pH neutralization tank, anaerobic bioreactor, and biosolids filter.

8. **Operation**: 24 hours per day, 7 days per week. Fully automated system that minimizes operator intervention. Vendor is to specify start-up protocol and time period required for growth of microorganisms to sustain effective treatment for chlorate and period prior to normal, full-scale operation of the anaerobic bioreactor.

9. **Controls**: Vendor shall recommend and provide instrumentation and controls for optimal performance of the anaerobic bioreactor system

(including pH neutralization tank and biosolids filter), and provide specifications for recommended instrumentation and controls.

10. **Control Panel**: The control panel enclosure shall be NEMA Type 4X. The control panel will be integrated for the pH neutralization tank, anaerobic bioreactor system, and biosolids filter, and must be equipped with operating controls/switches, indicator lights, operating data displays, and/or visual indicator lights to denote each alarm condition (e.g., high tank level, high discharge pressure, etc.) [HMI is acceptable]. The control panel must be equipped to relay each alarm signal from the anaerobic bioreactor system to a Master Control Panel for the overall GWET system to shut down the groundwater recovery pumps, notify the operator that the anaerobic bioreactor system has shut down, and identify the specific alarm condition that caused the shut down. The control panel must be equipped with interlock(s) to shut down the anaerobic bioreactor system in the event of an alarm condition for the overall GWET system and to allow for remote starting of the anaerobic bioreactor system (via Master Control Panel). As an added option, Vendor shall also recommend a remote monitoring and control system to access the control panel for the anaerobic bioreactor system via the Master Control Panel using a secure, password-protected internet site. All instrumentation, indicator lights, switches, and other items mounted on the control panel must be clearly labeled. Any panel tags to be engraved type, black background with white lettering. The control panel is to be mounted on the anaerobic bioreactor system skid, tested and verified by Vendor before shipping, and not disconnected prior to shipping. If control panel is disconnected from anaerobic bioreactor system skid prior to shipping for any reason, testing and verification is to be repeated by Vendor upon reconnection at Site. Control wire and electric junction boxes with HOA switches for motors must be mounted at the anaerobic bioreactor system.

11. **Electrical Power**: 480 VAC, 3-phase and 120 VAC, 1-Phase electric power sources are available. Any 120 VAC uses on anaerobic bioreactor system will be distributed through a main circuit breaker (sized by Vendor) and individual fused power distribution terminals mounted in the anaerobic bioreactor system control panel.

12. **Materials of Construction**: Materials of construction selected by the Vendor for the anaerobic bioreactor system must be compatible with the groundwater characteristics, constituents present in groundwater, and chemicals to be used in the treatment process. Any PVC pipe or fittings

shall be of Schedule 80 construction with flanged or union connections to facilitate O&M activities.

13. **Fabrication Drawings**: Vendor is required to provide PFD, P&ID, equipment arrangements, elevation, electrical (control panel and electric distribution), control logic/ladder diagrams, and other fabrication drawings, design specifications, and control narrative for the anaerobic bioreactor system to LSS for review, use in preparing the design package for the GWET system, and final approval prior to fabrication. All drawings to be submitted in AutoCAD format so that they can be incorporated into the overall GWET design package. Additional information to be provided shall include the required footprint of the system and ceiling height, equipment weight empty and full of water, recommended mounting/securing of the equipment (e.g., concrete floor, pedestal, concrete strength recommendation, bolt sizes, etc.), and whether the equipment will be delivered in pieces. If delivered in pieces, assembly specifications/instructions shall be provided. Vendor shall also provide a proposed schedule for delivery of fabrication drawings.

14. **Operation & Maintenance Manual**: Vendor must provide five hard copies and one electronic copy of an operation and maintenance (O&M) manual for the anaerobic bioreactor system including, but not limited to, startup and shutdown procedures; emergency shutdown procedure, if different; operating procedures; alarm settings and procedures for adjusting settings; maintenance/cleaning requirements, procedures, and frequency; equipment and components list; troubleshooting guidance; as-built engineering drawings of the system and controls; manufacturer's equipment information and O&M manuals for individual components; and list of equipment provided and replacement parts.

15. **Location**: The anaerobic bioreactor system will be located inside a building where the temperature will be maintained at 45°F and greater throughout the year, so no freeze protection will be required. However, some supplemental heating may be required for chemical feed systems (e.g., organic substrate) to reduce potential for clogging/fouling of feed systems.

The vendor is encouraged to propose an alternative treatment process if it will more reliably and consistently achieve the EQOs and/or be more cost effective considering capital, operating, and maintenance costs. Alternative processes,

including a PBR, EHC®/sand reactor, or other bioreactor configuration, will be considered and evaluated based on vendor recommendations during the bidding process.

6.0 INFLUENT GROUNDWATER CHARACTERISTICS

Constituents of potential concern (COPCs) present in groundwater, and water quality parameters that may affect the design of the GWET system, are presented in Table 1. While actual influent concentrations will likely vary, the influent groundwater concentrations presented in Table 1 are considered to be conservative estimates. As stated in Section 3.0, the bench-scale treatability study completed using groundwater samples collected from the Site demonstrated that both FBRs and PBRs were effective at reducing the concentrations of chlorate and perchlorate to below laboratory detection limits at both low (i.e., 1,600 mg/L) and high (i.e., 8,000 mg/L) chloride concentrations.

Based on actual operating experience from other GWET systems, actual influent concentrations are expected to decrease over time. However, sporadic increases in concentrations could occur in the short term due to areas of groundwater containing constituents at higher concentrations being pulled toward the recovery wells and/or more groundwater being pumped from areas with COPCs at higher concentrations. The conservative estimates of influent concentrations included in Table 1 provide some additional level of assurance that the GWET system will be able to effectively treat the groundwater if higher constituent concentrations are encountered. For purposes of this proposal, Vendors may assume that metals have been removed to levels necessary to achieve EQOs by the metals precipitation system.

7.0 PERFORMANCE CRITERIA

Treated groundwater will be discharged to the Willamette River through an existing stormwater outfall. The presumed EQOs for the treated groundwater are summarized in Table 2. Based on comparison of estimated influent concentrations to the EQOs and pending further negotiations with ODEQ, the proposed GWET system design parameters are summarized in Table 3. The COPCs in groundwater that will be included in the permit for discharge of treated effluent and their respective EQOs are currently being discussed between LSS and ODEQ. For purposes of this proposal, Vendors may assume that the anaerobic bioreactor system is intended for treatment of chlorate and perchlorate, and the bioreactor unit is not to be sized to specifically treat VOCs, SVOCs, and pesticides also present in groundwater.

8.0 QUOTATION REQUIREMENTS

The quotation **MUST** include the following items:

1. Price for the anaerobic bioreactor system per the above specifications, excluding the pH neutralization tank and biosolids filtration unit (including five O&M manuals). If multiple configurations that will satisfy the performance criteria are available, please provide pricing for all such configurations. Vendor shall recommend organic substrate and nutrient feed for system.
2. Add-on cost for pH neutralization tank with mixer, acid feed system (including feed tank and pump), and effluent pump, with corresponding controls. If recommended, the Vendor may also provide an add-on cost for an in-line acid feed system (including feed tank and pump) with corresponding controls in lieu of the pH neutralization tank. Vendor shall specify acid type and target pH for biological treatment process.
3. Estimated removal efficiencies for chlorate and perchlorate.
4. Estimated acid, organic substrate, and nutrient usage rates with unit costs.
5. Add-on cost for sand filter to remove biosolids from bioreactor effluent to reduce potential fouling of the LPGAC units and achieve applicable EQOs, including corresponding controls. If recommended, the Vendor may also provide an add-on cost for a different type of post-bioreactor solids filtration unit (e.g., backwashable cartridge filter).
6. Add-on cost for remote monitoring and control system to access the control panel for the anaerobic bioreactor system via the Master Control Panel using a secure, password-protected internet site.
7. Estimated residual concentrations of nitrogen, phosphorus, biological oxygen demand, chemical oxygen demand, total organic carbon, total suspended solids, and total volatile solids in the effluent from the bioreactor following biosolids filtration.
8. Price for shipping the anaerobic bioreactor system to Portland, Oregon.
9. Unit prices for start-up and training services provided by vendor.
10. Unit price for additional O&M support during two years of operation.
11. List of, and unit price for recommended spare parts.
12. Literature and typical schematics for the recommended system.
13. Manufacturer/vendor recommendations for improving system performance and/or reducing cost.

14. Vendor to indicate the maximum flow rate the system will be able to effectively treat, if higher than the upper end of the specified flow rate range.
15. Applicable equipment warranties and performance guarantee in terms of equipment operation, fabrication quality, and achieving the EQOs. Associated conditions and/or assumptions that affect the warranties and performance guarantee shall also be provided.
16. Schedule for developing design drawings and equipment design information; estimated time for LSS to review and approve drawings and equipment design information; fabrication; and delivery schedule. Include a list of drawings to be provided. LSS also reserves the right to visit the fabrication facility to inspect the anaerobic bioreactor system prior to shipping to the Site.
17. Key vendor assumptions for proposing the recommended anaerobic bioreactor system; developing the pricing, schedule, and performance guarantee; and key conditions affecting the manufacturer's warranty and performance guarantee.
18. Alternative processes will be considered and evaluated based on vendor feedback during the bidding process, and recommendations for improving anaerobic bioreactor system design, performance, operation, and maintenance are welcome. Separate cost additions/deductions and rationale are to be provided for all recommended improvements.

9.0 ESTIMATED PROJECT SCHEDULE

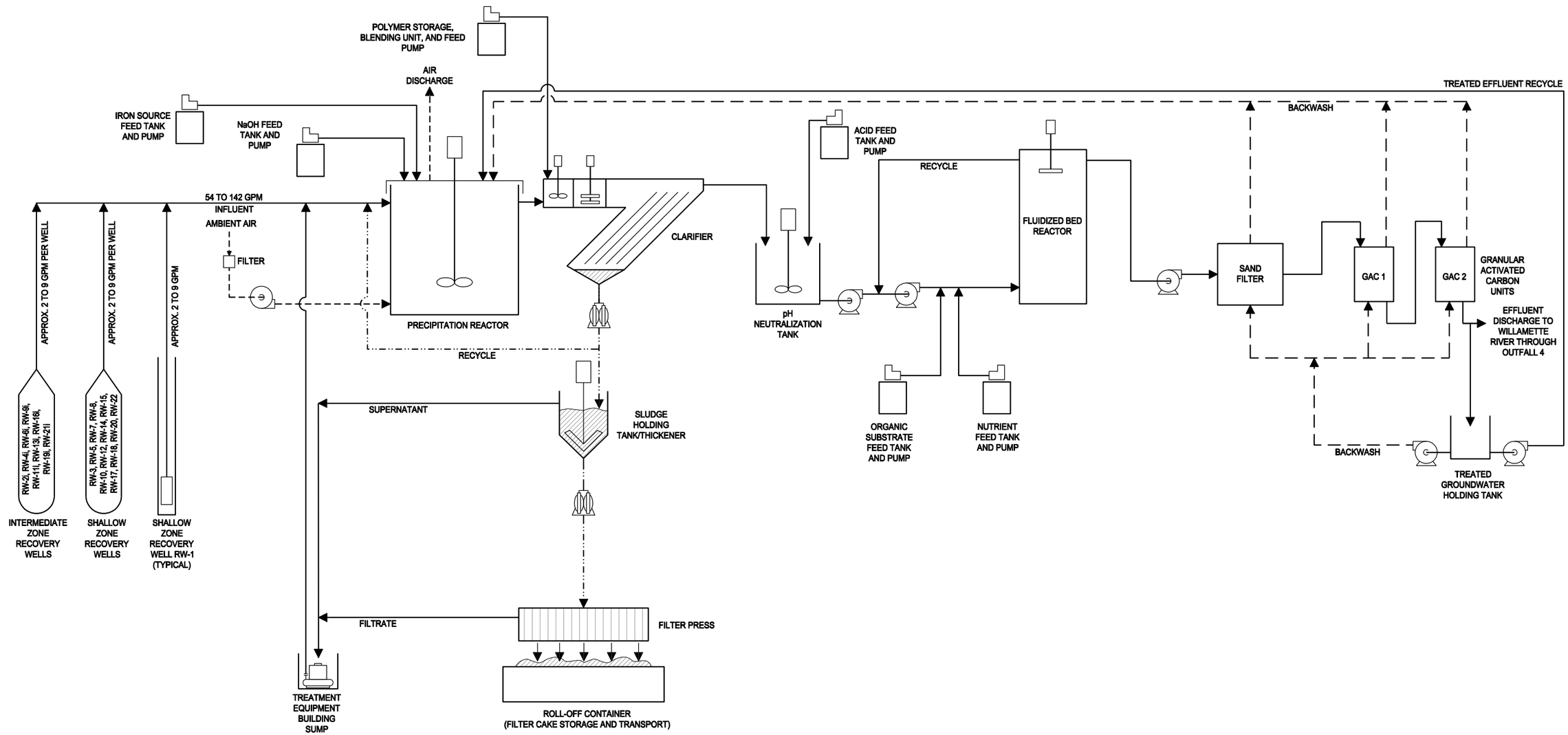
Design activities have been initiated for the GWET system, with a proposed delivery date for the pre-final design to regulatory agencies in December 2010. The proposed schedule for the GWET system design and implementation is presented in the Groundwater Source Control Measure Schedule as Figure 2. Based on expected agency review timeframes, ERM anticipates that the final design for the GWET system will be completed during Spring 2011 and approved during Summer 2011. Construction contractor bidding and equipment procurement activities are planned to be completed concurrent with agency review and approval of the final design, with contracts awarded during Summer 2011. Construction of the GWET system is slated to occur during Summer 2011 through Spring 2012, with startup activities scheduled for Spring/Summer 2012. This overall project schedule is subject to change based on agency review times and comments.

10.0 QUOTATION DUE DATE AND SUBMITTAL

The quotation must be submitted to the following by 8 October 2010 at 5:00 PM (electronic mail acceptable):

Mr. Chris Underwood
Environmental Resources Management
350 Eagleview Blvd., Suite 200
Exton, Pennsylvania 19341
Phone: 610-524-3605
E-Mail: christopher.underwood@erm.com

ERM will review the quotation and contact you with any questions and/or requested changes to the quotation. If you have any questions regarding this request for quotation, technical or otherwise, please submit questions in writing (again, electronic mail is acceptable) to Mr. Underwood. ERM will accept such questions until 1 October 2010 at 5:00 PM. ERM appreciates your effort in preparing this quotation and looks forward to reviewing your submittal.



Legend

Air Line		Centrufugal Pump	Mixer
Sludge Line			
Backwash Line		Air Blower	Flocculater
GAC	Granular Activated carbon		
GPM	Gallons Per Minute	Diaphragm Pump	Biosolids Separator
IEW	Intermediate Zone Extraction Well		
NaOH	Sodium Hydroxide	Chemical Feed Pump	Sump Pump
SEW	Shallow Zone Extraction Well		
		Submersible Well Pump	Sludge Mixer / Scraper

Figure 1

Preliminary GWET System Process Flow Diagram
Preliminary Design Report
Groundwater Source Control Measure
Arkema, Inc.
Portland, Oregon

ERM 5/10

Project No. 0114849
Date: 9/27/2010
Drawn By: MLB
CAD File: G:\CAD\Drawings\Arkema-Portland\0093634\K201.dwg

Table 1
Estimated Range of Influent Concentrations for GWET System Design
Groundwater Source Control Measure
Arkema Inc.
Portland, Oregon

Data Source	Groundwater Treatability Study[1]	Site-Wide Groundwater Sampling[2]				Recovery Well Pumping Tests[3]				Estimated Influent Concentration
Parameter	Blended	Average	Maximum	No. of Samples	No. of Detections	Average	Maximum	No. of Samples	No. of Detections	
VOCs (ug/L)										
Benzene	ND (6.4)	1.04	16.6	33	10	1.22	2.69	12	1	3
Chlorobenzene	1,700	948	12,500	33	30	80.5	286	12	6	2,000
Chloroform	9.9	298	9,800	33	17	NA	ND (5)	12	0	300
SVOCs (ug/L)										
Benzo(a)Anthracene	ND (1.7)	NA				NA				ND (1.7)
Benzo(a)Pyrene	ND (1.3)	NA				NA				ND (1.3)
Benzo(k)Fluoranthene	ND (0.46)	NA				NA				ND (0.46)
2-Chlorophenol	43	NA				NA				50
Chrysene	ND (1.0)	NA				NA				ND (1.0)
Dibenzo(a,h)Anthracene	ND (1.4)	NA				NA				ND (1.4)
Fluoranthene	ND (5.0)	NA				NA				ND (5.0)
Hexachlorobenzene	ND (2.1)	NA				NA				ND (2.1)
Pentachlorophenol	ND (20)	NA				NA				ND (20)
Pesticides (ug/L)										
Aldrin	ND (0.0059)	NA	ND (0.05)	36	0	NA				ND (0.0059)
Chlordane	ND (0.14)	NA	ND (0.5)	36	0	NA				ND (0.14)
DDD	0.027 COL	0.09	0.599	36	17	NA	ND (0.1)	12	0	0.1
DDE	ND (0.0075)	0.06	0.553	36	10	NA	ND (0.1)	12	0	0.1
DDT	0.015 COL	1.3	30.8	36	23	NA	ND (0.1)	12	0	1
Metals, total (ug/L)[4]										
Arsenic	ND (4.4)	NA	ND (3)	1	0	NA				10
Cadmium	5.6	NA	0.367 J	1	1	NA				5
Chromium, total	ND (2.6)	NA				NA				100
Chromium, hexavalent	ND (4.4)	98	1,100	30	15	NA				100
Copper	ND (4.5)	NA	ND (2)	1	0	NA				5
Iron	140,000	NA	205	1	1	NA				2,000
Lead	ND (2.6)	NA	ND (7)	1	0	NA				ND (2.6)
Manganese	NA	NA	641	1	1	NA				500
Nickel	ND (7.8)	NA	5.41 J	1	1	NA				5
Silver	ND (2.8)	NA				NA				ND (2.8)
Zinc	63	NA	2.25 J	1	1	NA				50
Metals, dissolved (ug/L)[4]										
Arsenic	ND (4.4)	45.4	892	31	17	13.2	51.9	12	9	10
Cadmium	4	NA	ND (0.7)	2	0	NA				5
Chromium, total	ND (2.6)	36.4	388	19	9	NA				100
Chromium, hexavalent	ND (4.4)	NA				NA				100
Copper	ND (4.5)	2.54	2.85 J	2	2	NA				5
Iron	110,000	1,637	17,800	31	28	500	1,940	12	9	2,000
Lead	ND (2.6)	NA	ND (7)	2	0	NA				ND (2.6)
Manganese	NA	471	4,190	21	20	616	2,090	12	12	500
Nickel	ND (7.8)	3.44	4.95 J	2	1	NA				5
Silver	ND (2.8)	NA				NA				ND (2.8)
Zinc	49	2.86	4.72 J	2	1	NA				50
Inorganics (mg/L)										
Chlorate	45.5	NA				NA				50
Perchlorate	3.2 Q	5.2	119	40	15	NA	ND (0.68)	6	0	5
Chloride	1,600 Q	3,251	39,400	40	40	294	860	12	12	2,500
pH (s.u.)	6.54	6.15	5.02 - 9.71	20	20	NA				6.5
Other Parameters (mg/L)										
Alkalinity	200	NA				NA				200
Calcium	73	NA				NA				75
Nitrate as N	ND (0.21) G	NA				NA				2.5
Nitrogen, Ammonium	5.2	NA				NA				5
Nitrogen, Total Kjeldahl	6.1	NA				NA				5
Phosphate, Total as P	0.18	NA				NA				0.2
Sulfate	1,300 Q	NA				NA				1,000
Total Organic Carbon	10	NA				NA				10
Total Suspended Solids	220 Q	NA				NA				100
Total Volatile Solids	48 Q	NA				NA				25

Notes

(1) - Based on analytical results for groundwater samples collected from on-site monitoring wells for the groundwater treatability study during 2007. Blended sample represents composite samples from MWA-5, MWA-14i, MWA-34i, MWA-43, MWA-44, MWA-52i, MWA-66i, and MWA-68si).

(2) - Based on analytical results for groundwater samples collected from on-site monitoring wells during site-wide groundwater samplings event in 2007 and 2009 (except for total metals and pH, which are based on 2009 event only and dissolved chromium, total, which is based on 2007 event only). Hexavalent chromium, total concentrations based on 2007 and 2009 events.

(3) - Based on analytical results for groundwater samples collected from proposed recovery wells during pumping tests in 2009.

(4) - Dissolved metal concentration may exceed total metal concentration based on data set used to estimate influent concentration.

When necessary, average concentrations calculated assuming concentrations equal to one half of laboratory method detection limit and/or reporting limit for non-detect values.

Non-detect (ND) values reported with laboratory method detection limits (groundwater treatability study and site-wide groundwater sampling) or reporting limit (recovery well pumping tests).

mg/L = milligrams per liter
ug/L = micrograms per liter
s.u. = standard units
NA = data not available
J = Estimated result. Result is less than laboratory method detection limit.

COL = More than 40% RPD between primary and confirmation column results. The lower of the two results is reported.
Q = Elevated reporting limit. The reporting limit is elevated due to high analyte levels.
G = Elevated reporting limit. The reporting limit is elevated due to matrix interference.
V = Elevated reporting limit. The reporting limit is elevated due to limited sample volume.

Table 2
Effluent Quality Objectives for GWET System Design
Groundwater Source Control Measure
Arkema Inc.
Portland, Oregon

Parameter	ODEQ MQL[1]	Estimated Influent Concentration	Effluent Quality Objective	Comments
VOCs (ug/L)[2]				
Benzene	0.5	3	<0.7	Based on LPGAC vendor information
Chlorobenzene	0.5	2,000	<200	Based on LPGAC vendor information; however, FBR treatability study effluent data suggests removal to <130 ug/L
Chloroform	0.5	300	<30	Based on LPGAC vendor information
SVOCs (ug/L)[2]				
Benzo(a)Anthracene	1	ND (1.7)	No design criteria	No design criteria, not detected in influent[5]
Benzo(a)Pyrene	1	ND (1.3)	No design criteria	No design criteria, not detected in influent[5]
Benzo(k)Fluoranthene	1	ND (0.46)	No design criteria	No design criteria, not detected in influent at concentration above MQL
2-Chlorophenol	1	50	<5	Based on LPGAC vendor information
Chrysene	1	ND (1.0)	No design critera	No design criteria, not detected in influent at concentration above MQL
Dibenzo(a)Anthracene	1	ND (1.4)	No design critera	No design criteria, not detected in influent[5]
Fluoranthene	2	ND (5.0)	No design critera	No design criteria, not detected in influent[5]
Hexachlorobenzene	1	ND (2.1)	No design critera	No design criteria, not detected in influent[5]
Pentachlorophenol	2	ND (20)	No design critera	No design criteria, not detected in influent[5]
Pesticides (ug/L)[2]				
Aldrin	0.01	ND (0.0059)	No design criteria	No design criteria, not detected in influent at concentration above MQL
Chlordane	0.1	ND (0.14)	No design criteria	No design criteria, not detected in influent[5]
DDD	0.01	0.1	<0.01	Based on LPGAC vendor information
DDE	0.01	0.1	<0.01	Based on LPGAC vendor information
DDT	0.01	1	<0.1	Based on LPGAC vendor information
Metals (ug/L)[3]				
Arsenic	0.05	10	<10	Based on FBR treatability study effluent
Cadmium	0.1	5	No design criteria	No design criteria, naturally-occurring, incidental removal expected[5]
Chromium, total	10	100	No design criteria	No design criteria, incidental removal expected[6]
Chromium, hexavalent	10	100	<10	Based on FBR treatability study effluent
Copper	10	5	No design criteria	No design criteria, naturally-occurring, incidental removal expected[5]
Iron	100	2,000	No design criteria	No design criteria, naturally-occurring, incidental removal expected
Lead	5	ND (2.6)	No design criteria	No design criteria, naturally-occurring, incidental removal expected[5]
Manganese	2	500	No design criteria	No design criteria, naturally-occurring, incidental removal expected
Nickel	10	5	No design criteria	No design criteria, naturally-occurring, incidental removal expected[5]
Silver	1	ND (2.8)	No design criteria	No design criteria, naturally-occurring, incidental removal expected
Zinc	5	50	No design criteria	No design criteria, naturally-occurring, incidental removal expected
Inorganics (mg/L)[4]				
Chlorate	NA	50	<0.015	Based on FBR treatability study effluent
Perchlorate	0.004	5	<0.015	Based on FBR treatability study effluent
Chloride	1	2,500	No design criteria	No treatment
pH (s.u.)	NA	6.5	6.5 to 8.5	Based on FBR treatability study effluent
Other Parameters (mg/L)[4]				
Alkalinity	1	200	No design criteria	No design criteria, naturally-occurring
Calcium	NA	75	No design criteria	No design criteria, naturally-occurring
Nitrate as N	0.1	2.5	<10	Total nitrogen based on FBR treatability study effluent
Nitrogen, Ammonium	1	5		
Nitrogen, Total Kjeldahl	NA	5		
Phosphate, Total as P	0.01	0.2	<1	Total phosphorus based on FBR treatability study effluent
Sulfate	NA	1,000	No design criteria	No treatment
Total Organic Carbon	NA	10	<10	Based on FBR treatability study effluent
Total Suspended Solids	NA	100	<25	Based on FBR treatability study effluent
Total Volatile Solids	NA	25	<25	Based on FBR treatability study effluent

Notes
(1) - Method Quantitation Limit (MQL) based on values published by Oregon Deparment of Environmental Quality (ODEQ) in guidance dated 16 November 2007.
(2) - Estimated effluent concentrations based on approximately 90% removal efficiency for liquid-phase granular activated carbon (LPGAC).
(3) - Estimated effluent concentrations assume iron co-precipitation with clarifier and optional solids filtration.
(4) - Estimated effluent concentrations based on documented performance of fluidized bed reactor.
(5) - Not detected in FBR treatability study effluent above MQL.
(6) - Assumes that majority of chromium present as hexavalent chromium, and total chromium concentrations will be reduced via removal of hexavalent chromium.
Non-detect (ND) values reported with laboratory method detection limits.
FBR = fluidized bed reactor
GWET = groundwater extraction and treatment
LPGAC = liquid-phase granular activated carbon
mg/L = milligrams per liter
ug/L = micrograms per liter
s.u. = standard units
NA = data not available

Table 3
Preliminary GWET System Design Parameters
Groundwater Source Control Measure
Arkema Inc.
Portland, Oregon

Parameter	Estimated Influent Concentration	Effluent Quality Objective
VOCs (ug/L)[2]		
Benzene	3	<0.7
Chlorobenzene	2,000	<200
Chloroform	300	<30
SVOCs (ug/L)[2]		
2-Chlorophenol	50	<5
Pesticides (ug/L)[2]		
DDD	0.1	<0.01
DDE	0.1	<0.01
DDT	1	<0.1
Metals (ug/L)[3]		
Arsenic	10	<10
Chromium, hexavalent	100	<10
Inorganics (mg/L)[4]		
Chlorate	50	<0.015
Perchlorate	5	<0.015
pH (s.u.)	6.5	6.5 to 8.5
Other Parameters (mg/L)[4]		
Nitrate as N	2.5	<10, Total as N
Nitrogen, Ammonium	5	
Nitrogen, Total Kjeldahl	5	
Phosphate, Total as P	0.2	<1
Total Organic Carbon	10	<10
Total Suspended Solids	100	<25
Total Volatile Solids	25	<25

Notes
mg/L = milligrams per liter
ug/L = micrograms per liter
s.u. = standard units

11903 – Carbon System

SECTION 11903
CARBON SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Contractor shall provide all labor, materials, equipment and incidentals, as shown, specified and required to provide a Carbon System specified hereinafter.

B. CONTRACTOR shall obtain the Carbon System from a vendor that has demonstrated experienced in the technology specified.

C. A request for quotation (dated September 2010) was issued to bidders. The updates to the RFQ are:
   1. Process Flow Diagram update (see attached Drawing package, Sheet PFD-01); and
   2. Effluent Quality Objectives (see Table 2 in 01740 Warranties and Bonds.

D. Additions to the RFQ are noted below:

   1. Providing PPL-line carbon steel schedule 40 piping.
   2. Design based on seismic loadings applicable in Seismic Zone 3.

E. A review of the bids was conducted with the preferred vendor Calgon Carbon based upon both cost and technical considerations. CONTRACTOR may propose a Carbon System from an alternative Vendor that meets the treatment objectives as specified herein, with approval from the ENGINEER and OWNER'S AGENT.

F. CONTRACTOR is responsible for providing a complete and functional Carbon System. Equipment, materials, and labor not provided by the Carbon System vendor shall be provided by the CONTRACTOR.

1.02 QUALITY ASSURANCE

A. Quality Source Control:

   1. Furnish all equipment per the requested for quotation and the applicable Carbon System components as shown in engineered design drawings (Attachment A), unless otherwise accepted by Engineer.

   2. Equipment shall be of the same manufacturer for each equipment and instrumentation type as noted in the drawings and specifications.

B. Reference Standards:

1. Comply with applicable provisions and per the requested for quotation, the engineered design drawings, and standards reference by manufacturer/equipment vendor, unless otherwise shown or specified.

1.03 SUBMITTALS

A. Fabrication/Shop Drawings: Submit per the attached RFQ. CONTRACTOR shall provide a schedule for submitting fabrication/shop drawings to OWNER'S AGENT and ENGINEER as part of the proposal. OWNER'S AGENT and ENGINEER must approve the drawings before fabrication commences. As such, CONTRACTOR shall provide a total of 30 calendar days for the OWNER'S AGENT and ENGINEER to review the drawings, request clarification and/or revisions, review the CONTRACTOR'S responses and revised drawings, and issue approval. CONTRACTOR shall assume participation in a conference call with the OWNER'S AGENT and ENGINEER to discuss their comments and the CONTRACTOR'S responses and revisions within the above 30 calendar days.

B. Operation and Maintenance Manual as As-Built Drawings: Submit per the attached RFQ. CONTRACTOR shall provide a draft manual to the OWNER'S AGENT and ENGINEER for review and approval prior to commencing system start up. As such, CONTRACTOR shall provide a total of 30 calendar days for the OWNER'S AGENT and ENGINEER to review the manual and as-built drawings, request clarification and/or revisions, review the CONTRACTOR'S responses and revised manual and drawings, and issue approval. CONTRACTOR shall assume participate in a conference call with the OWNER'S AGENT and ENGINEER to discuss their comments and the CONTRACTOR'S responses and revisions within the above 30 calendar days.

PART 2 - PRODUCTS

2.01 CARBON SYSTEM

A. Provide as noted in the request for quotation, updates, and additions listed above in Sections 1.01C and 1.01D.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation of the Carbon System will be in accordance with the manufacturer/equipment vendor instructions, engineered design drawings, and any specification recommended by the CONTRACTOR and approved by the ENGINEER and OWNER'S AGENT.

B. CONTRACTOR is responsible for providing a complete and functional Carbon System per the attached RFQ, design drawings and specifications, and vendor's/manufacturer's specifications. CONTRACTOR shall verify that all equipment, associated controls, and interlocks function per the design and that the treatment system is achieving the required discharge limits. Field/start up testing to verify this shall be proposed and conducted by the CONTRACTOR to the satisfaction of the OWNER'S AGENT and ENGINEER, and the project shall not be complete until such testing verifies that the system functions as designed and achieves the discharge limits. CONTRACTOR shall correct any deficiencies identified during the field/start up testing at no additional cost to the OWNER'S AGENT.

C. CONTRACTOR shall provide start up, operation, and maintenance training to the OWNER'S AGENT and ENGINEER, and such training shall include an overview of the operation and maintenance manual to understand the key features of the system operation and maintenance, walkthrough of the system to see and understand how the key features function and how maintenance is to be performed, hands-on startup, hands-on shut down, and health and safety considerations.

*** * END OF SECTION * ***

REQUEST FOR QUOTATION
Liquid-Phase Granular Activated Carbon System
Groundwater Extraction and Treatment System
Groundwater Source Control Measure
Arkema, Inc. Facility – Portland, Oregon
September 2010

1.0 INTRODUCTION

On behalf of Legacy Site Services, LLC (LSS), agent for Arkema Inc. (Arkema), ERM-West, Inc. (ERM) is requesting a quotation from treatment equipment vendors for a liquid-phase granular activated carbon (LPGAC) system as part of a groundwater extraction and treatment (GWET) system currently planned to be installed at the Portland, Oregon facility (the "Site"). The system will be used to remove volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and pesticides from groundwater to achieve effluent quality objectives (EQOs) set forth by the Oregon Department of Environmental Quality (ODEQ). This document outlines the treatment process, system description and specifications, influent groundwater characteristics, performance criteria, and quotation requirements.

2.0 PROCESS OVERVIEW

Groundwater at the Site contains VOCs, SVOCs, pesticides, metals, and other inorganics (i.e., chlorate and perchlorate) at concentrations exceeding EQOs. A preliminary process flow diagram for the GWET system is included as Figure 1.

The recommended GWET system consists of the following components:

- A total of 22 recovery wells, each equipped with a pump;
- Precipitation reactor with aeration and pH adjustment via sodium hydroxide to remove metals potentially present at concentrations exceeding their EQOs in groundwater, and is to include the option for ferrous sulfate or ferrous chloride addition to enhance metals removal via iron co-precipitation;
- Solids handling system (i.e., clarifier with polymer feed, sludge holding tank, filter press, optional post-clarifier solids filtration unit, and associated equipment) to dewater and prepare precipitated solids for off-site transportation and disposal;
- A pH neutralization tank to adjust the groundwater pH prior to anaerobic biological treatment;

- Fluidized bed reactor (FBR) to anaerobically biodegrade chlorate, perchlorate, and potentially biodegradable organics present in groundwater, with the option of utilizing either a packed bed reactor (PBR) or EHC®/sand reactor in the event they are determined to be more cost effective than a FBR;
- Post-FBR sand filter to remove biosolids potentially carried over into the FBR effluent;
- Two LPGAC units in series to remove VOCs, SVOCs, and pesticides from groundwater; and
- Discharge to the Willamette River through an existing stormwater outfall.

Vendors are requested to provide a quotation for the LPGAC system. Electronic copies of the bench-scale groundwater treatability study report (Adventus, April 2008) and draft preliminary design report (ERM, May 2010; excluding appendices), which provide additional information on the design basis for the GWET system, are provided for reference purposes.

3.0 LPGAC SYSTEM DESCRIPTION

Effluent from the FBR will be discharged through the post-FBR sand filter to the LPGAC system. Two LPGAC units in series will be used to remove VOCs, SVOCs, and pesticides, as well as residual organic substrate from the bioreactor, potentially still present in the effluent to meet the applicable EQOs. The LPGAC units may periodically need to be backwashed in the event of solids accumulation and/or biological growth, and the backwash water will be discharged to the precipitation reactor.

4.0 SPECIFICATIONS

The LPGAC units and ancillary equipment (e.g., interconnecting piping, valves) will be provided by the vendor as a package treatment system with associated controls. The vendor will be responsible for treatment equipment design, fabrication, delivery, and operator training, as well as process performance to meet specified EQOs for the Site. Equipment bidding is being completed in parallel with design of the GWET system so that the selected treatment system can be incorporated directly into the design, and the design and implementation schedule for the GWET system will be expedited. Specifications for the LPGAC system are summarized as follows:

1. **Expected Flow Rate Range**: Flow rate range of 54 to 142 gpm with an average predicted pumping rate of 109 gpm. The flow rate will be

adjusted periodically within the specified range to account for site-specific hydrogeologic conditions.

2. **System Configuration**: Modular LPGAC system with interconnecting piping, backwashing capability, and integrated controls. Vendor shall assume two LPGAC vessels operated in series for base bid, with redundant LPGAC vessels considered to reduce/eliminate downtime associated with carbon backwashing/replacement. Treatment building structural requirements (e.g., winch/lift system for carbon change-out activities, fork lift or vacuum truck access) shall be specified by Vendor. Vendor shall also recommend optimal equipment sizing (i.e., dimensions and volumes), types, and arrangement (e.g., layout of the equipment to optimize space requirements while enabling access for operation and maintenance).

3. **Tank Connections**: Vendor shall specify the number, location, size, and type of inlet and outlet connections for the LPGAC system. If LPGAC vessel changeout is the proposed method for replacement of spent LPGAC, Vendor shall consider the use of quick disconnect fittings integrated into the valve rack to facilitate changeout.

4. **Operation**: 24 hours per day, 7 days per week. Fully automated system that minimizes operator intervention.

5. **Controls**: Vendor shall recommend and provide instrumentation and controls for optimal performance of the LPGAC system, and provide specifications for recommended instrumentation and controls.

6. **Control Panel**: The control panel enclosure shall be NEMA Type 4X. The control panel must be equipped with operating controls/switches, indicator lights, operating data displays, and/or visual indicator lights to denote each alarm condition (e.g., high discharge pressure, etc.) [HMI is acceptable]. The control panel must be equipped to relay each alarm signal from the LPGAC system to a Master Control Panel for the overall GWET system to shut down the groundwater recovery pumps, notify the operator that the LPGAC system has shut down, and identify the specific alarm condition that caused the shut down. The control panel must be equipped with interlock(s) to shut down the LPGAC system in the event of an alarm condition for the overall GWET system and to allow for remote starting of the LPGAC system (via Master Control Panel). As an added option, Vendor shall also recommend a remote monitoring and control system to access the control panel for the LPGAC system via the Master Control Panel using a secure, password-

protected internet site. All instrumentation, indicator lights, switches, and other items mounted on the control panel must be clearly labeled. Any panel tags to be engraved type, black background with white lettering. The control panel is to be mounted on the LPGAC system skid, tested and verified by Vendor before shipping, and not disconnected prior to shipping. If control panel is disconnected from LPGAC system skid prior to shipping for any reason, testing and verification is to be repeated by Vendor upon reconnection at Site. Control wire and electric junction boxes with HOA switches for motors must be mounted at the LPGAC system.

7. **Electrical Power**: 480 VAC, 3-phase and 120 VAC, 1-Phase electric power sources are available. Any 120 VAC uses on LPGAC system will be distributed through a main circuit breaker (sized by Vendor) and individual fused power distribution terminals mounted in the LPGAC system control panel.

8. **Materials of Construction**: Materials of construction selected by the Vendor for the LPGAC system must be compatible with the groundwater characteristics, constituents present in groundwater, and chemicals to be used in the treatment process. Any PVC pipe or fittings shall be of Schedule 80 construction with flanged or union connections to facilitate O&M activities.

9. **Fabrication Drawings**: Vendor is required to provide PFD, P&ID, equipment arrangements, elevation, electrical (control panel and electric distribution), control logic/ladder diagrams, and other fabrication drawings, design specifications, and control narrative for the LPGAC system to LSS for review, use in preparing the design package for the GWET system, and final approval prior to fabrication. All drawings to be submitted in AutoCAD format so that they can be incorporated into the overall GWET design package. Additional information to be provided shall include the required footprint of the system and ceiling height, equipment weight empty and full of water, recommended mounting/securing of the equipment (e.g., concrete floor, pedestal, concrete strength recommendation, bolt sizes, etc.), and whether the equipment will be delivered in pieces. If delivered in pieces, assembly specifications/instructions shall be provided. Vendor shall also provide a proposed schedule for delivery of fabrication drawings.

10. **Operation & Maintenance Manual**: Vendor must provide five hard copies and one electronic copy of an operation and maintenance (O&M) manual for the LPGAC system including, but not limited to, startup and

shutdown procedures; operating procedures; emergency shutdown procedure, if different; alarm settings and procedures for adjusting settings; maintenance/cleaning requirements, procedures, and frequency; equipment and components list; troubleshooting guidance; as-built engineering drawings of the system and controls; manufacturer's equipment information and O&M manuals for individual components; and list of equipment provided and replacement parts.

11. **Location**: The LPGAC system will be located inside a building where the temperature will be maintained at 45°F and greater throughout the year, so no freeze protection will be required.

The vendor is encouraged to propose an alternative treatment process if it will more reliably and consistently achieve the EQOs and/or be more cost effective considering capital, operating, and maintenance costs. Alternative processes will be considered and evaluated based on vendor recommendations during the bidding process.

5.0 INFLUENT GROUNDWATER CHARACTERISTICS

Constituents of potential concern (COPCs) present in groundwater, and water quality parameters that may affect the design of the GWET system, are presented in Table 1. While actual influent concentrations will likely vary, the influent groundwater concentrations presented in Table 1 are considered to be conservative estimates. Based on actual operating experience from other GWET systems, actual influent concentrations are expected to decrease over time. However, sporadic increases in concentrations could occur in the short term due to areas of groundwater containing constituents at higher concentrations being pulled toward the recovery wells and/or more groundwater being pumped from areas with COPCs at higher concentrations. The conservative estimates of influent concentrations included in Table 1 provide some additional level of assurance that the GWET system will be able to effectively treat the groundwater if higher constituent concentrations are encountered. For purposes of this proposal, Vendors may assume that metals, chlorate, and perchlorate have been removed to levels necessary to achieve EQOs by the metals precipitation and anaerobic bioreactor systems. Vendors may also assume a residual organic substrate concentration in the bioreactor effluent of 5 mg/L, measured as total organic carbon (TOC).

6.0 PERFORMANCE CRITERIA

Treated groundwater will be discharged to the Willamette River through an existing stormwater outfall. The presumed EQOs for the treated groundwater are summarized in Table 2. Based on comparison of estimated influent concentrations to the EQOs and pending further negotiations with ODEQ, the proposed GWET system design parameters are summarized in Table 3. The COPCs in groundwater that will be included in the permit for discharge of treated effluent and their respective EQOs are currently being discussed between LSS and ODEQ. For purposes of this proposal, Vendors should assume that no treatment for VOCs, SVOCs, or pesticides is provided by the metals precipitation and anaerobic bioreactor systems.

7.0 QUOTATION REQUIREMENTS

The quotation **MUST** include the following items:

1. Price for the LPGAC system per the above specifications (including five O&M manuals). Vendor shall consider whether multiple, smaller LPGAC units in parallel may be warranted in the event that the minimum design flow rate for the GWET system (i.e., 54 gpm) is below the minimum recommended flow for a single LPGAC unit designed to accept the maximum design flow rate for the GWET system (i.e., 142 gpm). If multiple configurations that will satisfy the performance criteria are available (e.g., smaller and/or larger LPGAC units), please provide pricing for all such configurations with rationale for recommendation. Vendor shall recommend type of LPGAC to be used for system.
2. Add-on cost for redundant LPGAC system (i.e., two duplicate LPGAC systems connected in parallel configuration and/or in stand-by mode for connection using quick disconnect fittings) such that downtime associated with carbon backwashing/replacement may be reduced or eliminated. As indicated in Section 4, if LPGAC vessel changeout is the proposed method for replacement of spent LPGAC, Vendor shall consider the use of quick disconnect fittings integrated into the valve rack to facilitate changeout.
3. Add-on cost for remote monitoring and control system to access the control panel for the LPGAC system via the Master Control Panel using a secure, password-protected internet site.
4. Estimated LPGAC consumption rates, change-out frequency, and removal efficiencies for VOCs, SVOCs, and pesticides.

5. Specify and detail the process for spent carbon change-out services, and provide unit costs for on-site LPGAC change-out services, including removing spent carbon, providing new carbon, transporting the spent carbon off site, and regenerating or disposing of the spent carbon.
6. Specify and detail the process for spent carbon profiling (including any required carbon sampling and analyses), classification, regeneration, and acceptance criteria, and provide electronic copies of all related documentation that will need to be completed for spent carbon regeneration acceptance and/or disposal.
7. Price for shipping the LPGAC system to Portland, Oregon.
8. Unit prices for start-up and training services provided by vendor.
9. Unit price for additional O& M support during two years of operation.
10. List of, and unit price for recommended spare parts.
11. Literature and typical schematics for the recommended system.
12. Manufacturer/vendor recommendations for improving system performance and/or reducing cost.
13. Vendor to indicate the maximum flow rate the system will be able to effectively treat, if higher than the upper end of the specified flow rate range.
14. Applicable equipment warranties and performance guarantee in terms of equipment operation, fabrication quality, and achieving the EQOs. Associated conditions and/or assumptions that affect the warranties and performance guarantee shall also be provided.
15. Schedule for developing design drawings and equipment design information; estimated time for LSS to review and approve drawings and equipment design information; fabrication; and delivery schedule. Include a list of drawings to be provided. LSS also reserves the right to visit the fabrication facility to inspect the LPGAC system prior to shipping to the Site.
16. Key vendor assumptions for proposing the recommended LPGAC system; developing the pricing, schedule, and performance guarantee; and key conditions affecting the manufacturer's warranty and performance guarantee.
17. Alternative processes will be considered and evaluated based on vendor feedback during the bidding process, and recommendations for improving LPGAC system design, performance, operation, and

maintenance are welcome. Separate cost additions/deductions and rationale are to be provided for all recommended improvements.

8.0 ESTIMATED PROJECT SCHEDULE

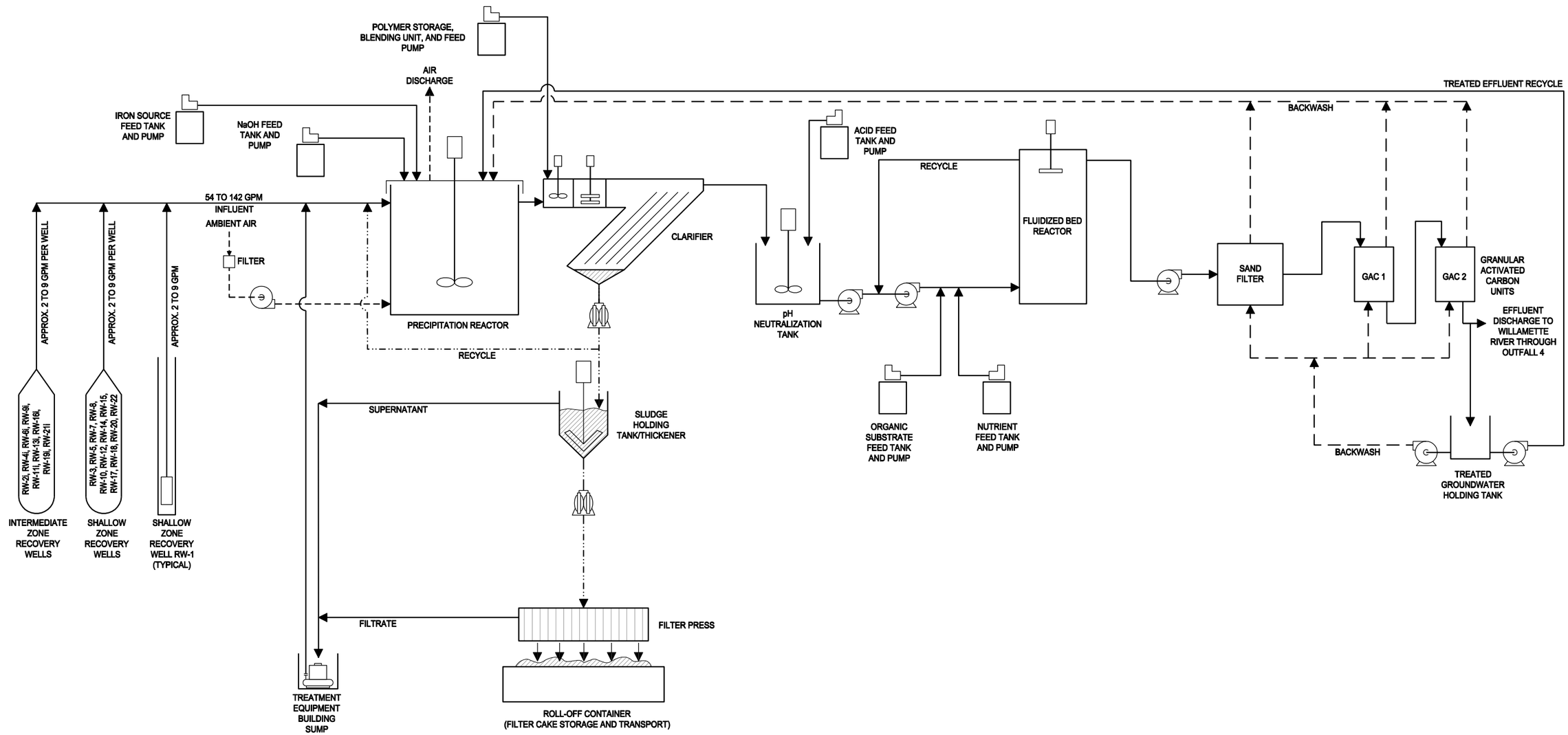
Design activities have been initiated for the GWET system, with a proposed delivery date for the pre-final design to regulatory agencies in December 2010. The proposed schedule for the GWET system design and implementation is presented in the Groundwater Source Control Measure Schedule as Figure 2. Based on expected agency review timeframes, ERM anticipates that the final design for the GWET system will be completed during Spring 2011 and approved during Summer 2011. Construction contractor bidding and equipment procurement activities are planned to be completed concurrent with agency review and approval of the final design, with contracts awarded during Summer 2011. Construction of the GWET system is slated to occur during Summer 2011 through Spring 2012, with startup activities scheduled for Spring/Summer 2012. This overall project schedule is subject to change based on agency review times and comments.

9.0 QUOTATION DUE DATE AND SUBMITTAL

The quotation must be submitted to the following by 8 October 2010 at 5:00 PM (electronic mail acceptable):

Mr. Chris Underwood
Environmental Resources Management
350 Eagleview Blvd., Suite 200
Exton, Pennsylvania 19341
Phone: 610-524-3605
E-Mail: christopher.underwood@erm.com

ERM will review the quotation and contact you with any questions and/or requested changes to the quotation. If you have any questions regarding this request for quotation, technical or otherwise, please submit questions in writing (again, electronic mail is acceptable) to Mr. Underwood. ERM will accept such questions until 1 October 2010 at 5:00 PM. ERM appreciates your effort in preparing this quotation and looks forward to reviewing your submittal.



Legend

Air Line		Centrufugal Pump	Mixer
Sludge Line			
Backwash Line		Air Blower	Flocculater
GAC	Granular Activated carbon		
GPM	Gallons Per Minute	Diaphragm Pump	Biosolids Separator
IEW	Intermediate Zone Extraction Well		
NaOH	Sodium Hydroxide	Chemical Feed Pump	Sump Pump
SEW	Shallow Zone Extraction Well		
		Submersible Well Pump	Sludge Mixer / Scraper

Figure 1

Preliminary GWET System Process Flow Diagram
Preliminary Design Report
Groundwater Source Control Measure
Arkema, Inc.
Portland, Oregon

ERM 5/10

Project No. 0114849
Date: 9/27/2010
Drawn By: MLB
CAD File: G:\CAD\Drawings\Arkema-Portland\0093634\K201.dwg

Table 1
Estimated Range of Influent Concentrations for GWET System Design
Groundwater Source Control Measure
Arkema Inc.
Portland, Oregon

Data Source	Groundwater Treatability Study[1]	Site-Wide Groundwater Sampling[2]				Recovery Well Pumping Tests[3]				Estimated Influent Concentration
Parameter	Blended	Average	Maximum	No. of Samples	No. of Detections	Average	Maximum	No. of Samples	No. of Detections	
VOCs (ug/L)										
Benzene	ND (6.4)	1.04	16.6	33	10	1.22	2.69	12	1	3
Chlorobenzene	1,700	948	12,500	33	30	80.5	286	12	6	2,000
Chloroform	9.9	298	9,800	33	17	NA	ND (5)	12	0	300
SVOCs (ug/L)										
Benzo(a)Anthracene	ND (1.7)	NA				NA				ND (1.7)
Benzo(a)Pyrene	ND (1.3)	NA				NA				ND (1.3)
Benzo(k)Fluoranthene	ND (0.46)	NA				NA				ND (0.46)
2-Chlorophenol	43	NA				NA				50
Chrysene	ND (1.0)	NA				NA				ND (1.0)
Dibenzo(a,h)Anthracene	ND (1.4)	NA				NA				ND (1.4)
Fluoranthene	ND (5.0)	NA				NA				ND (5.0)
Hexachlorobenzene	ND (2.1)	NA				NA				ND (2.1)
Pentachlorophenol	ND (20)	NA				NA				ND (20)
Pesticides (ug/L)										
Aldrin	ND (0.0059)	NA	ND (0.05)	36	0	NA				ND (0.0059)
Chlordane	ND (0.14)	NA	ND (0.5)	36	0	NA				ND (0.14)
DDD	0.027 COL	0.09	0.599	36	17	NA	ND (0.1)	12	0	0.1
DDE	ND (0.0075)	0.06	0.553	36	10	NA	ND (0.1)	12	0	0.1
DDT	0.015 COL	1.3	30.8	36	23	NA	ND (0.1)	12	0	1
Metals, total (ug/L)[4]										
Arsenic	ND (4.4)	NA	ND (3)	1	0	NA				10
Cadmium	5.6	NA	0.367 J	1	1	NA				5
Chromium, total	ND (2.6)	NA				NA				100
Chromium, hexavalent	ND (4.4)	98	1,100	30	15	NA				100
Copper	ND (4.5)	NA	ND (2)	1	0	NA				5
Iron	140,000	NA	205	1	1	NA				2,000
Lead	ND (2.6)	NA	ND (7)	1	0	NA				ND (2.6)
Manganese	NA	NA	641	1	1	NA				500
Nickel	ND (7.8)	NA	5.41 J	1	1	NA				5
Silver	ND (2.8)	NA				NA				ND (2.8)
Zinc	63	NA	2.25 J	1	1	NA				50
Metals, dissolved (ug/L)[4]										
Arsenic	ND (4.4)	45.4	892	31	17	13.2	51.9	12	9	10
Cadmium	4	NA	ND (0.7)	2	0	NA				5
Chromium, total	ND (2.6)	36.4	388	19	9	NA				100
Chromium, hexavalent	ND (4.4)	NA				NA				100
Copper	ND (4.5)	2.54	2.85 J	2	2	NA				5
Iron	110,000	1,637	17,800	31	28	500	1,940	12	9	2,000
Lead	ND (2.6)	NA	ND (7)	2	0	NA				ND (2.6)
Manganese	NA	471	4,190	21	20	616	2,090	12	12	500
Nickel	ND (7.8)	3.44	4.95 J	2	1	NA				5
Silver	ND (2.8)	NA				NA				ND (2.8)
Zinc	49	2.86	4.72 J	2	1	NA				50
Inorganics (mg/L)										
Chlorate	45.5	NA				NA				50
Perchlorate	3.2 Q	5.2	119	40	15	NA	ND (0.68)	6	0	5
Chloride	1,600 Q	3,251	39,400	40	40	294	860	12	12	2,500
pH (s.u.)	6.54	6.15	5.02 - 9.71	20	20	NA				6.5
Other Parameters (mg/L)										
Alkalinity	200	NA				NA				200
Calcium	73	NA				NA				75
Nitrate as N	ND (0.21) G	NA				NA				2.5
Nitrogen, Ammonium	5.2	NA				NA				5
Nitrogen, Total Kjeldahl	6.1	NA				NA				5
Phosphate, Total as P	0.18	NA				NA				0.2
Sulfate	1,300 Q	NA				NA				1,000
Total Organic Carbon	10	NA				NA				10
Total Suspended Solids	220 Q	NA				NA				100
Total Volatile Solids	48 Q	NA				NA				25

Notes

(1) - Based on analytical results for groundwater samples collected from on-site monitoring wells for the groundwater treatability study during 2007. Blended sample represents composite samples from MWA-5, MWA-14i, MWA-34i, MWA-43, MWA-44, MWA-52i, MWA-66i, and MWA-68si).

(2) - Based on analytical results for groundwater samples collected from on-site monitoring wells during site-wide groundwater samplings event in 2007 and 2009 (except for total metals and pH, which are based on 2009 event only and dissolved chromium, total, which is based on 2007 event only). Hexavalent chromium, total concentrations based on 2007 and 2009 events.

(3) - Based on analytical results for groundwater samples collected from proposed recovery wells during pumping tests in 2009.

(4) - Dissolved metal concentration may exceed total metal concentration based on data set used to estimate influent concentration.

When necessary, average concentrations calculated assuming concentrations equal to one half of laboratory method detection limit and/or reporting limit for non-detect values.

Non-detect (ND) values reported with laboratory method detection limits (groundwater treatability study and site-wide groundwater sampling) or reporting limit (recovery well pumping tests).

mg/L = milligrams per liter
ug/L = micrograms per liter
s.u. = standard units
NA = data not available
J = Estimated result. Result is less than laboratory method detection limit.

COL = More than 40% RPD between primary and confirmation column results. The lower of the two results is reported.
Q = Elevated reporting limit. The reporting limit is elevated due to high analyte levels.
G = Elevated reporting limit. The reporting limit is elevated due to matrix interference.
V = Elevated reporting limit. The reporting limit is elevated due to limited sample volume.

Table 2
Effluent Quality Objectives for GWET System Design
Groundwater Source Control Measure
Arkema Inc.
Portland, Oregon

Parameter	ODEQ MQL[1]	Estimated Influent Concentration	Effluent Quality Objective	Comments
VOCs (ug/L)[2]				
Benzene	0.5	3	<0.7	Based on LPGAC vendor information
Chlorobenzene	0.5	2,000	<200	Based on LPGAC vendor information; however, FBR treatability study effluent data suggests removal to <130 ug/L
Chloroform	0.5	300	<30	Based on LPGAC vendor information
SVOCs (ug/L)[2]				
Benzo(a)Anthracene	1	ND (1.7)	No design criteria	No design criteria, not detected in influent[5]
Benzo(a)Pyrene	1	ND (1.3)	No design criteria	No design criteria, not detected in influent[5]
Benzo(k)Fluoranthene	1	ND (0.46)	No design criteria	No design criteria, not detected in influent at concentration above MQL
2-Chlorophenol	1	50	<5	Based on LPGAC vendor information
Chrysene	1	ND (1.0)	No design critera	No design criteria, not detected in influent at concentration above MQL
Dibenzo(a)Anthracene	1	ND (1.4)	No design critera	No design criteria, not detected in influent[5]
Fluoranthene	2	ND (5.0)	No design critera	No design criteria, not detected in influent[5]
Hexachlorobenzene	1	ND (2.1)	No design critera	No design criteria, not detected in influent[5]
Pentachlorophenol	2	ND (20)	No design critera	No design criteria, not detected in influent[5]
Pesticides (ug/L)[2]				
Aldrin	0.01	ND (0.0059)	No design criteria	No design criteria, not detected in influent at concentration above MQL
Chlordane	0.1	ND (0.14)	No design criteria	No design criteria, not detected in influent[5]
DDD	0.01	0.1	<0.01	Based on LPGAC vendor information
DDE	0.01	0.1	<0.01	Based on LPGAC vendor information
DDT	0.01	1	<0.1	Based on LPGAC vendor information
Metals (ug/L)[3]				
Arsenic	0.05	10	<10	Based on FBR treatability study effluent
Cadmium	0.1	5	No design criteria	No design criteria, naturally-occurring, incidental removal expected[5]
Chromium, total	10	100	No design criteria	No design criteria, incidental removal expected[6]
Chromium, hexavalent	10	100	<10	Based on FBR treatability study effluent
Copper	10	5	No design criteria	No design criteria, naturally-occurring, incidental removal expected[5]
Iron	100	2,000	No design criteria	No design criteria, naturally-occurring, incidental removal expected
Lead	5	ND (2.6)	No design criteria	No design criteria, naturally-occurring, incidental removal expected[5]
Manganese	2	500	No design criteria	No design criteria, naturally-occurring, incidental removal expected
Nickel	10	5	No design criteria	No design criteria, naturally-occurring, incidental removal expected[5]
Silver	1	ND (2.8)	No design criteria	No design criteria, naturally-occurring, incidental removal expected
Zinc	5	50	No design criteria	No design criteria, naturally-occurring, incidental removal expected
Inorganics (mg/L)[4]				
Chlorate	NA	50	<0.015	Based on FBR treatability study effluent
Perchlorate	0.004	5	<0.015	Based on FBR treatability study effluent
Chloride	1	2,500	No design criteria	No treatment
pH (s.u.)	NA	6.5	6.5 to 8.5	Based on FBR treatability study effluent
Other Parameters (mg/L)[4]				
Alkalinity	1	200	No design criteria	No design criteria, naturally-occurring
Calcium	NA	75	No design criteria	No design criteria, naturally-occurring
Nitrate as N	0.1	2.5	<10	Total nitrogen based on FBR treatability study effluent
Nitrogen, Ammonium	1	5		
Nitrogen, Total Kjeldahl	NA	5		
Phosphate, Total as P	0.01	0.2	<1	Total phosphorus based on FBR treatability study effluent
Sulfate	NA	1,000	No design criteria	No treatment
Total Organic Carbon	NA	10	<10	Based on FBR treatability study effluent
Total Suspended Solids	NA	100	<25	Based on FBR treatability study effluent
Total Volatile Solids	NA	25	<25	Based on FBR treatability study effluent

Notes
(1) - Method Quantitation Limit (MQL) based on values published by Oregon Deparment of Environmental Quality (ODEQ) in guidance dated 16 November 2007.
(2) - Estimated effluent concentrations based on approximately 90% removal efficiency for liquid-phase granular activated carbon (LPGAC).
(3) - Estimated effluent concentrations assume iron co-precipitation with clarifier and optional solids filtration.
(4) - Estimated effluent concentrations based on documented performance of fluidized bed reactor.
(5) - Not detected in FBR treatability study effluent above MQL.
(6) - Assumes that majority of chromium present as hexavalent chromium, and total chromium concentrations will be reduced via removal of hexavalent chromium.
Non-detect (ND) values reported with laboratory method detection limits.
FBR = fluidized bed reactor
GWET = groundwater extraction and treatment
LPGAC = liquid-phase granular activated carbon
mg/L = milligrams per liter
ug/L = micrograms per liter
s.u. = standard units
NA = data not available

Table 3
Preliminary GWET System Design Parameters
Groundwater Source Control Measure
Arkema Inc.
Portland, Oregon

Parameter	Estimated Influent Concentration	Effluent Quality Objective
VOCs (ug/L)[2]		
Benzene	3	<0.7
Chlorobenzene	2,000	<200
Chloroform	300	<30
SVOCs (ug/L)[2]		
2-Chlorophenol	50	<5
Pesticides (ug/L)[2]		
DDD	0.1	<0.01
DDE	0.1	<0.01
DDT	1	<0.1
Metals (ug/L)[3]		
Arsenic	10	<10
Chromium, hexavalent	100	<10
Inorganics (mg/L)[4]		
Chlorate	50	<0.015
Perchlorate	5	<0.015
pH (s.u.)	6.5	6.5 to 8.5
Other Parameters (mg/L)[4]		
Nitrate as N	2.5	<10, Total as N
Nitrogen, Ammonium	5	
Nitrogen, Total Kjeldahl	5	
Phosphate, Total as P	0.2	<1
Total Organic Carbon	10	<10
Total Suspended Solids	100	<25
Total Volatile Solids	25	<25

Notes
mg/L = milligrams per liter
ug/L = micrograms per liter
s.u. = standard units

11904 – Oxygen Aerator System

SECTION 11904
OXYGEN GENERATION SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Contractor shall provide all labor, materials, equipment and incidentals, as shown, specified and required to provide an Oxygen Generator System specified hereinafter.

B. CONTRACTOR shall obtain OGSI OG-15 package system with following:
   1. Oxygen Quality 15 SCFH (7 LPM) @ 9 psi
   2. 0.4 Nm3/h @ 0.6 bar
   3. Dewpoint -60 °F (-51 °C)
   4. Oxygen Purity 93% (±3%) (depending on flow rate)
   5. Sound Levels 65 dBA @ 1 m, open field conditions (with enclosure)
   6. 55 dBA @ 1 m, open field conditions (with quiet muffler option)
   7. Dimensions 17 x 10 x 28 in (W x D x H)
   8. Weight 78 lb (35 kg)
   9. Power Requirements 115 VAC Model: 115 VAC, 60 Hz, Single Phase, 6 A

1.02 QUALITY ASSURANCE

A. Quality Source Control:

   1. Furnish all equipment per this specification unless otherwise accepted by Engineer or OWNER'S AGENT.

B. Reference Standards:

   1. Comply with applicable provisions and per the engineered design drawings, and standards reference by manufacturer/equipment vendor, unless otherwise shown or specified.

1.03 SUBMITTALS

A. Fabrication/Shop Drawings: Submit per the attached RFQ. CONTRACTOR shall provide a schedule for submitting fabrication/shop drawings to OWNER'S AGENT and ENGINEER as part of the proposal. OWNER'S AGENT and ENGINEER must approve the drawings before fabrication commences. As such, CONTRACTOR shall provide a total of 30 calendar days for the OWNER'S AGENT and ENGINEER to review the drawings, request clarification and/or revisions, review the CONTRACTOR'S responses and revised drawings, and issue approval. CONTRACTOR shall assume participation in a conference call with the OWNER'S AGENT and ENGINEER to discuss their comments and the CONTRACTOR'S responses and revisions within the above 30 calendar days.

B. Operation and Maintenance Manual as As-Built Drawings: Submit per the attached RFQ. CONTRACTOR shall provide a draft manual to the OWNER'S AGENT and ENGINEER for review and approval prior to commencing system start up. As such, CONTRACTOR shall provide a total of 30 calendar days for the OWNER'S AGENT and ENGINEER to review the manual and as-built drawings, request clarification and/or revisions, review the CONTRACTOR'S responses and revised manual and drawings, and issue approval. CONTRACTOR shall assume participate in a conference call with the OWNER'S AGENT and ENGINEER to discuss their comments and the CONTRACTOR'S responses and revisions within the above 30 calendar days.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation of the Carbon System will be in accordance with the manufacturer/equipment vendor instructions, engineered design drawings, and any specification recommended by the CONTRACTOR and approved by the ENGINEER and OWNER'S AGENT.

B. CONTRACTOR is responsible for providing a complete and functional Oxygen Generator per the design drawings and specifications, and vendor's/manufacturer's specifications. CONTRACTOR shall verify that all equipment, associated controls, and interlocks function per the design and that the treatment system is achieving the required discharge limits. Field/start up testing to verify this shall be proposed and conducted by the CONTRACTOR to the satisfaction of the OWNER'S AGENT and ENGINEER, and the project shall not be complete until such testing verifies that the system functions as designed and achieves the discharge limits. CONTRACTOR shall correct any deficiencies identified during the field/start up testing at no additional cost to the OWNER'S AGENT.

C. CONTRACTOR shall provide start up, operation, and maintenance training to the OWNER'S AGENT and ENGINEER, and such training shall include an overview of the operation and maintenance manual to understand the key features of the system operation and maintenance, walkthrough of the system to see and understand how the key features function and how maintenance is to be performed, hands-on startup, hands-on shut down, and health and safety considerations.

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Division 13 – Special Construction

13120 – Pre Engineered Building

SECTION 13120
PRE ENGINEERED BUILDING
DRAFT DOCUMENT – OBTAINING DATA FROM MANUFACTURER

PART 1 - GENERAL

1.01 SUMMARY

A. The Building System for this project will be a Structural Building System by Olympia Steel Building or OWNER's AGENT Approved Equal (See Section 1.05 Submittals). The Building System includes the structural steel system, primary and secondary, metal roof system, wall system, and all roof and wall insulation, canopies, trim and accessories as required by the drawings.

B. Technical specifications and information for Olympia products or equal and proprietary designs are included in the TECHNICAL SPECIFICATIONS portion of this document. Where several alternatives are described in the TECHNICAL SPECIFICATIONS, such as for finishes and trim options; the option proposed will be as set forth in this section.

1.02 DESCRIPTION

A. Building Size: The building size will be defined as structural line to structural line. The internal clean height and the building dimension are noted on the DRAWINGS. Final outside width and length to be determined based on specified wall thicknesses as shown on the structural building plan. Bays (spacing between primary frames), are as shown on the drawings.

B. Primary Structures:

1. Frames will consist of welded up plate section columns and roof beams or trusses complete with necessary splice plates for bolted field assembly as described in the PART 2 - PRODUCTS. All bolts for field assembly of frame members will be high strength bolts as indicated on the manufacturers certified erection drawings.

2. Beam and post end wall frames will consist of end wall corner posts, end wall roof beams, and end wall posts, all with base plates, as required by manufacturer design criteria.

3. Exterior columns will be welded-up "H" sections or cold-formed "C" sections.

4. Interior columns will be "H" sections or tube columns.

5. Connection of all major structural members will be made with A 325 high-tensile bolts through pre-punched or predrilled holes for exact alignment.

6. All structures will be painted with manufacturer's standard primer with manufacturer's standard surface preparation as specified in the Framing System Section.

C. Secondary Structures: Secondary structures shall be purlins, truss purlins or girts with minimum Gray primer finish applied by a coil coater or Olympia's G-40 Galv. Coating or approved equal.

D. Roof System: The roof system shall be Butler Rib 2 or MR-24 roof system or Olympia's Approved Equal, per the roof system specification in Section 2.02.

E. Wall System: The wall system shall be Olympia's 26 G17 R-Panel or Butler Rib 2 wall system or Approved Equal per the wall system specification in Section 2.03.

F. The metal roof panel coating system shall be Butler-Cote® finish system , a full strength, 70% Kynar 500®/Hylar 5000™ Fluoropolymer coating or AKZO Nobel, polyester baked-on paint system, or Baked on siliconized polyester, or approved equal. Manufacturer shall provide warrants that coating shall not blister, peel, crack, chip, or experience material rust through for min. 25 years. For a period of 25 years chalking shall not exceed #8 - ASTM and fading shall be 5 D E Color Difference Units or less.

G. Welded Sections shall be coated with min. Sherwin Williams, Rust-o-leum, gray primer system or minimum Gray primer finish applied by a coil coater or equal.

1.03 QUALITY ASSURANCE

A. Codes

1. It is the intent of these specifications that the building complies with the International Building Code (IBC) 2009/The 2010 Oregon Structural Specialty Code, as modified by the Uniform Construction Code (UCC).

B. AISC Certification

1. Building System Manufacturer shall comply with American Institute of Steel Construction - Category MB.

C. Letter of Certification

1. Certification: Submit written certification prepared and signed by a Professional Engineer, registered to practice in Oregon verifying that the building system design and metal roof system design (including panels, clips, steel components and support system components) meet indicated loading requirements and codes of authorities having jurisdiction. The certification must reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end use categories, governing code bodies including year, and load applications.

D. Material Testing

1. In addition to mill certifications of structural steel, the manufacturer shall provide, upon request, evidence of compliance with specifications through testing independent of the manufacturer's suppliers. This quality assurance testing to include structural bolts, nuts, screw fasteners, mastics, and metal coatings (primers, metallic coated products, and painted coil products).

E. Design Loads

1. Governing Design Code
   a. Structural design for the building structural system will be provided by the building manufacturer for the following design criteria;
      i. Governing Building Code: IBC 2009/The 2010 Oregon Structural Specialty Code, as amended by the state of Oregon or Multnomah County.

2. Roof Live Load
   a. Roof live loads are loads produce during the life of the structure by moveable objects. Roof live load shall be 20 psf min.

3. Roof Snow Load
   a. Roof Snow Load shall be 25 psf min.

4. Wind Load
   a. Wind load in miles per hour only. Wind speed is 100 mph min. Building condition is closed. Wind Pressure Coefficients and the design pressures shall be applied per governing code: IBC 2009 as amended in the state of Oregon or per governing local ordinances.

5. Seismic Load
   a. Seismic load applied per IBC 2009, or local governing codes. The site located area designated as Seismic Zone 3.

6. Dead Load
   a. The weight of building system construction, such as roof, framing, and covering members.
   b. Dead Load shall be 2.2 psf min. or per local governing code.

7. Collateral Load
   a. Additional imposed loads required by the contract document other than the weight of the metal building system. These added loads could include such items as sprinklers, mechanical, electrical and ceiling systems.
   b. Collateral load shall be a minimum of 5 psf min. or per local governing code.

8. Auxiliary Loads (if noted on plans)
   a. All dynamic loads required by the contract documents such as cranes and material handling systems.
   b. Per local governing code.

9. Load Combinations
   a. Load combinations used to design primary and secondary structural members shall be according to the governing code.

10. Soil Bearing Capacity
    a. The allowable foundation pressure, per the IBC, presumptive min. of 1,500 psf.

F. Structural Design Practice – Deflections

1. Calculations for deflections shall be done using only the bare frame method. Reductions based on engineering judgment using the assumed composite stiffness of the building envelope shall not be allowed. Drift shall follow AISC's "Serviceability Design Considerations for Low-Rise Buildings." The use of composite stiffness for deflection calculations is permitted only when actual calculations for the stiffness are included with the design for the specific project. When maximum deflections are specified, calculations shall be included in the design data.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Store frame and covering above ground on level platforms, which allows air circulation under stacked units.

B. Cover and protect painted steel and metal accessories from weather.

C. Handle panels to prevent damage to edges and corners.

1.05 WARRANTIES

A. Provide manufacturers written weather tightness warranty for a maximum of twenty (25) years against leaks in roof panels arising out of or caused by ordinary wear and tear under normal weather and atmospheric conditions. Warranty shall be signed by both the metal roofing system manufacturer and the metal roofing system contractor. Maximum liability of warranty shall be no less than $0.50 per square foot of roof area (MR-24®, CMR-24® and VSR™ Roof Systems or equal).

B. Provide manufacturer's standard paint film written warranty for twenty (25) years against cracking, peeling, chalking, and fading of the coating on painted wall panels, painted roof

panels and soffit panels. Warranty shall be signed by building system or roof system manufacturer and state that the coating shall not peel, crack, or chip for 20 years. For a period of 25 years chalking shall not exceed #8 - ASTM and fading shall be 5 D E Color Difference Units or less.

1.06 SUBMITTALS

A. In compliance with AISC Certification - Submit proof of AISC - MB (Category - Metal Building) AISC – MB Specification.

B. Product Data: Submit manufacturer's product information, specifications, and installation instructions for building components, accessories.

C. Erection Drawings: Manufacturer shall submit complete erection drawings, sealed and signed by a Professional Engineer registered to practice in Oregon, showing roof framing, transverse cross-sections, covering and trim details, and accessory installation details to clearly indicate proper assembly of building components.

D. Certification: Manufacturer shall submit written letter of certification prepared and signed by a Professional Engineer, registered to practice in Oregon verifying that the metal building system design and metal roof system design (including panels, clips, and support system components) meet indicated loading requirements and codes of authorities having jurisdiction. The certification must reference specific dead, live, snow, seismic, wind loads/speeds (including edge zone wind pressures), tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end use categories, governing code bodies (including year), and load applications.

E. Manufacturer shall submit certification verifying that the metal roofing system has been tested and approved by Underwriter's Laboratory as Class 90.

F. Dealer Certification: Submit certification that the building system supplier or metal roof system supplier is a manufacturer's authorized and franchised dealer of the system to be furnished. Certification shall state date on which authorization was granted.

G. Installer Certification: Submit certificate that the building or roof system installer has been regularly engaged in the installation of buildings systems of the same or equal construction to the system specified.

H. Anchorage: Provide a submittal on the building anchorage to the concrete foundation, including the option for field epoxy injection anchoring embedment substitution in accordance with IBC 2009 amended in the state of Oregon.

I. Samples: Manufacturer's submitted samples, two (2) each of the following for ENGINEER'S review. Samples will be used as basis for evaluating quality of finished roof and wall systems.

1. Twelve inch long by actual width of roofing, liner panel, and siding panels, with required finishes.

2. Fasteners (including standing seam roof clips) for application of roofing, siding, and soffit panels.

3. Twelve inches long min. x 12 inch wide min. of actual standing seam side lap seams for both sides of a typical panel including sealants and closures.

PART 2 - PRODUCTS

2.01 PRIMARY FRAMING

A. Rigid Frames

1. Frames shall consist of welded-up plate section columns and roof beams complete with necessary splice plates for bolted field assembly.
   a. All base plates, cap plates, compression splice plates and stiffener plates shall be factory welded into place and have the connection holes shop fabricated.
      i. Columns and roof beams shall be fabricated complete with holes in webs and flanges for the attachment of secondary structural members and bracing except for fieldwork as noted on manufacturer's erection drawings.

2. All bolts for field assembly of frame members shall be A-325 high strength bolts as indicated on erection drawings.

B. Endwall Structural

1. The end wall structures shall be cold-formed channel members designed in accordance with the 1986 AISI Specification or welded-up plate sections designed in accordance with the 1989 AISC Specification.

2. Endwall frames shall consist of end wall corner posts, end wall roof beams and end wall posts as required by design criteria.
   a. All splice plates and base clips shall be shop fabricated complete with bolt connection holes. All base plates, cap plates, compression splice plates and stiffener plates shall be factory welded into place and have the connection holes shop fabricated.
   b. Beams and posts shall be shop fabricated complete with holes for the attachment of secondary structural members except for field work as noted on manufacturer's erection drawings.

3. Intermediate frames shall be substituted for end wall roof beams when specified.

a. Necessary end wall posts and holes for connection to the intermediate frame used in the end wall shall be shop fabricated.

2.02 SECONDARY STRUCTURAL MEMBERS

A. Roof Purlins (<=30') and Wall Girts

1. Purlins and girts shall be "Z" shaped, precision roll formed.

2. Girts shall be 8" or 9-1/2" "Z" shaped sections.

3. Purlins shall be 8" or 9-1/2" deep "Z" shaped sections.

B. Eave Struts

1. Eave Struts shall be factory pre-punched 8", 9-1/2", or 11" deep "C" sections.

C. Bracing

1. Bracing shall be located as indicated on drawings.

2. Diagonal bracing shall be hot-rolled rod of size indicated on drawings, and attached to columns and roof beams as shown on the drawings.

3. Optional fixed base wind posts or pinned base portal frames, to withstand wind load bearing may be substituted for wall rod bracing on buildings as required by the IBC 2009, amended in the state of Oregon.

4. Flange braces, purlin braces, etc., when required, shall be cold formed and installed as indicated on drawings.

2.03 WELDING

A. Welding procedure, operator qualifications and welding quality standards shall be in accordance with the American Welding Society structural welding code. Inspection other than visual inspection, as defined by AWS paragraph 6.9, shall be identified and negotiated prior to bidding or shall conform to the IBC 2009 code standard.

B. Certification of welder qualification shall be supplied when requested.

C. Welding procedure, operator qualifications and welding quality standards shall be in accordance with local Codes and Standards.

2.04 STRUCTURAL PAINTING

A. General

1. All structural steel shall be prime painted as temporary protection against ordinary atmospheric conditions. Subsequent finish, painting, if required, shall be performed in the field by others.

2. Prior to painting, all steel shall be cleaned of loose rust, loose mill scale, dirt and other foreign material. Unless otherwise specified, the fabricator shall not sand blast, flame clean or pickle prior to painting.

3. Factory cover all steel with one coat of Gray paint formulated or Approved Equal or exceed the performance requirements of Federal Specification TT-P-664D and SSPC Paint-25.

B. Primary Frames

1. Clean all steel per SSPC-SP2.

2. Apply one coat of water reducible alkyd primer by spray or dip method to a minimum coating thickness of 1.0 mil.

C. Secondary Structures

1. Shall be a minimum of G-40 hot dip galvanized or approved equal.

2.05 ROOF SYSTEM

A. The roof shall be covered with the ML-90 roof system as furnished by Olympia or MR-24® roof system as furnished by Butler Manufacturing Company or approved equal, and installed in accordance with the manufacturer's instructions and per IBC 2009 code.

B. Component Description

1. Roof Panel
   a. Roof panel shall be factory roll-formed ML-90 by Olympia or MR-24 roof system panel as manufactured by Butler Manufacturing Company or approved equal; 24" wide, with 2 major corrugations, 2" high (2-3/4" including seam). 24" on center. The flat of the panel shall contain cross flutes 6" on center perpendicular to the major corrugations the entire length of the panel to reduce wind noise and improve walk ability.

2. Panel material as specified shall be 24 gage galvanized (G-90 coating) or equal, per ASTM specification A653 (G90), and Manufacturer warrants that coating shall not blister, peel, crack, chip, or experience material rust through for 20 years. For a

period of 20 years chalking shall not exceed #8 - ASTM and fading shall be 5DE Color Difference Units or less.

3. Panel of maximum possible length shall be used to minimize end lap; eave panel shall extend beyond the structural line of the sidewall.

4. Panel end splice shall be floating and allow the roof panel to expand and contract with roof panel temperature change.

5. Ridge assembly shall be designed to allow roof panels to move length wise with expansion/contraction as the roof panel temperature changes. Panel closure and interior reinforcing strap shall be installed to seal the panel end at the ridge. The attachment fasteners shall not be exposed on the weather side. A lock seam plug shall be used to seal the lock seam portion of the panel. A hi-tensile steel ridge cover shall span from panel closure to panel closure and flex as the roof system expands and contracts. Cross section of the ridge panel shall match the roof panel. Ridge panel splice shall occur over the first purlin on the either side of the building center. Eave panels shall extend beyond the building structural line.

6. Upper end of eave and splice panel will have ¾" long slots to provide for expansion and contraction of the panels. (An option: Required optional 10 – year weather tightness warranty).

C. System Design

1. All components of the ML-90 roof system paneling shall be designed in accordance with sound engineering methods and practices.

2. ML-90 roof system panel shall be designed in accordance with AISI "Specifications for the Design of Light-Gage, Cold-Formed Steel Structural Members" or CAN/CSAS136 "Cold-Formed Steel Structural Members" - latest edition.

3. Panel system shall be designed to support design live load. Panels shall be designed to support a 200 – pound load distributed evenly over a 2' square area centered between purlins without exceeding a panel deflection-to-span ration of 1/180 in a two-span condition.

4. All end wall trim and roof transition flashing shall allow the roof panel to move relative to the wall panel and/or the parapet as the roof expands and contracts with temperature change.

5. The ML-90 roof system panel shall not be considered a safe work platform until completely secured to the structural system. Therefore, walk boards or other safety equipment as required by safety standards shall be provided by the erecting contractor to provide for worker safety during panel installation.

6. Provisions for expansion/contraction, pre-punched roof panel shall have 5/16” x ¾” slotted holes at the upper end and 5/16” diameter holes at the lower end. The slotted holes shall permit thermal movement of the panel without detrimental effect on the roof panels.

7. Panel material and finish shall be one of the following:
   a. Panel material as specified shall be 28, 26 or 24 gage aluminum-zinc alloy-coated steel (AZ55) with mill-applied acrylic surface treatment (GALVALUME Plus® or ACRYLUME®). Minimum 0.55 ounce coated weight per square foot (approximately 55% aluminum 45% zinc applied by the continuous hot dip method) as determined by the triple-spot test per ASTM A792.
   b. Panel material as specified shall be 28, 26 or 24 gage galvanized steel per ASTM A653 painted with standard exterior colors of Butler-Cote® finish system, a full strength, 70% Kynar 500®* or Hylar 5000®* fluoropolymer coating or AKZO Nobel, polyester baked-on paint system. Manufacturer shall provide warrants that coating shall not blister, peel, crack, chip, or experience material rust through for min. 20 years. Manufacturer warrants that coating shall not blister peel crack chip or experience material rust through for 20 years min. For a period of 20 years min. chalking shall not exceed #8 - ASTM D 4214 and fading shall be 5DE Color Difference Units or less.

D. System Installation

1. Panel sidelap shall be field-seamed by a self-propelled and portable electrical lock-seaming machine. The machine field forms the final 180 degrees of a 360-degree Pittsburgh double-lock standing seam; all sidelap sealant shall be factory applied.

2. Panel end lap, when required, shall be at least 6”, sealed with Butler, McElroy, or approved equal sealant and fastened together by clamping plates. Sealant shall contain hard nylon beads, which prevent it from flowing out due to clamping actions. The panel lap shall be joined by means of a two-piece clamped connection consisting of a bottom reinforcing plate and a top panel strap. The panel end lap shall be located directly over, but not fastened to, a supporting secondary roof structural member and be staggered, to avoid a four panel lap splice condition.

3. A minimum blanket insulation thickness of two inches is required for all ML-90 roof system applications.

E. Fasteners

1. Connection of ML-90 roof system panel-to-structural member, except at eave, shall be made with clips with movable stainless steel tabs that are seamed into the standing seam sidelap.

2. Panel clip shall be fastened to structural member with Scrubolt™ fastener as per manufacturer's erection drawings, using factory pre-punched hole in structural member. Scrubolt™ fastener shall contain a metal backed rubber washer, which serves as a torque indicator.

3. MR-24 roof system panel-to-panel connection shall be made with a positive, field-formed standing double-lock seam, formed by a special seaming machine. The machine field forms the final 180 degrees of a 360-degree Pittsburgh double-lock standing seam; all side lap sealant shall be factory applied.

4. Fasteners penetrating the metal membrane at the following locations shall not exceed the frequency listed:

Fastening System	**Frequency**
Basic Panel System	0 per sq. ft.
Exterior Eave Gutter	2 per lineal ft.
Gable Trim (no parapet)	2 per lineal ft.
Ridge	1 per lineal ft.
High Eave (no parapet)	2 per lineal ft.
Panel Splices	2 per lineal ft.
High Side Transition	1 per lineal ft.

5. Panel-to-structural (standard)
   a. All connections of Butlerib II or Maxrib or approved equal roof system panel-to-structural members shall be made with galvanized steel, dichromate dipped Scrubolt™ fasteners, 3/8 "hex-head with ¾" metal backed sealing washer.

6. Panel-to-structural (optional)

a. Panel-to-structural member connections shall be made with ¼-14X1-1/4" galvanized 3/8" hex head self-drilling screw with 5/8" o.d. ALZN steel backed sealing washer.
b. Panel-to-structural member connections shall be made with #12 X 1-1/4" stainless steel 3/8" hex head self-drilling screw with 5/8" o.d. ALZN steel backed sealing washer.
c. Panel-to-structural member connections shall be made with stainless steel Scrubolt fasteners, 3/8" hex washer head with ALZN steel backed sealing washer.
d. Panel-to-structural member connections shall be made with self-clinching aluminum Lock-Rivet™ fasteners, ¾" diameter low profile head with sealing washer.

7. Panel-to-panel (standard)
   a. Panel-to-panel connections shall be made with #1/4-14 X 7/8" stainless or galvanized 3/8" hex head mini-point self-drilling screws with 5/8" o.d. metal backed sealing washer or equal.

8. Panel-to-panel (optional)
   a. Panel-to-panel connections shall be made with #1/4-14X7/8" stainless steel 3/8" hex head mini-pt. self-drilling screws with 5/8" o.d. ALZN steel back sealing washer.
   b. Fastener location and quantity shall be as shown on erection drawings as furnished by Butler Manufacturing Company or Olympia Building or approved equal.
   Warranty requirement:
   To qualify for the material Extended Life Endorsement (25 years for ALZN), Lock-Rivet, ALZN head Scrubolt or ALZN head self-drilling fasteners must be used. Either punched or un-punched panels may be ordered.
   To qualify for a 10 year Weather-tightness Endorsement the panel must be ALZN coated finish system or equal and the Extended Life Endorsement must be ordered. The roof panel and roof structural systems must be pre-punched and the panel-to-panel fasteners must be Lock-Rivet fasteners. Panel to structural fasteners must be ALZN head Scrubolt or Lock-Rivet fasteners.

F. Panel Application

1. Panel shall be factory cut-to-length according to the erection drawings as furnished by Butler Manufacturing Company or Olympia Steel Buildings or approved equal.

2. Panel shall be positioned and aligned to hold the 3' module throughout the building length.

3. Sidelap will be at least one full corrugation.

4. Endlap will be at least 6" and fastened together over and to structural members.

5. All panel side and endlap shall be sealed with Panlastic® sealant (weather sealing compound) or equal to prevent the entry of capillary moisture.

6. Fasteners shall be installed with proper tools, in a workman like manner according to the recommendations of the manufacturer.

G. Accessories

1. Accessories, i.e., ventilator, skylight, eave and gable trim, gutter, jacks and curb, shall be as standard with Olympia or Butler Manufacturing Company or approved equal, unless otherwise noted and furnished as specified.

2. The metal coating on all gutter, downspout, gable trim and eave trim to be Siliconized Polyester finish system or equal.

3. Location of standard accessories shall be as shown on erection drawings as furnished by Olympia Steel Buildings or Butler Manufacturing Company or approved equal.

4. Accessories (i.e., ventilator, skylight, gutter, fascia) shall be as standard with Butler Manufacturing Company or Olympia or approved equal, unless otherwise noted and furnished as specified.

5. The color coating on all gutter, downspout, gable trim and eave trim to be siliconized polyester finishing system or approved equal.

6. All materials used in flashing and transition parts furnished as standard by Olympia or approved equal or Butler Manufacturing Company or other supplier of equal standard of greater value, shall be compatible with the roof panel material and shall not cause a corrosive condition.

H. Performance Testing

1. Underwriters Laboratories - The roof system shall qualify for U.L. wind uplift classification Class 90 rating to ensure structural integrity and possible reduction of insurance rates (Construction No. 81).

2. Underwriters Laboratories - The roof system shall carry a U.L. wind uplift resistance classification of 90 to ensure structural integrity and possible reduction of insurance rates (Construction No’s Construction No. 62 , 62A & 178).

3. FM Global - The roof system shall qualify for Approval as Class 1 Panel Roof (FMRC Standard 4471) and be listed in Factory Mutual Approval Guide - latest edition.

4. FM Global - The roof system shall qualify for Approval as Class 1 Panel Roof (FMRC Standard 4471) and be listed in Factory Mutual Approval Guide - latest edition.

5. National Fire Protection Association - The roof system shall be considered acceptable where Class A roof coverings are required for exterior fire exposure.

6. U.B.C. The roof system shall be considered acceptable where Class A roof coverings are required for exterior fire exposure.

7. S.B.C. The roof system shall be considered acceptable where Class B roof coverings are required for exterior fire exposure.

8. B.O.C.A. - The roof system shall be considered acceptable where Class B roof coverings are required for exterior fire exposure or where specified on the IBC 2009 code, amended in the state of Oregon.

9. Air Infiltration shall not exceed .050 cfm per square foot of roof area when tested in reference to ASTM E 1680, latest edition at a static pressure differential of 12.0 psf.

10. There shall be no uncontrolled water penetration through the panel seams when tested in reference to ASTM E 1646, latest edition at a static pressure differential of 12.0 psf.

I. Provision for Expansion/Contraction

1. Provision for thermal expansion movement of the ML-90 roof system panel shall be accomplished by the use of clips with a movable tab. The stainless steel tab shall be factory centered on the roof clip when installed to assure full movement in either direction. A force of no more than 8 pounds will be required to initiate tab movement. Each clip shall accommodate a minimum of 1.25” in either direction or as specified by the IBC 2009.

2. The roof shall provide for thermal expansion/contraction without detrimental effect to the roof panel when there is a ±100°F. Temperature difference between the inside structural framework of the building and the temperature of the roof panels.

J. Energy Conservation

1. Purlins shall be insulated to eliminate “thermal short circuit” between purlin and roof panel. The heat loss (thermal short circuit) caused by compression of the blanket insulation between structural and panel is minimized by the use of a spacer block at each purlin location.

2.06 WALL SYSTEM

A. General

1. Exterior walls shall be covered with precision roll-formed 36” panels as furnished by Butler Manufacturing Company or Olympia or approved equal and installed in accordance with the manufacturer’s instructions.

B. Panel Description

1. Panels shall be 3’ wide with four major corrugations, 1-1/4” high 12” on center with two minor corrugations between each of the major corrugations the entire length of the panel.

2. Panels shall be one piece from base to building eave.

3. Maximum panel length shall be 38’ 9”.

4. The upper end of panels shall be fabricated with a mitered cut to match corrugations of Butlerib® II roof panels and square cut for all other roof panels.

5. The bottom end of the panels shall be straight cut.

C. Panel Design

1. Panel design shall be in accordance with AISI “Specifications for the Design of Light-Gage, Cold-Formed Steel Structural Members,” and in accordance with sound engineering methods and practices.

D. PANEL MATERIAL AND FINISH

1. The panel material as specified shall be one of the following:
   a. 28, 26 or 24-gage steel, coated both sides with a layer of GALVALUME® aluminum-zinc alloy (approximately 55% aluminum, 45% zinc) applied by the continuous hot dip method. Triple-spot minimum 0.55 ounce per square foot as determined by the triple-spot test per ASTM Specification A-792.

   OR

   b. 28, 26, 24 gage galvanized, per ASTM specification A-653, and painted with exterior colors, a full strength, 70% Kynar 500®/Hylar 5000™ fluoropolymer coating or AKZO Nobel, polyester baked-on paint system. Manufacturer shall provide warrants that coating shall not blister, peel, crack, chip, or experience material rust through for min. 20 years or a coating of equal strength where the manufacturer warrants that coating shall not blister, peel, crack, chip, or experience material rust through for 20 years. For a period of 20 years chalking

shall not exceed #8 - ASTM and fading shall be 5^E Color Difference Units or less.

E. Panel Application

1. Structural system shall be plumb before wall panels are attached.

2. Panels shall be aligned and attached in accordance with erection drawings furnished by Butler Manufacturing Company or Olympia or approved equal.

3. All sidelaps shall be at least one full corrugation.

4. Panels shall be sealed at the base with foam or rubber closures.

5. Trim material should be as follows;
   a. All exterior trim shall be of the same finish as the exterior coating or equal as follows;
      i. All gutters, downspouts, eave trim, gable trim, door side flashings to be pre-painted galvanized steel with, a full strength, 70% Kynar 500®/Hylar 5000™ fluorpolymer coating or Sherwin Williams grey primer secondary galvanize or Akzo Nobel polyester baked on coating with a complete manufactures warranty of a min. 20 years and rust perforation of 25 years or equal.
      ii. All gutters, downspouts, eave trim and gable trim shall be Polar White or Stone White or Charcoal or Slate Gray. These flashings and trims are also available in pre-primed galvanized steel for field painting.
      iii. Door side flashing and door header flashings shall be available in Charcoal or Slate Gray.
      iv. Windows shall be of aluminum extrusions (thermally broken) pre-painted to match charcoal or slate gray color.
      v. All corner trim shall be painted.
      vi. All flashings, trims, closures and similar items shall be as detailed on drawings as supplied by the manufacturer of the panel.

F. Fasteners

1. Wall panel-to-structural connections shall be made with Torx® head Scrubolt™ fasteners, Torx® head self-drilling screws or Lock-Rivet™ fasteners. Panel-to-panel connections shall be made with Torx® head self-drilling screws, or Lock-Rivet™ fasteners.

2. Lock-Rivet™ fasteners (optional) shall be set by a special Lock-Rivet™ tool.

3. Fastener locations shall be as shown on erection drawings as furnished by Butler Manufacturing Company.

4. All exposed fasteners shall be either pre-painted to match wall color or shall be covered with plastic color caps to match wall color.

G. Accessories

1. Accessories (i.e., doors, windows, louvers) shall be as standard with Butler Manufacturing Company or Olympia or approved equal unless otherwise noted, and furnished as specified.

2. Standard accessory locations shall be as shown on erection drawings as furnished by Butler Manufacturing Company or Olympia or approved equal.

3. Galvalume® is a registered trademark of BIEC International, Inc.

4. Fluropon® is a registered trademark of The Valspar Corporation.

5. Kynar 500® is a registered trademark of Elf Atochem North America, Inc.

6. Hylar 5000™ is a trademark of Ausimont USA, Inc.

7. Torx® is a trademark of the Camcar Division of Textron, Inc.

8. Sherwin William rust-o-leum grey primer secondary galvanize

9. Akzo Nobel polyester baked-on rust-o-leum

10. The ENGINEER must approve all other products of equal standard value or above standard.

2.07 FINISHES

A. Structural Steel

1. All primary and secondary members shall be cleaned of all foreign matter and loose scale and hot dipped galvanized (G90).

B. Finished Steel Panels

1. Panels shall be fabricated in a continuous roll-forming operation to assure uniformity of profile.

2. Panel with Dual Coat finish shall consist of base steel sheets conforming to ASTM 446 Grade 5, with a minimum yield of 33,000 psi. Then they shall be galvanized in accordance with ASTM A525 G90 (1.25 oz.). After alkali cleaning, hot water rinse, cold-water rinse, acid rinse seal and drying, the finish coat shall be applied.

3. DUAL COAT FINISH shall have the following physical properties:
   a. Primer: A high molecular weight modified epoxy optimized for maximum corrosion resistance shall be applied to a dry film thickness of 0.2-0.25 mil, oven cured, water quenched and dried.
   b. Finish: A thermo set coating of polyester resins co-polymerized with functional silicone resins, using only long-life, chemically resistant, inorganic pigments shall be applied to a dry film thickness of 0.7-0.8 mil or equal, oven cured, water quenched and dried.
   c. Gloss: Specular gloss shall be 20-35% as determined by tests on a flat sample measured at a 60° viewing angle in accordance with ASTM D523.
   d. Outdoor Florida Exposure: After 5 years of continuous exposure at an angle of 45o facing south in southern Florida the test panels shall show no evidence of blistering or loss of adhesion. There shall be only slight chalking and color fade.
   e. Weather-o-meter: When subject to accelerated weathering tests for 2,000 hours in accordance with ASTM G23, the finish shall show a chalk rating maximum of 8 and the color change shall not exceed 2 Hunter Delta E color units.
   f. Flexibility: The coating shall remain intact after a full 180 degree bend around a 1/8" diameter mandrel in accordance with ASTM D522. Complete adhesion between finish and base metal shall be maintained with no tape-off.
   g. Impact Adhesion Test: The coating shall show no loss of adhesion when subjected to a force equal to 2000* the metal thickness, in accordance with ASTM D2794.
   h. Surface Hardness: Shall be F-2H minimum pencil hardness in accordance with ASTM D3363.
   i. Salt Resistance: When subjected to a salt fog (5% salt fog at 95° F) for 1,000 hours in accordance with ASTM B117, there shall be no more than 1/16" creep corrosion and loss of adhesion from a line scribed to bare metal.
   j. Humidity Test: When subjected to 100% relative humidity at 95o F for 1,000 hours the coating shall show no softening, no color change, and no more than a few #8 blisters.
   k. Acid Pollutants: There shall be no effect on the panel finish when subjected to 10% Muriatic Acid for 15 minutes or 20% Sulfuric Acid for 24 hours, in accordance with ASTM D1308. When subjected to 70% Nitric Acid Vapors for 30 minutes, there shall be less than 5 units color change (Hunter Delta E color difference unit). There shall be no objectionable color change when subjected to the Kesternich SO2 Cyclic test for 10 cycles (2 liters).
   l. Alkali Resistance: There shall be minimal effect on the finish of the panel when subjected to 10%, 25% Sodium Hydroxide for 1 hour, in accordance with ASTM D1308.

2.08 INSULATION

A. General

1. Insulation shall be energy code compliant.

2. Provide vapor barrier faced fiberglass insulation for building walls and roof. Roof insulation shall have a thickness of 6” with a minimum R-value of 19.0; wall insulation shall have a thickness of 4” with a minimum R-value of 13.0.

B. Vapor Barrier Facing

1. Building insulation shall be faced with a polypropylene/scrim/core/metalized polyester film having the following properties:

a.	Basis weight and thickness	25 lbs/1000 ft2; 0.009 inch	
b.	Water vapor transmission rate:	0.02 perm (grains/hr ft2 in Hg) ASTM E96, Procedure A	
c.	Bursting strength:	10 psi - ASTM D774	
d.	Puncture resistance:	25 beach units - ASTM C1136	
e.	Tensile strength:	55 lbs/inch width (machine direction) 50 lbs/inch width (cross direction) ASTM C1136	
f.	Low temperature resistance:	-40°F - remains flexible, no delamination ASTM D1790	
g.	High temperature resistance:	4 hrs @ 240°F - remains flexible, no delamination	
h.	Water immersion:	24 hrs @ 73°F - no delamination	
i.	Mold resistance:	No growth - ASTM C655	
j.	Fire resistance UL – 723	Flame Spread	Smoke Developed
k.	Polypropylene exposed	5	25
l.	Polyester exposed	5	20

2. Provide WMP - 50 vapor barrier facing as supplied by Lamtec Corp., Flanders NJ, or approved equal.

2.09 ACCESSORIES

A. Service Doors

1. Door Leaf:
   a. Doors shall be fabricated from minimum spangle hot dipped textured Galvanized steel, mill treated for proper paint adherence.
   b. Series H20-4 Reversible doors have honeycomb cores. The honeycomb core shall be 99# test, impregnated with water resistant resin and shall have crush strength of 55 psi. The core shall be secured to the face sheets with a waterproof adhesive applied with automated spray equipment.

c. Reversible doors shall have 20 gauges Galvanized face sheets with top and bottom channels closed flush. The lock edge reinforcement shall be 9 gage steel minimum projection welded in six places.
d. Doors shall be beveled 1/8" in 2" on lock edge for neat fit and security with 1/8" clearance at head, 3/32" clearance at jambs, ¼" clearance at meeting edges of pairs and ¾" floor clearance.
e. Standard hardware preparations are 4 ½" (.134) standard weight hinges, conforming to ANSI A156.7-1981 and ANSI A115.1-1976 Series 1000 mortise locks (Gov. 86 or ANSI A115.2-1980 Series 4000 cylindrical locks (Gov. 161). Other hardware reinforcements are available upon request.
f. All doors shall be treated with a metal prep zinc-Chromate wash primer to produce a long lasting surface.
g. All pre-finished textured doors shall be packaged with polybag and full cardboard carton to protect the finish. Each door shall then be banded in three places. Part Number and Description shall be placed on leading edge, approximately centerline from top and bottom of door.

2. Door Frame:
   a. Reversible Metal Building Door Frames shall be fabricated from 16 gage minimum spangle hot dipped galvanized mill treated steel and factory applied Iron Phosphate coating for proper paint adhesion. Bends will be brake formed to assure true, sharp radii and to minimize camber.
   b. Series F16-4 Reversible Metal Building Frames shall receive a modified alkyd primer utilizing a dip process to insure complete coverage. Pre-finished frames to receive a primer base plus finish coat providing a double thickness of protection.
   c. Head and jamb corner brackets shall be projection welded to frame members and pre-punched for field assembly with 5/16" bolts, providing a simple rigid frame connection.
   d. Series F16-4 Reversible Metal Building Frame consists of three pieces with bolts and nuts for attaching. All reinforcements, clips and anchors shall be welded to the frame pieces at the factory.
   e. Standard hardware preparations for Series F16-4 Reversible Metal Building Frames will be (3) 4 ½" x 4 ½" (.134) regular weight hinges and the ANSI A115.1 and A155.2 (4 7/8") universal strike. Each of the hinge reinforcements shall be 9 gage steel projection welded to the frame in six places.
   f. All pre-finished Metal Building Frames shall be packaged in cardboard carton. Hinge, strike and head shall be interleafed with micro-foam the full length of the carton to prevent damaging finish. Hardware and/or accessory parts shall be placed in the head section. Carton shall be banded in three places. End flaps shall have identifying Number and Description of contents.

PART 3 - EXECUTION

3.01 EXISTING CONDITIONS

A. Inspection

1. Prior to all work of this section, and based on stamped and signed approved drawings from manufacturer, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Verify that the work of this section shall be rendered in accordance with IBC 2009 codes and all pertinent local codes and regulations, the original design, and all the referenced UCC standards.

B. Discrepancies

1. In the event of discrepancy, immediately notify the ENGINEER.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 ERECTION AND INSTALLATION

A. The erection of the building system shall be performed in accordance with the certified erection drawings. Drawings shall indicate part numbers, locations and details for structural steel, cover, trim and accessories furnished by Inland Buildings or Olympia or approved equal. Erection shall be by a qualified erector using proper tools, equipment, and erection practices. There shall be no field modifications to structural components except as authorized by Building Contractor.

3.03 TESTS

A. Upon completion of this portion of work, and prior to its acceptance by the Owner, make all required tests and adjustments for smooth and free operation. Secure all approvals from agencies having jurisdiction.

3.04 CLEANING

A. Clean exposed surface of all grease, dirt and other foreign materials.

B. Touch up all marred or abraded surfaces as specified herein.

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Division 15 – Mechanical

15001 – Piping, Accessories, and Plumbing

SECTION 15001
PIPING, ACCESSORIES AND PLUMBING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The CONTRACTOR shall furnish, install and test all exterior and interior piping, valves, fittings and appurtenances as indicated on the Contract Drawings and as specified in the Specifications. Piping includes all liquid, sludge, air, and chemical piping and valves.

B. The CONTRACTOR shall furnish and install all pipe hangers and supports whether or not shown on the Drawings as their exact location depends upon the field installation.

C. Prior to acceptance of the installation, all necessary inspection(s) and permit(s) from County, State, Municipal and/or other public authorities shall be secured.

1.02 WORK INCLUDED

A. The CONTRACTOR shall furnish all labor, materials, equipment, supplies, and appliances and all else necessary and required for complete, workable process piping, valves, plumbing and drainage installations as shown on the Drawings including, and as specified, but not necessarily limited to, the following principal items.

1. Fixtures and fittings as indicated on the drawings and as specified herein.
2. Plant drainage system.
3. Public water service.
4. Wall hydrants, hose bibs, and yard hydrants.
5. Vacuum breaker and back flow preventers.
6. Domestic cold water system.
7. Insulation on hot and cold water lines.
8. All excavating and backfilling for underground piping.
9. All necessary hangers and supports.
10. Plumbing connections to mechanical equipment including valves.
11. Riser piping and valves associated with the installation of the extraction wells.
12. Conveyance piping and cleanouts from the extraction wells to the treatment building.
13. Effluent discharge piping from the treatment building to the discharge outfall

14. Chemical process piping, valves, fittings, etc.

15. Interconnecting process units, piping, valves, fittings, etc.

16. Air/gas piping, valves, fittings, etc.

17. Process and discharge piping.

18. Installation of potable water mains and hydrants.

1.03 SUBMITTALS

A. Submit manufacturer's product literature, installation and maintenance instructions and all else requested by the ENGINEER.

1. Plug, Check, Butterfly, Ball, Gate valves with manual, pneumatic and/or electric operators as required.

2. Air Piping.

3. Solenoid Valves.

4. PVC Pipe, Fittings and Valves.

5. Ductile Iron and/or Cast Iron Pipe, Fittings.

6. Plumbing Equipment, Fixtures, Valves, etc.

1.04 DELIVERY, STORAGE, AND HANDLING

A. All materials, equipment and supplies shall be adequately stored and protected by the CONTRACTOR following delivery and prior to installation. Installed work shall also be protected. Protection shall include measures to guard against theft, damage or breakage, and protection (particularly for equipment) against moisture.

1.05 SCHEDULING

A. The CONTRACTOR shall schedule all installations so as not to interfere with other work under this or other Contracts.

1.06 WARRANTIES

A. All pipe, fittings, valves, operators, materials, etc., shall be fully warranted. All installations shall be warranted for a minimum of one (1) year from final acceptance.

PART 2 – PRODUCTS

2.01 PIPING MATERIALS

A. The manufacturer's name or trademark shall be stamped or cast on all pipes, fittings and valves, and marked for gauge or weight. Materials shall be as follows:

1. Soil, Waste and Drain Piping - Above ground and Underground

   All sizes - Schedule 40 PVC - DWV plastic pipe and fittings or PVC SDR 35, ASTM D3212, as shown on the Contract Drawings. Installation shall be in strict accordance with the manufacturer's published instructions. SDR 35 pipe installation shall conform to ASTM Designation D2321. Note that plastic pipe shall not be installed in ventilated ceiling plenums.

2. Domestic Hot and Cold Water Piping

   Above ground - Type "L" copper tubing with sweat joints and wrought copper or cast bronze fittings with, 95-5 solder.

   Underground - Type "K" copper tubing with Armaflex insulation.

3. Sludge Piping – Underground

   All outside sludge (waste) piping shall be socket weld or flanged Schedule 80 PVC pipe in conformance with item B 7 below.

4. Sludge Piping – Inside Structures/Exposed

   Sludge recycle piping shall be socket weld or flanged Schedule 80 PVC pipe in conformance with item B 7 below.

5. Process Air – Inside Structures/Exposed

   Process air piping shall be socket or flanged Schedule 40 carbon steel pipe in conformance with item B 11 below.

6. Process Air – Underground

   Process air piping installed below slabs and underground shall be Schedule 40 carbon steel in conformance with item B 11 below.

7. Process Piping – General Process/Backwash/Effluent/Flow Return

   All process piping shall schedule 80 PVC socket weld or flanged, in accordance with item B 7 below.

8. Riser Pipe – Extraction/Monitoring/Piezometer Wells

   All well riser pipe shall be schedule 10, 304 stainless steel pipe in accordance with item B 2 below.

9. Force Mains – Extraction Well Conveyance/Effluent

   All force mains shall be SDR 17 PVC socket weld or flanged, in accordance with item B 6 below.

10. Potable Water Pipe and Service Connections

    As specified by the Oregon Department of Transportation Standard Specifications for Highway and Bridges including, but not limited to, sections 02470, 02475, 02480, 02485, and 02490.

B. Pipe shall conform to the latest edition of the following Specifications and Standards:

1. Galvanized Steel Pipe - ASTM A-53B/A-106B, Schedule 10, or as shown on the Contract Drawings.

2. Stainless Steel pipe - ASTM A-312, Schedule 10, 304 stainless steel pipe or as shown on the Contract Drawings.

3. Brass Pipe - ASTM-B-43.

4. Copper Pipe - ASTM B-88, Seamless, type "L" or "K" tubing,

5. PVC-DWV - plastic pipe for interior aboveground and underground sanitary drainage and drainage systems shall be Schedule 40 with IPS outside dimensions. Pipe and fittings shall be manufactured from PVC Cell Classification 12454 B (Type 1, Grade 1) as described in ASTM D1784. Pipe and fittings shall conform to ASTM D2665, U.S. Standard 14 that is indicated by the logo "NSF-DWV." Joints shall be made with PVC pipe cleaner and solvent cement. Pipe, fittings, and pipe cleaner and cement shall be strictly in accordance with the manufacturer's published instructions.

6. PVC-SDR 17 – Conveyance piping from the well heads to the treatment works and from treatment works to effluent discharge shall be PVC-SDR 17 conforming to ASTM D2241. Cement shall conform to ASTM D2564 or as recommended by supplier and approved by the ENGINEER.

7. PVC Process - Schedule 40 or 80 Polyvinyl Chloride (PVC) as shown on the Contract Drawings. PVC shall meet requirements outlined in ASTM D1784. Solvent Cement shall conform to ASTM D2564 or as recommended by supplier and approved by the ENGINEER.

8. CPVC Pipe - Schedule 80, Chlorinated Poly Vinyl Chloride (CPVC), CPVC shall meet requirements of ASTM Class 23447 as defined in ASTM Specifications D1784 or as recommended by supplier and approved by the ENGINEER.

9. C900 PVC - Schedule 80, Polyvinyl Chloride (PVC), PVC shall meet requirements outlined in ASTM D1784. The elastomeric gasket shall be in conformance with ASTM F477.

10. Ductile Iron Pipe - ANSI/AWWA 150/A21.50 and ANSI/AWWA 151/A21.51, pressure class 150 or as shown on Drawings. Coatings and linings:

    a. All ductile iron pipe and fittings for water service and wastewater force main service shall be cement-lined in accordance with ANSI 21.4 / AWWA C 104 seal coated inside 3-12" pipe minimum 1/8", 14"-24" pipe minimum 3/16". The outside of the pipe shall be coated with at least 1 mil. thick asphaltic based paint which conforms to the requirements for seal coat in accordance with ANSI A21.4 / AWWA C151 latest revision.

    b. All other ductile iron pipe and fittings for gravity wastewater service shall be coated inside with a composite lining utilizing a primer coating containing fusion bonded epoxy (FBE) and a surface coating containing fusion bonded polyethylene (FBP). The lining shall be Polybond*Plus*® as manufactured by the American Cast Iron Pipe Company (Birmingham, AL). The outside of the pipe shall be coated with at least 1 mil. thick asphaltic based paint which conforms to the requirements for seal coat in accordance with ANSI A21.4 / AWWA C151 latest revision.
    c. Ductile iron pipe with restrained joints as shown on the drawings shall be designed to resist the thrust produced by 150 psi internal pressure. Restrained joint pipe shall be American Fastite Joint with Fast-Grip Gasket as manufactured by American Ductile Iron Pipe Company and shall conform to AWWA C151.

11. Carbon Steel Pipe – ASTM A691 / A691M –and ASTM A694 / A694M -08 pressure class 150 or as shown on the Contract Drawings.

C. Fittings shall conform to the latest edition of the following Specifications and Standards:

1. Cast Iron Screwed - ANSI B16.4

2. Malleable Iron Screwed - ANSI B16.3

3. Cast Bronze Screwed - ANSI B16.15

4. Unions - Malleable iron with brass to iron seat, ANSI B16.3 - 150 and 300 lbs.

    a. Copper - Wrought copper or cast bronze suitable for soldered joints with copper tubing, ANSI B16.18 and ANSI B16.22.
    b. PVC - ASTM D 1784 and D 1785, Schedule 80 socket weld or flanged. Schedule 40 fittings shall conform to the requirements of ASTM D 2467 (socket type).

5. Ductile Iron Push-on – AWWA C151, Gasket – ANSI A21.11 / AWWA C111

6. Ductile Iron Mechanical Joint – ANSI A21.10 / AWWA C 110 or ANSI A21.53 / AWWA C153; Jointing – ANSI A21.11 / AWWA C111

D. Joints shall conform to the latest edition of the following Specifications and Standards:

1. Screwed - Sealed with Teflon thread tape

2. Soldered - Lead free solder

3. Flanged - 125-150 lb. standard, suitably resistant gaskets, stainless steel hardware.

   a. Ductile Iron: ANSI/AWWA C 110/A21.10, ANSI B16.1
   b. PVC/ ASTM D 2467, ASTM D 1785

4. Mechanical Joint - Ductile Iron Pipe

   a. Accessories conforming to ANSI/AWWA C 111/A 21.11. Bolts to be minimum 45,000 psi tensile strength, and non-corrosive cathodically with respect to pipe.

5. Mechanical Couplings – Grooved Pipe (Victaulic)

   a. Galvanized Pipe Couplings - Mechanical couplings shall be Victaulic Style 07 (Zero-Flex®) Rigid coupling or Style HP-70 Rigid coupling for high-pressure service. Victaulic Style 77 or 75 coupling shall be used where system flexibility is desired. Noise and vibration reduction at mechanical equipment connections is achieved by installing three Style 77 or 75 flexible couplings near the vibrations source. Couplings shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12 or malleable iron conforming to ASTM A-47, Grade 32510.

   b. Galvanized Pipe Coupling Bolts - Mechanical Coupling bolts shall be zinc plated (ASTM B-633) heat treated carbon steel track head conforming to physical properties of ASTM A-183, minimum tensile strength 110,000 psi (758450 kPa) as provided standard Victaulic.

   c. Galvanized Pipe Coupling Gaskets – Gaskets shall be FlushSeal® design molded of synthetic rubber specially compounded to conform to ductile pipe surfaces with a short center leg which shall bridge the pipe ends offering an initial seal on the leading edge of the pipe ends. Elastomers shall have properties as designated in ASTM D-2000. Mechanical coupling gaskets for process air shall be Victaulic Grade "O" Fluoroelastomer compound (blue color coded) for operating temperatures above +180 degrees F up to +300 degrees F (+82 degrees C up to +149 degrees C).

d. Ductile Iron Pipe Couplings (Raw Sewage) - Couplings shall be Victaulic Style 31 cast of ductile iron conforming to ASTM A-536, Grade 65-45-12, with an alkyd-phenolic primer coating (unless specified otherwise) with a synthetic rubber gasket and plated nuts and bolts, 3"-36" (DN80-DN900) size range.

e. Ductile Iron Pipe Coupling Bolts (Raw Sewage) - Bolts shall be heat-treated plated carbon steel, track head, conforming to the physical properties of ASTM A-183, minimum tensile strength 110,000 PSI (758450 kPa).

f. Ductile Iron Pipe Coupling Gaskets (Raw Sewage) - Gaskets shall be FlushSeal® design molded of synthetic rubber specially compounded to conform to ductile pipe surfaces with a short center leg which shall bridge the pipe ends offering an initial seal on the leading edge of the pipe ends. Elastomers shall have properties as designated in ASTM D-2000. Gasket supplied for water service from -20 degrees F to +200 degrees F (-29 degrees C to +93 degrees C) on ductile iron pipe, from 3"-36" (DN75-DN900) shall be Grade “M” halogenated butyl, with brown color code, specially compounded to conform to ductile pipe surfaces recommended for water service within the specified temperature range plus a variety of diluted acids, oil-free air, and many chemical services.

6. Socket Weld PVC - Solvent cement ASTM D-2564.

7. Carbon Steel fittings as per ASTM A694 / A694M -08

2.02 FLEXIBLE FITTINGS

A. Expansion Joint/Vibration Isolators - Liquid service.

1. Flanged, arched spool with metal wire wrap and textile reinforcement. Tube material shall be suitably resistant to sewage and abrasion such as Neoprene, Nitrile or Hypalon. Cover shall be Neoprene or Butyl with U.V. and ozone inhibitors. Joints shall be single arched unless otherwise Specified or indicated and shall be of the pipe size to which it attaches. Joints shall be provided with retaining rings.

2. Expansion joints shall be as manufactured by Goodall Rubber Company, Trenton, NJ; Unaflex Rubber Corporation, Ft. Lauderdale, FL; or an approved equal product.

2.03 HANGERS AND SUPPORTS

A. Piping shall be installed without undue strain, sag or stresses; and provisions shall be made for expansion and contraction and structural settlement in a manner approved by the ENGINEER.

B. Pipe supports in finished spaces shall be neat in appearance and shall be as approved by the ENGINEER. Each hanger shall be fitted with a clamping or bolting device to engage beams or concrete inserts. All auxiliary steel required for pipe supports shall be furnished and installed by the CONTRACTOR.

C. Horizontal piping supports shall be spaced close enough to prevent sag, but not more than 6 feet apart, except that each length of hub and spigot cast iron pipe shall be supported individually.

2.04 FIXTURE JOINTS AND GASKETS

A. In screwed pipe, the joints shall be made up with best quality pure red lead and boiled linseed oil, "Teflon" or other approved equal joint compound carefully and smoothly placed on threads of pipe and not in fittings. "Teflon" shall be used on all cleanout plugs and strainer removal plugs.

B. Close nipples shall not be used. Where an unthreaded part is less than 1-1/2" long, nipples on iron pipe shall be of extra heavy weight pipe.

C. Water closet connections shall be made with floor flanges with approved type, one-piece ring gasket.

D. Screwed joints for water pipe shall be made with approved joint compound. Sweated joints shall be made according to fitting manufacturer's recommendations, and with the ends cleaned and sandpapered and heated until solder appears all around the face of the fitting.

E. All unions and flange unions shall be of the same material and weight as fittings used on lines to which they are connected. Unions shall have ground joints with bronze seats.

F. A sufficient number of unions or flanges shall be used to permit disassembling of pipe and to facilitate maintenance. Pipes smaller than 3" shall be screwed. Pipes 3" and larger shall be flanged.

2.05 TRAPS

A. Each fixture is to be separately trapped as near to the fixture as possible. Traps shall be self-cleaning, water-sealed, and shall have a scouring action. Traps shall be set true with respect to water seal and shall be protected from freezing. All underground traps except "P" traps to which removable strainers discharge shall be provided with accessible cleanouts. Traps, which are not part of plumbing fixtures, shall be of the same material and size as pipes or branches into which they discharge. All traps shall be installed with provision for cleaning.

2.06 FLOOR DRAINS

A. Not used.

2.07 CLEANOUTS

A. Clean outs shall be provided and set at end of all drains, soil and waste lines, at change of direction, and at base of stacks so that the interior of the system may be accessible throughout. These cleanouts shall be of the same size as the pipes up to 4"; for pipes larger than 4", the size shall be 4".

B. Where drains and traps run under the floor, make cleanouts accessible by extending piping to finished floor, ceiling or walls.

C. In cases where cleanout plugs occur behind walls, openings shall be cut and plugs shall be installed so that they will be behind the finished surface. A bronze cleanout shall be installed to provide access to each plug.

D. Cleanouts occurring in floors other than storage rooms and closets shall be cast iron with heavy brass, full pipe size, and countersunk plug.

2.08 VALVES

A. General

1. The CONTRACTOR shall provide all valves as required to permit complete control of all systems. Each valve shall bear the name or trademark of the manufacturer. Valves shall be installed to control all hot and cold-water branches, to each group of fixtures, and to individual fixtures and pieces of equipment.

2. All valves shall have a brass identification permanently attached to the valve body or handle with a brass chain. Valve ID schedule shall be approved by the ENGINEER, and shall be framed and hung in the MCC.

B. Bronze Gate Valves

1. Valves for potable water piping shall be 125 lbs. SWP (socket weld pipe) all bronze gate valves. Drip valves shall be all bronze 1/2" globe SWP (socket weld pipe) type. Where used in connection with chromium-plated pipe, valves shall be the same finish as the pipe. Install valves on all hot and cold-water branch lines and to each group of fixtures or individual fixtures. Valves shall be manufactured by Crane, Walworth, Jenkins or Fairbanks.

C. Check Valves – Cast Iron

1. Check valves for liquid service shall be of the Swing Flex full body, flanged type, with domed access cover and only one moving part. The valve body shall have full flow equal to the nominal pipe diameter at any point through the valve. The seating surface shall be on a 45-degree angle to minimize disc travel. The top access port shall be full size, allowing removal of the disc without removing the valve from then

pipeline. The access cover shall be domed in shape, to allow the disc to be fully operational in lines containing a high solids content.

2. The disc shall be of one-piece construction, precision molded with an integral o-ring sealing surface and contains steel and nylon reinforcements in the Memory flex and central disc areas. The flex portion of the disc shall be warranted for 25 years. Non-slam closing characteristic shall be provided through a short 35-degree disc stroke and a Memory-Flex disc return action.

3. The valve body and cover shall be ASTM A126, Class B cast iron. The disc shall be Buna-N (NBR), ASTM D 2000 – BG. Flanges shall be faced and drilled in accordance with the ANSI B16.1, 125 lbs. Standard. Check valves shall be capable of withstanding a working pressure of 175 psi. They shall be designed to operate in a vertical or horizontal position.

4. The interior of the valve shall be coated with an epoxy suitable for potable water. The exterior shall be coated with a universal primer.

5. The valve shall be cycle tested 1,000,000 times with no signs of wear or distortion to the valve disc or seat and shall remain drop tight at both high and low pressures. The test results shall be independently certified.

6. The valve shall be series 500 as manufactured by Val-Matic Valve and Manufacturing or approved equal.

D. Swing Check Valves-PVC

1. PVC swing check valves shall be of the sizes shown, and shall be of solid thermoplastic construction, having no metal that comes in contact with the media. Valves shall incorporate a single disc design suitable for either horizontal or vertical installations. Valves shall be of the top entry bonnet design for maintenance purposes. PVC shall conform to ASTM D1784 Cell Classification 12454-A. Valves shall be as manufactured by Asahi/America, Inc. or approved equal. See Drawings for identification of check valves requiring outside lever and weight.

E. Butterfly (Wafer) Check Valves

1. Wafer style check valves shall be provided in the sizes indicated on the drawings. Wafer check valve body shall be ductile iron. Valve liner shall be EPDM and molded to the inside of the valve body. All wetted parts other than spring mechanism shall be stainless steel. Spring mechanism for valves 2-6” shall be Nitronic 50 valves 8” and larger shall have stainless steel springs. Wafer check valves shall be Centerline Series 800, or approved equal.

F. Ball Check And Foot Valves - PVC

1. Ball check valves shall be provided in the sizes indicated on the drawings. Ball checks 1/2” to 2” shall be supplied with true union flanged connections. Single union flanged valves are required for 2-1/2” to 4” valves. Valve body, ball, end connector, union nut, stop ring, and factory flange shall be PVC. Flange retainer shall be PVDF, Seat, seal and face o-ring shall be EPDM. Ball check valves shall be Series BT/BC as manufactured by Chemline Plastics Limited or equal.

2. Foot valves shall be provided in the sizes as indicated on the drawings. All foot valves 1/2” to 2” shall be supplied with true union flanged connections. Single union flanged valves are required for 2-1/2” to 4” valves. Valve body, ball, end connector, union nut, stop ring, foot valve basket and factory flange shall be PVC. Flange retainer shall be PVDF, Seat, seal and face o-ring shall be EPDM. Foot valves shall be Series FV/FT as manufactured by Chemline Plastics Limited or equal.

G. Plug Valves

1. Plug valves are to be of the non-lubricated eccentric plug type. Valves shall be made of cast iron or semi-steel at least equal to ASTM A126, and designed for a working pressure of 150 psi. All valves must have a full round port to assure minimum turbulence and minimum pressure drop. Valves are to have a balanced plug, coated with EPT, Buna-N, Neoprene, natural rubber, or other material as required to assure low torque and bubble-tight shut-off. Valves to be coated. Means of operation shall be by handwheel or lever operator as indicated. Valves shall be faced and drilled to ANSI B16.1-125# Standard.

2. Valves shall be manufactured by Pratt, or approved equal.

H. Ball Valves

1. Metal - three piece brass body with full port stainless steel ball and trim and Teflon seats. Valve shall be fully serviceable without disassembly of the piping in which it is installed.

2. PVC – All thermoplastic ball valves shall be True Union type constructed from PVC Type I, ASTM D 1784 Cell Classification 12454 or CPVC Type IV, ASTM D 1784 Cell Classification 23447. All O-rings shall be EPDM or Viton®. All valves shall have Safe-T-Shear® stem and double stop Polypropylene handle. All valve union nuts shall have Buttress threads. All seal carriers shall be Safe – T-Blocked®. All valve components shall be replaceable. All valves shall be certified by NSF international for us in potable water service. All 1/2” through 2” calces shall be pressure rated at 235 psi and all 2-1/2” through 6” valves shall be pressure rated at 150 psi for water at 73 degrees F as manufactured by Spears® Manufacturing Company.

I. Butterfly Valves

1. Valves shall have a resilient seat of EPDM, or other suitable polymer recommended for sewage service. Body shall be ASTM A 395 Ductile Iron. The thin profile disk shall be 316 stainless steel. The wafer shall be of lugged type. Disk shaft shall be rated at 175 psi. Butterfly Valves shall be as manufactured by Pratt, or approved equal.

J. Solenoid Valves

1. All solenoid valves shall be as manufactured by ASCO - Automatic Switch Co., Florham Park, NJ or as approved equal. Electric solenoid valves shall be "Red Hat" type or equal, 3R rain proof/type 2 - drip proof. Air operated valves shall be rated for line pressures anticipated. Solenoid valves may be normally open or normally closed and in two or three way operation as the specified service conditions warrant.

K. Resilient Wedge Gate Valves

1. All valves 4" and larger shall be full port, non-rising stem resilient seat gate valves, with valve ends to match piping system in which they will be installed.

2. Valves shall have a rated working pressure of 200 psi (cold water, non-shock) and shall consist of a cast iron body and bonnet, fusion bonded epoxy coated, bronze disc nut and stem, cast iron disc coated with SBR rubber (ASTM D-429), Buna N stem seal O-ring, stainless steel thrust washer and bolts, hand wheel operator with "needle and slot" position indicator.

3. Provide valves as manufactured by Stockham Valves and Fittings, Mueller Corp., or approved equal.

2.09 VALVE OPERATORS & ACTUATORS

A. Handwheel Operators

1. Handwheels shall be of adequate size and strength to permit easy opening and closing of valve(s) by one man without additional mechanical assistance. Handwheels located more than 4 ft. 6 in. clear above floor level shall be provided with chain and suitably equipped chain accommodating "chain wheel". Sufficient galvanized chain shall be provided and installed to provide a continuous loop to a height of 4 ft. 0 in. above floor level.

B. Electric Actuators – Butterfly Valves

1. All electrically actuated Butterfly valves shall be constructed PVC Type I Cell Classification 12454 or CPVC Type IV Cell Classification 23447 or UV stabilized Polypropylene. All valve seats and O-rings shall be Buna-N, EPDM or Viton® Seat shall be a non-liner type interlocked to calve body. Bolt hole pattern shall conform to ANSI/ASME B16.5 CL 150. Disc shall be offset design with Type 316 stainless steel stem and hardware. Valves shall be pressure rated at 150 psi. for water at 73 degrees

F. Electric Actuators shall be factory installed, 115 VAC with thermally protected, reversing motor and powder coated NEMA 4 rated enclosure. Electric Actuators shall be manufactured by Spears® Manufacturing Company.

C. Electric Actuators – Ball Valves

1. All ball valves shall be electrically actuated True Union 2000 type constructed from PVC Type I Cell Classification 12454 or CPVC Type IV Cell Classification 23447. All O-rings shall be EPDM or Viton®. All valves shall have Safe-T-Shear® stem and double O-ring stem seals/ All calce union nuts shall have Buttress threads. All seal carriers shall be Safe – T-Blocked®. All calce components shall be replaceable. All calces shall be certified by NSF international for us in potable water service. All 1/2” through 2” calces shall be pressure rated at 235 psi and all 2-1/2” through 6” valves shall be pressure rated at 150 psi for water at 73 degrees F. Electric Actuators shall be factory installed, 115 VAC with thermally protected, reversing motor and powder coated NEMA 4 rated enclosure. Electric Actuators shall be manufactured by Spears® Manufacturing Company.

2.10 PRESSURE GAUGES

A. General Use - Provide liquid filled, diaphragm-isolated pressure gauges, location of gauges as shown on drawing and range suitable for the particular service. The pressure gage shall be 1/2" diameter dial white face, black lettering/markings, Ashcroft Model 1009 or approved equal.

2.11 TEMPERATURE GAUGES

A. Temperature gauges for use on permeate pump discharge lines shall be Ashcroft Bimetal Thermometer, Series BI Grade A (1%). Gauge shall be hermetically sealed, tamper resistant, 1% full span accuracy (ASME B40.3 Grade A, All welded stainless steel construction with heavy-duty glass. Gauge shall be warranted for 5 years. Gauge shall come complete with Thermowell to protect stem from flow velocity, and to ease removal. Thermowell shall have straight, uniform shank with 1/2” process connection, and shall be of stainless steel construction.

2.12 PIPE SLEEVES

A. Pipe to wall penetration closures shall be “Link-Seal” as manufactured by PSI/Thunderline/Link Seal Houston, Texas. Seals shall be modular mechanical type, consisting of interlocking rubber links shaped to continuously fill the annular space between the pipe and the wall opening. Links shall; be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the wall opening. The seal shall be constructed to provide electrical insulation between the pipe and wall, thus reducing chances of cathodic reaction between these two members.

B. The elastomer sealing elements shall be EPDM (ASTM D2000). Pressure plates shall be molded glass reinforced nylon. All fasteners (hardware) shall be 316 stainless steel.

2.13 AIR VALVES

A. Manual air shut off valves shall be brass WOG rated and 90° turn operation.

2.14 AIR ELIMINATORS

A. Care shall be exercised in installing hot and circulation water piping to avoid air traps and pockets. Where such air traps cannot be avoided, install at the high point an automatic 1/2" air vent with a 1/2" globe valve on the inlet of the air vent. All vents shall be similar to Crane No. 976. The discharge shall be piped to the nearest sink or other drain, as approved by the ENGINEER.

2.15 BACKFLOW PREVENTERS

A. Backflow preventer shall be of the reduced pressure zone type, to prevent backsiphonage and backflow of hazardous materials into the potable water supply. The assembly shall consist of a pressure differential relief valve located in a zone between two positive seating check valves. Backsiphonage protection shall include a provision to admit air directly into the reduced pressure zone via a separate channel from the water discharge channel, or directly into the supply pipe via a separate vent. The assembly shall include two tightly closing shutoff valves before and after the assembly, test cocks and a protective strainer upstream of the number 1 shutoff valve. The assembly shall meet the requirements of AWWA C-511.

B. The backflow preventers shall be mounted in a horizontal position, inside of the buildings as shown on the Drawings.

C. Provide Model 909QT-S Backflow Preventer as manufactured by Watts Industries, or approved equal.

2.16 PLUMBING FIXTURES

A. General Requirements

1. The CONTRACTOR shall furnish and install complete with necessary supports, all fixtures as shown on the Drawings in accordance with the following specifications. The CONTRACTOR shall also be responsible for checking all catalog numbers, sizes and installations of complete assemblies in the space provided.

2. At the time of the final acceptance of the work, every fixture shall be in perfect condition. All fixtures shall be Class "A".

3. Glazing shall be white, thoroughly fused, and united to a body without discoloration, chips, or flaws and shall be free from cracks. All surfaces shall be glazed except those exposed to walls or floors.

4. All sink and lavatory traps shall be provided with approved cleanout plugs. Water closets shall be set with gasket and approved flange.

5. Brass products are to contain at least 75% copper. All exposed metal below and above each fixture throughout shall be chrome plated on brass. All escutcheons shall be cast brass.

6. Furnish set and connect all plumbing fixtures including all necessary supports and chrome-plated exposed work and fittings. Provide fixture stops for all fixtures. Stops shall be loose-key type unless specifically stated otherwise herein. Fixtures are specified by Kohler. Catalog numbers are for type only. The CONTRACTOR may submit for the ENGINEER's approval fixtures of equal quality and design as manufactured by Eljer or Kohler.

2.17 SERVICE SINK

A. Service Sink: The service sink shall be 22" in length, and 20" in width. Sink shall be made of vitreous china, white color. Sink shall be single compartment with drilled back. Sink shall be 2-hole drilled. Sink shall have optional rim guard. Sink shall be Kohler Model K-6650.

B. Service Sink Faucet: Two-handle service sink faucet shall be of brass construction. Faucet shall feature brass valve bodies. Faucet shall also feature Valvet valves. Product shall include 2-1/4" threaded spout for hose connection, lever handles, pail hook, internal N.P.T. connections, and vacuum breaker. Faucet shall be Kohler Model K-8905, rough plate finish.

2.18 COMPACT ELECTRIC WATER HEATER

A. CONTRACTOR to supply and install one electric water heater:

3. Vanguard by Rheem Model #81VP6S/430126, 6-gallon tank, 120V, 2,000 W, single element, or approved equal.

2.19 HOSE BIBS

A. Hose bibs shall be brass with integral vacuum breaker/backflow preventer key handle and hose tread outlet.

2.20 WALL HYDRANTS

A. Wall hydrants to be Woodford model 24 P anti-contamination faucet for inside use including integral vacuum breaker/backflow preventer to be furnished with T-key or approved equivalent.

2.21 YARD HYDRANTS

A. Provide 4' bury depth yard (ground) hydrants in sizes and at the locations shown on the Drawings. CONTRACTOR to supply shop drawings for approval by the ENGINEER.

B. Yard hydrant shall be complete with the following:

1. Backflow preventer
2. Tamperproof lock
3. Female Inlet: 3/4”
4. Casing: 1” galvanized steel pipe
5. Operating rod: 3/8” steel rod
6. Drain hole: tapped 1/8” NPT
7. Removable nozzle: 3/4” brass male hose nozzle
8. Max pressure: 125 psi
9. Max temperature: 120 degrees F

C. Yard hydrants shall be Model 802 SB as manufactured by Simmons Manufacturing Co., Model X34 as manufactured by Woodford Manufacturing Co., or approved equal.

2.02 SPARE PARTS

The following spare parts shall be provided prior to acceptance:

Quantity	Description
1	Valve Actuator of each Type and Size
1	Set "O" Ring seals for PVC ball valves
1	Set seats for each size butterfly valve
1	Set seats for all other valves as appropriate
1	Set spare parts recommended by the manufacturer and approved by ENGINEER

PART 3 - EXECUTION

3.01 AS-BUILT DRAWINGS

A. As work progresses, record on one set of drawings all deviations from Contract Drawings in size, line or grade. Record exact final location of pipes by offset measurements to surface improvements such as buildings or curbs, or other fixed objects. Upon completion of the Work a set of tracings will be made from the Contract Drawings at the CONTRACTOR's expense showing final, exact location of pipes and offset measurements.

3.02 PIPE INSTALLATION – GENERAL

A. Excavation: All excavations shall be made in such a manner and to such widths as will give ample room for laying and jointing the pipe; and for such sheeting, pumping and draining as may be required. Refer also to Section 02200 Earth Work.

B. Alignment and Grade: The CONTRACTOR shall build structures and lay pipe in the location and exactly to the lines and grades as shown on the drawings. No deviation shall be made from the required line or grade, except with written consent of the ENGINEER. The ENGINEER shall order the removal or replacement of any structure or pipe laid contrary to the Plans, these Specifications, or his instruction.

C. Pipe Inspection: All pipe shall be carefully examined for dents, cracks, and other defects, and no pipe known to be defective shall be laid. Those pipes not meeting the Specifications shall be rejected and either destroyed or removed from the work immediately. If any pipe is found to be broken or defective after installation, it shall be removed and replaced by sound pipe without additional payment for removal and replacement. Pipe shall be thoroughly cleaned and ample precautions shall be taken to prevent entrance of dirt and debris into the pipe after laying. Exposed ends of the pipe shall be provided with temporary plugs or covers.

D. Pipe Handling: Proper implements, tools and facilities satisfactory to the ENGINEER shall be provided for the safe and efficient execution of the work. All structures, pipes, fittings and accessories shall be carefully lowered into the opening by means of cranes, ropes, or other suitable equipment in such manner as to prevent damage to said structures. Under no circumstances shall pipe or accessories be dropped or dumped into the opening.

E. Pipe Cutting: The CONTRACTOR must provide proper pipe cutting equipment on the project. Breaking the pipe with the chance of rupture will not be allowed. Hammer and chisel cutting of pipe will not be allowed. All threads shall be NPT standard.

F. Pipe Installation

1. Ductile Iron
   a. Cut pipe with milling, rolling pipe or abrasive saw cutter. Do not flame cut or hammer and chisel cut.

b. Dress end of cut according to type of joint.
c. Join pipe according to manufacturer's recommendations for flanged, push on and/or mechanical joints.
d. Mechanical joint pipe shall be used in all buried process applications unless otherwise specified and indicated.
e. "Victaulic" type couplings may be used for above ground piping.

2. PVC Pipe, 4 inches and Smaller
   a. Snake pipe from one side of the trench to the other where pipe is to be buried.
   b. Support pipe according to manufacturer’s recommendations and as directed for inside installations.
   c. Use proper solvent and cement for schedule of pipe to be joined.
   d. Do not thread Schedule 40 PVC pipe.
   e. Buried PVC pipe to be traced with metallic or other magnetic locating material. Tracer tape laid in the trench 6 in. above the pipe is preferred.

3. PVC SDR 17
   a. All fittings and pipe joint lubricant to be from the same manufacturer as pipe.
   b. PVC SDR 17 pipe to be delivered in banded pallet loads only and un-banded immediately prior to installation only.
   c. Maximum length of pipe sections shall be 20 ft.
   d. In addition to air test specified elsewhere in this section, PVC SDR 17 pipe shall be mandrill tested to insure that pipe deflection is less than 5%. Deflection 5% or more shall require removal and reinstallation of pipe at the CONTRACTOR's expense.

4. Steel
   a. Steel piping shall be cut to length with proper cutting tools and die and with proper lubrication. Threads to be NPT.

5. Copper
   a. Sweat solder copper joints after sandpaper cleaning to bright copper exposure. Use solder flux and lead-free solder. Supports as required to prevent excessive movement, sagging, etc.

G. Pipe Jointing: All pipe ends and pipe fitting sockets shall be thoroughly cleaned prior to, and kept clean during the jointing operation. The pipe shall be carefully jointed in conformity with the best practice and detailed instructions of the manufacturer to produce the required results for water tightness. "Victaulic" type couplings will be allowed for above ground DIP piping.

H. Backfilling of Trenches:

1. The opening shall be properly bedded, using a layer six inches (6") in thickness of broken stone subbase (3/4" crushed stone) prior to the installation of pipelines and appurtenances. After inspection and approval by the ENGINEER, the lines shall be backfilled with a minimum of six inches (6") of broken stone subbase (3/4" crushed

stone) covering the top of the pipe(s). Backfill material shall be placed by hand and compacted by hand tamping or vibratory soil compaction equipment. The remaining backfill material shall be obtained from the stockpile of general backfill material and shall be added in lifts not to exceed twelve inches (12"). Compaction of each lift shall be accomplished by hand compaction or vibratory soil compaction equipment.

2. All trenches beneath structures, sidewalks, paved areas, or piping shall be backfilled with borrow select backfill placed in 8" lifts and compacted, in place of the general fill. Any settlement or damage caused by settlement shall be promptly repaired at the CONTRACTOR's expense.

I. Pipe Sleeves and Penetrations

1. Piping passing through concrete or masonry shall be installed through pipe sleeves as shown on the drawings and specified below. Holes drilled with a suitable rotary drill will be considered in lieu of sleeves for non-water tank holding walls (chambers).

2. Pipe sleeves shall not be in contact with reinforcing steel.

3. Seal annular space between pipe and sleeve using interlocking rubber links, such as "Link Seal" specified in Part 2.

4. Seal penetrations through precast holes in precast structures using flexible sleeves precast into structure.

5. Where shown, provide "wall pipes" with center flange water stop and integral pipe ends to match piping system used (flanged or mechanical joint).

J. Pipe Supports:

1. Pipe supports, including thrust blocks, shall be installed where required. No attempt has been made to show all required supports. This does not alleviate the CONTRACTOR's responsibility to provide proper pipe supports throughout the system.

2. Pipe support systems shall withstand the dead loads imposed by the weight of the pipe filled with water, plus any insulation plus hydrodynamic forces. The minimum safety factor for pipe supports shall be 5.

3. Where pipe connects to equipment, it shall be supported by a pipe support and not by the equipment.

4. All piping shall be supported so that there will be no undue strain on any valve, fitting or piece of equipment. Provide support at changes in direction or elevations, adjacent to flexible couplings, and where shown. Supports and hangars all not interfere with equipment access.

K. Allowable Unsupported Length: Per manufacturer's requirements for each type and size pipe and as specified.

L. Thrust Blocks for pump discharge piping only at all bends, tees, and as detailed on the drawings.

3.03 VALVE INSTALLATIONS

A. All valves to be installed with unions or flanges to permit removal without cutting pipe.

B. Piping shall be independently supported. Piping support forces shall not be transmitted to valves.

C. Valves shall be installed in a neat, orderly, and workmanlike manner, and oriented to provide access for easy manual operation or access to automatic operator(s) for service.

3.04 TESTING, INSPECTION, AND CLEANING

A. Pipes and Fittings shall be subject to a careful inspection just before being installed.

B. The project shall be inspected regularly by the OWNER, ENGINEER or his representative. No trench, pit, or other opening shall be backfilled unless inspection and authorization has been given by the ENGINEER OR OWNER.

C. Exposed piping in treatment process area shall be tested with air and/or water under the supervision of the ENGINEER and/or OWNER.

D. Buried Pipe Testing - Gravity Lines

1. All gravity flow pipe shall be tested to assure soundness of all joints and connections by inserting plugs and filling the pipes with air. A compressor with a pressure gauge shall be attached to the pipe line by an approved means, using small outlets in the pipe or taps made in the plugs, caps or fittings for this purpose. The outlet should be slowly closed and the system slowly brought up to the desired test pressure. The pressure shall be a minimum of twenty five (25) psi for this installation. The pressure shall be maintained for a period of not less than two (2) hours, during which time no loss of pressure must occur. The CONTRACTOR shall furnish the compressor, connections, gauge, measuring device and all other necessary apparatus and labor to conduct the test. The pressure gauge must be easily readable and calibrated in two (2) pound increments. The cost of all tests shall be included in the price bid for the project. All tests must be witnessed by the ENGINEER.

2. The CONTRACTOR may perform an initial service leak test before backfilling is complete, however final testing witnessed by the ENGINEER shall be performed after backfilling is complete.

3. The CONTRACTOR is responsible for repairing any leaks and retesting until acceptable results are obtained.

4. The CONTRACTOR'S attention is directed to recognize the hazards associated with air testing and shall take all precautions to protect all personnel.

E. Pressure Pipe Testing

1. Exposed Piping:
   a. Potable water shall be used as the hydrostatic test fluid.
   b. Vent all air from piping system being tested while filling with test fluid. The CONTRACTOR is responsible for any taps needed for blowing off air at high points of the system.
   c. Once all is eliminated, bring pressure to 150 PSIG for a minimum time of one hour or longer as may be needed to examine piping for leakage.
   d. The piping system, exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of weeping or leaking.

2. Buried Piping:
   a. Conduct final testing, to be witnessed by the ENGINEER, after piping system has been completed and backfilled.
   b. Expel all air from the piping system and slowly bring the pressure to 150 PSIG using the hydraulic force pump and maintain pressure for one hour.
   c. Measure and record the amount of water that is used to maintain the test pressure over the one hour period.
   d. This volume of water added during the test represents the amount of leakage, and shall not exceed 12 gal. per inch of diameter per mile of pipe per day.

3. The CONTRACTOR shall be solely responsible to correct any leaks discovered and retest until passing results are obtained.

F. Disinfection of Water Lines

1. All potable and process water lines shall be thoroughly disinfected prior to acceptance and start-up.

2. Disinfection procedures shall conform to AWWA C601.

3. Prior to disinfection, thoroughly flush all foreign matter from the pipe by providing a flushing velocity of 2.5 fps.

4. Introduce a solution of sodium or calcium hypochlorite sufficient to maintain a free chlorine residual of 40 to 50 ppm throughout the piping being disinfected.

5. Operate all valves and appurtenances during disinfection so that the disinfectant reaches all parts of the piping system.

6. Retain the disinfection solution in the piping for a period of 24 hours, at which time chlorine residual shall be at least 10 ppm.

7. Flush disinfecting solution from the piping system with water of known potable quality, and obtain samples for bacteriologic analysis at points identified by the ENGINEER.

8. Samples shall meet NJDEP bacteriologic standards for potable water, or the CONTRACTOR shall re-disinfect and retest until passing results are obtained.

G. Demonstration

1. All manual and pneumatic valve operators shall be demonstrated in the presence of the ENGINEER to operate properly, without undue noise, binding, etc. Proper operation of all limit switches, fail-safe mechanisms, etc., shall be demonstrated.

H. Final Cleaning

1. Upon completion of testing all lines shall be thoroughly flushed with clean water and/or air, depending on the type of service, to remove all debris, grit and other foreign matter.

*** * END OF SECTION * ***

15160 – Pumping Equipment

SECTION 15160
PUMPING EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. The CONTRACTOR shall furnish and install all pumping equipment, piping, motors, controls and wiring, power wiring and accessories, as indicated on the Drawings and/or as Specified. Each pump installation shall include all equipment, materials, supplies and all else necessary and incidental to provide complete and operational system(s).

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 15001 - Piping, Accessories and Plumbing

1.03 SUBMITTALS

A. For all pumps, submit three (3) copies of the following:

1. Manufacturer's descriptive literature, dimensions, parts list, weights, materials, horsepower, capacities, controls and all accessories.

2. Certified pump curves for centrifugal pumps, and air consumption curves for diaphragm pumps.

3. Installation Instructions with certified dimensions.

4. Operation and Maintenance Manuals.

5. Spare Parts list of parts provided.

6. Any other information requested by the ENGINEER necessary to fully evaluate the equipment proposed by the CONTRACTOR.

1.04 DELIVERY, STORAGE AND HANDLING

A. Protect all equipment from damage due to exposure, the elements, theft, vandalism, or any other cause.

1.05 WARRANTY

A. All pumps, controls, miscellaneous equipment, and installations shall be warranted for a period of not less than one (1) year from the date of acceptance of the entire facility.

PART 2 - PRODUCTS

2.01 CENTRIFUGAL PUMPS

A. SCHEDULE - Pumps shall be supplied according to the following pump schedule and as specified in detail hereinafter or equal.

Pump Schedule						
Description	**Type**	**Design Point**	**Voltage**	**Phase**	**Frequency**	**Total # of Pumps**
Extraction Well Pumps	submersible	7 gpm @ 231' TDH	230	1	60	22
Carbon System Feed Pumps	horizontal mounted centrifugal	200 gpm @ 70' TDH	480	3	60	2
Carbon System Rinse Pump	horizontal mounted centrifugal	340 gpm @ 70' TDH	480	3	60	1
Floor Sump Pump	submersible	35 gpm @ 50 TDH	115	1	60	2

B. Extraction Well Pumps

1. Pumps shall be Grundfos Model 10SQE05-100NE Redi-Flow3 environmental submersible pump.

2. Each pump shall be equipped with Grundfos Model CU300 control box equipped with variable frequency drive.

3. Supply one (1) Grundfos Model R100 infrared remote.

C. Carbon System Feed Pumps

1. Pumps shall be Gould's Model 3755, or approved equal. If an approved equal pump is selected, all other centrifugal pumps of this type used in the GWET System shall be from the same manufacturer.

2. Pump shall have a capacity of 200 GPM at a total head of 70 feet and shall use a 7.5 HP motor operating at 1,750 RPM.

3. All pump materials of construction in contact with groundwater shall be compatible with groundwater and constituents, including various treatment system additives, for example, sodium hydroxide for pH adjustment.

D. Carbon System Rinse Pump

1. Pump shall be Gould's Model 3755, or approved equal. If an approved equal pump is selected, all other centrifugal pumps of this type used in the GWET System shall be from the same manufacturer.

2. Pump shall have a capacity of 340 GPM at a total head of 70 feet TDH and shall use a 10 HP motor operating at 1,750 RPM.

E. Floor Sump Pump

1. Pumps shall be Myers Model P51/P52, or approved equal.

2. Pump shall have a capacity of 35 GPM at a total head of 50.0 feet TDH and shall use a 7.5 HP operating at 3,450 RPM.

2.02 DIAPHRAGM PUMPS

A. All diaphragm pumps shall be air operated positive displacement, self-priming type, equipped with stroke counters and air pressure regulators

B. SCHEDULE - Pumps shall be supplied according to the following pump schedule and as specified in detail hereinafter or equal.

Diaphragm Pump Schedule		
Description	**Design Point**	**Total # of Pumps**
Pretreatment Sludge Transfer Pump	15 gpm @ 60 psig	1
Pretreatment Decant Transfer Pump	15 gpm @ 60 psig	1
Pretreatment Filtrate Transfer Pump	15 gpm @ 60 psig	1
Bio-reactor Sludge Transfer Pump	15 gpm @ 60 psig	2
Bio-reactor Decant Transfer Pump	15 gpm @ 60 psig	2

C. Manufacture

1. Pumps shall be Wilden Model P4/PPSPP/XXX/XX/XXX/XXXX (X to be determined by manufacture), or approved equal. If an approved equal pump is

selected, all other diaphragm pumps of this type used in the GWET System shall be from the same manufacturer.

2.03 SPARE PARTS – CENTRIFUGAL PUMPS

A. Pump Manufacturer recommended spare parts shall be furnished prior to acceptance. All parts shall be factory boxed and sealed with clear indication on the outside of each box identifying part name, number and quantity.

B. At a minimum, the following spare parts shall be provided for all pumps:

1. One impeller
2. One mechanical seal (carbon/ceramic/BUNA-N)
3. Two impeller washer O-Rings (Viton)
4. Two shaft sleeve O-Rings (BUNA –N)
5. Two Casing O-Rings

2.04 SPARE PARTS – OTHER PUMPS

A. Pump Manufacturer recommended spare parts shall be furnished prior to acceptance. All parts shall be factory boxed and sealed with clear indication on the outside of each box identifying part name, number and quantity.

B. At a minimum, the following spare parts shall be provided for all pumps:

1. One (1) complete pump repair kit
2. One (1) spare four function valve
3. One (1) spare head

C. Provide one (1) common spare Sludge Pump

PART 3 - EXECUTION

3.01 GENERAL

A. All pumps and pumping equipment shall be installed by skilled personnel in a neat and workmanlike manner, true to alignment and elevation to match piping and fittings and in accordance with each respective pump manufacturers latest printed instructions.

3.02 PROTECTION

A. All pumps, equipment and spare parts shall be carefully handled and stored to prevent damage, theft, weathering, etc., until final acceptance. All units shall be left in shipping containers where applicable until the time of installation.

3.03 INSTALLATION

A. All pump units and equipment shall be installed complete, with all accessories, connections, controls, etc. as indicated on the drawings and as specified to provide complete and operable system(s).

3.04 FIELD QUALITY CONTROL

A. Initial testing of all pumps shall only be performed by factory-trained representatives for each respective type/make of pump. Tests shall only be conducted with units fully lubricated and pumping water. Lubrication is necessary for electrical verification of direction of rotation by "bumping" the motor. No pump shall be run dry under any circumstances.

B. Final testing and demonstration shall be performed in the presence of the ENGINEER, given one-week minimum notice. Pump rotation speed, pressure, flow rates, etc. shall be verified.

C. All pumps, motors and drive units shall operate smoothly without undue noise and vibration, and without binding, slippage or overloading.

D. Failure of any pump, motor or drive unit to pass any test shall be cause for the CONTRACTOR to repair, replace or otherwise properly correct the malfunction or defect and to similarly reschedule and retest that entire pumping unit, motor and drive assembly complete.

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15500 – Unit and Cooling Units

SECTION 15500
HEATING AND COOLING UNITS

PART 1 - GENERAL

1.01 GENERAL

A. CONTRACTOR shall furnish and install unit heaters in the locations shown on the Contract Drawings. Systems shall be complete with all required, ducts, fans, heaters, air conditioners, thermostats and controls.

1.02 RELATED SECTIONS

SECTION 16010 – General Provisions Electrical

PART 2 - PRODUCTS

2.01 GAS FIRED UNIT HEATERS

A. Provide and install Natural Gas (NG) type gas-fired Unit Heaters, as manufactured by Dayton, or approved equal, in accordance with the following schedule:

Location	Model	Qty	BTU/hr In	BTU/hr Out	Height (in.)	Width (in.)	Depth (in.)	F.L.A. @ 115V	HP
Bio-Reactor Room	4LX66	4	350,000	283,000	34	55.25	44.75	13.5	(2) 1/3
Pretreatment Room	4LX68	2	400,000	324,000	34	55.25	44.75	13.5	(2) 1/3
Electrical Room	4LX56	1	150,000	121,500	33.75	25.25	43.5	5.8	(1) 1/2

B. Heaters shall be located as shown on the Contract Drawings.

C. Heaters shall be of the high efficiency type with a heavy-gauge neutral gray die-formed steel housing. Each heater to have an advance pull-through air flow design to draw air across heating element for more even air distribution and cooler element operation.

D. Thermostats shall be 24V. A single thermostat shall be provided in each process room and control all unit heaters within each corresponding process area.

E. Provide all electrical wiring and ventilation piping as required for installation as per the manufacture's printed recommendations.

2.02 AIR CONDITIONING UNITS

A. Provide and install a through the wall air conditioning units, as manufactured by Frigidaire, or approved equal, in accordance with the following schedule:

Location	Model	Quantity	BTU/hr	Height (in.)	Width (in.)	Depth (in.)	HP
Electrical Room	4YG99	1	12,000	14.5	24	18.5	(1) 1/2

B. CONTRACTOR shall provide all necessary sleeves and appurtenances to facilitate the installation of each unit including any necessary support rigging.

C. Units shall be installed flush with the exterior of the building or as directed by the Engineer in accordance with the manufacturer's recommended installation requirements.

D. Air conditioning units shall be located as shown on the Contract Drawings.

2.03 Duct Work

A. Install ductwork in accordance with the Contract Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All sheet metal work to be performed by personnel regularly engaged in the installation of HVAC equipment. Workmanship is to be first class in every respect.

B. All electrical work to be installed by a licensed electrician CONTRACTOR regularly engaged in the installation of electrical equipment. Unit heaters to be installed a minimum of seven feet above finished floor. Locations as shown on Plans are approximate. Heaters to be installed so as not to interfere with piping of other equipment. Adequate clearance to be provided around heater as per manufacturer's recommendations.

C. Provide all electrical connections required for the unit heaters including thermostats and fan motor. Installation to be in strict accordance with the manufacturer's recommendations.

3.02 ADJUSTMENT

A. Heaters to be aimed to provide even distribution of heat. Mountings to allow adjustable in both the horizontal and vertical planes.

3.03 DEMONSTRATION

A. CONTRACTOR to demonstrate the proper operation of all heating and ventilation equipment to the satisfaction of the Engineer.

*** * END OF SECTION * ***

15830 – Fans and Louvers

SECTION 15830
FANS AND LOUVERS

PART 1 - GENERAL

1.01 GENERAL

A. CONTRACTOR shall furnish and install sidewall propeller fans, a centrifugal roof-mounted exhaust fan, and louvers in the locations shown on the Drawings. Systems shall be complete with all required fans, accessories and controls.

1.02 RELATED SECTIONS

15500 – Heating and Cooling Units

1.03 SUBMITTALS

A. Submit shop drawings for approval.

B. Submit color samples of exterior covering, and window glazing.

C. Submit certificates of insurance.

D. Submit close-out documents, warranties, and manuals.

1.04 QUALITY ASSURANCE

A. Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts, and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Use materials which shall be free from defects impairing strength, durability, and appearance; shall be of best commercial quality for purpose required; and shall comply with Contract Drawings.

1.05 WARRANTY

A. Warrant the product for one year after date of completed installation by manufacturer of product.

B. Warrant the product for one year after date of delivery of product installed by others.

PART 2 - PRODUCTS

2.01 FRESH AIR INTAKE/EXHAUST LOUVERS

A. Louvers shall be drainable type incorporating stationary blades within a 6inch louver frame. Blades or damper section shall be of the low leakage design incorporating pressure activated vinyl blade edge and perimeter jamb seals. Each Stationary blade shall incorporate an integral drain gutter and each jamb shall incorporate an integral downspout so water drains to blade end, then down the downspouts and out at the louver sill rather than cascading from blade to blade.

B. Each factory assembled louver section shall be designed to withstand wind loading of 25 pounds per square foot (100 mph wind equivalent).

C. Louver performance data shall be licensed under the AMCA Certified Ratings Program and shall bear the AMCA Certified Ratings Seal. This certified performance data shall include airflow pressure loss, and air leakage, and shall demonstrate performance equal to or better than the model specified.

D. Louvers shall be supplied with a Kynar finish applied after a thorough cleaning and pretreatment of the metal surface. Dry film thickness of the Kynar shall be approximately 1.2 mils after baking at 450° F. Color shall be selectable.

E. Blade linkage shall be easily adjustable.

F. Provide complete unit with wall sleeves, bird and insect screens.

G. Intake louvers shall be Drainable Head Model EDJ-430 as manufactured by Greenheck, or approved equal, in accordance with the following.

Location	Model	Service	Quantity	Size	Actuation
Pretreatment Room	EDJ-430	Intake	2	30” x 30”	None
Bio-Reactor Room	EDJ-430	Intake	2	36” x 36”	None

2.02 SIDEWALL PROPELLER FANS

A. Provide sidewall propeller exhaust fans, which shall be located as shown on the Contract Drawings. Fans shall be of the belt driven axial type. Propellers shall be constructed with fabricated steel, and hubs. Propellers shall be securely attached to fan shafts. All propellers shall be statically and dynamically balanced.

B. Motors shall be permanently lubricated, heavy-duty type, and matched to the fan load. Motors shall be 1 Phase, 60 Hz.

C. Ground and polished steel shafts shall be mounted in permanently lubricated, sealed ball bearing pillow block and coated with an anti-corrosive coating. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speeds. Drives shall be sized for 150% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. Motor sheaves shall be adjustable for the system balancing.

D. Drive frame and panel assemblies shall be galvanized steel or painted steel. Drive frames shall be formed channels and fan panels shall have prepunched mounting holes, formed flanges, and a deep formed inlet venturi. Drive frames and panels shall be of bolted construction.

E. The axial exhaust fans shall bear the AMCA Certified Ratings Seals for both sound and air performance.

F. Sidewall Propeller Fans shall be manufactured by Greenheck or approved equal, based on the following schedule:

Location	Model	Quantity	HP	Capacity (CFM)	Static Pressure	RPM	Sones
Pretreatment Room	SBE-1H30-7	1	3/4	7779	0.25” W.C.	827	19.1
Bio-Reactor Room	SBE-1H30-5	2	1/2	6145	0.25” W.C.	631	15.5

G. Fans will be operated with a PLC-controlled thermostat, with operator controlled timer on/off:

2.03 SIDEWALL FAN ACCESSORIES

A. Provide sidewall housing complete with rear guard, weather hood, gravity backdraft damper, damper guard with bird and insect screen.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All fans and louvers shall be installed by personnel regularly engaged in the installation of HVAC equipment. Workmanship is to be first class in every respect.

B. Provide all electrical connections required for the exhaust fan motor including disconnects. Installation to be in strict accordance with the manufacturer’s recommendations.

3.02 DEMONSTRATION

A. CONTRACTOR to demonstrate the proper operation of all fans and louvers to the satisfaction of the ENGINEER. Fans shall operate without undue vibration and louvers shall operate smoothly, without binding and shall open completely.

**** END OF SECTION * ***

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Division 16 – Electrical

16010 – General Provisions
Electrical

SECTION 16010
GENERAL PROVISIONS – ELECTRICAL

PART 1 - GENERAL

1.01 GENERAL CONDITIONS

A. The specifications and Contract Drawings are complimentary. Items shown in one but not in the other shall be as binding as if included in both. Where a discrepancy exists, the CONTRACTOR shall assume the most expensive material and/or method for bidding and refer the matter to the ENGINEER.

B. All applicable General Conditions stated elsewhere in these specifications are to be considered as part of this specification.

C. Contract Drawings are meant to show the general arrangement only and do not include all details needed for a complete system.

D. Contract Drawings are based on preliminary information supplied by various equipment vendors. CONTRACTOR is expected to obtain specific wiring, motor horsepower and other electrical information from his equipment supplier prior to bid. No additional compensation will be allowed for electrical or other changes resulting from the use of a particular vendor's equipment.

1.02 SCOPE OF WORK

A. The CONTRACTOR shall provide all labor, materials, equipment, machinery and tools necessary to put into satisfactory operation all electrical equipment specified and as shown on the drawings. This CONTRACTOR shall connect the various items or sections of the work so as to form a complete and properly operating entity.

B. Work Included - The principal items of work to be furnished and installed, but are not necessarily limited to the following:

1. Exterior site work, including all related excavation work, concrete work and backfilling.

2. Conduits, junction boxes, pull boxes, hand holes, device boxes and receptacles.

3. All circuit breakers, disconnect switches, fuses and similar equipment as required to complete the electrical installation of all equipment required under this Contract.

4. All equipment systems and grounding.

5. Service including conduit, service conductors, meter pan, and main disconnect switch. Service entrance surge protection.

6. All lighting fixtures complete with mounting provisions, conduit, wiring, switches and lamps as required to complete the installation.

7. All supports and framing for mounting and supporting all pullboxes, panelboards, switches, circuit breakers, starters, equipment control panels and similar equipment required.

8. Temporary power as may be required

C. Equipment Furnished Under Other Divisions - The following shall be furnished by other contracts or other divisions of the specifications, however, all wiring, conduit and connections shall be furnished and installed under the Electrical Division:

1. Pre-packaged control panels and accessories.

1.03 STANDARDS, CODES AND PERMITS

A. All work shall be performed in strict compliance with all applicable Local and State codes. In addition, all practices shall be in accordance with the latest editions of the National Electrical Code of the National Fire Protection Association (NFPA), the National Electrical Safety Code, the AISC and the OSHA.

B. All material and equipment shall comply with Local and State electrical codes, the latest requirements of the National Electrical Code, OSHA and the applicable standards of the NEMA, ASTM, IEEE, ANSI, ICEA, the AISC. Local codes shall have precedence over the standards setting organizations and OSHA shall have precedence over local codes. Contractor shall furnish any and all labor or material, in addition to that described herein or shown on the drawings, necessary to comply with the previously mentioned codes and standards.

1.04 MATERIAL AND INSTALLATION WORK

A. All material and equipment shall be new without defects, and shall bear the inspection labels of the Underwriters Laboratories, if the material is of a class inspected by said laboratories.

1.05 SUPERVISION

A. The CONTRACTOR shall provide competent supervision of all phases of the electrical installations.

1.06 INSTALLATION

A. Any labor, material, or equipment not specifically mentioned herein or shown on the drawings, which is necessary to complete any part of the electrical installation, in order to constitute a satisfactorily operating entity shall be provided by the CONTRACTOR

without additional compensation. The CONTRACTOR shall furnish and install electrical connections to all apparatus requiring such connections.

B. The locations of equipment to which electrical connections are to be made are approximate as shown on the drawings. Locations of electrical equipment may be changed when necessary where conflict arises between structural or mechanical units, existing piping, etc., as authorized by the ENGINEER.

C. The CONTRACTOR shall install and/or wire all electrical equipment as per the manufacturer's recommendations. Failure to wire or install any equipment in accordance with the certified wiring diagrams, specifications and drawings shall be corrected at the CONTRACTOR'S expense.

D. The work shall be coordinated between all trades to avoid delays and unnecessary cutting, channeling and drilling. The CONTRACTOR shall perform all chasing, channeling, drilling and patching necessary to the proper execution of his Contract. Damage to any building, structure or equipment shall be repaired by qualified mechanics of the trades involved at the CONTRACTOR'S expense. If in the ENGINEER'S judgment the repair of damaged equipment would not be satisfactory, then the CONTRACTOR shall replace damaged equipment at his own expense.

E. Workmanship shall be first class in every respect.

1.07 SUBMITTALS

A. CONTRACTOR shall furnish to the ENGINEER five (5) sets each of detailed shop drawings, including elementary, connection and interconnection wiring diagrams. These diagrams shall show the interconnection of all equipment requiring electrical connections. All wiring diagrams shall bear wire and cable numbers and a uniform method shall be used so that wiring can be easily followed. All wiring shall bear a unique number at all points of junction and termination. These drawings shall be submitted to the ENGINEER for review before any wiring is installed.

B. CONTRACTOR shall also furnish for review of the ENGINEER five (5) sets each of manufacturer's specifications, drawings, operating and maintenance instructions, and any other data required to provide a complete description of the equipment being supplied and the construction to be performed.

C. CONTRACTOR shall also furnish samples of electrical construction material such as conduit, wires or cable, junction boxes, toggle switches, etc., if instructed to do so by the ENGINEER.

D. CONTRACTOR shall furnish a construction schedule with specific dates showing sequence and duration of the major items of work. This schedule shall be coordinated with the other trades and shall be available at the job site. Schedule shall be updated as needed and the ENGINEER and OWNER kept advised of all changes.

1.08 EQUIPMENT AND/OR INSTALLATION DEVIATIONS

A. Where redesign of the electrical work is required, due to the CONTRACTOR'S use of an approved equal item, the CONTRACTOR shall absorb the cost for all additional charges whether such charges are his own or other contractors. Any resulting rearrangement of equipment or layout other than herein specified or shown shall be submitted by the CONTRACTOR in the form of detailed drawings to the ENGINEER for review.

1.09 PERMITS AND FEES

A. CONTRACTOR shall prepare and submit all applications, working drawings and pay all fees required to obtain all necessary permits and certificates of compliance or approvals from all authorities having jurisdiction. These certificates shall be delivered to the ENGINEER.

1.10 TESTING

A. CONTRACTOR shall perform such tests as required for all component parts of the completed installation. Such tests shall demonstrate the proper functioning of all equipment and wiring and the adequacy of the entire electrical system. Any equipment or material which fails to perform satisfactorily shall be repaired or replaced and then retested until satisfactory results are obtained. All testing and retesting shall be at the CONTRACTOR'S expense.

1.11 ACCEPTANCE

A. The operation by the owner of the equipment and/or the electrical installations does not constitute an acceptance of the work. The final acceptance is to be made after the CONTRACTOR has adjusted equipment, demonstrated that it fulfills the requirements of the Contract documents, and has furnished all the required certificates, "as built" drawings and a satisfactory operations and maintenance manual.

1.12 GUARANTEE

A. CONTRACTOR assumes full responsibility for the proper functioning and quality of the entire electrical installation. Any breakdowns, deficiencies or deteriorations caused by poor workmanship, materials, method of installation or inferior equipment furnished by this CONTRACTOR shall be promptly remedied, replaced or repaired by the CONTRACTOR. Such full responsibility shall extend through the entire guarantee period. The terms of the guarantee are stipulated elsewhere in the Contract documents.

B. The CONTRACTOR shall guarantee that all materials, equipment and workmanship shall be free from defects for a period of one year from the date of acceptance of the work and shall replace any defective work or equipment at no cost to the OWNER.

1.13 STORAGE AND HANDLING OF MATERIALS

A. The CONTRACTOR shall make all necessary arrangements and provisions for the receiving, storage and protection of materials and equipment to be used in executing this Contract.

1.14 AS BUILT DIAGRAMS

A. After completion of the work the CONTRACTOR shall furnish to the ENGINEER "as built" drawings of all electrical construction drawings, such as conduit layouts, conduit and cable schedules, lighting layouts, interconnection and elementary wiring diagrams. "As built" drawings shall accurately locate all underground and concealed conduit. Five (5) marked sets of manufacturers' drawings and operating instructions shall also be forwarded to the ENGINEER showing "as built" conditions.

B. The CONTRACTOR shall maintain accurate records of all deviations from the work as shown on the Contract documents and indicate the actual construction with colored lines on a set of white prints. Mark drawings as "Record Drawings of Work as Built".

1.15 LABELING

A. All panelboards, control panels, switches, controls and indicators shall be permanently labeled with engraved plastic or metal labels. Labels shall be attached in such a way as not to be affected by heat, moisture or humidity. All labeling shall be consistent with the as built drawings.

B. All panelboards shall be provided with typewritten directories. Hand written directories are not acceptable. Panelboards shall have a permanent engraved plastic label securely attached.

1.16 OPERATOR TRAINING AND STARTUP ASSISTANCE

A. CONTRACTOR shall provide factory trained personnel to provide startup assistance as required. Operator training is also required under some sections of these specifications. Those individuals providing training shall be persons specifically qualified to instruct others in the safe and efficient operation of the installed equipment.

1.17 DEFINITIONS

A. Definitions of terms used herein:

1. "CONTRACTOR": the CONTRACTOR furnishing work under this Division of the Contract, except as otherwise noted.

2. "Supply": to purchase, procure, acquire and deliver complete with all related accessories necessary or required.

3. "Install": to erect, mount and connect complete with all related accessories wiring, conduit, etc., necessary or required.

4. "Furnish" or "Provide": to supply, install and connect complete and ready for safe and regular operation particular work referred to unless specifically indicated or specified otherwise.

5. "Mount": to erect and connect complete with all related accessories.

6. "Work": all labor, materials, equipment, apparatus, controls, accessories, and other items customarily furnished and/or required for proper and complete installation.

7. "Wiring": conduit, fittings, wire, junction and outlet boxes, switches, cutouts and receptacles and all items necessary or required in connection with or relating thereto.

8. "Concealed": embedded in masonry or other construction, installed behind wall furring, within double partitions, in trenches or underground.

9. "Exposed": not installed underground or "concealed" as defined above. Conduit above hung ceilings while concealed from view, shall be considered exposed.

10. "Noted": as indicated on drawings and/or specified.

11. "Similar" or "Equal": equal in kind, materials, weight, design and efficiency of performance.

PART 2 - PRODUCTS

2.01 U.L. LISTING

A. All products shall be U.L. listed where a U.L. listing exists for a similar product. If any non U.L. listed products are found in the installation they shall be removed and replaced with U.L. listed products at no additional expense to the owner.

2.02 ONLY NEW PRODUCTS SHALL BE ALLOWED

A. All products used on this project shall be new, without defects and covered by the manufacturer's full U.S. warranty.

2.03 INDUSTRIAL GRADE PRODUCTS REQUIRED

A. All products shall be of industrial grade and suitable for use in a wastewater treatment facility. All electrical components shall be rated for continuous 24 hour/day, 7 day/week operation. Components shall not overheat nor fail prematurely when used continuously.

All equipment shall be adequately protected from corrosion and shall not rust or deteriorate from use in a wastewater plant environment.

PART 3 - EXECUTION

3.01 GENERAL

A. All equipment shall be installed as per the manufacturer's recommendations and in accordance with accepted construction practices.

3.02 TESTING REQUIRED BEFORE APPLYING POWER

A. All electrical connections shall be verified before circuits are energized. Any equipment damaged due to a failure to check for short circuits or miswiring shall be corrected by the Contractor at no additional expense to the OWNER.

3.03 SAFETY DURING CONSTRUCTION

A. All electrical equipment shall be maintained in a safe manner during construction. No exposed live circuits shall be accessible to other than qualified personnel. Contractor shall lock out circuits as required to prevent accidental starting of equipment. The work area shall at all times be kept neat and free from hazards.

*** * END OF SECTION * ***

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16100 – Basic Materials and Methods Electrical

SECTION 16100
BASIC MATERIALS AND METHODS ELECTRICAL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish and install all conduit, conduit fittings and boxes to complete the installation of all electrically operated equipment as specified herein, in other Divisions of these specifications and as required.

B. Furnish and install all wires and cables for power, lighting, instrumentation and control as required to complete the electrical installation.

C. Furnish and install lighting switches and receptacles as shown on the Contract drawings.

1.02 LAYOUTS DIAGRAMMATIC

A. The Contract drawings indicate the general location of junction and pull boxes and conduits both exposed and concealed. However, the Design/Builder shall install these conduits and appurtenances in such a manner as to avoid all interferences.

PART 2 – PRODUCTS

2.01 CONDUIT

A. General: The minimum size conduit permitted is 1/2 inch for exposed work and 3/4 inch for concealed conduit except as may be shown on the Contract Drawings. 3/8" conduit shall not be permitted.

B. Rigid Metal Conduit (RMC). All conduit in the process areas shall be thickwall rigid hot-dipped galvanized steel inside and outside after threading. Each length of rigid conduit shall be shipped with one coupling at one end and a thread protector at the other end.

C. PVC Coated Rigid Conduit shall be installed where shown on contract drawings. Coating to be factory applied and undamaged with a minimum 40mil coating. All fittings shall be threaded.

D. PVC Conduit (Installed in grade). All conduit installed in grade shall be schedule 80 PVC. All connections shall be made with approved conduit fittings and shall be bonded with approved adhesive compound to form a rigid water tight connection.

E. PVC Conduit (Installed in slab). All conduit installed in concrete floors shall be Schedule 80 PVC. All connections shall be made with approved conduit fittings and shall be bonded with approved adhesive compound to form a rigid water tight connection.

F. Flexible Metallic Conduit. (Sealtite or equivalent) All flexible conduits shall be liquid-tight metal flexible type. The use of this type of conduit shall not be acceptable unless a ground conductor is pulled from the source with the load conductors to the equipment.

2.02 CONDUIT FITTINGS, PULLBOXES, JUNCTION BOXES, ETC.

A. Indoor Use. All junction boxes and pullboxes for indoor use shall be galvanized after fabrication and provided with rubber or neoprene gasketed screwed-on covers of the same gauge as the box being provided except as otherwise specified herein.

B. Outdoor Use or Use in or near well vaults. All junction boxes and pullboxes for use at or near well vaults shall be of NEMA 4X construction. Covers shall be same material as box and shall be hinged. Screws and all metal parts shall be stainless steel.

C. Switch/Receptacle Boxes. All cast fittings or sheet metal boxes containing wiring devices such as receptacles and switches shall be of the deep type. All device boxes used in the process area shall be cast type except those shown as recessed.

D. Cast fittings shall be non-ferrous metal or malleable iron thoroughly coated inside and outside with metallic zinc or cadmium after all machining has been completed. Cast fittings shall be provided with heavy threaded hubs to fit the conduit required. Covers shall be of the same material as the fittings to which they are attached and shall be screwed on with rubber or neoprene gaskets between the covers and fittings. All cast fittings 1-1/2 inches and larger shall be of the "mogul" type.

2.03 CONDUCTORS AND INSULATION

A. Each coil or reel of insulated wire and cable furnished shall bear a tag containing the Underwriters Laboratories approval stamp (providing cable is of a class inspected by said laboratory), name of manufacturer, trade designation, month and year of manufacture; and in no case shall be more than six months old, unless otherwise acceptable to the ENGINEER.

B. Wire and cable shall not have been stored in the weather, and shall meet all requirements of the ICEA.

C. Furnish and install all conductors, consisting of ninety-eight percent (98%) conductivity copper. Power wire sizes up to No. 10 AWG inclusive shall be stranded or solid; No. 8 AWG and larger shall be stranded. All control wires shall be stranded and shall be not less than No. 14 AWG unless otherwise shown on conduit schedule. All conductors shall be 600 V rated. All power and lighting feeder wire and cable shall be identified by color coding in all handholes, motor control centers, panelboards, pull boxes and junctions

boxes. All signal carrying cable shall be twisted shielded pairs or three (3) wire twisted with shield.

D. Conductors run below grade shall be type XHHW. All other wiring except signal wire, shall be THW or XHHW. THWN/THHN may be used for lighting and general purpose receptacles only. Signal cable carrying 4-20 ma dc signal shall be as indicated on the drawings and/or wiring schedules, with a polyethylene insulation and a 100% shield of aluminum-polyester and a 18 AWG tinned copper drain wire with an overall chrome PVC jacket. The cable shall be Belden Corp. 8719 or equal.

2.04 WIRING DEVICES

A. General: Products of a single manufacturer shall be used for the receptacles and switches. All devices shall be UL listed, specification grade devices as manufactured by Harvey Hubbell Co., or Bryant Electric Co. or approved equal.

B. Lighting Switches

1. Single pole, 20 Amp, 125V, Hubbell model 1221, or equal.

2. 3-way, 20 amp, 125V, Hubbell model 1223 or equal.

3. 4-way, 20 amp, 125V, Hubbell model 1224 or equal.

C. Duplex Receptacles

1. General Use - 20 Amp, 125V, 3-wire, polarized Hubbell model 5362, or equal.

2. In Process Areas - 20 Amp, 125V, 3-wire, polarized (in process areas) Hubbell model 53CM62 with 52CM21 cover, or equal.

3. GFCI receptacles- 20 Amp, 125V, 3-wire, polarized Hubbell model GF-5362 or equal.

4. Outdoor Use (if indicated) - Duplex 20 Amp, 125V, 2 pole, 3-wire, water tight with cover. Hubbell model 53CM62 with 52CM21 cover, or equal.

2.05 PANEL BOARDS

A. Panelboards shall be for the voltages indicated on the drawings. Size shall be as required for the loads shown. Panelboards shall have a solid neutral as well as a ground bus. Each panelboard shall have main breaker. The branch breakers shall all be full size switch duty type and shall have trip indicators. Panelboards shall be surface mounting. The panelboards shall be a Square D Co. with cover and door and a ground bar kit. Other acceptable manufacturers are GE, ITE Siemens, Westinghouse and Cutler Hammer.

2.06 DISCONNECT SWITCHES

A. The disconnect switches shall be 3 blade, non- fusible switches as shown on the Contract Drawings. They shall be rated 600 VAC and shall be capable of interrupting the full load current of the device to which they are attached. Switches shall have a withstand rating equal or greater than the equipment supplying the switch. The disconnect switches shall be as manufactured by Square D Co., Cutler Hammer, GE, Siemens or approved equal. Switches shall be housed in NEMA 1or NEMA 4X general purpose enclosures as shown on the contract drawings. All switches shall be heavy duty industrial type and be capable of being locked in either the "ON" or "OFF" position.

PART 3 - EXECUTION

3.01 CONDUIT

A. Connections to equipment. Connections from rigid conduit to motors, pressure switches, solenoid valves, level controls, etc., shall be made with short lengths of liquid-tight metal flexible conduit. With in these lengths shall be provided a grounding conductor for continuation of the grounding circuit from the source to the equipment frame.

B. Installation procedure. Each piece of conduit installed shall be free from blisters and other defects.

1. Each piece installed shall be cut square, taper reamed, and a coat of conductive sealing compound such as T & B "KOPR-SHIELD" applied to threads.

2. Conduit connections shall be screwed tight with only incomplete threads exposed. All conduit joints shall be made with standard couplings and the ends of the conduit shall butt tightly into the couplings. In exposed work only, where standard couplings cannot be used, only union type couplings are permitted.

3. Conduit threaded in the field shall have standard sizes and lengths.

4. No single conduit run shall have more than the equivalent of four (4) 90 degree bends. Bending radii shall comply with NEC Article 346-10. Factory bent elbows or field bent elbows with approved tools may be used. Heating of conduit to facilitate bending is prohibited. Only bending methods approved by the PVC conduit manufacturer shall be used for this type of conduit.

5. All exposed conduit shall be installed, either parallel or perpendicular to structural members, unless impractical, and shall be grouped wherever possible. Conduit shall be attached to structural components with approved supports spaced as required by the NEC; and shall form a neat rigid installation.

6. Conduit supports from building walls shall be installed with at least a 1/4 inch clearance from the walls to prevent the accumulation of dirt and moisture behind the conduit. Conduit and/or conduit fittings shall not be welded together or to any steel structure; however, conduit supports may be welded to flanges of steel beams, columns, etc., in accordance with approved welding techniques and engineering practice.

7. Approved conduit expansion joints shall be provided wherever conduit crosses a structural expansion joint, is attached between two separate structures, and wherever the conduit run is 100 feet or more in a single straight length.

8. All conduit extending through the floor behind panels or into control centers or similar equipment shall extend a minimum of six (6) inches above the floor elevations, with no couplings at floor elevations.

9. Horizontal conduit runs not in the floor slab shall be run above the ceiling wherever practical.

10. Conduit installed in concrete or other masonry walls shall be so arranged that a minimum of three (3) inches of covering is obtained. Spacings between conduit shall be sufficient to permit a complete filling with concrete or mortar without voids.

11. Conduit runs shall be installed in such locations as to avoid water pipes. A minimum separation of three (3) inches will be maintained where conduit crosses or parallels water pipes. A minimum of 12 inches will be maintained where conduit crosses or parallels hot water piping.

12. The cutting of walls or floors for conduit or other electrical equipment shall be kept to a minimum. Where such cutting is absolutely necessary, care must be taken so as not to weaken the wall or floor involved. Beams or other structural supports shall not be cut under any condition. All cutting, channeling and drilling of holes through walls, floors and ceilings, required for the correct installation of the electrical work, shall be done by and repaired by the Electrical Design/Builder. The cost of cutting and patching shall be borne by the Design/Builder. All work shall be finish painted (prime coat and two (2) finish coats) to match the existing finishes. All equipment fastenings to columns, steel beams, and trusses shall be by beam clamps or welded. No holes shall be drilled in the steel. All holes in hung ceilings for support rods, conduits and other equipment shall be made adjacent to bars where possible, to facilitate removal of ceiling panels.

13. Conduit shall be protected immediately after installation by installing flat non-corrosive metallic discs and steel bushings, designed for this purpose, at each end. Discs shall not be removed until it is necessary to clean the conduit and pull wire and cable. Before wire or cable is pulled, insulated bushings shall be installed at each end

of the conduit. Prior to pulling in wire and cables, each conduit shall be thoroughly cleaned inside, by the use of compressed air, to remove all sand and other foreign matter.

14. Where used, transition from PVC coated rigid galvanized steel conduit to PVC schedule 80 conduit shall be not less than six (6) inches from the outside surface of the tank wall.

15. Conduit buried in the earth (grade) shall be at the required depth as required by the NEC, or deeper as noted on the Drawings. Trenching and backfilling shall be provided by the CONTRACTOR in accordance with other applicable Divisions of these Specifications.

3.02 CONDUIT FITTINGS, PULLBOXES, JUNCTION BOXES, ETC.

A. Pullboxes and junction boxes shall be installed and located as indicated on the drawings. The size of boxes shall be generous, considering the number and size of conductors and providing generous access for removal of conductors.

B. Where nipples are used between fittings and electrical equipment, they shall be so installed that no threads are exposed.

C. All junction boxes, pullboxes, cabinets, lighting panels, switches, and similar devices shall be solidly attached to structural members prior to installation of conduit. These devices shall be set true and plumb. Wooden plugs are not permitted for securing equipment or conduit to concrete.

D. Conduit attachment to all electrical equipment, such as sheet steel junction boxes, pullboxes, switches, etc., shall be made with double steel locknuts. Threaded insulated bushings shall be used on the end of each conduit terminating in such equipment.

E. Where control wires must be interconnected in a junction box, terminal boards consisting of an adequate number of screw type terminals shall be installed. Terminal board current carrying parts must be of ample size to carry the full load current of the circuits connected thereto. Approximately 20 percent of the total number of terminals provided shall consist of spare terminals. Terminals shall be lettered and/or numbered to conform with the wiring.

F. Mounting heights from the finished floor to the centerline of the various boxes and equipment shall be as follows except as otherwise indicated on the Drawings:

P.B. Stations, Lighting Switches, etc.	4 ft. 6 in.
Power Receptacles	1 ft. 6 in.
Power Receptacles in Process Area	4 ft. 6 in.

3.03 INSTALLATION OF WIRE & CABLE

A. The best of care shall be exercised while installing wire and cable so as not to injure the conductor or insulation. Oils, grease, or compound other than powdered soapstone, or as recommended by the cable manufacturer, shall not be used for pulling in any conductor.

B. All grouping or bundling of control and circuit wiring in cabinets, panels, pullboxes and junction boxes shall be neatly trained and held with suitable cable ties. Where control or circuit baling is clamped or fastened in cabinets or other equipment, non-metallic cable clamps and mounting brackets shall be installed.

C. All wiring shall be tagged at each end and at all junction points with suitable wire markers displaying unique identifying numbers.

D. Connection of cable clamps or lugs shall be as follows: contact areas of bars, plates, and lugs shall be cleaned with steel wool, emery cloth or buffing machine, in such a manner as to leave the surfaces bright, clean, flat and/or parallel. Care shall be taken so that edges and corners are not rounded. Areas shall then be wiped with a clean cloth to remove all particles of abrasive matter, dust, and dirt. Each cleaned area shall then be completely covered with a thin layer of Vaseline, or other material approved for this purpose by the ENGINEER; the parts tightly drawn together with bolts and locknuts and excess grease wiped off.

E. CONTRACTOR shall be responsible for maintaining the proper electrical phasing of all equipment being installed. Where modifications are required to improperly phased equipment, the CONTRACTOR shall do the rewiring at no expense to the OWNER. The CONTRACTOR shall replace or repair any equipment damaged because of improper phasing at no cost to the OWNER.

F. Grounding of signal cable shield shall be done only at the power source end. The opposite end shall be protected against accidental contact with ground by bending the drain wire back along the outer cable insulation and sleeving over the drain wire with heat shrink tubing. The insulated conductors of signal cable stripped from their outer insulation and shield shall be as short as practical at their termination points.

G. Where long pulls are necessary, a messenger shall be pulled with the signal cable to relieve the stress of pulling on the cable.

3.04 SPLICING OF CONDUCTORS

A. Splicing shall be kept to a minimum. Splicing to extend the length of a wire is not permitted. If a wire is found to be too short, it shall be removed and a wire of adequate length installed. Under no circumstances shall signal wire be spliced. Splices shall not be made in cast fittings such as "Tee" or "L" types, but shall be made in junction boxes or

adequate size. All splices shall be made via terminal connections to terminal strips in a junction box. Wire nuts are permitted for lighting and receptacle circuits only.

3.05 IDENTIFICATION OF CONDUCTORS

A. Feeder wire and cable shall be identified by the following colors:

	208/120 VAC	480/277 VAC
PHASE A	BLACK	BROWN
PHASE B	RED	ORANGE
PHASE C	BLUE	YELLOW
NEUTRAL	WHITE	WHITE/GRAY
GROUND	GREEN	GREEN

B. 120V control wiring shall be identified by the following color code:

1. Panel wiring from panel power source – Red

2. Panel wiring from external power source - Yellow

C. In the 480/277V and 208/120V systems, phases shall be identified by colored insulation when wiring is No. 10 AWG or smaller. Wiring that is No. 8 and larger may be black with color tape bands nearest the termination to identify phases.

D. The CONTRACTOR shall devise a unique numbering system for the wires pulled in the field. All wires with a common node shall have the same number. All wires which do not have the same electrical continuity at all times shall have a different number. This numbering system shall be incorporated in the as-built drawings.

3.06 INSTALLATION LOAD CENTERS, DISCONNECT SWITCHES AND OTHER DEVICES

A. All devices shall be mounted true and plumb in the locations shown on the Drawings. Devices shall be located so as to be accessible once equipment is in place. Receptacles shall be arranged so as not to present a tripping hazard or interfere with the removal or normal service of equipment.

B. Control panel and panelboards shall be wall mounted. All control enclose power panels shall have an engraved label securely attached to the front cover. Individual breakers shall be clearly marked indicating the equipment being served. Labels shall be typed or printed. Handwritten labels will not be accepted.

C. The disconnect switches shall be mounted true and plumb as shown on the Contract drawings and as described herein. Disconnects shall be permanently labeled with plastic laminated labels. Labels shall be attached in such a way as to resist heat and moisture.

**** END OF SECTION * ***

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16390 - Grounding

SECTION 16010
GROUNDING

PART 1 - GENERAL

1.01 GENERAL CONDITIONS

A. All equipment and enclosures and system neutrals shall be properly connected to ground in accordance with NEC article 250. In addition to the requirements of NEC, the following shall be permanently and effectively grounded:

1. Building structural steel;
2. All handrails and metalic grating not otherwise grounded through metalic connection to building steel.
3. All GWET System exposed metal parts;
4. Revovery well pumps; and
5. Ground test pit at the GWET System building.

PART 2 - PRODUCTS

2.01 MATERIALS

A. The service grounding electrode contractors, building perimeter ground grid and connectivity pigtails shall be bare medium hard drawn 97.7% minimum conductivity stranded copper cable. Drivenground rods shall be furnished consisting of 3/4 inch diameter copper clad steel ten feet length. Allgrounding cable taps shall be made by the crucible weld method. Bolted type connections shall consist of corrosion resistance copper alloy with silicone bronze bolts, nuts and lockingwashers.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The CONTRACTOR shall furnish and install a grounding grid around the building perimeter with driven ground rods at the building corners and elsewhere indicated on the Drawings. Provide copper pigtails connected from the building stell to the grounding grid.

B. The grounding rods shall be driven deep enough to obtain a ground resistance of not more than 10 ohms. Copper pigtails shall be also connected to metal handrails grating. Conduit entering motor starter panels, control enclosures, panelboards, etc. shall be bonded using copper bonding jumpers to the ground bus where grounding connections are to be made shall be clean and dry. Copper and galvanized steel shall be cleaned with emory cloth to remove oxide before makiong connections.

C. Provide a ground rod at each recovery well head, Install and connect a pigtail from the cable mount inside the well vault to the driven ground rod.

D. Provide a grounding test pit where indicated at building exterior. Pit to consist of 4 inch terracotte pipe section 3 feet in length, with cap, installed in and extending 6 inch above grade.

*** * END OF SECTION * ***