







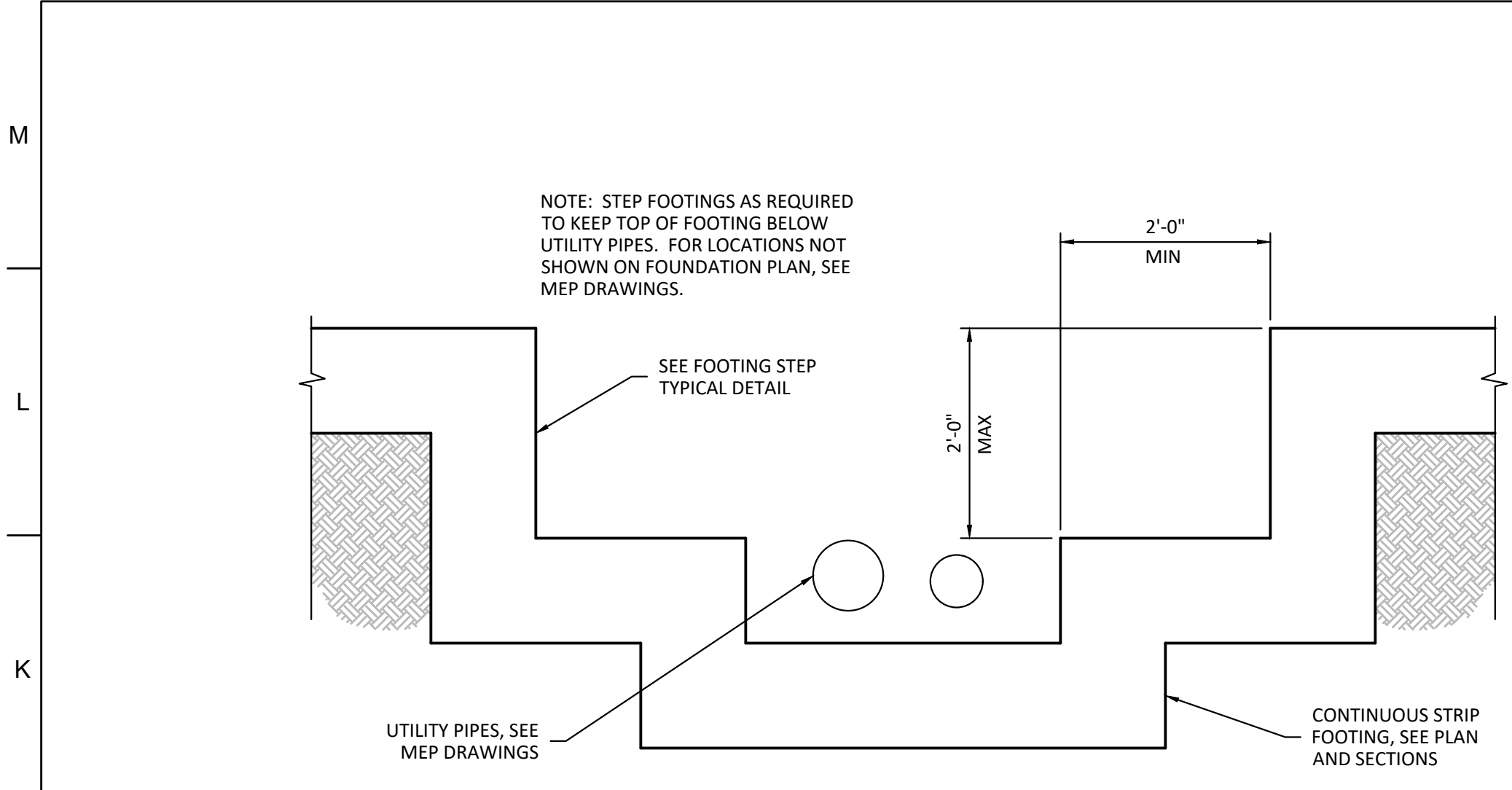


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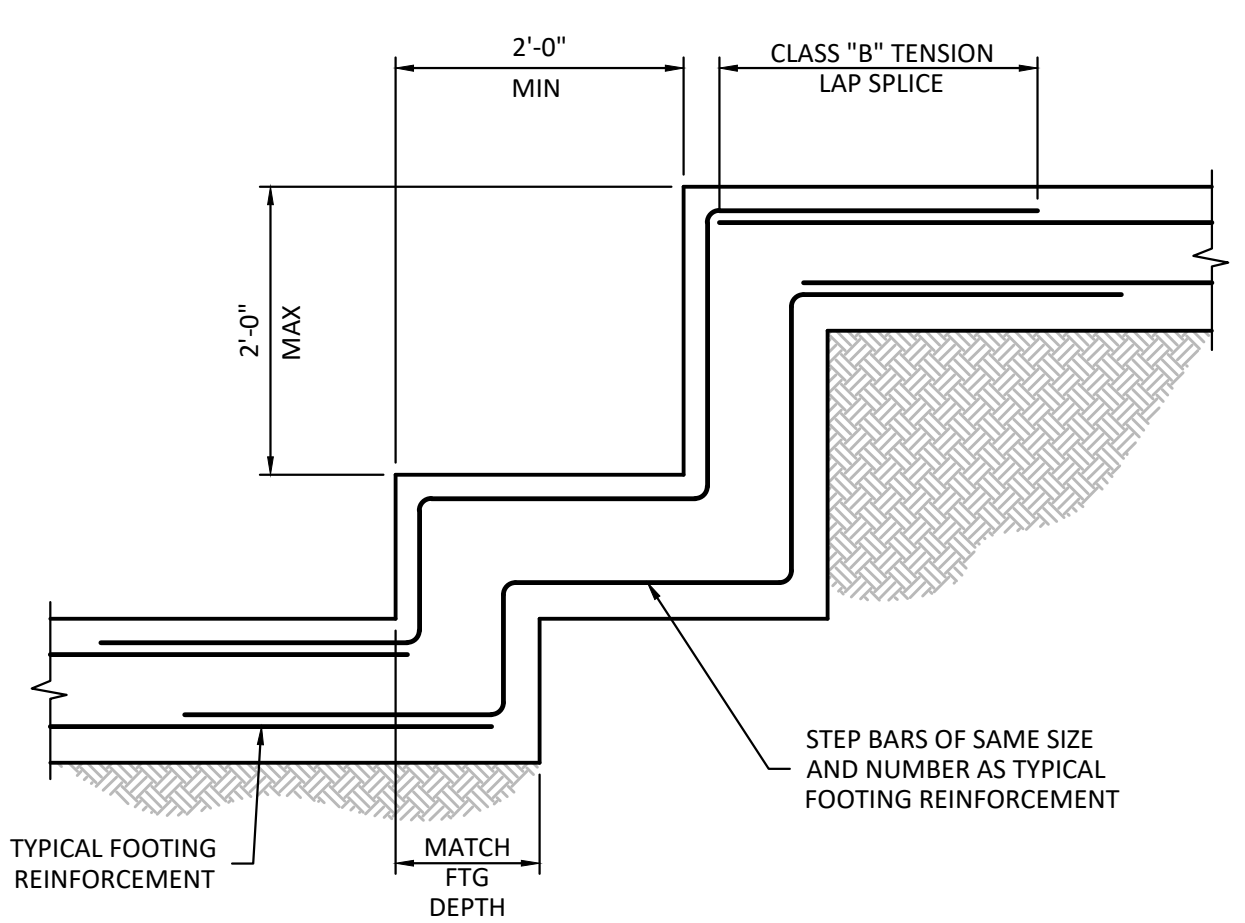
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Sheet Title  
**STRUCTURAL TYPICAL DETAILS, CHEMICAL FILL STATION STRUCTURAL PLAN, & SECTIONS**

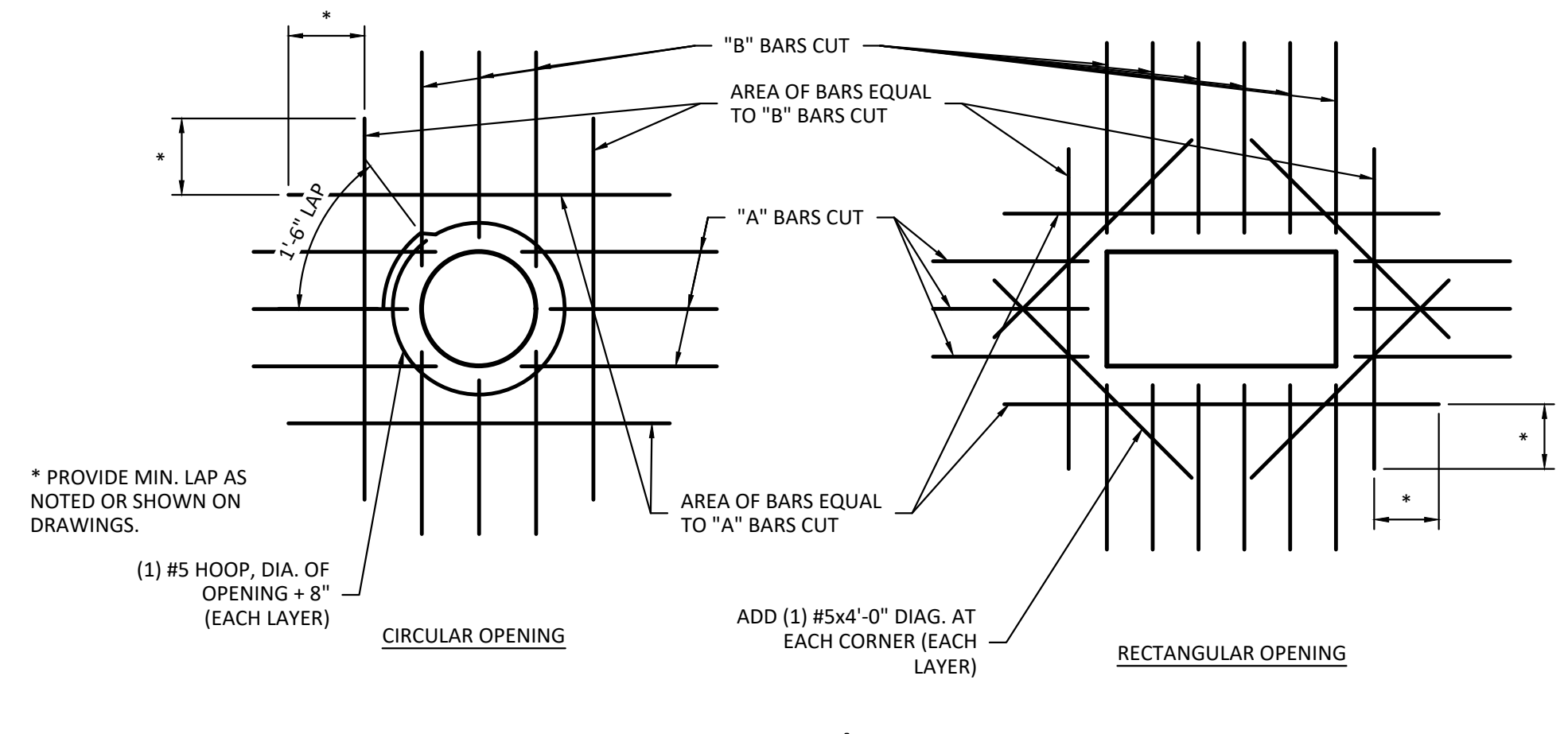
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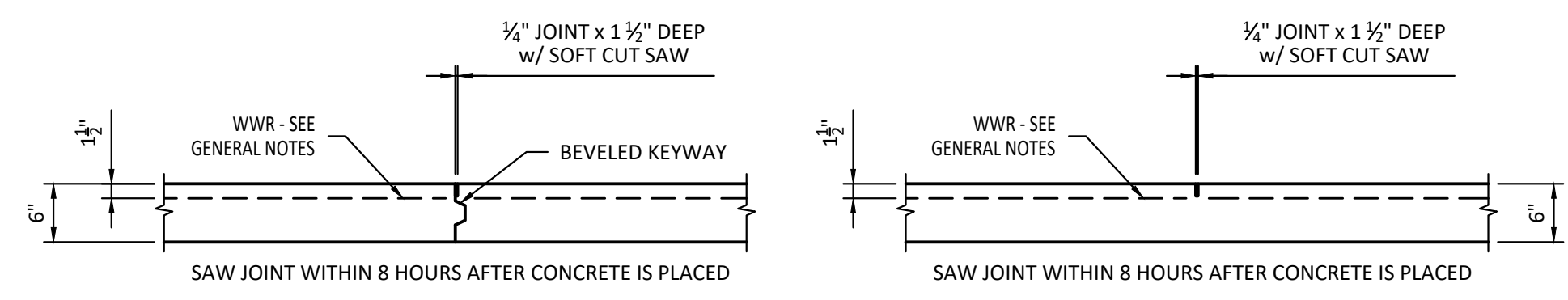
**FOUNDATION WALL AT PIPING DETAIL**  
TYPICAL



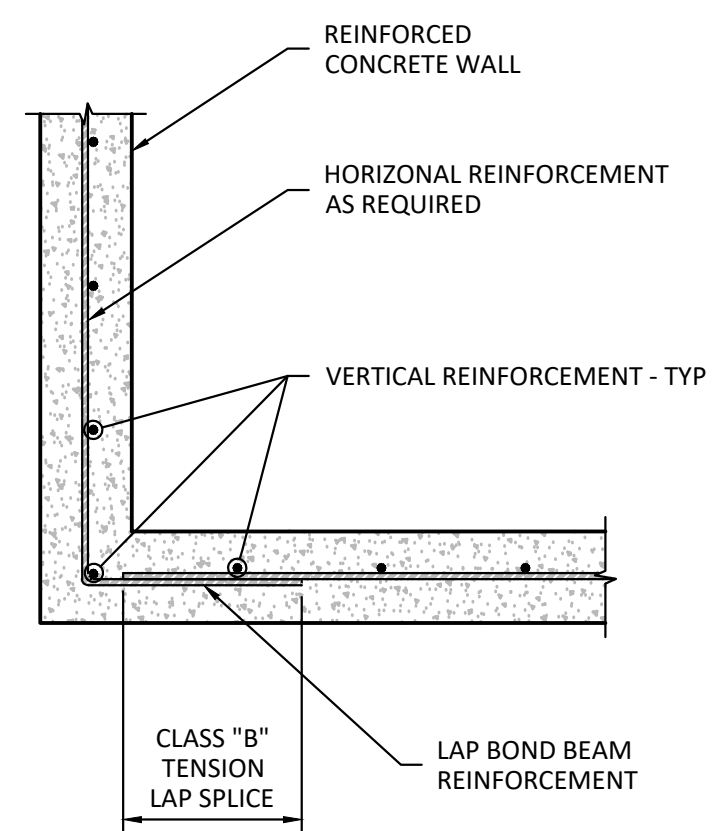
**FOOTING STEP DETAIL**  
TYPICAL



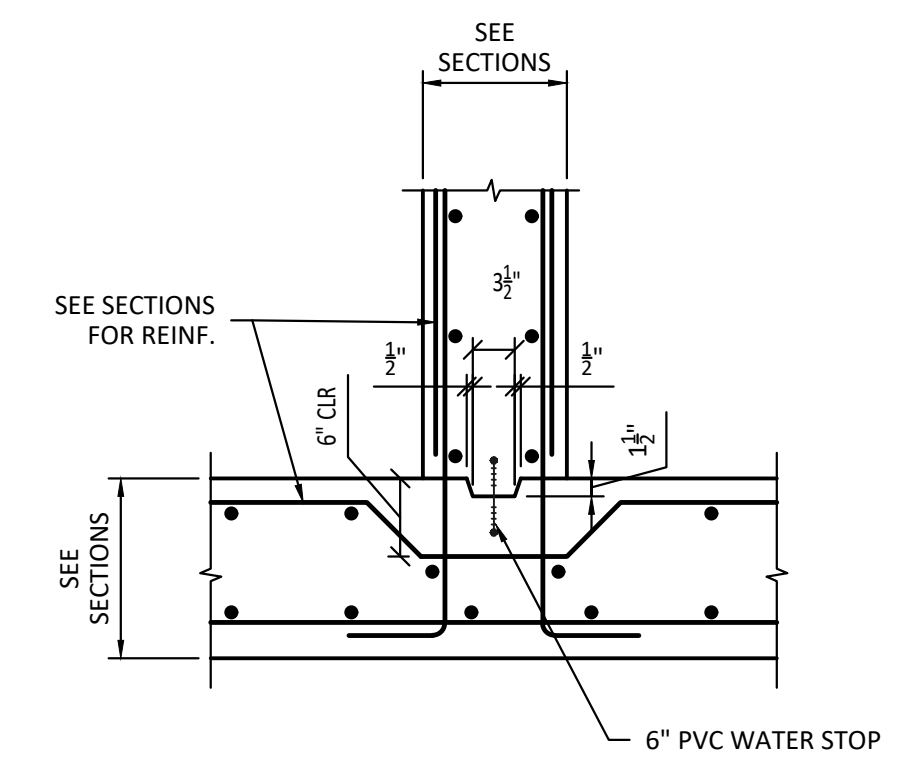
**CONCRETE WALL/FTG OPENING REINFORCEMENT DETAIL**  
TYPICAL



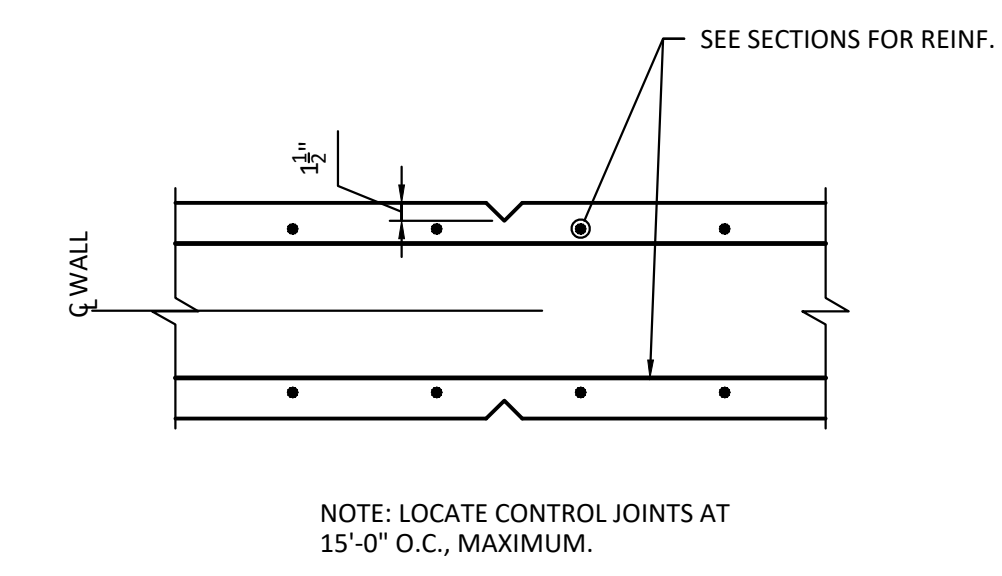
**6" SLAB CONTROL JOINT DETAILS**  
TYPICAL



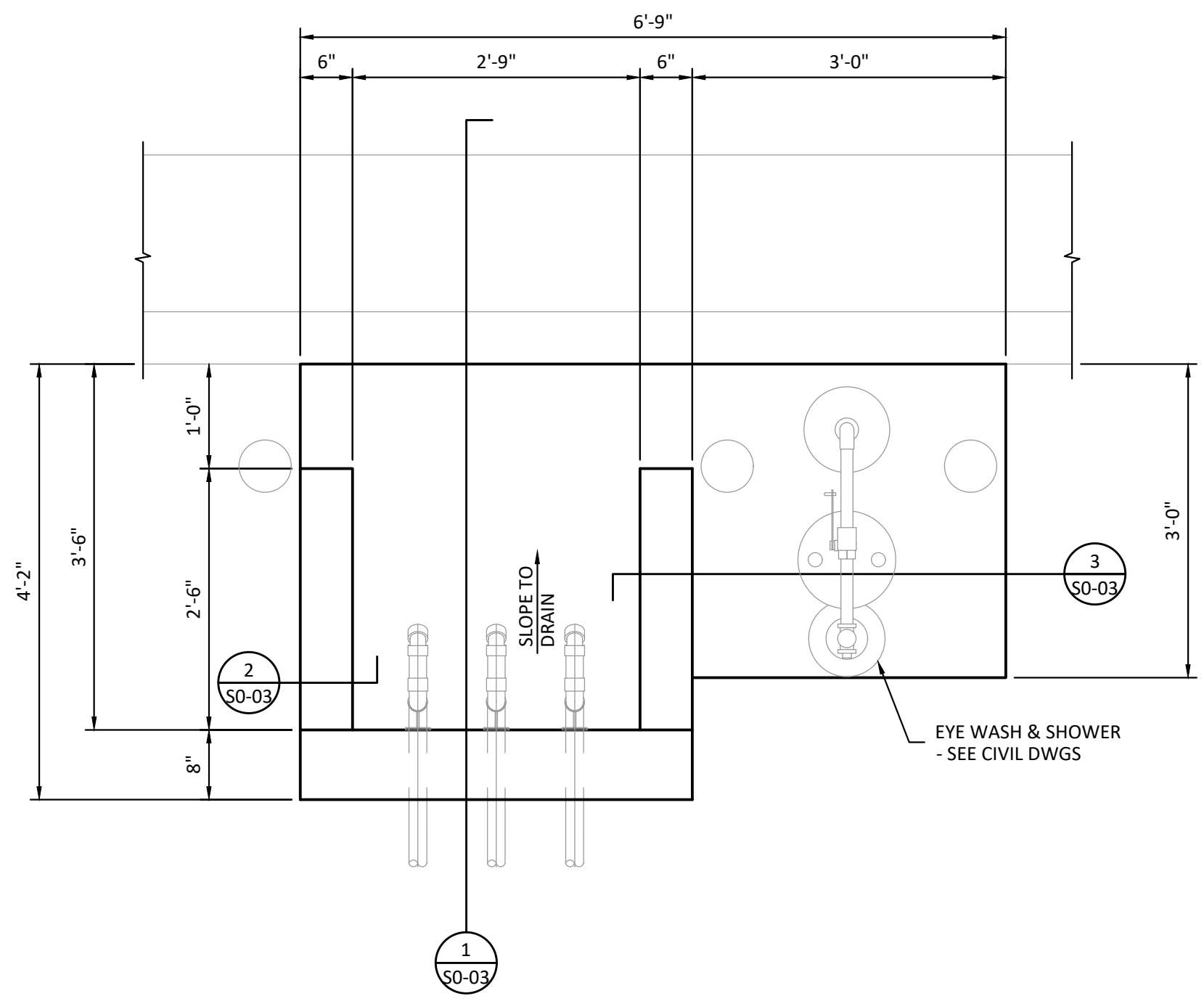
**CONCRETE WALL REINFORCEMENT**  
TYPICAL



**CONCRETE KEYED JOINT**  
TYPICAL

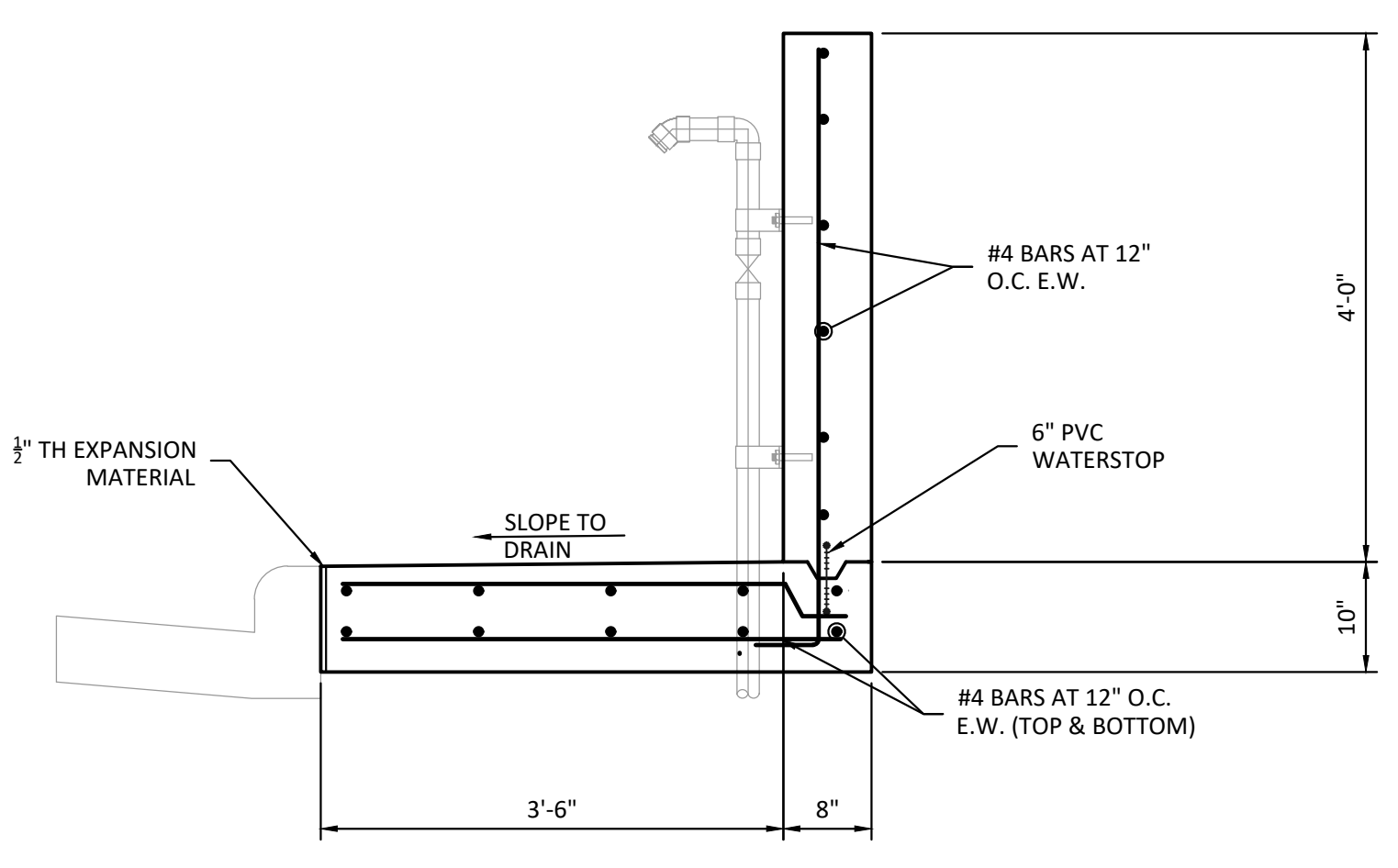


**CONCRETE WALL CONTROL JOINT DETAIL**  
TYPICAL

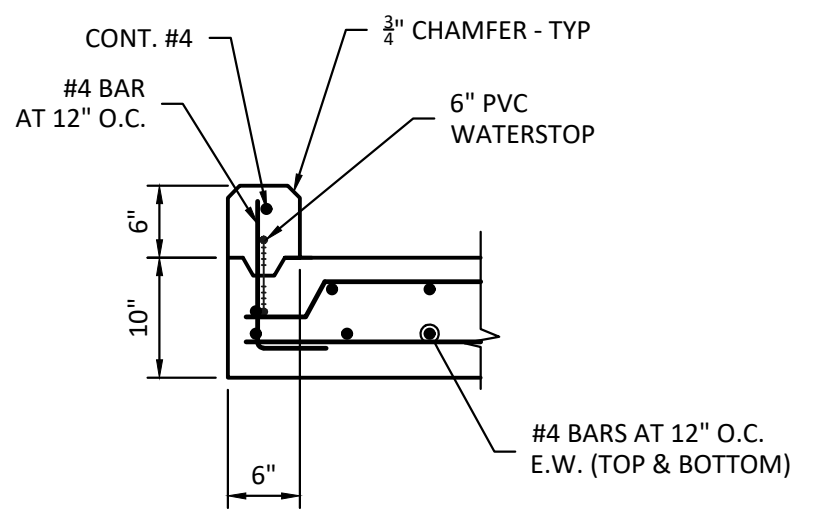


**CHEMICAL FILL STATION FOUNDATION PLAN**

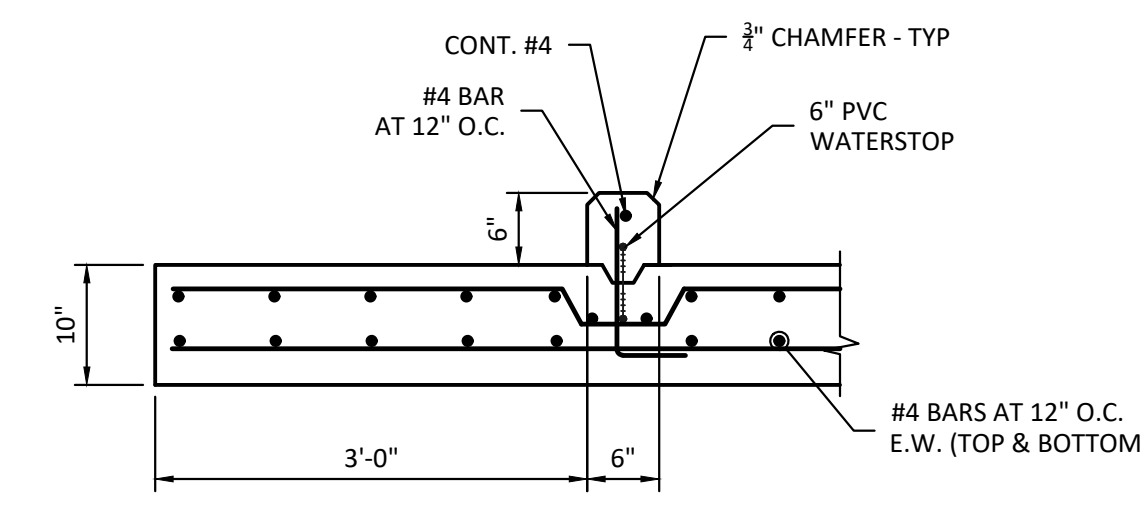
NOTES:  
 1. SEE CIVIL DRAWINGS FOR TOP OF CONCRETE ELEVATIONS.



**SECTION 1**  
S0-03 3/4"=1'-0"

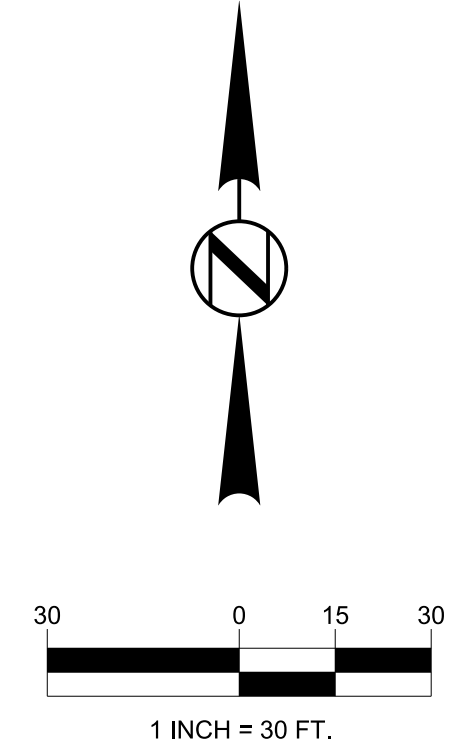
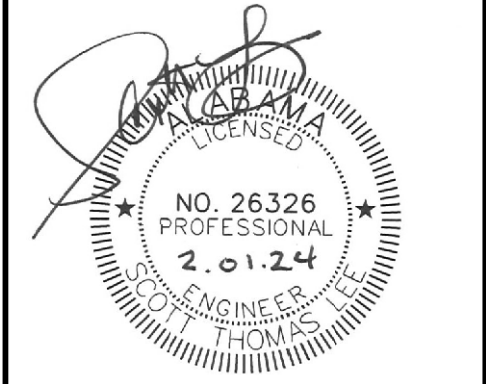


**SECTION 2**  
S0-03 3/4"=1'-0"



**SECTION 3**  
S0-03 3/4"=1'-0"





**APPLY TO ALL DISTURBED AREAS**

DC	DUST CONTROL
TS	TOPSOILING
PSM	PERMANENT SEEDING AND MULCHING

**LEGEND**

PSF	PERIMETER SILT FENCE
SCE	STABILIZED CONSTRUCTION ENTRANCE
TCF	TEMPORARY CONSTRUCTION FENCE

- NOTES:**
- PERMANENT SEEDING AND MULCHING SHALL BE PER ALDOT SPECIFICATIONS FOR ZONE 1.
  - CONTRACTOR SHALL LOCATE STABILIZED CONSTRUCTION ENTRANCE WHERE BEST SUITED FOR WORK SITE ACCESS AND TO PREVENT DISRUPTION OF WTP OPERATION AND DELIVERIES.
  - THE EXISTING SEPTAGE EFFLUENT DISPOSAL FIELD IS SHOWN BASED ON AVAILABLE RECORD DRAWINGS. CONTRACTOR SHALL CONFIRM EXTENT OF DISPOSAL FIELD & INSTALL TEMPORARY CONSTRUCTION FENCE AROUND ENTIRE PERIMETER AS TO NOT DISTURB AREA DURING CONSTRUCTION.

THE CITY OF NORTHPORT UTILITIES  
 NORTHPORT WTP CHEMICAL SYSTEM IMPROVEMENTS  
 NORTHPORT, ALABAMA

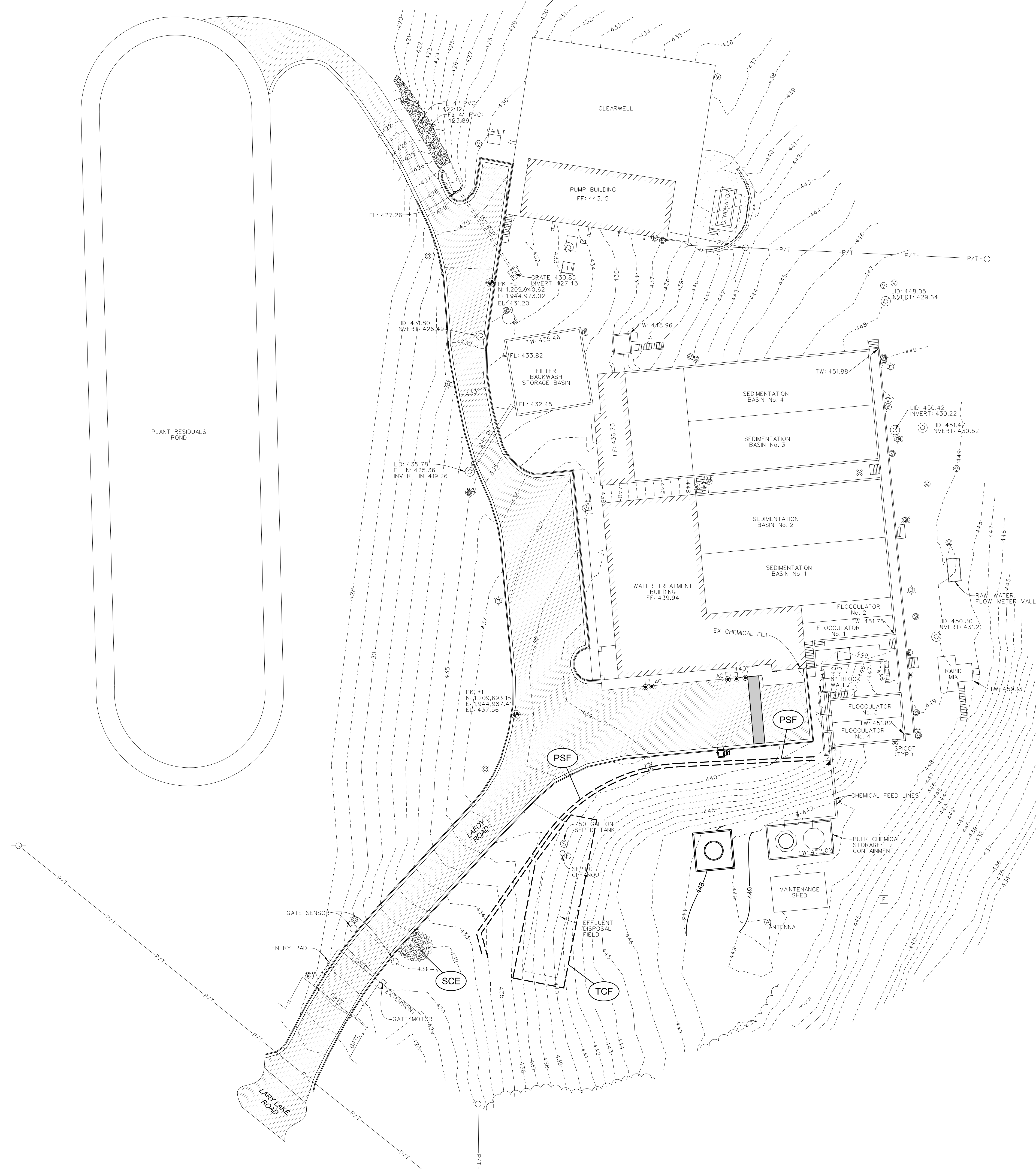


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Sheet Title  
**EROSION CONTROL PLAN**

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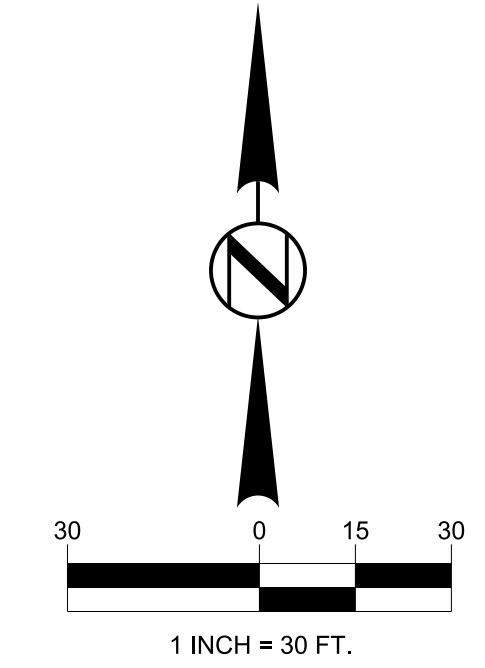
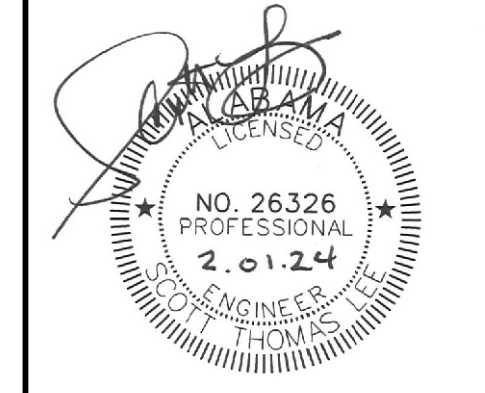


NOTE:  
 THE LOCATION OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE MANNER ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THEIR FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

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**LEGEND**



**THE CITY OF NORTHPORT UTILITIES**  
**NORTHPORT WTP CHEMICAL SYSTEM IMPROVEMENTS**  
**NORTHPORT, ALABAMA**

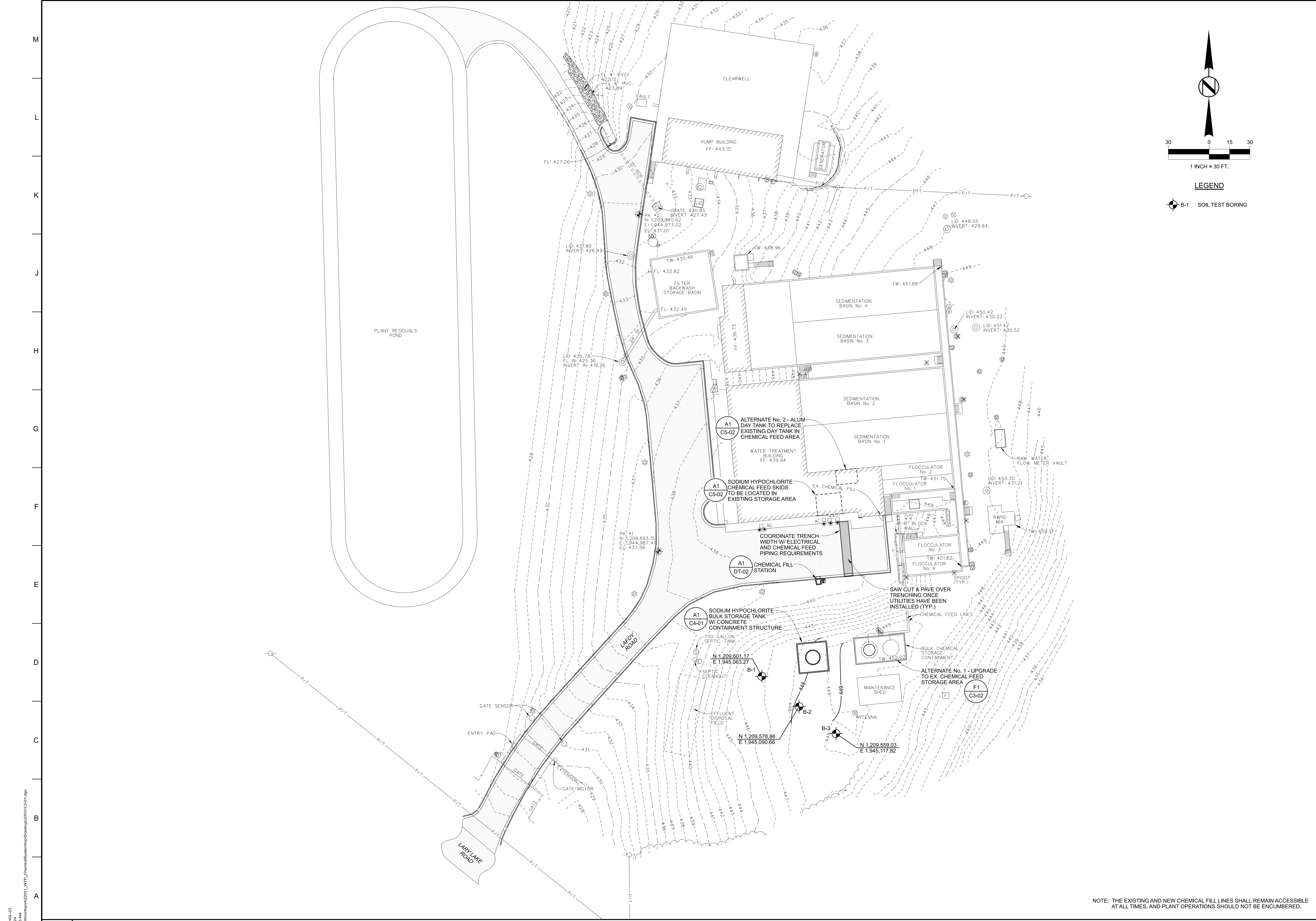


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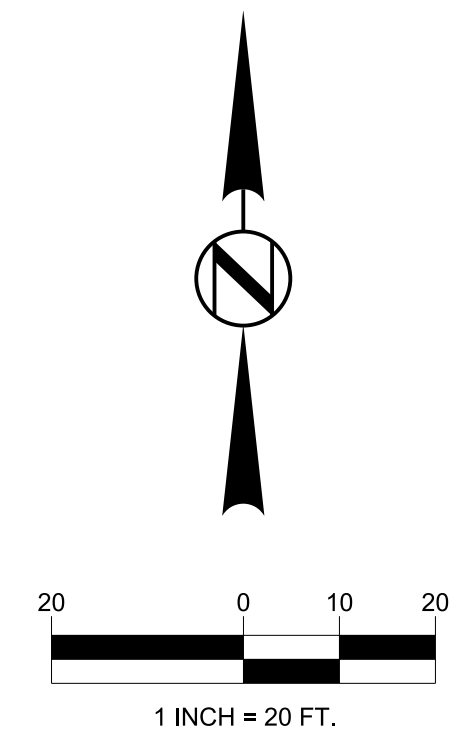
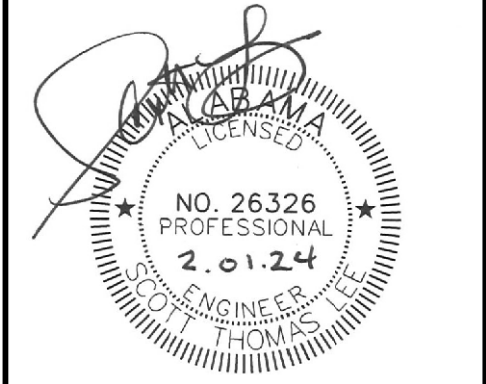
**SITE & GRADING PLAN**

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NOTE: THE EXISTING AND NEW CHEMICAL FILL LINES SHALL REMAIN ACCESSIBLE AT ALL TIMES, AND PLANT OPERATIONS SHOULD NOT BE ENCUMBERED.

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THE CITY OF NORTHPORT UTILITIES  
**NORTHPORT WTP CHEMICAL SYSTEM IMPROVEMENTS**  
 NORTHPORT, ALABAMA

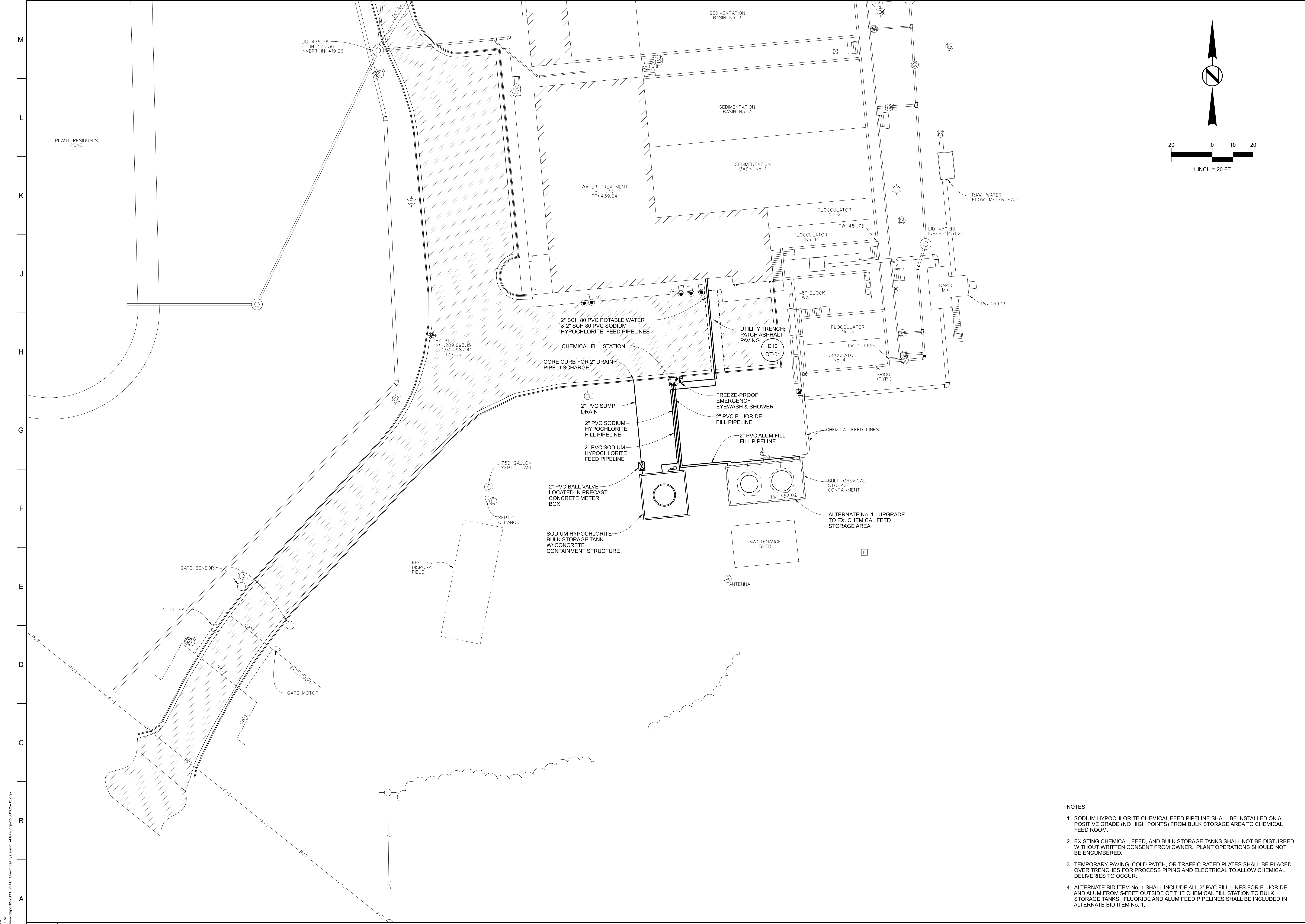


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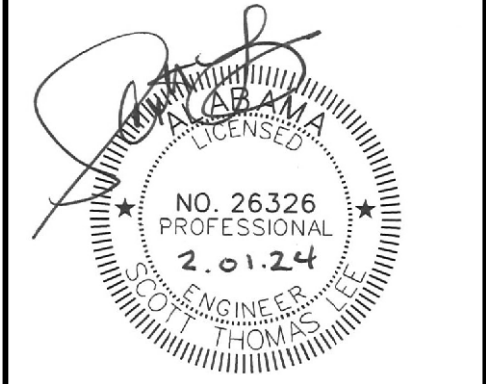
Sheet Title  
**YARD PIPING PLAN**

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- NOTES:
- SODIUM HYPOCHLORITE CHEMICAL FEED PIPELINE SHALL BE INSTALLED ON A POSITIVE GRADE (NO HIGH POINTS) FROM BULK STORAGE AREA TO CHEMICAL FEED ROOM.
  - EXISTING CHEMICAL, FEED, AND BULK STORAGE TANKS SHALL NOT BE DISTURBED WITHOUT WRITTEN CONSENT FROM OWNER. PLANT OPERATIONS SHOULD NOT BE ENCUMBERED.
  - TEMPORARY PAVING, COLD PATCH, OR TRAFFIC RATED PLATES SHALL BE PLACED OVER TRENCHES FOR PROCESS PIPING AND ELECTRICAL TO ALLOW CHEMICAL DELIVERIES TO OCCUR.
  - ALTERNATE BID ITEM No. 1 SHALL INCLUDE ALL 2" PVC FILL LINES FOR FLUORIDE AND ALUM FROM 5-FEET OUTSIDE OF THE CHEMICAL FEED STATION TO BULK STORAGE TANKS. FLUORIDE AND ALUM FEED PIPELINES SHALL BE INCLUDED IN ALTERNATE BID ITEM No. 1.

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NORTHPORT WTP CHEMICAL  
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NORTHPORT, ALABAMA

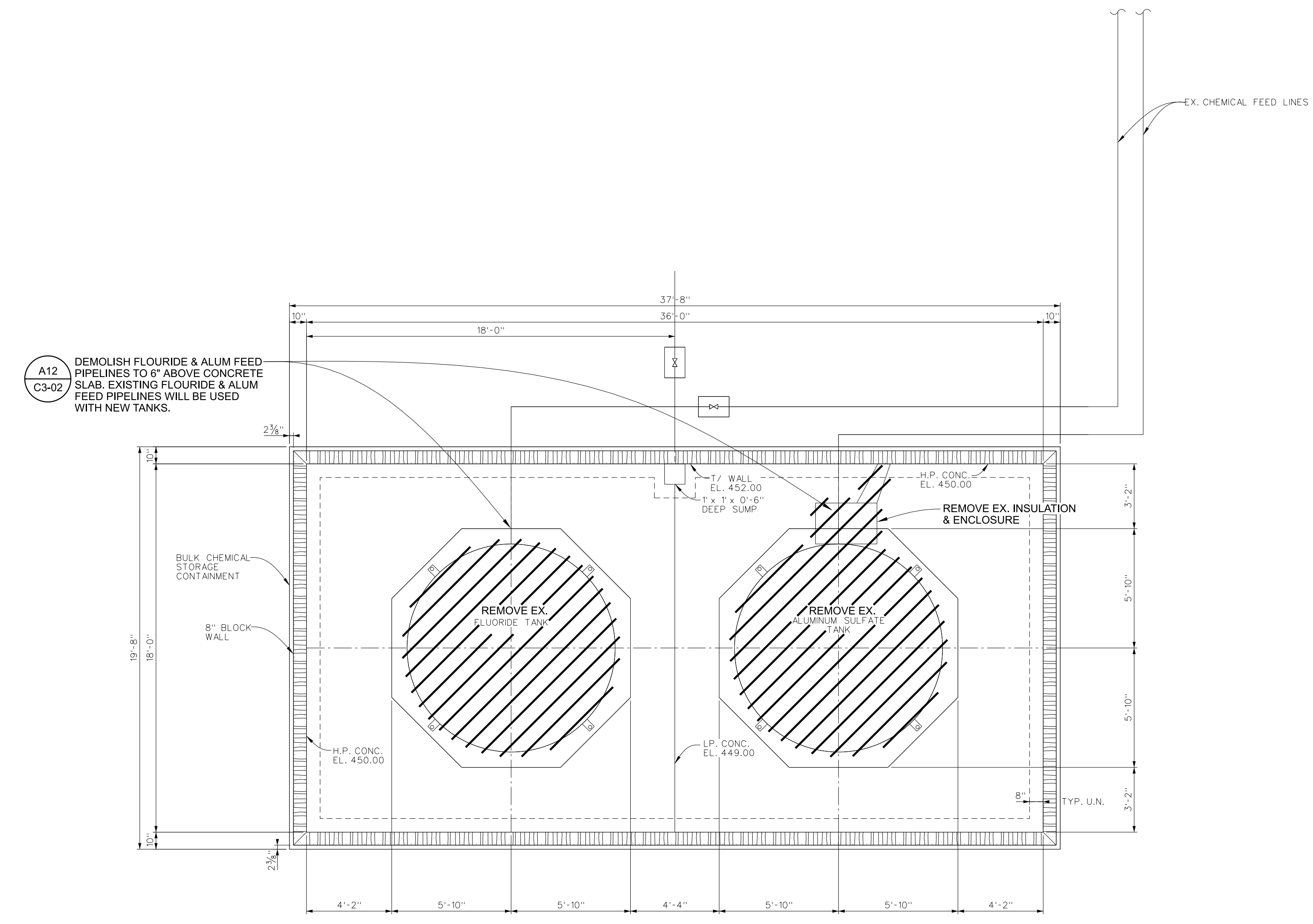
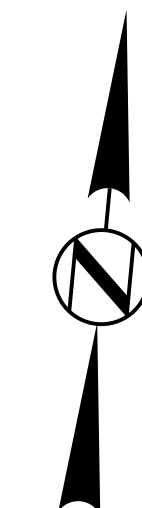


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Sheet Title  
**ALTERNATE No. 1  
EXISTING CHEMICAL  
FEED AREA  
DEMOLITION PLAN**

Issue Date <b>FEB., 2024</b>	Sheet No. <b>C3-01</b>
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**A12**  
**C3-02**  
DEMOLISH FLUORIDE & ALUM FEED PIPELINES TO 6" ABOVE CONCRETE SLAB. EXISTING FLUORIDE & ALUM FEED PIPELINES WILL BE USED WITH NEW TANKS.

- NOTES:
- ALL ABOVE GRADE PIPING SHALL BE REMOVED AND LEGALLY DISPOSED OF OFF SITE. ALL BELOW GRADE PIPING MAY BE ABANDONED IN PLACE UNLESS UNDERNEATH A BUILDING, STRUCTURE, OR SPECIFICALLY INDICATED OTHERWISE ON THE DRAWINGS.
  - ALL EQUIPMENT, CONTROLS, PIPING, HARDWARE, VALVES, APPURTENANCES AND MISCELLANEOUS ITEMS REMOVED UNDER THIS CONTRACT SHALL BE MADE AVAILABLE TO THE OWNER IN GOOD CONDITION. ALL MECHANICAL, CONTROL, AND ELECTRICAL EQUIPMENT ASSOCIATED WITH AN ITEM OR EQUIPMENT SHALL BE KEPT WITH THE ITEM AS A COMPLETE UNIT. SHOULD THE OWNER ELECT NOT TO RETAIN THE DEMOLISHED ITEMS, THE CONTRACTOR SHALL LEGALLY DISPOSE OF IT OFF-SITE AT NO ADDITIONAL COST TO THE OWNER. THE SALVAGED ITEMS SHALL BE PACKAGED AND DELIVERED BY THE CONTRACTOR TO THE OWNER'S FACILITY.
  - DEMOLITION PLANS ARE INTENDED TO SHOW ONLY MAJOR DEMOLITION ITEMS. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DEMOLITION AND/OR REPAIRING OF FACILITIES INCIDENTAL TO THE WORK.
  - DIMENSIONS ARE APPROXIMATE, CONTRACTOR TO FIELD VERIFY PRIOR TO BID AND CONSTRUCTION.
  - CONTRACTOR IS RESPONSIBLE FOR COORDINATING AND SCHEDULING ALL WORK SO THAT THE WTP REMAINS IN OPERATION. CONTRACTOR IS RESPONSIBLE FOR COORDINATING ALL NECESSARY WTP OUTAGES PER THE CONTRACT REQUIREMENTS. CONTRACTOR IS RESPONSIBLE FOR PERFORMING ALL NECESSARY BYPASS PUMPING. THIS INCLUDES BUT IS NOT LIMITED TO: PROVIDING ALL THE NECESSARY PIPING, PUMPS, AND MISCELLANEOUS APPURTENANCES REQUIRED FOR ANY BYPASS PUMPING PROCEDURES.
  - DEMOLITION TO INCLUDE REMOVAL OF SUPPORTS AND ANCHOR BOLTS. GRIND ALL EMBEDDED ANCHOR TO A MINIMUM 1/2" BELOW TOP OF CONCRETE AND PATCH WITH NON-SHRINK GROUT.
  - FLUORIDE TANK SHALL BE DEMOLISHED PRIOR TO NEW TANK INSTALLATION. THE OWNER WILL STOP FLUORIDE ADDITION DURING THE CONSTRUCTION PERIOD. TEMPORARY FLUORIDE FACILITIES ARE NOT REQUIRED. OWNER WILL PLAN TO USE STORED FLUORIDE TO THE GREATEST EXTENT POSSIBLE.
  - THE OWNER WILL PROVIDE TEMPORARY ALUM STORAGE WHILE THE ALUM TANK IS BEING REPLACED. CONTRACTOR IS RESPONSIBLE FOR SCHEDULING TIME AND DURATION WITH THE OWNER FOR TEMPORARY CHEMICAL FEED.

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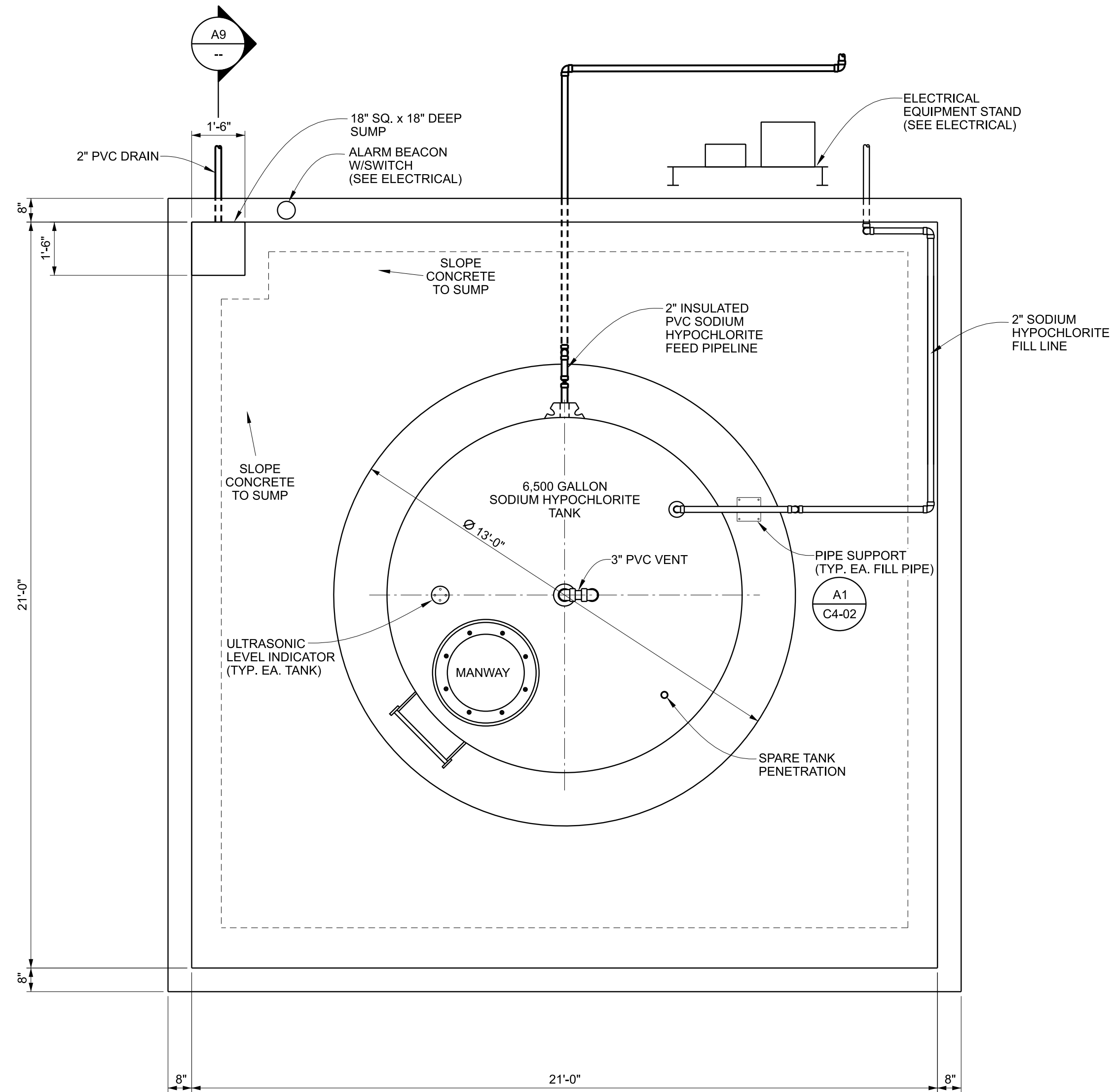


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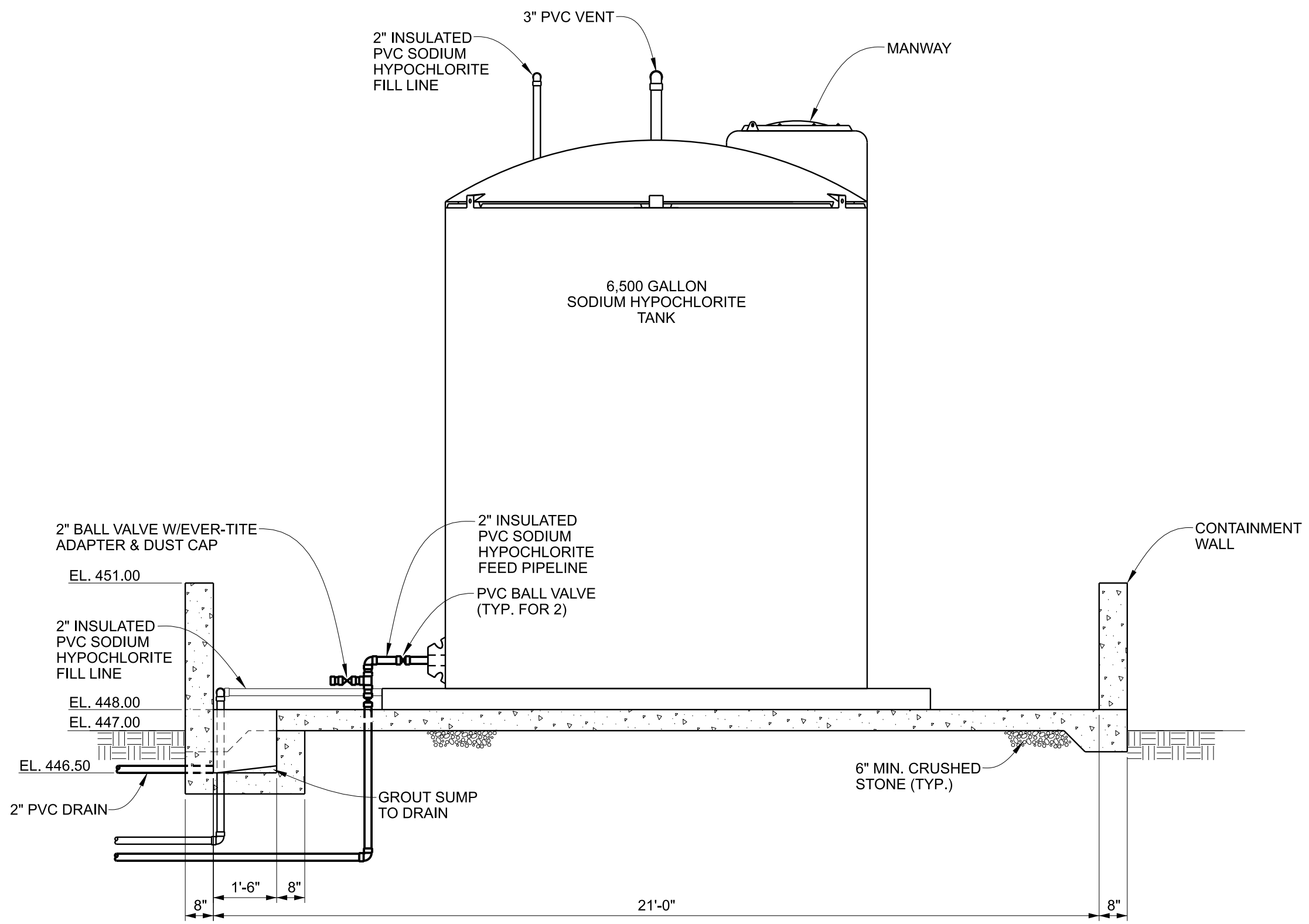
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Sheet Title  
**CHEMICAL STORAGE  
PLAN & SECTION**

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- NOTES:
- CONCRETE CHEMICAL STORAGE AREA FLOOR TO HAVE A TROWEL FINISH.
  - ALL EXPOSED CHEMICAL FEED & POTABLE WATER LINES SHALL BE HEAT TRACED & INSULATED.



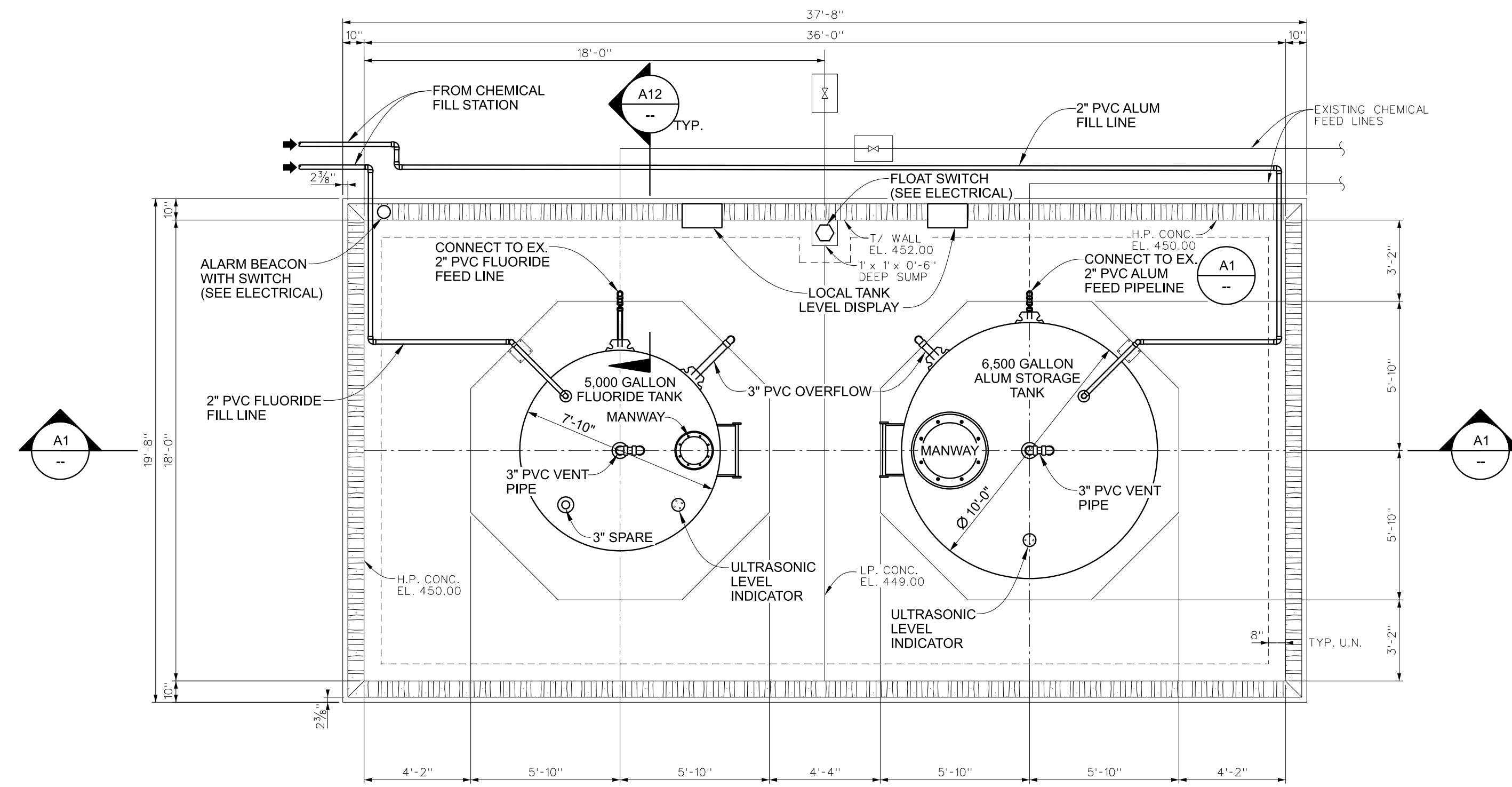
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A1 PLAN 3/8" = 1'-0"

A9 SECTION 3/8" = 1'-0"

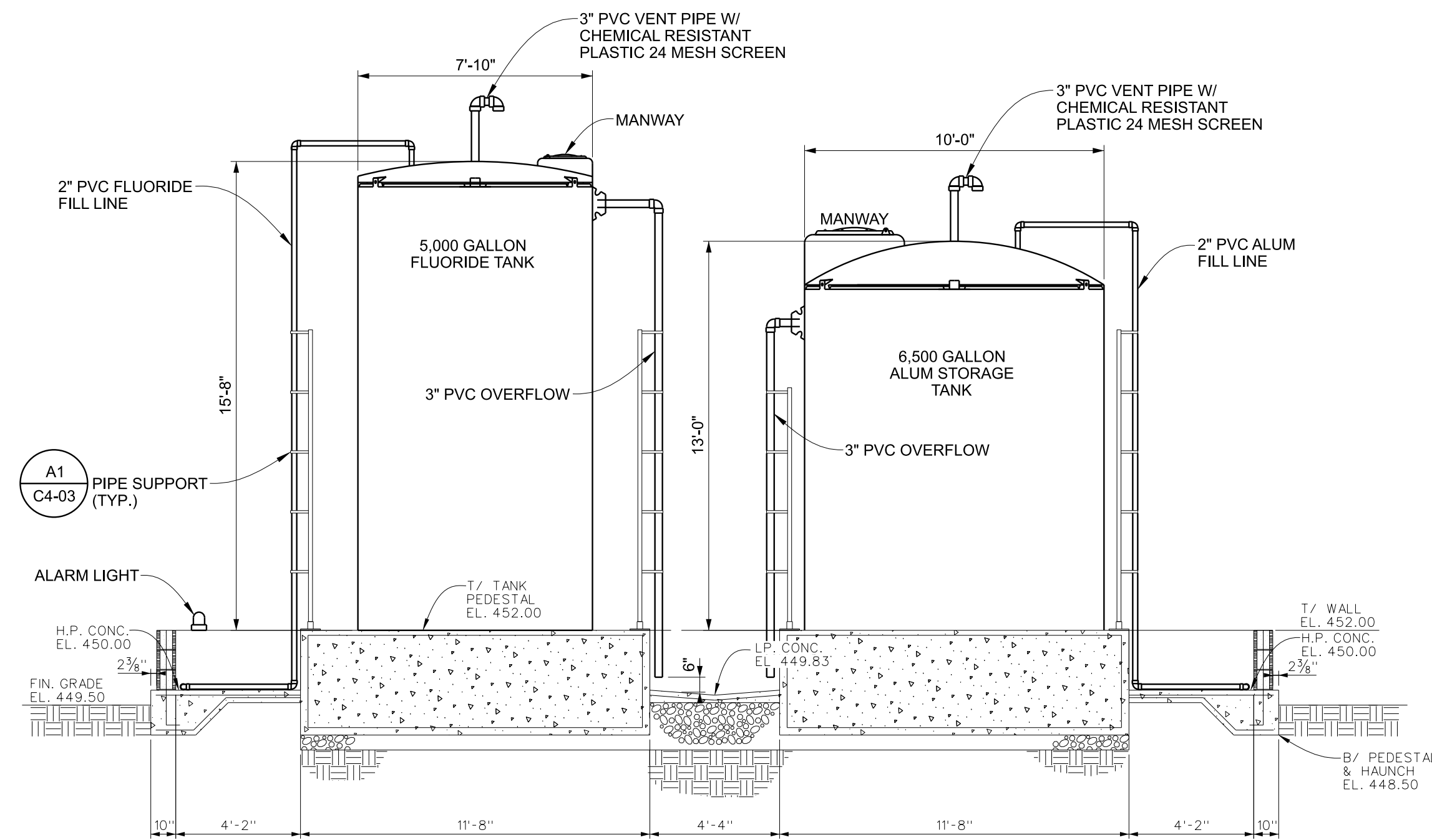


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NORTHPORT, ALABAMA



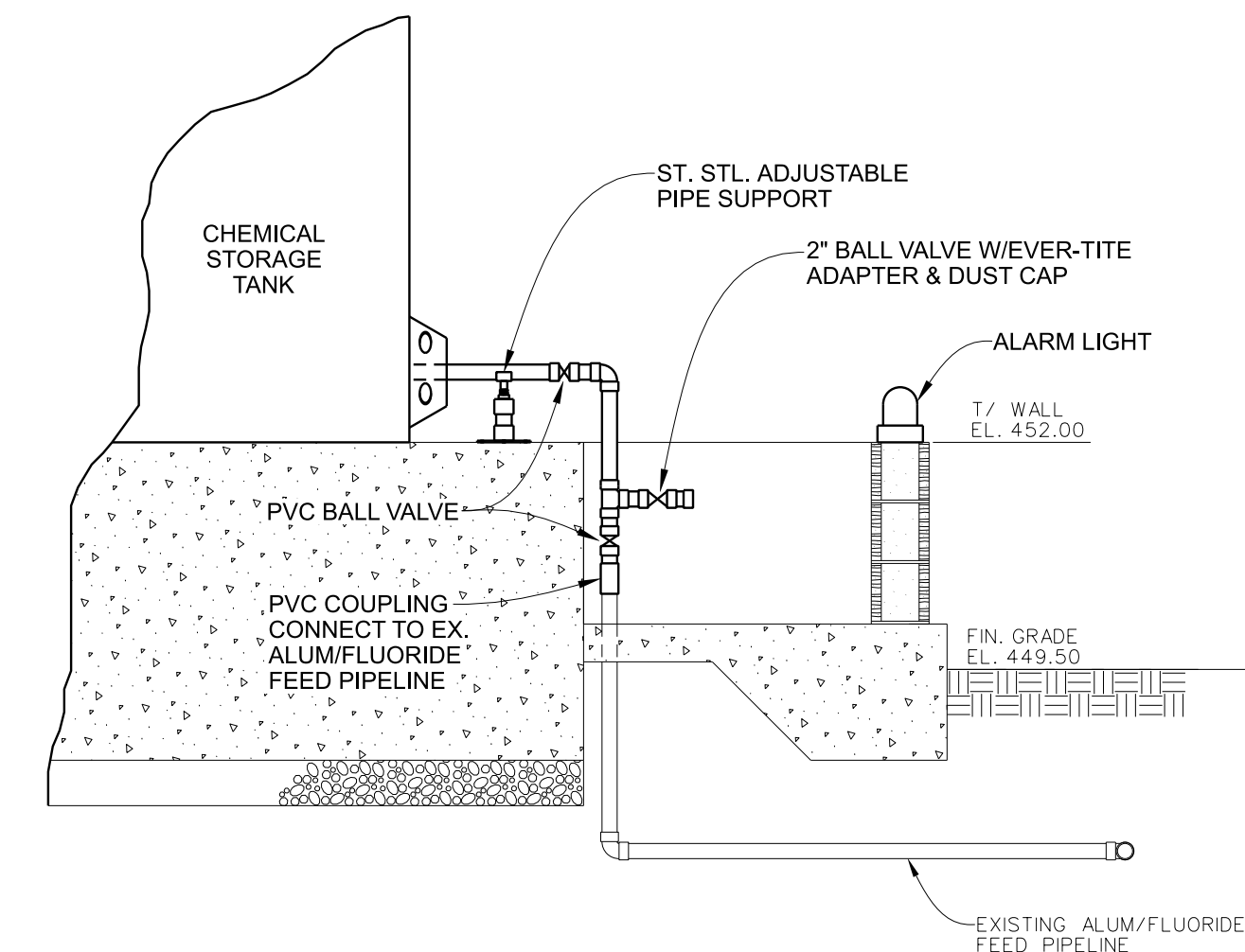
- NOTES:
- PLACE THREE (3) LAYERS OF FELT BETWEEN TANK AND CONCRETE.
  - CORE EX. CMU CONTAINMENT WALL FOR FLUORIDE & ALUM FILL PIPELINES. SEAL W/ NON-SHRINK GROUT.
  - ALL PIPES SHALL BE SUPPORTED WITH PIPE SUPPORT STAND OR FROM TANK WHEN SUPPORTS ARE INCLUDED FROM TANK MANUFACTURER.

F1 PLAN 1/4" = 1'-0"



- NOTES:
- TANKS SHOWN OUT OF ROTATION FOR CLARITY.
  - OVERFLOW PIPING SHALL BE INSTALLED SUCH THAT THE PIPING DOES NOT MAKE CONTACT WITH CONCRETE.
  - ALL PIPES SHALL BE SUPPORTED WITH PIPE SUPPORT STAND OR FROM TANK WHEN SUPPORTS ARE INCLUDED FROM TANK MANUFACTURER.

A1 SECTION 1/4" = 1'-0"



NOTE: ALUM FEED PIPELINE SHALL BE INSULATED FROM BULK STORAGE TANK TO FLOOR PENETRATION.

A12 SECTION (TYP.) 1/2" = 1'-0"



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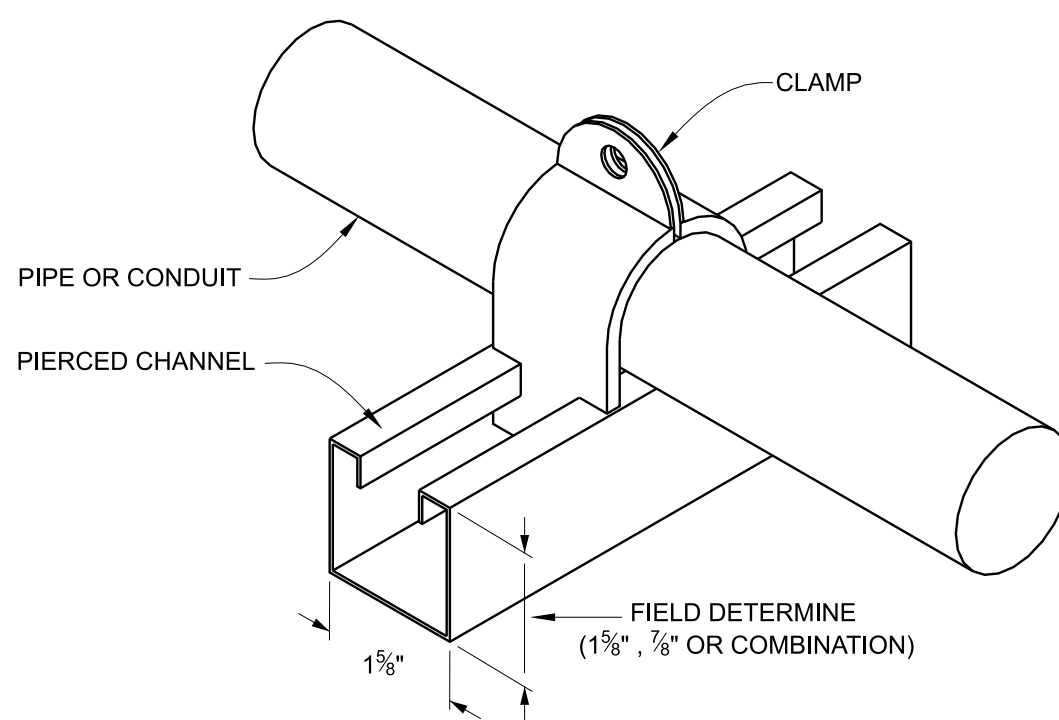
Sheet Title  
**ALTERNATE NO. 1  
EXISTING CHEMICAL  
FEED AREA  
IMPROVEMENTS  
PLAN & SECTION**

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PVC PIPE GENERAL INSTALLATION NOTES & REQUIREMENTS:

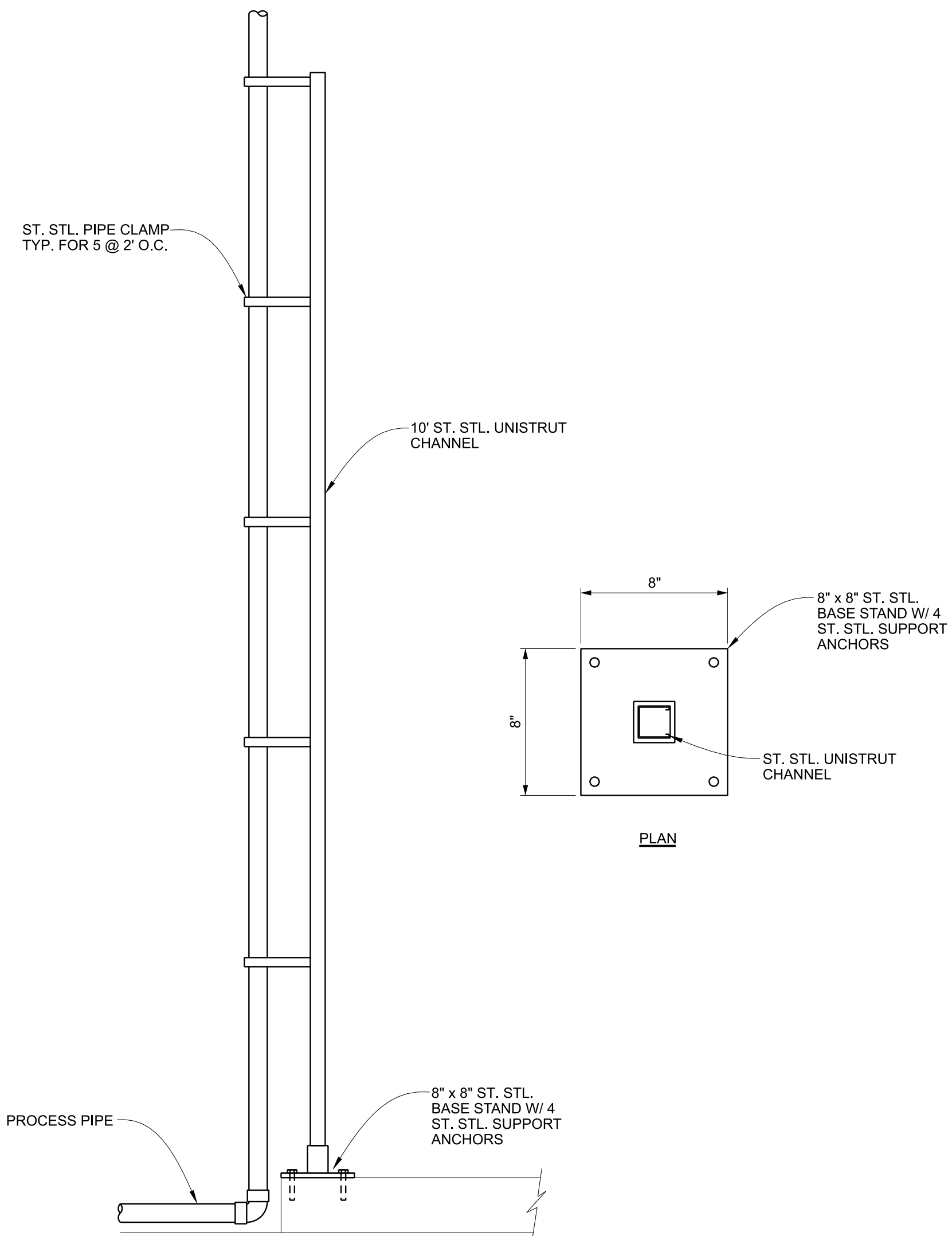
1. ALL VALVE CONNECTORS AND CONNECTING PIPE SHALL BE INSPECTED FOR ANY BREAKAGE, CHIPPING, GOUGING OR OTHER DAMAGE PRIOR TO INSTALLATION.
2. ALL BALL VALVES SHALL BE SCH. 80 PVC WITH TRUE UNION END CONNECTIONS.
3. ALL COMPONENTS SHALL BE REMOVED FROM PACKAGING AND EXPOSED TO THE ENVIRONMENT FOR A MINIMUM OF ONE (1) HOUR PRIOR TO INSTALLATION.
4. ALL COMPONENTS MUST BE CLEAN AND DRY PRIOR TO JOINING AND INSTALLATION MAY OCCUR AT TEMPERATURES BETWEEN 40°F AND 110°F.
5. ALL VALVES MUST BE INSTALLED IN THE OPEN POSITION TO ALLOW SOLVENT VAPORS TO EVAPORATE.
6. NO PRIMER OR SOLVENT CEMENT SHOULD CONTACT ANY INTERNAL VALVE COMPONENTS.
7. UNION NUTS AND END CONNECTORS FOR TRUE UNION VALVES MUST BE REMOVED PRIOR TO APPLICATION OF PRIMER AND CEMENT TO CONNECTIONS. CONNECTIONS MUST BE FULLY CURED PRIOR TO REINSTALLATION OF THE NUTS AND END CONNECTORS.
8. SOLVENT WELD JOINTS SHOULD BE MADE PER THE MANUFACTURERS WRITTEN INSTRUCTIONS WITH AN APPROPRIATE PRIMER, SOLVENT CEMENT AND CLEAN-UP SOLVENT. PIPE ENDS MUST BE SQUARE CUT AND ENDS MUST BE BEVELED AND DEBURRED PRIOR TO CONNECTING.
9. THREADED CONNECTIONS, IF NECESSARY, SHALL BE MADE PER THE MANUFACTURERS WRITTEN INSTRUCTIONS WITH AN APPROPRIATE THREAD SEALANT.
10. FLANGED CONNECTIONS SHALL BE MADE USING ONE-PIECE FLANGES. ONE-PIECE FLANGES SHALL BE ALIGNED PRIOR TO INSTALLATION OF THE PIPE. AVOID BENDING THE FLANGE WHEN TIGHTENING.
11. ALL WATER PIPING SHALL BE LABELED IN ACCORDANCE WITH SPECIFICATION.
12. ALL PIPING SHALL BE SUPPORTED INDEPENDENTLY OF THE TANK. FLEXIBLE EXPANSION JOINTS ARE REQUIRED AT ALL PIPE CONNECTIONS TO THE TANK.
13. ALL EXPOSED CHEMICAL FEED, CHEMICAL FILL, AND POTABLE WATER PIPING SHALL BE INSULATED.
14. ALL CHEMICAL FILL & FEED PIPING SHALL BE LABELED WITH THEIR RESPECTIVE NAME & FLOW DIRECTION AS DEPICTED IN THE CONSTRUCTION DOCUMENTS.

J6 PVC PIPING NOTES NO SCALE



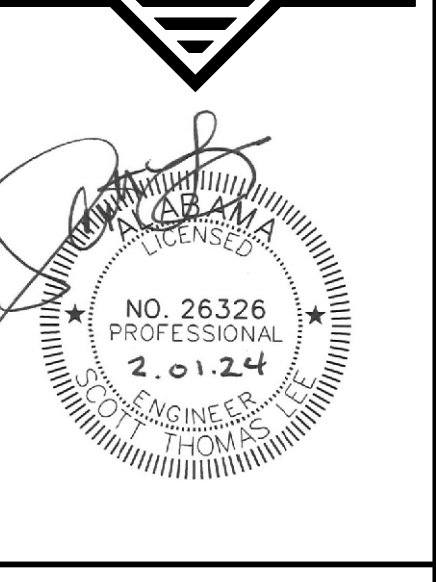
1. PIPE SUPPORT SHALL BE ST. STL. PIERCED CHANNEL, 12 GAUGE. PROVIDE COMBINATIONS IF REQUIRED FOR TOLERANCES.
2. SPACING OF PIPE SUPPORTS SHALL BE AS INDICATED ON THE DRAWINGS OR PER MANUFACTURERS REFERENCE DATA FOR EACH APPLICATION, WHICHEVER REQUIRES THE MINIMUM SPACING.
3. CLAMPS SHALL BE ST. STL. W/ MINIMUM 1/2" BOLT, LOCK-WASHER AND NUT.

E6 PIPE SUPPORT NO SCALE



A1 PIPE SUPPORT DETAIL NO SCALE

**KREBS**  
ENGINEERING



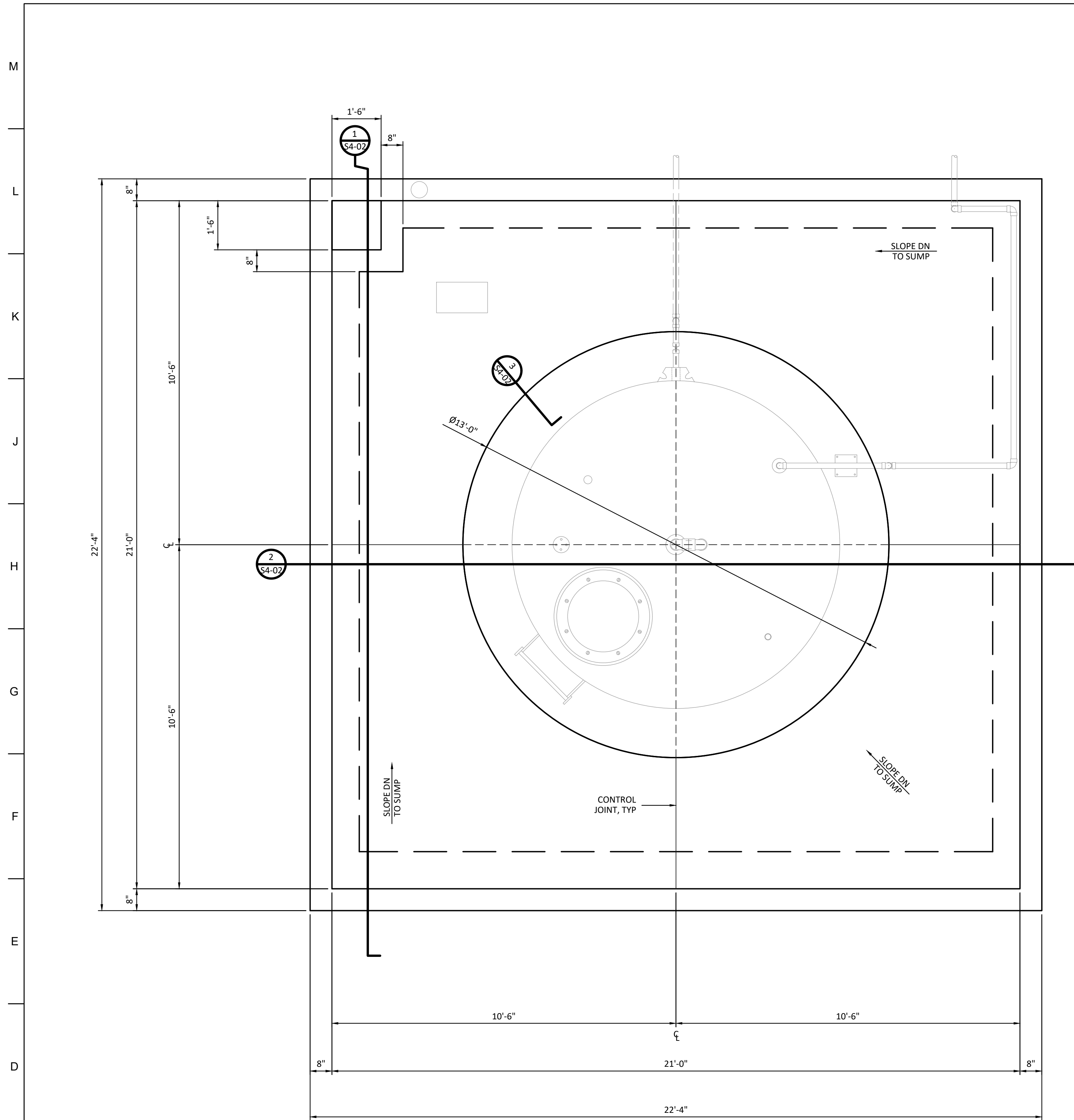
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NORTHPORT WTP CHEMICAL  
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NORTHPORT, ALABAMA



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Sheet Title <b>CHEMICAL BULK STORAGE DETAILS</b>	
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**PLAN AT TOC EL 448.00'**

- NOTES: 1/2" = 1'-0"
1. FINISHED FLOOR (TOP OF SLAB): AS NOTED ON PLAN.
  2. FOR SLAB-ON-GRADE CONSTRUCTION, SEE GENERAL NOTES.
  3. SEE GENERAL NOTES AND TYPICAL DETAILS FOR CONTROL JOINT REQUIREMENTS.

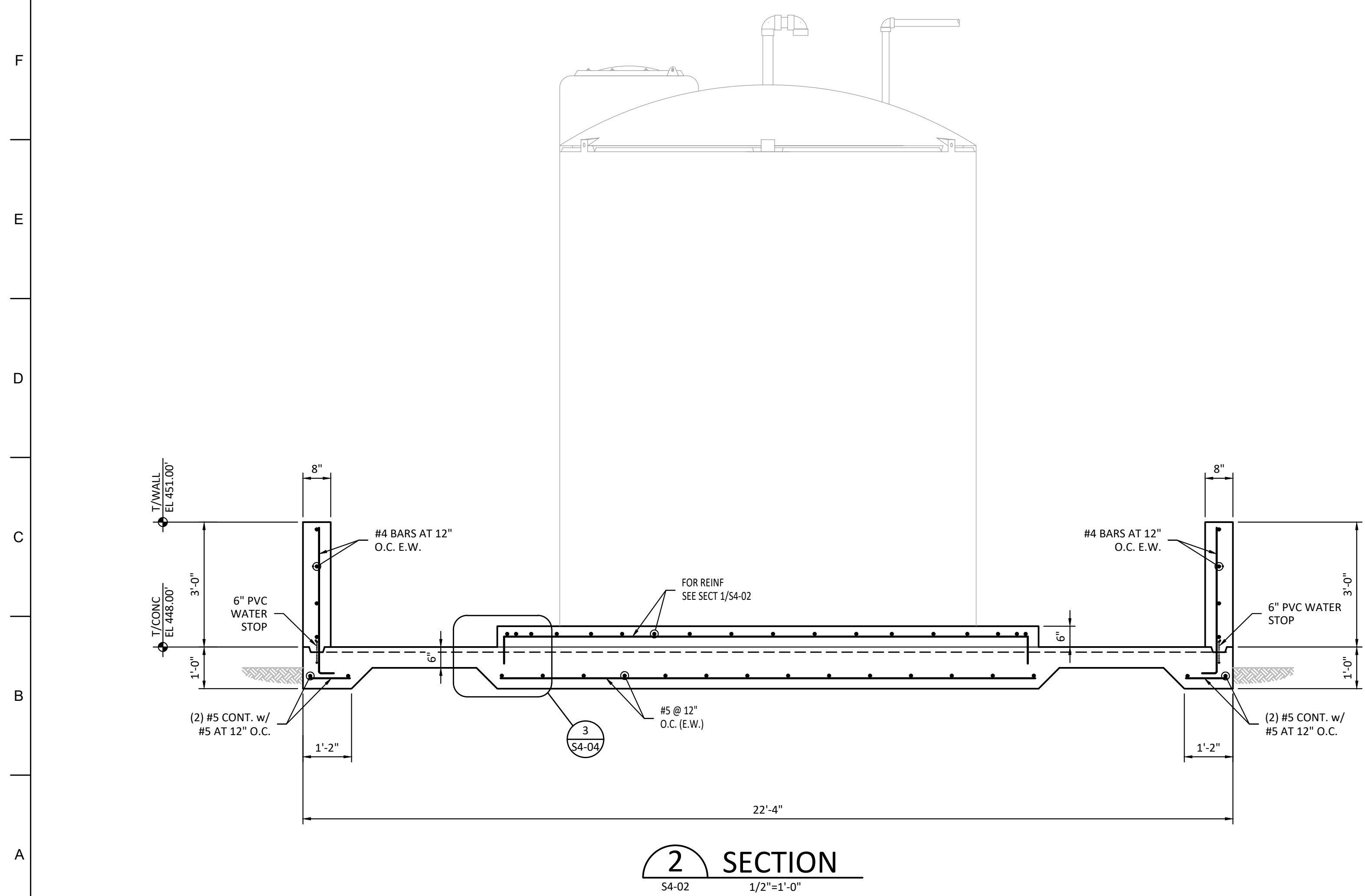
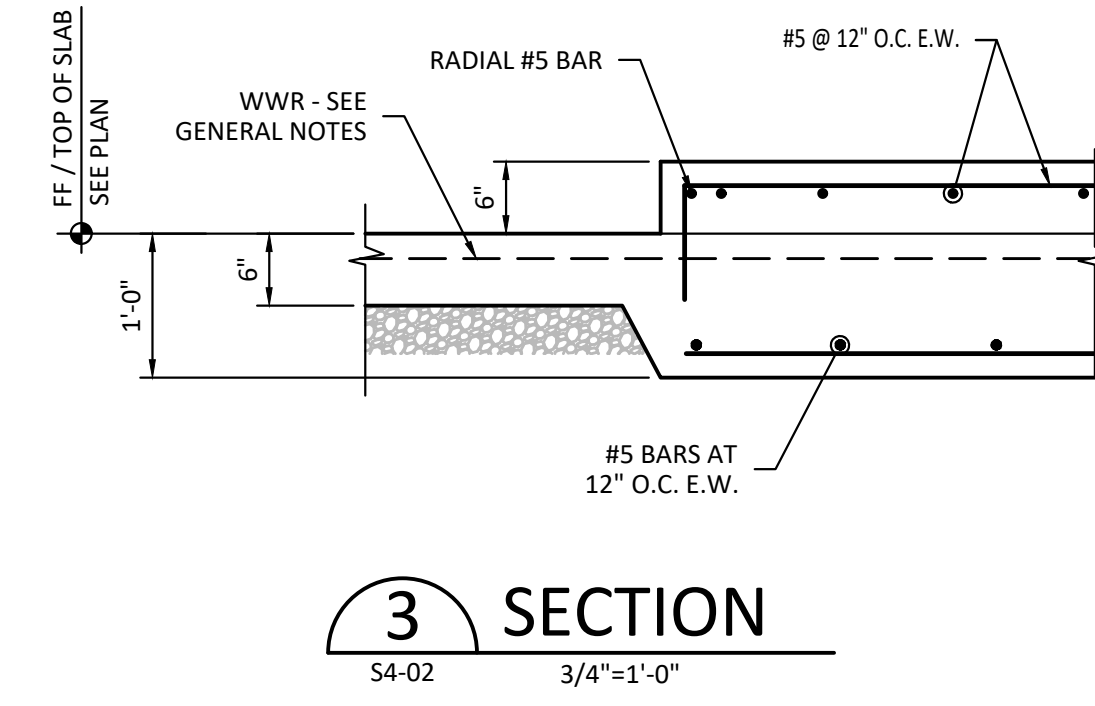
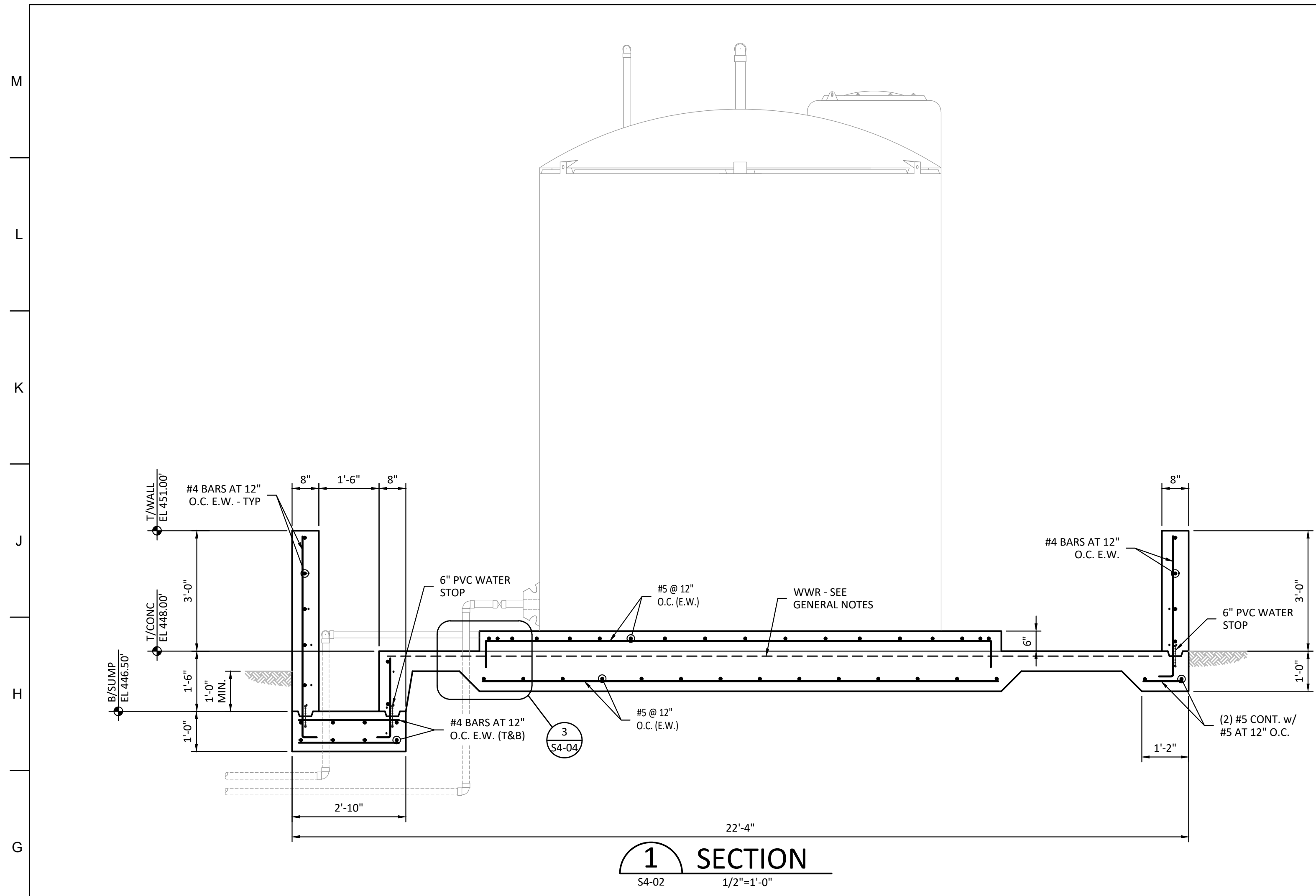


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Sheet Title  
**STRUCTURAL FOUNDATION PLAN**

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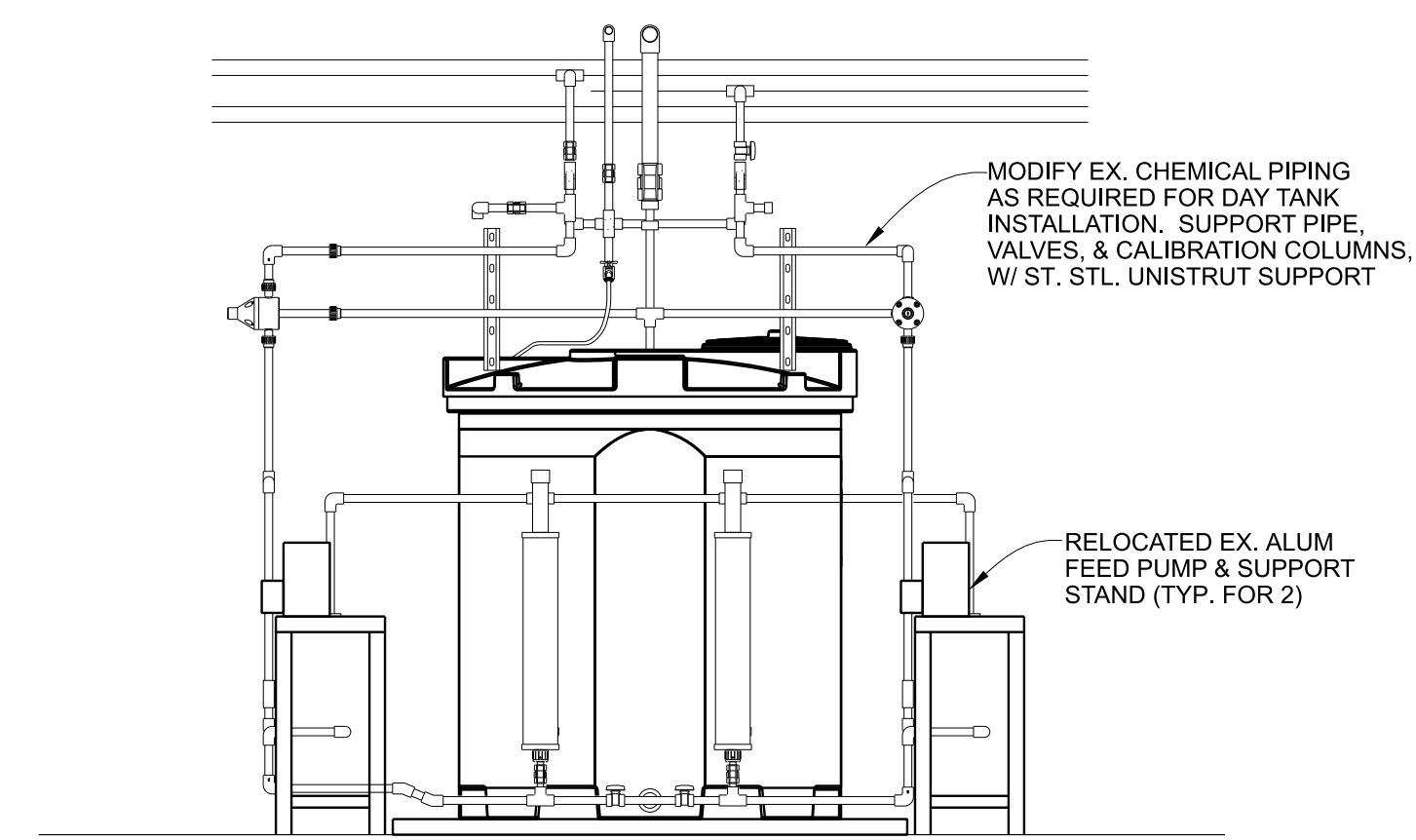
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Sheet Title  
**STRUCTURAL SECTIONS**

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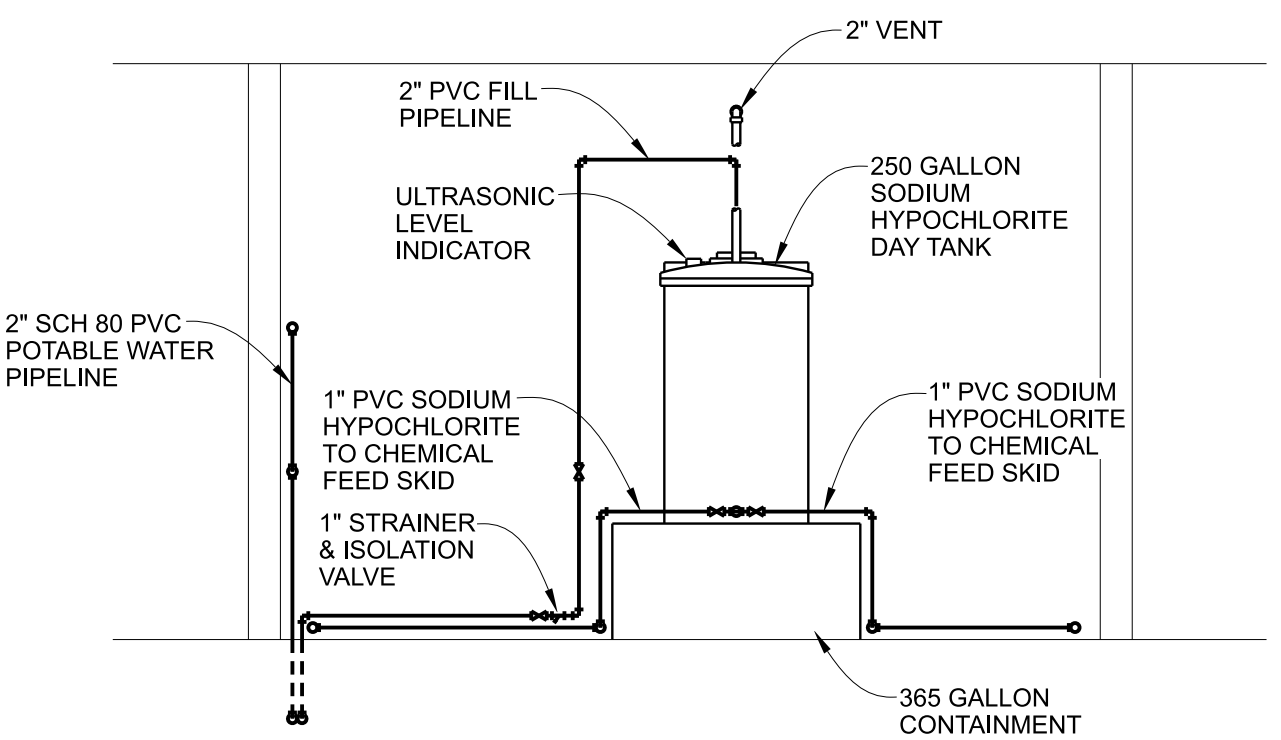






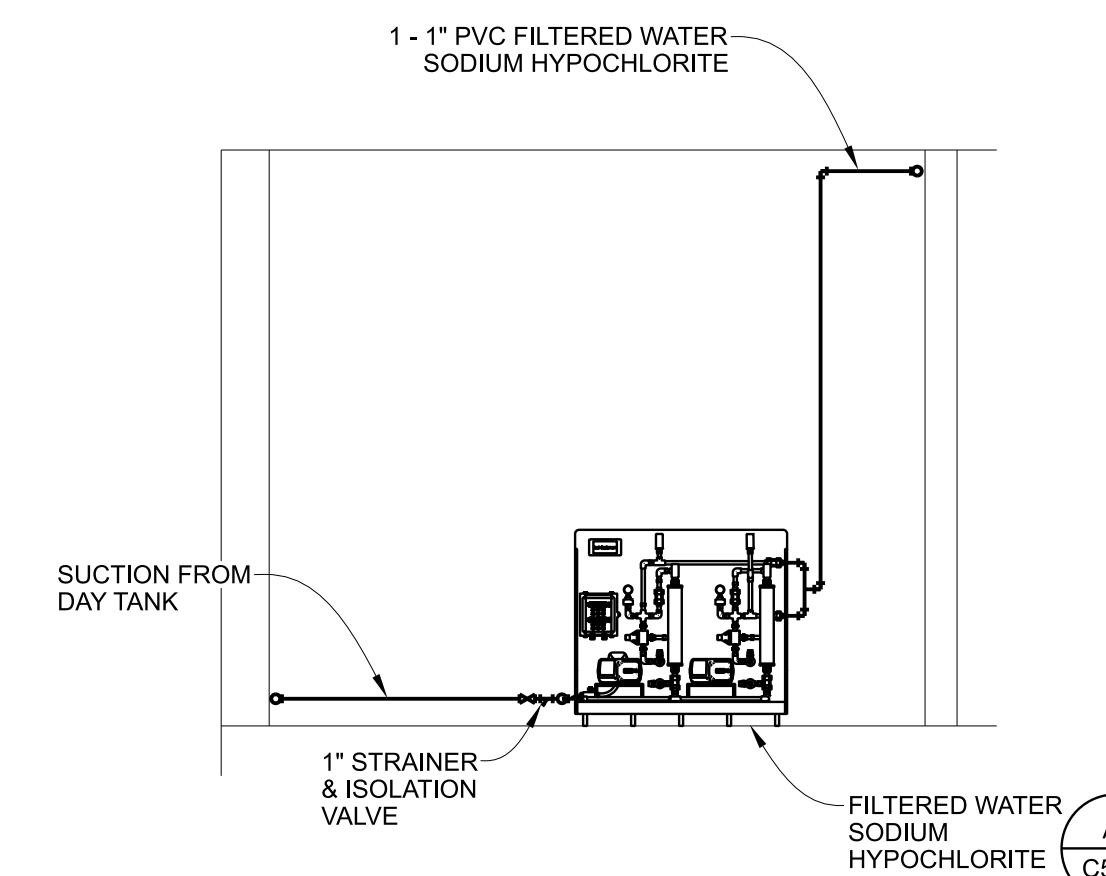
1/2" = 1'-0"

**K12 SECTION (ALTERNATE BID ITEM No. 2)**



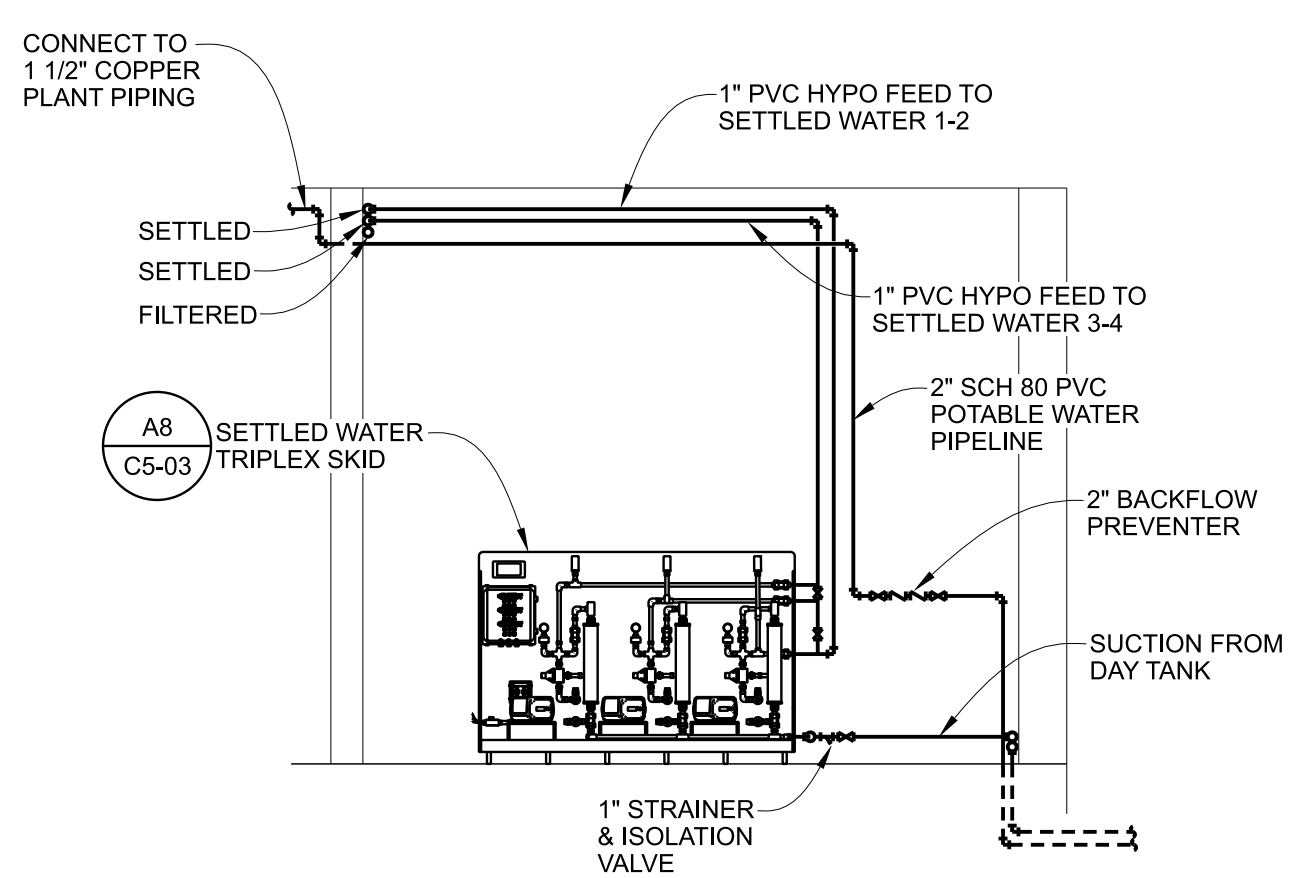
1/4" = 1'-0"

**G12 SECTION**



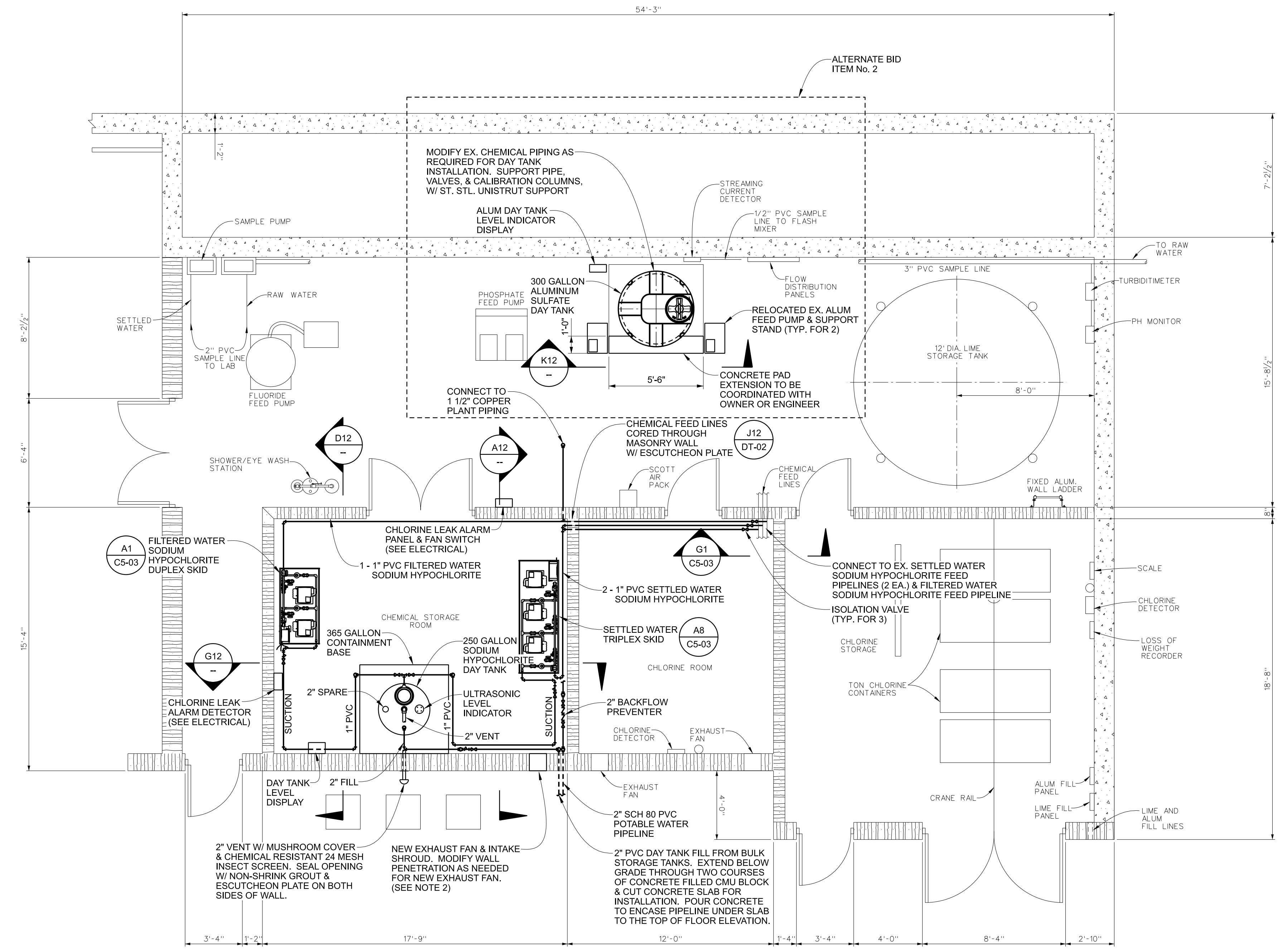
1/4" = 1'-0"

**D12 SECTION**



1/4" = 1'-0"

**A12 SECTION**



- NOTES:**
- CORE DRILL EXTERIOR WALL FOR 2 INCH VENT FROM DAY TANK. VENT SHALL EXTEND 1 FOOT OUTSIDE WALL AND HAVE 45° BEND W/ CHEMICAL RESISTANT 24 MESH SCREEN & RETAINER CAP.
  - BASIS OF DESIGN FOR REPLACEMENT EXHAUST FAN: CENTRI MASTER MODEL FX110, 1/12 HP, 810 CFM, AASV, SINGLE PHASE. FAN BLADE MATERIAL SHALL BE COMPATIBLE W/SODIUM HYPOCHLORITE STORAGE AREA.
  - COORDINATE INSTALLATION OF NEW ALUMINUM SULFATE DAY TANK W/ OWNER AND PLANT OPERATOR. OWNER WILL PROVIDE TOTES AND CONNECTION TO EXISTING CHEMICAL FEED PUMPS FOR TEMPORARY SERVICE WHILE WORK IS BEING PERFORMED. CONTRACTOR SHALL KEEP ONE ALUM FEED PUMP AVAILABLE FOR SERVICE AT ALL TIMES.

**A1 PLAN**

1/4" = 1'-0"

**THE CITY OF NORTHPORT UTILITIES**  
**NORTHPORT WTP CHEMICAL SYSTEM IMPROVEMENTS**  
**NORTHPORT, ALABAMA**



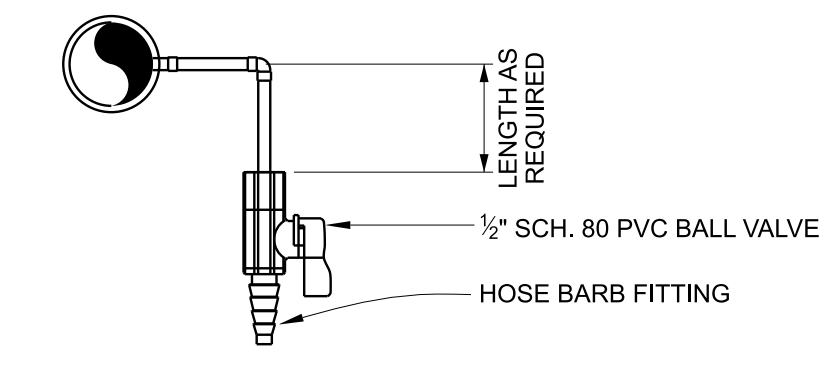
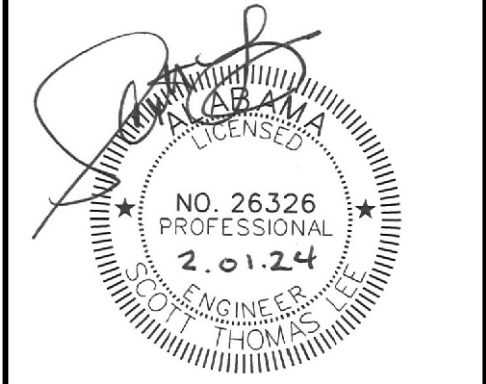
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Drawn	CLM		
Checked	JAD		
Revisions			
No.	Date	Description	

Sheet Title	EXISTING BUILDING IMPROVEMENTS PLAN & SECTIONS
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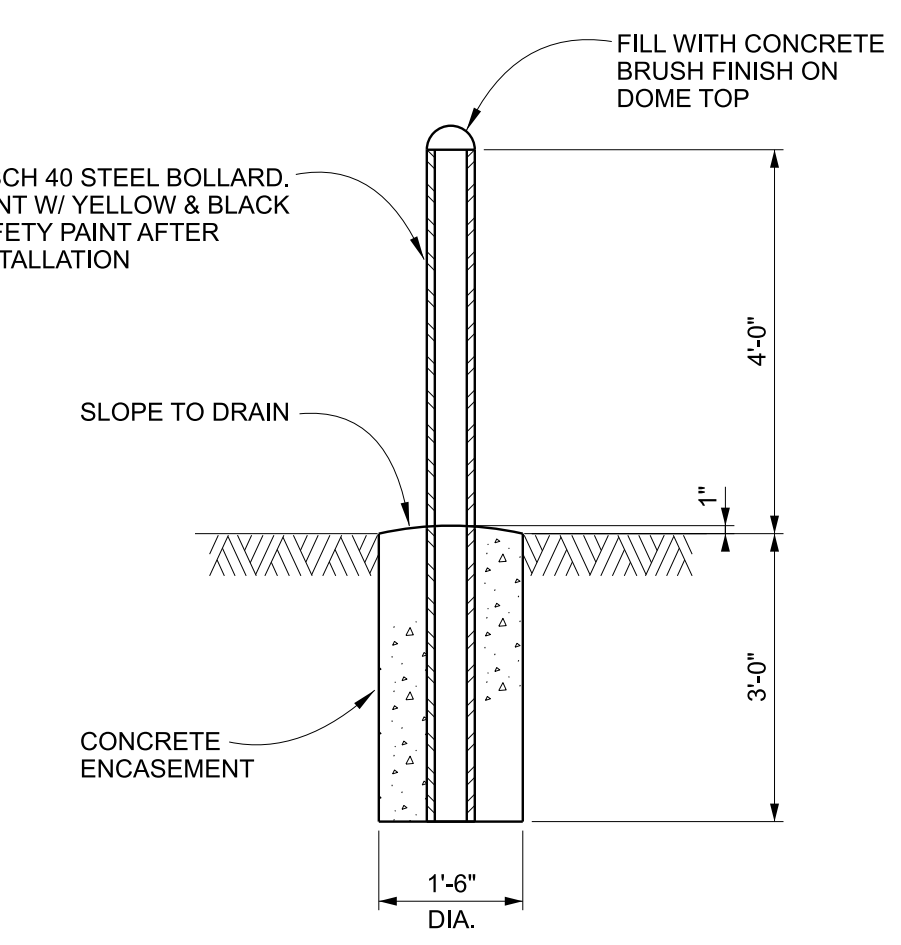
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- NOTES:
1. PROVIDE PIPE SUPPORTS AS REQUIRED FOR A UNIFORM, RIGID INSTALLATION.
  2. BALL VALVE FOR HYPOCHLORITE SHALL BE VENTED PORT.

**K13 SAMPLE TAP** NO SCALE

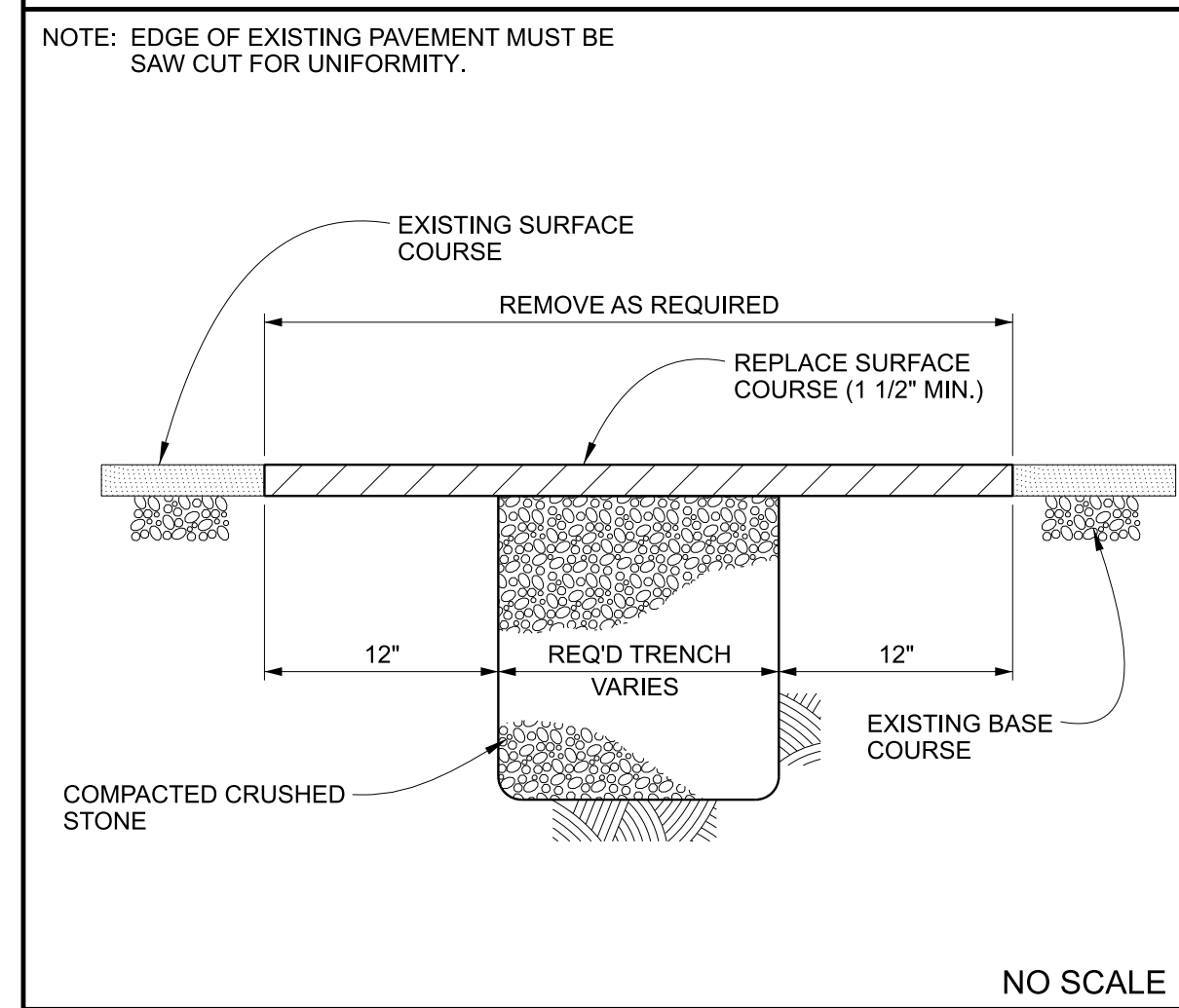


**G13 BOLLARD DETAIL** 1/2"=1'-0"

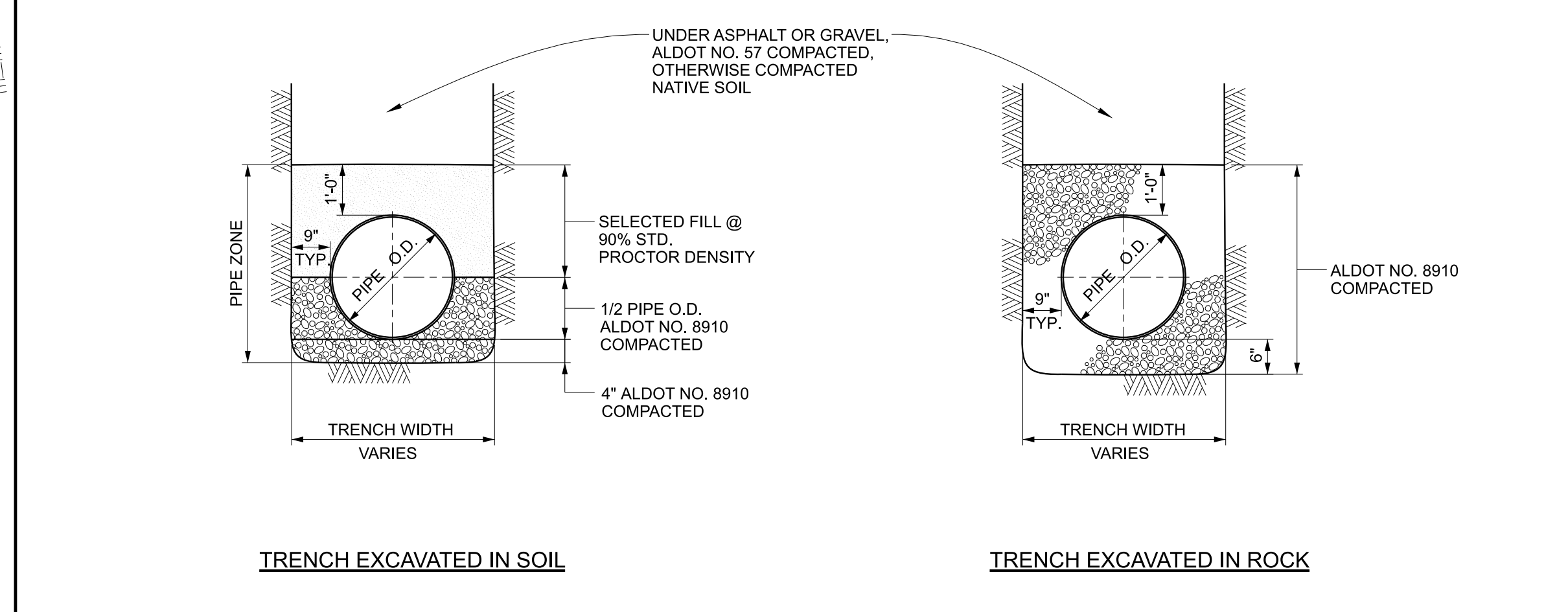
THE CITY OF NORTHPORT UTILITIES  
 NORTHPORT WTP CHEMICAL SYSTEM IMPROVEMENTS  
 NORTHPORT, ALABAMA



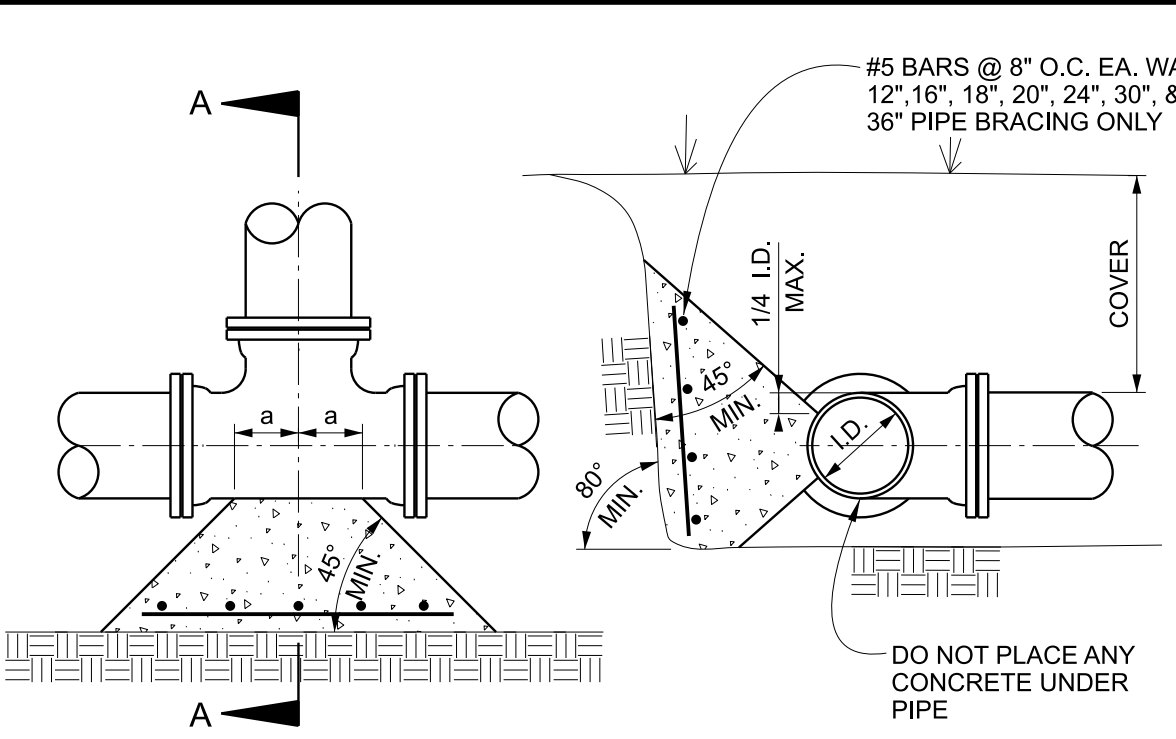
Designed	JAS/STL	Project No.	22031
Drawn	CLM		
Checked	JAD		
Revisions			
No.	Date	Description	



**D10 PAVEMENT REPLACEMENT DETAIL** NO SCALE



**A10 PVC & HDPE PIPE BEDDING & BACKFILL DETAIL** NO SCALE

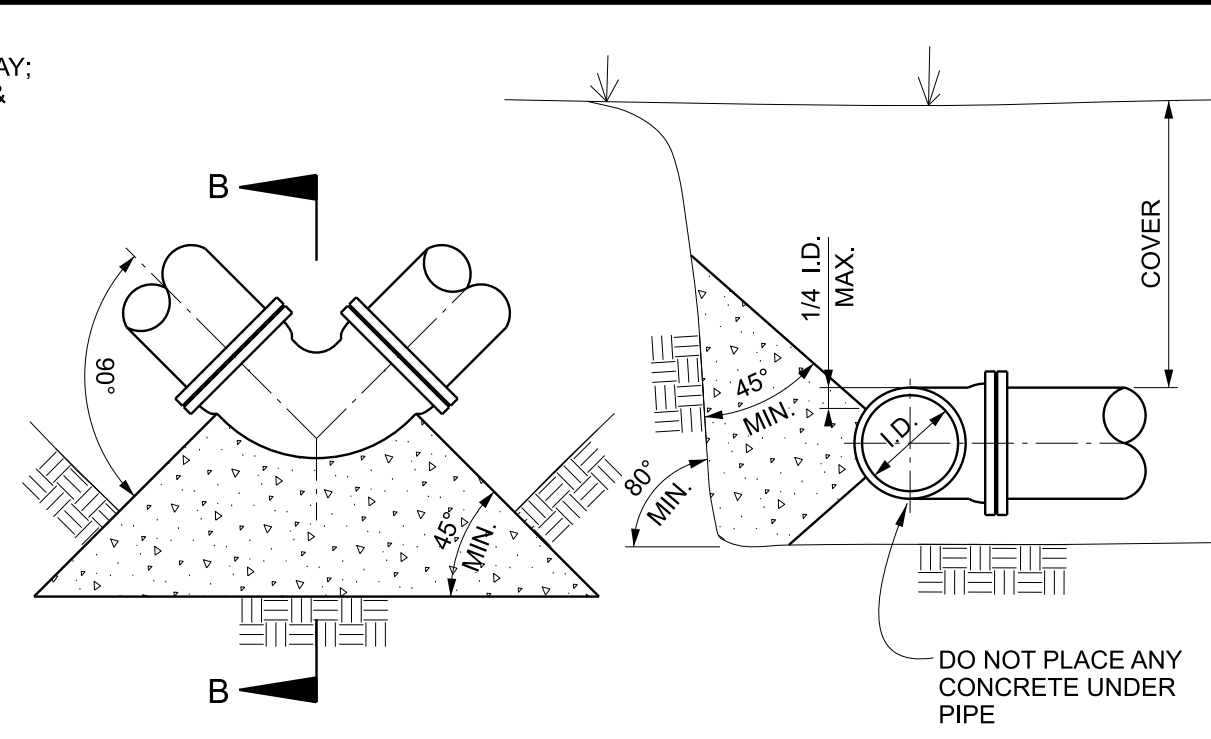


**PLAN SECTION A-A**

- NOTES:
1. CONCRETE MUST BE POURED AGAINST UNDISTURBED SOIL.
  2. DUCTILE IRON JOINTS SHALL NOT BE IN DIRECT CONTACT WITH CONCRETE. PIPE SHALL BE WRAPPED IN PLASTIC ENCASUREMENT.
  3. ASSUMED ALLOWABLE SOIL BEARING STRESS IS 2,500 lbs./SQ. FT. CONTACT ENGINEER SHOULD SOIL WITH LOWER BEARING STRESS BE ENCOUNTERED.

**TYPICAL CONCRETE BRACING FOR TEES**

PIPE DIA.	a	MIN. COVER	150 PSI BEARING AREA (SQ. FT.)	250 PSI BEARING AREA (SQ. FT.)
4"	5"	3'-0"	1	2
6"	6"	3'-0"	2	3
8"	7"	3'-0"	4	6
10"	9"	3'-0"	5	8
12"	10"	5'-0"	7	12
14"	1'-0"	5'-0"	10	16
16"	1'-1"	5'-0"	13	21
18"	1'-2"	5'-0"	16	26
20"	1'-4"	5'-0"	19	32
24"	1'-8"	5'-0"	28	46
30"	1'-11"	5'-0"	43	71
36"	2'-2"	5'-0"	62	102
42"	2'-4"	5'-0"	84	139
48"	2'-7"	5'-0"	109	181

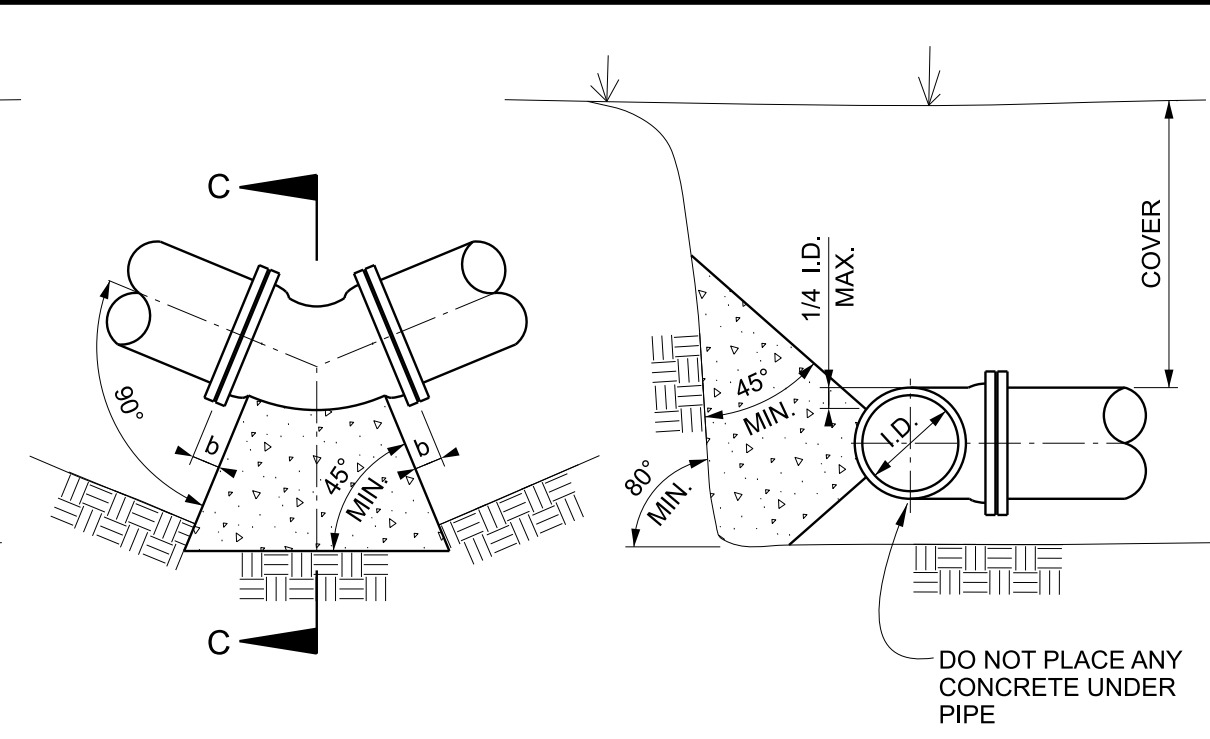


**PLAN SECTION B-B**

- NOTES:
1. CONCRETE MUST BE POURED AGAINST UNDISTURBED SOIL.
  2. DUCTILE IRON JOINTS SHALL NOT BE IN DIRECT CONTACT WITH CONCRETE. PIPE SHALL BE WRAPPED IN PLASTIC ENCASUREMENT.
  3. ASSUMED ALLOWABLE SOIL BEARING STRESS IS 2,500 lbs./SQ. FT. CONTACT ENGINEER SHOULD SOIL WITH LOWER BEARING STRESS BE ENCOUNTERED.

**TYPICAL CONCRETE BRACING FOR 90° BENDS**

PIPE DIA.	b	MIN. COVER	150 PSI BEARING AREA (SQ. FT.)	250 PSI BEARING AREA (SQ. FT.)
4"	5"	3'-0"	2	2
6"	5"	3'-0"	3	4
8"	5"	3'-0"	5	8
10"	5"	3'-0"	7	12
12"	6"	5'-0"	10	16
14"	6"	5'-0"	14	22
16"	6"	5'-0"	18	29
18"	6"	5'-0"	22	36
20"	6"	5'-0"	27	45
24"	7"	5'-0"	39	64
30"	8"	5'-0"	60	100
36"	8"	5'-0"	87	144
42"	9"	5'-0"	118	196
48"	9"	5'-0"	154	256

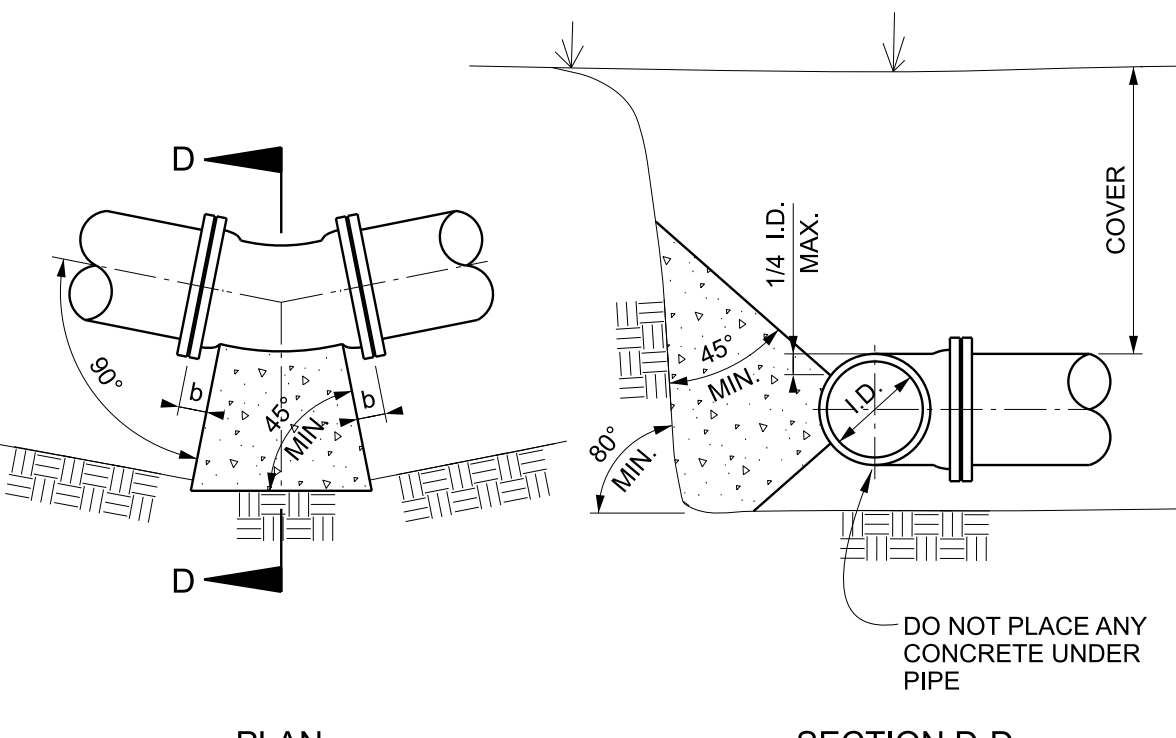


**PLAN SECTION C-C**

- NOTES:
1. CONCRETE MUST BE POURED AGAINST UNDISTURBED SOIL.
  2. DUCTILE IRON JOINTS SHALL NOT BE IN DIRECT CONTACT WITH CONCRETE. PIPE SHALL BE WRAPPED IN PLASTIC ENCASUREMENT.
  3. ASSUMED ALLOWABLE SOIL BEARING STRESS IS 2,500 lbs./SQ. FT. CONTACT ENGINEER SHOULD SOIL WITH LOWER BEARING STRESS BE ENCOUNTERED.

**TYPICAL CONCRETE BRACING FOR 45° BENDS**

PIPE DIA.	b	MIN. COVER	150 PSI BEARING AREA (SQ. FT.)	250 PSI BEARING AREA (SQ. FT.)
4"	5"	3'-0"	1	1
6"	5"	3'-0"	2	3
8"	5"	3'-0"	3	4
10"	5"	3'-0"	4	7
12"	6"	5'-0"	6	9
14"	6"	5'-0"	8	12
16"	6"	5'-0"	10	16
18"	6"	5'-0"	12	20
20"	6"	5'-0"	15	25
24"	7"	5'-0"	21	35
30"	8"	5'-0"	33	55
36"	8"	5'-0"	47	78
42"	9"	5'-0"	64	107
48"	9"	5'-0"	84	139

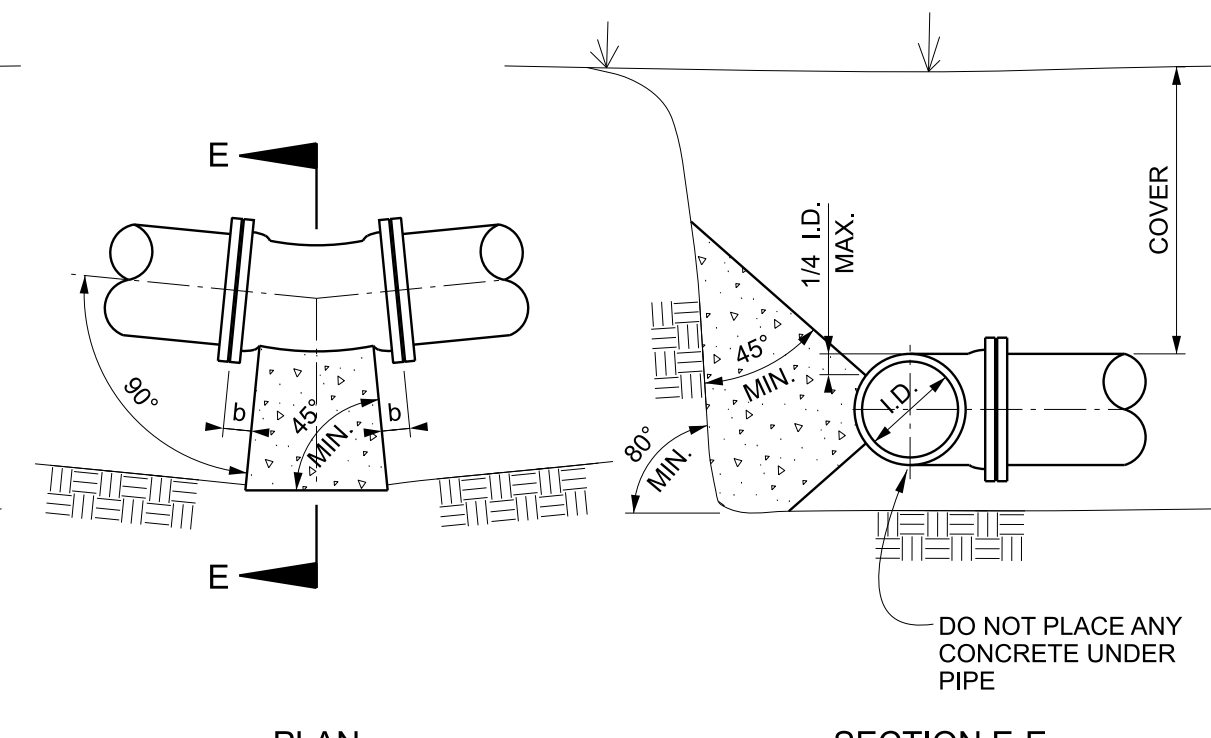


**PLAN SECTION D-D**

- NOTES:
1. CONCRETE MUST BE POURED AGAINST UNDISTURBED SOIL.
  2. DUCTILE IRON JOINTS SHALL NOT BE IN DIRECT CONTACT WITH CONCRETE. PIPE SHALL BE WRAPPED IN PLASTIC ENCASUREMENT.
  3. ASSUMED ALLOWABLE SOIL BEARING STRESS IS 2,500 lbs./SQ. FT. CONTACT ENGINEER SHOULD SOIL WITH LOWER BEARING STRESS BE ENCOUNTERED.

**TYPICAL CONCRETE BRACING FOR 22½° BENDS**

PIPE DIA.	b	MIN. COVER	150 PSI BEARING AREA (SQ. FT.)	250 PSI BEARING AREA (SQ. FT.)
4"	5"	3'-0"	1	1
6"	5"	3'-0"	1	2
8"	5"	3'-0"	2	2
10"	5"	3'-0"	2	4
12"	6"	5'-0"	3	5
14"	6"	5'-0"	4	7
16"	6"	5'-0"	5	8
18"	6"	5'-0"	6	10
20"	6"	5'-0"	8	13
24"	7"	5'-0"	11	18
30"	8"	5'-0"	17	28
36"	8"	5'-0"	24	40
42"	9"	5'-0"	33	55
48"	9"	5'-0"	43	71

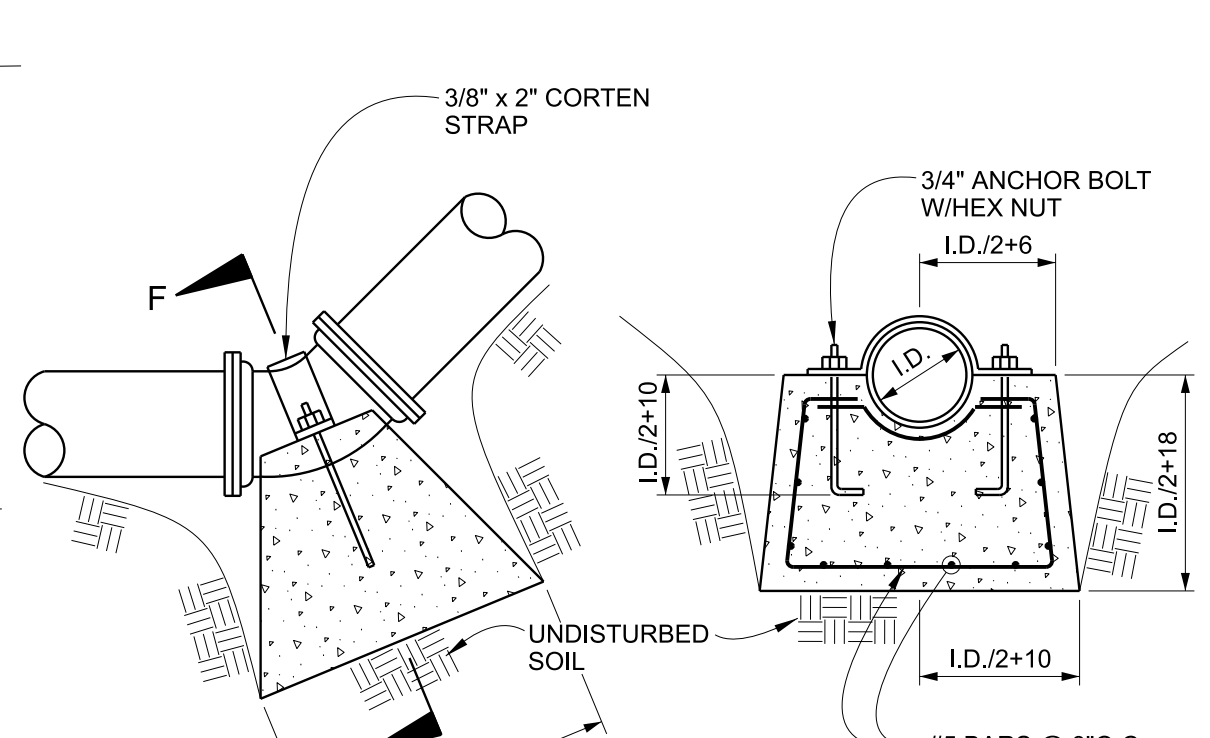


**PLAN SECTION E-E**

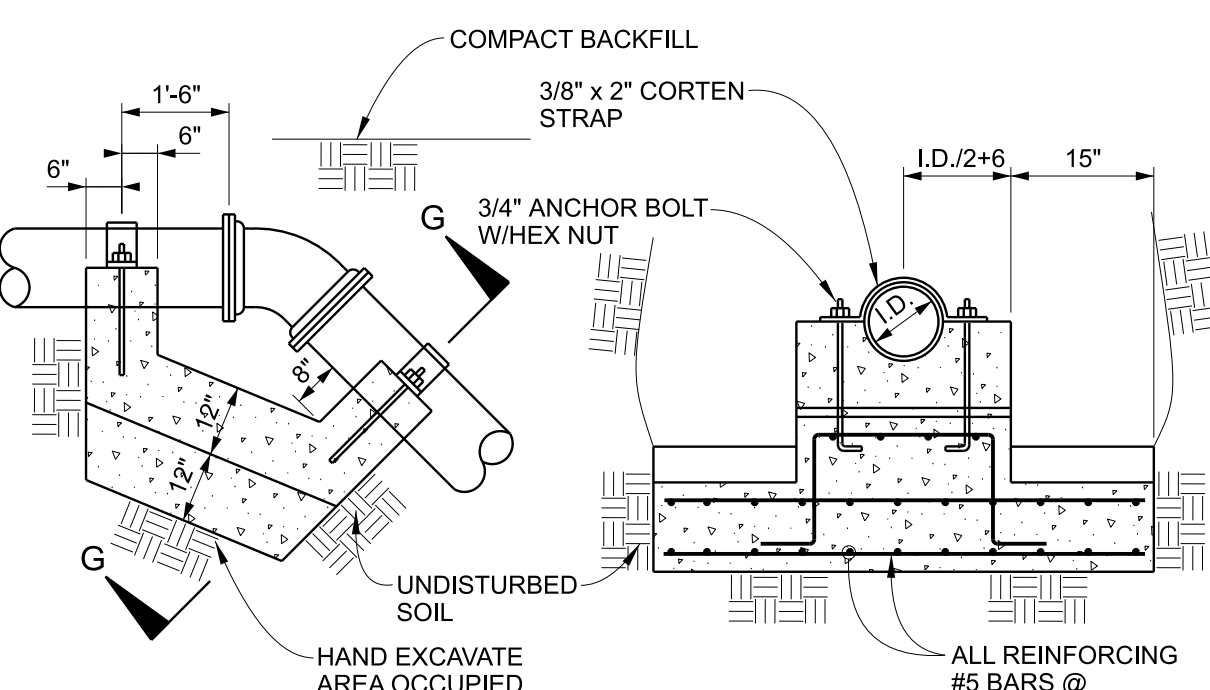
- NOTES:
1. CONCRETE MUST BE POURED AGAINST UNDISTURBED SOIL.
  2. DUCTILE IRON JOINTS SHALL NOT BE IN DIRECT CONTACT WITH CONCRETE. PIPE SHALL BE WRAPPED IN PLASTIC ENCASUREMENT.
  3. ASSUMED ALLOWABLE SOIL BEARING STRESS IS 2,500 lbs./SQ. FT. CONTACT ENGINEER SHOULD SOIL WITH LOWER BEARING STRESS BE ENCOUNTERED.

**TYPICAL CONCRETE BRACING FOR 11¼° BENDS**

PIPE DIA.	b	MIN. COVER	150 PSI BEARING AREA (SQ. FT.)	250 PSI BEARING AREA (SQ. FT.)
4"	5"	3'-0"	1	1
6"	5"	3'-0"	1	1
8"	5"	3'-0"	1	1
10"	5"	3'-0"	1	2
12"	6"	5'-0"	2	3
14"	6"	5'-0"	2	4
16"	6"	5'-0"	3	4
18"	6"	5'-0"	3	5
20"	6"	5'-0"	4	7
24"	7"	5'-0"	6	9
30"	8"	5'-0"	9	14
36"	8"	5'-0"	12	20
42"	9"	5'-0"	17	28
48"	9"	5'-0"	22	36



**ELEVATION SECTION F-F**



**ELEVATION SECTION G-G**

**CONCRETE BRACING FOR VERTICAL BENDS**

**A1 STANDARD PIPE BRACING DETAILS**

NO SCALE

**A10 PVC & HDPE PIPE BEDDING & BACKFILL DETAIL**

NO SCALE

MISCELLANEOUS DETAILS

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**GENERAL ELECTRICAL LEGEND**

§	SWITCH OUTLET - S.P.S.T. - 20A - 120-277VAC.
§PL	SWITCH OUTLET - CLEAR POLYCARBONATE LIGHTED TOGGLE - S.P.S.T. - 20A - 120-277VAC - LIGHT ON WHEN LOAD IS ON.
§X	SWITCH OUTLET - MANUAL MOTOR STARTER - TOGGLE TYPE - 2 POLE - SQUARE "D" TYPE K01 WITH ENCLOSURE AS REQUIRED BY APPLICATION - PROVIDE LOCK-OFF HARDWARE.
⊕	WALL OUTLET - RECEPTACLE - 20A - 125V - 2P - 3W - SIMPLEX - GROUNDING - NEMA 5-20R.
DUPLX	DOUBLE DUPLEX
⊕	WALL OUTLET - RECEPTACLE - 20A - 125V - 2P - 3W - GROUNDING - "GFI" TYPE - WEATHER RESISTANT - NEMA 5-20R - SINGLE PLATE.
OUTLET INSTALLATION DESIGNATIONS (APPLY TO ALL OUTLETS, DEVICES & EQUIPMENT):	
CM	OUTLET MOUNTED TO 4" STAINLESS STEEL CHANNEL BOLTED TO CONCRETE BASE.
ES	EQUIPMENT MOUNTED TO ALUMINUM SUPPORT FRAME - SEE DETAIL "E-ES".
SRS	PROVIDE SUN/RAIN SHIELD FOR DEVICE/EQUIPMENT PER DETAIL "E-SRS".
VL	VERIFY EXACT OUTLET LOCATION WITH OWNER PRIOR TO ROUGH-IN.
W	WEATHER PROOF - OUTLET SHALL BE INSTALLED WITH WEATHERPROOF, IN-USE, CAST COVER.
⊕	FLOOR OR SURFACE-MOUNTED OUTLET - JUNCTION BOX.
⊕	WALL OUTLET - JUNCTION BOX - FLUSH MOUNTED.
⊕	CEILING OUTLET - JUNCTION BOX.
⌒	BRANCH/FEEDER CIRCUIT - CONCEALED IN WALLS OR CEILING.
—	BRANCH/FEEDER CIRCUIT - EXPOSED ON WALLS OR CEILING.
⌒	BRANCH/FEEDER CIRCUIT - CONCEALED IN FLOOR SLAB OR DIRT FILL.
⌒	BRANCH/FEEDER CIRCUIT - HOMERUN - CAN BE USED WITH OTHER BRANCH/FEEDER TYPES.
BRANCH/FEEDER CIRCUIT MODIFIERS:	
—	: 2#12 & 1#12G UNLESS NOTED OTHERWISE.
—	: 3#12 & 1#12G, ETC. UNLESS NOTED OTHERWISE (TICK MARKS INDICATE CONDUCTOR QUANTITY NOT INCLUDING GROUND WIRE).
—	: 2#10 & 1#10G UNLESS NOTED OTHERWISE (NUMBER INDICATES WIRE AWG).
SIZE CONDUIT PER N.E.C. UNLESS INDICATED OTHERWISE.	
~	FLEXIBLE CONNECTION TO EQUIPMENT.
•	BRANCH CIRCUIT - RISER DOWN OR GENERAL CONDUIT STUB-OUT.
■	LIGHTING PANEL - SURFACE MOUNTED.
⊕	MOTOR OUTLET - SIZE AS SHOWN.
⊕	CONTROL STATION - SEE DETAIL "E-CS".
■■■■■	CONCRETE-ENCASED DUCTBANK - SEE DETAIL "E-DR".
⊕	CHLORINE LEAK ALARM.
⊕	FLOAT SWITCH.
⊕	LIMIT SWITCH.
⊕	ULTRASONIC LEVEL TRANSDUCER.
⊕	ANALOG INDICATING TRANSMITTER.
⊕	LEVEL INDICATING TRANSMITTER.
⊕	ALARM BEACON - MOUNT TO EQUIPMENT STAND POST OR COLUMN AT HEIGHT AS DIRECTED BY OWNER - VERIFY EXACT LOCATION WITH OWNER PRIOR TO ROUGH-IN - SEE INSTRUMENT SCHEDULE & SPECIFICATIONS.
⊕	HEAT TRACING WITH INSULATION - SHALL BE PROVIDED ALONG FULL LENGTH(S) OF ALL SMALL DIAMETER PIPING IN INDICATED AREA UNLESS NOTED OTHERWISE - REFER TO CIVIL PLANS FOR PIPING LAYOUTS - VERIFY EXACT TERMINATION LOCATIONS(S) WITH SUPPLIER(S) PRIOR TO ROUGH-IN - REFER TO SPECIFICATION SECTION 26 44 00.

⊕	NEMA 4X S.S. CHLORINE LEAK ALARM PANEL COMPLETE WITH: -FEDERAL SIGNAL MODEL SLM100 FLASHING RED 4" ALARM BEACON MOUNTED TO TOP OF ENCLOSURE -EDWARDS #B70P-N5 ALARM HORN PANEL-MOUNTED TO FRONT OF ENCLOSURE -30MM RED PTT "CHLORINE LEAK ALARM" INDICATOR LIGHT PANEL-MOUNTED TO FRONT OF ENCLOSURE -30MM MOMENTARY CONTACT "TEST" PUSHBUTTON PANEL-MOUNTED TO FRONT OF ENCLOSURE -30MM MOMENTARY CONTACT "SILENCE" PUSHBUTTON PANEL-MOUNTED TO FRONT OF ENCLOSURE -PROVISIONS TO MONITOR DRY CONTACT AT REMOTE CHLORINE LEAK ALARM DETECTOR (TO TRIGGER ALARM CONDITION) -RED 1/4" ENGRAVED NAMEPLATE TO READ: "CHLORINE LEAK ALARM PANEL" -CONTROL RELAYING AS REQUIRED -120VAC POWER INPUT -ALL PER SPECIFICATION SECTION 26 29 00 (MANUFACTURED CONTROL PANELS") REQUIREMENTS		
--G--	BARE SUPPLEMENTAL GROUND WIRE - #4/0G IF NOT INDICATED OTHERWISE - INSTALLED A MINIMUM OF 24" BELOW GRADE AND 24" MINIMUM FROM STRUCTURES WHERE POSSIBLE.		
⊕	SUPPLEMENTAL GROUNDING SYSTEM - GROUND ROD - 3/4" x 10'-0" COPPER-CLAD - TOP DRIVEN A MINIMUM OF 24" BELOW GRADE.		
■	SUPPLEMENTAL GROUNDING SYSTEM - GROUND CONNECTION - CADWELD WHERE BELOW GRADE OR CONCEALED.		
⊕	SUPPLEMENTAL GROUNDING SYSTEM - CAST GROUND PLATE ASSEMBLY (ERICO OR EQUAL) - CAST FLUSH WITHIN CONCRETE WITH FLEXIBLE BARE COPPER GROUND WIRE CONNECTIONS VIA COMPRESSION LUGS TO EQUIPMENT.		
•	SUPPLEMENTAL GROUNDING SYSTEM - GROUND CONNECTION - TO EQUIPMENT OR STRUCTURE.		
GEQ	#4/0 BARE COPPER GROUND WIRE (UNLESS INDICATED OTHERWISE) - BOND TO EQUIPMENT/MOTOR/PANEL/TRANSFORMER, ETC.		
GES	#2 BARE COPPER GROUND WIRE - BOND TO EQUIPMENT STAND.		
GS	#4/0 BARE COPPER GROUND WIRE - BOND TO STRUCTURE/REBAR/WIRE MESH REINFORCEMENT.		
⊕	DETAIL DESIGNATOR - "A" INDICATED DETAIL MARK - "E-1" INDICATED SHEET NUMBER WHERE DETAIL IS LOCATED (TYPICAL).		
GENERAL ABBREVIATIONS:			
(EX)	EXISTING TO REMAIN.		
(EX-R)	EXISTING TO BE REMOVED - REMOVE ALL ASSOCIATED ELECTRICAL EQUIPMENT, DEVICES, CONDUIT AND WIRING CONNECTIONS TO OTHER ELECTRICAL ITEMS UNLESS SHOWN OTHERWISE.		
(EX-RL)	EXISTING TO BE RELOCATED - REMOVE ALL ASSOCIATED ELECTRICAL EQUIPMENT, DEVICES, CONDUIT AND WIRING AT EXISTING LOCATION. RELOCATE ITEM TO NEW LOCATION SHOWN ON ELECTRICAL PLANS. EXTEND AND RECONNECT EXISTING CONDUIT, WIRING, ETC. TO NEW LOCATION AS REQUIRED UNLESS SHOWN OTHERWISE.		
(EX-RP)	EXISTING TO BE REPLACED - EXTEND AND RECONNECT EXISTING CONDUIT AND WIRING TO REPLACED ITEM.		
ELECTRICAL ABBREVIATIONS:			
A	AMPERES.	NSV	NEW, SPARE OR VACATED.
AIC	AMPERES INTERRUPTING CAPACITY.	OC	ON CENTER.
AFF	ABOVE FINISHED FLOOR.	P	POLES.
AL	ALUMINUM.	PF	POWER FACTOR.
ATS	AUTOMATIC TRANSFER SWITCH.	∅	PHASE.
AWG	AMERICAN WIRE GAUGE.	PVC	POLYVINYL CHLORIDE.
C	CONDUIT.		
CU	COPPER.	SLD	SINGLE LINE DIAGRAM.
EC	EMPTY CONDUIT OR ELECTRICAL CONTRACTOR	SS	STAINLESS STEEL.
FPN	FUSE PER NAMEPLATE.	UL	UNDERWRITERS' LABORATORY.
G	GROUND CONDUCTOR.	UNO	UNLESS NOTED OTHERWISE.
KVA	KILOVOLT-AMPERES.	V	VOLTS.
KW	KILOWATT.	W	WIRES.
LV	LOW VOLTAGE.	CFCI	CONTRACTOR FURNISHED, CONTRACTOR INSTALLED.
MCM	THOUSAND CIRCULAR MILS.	CFOI	CONTRACTOR FURNISHED, OWNER INSTALLED.
MV	MEDIUM VOLTAGE.	OFOI	OWNER FURNISHED, OWNER INSTALLED.
N	NEUTRAL.	OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED.
NEC	NATIONAL ELECTRICAL CODE.		
NEMA	NATIONAL ELECTRICAL MANUFACTURER ASSOCIATION.		
NIC	NOT IN CONTRACT.		
TYPICAL CIRCUITRY DESIGNATIONS:			
2 SETS OF 4#3/0 & 1#3G - 2 1/2" C			
CONDUIT SIZE.			
GROUND CONDUCTOR WIRE GAUGE.			
QUANTITY OF GROUND CONDUCTORS (PER SET)			
PHASE/NEUTRAL CONDUCTOR WIRE GAUGE.			
QUANTITY OF PHASE/NEUTRAL CONDUCTORS (PER SET).			
QUANTITY OF PARALLEL SETS OF THE PHASE/NEUTRAL CONDUCTORS, GROUND CONDUCTOR AND CONDUIT SPECIFIED.			
MULTI-CONDUCTOR CONTROL 600V TRAY CABLE DESIGNATIONS:			
(2) 4C#14 W/G - 1 1/4" C			
CONDUIT SIZE.			
"W/G" = WITH ADDITIONAL INTEGRAL GROUND CONDUCTOR WITH GREEN INSULATION IN EACH CABLE SHEATH.			
WIRE GAUGE.			
QUANTITY OF CONDUCTORS IN EACH CABLE SHEATH (NOT INCLUDING GROUND).			
QUANTITY OF MULTI-CONDUCTOR CABLES OF THE TYPE SPECIFIED WITHIN THE SPECIFIED CONDUIT.			
TWISTED, SHIELDED INSTRUMENTATION CABLE DESIGNATIONS:			
(2) #16TSP - 1" C			
CONDUIT SIZE.			
"TSP" = TWISTED SHIELDED PAIR.			
WIRE GAUGE.			
QUANTITY OF INSTRUMENTATION CABLES IN THE SPECIFIED CONDUIT.			

**GENERAL ELECTRICAL NOTES**

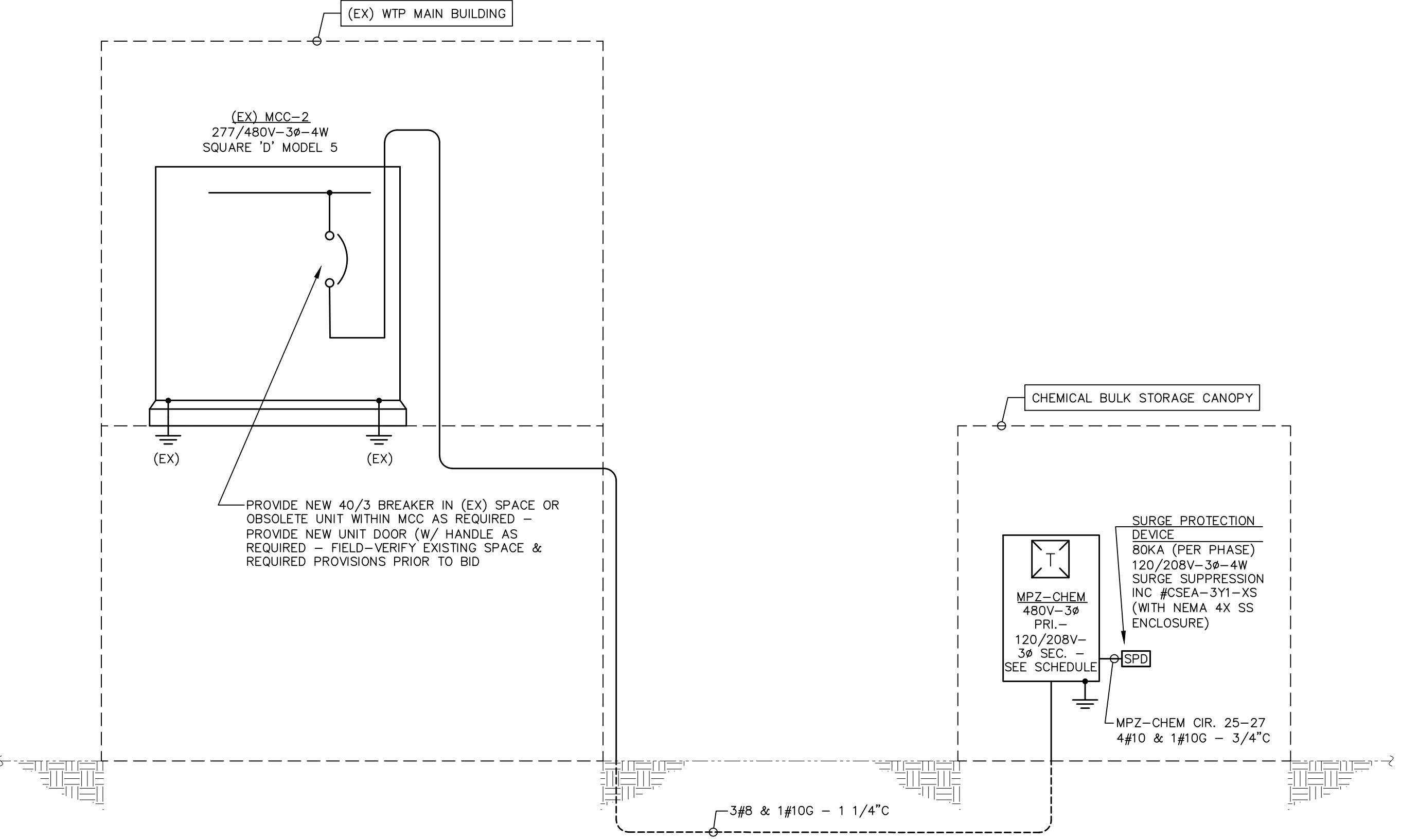
- REMOVE ALL EXISTING ELECTRICAL EQUIPMENT AND WIRING MADE OBSOLETE BY THIS RENOVATION AND DISPOSE OF AS DIRECTED BY THE ENGINEER.
- EXISTING PANEL DIRECTORY CARDS MODIFIED BY THIS RENOVATION SHALL BE RETYPED TO INDICATE CONNECTED CIRCUITS.
- ALL EQUIPMENT SHALL BE GROUND AND BONDED IN ACCORDANCE WITH NEC.
- CONTRACTOR SHALL VISIT THE SITE OF THE WORK PRIOR TO SUBMITTING BID TO EXAMINE CAREFULLY LOCAL CONDITIONS AND DIFFICULTIES TO BE ENCOUNTERED. ANY DISCREPANCY BETWEEN PLANS AND EXISTING CONDITIONS SHALL IMMEDIATELY BE CALLED TO THE ATTENTION OF THE ENGINEER.
- SPECIAL ATTENTION IS CALLED TO THE FACT THAT THE REQUIRED WORK IS AT OPERATING FACILITIES, AND AS SUCH, NO UNNECESSARY SHUTDOWNS WILL BE ALLOWED. ANY NECESSARY SHUTDOWNS SHALL BE APPROVED IN WRITING BY THE PLANT MANAGER A MINIMUM OF TWO (2) WEEKS IN ADVANCE. TEMPORARY/PORTABLE PUMPING PROVISIONS (AND OTHER TEMPORARY PROVISIONS AS REQUIRED FOR OPERATION OF THE EXISTING SYSTEMS) SHALL BE PROVIDED BY THE CONTRACTOR IF OWNER-MANDATED MAXIMUM SHUTDOWN PERIODS ARE ANTICIPATED OR ARE POSSIBLE.
- ELECTRICAL PLANS & DETAILS INDICATE TYPICAL WIRING REQUIREMENTS FOR PROCESS EQUIPMENT. VERIFY EXACT WIRING REQUIREMENTS & ALL DEVICE LOCATIONS WITH APPROVED MANUFACTURERS SHOP DRAWINGS PRIOR TO ROUGH-IN. NO ADDITIONAL COMPENSATION WILL BE PAID FOR MINOR CIRCUITRY ADJUSTMENTS REQUIRED TO COMPLY WITH MANUFACTURERS INSTALLATION DETAILS.
- THIS CONTRACTOR SHALL VERIFY EXACT REQUIREMENTS FOR ALL MECHANICAL EQUIPMENT FROM MANUFACTURER'S RECOMMENDATIONS PRIOR TO ROUGHING IN CONDUIT AND SHALL ADJUST CONDUIT SIZE, WIRE SIZE AND CIRCUIT PROTECTION SIZE ACCORDINGLY. IF REQUIREMENTS ARE LARGER THAN CALLED FOR ON ELECTRICAL PLANS NOTIFY ENGINEER IMMEDIATELY.
- THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLATION AND MOUNTING OF ALL INSTRUMENTATION DEVICES (EXCLUDING THOSE PRE-INSTALLED ON SKIDS BY THE MANUFACTURER). SEE INSTALLATION DETAILS ON CIVIL & ELECTRICAL DRAWINGS AND PROVIDED BY SUPPLIERS. COORDINATE ALL REQUIREMENTS WITH SUPPLIERS PRIOR TO ROUGH-IN.
- THIS CONTRACTOR SHALL FURNISH ALL MATERIALS AND LABOR NECESSARY TO EXTEND CIRCUITS AND MAKE RECONNECTIONS TO ANY ACTIVE ELECTRICAL DEVICES ON WHICH THE BRANCH CIRCUIT IS INTERRUPTED BY THIS ALTERATION. CARE SHALL BE TAKEN TO INSURE THAT EXISTING PANEL AND FEEDER RATINGS ARE NOT EXCEEDED.
- WET OR PROCESS AREAS (FOR USE IN DETERMINING TYPES OF MATERIALS REQUIRED PER ELECTRICAL SPECIFICATIONS) SHALL BE DEFINED AS ALL AREAS WITHIN THE PROJECT SCOPE EXCEPT THE FOLLOWING:
  - OFFICES, RESTROOMS, BREAK ROOMS, ELECTRICAL ROOMS AND OTHER SIMILAR, ANCILARY, NON-PROCESS, AIR-CONDITIONED SPACES.
- CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING 120V AND ANALOG SURGE PROTECTION DEVICES AT ALL INSTRUMENTS LOCATED IN EXTERIOR ENVIRONMENTS. CONTRACTOR SHALL COORDINATE WITH INSTRUMENT SUPPLIER(S) PRIOR TO SUBMITTAL OF SHOP DRAWINGS.
  - SURGE PROTECTION DEVICES AT 2-WIRE INSTRUMENTS SHALL BE DEHN DEHNPIPE SERIES (IP67 STAINLESS STEEL DEVICE WITH 10KA TOTAL NOMINAL DISCHARGE CURRENT PER LINE (NO EQUAL ALLOWED).
  - SURGE PROTECTION DEVICES AT 4-WIRE INSTRUMENTS SHALL BE DEHN BLITZDUCTOR XT SERIES (FOR THE ANALOG SIGNAL) PLUS DEHNGUARD SERIES (FOR THE POWER INPUT) COMBINED INTO ONE OVERALL NEMA 4X ENCLOSURE WITH VIEWING WINDOW PER SPEC SECTION 27 60 05 REQUIREMENTS. SPD'S SHALL BE 10KA DISCHARGE CURRENT PER LINE FOR ANALOG, 15KA DISCHARGE CURRENT PER LINE FOR 120V POWER).
- CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING IDENTIFICATION/LABELING FOR ALL NEW OR MODIFIED INSTRUMENTS, UTILIZATION EQUIPMENT (PUMPS, BLOWERS, ETC.), CONTROL DEVICES, CONTROL PANELS, STARTERS, POWER PANELS, ETC. (REGARDLESS OF WHICH ENTITY PROVIDES THE EQUIPMENT) PER DETAILED REQUIREMENTS OF SPECIFICATION SECTION 26 05 53.

PANELBOARD SCHEDULE - MPZ-CHEM										
PANEL TYPE: SQUARE 'D' MINI POWER ZONE				AIC RATING: 10KAC						
VOLTAGE: 120/208V-3P-4W				MOUNTING: SURFACE						
AMPS & TYPE: SEE NOTE 2				LOCATION: BULK CHEMICAL STORAGE CANOPY						
FED FROM: (EX) MCC-2 - SEE SINGLE LINE DIAGRAM				FEEDER: SEE SINGLE LINE DIAGRAM						
CKT. NO.	NOTES	BKR	DESCRIPTION	WATTS	PHASE	WATTS	DESCRIPTION	BKR	NOTES	CKT. NO.
1	-	201	SPARE		A		SPARE		201	- 16
2	GFIE	201	EYE WASH & SHOWER HEATER	500	B		SPARE		201	- 17
3	LON	201	FLUORIDE SUMP ALARM SYSTEM	100	C		SPARE		201	- 18
4	-	201	FL. STORAGE RECEPTACLE	200	A				201	- 19
5	-	201	FLUORIDE STOR. TANK LVL.XMTR	200	B				201	- 20
6	-	201	ALUM STOR. TANK LVL.XMTR	200	C				201	- 21
7	-	201	HYP0 AREA RECEPTACLE	200	A				201	- 22
8	LON	201	HYP0 STOR. SUMP ALARM SYSTEM	100	B				201	- 23
9	-	201	SODIUM HYP0. TANK LVL. XMTR.	200	C				201	- 24
10	GFIE	201	SODIUM HYP0. HEAT TRACE & INS.	500	A		SURGE PROTECTION DEVICE	303	-	25
11	-	201	SPARE		B					- 26
12	-	201	SPARE		C					- 27
13	-	201	SPARE		A		MAIN BREAKER	603	-	28
14	-	201	SPARE		B					- 29
15	-	201	SPARE		C					- 30
NOTES:				PH. A:	PH. B:	PH. C:	TOTAL CONNECTED LOAD:		2.2 KVA	
1. ENCLOSURE SHALL BE NEMA 3R STAINLESS STEEL.				900	800	500	TOTAL DEMAND LOAD:		6.1 AMPS	
2. MPZ SHALL HAVE INTEGRAL 15KVA TRANSFORMER.						TOTAL COMPUTED LOAD:		2.5 KVA		
40A/3P PRIMARY MAIN BKR, 60A/3P SECONDARY MAIN BKR, AND SHALL BE CONFIGURED FOR 480V-3P-3W INPUT.						TOTAL COMPUTED LOAD:		6.8 AMPS		

PANELBOARD/EQUIPMENT SCHEDULE(S) KEYED NOTES LEGEND	
KEYED NOTE	DESCRIPTION
GFIE	INDICATED BREAKER SHALL BE GF1-EPD TYPE (30ma TRIP).
LON	INDICATED BREAKER SHALL BE PROVIDED WITH LOCK-ON HARDWARE.

SEPARATELY ENCLOSED CONTROLS UNIT SCHEDULE				
NAMEPLATE DESCRIPTION	UNIT DESCRIPTION	MOUNTING/ENCLOSURE	LOCATION	REMARKS
CHLORINE LEAK ALARM PANEL	120V-1Ø CONTROLS UNIT	NEMA 4X S.S.	OUTSIDE CHLORINE FEED ROOM	SEE DESCRIPTION ON GENERAL ELECTRICAL LEGEND
1. SEE SPECIFICATIONS SECTION 28 29 00 FOR ADDITIONAL REQUIREMENTS.				

INSTRUMENT SCHEDULE								
INSTRUMENT NAME	INSTRUMENT TYPE	SHEET	ASSOCIATED SPECIFICATION SECTION	FURNISHED BY	PROVIDE 2-WIRE SURGE PROTECTION DEVICE	PROVIDE 4-WIRE SURGE PROTECTION DEVICE	PROVIDE SUNSHIELD	NOTES
FLUORIDE BULK TANK LEVEL TRANSMITTER	ULTRASONIC LEVEL TRANSDUCER WITH REMOTE TRANSMITTER	E3-01	27 60 05	INSTRUMENTATION INTEGRATOR		X	X	MOUNT TRANSDUCER TO BLIND FLANGE ON TOP OF TANK AS DIRECTED BY TANK SUPPLIER
ALUM BULK TANK LEVEL TRANSMITTER	ULTRASONIC LEVEL TRANSDUCER WITH REMOTE TRANSMITTER	E4-01	27 60 05	INSTRUMENTATION INTEGRATOR		X	X	MOUNT TRANSDUCER TO BLIND FLANGE ON TOP OF TANK AS DIRECTED BY TANK SUPPLIER
SODIUM HYP0 BULK TANK LEVEL TRANSMITTER	ULTRASONIC LEVEL TRANSDUCER WITH REMOTE TRANSMITTER	E4-01	27 60 05	INSTRUMENTATION INTEGRATOR		X	X	MOUNT TRANSDUCER TO BLIND FLANGE ON TOP OF TANK AS DIRECTED BY TANK SUPPLIER
FLUORIDE & ALUM STORAGE AREA SUMP HIGH LEVEL FLOAT SWITCH	POLY PROPYLENE FLOAT SWITCH	E3-01	27 60 05	INSTRUMENTATION INTEGRATOR				SEE ELEM. DIAG. NO. 1
SODIUM HYP0CHLORITE STORAGE AREA SUMP HIGH LEVEL FLOAT SWITCH	POLY PROPYLENE FLOAT SWITCH	E4-01	27 60 05	INSTRUMENTATION INTEGRATOR				SEE ELEM. DIAG. NO. 1
FLUORIDE & ALUM STORAGE AREA SUMP HIGH LEVEL/DRAIN VALVE OPEN ALARM BEACON	FLASHING LED NEMA 4X ALARM BEACON - AMBER LENS	E3-01	27 60 05	INSTRUMENTATION INTEGRATOR				SEE ELEM. DIAG. NO. 1
SODIUM HYP0CHLORITE STORAGE AREA SUMP HIGH LEVEL/DRAIN VALVE OPEN ALARM BEACON	FLASHING LED NEMA 4X ALARM BEACON - AMBER LENS	E4-01	27 60 05	INSTRUMENTATION INTEGRATOR				SEE ELEM. DIAG. NO. 1
FLUORIDE & ALUM STORAGE AREA SUMP/DRAIN ALARM BEACON ENABLE/DISABLE CONTROL STATION	NEMA 4X STAINLESS STEEL CONTROL STATION WITH 30MM, MAINTAINED-CONTACT, 2-POSITION, "ENABLE - DISABLE" SELECTOR SWITCH	E3-01	26 29 00	CONTRACTOR				SEE ELEM. DIAG. NO. 1
SODIUM HYP0CHLORITE STORAGE AREA SUMP/DRAIN ALARM BEACON ENABLE/DISABLE CONTROL STATION	NEMA 4X STAINLESS STEEL CONTROL STATION WITH 30MM, MAINTAINED-CONTACT, 2-POSITION, "ENABLE - DISABLE" SELECTOR SWITCH	E4-01	26 29 00	CONTRACTOR				SEE ELEM. DIAG. NO. 1
ALUM DAY TANK LEVEL TRANSMITTER	ULTRASONIC LEVEL TRANSDUCER WITH REMOTE TRANSMITTER	E5-01	27 60 05	INSTRUMENTATION INTEGRATOR				MOUNT TRANSDUCER TO BLIND FLANGE ON TOP OF TANK AS DIRECTED BY TANK SUPPLIER
SODIUM HYP0 DAY TANK LEVEL TRANSMITTER	ULTRASONIC LEVEL TRANSDUCER WITH REMOTE TRANSMITTER	E5-01	27 60 05	INSTRUMENTATION INTEGRATOR				MOUNT TRANSDUCER TO BLIND FLANGE ON TOP OF TANK AS DIRECTED BY TANK SUPPLIER
CHLORINE LEAK DETECTOR	CHLORINE LEAK ALARM DETECTOR	E5-01	27 60 05	INSTRUMENTATION INTEGRATOR				
NOTES: 1. SEE INSTRUMENTATION & EQUIPMENT SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS. 2. ELECTRICAL CONTRACTOR SHALL COORDINATE ALL EQUIPMENT MOUNTING HARDWARE REQUIREMENTS WITH INSTRUMENT MANUFACTURERS. 3. SEE PLANS FOR ADDITIONAL REQUIREMENTS. 4. RANGES AND/OR MOUNTING HEIGHTS OF ALL INSTRUMENTS/DEVICES LISTED ABOVE SHALL BE AS DIRECTED BY CIVIL ENGINEER.								

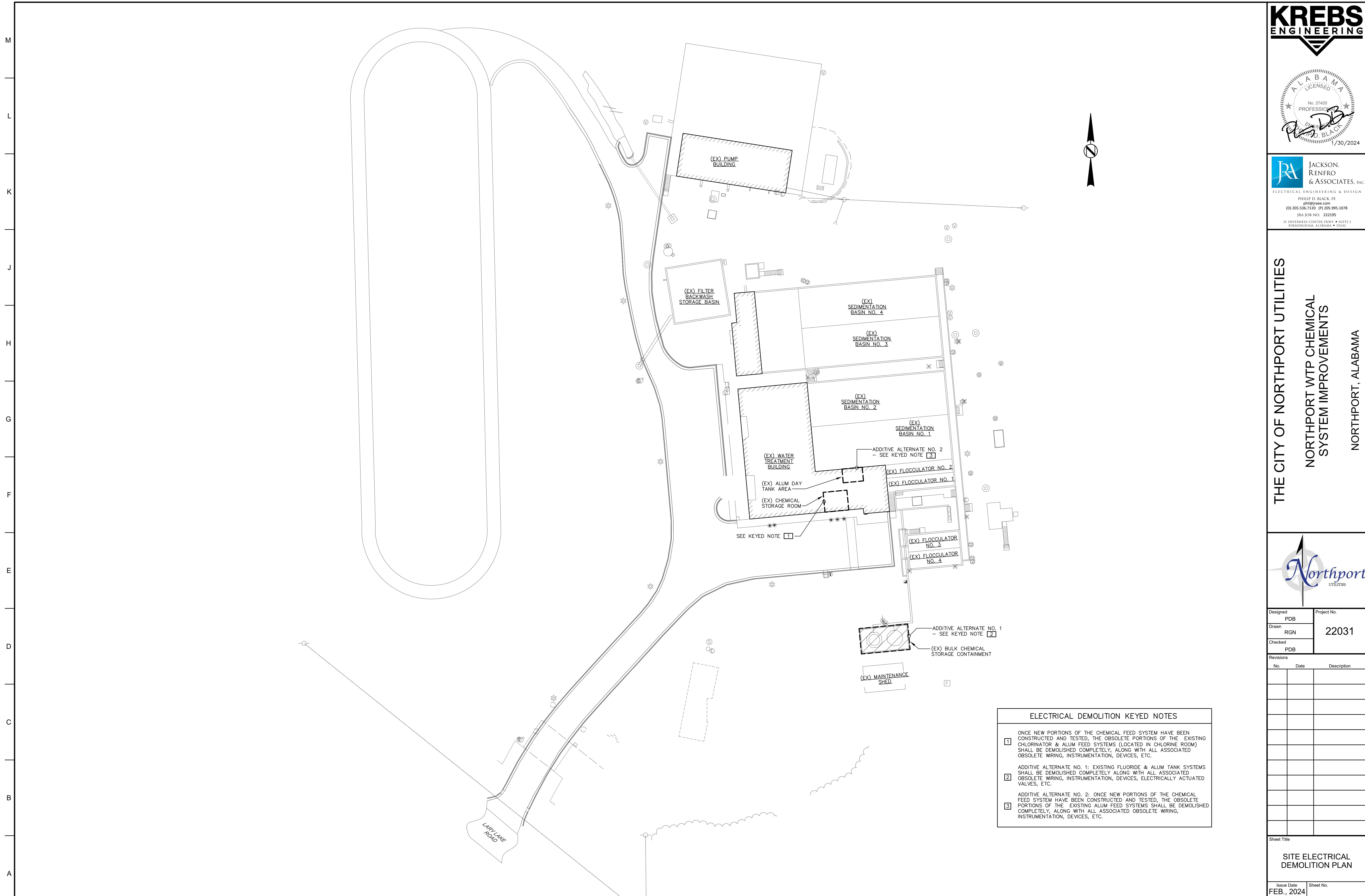


**PARTIAL SINGLE LINE DIAGRAM**  
SCALE : NONE

DIAGRAM NOTES	
1.	THIS DIAGRAM IS INTENDED TO BE A PARTIAL DIAGRAM SHOWING NEW EQUIPMENT & FEEDERS ONLY. EXISTING UNAFFECTED EQUIPMENT & FEEDERS ARE NOT INTENDED TO BE SHOWN ON THIS DIAGRAM.
2.	PROVIDE NEW ENGRAVED MASTER NAMEPLATES FOR NEW DISTRIBUTION EQUIPMENT (PANELS, ETC.) PER DETAIL "E-EDL".







THE CITY OF NORTHPORT UTILITIES  
 NORTHPORT WTP CHEMICAL SYSTEM IMPROVEMENTS  
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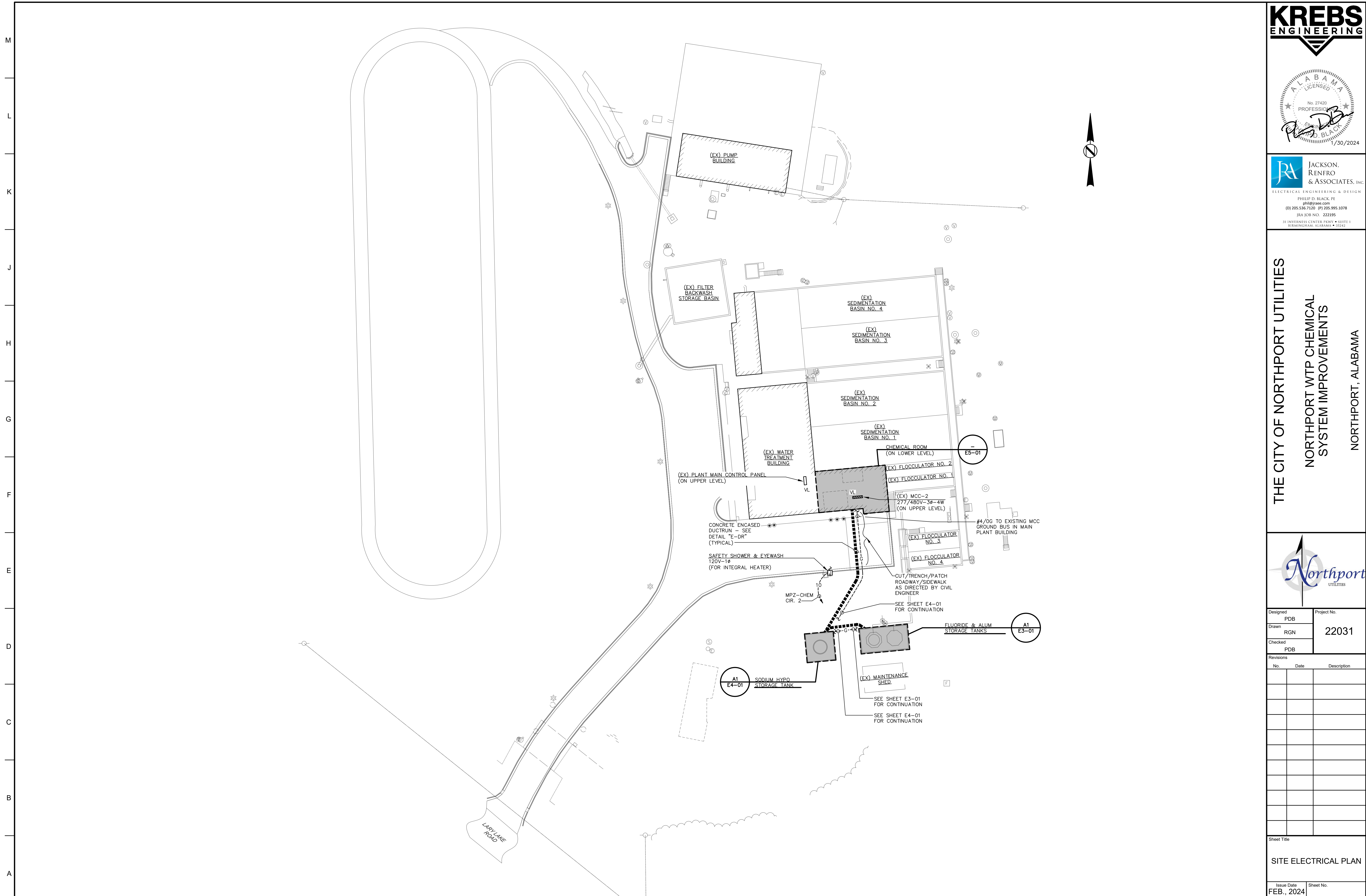
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**ELECTRICAL DEMOLITION KEYED NOTES**

[1] ONCE NEW PORTIONS OF THE CHEMICAL FEED SYSTEM HAVE BEEN CONSTRUCTED AND TESTED, THE OBSOLETE PORTIONS OF THE EXISTING CHLORINATOR & ALUM FEED SYSTEMS (LOCATED IN CHLORINE ROOM) SHALL BE DEMOLISHED COMPLETELY, ALONG WITH ALL ASSOCIATED OBSOLETE WIRING, INSTRUMENTATION, DEVICES, ETC.

[2] ADDITIVE ALTERNATE NO. 1: EXISTING FLUORIDE & ALUM TANK SYSTEMS SHALL BE DEMOLISHED COMPLETELY ALONG WITH ALL ASSOCIATED OBSOLETE WIRING, INSTRUMENTATION, DEVICES, ELECTRICALLY ACTUATED VALVES, ETC.

[3] ADDITIVE ALTERNATE NO. 2: ONCE NEW PORTIONS OF THE CHEMICAL FEED SYSTEM HAVE BEEN CONSTRUCTED AND TESTED, THE OBSOLETE PORTIONS OF THE EXISTING ALUM FEED SYSTEMS SHALL BE DEMOLISHED COMPLETELY, ALONG WITH ALL ASSOCIATED OBSOLETE WIRING, INSTRUMENTATION, DEVICES, ETC.



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Sheet Title  
**SITE ELECTRICAL PLAN**

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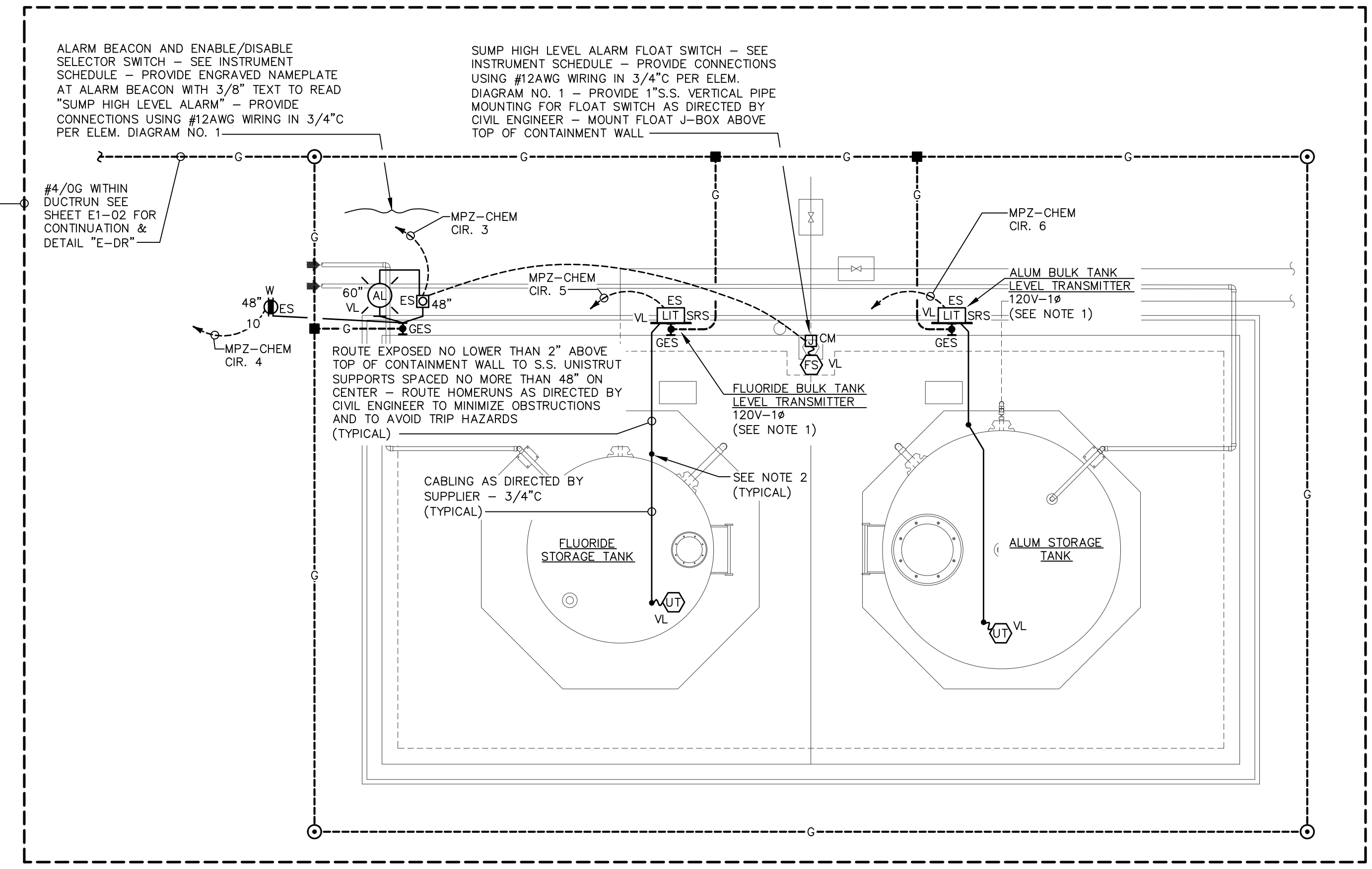


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Sheet Title  
**FLUORIDE & ALUM STORAGE TANKS PROCESS ELECTRICAL PLAN**

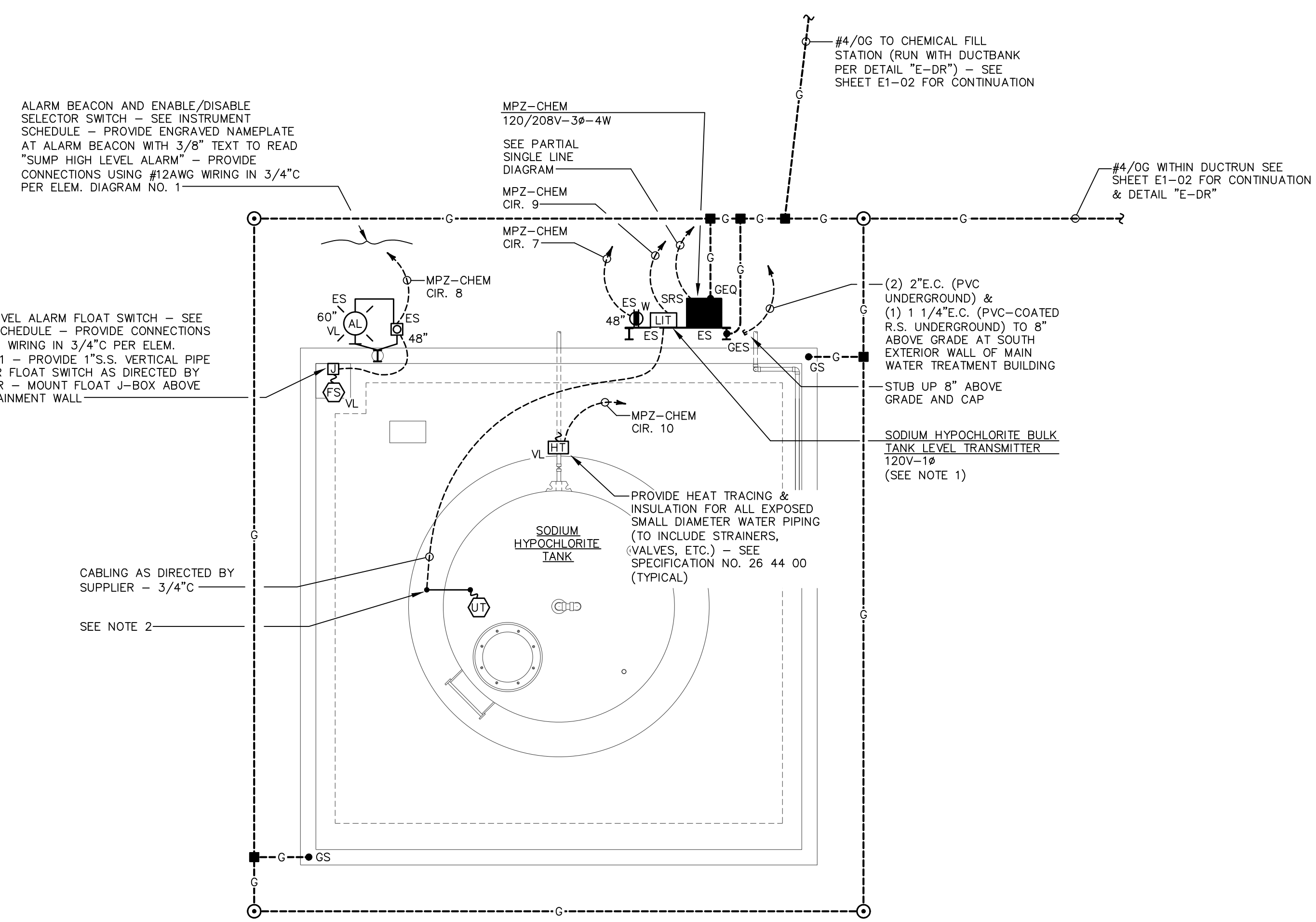
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**PLAN NOTES**

- CONDUITS ENTERING LEVEL TRANSMITTERS SHALL ENTER FROM BOTTOM OF TRANSMITTER (TO FORM "DRIP LOOP" BELOW TRANSMITTER). EACH LEVEL TRANSMITTER SHALL BE PROVIDED WITH A 4-WIRE SURGE PROTECTION DEVICE AT TRANSMITTER PER INSTRUMENTATION SPECIFICATION REQUIREMENTS.
- SUPPORT VERTICAL CONDUITS AT TANKS (FOR LEVEL TRANSDUCER CIRCUITRY) USING STAINLESS STEEL UNISTRUT SUPPORT RACKS FROM CONCRETE FLOOR TO TOP OF TANK SIMILAR TO DETAIL A1/C4-03, WITH BRACING AT TOP OF TANK AS DIRECTED BY TANK SUPPLIER AND CIVIL ENGINEER.
- ALL IMPROVEMENTS SHOWN ON THIS PLAN ARE TO BE BID AS ADDITIVE ALTERNATE NO. 1. GENERAL SUMMARY OF WORK INCLUDES THE DEMOLITION OF EXISTING FLUORIDE & ALUMINUM SULFATE TANK SYSTEMS, TO INCLUDE ALL ELECTRICAL DEVICES, INSTRUMENTATION CIRCUITRY, RACEWAYS, ETC. AND TO INSTALL A NEW FLUORIDE AND ALUM STORAGE TANK SYSTEMS AS DESCRIBED IN THESE PLANS.

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ALARM BEACON AND ENABLE/DISABLE SELECTOR SWITCH - SEE INSTRUMENT SCHEDULE - PROVIDE ENGRAVED NAMEPLATE AT ALARM BEACON WITH 3/8" TEXT TO READ "SUMP HIGH LEVEL ALARM" - PROVIDE CONNECTIONS USING #12AWG WIRING IN 3/4" C PER ELEM. DIAGRAM NO. 1

SUMP HIGH LEVEL ALARM FLOAT SWITCH - SEE INSTRUMENT SCHEDULE - PROVIDE CONNECTIONS USING #12AWG WIRING IN 3/4" C PER ELEM. DIAGRAM NO. 1 - PROVIDE 1" S.S. VERTICAL PIPE MOUNTING FOR FLOAT SWITCH AS DIRECTED BY CIVIL ENGINEER - MOUNT FLOAT J-BOX ABOVE TOP OF CONTAINMENT WALL

CABLING AS DIRECTED BY SUPPLIER - 3/4" C  
SEE NOTE 2

- PLAN NOTES**
- CONDUITS ENTERING LEVEL TRANSMITTERS SHALL ENTER FROM BOTTOM OF TRANSMITTER (TO FORM "DRIP LOOP" BELOW TRANSMITTER. EACH LEVEL TRANSMITTER SHALL BE PROVIDED WITH A 4-WIRE SURGE PROTECTION DEVICE AT TRANSMITTER PER INSTRUMENTATION SPECIFICATION REQUIREMENTS.
  - SUPPORT VERTICAL CONDUITS AT TANKS (FOR LEVEL TRANSDUCER CIRCUITRY) USING STAINLESS STEEL UNISTRUT SUPPORT RACKS FROM CONCRETE FLOOR TO TOP OF TANK SIMILAR TO DETAIL A1/C4-03, WITH BRACING AT TOP OF TANK AS DIRECTED BY TANK SUPPLIER AND CIVIL ENGINEER.



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**SODIUM HYPO. STORAGE TANK ELECTRICAL PLAN**

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NORTHPORT WTP CHEMICAL  
SYSTEM IMPROVEMENTS  
NORTHPORT, ALABAMA

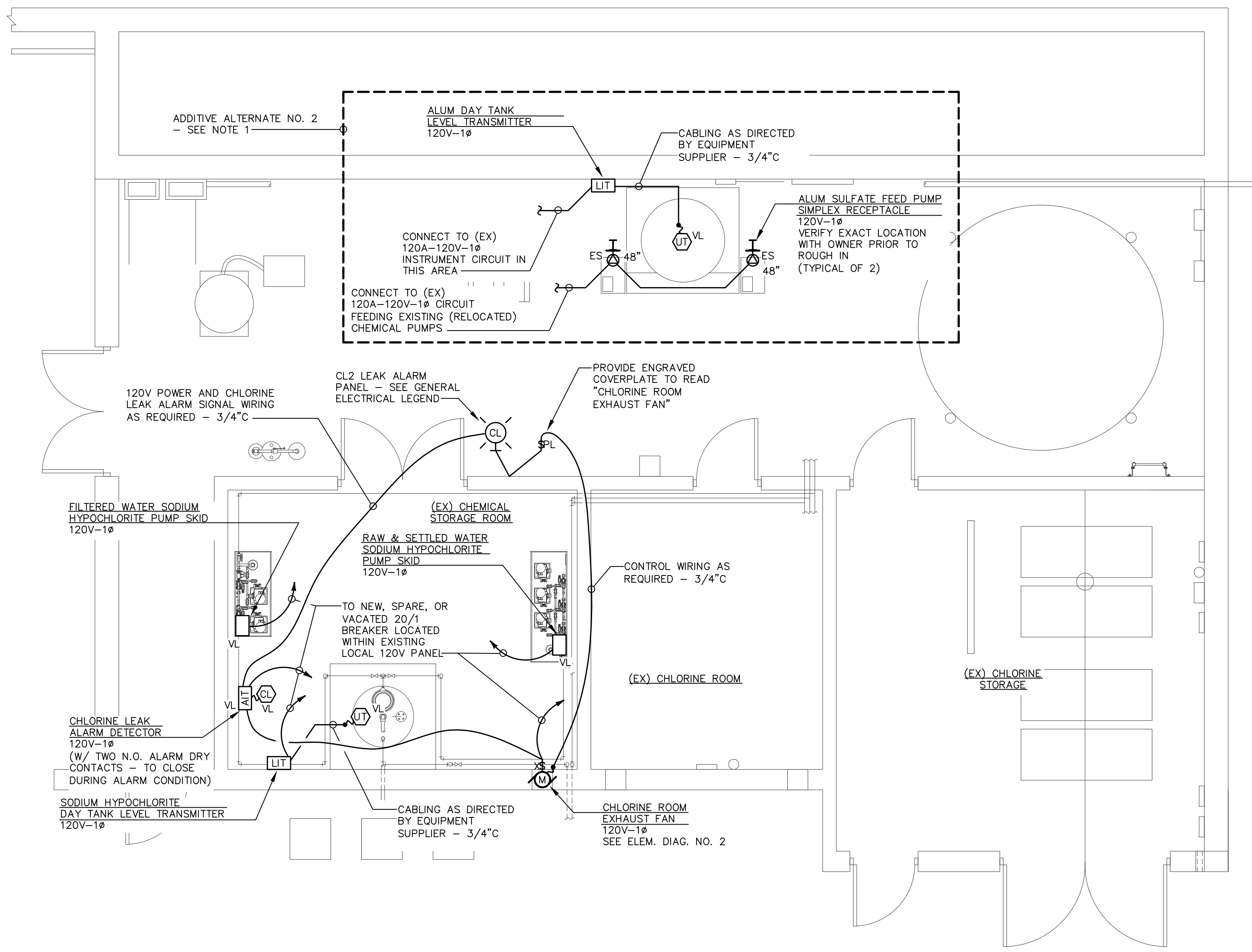


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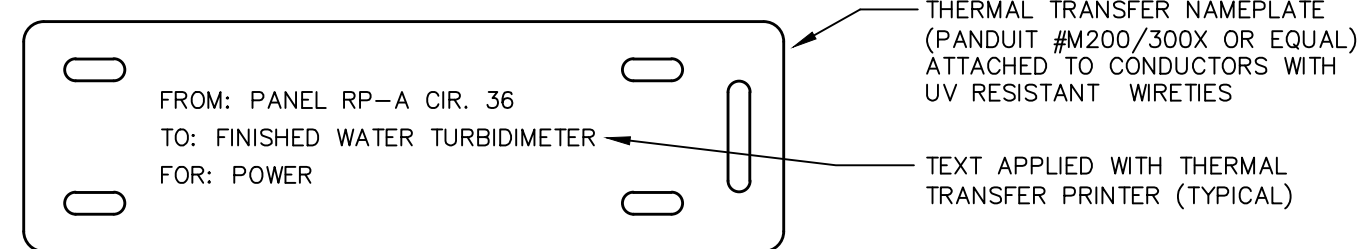
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**EXISTING CHEMICAL  
BUILDING ELECTRICAL  
PLAN**

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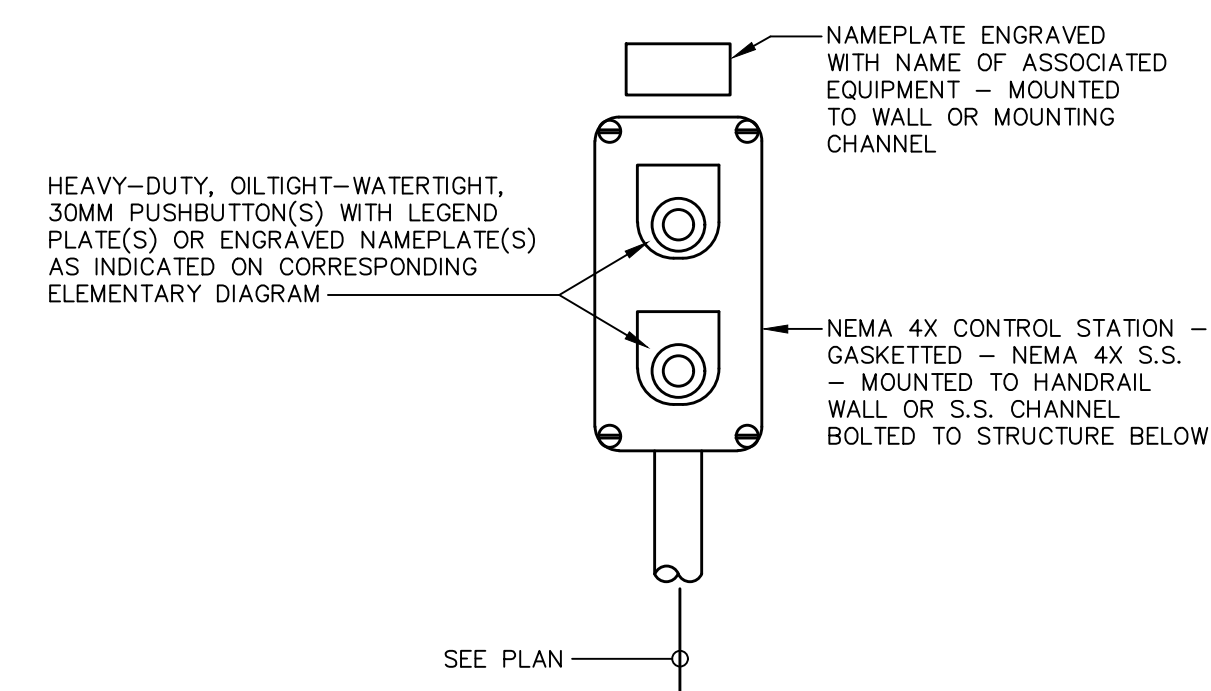
**PLAN NOTES**

1. INDICATED IMPROVEMENTS ON THIS PLAN ARE TO BE BID AS ADDITIVE ALTERNATE NO. 2. GENERAL SUMMARY OF WORK INCLUDES THE REPLACEMENT OF EXISTING ALUM DAY TANK SYSTEM, TO INCLUDE ALL ALL ELECTRICAL DEVICES, INSTRUMENTATION CIRCUITRY, RACEWAYS, ETC. AND RELOCATION OF EXISTING ASSOCIATED CHEMICAL FEED PUMPS, TO INCLUDE EXTENDING AND RECONNECTING EXISTING CIRCUITRY AND RACEWAYS.

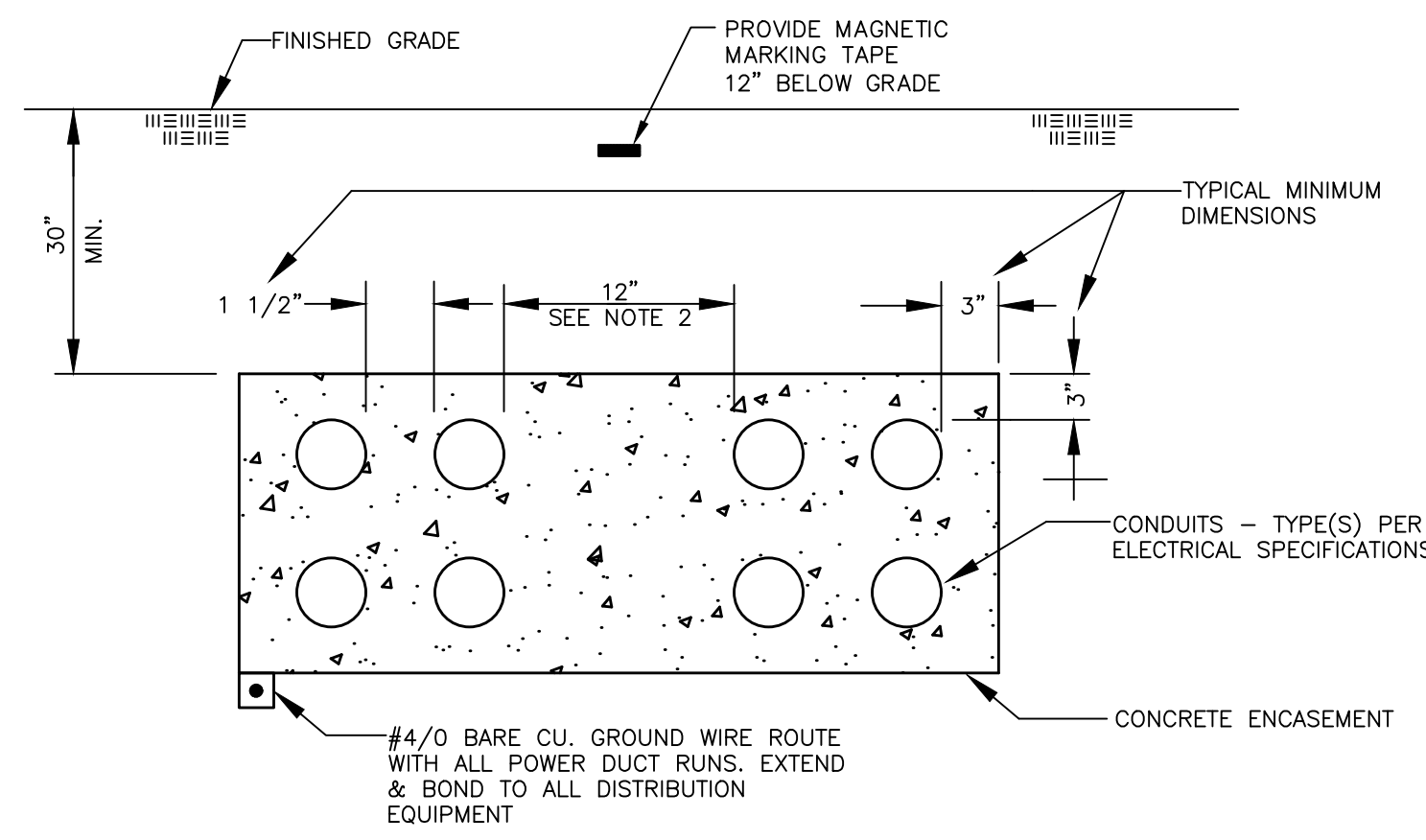


**DETAIL "E-CL"**  
**TYPICAL CIRCUIT LABEL**  
SCALE : NONE

- NOTES THIS DETAIL ONLY
1. CIRCUIT LABEL TYPES SHOWN ABOVE SHALL BE USED TO IDENTIFY ALL CIRCUITS WITHIN PULLBOXES, HANDHOLES, VAULTS JUNCTION BOXES LARGER THAN 4'-11/16", APPROXIMATELY EVERY 50 FEET WITHIN CABLE TRAYS (INCLUDING AT MAJOR CABLE TRAY JUNCTIONS AND BREAKOUT LOCATIONS) AND AT OTHER SIMILAR LOCATIONS. SEE SPECIFICATIONS FOR LABELING REQUIREMENTS IN OTHER AREAS.
  2. CIRCUIT NUMBERS SHALL BE IDENTIFIED FOR ALL CIRCUITS FED FROM LIGHTING OR POWER PANELBOARDS.
  3. "FROM", "TO" & "FOR" TEXT SHOWN ABOVE ARE FOR EXAMPLE PURPOSES ONLY. NAMES/NUMBERS SHALL BE ADJUSTED TO MATCH ASSOCIATED CIRCUITS/CABLES.
  4. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

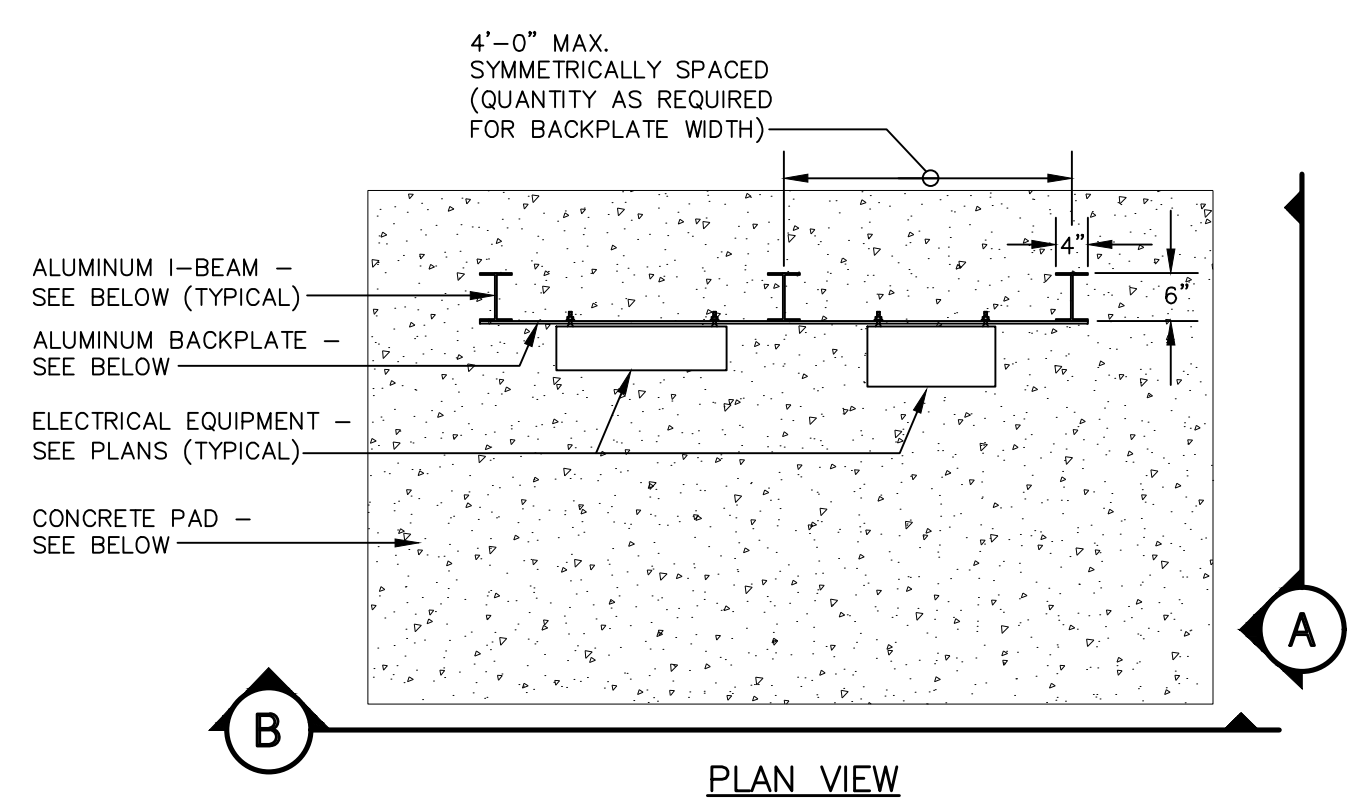


**DETAIL "E-CS"**  
**TYPICAL CONTROL STATION**  
SCALE : NONE

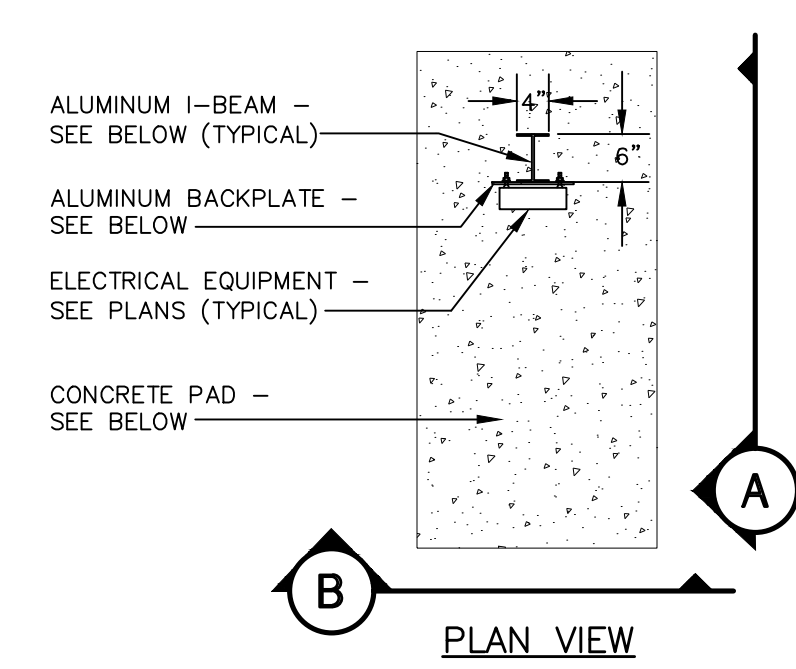


**DETAIL "E-DR"**  
**TYPICAL DUCT RUN SECTION**  
SCALE : NONE

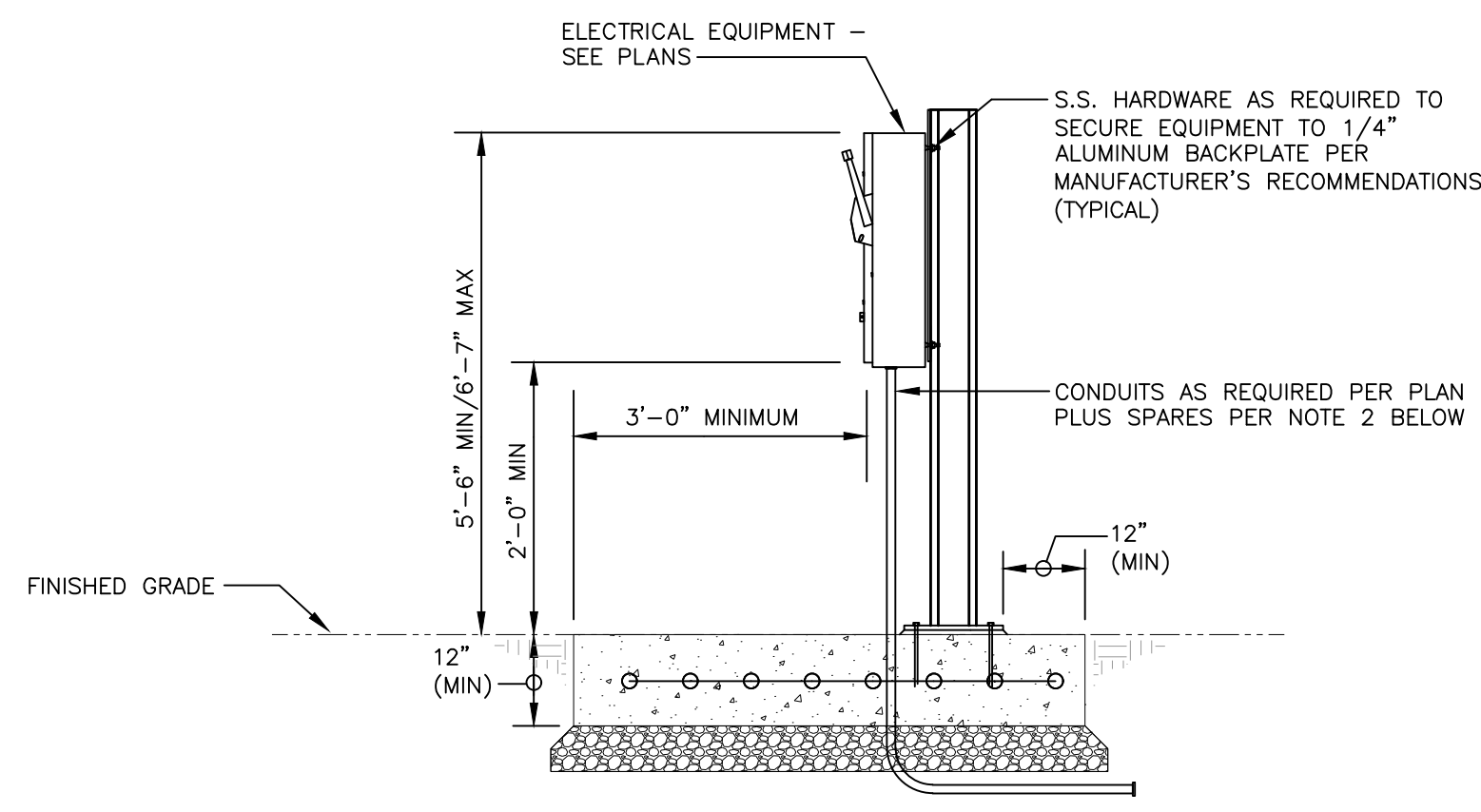
- DETAIL NOTES
1. PVC SPACERS SHALL BE INSTALLED AT RECOMMENDED INTERVALS TO SUPPORT AND MAINTAIN SPACING FOR CONDUITS.
  2. INSTRUMENTATION CONDUITS SHALL BE SEPARATED FROM POWER/CONTROL CONDUITS BY A MINIMUM OF 12" THROUGHOUT ANY DUCT RUNS.



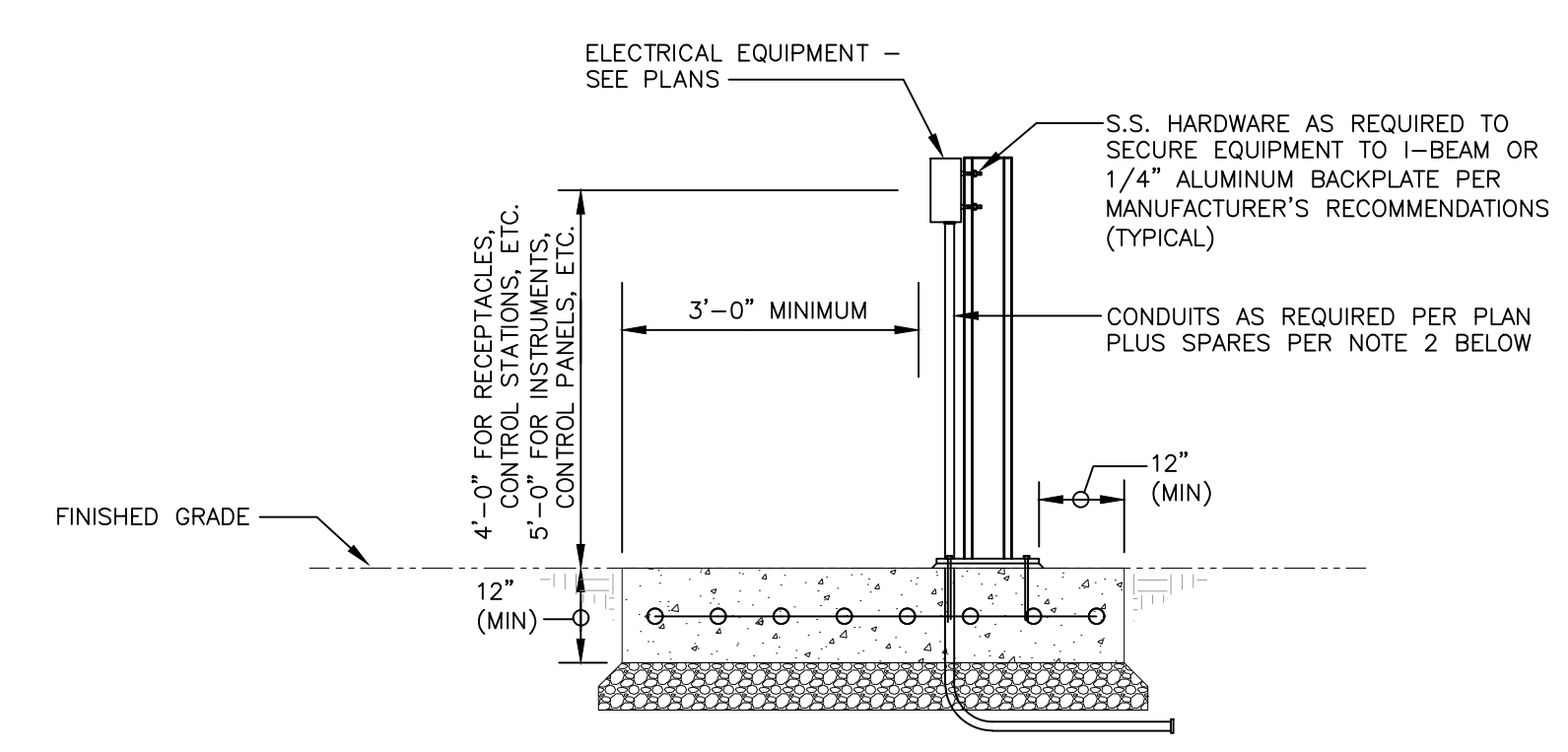
PLAN VIEW



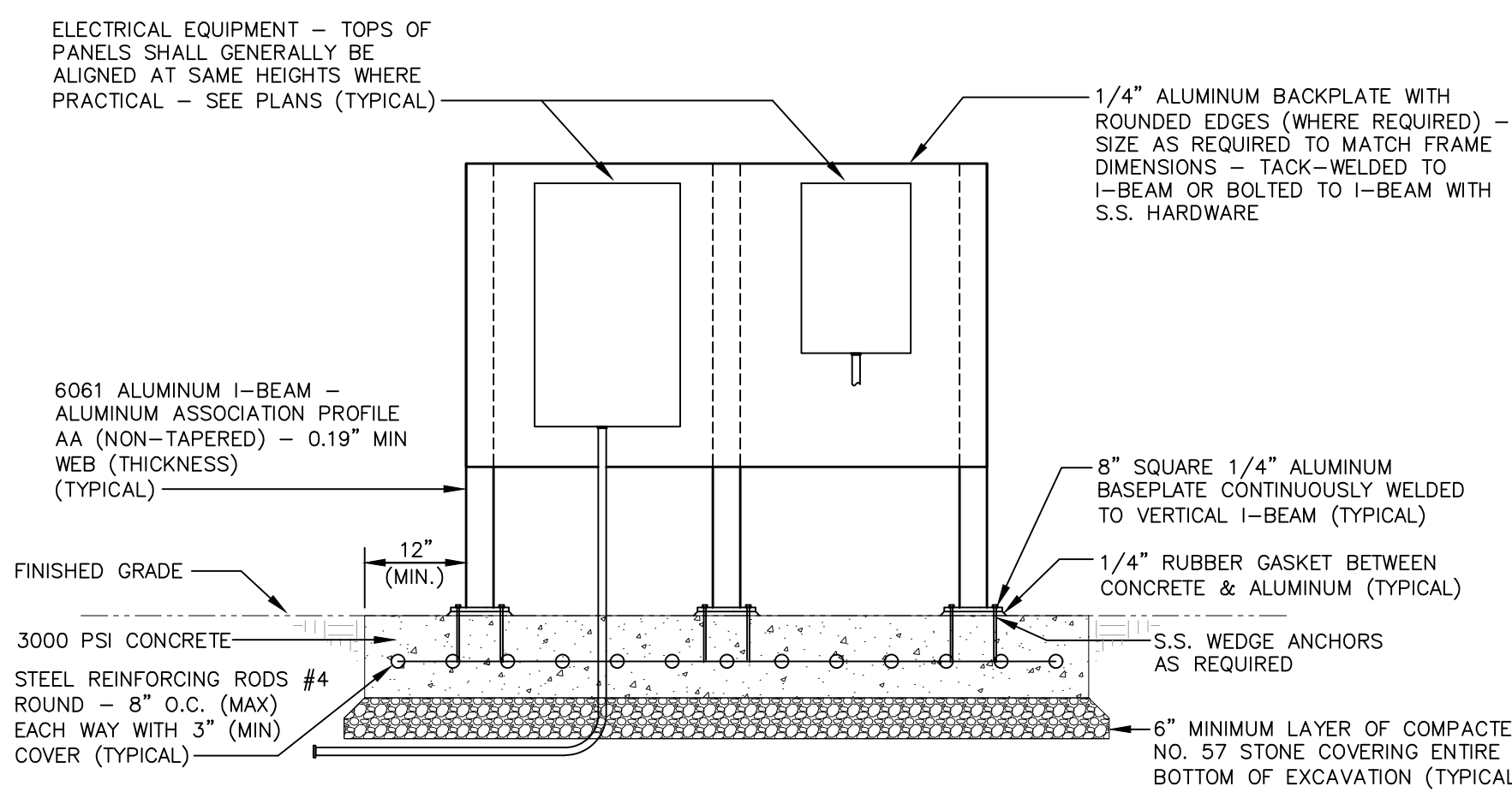
PLAN VIEW



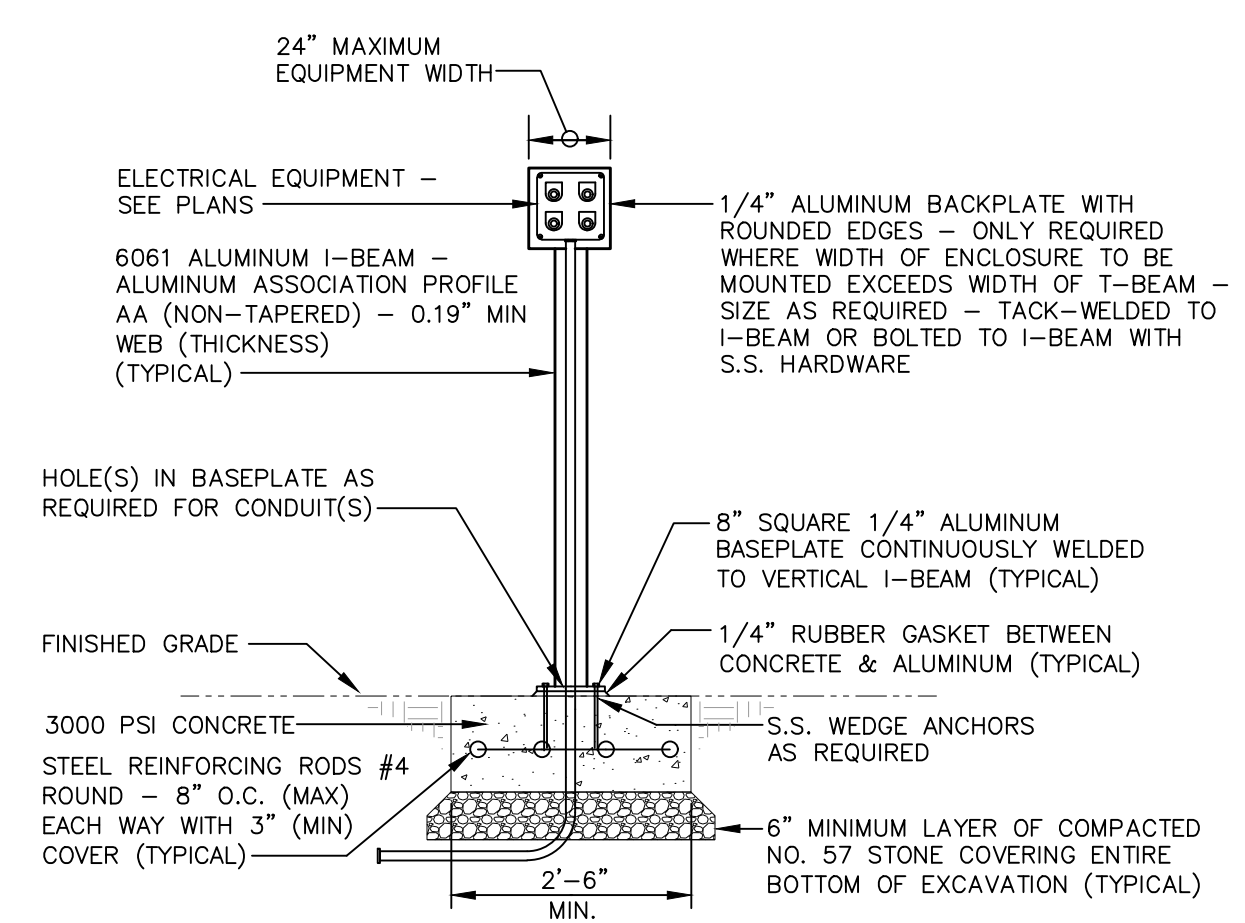
A PROFILE VIEW



A PROFILE VIEW



B FRONT VIEW



B FRONT VIEW

**DETAIL "E-ES"**  
**EQUIPMENT SUPPORT**  
SCALE : NONE

- DETAIL NOTES
1. ALL DIMENSIONS SHOWN ARE TYPICAL.
  2. PROVIDE TWO (2) 1" E.C. FROM ALL DISTRIBUTION PANELS, LIGHTING PANELS, PLC'S AND CONTROL PANELS ROUTED BELOW CONCRETE PAD TO NEAREST PULLBOX OR ACCESSIBLE STUB OUT LOCATION (NOT UNDERNEATH CONCRETE/ROCK/STRUCTURE/ETC).

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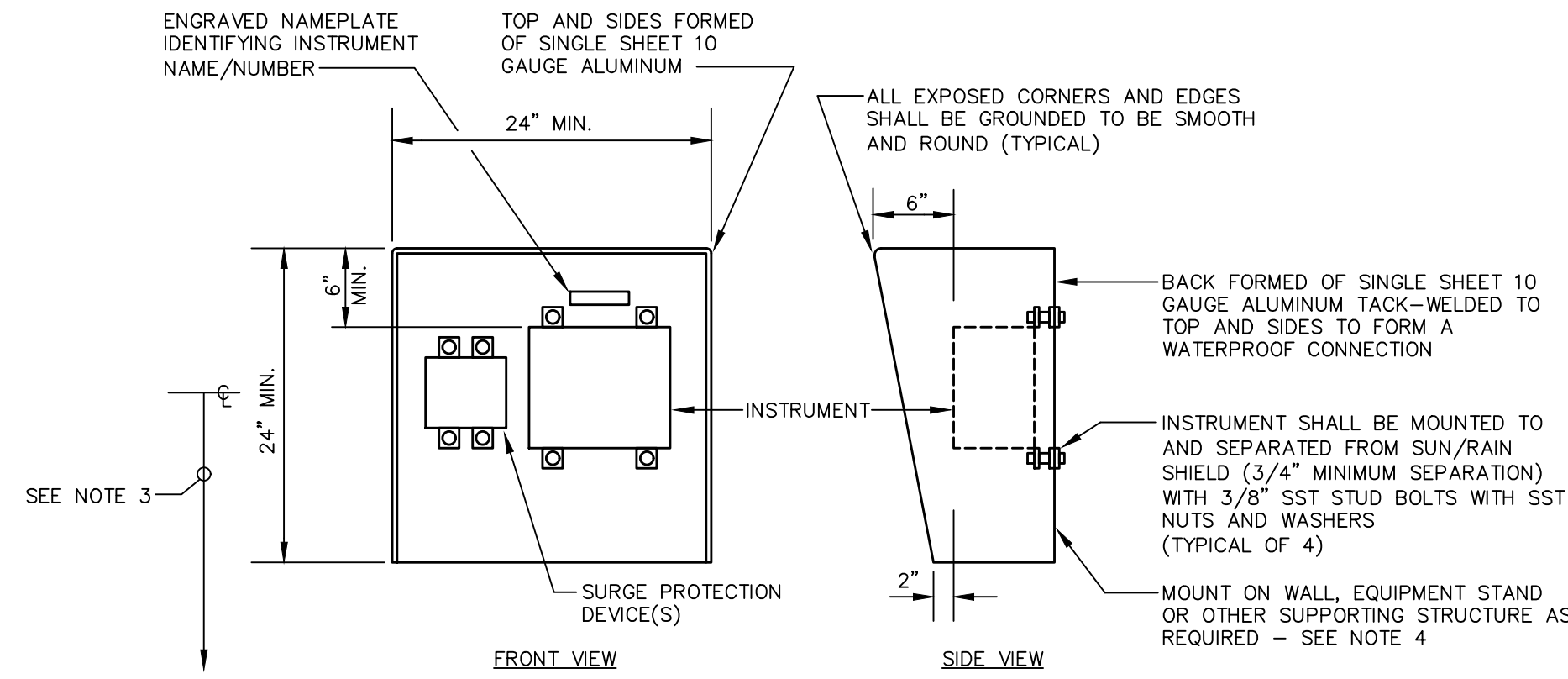
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NAME:	RP-A
RATING:	120/208V-3Ø-4W
FED FROM:	PP-A CIR. 4 (IN MAIN ELEC. ROOM)

### DETAIL "E-EDL" ELECTRICAL DISTRIBUTION EQUIPMENT LABEL

SCALE : NONE

DETAIL NOTES	
1.	PANEL NAMES & RATINGS LISTED ABOVE ARE FOR EXAMPLE PURPOSES ONLY. NAMES & RATINGS SHALL BE ADJUSTED TO MATCH ASSOCIATED EQUIPMENT.
2.	THE INTENT OF THIS DETAIL IS TO DEMONSTRATE GENERAL ELECTRICAL IDENTIFICATION REQUIREMENTS FOR ELECTRICAL DISTRIBUTION AND UTILIZATION EQUIPMENT. REFER TO SPECIFICATIONS FOR SPECIFIC REQUIREMENTS REGARDING LOCATIONS, CONTENT, MATERIALS, ETC..



### DETAIL "E-SRS" INSTRUMENT SUN/RAIN SHIELD INSTALLATION DETAIL

SCALE : NONE

DETAIL NOTES	
1.	SUN/RAIN SHIELDS SHALL BE FURNISHED FOR ALL ELECTRONIC INSTRUMENTS THAT WILL BE EXPOSED TO SUN OR RAIN (OR WHERE OTHERWISE SPECIFICALLY NOTED).
2.	DIMENSIONS SHOWN ABOVE ARE MINIMUM. SUN/RAIN SHIELDS SHALL BE SUFFICIENTLY SIZED TO ACCOMMODATE INSTRUMENT PLUS ASSOCIATED SURGE PROTECTION DEVICE(S), POWER SUPPLIES, AND OTHER SIMILAR DEVICES.
3.	CENTERLINE OF INSTRUMENT SHALL BE LOCATED AT APPROXIMATELY 60" ABOVE GRADE/FLOOR LEVEL.
4.	WHERE SUN/RAIN SHIELD IS SHOWN TO BE MOUNTED AT HANDRAIL(S) WITH LESS THAN 60" OF FRONTAL CLEARANCE (FOR PROPOSED INSTRUMENT), PROVIDE TWO (2) SETS OF VERTICAL 316 STAINLESS STEEL UNISTRUT FRAMES FROM "BACK" SIDE OF BOTH RAILS OF HANDRAIL SYSTEM AS REQUIRED TO OFFSET SUN/RAIN SHIELD BEHIND HANDRAIL SYSTEM, SUCH THAT FRONT OF SUN/RAIN SHIELD DOES NOT PROTRUDE INTO WALKWAY PAST INSIDE OF HANDRAIL, TO "BACK" SIDE OF SUN/RAIN SHIELD.

PROJECT MANUAL  
FOR  
**NORTHPORT WTP CHEMICAL SYSTEM  
IMPROVEMENTS**



**THE CITY OF NORTHPORT  
NORTHPORT, ALABAMA**

**PROJECT NO. 22031**



**FEBRUARY 2024**

PREPARED BY



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### **APPENDIX A – GEOTECHNICAL REPORT**

## ADVERTISEMENT FOR BIDS

Sealed proposals will be received by the City of Northport (Owner), City Hall, 3500 McFarland Boulevard, Northport, Alabama, 35476 until 2:00 PM CST on Tuesday, March 5, 2024 for

### Northport WTP Chemical System Improvement

at which time and place they will be publicly opened and read.

A summary of the work items is included below:

Upgrade of existing chemical systems to include a chemical containment area, bulk chemical storage for Alum, Fluoride, and Sodium Hypochlorite, day storage tanks for Alum and Sodium Hypochlorite, Sodium Hypochlorite chemical feed skids, small diameter chemical piping, valves, fittings, and appurtenances, instrumentation, general site improvements and yard piping, and electrical improvements.

The work of constructing the project will be let under one Contract if an award should be made; and the Owner reserves the right to select the Bid considered by the Owner to be in the best interest of the Owner.

A cashier's check or bid bond payable to the Owner in an amount not less than five (5) percent of the amount of the bid, but in no event more than \$10,000, must accompany the bidder's proposal. Performance and Payment Bonds and evidence of insurance required in the bid documents will be required at the signing of the Contract.

Bid Documents may be examined at the office of the Engineer, Dodge Data and Analytics, Isqft, or CMD Group.

Bid Documents may be obtained from the Engineer, Krebs Engineering, Inc., 2100 River Haven Drive, Birmingham, Alabama. Complete sets of electronic Bidding Documents are available for download through Quest Construction Data Network. The bidding documents are available at <https://qcpi.questcdn.com/cdn/posting/?group=8009230&provider=8009230&projType=all> and/or [www.questcdn.com](http://www.questcdn.com) utilizing the Reference Quest Number 8956752. To be considered a plan holder, Bidders will be required to register with QuestCDN.com for a free regular membership and download the bidding documents for a \$22 fee. Hard copies of the Bidding Documents are the responsibility of the Bidders. Contact QuestCDN at (952)-233-1632 or [support@questcdn.com](mailto:support@questcdn.com) for assistance with navigating the website and digital project information. For the duration of the advertisement period, a list of plan holders may be found at [QuestCDN.com](http://QuestCDN.com).

Bids must be submitted on proposal forms furnished by the Engineer or copies thereof. All bidders bidding in amounts exceeding that established by the State Licensing Board for General Contractors must be licensed under the provisions of Title 34, Chapter 8, Code of Alabama, 1975, and must show evidence of license before bidding or bid will not be received or considered by the Engineer; the bidder shall show such evidence by clearly displaying his or her current license number on the outside of the sealed envelope in which the proposal is delivered. The Owner reserves the right to reject any or all proposals and to waive technical errors if, in the Owner's judgment, the best interest of the Owner will thereby be promoted.

(OWNER)  
City of Northport  
3500 McFarland Boulevard  
Northport, AL

(ENGINEER)  
Krebs Engineering, Inc.  
2100 River Haven Drive - Suite 100  
Birmingham, AL. 35244  
(205) 987-7411

## **INSTRUCTIONS TO BIDDERS**

### **RECEIPT OF BIDS**

Sealed Proposals will be received by The City of Northport, City Hall, at 3500 McFarland Boulevard, Northport, Alabama, 35476 until **2:00 PM, local time Tuesday, March 5, 2024**, for furnishing all labor, tools, materials and equipment, and for doing the work of construction, according to the Contract Documents, as described in the Advertisement for Bids and in the Specifications. No bids will be received after the time set forth hereinabove; and the Proposals will be publicly opened and read aloud.

### **CONTRACT DOCUMENTS**

Contract Documents are open to public inspection at City of Northport, City Hall, 3500 McFarland Boulevard, Northport, Alabama, or may be obtained from the office of the Engineer, Krebs Engineering, Inc., 2100 River Haven Drive, Suite 100, Birmingham, Alabama 35244. Contract Documents are available at QuestCDN.com reference Quest Number 8558222.

### **DEFINITIONS**

The following terms as used in these Contract Documents, are respectively defined as follows:

- (a) "Contractor" or "Contractors": The person, firm or corporation signing the Contract with the Owner.
- (b) "Sub-Contractor": One who contracts with the Contractor to perform all or any part of the Contract to be performed by the Contractor under the attached Documents.
- (c) "Work at Site of Project": Work to be performed, including work normally done at the location of the project.
- (d) "Purchaser, Owner, Authority": The City of Northport.
- (e) Engineer: Krebs Engineering, Inc. or their duly authorized representative.
- (f) "Days": Calendar days, unless otherwise specified.
- (g) "Proposal": Wherever "Proposal" is used, it shall mean "Bid".

## **PROPOSAL FORM**

The Engineer will furnish Bidders with a Proposal Form. No bid will be considered unless submitted on such form. The Bidders shall complete the Proposal Form in manner prescribed, using ink for writing figures, or figures may be typed. The Bidder must sign the Bid correctly and legibly; and shall state his interest, title, or office in the company submitting the Bid. If the Bid should be made by an individual, his full name and address shall be shown; if made by a firm or partnership, the full name and address of each member of the firm or each partner shall be shown; and if made by a corporation, the full names and addresses of the president, secretary and treasurer shall be shown. Should the Proposal Form not be fully completed in ink by the Contractor, the Bid will be deemed to be informal and may be rejected.

The Proposal Form shall be fully completed in accordance with the Instruction to Bidders, in accordance with any instructions to bidders given in the Specifications, and without any excisions, alterations, special conditions or alterations made by the Bidder. The Bidder shall be fully responsive to all instructions relating to the Proposal.

## **BIDS**

Bids shall be enclosed in a sealed envelope, endorsed **Northport WTP, Chemical System Improvements** and addressed to the City of Northport.

The Bidder shall show, on the outside of the envelope and on the last page of the Proposal Form, his Contractor's License Number for the State of Alabama, and shall also show, on the outside of the envelope, his name and address.

No Bid will be received after the time specified in the Advertisement for Bids.

Any Bidder may withdraw his bid, either personally or by telegraphic or written request, at any time prior to the scheduled closing time for the receipt of bids.

No Bidder may withdraw his bid for a period of sixty (60) days after the scheduled closing time for receipt of bids, as set forth in the Advertisement for Bids.

The Owner reserves the right to reject any or all bids, to waive any informalities in any bid, and to accept any bid considered advantageous to the Owner.

A bid which has been sealed in its delivery envelope may be revised by writing a change in price on the outside of the envelope over the signature of the bidder or the bidder's "authorized representative". In revising the bid in this manner, the bidder must only write the amount of the change in price of the envelope and must not reveal the bid price. An envelope change to a unit price proposal shall be specifically written in such a way as to alter one or more unit prices.

## **AWARD OF CONTRACT**

The Contract, if awarded, will be awarded to the low, responsive, responsible bidder as soon as practicable, provided a satisfactory bid has been received. In order to be

considered for the award of the Contract, the Bidder shall demonstrate to the Owner that he possesses all of the above named qualifications.

### **GUARANTY**

Each Bidder must enclose with his Proposal a Bid Bond or a Cashier's Check drawn on an Alabama bank in the amount of not less than five percent (5%) of the total bid, but not more than \$10,000.00. The payee of such bond or cashier's check shall be The City of Northport. The Bid Bond or Cashier's Check shall bear the same date as that set for the receipt of bids.

Bid Bonds shall be returned to all bidders, other than the low and two next low bidders, when the low bids have been determined. Those of the three low bidders will be returned after execution of the Contract.

If a bidder to whom a contract is awarded shall refuse or neglect to execute the contract and furnish security in the amount required within ten (10) days after the notice has been given him of such award, his bid bond shall be forfeited to the Owner as liquidated damages for such refusal or neglect.

The successful bidder will be required to furnish, through an authorized agent in the State of Alabama a Performance Bond, Labor and Material Payment Bond, Employer's Liability and Workmen Compensation Insurance, Public Liability and Property Damage Insurance, Comprehensive Automobile Liability, Special Hazards or Perils and shall furnish proof of carriage of all of the above insurance all as set out in detail under "General Conditions" of these Specifications. The Performance Bond and the Labor and Material Payment Bond must be countersigned by an agent whose office is located in the State of Alabama and who is authorized to do business in the State of Alabama; and a valid Power-of-Attorney shall be attached to each Bond.

### **INTERPRETATIONS**

If any person contemplating submitting a bid for the proposed contract is in doubt as to the true meaning of any part of the Contract Documents, he may submit a written request to the Engineer for interpretations thereof. The persons submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made by addendum duly issued, and copy of such addendum will be mailed by certified mail (with return receipt requested) or delivered to each person receiving a set of such documents. The Owner will not be responsible for any other explanation or interpretation of the proposed documents.

### **COMMENCEMENT AND COMPLETION OF WORK**

Following the execution of the Contract by the Owner and the Contractor, the Contractor will be authorized to commence work by written order from the Owner. The Contractor shall then commence work on the project within the time stated in the Proposal, unless such time stated is extended by mutual agreement between the Owner and the

Contractor, and shall fully complete all work under the Contract within the number of consecutive calendar days specified in the Contract.

### **FAMILIARITY WITH LAWS**

The Bidder is assumed to have familiarized himself with all state laws and with all local ordinances and regulations which, in any manner, may affect the conduct of the work or those engaged or employed on the work, and no pleas of misunderstanding will be considered.

The attention of bidders is called to the provisions of State Law Governing General Contractors, as set forth in Sections 34-8-1 to 34-8-24, inclusive, Code of Alabama of 1975, as amended; and bidders shall be governed by the provisions of said law insofar as it is applicable. The above mentioned provisions of the Code make it illegal for the Owner to consider a bid from anyone who is not properly licensed under such code provisions. The Owner, therefore, will not consider any bid unless the bidder produces evidence that he is so licensed. Neither will the Owner enter into a Contract with a foreign corporation which is not qualified under State Law to do business in the State of Alabama.

The attention of nonresident bidders is called to the provisions of Alabama Law, Act No. 84-227, requiring every nonresident contractor, as defined in Section 39-2-14, Code of Alabama 1975, as amended, to register with the Department of Revenue prior to engaging in the performance of a Contract in the State of Alabama, and to deposit with the Department of Revenue an amount, or approved corporate surety bond in lieu thereof, equal to five percentum (5%) of the amount such contractor is to receive for performance of the contract, such amount or bond to be held pending completion of the contract and the payment of taxes due the State and the governmental bodies.

The attention of nonresident bidders is called to the provisions of Alabama Law, Section 39-3-5, Code of Alabama 1975, as amended, relating to preference to be given to resident contractors in Alabama over nonresident contractors in the award of contracts in the same manner and to the same extent as provided by the laws of the state of domicile of the nonresident contractor, and to the requirements that the bid documents tendered by any nonresident contractor must be accompanied by "a written opinion of an attorney-at-law licensed to practice law in such nonresident contractor's state of domicile as to the preference, if any or none, granted by the law of that state to its own business entities whose principal places of business are in that state in the letting of any or all public contracts" (sic).

The bidder is advised that the above referenced act is subject to the opinion of the Attorney General of the State of Alabama.

### **ASSIGNMENT OF CONTRACT**

The Contractor shall not assign his Contract, nor any part thereof, nor any monies due, or to become due thereunder, without prior written consent of the Owner. In case the Contractor, with the consent of the Owner assigns all or any part of any monies due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in or to any

monies due or to become due to the Contractor shall be subject to prior valid claims of all persons, firms, and corporation for services rendered or materials supplied for the performance of work under his Contract.

### **SUB-CONTRACTING**

No part of the Contract shall be sublet without the prior written consent of the Owner. The Contractor shall, following execution of the Contract, immediately submit to the Owner the names of sub-contractors whom he proposes to employ on the project.

### **EXECUTION OF CONTRACT**

The Contract documents shall be executed in triplicate, each counterpart of which shall be considered as an original without accounting for the absence of any of the other counterparts or copies.

### **QUALIFICATIONS OF BIDDERS**

The Contract award, if made, will be made to the low, responsive, responsible Bidder.

A responsive bid shall be evidenced by: (1), a Proposal Form complete in accordance with the Instructions to Bidders and with instructions and/or requests contained in any other sections of the Contract Documents; (2), a Proposal Form not evidencing any apparent unbalanced pricing for performance of the items of work; (3), a Proposal Form without excisions, alterations, special conditions or qualifications made by the Bidder; and, (4), a Proposal Form containing no alternative bids or offerings (by inclusion, attachment, or otherwise) for any items unless such alternative bids or offers are requested in the Technical Specifications.

That a Bidder is responsible may be evidenced by the following facts: (1), that he maintains a permanent place of business; (2), that he has adequate financial capability for meeting the obligations contingent to the work; (3), that he has adequate forces to properly perform the work within the time limit specified; and (4), that he has a competent and experienced organization.

In order to be considered for the award the Bidder shall present to the Owner satisfactory evidence that: (1), he has the necessary capital and financial resources to undertake and complete the project; (2), he has equipment, in good working order, adequate for performance of work within the time specified; (3), he has within his organization, at the time of construction, management and supervisory personnel available for assignment to the project; (4), the construction management and supervisory personnel are skilled and experienced in the particular type of work to be undertaken on the project; and (5), meets the requirements listed above.



**PROPOSAL FORM**

MADE BY \_\_\_\_\_

ADDRESS \_\_\_\_\_

TO: City of Northport

The undersigned, as Bidder, proposes and agrees, if this Bid is accepted, to enter into a Contract with the City of Northport, in the form of Contract specified and shown in the attached Contract Documents, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation, and labor necessary to complete the construction of a **Northport WTP Chemical System Improvements, 22031**, as described in the Advertisement for Bids, and in the Contract Documents, which are hereby referred to and made a part of the same extent as if fully set out herein, and in full and complete accordance with the shown, noted, described and reasonably intended requirements of the Contract Documents, to the full and entire satisfaction of the Owner, with a definite understanding that no money will be allowed for extra work except as set forth in the attached Instructions to Bidders, General Conditions, and other Contract Documents, for the following bid amounts:

**BASE BID ITEMS**

<b>Item No.</b>	<b>Approximate Quantities</b>	<b>Description of Item</b>	<b>Lump Sum Price</b>	<b>Total Price for Item</b>
1.	Complete	Mobilization, Demobilization, and Insurance		
2.	Complete	Furnish and Install Sodium Hypochlorite Containment area to include all required Site Work and Concrete in Accordance with the Plans and Specifications		
3.	Complete	Furnish and Install 6,500 Gallon Sodium Hypochlorite Bulk Storage Tank in Accordance with the Plans and Specifications		
4.	Complete	Furnish and Install Sodium Hypochlorite Pump Skids in Accordance with the Plans and Specifications		
5.	Complete	Furnish and Install Sodium Hypochlorite Day Tank to include Containment Base in Accordance with the Plans and Specifications		
6.	Complete	All electrical work identified with the Base Bid Work Items to include Instrumentation in Accordance with the Plans and Specifications		
7.	Complete	Furnish, Install, and Maintain all Erosion Control Devices as shown on the Contract Plans or Required by Permit to include all labor, reports, materials, equipment, tools, and appurtenances required.		
8.	Complete	Labor, Equipment, and Materials Required for the Northport WTP Chemical System Improvements Which is Not Specifically Identified in Bid Item Nos. 1-7, in Accordance with the Plans and Specifications		

**TOTAL AMOUNT OF BASE BID (Total of Items 1-8)                    \$ \_\_\_\_\_**

## **ALTERNATE BID ITEMS**

If alternates as set forth in the Contract Documents are accepted, the following adjustments are to be made to the Base Bid.

<b>Item No.</b>	<b>Approximate Quantities</b>	<b>Description of Item</b>	<b>Lump Sum Price</b>	<b>Total Price for Item</b>
ALT 1.	Complete	Labor, Equipment, and Materials Required for the Work Identified for the modifications of the Existing Chemical Feed Area in Accordance with the Plans and Specifications		
ALT 2.	Complete	Labor, Equipment, and Materials Required for the Work Identified for the Replacement of the Aluminum Sulfate Day Tank in Accordance with the Plans and Specifications		

A Notice to Award if Contract Award is to be provided by the Owner will be done within 60 days of the bid.

The award of the Contract will be based on the total/sum of the base bid price and the alternates (if any) selected by the Owner. The Owner will receive bids and all pricing will be read aloud, but the project will not be awarded until the bids are evaluated and a determination is made on which alternates are selected. Once the Alternates have been selected, the final bid amount will be calculated (base bid price plus adjustments for any alternate selected) for each bid submitted, and if an award is made, the project will be awarded to the responsive bidder with the lowest final bid amount.

The Bidder declares that he has examined the site of the work, that he has fully informed himself of conditions that would affect the proposed work, that, prior to the tender of his bid, he has examined the Contract Documents for the work and has read all special instructions and provisions contained in the Documents, and that he has satisfied himself with respect to the quality and extent of work to be performed.

The Bidder declares that he understands that, when quantities of work for which unit price bids are requested in the Proposal, such quantities are approximate only and are subject to either increase or decrease, that, should the quantities of any of the work items be increased, the Bidder proposes to perform the additional work at

the unit prices bid by him, that, should the quantities of any of the work items be decreased, payment will be made only for the actual quantities of work performed and such payment will be based upon the unit prices bid by him, and that he shall make no claim for profits anticipated on the decrease in quantities of work. Actual quantities will be paid for as the work progresses, in accordance with the provisions of the Contract Agreement, and such quantities shall be subject to final measurements and determinations made upon completion of the work.

The Bidder understands that the Owner reserves the right, in the Owner's discretion, to reject any or all bids, to waive any informality in any bid, and to accept any bid considered to be advantageous to the Owner.

The Bidder agrees that his bid shall be valid for a period of sixty (60) calendar days after the date set for receipt of bids, and shall not be withdrawn for a period of sixty (60) calendar days after the date set for receipt of bids.

The Bidder has attached hereto a Bid Bond executed by a Surety Company authorized to do business in the State of Alabama (with valid Power-of-Attorney attached), or a cashier's check drawn on an Alabama bank, in favor of (made payable to) the City of Northport, in the amount of 5% of the bid amount (total), but in no event more than \$10,000.

The Bidder agrees that, should he be notified that his Bid on the work has been accepted, he will, within ten (10) days from receipt of such notice, execute the formal Contract Agreement bound herein, and will furnish with the Contract evidence of Insurance Coverage of his construction operations and all of his operations associated with the project, all in accordance with the requirements of the General Conditions.

The Bidder further agrees that, in case of failure on his part to execute said Contract Agreement, and to furnish all Bonds required by the Contract Documents, within ten (10) consecutive calendar days after receipt of notice of award of Contract to him, the monies payable to the Obligee of his Bid Bond, in accordance with the terms and conditions of the Bond, shall be paid to the Owner as liquidated damages for the delay and additional expense to the Owner caused by such failure on the part of the Bidder.

The Bidder hereby agrees that, should the work under the Contract be awarded to him, he will commence work under this Contract on or before a date to be specified in written "Notice to Proceed" given by the Owner, and that he will fully complete the Contract within 270 consecutive calendar days thereafter. The Bidder further agrees to pay, as liquidated damages, the sum of \$1,500.00 for each consecutive calendar day after the date set for completion of the work, as provided in the General Conditions. The Bidder further agrees that he will not make any claim for

extra compensation should completion of work under the Contract be effected in advance of the time specified hereinabove.

The undersigned Bidder states that he fully understands the meaning of "low, responsive, responsible Bidder", as defined in these Documents, and that these criteria will be applied in the evaluation of this Bid.

The undersigned, as Bidder, hereby declares that the name (or names) of the only person (or persons) interested in this Proposal, as principal (or principals), is (or are) as herein below set out and that no person other than that (or those) herein below stated has any interest in this Proposal, or in the Contract to be entered into; that this Proposal is made without connection with any other person, firm or corporation making a proposal; and that it is in all respect fair and in good faith, without collusion or fraud.

Bidder acknowledges receipt of the Following Addenda:

Addendum No. 1, dated: \_\_\_\_\_

Addendum No. 2, dated: \_\_\_\_\_

Addendum No. 3, dated: \_\_\_\_\_

Addendum No. 4, dated: \_\_\_\_\_

Following are the names and addresses of all persons, firms, and corporation interested in the foregoing bid:

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Address:

Respectfully submitted,

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_

By

Date \_\_\_\_\_

\_\_\_\_\_  
Title

Contractor's License No. \_\_\_\_\_  
(SEAL - if Bid is made by a Corporation)

**BID BOND**

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned,

\_\_\_\_\_  
\_\_\_\_\_  
as Principal \_\_\_\_\_ and  
as Surety, are hereby held and firmly bound  
unto \_\_\_\_\_

\_\_\_\_\_  
as owner in the penal sum  
of \_\_\_\_\_

\_\_\_\_\_  
for the payment of which, well and truly to be made, we hereby jointly and severally bind  
ourselves, our heirs, executors, administrators, successors  
and assigns.

Signed  
this \_\_\_\_\_ day of \_\_\_\_\_, 20 \_\_\_\_\_

The condition of the above obligation is such that whereas the Principal  
submitted \_\_\_\_\_  
to \_\_\_\_\_ a certain Bid, attached hereto and hereby made  
a part hereof to enter into a contract in writing, for  
the \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
NOW, THEREFORE,

- (a) If said Bid shall be rejected, or in the alternate,
- (b) If said Bid shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attached hereto (properly completed in accordance with said Bid) and shall furnish a bond for his faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said bid, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all

claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers the day and year first set forth above.

\_\_\_\_\_  
Principal (L.S.)

\_\_\_\_\_  
Surety

By \_\_\_\_\_

SEAL



## CONTRACT AGREEMENT

THIS AGREEMENT, made and entered into as of the \_\_\_\_\_ day of \_\_\_\_\_  
\_\_\_\_\_ in the year of 2024, by and between the City of Northport (hereinafter  
called the Owner), and \_\_\_\_\_ (hereinafter called  
the Contractor)

WITNESSETH: That the Owner and the Contractor, in consideration of the  
mutual covenants hereinafter set forth, agree as follows:

Article I. **CONTRACT DOCUMENTS.** The Contract Documents shall consist  
of: this Agreement; Contractor's Proposal; Contractor's Bid Bond; Notice to Contractors  
(Advertisement for Bids); Instructions to Bidders; General Conditions; Supplemental  
Conditions; Performance Bond; Labor and Material Payment Bond; all Addenda issued  
prior to the submittal of the Proposal; all Modifications issued and agreed upon by the  
Owner and the Contractor prior to and subsequent to the execution of this Agreement;  
and the Plans (Contract Drawings) and Specifications as prepared by Krebs  
Engineering, Inc., 2100 River Haven Drive, Birmingham, Alabama 35244, and as on file  
in the office of the Owner. The documents enumerated hereinabove form the Contract  
and all are as fully a part of the Contract as if attached to this Agreement and/or fully set  
forth herein.

Article II. **SCOPE OF WORK.** The work to be done under this Contract by  
the Contractor, at his own cost, shall consist of furnishing all labor, materials, supplies,  
tools and equipment, and of performing all work necessary to construct and fully  
complete the project entitled Northport WTP Chemical Systems Improvements,  
Project No. 22031 all in accordance with the Contract Drawings and Specifications and  
with the requirements and provisions of the Contract Documents, all of which form this  
Contract.

Article III. **TIME OF COMPLETION.** The work shall be fully completed within  
270 calendar days after the date on which the Notice to Proceed is issued, subject,  
however, to such extensions of time as may be authorized in accordance with the  
provisions of the Contract Documents.

Should the work under this Contract not be fully completed within the time  
specified, it is understood and agreed that there will be deducted from the periodic and  
final estimates of work performed by the Contractor a sum computed at the rate of  
\$1500.00 per day for each additional day required to fully complete the work, beginning  
from the specified date of completion and extending to the date of final acceptance of  
the work. It is understood and agreed that the sum thus deducted is not a penalty, but  
money due to reimburse the Owner for the extra cost and expense caused by the delay  
in the completion of the work. It is also understood and agreed that, in the event that the  
work should be completed in advance of the completion date specified, the Contractor  
will make no claim for extra payment therefor.

Article IV. **CONTRACT PRICE.** The Owner shall pay the Contractor in full  
payment for performance of work under this Contract, in accordance with the price or  
prices set forth in the Proposal submitted by the Contractor, which proposal is bound

herewith and made a part hereof to the same extent as if fully set out herein, but subject to such additions and deductions as provided for in the Contract Documents, the sum of \_\_\_\_\_ (\$\_\_\_\_\_).

The Contract Price shall be equitably adjusted to compensate for any changes in the work as may be ordered by the Owner.

Article V. **CHANGES IN WORK AND EXTRA WORK.** The Owner shall have the right to increase or decrease quantities of work, to make changes in the work, and to require the Contractor to perform extra work necessary for the satisfactory completion of the project.

Where new and/or additional items of work are found to be necessary for the satisfactory completion of the project, and where the character of the work is such that a reasonable price for the performance of the work cannot be established by use of contract prices or combinations thereof, such new and/or additional items of work shall be classed as Extra Work.

Where the satisfactory completion of the project requires that changes in work be effected or extra work be ordered, the procedure to be followed in such cases shall be in accordance with the provisions of the Articles of the General Conditions relating to CHANGES IN WORK, EXTRA WORK, and PAYMENT FOR EXTRA WORK.

Article VI. **PROGRESS PAYMENTS.** The Owner shall make progress payments to the Contractor in amounts equal to values of work performed on the project through the closing dates of the preceding estimate periods, but less five percent (5%) of the combined values and less previous payments made. The five percent (5%) retained percentage may be held by the Owner until the value of work completed at the end of any estimate period equals or exceeds fifty percent (50%) of the total amount of the Contract, after which time, if the Owner and the Engineer deem that satisfactory progress is being made, no further retainage will be withheld. The retainage as set forth above shall be held until final completion and acceptance of the Contract. When the work has been substantially completed, reviewed by the Owner and the Engineer, and found to be in accordance with the provisions of the Contract Documents, the retainage may be reduced to such an amount as would reasonably cover the cost of correction of minor items of work heretofore found to be faulty and the cost of work remaining to be done in order to effect the completion of all of the work in full accordance with the provisions of the Contract Documents. Progress payments will be made in accordance with the provisions of the General Conditions.

Article VII. **FINAL PAYMENT.** Final payment, constituting the entire balance of the Contract Price, shall be paid by the Owner to the Contractor within thirty days after the acceptance of the work. The work will not be accepted until the Contractor has certified that he has completed all of the work in full accordance with the provisions of the Contract Documents, the Owner and the Engineer have completed the final review of the work and found that it has been fully completed in accordance with the provisions of the Contract Documents, the Contractor has advertised completion of the work in accordance with the General Conditions, and the Contractor has presented to the Owner satisfactory evidence that all indebtedness connected with the work has been fully paid and satisfied, all as set forth in the General Conditions.

Article VIII. **MISCELLANEOUS PROVISIONS.** Terms used in this Agreement which are defined in the General Conditions and in the Instructions to Bidders shall have the same meanings as designated in those component parts of the Contract Documents.

The Contract Documents, which constitute the entire agreement between the Owner and the Contractor are listed in Article I of this Agreement and, except for Modifications issued after the execution of this Agreement, are enumerated hereinbelow. The signatures which appear hereunder shall have the same force and effect as if appearing on all of the Contract Documents enumerated as follows:

1. Contract Agreement
2. Proposal
3. Bid Bond
4. Advertisement for Bids
5. Instructions to Bidders
6. General Conditions
7. Supplementary Conditions
8. Performance Bond
9. Labor and Material Payment Bond
10. Specifications
11. Drawings
12. Addenda

IN WITNESS HEREOF, the said Contractor has hereunder executed this Agreement by his signature shown hereon, and said Owner has hereunder executed this Agreement by affixing hereto his corporate seal and by signature of his corporate officer(s) as shown, on the date first written above, in 3 counterparts, each of which shall, without proof or accounting for the other counterparts, be deemed an original.

By signing this contract, the contracting parties affirm, for the duration of the agreement, that they will not violate federal immigration law or knowingly employ, hire for employment, or continue to employ an unauthorized alien within the state of Alabama. Furthermore, a contracting party found to be in violation of this provision shall be deemed in breach of the agreement and shall be responsible for all damages resulting therefrom.

ATTEST:

\_\_\_\_\_  
(Contractor)

By \_\_\_\_\_

Title \_\_\_\_\_

ATTEST:

City of Northport

By \_\_\_\_\_

Title \_\_\_\_\_

**LABOR AND MATERIAL PAYMENT BOND**

KNOW ALL MEN BY THESE PRESENTS: that we \_\_\_\_\_

\_\_\_\_\_ hereinafter called the Principal, and \_\_\_\_\_

\_\_\_\_\_ hereinafter called the Surety, do acknowledge ourselves to be held and firmly bound unto \_\_\_\_\_  
City of Northport, AL

\_\_\_\_\_ hereinafter called the Owner, in the penal sum of \_\_\_\_\_

\_\_\_\_\_ for payment of which sum well and truly to be made in lawful money of the United States, we bind ourselves, our successors, heirs, executors, administrators, assigns and personal representatives, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION OR BOND IS THIS:

Whereas, the Principal has entered into a certain written contract with the Owner, bearing the

date of \_\_\_\_\_, 20 \_\_\_\_\_ for the construction of the

\_\_\_\_\_ a copy of which contract is attached hereto, incorporated herein by reference, and made a part of to the same extent as if set out herein in full, and the Principal and Surety are bound under this Bond which shall remain in full force and effect until all claims and demands with respect to labor and materials connected with the work under the contract have been satisfied, subject however to statutory limitations and to such other conditions as hereinafter stated.

NOW, THEREFORE, if the Principal and all Subcontractors to whom any portion of the work provided for in the contract is sublet, and all assignees of said Principal and said sub- contractors, shall promptly make payment to all persons, firms, subcontractors and corporations for furnishing said Principal and said Subcontractors with labor, materials, equipment, machinery, parts, fuel, foodstuffs, supplies, or repairs on machinery or equipment used in or incorporated in the work, for performing any work in connection with the prosecution of the work under the Contract, and under any modifications or extensions thereof, for all insurance premiums in connection with the work, for all labor performed in connection with the work whether by subcontractor or otherwise, or for reasonable attorney's fees incurred by any claimant or claimants in suits under this Bond, then this obligation shall be void; otherwise it shall remain in full force

and effect.

PROVIDED FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder or to the Specifications accompanying the same, shall in any wise affect the obligation of the Surety under this Bond, and the Surety does hereby waive notice of any such change, extension of time, or alteration or addition to the terms of the Contract or to the Specifications.

PROVIDED FURTHER, that this Bond is subject to the following limitations and conditions:

(a) Any person, firm or corporation who has furnished labor, materials, equipment, machinery, fuel, parts, foodstuffs, supplies, or repairs for machinery or equipment used or incorporated in the prosecution of the work under the Contract, or amendment or extension thereof, and who has not received due payment for furnishing such items, shall have a direct right of action in his or their name or names against the Principal and Surety on this Bond, which right of action shall be asserted in a proceeding instituted in a Court of competent jurisdiction in the area in which the work under the contract has been performed. Such right of action shall be asserted in a proceeding brought in the name of the claimant for his or their use and benefit against said Principal or Surety, or either of them not later than one year after the final settlement of the contract, in which action such claim or claims shall be adjudicated and judgement thereon.

(b) In addition to any other legal mode of service, service of summons and other process in suits brought on this Bond may be had on the Principal or Surety by leaving a copy of the summons and complaint, or other pleading or process, with the and the principal and the Surety agree to be bound by such mode of service above described, and consent that such service shall be the same as personal service on the Principal or Surety.

(c) The Surety shall not be liable hereunder for any damage or compensation recoverable under any workmen's compensation or employer's liability statute.

(d) In no event shall the Surety be liable for a greater sum than the penalty of this bond, or subject to any suit, action or proceeding thereon that is instituted later than one year after final settlement of the said Contract.

(e) No final settlement between the Owner and the Principal shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in 3 counterparts, each one of which shall, without proof of or accounting for the other counterparts, be deemed an original, on this day the \_\_\_\_ day of \_\_\_\_\_, 20 \_\_\_\_.

ATTEST:

By

\_\_\_\_\_  
(Principal Secretary)

By

Title

\_\_\_\_\_  
Principal

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_  
Witness as to Principal

\_\_\_\_\_  
Address

\_\_\_\_\_

\_\_\_\_\_  
Address

\_\_\_\_\_  
Surety

ATTEST:

By

\_\_\_\_\_  
(Surety Secretary)

By

\_\_\_\_\_  
Attorney-in-Fact

\_\_\_\_\_

\_\_\_\_\_  
Address

\_\_\_\_\_  
Witness to Surety

\_\_\_\_\_

\_\_\_\_\_  
Address

Countersigned

\_\_\_\_\_  
Resident Agent of Surety

\_\_\_\_\_

\_\_\_\_\_  
Resident Agent Address

\_\_\_\_\_  
Phone No.

**PERFORMANCE BOND**

KNOW ALL MEN BY THESE PRESENTS: that we \_\_\_\_\_

\_\_\_\_\_

hereinafter called the Principal, and \_\_\_\_\_

\_\_\_\_\_

hereinafter called the Surety, do acknowledge ourselves to be held and firmly bound unto  
City of Northport, AL

\_\_\_\_\_

hereinafter called the Owner, in the penal sum of \_\_\_\_\_

\_\_\_\_\_

for payment of which sum well and truly to be made in lawful money of the United States, we bind ourselves, our successors, heirs, executors, administrators, assigns and personal representatives, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION OR BOND IS THIS:

Whereas, the Principal has entered into a certain written contract with the Owner, bearing the

date of \_\_\_\_\_, 20 \_\_\_\_\_ for the performance of the

\_\_\_\_\_

(the "Contract"), which is fully incorporated herein by reference, and made a part hereof to the same extent as if set out herein in full, and the Principal and Surety are and shall remain bound under this Bond for the full and faithful performance and satisfaction of all of the Principal's duties, undertakings, work, and obligations under the Contract,

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform and satisfy all of his duties, undertakings, work, and obligations, all in accordance with the covenants, terms, conditions, agreements and provisions of the Contract, and if the Principal shall satisfy all claims and demands made or incurred under the Contract, shall fully correct all faulty work or defective work and make good any work that does not comply with the Principal's warranty and guaranty, shall fully indemnify and save harmless the Owner from all costs and damages whatsoever which the Owner may suffer by reason of any failure on the part of the Principal to do so, and shall fully reimburse and repay the Owner for any and all outlay, damage, and expense (including all additional engineering costs, all legal costs and attorney's fees) which the Owner may incur in making good any default or by reason of any failure by the Principal to fully perform and satisfy all of the Principal's duties, undertakings, work, and obligations under the Contract, then this obligation shall be void; otherwise, it shall remain in full force and effect.



Be it also understood that should the Principal be in default on or non-compliance with any of its obligations under the Contract, the Owner having performed the Owner's obligations thereunder, then upon written notice by the Owner to the Surety of such default or non-compliance, the Surety shall promptly:

- (1) Remedy the default or non-compliance of the Principal, or
- (2) Perform and satisfy all of the Principal's remaining work and obligations under the Contract in full accordance with the terms and conditions of the Contract, using for performance of such work a contractor chosen by the Surety and approved by the Owner, or

"Promptly", as used herein, shall be defined as within thirty (30) days from the date on which the Owner has notified the Surety in writing of the Principal's default on or non-compliance with the Contract.

Whichever method may be used by the Surety to remedy the Principal's default on or non-compliance with the Contract or to complete the work under the Contract and satisfy the Principal's obligations, the Surety shall also pay to the Owner all additional costs and damages incurred by the Owner by reason of the Principal's default on or non-compliance with the Contract and the subsequent completion of the work under the Contract by the Surety.

PROVIDED FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, modification, extension of time, alteration, or addition to or of the terms of the Contract or to the work to be performed thereunder shall in any wise affect the obligation of the Surety under this Bond and the Surety does hereby waive notice of any such change, modification, extension of time, alteration, or addition to or of the terms of the Contract or to the work to be performed thereunder.

PROVIDED FURTHER, that final payment by the Owner to the Principal shall not abridge the rights of the Owner hereunder.

IN WITNESS WHEREOF, this instrument is executed in  3  counterparts, each one of which shall, without proof of or accounting for the other counterparts, be deemed an original, on this day the \_\_\_\_ day of \_\_\_\_\_, 20 \_\_\_\_.

ATTEST:

By

\_\_\_\_\_  
(Principal Secretary)

By

Title

\_\_\_\_\_  
Principal

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_  
Witness as to Principal

\_\_\_\_\_  
Address

\_\_\_\_\_

\_\_\_\_\_  
Address

\_\_\_\_\_  
Surety

ATTEST:

By

\_\_\_\_\_  
(Surety Secretary)

By

\_\_\_\_\_  
Attorney-in-Fact

\_\_\_\_\_

\_\_\_\_\_  
Address

\_\_\_\_\_  
Witness to Surety

\_\_\_\_\_

\_\_\_\_\_  
Address

Countersigned

\_\_\_\_\_  
Resident Agent of Surety

\_\_\_\_\_

\_\_\_\_\_  
Resident Agent Address

\_\_\_\_\_  
Phone No.

## **GENERAL CONDITIONS**

### **1. WORK TO BE PERFORMED**

- 1.1 The work to be performed under this Contract shall include, but without limitation, the furnishing of all materials, labor, tools, appliances, equipment, supplies, transportation and services necessary to accomplish the work, and the construction complete of all facilities and improvements as described and/or shown by the Contract Documents.
- 1.2 The Contractor shall pay all sales, consumer, use and similar taxes for the work to be performed by the Contractor which are legally enacted when bids are received or negotiations concluded.

### **2. CONTRACT/BID DOCUMENTS**

- 2.1 The Bid Documents form the Contractor's formal response to the invitation to bid. The Contract Documents form the Contract for Construction between the Owner and Contractor. These documents supersede prior negotiations or agreements, either written or oral, and shall not be interpreted to create a contractual relationship between the Engineer and Contractor, or between any persons or entities other than the Owner and Contractor. The Contract/Bid Documents are comprised of the following documents:

#### Bid Documents

- A. Advertisement for Bids (Notice to Contractors), listing date and time for receipt of bids, principal items of work, and requirements for bidding.
- B. Instructions to Bidders containing information for use of Contractors preparing a Proposal.
- C. Proposal shall be tendered on Proposal Forms provided in the Specifications. The Proposal shall be properly executed and guaranteed as specified in the Instructions to Bidders.
- D. Bid Bond shall accompany the Proposal, and shall guarantee that the Bidder will enter into an agreement with the Owner for construction of the work should the Contract be awarded to him.

#### Contract Documents

- E. Contract Agreement Between the Owner and Contractor covers the performance of the work described in the Contract Documents including all supplemental addenda thereto and all general and special provisions pertaining to the work or materials therefor. Execution of the Contract by the Contractor represents that the Contractor has visited the site to become familiar with the conditions under which the work is to be performed.
- F. General Conditions outline certain responsibilities of the Owner and the Contractor (who are the parties to the Contract Agreement) and also those responsibilities delegated by the Owner to the Engineer who acts as the agent of the Owner. Supplemental General Conditions or Special Provisions, when

required, are bound in the Contract Documents following the General Conditions, and are a part of the Contract.

- G. Drawings (Plans) and Specifications show and describe the work to be performed, and it is the intent of the Drawings and Specifications that the Contractor shall furnish all labor, tools, materials, equipment, transportation and services necessary for the proper execution of the work so shown and/or described, unless specifically noted otherwise. The Contractor shall execute all work so described in full conformance with the Plans, Specifications and all Contract Documents; shall perform all incidental work necessary to complete the project in an acceptable manner; and shall fully and satisfactorily complete all work, facilities, and improvements, ready for use, occupancy and operation by the Owner.

The Engineer shall be deemed the author of the Drawings and Specifications, including those in electronic format, and shall retain all reserved rights, including the copyright. The Contract Documents are for use solely with respect to this project, and shall not be used by the Contractor for any other purpose.

Responsibilities for adequacy of the design and for sufficiency of the Contract Documents shall be borne by the Owner. The complete requirements of the work to be performed under the Contract shall be set forth in the Contract Documents supplied by the Owner through the Engineer or by the Engineer as representative of the Owner. The Contract Documents shall be considered to be inseparable documents, and in considering them, the Contractor shall use them in performing the work in accordance with their combined intent.

The Drawings and Specifications are intended to be complementary; and where work is called for in one but not in the other, it shall be performed as though it were specified and/or indicated in both. Any seeming conflict between the Drawings, Specifications, and other Contract Documents, shall be submitted to the Engineer, and the Engineer's decision shall be final.

All discrepancies found between the Contract Documents and site conditions or any inconsistencies or ambiguities in the Contract Documents shall be immediately reported by the Contractor to the Engineer, who shall promptly correct such inconsistencies or ambiguities in writing. After discovery of such inconsistencies or ambiguities by the Contractor, any work done by the Contractor on any part of the project affected by such inconsistencies or ambiguities before receipt of written corrections from the Engineer shall be at the Contractor's risk.

The figured dimensions and/or elevations shown on the Drawings shall be used by the Contractor for the layout of the work. Where the work of the Contractor is affected by finish dimensions, such dimensions shall be determined by the Contractor at the site of the work, and he shall assume the responsibility therefor.

The Owner reserves the right to amend or revise the Drawings and/or Specifications, and to furnish such other detail drawings as, in the opinion of the Engineer, may be necessary for the proper prosecution of the work. All such additional drawings and/or specifications shall have equal force and effect as the original drawings.

Except as provided for otherwise, or specified to the contrary, all copies of Contract Documents required for and necessary for the execution of the work will be furnished to the Contractor (on the Contract) without charge.

- H. Addenda to Contract Documents issued during the time of bidding (before receipt of bids) or forming a part of the Contract Documents issued to the Contractor for the preparation of the Proposal, shall be covered in the Proposal, and shall be made a part of the Contract. Receipt of each Addendum shall be acknowledged in the Proposal.
- I. Bonds shall be furnished by the Contractor at the time of execution of the Contract Agreement, shall be in the form prescribed by the Owner, shall be with a Surety Company authorized to do business in the State in which the work is located, and shall be countersigned by a resident agent of the Surety Company in that State. Bonds shall be as follows:
1. Performance Bond in an amount equal to 100% of the Contract Amount as a guaranty of good faith on the part of the Contractor to execute the work in accordance with the terms of the Contract.
  2. Labor and Material Payment Bond in an amount equal to 100% of the Contract Amount as a guaranty of good faith on the part of the Contractor to make all payments for labor, material, supplies, and equipment in connection with the Contract.

The Bonds shall remain in full force and effect for the period of the full year following the date of Substantial Completion.

- J. Modifications Issued After Execution of the Contract including, but not limited to, written amendments to the Contract, Change Orders, Construction Change Directives and minor changes in the work issued by the Engineer.

### **3. INSURANCE**

- 3.1 The Contractor shall not commence any work on the project until he obtains, at his own expense, all required insurance; and the Contractor shall not, at any time, conduct any operations on the project or associated with the project unless such operations are covered by the specified insurance. Such insurance must have the approval of the Owner as to limit, form, and amount. The Contractor shall not permit any subcontractor to commence work on the project until the same insurance requirements have been complied with by such subcontractor (or sub-contractors). The insurance coverage shall be maintained throughout the full period of the contract. Any insurance bearing on adequacy of performance shall be maintained after completion of the project for the full guaranty period.
- 3.2 As evidence of specified insurance coverage the Owner may in lieu of receipt of actual policies, accept certificates issued by the insurance carrier showing such policies to be in force for the specified period.
- 3.3 Nothing contained in these insurance requirements is to be construed as limiting the extent of the Contractor's responsibility for payment of damages resulting from his operations under this Contract. The Contractor shall have responsibility to enforce Subcontractor compliance with these insurance requirements.

3.4 The types of insurance that the Contractor shall be required to obtain and maintain for the full period of the Contract are listed hereinbelow:

A. Workmen's Compensation and Employer's Liability Insurance shall be in strict accordance with the requirements of the current and applicable Workmen's Compensation Laws of the State. The insurance shall cover all of the Contractor's employees employed or associated with the project; and where any part of the work is subcontracted, the Contractor shall require the subcontractor to provide similar Workmen's Compensation and Employer's Liability Insurance for all employees of the subcontractor unless such employees are covered by the protection afforded by the Contractor. In case any class of employees engaged in hazardous work under this Contract is not protected under the Workmen's Compensation Statute the Contractor shall provide, and shall cause such subcontractor to provide, adequate coverage for the protection of all employees on the project not otherwise protected under applicable provisions of the Statutes relating to Workmen's Compensation and Employer's Liability Insurance.

B. Comprehensive General Liability Insurance shall protect the Contractor and any subcontractors performing work under this Contract from any claims for bodily injury, for sickness or disease, for death, for personal injury, and for property damages which may arise either directly or indirectly out of, or in connection with, the performance of work under this Contract. The minimum limits of coverage shall be as follows:

Bodily Injury \$1,000,000 each occurrence, \$1,000,000 aggregate  
Property Damage \$500,000 each occurrence, \$500,000 aggregate  
Personal Injury \$250,000 each occurrence, \$250,000 aggregate

The naming of minimum limits of coverage shall not be construed as limiting the Contractor's responsibility to provide contractual coverage sufficiently broad to ensure the provisions of the Article of these General Conditions relating to Indemnity, or limiting the responsibilities of the Contractor as outlined under the aforesaid Article.

C. Comprehensive Automobile Liability Insurance shall protect the Contractor and any subcontractor performing work under this Contract from any claims for bodily injury, for death, and for property damages which may arise either directly or indirectly out of, or in connection with, the performance of work under this Contract. The minimum limits of coverage shall be as follows:

Bodily Injury - \$500,000 per person, \$1,000,000 each occurrence  
Property Damage - \$250,000 each occurrence

The naming of minimum limits of coverage shall not be construed as limiting the Contractor's responsibility to provide contractual coverage sufficiently broad to ensure the provisions of the Article of these General Conditions relating to Indemnity, or limiting the responsibilities of the Contractor as outlined under the aforesaid Article.

D. Property Insurance shall afford protection against physical damage to the insured property during the entire construction period. Insurable portions of the project shall be covered on a completed value basis; and at any given time the dollar coverage provided shall be actual value of completed work, value of work in progress, and value of stored materials. The policy by its own terms or by

endorsement shall specifically permit partial or beneficial occupancy or use prior to completion or acceptance of the entire work.

Perils named in the policy shall be Fire and Lightning, Extended Coverage, Vandalism and Malicious Mischief, and other perils associated with the particular nature and character of the work.

- E. Special Hazards or Perils. The Liability and Property Damage Insurance Coverage of the Contractor's operations shall provide adequate protection against any death, any bodily injury or any property damage resulting from the blasting operations in connection with the Contractor's work, or in connection with the work of his subcontractors.

Insurance carried by the Contractor on the insurable portions of the work shall not relieve the Contractor of the responsibility for the protection of all materials and all work until the project has been accepted by the Owner. Any loss suffered on the project by reason of the perils named under Article 3.d. or under this subpart of Article 3. shall be borne by the Contractor and/or the Insurance Company providing the coverage for the Contractor; and the Owner shall not be liable for any cost of replacement of lost or damaged work or material.

The Contractor shall purchase Builder's Risk "all risk" insurance providing protection against losses stemming from natural disasters.

- F. Protection of the Owner and the Engineer. The Owner and his agents, and the Engineer shall also be named insureds in all insurance policies provided by the Contractor for his own protection and for that of his subcontractors.

In the event that the Contractor or his Surety is prevented by law or by charter from naming the Owner and his agents, and the Engineer, as insureds in the policies providing the coverages listed under this Article, the Contractor shall purchase and maintain during the life of this agreement Owner's & Contractors's Protective Liability Insurance in amount of not less than \$1,000,000.00; and the named insureds shall be the Owner, his agents, and the Engineer. The insurance shall protect the Owner and his agents, and the Engineer, from any claim or loss arising from any act of the Contractor or his subcontractors, or any failure to act on the part of the Contractor or his subcontractors, during the performance of work under this agreement.

- G. Pollution Insurance. In addition to the requirements of the Contract for General Liability and other insurance coverage, the Contractor shall be required to carry a minimum of \$5,000,000 of Pollution Hazard Insurance Coverage per project. An approved insurance certificate indicating the required Pollution Hazard Coverage shall be provided prior to award of Contract.

#### **4. INDEMNIFICATION**

- 4.1 The Contractor shall hold harmless, indemnify and defend the Owner and the Engineer, their subconsultants, and each of their officers, agents and employees, from and against all loss or expense (including costs and attorney's fees) by reason of any or all suits, actions or claims of any character, name or description brought for or on account of any injuries or damages received or sustained by any person or persons, by any property, or by the Contractor or any of his employees, as a consequence of any action of the

Contractor or actions of his employees in connection with the prosecution of the work, or by or on account of any claim arising from or any amounts recovered under the Workmen's Compensation Law or any other law, ordinance, or decree, excepting only such injury or damage as shall have been occasioned by the sole negligence of the Owner or Engineer.

## **5. PATENTS AND ROYALTIES**

5.1 The Contractor shall pay the costs of all royalties, license fees and patent fees involved by use, or manner of use in the work of all designs, devices, materials, equipment or processes, and the Contractor shall provide for such use or manner of use by legal agreement with the Owner of the patent or a duly authorized licensee of such owner. All such costs referred to hereinabove shall be included in the price bid for the work under this Contract.

5.2 The Contractor shall save harmless the Owner and the Engineer from any and all loss or expense by reason of use, or manner of use, in the work of any design, device, material, equipment or process covered by letter of patent or copyright; and the Contractor shall defend all suits resulting from claims for royalties, license fees or patent fees on designs, devices, materials, equipment or processes purchased by the Contractor for use in the work, and from claims for royalties, license fees or patent fees involved by use, or manner of use, of such items by the Owner.

## **6. LICENSES AND PERMITS**

6.1 All licenses, fees, inspections and permits necessary for the prosecution of the work shall be secured and paid for by the Contractor at no expense to the Owner other than as reflected in the price bid for the work.

## **7. COMPLIANCE WITH LAWS, ORDINANCES AND REGULATIONS**

7.1 The Contractor shall comply with all Federal, State, and Local Laws, Ordinances and Regulations which in any manner affect the work or the conduct of the work; shall comply with all orders and decrees as may have been adopted or as may be enacted by bodies or tribunals having any legal jurisdiction or authority over the work. The Contractor shall file all reports and give all notices as required for compliance with the above. The Contractor shall indemnify and save harmless the Owner and the Engineer against any suits or actions of any kind or nature brought, or may be brought, against them for any claim or liability arising from or based upon the violation of any such laws, ordinances, work regulations, safety and health regulations, orders or decrees by the Contractor, his subcontractors, his agents, his representatives, his employees, or employees of his subcontractors.

## **8. SAFETY**

8.1 The Contractor, in the prosecution of his work under the Contract, is bound by the requirements of "Safety and Health Regulations for Construction" of the Occupational Safety and Health Administration, U.S. Government Department of Labor, and of other authorities having jurisdiction in safety matters.

8.2 Under the terms and conditions of this Contract, the Engineer shall not act as Safety Supervisor, since such responsibility remains solely with the Contractor. The Engineer shall not be responsible for establishing safety practices or for prescribing safety measures for the contractor.



- 8.3 The Contractor is solely and completely responsible for conditions of the job site, including safety of all persons and property affected directly or indirectly by his operations during the performance of the work; and this requirement is not limited in application to normal working hours, but applies continuously twenty-four (24) hours per day until acceptance of the work by the Owner, and thereafter shall be subject to the terms and conditions of the Guaranty.
- 8.4 The duty of the Engineer to review the work in order to determine its acceptability in accordance with the Contract Documents and to conduct construction review of the Contractor's performance for the benefit of the Owner, shall not be construed as a duty to review the adequacy of the Contractor's safety measures on or near the construction site and/or to direct the actions of the Contractor's employees in the performance of the work as such duties are not included among the responsibilities of the Engineer.

## **9. WARNING SIGNS AND BARRICADES**

- 9.1 The provision by the Contractor of warning signs, warning lights, barricades and watchmen is subject to the requirements of "Safety and Health Regulations for Construction" of the Occupational Safety and Health Administration, U.S. Government Department of Labor, of the State "Manual on Uniform Traffic Control Devices for Streets and Highways," and of other authorities having jurisdiction in the areas of safety and traffic control. The Contractor is solely responsible for satisfying the safety and traffic control requirements of authorities concerned with or affected by this work.

## **10. PUBLIC CONVENIENCE**

- 10.1 The Contractor is required to conduct his work as to ensure the least possible obstruction to traffic, to ensure the least possible inconvenience to the general public and the residents in the vicinity of the work, and to ensure the protection of persons and property. Permission of the proper authority is required before any road or street is closed to the public. The maintenance of accessibility of fire-fighting equipment to fire hydrants and to such areas as are necessary for the provision of fire protection is a requirement of the Fire Department of the authority having jurisdiction. The provision of temporary measures as required to ensure the safe use of sidewalks and streets by the public is the responsibility of the Contractor. The proper functioning of all gutters, sewer inlets, drainage ditches and irrigation ditches is to be ensured by constant clean-up along with the work and by provision of temporary facilities where required for the maintenance of natural surface drainage. The implementation of all such maintenance measures and safety precautions is the sole responsibility of the Contractor.

## **11. SANITARY PROVISIONS**

- 11.1 The Contractor is responsible for the maintenance of proper sanitary conditions in the area of his work. The provision and maintenance of such sanitary accommodations as may be required for the use of his employees and of his subcontractor's employees is subject to the Rules and Regulations of the State Board of Health and to all local Codes and Ordinances. Refer to Article 7.

## **12. EXISTING CONSTRUCTION AND FACILITIES**

- 12.1 Where construction work under this Contract is adjacent to or crosses highways, railroads, streets, roads, access facilities, or utilities under the jurisdiction of State,

County, City or other public agency, public utility or private entity, the Contractor is required to secure written permission from the proper authority and to furnish such bond (cash or surety as required), or insurance agreement as may be required before executing such construction work. A copy of the written permission and bond or insurance agreement (when required) must be filed with the Owner before any work is done. The Contractor is responsible for the replacement and/or repair of all existing construction, utilities or facilities damaged in the execution of work under this Contract. The Contractor will be required to furnish releases from all authorities affected by the work before final acceptance of the work under this Contract.

- 12.2 The type, size and physical location of existing facilities are shown from available records and the accuracy of said information is not guaranteed. The Contractor is requested to make additional investigations as he may desire. The Contractor shall assume all risks arising from, or out of, performing work in the vicinity of existing facilities, or connection to existing facilities.

**13. COMMENCEMENT, PROSECUTION, AND COMPLETION OF THE WORK**

- 13.1 Following the execution of the Contract by the Owner and the Contractor, a written Notice to Proceed will be given to the Contractor by the Owner. The Contractor shall commence work on the project in good faith within the number of days specified in the Contract Agreement; and the Contractor, in accordance with the terms and provisions of the Contract Agreement, will be required to prosecute the work in such a manner and with such force as will enable him to secure the satisfactory completion of the project within the time period stated in the Contract Agreement.
- 13.2 It is intended that the date of issuance of the Notice to Proceed will coincide with the date of the execution of the Contract, or as soon thereafter as is practicable. The time allowed for commencement of the work shall be the number of consecutive calendar days specified in the Proposal and in the Contract Agreement; and the number of days shall be reckoned from the date of the Notice to Proceed. The time allowed for the completion of the work shall be the number of consecutive calendar days as specified in the Proposal and in the Contract Agreement; and the number of days shall be reckoned from the date specified in the Notice to Proceed for commencement of work.
- 13.3 Should the work under this Contract not be completed within the time specified, it is understood and agreed that there will be deducted from the monthly and final estimates of work performed by the Contractor a sum computed at the rate per day as shown in the Contract Agreement, beginning from the stated date of completion and extending to the date of final acceptance of the work. It is understood and agreed that the above deduction is not a penalty, but money due to reimburse the Owner for the extra cost and expense caused by the delay in the completion of the work. It is also understood and agreed that, in the event that the work should be completed in advance of the scheduled date of completion, the Contractor will make no claim for extra payment therefor.
- 13.4 The Owner may grant an extension of time for completion of the work when prosecution of the work is delayed or, halted by occurrences beyond the Contractor's control, such as strikes, lockouts, acts or omissions on the part of the Owner, fire or other catastrophes, provided however, that the Contractor shall, within ten days after the delay first occurs, give written notice to the Engineer of the cause of the delay and its probable effect on progress of the entire Work.

13.5 Adverse weather conditions that are more severe than anticipated for the locality of the Work during any given month may entitle the Contractor to an extension of Contract Time provided, however;

(1) the weather conditions had an adverse effect on construction scheduled to be performed during the period in which the adverse weather occurred, which in reasonable sequence would have an effect on completion of the entire Work,

(2) the Contractor shall, within twenty-one days after the end of the month in which the delay occurs, give the Architect written notice of the delay that occurred during that month and its probable effect on progress of the Work, and

(3) within a reasonable time after giving notice of the delay, the Contractor provides the Architect with sufficient data to document that the weather conditions experienced were unusually severe for the locality of the Work during the month in question. Unless otherwise provided in the Contract Documents, data documenting unusually severe weather conditions shall compare actual weather conditions to the average weather conditions for the month in question during the previous five years as recorded by the National Oceanic and Atmospheric Administration (NOAA) or similar record-keeping entities.

13.6 Adjustments, if any, of the Contract Time pursuant to this Article shall be incorporated into the Contract by a Contract Change Order prepared by the Architect and signed by the Contractor, Owner, and other signatories to the Construction Contract or, at closeout of the Contract, by mutual written agreement between the Contractor and Owner. The adjustment of the Contract Time shall not exceed the extent to which the delay extends the time required to complete the entire Work of the Contract.

13.7 The Owner shall not suffer any loss or expense as a result of such occurrences or delays, except when caused by any act or omission on the part of the Owner; and the Contractor shall not be allowed any damages or claims for extra compensation resulting from such occurrences or delays, except when caused by any act or omission on the part of the Owner.

#### **14. CONSTRUCTION SCHEDULE**

14.1 The Contractor is instructed to submit to the Owner, prior to initiating the work but not later than thirty days after the execution of the Contract, a schedule of construction operations so planned as to ensure completion of the work within the time limit specified in the Proposal and in the Contract Agreement. The maintenance of such schedule in order to fulfill the terms of the Contract Agreement is the responsibility of the Contractor, and he may employ such reasonable and proper measures, subject to other conditions of these Documents, as he deems to be required to expedite the work and to ensure that it will be fully and satisfactorily completed within the stated time limit. If the Contractor's progress falls materially behind the currently approved construction schedule and, in the opinion of the Engineer or Owner, the Contractor is not taking sufficient steps to regain schedule, the Engineer may, with the Owner's concurrence, issue the Contractor a Notice to Cure. In such a Notice to Cure the Engineer may require the Contractor to submit a revised construction schedule to demonstrate the manner in which schedule will be regained. The Contractor shall not be allowed additional compensation for employment of such measures.

14.2 The Contractor will be required to show in the schedule the proposed dates of commencement and completion of the various subdivisions of work comprising the

project, and also to show in the schedule the estimated amount of each monthly payment (periodic estimate) that will become due to the Contractor as he maintains the progress schedule prepared by him. The preparation and submittal of the progress and payment schedule to the Owner is of benefit both to the Contractor and the Owner in that it will enable the Owner to anticipate the periodic financial needs of the project and facilitate the making of timely payments for the work. Submission of a schedule showing a completion date beyond the contract completion date should not be interpreted as approval of a contract extension by the Owner.

- 14.3 The Contractor shall prepare and keep current a schedule of submittals coordinated with the Contractor's schedule of construction operations. The submittal schedule shall be approved by the Engineer and shall allow the Engineer reasonable time the review submittals.

## **15. SUPERVISION OF THE WORK**

- 15.1 The Contractor shall be solely responsible for planning, scheduling, organization and prosecution of the work in accordance with the Contract Documents. Observations, construction reviews, tests, recommendations or comments made by the Engineer, or by persons other than the Contractor, shall in no way relieve the Contractor of his obligation to complete all work in accordance with the Contract Documents. All work shall be done under the direct supervision of the Contractor. The Contractor shall be solely responsible for construction means, methods, techniques, sequences and procedures. The Contractor is solely responsible for safe access to the work, safe use of the work, safe working conditions, and safe occupancy of the work by and/or for all authorized persons.

- 15.2 The Contractor shall maintain on the project a qualified superintendent who is acceptable to the Owner, and who is capable of providing the efficient supervision required for the successful and satisfactory completion of the work. The superintendent shall have the authority to act in behalf of the Contractor, and all communication with the superintendent shall be considered a communication with the Contractor. The Contractor's superintendent is responsible for coordinating the work of all subcontractors, and his presence at the site of the work is necessary for the adequate performance of his supervisory duties and for the coordination of the work of all subcontractors.

- 15.3 The responsibilities of the Contractor relating to supervision of the work as outlined hereinabove, and the duties of the Contractor as outlined hereinabove, are all a part of the Conditions of this Contract as referred to in the Contract Agreement.

## **16. SUBCONTRACTORS**

- 16.1 The Contractor may utilize the services of specialty subcontractors on those parts of the work, which under normal contracting practices, are performed by subcontractors. No part of the work, however, shall be sublet by the Contractor without the prior written consent of the Owner, or the Engineer acting upon the instructions of the Owner. Following the execution of the Contract, the Contractor shall submit in writing for review by the Owner the names of subcontractors to whom he proposes to subcontract portions of the work. The Engineer shall promptly reply to the Contractor in writing stating whether or not the Owner or the Engineer has reasonable objection to any proposed subcontractor. If the Owner or the Engineer has reasonable objection to a listed subcontractor, the Contractor shall propose another which is acceptable to the Owner.

Any documented changes to the Contract Amount or Time due to the replacement of a subcontractor shall be increased or decreased by the difference, and a Change Order issued prior to commencement of the substitute subcontractor's work. The early selection of subcontractors, in the case where the Contractor proposes to subcontract any part of the work, is essential to the proper organization of the work, and the Contractor shall therefore submit any names of proposed subcontractors upon or before request by the Owner.

- 16.2 The names of proposed subcontractors so submitted shall not be changed by the Contractor after submittal of the list to the Owner unless the consent of the Owner is first obtained.
- 16.3 The Contractor shall be responsible to the Owner for the acts, deficiencies, and omissions of his subcontractors and those of their direct and indirect employees to the same extent as he is responsible for the acts, deficiencies, and omissions of his own and those of his employees.
- 16.4 The Contractor shall bind all subcontractors to the terms of the General Conditions and Contract Documents insofar as they are applicable to the work under subcontract, and shall insert in all agreements with subcontractors appropriate provisions such as to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provision of the Contract Documents. The Contractor is required to submit evidence of compliance with such conditions to the Owner before commencement of work by the particular subcontractors.
- 16.5 Nothing contained in the Contract Documents shall be construed as creating any contractual relationship between any subcontractor and the Owner.
- 16.6 For convenience of reference, to facilitate organization of the work, and for convenience in evaluating work in progress, the Specifications have been separated into titled Sections. Such separation shall not, however, operate to make the Owner or the Engineer an arbiter to establish limits of work in the contracts between the Contractor and subcontractors. The general charge to the Contractor is that all work be fully completed in accordance with the Contract Documents, and that the Contractor adhere to the terms and provisions of the Contract Agreement, of which these Conditions are a part.

## **17. CONTRACTOR'S RESPONSIBILITIES WITH RESPECT TO WORK BY OTHERS**

- 17.1 The Owner reserves the right to perform construction or operations related to the project with his own forces, and to place portions of the work on the project under separate contracts. The Owner shall provide for coordination of the activities of his own forces or of each separate contractor with the work of the Contractor. The Contractor is requested to cooperate with other contractors with regard to use of the site, storage or materials, and execution of their work.
- 17.2 It is the Contractor's responsibility to inspect all work performed by other contractors which in any manner affects his work, and to report to the Owner the existence of any irregularities or discrepancies which will not permit him to complete his work in a satisfactory manner. The failure of the Contractor to notify the Owner of the existence of such irregularities or discrepancies shall indicate that the work of other contractors has been satisfactorily completed and is in condition to receive his work.

17.3 The Contractor is required to keep himself informed of the progress and performance of other contractors; and, where the lack of progress or poor performance (defective workmanship) on the part of other contractors will affect the Contractor in the performance and completion of his work, he is requested to immediately notify the Owner of the existence of such conditions. Failure of the Contractor to keep himself informed of the status and condition of work being performed by other contractors on the project, where the status or condition of such work will affect the performance of his work, and failure of the Contractor to notify the Owner of status or conditions unfavorable to the proper coordination, performance, and completion of his work shall be construed to be acceptance by the Contractor that the status and condition of work being performed by other contractors is satisfactory for the proper coordination, performance, and completion of his work.

**18. SATURDAY, SUNDAY, HOLIDAY, NIGHT AND OVERTIME WORK**

18.1 Work on Saturdays, Sundays and Holidays, or at night, will be permitted only when the Contractor has received the written permission of the Owner. Work at such times may be required when special connections to existing systems are to be made, when new facilities are to be placed in service, when existing facilities are to be taken out of service, when it is more advantageous to the utilities involved, or when an emergency arises in the work schedule. In such cases the permission of the Owner must be secured prior to beginning work at such times, the work scheduled well in advance, and arrangements made for prosecution of the work with all safety and minimum inconvenience to the public. All work necessary to be performed on Saturdays, Sundays and Holidays, or at night shall be so performed without additional expense to the Owner.

18.2 Holidays for the purposes of this project shall be defined as those holidays normally observed by the Owner.

18.3 It is understood that the Contractor's proposed construction schedule is based on a 40 hour work week occurring within 10 hour days, Monday through Friday, less recognized holidays. The Contractor shall be responsible for additional expenses incurred by the Owner for the Engineer's field representative overtime premium associated with work hours in excess of the 40 hour work week. This cost will be deducted from the Contractor's monthly payment request, and will be \$45 per hour. No overtime pay will be charged to the Contractor for work performed at night or on weekends, when, due to operational conditions of the Owner's facilities, the work must be performed during these non-standard work hours.

18.4 Maintenance work normally required for protection of persons, or for protection of the work or property, will be permitted at any time.

18.5 For work during an emergency threatening bodily injury, loss of life, or damage to property refer to Article 19 of these General Conditions.

**19. EMERGENCY WORK**

19.1 It is the Contractor's responsibility at all times to guard against bodily injury, loss of life, damage to the Owner's property, damage to his own work on the site, and damage to adjacent property. In the case of the development of an emergency which should threaten loss of life, injury to persons, or damage to property, it is the Contractor's responsibility to furnish and install all necessary materials and equipment, and to perform all work as could possibly be accomplished to prevent loss of life, bodily injury, or damage to property. In all such cases the contractor is requested to immediately

notify the Owner of the emergency, but he need not wait for advice or authorization from the Owner before proceeding to employ all measures necessary to protect life and property. Nothing stated hereinabove shall be construed as limiting the Contractor's responsibility under the terms and provisions of the General Conditions and Contract Documents, to protect life and property and to pay claims resulting from loss of life, bodily injury, or damage to property. The substance of this Article of the General Conditions is that, in case of an emergency, the Contractor will act with all speed, with all force, and in an expeditious manner, to avert loss of life, bodily injury, and property damage.

## **20. CHANGES IN WORK**

- 20.1 The Owner shall have the right to make changes in the work, and to require the Contractor to perform extra work necessary for the satisfactory completion of the project. These changes in the work may be accomplished by Change Order, Construction Change Directive or by order for minor changes in the work, and shall be performed under applicable provisions of the Contract Documents. Such increases, decreases, changes, and extra work shall not invalidate the Contract. Should the Contract Price or the Contract Completion Time be affected by such increases, decreases, changes or extra work, the compensation and time shall be adjusted at the time when such increases, decreases, changes or extra work items are ordered.
- 20.2 Where new and/or unforeseen items of work are found to be necessary for the satisfactory completion of the project, and where the character of the work is such that a reasonable price for the performance of the work cannot be established by use of contract prices or combinations thereof, such new and/or unforeseen items of work shall be classed as Extra Work. No Extra Work shall be undertaken except by written order from the Owner in the form of a Change Order or Construction Change Directive. The Contractor shall, upon receipt of written order from the Owner, perform such Extra work and furnish such materials as may be required for the proper completion of construction of the whole work contemplated. In the absence of such written order no claim for extra compensation by reason of performance of Extra Work shall be allowed. Extra Work shall be performed in accordance with the Contract Documents, insofar as they are applicable; and where such Extra Work is not covered by the Contract Documents, the performance of the work shall be consistent with the intent of these Contract Documents.

## **21. FAULTY WORK AND DEFECTIVE WORK**

- 21.1 The performance of satisfactory work is, under the terms and conditions of this Contract, the obligation of the Contractor. Any faulty work or defective work, whether the result of poor workmanship, use of defective materials, damage through carelessness or any other cause, will neither be accepted nor paid for. The terms "Faulty Work" or "Defective Work" shall apply to: (1) any product, material, system, process, equipment, or service, or its installation or performance, which does not conform to the requirements of the Contract Documents, (2) in-progress or completed work the workmanship of which does not conform to the quality specified or, if not specified, to the quality produced by skilled workers performing work of a similar nature on similar projects in the state, (3) substitutions and deviations not properly submitted and approved or otherwise authorized, and (4) materials or equipment rendered unsuitable for incorporation into the work due to improper storage or protection. The Contractor shall bear all expenses related to the correction of faulty or defective work, including but not limited to: (1) additional testing and inspections, including repeating specified inspections and tests, (2) reasonable services and expenses of the Engineer, and (3) the expense of making good all work done by the Contractor, Owner, or separate contractors which is destroyed

or damaged by the correction of the faulty or defective work. Payment for faulty or defective work will not be made until such work has been removed, re-executed and corrected in manner and form satisfactory to the Owner and in accordance with the Contract Documents. The existence of any faulty or defective work will prevent the acceptance of the project. The fact that the Engineer may have previously overlooked such faulty or defective work shall not constitute acceptance of any part of it. The failure by the Engineer to discover faulty or defective work prior to the making of final payment by the Owner to the Contractor, or the discovery or appearance of faulty or defective work after the making of said final payment, shall not relieve the Contractor of responsibility for defective materials or faulty workmanship. The Contractor shall, at his own expense, promptly replace all defective materials or equipment and correct all faulty workmanship discovered and/or appearing within one year from date of written acceptance of the work. Refer to Article 26.

- 21.2 If the Contractor fails to correct nonconforming work within a reasonable time, the Owner may, upon written notice to the Contractor, correct the nonconforming work and reduce all costs associated with the correction of nonconforming work from the Contractor's final payment.

## **22. UNCOVERING WORK**

- 22.1 If any portion of the work is covered by the Contractor or his subcontractors contrary to the requirements expressed in the Contract Documents or the Engineer's specific request, it shall be uncovered for the Engineer's observation and recovered at the Contractor's expense without change in the Contract Amount or Contract Time.
- 22.2 The Engineer may request to see covered work which has not been specifically requested by the Contract Documents or Engineer to remain uncovered until observed by the Engineer. If such work has been properly installed according to the Contract Documents, costs for uncovering and replacement shall be charged to the Owner. However, if such work is not in accordance with the Contract Documents, the Contractor shall bear all costs for uncovering and replacement.

## **23. USE OF COMPLETED PORTIONS OF THE WORK**

- 23.1 The Owner shall have the right to take possession of and use any completed or partially completed portion of the work provided all insurers and authorized public authorities having jurisdiction over the project consent to this partial occupancy, notwithstanding that the time for completing the entire work or such portions of the work may not have expired; but such taking possession and use shall not be deemed to be acceptance of any work not completed in accordance with the Contract Documents. The Owner and Contractor shall agree in writing the equitable assignment of security, maintenance, utilities, commencement of warranties, insurance and damages to the areas of work to be used by the Owner. If such prior use should increase the cost of or delay the completion of uncompleted work, or should cause refinishing of completed work subjected to such prior use, the Contractor shall be entitled to extra compensation or extension of time, or both, as agreed upon by the Owner.
- 23.2 Prior to occupancy by the Owner of any partially completed work, the Owner, Contractor and Engineer shall inspect the portion of work to be occupied by the Owner to record the condition of the work.



## **24. CUTTING AND PATCHING OF WORK**

- 24.1 The Contractor shall perform all necessary cutting and patching as required to connect new work to existing work and as required in new work to properly receive the work of the various trades involved in the entire work; and the Contractor shall restore all such cut and patched work, and shall refinish all surfaces affected by such work, to conditions acceptable to the Engineer. Cutting of the existing work, or any work, in such a manner as would endanger the work, adjacent property, the workmen, or the public, is contrary to the provisions of Article 8, SAFETY.

## **25. CLEANING UP THE WORK**

- 25.1 During construction of the work, the Contractor shall keep the property and the surrounding areas free from the accumulation of waste materials or rubbish caused by the Contractor's operations. If the Contractor fails to keep the site clean, the Owner may do so at the expense of the Contractor.
- 25.2 At completion of the work the Contractor shall remove from the property of the Owner, and from all public and private property, all temporary structures, rubbish, waste materials resulting from his operations or caused to be in such locations by actions of his employees and surplus materials. The Contractor shall remove all of his equipment, tools, and supplies from the property of the Owner. The entire work shall be clean and finished as specified. The site shall be clean, true to finished contours given, and improved as specified. The entire work shall be ready for permanent occupancy and/or use before acceptance of the work can become fact. Should the Contractor fail to remove his equipment, tools and supplies from the property of the Owner, the Owner shall have the right to remove them at the expense of the Contractor.

## **26. CONTRACTOR'S RESPONSIBILITY FOR PERFORMANCE AND ACTIONS OF WORKMEN**

- 26.1 The Contractor is responsible for the conduct, performance, acts, and omissions of all persons and entities on the project site who are engaged in work on behalf of the Contractor under this contract between the Owner and the Contractor. All workmen should have such skill and experience as would enable them to reliably, safely and properly perform the particular work or task assigned to them. It is in the best interest of the Contractor to terminate the employment of workmen whose performance endangers the safety of other workmen or any person, or results in unsatisfactory work, or contributes to delay in the progress of the work, before the Contractor bears the burden of re-executing unsatisfactory work and suffers the cost of delays in the prosecution of the work.
- 26.2 The Contractor may be requested by the Owner to remove or to have removed from the job site for the duration of the project any of his employees, or any of his subcontractors, or any of the employees of his subcontractors who acts in a disorderly or intemperate manner, or who is abusive to representatives of the Owner or of the Engineer or of any Agency having jurisdiction over the project, or who acts in such a manner as would endanger the safety of any person or of the work, all of which acts could give cause for concern for the safety of any person or of the work, for which safety the Contractor is solely responsible.

## **27. GUARANTY**

- 27.1 Neither the final certificate of payment, nor any provision of the Contract Documents, nor partial or entire occupancy and/or use of the work by the Owner, shall constitute an acceptance of work not done in accordance with the Contract Documents or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The Contractor shall remedy any defects in the work which shall appear within a period of one year from the date of final acceptance of the work, and shall pay for damages to other work, facilities, persons, or property resulting from such defects. Equipment items replaced under the one year warranty period shall carry a new one year warranty beginning on the date of acceptance of the associated corrective work.
- 27.2 The Performance Bond shall remain in full force and effect during the guaranty period, and the Surety shall be liable for the correction of any faults and/or defects that may have appeared within the guaranty period and have not been corrected by the Contractor.

## **28. MATERIALS AND EQUIPMENT**

- 28.1 The materials and equipment incorporated and/or installed in the work shall be of good quality and shall meet the requirements of the Contract Documents. All materials and equipment shall be subject to review by the Engineer, and no materials and equipment shall be ordered until information relating to such materials and equipment has been reviewed by the Engineer. The Contractor shall be responsible for furnishing and installing all materials and equipment required for the complete work, and all materials and equipment so furnished and installed shall be guaranteed by the Contractor in accordance with the provisions of Article 27.
- 28.2 It is essential that all material, manufactured articles and equipment be applied, installed, erected, connected, cleaned, conditioned for use and placed in service in accordance with the instructions of the particular manufacturer of such materials, articles and equipment.
- 28.3 Only those manufactured and fabricated items fully complying with applicable standards of the Occupational Safety and Health Administration may be offered, and the manufacturer's or fabricator's certificate to that effect will be required with the submittal of each item by the Contractor.
- 28.4 Items of equipment, articles or materials which are not equal to samples reviewed by the Engineer, do not conform to the requirements of the Specifications or the requirements of applicable standards, or are in any way unsatisfactory or unsuitable for the purpose or service for which they are intended, shall neither be furnished nor installed.
- 28.5 In order to establish standards of quality, the detailed Specifications, or the Plans, include references to certain products by name or by name and catalog number. This procedure is not to be construed as eliminating from competition other products of equivalent or better quality as manufactured by other companies, unless specifically stated that no other manufacturers will be acceptable. Materials or articles which, according to the judgment of the Engineer, will fully meet the design criteria, are equivalent in function and durability, and are suitable for use in arrangement as shown on the Plans, may be acceptable.

- 28.6 It must be understood that equipment and articles of different manufacturer, although they may be equivalent in construction, quality, durability and performance, may not have the same dimensions, configurations and arrangement of connections. It then becomes the responsibility of the Contractor to take into consideration any variations in dimensions and connection arrangement of the equipment or articles that he proposes to offer from those of equipment shown on the Drawings, or called for in the Specifications, and make certain that the proposed equipment or article can be installed in a neat and efficient arrangement in the space available. In the layout of the equipment and connections thereto, accessibility for proper maintenance is a requirement in order to ensure satisfactory operation.
- 28.7 Substitution of equipment, articles or materials other than those shown on the Plans or specifically named in the Specifications, when requested by the Contractor, will be considered, provided that the design and construction of such equipment, articles or materials indicate that they will meet the requirements of these Specifications. All substitution requests shall be accompanied by a fully completed CSI form 13.1A. By tender of a request for a substitution, the Contractor implies that he has fully investigated and analyzed the product, and that he guarantees that the product will fully meet the design criteria of the product specified, has the durability and life expectancy of the product specified, is equivalent in function and performance to the product specified, and is suitable for installation in efficient arrangement in the space shown on the plans. The Engineer will review the proposed substitutions and make his recommendations within a timely manner as defined below. The Contractor shall abide by the Engineer's decision when proposed substitute equipment, articles or materials are not recommended for installation and, in such case, shall furnish the specified article, item of equipment or material. The decision of the Engineer to accept the substitute product shall not relieve the Contractor of his guarantee as set forth hereinabove, and such guarantee shall be furnished before the equipment is ordered.
- 28.8 In order to be considered by the Engineer, any request by the Contractor for substitution of products must be made in a timely manner. By "timely" it is meant that any such requests should be made as early after the commencement of the project as is possible so that sufficient time will be allowed for: review by the Engineer along with review of other submittals in connection with the project; in case of rejection of the submittal, preparation of succeeding submittals covering other substitute products; reviews of the succeeding submittals; ordering and manufacture of an acceptable product; delivery of product to job site well in advance of the time that it is scheduled to be installed.

## **29. SHOP DRAWINGS AND PRODUCT DATA**

- 29.1 Shop drawings are drawings, diagrams and other data prepared for the work by the Contractor, subcontractor, or supplier to illustrate some portion of the work. Product data are illustrations, schedules, charts, brochures, instructions or other information furnished by the Contractor, subcontractor, or supplier to illustrate materials or equipment for some portion of the work. Shop drawings and product data are submitted to demonstrate how the Contractor proposes to conform to the information given in the Contract Documents.
- 29.2 The Contractor shall provide all shop drawings and product data as may be necessary for the proper and satisfactory prosecution of the work, all in accordance with the intent of the Contract Documents to secure a complete and operable project capable of satisfactory performance of the service intended. The shop drawings and product data shall be submitted in accordance with an orderly schedule based upon time required for fabrication or manufacture and delivery, and upon time at which materials, fabricated

items, or manufactured items will be required to be incorporated in the work. The Contractor shall perform no portion of the work requiring submittal and review of shop drawings and product data prior to receipt of the Engineer's approval. Ordering material or equipment by the Contractor prior to receipt of concurrence from the Engineer will be fully at the Contractor's risk, even if the materials or equipment ordered are identical to the items listed in the specifications or shown on the drawings. No consideration will be made for reimbursement to the contractor for restocking fees, purchase costs, delivery costs, or any other expenses caused by the Contractor's decision to place premature orders for materials or equipment.

- 29.3 The Engineer's review of shop drawings is not intended to verify the accuracy and completeness of details such as dimensions and quantities nor to substantiate installation instructions or performance of equipment or systems, all of which remain the responsibility of the Contractor. Deviations from the Contract Documents shall be called to the attention of the Engineer by the Contractor at the time when such shop drawings or product data are first submitted to the Engineer for his consideration. The Engineer's review of any drawings shall not release the Contractor for responsibility for such deviations, or any subsequent deviations not noted by the Contractor or the Engineer.
- 29.4 Shop drawings and product data submitted for review by the Engineer shall bear the Contractor's certification that he has reviewed, checked, and approved the submittals, that they are in harmony with the requirements of the project and with the provisions of the Contract Documents, and that he has verified all field measurements, construction criteria, materials, catalog numbers, and similar data. The Contractor shall also certify that the work represented by the shop drawings is recommended by the Contractor and that the Contractor's Guaranty will fully apply.
- 29.5 All shop drawings and product data submitted to the Engineer shall be numbered by the Contractor using a three part numbering methodology. The three part number shall include a submittal number, the specification section number where the submitted item is described, and an indication of whether the information is an initial submittal or a resubmittal.

### **30. SAMPLES OF MATERIALS**

- 30.1 All samples called for in the Specifications or required by the Engineer shall be furnished by the Contractor and submitted to the Engineer for his review. Samples shall be furnished well in advance of the anticipated time of fabrication or use of materials represented, and the Engineer shall be allowed reasonable time for consideration of samples submitted.
- 30.2 When required, samples shall be accompanied by laboratory test reports and/or certified compliance statements indicating that the materials represented conform to the requirements of the Specifications. Sampling and testing of materials shall be performed in accordance with standard methods referred to in the Specifications.
- 30.3 All samples submitted by the Contractor shall be accompanied by a covering letter indicating that such samples are recommended by the Contractor and that the Contractor's Guaranty will fully apply. All materials, equipment, and workmanship represented by samples accepted for use in the work shall be guaranteed by the Contractor in accordance with the Guaranty provisions of the Contract Documents.

### **31. PROJECT RECORD DOCUMENTS**

31.1 The Contractor shall maintain at the site one record copy of the Contract Documents, approved Shop Drawings, Product Data, Samples and other required submittals. These are to be in good order and marked to record changes made during construction. All site documents shall be delivered to the Engineer for submittal to the Owner at the completion of the work.

### **32. TEST REPORTS AND CERTIFICATES**

32.1 Laboratory test reports on materials proposed to be used in the work shall be furnished by the Contractor in accordance with the provisions of Article 30.

32.2 Certified statements of compliance, where required by the Specifications, shall be furnished by the Contractor.

32.3 Certified mill test reports, where required by the Specifications, shall be furnished by the Contractor.

### **33. STORAGE OF MATERIALS AND/OR EQUIPMENT**

33.1 Materials and/or equipment to be incorporated in the work shall be properly housed or otherwise protected from corrosion and damage so as to ensure the preservation of their finish, quality, and fitness for the work. Where considered necessary to secure proper protection, the materials shall be placed on racks, platforms, or hard clean surfaces not subject to surface drainage. Factory finished items shall be stored above ground, covered, individually sealed, or housed indoors as required. Materials not properly stored, housed and maintained in condition for service as intended will neither be paid for as stored materials nor as materials incorporated in the work.

33.2 Stored materials and equipment shall be located and arranged so as to facilitate observation. Private property shall not be used for storage purposes without the written consent of the owner or lessee of said property. When the Contractor desires to accept delivery of material or equipment which cannot be accommodated or housed on the site of the work he may, but only with the permission of the Owner, store such material and/or equipment in an insured warehouse. Any agreement for rental of such storage space by the Contractor shall contain a provision that the material and/or equipment thus stored shall not be subject to a lien for payment of storage. The Owner shall be protected against loss of or damage to such stored equipment by the terms and endorsements of the Contractor's insurance policies.

### **34. LANDS AND RIGHTS-OF-WAY**

34.1 The Owner will provide the lands (property, easements and /or rights-of-way) shown on the Drawings, or described in the Specifications, upon which the work under the Contract is to be performed, and which are to be used for access to the work. Any delay in furnishing these lands by the Owner that would prevent the Contractor from beginning the work or continuing the prosecution of the work, may be deemed to be proper cause for adjustment of the Time of Completion of the work or for adjustment of the Contract Amount.

34.2 Any land and access thereto not specifically shown to be furnished by the Owner that may be required for temporary construction facilities or for storage of materials shall be provided by the Contractor with no liability to the Owner. The Contractor shall confine

his equipment, apparatus, and storage to such additional areas as he may provide at his own expense.

- 34.3 The Contractor shall not enter upon private property for any purpose without obtaining permission; and the Contractor shall be responsible for the preservation of all public property, trees, monuments, structures and improvements, along and adjacent to the street and/or right-of-way, and shall use every precaution necessary to prevent damage or injury thereto. The Contractor shall use suitable precautions to prevent damage to pipes, conduits, other underground structures, and utilities. The Contractor shall carefully protect from disturbance or damage all monuments and property marks until an authorized agent has witnessed or otherwise referenced their location; shall not remove such monuments and property marks until authorized to do so; and, in the event that they should be removed, shall replace them in original location when the work in the area has been completed.

**35. ACCESS TO THE WORK**

- 35.1 The Engineer and his representatives shall have free access to the work and shall be given full opportunity to observe the work in progress and to examine such records of the Contractor as may have bearing on the proper review and observation of the work. The Contractor shall provide at the site of the work such space as would be reasonably adequate to serve as a field office for representatives of the Engineer and as storage area for their equipment and supplies.

**36. OBSERVATION OF THE WORK**

- 36.1 The Engineer will decide questions which may arise as to the quality and acceptability of materials and/or equipment furnished, the quality and acceptability of work performed, interpretations of the Contract Documents, and all questions with respect to the acceptable fulfillment of the Agreement on the part of the Contractor. The Contractor shall abide by these decisions. The duties and responsibilities of the Engineer as set forth herein shall not be extended except through written consent of the Engineer and the Owner.
- 36.2 All materials and each part or detail of the work shall be subject at all times to observation by the Engineer and the Owner, and the Contractor shall be held strictly to the intent of the Contract Documents in regard to quality of materials, equipment and workmanship, and also in regard to the diligent execution of the Contract. Observations may be made at the site or at the sources of supply, of material whether mill, plant or shop. The Engineer shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the Contractor as is required to make his observations and construction review.
- 36.3 The Engineer's decision as to the acceptability or adequacy of the work shall be final and binding upon the Contractor. The Contractor agrees to abide by the Engineer's decision relative to the performance of the work.
- 36.4 All claims made by the Contractor shall be submitted to the Engineer for his decisions. Such decisions shall be final except that, in cases where time and/or financial considerations are involved, the claims shall be submitted to the Owner for his review and shall be subject to the approval of the Owner. Meritorious claims shall be resolved, if possible, by mutual agreement between the Contractor and the Owner.

### **37. SCHEDULE OF VALUES & UNIT PRICES**

- 37.1 The Contractor shall, within ten (10) days of receipt of Notice to Proceed, submit a Schedule of Values showing the value assigned to each part of the work, the total of the assigned values of all parts or components being equal to the total Contract Price. Such breakdown, or division of the work into parts or components according to trades and/or sections of the Specifications shall have the concurrence of the Engineer before being used as the basis for estimating partial payments for work performed under the Contract. No partial payment will be made to the Contractor until an acceptable Schedule of Values is received by the Engineer. The costs shown in the Schedule of Values shall not, however, be considered as fixing a basis for additions to or deductions from the Contract Price, nor shall they be considered as fixing a basis for computing the cost of Extra Work.
- 37.2 The Schedule of Values shall correlate with the construction categories which make up the Application for Payment and shall be updated and resubmitted when a Change Order or Construction Change Directive is issued which results in a change to the Contract Amount.
- 37.3 Where unit prices form the basis for payment under the Contract, such unit prices as set forth in the Proposal, when applied to the corresponding quantities of work performed during a given estimate period, shall represent the value of work performed during that estimate period. It shall be understood, however, that the estimated quantities of work shown in the Proposal to be paid for on unit price basis are given for the purposes of determining the approximate value of the work and comparing bids, that the Owner reserves the right to increase or decrease the estimated quantities of work as may be deemed reasonably necessary or desirable by the Owner to complete the work contemplated under this Contract, and that such increase or decrease in the estimated quantities of work shall in no way, neither vitiate this Contract nor give cause for claims or liability for damages.
- 37.4 Mobilization and demobilization may be included in the schedule of values. If submitted with the schedule of values, mobilization and demobilization shall not exceed six percent of the Contract Amount, and mobilization shall be limited to four percent of the Contract Amount. Mobilization shall be considered payment for items to include, but not limited to, costs associated with insurance and bonds, job trailers, plan production, equipment delivery, and permits.

### **38. APPLICATIONS FOR PAYMENT**

- 38.1 The Owner shall, on or before the 15th day of each calendar month, make a progress payment to the Contractor, and such payment shall be based upon a duly certified and approved estimate of the work performed under this Contract during the preceding calendar month, but, to ensure the proper performance of the work under this Contract, the Owner shall retain five percent (5%) of the amount of each estimate until final completion and acceptance of all work covered under this Contract. Such periodic payment shall, however, be subject to the following provisions:
- A. That the Contractor or his Superintendent on the work shall have agreed with the representative of the Engineer regarding value of work performed during an estimate period before the estimate is submitted to the Engineer.

- B. That the estimate of value of work performed in the month preceding the month during which payment is to be made be submitted to the Engineer by the first day of the calendar month during which payment is to be made.
  - C. That payment may not be made for work on which satisfactory test reports have not been received before the submittal of the estimate.
  - D. That payment shall not be made for defective work, or for faulty work not completely corrected before the submittal of the estimate.
  - E. That if, after fifty percent (50%) of the construction work, including the value of materials and/or equipment stored, has been satisfactorily completed, no additional deductions for retainage will be made from the succeeding periodic payments made to the Contractor after the retainage amount becomes equal to five percent (5%) of one-half of the completed construction value of the project. The intent of this provision is that, at the time when the value of the completed Contract work equals or exceeds fifty percent (50%) of the completed Contract value no additional retainage will be withheld so that the retainage amount shall be equal to two and one-half percent (2½%) of the completed Contract value, and this amount shall be retained until the Contract has been completed and the work has been accepted subject, however, to other provisions of these General Conditions.
  - F. That, following a certification by the Engineer that the work has been substantially completed in accordance with the provisions of the Contract Documents but has not yet been fully completed and accepted, the retainage may be reduced to such an amount as would reasonably cover the cost of correction of minor items of work heretofore found to be faulty and the cost of the work remaining to be done in order to effect the completion of all of the work in full accordance with the provisions of the Contract Documents. The consent of the Surety shall be obtained prior to any reduction in retainage.
- 38.2 The value of preparatory work done and the value of materials and/or equipment stored in accordance with these Specifications may be taken into consideration in the preparation of estimates, provided that materials stored meet the requirements of the Contract Documents.
- 38.3 The Contractor agrees that he will indemnify and save the Owner harmless from all claims arising out of the lawful demands of subcontractors, laborers, workmen, mechanics, and suppliers of machinery, parts, equipment, power tools, fuel, materials and other construction items, incurred in the performance of work under this Contract. The Contractor shall, at the Owners request, furnish satisfactory evidence that all obligations of the nature hereinabove described have been paid, discharged, or waived. If the Contractor should fail to do so, then the Owner may, after having served written notice on the Contractor, either directly pay those unpaid bills of which the Owner has received written notice, or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is presented that all such liabilities have been fully discharged, whereupon payment to the Contractor shall be resumed in accordance with the terms of this Contract, but, in no event, shall the provisions of this sentence be construed to impress upon the Owner any obligations to either the Contractor or this Surety. In paying any unpaid bills of the Contractor the Owner shall be deemed to be the temporary agent of the Contractor for this specified purpose; and any payment so made by the Owner shall be considered as a payment made under the Contract by the Owner



to the Contractor, and the Owner shall not be liable to the Contractor for any such payments made in good faith.

**39. PAYMENT FOR MATERIALS STORED**

39.1 Payment for materials and equipment stored shall be subject to the requirements of Articles 28, 29, 30, 32 and 33 of these General Conditions.

39.2 No materials or supplies for the work shall be purchased by the Contractor or by any subcontractor subject to any chattel mortgage, or under a conditional sale contract or other agreement by which an interest is retained by the seller. The Contractor warrants that he has good title to all materials, equipment, and supplies used by him in the work, and that such title is free from all liens, claims or encumbrances.

39.3 Payment for materials stored will be conditioned upon evidence submitted to establish the Contractor's title to materials and/or equipment stored, such as paid invoices, receipts of payment, satisfied purchase agreements, etc. When value of materials stored is allowed to be included in the Contractor's periodic estimates, the materials and/or equipment represented by such value shall become the property of the Owner, and the Contractor shall be responsible for safeguarding and using such materials and/or equipment in accordance with the provisions of the Contract Documents.

**40. PAYMENT FOR EXTRA WORK**

40.1 Extra Work shall be undertaken and prosecuted in accordance with the provisions of Article 20 of these General Conditions.

40.2 Payment for Extra Work may be made by use of any one of the following methods:

A. Unit prices or combinations of unit prices which formed the basis of the original Contract.

B. A lump sum based upon the Contractor's estimate and accepted by the Owner.

C. Work Performed by the Prime Contractor: Actual cost of performing the work plus fifteen percent (15%) of actual cost to cover supervision, overhead, bond and profit. The Contractor shall submit to the Owner itemized cost sheets showing actual cost of performance of the work. Actual costs are defined as follows:

1. Labor costs, including time of superintendent and foremen while engaged directly on the extra work.

2. Labor Insurance and Workmen's Benefits.

3. Social Security and unemployment contributions.

4. Ownership or rental costs of construction plant and/or equipment used in the actual prosecution of the extra work. Such costs shall not exceed the AED Green Book standard rental rates or rental rates prevailing in the area of the work. Charges for equipment already allocated to the project shall be based upon standard or prevailing monthly rental rates. Daily rates shall be determined by dividing monthly rates by twenty-two (22); and hourly rates shall be determined by dividing monthly rates by one

hundred and seventy-six (176). Rental rates or use rates shall not be charged for equipment having a value of less than \$50.00 since equipment and tools having values of less than \$50.00 are classed as small tools and as such are considered to be part of overhead.

5. Costs of materials and/or equipment entering permanently into the work.
6. Costs of power and consumable supplies for the operation of power equipment where such costs are not included in rental rates or use charges.

D. Work Performed by a Subcontractor for Prime Contractor: The Prime Contractor shall receive five (5%) percent of Subcontractor's costs to defer cost of insurance, supervision, and management. The Subcontractor shall be entitled to actual costs of performing the work plus fifteen percent (15%) of actual cost to cover supervision, overhead, bond and profit. The Prime Contractor shall submit to the Owner itemized cost sheets showing actual cost of performance of the work. Actual costs are defined above in C.1. through C.6.

#### **41. SUBSTANTIAL COMPLETION**

41.1 Substantial Completion is the point at which all or a designated portion of the work has been sufficiently completed in accordance with the Contract Documents so the Owner can occupy the work for its intended use.

41.3 When the Contractor considers the work, or a designated portion of the work which the Owners agrees to accept separately, to be substantially complete, the Engineer will observe the work and develop a list of remaining items of work to be finished by the Contractor prior to final acceptance. The Engineer will make repeat inspections when requested and assured by the Contractor that the work has been substantially completed. Following the repeat inspections the Engineer may add to the list of items required for final acceptance. The Engineer will notify the Owner when in the judgement of the Engineer the work, or designated portion thereof, has reached a point of substantial completion. The Owner may then elect to accept the work, or designated portion thereof, as substantially complete.

41.4 Failure of the Contractor or Engineer to include an item on the list of items to be completed for final acceptance does not alter the Contractor's responsibility to complete all work in accordance with the Contract Documents.

#### **42. ACCEPTANCE AND FINAL PAYMENT**

42.1 When the Contractor shall have completed all of the work in accordance with the terms of the Contract Documents, he shall certify to the Owner that he has completed all of the work in accordance with the provisions of the Contract Documents. The Contractor shall also prepare and submit to the Owner a Final Request for Payment in an amount which shall be the Contract Amount plus all approved additions, less all approved deductions and less previous payments made.

42.2 The Contractor shall give notice of the completion of the work by advertisement in a newspaper of general circulation in the area in which the work has been performed and said notice shall appear once each week for a period of four (4) consecutive weeks. Proof of publication of said notice shall be furnished by the Contractor to the Owner by

affidavit of the publisher of the newspaper, to which affidavit shall be attached a copy of the Notice.

42.3 When the Owner and the Engineer have completed a review of the work and of the request for final payment, and have determined that all of the work has been completed in substantial accordance with the provisions of the Contract Documents, final payment of the amount determined to be due under the Contract will be made to the Contractor, provided that:

- A. Any deficiencies in the work noted during the review shall have been satisfactorily corrected.
- B. Final acceptance has been achieved.
- C. The Contractor shall have submitted an Affidavit of Release of Liens, and Affidavit of Payment of Debts and Claims, both as outlined below; and satisfactory evidence that there are not outstanding claims or demands against the Contractor in any manner connected with the work.

The Affidavit of Release of Liens shall include the following wording:

“The undersigned hereby certifies to the best of his knowledge, information, and belief, the Releases of Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of work, labor, or services who have or may have liens against any property of the Owner arising in any manner out of the performance of the referenced Contract.”

The Affidavit of Payment of Debts and Claims shall include the following wording:

“The undersigned hereby certifies that he has paid in full or has otherwise satisfied all obligations for all materials and equipment furnished, for all work, labor, and service performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced for which the Owner or his property might in any way be held responsible.”

42.4 Final Acceptance of the work shall be achieved (1) when all punch list items are accounted for by their completion or correction by the Contractor and acceptance by the Engineer and Owner and, (2) all outstanding warranty items have been satisfactorily addressed.

42.5 Acceptance of the work by the Owner will release the Contractor except as to the conditions of the Performance Bond and the Labor and Material Payment Bond, any legal rights of the Owner, required guaranties, and correction of faulty work after final payment.

42.6 Acceptance of final payment by the Contractor shall be, and shall operate as a release to the Owner of all claims and all liability to the Contractor for all things done or furnished in connection with the work, and for every act and neglect of the Owner and others relating to or arising out of the work. No payments, final or otherwise, shall release the Contractor or his Sureties from any obligations under this Contract or under the Performance and Payment Bonds.

**43. TESTS AND INSPECTIONS**

43.1 Tests, inspections and approvals of portions of the work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at appropriate times. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals.

**44. TESTING OF COMPLETED WORK**

44.1 After completion of work and before acceptance of the work by the Owner, the Contractor shall perform all tests as required by the Specifications. The cost of all labor, tools, materials and equipment necessary for making the required test, including the initial supply of treatment chemicals from a vendor approved by the Owner, shall be borne by the Contractor. Any work found to be defective, faulty, or otherwise unsatisfactory shall be corrected by the Contractor without additional compensation. All work shall be guaranteed against defects for a period of one year after the acceptance of the work.

**45. INCIDENTALS ABSORBED**

45.1 All work and material covered by these Specifications, or the drawings illustrating the same, or any work, or material that may be reasonable from the information given upon plans or in the Specifications and that is necessary to complete the work, or any tools, or appliances, or structures that may be constructed by the Contractor for carrying out the work, shall be furnished by the Contractor and the cost of all this material and work shall be included in and absorbed by the prices and amounts mentioned in the Contractor's Proposal.

45.2 The Contractor shall arrange and pay for all water, power, gas, sewer, telephone, cable, or other utility services used in his construction operations. The Contractor shall also establish and pay for all temporary/permanent utility services for the project until acceptance of the completed work by the Owner.

**46. ASSIGNMENT OF CONTRACT**

46.1 The Contractor shall not assign his Contract, nor any part thereof, nor any monies due, or to become due hereunder, without prior written consent of the Owner. In case the Contractor, with the consent of the Owner, assigns any or all of any monies due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any monies due or to become due to the Contractor shall be subject to prior valid claims of all persons, firms, and corporations for services rendered or materials supplied for the performance of work under this Contract.

**47. ORAL AGREEMENTS**

47.1 No oral order, objection, claim or notice given by any party to the others shall affect or modify any of the terms or obligations contained in any of the Contract Documents, and none of the Contract Documents shall be held to be waived or modified by reason of any act whatsoever, other than by a definitely agreed upon waiver or modification thereof in writing, and no evidence of any other waiver or modification shall be introduced in any proceeding.

**48. NOTICE AND SERVICE THEREOF**

48.1 All notices, demands, requests, instructions, approvals and claims shall be in writing.

48.2 Any notice to or demand upon the Contractor shall be sufficiently given if delivered at the local office of the Contractor, or by personal service upon the representative of the Contractor in local charge of the work, or by depositing in United States mail in a sealed envelope with sufficient postage prepaid, or delivered with charges prepaid to any telegraph company for transmission to the Contractor, addressed to such Contractor at the address stated by the Contractor in the Proposal, or at the local address used by the Contractor during the process of the work (or at such other address as the Contractor may from time to time designate to the owner in writing). Any notice to or demand upon the Owner shall be sufficiently given if delivered to the Owner or deposited in the United States Mail in a sealed, postage prepaid envelope, or delivered with charges prepaid to said Owner or to authorized representatives of the Owner, or to such address as the Owner may subsequently specify in writing to the Contractor for such purposes.

**49. SUSPENSION OF WORK**

49.1 The Owner shall have the right to suspend the work, wholly or in part, for such periods of time as he may deem necessary, when the prosecution of the work during unsuitable weather or under other conditions adversely affecting the work is considered to be unfavorable to the satisfaction of the provisions of the Contract, or when time is required to allow for the supplying of materials meeting the requirements of the Contract Documents. The Contractor shall be entitled to adjust the Time of Completion and/or the Contract Amount caused by the suspension unless the suspension, delay or interruption was caused as a result of the performance of the Contractor; or unless an adjustment in the Time of Completion and/or the Contract Amount is made or denied under another provision of the Contract.

**50. TERMINATION FOR BREACH**

50.1 In the event that any of the provisions of this Contract are violated by the Contractor, or by any of his subcontractors, the Owner may serve written notice upon the Contractor and Surety of its intention to terminate such Contract, such notices to be signed by the Owner and to contain the reasons for such intentions to terminate the Contract. Unless within ten days after serving of such notice upon the Contractor such violation shall cease and arrangements satisfactory to the Owner for the correction of such default be made, the Owner may finally terminate the Contract by giving to the Contractor notice of such termination for the reasons stated in the initial notice. In the event of any such final termination, the Owner shall immediately serve notice thereof upon the Surety and the Surety shall have the right to take over and complete the performance of the Contract, providing, however, that if the Surety does not in good faith commence performance thereof within thirty (30) days from the date of the mailing of such notice to such Surety, the Owner may take over the work and prosecute the same to completion by Contract or otherwise for the account of and at the expense of the Contractor, and the Contractor and his Surety shall be liable to the Owner for any excess cost occasioned thereby, and in such event the Owner may take possession of and utilize in completing the work such materials, appliances, equipment and plant as may be on the site of the work and necessary or useful therefor.

50.2 The Owner may terminate the Contract if the Contractor persistently fails to supply enough properly skilled workers or proper materials; fails to make payment to

Subcontractors for materials or labor; persistently disregards laws, ordinances or regulations of a public authority having jurisdiction; or otherwise is guilty of substantial breach of a provision of the Contract Documents.

**51. ADDITIONAL OR SUBSTITUTE BONDS**

51.1 If, at any time after the execution of the Contract Agreement and the Surety Bonds attached thereto, the Owner should, for justifiable cause, deem the Surety or Sureties then upon the Performance and/or Payment Bonds, to be unsatisfactory, the Contractor shall within five (5) days after notice from the Owner to do so, furnish an acceptable bond (or bonds) in such form as may be satisfactory to the Owner and with such Surety or Sureties as may be satisfactory to the Owner. The premiums on such bond (or bonds) shall be paid for by the Contractor. No further payments to the Contractor shall be deemed to be due until such new and/or additional security for the performance of the work and/or for the payment for labor and materials shall have been furnished in form and amount satisfactory to the Owner.

**52. HAZARDOUS MATERIALS**

52.1 The term "hazardous materials" shall mean any substances, including but not limited to asbestos, toxic or hazardous waste, PCBs, combustible gases and materials, petroleum or radioactive materials (as each of these is defined in applicable federal statutes) or any other substances under any conditions and in such quantities as would pose a substantial danger to persons or property exposed to such substances at or near the Project site.

52.2 If reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a hazardous material encountered at the site, the Contractor shall, upon recognizing the condition, immediately stop work in the affected area and report the condition to the Owner and Engineer in writing.

52.3 The Contractor is responsible for being aware of and complying with the Asbestos National Emission Standard for Hazardous Air Pollutants (NESHAP). The Contractor shall perform all work activities in accordance with the Asbestos NESHAP regulation and any other applicable federal, state or local codes, laws, and regulations.

**53. SCHEDULE OF WORK**

53.1 All activities associated with the work requiring partial or complete shutdown of the existing facilities shall be scheduled by the Contractor and approved the Owner. The schedule approved by the Owner must include the exact time and duration of any and all periods of shutdown of the existing facilities.

## **SUPPLEMENTAL GENERAL CONDITIONS - ARPA AWARD TERMS AND CONDITIONS**

### I. Legal Terms and Conditions Applicable to Contract

Contractor agrees to comply with the requirements of section 603 of the American Rescue Plan Act, Pub. L. No. 117-2 (March 11, 2021) (the "Act"), regulations adopted by Treasury pursuant to section 603(f) of the Act, codified as 31 C.F.R. Part 35, and guidance issued by Treasury regarding the foregoing. Contractor shall provide for such compliance by other parties in any agreements it enters into with other parties relating to this project.

Federal regulations which may be applicable to this contract may include, without limitation, the following:

1. Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards, 2 C.F.R. Part 200, other than such provisions as Treasury may determine are inapplicable to this award and subject to such exceptions as may be otherwise provided by Treasury.
2. OMB Guidelines to Agencies on Governmentwide Debarment and Suspension Non-procurement, 2 C.F.R. Part 180, including the requirement to include a term or condition in all lower tier covered transactions (contracts and subcontracts described in 2 C.F.R. Part 180, subpart B) that the award is subject to 2 C.F.R. Part 80 and Treasury's implementing regulation at 31 C.F.R. Part 19.
3. Recipient Integrity and Performance Matters, pursuant to which the award term set forth in 2 C.F.R. Part 200, Appendix XII to Part 200 is hereby incorporated by reference.
4. Governmentwide Requirements for Drug-Free Workplace, 31 C.F.R. Part 20.
5. New Restrictions on Lobbying, 31 C.F.R. Part 21.
6. Generally applicable federal environmental laws and regulations.

Statutes and regulations prohibiting discrimination applicable to this award include, without limitation, the following:

1. Title VI of the Civil Rights Act of 1964 (42 USC §§ 2000d, *et seq.*) and Treasury's implementing regulations at 31 C.F.R. Part 22, which prohibit discrimination on the basis of race, color, or national origin under programs or activities receiving federal financial assistance;
2. The Fair Housing Act, Title VIII of the Civil Rights Act of 1968 (42 USC §§ 3601, *et seq.*), which prohibits discrimination in housing on the basis of race, color, religion, national origin, sex, familial status, or disability;
3. Section 504 of the Rehabilitation Act of 1973, as amended (29 USC § 794), which prohibits discrimination on the basis of disability under any program or activity receiving federal financial assistance;

4. The Age Discrimination Act of 1975, as amended (42 USC §§ 6101, *et seq.*), and Treasury's implementing regulations at 31 C.F.R. Part 23, which prohibit discrimination on the basis of age in programs or activities receiving federal financial assistance; and
5. Title II of the Americans with Disabilities Act of 1990, as amended (42 USC §§ 12101, *et seq.*), which prohibits discrimination on the basis of disability under programs, activities, and services provided or made available by state and local governments or instrumentalities or agencies thereto.

Contractor agrees to comply, as applicable, with requirements of the Hatch Act (5 USC §§ 1501-1508 and 7324-7328), which limit certain political activities of state or local government employees whose principal employment is in connection with an activity financed in whole or in part by this federal assistance.

Contractor understands that making false statements or claims in connection with the use of ARPA funds is a violation of federal law and may result in criminal, civil, or administrative sanctions, including fines, imprisonment, civil damages and penalties, debarment from participating in federal awards or contracts, and/or any other remedy available by law.

In accordance with 41 USC § 4712, Contractor may not discharge, demote, or otherwise discriminate against an employee in reprisal for disclosing to any of the list of persons or entities provided below, information that the employee reasonably believes is evidence of gross mismanagement of a federal contract or grant, a gross waste of federal funds, an abuse of authority relating to a federal contract or grant, a substantial and specific danger to public health or safety, or a violation of law, rule, or regulation related to a federal contract (including the competition for or negotiation of a contract) or grant.

The list of persons and entities referenced in the paragraph above includes the following:

1. A member of Congress or a representative of a committee of Congress;
2. An Inspector General;
3. The Government Accountability Office;
4. A Treasury employee responsible for contract or grant oversight or management;
5. An authorized official of the Department of Justice or other law enforcement agency;
6. A court or grand jury; or
7. A management official or other employee of the County, contractor, or subcontractor who has the responsibility to investigate, discover, or address misconduct.

Contractors shall inform their employees in writing of the rights and remedies provided for whistleblowers in the predominant native language of the workforce.

Pursuant to Executive Order 13043, 62 F.R. 19217 (Apr. 18, 1997), Contractor is encouraged to adopt and enforce on-the-job seat belt policies and programs for their employees when operating company-owned, rented, or personally owned vehicles.

Pursuant to Executive Order 13513, 74 F.R. 51225 (Oct. 6, 2009), is encouraged to adopt and enforce policies that ban text messaging while driving, and recipient should establish workplace safety policies to decrease accidents caused by distracted drivers.



II. Terms and Conditions related to contractors, mechanics, and laborers:

The following terms and conditions must be built into any bid or resulting contract documents with any contractor engaged to perform work on the project:

Contractor must agree to the terms and conditions included above.

Contractor must use strong labor standards, including payment of a competitive and prevailing wage in the County.

Contractor must adopt and follow high safety standards and provide training based upon the appropriate licensures, certifications, and industry standards.

Contractor should prioritize local hiring consistent with the racial, gender, geographic, urban, rural, and economic diversity of the County.

For contracts/subcontracts over \$100,000, work performed by mechanics and laborers are subject to the provisions of the Contract Work Hours and Safety Standards Act (40 USC 3702 and 3704), as supplemented by 29 C.F.R. Part 5, including, specifically, safety standards, limitations on hours in a work week and overtime for any work spent over 40 hours, and proper documentation for all employees.

(1) A contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall not require or permit any laborer or mechanic, in any workweek in which the laborer or mechanic is employed on that work, to work more than 40 hours in that workweek, except as provided 40 USC Chapter 37; and

(2) when a violation of clause (1) occurs, the contractor and any subcontractor responsible for the violation are liable—

(A) to the affected employee for the employee's unpaid wages; and

(B) to the Government, the District of Columbia, or a territory for liquidated damages as provided in the contract.

State of \_\_\_\_\_ )

County of \_\_\_\_\_ )

CERTIFICATE OF COMPLIANCE WITH THE BEASON-HAMMON ALABAMA TAXPAYER AND CITIZEN PROTECTION ACT (ACT 2011-535, as amended by Act 2012-491)

DATE: \_\_\_\_\_

RE: Contract/Grant/Incentive (*describe by number as subject*):

\_\_\_\_\_ by and between  
\_\_\_\_\_ (Contractor/Grantee) and  
\_\_\_\_\_ (State Agency, Department or Public Entity)

The undersigned hereby certifies to the State of Alabama as follows:

1. The undersigned holds the position of \_\_\_\_\_ with the Contractor/Grantee named above, and is authorized to provide representations set out in this Certificate as the official and binding act of that entity, and has knowledge of the provisions of THE BEASON-HAMMON ALABAMA TAXPAYER AND CITIZEN PROTECTION ACT (ACT 2011-535 of the Alabama Legislature, as amended by Act 2012-491) which is described herein as “the Act”.
2. Using the following definitions from Section 3 of the Act, select and initial either (a) or (b), below, to describe the Contractor/Grantee’s business structure.

BUSINESS ENTITY. Any person or group of persons employing one or more persons performing or engaging in any activity, enterprise, profession, or occupation for gain, benefit, advantage, or livelihood, whether for profit or not for profit. “Business entity” shall include, but not limited to the following:

- a. Self-employed individuals, business entities filing articles of incorporation, partnerships, limited partnerships, limited liability companies, foreign corporations, foreign limited partnerships, foreign limited liability companies authorized to transact business in this state, business trusts, and any business entity that registers with the Secretary of State.
- b. Any business entity that possesses a business license, permit, certificate, approval, registration, charter, or similar form of authorization issued by the state, any business entity that is exempt by law from obtaining such a business license, and any business entity that is operating unlawfully without a business license.

EMPLOYER. Any person, firm, corporation, partnership, joint stock association, agent, manager, representative, foreman, or other person having control or custody of any employment, place of employment, or of any employee, including any person or entity employing any person for hire within the State of Alabama, including a public employer. This term shall not include the occupant of a household contracting with another person to perform casual domestic labor within the household.

(a) The Contractor/Grantee is a business entity or employer as those terms are defined in Section 3 of the Act.

(b) The Contractor/Grantee is not a business entity or employer as those terms are defined in Section 3 of the Act.

3. As of the date of this Certificate, Contractor/Grantee does not knowingly employ an unauthorized alien within the State of Alabama and hereafter it will not knowingly employ, hire for employment, or continue to employ an unauthorized alien within the State of Alabama;
4. Contractor/Grantee is enrolled in E-verify unless it is not eligible to enroll because of the rules of that program or other factors beyond its control.

Certified this \_\_\_\_\_ day of \_\_\_\_\_ 20 \_\_\_\_\_.

\_\_\_\_\_  
Name of Contractor/Grantee/Recipient

By: \_\_\_\_\_

Its \_\_\_\_\_

The above Certification was signed in my presence by the person whose name appears above, on this \_\_\_\_\_ day of \_\_\_\_\_ 20 \_\_\_\_\_.

WITNESS: \_\_\_\_\_

\_\_\_\_\_  
Printed Name of Witness

## CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents of all sub-awards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, United States Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Organization: \_\_\_\_\_

Street address: \_\_\_\_\_

City, State, Zip: \_\_\_\_\_

\_\_\_\_\_  
CERTIFIED BY: (type or print)

\_\_\_\_\_  
TITLE:

\_\_\_\_\_  
(signature)

\_\_\_\_\_  
(date)

**Disclosure of Lobbying Activities**

Complete this form to disclose lobbying activities pursuant to 31 U.S.C. 1352  
(See reverse for public burden disclosure)

<p><b>1. Type of Federal Action:</b>                  a. contract                  _____ b. grant                  c. cooperative agreement                  d. loan                  e. loan guarantee                  f. loan insurance</p>	<p><b>2. Status of Federal Action:</b>                  a. bid/offer/application                  _____ b. initial award                  c. post-award</p>	<p><b>3. Report Type:</b>                  a. initial filing                  _____ b. material change</p> <p><b>For material change only:</b>                  Year _____ quarter _____                  Date of last report _____</p>
<p><b>4. Name and Address of Reporting Entity:</b>                  _____ Prime _____ Subawardee                  Tier _____, if Known:</p> <p><b>Congressional District, if known:</b></p>	<p><b>5. If Reporting Entity in No. 4 is Subawardee, Enter Name and Address of Prime:</b></p> <p><b>Congressional District, if known:</b></p>	
<p><b>6. Federal Department/Agency:</b></p>	<p><b>7. Federal Program Name/Description:</b></p> <p>CFDA Number, <i>if applicable</i>: _____</p>	
<p><b>8. Federal Action Number, if known:</b></p>	<p><b>9. Award Amount, if known:</b></p> <p>\$</p>	
<p><b>10. a. Name and Address of Lobbying Registrant</b>  <i>(if individual, last name, first name, MI):</i></p>	<p><b>b. Individuals Performing Services</b> <i>(including address if different from No. 10a)</i>  <i>(last name, first name, MI):</i></p>	
<p><b>11. Information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when this transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be reported to the Congress semi-annually and will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.</b></p>	<p><b>Signature:</b> _____</p> <p><b>Print Name:</b> _____</p> <p><b>Title:</b> _____</p> <p><b>Telephone No.:</b> _____ <b>Date:</b> _____</p>	
<p><b>Federal Use Only</b></p>	<p><b>Authorized for Local Reproduction</b>  <b>Standard Form - LLL (Rev. 7-97)</b></p>	

## INSTRUCTIONS FOR COMPLETION OF SF-LLL, DISCLOSURE OF LOBBYING ACTIVITIES

This disclosure form shall be completed by the reporting entity, whether subawardee or prime Federal recipient, at the initiation or receipt of a covered Federal action, or a material change to a previous filing, pursuant to title 31 U.S.C. section 1352. The filing of a form is required for each payment or agreement to make payment to any lobbying entity for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a covered Federal action. Complete all items that apply for both the initial filing and material change report. Refer to the implementing guidance published by the Office of Management and Budget for additional information.

1. Identify the type of covered Federal action for which lobbying activity is and/or has been secured to influence the outcome of a covered Federal action.
2. Identify the status of the covered Federal action.
3. Identify the appropriate classification of this report. If this is a followup report caused by a material change to the information previously reported, enter the year and quarter in which the change occurred. Enter the date of the last previously submitted report by this reporting entity for this covered Federal action.
4. Enter the full name, address, city, State and zip code of the reporting entity. Include Congressional District, if known. Check the appropriate classification of the reporting entity that designates if it is, or expects to be, a prime or subaward recipient. Identify the tier of the subawardee, e.g., the first subawardee of the prime is the 1st tier. Subawards include but are not limited to subcontracts, subgrants and contract awards under grants.
5. If the organization filing the report in item 4 checks "Subawardee," then enter the full name, address, city, State and zip code of the prime Federal recipient. Include Congressional District, if known.
6. Enter the name of the federal agency making the award or loan commitment. Include at least one organizational level below agency name, if known. For example, Department of Transportation, United States Coast Guard.
7. Enter the Federal program name or description for the covered Federal action (item 1). If known, enter the full Catalog of Federal Domestic Assistance (CFDA) number for grants, cooperative agreements, loans, and loan commitments.
8. Enter the most appropriate Federal identifying number available for the Federal action identified in item 1 (e.g., Request for Proposal (RFP) number; Invitations for Bid (IFB) number; grant announcement number; the contract, grant, or loan award number; the application/proposal control number assigned by the Federal agency). Included prefixes, e.g., "RFP-DE-90-001."
9. For a covered Federal action where there has been an award or loan commitment by the Federal agency, enter the Federal amount of the award/loan commitment for the prime entity identified in item 4 or 5.
10. (a) Enter the full name, address, city, State and zip code of the lobbying registrant under the Lobbying Disclosure Act of 1995 engaged by the reporting entity identified in item 4 to influence the covered Federal action.  
  
(b) Enter the full names of the individual(s) performing services, and include full address if different from 10(a). Enter Last Name, First Name, and Middle Initial (MI).
11. The certifying official shall sign and date the form, print his/her name, title, and telephone number.

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According to the Paperwork Reduction Act, as amended, no persons are required to respond to a collection of information unless it displays a valid OMB control Number. The valid OMB control number for this information collection is OMB No. 0348-0046. Public reporting burden for this collection of information is estimated to average 10 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0046), Washington, DC 20503



Company ID Number: \_\_\_\_\_

## **THE E-VERIFY MEMORANDUM OF UNDERSTANDING FOR EMPLOYERS**

### **ARTICLE I PURPOSE AND AUTHORITY**

The parties to this agreement are the Department of Homeland Security (DHS) and the \_\_\_\_\_ (Employer). The purpose of this agreement is to set forth terms and conditions which the Employer will follow while participating in E-Verify.

E-Verify is a program that electronically confirms an employee's eligibility to work in the United States after completion of Form I-9, Employment Eligibility Verification (Form I-9). This Memorandum of Understanding (MOU) explains certain features of the E-Verify program and describes specific responsibilities of the Employer, the Social Security Administration (SSA), and DHS.

Authority for the E-Verify program is found in Title IV, Subtitle A, of the Illegal Immigration Reform and Immigrant Responsibility Act of 1996 (IIRIRA), Pub. L. 104-208, 110 Stat. 3009, as amended (8 U.S.C. § 1324a note). The Federal Acquisition Regulation (FAR) Subpart 22.18, "Employment Eligibility Verification" and Executive Order 12989, as amended, provide authority for Federal contractors and subcontractors (Federal contractor) to use E-Verify to verify the employment eligibility of certain employees working on Federal contracts.

### **ARTICLE II RESPONSIBILITIES**

#### **A. RESPONSIBILITIES OF THE EMPLOYER**

1. The Employer agrees to display the following notices supplied by DHS in a prominent place that is clearly visible to prospective employees and all employees who are to be verified through the system:
  - a. Notice of E-Verify Participation
  - b. Notice of Right to Work
2. The Employer agrees to provide to the SSA and DHS the names, titles, addresses, and telephone numbers of the Employer representatives to be contacted about E-Verify. The Employer also agrees to keep such information current by providing updated information to SSA and DHS whenever the representatives' contact information changes.
3. The Employer agrees to grant E-Verify access only to current employees who need E-Verify access. Employers must promptly terminate an employee's E-Verify access if the employee is separated from the company or no longer needs access to E-Verify.

4. The Employer agrees to become familiar with and comply with the most recent version of the E-Verify User Manual.
5. The Employer agrees that any Employer Representative who will create E-Verify cases will complete the E-Verify Tutorial before that individual creates any cases.
  - a. The Employer agrees that all Employer representatives will take the refresher tutorials when prompted by E-Verify in order to continue using E-Verify. Failure to complete a refresher tutorial will prevent the Employer Representative from continued use of E-Verify.
6. The Employer agrees to comply with current Form I-9 procedures, with two exceptions:
  - a. If an employee presents a "List B" identity document, the Employer agrees to only accept "List B" documents that contain a photo. (List B documents identified in 8 C.F.R. § 274a.2(b)(1)(B)) can be presented during the Form I-9 process to establish identity.) If an employee objects to the photo requirement for religious reasons, the Employer should contact E-Verify at 888-464-4218.
  - b. If an employee presents a DHS Form I-551 (Permanent Resident Card), Form I-766 (Employment Authorization Document), or U.S. Passport or Passport Card to complete Form I-9, the Employer agrees to make a photocopy of the document and to retain the photocopy with the employee's Form I-9. The Employer will use the photocopy to verify the photo and to assist DHS with its review of photo mismatches that employees contest. DHS may in the future designate other documents that activate the photo screening tool.

Note: Subject only to the exceptions noted previously in this paragraph, employees still retain the right to present any List A, or List B and List C, document(s) to complete the Form I-9.

7. The Employer agrees to record the case verification number on the employee's Form I-9 or to print the screen containing the case verification number and attach it to the employee's Form I-9.
8. The Employer agrees that, although it participates in E-Verify, the Employer has a responsibility to complete, retain, and make available for inspection Forms I-9 that relate to its employees, or from other requirements of applicable regulations or laws, including the obligation to comply with the antidiscrimination requirements of section 274B of the INA with respect to Form I-9 procedures.
  - a. The following modified requirements are the only exceptions to an Employer's obligation to not employ unauthorized workers and comply with the anti-discrimination provision of the INA: (1) List B identity documents must have photos, as described in paragraph 6 above; (2) When an Employer confirms the identity and employment eligibility of newly hired employee using E-Verify procedures, the Employer establishes a rebuttable presumption that it has not violated section 274A(a)(1)(A) of the Immigration and Nationality Act (INA) with respect to the hiring of that employee; (3) If the Employer receives a final nonconfirmation for an employee, but continues to employ that person, the Employer must notify DHS and the Employer is subject to a civil money penalty between \$550 and \$1,100 for each failure to notify DHS of continued employment following a final nonconfirmation; (4) If the Employer continues to employ an employee after receiving a final nonconfirmation, then the Employer is subject to a rebuttable presumption that it has knowingly employed an unauthorized alien in



violation of section 274A(a)(1)(A); and (5) no E-Verify participant is civilly or criminally liable under any law for any action taken in good faith based on information provided through the E-Verify.

b. DHS reserves the right to conduct Form I-9 compliance inspections, as well as any other enforcement or compliance activity authorized by law, including site visits, to ensure proper use of E-Verify.

9. The Employer is strictly prohibited from creating an E-Verify case before the employee has been hired, meaning that a firm offer of employment was extended and accepted and Form I-9 was completed. The Employer agrees to create an E-Verify case for new employees within three Employer business days after each employee has been hired (after both Sections 1 and 2 of Form I-9 have been completed), and to complete as many steps of the E-Verify process as are necessary according to the E-Verify User Manual. If E-Verify is temporarily unavailable, the three-day time period will be extended until it is again operational in order to accommodate the Employer's attempting, in good faith, to make inquiries during the period of unavailability.

10. The Employer agrees not to use E-Verify for pre-employment screening of job applicants, in support of any unlawful employment practice, or for any other use that this MOU or the E-Verify User Manual does not authorize.

11. The Employer must use E-Verify for all new employees. The Employer will not verify selectively and will not verify employees hired before the effective date of this MOU. Employers who are Federal contractors may qualify for exceptions to this requirement as described in Article II.B of this MOU.

12. The Employer agrees to follow appropriate procedures (see Article III below) regarding tentative nonconfirmations. The Employer must promptly notify employees in private of the finding and provide them with the notice and letter containing information specific to the employee's E-Verify case. The Employer agrees to provide both the English and the translated notice and letter for employees with limited English proficiency to employees. The Employer agrees to provide written referral instructions to employees and instruct affected employees to bring the English copy of the letter to the SSA. The Employer must allow employees to contest the finding, and not take adverse action against employees if they choose to contest the finding, while their case is still pending. Further, when employees contest a tentative nonconfirmation based upon a photo mismatch, the Employer must take additional steps (see Article III.B. below) to contact DHS with information necessary to resolve the challenge.

13. The Employer agrees not to take any adverse action against an employee based upon the employee's perceived employment eligibility status while SSA or DHS is processing the verification request unless the Employer obtains knowledge (as defined in 8 C.F.R. § 274a.1(l)) that the employee is not work authorized. The Employer understands that an initial inability of the SSA or DHS automated verification system to verify work authorization, a tentative nonconfirmation, a case in continuance (indicating the need for additional time for the government to resolve a case), or the finding of a photo mismatch, does not establish, and should not be interpreted as, evidence that the employee is not work authorized. In any of such cases, the employee must be provided a full and fair opportunity to contest the finding, and if he or she does so, the employee may not be terminated or suffer any adverse employment consequences based upon the employee's perceived employment eligibility status (including denying, reducing, or extending work hours, delaying or preventing training, requiring an employee to work in poorer conditions, withholding pay, refusing to assign the employee to a Federal contract or other assignment, or otherwise assuming that he or she is unauthorized to work) until

and unless secondary verification by SSA or DHS has been completed and a final nonconfirmation has been issued. If the employee does not choose to contest a tentative nonconfirmation or a photo mismatch or if a secondary verification is completed and a final nonconfirmation is issued, then the Employer can find the employee is not work authorized and terminate the employee's employment. Employers or employees with questions about a final nonconfirmation may call E-Verify at 1-888-464-4218 (customer service) or 1-888-897-7781 (worker hotline).

14. The Employer agrees to comply with Title VII of the Civil Rights Act of 1964 and section 274B of the INA as applicable by not discriminating unlawfully against any individual in hiring, firing, employment eligibility verification, or recruitment or referral practices because of his or her national origin or citizenship status, or by committing discriminatory documentary practices. The Employer understands that such illegal practices can include selective verification or use of E-Verify except as provided in part D below, or discharging or refusing to hire employees because they appear or sound "foreign" or have received tentative nonconfirmations. The Employer further understands that any violation of the immigration-related unfair employment practices provisions in section 274B of the INA could subject the Employer to civil penalties, back pay awards, and other sanctions, and violations of Title VII could subject the Employer to back pay awards, compensatory and punitive damages. Violations of either section 274B of the INA or Title VII may also lead to the termination of its participation in E-Verify. If the Employer has any questions relating to the anti-discrimination provision, it should contact OSC at 1-800-255-8155 or 1-800-237-2515 (TDD).

15. The Employer agrees that it will use the information it receives from E-Verify only to confirm the employment eligibility of employees as authorized by this MOU. The Employer agrees that it will safeguard this information, and means of access to it (such as PINS and passwords), to ensure that it is not used for any other purpose and as necessary to protect its confidentiality, including ensuring that it is not disseminated to any person other than employees of the Employer who are authorized to perform the Employer's responsibilities under this MOU, except for such dissemination as may be authorized in advance by SSA or DHS for legitimate purposes.

16. The Employer agrees to notify DHS immediately in the event of a breach of personal information. Breaches are defined as loss of control or unauthorized access to E-Verify personal data. All suspected or confirmed breaches should be reported by calling 1-888-464-4218 or via email at [E-Verify@dhs.gov](mailto:E-Verify@dhs.gov). Please use "Privacy Incident – Password" in the subject line of your email when sending a breach report to E-Verify.

17. The Employer acknowledges that the information it receives from SSA is governed by the Privacy Act (5 U.S.C. § 552a(i)(1) and (3)) and the Social Security Act (42 U.S.C. 1306(a)). Any person who obtains this information under false pretenses or uses it for any purpose other than as provided for in this MOU may be subject to criminal penalties.

18. The Employer agrees to cooperate with DHS and SSA in their compliance monitoring and evaluation of E-Verify, which includes permitting DHS, SSA, their contractors and other agents, upon reasonable notice, to review Forms I-9 and other employment records and to interview it and its employees regarding the Employer's use of E-Verify, and to respond in a prompt and accurate manner to DHS requests for information relating to their participation in E-Verify.

19. The Employer shall not make any false or unauthorized claims or references about its participation in E-Verify on its website, in advertising materials, or other media. The Employer shall not describe its services as federally-approved, federally-certified, or federally-recognized, or use language with a similar intent on its website or other

materials provided to the public. Entering into this MOU does not mean that E-Verify endorses or authorizes your E-Verify services and any claim to that effect is false.

20. The Employer shall not state in its website or other public documents that any language used therein has been provided or approved by DHS, USCIS or the Verification Division, without first obtaining the prior written consent of DHS.

21. The Employer agrees that E-Verify trademarks and logos may be used only under license by DHS/USCIS (see [M-795 \(Web\)](#)) and, other than pursuant to the specific terms of such license, may not be used in any manner that might imply that the Employer's services, products, websites, or publications are sponsored by, endorsed by, licensed by, or affiliated with DHS, USCIS, or E-Verify.

22. The Employer understands that if it uses E-Verify procedures for any purpose other than as authorized by this MOU, the Employer may be subject to appropriate legal action and termination of its participation in E-Verify according to this MOU.

## **B. RESPONSIBILITIES OF FEDERAL CONTRACTORS**

1. If the Employer is a Federal contractor with the FAR E-Verify clause subject to the employment verification terms in Subpart 22.18 of the FAR, it will become familiar with and comply with the most current version of the E-Verify User Manual for Federal Contractors as well as the E-Verify Supplemental Guide for Federal Contractors.

2. In addition to the responsibilities of every employer outlined in this MOU, the Employer understands that if it is a Federal contractor subject to the employment verification terms in Subpart 22.18 of the FAR it must verify the employment eligibility of any "employee assigned to the contract" (as defined in FAR 22.1801). Once an employee has been verified through E-Verify by the Employer, the Employer may not create a second case for the employee through E-Verify.

a. An Employer that is not enrolled in E-Verify as a Federal contractor at the time of a contract award must enroll as a Federal contractor in the E-Verify program within 30 calendar days of contract award and, within 90 days of enrollment, begin to verify employment eligibility of new hires using E-Verify. The Employer must verify those employees who are working in the United States, whether or not they are assigned to the contract. Once the Employer begins verifying new hires, such verification of new hires must be initiated within three business days after the hire date. Once enrolled in E-Verify as a Federal contractor, the Employer must begin verification of employees assigned to the contract within 90 calendar days after the date of enrollment or within 30 days of an employee's assignment to the contract, whichever date is later.

b. Employers enrolled in E-Verify as a Federal contractor for 90 days or more at the time of a contract award must use E-Verify to begin verification of employment eligibility for new hires of the Employer who are working in the United States, whether or not assigned to the contract, within three business days after the date of hire. If the Employer is enrolled in E-Verify as a Federal contractor for 90 calendar days or less at the time of contract award, the Employer must, within 90 days of enrollment, begin to use E-Verify to initiate verification of new hires of the contractor who are working in the United States, whether or not assigned to the contract. Such verification of new hires must be initiated within three business days after the date of hire. An Employer enrolled as a Federal contractor in E-Verify must begin verification of each employee assigned to the contract within 90 calendar days after date of contract award or within 30 days after assignment to

the contract, whichever is later.

c. Federal contractors that are institutions of higher education (as defined at 20 U.S.C. 1001(a)), state or local governments, governments of Federally recognized Indian tribes, or sureties performing under a takeover agreement entered into with a Federal agency under a performance bond may choose to only verify new and existing employees assigned to the Federal contract. Such Federal contractors may, however, elect to verify all new hires, and/or all existing employees hired after November 6, 1986. Employers in this category must begin verification of employees assigned to the contract within 90 calendar days after the date of enrollment or within 30 days of an employee's assignment to the contract, whichever date is later.

d. Upon enrollment, Employers who are Federal contractors may elect to verify employment eligibility of all existing employees working in the United States who were hired after November 6, 1986, instead of verifying only those employees assigned to a covered Federal contract. After enrollment, Employers must elect to verify existing staff following DHS procedures and begin E-Verify verification of all existing employees within 180 days after the election.

e. The Employer may use a previously completed Form I-9 as the basis for creating an E-Verify case for an employee assigned to a contract as long as:

- i. That Form I-9 is complete (including the SSN) and complies with Article II.A.6,
- ii. The employee's work authorization has not expired, and
- iii. The Employer has reviewed the Form I-9 information either in person or in communications with the employee to ensure that the employee's Section 1, Form I-9 attestation has not changed (including, but not limited to, a lawful permanent resident alien having become a naturalized U.S. citizen).

f. The Employer shall complete a new Form I-9 consistent with Article II.A.6 or update the previous Form I-9 to provide the necessary information if:

- i. The Employer cannot determine that Form I-9 complies with Article II.A.6,
- ii. The employee's basis for work authorization as attested in Section 1 has expired or changed, or
- iii. The Form I-9 contains no SSN or is otherwise incomplete.

Note: If Section 1 of Form I-9 is otherwise valid and up-to-date and the form otherwise complies with Article II.C.5, but reflects documentation (such as a U.S. passport or Form I-551) that expired after completing Form I-9, the Employer shall not require the production of additional documentation, or use the photo screening tool described in Article II.A.5, subject to any additional or superseding instructions that may be provided on this subject in the E-Verify User Manual.

g. The Employer agrees not to require a second verification using E-Verify of any assigned employee who has previously been verified as a newly hired employee under this MOU or to authorize verification of any existing employee by any Employer that is not a Federal contractor based on this Article.

3. The Employer understands that if it is a Federal contractor, its compliance with this MOU is a performance requirement under the terms of the Federal contract or subcontract, and the Employer consents to the release of information relating to compliance with its verification responsibilities under this MOU to contracting officers or

other officials authorized to review the Employer's compliance with Federal contracting requirements.

### **C. RESPONSIBILITIES OF SSA**

1. SSA agrees to allow DHS to compare data provided by the Employer against SSA's database. SSA sends DHS confirmation that the data sent either matches or does not match the information in SSA's database.
2. SSA agrees to safeguard the information the Employer provides through E-Verify procedures. SSA also agrees to limit access to such information, as is appropriate by law, to individuals responsible for the verification of Social Security numbers or responsible for evaluation of E-Verify or such other persons or entities who may be authorized by SSA as governed by the Privacy Act (5 U.S.C. § 552a), the Social Security Act (42 U.S.C. 1306(a)), and SSA regulations (20 CFR Part 401).
3. SSA agrees to provide case results from its database within three Federal Government work days of the initial inquiry. E-Verify provides the information to the Employer.
4. SSA agrees to update SSA records as necessary if the employee who contests the SSA tentative nonconfirmation visits an SSA field office and provides the required evidence. If the employee visits an SSA field office within the eight Federal Government work days from the date of referral to SSA, SSA agrees to update SSA records, if appropriate, within the eight-day period unless SSA determines that more than eight days may be necessary. In such cases, SSA will provide additional instructions to the employee. If the employee does not visit SSA in the time allowed, E-Verify may provide a final nonconfirmation to the employer.

Note: If an Employer experiences technical problems, or has a policy question, the employer should contact E-Verify at 1-888-464-4218.

### **D. RESPONSIBILITIES OF DHS**

1. DHS agrees to provide the Employer with selected data from DHS databases to enable the Employer to conduct, to the extent authorized by this MOU:
  - a. Automated verification checks on alien employees by electronic means, and
  - b. Photo verification checks (when available) on employees.
2. DHS agrees to assist the Employer with operational problems associated with the Employer's participation in E-Verify. DHS agrees to provide the Employer names, titles, addresses, and telephone numbers of DHS representatives to be contacted during the E-Verify process.
3. DHS agrees to provide to the Employer with access to E-Verify training materials as well as an E-Verify User Manual that contain instructions on E-Verify policies, procedures, and requirements for both SSA and DHS, including restrictions on the use of E-Verify.
4. DHS agrees to train Employers on all important changes made to E-Verify through the use of mandatory refresher tutorials and updates to the E-Verify User Manual. Even without changes to E-Verify, DHS reserves the right to require employers to take mandatory refresher tutorials.
5. DHS agrees to provide to the Employer a notice, which indicates the Employer's participation in E-Verify. DHS also agrees to provide to the Employer anti-discrimination

notices issued by the Office of Special Counsel for Immigration-Related Unfair Employment Practices (OSC), Civil Rights Division, U.S. Department of Justice.

6. DHS agrees to issue each of the Employer's E-Verify users a unique user identification number and password that permits them to log in to E-Verify.
7. DHS agrees to safeguard the information the Employer provides, and to limit access to such information to individuals responsible for the verification process, for evaluation of E-Verify, or to such other persons or entities as may be authorized by applicable law. Information will be used only to verify the accuracy of Social Security numbers and employment eligibility, to enforce the INA and Federal criminal laws, and to administer Federal contracting requirements.
8. DHS agrees to provide a means of automated verification that provides (in conjunction with SSA verification procedures) confirmation or tentative nonconfirmation of employees' employment eligibility within three Federal Government work days of the initial inquiry.
9. DHS agrees to provide a means of secondary verification (including updating DHS records) for employees who contest DHS tentative nonconfirmations and photo mismatch tentative nonconfirmations. This provides final confirmation or nonconfirmation of the employees' employment eligibility within 10 Federal Government work days of the date of referral to DHS, unless DHS determines that more than 10 days may be necessary. In such cases, DHS will provide additional verification instructions.

### **ARTICLE III REFERRAL OF INDIVIDUALS TO SSA AND DHS**

#### **A. REFERRAL TO SSA**

1. If the Employer receives a tentative nonconfirmation issued by SSA, the Employer must print the notice as directed by E-Verify. The Employer must promptly notify employees in private of the finding and provide them with the notice and letter containing information specific to the employee's E-Verify case. The Employer also agrees to provide both the English and the translated notice and letter for employees with limited English proficiency to employees. The Employer agrees to provide written referral instructions to employees and instruct affected employees to bring the English copy of the letter to the SSA. The Employer must allow employees to contest the finding, and not take adverse action against employees if they choose to contest the finding, while their case is still pending.
2. The Employer agrees to obtain the employee's response about whether he or she will contest the tentative nonconfirmation as soon as possible after the Employer receives the tentative nonconfirmation. Only the employee may determine whether he or she will contest the tentative nonconfirmation.
3. After a tentative nonconfirmation, the Employer will refer employees to SSA field offices only as directed by E-Verify. The Employer must record the case verification number, review the employee information submitted to E-Verify to identify any errors, and find out whether the employee contests the tentative nonconfirmation. The Employer will transmit the Social Security number, or any other corrected employee information that SSA requests, to SSA for verification again if this review indicates a need to do so.
4. The Employer will instruct the employee to visit an SSA office within eight Federal Government work days. SSA will electronically transmit the result of the referral to the Employer within 10 Federal Government work days of the referral unless it determines

that more than 10 days is necessary.

5. While waiting for case results, the Employer agrees to check the E-Verify system regularly for case updates.

6. The Employer agrees not to ask the employee to obtain a printout from the Social Security Administration number database (the Numident) or other written verification of the SSN from the SSA.

## **B. REFERRAL TO DHS**

1. If the Employer receives a tentative nonconfirmation issued by DHS, the Employer must promptly notify employees in private of the finding and provide them with the notice and letter containing information specific to the employee's E-Verify case. The Employer also agrees to provide both the English and the translated notice and letter for employees with limited English proficiency to employees. The Employer must allow employees to contest the finding, and not take adverse action against employees if they choose to contest the finding, while their case is still pending.

2. The Employer agrees to obtain the employee's response about whether he or she will contest the tentative nonconfirmation as soon as possible after the Employer receives the tentative nonconfirmation. Only the employee may determine whether he or she will contest the tentative nonconfirmation.

3. The Employer agrees to refer individuals to DHS only when the employee chooses to contest a tentative nonconfirmation.

4. If the employee contests a tentative nonconfirmation issued by DHS, the Employer will instruct the employee to contact DHS through its toll-free hotline (as found on the referral letter) within eight Federal Government work days.

5. If the Employer finds a photo mismatch, the Employer must provide the photo mismatch tentative nonconfirmation notice and follow the instructions outlined in paragraph 1 of this section for tentative nonconfirmations, generally.

6. The Employer agrees that if an employee contests a tentative nonconfirmation based upon a photo mismatch, the Employer will send a copy of the employee's Form I-551, Form I-766, U.S. Passport, or passport card to DHS for review by:

- a. Scanning and uploading the document, or
- b. Sending a photocopy of the document by express mail (furnished and paid for by the employer).

7. The Employer understands that if it cannot determine whether there is a photo match/mismatch, the Employer must forward the employee's documentation to DHS as described in the preceding paragraph. The Employer agrees to resolve the case as specified by the DHS representative who will determine the photo match or mismatch.

8. DHS will electronically transmit the result of the referral to the Employer within 10 Federal Government work days of the referral unless it determines that more than 10 days is necessary.

9. While waiting for case results, the Employer agrees to check the E-Verify system regularly for case updates.

## **ARTICLE IV SERVICE PROVISIONS**

## **A. NO SERVICE FEES**

1. SSA and DHS will not charge the Employer for verification services performed under this MOU. The Employer is responsible for providing equipment needed to make inquiries. To access E-Verify, an Employer will need a personal computer with Internet access.

## **ARTICLE V MODIFICATION AND TERMINATION**

### **A. MODIFICATION**

1. This MOU is effective upon the signature of all parties and shall continue in effect for as long as the SSA and DHS operates the E-Verify program unless modified in writing by the mutual consent of all parties.
2. Any and all E-Verify system enhancements by DHS or SSA, including but not limited to E-Verify checking against additional data sources and instituting new verification policies or procedures, will be covered under this MOU and will not cause the need for a supplemental MOU that outlines these changes.

### **B. TERMINATION**

1. The Employer may terminate this MOU and its participation in E-Verify at any time upon 30 days prior written notice to the other parties.
2. Notwithstanding Article V, part A of this MOU, DHS may terminate this MOU, and thereby the Employer's participation in E-Verify, with or without notice at any time if deemed necessary because of the requirements of law or policy, or upon a determination by SSA or DHS that there has been a breach of system integrity or security by the Employer, or a failure on the part of the Employer to comply with established E-Verify procedures and/or legal requirements. The Employer understands that if it is a Federal contractor, termination of this MOU by any party for any reason may negatively affect the performance of its contractual responsibilities. Similarly, the Employer understands that if it is in a state where E-Verify is mandatory, termination of this by any party MOU may negatively affect the Employer's business.
3. An Employer that is a Federal contractor may terminate this MOU when the Federal contract that requires its participation in E-Verify is terminated or completed. In such cases, the Federal contractor must provide written notice to DHS. If an Employer that is a Federal contractor fails to provide such notice, then that Employer will remain an E-Verify participant, will remain bound by the terms of this MOU that apply to non-Federal contractor participants, and will be required to use the E-Verify procedures to verify the employment eligibility of all newly hired employees.
4. The Employer agrees that E-Verify is not liable for any losses, financial or otherwise, if the Employer is terminated from E-Verify.

## **ARTICLE VI PARTIES**

A. Some or all SSA and DHS responsibilities under this MOU may be performed by contractor(s), and SSA and DHS may adjust verification responsibilities between each



other as necessary. By separate agreement with DHS, SSA has agreed to perform its responsibilities as described in this MOU.

B. Nothing in this MOU is intended, or should be construed, to create any right or benefit, substantive or procedural, enforceable at law by any third party against the United States, its agencies, officers, or employees, or against the Employer, its agents, officers, or employees.

C. The Employer may not assign, directly or indirectly, whether by operation of law, change of control or merger, all or any part of its rights or obligations under this MOU without the prior written consent of DHS, which consent shall not be unreasonably withheld or delayed. Any attempt to sublicense, assign, or transfer any of the rights, duties, or obligations herein is void.

D. Each party shall be solely responsible for defending any claim or action against it arising out of or related to E-Verify or this MOU, whether civil or criminal, and for any liability wherefrom, including (but not limited to) any dispute between the Employer and any other person or entity regarding the applicability of Section 403(d) of IIRIRA to any action taken or allegedly taken by the Employer.

E. The Employer understands that its participation in E-Verify is not confidential information and may be disclosed as authorized or required by law and DHS or SSA policy, including but not limited to, Congressional oversight, E-Verify publicity and media inquiries, determinations of compliance with Federal contractual requirements, and responses to inquiries under the Freedom of Information Act (FOIA).

F. The individuals whose signatures appear below represent that they are authorized to enter into this MOU on behalf of the Employer and DHS respectively. The Employer understands that any inaccurate statement, representation, data or other information provided to DHS may subject the Employer, its subcontractors, its employees, or its representatives to: (1) prosecution for false statements pursuant to 18 U.S.C. 1001 and/or; (2) immediate termination of its MOU and/or; (3) possible debarment or suspension.

G. The foregoing constitutes the full agreement on this subject between DHS and the Employer.

**To be accepted as an E-Verify participant, you should only sign the Employer's Section of the signature page. If you have any questions, contact E-Verify at 1-888-464-4218.**

**Approved by:**

<b>E-Verify Employer</b>	
Name (Please Type or Print)	Title
Signature	Date

<b>Department of Homeland Security – Verification Division</b>	
Name (Please Type or Print)	Title
Signature	Date

<b>Information Required for E-Verify</b>	
Information relating to your Company:	
Company Name:	
Company Facility Address:	
Company Alternate Address:	
County or Parish:	
Employer Identification Number:	
North American Industry Classification Systems Code:	
Parent Company:	
Number of Employees:	
Number of Sites Verified for:	

Are you verifying for more than one site?  
 If yes, please provide the number of sites verified for in each State:

State	Number of sites	Site(s)

Information relating to the Program Administrator(s) for your Company on policy questions or operational problems:

Name:	
Telephone Number:	
Fax Number:	
E-mail Address:	

Name:	
Telephone Number:	
Fax Number:	
E-mail Address:	

CERTIFICATE OF COMPLIANCE WITH ACT 2016-312

DATE: \_\_\_\_\_

Re: Contract/Grant/Incentive (describe by number or subject):

\_\_\_\_\_ by and between \_\_\_\_\_  
(Contractor/Grantee) and \_\_\_\_\_ (State Agency, Department or  
Public Entity.

The undersigned hereby certifies to the State of Alabama as follows:

1. The undersigned holds the position of \_\_\_\_\_ with the Contractor/Grantee named above, and is authorized to provide representations set out in this Certificate as the official and binding act of that entity, and has knowledge of Alabama's Act 2016-312.
2. In compliance with Act 2016-312, the contractor hereby certifies that it is not currently engaged in, and will not engage in, the boycott of a person or an entity based in or doing business with a jurisdiction with which this state can enjoy open trade.

Certified this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
Name of Contractor/Grantee/Recipient

By: \_\_\_\_\_

Its: \_\_\_\_\_

The above Certification was signed in my presence by the person whose name appears above on this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

Witness: \_\_\_\_\_

\_\_\_\_\_  
Printed Name of Witness

## **SECTION 01 10 00 - SUMMARY**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Project information.
  - 2. Work covered by Contract Documents.
  - 3. Access to site.
  - 4. Coordination with occupants.
  - 5. Work under separate contracts
- B. Related Requirements:
  - 1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

#### **1.3 PROJECT INFORMATION**

- A. Project Identification: Northport WTP Chemical Systems Improvements
  - 1. Project Location: 11045 Lary Lake Road, Northport, AL 35475
- B. Owner: City of Northport
- C. Engineer: Krebs Engineering, Inc, 2100 River Haven Drive, Suite 100, Birmingham, AL 35244, Scott Lee, Associate, [scott.lee@krebseing.com](mailto:scott.lee@krebseing.com), 205.987.7411

#### **1.4 WORK COVERED BY CONTRACT DOCUMENTS**

- A. The Work of Project is defined by the Contract Documents and consists of the following:
  - 1. Erosion Control Measures.
  - 2. General site improvements and yard piping.
  - 3. New Chemical Storage Area to include covered storage area, bulk storage tanks for Alum and Sodium Hypochlorite, and all required appurtenances as shown on the Contract Documents.

4. Demolition of existing outdoor storage tanks and installation of a new Fluoride Tank in the outdoor storage area. General reconditioning of the outdoor storage area.
5. Demolition of existing chemical systems inside the chemical feed building as shown on the plans.
6. New Sodium Hypochlorite day tank, feed pump skids, and all associated appurtenances.
7. Commissioning of new Sodium Hypochlorite feed system.
8. New Alum day tank.
9. The Water Treatment Plant will remain in operation throughout the entirety of the project. The Contractor shall take such measures as necessary to ensure the WTP remains in operation to include, but not limited to temporary storage, chemical pumping, and pipelines as may be necessary to provide continuous operation while the improvements are being made.
10. The new Fluoride tank shall be placed into commission at a time selected by the Owner. The Owner may endeavor to remove as much of the existing fluoride from the existing bulk storage tank before demolition proceeds. Removal of the existing fluoride tank and the installation of the new fluoride tank shall be coordinated with the Owner and may be scheduled several months after the Notice to Proceed, dependent on the volume of fluoride stored. The schedule can be expedited if the Contractor desires to transfer fluoride from the existing tank to the new tank by the Contractor's selected method. The feeding of fluoride may be discontinued for a portion of the Construction period. The Owner will notify ADEM of the proposed halt in fluoride addition. The Contractor shall provide the Owner notification in writing at least two weeks in advance of the temporary halt of fluoride addition.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations. The Northport Water Treatment Plant will remain in operation for the duration of the project. The Contractor will have access to the work areas so long as it does not interrupt WTP operations or chemical deliveries. The Owner will coordinate times of chemical deliveries to the Contractor. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Access Roads, Walkways and Entrances: Keep access roads, walkways, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
  - a. Schedule operations to minimize use of driveways and entrances.

- b. Any damage caused by Contract work activities to existing entrances, walkways, and access roads shall be repaired by the Contractor at no additional cost to the Owner.

## 1.6 COORDINATION WITH OWNER

- A. Full Owner Occupancy: Owner will occupy site and operate the water treatment plant during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing entrances and access roads.
  - 1. Do not close or obstruct walkways, access roads, or other occupied or used facilities without written permission from Owner.
  - 2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

## 1.7 COMMISSIONING PERIOD

- A. All new facilities shall undergo a commissioning period.
  - 1. The commissioning period shall be 14 consecutive operational days.
  - 2. Any operational issues experienced during the commissioning period may at the discretion of the Owner, require the restart of the commissioning period.
  - 3. During the commissioning period, the facility shall be used for its intended purpose but the existing facility performing the same function shall remain available for operation if required. Facilities include:
    - a. Existing Chlorine Gas Disinfection Systems
    - b. Alum feed systems

## 1.8 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

## 1.9 WORK HOURS AND OTHER RESTRICTIONS

- A. The Contractor shall limit work hours as described in the General Conditions. On site work hours shall be between 7 a.m. and 6 p.m. unless prior written permission is obtained from the Owner.

- B. The Contractor shall take all necessary precautions/measures to limit noise, dust, odors and other disruptive impacts to the Owner and/or neighboring properties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00



## SECTION 01 22 00 - UNIT PRICES

### PART 1 - GENERAL

#### 1.1 UNIT PRICES

- A. Unit prices are based on estimated quantities of items, but the Contractor shall be paid based on the actual measured quantity of each unit price item that is furnished and/or installed. Unit prices shall include all labor, delivery, materials, equipment, services, overhead, and profit attributable to each unit price item. Once the actual quantities are known, then a Change Order will be issued to incorporate the quantity increase or decrease into the Work.
- B. Refer to individual Specification Sections for additional information.
- C. The Contractor shall measure the unit price quantities furnished and/or installed, but the Owner shall have the right to verify the Contractor's measurements with Owner's forces and/or independently at Owner's expense.
- D. List of Unit Price Bid Items: A schedule and description of the unit price bid items included in this Contract is provided below:
  - 1. Mobilization and Insurance – Shall be considered payment for mobilization, demobilization, office overhead, temporary facilities, field offices, bonds, insurance, permits, and any other fixed costs associated with the execution of the work. The value of the bid price shall not exceed five percent (5%) of the total base bid. Any fixed cost in excess of this value shall be included in the unit prices bid for the various unit price items of the work. 75% of the Lump Sum Bid Unit Price for Mobilization and Insurance shall be included as work complete on the first application for payment after the Contractor occupies the site, moves in equipment for the execution of the work, and begins the work. The remaining 25% shall be equally divided over the remaining partial payment applications.
  - 2. Furnish and Install Sodium Hypochlorite Containment area to include all required Site Work and Concrete - Shall be considered payment for all materials, labor, equipment, management, and overhead to complete the concrete containment area for the Sodium Hypochlorite Bulk Storage Tank in accordance with the plans and specifications. This payment item shall not include cost for chemical piping, instrumentation, alarm beacon, bulk storage tank, and electrical work as these payment items shall be included in other Bid Items.
  - 3. Furnish and Install 6,500 Gallon Sodium Hypochlorite Bulk Storage Tank - Shall be considered payment for all materials, labor, equipment, management, and overhead to furnish and install the Sodium Hypochlorite Bulk Storage Tank in accordance with the plans and specifications. This payment item shall not include cost for chemical piping, instrumentation, concrete containment area, and electrical work as these payment items shall be included in other Bid Items.
  - 4. Furnish and Install Sodium Hypochlorite Pump Skids - Shall be considered payment for all materials, labor, equipment, management, and overhead to complete the installation of the sodium hypochlorite pumps skids and all appurtances and pumps included with the skids. This payment item shall not

include cost for chemical piping (off skid), instrumentation (off skid), day tank, and electrical work as these payment items shall be included in other Bid Items.

5. Furnish and Install Sodium Hypochlorite Day Tank - Shall be considered payment for all materials, labor, equipment, management, and overhead to complete the installation of the sodium hypochlorite day tank and containment base. This payment item shall not include cost for chemical piping, instrumentation, pump skids, and electrical work as these payment items shall be included in other Bid Items.
6. All electrical work identified with the Base Bid Work - Shall be considered payment for all materials, labor, equipment, management, and overhead to complete the installation of all electrical and instrumentation.
7. Erosion Control measures furnished, installed, and modified as necessary to prevent the discharge of sediment from the Construction Site. Lump sum payment shall be divided into 75% of the Lump Sum Bid Unit Price shall be submitted after installation of erosion control measures are complete. The remaining 25% shall be equally divided over the remaining partial payment applications for erosion control maintenance and administrative costs.
8. Lump Sum for the Northport WTP Chemical System Improvements to include all materials, labor, equipment, management, and overhead to complete the work identified in the Contract Documents which is not specifically identified in Bid Items Nos. 1-7.
9. Alternate Bid No. 1 Modifications to the Existing Chemical Storage Area: Demolition and Improvements to include all materials, labor, equipment, management, and overhead to complete the work identified in the Contract Documents. The Owner may select or reject the alternate bid item based on the Owner's best interest. Lump Sum cost shall include all necessary items required to complete the work and if the Owner does not select the alternate bid item, the Contractor shall not be entitled to claim lost profit, extended overhead, or any cost associated with the Alternate Bid Item.
10. Alternate Bid No. 2 Replacement of the Alum Day Tank: Demolition and Improvements to include all materials, labor, equipment, management, and overhead to complete the work identified in the Contract Documents. The Owner may select or reject the alternate bid item based on the Owner's best interest. Lump Sum cost shall include all necessary items required to complete the work and if the Owner does not select the alternate bid item, the Contractor shall not be entitled to claim lost profit, extended overhead, or any cost associated with the Alternate Bid Item.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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UNIT PRICES  
01 22 00

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END OF SECTION 01 22 00

## **SECTION 01 23 00 – ALTERNATES**

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. The Owner reserves the right to select or reject alternates that are considered to be advantageous to the Owner.
- B. No adjustments to the pricing for other components of the Work will be made.
- C. No adjustments to the schedule or Contract completion dates will be made unless specifically identified for an alternate.
- D. Only those alternates selected by the Owner and incorporated into the Contract Agreement are included in the Work.
- E. Contractor's cost for Alternate Items shall be as listed on the proposal form and no additional costs shall be considered for administration, overhead, extended overhead, time, equipment, labor, and materials.

#### 1.2 SCHEDULE OF ALTERNATES

- A. The alternates shown in the Proposal Form are listed and described below:
  - 1. Alternate No. 1: Modifications of the Existing Chemical Feed Area. The work shall include the items identified on the Contract Documents and include at a minimum:
    - a. The demolition of the existing bulk storage tanks and associated piping and appurtenances.
    - b. New Alum and Fluoride bulk storage tanks to include pipe systems, instrumentation, and appurtenances.
    - c. New sump alarm beacon system.
    - d. All associated electrical improvements.
  - 2. Alternate No. 2: Replacement of Existing Alum Day Tank
    - a. Demolition of existing alum day tank and appurtenances.
    - b. Installation of new alum day tank and pipe connections.
    - c. All associated modifications existing piping and pumps required for installation of new alum day tank.
    - d. New level indication instrumentation for alum day tank.
    - e. All associated electrical improvements.

PART 2 - PART 2 - PRODUCTS (Not Used)

PART 3 - PART 3 – EXECUTION (Not Used)

**END OF SECTION 01 23 00**

## **SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. Requests for Information (RFIs).
  - 2. Project meetings.

#### **1.3 DEFINITIONS**

- A. RFI: Request from Owner, Construction Manager, Engineer, or Contractor seeking information required by or clarifications of the Contract Documents.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

#### **1.5 REQUESTS FOR INFORMATION (RFIs)**

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
  - 1. Engineer will return RFIs submitted to Engineer by other entities controlled by Contractor with no response.

2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
  2. Project number.
  3. Date.
  4. Name of Contractor.
  5. Name of Engineer.
  6. RFI number, numbered sequentially.
  7. RFI subject.
  8. Specification Section number and title and related paragraphs, as appropriate.
  9. Field dimensions and conditions, as appropriate.
  10. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  11. Contractor's signature.
  12. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. Engineer's Action: Engineer will review each RFI, determine action required, and respond. Allow seven working days for Engineer's response for each RFI. RFIs received by Engineer after 1:00 p.m. will be considered as received the following working day.
1. Engineer's action may include a request for additional information, in which case Engineer's time for response will date from time of receipt of additional information.
- D. On receipt of Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer within seven days if Contractor disagrees with response.
- 1.6 PROJECT MEETINGS
- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Engineer. Hold the conference at Project site or another convenient location.
1. Conduct the conference to review responsibilities and personnel assignments.
  2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Process Solids Removal
    - c. Process Solids Storage (if required)
    - d. Transportation of Process Solids
    - e. Disposal of Process Solids
    - f. Designation of key personnel and their duties.
    - g. Lines of communications.
    - h. Procedures for processing field decisions and Change Orders.
    - i. Procedures for RFIs.
    - j. Procedures for processing Applications for Payment.
    - k. Distribution of the Contract Documents.
    - l. Use of the premises.
    - m. Work restrictions.
    - n. Working hours.
    - o. Responsibility for temporary facilities and controls.
    - p. Progress cleaning.
  3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Progress Meetings: Conduct progress meetings as required by the Owner.
1. Coordinate dates of meetings with preparation of payment requests.
  2. Attendees:
    - a. Contractor's Project Manager
    - b. Contractor's Superintendent
    - c. Any pertinent subcontractors
    - d. Engineer
    - e. Owner
  3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be

expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

- 1) Review schedule for next period.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00



## **SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Start-up construction schedule.
  - 2. Contractor's construction schedule.
  - 3. Daily construction reports.
  - 4. Material location reports.
  - 5. Field condition reports.
  - 6. Special reports.
- B. Related Sections:
  - 1. Division 01 Section "Multiple Contract Summary" for preparing a combined Contractor's Construction Schedule.
  - 2. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
  - 3. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

#### **1.3 DEFINITIONS**

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
  - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.

- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Engineer.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of the Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
  - 1. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
  - 2. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
  - 1. PDF electronic file.
  - 2. Paper copies only when requested for clarity.
- B. Start-up construction schedule.
  - 1. Approval of cost-loaded start-up construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Start-up Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
  - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

## 1.5 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.
  - 1. Secure time commitments for performing critical elements of the Work from entities involved.
  - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

## PART 2 - PRODUCTS

### 2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion and Final Completion.
  - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
  - 1. Activity Duration: Define activities so no activity is longer than 31 days, unless specifically allowed by Engineer.
  - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
  - 3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
  - 4. Startup and Testing Time: Include not less than 14 days for startup and commissioning.
  - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Engineer's administrative procedures necessary for certification of Substantial Completion.

6. Punch List and Final Completion: Include not more than 14 days for punch list and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
  2. Work under More Than One Contract: Include a separate activity for each contract.
  3. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Limitations of continued occupancies.
    - c. Uninterruptible services.
    - d. Partial occupancy before Substantial Completion.
    - e. Use of premises restrictions.
    - f. Provisions for future construction.
    - g. Seasonal variations.
  4. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    - a. Subcontract awards.
    - b. Submittals.
    - c. Purchases.
    - d. Fabrication.
    - e. Sample testing.
    - f. Deliveries.
    - g. Installation.
    - h. Tests and inspections.
    - i. Adjusting.
    - j. Curing.
    - k. Startup and placement into final use and operation.
  5. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
    - a. Structural completion.
    - b. Completion of mechanical installation.
    - c. Completion of electrical installation.
    - d. Substantial Completion.
- D. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
  2. Unanswered RFIs.
  3. Rejected or unreturned submittals.
  4. Notations on returned submittals.
- E. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Engineer, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
  2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

## **SECTION 01 33 00 - SUBMITTAL PROCEDURES**

### PART 1 - GENERAL

#### 1.1 SUBMITTAL REVIEW AND COORDINATION

- A. Submittal Development and Contractor Review: Contractor shall develop and submit submittals as required to allow adequate time for review without delaying/affecting the schedule for the Work. No Contract extension will be allowed for submittal development and/or review/resubmittals. Contractor shall thoroughly review and familiarize himself with the existing facilities and shall obtain/incorporate all necessary field dimensions into the submittals prior to submitting and prior to beginning Work.
- B. The Contractor shall be solely responsible for coordinating preparation and review/processing of the submittals with manufacturers and suppliers and for ensuring that they are developed and approved as required to complete the Work on schedule.
- C. Time for submittal review shall begin upon receipt of complete submittal by Engineer. Contractor shall allow a minimum of 14 days for submittal review when no concurrent consultant review (e.g. electrical review) is required. Where concurrent consultant submittal review is required, allow an additional 7 days (total of 21 days).
- D. Resubmittal Review: Allow 14 days for review of each resubmittal.
- E. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received. No extension of Contract time will be granted for this.
- F. Engineer will maintain a submittal log throughout the project.

#### 1.2 ENGINEER'S DIGITAL CAD FILES

- A. Engineer's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Engineer for Contractor's use in preparing submittals.
- B. Engineer makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
- C. Digital Drawing Software Program: The Contract Drawings are available in Bentley Microstation (.dgn) or AutoCAD (.dwg) format.
- D. Contractor shall execute a data licensing/use agreement provide by the Engineer.

## PART 2 - PRODUCTS

### 2.1 GENERAL SUBMITTAL REQUIREMENTS AND PROCEDURES

- A. Contractor shall prepare and submit submittals in accordance with requirements in each Specification Section.
- B. Electronic submittals (pdf format) are acceptable and can be submitted via email or other means.
- C. Submittals shall include the following information:
  - 1. Project name, Owner Name and Date.
  - 2. Name of Engineering Firm and name/contact information for Engineer.
  - 3. Name, Addresses and Contact Information for Contractor, Subcontractor, Supplier and Manufacturer
  - 4. Submittal number or other unique identifier, including revision identifier. Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
  - 5. Number and title of appropriate Specification Section.
  - 6. Drawing number and detail references, as appropriate.
  - 7. Location(s) where product is to be installed, as appropriate.
  - 8. Other necessary identification.
- D. During the bid period and again prior to submitting/ordering and installing materials, products and equipment, the Contractor and all manufacturers and suppliers shall thoroughly review the materials, products and equipment being supplied and shall familiarize themselves with the existing and proposed/new facilities, as well as connections to existing facilities/utilities. This shall include field verification of the location, nature, size/dimensions, current and intended future use, etc. Prior to ordering and installation, the Contractor shall coordinate with all manufacturers and suppliers to provide all needed information including field dimensions, photographs, information on related materials and equipment, etc.). The Contractor and all manufacturers and suppliers shall confirm the following:
  - 1. The materials, products, and equipment being supplied are of the correct size, materials and type
  - 2. The materials, products and equipment being supplied do not conflict with existing or proposed/new facilities.
  - 3. The products/equipment being supplied are intended for use in this application.
  - 4. Engineer's review and comment on submittals does not revise the requirements of the Contract. Contractor shall be responsible for meeting all Contract requirements.

All manufacturer(s) and supplier(s) shall provide (either with submittals or separately) written concurrence/acknowledgement of their review/coordination and concurrence with the items above.

## 2.2 TYPES OF SUBMITTALS

- A. Contractor's Construction Schedule: Prepare the construction schedule for review by the Engineer prior to the first progress meeting and prior to submitting an application for payment.
- B. Schedule of Values – Prepare a schedule of values for review by the Engineer prior to submitting an application for payment.
- C. List of Subcontractors and Major Equipment Suppliers: Prepare a written list of significant subcontractors and equipment suppliers to include name and contact information, and brief description of work and/or equipment being provided.
- D. Application for Payment
- E. Product Data: Develop and submit information as a single submittal for each component of the Work. Product data shall include the following:
  - 1. Indicate which options are available and which ones are being furnished.
  - 2. Manufacturer's catalog cuts, product specifications, and color charts.
  - 3. Statement of compliance with specified referenced standards.
  - 4. Testing data.
  - 5. Delivery/availability/schedule information.
  - 6. Availability and delivery time information.
  - 7. Wiring diagrams.
  - 8. Performance curves.
  - 9. Other relevant information.
- F. Shop Drawings: Shop drawings shall be developed/drawn to scale and shall include the following:
  - 1. Name/Number/Identification.
  - 2. Drawings shall be in sufficient detail to determine size and configuration.
  - 3. Dimensions in plan and section/elevation, where applicable.
  - 4. Requirements for coordination.
  - 5. Signed and sealed, if required, by professional engineer.
- G. Samples: Submit samples that are representative of the type, color, pattern and texture to be furnished/installed. Samples shall include the following:
  - 1. Name/Number/Identification/Description
  - 2. Product name, manufacturer name, and source of sample.



3. Location to be installed (include reference to specification numbers and/or drawings).
  4. Samples for related components shall be submitted as a single package.
- H. Welding Certificates: Prepare and submit welding certificates to certify that welding personnel are qualified and that welding was performed in accordance with all applicable standards.
- I. Product/Material Certificates and Test Reports: Submit written reports on supplier/manufacturer letterhead to certify that products/materials and/or test reports comply with the Contract Documents and all other applicable codes/standards.  
Field Test Reports.

## PART 3 – EXECUTION

### 3.1 CONTRACTOR'S REVIEW

- A. The Contractor shall review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. The Contractor shall note corrections and field dimensions, and shall include an approval stamp before submitting to Engineer.
- B. The Contractor's approval stamp shall include the following:
1. Project name and location.
  2. Submittal number and specification title/number.
  3. Name of reviewer and date of Contractor approval.
  4. Statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

### 3.2 ENGINEER'S REVIEW

- A. Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. Engineer will either stamp each submittal with an action stamp and will mark stamp appropriately to indicate action or will provide an electronic stamp including comments pertaining to the submittal. Each submittal will be marked with one of the items below:
1. No Exceptions Taken: The Engineer has no comments to provide the Contractor. Contractor may proceed with current submittal acting as final submittal.
  2. Make Corrections: The Contractor shall include any corrections provided by the Engineer and shall proceed with current submittal acting as final submittal.

3. Amend & Resubmit: Contractor shall make all necessary revisions as indicated by the Engineer and shall submit the corrected submittal to the Engineer for approval.
  4. Rejected: Contractor shall resubmit based on the Engineer's comments.
- C. Engineer's review does not relieve the Contractor from meeting the requirements of the Contract.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

**END OF SECTION 01 33 00**

## **SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

#### **1.3 USE CHARGES**

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, and Engineer.
- B. Temporary Water Service from Existing System: Water from Owner's existing water system is available for temporary use without metering and without payment of use charges until the (Final) Contract Completion date. Provide connections, backflow prevention, and extensions of services as required for construction operations.
- C. Temporary Electric Power Service from Existing System: Electric power from Owner's existing system is available for temporary use without metering and without payment of use charges until the (Final) Contract Completion date. Provide connections and extensions of services as required for construction operations.

#### **1.4 QUALITY ASSURANCE**

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Retain subparagraph below for greenfield sites if reduced site disturbance is required for LEED-NC, LEED-CS, or LEED for Schools Credit SS 5.1.

### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
  - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
  - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- F. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

### 3.3 SUPPORT FACILITIES INSTALLATION

- A. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
  - 1. Comply with work restrictions specified in Section 01 10 00 "Summary."

### 3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
- C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  - 1. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

## **SECTION 01 73 00 – EXECUTION**

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Existing Conditions
  - 2. Preparation and Construction layout.
  - 3. Installation of the Work.
  - 4. Cutting and patching.
  - 5. Progress cleaning.
  - 6. Starting and adjusting.
  - 7. Protection of installed construction.
  - 8. Correction of the Work.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. General: All materials used for cutting and patching shall be identical to in place materials. When identical materials are not available, new materials shall match existing (visually/aesthetically) as closely as possible, and shall be as durable in nature and as functional as existing materials.

### PART 3 - EXECUTION

#### 3.1 EXISTING CONDITION

- A. The Contractor shall visit the site prior to bidding the Work and shall become familiar with the existing facilities, including sizes, locations, materials and other features of existing utilities/facilities. Prior to beginning work, the Contractor shall verify the location, sizes, and other features of existing utilities at connection points, crossing locations and/or other key locations. The existence and location of underground and other utilities and construction indicated as existing are not guaranteed, so the Contractor shall fully investigate the existence, size, location and features (e.g. materials) as required to accurately price the Work prior to bidding the Work, and as required to execute the Work prior to orderings/installation.
- B. Prior to bidding the Work, and prior to ordering materials and beginning Work, the Contractor shall examine all existing conditions (utilities, structures, finishes, etc.) and verify compatibility and suitability of materials, equipment and systems for all Work. Include all relevant information (including potential conflicts and/or issues such as

compatibility, sizing) in a submittal(s) for review by the Engineer. Proceed with ordering and installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION AND CONSTRUCTION LAYOUT

- A. The Contractor shall coordinate with the Owner and/or local utilities regarding the need to relocate existing utilities.
- B. The Contractor shall be solely responsible for taking field measurements required to complete the Work, and shall incorporate the field measurements into submittals for review by Engineer prior to ordering materials and equipment and prior to beginning Work
- C. The Contractor shall verify that no conflicts exist prior to ordering materials and equipment and prior to beginning Work. If conflicts and/or different field conditions are discovered, then the Contractor shall notify the Engineer immediately.
- D. Construction Layout: The Contractor shall engage a land surveyor to verify and/or establish benchmarks, to verify layout information shown on the Drawings, and to lay out the Work. The Contractor shall check the location and correctness of the Work as it progresses.

### 3.3 INSTALLATION

- A. The Contractor shall always confirm with manufacturer and shall follow manufacturer's written instructions and recommendations for installing products.
- B. Bracing and Supports: The Contractor shall furnish and install all necessary anchors, fasteners, braces and supports required to securely anchor/support the Work. If size, quantity and/or type of anchor/support/brace is not shown, verify with manufacturer(s).
- C. All components of the Work shall be installed plumb, straight, and level, and to maximize clearance(s) for access and/or maintenance. The Contractor shall also make provisions for thermal expansion and contraction.

### 3.4 CUTTING AND PATCHING

- A. The Contractor shall employ skilled and experienced workers and shall do the following with respect to cutting and patching:
  - 1. Patch the Work as quickly as possible after cutting.
  - 2. Restore surfaces/cuts to their original condition or better.
  - 3. Provide temporary bracing and supports.
  - 4. Protect adjacent areas and/or other new construction.
  - 5. Minimize interruption of existing utilities/facilities and coordinate with Owner prior to cutting/patching.
  - 6. Patch in a manner that minimizes evidence of the Work.
  - 7. Clean affected areas after cutting and patching is complete.

### 3.5 PROGRESS CLEANING

- A. The Contractor shall maintain a clean project site and shall clean daily.
- B. The Contractor shall not hold/accumulate waste(s) and shall dispose of waste in accordance with all applicable regulations/requirements. Waste materials shall not be buried or burned on site.
- C. The Contractor shall clean and protect installed Work.

### 3.6 STARTING AND ADJUSTING

- A. The Contractor shall coordinate startup and testing of equipment with the manufacturer, subcontractors, Engineer and the Owner.
- B. The Contractor shall obtain manufacturer concurrence/approval of installation prior to startup. Malfunctioning/defective materials and equipment shall be replaced with new materials and equipment at no cost to the Owner.

### 3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. The Contractor shall protect and maintain the Work in new condition (without damage or degradation) until Final Completion. This includes maintaining cleanliness and avoiding staining of concrete walls and slabs due to construction activities. The Contractor shall be solely responsible for maintaining and/or cleaning to achieve a new finish, even if it requires resurfacing/recoating and/or replacing the affected Work.

### 3.8 CORRECTION OF THE WORK

- A. The Contractor shall repair or remove and replace defective equipment, materials and/or construction at no cost to the Owner. All Work shall be restored and/or maintained in new condition until Final Completion.

END OF SECTION 01 73 00



## **SECTION 01 77 00 - CLOSEOUT PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. Final cleaning.

#### **1.3 SUBSTANTIAL COMPLETION**

- A. Substantial Completion will be issued for each time the Residuals Pond is cleaned.
- B. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete with request.
  - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  - 2. Obtain and submit releases permitting Owner unrestricted use of the Process Residuals Pond.
  - 3. Complete final cleaning requirements.
  - 4. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- C. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for final completion.
- D. Submit cross section surveys of the pond. Cross sections should be taken along the north-south axis of the pond and at no greater than 50 feet intervals.

#### 1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
  2. Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

#### 1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

1. Contractor shall review the work and provide a punch list of incomplete work items
2. Submit list of incomplete items in the following format:
  - a. PDF electronic file.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning

agents that are potentially hazardous to health or property or that might damage finished surfaces.

### PART 3 - EXECUTION

#### 3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

END OF SECTION 01 77 00

## **SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA**

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes requirements for Operation and Maintenance manuals.
- B. Additional information on Operation and Maintenance manual content may be included in the individual specification sections for equipment and systems.

#### 1.2 SUBMITTALS

- A. Submit three (3) initial hard copies and one digital (pdf) copy of Operation and Maintenance Manuals prior to training and prior to Substantial Completion.
- B. Engineer/Owner will review initial submittals and provide comments. Incorporate comments and resubmit three (3) Final hard copies and one final digital (pdf) copy.

### PART 2 - PRODUCTS

#### 2.1 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

- A. Operation and Maintenance manuals shall be organized into separate sections for each system, and each manual shall include the following:
  - 1. Title page with name and address of Project, name and address of Owner, Contractor, Engineer.
  - 2. Date of Submittal
  - 3. Table of contents.
  - 4. Manual contents.
- B. Hard copies shall be bound in heavy duty, three-ring binders (8-1/2x11 inch). Each binder shall be labeled on the cover and on the spine, and sections shall be tabbed.

#### 2.4 OPERATION AND MAINTENANCE MANUALS

- A. Generally, Operation Manual content shall include the following:
  - 1. Product name, model number, and description of systems and equipment.
  - 2. Serial numbers.
  - 3. Drawings and diagrams/identification of parts and components.
  - 4. Design and performance criteria and curves.
  - 5. Operating standards and procedures.
  - 6. Wiring and control diagrams and description of controls.
  - 7. Precautions against improper use.
  - 8. Maintenance, cleaning, and inspection requirements and procedures.
  - 9. Engineering data and tests.

10. Startup procedures.
11. Routine and normal operating procedures.
12. Normal shutdown instructions.
13. Warranties/Bonds.
14. Troubleshooting Guide(s).
15. Other pertinent data and/or instructions.

## PART 3 – EXECUTION

### 3.1 MANUAL PREPARATION

- A. Operation and Maintenance Manuals shall be prepared by the manufacturer(s).

**END OF SECTION 01 78 23**

## SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
  - 1. Footings.
  - 2. Foundation walls.
  - 3. Slabs-on-grade.
  - 4. Suspended slabs.
  - 5. Concrete toppings.
  - 6. Building frame members.
  - 7. Building walls.

#### 1.3 DEFINITIONS

- A. **Cementitious Materials:** Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

#### 1.4 SUBMITTALS

- A. **Certification from Contractor and Manufacturer/Suppliers:** During the bid period and again prior to submitting/ordering and installing materials, products and equipment, the Contractor and all manufacturers and suppliers shall thoroughly review the materials, products and equipment being supplied and shall familiarize themselves with the existing and proposed/new facilities, as well as connections to existing facilities/utilities. This shall include field verification of the location, nature, size/dimensions, current and intended future use, etc. Prior to ordering and installation, the Contractor shall coordinate with all manufacturers and suppliers to provide all needed information including field dimensions, photographs, information on related materials and equipment, etc.). The Contractor and all manufacturers and suppliers shall include written confirmation (with the submittal) of the following:
  - 1. The materials, products, and equipment being supplied are of the correct size,

materials and type.

2. The materials, products and equipment being supplied do not conflict with existing or proposed/new facilities.
3. The products/equipment being supplied are intended for use in this application.
4. All manufacturer(s) and supplier(s) shall provide (either with submittals or separately) written concurrence/acknowledgement of their review/coordination and concurrence with the items above.
5. Shop drawings and product data submitted for review by the Engineer shall bear the Contractor's certification that he has reviewed, checked, and approved the submittals, that they comply with the requirements of the project and with the provisions of the Contract Documents, and that he has verified all sizes, dimensions, locations, field measurements, construction criteria, materials, catalog numbers, and similar data. Field dimensions, sizes and other pertinent information shall be clearly shown on the shop drawings/submittals. The Contractor shall also certify that the work represented by the shop drawings is recommended by the Contractor and that the Contractor's warranty and guaranty will fully apply.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site. Amounts of "hold-back water" must be clearly identified on each truck delivery ticket and provided to the field representative and testing firm technician on site.

C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

D. Formwork: Submit the type of system(s) to be used. Design and engineering of formwork are the Contractor's responsibility.

E. Welding certificates: Copies of welding procedures and personnel certifications.

F. Material Certificates for cementitious materials, aggregates and waterstops; signed by manufacturers certifying compliance with requirements including applicable ASTM standards as specified.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."
- E. ACI Publications: Comply with ACI 301 (Specifications for Structural Concrete) and ACI 117 (Specifications for Tolerances for Concrete Construction and Materials), unless more stringent provisions are indicated.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Cement: Store in dry, weather-tight, well ventilated storage shed or storage bin.
- C. Aggregate: Store to protect against contamination from surface runoff, trash, debris, dirt, site materials, oils, grease, etc. Store coarse aggregate to prevent segregation, and store fine aggregate in bins or compartments.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. PVC Waterstops:
    - a. Greenstreak
    - b. Approved Equivalent
  - 2. Self Expanding Strip Waterstops:
    - a. Superstop; Progress Unlimited Inc.
    - b. Approved Equivalent
  - 3. Joint Filler Material:
    - a. Sika Chemical Corp.
    - b. Grace Construction Products Co.
    - c. W.R. Meadows, Inc.
    - d. Approved Equivalent



4. Cement Based Sealers:
  - a. Thoro Concrete Products (ChemRex)
  - b. Approved Equivalent
  
5. Grout
  - a. General Construction
    - 1) Bonsal/ProSpec F-77
    - 2) Approved equivalent
  - b. Machinery, Non-Shrink
    - 1) Sika 212
    - 2) Approved equivalent
  - c. Epoxy
    - 1) Fivestar HP
    - 2) Approved equivalent
  - d. Rock Anchor Bolt
    - 1) Euco Rock Anchor Bolt Grout
    - 2) Approved equivalent
  
6. Vapor Retarders
  - a. Stego Industries, LLC; Stego Wrap 10 mil.
  - b. Carlisle Coatings & Waterproofing, Inc.; Blackline 400 10 mil.
  - c. Grace Construction Products, W.R. Grace & Co.; Florprufe 120 10 mil.

## 2.2 VAPOR RETARDERS

- A. Vapor Retarder: ASTM E 1745, Class A.
- B. Include manufacturer's recommended adhesive or pressure sensitive tape for overlapping joints and penetrations.

## 2.3 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  1. Plywood, metal, or other approved panel materials.
  2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1.
- B. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt

irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation. Maintain true radii so that no irregularities or breakpoints around the circumferences of the circles will be visible.

- C. Chamfer Strips: Wood, Metal, PVC, or rubber strips,  $\frac{3}{4}$  by  $\frac{3}{4}$  inch, minimum.
- D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish units that will leave no corrodible metal closer than **1 inch** to the plane of exposed concrete surface.
  - 2. Furnish ties that, when removed, will not leave holes through the concrete surface.
  - 3. Furnish ties with integral water-barrier plates.

## 2.4 STEEL REINFORCEMENT

- A. Fabricating Reinforcement: Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

## 2.5 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
  - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
- B. Joint Dowel Bars: Plain round stick steel bars, ASTM 675, Grade 80. Bars used in expansion joints shall be as shown in drawing detail(s) with a minimum of  $\frac{3}{4}$ " diameter x 24" long fitted with end caps. Cut bars true length with ends square and free of burrs.

## 2.6 WATERSTOPS

- A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
  - 1. Profile: Flat, dumbbell with center bulb for expansion joints, 9" width and  $\frac{3}{4}$ " thickness, min. for use at expansion joints.
  - 2. Profile: Ribbed with center bulb for construction joints, 6" width and  $\frac{3}{4}$ " thickness, min. for use at construction joints.
- B. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material for adhesive bonding to concrete.

## 2.7 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash: 25 percent.
  - 2. Combined Fly Ash and Pozzolan: 25 percent.
  - 3. Ground Granulated Blast-Furnace Slag: 50 percent.
  - 4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
  - 5. Silica Fume: 10 percent.
  - 6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
  - 7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 5 to 7 percent, unless otherwise indicated.
- E. Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
  - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
  4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
- F. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

## 2.8 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type II
1. Fly Ash: ASTM C 618, Class F.
- B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, intended for moderate weathering region, but not less than Class 3M, and as follows:
1. Fine Aggregate: Clean, hard, durable, uncoated particles of natural silica or acceptable alluvial sand with the following gradation requirements:
 

a. Passing 3/8" Standard Sieve	100 %
b. Passing #4 Standard Sieve	95 - 100 %
c. Passing #8 Standard Sieve	80 - 100 %
d. Passing #16 Standard Sieve	50 - 85 %
e. Passing #30 Standard Sieve	25 - 60 %
f. Passing #50 Standard Sieve	10 - 30 %
g. Passing #100 Standard Sieve	2 - 10 %
  2. Coarse Aggregate with the following gradation requirements:
 

a. Passing 1 1/2" Standard Square Sieve	100 %
b. Passing 1" Standard Square Sieve	95 - 100 %
c. Passing 1/2" Standard Square Sieve	25 - 60 %
d. Passing #4 Standard Square Sieve	0 - 10 %
e. Passing #8 Standard Square Sieve	0 - 5 %

Water: Potable and complying with ASTM C 94.

## 2.9 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260.
- C. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

- D. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- E. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

## 2.10 FLOOR AND SLAB TREATMENTS

- A. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, non-glazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- B. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.
- C. Pigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground, nonfading mineral oxides interground with cement.
  - 1. Colors: Match Engineer's samples.
  - 2. Colors: As indicated by referencing manufacturer's designations.
  - 3. Colors: As selected by Engineer from manufacturer's full range for these characteristics.
- D. Penetrating Liquid Floor Treatment: Chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

## 2.11 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Membrane Curing Compounds: Conform to ASTM C 309 and shall have a minimum of 18% solids, be non-yellowing, and have a unit moisture loss of less than 0.039 gm/cm<sup>2</sup> at 72 hours. Rate of application of curing compounds should follow manufacturer's recommendations or be in the range of 150 to 200 ft<sup>2</sup>/gal.
  - 1. Curing compounds for use in water treatment facilities shall be nontoxic, free of taste and odor, and NSF approved.

2. Curing compounds must be suitable for specific applications such as underneath floor treatments, etc.

## 2.12 RELATED MATERIALS

- A. Joint Filler Material: Isolation/Expansion Joints
  1. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber for non-water bearing applications.
  2. Joint-Filler Strips: ASTM D 1752, Type 1, elastic sponge rubber for water bearing applications
  3. Backer Rod: Premium grade polyethylene foam or Rescor type filler material.
  4. Joint Primer: Recommended by manufacturer of the joint sealant, similar and equivalent to Sikaflex Primer 429.
  5. Joint Sealer: Provide non-sag elastomeric, moisture cured sealant (one component, polyurethane base)
- B. Bonding Agents: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements.
- D. Reglets: Fabricate reglets of not less than 0.0217-inch-thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- E. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- F. Cement Based Sealers: Portland cement based coatings to fill and seal concrete pores and voids; to correct surface irregularities; capable of being overcoated with decorative finish
- G. Water Based High Build Acrylic Coatings: Refer to Division 9 Section "High Performance Coatings"

## 2.13 CONCRETE MIXES

- A. Reinforced Structural Concrete: Proportion concrete mix as follows:
  1. Compressive Strength (28 Days): 4000 psi.
  2. Slump: 3 to 5 inches
  3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture is 8 inches after admixture is added to concrete that had an initial slump of 3 to 5 inches.
  4. Air Content – 5 to 7 percent.

- B. Maximum W/C (water-to-cementitious materials) ratio = 0.45
- C. Unreinforced Concrete: Proportion concrete mix as follows:
  - 1. Compressive Strength (28 Days): 3,000 psi.
  - 2. Maximum Slump: 3 to 5 inches
- D. Reinforced Masonry Walls:
  - 1. Compressive Strength (28 Days): 3,000 psi.
  - 2. Maximum Slump: 8 inches.
  - 3. Coarse Aggregate: Pea Gravel no greater than ½ inch.
- E. Grout
  - 1. Grout to be used for various purposes and in various locations on the project shall be as specified below.
    - a. Place grout with a cement/sand ratio of 1:2 in forms for starting pours or lifts of concrete.
    - b. General Construction grout shall be non-shrink, expanding type, and shall have the following characteristics: non-ferrous; non-staining; non-bleeding; high density; and not containing gas-generating agents. The compressive strength at 28 days of grout mix of 50 pounds with 5-3/4 quarts of water shall not be less than 4500 psi (per ASTM C109). The mix shall retain high compressive strength when containing coarse aggregate crushed stone in size range ¼" – 3/8". General construction grout shall be used for closing in box-outs, filling holes in concrete, patching walls, etc.
    - c. Machinery grout shall be non-shrink type, and shall have the following characteristics: high flow at low water content; non-staining; non-bleeding; non-metallic; high density; and not containing gas-generating agents. The compressive strength at 28 days of grout mix of 50 pounds with 3-3/4 quarts of water shall not be less than 7500 psi (per ASTM C109). The grout mix shall meet the requirements of Corps of Engineers Specification CRD C-621 and ASTM C-1107. Machinery grout shall be used for structural bearing plates, anchor bolts, machinery and equipment.
    - d. Epoxy grout shall be a non-shrink, 100% solids grout containing thermosetting epoxy resins, expansive additives and inert fillers. Compressive strength at 7 days shall be 16,000 psi. Tensile strength and flexural strength shall be 2000 psi and 4400 psi, respectively. Epoxy grout shall be used where indicated.
    - e. Rock anchor bolt grout shall be non-shrink, pumpable, portland cement-based with high early strength and low permeability. Compressive strength at 24 hours shall be 4000 psi, unless specifically noted otherwise.
  - 2. All prepared grout mixes shall be used in strict accordance with the manufacturer's recommendations. Compressive strength testing of grout cubes may be required if requested by the Engineer.

## PART 3 - EXECUTION

### 3.1 VAPOR RETARDERS

- A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.
  - 1. Lap joints 6 inches and seal with manufacturer's recommended tape or sealant.
  - 2. Tape or seal all penetrations through slab according to manufacturer's standard requirements.

### 3.2 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual to  $\frac{1}{4}$ ".
- D. Construct forms tight enough to prevent loss of concrete mortar or water.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
  - 1. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.



- J. Block or bulkhead openings for pipe to prevent entrance of water.
- K. Form openings for gates even and true both horizontally and vertically so that gates can be installed watertight.
- L. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- M. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- N. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### 3.3 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 1. Install anchor bolts, accurately located, to elevation required.
  - 2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashing in outer face of concrete frame at exterior walls, where flashing is shown at linets, shelf angles, and other conditions.
  - 3. Install dovetail anchor slots in concrete structures as indicated.

### 3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Do not heat, straighten, bend or re-bend reinforcing steel in a manner that will injure the material.
- C. Roll bars to radius per CRSI recommendations. Roll bars if located in critical areas with tight placing tolerances where straight bars sprung in place to fit would not be satisfactory.
- D. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
- E. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
  - 1. Shop- or field-weld reinforcement according to AWS D1.4, only where indicated on plans.
  - 2. Minimum cover requirements for reinforcing steel:

- a. Conc. cast against/permanently exposed to earth: 3 inches
  - b. Conc. exposed to earth/water: 2 inches
  - c. Conc. slabs and walls not exposed to earth/water: 1 inch
  - d. Conc. beams/columns not exposed to earth/water: 1.5 inches
- F. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
  - G. Clips, wire ties, spacers, or any material installed to support the reinforcing steel shall not be in contact with the forms in any location.
  - H. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
  - I. Contractor must submit plans for alternate splices for review.
  - J. Length of lap shall be made in accordance with ACI 318, latest revision.

### 3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  - 2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
  - 3. Avoid locating joints in beams, girders, and joists. If required, locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  - 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  - 6. Use a bonding agent at locations where fresh concrete is placed against existing concrete surfaces.
- C. Control Joints in Slabs-on-Grade: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness. Form control joints (saw joints) with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
  - 2. Terminate full-width joint-filler strips not less than ½ inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated. Cap joint-filler strips with removable plastic caps equal to W.R. Meadows Removable Cap Strips. Remove caps before installing traffic sealant in joints.
  - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Dowel Joints: Install dowel sleeves and dowels or slick steel dowel bar and support assemblies at joints where indicated. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

### 3.6 WATERSTOPS

- A. Install all waterstops within 8 months after date of manufacture.
- B. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.
- C. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

### 3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that previously placed concrete has attained sufficient strength to bear the weight of new concrete; and that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. All debris, mud and water shall be entirely removed from the forms.
- C. Water may be added at the jobsite provided the following conditions are met:
  - 1. The approval of the Engineer is obtained.
  - 2. The maximum slump and water-cementitious ratio is not exceeded after the addition of the water.
  - 3. High-range water-reducing admixtures, if used, are added at the plant and not at the jobsite.

4. The truck can accurately measure the water added and the amount of "hold-back" water as indicated on the truck delivery ticket is not exceeded.

Add water prior to any concrete being discharged (except that used for slump testing). Turn mixing drum an additional 30 revolutions, minimum. No water may be added to the batch at any later time. Air content and slump shall be checked after the water is added.

- D. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.
- E. Deposit concrete in forms in continuous horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints. No more than 30 minutes shall elapse between placement of successive layers.
  1. Lifts above horizontal construction joints shall be started with the placement of cement/sand grout having the same water-cement ratio as the concrete and a slump of not more than 6". The grout bed shall be approximately 2" thick, and placement of concrete shall be started as soon as the mortar bed has been spread.
  2. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
- F. **Placement of concrete in lifts greater than 10 vertical feet shall require prior written approval of the Engineer, unless otherwise shown on the plans.**
- G. When placing concrete in walls, the concrete shall be deposited in tremies or by other approved methods to prevent segregation and to minimize splatter.
- H. When conveying by chutes, the equipment shall be of such size and design as to insure a continuous flow in the chute. The slope shall not be less than 2:1 and shall be such that will prevent segregation of materials. The discharge end of the chute shall not be more than five feet above the surface of the concrete.
- I. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  2. Maintain reinforcement in position on chairs during concrete placement.
  3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  4. Slope surfaces uniformly to drains where required such that no standing water is allowed on the surface.
  5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

- J. Concrete in drilled piers shall be placed continuously and in a smooth flow by methods which prevent segregation of ingredients. Temporary casing shall be withdrawn as the concrete is being placed in order to maintain sufficient head of concrete within the casing. The top 5 feet of concrete shall be vibrated after the temporary casing has been withdrawn and dowels/anchor bolts are set.
1. If concrete placement is interrupted, the surface shall be left rough and keyed.
  2. If concrete placement is interrupted, the surface shall be doweled as directed by the Engineer.
- K. Concrete poured in footing extensions shall be reinforced and shall extend to greater depth than indicated in order to bear on firm ground. Locations around existing footings that have been excavated shall be backfilled with lean concrete.
- L. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
  2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
  4. Obtain concurrence of protection measures from the Engineer.
- M. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
  3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.
- N. If completion of the pour is prevented, fit the placed concrete with a keyway.
- O. If completion of the pour is prevented for walls or water containing structures, fit the placed concrete with a keyway and waterstop.
- P. Prior to resuming concrete placement on the area of the uncompleted pour, the area shall be "green-cut" and coated with a bonding agent as specified.
- Q. In the case where concrete pours in beams and columns are terminated prior to completion, the pours shall not be restarted until all concrete placed in the incomplete

pour has been removed and until all the reinforcement affected has been cleaned and adjusted to the correct location.

### 3.8 REMOVING AND REUSING FORMS

- A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 36 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
- B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until the concrete has achieved at least 70 percent of 28-day design compressive strength.
  - 1. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.
  - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
  - 3. Concrete has attained sufficient strength to withstand any live loads that may be imposed by succeeding steps in the construction process.
- C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by the Engineer.

### 3.9 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than ½ inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen

with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar/grout before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Form tie holes and form bolt holes shall be immediately plugged. Where form ties or form bolts are left in the concrete, such accessories shall be equipped with integral waterstops, and the ends of such accessories shall be equipped with integral waterstops, and the ends of such accessories shall not be closer than one inch (1") to the surface of the concrete. The holes left in each face shall then be primed with a tack coat of grout mixed with an approved accelerator, a stiff mix of mortar with approved accelerator tamped in the holes, and the surfaces finished flush with the concrete surfaces.
3. In cases where a form bolt of approved through-type is used, the hole left by withdrawal of the form bolt shall be sealed by driving a PVC plug (furnished by the manufacturer of the form bolt) to the mid-point of the length of the hole, by coating the interior surfaces of the hole on each side of the plug with a tack coat of grout mixed with an approved accelerator, by tamping in the hole, on each side of the plug, a stiff mix of mortar with acceptable bonding agent, and by finishing the surfaces of the mortar mix flush with the concrete surfaces.
4. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
5. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of  $\frac{1}{4}$  inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least  $\frac{3}{4}$  inch clearance all around. Dampen concrete surfaces in contact with patching

concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours

E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

### 3.10 CONCRETE FINISHING

#### A. Formed Finishes

1. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height.

- a. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
- b. Do not apply rubbed finish to smooth-formed finish.

2. Rubbed Finish:

- a. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- b. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

3. Applied Finishes:

- a. Cement Based Sealer Finish: Prepare and clean cured concrete surfaces, apply base coat, let set 24 hours, then apply finish coat. When finish coat



has set, sponge float to provide uniform texture. Coordinate color selection with Engineer.

- b. Other Coatings: See Division 9 Section "High Performance Coatings"
- c. Maintain all expansion and control joints.

## B. Unformed Finishes (Floors and Slabs)

### 1. General:

- a. Comply with recommendations in ACI 302.1R for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- b. Finish concrete surfaces to designed elevations.
- c. Finish concrete surfaces to level below the final finish elevations as correct or suitable for the particular final finish.
- d. No water shall stand on the finished floors or slabs.
- e. Floors shall be sloped to floor drains and/or sumps such that no standing water shall remain.
- f. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

- 2. Broom Finish: Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.
- 3. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes and apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes.
- 4. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- 5. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings. Apply a trowel finish to surfaces indicated and to floor and slab surfaces, including steps and stairs, exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.
- 6. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after

second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

7. Hardened/Colored Floors:

- a. Apply only after concrete has cured a minimum of 28 days.
- b. Roughly strike off floors at a level 1-1/2" below finished grade.
- c. Slump of base mix shall not exceed 1-1/2".
- d. All laitance shall be brushed off leaving only coarse aggregate, and a bonding agent shall be used.
- e. Place final topping consisting of a 3,500 psi mix, with 1/8" to 3/8" aggregate, to complete monolithic slab.
- f. Prepare and apply hardener/colorer during the finishing operation according to manufacturer's recommendations.

8. Special Finishes:

- a. Rough screed floors equipped with sludge collecting mechanisms or sludge scraping mechanisms to an elevation approximately 2 inches below the finished floor elevation. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
- b. Final topping shall be swept in by the mechanism. Topping shall have a cement/sand mix in proportion 1:3, with a slump not to exceed 6 inches.

9. Penetrating Liquid Floor Treatment:

- a. Prepare, apply, and finish according to manufacturer's written instructions.
- b. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
- c. Do not apply to concrete that is less than seven days old.
- d. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

10. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

C. Schedule of Concrete Finishes

1. Sidewalks, curbs, gutters, ramps, and platforms shall receive a broom finish unless otherwise shown or specified.
2. Interior and exterior concrete stair treads shall have a non-slip finish.
3. All interior floors shall be given a monolithic cement top, steel trowel finish unless otherwise shown or specified.
4. Interior and exterior concrete walls shall have a rubbed finish

3.11 CONCRETE PROTECTION AND CURING

A. General:

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
2. Keep concrete poured in walls wet until forms have been removed. Upon removal of the forms, cure the concrete using one or a combination of the specified methods.
3. Concrete finished prior to completion of the project shall be protected from damage by covering with boards and sisal kraft building paper.
4. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
5. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the specified period using one or a combination of the specified methods.
6. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the specified methods.

#### B. Curing Methods

1. Moisture Curing: Keep surfaces continuously moist for not less than twenty-one days with the following materials:
  - a. Water.
  - b. Continuous water-fog spray.
  - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than twenty-one days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
  - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
  - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
  - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.
3. Curing Compound: Apply curing compound meeting ASTM Designation C-309 uniformly in continuous operation by power spray or roller according to manufacturer's written instructions or at a uniform rate of approximately 150 to

200 sq. ft. per gallon in accordance with ACI 308. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

### 3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

### 3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

### 3.14 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage an independent testing and inspecting agency to sample materials, transport cylinders, perform tests, and submit test reports during concrete placement. The Owner will pay all costs associated with initial tests; including compressive strength testing (4 cylinders per sample as described below), slump, air, temperature and unit weight.

- B. Contractor shall pay all costs for re-testing, non-destructive testing, and other additional tests required due to questionable or unsatisfactory concrete.
- C. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
  - 1. Sampling Frequency:
    - a. When several intermittent pours are made in separate locations during a single day, one (1) sample shall be taken for each eight (8) cubic yards of concrete placed.
    - b. When a continuous pour of concrete is made in a single location during a single day, two (2) samples shall be taken for the first twenty-five (25) cubic yards of concrete placed, and one (1) sample shall be taken for each succeeding fifty (50) cubic yards placed, or fraction thereof.
    - c. There shall be no concrete poured at any location on the project site(s) that is not represented by a sample (cylinder specimens).
  - 2. Compressive Strength Testing:
    - a. Cast and laboratory cure (ASTM C 31/C 31M) one set of four standard cylinder specimens for each composite sample.
    - b. Test (ASTM C 39) one (1) laboratory-cured specimen at 7 days and one (1) at 28 days. A third cylinder will be broken at 56 days only if needed, and the fourth cylinder will be considered a spare.
    - c. The strength of each concrete mix will be considered satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified 28 day compressive strength and no 28 day compressive-strength test value falls below 85 percent of the specified compressive strength.
    - d. When the 28 day compressive strength of a single cylinder falls below 85 percent of the specified strength, a third cylinder shall be broken at 56 days.
    - e. When the average 28 day compressive cylinder strength of three (3) consecutive cylinders is less than 85 percent of specified strength, the Contractor shall evaluate operations, provide corrective procedures for protecting, and curing in-place concrete, and additional testing may be required at no cost to the Owner.
    - f. Test results will be reported in writing to Engineer and Contractor within 48 hours of testing. Reports of compressive-strength tests will contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for 7 day, 28-day and 56 day (if required) tests.
    - g. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted or required by Engineer (at no cost to Owner) but will not be used as sole basis for approval or rejection of concrete.

- h. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Engineer at no cost to the Owner.
- 3. Slump Testing: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
- 4. Air Content Testing: ASTM C 231, pressure method, for reinforced concrete; ASTM C 173, volumetric method, for unreinforced concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
- 5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

D. Testing Concrete Watertightness:

- 1. The basins, tanks, or any structure to contain liquid shall be so constructed that when completed and tested, there shall be no appreciable loss of water and no wet spots, damp spots or visible moisture shall show. **Testing shall not begin until all visible leaks, damp spots, wet spots..etc have been eliminated. Testing shall be successfully completed prior to backfilling or covering walls, elevated slabs..etc., such that all surfaces of the structure may be visually inspected.**
- 2. Furnish and install all necessary bulkheads over pipe or gate openings and all necessary pipe plugs to permit proper testing of the structures as soon as possible after completion of the concrete work.
- 3. Fill water containing structure(s) (basins, tanks...etc.) with water to the overflow line or to the maximum operating level if no overflow exists. Testing for watertightness (including discharge of water after completion of the test) shall comply with all pertinent regulations. The duration of each test (and all retests) shall be a minimum of 72 hours. There are two general requirements for each test:
  - a. The first requirement is that no leakage, damp spots, wet spots or visible moisture will be accepted. The second requirement is that the water level must be monitored during the test and the loss of water in the structure cannot exceed one tenth of one percent (0.1%) of the volume of water in the structure in a 24 hour period, excluding evaporation.
  - b. If either of these requirements is not met at any time during the test, then the defective structure(s) must be emptied and the leakage must be corrected in a manner acceptable to the Engineers at the Contractor's expense. All repairs must be made by qualified individuals experienced in concrete repair and repair methods must be submitted in writing to the Engineer for review prior to beginning the work.
  - c. Once the problem(s) have been addressed, the testing must be performed again and both requirements must be met.

- d. Substantial leakage requiring extensive repair work, such as multiple damp or wet spots in a single area or wall section, shall be cause for removal and replacement of the structure at the discretion of the Engineer, and at no cost to the Owner.
4. Leakage testing and re-testing shall be included in cost of concrete for payment purposes and full payment will not be made until the concrete has passed leakage tests. This also includes furnishing and installing (temporary or permanent) piping, valves, equipment and other appurtenances required to fill the structures for testing. The Owner will not charge the Contractor for the water required for initial testing. However, the Contractor may, at the Owner's discretion, be charged for the use of water during any retesting.
5. Any/all water discharged from testing shall be dechlorinated and shall otherwise meet all pertinent regulatory requirements.

**END OF SECTION 03 30 00**

## **SECTION 05 53 00 – GRATINGS**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Extruded-aluminum plank gratings.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide gratings capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections:
  - 1. Floors: Capable of withstanding a uniform load of 125 lbf/sq. ft. or a concentrated load of 2000 lbf, whichever produces the greater stress.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Extruded-aluminum plank gratings.
  - 2. Clips and anchorage devices for gratings.
  - 3. Paint products.
- B. Shop Drawings: Show fabrication and installation details for gratings. Include plans, elevations, sections, and details of connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.
  - 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- D. Welding Certificates: Copies of certificates for welding procedures and personnel.
- E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Engineer and owners, and other information specified.



## 1.5 QUALITY ASSURANCE

- A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of gratings that are similar to those indicated for this Project in material, design, and extent.
- B. Fabricator Qualifications: A firm experienced in producing gratings similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Metal Bar Grating Standards:
  - 1. Non-Heavy-Duty Metal Bar Gratings: Comply with NAAMM MBG 531, "Metal Bar Grating Manual for Steel, Stainless Steel, and Aluminum Gratings and Stair Treads."
- D. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.2, "Structural Welding Code--Aluminum."
  - 2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

## 1.6 PROJECT CONDITIONS

- A. Field Measurements: Where gratings are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating gratings without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

## 1.7 COORDINATION

- A. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Extruded-Aluminum Plank Gratings:

- a. Thompson Fabricating Company
- b. IKG Borden.
- c. Klemp Corp.
- d. Ohio Gratings, Inc.
- e. Seidelhuber Metal Products, Inc.

## 2.2 ALUMINUM

- A. Extruded Bars and Shapes: ASTM B 221, alloys as follows:
  - 1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
  - 2. 6061-T1, for grating crossbars.
- B. Aluminum Rivets: ASTM B 316/B 316M, alloy 6053-T4 or 6061-T6.
- C. Aluminum Sheet: ASTM B 209, alloy 5052-H32.

## 2.3 PAINT

- A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."
- B. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- D. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

## 2.4 FASTENERS

- A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Fasteners for Aluminum Gratings: Provide fasteners of aluminum, nonmagnetic stainless steel, zinc-plated steel, or other material warranted by the manufacturer to be compatible with aluminum gratings and other components.
- C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- D. Plain Washers: Round, carbon steel, ASME B18.22.1.
- E. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.
- F. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in

concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

## 2.5 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- C. Shear and punch metals cleanly and accurately. Remove burrs.
- D. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated.
- E. Fit exposed connections accurately together to form hairline joints.
- F. Welding: Comply with AWS recommendations and the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
- G. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
  1. Fabricate toeplates to fit grating units and weld to units in shop, unless otherwise indicated.
  2. Fabricate toeplates for attaching in the field.
  3. Toeplate Height: 4 inches, unless otherwise indicated.

## 2.6 FLOOR GRATINGS

- A. Floor gratings shall be furnished and installed as indicated and shall conform to one of the following requirements:
  1. Set in angle frames embedded and anchored in monolithic concrete.
  2. Set in angle frames forming metal platforms or walkways.
- B. All walkways shall be held firmly in place by removable metal clips.

1. Clips shall not project above surface of grating or walkway.
- C. Frames and accessories shall be of same material and finish as grating.
- D. Where openings are cut in floor gratings to permit passage of valve stems or for other purposes, such openings shall be framed with 1/8" bar stock of same depth as grating.
- E. Floor grating shall conform to the following requirements:
1. Fabricated from straight extruded aluminum I-bars (Alloy 6063-T6) laced together by interlocking cross-bridges or spacers, securely fastened to the bearing bars.
  2. Ends of spans shall be closed with flat bars to form box panels.
  3. Tread surfaces shall be non-skid type, with longitudinal grooves performed by the extrusion process.
  4. Cutouts shall be made in tread surfaces between bearing bars to form alternate rectangular pattern.
  5. Grating shall be designed to safely support uniform load of not less than 250 psf; but in no case shall depth of grating be less than 1½".
- F. Aluminum Finish: As follows:
1. Mill.
  2. Subparagraph above is standard finish.
  3. Class I, clear, anodized finish.
  4. Delete paragraph and subparagraphs below if no grating sections are removable.
  5. Provide not less than four weld lugs for each heavy-duty grating section, with each lug shop welded to two bearing bars.
  6. Provide not less than four saddle clips for each grating section composed of rectangular bearing bars 3/16 inch (4.8 mm) or less in thickness and spaced 15/16 inch (24 mm) or more o.c., with each clip designed and fabricated to fit over two bearing bars.
  7. Provide not less than four weld lugs for each grating section composed of rectangular bearing bars 3/16 inch (4.8 mm) or less in thickness and spaced less than 15/16 inch (24 mm) o.c., with each lug shop welded to three or more bearing bars. Interrupt intermediate bearing bars as necessary for fasteners securing grating to supports.
  8. Provide not less than four flange blocks for each section of aluminum I-bar grating, with block designed to fit over lower flange of I-shaped bearing bars.
  9. Furnish threaded bolts with nuts and washers for securing grating to supports.
  10. Furnish self-drilling fasteners with washers for securing grating to supports.
  11. Furnish galvanized malleable-iron flange clamp with galvanized bolt for securing grating to supports. Furnish as a system designed to be installed from above grating by one person.
    - a. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to, "Grate-Fast" by Struct-Fast Inc.
    - b. Product: Subject to compliance with requirements, provide "Grate-Fast" by Struct-Fast Inc.

- G. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
  - 1. Edge-band openings in grating that interrupt four or more bearing bars with bars of the same size and material as bearing bars.
- H. Do not notch bearing bars at supports to maintain elevation.

## 2.7 EXTRUDED-ALUMINUM PLANK GRATINGS

- A. Provide extruded-aluminum plank gratings in type, size, and finish indicated or, if not indicated, as recommended by manufacturer for indicated applications and as needed to support indicated loads.
  - 1. Type: Extruded-aluminum planks approximately 6 inches wide with multiple flanges approximately 1.2 inches o.c., acting as bearing bars connected by a web that serves as a walking surface. Top surface has raised ribs to increase slip resistance.
  - 2. Depth: 1 inch.
  - 3. Depth: 1-1/2 inches.
  - 4. Depth: 2 inches.
  - 5. Depth: As needed to support indicated loads.
  - 6. Perforations: None.
  - 7. Perforations: Rectangular, 19/32 by 3 inches, with adjacent rows staggered.
  - 8. Perforations: 19/32 inch square, with adjacent rows aligned.
  - 9. Finish: Mill, as fabricated.

## 2.8 GRATING FRAMES AND SUPPORTS

- A. Steel Frames and Supports: Fabricate from structural-steel shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
- B. Aluminum Frames: Fabricate frames for aluminum gratings from extruded-aluminum shapes to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections. Cut, drill, and tap units to receive hardware and similar items.
- C. Equip units with integrally welded anchors for casting into concrete or building into masonry.
  - 1. Unless otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.
- D. Galvanize frames and supports in the following locations:
  - 1. Exterior.
  - 2. Interior, where indicated.

## 2.9 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish gratings, frames, and supports after assembly.
- C. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with ASTM A 123.
- D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed items:
  - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- E. Apply shop primer to uncoated surfaces of gratings, frames, and supports, except those with galvanized finishes and those to be embedded in concrete or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free from rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Attach toeplates to gratings by welding at locations indicated.
- F. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
- G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact

with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

### 3.2 INSTALLING METAL PLANK GRATINGS

- A. General: Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard anchor clips and hold-down devices for bolted connections.
- B. Attach removable units to supporting members by bolting at every point of contact.
- C. Attach non-removable units to supporting members by welding, unless otherwise indicated. Comply with manufacturer's written instructions for size and spacing of welds.
- D. Attach aluminum units to steel supporting members by bolting at side channels at every point of contact and by bolting intermediate planks at each end on alternate sides. Bolt adjacent planks together at midspan.

### 3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 53 00

## **SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 DEFINITIONS

- A. Standard coating terms defined in ASTM D 16 apply to this Section.
- B. SSPC - The Society for Protective Coatings.
- C. NACE - National Association of Corrosion Engineers.

#### 1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Specification Sections.
- B. Product Data: For each paint system indicated. Include block fillers and primers.
  - 1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
  - 2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with the following information:
  - 1. Name or title of material.
  - 2. Product description (generic classification or binder type).
  - 3. Manufacturer's stock number and date of manufacture.
  - 4. Contents by volume, for pigment and vehicle constituents.
  - 5. Thinning instructions.
  - 6. Application instructions.
  - 7. Color name and number.
  - 8. Handling instructions and precautions.
  - 9. VOC Content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a



clean condition, free of foreign materials and residue.

1. Protect materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.

## 1.5 PROJECT CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 45 and 95 deg F and is expected to remain between 45 and 95 deg F for at least two hours after application (or according to the manufacturer's recommendation).
- B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
  1. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating operation.
  2. Work may continue during inclement weather only if areas and surfaces to be coated are enclosed and temperature within the area can be maintained within limits specified by manufacturer during application and drying periods.
  3. All surface preparation and painting work is performed under the protective guidelines and requirements of OSHA "Safety and Health Regulations for Construction", latest revision, as set forth in the Federal Register, and that all such protection is the responsibility of the Contractor and shall be provided at the Contractor's expense.
- C. Environmental Requirements:
  1. Proceed with containment lining Work only when temperature and moisture conditions of substrates, air temperature, relative humidity, dew point and other conditions comply with the containment lining manufacturer's written recommendations and when no damaging environmental conditions are forecasted for the time when the material will be vulnerable to such environmental damage. Record all such conditions and include in final Site Quality Control Report.
  2. Novolac vinyl ester materials should not be applied in direct sunlight exposure. Appropriate tenting or covering of the work area should be in place in accordance with manufacturer's recommendations.
  3. Do not begin Work when relative humidity is expected to rise above 90 percent during the time of installation and catalyzation, nor when substrate temperature are not at least five degrees above the dew point temperature and rising.
  4. Utilities, including electric, water, heat (air temperature between 65 degrees F and 90 degrees F), and finished lighting to be supplied by the general contractor.
  5. Job area to be free of other trades during, and for a period of 24 hours, after lining installation.
  6. Do not begin containment lining Work until manufacturer's recommended environmental conditions can be maintained and only when manufacturer and installer are willing to guarantee the Work as required and without additional reservations and restrictions.

7. Protection of finished walls and floor from damage by subsequent trade shall be the responsibility of the general contractor.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated in the coating system descriptions.
- B. Manufacturers' Names: The following manufacturers are referred to in the coating system descriptions by shortened versions of their names shown in parenthesis:
  1. Induron Coatings, Inc. (Induron).
  2. Tnemec Company, Inc. (Tnemec).

### 2.2 COATINGS MATERIALS, GENERAL

- A. Material Compatibility: Provide primers, undercoats, and finish-coat materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's highest grade of the various high-performance coatings specified. Materials not displaying manufacturer's product identification are not acceptable.
  1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that have a VOC classification of 450 g/L or less.
- D. No claim of the Contractor concerning the unsuitability of the material specified or his inability to produce first class work with the same, will be entertained, unless such claim is made in writing to the Engineers before the Contract is signed.

### 2.3 COLORS

- A. Colors: As selected by Owner from manufacturer's full range.

### 2.4 HIGH-PERFORMANCE COATINGS

- A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in "MPI Approved Products List."
- B. Material Compatibility:

1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
  3. Provide products of same manufacturer for each coat in a coating system.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction [and, for interior coatings applied at project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24)].
1. Flat Paints and Coatings: 50 g/L.
  2. Nonflat Paints and Coatings: 150 g/L.
  3. Primers, Sealers, and Undercoaters: 200 g/L.
  4. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: 250 g/L.
  5. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
  6. Pre-Treatment Wash Primers: 420 g/L.
  7. Floor Coatings: 100 g/L.
  8. Shellacs, Clear: 730 g/L.
  9. Shellacs, Pigmented: 550 g/L.
- D. General: Outline of coating work follows (with number of coats shown in parenthesis):

## 2.5 HIGH PERFORMANCE COATING SYSTEMS.

### A. Chemical Storage Containment

1. Concrete Surface for Fluoride Resistant Coating system (includes interior of existing containment structure (Floor, Walls, and Concrete Pads) and top of walls.

Coating Type	Manufacturer and Coating	Number of Coats	Total DFT, mils
Cant Cove & Primer	Induron: See Containment Liner	1	n/a
	Tnemec Series 1402 ProPolymer	1	2-6 mils
Containment Liner	Induron Perma Clean 100-100% solids ceramic epoxy (two 30-40 mil coats)	1	60-80 mils
	Tnemec Series 1416-900 Vinester	1	90-110 mils
	Tnemec Series 211-9111 Bulking Powder		
	Tnemec Series 211-215 Fiberglass Mat		
Finish	Induron: See Containment Liner	1	n/a
	Tnemec Series 1448 Vinester (silica free – graphite filled)	1	15-20 mils

- B. Guard chains, supports and brackets not immersed in liquid and other miscellaneous ironwork items specified to be galvanized shall not be painted.
- C. Certain items such as control center sections, control cubicles and panel boards are specified to be furnished with baked-on enamel or other factory finish, and shall not be painted. Should finish of these items, however, be scarred or otherwise damaged, the items shall be touched up if possible or completely refinished, as required by the Engineer.
- D. Brass, bronze, copper and aluminum or equipment components fabricated from these materials shall not be painted.
- E. Where surfaces are specified to be coated with coal tar epoxy, total dry film thickness of coating shall not be less than 16 mils.

2.6 MASONRY - (CMU – Exterior of Fluoride Containment Area)

- A. Basis of Design: Benjamin Moore
- B. Latex Systems:
  - 1. Low Sheen:
    - a. 1st Coat: Corotech Acrylic Block Filler V114 (43 g/L)
    - b. 2nd Coat: Benjamin Moore Ultra Spec HP D.T.M. Acrylic Low Lustre Enamel HP25 (45 g/L), MPI # 141, X-Green 141, 153, X-Green 153
    - c. 3rd Coat: Benjamin Moore Ultra Spec HP D.T.M. Acrylic Low Lustre Enamel HP25 (45 g/L), MPI # 141, X-Green 141, 153, X-Green 153

2.7 COLOR COATING SCHEDULE

- A. Color coding and identification of piping shall be in accordance with American National Standards Institute Standard ANSI A13.1-1975. The color schedule is preliminary, except for those items covered by ANSI A13.1-1975, and is subject to change by the Owner.

Water Piping Designations (Including Sample Piping)	Color
Raw Water	Utility Green
Settled Water	Aqua
Finished Water	Dark Blue
Washwater	Azure Blue
Sludge	Brown
Fire Hydrants	Safety Red
Potable Water	Safety Green
Hot Water, Potable	Safety Green w/ Red Band

Chemical Piping Designations	Color
Alum/PAC	Label Only (No Paint)
Caustic	Label Only (No Paint)
Chlorine (Sodium Hypochlorite)	Label Only (No Paint)
Fluoride	Label Only (No Paint)
Phosphate	Label Only (No Paint)
Polymer	Label Only (No Paint)

Miscellaneous Piping	Color
Compressed Air	Label Only (No Paint)

Equipment	Color
Compressors	Safety Blue
Sludge Pumps	Pump Gray
High Service Pumps	Safety Green
Drive Heads (Clarifier, Mixers etc.)	Vermillion
Floor Stands, Gate Floor Stands	Vermillion
Service Pumps	Azure Blue
Sampling Pumps	Pump Gray

- B.** Lettering on pipe shall be in accordance with the above Standard. A pipe identification system incorporating pipe markers such as Setmark by Seton Name Plate Co., may be considered in lieu of painted on stenciling. **All exposed piping and piping in trenches shall be labeled.**
1. Pipe lettering or pipe markers shall be placed at all change of directions and at no more than 30-foot intervals.
  2. Piping shall be labeled to indicate direction of flow.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A.** The Contractor shall have on the project site the following testing equipment. Equipment shall be in calibration and proper working order. Equipment shall be used in accordance with the manufacturers' instructions or as directed by the Engineer. The Engineer shall be notified of time of testing so that he might be present to witness testing.
1. Sling Psychrometer: Relative humidity and dew point readings shall be taken at intervals throughout the days work. Readings shall be taken at the start of the mornings work, mid day and afternoon. Should environmental conditions change, additional reading shall be taken to assure that coatings are being applied under the conditions as outlined by the coatings manufacturer.
  2. Surface Temperature Thermometer: Surface temperatures shall be taken in areas where work is being performed. Surface temperature shall be that as specified by the coatings manufacturer.
  3. Replica Tape & Micrometer Testex X-Course Replica Tape shall be employed to determine the surface profile of blasted surfaces. Surface profile shall be as

specified.

4. Dry Film Thickness Measurements: Dry film thickness reading shall be taken with a properly calibrated (per the manufacturer's instructions) Type 1 (magnetic) or Type 2 (electromagnetic) instrument. Dry film thickness reading will be taken and recorded in the in a frequency and manner as dictated by the Engineer.

### 3.2 EXAMINATION

- A. With Applicator present, examine substrates and conditions under which high-performance coatings will be applied, for compliance with coating application requirements.
  1. Apply coatings only after unsatisfactory conditions have been corrected and surfaces to receive coatings are thoroughly dry.
  2. Start of application is construed as Applicator's acceptance of surfaces within that particular area.
- B. Coordination of Work: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.
  1. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
    - a. Confirmation of primer's suitability for expected service conditions.
    - b. Confirmation of primer's ability to be top coated with materials specified.
  2. Notify Engineer about anticipated problems before using the coatings specified over substrates primed by others.

### 3.3 PREPARATION

- A. General: Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
  1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.
- B. Cleaning: Before applying high-performance coatings, clean substrates of substances that could impair bond of coatings.
  1. Remove oil and grease before cleaning per SSPC-SP1 solvent cleaning.
  2. Schedule cleaning and coating application so dust and other contaminants from cleaning process will not fall on wet, newly coated surfaces or contaminate previously cleaned surfaces.
  3. Sprinkle floors to lay the dust if necessary to prevent dust from falling on wet paint.
- C. Surface Preparation: Clean and prepare surfaces to be coated according to manufacturer's written instructions for each substrate condition and as specified.

1. Concrete surfaces to be coated shall be free of curing compounds and form release agents, laitance and foreign particles that may inhibit bonding. Prior to start of protective lining systems application, high-pressure water clean, waterjet or abrasive blast surfaces to be covered as required and inspect the substrate in accordance with SSPC-SP13/NACE No. 6. Surface preparation procedures shall be in accordance with SSPC-SP13/NACE No. 6 and ICRI Guideline No. 310.2. Surface preparation requirement is to expose aggregate and obtain a uniform surface texture resembling an ICRI-CSP5.
2. Level or grind concrete substrates to manufacturer's recommended tolerances and produce a smooth, uniform installation, including removal of all sharp edges, ridges, or depressions.

D. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
3. Use only the type of thinners approved by manufacturer and only within recommended limits.
4. All thinner shall be added to the paint upon activation. No thinner will be allowed to be added to activated paint to prevent hardening or curing of project prior to application.

### 3.4 APPLICATION

A. General: Apply high-performance coatings according to manufacturer's written instructions., unless Engineer specifically authorize the contractor, in writing, to modify the procedure outlined in the manufacturer's instructions.

1. Use applicators and techniques best suited for the material being applied.
2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
3. Provide finish coats compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
  - a. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
  - b. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
5. All paints and coatings shall be applied by qualified workmen, experienced in the application of particular type of paint or coating used.

- a. Workmen shall exercise extreme care to protect all painted surfaces and/or those prepared for painting.
  - b. It shall be the Contractor's responsibility to prevent damage to any structures, vehicles, vegetation, etc., that might be affected by transmittal of solvent, or coating droplets, or mist, by wind or other means during the performance of the work outlined herein.
  - c. All workmanship shall be of the very best, with all materials evenly spread and smoothly flowed on without runs or sagging.
- B. Finish paint coat shall not be applied to the structural parts of equipment, motors drives and similar items until such equipment has been erected, installed, tested and adjusted under service conditions.
- C. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration. Additional coats shall be required to achieve the specified Dry Film Thickness.
1. The number of coats and film thickness required is the same regardless of application method.
    - a. Omit primer on metal surfaces that have been shop primed and touch-up painted.
    - b. Do not apply succeeding coats until the previous coat has cured as recommended by manufacturer.
    - c. Where manufacturer's written instructions require sanding, sand between applications to produce a smooth, even surface.
    - d. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.
  2. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance. Give special attention to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.
- D. Fluoride Exposed Concrete:
1. If any bugholes, spalls, cracks, or other surface defects are present on the concrete substrate, they should be addressed via the coating system manufacturer's recommendations prior to the installation of the containment lining system.
  2. Cant cove bases shall be installed using mixed trowelable version of lining system in accordance with the Manufacturer's written instructions and as indicated on the Standard Secondary Containment Lining Details.
  3. To all horizontal and vertical surfaces, apply a full parge coat of the manufacturer's recommended product(s) surfacing epoxy at a minimum 1/16" to 1/8" thickness, trowel applied.
  4. Cant Cove Bases shall be installed using mixed trowelable version of lining system in accordance with the Manufacturer's written instructions as indicated.



5. To all horizontal and vertical surfaces, apply primer to the manufacturer's recommendations.
  6. To all horizontal and vertical surfaces, apply any required powders, mats, and coatings for the containment layer to the manufacturer's recommendations as required.
  7. Once cured, sand to remove any imperfections or fiberglass fibers that may be sticking up through the cured film. Grind if required to remove.
  8. To all horizontal and vertical surfaces, roller apply finished coat to manufacturer's recommendations.
  9. All areas exposed to Ultra Violet Light shall be coated with a sacrificial UV resistant coating if required by the manufacturer's coating system.
  10. Saw Cuts – all areas where the installed lining does not transition on to another surface of a different angle shall be saw cut. The Saw cut shall be ¼" wide by a ¼" deep.
  11. Expansion and Control Joints – Where specified, a joint shall be saw-cut after the lining installation and filled with a flexible epoxy or urethane sealant, or as required.
  12. Application in direct sunlight and/or with rising surface temperature is not allowed, as this may result in blistering of the materials due to expansion of entrapped air or moisture in the concrete. In such cases, it will be necessary to postpone the application until later in the day when the temperature of the substrate is falling.
  13. Areas not to receive containment lining shall be masked or otherwise protected to prevent these surfaces from being coated.
  14. Ensure straight, even termination of protective lining system on wall edges and flush with embedded steel.
- E. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brush Application: Use brushes best suited for material applied and of appropriate size for the surface or item being coated.
    - a. Apply primers and first coats by brush unless manufacturer's written instructions permit using roller or mechanical applicators.
    - b. Brush out and work brush coats into surfaces in an even film.
    - c. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.
  2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for the material and texture required.
- F. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.
- G. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by manufacturer, to material required to be coated or finished that has not been prime coated by others.
1. Recoat primed and sealed substrates if there is evidence of suction spots or unsealed areas in first coat, to ensure a finish coat with no burn-through or other defects caused by insufficient sealing.

- H. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

### 3.5 FIELD QUALITY CONTROL

- A. Owner or Engineer may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. If necessary, Contractor may be required to remove rejected materials from previously coated surfaces if, on recoating with specified materials, the two coatings are not compatible.
- B. Paints approved for various surfaces shall be as manufactured by companies listed above. The manufacturer shall make available to the Contractor the services of a technical representative who shall be consulted with respect to drying times, cure-out times, compatibility of primers and overcoats, and miscellaneous problems that might arise during the progress of the work.
- C. The Contractor shall properly prepare surfaces prior to proceeding with work and shall be held responsible for any poor work caused by improperly prepared surfaces. The application of the first coat of paint by the Contractor shall be construed as an acceptance by him of the responsibility for the condition of the base.
- D. No sooner than nine months, but no later than twelve months after Substantial Completion, the Owner will make arrangements for an inspection of the coatings, both interior and exterior.
  - 1. The Contractor shall have a representative present for the inspection and shall be prepared to perform any minor corrective work at the time of inspection.

### 3.6 CLEANING

- A. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
  - 1. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

### 3.7 PROTECTION

- A. The Contractor is solely responsible for protecting all existing surfaces, structures, and other facilities adjacent to or in the vicinity of the surfaces being coated, whether above or below ground. The Contractor must furnish, install and maintain all necessary protective measures in order to prevent overspray and/or other damage from occurring. The Contractor shall repair and/or pay for all damages resulting from his operations or personnel to existing facilities, and shall settle in full all damage suites which may arise as a result of his operations.
- B. Protect work of other trades, whether being coated or not, against damage from coating

operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Engineer, and leave in an undamaged condition.

1. Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work.
2. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces to original condition, or replace with new. Comply with procedures specified in PDCA P1.

**END OF SECTION 09 96 00**

## **SECTION 133419 - METAL BUILDING SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Structural-steel framing.
  - 2. Metal roof panels.
  - 3. Metal wall panels.
  - 4. Metal soffit panels.
  - 5. Thermal insulation.
  - 6. Accessories.
- B. Related Sections:
  - 1. Division 3 Section Concrete

#### **1.3 DEFINITIONS**

- A. Bay Spacing: Dimension between main frames measured normal to frame (at centerline of frame) for interior bays, and dimension from centerline of first interior main frame measured perpendicular to end wall (outside face of end-wall girt).
- B. Building Length: Dimension of the building measured perpendicular to main framing from end wall to end wall (outside face of girt to outside face of girt).
- C. Building Width: Dimension of building measured parallel to main framing from sidewall to sidewall (outside face of girt to outside face of girt).
- D. Clear Span: Distance between supports of beams, girders, or trusses (measured from the lowest level of connecting area of a column and a rafter frame, or knee).
- E. Eave Height: Vertical dimension from the finished floor to eave (the line along the sidewall formed by the intersection of the planes of the roof).
- F. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

## 1.4 SUBMITTALS

- A. Product Data: For each type of metal building system component. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
1. Structural-steel-framing system.
  2. Metal roof panels.
  3. Metal wall panels.
  4. Metal soffit panels.
  5. Insulation and vapor retarder facings.
  6. Flashing and trim.
  7. Accessories.
  8. Gutters and Downspouts
- B. Shop Drawings: For the following metal building system components. Include plans, elevations, sections, details, and attachments to other work.
1. For installed components indicated to comply with design loads, include structural analysis data signed by the qualified engineer, registered in the State of Alabama, responsible for their preparation.
  2. Anchor-Bolt Plans: Submit anchor-bolt plans and templates before foundation work begins. Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.
  3. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
  4. Metal Roof and Wall Panel Layout Drawings: Show layouts of metal panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
    - a. Show wall-mounted items including doors, windows, louvers, and lighting fixtures.
  5. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches :
    - a. Flashing and trim.
    - b. Gutters.
    - c. Downspouts.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors for each type of the following products with factory-applied color finish.
- D. Qualification Data: For qualified Firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects, and addresses of architects and owners.
- E. Welding certificates. Copies of certificates for welding procedures and personnel.

- F. Metal Building System Certificates: For each type of metal building system, from manufacturer. Signed by the manufacturer's certifying that products comply with requirements. Include evidence of manufacturing experience and sealed by qualified professional engineer registered in the State of Alabama. Include the following:
- a. Name and location of Project.
  - b. Order number.
  - c. Name of manufacturer.
  - d. Name of Contractor.
  - e. Building dimensions including width, length, height, and roof slope.
  - f. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
  - g. Governing building code and year of edition used in design.
  - h. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category.
  - i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
  - j. Building-Use Category: Indicate category of building use and its effect on load importance factors.
  - k. AISC Certification for Category MB or IAS Certification: Include statement that metal building system and components were designed and produced in an AISC-Certified Facility or an IAS Certified facility by an AISC-Certified Manufacturer or an IAS Certified Manufacturer.
- G. Erector Certificates: For each product, from manufacturer. Signed by manufacturer certifying that erectors comply with requirements.
1. Manufacturer Certificates: For each product, from manufacturer.
  2. Thermal insulation.
- H. Maintenance Data: For metal panel finishes to include in maintenance manuals.
- I. Warranties: Sample of special warranties.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide a metal building system manufactured by a firm experienced in manufacturing metal building systems that are similar to those indicated for this project and have a record of successful in-service performance and are qualified manufacturer and member of MBMA or IAS.
1. AISC Certification for Category MB: An AISC-Certified Manufacturer that designs and produces metal building systems and components in an AISC-Certified Facility.
  2. IAS Certification for Metal Buildings
  3. Engineering Responsibility: Preparation of Shop Drawings, testing program development, test result interpretation and comprehensive engineering analysis by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing

engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal building systems that are similar to those indicated for this Project in material, design and extent.

- C. Erector Qualifications: Engage an experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is certified in writing by the metal building manufacturer as qualified for the erection of the manufacturer's products.
- D. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- E. Single - Source Responsibility: Obtain metal building system components, including primary and secondary framing, metal panel assemblies, and accessory components from single source from single manufacturer.
- F. Product Options: Information on Drawings and Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject or verifications by one or more methods including preconstruction testing, field testing or in-service performance. Do not modify intended aesthetic effects, as judged by the architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- G. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."
- H. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.
- I. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- J. Pre-installation Conference: Conduct conference at Project site. Attendees list to include (minimum) owner's representative, engineer, general contractor's project manager, general contractor's project superintendent, metal building manufacturer's representative and metal building erector's representative. Review methods and procedures related to metal building systems.
  - 1. Review methods and procedures related to metal building systems including, but not limited to, the following:
    - a. Condition of foundations and other preparatory work performed by other trades.
    - b. Structural load limitations.
    - c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver prefabricated components, sheets, panels, and other manufactured items so they will not be damaged or deformed. Package metal wall and roof panels for protection during transportation and handling.
- B. Handling: Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weather tight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Protect plastic insulation as follows:
  - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
  - 2. Protect against ignition at all times. Do not deliver -plastic insulation materials to Project site before installation time.
  - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## 1.7 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify metal building system foundations on the contract drawings and by field measurements before metal building fabrication and indicate measurements on shop drawings.
- C. Temporary Shoring: Provide temporary shoring as necessary to prevent damage during construction.

## 1.8 COORDINATION

- A. Coordinate sizes and locations of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Concrete."
- B. Coordinate installation of roof penetrations.
- C. Coordinate fabrications schedule with construction schedule to avoid delaying the work.
- D. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leak proof, secure, and noncorrosive installation.



## 1.9 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.
- B. Warranty Period: Five years from the date of Substantial Completion.
- C. Special Warranty on Metal Panel Finishes: Written warranty, signed by manufacturer agreeing to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period. Deterioration of finish includes but is not limited to, color fade, chalking, cracking, peeling, and loss of film integrity.
  - 1. Finish Warranty Period: 20 years from date of Substantial Completion.
- D. Special Weather tightness Warranty for Standing-Seam Metal Roof Panels: Written warranty, signed by manufacturer agreeing to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weather tight within specified warranty period. This Special Warranty is to be a "Full Value Warranty" with third party inspection prior to issuance of Special Warranty, and shall include coverage for replacement of materials and all required labor for full warranty period.
- E. Roofing warranties or guarantees which contain language regarding the governing of the warranties or guarantees by any other state other than the State of Alabama, must be amended to exclude such language and substituting the requirements that the Laws of the State of Alabama shall govern all such warranties or guarantees.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
  - 1. American Buildings Company; Division of Magnatrx Corp.
  - 2. Bigbee Steel Buildings, Inc.
  - 3. Ceco Building Systems; Division of NCI Building Systems, L.P.
  - 4. Gulf States Manufacturers, Inc.; Division of Magnatrx Corp.
  - 5. Star Building Systems; an NCI company.
  - 6. Varco – Pruden Buildings
  - 7. Kirby – A Nucor Company
  - 8. Cheyenne Mountain Steel, LLC
  - 9. Mid-West Steel Building Company
  - 10. Nucor Building Systems
- B. Other manufacturers may be submitted subject to compliance with this specification and the Owner's approval.

## 2.2 METAL BUILDING SYSTEMS

- A. General Description: Provide a complete, integrated set of metal building system manufacturer's standard mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior. Include primary and secondary framing, roof, wall panels, and accessories complying with requirements indicated, including those in this article.
- B. Metal Buildings System Design: Provide metal building system of size and with bay spacings, roof slopes, and spans indicated.
  - a. Primary-Frame Type: Rigid Clear Span: Solid-member, structural-framing system without interior columns.
  - b. No fixed base columns.
- C. End-Wall Framing: Provide Manufacturer's standard framing, load-bearing end-wall and corner columns and rafters.
- D. Secondary-Frame Type: Manufacturer's standard rafters and partially inset-framed girts.
- E. Eave Height: as indicated by nominal height on Drawings.
- F. Bay Spacing: As indicated on the drawings.
- G. Roof Slope: As indicated on the drawings.
- H. Roof System: Manufacturer's standard standing seam metal roof panels.
- I. Exterior Wall System: Manufacturer's standard field-assembled wall panels.

## 2.3 METAL BUILDING SYSTEM PERFORMANCE

- A. Structural Performance: Provide metal building systems capable to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual or IAS standards."
  - 1. Design Loads: Basic design loads, as well as collateral loads are to be in accordance with the International Building Code latest edition as modified for the particular geographical area. Building structure shall be designed to meet required loads as erected from factory without field modification of primary framing. Metal Building Systems Manufacturer is to include Design Loads used with his submittals.
  - 2. Design Load shall include all equipment/utilities supported from Metal Building System.
  - 3. Other structural loads for hanging pipe supports.
- B. Seismic Performance: Design and engineer metal building systems capable of withstanding the effects of earthquake motions determined according to the building

code in effect for this Project of ASCE 7 “Minimum Design Loads for buildings and Other Structures” Section 9, Earthquake Loads,” whichever is more stringent.

- C. Thermal Movements: Provide metal building roof and wall panel systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F , material surfaces.
- D. Air Infiltration for Roof Panels: Provide roof panel assemblies with permanent resistance to air leakage through assembly of not more than 0.09 cfm/sq. Ft. of fixed roof area when tested according to ASTM E 1680 at a static-air-pressure difference of 4 lbs/Sq. Ft.
- E. Air Infiltration for Wall Panels: Provide wall panel assemblies with permanent resistance to air leakage through assembly of not more than 0.090 cfm/sq.Ft. of wall area when tested according to ASTM E 283 at static-air-pressure difference of 4 lbs/sq. Ft.
- F. Water Penetration for Roof Panels: Provide roof panel assemblies with no water penetration when tested according to ASTM E 1646 at a minimum differential test-pressure difference of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. Ft. (300 Pa) and not more than 12 lbf/sq. Ft. (575 Pa).
- G. Water Penetration for Wall Panels: Provide wall panel assemblies with no water penetration when tested according to ASTM E 331 at a minimum differential pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. Ft. (300 Pa) and not more than 12 lbf/sq. Ft. (575 Pa)

## 2.4 STRUCTURAL-STEEL FRAMING

- A. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
  - 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
  - 2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
  - 3. Rigid Modular Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
  - 4. Frame Configuration: Single gable or as indicated on the drawings.
  - 5. Exterior Column Type: Uniform depth.
  - 6. Rafter Type: Uniform depth.

- B. End-Wall Framing: Provide the following primary end wall framing members fabricated for field-bolted assembly:
1. End-Wall and Corner Columns: Manufacturer's standard shop-painted, built-up factory-welded I-shaped or cold-formed C-shaped sections fabricated from 14-gage (0.0747-inch) steel. End-Wall Rafters: Manufacturer's standard shop-painted C-shaped, cold-formed, structural-steel sheet fabricated from 16-gage (0.0598-inch) Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, pre-painted with coil coating, to comply with the following:
    2. Purlins: Z-shaped sections; fabricated from 16 gage thick (0.0598 inch) built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch-wide flanges.
      - a. Depth: As needed to comply with system performance requirements.
    3. Girts: Z-shaped sections; fabricated from 16 gage (0.0598 inch) thick built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 45 to 50 degrees from flange, and with minimum 2-1/2-inch-wide flanges.
      - a. Depth: As required to comply with system performance requirements.
    4. Eave Struts: Unequal-flange, C-shaped sections; formed to provide adequate backup for both wall and roof panels. Fabricate from 16 gage (0.0598-inch) thick steel sheet, built-up plates or structural-steel shapes; to provide adequate backup for metal panels.
    5. Flange and Sag Bracing: Minimum 1-5/8" x 1-5/8" structural-steel angles or 1-inch diameter, cold-formed structural tubing to stiffen primary-frame flanges fabricated from 16-gage (0.0598-inch) shop painted roll-formed steel.
    6. Base or Sill Angles: Fabricate from 14-gage (0.0747-inch) cold-formed galvanized steel sections.
    7. Purlin and Girt Clips: Clips shall be fabricated from 14-gage (0.0747-inch) zinc coated steel sheet. Secondary End-Wall Framing: Structural members, except columns and beams, shall be the manufacturer's standard sections fabricated from 14-gage (0.0747-inch) cold-formed shop painted steel.
    8. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
- C. Canopy Framing: Manufacturer's standard structural-framing system, designed to withstand required loads; fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide frames with attachment plates and splice members, factory drilled for field-bolted assembly.
1. Type: as indicated.
- D. Wind Bracing: Provide portal frames or rods or cables for wind bracing. Portal frame bracing will be required for the southern bays of the Solids Storage canopy to allow clearance for heavy equipment access.

- E. Bolts: Provide shop-painted bolts except when structural-framing components are in direct contact with roof and wall panels. Provide zinc-plated or cadmium-plated bolts when structural-framing components are in direct contact with roof and wall panels.
- F. Materials:
  - 1. Structural Steel Shapes: Comply with ASTM A 36/A 36M or A529/A 529M.
  - 2. Steel Plate, Bar or Strip: Provide 55,000 psi minimum yield stress and 70,000 psi minimum tensile strength. Comply with ASTM A 529 /A 529M, ASTM A 570/A 570M or ASTM A 572/A 572M.
  - 3. Steel Tubing or Pipe: Comply with ASTM A 500, Grade B, ASTM A, 501 or ASTM A 53, Grade B.
  - 4. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B structural tubing.
  - 5. Structural Quality Zinc-Coated Steel Sheet: Comply with ASTM A 446 with G90 coating complying with ASTM A 525. Material to comply with ASTM A 653/A 653M, Grade 80. Retain first subparagraph below for secondary framing if required.
  - 6. Structural Quality Aluminum-Zinc Alloy Steel Sheet: Comply with requirements of ASTM A 792/A 792M.
  - 7. Bolts for Structural Framing: Comply with ASTM A 307 or ASTM A 325 as necessary for design loads and connection details.
- G. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.
  - 1. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.
    - a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.
  - 2. Prime galvanized members with specified primer after phosphoric acid pretreatment.
  - 3. Primer: SSPC-Paint 15, Type I, red oxide.

## 2.5 METAL ROOF PANELS

- A. Vertical-Rib, Standing-Seam Metal Roof Panels: Manufacturer's standard factory-formed standing seam roof panel system designed for mechanical attachment of panels to roof purlins using concealed fasteners and sealants. **Profile of roof panels shall be the standard system closest to the match of the existing standing seam metal roof on the Administration Building.** Form panels of 24 gage (0.0239-inch), Grade C, aluminum-zinc alloy coated steel sheets. Panels are joined at side laps with an interlocking standing seam 1 inch above the major rib. Each panel provides 18 inch net coverage in width. The female panel seam shall have a factory applied sealant.
  - 1. Material: Aluminum-zinc alloy-coated steel sheet. 0.028-inch
    - a. Exterior Finish: Fluoropolymer.
  - 2. Color: As selected by Engineer from manufacturer's full range. (Color selection closes match to existing standing seam roof)

3. Roof Panel Accessories: Provide components required for a complete roof panel's assembly including trim, copings, fascia, mullions, sills, corner units, ridge closures, clips seam covers, battens, flashings, gutters, downspouts, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of roof panels unless otherwise indicated.
  - a. Clips: Provide 16-gage (0.0598-inch) panel clips. floating type to accommodate thermal movement ; fabricated from zinc-coated (galvanized) steel
  - b. Cleats: Factory-caulked, mechanically seamed cleats formed from 24-gage (0.0239-inch), Grade C, zinc-coated steel sheets.
  - c. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets, self-locking bolts, end – welded studs and other suitable fasteners designed to withstand design loads.
  - d. Provide metal-backed neoprene washers under heads of fasteners bearing on weather side of panels.
  - e. Use aluminum or stainless steel fasteners for exterior application and galvanized or cadmium-plated fasteners for interior applications.
  - f. Locate and space fastenings in true vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of neoprene washer.
  - g. Provide fasteners with heads matching color of roofing or siding sheets by means of plastic caps or factory-applied coating.
  - h. Flexible Closure Strips: Closed-cell, expanded cellular rubber, self-extinguishing flexible closure strips. Cur or pre-mold to match configuration of roofing and siding sheets. Provide closure strips where indicated or necessary to ensure weather-tight construction.
  - i. Sealing Tape: Pressure-sensitive 100 percent solids grey polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, nonsag, nontoxic, non-staining tape ½” wide and 1/8” inch thick.
4. Joint Type: Mechanically seamed, folded according to manufacturer's standard.
5. Panel Coverage: 18 inches .
6. Panel Height: 2 inches .
7. Uplift Rating: UL Class 90.

B. Materials:

1. Metallic-Coated Steel Sheet: Restricted-flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
  - a. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 50; structural quality.
  - b. Surface: Smooth, flat finish.

C. Finishes:

1. Exposed Coil-Coated Finish:

- a. Two-Coat Fluoropolymer: AAMA 621. Panel finish shall be a two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight, with a total minimum dry film thickness or 1 mil (0.025 mm) and 30 percent reflective gloss when tested according to ASTM D 523. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

## 2.6 METAL WALL PANELS

- A. Uninsulated Exterior Wall Panels: Manufacturer's standard factory-formed ribbed panels fabricated from 24 gage (0.028 inch) aluminum-zinc alloy coated steel sheets pre-painted with coil coating to provide 36-inch wide (914 mm) coverage, with 1-1/4" raised ribs at 12 inches (305 mm) o.c., and intermediate stiffening ribs symmetrically spaced between major ribs for full length of panel. Design panels for mechanical attachment to structure with exposed fasteners, in color to match prefinished wall panels, lapping major ribs at panel edges. There shall be a purlin bearing leg on the bottom section of the lap.
- B. Reverse-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with recessed, trapezoidal major valleys and intermediate stiffening valleys symmetrically spaced between major valleys; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
  1. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch nominal thickness.
    - a. Exterior Finish: Fluoropolymer.
    - b. Color: As selected by Engineer from manufacturer's full range.
  2. Major-Rib Spacing: 12 inches o.c.
  3. Panel Coverage: 36 inches.
  4. Panel Height: 1.25 inches.
- C. Materials:
  1. Metallic-Coated Steel Sheet: Restricted-flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
    - a. Aluminum-Zinc Alloy-Coated Steel Sheet Surface: Smooth, flat finish.
- D. Finishes:
  1. Exposed Coil-Coated Finish:
    - a. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat. Use for interior.

- E. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
- F. Wall Panel Accessories: Provide components required for a complete wall panel assembly, including trim, copings, mullions, sills, corner units, clips, seam covers, battens, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of panels.

## 2.7 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
  - 1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
  - 1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
  - 2. Clips: Manufacturer's standard, formed from steel sheet, designed to withstand negative-load requirements.
  - 3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from steel sheet.
  - 4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  - 5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weather tight construction.
- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
  - 1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
  - 2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weather tight construction.



- D. Flashing and Trim: Formed from 24 gage nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match adjacent metal panels.
1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
  2. Opening Trim: Formed from 24 gage nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
- E. Gutters: Formed from 24 gage nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, sized according to SMACNA's "Architectural Sheet Metal Manual." Finish gutters to match roof fascia and rake trim.
1. Gutter Supports: Fabricated from same material and finish as gutters spaced 36" o.c.
  2. Strainers: Provide Bronze, copper, or aluminum wire ball type at outlets.
  3. All exterior gutters and downspouts shall be designed for a minimum rainfall intensity based upon a 5-year recurrence interval for a five-minute duration. All interior gutters, valleys and downspouts shall be designed for a minimum rainfall intensity based upon a 25-year recurrence interval based on a five-minute duration.
- F. Downspouts: Formed from 26 gage nominal-thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot- long sections, complete with formed elbows and offsets. Finish downspouts to match wall panels. Provide in size and shape required for roof area.
1. Mounting Straps: Fabricated from same material and finish as gutters.
- G. Materials:
1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
    - a. Fasteners for Roof and Wall Panels: Self-drilling or self-tapping Type 410 stainless-steel, or zinc-alloy-steel hex washer head, with EPDM washer under heads of fasteners bearing on weather side of metal panels.
    - b. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
    - c. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

## 2.8 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly and disassembly.
  - 1. Fabricate components in such a manner that once assembled, they may be disassembled, repackaged, and res-assembled with a minimum amount of labor.
  - 2. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
  - 3. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop-fabricate framing components to indicated size and section, with base plates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly. Straight columns required.
  - 1. Make shop connections by welding or by using high-strength bolts.
  - 2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
  - 3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
  - 4. Weld clips to frames for attaching secondary framing members.
  - 5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication to a minimum dry film thickness of 1 mil (0.025mm).
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with base plates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
  - 1. Make shop connections by welding or by using non-high-strength bolts.
  - 2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication to a minimum film thickness of 1 mil (0.025mm).
- E. Tolerances: Comply with MBMA's "Low rise building System manual": chapter IV, Section 9, "Fabrication and Erection Tolerances."
- F. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

- G. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.
- H. FINISHES GENERAL
- I. Comply with NAAMM's "Metal finishes manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- J. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved samples and assembled or installed to minimize contrast.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with erection only after unsatisfactory conditions have been corrected.

#### **3.2 PREPARATION**

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
- B. Clean substrates of oil, grease, rolling compounds, incompatible primers, and loose mill scale that impair bond of erection materials.
- C. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

#### **3.3 ERECTION OF STRUCTURAL FRAMING**

- A. Erector must be certified in writing by the metal building manufacturer as capable of erection of the metal buildings in accordance with all the requirements of these specifications and drawings.
- B. Erect metal building system according to manufacturer's written erection instructions and erection drawings.

- C. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- D. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- E. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surfaces of base plates and bearing plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow curing. Comply with manufacturer's written installation instructions for proprietary grout materials.
- F. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- G. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level base plates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use non-shrinking grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
  - 1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.
    - a. Joint Type: Snug tightened or pretensioned. Tighten bolts by turn-of-the-nut method.
- H. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing, using clips with field connections using non-high strength bolts. Secure purlins and girts to structural framing and hold rigidly to a straight line by sag rods.
  - 1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
  - 2. Locate and space wall girts to suit openings such as doors and windows.
  - 3. Secure purlins and girts to structural framing and hold rigidly to a straight line by sag rods.
  - 4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

- I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
  - 1. Tighten rod and cable bracing to avoid sag.
  - 2. Locate interior end-bay bracing only where indicated.
- J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

### 3.4 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge when possible, unless otherwise indicated or restricted by shipping limitations.
  - 1. Install ridge and hip caps as metal roof panel work proceeds.
  - 2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- B. Standing-Seam Metal Roof Panels: Fasten roof panels to purlins with concealed clips at each standing-seam joint. Install clips over top of insulation at location and spacing determined by manufacturer. Install clips to supports with self-drilling screws. Apply a continuous ribbon of sealant tape to clean dry surface of the weather side of fastening on end laps, and on side laps as needed to make roof sheets weatherproof to driving rains.
  - 1. Field cutting by torch is not permitted.
  - 2. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
  - 3. Install clips to supports with self-drilling or self-tapping fasteners.
  - 4. Install pressure plates at locations indicated in manufacturer's written installation instructions.
  - 5. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
  - 6. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Pre-drill panels for fasteners.
- C. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

### 3.5 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, where

possible, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. When two rows of metal panels are required, lap panels 4 inches minimum.
4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
5. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Pre-drill panels.
6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
7. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads or panels. Install screws in predrilled holes.
8. Install flashing and trim as metal wall panel work proceeds.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated; or, if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
11. Field cutting by torch is not permitted.

B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, noncumulative, on level, plumb, and on location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

### 3.6 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weather tight mounting, and provide for thermal expansion. Coordinate installation with door and louver manufacturer and flashings and other components.

1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide for

thermal expansion of metal units; conceal fasteners when possible and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
  2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
1. Provide fittings as required to connect to underground storm drain piping.

### 3.7 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- C. Touchup Painting: After erection, promptly clean, prepare, and prime or re-prime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
  2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- D. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.
- E. Metal Panels: Remove temporary protective coverings and strippable films, if any, as soon as each metal panel is installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION 13 34 19**



## **SECTION 22 05 23 - VALVES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

A. This Section includes the following general-duty valves:

1. Gate Valves - Water Service
2. Check Valves - Water Service
3. Ball Valves
4. Check Valves - Chemical Service
5. Strainers - Chemical Service
6. Hose Gate Valves
7. Strainers
8. Valve Boxes
9. Valve Markers
10. Valve Position Monitoring

#### **1.2 SUBMITTALS**

A. Product Data:

1. For each type of valve indicated include the following information:

- a. Body, seating, and trim materials
- b. Valve design
- c. Pressure and temperature classifications
- d. End connections
- e. Arrangement
- f. Dimensions
- g. Required clearances

2. Include list indicating valve and its application.
3. Include rated capacities.
4. Include shipping, installed, and operating weights.
5. Include list of furnished specialties and accessories.
6. Include proof of hydrostatic test and proof of design test.

B. Product Data: For each type of product indicated. B. Shop Drawings: Include the following.

1. Detail each equipment assembly, include make, model weight, and indicate installation details, dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
2. Complete catalog information, descriptive literature, materials of construction, wheels, gears and bearing, trolley drive system, brakes, staging system, variable speed drive system, conductors (bus bar, festoon, cable reel), controls, remote control system, and accessories.
3. Power and control wiring diagrams, including terminals and numbers.
4. Motor nameplate data in accordance with NEMA MG 1 and include any motor modifications.

5. Factory finish system.

### 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  1. Protect internal parts against rust and corrosion.
  2. Protect threads, flange faces, grooves, and weld ends.
  3. Set angle, gate, and globe valves closed to prevent rattling.
  4. Set ball and plug valves open to minimize exposure of functional surfaces.
  5. Set butterfly valves closed or slightly open.
  6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  1. Maintain valve end protection.
  2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturer's: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Gate Valves - Water Service
    - a. Mueller Company
    - b. M&H Valves and Fittings Company
    - c. American-Darling
    - d. Clow
  2. Check Valves - Swing Type
    - a. APCO
    - b. Golden-Anderson
    - c. CCNE
  3. Ball Valves
    - a. Hills-McCanna
    - b. Chemetron
  4. Check Valves - Chemical Service
  5. Strainers - Chemical Service

## 6. Valve Boxes

- a. Valve boxes for 2¼" and smaller valves:
  - 1) Opelika Foundry Company, Roadway type
- b. Valve boxes for valves larger than 2¼"
  - 1) Mueller Buffalo type
  - 2) Opelika Foundry Company

## 7. Valve Position Monitors

- a. Monitors
  - 1) Moniteur
  - 2) Approved Equivalent

## 2.2 GATE VALVES (3" & Larger)

- A. Gate valves, 3" and larger, shall be resilient seated solid wedge gate valves and shall be rated for 250 psig cold water working pressure, bi-directional. Valves shall meet AWWA C509 or C515.
- B. Valves shall be iron body construction, full opening, non-rising stem. Stem shall be brass, bronze or stainless steel and shall have a minimum of three O-ring seals. The top seals shall be replaceable with the valve fully open and while under full operating pressure. Thrust collar and bearing surfaces shall be isolated from the waterway and provided with continuous lubrication. Alternatively, non-corrosive thrust bearings shall be furnished above and below the collar. Wedge shall be encapsulated with EPDM rubber. Bolting materials shall be 305 stainless steel.
- C. Ferrous metal surfaces shall have a 12 mil, fusion bonded, NSF 61 certified coating applied in accordance with AWWA C550.
- D. Valves 30" and larger in diameter for horizontal applications shall have brass stem bushings located in the bonnet, and shall have bronze rollers housed in a bronze scraper on the bottom of the wedge, traveling in a 316 SS track.
- E. Operators for valves 18" and larger shall be provided. Operator shall have bevel gears (horizontal) or spur gears (vertical).
- F. Valve shall be equipped with flanged or mechanical joint ends, hand wheels, operators, or operating nuts as required or indicated.
- G. Each valve shall be hydrostatically tested in accordance with AWWA C515.

## 2.3 CHECK VALVES - SWING TYPE

- A. Check Valves for liquid water service shall meet AWWA C-508 and have ductile iron or cast iron (ASTM A48, Class 40) bodies, stainless steel seats ASTM A276, Buna-N seat rings (80 Durameter), and extended stainless hinge pins (pivot shafts) Type 304, 309 or 316.

- B. Valve shall be cushioned gravity swing type, and shall be equipped with levers, weights, and air cushion chamber adjustable for controlling closure.
- C. Finishes:
  - 1. Exterior surfaces of valves shall receive rust-inhibitive primer, not less than 3 mils dry film thickness.

#### 2.4 INSERTING VALVES

- A. Inserting valves, 20" diameter and smaller, shall be of ductile iron body construction; shall be bronze mounted, full opening, non-rising stem, double disc parallel seat type; and shall meet AWWA Specifications C500, latest revision.
- B. Inserting valves, 12" diameter and smaller, shall be pressure rated at not less than 200 psi WOG. In order to ensure an adequate safety factor, valve shells shall be hydrostatically tested at not less than 400 psi.
- C. Inserting valves, 14" diameter to 20" diameter, shall be pressure rated at not less than 150 psi WOG. In order to ensure an adequate safety factor, valve shells shall be hydrostatically tested at not less than 300 psi.
- D. Finishes:
  - 1. All internal and external ferrous metal surfaces shall have an approved epoxy coating to provide a corrosion resistant barrier between the base metal and the surroundings.
  - 2. The epoxy coating shall be FDA approved and shall be taste and odor free, non-toxic after application, and shall meet or exceed the requirements of AWWA Specifications C550, latest revision.
  - 3. The epoxy coating shall be applied to a thickness of not less than 4 mils.

#### 2.5 BALL VALVES

- A. Ball valves for chemical service shall be manufactured from rigid polyvinyl compounds conforming to ASTM Specification Designation D-1784, latest revision, Type 1 Grade 1.
- B. Valves shall be suitable for 100 psi service and shall be approved by the National Sanitation Foundation.

#### 2.6 CHECK VALVES, CHEMICAL SERVICE

- A. Check valves for chemical service shall be manufactured from rigid polyvinyl compounds conforming to ASTM Specification Designation D-1784, latest revision, Type 1 Grade 1.
- B. Valves shall be suitable for 100 psi service and shall be approved by the National Sanitation Foundation.

## 2.7 STRAINERS, CHEMICAL SERVICE

- A. Strainers for chemical service shall be manufactured from rigid polyvinyl compounds conforming to ASTM Specification Designation D-1784, latest revision, Type 1 Grade 1.
- B. Strainers shall be suitable for 100 psi service and shall be approved by the National Sanitation Foundation.

## 2.8 VALVE BOXES

- A. All buried valves, including by-pass valves on geared valves, shall be equipped with valve boxes.
- B. Valve boxes shall be cast iron, **screw type**, with cast iron extension pieces as required to make up length of box from surface of ground to top of valve body.
- C. Valve boxes shall be manufactured of cast iron in accordance with the requirements of ASTM A48, Class 35.
- D. Covers shall be marked "WATER" or "WASTEWATER", or other as required by Engineer, according to the application.
- E. Finishes:
  - 1. All parts of valve boxes, bases, and covers shall be shop coated by dipping in asphalt varnish.

## 2.9 VALVE MARKERS

- A. Valve markers shall be furnished and installed for all valves in locations other than city streets.
- B. Valve markers shall be precast reinforced concrete posts, 4"x4" or 4"x5" in cross-section and 4'-0" long.
- C. Markers shall be equipped with brass or aluminum discs (as for monuments or benchmarks) monolithically in tops of the posts.
- D. Discs shall be stamped "GV" for gas valves, or "BFV" for butterfly valves, or "PV" for plug valves.
- E. After a post has been set, there shall be die-stamped on the face of the disc an arrow indicating the location of the valve with respect to the marker, and there shall also be stamped on the disc the measured distance of the valve from the marker.

## 2.10 VALVE LIMIT SWITCH AND POSITION MONITORS FOR DRAIN VALVES

- A. Valve Limit switch and Position Monitors shall be added on any PVC drain valves included in this project as required by the construction documents. The position monitors shall be capable of monitoring and relaying whether the valve is in the open or closed position.
- B. Valve limit switches and position monitor components that are defective, or deemed obsolete by an owner's representative or the Engineer shall not be used.

- C. The Contractor shall coordinate, furnish, and install all conduit, wiring, contacts, rocker arms, mounting brackets, and any other appurtenances necessary for installation of the position monitors.
- D. The valve limit switch and position monitors should be capable of communicating with alarm lights, and enabling their alarm function if the valve is left in the open position as defined in the construction documents.
- E. The valve limit switch and position monitor shall have two mechanical Single Pole Double Throw (SPDT) switches and an enclosure rated for outdoor environments.
- F. All of the components shall be rated for a Nema 4x application. The contractor shall coordinate that all of the components fit within the existing available space.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE INSTALLATION

- A. General
  - 1. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

2. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
3. Locate valves for easy access and provide separate support where necessary.
4. Install valves in horizontal piping with stem at or above center of pipe.
5. Install valves in position to allow full stem movement.
6. For buried valves, contractor shall provide operator extensions as required to bring operating nut within 4 feet of finished grade.

B. Gate Valves -Water Service

1. Valves 12" in size and smaller shall be installed in vertical position with valve stems extending to within 24" of the surface of the finished ground.
2. Valves larger than 12" shall be installed in horizontal position with valve stems extending to within 24" of the surface of finished ground.
3. Top of operating nut on valve stem shall not be closer than 20" to surface of finished ground.
4. It shall be the responsibility of the Contractor to make such variations in depths of trench as necessary to secure proper bury for the valves. The Contractor will not be permitted to make a sudden or local dip in the trench that would deviate from a constant downgrade or constant upgrade to an air release valve.
5. Where depth of bury is such that the operating nut is not at the specified depth below ground surface, extension stems shall be furnished and installed by the Contractor.
6. All underground valves, mainline and by-pass, shall be equipped with valve boxes of proper size and height, complete with covers.
7. The Contractor shall be responsible for filling of the gear case with lubricants as recommended by the manufacturer; and lubricant level shall be checked and the valve operated in the presence of the Engineer before the trench is backfilled.

3.3 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.4 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 22 05 23

## **SECTION 22 05 29 - PIPE HANGERS, BRACKETS, AND SUPPORTS**

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes hangers and supports for mechanical system piping and equipment.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. B. Shop Drawings: Include the following.
  - 1. Detail each equipment assembly, include make, model weight, and indicate installation details, dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Complete catalog information, descriptive literature, materials of construction, wheels, gears and bearing, trolley drive system, brakes, staging system, variable speed drive system, conductors (bus bar, festoon, cable reel), controls, remote control system, and accessories.
  - 3. Power and control wiring diagrams, including terminals and numbers.
  - 4. Motor nameplate data in accordance with NEMA MG 1 and include any motor modifications.
  - 5. Factory finish system.

#### 1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design shall allow for free expansion and contraction of piping.
- C. Design shall be such that the hangers and supports cannot become disengaged by moments of the supported pipe.
- D. Size and spacing of hanger rods shall be such that load carrying capacities of rods (based upon root area of thread) will not be less than 2.0 times the actual load on the hanger.
- E. All supports and parts shall conform to the latest requirements of the ANSI Code for Pressure Piping B 31.1.0, and MSS Standard Practice SP-58, except as supplemented or modified by this specification.



## 1.5 SUBMITTALS

- A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.
- C. Welding Certificates: Copies of certificates for welding procedures and operators.

## 1.6 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.
  - 1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. All piping shall be securely fastened, anchored, and supported by means of hangers, rods, clips, clip bases, anchor bolt inserts, brackets, rolls, roll stands, beam clamps, posts, braces, pipe stands, bases, slides and similar items as required.
- B. Designs using stock or production parts shall be utilized insofar as is possible, provided that such designs are those generally accepted as exemplifying good engineering practice.
- C. All rigid hangers shall provide a means of vertical adjustment after erection.
- D. Pipe hangers and supports adjacent to pumps, blowers, engines and other equipment shall be so located and adjusted that equipment flanges or other connection devices will be perfectly mated before joints or connections are tightly made up.
- E. Hanger rods shall be subject to tensile loading only. At hanger locations where lateral or axial movement is anticipated, suitable linkage shall be provided to permit swing.
- F. Pipe attachments for horizontal piping shall be pipe clamps, insofar as is possible.
- G. Structural attachments shall be beam clamps, insofar as is practicable.
  - 1. Where piping is supported from concrete slabs the Contractor shall furnish and install concrete inserts for attachment of hanger rods.
  - 2. Ceiling flanges and anchor bolts may be used for attachment of hanger rods for smaller piping subject, however, to the approval of the Engineer.
- H. All riser piping shall be supported independently of the horizontal piping, using riser clamps with structural attachments, base elbows or base tees.

- I. All pressure piping shall be adequately braced at all points of change in direction of piping runs.
- J. Pipe saddle supports and pipe stanchion saddles shall be furnished and installed where indicated on the Drawings or as required in order that piping support system will be in compliance with these Specifications.
  - 1. Saddles and stanchion saddles shall be complete with riser pipe, flanges, and anchors.
  - 2. Saddle and stanchion saddle units shall be adjustable when vertical adjustment is required.
- K. Roll supports, rolls, roll stands, and slide assemblies shall be furnished and installed where indicated on the Drawings or as required in order that piping support system will be in compliance with these Specifications.
- L. Unless otherwise specified, all fasteners, anchors, and anchor bolts shall be stainless steel.

## 2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by Grinnell Corporation, or equivalent.

## 2.3 MATERIALS

- A. Hanger rods shall be hot rolled steel rod meeting the requirements of ASTM Specification Serial Designation A36, the latest revision.
- B. Unless otherwise specified, all fasteners, anchors and anchor bolts shall be stainless steel.

## PART 3 - EXECUTION

### 3.1 PAINTING

- A. Touching Up: Clean and touch-up paint field welds, bolted connections, and abraded areas of shop paint on miscellaneous metals.

END OF SECTION 22 05 29

## **SECTION 22 07 50 – PIPE INSULATION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for the correct fabrication and installation of process piping insulation applied in accordance with applicable project specifications

#### **1.3 SUBMITTALS**

- A. Action submittals: Product description, include list of materials, thickness for each service scheduled, and locations.
- B. Informational Submittals:
  - 1. Proof of compliance for test of products for fire rating, corrosiveness, and Compressive Strength.
  - 2. Manufacturer's installation instructions.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.
- B. The contractor shall use whatever means are necessary to protect the insulation materials and accessories before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The contractor shall also use all means necessary to protect work and materials installed by other trades.
- C. If any insulation material has become wet because of transit or job site exposure to moisture or water, the contractor shall not install such material, and shall remove it from the job site. An exception may be allowed in cases where the contractor is able to demonstrate that wet insulation when fully dried out (either before installation or afterward following exposure to system operating temperatures) will provide installed performance that is equivalent in all

respects to new, completely dry insulation. In such cases, consult the insulation manufacturer for technical assistance.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

#### A. Aluminum Clad Fiberglass Insulation

1. Owens-Corning ASJ Max
2. Pre-Approved Equivalent

### 2.2 GENERAL

- A. Molded pipe insulation shall be composed of hydrous calcium silicate, manufactured to meet ASTM C 533.
- B. Fittings and valves shall be insulated with pre-formed sections, with thickness equal to adjacent pipe insulation. Flanges, couplings and valve bonnets shall be covered with an oversized pipe insulation section sized to provide the same insulation thickness as on the main pipe section.
- C. All piping shall be supported in such a manner that neither the insulation nor the vapor/weather barrier is compromised by the hanger or the effects of the hanger. In all cases, hanger spacing shall be such that the circumferential joint may be made outside the hanger.
- D. Where pipe shoes and roller supports are required, insulation shall be inserted in the pipe shoe to minimize pipe heat loss. Where possible, the pipe shoe shall be sized to be flush with the outer pipe insulation diameter.
- E. Thermal expansion and contraction of the piping and insulation system can generally be taken care of by utilizing double layers of insulation and staggering both longitudinal and circumferential joints. Where long runs are encountered, expansion joints may be required where single layers of insulation are being used and should be so noted on the contract drawings.
- F. On vertical runs, insulation support rings shall be used necessary.

### 2.3 FIBERGLASS PIPE INSULATION

- A. Material: UL rated, preformed, sectional bonded fiberglass.

1. Insulation thickness shall be per the manufacturer's recommendation for corresponding pipe sizes and system operating temperatures. At a minimum insulation thickness shall be 2".
2. ASTM C585 with factory applied, Kraft paper with aluminum foil vapor barrier jacket with pressure-sensitive, self-sealing lap.
3. Insulation Temperature Rating: Zero to 1000 degrees F.
4. Thermal insulation shall be suitable for use in contact with stainless steel, and conform to ASTM C795.
5. Jacketing per ASTM C 1136 with minimum water vapor transmission for jacket of 0.02 perm-inch per ASTM E96.
  - a. Joints: Matching pressure-sensitive butt strips for sealing circumferential joints.
6. Flame Spread Rating: less than 25 per ASTM E 84.
7. Smoke Developed Index: Less than 50 per ASTM E 84.

#### B. ALUMINUM JACKET

1. Aluminum jacket shall be .016" smooth aluminum coated inside with a poly moisture retarder. Apply to all exterior, exposed insulated pipe.
2. Install with stainless steel banding.
  - a. Use continuous friction type joint to hold jacket in place, providing positive weatherproof seal over entire length of jacket.
  - b. Secure circumferential joints with preformed snap straps containing weatherproof sealant.
3. Replace bent or damaged jacket at project's end.

#### C. ACCESSORY MATERIALS

1. Accessory materials installed as part of insulation work under his section shall include (but not be limited to):
  - a. Closure Materials - Butt strips, bands, wires, staples, mastics, adhesives; pressure-sensitive tapes.
  - b. Support Materials - Hanger straps, hanger rods, saddles, support rings.
2. All accessory materials shall be installed in accordance with project drawings and specifications, manufacturer's instructions.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Insulate Valve Bodies, flanges, and pipe couplings.
- B. Insulate and vapor seal hangers, supports, anchors and other piping appurtenances that are secured directly to cold surfaces.
- C. Do not insulate flexible pipe couplings and expansion joints.

### 3.2 EXAMINATION

- A. Before starting work under this section, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin.
- B. Verify that all materials and accessories can be installed in accordance with project drawings and specifications and material manufacturers' recommendations.
- C. Verify, by inspecting product labeling, submittal data, and/or certifications which may accompany the shipments, that all materials and accessories to be installed on the project comply with applicable specifications and standards and meet specified thermal and physical properties.

### 3.3 INSTALLATION

#### A. General

- 1. Comply with manufacturer's detailed written instructions for installing equipment.
- 2. Install insulation on piping subsequent to installation of heat tracing, painting, and acceptance tests.
- 3. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other. Butt insulation joints firmly to ensure complete, tight fit over all piping surfaces.
- 4. Maintain the integrity of factory-applied vapor barrier jacketing on all pipe insulation, protecting it against puncture, tears or other damage. All staples used on cold pipe insulation shall be coated with suitable sealant to maintain vapor barrier integrity.

#### B. Fittings

- 1. Cover valves, fittings, and similar items in each piping system using one of the following:
  - a. Mitered sections of insulation equivalent in thickness and composition to that installed on straight pipe runs.

- b. Fitting Covers insulated with material equal in thickness and composition to adjoining insulation.
- c. Insulate valves and fittings with sleeved or cut pieces of same material.

C. Penetrations

- 1. Extend piping insulation without interruption through walls, floors, and similar piping penetrations, except where otherwise specified.

D. Joints

- 1. An expansion joint shall be installed on all piping every 20 ft.
- 2. All joints and laps should be caulked with aluminum colored silicone caulking.
- 3. Butt pipe insulation against hanger inserts. For hot pipes, it is recommended all joints be staggered when operating temperature is over 400F double layer. Seal jacketing according to type being used.
- 4. All pipe insulation ends shall be tapered and sealed, regardless of service.

### 3.4 CLEANING AND PROTECTING

- A. Ensure that all pipe and fitting surfaces over which insulation is to be installed are clean and dry.
- B. Ensure that insulation is clean, dry, and in good mechanical condition with all factory-applied vapor or weather barriers intact and undamaged. Wet, dirty, or damaged insulation shall not be acceptable for installation.
- C. Ensure that pressure testing of piping and fittings has been completed prior to installing insulation.

END OF SECTION 22 05 19

## **SECTION 22 11 13 - WATER DISTRIBUTION**

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes water-distribution piping and specialties outside buildings for the following:
1. Meter boxes
  2. Hose-connection, backflow prevention devices
  3. Backflow preventer
  4. Pipeline Testing
  5. Pipeline Cleaning and Disinfection
  6. Connections to existing system
  7. Water systems and appurtenances

#### 1.2 SUBMITTALS

- A. Product Data: For the following:
1. Water Main Pipe
  2. Piping specialties.
  3. Water meters and accessories.
  4. Backflow preventers and assemblies.
  5. Protective enclosures.
  6. Fire hydrants.
  7. Yard hydrants.
  8. Tapping sleeves and valves.
  9. Pipe saddles.
- B. Shop Drawings: Include the following.
1. Detail each equipment assembly, include make, model weight, and indicate installation details, dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
  2. Complete catalog information, descriptive literature, materials of construction, wheels, gears and bearing, trolley drive system, brakes, staging system, variable speed drive system, conductors (bus bar, festoon, cable reel), controls, remote control system, and accessories.
  3. Power and control wiring diagrams, including terminals and numbers.
  4. Motor nameplate data in accordance with NEMA MG 1 and include any motor modifications.
  5. Factory finish system.

#### 1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:



1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
  2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
  3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- C. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- D. NSF Compliance: Comply with NSF 14 for plastic potable-water-service piping and/or comply with NSF 61 for materials for water-service piping and specialties for domestic water.

#### 1.4 DELIVERY, STORAGE, AND HANDLING OF APPURTENANCES

- A. Preparation for Transport: Prepare appurtenances, including fire hydrants, according to the following:
1. Ensure that appurtenances are dry and internally protected against rust and corrosion.
  2. Protect appurtenances against damage to threaded ends and flange faces.
  3. Set appurtenances in best position for handling.
- B. During Storage:
1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
  2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature.
  3. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle appurtenances if size requires handling by crane or lift.
1. Rig valves to avoid damage to exposed parts.
  2. Do not use handwheels or stems as lifting or rigging points.

#### 1.5 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
- B. Notify Engineer not less than two days in advance of proposed utility interruptions. Do not proceed with utility interruptions without Owner's written permission.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

#### A. Meter Boxes

1. Ford Meter Box Company
2. Opelika Foundry Company
3. Taylor Foundry Company
4. Equivalent.

#### B. Backflow Preventers

1. Watts Industries, Inc.; Water Products Div; Model 909S
2. Approved Equivalent.

#### C. Backflow Preventer Enclosure

1. Lokbox Model No. 2, Northeast Florida Enterprises
2. Approved Equivalent
3. Watts Industries, Inc.; Water Products Div.
4. Approved Equivalent

#### D. Hose Reels

1. Wirt & Knox Catalog No. FD47-1
2. Allenco
3. Ames
4. Approved Equivalent

#### E. Pipe Saddles:

1. American Cast Iron Pipe Company
2. Approved equivalent

#### F. Corp Stops and Fittings

1. Mueller Company
2. Hays Manufacturing Company
3. Ford Meter Box Company, Inc.
4. Approved Equivalent

### 2.2 METER BOXES

A. Boxes shall be constructed of reinforced concrete or cast iron.

B. Concrete boxes shall have tight-fitting concrete covers equipped with insert reading lids of cast iron, hinged type and self-closing; and cast iron boxes shall have cast iron tightfitting lids. All lids shall have the words "WATER METER" or "WATER" integrally cast in the cast iron lid section.

C. Meter boxes for meters 3/4" in size and smaller shall have inside area dimensions approximately 10-5/8" x 17-1/4" or may be not less than 18" more or less in diameter.

## 2.3 HOSE-CONNECTION, BACKFLOW-PREVENTION DEVICES

- A. General: ASSE standard, non-removable type, backflow prevention devices with ASME B1.20.7, garden-hose threads on outlet.
- B. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with manual drain feature. Units attached to rough bronze finish hose connections may be rough bronze. Not suitable for continuous pressure.
- C. Hose-Connection Backflow Preventers: ASSE 1052, suitable for at least 3-gpm flow and applications with up to 10-foot head of water back pressure. Include two check valves and intermediate atmospheric vent.

## 2.4 BACKFLOW PREVENTER

- A. General: Backflow Preventer.
  - 1. Bronze body, bronze working parts, stainless steel springs, neoprene valve discs, neoprene coated cotton duck diaphragm
  - 2. Maximum working pressure of 175 psi, hydrostatic test pressure of 350 psi and temperature range of 32°F - 145°F.
  - 3. The device shall consist of two spring-loaded check valves and a spring-loaded, diaphragm actuated, differential pressure relief valve located in the zone between the check valves.
  - 4. All piping in backflow preventer box including backflow preventer shall be insulated with 1" thick fiberglass Micro Lok pipe insulation with weather protective jacket to prevent freezing.
  - 5. Fiberglass enclosure shall be insulated and lockable, with provisions for drainage.
  - 6. Enclosure shall be mounted to 4" thick concrete pad as indicated.

## 2.5 PIPE SADDLES

- A. Pipe saddles shall be manufactured from ductile iron and shall have positively confined "O-Ring" type sealing gaskets.
- B. Pipe saddles shall be equipped with high strength stainless steel (or Cor-Ten Steel) straps with minimum cross section dimensions of ¼"x1½" and fabricated with hexagonal nuts for fastening to transmission mains.
- C. Pipe saddles shall be furnished with mechanical joint outlets conforming to the requirements of ANSI A21.11 (AWWA C111); or, with flange outlet conforming to the requirements of ANSI A21.15 (AWWA C110), as indicated and/or as described in these Specifications.
- D. Inside diameter of saddle outlet shall be ¼" greater than the nominal in order that a full size opening can be made in pipe wall.

## PART 3 - EXECUTION

### 3.1 PIPELAYING

- A. Minimum depth of cover for all pipe shall be 3'-0" unless otherwise shown. The Contractor shall excavate the trenches to such depths so as to obtain the cover specified hereinabove or as indicated.
- B. Minimum depth of cover for ALDOT utility relocation work is forty (40) inches, unless otherwise shown.
- C. Pipe Installation
  - 1. Installation and joining of pipe shall be performed in accordance with the requirements of ANSI/AWWA C600 (for ductile iron pipe) or C605 (for PVC pipe), latest revision, and with the requirements of these Specifications.
  - 2. Pipe shall be installed so as to conform to the alignment and grade indicated. If other utilities, pipe, cables, conduits, etc., are encountered they shall be handled as described in these Specifications.
  - 3. Pipe shall be laid so that the invert elevations will correspond to those indicated for the particular stations along the pipe line.
    - a. The difference in elevation between any two consecutive grade points (elevation control points or stations) shall be uniformly and proportionately distributed between the pipe lengths comprising the section of pipe line between such control points.
    - b. The maximum deflection for a particular size and length of pipe shall be in accordance with the manufacturer's recommendations.
  - 4. Proper and suitable tools and appliances for handling of the pipe shall be used.
  - 5. The bottom of the trench shall be prepared as described in these Specifications.
  - 6. Each piece of pipe or fitting shall be cleaned and carefully examined for defect.
  - 7. No defective pipe or fittings shall be used. If a defective piece should be discovered after having been used it shall be removed and replaced with a non-defective piece by the Contractor at the Contractor's expense.
  - 8. The pipe shall be accurately installed to the lines and grades indicated
  - 9. Whenever a length of pipe requires cutting to fit the lines, it shall be done as to leave a smooth end at right angles to the axis of the line; and the Contractor shall not receive extra compensation for this work.
  - 10. Open ends of the unfinished pipe line shall be securely closed when the work is stopped temporarily at night or other times.

### 3.2 BRACING OF PIPE AND FITTINGS

- A. All piping shall be braced against internal thrust by means of restrained joints and/or poured-in-placed concrete bracing where changes in direction occur or where branches from the line are located.
- B. Braced underground piping shall be securely braced against movement with concrete thrust blocks and bearing against solid, undisturbed ground. Where solid or

undisturbed ground cannot be obtained for bracing or where indicated on the Drawings restrained joint pipe and/or fitting shall be required.

- C. Concrete braces shall be constructed in accordance with details shown on the Drawings; and shall be plain or reinforced as indicated or required. All reinforced concrete used in underground bracing shall be "Class A" concrete in accordance with the requirements of these Specifications.
- D. Special bracing for particular locations identified on the Drawings and/or described herein shall be in accordance with details shown on the Drawings for the particular special brace and shall be complete with reinforcing steel and miscellaneous metal work.
- E. Piping installed above ground in buildings, galleries, tunnels, piping trenches and chases shall be supported and braced as indicated on the Drawings and specified herein.
  - 1. Where pipes are braced or supported above ground piping by means of concrete piers or thrust blocks, the concrete used for construction of such piers or thrust blocks shall be:
    - a. Class "A" as specified in these Specifications
    - b. Reinforced
    - c. Anchored to slabs and/or walls by dowels
    - d. Finished to match adjacent concrete surfaces or finished surfaces of adjacent walls or floors, whichever is applicable.

### 3.3 METER BOX INSTALLATION

- A. Meter boxes shall be furnished and installed for all meter installations.
- B. Meter boxes shall be of such depth as to provide a meter setting depth of not less than 18", and depth extension shall be provided when greater setting depth is required at particular locations.

### 3.4 BACKFLOW-PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install backflow preventers with relief drain in vault or other space subject to flooding.
- C. Do not install bypass piping around backflow preventers.
- D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

### 3.5 CONNECTIONS

- A. The Contractor shall make all connections to existing mains as indicated and as specified herein.
  - 1. These connections shall be made at such times and in such manner as will keep to a minimum any interruptions of service or inconvenience to users of the system.
  - 2. Connections to the existing system shall only be made after obtaining permission from the Owner specifically for each connection.
- B. Ground equipment according to Division 16 Section "Grounding and Bonding."
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.6 PIPELINE TESTING

- A. The Contractor shall furnish all equipment, labor, materials, and supervision necessary to perform the tests required.
  - 1. The Contractor shall bear the cost of testing, retesting, and any replacement work required (including all materials required).
  - 2. The Contractor is reminded that he is solely responsible for observance of all safety regulations and for the maintenance of safe conditions during all testing work.
  - 3. Should any pipe line, or any section of the line fail to meet the criteria established hereinbelow, all deficiencies shall be corrected and the testing repeated until the specified test results have been achieved.
- B. All pipelines shall be tested in accordance with procedures and practices applicable to the various types and kinds of pipe and to the various sizes of pipe.
  - 1. The Contractor is reminded that personnel not experienced in testing procedures and practices, and particularly in air-testing of pipelines, should neither be allowed to conduct the test nor assist in the test procedures.
- C. Testing Water Supply Mains
  - 1. The Contractor shall furnish all meters, gauges, pressure recorders, test plugs, valves, couplings, pitot gauges, test piping and fittings, pumps, compressors, receivers, motors, engines, electric power, fuel, water, supplies, labor tools, materials, equipment and supervision necessary to perform the tests required and shall make all connections necessary to perform the tests required.
  - 2. Should any pipe line, or any section of the line, fail to meet the criteria established hereinbelow, any deficiencies shall be corrected and the testing repeated until the specified test results have been achieved.
  - 3. All water supply mains and other water lines underground shall be tested in accordance with the requirements of ANSI/AWWA C600 (for ductile iron pipe) or C605 (for PVC pipe) and in accordance with the requirements of these Specifications.

4. Test pressure shall not be applied to instruments, controls, regulators or equipment.
5. Sections of mains placed under test shall be 1200 feet or less in length unless the concurrence of the Engineer is first secured.
  - a. Test sections may not exceed 3000 feet in length.
  - b. Sections of mains to be placed under test shall be isolated by means of valves or test plugs.
6. The duration of the test shall be 24 hours, and the test pressure shall be 150 psi or 1½ times the normal working pressure, whichever is greater.
7. Pressure shall be recorded on a 24 hour pressure recorder satisfactory to the Engineer and test charts shall be provided to the Engineer prior to acceptance of testing.
8. No pipe line, or section of pipe line, will be accepted if the leakage is greater than that as determined by application of the following formula:

$$L = SD \times (\sqrt{P/133,200})$$

where,

L = Allowable leakage in gallons per hour  
 D = Nominal diameter of pipe in inches  
 S = Length of pipe being tested in feet  
 P = Average test pressure in PSIG

9. During testing the pressure in the main or line being tested shall be maintained as closely as possible to the test pressure specified.
  - a. The pressure shall not be allowed to fall more than 5 psi below the specified test pressure.
  - b. Should the pressure be allowed to drop more than 5 psi the test shall be re-started.
10. The water added to the main or pipe line in order to maintain the desired test pressure shall be metered through a bench-tested meter registering in gallons and fractions of a gallon.
11. The quantity of water added to the main or line during the test period shall be the leakage.
12. All visible leaks shall be repaired even when tested leakage rates are less than the limits as determined by application of the formula given hereinabove.
13. Prepare reports of testing activities.

### 3.7 DISINFECTION AND CLEANING

#### A. Water Mains and Hydrants

1. The Contractor shall disinfect the pipe, pipe fittings, valves, and hydrants installed in the system.
2. In general, all disinfection shall be in accordance with AWWA C651, latest revision.

3. The interior of the pipe fittings and accessories shall be kept clean and free from dirt; pipe shall be cleaned before installation; and shall be protected during laying to prevent earth entering pipe.
  4. During periods when pipe laying is not in progress, open ends of laid pipe shall be protected by means of water-tight plug or other means satisfactory to the Engineer.
  5. All joints of pipe in trench shall be made up tightly before stopping work at night.
  6. After the mains are laid and pressure tested, they shall be dechlorinated prior to flushing thoroughly, either through fire hydrants or by means of taps at the end of the mains (the taps to be large enough to insure a velocity of at least 2.5 f.p.s. in the mains). Should the flushed water not be dechlorinated, it shall be put into a temporary holding basin for natural dechlorination.
  7. The mains shall be chlorinated (after flushing) with sufficient liquid chlorine, or powdered chlorine, to provide at least 50 mg/L available chlorine to the water in the mains.
    - a. The chlorine solution shall remain in the pipe at least 24 hours and then flushed until main is filled with water having normal chlorine residual.
    - b. Samples for bacteriological examination by the State Health Department shall be taken on consecutive days (two sets of samples taken 24 hours apart) by the Contractor and delivered to the State Health Department; and if the water quality does not meet the standards of the Health Department, the disinfection process shall be repeated until satisfactory water is obtained.
    - c. Samples for bacteriological examination shall be collected at not greater than 2,000 foot intervals along transmission mains.
  8. The Contractor shall furnish all chemical feed pumps, generator sets, valves, connections, materials, labor and equipment required for proper disinfection of the mains.
- B. Prepare reports of purging and disinfecting activities.

END OF SECTION 22 11 13



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Northport, Alabama  
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**ELECTRICAL SPECIFICATION INDEX:**

SECTION NO.....	SECTION DESCRIPTION
<a href="#"><u>26 05 00</u></a> .....	BASIC ELECTRICAL MATERIALS AND METHODS
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# DIVISION 26/27 ELECTRICAL



1/30/2024

## **SECTION 26 05 00 - BASIC ELECTRICAL MATERIALS AND METHODS**

### **PART 1 - GENERAL**

#### **1.1. DESCRIPTION**

##### **A. General Conditions:**

1. The accompanying General Conditions (front-end specifications) shall apply to and form a part of this section.

##### **B. General Requirements:**

1. Carefully examine General Conditions, other specification sections, and other drawings (in addition to Electrical) in order to be fully acquainted with their effect on electrical work.
2. Do all work in compliance with all applicable codes, laws, and ordinances, the National Electrical Safety Code, the National Electrical Code (hereinafter referred to as "Code"), applicable energy codes, and the regulations of the local utility companies. Obtain and pay for any and all required permits, inspections, certificates of inspections and approval, and the like.
3. Cooperate with other trades and contractors at job. Perform work in such manner and at such times as not to delay work of other trades. Complete all work as soon as the structure and installations of equipment will permit. Patch, in a satisfactory manner and by the proper craft, any work damaged by electrical workmen.
4. The Owner shall be provided access to all software to include copies of software for all systems provided under this division of the specifications. Software shall be password protected where applicable.
5. Only qualified electrical sub-contractors will be allowed to submit proposals for this project. In order to be considered qualified, contractor shall have completed a minimum of five (5) projects of similar type/scope and equal or greater magnitude and complexity within the last ten (10) years. Sub-contractors without qualifications will be rejected. If desired, potential electrical sub-contractors may submit qualification evidence for review and pre-bid approval a minimum of ten (10) days prior to bid. Previous projects used to meet this experience requirement must have included similar (or greater) scopes of work for each of the following areas:
  - a. Power Systems.
  - b. Control Systems.
  - c. Instrumentation Systems.
6. Electrical contracting firm shall be licensed as an electrical contractor in the state where work will be performed

#### **1.2. GENERAL SCOPE OF ELECTRICAL WORK (REFER TO DRAWINGS FOR OTHER SPECIFIC SCOPE ITEMS)**

- ##### **A. Furnish all labor and materials to complete electrical work as shown on drawings and/or herein specified.**

- ##### **B. Remove all existing electrical equipment and wiring made obsolete by this project and remove or relocate all electrical services located on or crossing through the project property, either above or below grade, which would obstruct the construction of the project or conflict in any manner with the completed project or any code pertaining**

thereto. Dispose of salvageable materials as directed by the Engineer. Contractor shall schedule meeting to review scope of electrical demolition and to confirm scope and phasing of proposed demolition with the owner in the presence of the prime consultant prior to start of any electrical demolition.

- C. Furnish and install complete power distribution system as shown on drawings and/or specified herein.
- D. Furnish and install complete electrical grounding systems as shown on drawings and/or specified herein.
- E. Install and connect electrical equipment mentioned in Division 26/27/28 Specifications or noted in drawings, whether furnished by electrical contractor or by others.
  - 1. Where shown or specified, equipment furnished by others shall be installed and connected under this Contract.
  - 2. Where shown or specified, Contractor shall receive, unpack, check and assume custody of equipment furnished by Others. Contractor shall assume responsibility for care and safekeeping of this equipment, when delivered into his custody. He shall protect it from moisture, dust and damage during construction and until Owner acceptance of project.
- F. Furnish and install complete electrical lighting systems as shown on drawings and/or specified herein.
- G. Furnish and install all electrical items shown on drawings and/or herein specified, unless shown or specified otherwise.
- H. Furnish and install complete controls, instrumentation & auxiliary systems as shown on drawings and/or specified herein.
- I. Procure and pay for permits and certificates as required by local and state ordinances and fire underwriter's certificate of inspection.
- J. Balance loads as equally as practicable on services, distribution feeders, circuits and buses. Provide typewritten directory for each panel.
- K. Unless specifically indicated or required otherwise, terminate all circuitry/cabling provided within this contract at associated equipment/devices/etc. in accordance with all applicable codes, standards and supplier requirements, whether associated equipment/device/etc. is furnished within this contract or by others.
- L. Complete field testing, adjustment & startup of all systems listed above as shown on drawings and/or specified herein.

## **PART 2 - PRODUCTS**

### **2.1. APPROVED MATERIALS AND DEVICES**

- A. Where not otherwise specified, provide only new, standard, first-grade materials/systems throughout, conforming to standards established by Underwriter's Laboratories, Inc., and so marked or labeled, together with manufacturer's brand or

trademark. All equipment/systems subject to approval of Engineer before installation. All like items and associated equipment/systems shall be of one manufacturer.

- B. To ensure proper coordination, it is intended that all electrical equipment and materials specified in Division 26/27/28 of these specifications and shown on the electrical drawings be furnished and installed by the electrical sub-contractor. It will not be permissible for any of these items to be furnished directly by the general contractor without the electrical contractor's coordination.

## 2.2.

### 1. SUBMITTALS

- B. All submittals to the design team shall be accompanied by a letter summarizing all proposed deviations from specified products or pre-approved substitutions. The absence of such a letter shall be understood to indicate that the contractor intends to meet all contract requirements, regardless of cut-sheets/data-sheets provided within the submittal.
- C. Submit to Engineer ten (10) days prior to bid date three (3) copies of any items and/or manufacturers which are proposed as substitutes for those specified.
- D. Submit to Engineer promptly after award of Contract and prior to purchasing, the number of copies required by the contract. All drawings of a specific item or system shall be made in one submittal, and within thirty (30) days after award of Contract. Shop drawings of all power equipment shall contain exact details of device placement, phasing and numbering, in form of elevations, for each major piece of equipment. Shop drawings shall be submitted on the following:
  - 1. SECTION 26 24 17: LIGHTING PANELBOARDS
  - 2. SECTION 26 29 00: MANUFACTURED CONTROL PANELS
  - 3. SECTION 26 44 00: ELECTRICAL HEAT TRACING SYSTEMS
  - 4. SECTION 26 50 00: LIGHTING MATERIALS AND METHODS
  - 5. SECTION 27 60 05: INSTRUMENTATION
  - 6. ALL POWER DISTRIBUTION EQUIPMENT (i.e. SWITCHBOARDS, PANELBOARDS, DRY TYPE TRANSFORMER, ETC.)
  - 7. ALL CONTROL ITEMS & SYSTEMS
- E. The contractor shall fully review, comment upon and correct all shop drawings as required to assure compliance with contract documents prior to submittal to Engineer. The failure of the contractor to properly review and correct shop drawings prior to submittal will result in rejection of shop drawings by the engineer. Review by the Engineer will be for general conformance with contract documents. The contractor shall be fully responsible for correctness of all submitted dimensions, details, quantities and locations.
- F. None of the above items shall be installed until shop drawings or catalog data have been reviewed by Engineer without rejection or required resubmittal. Any listed item not submitted, even if specified, shall be considered not acceptable and shall be removed if directed.
- G. Any required resubmittal will be reviewed by the Engineer for conformance with previously issued comments only. The contractor shall be responsible for verifying

that all items not specifically requiring resubmittal have not been altered from the previously reviewed submittal.

- H. Material proposed for substitution shall be of the same quality, perform the same functions, conform to such physical dimensions and appearance as are required by the Engineer. All material proposed for substitution is subject to the approval of the Engineer and his authority for approval is final. No material proposed for substitution will be considered unless all submittal data complies with the drawings and specifications of Section 16 as to time of submission, number of copies of submittal, and detail requirements.
- I. Samples of material shall be furnished where required by drawings or Division 26/27/28 Specification, or as requested by the Engineer on items proposed as substitutes.
- J. Submit to Engineer a certificate of final inspection from local inspection department.

### **PART 3 - EXECUTION**

#### **3.1. SITE VISIT**

- A. The Contractor shall visit the site to determine existing dimensions and conditions affecting electrical work. Failure to do so in no way relieves Contractor of his responsibility under Contract.

#### **3.2. WORKMANSHIP**

- A. All work shall be in accordance with the latest editions of NFPA 70 (National Electrical Code), NFPA 101 (Life Safety Code), National Electric Safety Code, International Building Code, applicable NECA standards and the rules and regulations of State and Local Authorities Having Jurisdiction.
- B. All work shall be executed in a workmanlike manner and shall present a neat and mechanical appearance upon completion.
- C. All equipment, devices, etc. shall be installed in accordance with manufacturer's recommendations.
- D. All items shall be installed straight and plumb in a workmanlike manner and care shall be exercised so that like items are mounted the same position, heights and general location.
- E. Keep site clean of accumulation of cartons, trash and debris.

#### **3.3. SAFETY**

- A. The contractor is solely responsible for all job safety. Engineer assumes no responsibility for job safety. Maximum consideration shall be given to job safety and only such methods as will reasonably insure the safety of all persons shall be employed. The codes and regulations of OSHA shall be given strict compliance as well as such other codes, laws, and regulations as may be applicable.

### 3.4. CONTRACT DOCUMENTS

- A. Contract documents indicate diagrammatically, extent, general character and approximate location of work. Where work is indicated but minor details omitted, furnish and install it complete so as to perform its intended functions. For details and mechanical equipment, follow drawings provided by other disciplines (Architectural, Mechanical, Structural, Civil, etc.) and fit electrical work thereto.
- B. Contract documents consist only of the hardcopy documents issued by the Prime Engineer. Electronic documents issued directly by the electrical engineer to the contractor and/or its sub-contractors/vendors are issued for convenience only (electronic documents are not formal contract documents).
- C. If the contractor and/or one of its suppliers require a one-time transfer of electronic files of the current electrical construction documents to prepare shop drawings (or for another similar purpose), it shall:
  - 1. Sign a waiver prepared by the electrical engineer prior to the transmittal of these files.
  - 2. Agree to pay the electrical engineer a fee of \$50.00 per drawing, up to a maximum of \$400 per transfer, payable upon receipt of the files.
  - 3. To the fullest extent permitted by law, indemnify, hold harmless, and defend JRA from all claims, damages, losses and expenses, including attorneys' fees arising out of or resulting from the use of the CAD files.
- D. Take finish dimensions at job in preference to scaled dimensions.
- E. Except as above noted, make no changes in or deviations from work as shown or specified except on written order of Engineer.

### 3.5. UNDERGROUND UTILITY/EQUIPMENT COORDINATION

- A. Prior to commencement of work, verify exact locations of all existing or proposed underground utilities and/or underground equipment and verify that proposed electrical installation does not conflict with these items. Notify Engineer immediately if any conflict is found.

### 3.6. EQUIPMENT STORAGE

- A. Store all electrical equipment in dry, covered locations as directed by equipment manufacturers. Contractor shall be responsible for replacing or repairing improperly-stored equipment as directed by Engineer.

### 3.7. EXCAVATION, CUTTING AND PATCHING

- A. Perform all cutting and excavating as necessary for installation of electrical systems, unless specifically covered under another section. After Engineer's observation, complete all excavation, filling and backfilling as directed under specifications for preparation of site and earthwork. Foundations for equipment shall be as specified under concrete section. Concrete pads shall be minimum of 6" thick; unless greater thickness required by equipment manufacturer. Obtain specific approval of Engineer before cutting into any structural members.

- B. For all such work employ competent workmen, and finish up in neat and workmanlike manner, equal to quality and appearance to adjacent work.

### 3.8. PENETRATIONS

- A. All penetrations in water tight barriers shall be made so that barrier rating is not compromised. Furnish roof flashing for all equipment installed under Division 26/27/28 that penetrates through the roof. Appropriate flashing is specified under roofing and sheet metal section. Supply these flashings for installation under roofing and sheet metal section.
- B. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly to maintain the fire/smoke rating of the associated membrane.
- C. Where penetrations are required through structural elements, verify penetration locations and sizes with structural engineer. In no case shall the structural integrity be compromised without written approval from structural engineer.

### 3.9. INSTALLATION OF EQUIPMENT - GENERAL

- A. Care shall be exercised in exact routing and location of all items so as not to obstruct access to equipment, personnel walkways, or expose it to potential mechanical damage.
- B. Items shall be securely anchored and/or fastened. Provide proper support for all equipment, devices, conduits, boxes, panels, etc. as required by code and for a workmanlike installation. Provide guy wiring for wood poles where required to prevent leaning. All construction shall meet the seismic design requirements of the building code. Items (especially transformers, light fixtures, equipment racks, freestanding gear, etc.) installed in seismic zones C, D, E or F shall be supported and braced per applicable codes and standards.
- C. All wall, pole or frame-mounted electrical equipment shall be mounted to metal unistrut (or similar) frames of same material as electrical equipment. For example, pole-mounted stainless steel disconnect switches shall be mounted to stainless steel unistrut frames.
- D. All electrical equipment, furnished by Contractor or by others shall be covered and protected during construction.
- E. All control cabinets, panels, motor control centers and other electrical cabinets and enclosures shall have all trash removed and be vacuumed clean. All foreign paint, etc., shall be removed from exterior and all scratches in finish touched up with same color and material as original. Any rusted areas shall be sanded, primed and repainted.
- F. All relays, starters, push-button and other control devices shall be cleaned and if necessary, lubricated with CRC 2-26 to assure free operation.

### 3.10. MOTORS, STARTERS AND CONTROLS



- A. Unless otherwise specified or shown, all motors will be furnished and installed under other sections of this specification.
- B. Electrical Contractor shall install all starters and all electrical power wiring and connections to motors and starters.
- C. Unless otherwise specified or shown, all control items for motors shall be furnished, installed and wired in conduit by the electrician.

### 3.11. CIRCUITS AND BRANCH CIRCUITS

- A. Outlets shall be connected to branch circuits as indicated on drawings by circuit numbers. No more outlets than are indicated shall be connected to a circuit.
- B. Branch circuit homeruns shall be installed as shown on drawings. Multiple homerun conduits shall not be combined by contractor into larger, single homerun conduits unless specific permission is granted by the Engineer.

### 3.12. LUG/TERMINAL RATINGS

- A. All lug/terminal ratings, sizes, locations, types, etc. shall be coordinated with the associated conductor sizes, types, routings, etc. by the contractor.
- B. All lugs/terminals/etc. shall be rated for 75 degree C terminations (minimum, unless specified otherwise).

### 3.13. EQUIPMENT FAULT CURRENT RATINGS

- A. All equipment and breakers shall meet the minimum RMS symmetrical interrupting capacity ratings shown on plans for the associated distribution equipment. All interrupting ratings shall be full ratings. Where new devices or breakers are added to existing distribution equipment, the new devices/breakers shall have interrupting ratings matching or exceeding that of the existing distribution equipment.

### 3.14. OUTLET LOCATION

- A. Symbols shown on drawings and mounting heights indicated on drawings and in specifications are approximate only. The exact locations and mounting height must be determined on the job and it shall be the Contractor's responsibility to coordinate with other trades to insure correct installation.

### 3.15. IDENTIFICATION

- A. Each panel shall have each circuit identified. Panels without branch circuit nameplates shall have typewritten directories.
- B. Each individually mounted switch, circuit breaker, starter and/or any other control or protective device shall identify equipment fed and fuse size, if any, by engraved plastic nameplate, white with black letters, screw attached.
- C. See Specification Section 26 05 53 for additional requirements.

3.16. GROUNDING

- A. All equipment shall be grounded and bonded in accordance with all state/local regulations, The National Electrical Code and as specified herein.

3.17. PAINTING

- A. Refer to Painting/Finishing specifications for requirements regarding field painting of exposed conduit. Any scratches, dents or rust spots in conduit electrical enclosures, panels, motor control or any other electrical items shall have the dents removed, and they, along with any rust spots or scratches, sanded and touched up with the same exact color paint as original finish.

3.18. ACCEPTANCE TESTING

- A. Upon completion of work, the entire electrical system installed within this project shall be tested and shall be shown to be in perfect working condition, in accordance with the intent of the specifications and drawings. It shall be the responsibility of the Electrical Contractor to have all systems ready for operation and to have an electrician available to operate same in accordance with and under the supervision of the observation representative(s) of the Engineer. The Electrician shall be available to assist in removal of panel fronts, etc., to permit inspection as required.
- B. The electrical sub-contractor shall include in bid price start-up assistance and training from a certified representative of the manufacturer for the following systems:
  - 1. SECTION 26 44 00: ELECTRICAL HEAT TRACING SYSTEMS
  - 2. SECTION 27 60 05: INSTRUMENTATION

3.19. OPERATION AND MAINTENANCE DATA

- A. One set of marked "AS BUILT" drawings, three (3) sets of all equipment catalog and maintenance data and three (3) sets of all final shop drawings, on all equipment requiring same shall be turned over to owner. These items shall be bound in hard back book. Contractor shall explain and demonstrate all systems to Owner's representative.

3.20. GUARANTY-WARRANTY

- A. Furnish a written Guarantee-Warranty, countersigned and guaranteed by General Contractor, stating:
  - 1. That all work executed under this section will be free from defects of workmanship and materials for a period of one (1) year from date of final acceptance of this work.
  - 2. Above parties further agree that they will, at their own expense, repair and replace all such defective work, and all other work damaged thereby, which becomes defective during the term of the Guaranty-Warranty.

END OF SECTION 26 05 00

## **SECTION 26 05 19 - POWER CONDUCTORS AND CABLES 51V-600V**

### **PART 1 - GENERAL**

#### 1.1. DESCRIPTION

- A. Power Wires and Cables
- B. Low Voltage Wires and Cables

### **PART 2 - PRODUCTS**

#### 2.1. POWER WIRES AND CABLES - 600 VOLT

- A. General: Conductors shall have current carrying capacities as per N.E.C. and with 600 volt insulation, #12 minimum except for controls and fixture wire. Conductors shall be copper.
- B. General Application (see below for exceptions):
  - 1. At or Below Grade (including within slab-on-grade):
    - a. #8 or larger conductors:
      - 1) XHHW or RHH/RHW/USE stranded (in conduit).
    - b. #10 or smaller conductors for circuits terminating at motors:
      - 1) THHN/THWN or XHHW stranded (in conduit).
    - c. #10 or smaller conductors (excluding circuits terminating at motors):
      - 1) THHN/THWN or XHHW solid (in conduit).
  - 2. Above Grade:
    - a. #8 or larger conductors:
      - 1) THHN/THWN, XHHW or RHH/RHW/USE stranded (in conduit).
    - b. #10 or smaller conductors for circuits terminating at motors:
      - 1) THHN/THWN, XHHW or RHH/RHW/USE stranded (in conduit).
    - c. #10 or smaller conductors (excluding circuits terminating at motors):
      - 1) THHN/THWN, XHHW or RHH/RHW/USE solid (in conduit).
  - 3. Power Wire and cable shall be as manufactured by Southwire, Rome, Encore Wire, American Insulated Wire, Okonite, Phelps-Dodge, Americable, Aetna or approved equal.
- C. Class 1 Control Cabling (120VAC Control Circuits, Etc.)
  - 1. Unless specified otherwise, Class 1 control cabling shall:
    - a. Be rated for exposed cable tray installation.
    - b. Be plenum rated (Class 1 Control cabling and Instrumentation cabling installed in conduit or exposed in cable tray in non-plenum areas is not required to be plenum-rated).
    - c. Be UL-rated for the proposed application.
    - d. Be multi-conductor with overall outer sheath as required by the application. The insulation of each conductor within the overall multi-conductor cable shall be uniquely color-coded. Ground conductors (when provided) within the multi-conductor cable shall have green insulation. Conductors with green insulation shall not be used for conductors other than ground.
    - e. Utilize copper conductors.

- f. Have wire gauge as required to limit voltage drop to acceptable limits determined by the system supplier and to meet all applicable code requirements.
  - g. Where installed underground, within slab-on-grade or in exterior locations, be rated for wet locations.
  - h. Where required for specific systems, meet the specific requirements (conductor quantity, wire gauge, insulation type, shielding, etc.) of the system supplier.
  - i. Be rated for 600V.
  - j. Be industrial grade.
  - k. Have stranded conductors.
  - l. Have sunlight/oil-resistant PVC/Nylon insulation and jacket with ripcord.
2. Control cabling shall be as manufactured by Belden, AlphaWire or General Cable.

## 2.2. WIRE CONNECTIONS:

- A. All connector types:
  - 1. Shall be properly rated for the proposed application by UL and per the manufacturer.
- B. At Motor Connections (within motor terminal boxes):
  - 1. Single conductor per phase: shall be made with insulated set screw connectors or 3M 5300 Series 1kV Motor Lead Connections kits with mechanical lugs as required.
  - 2. Multiple conductors per phase: shall be made with insulated mechanical lugs, rated for the associated motor cable types, by Polaris or IlSCO.
- C. Other Dry locations:
  - 1. On Wire larger than #10: shall be made with solderless, non-insulated compression-type connectors meeting requirements of Federal Specification WS-610e for Type II, Class 2 and shall be covered with Scotch #33 electrical tape so that insulation is equal to 150% of conductor insulation.
  - 2. On Wire #10 and smaller: shall be made with one of the following:
    - a. Ideal Wing Nuts or equal by 3M .
    - b. Ideal Push-In Wire Connectors (for #12 and smaller only).
- D. Other Wet/Damp locations:
  - 1. On Wire larger than #10: shall be made with underground/direct-burial, waterproof rated EPDM or TPE-insulated connectors by IlSCO, Burndy or T&B.
  - 2. On Wire #10 and smaller: shall be made with one of the following:
    - a. Ideal Weatherproof or Underground Wire Connectors pre-filled with 100% silicone sealant as required by the application.

## PART 3 - EXECUTION

### 3.1. GENERAL INSTALLATION

- A. All wires and cables shall be installed in conduit unless specifically noted otherwise.
- B. All joints and splices on wire shall be made with solderless connectors, and covered so

that insulation is equal to conductor insulation.

- C. No splices shall be pulled into conduit.
- D. No conductor shall be pulled until conduit is cleaned of all foreign matter.
- E. Wire and cable shall be neatly formed, bundled and tied in all panelboards, wireways, disconnect switches, pullboxes, junction boxes, cabinets and other similar electrical enclosures.
- F. All wires and cables installed in underground or other wet locations shall be rated by the manufacturer for wet locations.
- G. Network cabling shall be continuous from endpoint to endpoint and shall not be spliced unless specifically noted otherwise.
- H. All conductors/cabling (including spare conductors) shall be properly terminated unless specifically directed otherwise. See above for general termination hardware requirements.

### 3.2. POWER WIRE AND CABLE INSTALLATION:

- A. No power conductor shall be smaller than #12 except where so designated on the drawings or hereinafter specified.
- B. Multi-wire lighting branches shall be used as indicated.
- C. Where more than three current-carrying conductors are installed in a single raceway or cable, conductors shall be derated as indicated in NEC Table 310.15(B)(3)(a).
- D. Raceways/cables shall generally not be installed exposed to sunlight on roofs unless specifically required. Where raceways or cables are installed exposed to sunlight on roofs, conductors shall be derated with ampacities adjusted per NEC Table 310.15(B)(3)(c).
- E. In installing parallel power conductors, it is mandatory that all conductors making up the feeder be exactly the same length, the same size, the same type of conductor with the same insulation. Each group of conductors making up a phase or neutral must be bonded at both ends in an approved manner.
- F. In installing overhead main power services, a minimum of 5'-0" of cable per run shall be extended beyond the weatherhead(s) for connection to service drop. Confirm exact requirements with local utility company.

### 3.3. WIRE CONNECTIONS

- A. See Part 2 above for material types.
- B. Aluminum Wire Connections:
  - 1. Where aluminum wiring is allowed, connections shall utilize compression fittings, no exceptions (Anderson Versa Crimp or equal).

- C. Any stranded wire connection to wiring devices shall be made with crimp type terminals.
- D. All electrical connections and terminals shall be tightened according to manufacturer's published torque-tightening values with calibrated torque wrenches as required to clearly indicate final torque value to the contractor. Where manufacturer's torque values are not provided, those specified in UL 486A & 486B shall be used.
- E. All connections and connector types shall be installed in strict compliance with all requirements of the connector manufacturer.
- F. Under no condition shall the specified conductors be connected to terminals rated less than 75°C. Where conductors sized #1 or smaller are shown to be terminated at equipment and the terminals of that equipment are rated for less than 75°C, contractor shall install junction box near equipment to capture the specified conductors, splice with compression connections (rated for a least 75°C) and extend conductors with ampacity rating as required by NEC (based on terminal temperature rating) to equipment terminals. The length of the conductors to be terminated shall be as directed by the AHJ but not less than 48 inches.

#### 3.4. SHIELDED CABLE INSTALLATION

- A. Shielded instrumentation (low voltage) cables:
  - 1. The outer foil of shielded instrumentation cables shall be grounded at the PLC/control panel end only (not at the field device end) with a termination kit as directed by the PLC/control panel supplier.

#### 3.5. LOW VOLTAGE (LESS THAN 50V) CONTROL AND NETWORK CABLE INSTALLATION:

- A. All wires and cables shall be installed in conduit unless specifically noted otherwise. Low voltage control and/or network cabling located within concealed, accessible ceiling spaces (such as above lay-in ceilings) may be run without conduit if the following requirements are met:
  - 1. Cabling shall be plenum-rated, multi-conductor.
  - 2. Cabling shall be supported by cable tray or with J-hook supports on intervals not to exceed 5'-0" on center. Cabling shall be supported solely from the cable tray or j-hooks supported from the building structure, without using piping, ductwork, conduit or other items as supports.
  - 3. Cabling shall be properly bundled with plenum-rated Velcro straps on intervals not to exceed 30" on center.
  - 4. Properly-sized conduit(s) shall be provided wherever cabling enters an inaccessible or exposed area (such as above gyp board ceilings or through walls). End bushings shall be provided on both ends of all raceway terminations. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly.

#### 3.6. CIRCUITS AND BRANCH CIRCUITS

- A. Outlets shall be connected to branch circuits as indicated on drawings by circuit number adjacent to outlet symbols, and no more outlets than are indicated shall be

connected to a circuit.

### 3.7. LABELING AND COLOR CODING OF WIRE AND CABLE

- A. Refer to Specification Section 26 05 53 for all labeling requirements.
- B. A color coding system as listed below shall be followed throughout the network of branch power circuits as follows:

PHASE	120/208/240/ COLOR	120/240 HIGH LEG DELTA COLOR	277/480 VOLT COLOR
A	BLACK	BLACK	BROWN
B	RED	ORANGE (FOR HI- LEG)	ORANGE
C	BLUE	BLUE	YELLOW
NEUTRAL	WHITE	WHITE	GRAY
GROUND	GREEN	GREEN	GREEN

- C. Where dedicated neutrals are installed for multi-wire branch circuits, the neutral conductors shall be color coded as follows:

PHASE	120/208/240/ COLOR	120/240 HIGH LEG DELTA COLOR	277/480 VOLT COLOR
NEUTRAL A	WHITE W/ BLACK TRACER	WHITE W/ BLACK TRACER	GRAY W/ BROWN TRACER
NEUTRAL B	WHITE W/ RED TRACER	WHITE W/ ORANGE TRACER (FOR HI-LEG NEUTRAL)	GRAY W/ ORANGE TRACER
NEUTRAL C	WHITE W/ BLUE TRACER	WHITE W/ BLUE TRACER	GRAY W/ YELLOW TRACER

- D. Control Conductors: Shall be color coded by use of colored “tracers”. No control circuit shall contain two identical conductors. For example, a set of five (5) control conductors for a pushbutton station represents one (1) control circuit which would require five (5) uniquely-colored control conductors.

### 3.8. TESTING

- A. The insulation resistance of all feeder conductors (feeding electrical distribution equipment such as switchboards, panelboards, transfer switches, transformers, etc.) shall be tested at the load side of the feeder breaker with a 1000-volt DC Megger Tester prior to energization or final termination. Any feeder conductor with an insulation resistance less than the recommended minimums in the latest version of NETA Acceptance Testing Specification (“ATS”) standard shall be replaced by the contractor at the contractor’s expense. All final test results shall be clearly documented (with date, time, feeder, results, test equipment, etc.), and the final test results shall be submitted to the design team for review.

END OF SECTION 26 05 19



## **SECTION 26 05 26 - GROUNDING**

### **PART 1 - GENERAL**

#### 1.1. GENERAL

- A. THE WORK UNDER THIS SECTION INCLUDES BUT IS NOT LIMITED TO GROUNDING OF THE FOLLOWING:
1. Service Equipment.
  2. Transformers.
  3. Non-current carrying conductive surfaces of equipment.
  4. Metal Buildings.
  5. Structures.
  6. Other Equipment.

#### 1.2. GENERAL REQUIREMENTS

- A. All equipment, building steel, and main service shall be effectively and permanently grounded with a conductor cross section as required by the National Electrical Code and of capacity sufficient to insure continued effectiveness of the ground connections for fault current. Ground conductors shall be as short and straight as possible, protected from mechanical injury and, if practicable, without splice or joint.
- B. All grounding connections shall be installed in accordance with the National Electrical Code and all local codes and requirements. Such codes shall be considered minimum requirements and the installation of the grounding system shall insure freedom from dangerous shock voltage exposure and provide a low impedance ground fault path to permit proper operation of overcurrent and ground fault protective devices.

### **PART 2 - PRODUCTS**

#### 2.1. CONDUCTORS

- A. All grounding conductors shall be insulated with green colored, 600 volt insulation unless noted otherwise.
- B. Motors having power supplied by single conductor wire in conduit shall be grounded through the conduit system. Flexible conduit shall be "jumped" by an appropriate bonding conductor.
- C. Supplemental grounding system conductors shall be bare, softdrawn, stranded, single conductor copper wire, and generally sized as follows (unless shown otherwise on plans):
1. Switchgear, motor control centers, and power transformer #4/0 minimum or as shown on plans.
  2. Power panels, #2/0.
  3. Control panels and consoles, #4.
  4. Process Motors, #1/0.
  5. Building Columns, #4/0.

#### 2.2. GROUNDING ELECTRODES

- A. Grounding electrodes shall be copper-clad steel rods 3/4 inch in diameter and ten feet long. Where longer electrodes are necessary to reduce the ground resistance, Contractor shall provide sectional rods, connectors, drive heads, etc.

### 2.3. CONNECTIONS

- A. All conductor-to-conductor, conductor-to-ground rod, conductor-to-structure, conductor-to-fence connections of #6 and larger sized conductors and underground ground connections shall be permanent exothermic welded connections (Cadweld or equal) unless otherwise noted on applicable drawings.
- B. Connections to equipment shall be by bolted compression type lugs (except for motors). When the conductor is #6 and larger, the lug shall be joined to the conductor by an exothermic weld (Cadweld or equal).
- C. Motors to be grounded by the grounding conductors run with the power conductors shall have a split-post grounding stud installed in the connection box.
- D. Each cast pull box or junction box shall have a ground lug, connected to largest ground conductor to enter box.
- E. Ground connections at conduit terminations shall be made by approved grounding bushings (see Raceways Specification Section for additional requirements).

### 2.4. MANUFACTURERS

- A. Conduit clamps and connectors shall be manufactured by Raco, OZ., or Ercon.
- B. Lugs shall be as manufactured by Square "D", Burndy, or T and B.
- C. Exothermic weld connections shall be as manufactured by Cadweld, or approved equal.
- D. Ground rods shall be as manufactured by Joslyn or McGraw Edison.
- E. Split post grounding shall be as manufactured by Burndy or T and B.

## **PART 3 - EXECUTION**

### 3.1. TRANSFORMER GROUNDS

- A. Dry type insulation transformers with a grounded conductor in the secondary shall be grounded in accordance with N.E.C. Section 250-30.

### 3.2. EXPOSED NON-CURRENT-CARRYING METAL PARTS

- A. General: Ground connections to equipment or devices shall be made as close to the current carrying parts as possible, that is, to the main frame rather than supporting structures, bases or shields. Grounding connections shall be made only to dry surfaces that are clean and dry. Steel surfaces shall be ground or filed to remove all scales, rust, grease, and dirt. Copper and galvanized steel shall be cleaned to remove

oxide before making welds or connections. Code size ground conductors shall be run in all power conduits and properly terminated at each end.

- B. Ground conductors shall be routed as straight as possible. Where possible, ground conductors shall be routed such as to avoid bends exceeding 90 degrees or with a radius of less than 8”.
- C. Motors: Exposed non-current-carrying metal parts, shall be grounded by a grounding conductor either run with power conductors, and/or separate grounding conductors. Drawings will show method(s) to be used. The ground conductors with all motor conductors shall be connected to the ground buss in the motor connection box. Jumper connections shall be installed between frames and rigid conduit for equipment having flexible conduit connections (sealtight). All AC motor grounds shall provide a low impedance path to ground. Connections from the supplemental grounding system (when specified) shall be made directly to the motor frame. Additionally, utilization equipment connected to the motor (pump, fan, mixer, etc.) shall be bonded to the motor with flexible braid-type bonding strap to ensure equalization of ground potentials.
- D. Raceways & boxes: All raceways, conduits, armored or shielded cable and all exposed non-current carrying metal parts shall be grounded. Such items shall be bonded together and permanently grounded to the equipment ground buss. Metallic conduits shall be connected by grounding or clamps to ground buss. Flexible “jumpers” shall be provided around all raceway expansion joints. Bonding straps for steel conduit shall be copper. Jumper connections shall be provided to effectively ground all sections or rigid conduit connected into plastic pipe. No metallic conduit shall be left ungrounded. In conduit systems interrupted by junction or switch boxes where locknuts and bushings are used to secure the conduit in the box, the sections of conduit and box must be bonded together. If conduit, couplings or fittings have a protective coating or non-conductive material, such as enamel, such coating must be thoroughly removed from threads of both couplings and conduit and the surface of conduit or fitting where the ground clamp is secured.
- E. Enclosures: Metal conduits entering free standing motor control centers, switchboards or other free standing equipment shall be grounded by bare conductors and approved clamp. Any conduits entering low voltage (480 volts or below) equipment through sheet metal enclosure and effectively grounded to enclosure by double locknut or hub need not be otherwise bonded.
- F. Equipment: In addition to equipment grounding provisions mandated by code requirements, additional equipment grounding provisions (including local ground rods, connections, etc.) shall be provided by the contractor as directed by equipment suppliers.
- G. Both ends of ground busses in motor control centers, switchboards, etc., shall be separately connected to the main ground buss to form two separate paths to ground.
- H. Fences and Grills: Fences and metal grills around equipment carrying voltage above 500 volts between phases shall be bonded together and to ground. Fences and grill work shall be grounded at every post, column, or support, and on each side of every gate.

### 3.3. ACCEPTANCE DOCUMENTATION AND TESTING

- A. Contractor shall take and store photographs of all underground grounding system connections prior to burial of connections, for review by Engineer.
- B. Upon completion of work, the entire ground system shall be shown to be in perfect working condition, in accordance with the intent of the Specifications.
- C. Contractor shall measure the resistance between the main ground bonding jumper to true earth ground using the Fall of Potential method as described by ANSI/IEEE Standard 81 ("Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of an Earth System"). If the measured value is greater than five ohms, additional grounding electrodes shall be installed as described in Part 3.1 above. The final ground resistance value shall be submitted in writing, and documented via picture of the meter reading from the Fall of Potential test, to the Engineer prior to the final observation, and shall be included in final O&M documentation.

END OF SECTION 26 05 26

## **SECTION 26 05 33 - RACEWAYS**

### **PART 1 - GENERAL**

#### 1.1. DESCRIPTION

- A. THE WORK UNDER THIS SECTION INCLUDES BUT IS NOT LIMITED TO THE FOLLOWING:
1. Conduits
  2. Conduit Fittings
  3. Couplings & Connectors
  4. Bushings
  5. Raceway Hardware, Conduit Clamps & Supports
  6. Watertight Entrance Seal Devices

### **PART 2 - PRODUCTS**

#### 2.1. CONDUITS

- A. PVC-Coated Rigid Steel:
1. The PVC coated rigid metal conduit must be UL Listed. Hazardous location fittings, prior to plastic coating must be UL listed. All conduit and fittings must be new, unused material. Applicable UL standards may include: UL 6 Standard for Safety, Rigid Metal Conduit, UL514B Standard for Safety, Fittings for Conduit and Outlet Boxes.
  2. The PVC-coated rigid metal conduit shall be ETL PVC-001 listed.
  3. The conduit shall be hot dip galvanized inside and out with hot galvanized threads.
  4. Form 8 Condulets®, 3/4" through 2" diameters, shall have a tongue-in-groove "V-Seal" gasket to effectively seal against the elements. The design shall be equipped with a positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 in. of mercury (vacuum) for 72 hours shall be available.
  5. A PVC sleeve extending one pipe diameter or two inches, whichever is less, shall be formed at every female fitting opening except unions. The inside sleeve diameter shall be matched to the outside diameter of the conduit.
  6. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs 40 mils in thickness to protect the coating from tool damage during installation.
  7. Form 8 Condulets® shall be supplied with plastic encapsulated stainless steel cover screws.
  8. A urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. Conduit or fittings having areas with thin or no coating shall be unacceptable.
  9. The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above 30deg.F (-1deg.C).
  10. All male threads on conduit, elbows and nipples shall be protected by application of a urethane coating.
  11. All female threads on fittings or conduit couplings shall be protected by application of a urethane coating.

12. Independent certified test results shall be available to confirm coating adhesion per ETL PVC-001 standards under the following conditions:
    - a. Conduit immersed in boiling water with a minimum mean time to adhesion failure of 200 hours. ASTM D870)
    - b. Conduit and conduit exposure to 150deg F (65deg C) and 95% relative humidity with a minimum mean time to failure of 30 days. (ASTM D11513.
    - c. The interior coating bond shall be confirmed using the Standard Method of Adhesion by Tape Test (ASTM D3359).
    - d. No trace of the internal coating shall be visible on a white cloth following six wipes over the coating which has been wetted with acetone (ASTM D1308).
    - e. The exterior coating bond shall be confirmed using the methods described in Section 3.8, NEMA RN1.
    - f. After these tests the physical properties of the exterior coating shall exceed the minimum requirements specified in Table 3.1, NEMA RN1.
  13. Water tight flex connectors used in areas where PVC coated metal conduit is utilized shall be PVC coated also.
  14. Shall be as manufactured by Perma-Cote, Plastibond, Korkap, Ocal or Okote.
- B. Rigid Galvanized Steel and I.M.C.:
1. Shall be galvanized outside and inside by hot dipping.
  2. Shall be as manufactured by Republic, Wheatland, Triangle, Pittsburg Standard, Youngstown, Allied or equal.
- C. E.M.T.:
1. Shall be Electro-Galvanized.
  2. Shall be as manufactured by Republic, Wheatland, Triangle, Pittsburg Standard, Youngstown, Allied or equal.
- D. Rigid Aluminum:
1. Shall be manufactured of 6063 Alloy, T-1 temper.
  2. Shall be as manufactured by Republic, Wheatland, Triangle, Pittsburg Standard, Youngstown, Allied or equal.
- E. Schedule 40 and 80 PVC:
1. Shall be composed of polyvinyl chloride and shall be U.L. rated type 40 or 80 for use with 90 degree rated conductors. Conduit shall conform to NEMA Standards and applicable sections of N.E.C.
  2. The conduit manufacturer shall have had a minimum of 5 years experience in the manufacture of the products. Non-metallic raceways shall be as manufactured by Carlon, Triangle, Can-Tex, Allied or equal.
- F. HDPE Innerduct
1. Shall be composed high density polyethylene and shall be orange in color, unless noted otherwise.
  2. Shall be corrugated unless noted otherwise.
  3. Shall be manufactured by Carlon, Ipex or equal.
- G. Flexible Metallic Conduit:
1. Shall be continuous spiral wound and interlocked galvanized material, code approved for grounding.

- H. Liquidtight Flexible Metallic Conduit:
  - 1. Shall be galvanized steel-core sealtite, code approved for grounding.
  - 2. Shall have an outer liquidtight, nonmetallic, sunlight-resistant jacket over an inner flexible metal core.
  - 3. Shall be as manufactured by Electric-Flex, Anaconda or equal.

## 2.2. FITTINGS, COUPLINGS & CONNECTORS

- A. Rigid Galvanized Steel and I.M.C. couplings and connectors shall be standard threaded type, galvanized outside and inside by hot dipping. Threadless and clamp type are not acceptable. Couplings/connectors shall be as manufactured by Raco, Efcor, or Appleton or equal.
- B. All fittings, couplings and connectors (**including, but not limited to, conduit couplings, connectors, hubs, nipples, unions, expansion fittings, explosion proof seal-offs, threaded hole closures, and seal-tight connectors, etc.**) used in areas where PVC-Coated Rigid conduit is used shall also be PVC-coated.
- C. All fittings, couplings and connectors (**including, but not limited to, conduit couplings, connectors, hubs, nipples, unions, expansion fittings, explosion proof seal-offs, threaded hole closures, and seal-tight connectors, etc.**) installed in other wet, exterior or process areas where PVC-coated conduit systems are not required, shall be aluminum or stainless steel type. Standard steel fittings will not be acceptable.
- D. All rain tight connectors shall be threaded Myers or approved equal, rated for outdoor application.
- E. E.M.T. couplings and connectors shall be set screw, or steel compression type. All couplings and connectors shall be 720B, 730, 750B, or 760 series of Efcor or equal series of Raco. Pressure indented type connectors or cast metal will not be approved for any location. E.M.T. couplings and connectors shall be as manufactured by O-Z/Gedney, T&B, Efcor, Raco, Midwest or equal. E.M.T. fittings, couplings and connectors located within concrete (where allowed) shall be compression type and shall be adequately sealed with tape to ensure a concrete-tight seal.
- F. Rigid Aluminum couplings and connectors shall be standard threaded type, of the same alloy as the associated conduit. Threadless and clamp type are not acceptable. Fittings shall be as manufactured by Thomas & Betts, Crouse-Hinds, Appleton, Pyle-National or equal.
- G. All PVC couplings, adapters, end bells, reducers, etc., shall be of same material as conduit.
- H. Liquidtight Flexible Metallic Conduit connectors shall be liquidtight with insulating throat or end bushing, designed for application with Liquidtight Flexible Metallic Conduit. Fittings shall be as manufactured by Efcor, Raco, Midwest or equal.
- I. All LB unilets sizes 1 ¼" or larger shall have rollers.
- J. Miscellaneous conduit fittings shall be as manufactured by Appleton, Crouse-Hinds,

Pyle-National, Russell & Stoll or equal.

### 2.3. BUSHINGS

- A. All non-grounding rigid bushings 1-1/4" and larger shall be the insulating type (O-Z/Gedney type "BB" or equal by T&B, Midwest Electric or Penn Union).
- B. All non-grounding rigid bushings 1" and smaller shall be threaded malleable iron with integral noncombustible insulator rated for 150°C. Non-grounding rigid conduit bushings shall be O-Z/Gedney type "B" or equal by T&B, Midwest Electric or Penn Union.
- C. All grounding rigid bushings shall be threaded malleable iron with integral noncombustible insulator rated for 150°C. All grounding rigid conduit bushings shall be O-Z/Gedney type "BLG" or equal by T&B, Midwest Electric or Penn Union.

### 2.4. HARDWARE, CONDUIT CLAMPS AND SUPPORTS

- A. All hardware such as expansion shields, machine screws, toggle bolts, "U" or "J" bolts, machine bolts, conduit clamps and supports shall be of corrosion resistant materials (stainless steel, aluminum, galvanized or plated steel, or other approved materials).
- B. Hardware in contact with aluminum handrails, plates or structural members and all hardware in exterior, wet or corrosive areas shall be type 316 stainless steel or aluminum (with bitumastic paint coating to isolate aluminum from contact with concrete where necessary) unless specifically noted otherwise.
- C. Supports in exterior, process, wet or corrosive locations shall be type 316 stainless steel or aluminum (with bitumastic paint coating to isolate aluminum from contact with concrete where necessary) unless specifically noted otherwise.
- D. Supports in extremely corrosive environments (such as chlorine or fluoride storage rooms) shall be PVC-Coated steel unless specifically noted otherwise.
- E. Hardware and conduit clamps shall be as manufactured by Efcor, Steel City, G.A., Tinnerman or equal.

### 2.5. WATERTIGHT ENTRANCE SEAL DEVICES

- A. For new construction, seal devices shall consist of oversized sleeve and malleable iron body with sealing rings, pressure rings, sealing grommets and pressure clamps as required (O-Z/Gedney type FSK/WSK or equal).
- B. For cored-hole applications, seal devices shall consist of assembled dual pressure disks with neoprene sealing rings and membrane clamps as required (O-Z/Gedney type CSM or equal).

## **PART 3 - EXECUTION**

### 3.1. RACEWAY APPLICATION



- A. Minimum Diameter: 3/4-inch.
- B. Raceway Type: Raceway types shall be as specified below, unless indicated otherwise on drawings:
  1. Exterior, Exposed: Rigid Aluminum unless otherwise noted.
  2. Exterior, Used for Instrumentation Circuits: See Below.
  3. Other Exterior (Concrete-Encased or Direct Earth Buried): Schedule 40 PVC. PVC conduit shall convert to metallic conduit prior to exiting concrete-encasement or direct earth burial. See "transition" items below for additional requirements. Conduits shall be left exposed until after Engineer's observation.
  4. Interior, Exposed:
    - a. Hazardous Locations: Rigid Aluminum .
    - b. Wet Locations (including, but not limited to, Pump Rooms, Areas with exposed piping, Dewatering Rooms, Wet Wells, Underground Vaults, and other similar locations): Rigid Aluminum .
    - c. Dry Locations: Rigid Aluminum.
    - d. Extremely Corrosive Locations (Chlorine Storage Rooms, Fluoride Storage Rooms and other similar areas): Schedule 80 PVC.
  5. Interior, Concealed:
    - a. Embedded inside Poured Concrete Walls, Ceilings or Floors, with a minimum of 2" of concrete between finished surface and outer wall of conduit on all sides, where no anchor bolts, screws or other similar items will be installed: Schedule 40 PVC. PVC conduit shall convert to metallic conduit (exact type as specified elsewhere within this section) prior to exiting poured concrete-encasement of wall, ceiling, floor or ductbank. See "transition" items below for additional requirements.
    - b. Other Raceways Embedded inside Poured Concrete Walls, Ceilings or Floors (not meeting requirements above): PVC-Coated Rigid Steel
    - c. Other Raceways: E.M.T.
  6. Raceways used for Instrumentation Circuits:
    - a. Typical Dry or Wet Locations: Rigid Aluminum .
    - b. Underground or Locations Embedded inside Poured Concrete: PVC-Coated Rigid Steel.
    - c. Extremely Corrosive Locations (Chlorine Storage Rooms, Fluoride Storage Rooms and other similar areas): PVC-Coated Rigid Steel.
  7. Terminations at motors, transformers and other equipment which has moving or vibrating parts:
    - a. Exterior or Wet Locations (including, but not limited to, Pump Rooms, Wet Wells, Underground Vaults, and other similar locations): Liquidtight Flexible Metallic Conduit (shall generally not exceed 24 inches in length) with watertight fittings.
    - b. Dry, Interior Locations: Flexible Metallic Conduit (shall generally not exceed 24 inches in length).
  8. Terminations at instruments:
    - a. Liquidtight Flexible Metallic Conduit (shall generally not exceed 12 inches in length) with watertight fittings.
  9. Terminations at fixtures mounted in grid-type ceilings:
    - a. Flexible Metallic Conduit or MC cabling (shall generally not exceed 72 inches in length and shall run from junction box to fixture, not from fixture to fixture).

10. Transition from underground or concrete-encased to exposed:
  - a. Convert PVC to PVC-Coated Rigid Steel utilizing PVC-Coated Rigid Steel 90 degree bends (and vertical conduits as required by application) prior to exiting concrete/grade (except at outdoor pull boxes and under freestanding electrical equipment, where terminations shall be by PVC end bells installed flush with top of slab). Exposed portions of these coated conduits shall extend a minimum of 6" above floor level, and shall be installed at uniform heights.

### 3.2. RACEWAY INSTALLATION

#### A. General:

1. Follow methods which are appropriate and approved for the location and conditions involved. Where not otherwise shown, specified, or approved in a particular case, run all wiring concealed.
2. Where conduit crosses a structural expansion joint an approved conduit expansion fitting shall be installed.
3. Where any run of rigid aluminum conduit (including bends) exceeds 50' in length, an approved conduit expansion fitting shall be installed (beginning at center of run) at intervals not to exceed 50' on center.
4. A non-conductive polypropylene pull string, properly tied/secured at either end, shall be installed in all empty conduits.
5. Metal conduit field-cuts shall be cut square with a hacksaw and the ends reamed after threading.
6. PVC conduit field-cuts shall be made with hacksaw, and ends shall be deburred.
7. All PVC joints shall be made as follows:
  - a. Clean the outside of the conduit to depth of the socket, and the inside of socket with an approved cleaner.
  - b. Apply solvent cement as recommended by the conduit manufacturer to the interior of the socket and exterior of conduit, making sure to coat all surfaces to be joined.
  - c. Insert conduit into the socket and rotate 1/4 to 1/2 turn and allow to dry.
8. All metallic conduit installed below grade or within concrete shall be coated with two (2) spiral-wrapped layers of 3M Scotchrap 50 PVC tape or two coats of asphaltum paint prior to installation.
9. Install ground wire sized per N.E.C. Table 250.122 in all conduits.
10. Use of running threads is absolutely prohibited. Conduit shall be jointed with approved threaded conduit couplings. Threadless and clamp type not acceptable.
11. Conduits shall be sized in accordance with latest National Electrical Code except when size shown on drawings.
12. Exposed, field-cut threads on all metal conduits shall be painted with zinc primer (for Galvanized Rigid or I.M.C.) or urethane paint (for PVC-Coated Rigid Steel) as recommended by conduit manufacturer .
13. Installation of PVC coated conduit systems shall be performed in strict accordance with the manufacturer's installation instructions. Damage to PVC coated conduit coating shall be touched up with patching compound as directed by manufacturer. To assure correct installation, the installer shall be certified by the manufacturer to install coated conduit.

#### B. Routing/Locating:

1. Exposed conduit runs shall be run level and plumb and shall, on interior of buildings, be run parallel and/or at right angles to building walls and/or partitions.
2. Conduit with an external diameter larger than 1/3 the thickness of a concrete slab shall not be placed in the slab. Conduits in slab shall not be spaced closer than 3 diameters on center.
3. Conduit run in ceiling spaces shall be run as high as possible, all at same level, and shall be supported from building structure. Do not support conduit from any other installation.
4. Conduit run within exterior CMU, concrete or other similar walls shall be run within the CMU cells / concrete structure / etc. Conduits shall not be run on the outside surface of CMU cells / concrete structure / etc. underneath exterior veneers / etc., which could cause a thermal break in the wall insulation or a future water intrusion problem.
5. Install conduit runs to avoid proximity to steam or hot water pipes. In no place shall a conduit be run within 6" of such pipes except where crossing is unavoidable, then conduit shall be kept at least 3" from the covering of the pipe crossed.
6. Before installing raceways for motors, HVAC equipment and other fixed equipment, check location of all equipment connections/terminal boxes with equipment supplier and locate and arrange raceways appropriately.
7. No conduit for instrumentation shall be run closer than 12 inches to parallel power conduits.
8. A minimum of 12" of clearance (or more as required by associated utility companies) shall be provided between the finished lines of exterior, underground conduit runs and exterior, underground utilities (gas, water, sewer, etc.).
9. Where any portion of raceway is installed in a wet environment (such as below grade) and located at a higher elevation than the raceway termination point in a dry environment, install watertight compound inside raceway at termination around cabling to prevent transfer of water through conduit system. Watertight compound shall be rated for the potential water head pressure, based on the assumption that ground water level would be at grade level.

C. Bends:

1. Do not make bends (in any raceway, including flexible conduits) that exceed allowable conductor bending radius of cable to be installed or that significantly restrict conductor flexibility.
2. All bends within concrete-encased ductbanks installed in exterior locations shall be long radius bends (24" minimum bending radius – varies with conduit diameter).
3. All bends in raceways containing multi-conductor power cables (such as shielded VFD cables) shall be long radius bends (24" minimum bending radius – varies with conduit diameter).
4. Where numerous exposed bends or grouped together, all bends shall be parallel, with same center and shall be similar in appearance
5. All PVC elbows, bends, etc., shall be either factory bends or made with an approved heat bender.

D. Support:

1. Anchor conduit securely in place by means of approved conduit clamps, hangers, supports and fastenings. Arrangement and methods of fastening all conduits shall be subject to Engineer's direction and approval. All conduits shall be rigidly

supported (wire supports may not be used in any location). Use only approved clamps on exposed conduit.

2. Rigid Aluminum Conduits shall be supported at intervals not to exceed 5' on center.
3. Conduit in riser shafts shall be supported at each floor level by approved clamp hangers.
4. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit the outside diameters of conduits.
5. Where installed in seismic zones, suspended raceways shall be braced in two (2) directions as required to prevent swaying and excessive movement.
6. Raceways installed on top of flat roofing shall be supported a minimum of 3 ½" above roof with rubber block supports (Cooper B-Line Dura-Blok or equal). Installation shall be in strict accordance with support manufacturer's instructions and recommendations.

E. Terminations:

1. All conduit connections to sheet metal cabinets or enclosures located in exterior or wet locations shall terminate by use of rain tight (Meyers) hubs.
2. In wet, exterior or process areas, conduits shall NOT enter tops of enclosures. All conduits shall enter enclosures from bottom, left or right sides of the enclosure (utilizing rain-tight Meyers hubs as indicated above).
3. Where rigid or I.M.C. conduits enter sheet metal boxes, they shall be secured by approved lock nuts and bushings.
4. Where metal conduits enter outdoor pull boxes, manholes, under freestanding electrical equipment or other locations where direct metal-to-metal contact does not exist between enclosure and conduit, grounding bushings shall be installed. Each grounding bushing shall be connected to the enclosure ground and all other grounding bushings with properly sized grounding conductors.
5. Where E.M.T. enters sheet metal boxes they shall be secured in place with approved insulating fittings.
6. Where PVC enters outdoor pull boxes, manholes or under freestanding electrical equipment, PVC end bells shall be installed.
7. Contractor shall be responsible for coordinating required conduit sizes with equipment hubs/conduit entry provisions (such as at motor tap boxes) prior to installation of conduit systems. Contractor shall field adjust final conduit sizes at terminations where so required (only as allowed by code) from those indicated on plans to coordinate with equipment hubs/conduit entry provisions.
8. Where conduit terminates in free air such that associated cabling/circuitry becomes exposed (such as at cable trays, etc.), conduit shall generally terminate in a horizontal orientation (to prevent dust/debris/etc. from entering conduit system). Where vertical conduit termination is necessary, the termination shall be provided with cord-grip conduit terminations to seal the conduit system.
9. Conduit ends shall be carefully plugged during construction.
10. Permanent, removable caps or plugs shall be installed on each end of all empty raceways with fittings listed to prevent water and other foreign matter from entering the conduit system.

F. Penetrations:

1. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly. Refer to drawings and other specifications for additional requirements.

2. All penetrations shall be at right angles unless shown otherwise.
3. Structural members (including footings and beams) shall not be notched or penetrated for the installation of electrical raceways unless noted otherwise without specific approval of the structural engineer.
4. Dry-packed non-shrink grout or watertight seal devices shall be used to seal openings around conduits at all penetrations through concrete walls, ceilings or aboveground floors.
5. All raceways entering structures, or where water is otherwise capable of entering equipment/devices through the raceway system, shall be sealed (at the first box or outlet) with foam duct sealant to prevent the entrance of gases or liquids from one area to another or into equipment/devices.
  - a. Where the elevation of the raceway penetration (into the structure) is no more than 15' below the other (higher) end of the same raceway, Polywater FST sealant (rated to hold back up to 22' of continuous water head pressure), or pre-approved equal, shall be used.
  - b. Where the elevation of the raceway penetration (into the structure) is between 15' and 75' below the other (higher) end of the same raceway, Polywater PHRD Custom Mechanical Seals (rated to hold back up to 36psi or 83' of continuous water head pressure), or pre-approved equal, shall be used.
  - c. Where the elevation of the raceway penetration (into the structure) is more than 75' below the other (higher) end of the same raceway, the contractor shall propose a custom solution designed to hold back or to drain the possible water within the associated raceway. Submittals shall be provided to the engineer for review/approval, including a summary of the anticipated elevations/PSIs, details of the proposed installation, cut-sheets of devices/materials, etc.
6. Additionally, where necessary to ensure that water does not enter equipment/devices through the raceway system (where raceways extend to equipment/devices from wet areas), junction boxes with drain assemblies in bottom shall be located at low point of raceway system near equipment/devices (to drain water out of raceway system before it enters equipment/devices). Contractors shall provide drains in raceway systems where so necessary to prevent water entry into equipment/devices. In special applications (such as to instruments, etc.), where cabling rated for exposed application is provided, contractor may propose short air gaps (approximately 6" or less) between the end of the conduit system and the equipment/device cable entry (to be made with cable gland connectors) to prevent water in conduit system from entering equipment/devices in lieu of drained junction boxes.
7. All raceways passing through concrete roofs or membrane-waterproofed walls or floors shall be provided with watertight seals as follows:
  - a. Where ducts are concrete encased on one side: Install watertight entrance seal device on the accessible side of roof/wall/floor as directed by equipment manufacturer.
  - b. Where ducts are accessible on both sides: Install watertight entrance seal device on each side of roof/wall/floor as directed by equipment manufacturer.
8. All raceways passing through walls of rooms containing/storing noxious chemicals (chlorine, ammonia, etc.) or through hazardous locations shall be sealed with conduit seals (Crouse-Hinds type EYS or equal).

9. All raceways terminating into electrical enclosures/devices/panels/etc. located in hazardous locations shall be sealed with conduit seals (Crouse-Hinds type EYS, EZS or equal) within 18" of the termination.

G. Exterior Electrical Ductbanks:

1. Where exterior electrical concrete-encased ductbanks are indicated on drawings, conduit runs between buildings or structures shall be grouped in concrete-encased ductbanks as follows:
  - a. A minimum of 3" of concrete shall encase each side of all ductbanks.
  - b. A minimum of 1 1/2" of separation shall be provided between each conduit within ductbanks. PVC spacers shall be installed at the necessary intervals prior to placement of concrete to maintain the required spacing and to prevent bending or displacement of the conduits.
  - c. Top of concrete shall be a minimum of 30" below grade. A continuous magnetic marking tape shall be buried directly above each ductbank, 12" below grade.
  - d. Exact routing of ductbanks shall be field verified and shall be modified as necessary to avoid obstruction or conflicts.
  - e. Underground electrical raceways shall be installed to meet the minimum cover requirements listed in NEC Table 300.5. Refer to drawings for more stringent requirements.

END OF SECTION 26 05 33

## **SECTION 26 05 34 - OUTLET BOXES, JUNCTION BOXES, WIREWAYS**

### **PART 1 - GENERAL**

- 1.1. DESCRIPTION
  - A. Outlet and Junction Boxes
  - B. Pull Boxes
  - C. Wireways

### **PART 2 - PRODUCTS**

- 2.1. OUTLET BOXES & JUNCTION BOXES (THROUGH 4-11/16")
  - A. Sheet Metal: Shall be standard type with knockouts made of hot dipped galvanized steel as manufactured by Steel City, Raco, Appleton, Bowers or equal.
  - B. Cast: Shall be type FS, FD, JB, GS, or SEH as required for application as manufactured by O-Z/Gedney, Appleton, or equal.
  - C. Nonmetallic: Shall be type Polycarbonate/ABS construction as required for application with non-metallic quick-release latches as manufactured by Hoffman, O-Z/Gedney, Appleton, or equal.
- 2.2. JUNCTION AND PULL BOXES (LARGER THAN 4-11/16")
  - A. Oil-Tight JIC: Shall be Hoffman Type CH box or approved equal.
  - B. Galvanized Cast Iron or Cast Aluminum: Shall be O-Z/Gedney or approved equal.
  - C. Stainless Steel: Shall be as manufactured by O-Z/Gedney, Hoffman or approved equal. Boxes shall have continuous hinges, seamless foam-in-place gaskets and screw-down clamps.
  - D. Nonmetallic: Shall be type Polycarbonate/ABS construction as required for application with non-metallic quick-release latches as manufactured by Hoffman, O-Z/Gedney, Appleton, or equal. Boxes shall have hinged covers and screw-down clamps.
  - E. Wireways: Shall be standard manufacturer's item as manufactured by Hoffman, Square "D", Burns, B & C or equal. Wireways shall have hinged covers and screw-down clamps.
  - F. Above-Grade Padmounted Low Profile Pull Boxes:
    - 1. Construction:
      - a. 12Ga. stainless steel base with 12Ga aluminum top with brushed finish, and structural bracing as required.
      - b. Continuous base frame with open bottom and eight (8) ½" x 1" slots for securing box to concrete pad below and a center support member.

- c. Two (2) full-size swing-open lids with full-length, stainless steel continuous hinges, lifting handles, key-locking provisions and provisions for latching lids in open position (with stainless steel chain or approved equal).
  - d. Guides on lid and base frame as required to insure proper closing of box and to provide increased security.
  - e. Aluminum or stainless steel barrier between power & instrumentation areas within box if box is used for both power and instrumentation wiring.
  - f. Other stainless steel hardware as required.
2. Minimum Dimensions:
- a. Power: 40 inches square x 18 inches high.
  - b. Instrumentation: 24 inches square x 18 inches high.
3. Manufacturer:
- a. Electrical Enclosure Mfg. (Pell City, AL).
  - b. Ebox (Pelham, AL).
  - c. Approved Equal.

### **PART 3 - EXECUTION**

#### **3.1. APPLICATION**

##### **A. General**

- 1. All boxes and wireways shall be of sufficient size to provide free space for all enclosed conductors per NEC requirements. Fill calculations shall be performed by contractor per NEC requirements.

##### **B. Outlet Boxes & Junction Boxes (through 4-11/16")**

- a. Sheet metal boxes shall be used on concealed work in ceiling or walls.
- 2. Cast boxes shall be used wherever Rigid or I.M.C. conduits are installed.
- 3. All boxes installed in extremely corrosive areas (such as chlorine and fluoride storage rooms) where non-metallic raceways are used shall be non-metallic.
- 4. Except when located in exposed concrete block, switch and receptacle boxes shall be 4" square for single gang installation. Appropriate gang boxes shall be used for mounting ganged switches.
- 5. When installed in exposed concrete block, switch and receptacle boxes shall be square type designed for exposed block installation.
- 6. Ceiling outlet boxes shall be 4" octagon 1-1/2" deep or larger required due to number of wires.
- 7. Boxes installed in hazardous locations shall be explosion-proof rated for the associated application, constructed of copper-free cast aluminum.

##### **C. Junction & Pull Boxes (larger than 4-11/16")**

- 1. For all below grade exterior use and elsewhere as shown:
  - a. In areas subject to future vehicular traffic: shall be galvanized cast iron (rated AASHTO H-20 Loading unless noted otherwise).
  - b. In areas not subject to vehicular traffic: shall be galvanized cast iron or pre-cast polymer concrete (rated for Tier 15 Loading unless noted otherwise).
- 2. All boxes installed exposed in exterior or wet areas shall be stainless steel (NEMA 4X).
- 3. All boxes installed exposed in corrosive areas shall be stainless steel (NEMA 4X).



4. All boxes installed in extremely corrosive areas (such as chlorine and fluoride storage rooms) where non-metallic raceways are used shall be non-metallic.
5. Padmounted Pull Boxes shall be installed as shown on Plans or as required by project conditions. Transclosure-style Padmounted boxes shall be installed wherever required by the quantities and sizes of conductors. Contractor shall submit all Padmounted Pull Box types prior to ordering for engineer's review and comment.
6. Boxes installed in hazardous locations shall be explosion-proof rated for the associated application, constructed of copper-free cast aluminum.
7. All others shall be oil tight JIC box not less than 16 gauge.

### 3.2. INSTALLATION

#### A. General

1. All boxes and wireways shall be securely anchored.
2. All boxes shall be properly sealed and protected during construction and shall be cleaned of all foreign matter before conductors are installed.
3. All boxes and wireways shall be readily accessible. Contractor shall be responsible for furnishing and installing access panels per architect's specifications. Locations shall be as directed by the architect as required to make boxes, wireways, electrical connections, etc. accessible where above gypsum board ceilings or in other similar locations.
4. All metallic boxes and wireways shall be properly grounded.
5. Refer to Specification Section 26 05 53 for identification requirements.

#### B. Outlet Boxes & Junction Boxes (through 4-11/16")

1. Boxes shall be provided with approved 3/8" fixture studs were required.
2. Recessed boxes for wiring devices, surface fixtures, or connections, shall be set so that the edge of cover comes flush with finished surface.
3. There shall be no more knockouts opened in any sheet metal box than actually used.
4. Any unused opening in cast boxes shall be plugged.
5. Back to back boxes to be staggered at least 3 inches.
6. Under no circumstances shall through-the-wall boxes be used.

#### C. Junction & Pull Boxes (larger than 4-11/16")

1. Pull boxes shall be installed as indicated on plans and/or as required due to number of bends, distance or pulling conditions.
2. Boxes to be imbedded in concrete shall be properly leveled and anchored in place before the concrete is poured.
3. All pull boxes and/or junction boxes installed exterior below grade, shall have their tops a minimum of 1-1/2 inches above surrounding grade and sloped so that water will not stand on lid. A positive drain shall be installed, to prevent water accumulation inside.
4. Above grade pull boxes shall be installed on concrete anchor bases as shown on Plans.

#### D. Wireways and/or wall-mounted equipment

1. Mount each wireway to channels of the same metal type as the wireway.

2. Conductors serving a wireway shall be extended without reduction in size, for the entire length of the wireway. Tap-offs to switches and other items served by the wireway shall be made with ILSCO type GTA with GTC cap.

END OF SECTION 26 05 34

## **SECTION 26 05 53 - ELECTRICAL IDENTIFICATION**

### **PART 1 - GENERAL**

#### 1.1. DESCRIPTION

- A. Wire and cable identification.
- B. Pullbox & Junction Box Identification
- C. Electrical distribution & utilization equipment identification.
- D. Instrument and control device identification.
- E. Raceway identification.

### **PART 2 - PRODUCTS**

#### 2.1. WIRE AND CABLE IDENTIFICATION

- A. Intermediate Locations:
  - 1. Wires and cable labels shall be white, thermal transfer, halogen-free, flame-retardant marker plates (sized to accommodate three lines of text) permanently affixed to the associated cable with UV-resistant plastic wire ties. Labels shall be Panduit #M200X/300X series or equal.
- B. Circuit/Cable Termination Locations:
  - 1. Wires and cable labels shall be non-ferrous identifying tags or pressure sensitive labels unless noted otherwise.

#### 2.2. ELECTRICAL DISTRIBUTION & UTILIZATION EQUIPMENT IDENTIFICATION

- A. Labels on electrical distribution & utilization equipment shall be black-on-white engraved Bakelite nameplates permanently affixed to the equipment with rivets or silicone adhesive unless noted otherwise.

#### 2.3. INSTRUMENT AND CONTROL DEVICE IDENTIFICATION

- A. Instruments and control device labels shall be black-on-white engraved Bakelite nameplates permanently affixed to the equipment or the adjacent, visible mounting surface with silicone adhesive or stainless steel wire ties.

#### 2.4. RACEWAY IDENTIFICATION

- A. Raceway labels shall be white thermal transfer marker plates permanently affixed to the associated raceway with stainless steel wire ties, with two wire ties (one on either end of marker plate to provide a flush installation) where possible. Labels shall be Panduit #M300X series or equal.

### **PART 3 - EXECUTION**

#### 3.1. GENERAL

- A. Any proposed deviation in identification methods and materials from those described herein shall be submitted to Engineer for review and comment prior to installation.
- B. Contractor shall provide all labeling or identification required by applicable local, state and national codes. These specifications do not intend to itemize all code-required labeling or identification requirements.
- C. All labels/identification shall be positioned such as to be readable from the normal perspective without adjusting wiring/cables/labels. For example, labels/identification of wires/cables within cable trays shall be positioned to point towards the viewer (typically downward for overhead cable trays, or upward for cable trays within trenches).
- D. All labels/identification (except for handwritten labels on concealed pullbox/junction box covers as noted below) shall be typewritten/printed/engraved in a neat, workmanlike, permanent, legible, consistent and meaningful manner. Labels shall not be handwritten unless specific approval is granted by engineer.

### 3.2. WIRE AND CABLE IDENTIFICATION

- A. General:
  - 1. Where cabling is exposed (such as within cable trays), provide two wire ties per cable (one on either end of marker plate to provide a flush installation). Where cabling is concealed (such as within pullboxes/wireways), one wire tie per cable will be acceptable.
- B. Intermediate Locations:
  - 1. Thermal transfer labels shall be securely fastened to all wiring and cabling in the following locations:
    - a. Wireways
    - b. Pullboxes/Junction boxes larger than 4-11/16"
    - c. Pullboxes/Junction boxes through 4-11/16" where wires and cables are not easily identifiable via the color coding and box labeling
    - d. Vaults & Manholes
    - e. Approximately every 50 feet within cable trays (especially at locations where cables exit or diverge). Labels within cable trays shall be grouped (rather than being pre-labeled on cables and pulled into cable trays).
    - f. Other similar intermediate locations.
  - 2. Labels shall be stamped or printed with the following data so that the feeder or cable can be readily identified and traced:
    - a. From where the circuit originates (including panel designation and circuit number):
      - 1) Ex: "FROM: PP-A CIR. 3 (IN MAIN ELEC ROOM)"
    - b. To where the circuit extends (using the common name of the equipment):
      - 1) Ex: "TO: RTU-6 (ON ROOF)"
    - c. The purpose of the circuit:
      - 1) Ex: "POWER"
    - d. The set number (If parallel power feeds are used).
      - 1) Ex: "SET NO. 3 OF 4"
- C. Circuit/Cable Termination Locations:

1. Where multiple termination points exist within a circuit origination point (panelboard, switchboard, MCC, starter, etc.) or other similar circuit endpoint (control panel, etc.), labels shall be securely fastened to all ungrounded and neutral conductors to clearly identify the terminal and/or circuit number associated with each conductor. For example, within lighting panels, each phase and neutral conductor shall be labeled near the terminals at a clearly visible location with the associated circuit number(s), so that if all conductors were unterminated, the labels would clearly indicate which conductor was associated with each circuit.
- D. Refer to Specification Section 26 05 19 for all color-coding requirements of wires and cables.

### 3.3. PULLBOX & JUNCTION BOX IDENTIFICATION

- A. Concealed pullboxes/junction boxes:
1. Front surface of all pullbox/junction box covers in concealed areas (such as above lay-in ceilings) or within mechanical/electrical rooms (and other similar areas where appearance of boxes is not an issue) shall be neatly marked with the ID of circuits/cables contained with permanent black marker on cover of box (Ex: "RP-1A Cir. 1, 2 & 3"). Additionally, front surface of box shall be painted red where box contains fire alarm system cabling.
- B. Exposed pullboxes/junction boxes:
1. Interior surface of all pullbox/junction box covers in exposed areas shall be labeled "Power", "Telecommunications", "Fire Alarm" or with other similar general text neatly with permanent black marker to indicate function of box. Circuit/cable labeling within box (see above) shall identify specific cables contained. Additionally, interior surface of cover shall be painted red where box contains fire alarm system cabling.
- C. Where pullboxes/junction boxes are named on contract documents (Ex: "PULLBOX #3"), an engraved nameplate shall be installed on the front surface of the box to identify the name.

### 3.4. ELECTRICAL DISTRIBUTION & UTILIZATION EQUIPMENT IDENTIFICATION

- A. General:
1. All new and existing equipment modified by this project shall include arc-flash warning labels in accordance with NEC article 110.16.
- B. All Panels, Motor Control Centers, Switchboards, Switchgear, Transformers, Etc.:
1. Engraved nameplates identifying name of equipment, nominal voltage and phase of the equipment and where the equipment is fed from shall be installed on front surface of all panels, motor control centers, switchboards, switchgear, transformers, etc.:
    - a. Ex: First Line: "NAME: RP-A", Second Line: "120/208V-3Ø-4W", Third Line: "FED FROM: PP-A CIR. 4 (IN MAIN ELEC ROOM)"
  2. Refer to Panelboard Specification Sections for additional labeling requirements (circuit directory cards, permanent circuit labels, permanent circuit numbers, etc.) required inside panelboards.

- C. Safety/Disconnect Switches and Utilization Equipment (HVAC Equipment, Pumps, Powered Valves, Control Panels, Starters, Etc.):
  - 1. Engraved nameplates identifying equipment being fed and where the equipment is fed from shall be installed on front surface of all disconnect switches (including both visible blade type switches and toggle-type switches) and on utilization equipment (where not clearly identified by immediately adjacent local disconnect switch):
    - a. Ex: First Line: "RTU-6", Second Line: "FED FROM: PP-A CIR. 5"
  - 2. Where safety/disconnect switches are installed on the load side of variable frequency drives, the safety/disconnect switch shall be furnished with an additional engraved nameplate to read: "WARNING: TURN OFF VFD PRIOR TO OPENING THIS SWITCH".
  - 3. Safety/Disconnect switches feeding equipment that is fed from multiple sources (such as motors with integral overtemperature contacts that are monitored via a control system) and Utilization Equipment fed from multiple sources shall be furnished with an additional BLACK-ON-YELLOW engraved nameplate to read: "WARNING: ASSOCIATED EQUIPMENT FED FROM MULTIPLE SOURCES – DISCONNECT ALL SOURCES PRIOR TO OPENING COVER".

### 3.5. INSTRUMENT AND CONTROL DEVICE IDENTIFICATION

- A. New Instruments and control devices (whether furnished by contractor or not) shall be labeled with black-on-white engraved nameplates permanently affixed to the equipment or to the adjacent, readily-visible mounting surface with silicone adhesive or stainless steel wire ties.
  - 1. Instruments and process control devices (float switches, etc.) shall be labeled with instrument name and, where available, instrument ID number.
  - 2. Pushbutton stations shall be labeled with equipment being controlled. Labels shall be installed on front surface (or adjacent mounting surface) of all pushbutton stations.
  - 3. Thermostats and other similar HVAC control devices installed in process areas shall be labeled with equipment being controlled. Labels shall be installed on front surface (or adjacent mounting surface) of all thermostats and other similar HVAC control devices.

### 3.6. RACEWAY IDENTIFICATION

- A. Each exposed raceway shall be labeled at the point where it becomes concealed, such as where it enters a concrete floor slab, a concrete wall, the ground, etc.
- B. Each raceway entering in-grade or on-grade pullboxes/junction boxes, where the conduits are only visible inside the box, shall be labeled within the box at the point where the raceway becomes concealed.
- C. Raceway nameplates shall identify:
  - 1. The location of the other end of the raceway ("TO MCC-1" or similar). If the other end of the raceway is at an intermediate, named pullbox ("INSTRUMENTATION PULLBOX #4" or similar), that pullbox name shall be labeled rather than the endpoint of the circuitry.

### 3.7. OTHER IDENTIFICATION

- A. Factory-engraved coverplates identifying functions of light switches and other similar devices shall be installed where so required by plans/specifications.

END OF SECTION 26 05 53

## **SECTION 26 24 17 - LIGHTING PANELBOARDS**

### **PART 1 - GENERAL**

#### 1.1. GENERAL

- A. The work under this section includes but is not limited to the following:
  - 1. Lighting Panelboards
  - 2. Circuit Breakers

### **PART 2 - PRODUCT**

#### 2.1. PANELBOARDS

- A. Enclosure:
  - 1. Panelboards shall be dead front type and shall be in accordance with Underwriter's Laboratories, Inc., standard of panelboards and enclosing cabinets and so labeled.
  - 2. Panelboards installed in dry locations shall have enclosures fabricated from sheet steel and shall be finished in ASA #49. Panelboards installed in corrosive, exterior or wet locations shall have NEMA 4 stainless steel enclosures.
  - 3. The door shall have a cylinder type lock. Lock shall be held in place by concealed screw to a captive nut, welded to inside of door. All locks shall be keyed alike.
  - 4. A metal framed circuit directory card holder with clear plastic covering shall be factory-mounted on the inside of door.
  - 5. Panels for 20 or more circuits, including spares and spaces, shall be 20 inches wide.
  - 6. Panelboards enclosures shall be as shown on panel schedule on plans for surface, flush or motor control center mounting.
  - 7. Provide hinged trim with piano-hinge down full length of one side to allow access to wiring without complete removal of outer trim.
  - 8. Each section of multi-section panelboards shall be of matching heights and depths.
- B. Bussing/Lugs:
  - 1. Ampacity and service voltage of main buss, lugs or main breakers and branch circuit breakers shall be as shown on drawings.
  - 2. All bussing and associated connectors shall be tin-plated copper.
  - 3. All panelboards shall contain ground buss.
  - 4. Entire panelboard shall be capable of withstanding a short circuit not less than the interrupting capacity of any breaker in the panel. When a power distribution system electrical study (including short circuit stud, etc.) is a part of the project, contractor shall further verify that all proposed equipment is properly rated (per the results of the study) prior to submitting shop drawings. Interrupting ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.
  - 5. Buss connectors shall be for distributed phase arrangement.
  - 6. Main and sub-feed lugs shall be provided with AL/CU compression lugs suitable for the quantities and sizes of conductors required.
  - 7. Top/bottom feed arrangement and lug sizes/quantities shall be coordinated by the contractor.



8. Entire panelboard assembly, including all bussing, shall have SCCR ratings meeting or exceeding the minimum AIC ratings listed on the plans for the panel. When a power distribution system electrical study (including short circuit stud, etc.) is a part of the project, contractor shall further verify that all proposed equipment is properly rated (per the results of the study) prior to submitting shop drawings. All ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.
  9. Service entrance panelboards shall be provided with barrier such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations
- C. Breaker arrangement and numbering:
1. Panelboards shall be factory assembled with branch breakers arranged exactly as indicated on plans.
  2. Breakers shall be numbered vertically beginning top left. Multi-section panelboards shall be numbered consecutively through all sections.
  3. Breaker numbers shall be permanently attached to trim.
  4. Main breakers shall be vertically-mounted (branch-mounted or back-fed main breakers will not be acceptable unless specifically so shown on plans).

## 2.2. CIRCUIT BREAKERS

- A. Circuit breakers shall be quick break, quick make, thermal magnetic type, for alternating current. Breakers shall trip free for the handle and tripping shall be indicated by the handle assuming a position between OFF and ON.
- B. Circuit breakers shall be of the bolt-on type.
- C. Multi-pole breakers shall be internal common trip with single operating handle; external handle ties are not acceptable, unless specifically noted otherwise (such as for multi-wire branch circuits described below).
- D. Circuit breakers feeding multiwire branch circuits (as defined by NEC) consisting of separate single phase loads sharing a common neutral shall be provided with multi-pole breakers or handle ties to simultaneously disconnect all ungrounded conductors per NEC Article 210.4(B). The necessary locations of these multi-pole breakers or handle ties shall be coordinated by the contractor. Where necessary, the contractor may rearrange circuit breakers (as minimally as possible) as required to meet this requirement.
- E. All breakers shall meet the minimum RMS symmetrical interrupting capacity ratings shown on plans for the associated panel. All interrupting ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.
- F. All branch circuit breakers shall be listed to UL489 or shall be specially-tested to be HACR listed.

## 2.3. SPECIAL REQUIREMENTS

- A. Any special requirements on the drawings, such as for increased interrupting rating,

ground fault protection, etc., shall supersede these specifications, but only insofar as that particular requirement is concerned.

- B. Lighting panels larger than 400A shall conform to the requirements for power panels.

#### 2.4. MANUFACTURER

- A. Panelboards shall be as manufactured by Square 'D' or Cutler Hammer.

### **PART 3 - EXECUTION**

#### 3.1. INSTALLATION

- A. All panelboard dimensions and clearances shall be carefully checked and coordinated with the proper trades to insure proper mounting space and support prior to roughing in equipment. In no case shall any circuit breaker be located above 6'-7" A.F.F..
- B. Wiring in panelboard wireways shall be done in a neat and workmanlike manner. Wiring shall be grouped into neat bundles and secured with approved tie wraps.
- C. For all flush-mounted panelboards, a minimum of three (3) one-inch empty conduits shall be stubbed out above the nearest accessible ceiling space for future use.

#### 3.2. PANEL IDENTIFICATION

- A. Refer to Specification Section 26 05 53.

END OF SECTION 26 24 17

## **SECTION 26 27 26 - WIRING DEVICES**

### **PART 1 - GENERAL**

#### 1.1. DESCRIPTION

- A. Wiring Devices
- B. Plates
- C. Finishes

### **PART 2 - PRODUCTS**

#### 2.1. WIRING DEVICES AND PLATES

- A. Switches shall be AC type, extra-heavy duty industrial grade (unless otherwise shown) of ratings shown on drawings. Switches shall be as manufactured by Hubbell, P & S, Sierra, Bryant, GE, Arrow Hart or equal.
- B. Receptacles shall have blade configuration and shall be heavy duty industrial grade (unless otherwise shown) of current and voltage rating as shown on drawings. Receptacles shall be as manufactured by Hubbell, P & S, Sierra, Bryant, GE, Arrow Hart or equal.
- C. All GFCI-type receptacles shall continuously self-test and shall trip/deny power if the receptacle does not provide proper GFCI protection or if the line/load terminations are miswired and shall provide visual indication of power status, trip conditions, ground fault conditions and end-of-life status.
- D. Each wiring device shall have a plate (see "Finishes" section below for specific requirements).

#### 2.2. FINISHES

- A. All wiring devices (switches, receptacles, etc.) shall be colored to match the coverplates described below. For instance, all items covered by stainless steel, aluminum or malleable iron plates shall be gray in color.
- B. Coverplates for recessed, wall-mounted electrical items (switches, receptacles, telephone outlets, etc.) shall be stainless steel unless shown otherwise.
- C. Coverplates, trim rings, etc. for recessed, floor-mounted electrical items (floor outlets, underfloor duct junctions, etc.) shall match finish of building hardware (302/304 stainless steel, brass, etc.) in area installed.
- D. Coverplates for exposed electrical items (switches, receptacles, telephone outlets, etc.) shall be of same material as exposed boxes (see Outlet Box Specification for required material type) and shall have beveled edges.
- E. Coverplates for receptacles in wet locations shall be metallic, in-use type, rated for wet locations per NEC requirements unless noted otherwise.

- F. See "Electrical Identification" specification section for coverplate labeling requirements.

### **PART 3 - EXECUTION**

#### **3.1. GENERAL MOUNTING**

- A. Symbols on drawings and mounting heights are approximate. The exact locations and mounting heights shall be determined on the job, and it shall be the Contractor's responsibility to coordinate with all trades to secure correct installation. For example, Contractor shall coordinate exact mounting heights over counters, in or above backsplashes, in block walls, and at other specific construction features.
- B. Verify all door swings with Architectural. Locate boxes for light switches within four inches of door trim on swing side (not hinge side) of door.
- C. Devices and associated plates shall not be used as support; outlet boxes shall be rigidly supported from structural members.
- D. Mount all straight-blade receptacles vertically with ground pole up, unless specifically noted otherwise.
- E. Unless otherwise shown or required by local handicap codes, outlet boxes shall be the following distances above the finished floor unless otherwise noted.
  - 1. Receptacles and telephone outlets in offices and other finished areas: 1'-6" to the center of the box.
  - 2. Receptacles and telephone outlets in equipment rooms and other unfinished areas: 4'-0" to the center of the box.
  - 3. Receptacles over counters: As Noted
  - 4. Switches, general: 4'-0" to the top of the box.
  - 5. Push-button, etc., general: 4'-0" to the top of the box.
  - 6. Other device types: verify with engineer prior to rough-in.

END OF SECTION 26 27 26

## **SECTION 26 29 00 - MANUFACTURED CONTROL PANELS**

### **PART 1 - GENERAL**

#### **1.1. SCOPE**

- A. This section describes control stations, PLC panels, motor control panels, manufactured control panels, and other similar panels specified herein. Specifications herein are intended as an extension of requirements in other Divisions of these specifications where reference is made to Electrical Specifications.

#### **1.2. DEFINITIONS**

- A. "Control Stations": Enclosures (with all required accessories) containing only door-mounted pushbuttons, indicator lights and/or selector switches (no electronic components or starter/controller equipment).
- B. "Control Panels": Enclosures (with all required accessories) containing equipment/devices other than door-mounted pushbuttons, indicator lights and/or selector switches (such as electronic components, starter/controller equipment, etc.).

#### **1.3. SUBMITTALS**

- A. Provide the following for each control panel:
  - 1. A job-specific, custom wiring diagram
    - a. The wiring diagram shall clearly show all components (whether the components are mounted internal or external to the control panel enclosure).
    - b. All wires and terminal blocks shall be clearly labeled.
    - c. Diagram shall be in accordance with NEMA/ICS standards.
  - 2. Size, type and rating of all system components.
  - 3. Unit frontal elevation and dimension drawings.
  - 4. Internal component layout diagrams.
  - 5. Manufacturer's product data sheets for all components.
- B. A Bill of Materials shall be included with catalog information on all components.
- C. Information shall be included on any proprietary logic component sufficient to demonstrate its ability to perform the required functions.
- D. The following calculations shall be submitted:
  - 1. Thermal calculations showing amount of air conditioning or ventilation and heating required for each control panel, per ambient requirements listed below and operating temperature limitations of all equipment/devices within each control panel. Where possible, forced air ventilation shall be utilized rather than air conditioning. Panel shall be oversized, interior equipment/devices shall be derated, and solar shielding shall be provided as required to allow the use of forced air ventilation as the cooling method. Air conditioning, ventilation, and/or heating equipment shall each have ratings/capacities at least 20% larger than required by calculations below unless noted otherwise:

- a. Thermal calculations used for sizing cooling/ventilation systems for each control panel located in exterior or non-conditioned spaces shall assume:
  - 1) Ambient exterior air temperature ranges of -5 degrees F to 105 degrees F.
  - 2) Full solar contact where applicable (not applicable where enclosures are fully protected from solar contact using solar shields separated from panel enclosure with standoffs or similar).
  - 3) No wind.
  - 4) Heat loss from interior equipment (electronics, etc.) per equipment supplier's information.
- b. Thermal calculations used for sizing heating systems for each control panel shall assume:
  - 1) Ambient exterior air temperature ranges of -5 degrees F to 105 degrees F.
  - 2) No heat loss by interior components of control panel.
  - 3) No solar gain on exterior of control panel.
  - 4) Doubling of heating wattage required to account for wind where control panels are located outdoors.
  - 5) Minimum temperature difference (due to heating) of 10 degrees F to prevent condensation, regardless of equipment temperature limitations.
2. Load calculations showing the sizing of all power supplies provided (with spare capacity as specified). Power supplies shall each have ratings/capacities at least 20% larger than required by load calculations unless noted otherwise.
3. Load calculations showing the sizing and anticipated runtime of all Uninterruptible Power Supply systems provided (with spare capacity as specified).

## **PART 2 - PRODUCTS**

### **2.1. GENERAL**

- A. Control panels shall be Underwriters' Laboratories labeled by the panel manufacturer. Control panel manufacturers not capable of applying the U.L. label to their products are unacceptable.
- B. All human interface equipment/devices (indicator lights, selector switches, pushbuttons, time switches, displays, keypads, and other similar items used for control, adjustments or monitoring) shall be mounted on the non-energized side of enclosure door(s) in such a way as to be accessible without exposing the user to energized parts.

### **2.2. RATINGS**

- A. All Control Panels shall have short circuit current ratings at least equal to the lesser of the following, unless noted otherwise on plans:
  1. The short circuit current rating of the electrical distribution equipment that feeds the Control Panel.
  2. 150% of the available fault current at the Control Panel as determined by a Short Circuit Current study prepared by a licensed professional electrical engineer.

- B. All equipment/devices installed within control panels shall be rated to operate in ambient temperatures of 50 degrees C (122 degrees F) or higher.

### 2.3. ENCLOSURES

- A. All enclosures (with any required accessories or auxiliary items) shall fit within the space shown on the Plans. Any costs associated with furnishing equipment which exceeds the available space shall be borne by the Contractor.
- B. Enclosures (with any required accessories or auxiliary items) shall be suitable for the environment where installed.
- C. Enclosure materials shall be as follows unless noted otherwise:
  - 1. Control Stations:
    - a. Where located in extremely corrosive areas (chlorine rooms, fluoride rooms, etc.): NEMA 4X of non-metallic construction (with non-metallic hardware) compatible with the associated chemical(s).
    - b. Where located in other wet, process or outdoor areas: NEMA 4X of type 304 stainless steel construction (with stainless steel hardware).
    - c. Where located in dry, non-process, indoor areas (such as electrical rooms): NEMA 1 of die cast zinc/aluminum construction.
  - 2. Control Panels:
    - a. Where located in extremely corrosive areas (chlorine rooms, fluoride rooms, etc.): NEMA 4X of non-metallic construction (with non-metallic hardware) compatible with the associated chemical(s).
    - b. Where located in other wet, process or outdoor areas: NEMA 4X of type 316 stainless steel construction (with stainless steel hardware).
    - c. Where located in dry, non-process, indoor areas (such as electrical rooms): NEMA 1 or 12.
- D. Control Panel Enclosure Construction:
  - 1. Non-metallic control panel enclosure material, where specified, shall be reinforced polyester resin or equivalent, with a minimum thickness of 3/16 inch for all surfaces except those requiring reinforcement. Panels shall be precision molded to form a one piece unit with all corners rounded. Exterior surfaces shall be gel-coated to provide a corrosion-resistant maintenance-free satin finish which shall never need painting. Color pigments shall be molded into the resin. Color shall be grey.
  - 2. Metallic control panel enclosures, where specified, shall be fabricated using a minimum of 14 gauge steel for wall or frame mounted enclosures and a minimum of 12 gauge for freestanding enclosures. Continuously weld all exterior seams and grind smooth. Reinforce sheet steel with steel angles where necessary support equipment and ensure rigidity and preclude resonant vibrations.
  - 3. Use pan-type construction for doors.
  - 4. Door widths shall not exceed 36-inches.
  - 5. Mount doors with full length, heavy duty piano hinge with hinge pins.
  - 6. Provide gasket completely around each door opening.
  - 7. Mount and secure all internal components to removable back plate assembly.
  - 8. For NEMA 1 or 12 enclosures, provide handle-operated key-lockable three point stainless steel latching system for each door.

9. For NEMA 4X enclosures, provide provisions for padlocking all doors and provide clamps on three (3) sides of each door.

E. Control panel enclosures (and associated backpanels and other similar accessories) shall be manufactured by Hoffman Engineering Co., or Saginaw Control & Engineering.

#### 2.4. CONTROL PANEL ACCESSORIES:

A. Cooling systems shall be provided if so required by the application to maintain temperatures within the acceptable ranges of the interior equipment. In no case (regardless of temperature ratings of internal equipment) shall maximum temperatures within control panels be allowed to exceed 50 degrees C (122 degrees F). Thermostats shall be provided to control cooling without need of manual operation. Thermostat setpoints shall be as per recommendations of the equipment suppliers. See above for thermal calculation requirements. Cooling units shall be as manufactured by Hoffman Engineering Co., Rittal or approved equal and shall be thermostatically controlled.

B. Space heaters shall be provided for condensation and temperature control. Thermostats AND hygrometers (or combination hygrometers) shall be provided to control heating requirements (based on temperature and relative humidity within enclosure) without need of manual operation. Setpoints shall be as per recommendations of the equipment suppliers. See above for thermal calculation requirements. Space heaters and associated control devices shall be as manufactured by Hoffman Engineering Co., Rittal, Stego or approved equal.

C. NEMA 4X control panels shall be provided with vapor-phase corrosion inhibitor(s) (chemical combinations that vaporize and condense on all surfaces in the enclosed area, to protect metal surfaces/devices within the enclosed area from corrosion). Corrosion inhibitor shall be Hoffman #AHCI series (sized as required by the enclosure volume to be protected) or equal.

D. For outdoor panels, stainless steel solar shields for front, top and each side of panel, supported to associated panel face with standoffs as required (to allow free air flow between solar shield and panel enclosure), shall be provided where required to limit solar loading on panel to allow use of a ventilated panel design rather than an air-conditioned panel design.

E. Provide a sun shield over all LCD displays in exterior-mounted panels. Sun shield shall be collapsible to fully protect LCD display from UV light when not in use, shall provide side and top shielding when in use, shall be constructed of stainless steel and shall be installed such as to maintain NEMA 4X ratings of enclosures.

F. Provide a clear polycarbonate gasketed hinged door or window to encompass all indicators, controllers, recorders, etc. mounted on NEMA 4 and 4X enclosures.

G. Provide interior mounting panels and shelves constructed of minimum 12 gauge steel with white enamel finish. Provide metal print pocket with white enamel finish on inside of door.



- H. Provide interior LED light kit, mounted at top of interior of panel, and switched to turn "ON" when door is opened for the following control panels:
  - 1. Control panels with outer dimensions greater than 20" wide or 30" high.
  - 2. Control panels containing PLCs or other similar programmable devices.
- I. Control panels containing VFDs or Reduced Voltage Soft Starters shall include a door mounted digital keypad for adjusting the starter parameters and viewing process values and viewing the motor and starter statuses without opening the enclosure deadfront door.

## 2.5. CONTROL COMPONENTS

### A. General:

- 1. All pushbuttons, pilot lights, selector switches and other control devices shall be separate, standard size (full 30mm) and shape, heavy duty oil-tight units.
  - a. Devices in extremely corrosive areas (chlorine rooms, fluoride rooms, etc.) shall be of non-metallic construction.
  - b. Devices in other areas shall be of chrome-plated construction.
- 2. All components and devices so that connection can be easily made and so there is ample room for servicing each item.
- 3. Door-mounted indicators, recorders, totalizers and controllers shall be located between 48" and 72" above finished floor level.
- 4. Door-mounted indicator lights, selector switches and pushbuttons shall be located between 36" and 80" above finished floor level.
- 5. All devices and components shall be adequately supported to prevent movement. Mounting strips shall be used to mount relays, timers and other devices suitable for this type of mounting.

### B. Pilot Lights:

- 1. All pilot lights to be cluster LED type & push to test.

### C. Pushbuttons:

- 1. All STOP operators within control stations located at equipment shall be provided with lockout provisions and a minimum of two (2) sets of contact blocks.
- 2. Emergency shutoff pushbutton devices shall be as follows unless noted otherwise:
  - a. 2 ¼" diameter, mushroom-style, maintained contact push buttons
  - b. With a minimum of one (1) normally open dry contact and three normally closed dry contacts.
  - c. Connections made such that pushing "in" the button will shutoff the associated equipment.
  - d. Provided with a red engraved nameplate with ½" lettering to read "Emergency Shutoff".

### D. Relays:

- 1. Control relays shall have the following characteristics, unless noted otherwise:
  - a. General purpose, plug-in type.
  - b. Minimum mechanical life of 10 million operations.
  - c. Coil voltage as indicated or required by application.
  - d. Single-break contacts rated 12 amperes, resistive at 240 volts.

- e. Contacts as shown on wiring diagrams plus a minimum of one (1) spare N.O. contact and one (1) spare N.C. contact. At a minimum, each individual relay shall have 3PDT contacts. Where required, multiple control relays shall be provided (to provide the required quantities of contacts) for each "relay" function shown on plans/diagrams.
  - f. Furnished with RC transient suppressor to suppress coil-generated transients to 200% of peak voltage.
  - g. LED on/off indicator light and manual operator.
  - h. Industry standard wiring and pin terminal arrangements.
  - i. Equal to Square D 8501KP series with matching plug-in socket.
2. Interposing/isolation relays used to isolate discrete output field wiring (and where required for voltage translation for other discrete signals) to/from PLC inputs/outputs shall be terminal-block style. Terminal-block style relays shall have the following characteristics, unless noted otherwise:
- a. Minimum mechanical life of 10 million operations.
  - b. Single-break contacts rated 6 amperes, resistive at 120 volts.
  - c. One (1) N.O. contact per relay.
  - d. Furnished with integral transient protection.
  - e. LED on/off indicator light.
  - f. DIN-rail mounted.
  - g. Equal to Square D type Zelio RSL.
3. Timer relays shall be electronic, adjustable plug-in devices meeting the following characteristics, unless noted otherwise:
- a. General purpose, plug-in type.
  - b. Minimum mechanical life of 10 million operations.
  - c. Single-break contacts rated 10 amperes, resistive at 240 volts.
  - d. Contacts as shown on wiring diagrams plus a minimum of one (1) spare N.O. contact and one (1) spare N.C. contact. At a minimum, each relay shall have DPDT contacts (2 N.O. & 2N.C.). Where required, multiple timer or control relays shall be provided (to provide the required quantities of contacts) for each "relay" function shown on plans/diagrams.
  - e. Rotary-thumbwheel adjustments for time value, timing range and function.
  - f. Time value adjustments from .05 seconds to 999 hours
  - g. Selectable Timing Functions, including the following:
    - 1) On Delay
    - 2) Interval
    - 3) Off Delay
    - 4) One Shot
    - 5) Repeat Cycle-Off
    - 6) Repeat Cycle-On
    - 7) On/Off Delay
    - 8) One Shot Falling Edge
    - 9) Watchdog
    - 10) Trigger On Delay
  - h. Accuracy shall be  $\pm 2\%$  and repeatability shall be  $\pm 0.1\%$ .
  - i. Furnished with integral transient protection.
  - j. LED indicator light(s) for "timing" and "on/off status"
  - k. Held in place with hold-down spring
  - l. Equal to Square D type JCK with matching plug-in socket.

## 2.6. CONFORMAL COATINGS

- A. All printed circuit boards within electronic devices (PLCs, RTUs, controllers, I/O modules, power supplies, touchscreens, Ethernet switches, radios, etc.) installed in panels located in non-conditioned or exterior/process areas shall be conformal-coated for harsh environments.

## 2.7. DC POWER SUPPLIES

- A. DC Power supplies shall be provided where specified elsewhere, or as required by design of system. Power supplies shall be industrial type, AC-to-DC switching, output voltage as required, 120vac input, size as required for the initial application plus 50% spare capacity.
- B. Redundant power supplies with diode isolation shall be provided so that the loss of one power supply does not affect system operation. The back-up supply systems shall be designed so that either the primary or the back-up supply can be removed, repaired, and returned to service without disrupting the system operation.
- C. Power supply output shall be protected by secondary overcurrent protection device(s).
- D. The power distribution from multiloop supplies shall be selectively fused so that a fault in one instrument loop will be isolated from the other loops being fed from the same supply.
- E. Each power supply shall meet the following requirements.
  1. Regulation, line: 0.4% for input from 105 to 132vac.
  2. Regulation, load: 0.8%
  3. Ripple/Noise: 15mV RMS / 200 mV peak to peak
  4. Operating temperature range: 0 deg C - 60 deg C
  5. Overvoltage protection
  6. Overload Protection
  7. Output shall remain within regulation limits for a least 16ms after loss of AC power at full load.
  8. Output status indicator.
  9. UL listing
- F. Power supplies shall be manufactured by Puls, Sola, Phoenix Contact or equal.

## 2.8. UNINTERRUPTIBLE POWER SUPPLIES

- A. Uninterruptible power supplies (UPSs) shall be provided where specified elsewhere, or as required by design of system. Power supplies shall be industrial type, size as required for the initial application plus 50% spare capacity unless noted otherwise.
- B. Battery runtime shall be as specified elsewhere. If no other specification for battery runtime is specified, battery runtime shall be 12.5 minutes at full load.
- C. UPSs shall be double-conversion, on-line type.
- D. UPSs shall be rated for operation in -20 degrees C to 55 degrees C ambient

temperatures.

- E. UPS batteries shall be hot-swappable and 12-year rated when installed in 25 degrees C environment and 4-year rated when installed in 50 degrees C environment.
- F. UPSs shall include dry contacts for the following alarm points:
  - 1. Loss of Input Power Alarm
  - 2. Low Battery Alarm
- G. UPSs shall be manufactured by Falcon UPS or approved equal.

## 2.9. DISCONNECTS

- A. A main disconnect switch or circuit breaker shall be supplied integral to all control panels. The main disconnect or circuit breaker shall be accessible/operable without exposing the operator to energized sections of the control panel(s), and shall be lockable in the open/off position.
- B. Individual circuit breakers shall be provided integral to the manufactured control panel for each separate power circuit originating within the control panel.
- C. Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated (or can be adjusted to is 1200A or higher, breakers shall be electronic trip and shall be provided with arc energy-reducing maintenance switching (with local status indicator) to reduce arc flash energy per NEC 240.87 requirements.
- D. Manufacturers:
  - 1. Square 'D' or Cutler Hammer.

## 2.10. COMBINATION STARTERS

- A. All combination starters shall utilize a unit disconnect. Magnetic starters shall be furnished in all combination starter units unless specifically shown otherwise. All starters shall utilize full NEMA/EEMAC rated contactors (size 1 minimum).
- B. Starters shall be provided with a three-pole, external (door mounted) manual reset, solid state overload relay. Solid state overload relay shall have switch-selectable trip class and shall provide protection from:
  - 1. Overload.
  - 2. Phase Unbalance.
  - 3. Phase Loss.
  - 4. Ground Fault (Class II detection).
- C. Unless specifically shown otherwise, each combination starter or each group of starters shall be furnished with a control circuit transformer including two primary protection fuses and one secondary fuse (in the non-ground secondary conductor). The transformer shall be sized to accommodate the contactor(s) and all connected control circuit loads (including motor space heaters and other similar loads where specified). The transformer rating shall be fully visible from the front when the unit door is opened. Unless otherwise indicated, control voltage shall be 120V AC.

Control power shall be provided by individual unit control power transformers.

- D. When a unit control circuit transformer is not provided, the disconnect shall include an electrical interlock for disconnection of externally powered control circuits.
  - E. Auxiliary control circuit interlocks shall be provided where indicated. Auxiliary interlocks shall be field convertible to normally open or normally closed operation.
  - F. NEMA/EEMAC Size 1-4 starters shall be mounted directly adjacent to the wireway so that power wiring (motor leads) shall connect directly to the starter terminals without the use of interposing terminals. Larger starters shall be arranged so that power wiring may exit through the bottom of the starter cubical without entering the vertical wireway.
  - G. Each starter shall be equipped with a minimum of the following control devices:
    - 1. Door-mounted reset button.
    - 2. Two (2) field-reversible (N.O./N.C.) auxiliary contacts
    - 3. For reversing and two-speed starters: Four (4) field-reversible (N.O./N.C.) auxiliary contacts
    - 4. Additional control devices as indicated on plans.
  - H. Control Wiring Terminal Blocks
    - 1. Terminal blocks shall generally be:
      - a. Feed-thru, screw-in type
      - b. DIN rail mounted
      - c. Furnished with the stationary portion of the block secured to the unit bottom plate
      - d. Furnished with unit-mounted control terminal blocks for each field wire.
      - e. Rated for the voltage and current of the proposed application per UL/NEC standards.
      - f. Sized (by supplier) for the associated wire gauges/types/quantities.
      - g. Phoenix Contact UT-4 series, Weidmuller WDU-4 series (or equivalent) unless required otherwise by application.
  - I. Nameplates
    - 1. Each unit shall be properly labeled with an engraved phenolic nameplate with a white background and black letters.
    - 2. Each pilot device shall be properly labeled with a legend plate or an engraved phenolic nameplate.
  - J. Manufacturers:
    - 1. Square 'D' or Cutler Hammer.
- 2.11. WIRING
- A. Refer to Section 26 05 19 for all wiring types/applications.
  - B. All wiring shall be identified on each end with hot stamped, shrink tube type, or self-laminating vinyl permanent wire markers to correspond with numbering shown on wiring diagrams.
  - C. All connections shall be made on terminals with no splices.

- D. All wiring runs shall be along horizontal or vertical routes to present a neat appearance. Angled runs will not be acceptable. Group or bundle parallel runs of wire in plastic wire duct where practical.
- E. All wiring runs shall be securely fastened to the panel or wire duct by means of plastic wire ties. Adequately support and restrain all wire runs to prevent sagging or movement.
- F. AC power wiring and instrumentation/analog wiring shall be run separate.
- G. Color code all internal wiring (not field wiring) as follows:
  - 1. Line and load circuits: Black (B)
  - 2. AC control wiring: Red (R)
  - 3. Externally-Powered control wiring: Yellow (Y)
  - 4. Neutral wiring: White (W)
  - 5. Low voltage DC(+)pos: Blue (BL)
  - 6. Low voltage DC(-)neg: Blue/White Tracer (BL/W)
  - 7. Grounding: Green (G)
- H. Terminal strips shall be provided for all input and output wiring. No more than two (2) wires shall be connected to one (1) terminal block.

## 2.12. ELECTRICAL SURGE AND TRANSIENT PROTECTION

- A. General
  - 1. Function: Protect the system against damage due to electrical surges.
- B. Application: As a minimum, provide surge and transient protection (with proper grounding) at the following locations as described below:
  - 1. Power Input High Frequency Noise Filtering:
    - a. 120VAC Control panels with integral UPSs, PLCs, or other electronic/microprocessor equipment that is susceptible to failure or improper operation due to high frequency/harmonic input transients shall be provided with series-connected high-frequency noise filters on the line input (downstream of any panel main disconnects/breakers). Filters shall be as manufactured by Edco/Emerson/Islatrol or equal (exact type(s) as required by application).
  - 2. Power Input Surge Protection:
    - a. Provide surge protection device at any connection of 120VAC power to panels containing programmable logic controllers, remote I/O equipment, UPS's, transmitters, radios, VFDs, Reduced Voltage Soft Starters or other electronic equipment. Device shall:
      - 1) Be mounted internal to the associated panel, with dedicated overcurrent protection.
      - 2) Be of two-part (base and SPD), DIN-rail mountable construction.
      - 3) Have 15kA total nominal discharge current per line (based on 8/20 $\mu$ s waveform).
      - 4) Have maximum continuous operating voltage (MCOV) rating as required by the associated circuit voltage.
      - 5) Visually indicate operational status.

- 6) Be Dehn DEHNguard series or equal by MTL Technologies, or may be combined with the High Frequency Noise Filtering device required above.
  - b. Provide surge protection device at any connection of multi-pole AC power to panels containing programmable logic controllers, remote I/O equipment, UPS's, transmitters, radios, VFDs, Reduced Voltage Soft Starters or other electronic equipment. Device shall:
    - 1) Be mounted internal to the associated panel, with dedicated overcurrent protection.
    - 2) Provide protection for all phases.
    - 3) Have 40kA (per phase) peak surge current rating.
    - 4) Have maximum continuous operating voltage (MCOV) rating as required by the associated circuit voltage.
    - 5) Visually indicate operational status.
    - 6) Be Square D SDSA or HWA series or equal.
  3. Analog I/O Panel Terminations Surge Protection:
    - a. Provide surge protection device at the PLC (or similar) panel connection of each analog I/O signal. Device shall:
      - 1) Be mounted internal to the associated panel.
      - 2) Be of two-part (base and SPD), DIN-rail mountable construction.
      - 3) Have 10kA total nominal discharge current per line (based on 8/20 $\mu$ s waveform).
      - 4) Have maximum continuous operating voltage (MCOV) rating as required by the associated signal.
      - 5) Be Dehn Blitzductor XT series or equal by MTL Technologies.
  4. Discrete I/O Panel Terminations Surge Protection:
    - a. Provide isolation relay at the PLC (or similar) panel connection of each discrete output signal (within the associated panel). See above for isolation relay requirements.
  5. Low Voltage Power Supply Load Side Surge Protection:
    - a. Provide surge protection device at the PLC (or similar) panel on the load side of each low voltage power supply that has low voltage connections extending external to the panel. Device shall:
      - 1) Be mounted internal to the associated panel.
      - 2) Be of two-part (base and SPD), DIN-rail mountable construction.
      - 3) Have 10kA total nominal discharge current per line (based on 8/20 $\mu$ s waveform).
      - 4) Have maximum continuous operating voltage (MCOV) rating as required by the associated utilization voltage.
      - 5) Be as manufactured by Dehn, MTL Technologies, or Phoenix Contact.
- C. Installation and grounding of suppressor: As directed by manufacturer. Provide coordination and inspection of grounding.

### **PART 3 - EXECUTION**

#### **3.1. INSTALLATION**

- A. Provide enclosure mounting supports as required for floor, frame or wall mounting. All supports in exterior, wet or process areas shall be stainless steel unless noted otherwise. All floor-mounted panels or other similar distribution equipment shall be

mounted on 6" concrete housekeeping pads unless specifically shown otherwise.

- B. All enclosures used outside shall be solid bottom unless otherwise specified. All cable and piping openings shall be sealed watertight. Cable and piping shall enter the enclosure as shown on drawings or specified herein.
- C. All equipment and components shall be solidly grounded to the control panel. One grounded terminal unit shall be provided in each control panel for connection to plant ground system. Grounding digital and analog components shall be performed in accordance with the instrument supplier's installation recommendations. Signal ground shall be solidly connected to the ground system so as to prevent ground loops

### 3.2. PAINTING

- A. For enclosures other than NEMA 4X stainless steel or fiberglass:
  - 1. Completely clean all surfaces so that they are free of corrosive residue. Then, phosphatize all surfaces for corrosion protection.
  - 2. Prime with two (2) coats and finish with one coat of factory finish textured polyurethane. Paint shall be Sherwin-Williams Polane "T" or approved equal.
  - 3. Color to be selected during shop drawing review phase.

### 3.3. IDENTIFICATION & DOCUMENTATION

- A. Refer to specification section 26 05 53 for additional requirements.
- B. Control panel power supply source, type, voltage, number or circuit ratings shall be identified inside control panels and on drawings.
- C. All interior devices and components shall be identified with thermal transfer labels with black letters on white background. Labels shall be placed on the subpanel and not the component. Marking system shall be a Brother "PTouch II" or equal. Lettering shall be 1/4" high.
- D. All front panel mounted devices such as push buttons shall be identified by the use of engraved bakelite nameplates or legend plates. Nameplates shall be 1/8" thick, white with black core.
- E. Where a panel includes a PLC or other network-connected device that is intended to be connected to another system (such as a plant SCADA system) via a network connection, the panel supplier shall provide an Interface Control Document (ICD) to the other system supplier (such as the SCADA Integrator). This document shall itemize the following for each networked parameter that is capable of being monitored or controlled by the other system:
  - 1. Parameter Name/Function (ex: Pump No. 1 On/Off Status)
  - 2. Parameter Type (discrete or analog, input or output)
  - 3. Parameter register ID/location
- F. Where a panel includes a touchscreen or other programmable HMI display and is to be monitored by another system (such as a plant SCADA system), the panel supplier shall provide copies of the HMI display code and screenshots of all proposed HMI screens to the other system supplier (such as the SCADA Integrator) for their use in



duplicating the associated HMI.

- G. A job-specific, custom wiring diagram for each control panel (not including control stations without relays) shall be provided to the contractor prior to installation for making the appropriate electrical connections. The wiring diagram shall clearly show all control components connected to the panel (whether the components are mounted internal or external to the enclosure). All wires and terminal blocks shall be clearly labeled. A laminated copy of the final wiring diagram for each unit shall be installed inside the door of the associated panel, and submitted to the owner with the as-built documentation.

#### 3.4. OWNER TRAINING

- A. Fully train the owner in the proper operation of all control panels/equipment, describing and demonstrating full operation, including function of each door-mounted device.

#### 3.5. SPARE EQUIPMENT

- A. Provide the following spare equipment:
  1. Fuses: 10% (minimum of 3) of each size and type utilized, mounted within a pocket within the associated control panel.
  2. Where control panel contains programmable controller (or similar equipment): Flash drive containing copies of all final programs utilized within the control panel, with provisions/cable assemblies as required to connect the flash drive provided to the controller to download the programs. Flash drive shall be attached to retractable cord (long enough to reach the associated port) attached to the inside of the panel door.

END OF SECTION 26 29 00

## **SECTION 26 44 00 - ELECTRICAL HEAT TRACING SYSTEMS**

### **PART 1 - GENERAL**

#### 1.1. SCOPE

- A. This specification covers the requirements of materials and support services for heat-tracing systems. Heat tracing systems (including insulation and all accessories) shall be provided on all piping installed exposed in exterior locations or where otherwise indicated on plans unless noted otherwise.

#### 1.2. CODES, APPROVALS, AND STANDARDS

- A. The electric heat-tracing system shall conform to this specification. It shall be designed, manufactured, and tested in accordance with the applicable requirements of the latest edition of the following codes and standards.
  - 1. ANSI American National Standards Institute
  - 2. CEC Canadian Electrical Code
  - 3. CSA CSA International
  - 4. FM FM Approvals
  - 5. IEC International Electro-Mechanical Commission
  - 6. IEEE Institute Of Electrical and Electronics Engineers
  - 7. ITS Intertek Testing Services (Intertek ETL SEMKO)
  - 8. NEC U.S. National Electrical Code (NFPA 70)
  - 9. NEMA National Electrical Manufacturers Association
  - 10. NESC National Electrical Safety Code
  - 11. UL Underwriters' Laboratories, Inc.

### **PART 2 - PRODUCTS**

#### 2.1. ACCEPTABLE MANUFACTURERS

- A. Heat Tracing:
  - 1. Raychem/Tyco Thermal Controls.
  - 2. Thermon.
  - 3. Nelson Heat Tracing.
  - 4. Chromalox.
- B. Insulation:
  - 1. Armstrong World Industries, Inc.
  - 2. Babcock & Wilcox; Insulationg Products Division
  - 3. CertainTeed Corporation
  - 4. Knauf Fiber Glass GmbH
  - 5. Manville Products Corp.
  - 6. Owens-Corning Fiber Glass Corp.
  - 7. Pittsburg Corning Corp.
  - 8. Rubatex Corp.

#### 2.2. SELF-REGULATING HEATING CABLES

- A. All heat-tracing applications with continuous exposure (maintain) temperatures from

150°F (65°C) to 250°F (121°C) or intermittent exposure temperatures from 185°F (85°C) to 420°F (215°C) shall use self-regulating cables.

1. Self-regulating heating cable shall vary its power output relative to the temperature of the surface of the pipe or the vessel. The cable shall be designed such that it can be crossed over itself and cut to length in the field.
2. Self-regulating heating cable shall be designed for a useful life of 20 years or more with “power on” continuously, based on the following useful life criteria:
  - a. Retention of at least 75 percent of nominal rated power after 20 years of operation at the maximum published continuous exposure (maintain) temperature.
  - b. Retention of at least 90 percent of nominal rated power after 1000 hours of operation at the maximum published intermittent exposure temperature. The testing shall conform to UL 746B, IEC 216-1 Part 1.
3. A warranty against manufacturing defects for a period of 10 years shall be available.
4. All cables shall be capable of passing a 2.5 kV dielectric test for one minute (ASTM 2633) after undergoing a 0.5 kg-m impact (BS 6351, Part 1, 8.1.10).

### 2.3. FREEZE-PROTECTION SYSTEMS

- A. The heating cable shall consist of two 16 AWG or larger nickel-plated copper bus wires, embedded in a self-regulating polymeric core that controls power output so that the cable can be used directly on plastic or metallic pipes. Cables shall have a temperature identification number (T-rating) of T6 (185°F or 85°C) without use of thermostats.
- B. The heating cable shall have a tinned copper braid with a resistance less than the heating cable bus wire resistance as determined in type test (ASTM, B193, Sec. 5). The braid shall be protected from chemical attack and mechanical abuse by a modified polyolefin or fluoropolymer outer jacket.
- C. In order to provide rapid heat-up, to conserve energy, and to prevent overheating of fluids and plastic pipe, the heating cable shall have the following minimum self-regulating indices:

1. Table K.1 Minimum Self-Regulating Indices

Heating cable	S.R. index (W/°F)	S.R. Index (W/°C)
3 W/ft	0.038	0.068
5 W/ft	0.060	0.108
8 W/ft	0.074	0.133
10 W/ft	0.100	0.180

- D. The self-regulating index is the rate of change of power output in watts per degree Fahrenheit or watts per degree Celsius, as measured between the temperatures of 50°F (10°C) and 100°F (38°C) and confirmed by the type test and published data sheets.
  1. In order to ensure that the self-regulating heating cable does not increase power output when accidentally exposed to high temperatures, resulting in thermal runaway and self- ignition, the cable shall produce less than 0.5 watts per foot (1.64 watts per meter) when energized and heated to 350°F (177°C) for 30

minutes. After this test, if the cable is reenergized, it must not have an increasing power output leading to thermal runaway.

2. In order to confirm 3.1B, the self-regulating heating cable shall retain at least 90 percent of its original power output after having been cycled 300 times between 50°F (10°C) and 210°F (99°C), allowing at least six minutes of dwell time at each temperature.
3. The heating cable shall be Raychem® BTV-CT or BTV-CR self-regulating heater, with continuous exposure (maintain) capability up to 150°F (65°C) and intermittent exposure capability up to 185°F (85°C), as manufactured by Tyco Thermal Controls.

#### 2.4. SYSTEMS FOR DIVISION 1 HAZARDOUS LOCATIONS

- A. The following requirements shall apply in addition to the criteria specified above:
  1. The self-regulating heating cable shall be specifically FM Approved or CSA Certified for use in Division 1 locations.
  2. A ground-fault protection device set at 30 mA, with a nominal 100 ms response time, shall be used to protect each circuit.
  3. The temperature identification number (T-rating) of the cable used shall comply with FM and CSA requirements as applicable.
  4. Connection methods used with the cable shall be compatible and approved as a part of the system manufactured and supplied by the heating cable vendor for use in the Division 1 location.
  5. For plastic pipe and vessel applications, the heating cable shall be Raychem HBTV-CT or Raychem BTV-CT self-regulating heaters, with continuous exposure capability up to 150°F (65°C) and intermittent exposure capability up to 185°F (85°C), as manufactured by Tyco Thermal Controls.
  6. The heating cable shall be Raychem HQTV-CT or Raychem QTVR-CT self-regulating heaters, for continuous and intermittent exposure capability up to 225°F (110°C), as manufactured by Tyco Thermal Controls.
- B. Terminations for nonhazardous And hazardous class 1, div 2 locations
  1. All connection components used to terminate heating cables, including power connectors, splices, tees, and connectors shall be approved for the respective area classification and approved as a system with the particular type of heating cable in use. Under no circumstances shall terminations be used which are manufactured by a vendor other than the cable manufacturer.
  2. In order to keep connections dry and corrosion resistant, components shall be constructed of nonmetallic, electrostatic, charge-resistant, glass-filled, engineered polymer enclosure rated NEMA 4X. The component stand shall allow for up to four inches (100 mm) of thermal insulation.
  3. Terminals shall be spring clamp wire connection type to provide reliable connection, maintenance-free operation, and ease of reentry.
  4. Heating cable terminations shall use cold-applied materials and shall not require the use of a heat gun, torch, or hot work permit for installation.
  5. Components shall be rated to a minimum installation temperature of -40°F (-40°C), minimum usage temperature of -75°F (-60°C), and maximum pipe temperature of 500°F (260°C).
  6. The component system shall be Raychem JBM-100-L-A connection kit complete with integral LED power indicating light to serve as complete power, splice, or tee

connection for up to three Raychem BTV, QTVR, or XTV industrial parallel heating cables as manufactured by Tyco Thermal Controls.

## 2.5. THERMOSTATS AND CONTACTORS

- A. Freeze protection systems shall operate using self-regulating control or with the DigiTrace AMC-1A or DigiTrace AMC-F5 thermostat and the DigiTrace E104-100A or DigiTrace E304-40A contactor in nonhazardous locations, and DigiTrace AMC-1H thermostat with DigiTrace E307-40A contactor in hazardous locations, as supplied by Tyco Thermal Controls.
- B. Where heat tracing is applied to emergency showers and/or emergency eye wash systems (or other systems where the heated piping system provides water that may be applied to persons in emergency or non-emergency situations), the sensor (that determines whether the heat tracing system is ON or OFF) shall be placed on the associated pipe or tank wall rather than in ambient air (such as to prevent the heat tracing system from overheating the associated liquid).

## 2.6. END SEAL

- A. An above-insulation, lighted end seal kit shall be provided for each heat trace circuit termination as per the manufacturer's installation details. The kit shall be E-100-LBTV2 as supplied by Tyco Thermal Controls.

## 2.7. INSULATION

- A. All components of the insulation, including covering, mastics and adhesives shall have a flame-spread rating of not over 25, and a smoke development rating of not over 50. Ratings shall be as established by tests in accordance with ASTM E 84 and Federal Specification standards. The integrated insulation assemblies shall also conform to the above specifications. Insulation shall be applied in strict accordance with the manufacturer's instructions.
- B. Description:
  - 1. This type of insulation shall be employed for process, cold-and hot water, steam, and condensate piping and equipment with surface temperatures up to 850 degrees F. Pipe insulation and jacketing shall be applied to piping where shown, and shall include fittings, flanges, and valves. Pipe insulation shall be molded-type pipe covering, made of fibrous glass with a minimum k-factor of 0.23 at 75 degrees F mean temperature. Unless otherwise specified the insulation thickness shall be 1" minimum.
  - 2. The insulation shall be oversized for installation over electric heating cable. Insulation shall have a factory-applied white fire-retardant vapor-barrier jacket of kraft paper and aluminum foil laminated together and reinforced with fiberglass yarn. Fittings and valves shall be covered with the same material as the pipe, cut in segments to fit snugly without open spaces, held in place with copper wire or cement, and then covered with the same jacketing material as the pipe. Insulated fittings adjacent to vapor-barrier insulation shall be sealed with an acceptable vapor-barrier cement before installation of the finish jacket. Pipe insulation and vapor-barrier shall be continuous through hangers and supports. Insulation shall be coordinated with the pipe hangers and supports and where insulation

protection shields are provided the top half section of pipe insulation at support locations shall be of the same specified density, and the bottom half insulation segments provided between the pipe and the insulation protection shields shall have a density of not less than 6 lb/cu ft. All insulation shall be covered with smooth aluminum weatherproof metal or plastic preformed jacketing with a factory attached moisture barrier. The jacket for the fittings shall consist of precision-formed smooth-sided sections and shall be sized to cover and protect the insulated fitting. Each section shall be manufactured from aluminum or PVC, and all joints shall be sealed with silicon mastic or solvent welding, to provide a continuous, air and weathertight joint. Strapping shall be 1/2-inch wide, Type 3003 aluminum or stainless steel.

### **PART 3 - EXECUTION**

#### **3.1. GENERAL**

- A. Heat tracing shall be provided along full length of all exposed piping or vessels located outside of buildings or in other areas designated on plans (such as by insulated piping in areas subject to cold temperature). Insulation shall be provided over all heat traced pipes.
- B. The vendor shall provide a detailed design utilizing standard heat-tracing design software, such as Tyco Thermal Controls TraceCalc® Pro design software or equal. At minimum, the design must provide the following:
  - 1. Circuit identification number
  - 2. Maintain temperature
  - 3. Line size and insulation
  - 4. Heat loss for pipe, valves, and supports
  - 5. Amount and type of heating cable required
  - 6. Spiral requirements
  - 7. Heating cable service voltage
  - 8. Heating cable power output at the maintain temperature
  - 9. Minimum and maximum maintain temperature vs. minimum and maximum ambient temperatures
  - 10. Circuit breaker and transformer sizing
- C. A ground-fault protection device set at 30 mA, with a nominal 100-ms response time, shall be used to protect each circuit.
- D. Install additional heating tape at bolted flanges, valves, pipe supports, and other fittings and fixtures as recommended by supplier, but not less than the following:
  - 1. Bolted flanges (per pair): Two times pipe diameter
  - 2. Valves: Four times valve length
  - 3. Pipe hanger or support penetrating insulation: Three times pipe diameter
- E. The entire system shall be installed in compliance with the manufacturer's recommendations for a fully-functional, code-compliant system.
- F. All insulation shall be installed by a qualified insulation contractor in strict accordance with the manufacturer's recommendations and the requirements of these specifications.

- G. All piping insulation shall be installed following required testing and approval of piping.

### 3.2. IDENTIFICATION

- A. Heat tracing systems shall be labeled at the field connection of power to the heat tracing equipment per the requirements for Utilization Equipment within Specification Section 26 05 53.
- B. Heat traced piping, vessels, etc. shall be identified with appropriate caution signs or markings at intervals not exceeding 20 feet on center per NEC requirements.

### 3.3. TESTING

- A. Factory inspections and tests for self-regulating, power limiting, series constant wattage and constant wattage (MI) heater cables shall include but are not limited to the following:
  1. Testing shall be done per the latest IEEE Std. 515 test section and applicable manufacturer's standards.
  2. In the field, all heater cables shall be meggered. The following separate field megger readings shall be taken on each self-regulating and each M.I. heater cable:
    - a. Heater cable shall be meggered when received at jobsite before installation.
    - b. Heater cable shall be meggered after installation, but before insulation is applied.
    - c. Heater cable shall be meggered after insulation has been installed.
  3. All three of the above field megger readings shall be greater than 20 megohms. Otherwise, the heater cable is not acceptable and shall be replaced.
  4. Field megger tests shall be recorded for each heater cable, and certified reports shall be submitted to the user.

END OF SECTION 26 44 00

## **SECTION 26 50 00 - LIGHTING MATERIALS AND METHODS**

### **PART 1 - GENERAL**

#### 1.1. DESCRIPTION

- A. Lighting Fixtures
- B. Drivers

#### 1.2. SUBMITTALS

- A. Complete submittals shall be provided identifying all lighting fixture types and options, all lamp types (where applicable) and compliance with all contract requirements. The absence of clear submittal information specifically listing exceptions/deviations from detailed contract requirements will be understood to indicate that the contractor/supplier intends to meet all contract requirements. Refer to specification section 26 05 00 for additional requirements.

### **PART 2 - PRODUCTS**

#### 2.1. GENERAL

- A. Lighting fixtures shall be furnished as shown on plans and specified herein. It shall specifically be the responsibility of Contractor to verify exact types ceilings, walls, etc. and recessing depth of all recessed fixtures and furnish the specific mounting trims and accessories of the specified and/or accepted fixture specifically for the ceiling, wall etc. in which each fixture is to be installed.
- B. Base bid manufacturers are listed on the lighting fixture schedule. Manufacturers listed without accompanying catalog numbers are responsible for meeting the quality standards, efficiency, maximum wattages and photometric distributions set by the specified product.
- C. All lighting fixtures shall be so designed and shall have drivers and other similar items so installed as to function without interruptions or failures when operating in the environment in which they are proposed to be installed. Special attention shall be given to environments with potentially high ambient temperatures such as attic spaces, exterior soffits, confined interior soffits, coves, unconditioned spaces, etc. and shall be addressed by providing fixtures with suitable high ambient temperature ratings, remote mounting of drivers/ballasts, providing approved ventilation, etc. as directed by fixture manufacturer and approved by engineer, at contractor's expense.
- D. All fixtures installed such as to create penetrations through fire rated ceiling or wall assemblies shall be labeled as suitable for that purpose or installed with covers, tenting or other means as required to maintain the fire rating of the assembly.

#### 2.2. LED LUMINAIRES

- A. For the purpose of these specifications, LED Luminaires shall be defined as the entire LED fixture assembly including LED array, drivers, housing, electronics, etc. that compose the lighting fixture.



- B. Furnish and install LED Luminaire of proper size, type, efficacy, delivered lumen output, color temperature, distribution pattern, operational life, and CRI as shown on drawings.
- C. LED Luminaires shall be tested in accordance with LM-79 and LM-80 standards.
- D. LED drivers shall comply with NEMA 410 standards for inrush current, etc.
- E. Exterior, pole mounted LED Luminaires shall be provided with an easily-serviceable, UL recognized surge protection device that meets a minimum 10kA Category C Low operation (IECC C62.41.2-2002). Device shall be wired in front of light engine(s) and driver(s) and shall fail "open" such as to prevent fixture operation after a surge protection failure.
- F. LED Luminaires shall have a guarantee-warranty of at least five years unless specifically noted otherwise on contract documents.
- G. LED Luminaire assembly shall comply with ambient temperature requirements specified in General section above.

### 2.3. STEMS/PENDANTS

- A. Hangers shall be approved ball aligner type swivel, 30 degrees from vertical with swivel below canopy.
- B. Stems/Pendants shall be rigid conduit unless specified otherwise on plans. Proposed stem/pendant types shall be submitted for review prior to shipment of light fixtures from factory.
- C. Stems/Pendants shall be provided as required to prevent swaying of fixtures due to HVAC system airflow or other similar occurrences.
- D. Shall be painted the same color as the fixture trim unless noted otherwise.

### 2.4. MANUFACTURER

- A. Fixtures and stems shall be manufactured as shown in fixture schedule or approved equals.
- B. Drivers shall be as manufactured by Philips/Advance, GE, Lutron, Magnatec, Motorola, EldoLED or approved equal.

## PART 3 - EXECUTION

### 3.1. INSTALLATION OF LIGHTING FIXTURES

- A. Support:
  1. Support of all lighting fixtures shall be responsibility of electrical contractor. All lighting fixture supports shall be installed in accordance with lighting fixture supplier's recommendations.

2. Contractor shall coordinate installation requirements for all wall-mounted fixtures (especially for wall-mounted fixtures on uneven wall surfaces, etc.) as required to assure a level/flat mounting surface and level/plumb/secure finished installation. Contractor shall provide flat mounting plates or other mounting provisions where necessary. Any proposed mounting plates, etc. shall be submitted to and approved by project architect prior to ordering materials.
  3. Contractor shall submit typical hanging detail to Engineer before installing any fixtures.
- B. Row-Mounted fixtures:
1. All stems on row-mounted fluorescent fixtures shall be installed as follows (except fixtures with slide grip hangers):
    - a. One stem shall be installed in the first fixture knockout from end of row (on the first and last fixture of the row).
    - b. One stem shall be installed between each two fixtures. Stem shall center joint where fixtures join and shall attach by use of "joining plates".
  2. All fixtures in continuous rows other than recessed grid type shall be connected by nipples with locknuts bushings.
- C. Coordination:
1. Contractor shall coordinate all dimensions & locations of light fixtures prior to rough-in to insure proper fit and coordination with other trades.
  2. Contractor shall verify exact ceiling types being installed and shall adjust fixture trim types accordingly (prior to submitting light fixture shop drawings).

END OF SECTION 26 50 00

## **SECTION 27 05 00 - AUXILIARY SYSTEM CABLES, 0-50V**

### **PART 1 - GENERAL**

#### 1.1. DESCRIPTION

- A. Cables rated for 0V-50V application

### **PART 2 - PRODUCTS**

#### 2.1. GENERAL

- A. Unless specified otherwise, all cables within the scope of this specification section shall:
  1. Be rated for exposed cable tray installation.
  2. Be plenum rated (Class 1 Control cabling and Instrumentation cabling installed in conduit or exposed in cable tray in non-plenum areas is not required to be plenum-rated).
  3. Be UL-rated for the proposed application.
  4. Be multi-conductor with overall outer sheath as required by the application. The insulation of each conductor within the overall multi-conductor cable shall be uniquely color-coded. Ground conductors (when provided) within the multi-conductor cable shall have green insulation. Conductors with green insulation shall not be used for conductors other than ground.
  5. Utilize copper conductors.
  6. Have wire gauge as required to limit voltage drop to acceptable limits determined by the system supplier and to meet all applicable code requirements.
  7. Where installed underground, within slab-on-grade or in exterior locations, be rated for wet locations.
  8. Where required for specific systems, meet the specific requirements (conductor quantity, wire gauge, insulation type, shielding, etc.) of the system supplier.

#### 2.2. INSTRUMENTATION CABLING

- A. In addition to above requirements, and unless specified otherwise, Instrumentation cabling shall:
  1. Be #16awg minimum.
  2. Be rated for 300V.
  3. Have aluminum foil shielding.
  4. Have stranded, twisted conductors.
  5. Have PVC insulation/jacket with ripcord.
  6. Be manufactured by Belden, AlphaWire or General Cable.

#### 2.3. CLASS 1 CONTROL CABLING (120VAC CONTROL CIRCUITS, ETC.)

- A. In addition to above requirements, and unless specified otherwise, Class 1 control cabling shall:
  1. Be rated for 600V.
  2. Be industrial grade.
  3. Have stranded conductors.
  4. Have sunlight/oil-resistant PVC/Nylon insulation and jacket with ripcord.
  5. Be manufactured by Belden, AlphaWire or General Cable.

## 2.4. CLASS 2 & 3 CONTROL CABLING (FED FROM CLASS 2 OR 3 POWER SUPPLIES)

- A. In addition to above requirements, and unless specified otherwise, Class 2 & 3 control cabling shall:
1. Be rated for 300V.
  2. Be shielded if so recommended by the system supplier/integrator.
  3. Have twisted conductors.
  4. Have plenum-rated insulation/jacket with ripcord.
  5. Be manufactured by AlphaWire, Belden, General Cable, Superior Essex or West Penn.

## PART 3 - EXECUTION

### 3.1. GENERAL INSTALLATION

- A. Routing:
1. All wires and cables shall be installed in conduit unless specifically noted otherwise. Where conduit is not otherwise required by contract documents, 0-50V Cabling located within concealed, accessible ceiling spaces (such as above lay-in ceilings) may be run without conduit if the following requirements are met:
    - a. Cabling is plenum-rated, multi-conductor.
    - b. Cabling is supported by cable tray or with J-hook supports on intervals not to exceed 5'-0" on center. Cabling shall be supported solely from the cable tray or j-hooks supported from the building structure, without using piping, ductwork, conduit or other items as supports.
    - c. Cabling is neatly formed, bundled and tied with plenum-rated Velcro straps on intervals not to exceed 30" on center.
    - d. Properly-sized conduit(s) are provided wherever cabling enters an inaccessible or exposed area (such as above gyp board ceilings, within walls or through walls).
    - e. Cabling is not a part of a Fire Alarm System, Smoke Control System, Emergency Generator Control System or other life-safety related system.
  2. End bushings shall be provided on both ends of all raceway terminations.
  3. No splices shall be pulled into conduit.
  4. No cabling shall be pulled until conduit is cleaned of all foreign matter.
- B. Penetrations:
1. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly.
  2. For cabling not installed in conduit:
    - a. Fire/smoke barrier penetrations shall be sealed utilizing an enclosed fire-rated pathway device (STI EZ Path or equal) containing a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed or retrofitted without the need to remove or reinstall firestop materials. The pathway shall be UL Classified and tested to the requirements of applicable ASTM/UL1479 standards.
  3. For cabling installed within conduit from endpoint to endpoint:

- a. Fire/smoke barrier penetrations shall be sealed utilizing fire caulk or other equivalent firestop systems around perimeters of conduits per UL requirements.
- 4. For cabling installed within cable trays:
  - a. Fire/smoke barrier penetrations shall be sealed with one of the following methods:
    - 1) Continuous cable tray through the penetration, with a combination of large firestop pillows and small firestop pillows contained, supported and secured (to prevent unauthorized removal) on both sides by aluminum wire mesh and firestop putty. Firestop pillows shall be STI Series SSB or equal and Firestop putty shall be STI Spec Seal or equal.
    - 2) Cable tray broken at the penetration, with fire/smoke barrier penetrations sealed utilizing an enclosed fire-rated pathway device (STI EZ Path or equal) containing a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed or retrofitted without the need to remove or reinstall firestop materials. The pathway shall be UL Classified and tested to the requirements of applicable ASTM/UL1479 standards.

C. Excess Cabling:

- 1. Excess cabling shall be neatly coiled within all junction boxes, pullboxes, wireways, etc. and at all terminations as required to allow future re-termination of cabling.

D. Terminations:

- 1. All conductors/cabling (including spare conductors) shall be properly terminated unless specifically directed otherwise. See below for general termination hardware requirements.
- 2. Cabling shall be neatly formed, bundled and tied at all terminations.

3.2. SPLICES/CONNECTIONS/TERMINATIONS:

A. Network Cabling:

- 1. Network and fiber optic cabling shall be continuous from endpoint to endpoint and shall not be spliced unless specifically noted otherwise.

B. Control Cabling:

- 1. Connections shall be made with T & B Sta-Kon wire joints EPT66M, complete with insulating caps. To be installed with WT161 Tool or C nest of WT11M Tool, Ideal Super - Nuts (not wire nuts), Ideal Wing Nuts, or Buchanan Elec. Products B Cap or Series 2000 Pressure connectors complete with nylon snap on insulators to be installed with C24 pressure tool.

C. Shielded cabling:

- 1. Unless directed otherwise by the system supplier, 0-50V cable shielding shall be grounded at the PLC/control panel end only (not at the field device end) with a termination kit as directed by the PLC/control panel supplier.

2. Shielded cabling shall be continuous from endpoint to endpoint and shall not be spliced without prior written approval from the Engineer.

3.3. LABELING

- A. Refer to Specification Section 26 05 53 for all labeling requirements.

END OF SECTION 27 05 00

## **SECTION 27 60 05 - INSTRUMENTATION**

### **PART 1 - GENERAL**

#### **1.1. DESCRIPTION**

- A. Work included: Provide a complete system of instrumentation and controls with appurtenant equipment and accessories as indicated, specified, and as necessary for a complete and proper operating system.
  - 1. Work includes, but not necessarily limited to, the following:
    - a. All engineering, hardware and software development, installation, startup, ranging, calibration services and supervision necessary.
    - b. Testing and operational demonstrations as specified.
    - c. Training programs as specified.
    - d. Preparation of manuals.
- B. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Specifications, Special Provisions, and all other related Sections.
  - 2. Refer to instrument schedules, plans for point lists and additional device requirements.

#### **1.2. QUALITY ASSURANCE**

- A. Where not specifically allowed or required otherwise by contract documents, all instrumentation and related equipment specified within this section shall be furnished by an experienced/trained instrumentation integrator (with permanent staff that are factory-trained for proper installation, calibration, and setup of the proposed instruments) for the project for proper system coordination.
- B. Contractor:
  - 1. Shall be fully and solely responsible for the work of the systems supplier and solely responsible to the Owner for having supplied to the Owner the complete integrated control system.
  - 2. To provide personal superintendence and direction of the work, maintaining and supplying complete supervision over and coordination between all subcontractors employed by him and the Instrumentation and Control System Integrator.
  - 3. To be responsible for defining the limits of his subcontractor's work.
  - 4. To be responsible for setting of instruments (including alarms, etc. as provided under other sections).
- C. Provide Operation and Maintenance manuals
  - 1. Operating instructions shall incorporate a functional description of the entire system, including the system schematics which reflect "as-built" modifications.
  - 2. Special maintenance requirements particular to the system shall be clearly defined along with special calibration and test procedures.
  - 3. As part of the operation and maintenance manuals, provide one hard copy of the program used to program the programmable logic controller.

#### **1.3. WARRANTY**

- A. Systems supplier shall furnish a hardware and software warranty for the system

starting at substantial completion and ending one year from this date.

#### 1.4. REFERENCES

- A. Instrument Society of America (ISA) PR7. 1, Pneumatic Control Circuit Pressure Test, Tentative Recommendation Practice.
- B. Instrument Society of America (ISA) S5.4, Instrument Loop Diagrams, standard.
- C. National Electrical Manufacturers Association (NEMA) Publication, General Standards for Industrial and Control Systems, ICS 1 and Industrial Controls and Systems ICS2.

#### 1.5. SUBMITTALS

- A. General/System submittal requirements:
  - 1. Provide submittal (quantity as required by contract) of:
    - a. Component manufacturing data sheets indicating pertinent data and identifying each component (including all instruments, surge protection devices, antennae, sun/rain shields, etc.) by tag number and nomenclature as indicated on drawings and in specifications.
    - b. Component drawing showing dimensions, mounting, and external connection details,
    - c. List of all spare parts. All manufacturers recommended spare parts shall be provided in addition to required spare parts.
  - 2. Identify any specification section where exceptions are being taken or an "or equal" piece of hardware is being proposed.
  - 3. A Bill of Materials shall be included with catalog information on all components.
  - 4. Information shall be included on any proprietary logic component sufficient to demonstrate its ability to perform the required functions.
- B. Instrumentation/Field Device submittal requirements:
  - a. Manufacturer's product data sheets
  - b. Job-specific model numbers for each instrument/field device
  - c. Job-specific ranges/setpoints/etc. proposed for each instrument/field device

#### 1.6. DELIVERY, STORAGE AND HANDLING:

- A. Packing and Labeling:
  - 1. Prior to shipment, each component shall be tagged to identify its' location, tag number, and system function. Identification shall be prominently displayed on the outside of the package.
  - 2. Firmly attach permanent stainless-steel, or other durable non corrosive tag to the equipment. Mark tags with the instrument tag number shown in the Instrumentation Data Sheets and/or Instrument drawings.
- B. Delivery:
  - 1. Following completion of shop assembly, factory test, and successful submittal of all equipment information (without requirement for resubmittal), equipment shall be shipped. Provide protection for equipment from handling and the environment.
- C. Receiving:



1. The contractor is responsible for receiving and proper storage of equipment delivered to the job site.
2. All received items shall be protected from the elements and where required stored in a low humidity environment.
3. Protect materials and equipment against damage in storage and during construction.

## **PART 2 - INSTRUMENTATION**

### **2.1. GENERAL**

- A. All equipment and materials shall be new, unused and proved by previous use of similar products to be completely suitable for the service intended.
- B. All of the equipment shall be the manufacturer's latest and proven design. Specifications and drawings call attention to certain features but do not purport to cover all details entering into the design of the system. All accessories, hardware, etc. shall be provided as required for a fully functional system. The completed system shall be compatible with the functions required and other equipment furnished by the Contractor.
- C. All electrical components of the system shall be powered by 120V, single phase, 60 cycle current or 24VDC loop-powered from control panel, except as otherwise indicated or specified.
- D. Cable lengths between sensors/elements and associated transmitters shall be as required by application. Contractor shall coordinate lengths and types of all sensor cables with the associated sensor supplier prior to bid and shall provide cable lengths/types as required.

### **2.2. LEVEL TRANSMITTERS & ULTRASONIC TRANSDUCERS**

- A. General:
  1. Scope -This section describes the requirements for a 4-wire, multi-functional ultrasonic level/open channel flow transmitter system.
  2. Basic System Description
    - a. The multi-functional level control system (level system) shall employ acoustic echo-ranging technology to determine the distance between the transducer(s) and monitored surface(s), as a basis for display, output, and digital communication.
    - b. The level/flow monitoring system shall consist of a microprocessor based level transmitter and one or two ultrasonic transducers.
    - c. The level/flow transmitter shall be operator configurable to meet specific application requirements by implementation of available signal processing and process control functions, in any allowable combination.
- B. Technical Specifications:
  1. Signal Processing - The level transmitter shall:
    - a. Employ ultrasonic transceiver(s) suitable for providing excitation to, and processing resultant signals from the attached ultrasonic transducer(s).

- b. Create a digitized echo profile, and apply patented Sonic Intelligence echo processing techniques to select and verify the echo representing the reflective surface monitored.
  - c. Calculate the distance between the transducer face and reflective surface based on the echo selected. The calculated distance may be converted to represent: material level, differential level, average level, space, material volume, vessel ullage, pumped volume, or head, open channel flow rate, and/or total flow volume.
  - d. Compensate temperature-induced variation in the acoustic wave propagation velocity in air. This compensation shall be based on signals received from the ultrasonic transducer(s) and/or a TS-3 temperature sensor.
  - e. Include a calibration method and/or enable manual operator value entry, to set a fixed acoustic wave propagation velocity for transmission mediums other than air.
  - f. Include configuration and calibration ability via integral keypad with non-volatile EEPROM memory to store user-programmed configuration.
  - g. Display measured variable (level/flow) on the main backlit LCD display along with associated units.
2. Process Control Functions - The level transmitter shall provide an assortment of process control functions that may be user implemented in any allowable combination.
- a. Standard Process Control Functions
    - 1) 0/4–20 mA output directly / inversely proportional to level, space, flow or distance
    - 2) Level alarm(s) based on on/off setpoints
    - 3) Loss of Echo or Cable Fault alarm
    - 4) Duty assist pump operation based on fixed or alternating level setpoints
    - 5) Remote relay state control via communications
    - 6) Basic failsafe operation on measurement loss
    - 7) Discrete inputs configurable to override level transmitter I/O operations
3. User Interface - The level transmitter shall enable user access to read only and read/write enabled data, using any of the following methods:
- a. Direct or scroll access to data stored in numerical parameters, using the hand programmer and graphic LCD display.
  - b. IBM PC compatible computer access to data and digital echo profiles, using the Dolphin Plus instrument configuration package.
  - c. HMI, SCADA, PLC, or DCS system access to data stored in Modbus registers via digital communications.
4. Detailed Specifications:
- a. Power
    - 1) 100-230 VAC  $\pm$  15%, 50 / 60 Hz, 50VA or less
  - b. Enclosure
    - 1) Polycarbonate/Polyester, Indoor/Outdoor
    - 2) NEMA 4X / IP 65
  - c. Ambient Temp.
    - 1) -20 to 50°C (-5 to 122°F)
  - d. Display

- 1) Back lit LCD, multi-line display
  - e. Process Control I/O - The level transmitter shall provide:
    - 1) One (1) 4-20mA HART analog signal output, directly or inversely proportional and scalable to the configured process variables, (dependent upon the transmitter model), capable of driving a 750 ohm load.
    - 2) A minimum of three (3) form C relays with contact outputs based on the level conversion or other process variable as set by the Relay Function and other user configurable relay parameters.
    - 3) Two discrete inputs that may be configured to override normal Process Control Functions.
    - 4) One (1) 4-20mA input (model dependant) that may be scaled to a monitored process variable, to be used as a basis for level transmitter Process Control Functions.
  - f. Ranges: As directed by Civil Engineer.
  5. Accessories:
    - a. Stainless steel mounting bracket/hardware as recommended by manufacturer.
  6. Spare Parts:
    - a. Provide one (1) spare transducer of each type furnished with manufacturer's cable length to match longest cable length furnished within project.
  7. Execution:
    - a. Maintain minimum separation between transducer and maximum process material level as recommended by manufacturer.
    - b. Mount transducer to ensure a clear path from the transducer to the process material surface.
    - c. Where required by the application, provide submergence shield for the transducer(s).
- C. Manufacturer/ Model:
1. Pulsar Ultra 5 series transmitter with dB Ultrasonic Level Transducer(s) as required by application.
  2. Equal by Siemens Milltronics
  3. Equal by Endress + Hauser

### 2.3. POLYPROPYLENE FLOAT SWITCHES

- A. Standard Specifications:
1. Chemical Resistant polypropylene casing.
  2. Enclosed/encapsulated mercury SPST switch rated for 100VA at up to 250V. N.O. and N.C. contacts shall be provided, and shall be connected as indicated on wiring diagrams or required by application, coordinated by contractor and equipment supplier.
  3. Complete with factory-installed PVC-jacketed STO cable designed for industrial duty, length as required to be extended to contractor-furnished termination point.
- B. Execution:
1. Contractor shall be responsible for verifying that adequate space is available for the proposed float switch installation prior to submitting shop drawings.

2. Contractor shall provide pipe mounting provisions with 1" stainless steel vertical mounting pipe and stainless steel hardware as required – exact installation shall be coordinated by contractor within the limited sump space as required.
  3. Install float switches at heights as directed by civil engineer at locations that do not risk damage to the float switches.
  4. Contractor shall provide corrosion resistant junction box or other termination point above high water level for splicing cables furnished with float switch(es) to cables furnished by contractor. Provide cord connectors at base of junction box (or similar) and conduit sleeves through any grating/etc. for proper strain relief of all float switch cables.
- C. Manufacturer/ Model: Anchor Scientific Roto-Float Type P with hardware/accessories as described above, or equal. Normally-open/normally-closed contact types shall be coordinated by supplier and shall be as required by application.

#### 2.4. CHLORINE LEAK ALARM DETECTOR

- A. Standard Specifications:
1. Transmitter:
    - a. NEMA 4X, corrosion resistant enclosure
    - b. 120VAC, 60Hz Power Input
    - c. Complete with power supply, battery backup & quantities of receivers as required for quantities of sensors shown on plans
    - d. Integral digital 4-digit backlit LED display with 2 alarm LED's for each sensor
    - e. 90dB audible alarm horn and front-panel mounted "silence" pushbutton
    - f. Two (2) high level alarm adjustable relays per sensor and two (2) common alarm relays (to indicate loss of power and loss of sensor signal). All relays shall be rated for a minimum of 5A at 240VAC.
    - g. Battery-backup to power the unit for a minimum of 12 hours (when fully charged).
  2. Sensor(s):
    - a. Quantity as shown on plans
    - b. Furnished with signal cable of length as required by application
    - c. Chlorine gas sensors of the electrochemical type having a range of 0 to 10 PPM and a resolution of 0.1 PPM.
- B. Execution: Sensors shall be installed at 18" above floor at locations as directed by civil engineer for proper detection.
- C. Acceptable manufacturers: Wallace & Tiernan/Evoqua Acutec 35 Gas Detection System with quantities of CL2 detection sensors as shown on plans

#### 2.5. FLASHING LED NEMA 4X ALARM BEACON

- A. Standard specifications:
1. NEMA 4X, corrosion resistant enclosure
  2. 120VAC, 60Hz Power Input.
  3. LED Flashing beacon
  4. Amber 3.25" wide polycarbonate lens (unless noted otherwise on plans)
  5. Labeled with red engraved nameplate with 3/8" white lettering unless specified otherwise.

6. Immune to shock and vibration
7. -31F to 150F (-35C to 66C) operating temperature
8. Provide stainless steel wall-mounting hardware or panel-mount hardware as required by application.

- B. Execution:
1. Verify exact location, and labeling requirements with owner prior to rough-in.
- C. Acceptable manufacturers Edwards Signaling #125LEDFA120A with #WBR wall mount bracket.

## 2.6. ELECTRICAL SURGE AND TRANSIENT PROTECTION

- A. General
1. Function: Protect the system against damage due to electrical surges.
- B. Application: As a minimum, provide surge and transient protection (with proper grounding) at all field instrumentation connected to process piping or where part of circuitry extends outside building(s), as described below:
1. Analog Instruments:
    - a. Provide surge protection device(s) at power and analog circuit connections to the instrument equipment.
    - b. At 2-wire, loop-powered instruments, surge protection device shall:
      - 1) Be of stainless steel, pipe-mounted, IP67 construction, nipple-mounted at the instrument as directed by the device supplier.
      - 2) Have 10kA total nominal discharge current per line (based on 8/20 $\mu$ s waveform).
      - 3) Have maximum continuous operating voltage (MCOV) rating as required by the associated signal.
      - 4) Be Dehn DEHNpipe series or equal by MTL Technologies.
    - c. At 4-wire, separately-powered instruments, surge protection device(s) shall:
      - 1) Be mounted within one (1) appropriately-sized NEMA 4X enclosure with viewing window at the field device.
      - 2) Be of DIN-rail mountable construction.
      - 3) Have 10kA total nominal discharge current per line (based on 8/20 $\mu$ s waveform) for the analog signal.
      - 4) Have 15kA total nominal discharge current per line (based on 8/20 $\mu$ s waveform) for the power input.
      - 5) Have maximum continuous operating voltage (MCOV) rating as required by the associated signal/power circuit(s).
      - 6) Be one of the following:
        - (a) Edco SLAC series
        - (b) Dehn Blitzductor XT series (for the analog signal) plus Dehn DEHNguard series (for the power input), combined into (1) overall NEMA 4X enclosure.
- C. Installation and grounding of suppressor: As directed by manufacturer. Provide coordination and inspection of grounding.

## PART 3 - EXECUTION

### 3.1. INTERFACE REQUIREMENTS

- A. The instrumentation supplier shall forward submittals clearly identifying all instrumentation interface requirements (inputs/outputs, network connections, register locations for network connections, loop power source requirements, etc.) to the supplier of the associated control and monitoring system, or SCADA system, prior to construction of the associated control and monitoring panels, PLC's, RIO's, RTU's, etc.

### 3.2. IDENTIFICATION AND LABELING:

- A. Refer to Specification Section 26 05 53 for identification and labeling requirements.

### 3.3. INSTALLATION

- A. All equipment shall be installed in accordance with the manufacturer's recommendations.
- B. All mounting hardware shall be of corrosion resistant material unless noted otherwise. In exterior or typical process areas, mounting hardware shall be type 316 stainless steel. In extremely corrosive areas (Chlorine rooms, Fluoride rooms, etc.), mounting hardware shall be of non-metallic construction as recommended by the equipment supplier.

### 3.4. CALIBRATION

- A. All instruments provided, relocated or modified within the project shall be calibrated and ranged by a factory-trained representative to the range specified by the process engineer.
- B. All calibration procedures shall be implemented using equipment meeting NIST standards.
- C. Calibration sheets shall be used to record all applicable calibration settings and calibration equipment data, and to indicate certification of traceability to National Institute of Standards and Technology (NIST) standards.

### 3.5. TESTING

- A. General
  1. All elements of the instrumentation system shall be tested to demonstrate that the total system satisfies all of the requirements of this specification.
  2. As a minimum the testing shall include the following:
    - a. Operational Readiness Test (ORT)
    - b. Functional Acceptance Test (FAT)
  3. Each test shall be in the cause and effect format. The person conducting the test shall initiate an input (cause) and upon the system's or subsection's producing the correct result (effect), the specific test requirement will have been satisfied.
- B. Operational Readiness Test (ORT)
  1. General: Prior to start-up, the entire installed instrumentation system shall be certified (inspected, tested and documented) that it is ready for operation.

- C. Functional Acceptance Test (FAT)
  - 1. The entire instrumentation system shall be tested on-site to demonstrate that it is operational and in conformance with these specifications.
  - 2. Tests shall demonstrate specified functions, calibration and ranging to the satisfaction of the owner.

### 3.6. TRAINING

- A. General
  - 1. Provide an integrated training program for the owner's personnel at the jobsite. Tailor the training program to meet the specific needs of the Owner's personnel. Include training sessions, classroom and field, for managers, engineers, operators and maintenance personnel.
  - 2. The training shall be carried out by technically competent and experienced instructors
  - 3. A minimum of one eight (8) hour day shall be provided on site for training owner and or engineer selected attendees.

### 3.7. SPARES:

- A. A quantity of spare surge protection devices for field instruments equal to 25% of the quantity specified of each type, or one of each type (whichever is greater) shall be provided. For example, a system with surge protection devices for two (2) loop-powered 2-wire field instruments and nine (9) 120V-powered 4-wire field instruments shall be provided with one (1) spare surge protection device for loop-powered 2-wire field instruments and three (3) spare surge protection devices for 120V-powered 4-wire field instruments.

### 3.8. SYSTEM DOCUMENTATION:

- A. Upon completion of the installation, the instrumentation supplier shall provide full documentation sets (quantity as required by other specification sections) to the owner for approval. Documentation shall include:
  - 1. A record set of all information submitted prior to installation.
  - 2. Records of all calibration sheets described above.

### 3.9. FINAL ACCEPTANCE & SYSTEM CERTIFICATION:

- A. Completion of the installation, in-progress and final inspections, receipt of the system documentation, and successful performance of the instrumentation system for a two week period will constitute acceptance of the system.

### 3.10. WARRANTY:

- A. The contractor shall fully warrant the completed instrumentation system to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of final acceptance.

END OF SECTION 27 60 05

## **SECTION 31 10 00 - SITE CLEARING**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Erosion control best management practices (BMP's).
  - 2. Protecting existing trees and vegetation designated to remain.
  - 3. Clearing and grubbing.
  - 4. Topsoil stripping.
  - 5. Demolition of existing above-grade and below-grade site improvements.
  - 6. Disconnecting, capping or sealing, and abandoning site utilities in place.
  - 7. Demolition of existing site utilities.

#### 1.3 MATERIALS OWNERSHIP

- A. Anything of value found during the progress of the work, as determined by the Owner, shall become the property of the Owner.
- B. Except for anything of value, materials indicated to be stockpiled or materials indicated to remain the Owner's property, cleared materials shall become the Contractor's property, be removed from the site and legally disposed of by the Contractor.

#### 1.4 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
  - 1. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
    - a. Use sufficiently detailed photographs or videotape.
    - b. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

#### 1.5 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.



1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Owner and authorities having jurisdiction.
  2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction over the site.
- B. **Limit of Construction Activity:** Unless specifically authorized by the Owner, the Contractor shall confine all construction activity within the boundary of the Project property, adjacent public rights-of-way and prescribed rights-of-way or easements. Work within public rights-of-way is subject to permit. If clearing and grubbing limits are indicated, the Contractor shall confine all construction activity within those limits.
- C. **Improvements on Adjoining Property:** Authority for performing any indicated work on property adjoining the Owner's property shall be obtained by the Owner before award of the Contract.
- D. **Items to be Salvaged:** Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- E. **The Contractor shall utilize utility locator services for the Project site before any site clearing work is commenced.**

## PART 2 - PRODUCTS

### 2.1 EROSION CONTROL MATERIALS

- A. **Silt Fence Materials:** Silt fences shall consist of a geotextile filter fabric attached to posts by means of adjustable belts or loops or other means that will securely hold the fabric in an upright position. The filter fabric shall be a polymeric fabric formed from a plastic yarn of long-chain synthetic polymer composed of at least 85% by weight of propylene ethylene, amide, ester or vinylidene chloride and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and heat exposure for at least six months. The filter fabric roll shall be a minimum of three feet in width.
1. The filter fabric shall conform to the following physical requirements:

<b>Physical Property</b>	<b>Test Method</b>	<b>Test Results</b>
Grab Tensile Strength, lbs, min.	ASTM D-4632	120
Grab Elongation, %, max.	ASTM D-4632	40
Mullen Burst Strength, psi, min.	ASTM D-3786	175
Apparent Opening Size, max., U.S. Standard Sieve	ASTM D-4751	30
Flow Rate, max. gal/minute/ft <sup>2</sup>	ASTM D-4751	30

UV Resistance, %, min.	ASTM D-4632 ASTM D-4355	70
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B. Riprap Materials:

1. Riprap shall be limestone conforming to the requirements of ALDOT Specifications Section 814.01, Class 2 Riprap (unless otherwise specifically shown on Drawings).
2. Riprap bedding, where required, shall consist of gravel or crushed stone ALDOT Size #467. All stone for riprap and bedding, such as shot rock, quarry rock, quarry waste or other materials, shall be sound, durable, and free from seams, cracks or other structural defects.

C. Grouted-In Riprap Materials: Riprap stone to be grouted in place shall be of the same size and placed in the same manner as specified for riprap. Grout for grouted-in riprap shall consist of 1 part hydraulic cement to 3 parts sand, thoroughly mixed with water to produce a thick, creamy consistency.

D. Geotextile Riprap Bedding Materials: The geotextile shall be of nonwoven construction. The geotextile shall be mildew, insect, and rodent resistant and shall be inert to chemicals commonly found in soil.

1. The geotextile shall conform to the physical property requirements listed in the table below:

<b>Physical Property</b>	<b>Test Method</b>	<b>Test Results</b>
Grab Tensile Strength, lbs, min.	ASTM D-4632	120
Puncture Strength, lbs, min.	ASTM D-4833	70
Grab Elongation, %, max.	ASTM D-4632	50
Mullen Burst Strength, psi, min.	ASTM D-3786	240
Apparent Opening Size, max., U.S. Standard Sieve	ASTM D-4751	70
Flow Rate, max. gal/minute/ft <sup>2</sup>	ASTM D-4751	135

2. The geotextile shall be furnished in a protective wrapping which shall protect the fabric from ultraviolet radiation and from abrasion due to shipping and handling. The fabric shall be ultraviolet stabilized.

E. Hay Bale Materials: Hay bales shall be rectangular and may be either hay or straw securely bound with twine or wire. Bales shall contain a minimum of 5 cubic feet of material and shall weigh a minimum of 35 pounds when dry.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain and to be protected. All work shall be performed within the limits shown.
- C. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to the Owner.

### 3.2 EROSION CONTROL BEST MANAGEMENT PRACTICES (BMP's)

- A. General:
  - 1. The Contractor shall utilize erosion control best management practices (BMP's) to prevent the discharge of sediment-bearing water runoff or airborne dust from the project site in accordance with all federal, state and local regulations during construction.
  - 2. The Contractor shall be responsible for obtaining an NPDES Permit for stormwater discharge from the construction site(s) for all work described in these Specifications and shown on the Drawings. It shall be the Contractor's responsibility to meet all requirements and obligations of the Permit. The Contractor shall be responsible for all costs associated with making application for the permit and for meeting the requirements of the Permit.
  - 3. The Contractor shall be responsible for the inspection and maintenance of all BMP's in accordance with the requirements of the permitting authority.
  - 4. The Contractor shall ensure that all downslope BMP's are installed and functional before any land disturbing activity is commenced on any portion of the site.
  - 5. The Contractor shall be responsible for the installation and maintenance of additional BMP's if required by field conditions, the Engineer or a permitting authority having jurisdiction over the site.
- B. Silt Fence:
  - 1. The installation of silt fences shall be in conformance with the silt fence manufacturer's recommendations. Particular care shall be exercised to ensure that all silt fencing is properly keyed into the earth at the toe.
  - 2. The Contractor shall maintain, clean, repair or replace silt fence as may be required during the construction period. If a line of silt fencing exceeds its capacity to function properly and the need for a back-up fence becomes evident, the Contractor shall install a secondary line of silt fence at the affected area as required and authorized by the Engineer. Failure to maintain a silt fence shall not be cause for the Contractor to claim additional compensation.
- C. Riprap:
  - 1. Placement: Riprap shall be placed in accordance with ALDOT Specifications Section 610 for Class 2 riprap. Riprap shall be placed in such a manner as to

produce a reasonably well graded mass or rock having the minimum practical percentage of voids. Riprap shall be placed to its full course thickness in one operation, and in such a manner as to avoid displacement of bedding material if bedding is required. The finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones. The dumping of riprap shall be allowed provided that riprap bedding material, if required, is not displaced and that mechanical equipment is used to dress the stones to a reasonably uniform slope.

2. Riprap placed in unauthorized locations without prior approval of the Engineer shall be considered to have been wasted, and, therefore, placed at no cost to the Owner.
3. The Contractor shall maintain all riprap protection until the project is accepted, and any material displaced by any cause prior to acceptance of the project shall be replaced at the Contractor's expense.

D. Grouted-In Riprap:

1. Care shall be exercised during placement to keep fine materials from filling the voids between the stones.
2. After the stones are in place, the voids between them shall be completely filled with grout from bottom to top and the surface swept with a stiff broom.
3. No riprap shall be grouted in freezing weather. In hot, dry weather the grout work shall be protected and kept moist for at least 3 days by the use of saturated burlap.
4. Grouted-in riprap placed in unauthorized locations without prior approval of the Engineer shall be considered to have been wasted, and, therefore, placed at no cost to the Owner.
5. The Contractor shall maintain all grouted-in riprap protection until the project is accepted, and any material damaged or displaced by any cause prior to acceptance of the project shall be replaced at the Contractor's expense.

E. Geotextile Riprap Bedding: The fabric shall be placed in the manner described and in accordance with the manufacturer's recommendations.

1. The surface to receive the geotextile shall be prepared to a smooth condition free of obstructions, depressions and debris.
2. The fabric shall be placed loosely, not in a stretched condition.
3. The riprap shall be carefully placed so that the geotextile is not punctured.
4. The riprap shall completely cover the fabric.
5. The fabric shall be placed on the slopes so as to provide a minimum overlap of 18 inches at seams.
6. The geotextile may be placed with seams either parallel or perpendicular to the direction of the flow. If placed perpendicular to the flow, the upstream or higher panel shall overlap the downstream or lower panel. At the top of the bedding installation the fabric shall be keyed into the ground a minimum of 18 inches.
7. If a cushion layer is required, the bottom toe shall be finished by lapping the fabric back onto the cushion layer and securing with riprap.

F. Hay Bales: Hay bales shall be installed using keyways cut into grade or aggregate fill bedding as required. All hay bales shall be properly oriented and staked. Hay bales shall be removed and properly disposed of when the project area upslope from them has been stabilized.

1. The Contractor is responsible for the periodic checking and maintenance of hay bale installations. Silt trapped by hay bale installations shall be removed and properly disposed of.

- G. Rock Check Dams: Rock check dams shall be carefully installed in the drainage ditch. Rock check dams shall be removed and properly disposed of when the project area upslope from them has been stabilized.
  - 1. The Contractor is responsible for the periodic checking and maintenance of rock check dam installations. Silt trapped by rock check dam installations shall be removed and properly disposed of.
- H. Sediment Traps: Sediment traps shall be backfilled and any associated granular material removed and properly disposed of when the project area upslope from them has been stabilized.
  - 1. The Contractor is responsible for the periodic checking and maintenance of sediment trap installations. Silt trapped by sediment trap installations shall be removed and properly disposed of.
- I. Temporary Sediment Basins: Temporary sediment basins which are installed at locations other than permanent storm water detention basins shall be backfilled and any associated granular material removed and properly disposed of when the project area contributing runoff to them has been stabilized.
  - 1. Permanent storm water detention basins with temporary modifications to their outlet structures may serve as temporary sediment basins. The Contractor shall remove the temporary outlet structure modifications and properly dispose of the associated materials when the project area contributing runoff to the permanent storm water detention basin has been stabilized.
  - 2. The Contractor is responsible for the periodic checking and maintenance of temporary sediment basin installations. Silt trapped by temporary sediment basin installations shall be removed and properly disposed of.
- J. After stabilization of the disturbed area has been achieved, the Contractor shall remove and dispose of all temporary BMP's and dress out those areas to the proper line and grade.

### 3.3 PROTECTION OF DESIGNATED VEGETATION OR INDIVIDUAL TREES

- A. The Contractor shall erect and maintain a clearly marked temporary fence around designated areas of the site, the perimeter drip line of groups of trees or the drip line of individual trees designated to remain and be protected.
  - 1. Do not store construction materials, debris, or excavated material within the above-described fenced areas.
  - 2. Do not permit vehicles, equipment, or foot traffic within the above-described fenced areas.
  - 3. Remove temporary fencing around the above-described areas upon substantial completion.
- B. Where excavation for new construction is required within areas designated to remain and be protected, the Contractor shall hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to the excavation limits as possible.

1. Cover exposed roots with burlap and water regularly.
  2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
  3. Clean cut limbs which obstruct the work. Minimize limb cutting as much as practicable.
  4. Coat cut faces of roots or limbs more than 1-1/2 inches (38 mm) in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
  5. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.
- C. Repair or replace trees and vegetation indicated to remain and be protected that are accidentally damaged by construction operations.
1. Replace trees that cannot be repaired and restored to full-growth status, as determined by the Engineer.

### 3.4 UTILITIES

- A. The Contractor will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing.
1. Contractor shall coordinate with utility companies to shut off indicated utilities.
  2. Contractor shall arrange for utility company to locate, identify, disconnect, and seal or cap off utilities indicated to be removed, or shall receive written permission from utility companies to perform work.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify utility companies in accordance with their policies in advance of any proposed utility interruption.
  2. Do not proceed with utility interruptions without written permission from the Engineer.

### 3.5 CLEARING AND GRUBBING

- A. Clearing and grubbing shall consist of cutting, removing and disposal of all trees, tree stumps, brush, grass, roots and other organic material within areas to be subject to earthwork and/or occupied by proposed structures or facilities. If clearing and grubbing limits are indicated, those lines shall define the extent of clearing and grubbing activity on the site.
1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated. Contractor shall replace all damaged trees, shrubs, or other vegetation at no cost to the Owner.
  2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
  3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
  4. Roots projecting from the walls of excavations shall be either cut or removed to provide a minimum clearance of 3 feet for the outside line of structures.

- B. Fill depressions caused by clearing and grubbing operations with fill material in accordance with Division 2 Section "Earthwork" unless area is designated for further excavation.

### 3.6 TOPSOIL STRIPPING

- A. Strip topsoil to the depths indicated in the geotechnical report or a minimum depth of 6 inches.
  - 1. The stripping layer may include topsoil, muck, trash, debris, grass, weeds, roots and other organic materials.
  - 2. The stripping process should result in a clean subgrade surface free from organic material and ready for earthwork operations.
- B. Stockpile topsoil materials in areas which will prevent intermixing with subgrade or fill soils. If topsoil is stockpiled on site, the stockpile locations must be acceptable to the Engineer and the Owner. Stockpile locations shall allow for access for the re-loading and spreading of topsoil.
  - 1. Grade and shape stockpiles to drain surface water.
  - 2. Stockpiles shall be protected from wind erosion by periodic water sprinkling, covering or temporary seeding.
  - 3. Dispose of excess topsoil as specified for waste material disposal.

### 3.7 DEMOLITION OF EXISTING SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate construction. Break holes in structures as required to prevent collection of groundwater.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
- C. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

### 3.8 DISPOSAL

- A. Disposal: The Contractor shall remove cleared vegetation, surplus soil material, surplus topsoil, demolition debris, and waste materials including trash and dispose of them off of the Owner's property. All disposal shall conform to all applicable federal, state and local regulations.
- B. Disposal of Wood Chips: If permitted by the Owner, processed wood chips may be left on the site. The location of wood chip stockpiles or spreading areas shall be as designated by the Owner.
- C. Disposal by Burning: The burning of material on the Project site, when permitted by the Owner, shall be performed in accordance with the "Air Pollution Control Rules and Regulations" of the Alabama Department of Environmental Management (ADEM) and with the "Air Pollution Control Rules and Regulations" of the County Department of Health. The Contractor shall secure written approval of burning and the proposed

method of burning from the County Health Officer or appropriate local authority before any burning is commenced.

1. The burning of stumps, timber, logs, trimmings, brush, or other combustible materials where allowed shall be accomplished in such a manner that there shall be no smoke or flyash nuisance.
2. Burning shall not be initiated or continued when atmospheric conditions will cause or are causing a static smoke cover in the area.
3. Burning shall be strictly controlled to prevent damage to trees and/or growth adjacent to the cleared area or to facilities or structures located in the surrounding area. The quantities of materials being burned shall be strictly limited to ensure that fires are within the control of the personnel and equipment present. Fires shall be attended at all times.

END OF SECTION 31 10 00



## **SECTION 31 20 00 – EARTH MOVING**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes excavation and backfill for structures, pipelines, embankments and other areas.
- B. If the Owner has engaged a geotechnical engineer to investigate the subsurface conditions, then the Owner may share this information with the Contractor. However, the Contractor shall only rely on this information at their own risk, and the Contractor shall make whatever additional investigations they believe to be necessary for bidding and construction purposes. If the Contractor desires to make their own investigations prior to bidding the project, then the Contractor shall coordinate this work with the Owner. The Owner/Engineer is not responsible for variations in subsurface conditions (soil, rock, groundwater, etc.).
- C. Related Sections include the following:
  - 1. Division 03 Section "Cast-in-Place Concrete"
  - 2. Division 22 Section "Water Distribution."
  - 3. Division 31 Section "Site Clearing"
  - 4. Division 31 Section "Dewatering"

#### 1.3 DEFINITIONS

- A. Backfill: Suitable soil materials used to fill an excavation.
- B. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- C. Base Course: Layer placed between the subgrade and slabs-on-grade, walkways, and pavements.
- D. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
- E. Borrow: Suitable soil imported from off-site for use as fill or backfill.
- F. Crushed Stone Backfill: Crushed stone, where specified to be used as backfill or a stone cushion for structures shall be crushed stone meeting Alabama Department of Transportation Gradation #57.

- G. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- H. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2- inch sieve and 0 to 5 percent passing a No. 8 sieve.
- I. Excavation: Removal of material encountered above subgrade elevations.
  - 1. Earth Excavation: Removal of all materials, not including that specified under the "Clearing and Grubbing" and "Rock Excavation" items. Rocks and boulders eight (8) cubic feet or less in volume shall be classified as earth.
  - 2. Rock Excavation: loosening, removing, and disposing of all rock in original bed, in well-defined ledges, or in boulder form. Boulders having a volume of eight (8) cubic feet or less shall not be classified as rock. Material that can be loosened, separated, or ripped by means of heavy duty power tools or excavating equipment shall not be classified as rock.
  - 3. Additional Excavation: Excavation below subgrade elevations as directed by Engineer.
  - 4. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.
- J. Fill: Suitable soil materials used to raise existing grades.
- K. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- L. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- M. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- N. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base, drainage fill, or topsoil materials.
- O. Suitable Soils: As defined in the geotechnical report (if applicable), or the following ASTM D 2487 soil classification groups as a minimum; GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- P. Unsuitable Soils: As defined in the geotechnical report (if applicable), or the following soil classification groups as a minimum; ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols. Unsuitable soils also include suitable soils not maintained within 2 percent of optimum moisture content at time of compaction.

- Q. Utilities include on-site underground pipes, conduits, ducts, and cables.

#### 1.4 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by the Owner and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Owner's written permission.
  - 3. Contact utility-locator service for area where Project is located before excavating.
  - 4. All existing underground utilities may not be indicated. Contractor is responsible for locating all underground utilities before beginning excavation.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

### PART 2 - PRODUCTS

#### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient suitable soil materials are not available from excavations.
- B. Structural Backfill:
  - 1. Suitable backfill materials shall be within moisture limits required for compaction; silty-clay, weathered shale or other suitable soil mixtures; and such soils shall not contain rock or stone in sizes greater than ½".
  - 2. Native soils as excavated from the site may be used provided that they satisfy the criteria specified herein. If native soils are unsuitable, then Contractor shall furnish and install suitable soils from off-site at Contractor's expense.
  - 3. Material for structural and general backfill may be that excavated on the site; but in the event that the excavated material is not in suitable condition at the time when it is required for backfilling purposes, or the quantity of material excavated is not sufficient to make the finished fills indicated, the Contractor shall provide, at his own expense, such additional suitable material as is required.
  - 4. If paved areas (or areas to be paved) abut structures, then backfill material under these areas shall be crushed stone.
  - 5. Contractor is responsible for removing and disposing of unsuitable materials off-site, unless otherwise specifically shown to be disposed of on-site.
- C. Utility Trench Bedding and Backfill:
  - 1. Bedding Materials
    - a. Where trenches are excavated in soil, bedding material shall be silty sand to a depth of approximately 4" under barrel of pipe, unless otherwise noted on the drawings.

- b. Where trenches are excavated in rock, bedding material shall be #57 stone, placed and compacted to a depth of approximately 6" under barrel of pipe.

## 2. Backfill Materials

- a. Where trenches are excavated in soil, backfill material shall be #57 stone to ½ the depth of the pipe, then the remainder shall be suitable soil placed and compacted as described in these Specifications.
- b. #57 stone shall be used in the following locations:
  - 1) For backfill where trenches are excavated in rock (to a depth of 12 inches above the top of the pipe)
  - 2) For backfill in trenches cut in paved streets, in paved areas, areas to be paved as part of this Contract or future work, beneath footings, beneath slabs, or as specifically indicated.
  - 3) For backfill (to a depth of 12" above the highest pipe) in areas of general excavation (where pipe lines are installed and where, because of proximity of several pipe lines, individual trenches cannot be excavated), and in areas where two or more utilities cross.
- c. The top foot of depth of all trenches (except under slabs, footings, roads, walks and paved areas, along road shoulders and other areas where crushed stone may be specified or directed to be used) shall be backfilled with soil that can be smoothly dressed to match surface of ground adjoining the edges of the trench, and that will support the vegetation desired for the finished surface and required by the finished grading and grassing requirements.

## D. Embankment and Fill Work:

- 1. The material used in embankments and fills shall be free from frost, stumps, trees, roots, sod, muck or debris of any kind.
- 2. Only materials as specified herein and/or approved by the geotechnical engineer shall be used.
- 3. Fill and embankment materials shall not be placed on frozen ground.
- 4. Embankment and fill materials shall be provided as follows:
  - a. Underneath grass and planted areas: Use suitable soils.
  - b. Underneath walks and pavements: Use suitable soils.
  - c. Underneath footings, foundations, building slabs, steps and ramps: Use suitable soils, crushed stone, or ALDOT #57 stone or as indicated in the geotechnical report.
  - d. Dikes and/or Embankments Intended to Hold Water: Use an impervious fill such as a sandy-clay or clayey sand or as indicated in the geotechnical report.
- 5. Rock greater than two (2) inches in any dimension shall not be placed in compacted fills for embankments, dikes or earth sections forming the walls of water containing structures (holding ponds, reservoirs, lagoons, etc.) unless all voids are filled with fine material and the complete fill is compacted to a dense mass as specified hereinabove.

6. Rock greater than one (1) cubic foot in volume, or having any dimension greater than one (1) foot, shall not be placed in compacted fills in areas to be occupied by structures, bearing slabs, footings, roadways, walks, etc.
  - a. Rock of permissible size deposited in such fills shall be placed in layers not greater than one (1) foot in depth, and such rock layers shall be separated by not less than one (1) foot (compacted thickness) of clay or other acceptable backfill material.
  - b. Rock shall not be placed nearer than two (2) feet to the surface of any fill, nor nearer than three (3) feet to the wall or surface of any structures.
7. Rock shall not be placed in fill areas which pipes, conduits, cables, etc., are to be laid, nor shall rock be placed in trench backfill except as described in these Specifications.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways in accordance with Division 2 Section "Site Clearing."

### 3.2 SITE DRAINAGE

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
  1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
  2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.
  3. The Contractor shall complete all dewatering operations and dispose of the water from the work in a manner that will not cause damage to adjacent properties or environment, nor restrict access to any new or existing facilities. No water shall be drained into work under construction.
  4. The Contractor shall keep excavations and work dry until the structures or facilities to be constructed are completed and the Engineer is in agreement with the Contractor to discontinue dewatering operations.

C. Drainage Ditches:

1. New ditches shall be cut and existing ditches shall be cleaned out and extended as required to provide for surface drainage around structures and to divert water away from excavations.
2. New (permanent) ditches:
  - a. Flowlines shall be graded as indicated.
  - b. The cross-sections of the ditches shall conform to details specified.
3. Temporary ditches:
  - a. When temporary ditches have served their purpose, all such ditches shall be filled and finished to conform to existing contours or finished contours.
  - b. It shall be the Contractor's responsibility to provide and maintain drainage ditches during the progress of the work.

3.3 EXPLOSIVES

- A. Explosives: The use of explosives will not be allowed.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
1. All excavation for this Project is unclassified.
  2. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
- B. General Rock Excavation:
1. All rock excavated from the site shall be designated as rock spoil. Rock spoil must be removed and disposed of off-site unless Contractor receives written permission from Engineer to use it for rip rap on-site, or to dispose of it on-site in non-structural fill areas.
  2. The permission of the Owner shall be secured before any rock spoil is disposed of on site.
- C. The Contractor is reminded that all excavation is under the protective guidelines and requirements of OSHA "Safety and Health Regulation for Construction", as set forth in the Federal Register, latest revision, and all such protections are the responsibility of the Contractor and shall be provided at the Contractor's expense.

3.5 SHEETING, SHORING, AND BRACING

- A. Sheeting, shoring, bracing and sloping are methods of excavation, and such methods may vary according to the Contractor's methods of dewatering, excavating and installing the work.
- B. All such methods of accomplishing the work are the sole responsibility of the Contractor, in accordance with the OSHA guidelines referred to hereinabove, and the sole responsibility of the Engineer is to review the finished work for compliance with the requirements of the Plans and Specifications.

### 3.6 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  - 1. Earth Excavation for Footings, Foundations, and Floor slabs: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
    - a. In the event that, at the elevation indicated, soil over the general area to be occupied by a bearing slab is found to be unsuitable for supporting the design load, the Contractor shall remove such soil and replace it with backfill material (compacted as specified herein), crushed stone, or concrete as concurred with the Engineer.
    - b. In the event that, at the elevation indicated, soil over the area to be occupied by footings is found to be unsuitable for supporting the design load, the Contractor shall remove such soil and replace it with backfill material (compacted as specified herein), crushed stone, or concrete as concurred with the Engineer.
    - c. Excavations shall not be exposed to rainfall and must be protected to keep dry. Excavations that are exposed to excessive moisture must be re-worked or soil must be replaced at Contractor's expense.
  - 2. Rock Excavation for footings, foundations, and floor slabs: Where rock is found to be the supporting material for footings, foundations, or floor slab, the Contractor shall reasonably clean the foundation area in order that proper inspection and evaluation of foundation conditions can be made.
    - a. If unusual conditions such as would be indicated by presence of seams, fissures or voids should be found, the Contractor may be directed to perform additional cleaning work, utilizing air jets, water jets, or other suitable methods.
    - b. All seams, voids or fissures found shall be filled with crushed stone of gradation suitable for the particular situation encountered.
    - c. In the event that, when excavation to grade line has been completed, it is found that the footing, foundation or slab would bear partly on soil and partly on rock, the rock shall be excavated to depth of six inches (6") below the gradeline indicated and/or specified herein, and a compacted crushed stone cushion shall be placed on the rock surface before the concrete is poured. The compacted cushion shall be wetted before placement of concrete.

### 3.7 EXCAVATION FOR UTILITY TRENCHES

- A. All trenches for pipe shall be excavated in open cut to such depths as indicated or as required to secure the specified minimum cover over the pipe.
- B. Where trenches are excavated in native soil, excavation shall be carried to a depth of approximately 4" under barrel of pipe for placement of the specified bedding material.
- C. The trench shall have a uniform cross section and bottom conforming to the grades as indicated.
- D. The pipe shall be laid on firmly compacted approved bedding material, and the barrel of the pipe shall have uniform bearing for its full length.
- E. Any part of the trench excavation below the grade specified shall be corrected with bedding material placed and compacted in accordance with the requirements of these Specifications.
- F. Where unsuitable or unstable material is encountered at the elevation indicated, the Contractor shall excavate below the grade (or elevation) shown and backfill such excavation with bedding or stabilizing material.
- G. Boulders and large stones, rock or shale, shall be removed to provide a clearance of at least six (6) inches below all parts of the pipe or fittings and to clear width of at least six (6) inches on each side of all pipe and appurtenances.
- H. Where the trench is excavated in rock or shale, the six (6) inch space below the pipe shall be filled with crushed stone firmly compacted in accordance with these Specifications to form a cushion for the pipe.
- I. Bell holes of ample dimensions shall be dug to permit joining to be properly made and to insure that the pipe is evenly supported throughout its length rather than on joints or couplings.

### 3.8 SUBGRADE

- A. Notify Engineer when excavations have reached required subgrade.
- B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
  - 1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer.



### 3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Engineer.
- B. In the event that the Contractor should excavate below the grade specified, and excess excavation is not authorized by the Engineer, such excess excavation shall be backfilled to the grade specified and/or indicated with compacted crushed stone or compacted backfill material. All such backfilling of excess excavation shall be done at the Contractor's expense.
- C. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

### 3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
  - 2. Stockpile soil materials in a manner that will not cause damage to adjacent properties or environment, nor obstruct access to any new or existing facilities.
  - 3. Drainage lines shall not be obstructed nor shall natural drainage of the surrounding ground be altered or obstructed.
  - 4. If Contractor mixes suitable and unsuitable soil materials, then Contractor shall furnish and install equivalent amount of suitable materials from off-site at no additional cost to the Owner.

### 3.11 BACKFILL, EMBANKMENTS, AND FILL WORK

- A. General: Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for record documents.
  - 3. Inspecting and testing underground utilities.
  - 4. Removing concrete formwork.
  - 5. Removing trash and debris.
  - 6. Removing temporary shoring and bracing, and sheeting.
  - 7. Embankments and fills shall not be started without the concurrence of the Engineer.
  - 8. If embankment or fill is to be placed on a surface which slopes more than 4:1, the surface shall be scarified and compacted to provide bond with the new material.
  - 9. Steep slopes may require the existing surface to be benched.
  - 10. Wet ground to be covered by fill shall be drained.
- B. Compaction Requirements:

1. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
2. Under structures, building slabs, steps, utility trenches and pavements, scarify and recompact top 6 inches of existing subgrade and each layer of backfill or fill material at 98 percent.
3. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 95 percent.
4. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 90 percent.
5. Place base course material over subgrade.
6. Compact base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 1557.
7. Shape base to required crown elevations and cross-slope grades.
8. When thickness of compacted base course is 6 inches or less, place materials in a single layer.
9. When thickness of compacted base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

C. Drainage Courses: Under slabs-on-grade, place drainage course on prepared subgrade and as follows:

1. Compact drainage course to required cross sections and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 698.
2. When compacted thickness of drainage course is 6 inches or less, place materials in a single layer.
3. When compacted thickness of drainage course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

### 3.12 STRUCTURAL BACKFILL

A. General:

1. Backfill shall be made around the walls of the structures as indicated; and backfill shall be placed only after the walls have gained sufficient strength to support the load.
2. No rock shall be placed in fill within three (3) feet of the walls of structures.
3. In all fill work the best dirt shall be used as top soil for any planting, sprigging, or sodding that may be required.
4. Backfill material shall be placed within foundation walls, under footings or slabs, under and around piping installed under footing or slabs, under and around piping located in areas of general excavation (where because of proximity of several pipe lines individual trenches could not be excavated) as indicated.
5. All such backfill material for purposes specified hereinabove, whether obtained from suitable on-site soils, crushed stone, or from suitable off-site soils, shall be furnished and placed by the Contractor at the Contractor's expense.
6. The Contractor shall be responsible for maintenance of the backfill; and shall promptly re-work and/or refill any areas where settlement of backfill has occurred.

7. All backfill around structures shall be sloped and graded as indicated or as requested by the Engineer.
8. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
9. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
10. The surface of each layer shall be kept parallel to the elevation of the finished compacted fill by use of blade graders. In proximity to existing structures, leveling shall be accomplished by use of small spreaders, bulldozers, or hand method.
11. Each layer shall be compacted by use of heavy earth compaction equipment suitable for the particular type of soil/stone.
12. Each layer shall be rolled and compacted to the specified density before the succeeding layer is placed.
13. The final layer shall be brought to elevation of finished compacted fill before topsoil or pavement is placed to conform to the finished contour specified.

### 3.13 UTILITY TRENCH BACKFILL

#### A. General:

1. The Contractor shall notify the Engineer prior to backfilling any trench in which pipe has been installed.
2. No extra compensation will be allowed for backfill as specified herein.
3. Trench backfill materials shall be thoroughly compacted by means of pneumatic tampers or mechanical tampers.
4. Each layer of trench backfill shall be carried up to the same level on both sides of the pipe so as to avoid unbalanced loading.
5. Each layer of trench backfill shall be evenly compacted on both sides of pipe before the next layer is placed.
6. Backfill for pipe line trenches shall be placed in 4" layers from the bottom of the trench to a level 12" above the top of the pipe.
7. Backfill above a level 12" above the crown of the pipe shall be placed in layers not exceeding 6" in areas beneath pavement, slabs, footings, etc. and 12" in thickness elsewhere.
8. After the pipe has been covered to elevation three (3) feet above top of pipe, backfilling may be accomplished by use of bulldozer, bucket or other mechanical equipment if carefully performed in a manner suitable to the Engineer.
9. #57 stone backfill shall extend out from either end (or side) of the paved areas, slab or footing and along the trench on a 1:1 slope.

- B. Special Trench Conditions: Where the character of the soil is such that the employment of proper and adequate drainage of the work will not enable the Contractor to secure a suitable bed for the pipe, the Engineer may request the Contractor to excavate below the specified bedding depth, and backfill the excess excavation with #57 stone. Backfill throughout remainder of trench depth shall be as specified.

### 3.14 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### 3.15 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Provide a smooth transition between adjacent existing grades and new grades. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- C. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations

### 3.16 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will select a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
  1. The cost of initial sampling and testing shall be borne by the Owner.
  2. Subsequent re-testing of any samples or locations failing the initial test shall be performed at the expense of the Contractor.
- B. Allow testing agency to inspect and test subgrades and to test each lift of fill or backfill as frequently as recommended by the geotechnical engineer, or as recommended by Engineer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements. Contractor shall be responsible for scheduling testing at the required intervals as work progresses.
- C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.
- D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

### 3.17 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due

to subsequent construction operations or weather conditions. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

### 3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: The Contractor shall remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off of Owner's property.
- B. The Contractor shall make all necessary arrangements for disposal areas, and pay all costs incidental to securing permission for their use and shall dispose of all surplus material without cost to the Owner, other than as reflected in the prices bid.

END OF SECTION 31 20 00

## **SECTION 31 23 19 - DEWATERING**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes construction dewatering.
- B. Groundwater conditions are likely to fluctuate. The Contractor is solely responsible for all dewatering, including groundwater, leaks from process structures, piping, and/or other sources. The Contractor is also solely responsible for making provisions to prevent flotation of structures, piping, equipment and appurtenances during construction. The Contractor shall make whatever investigations he/she deems necessary (before bidding and during construction) to quantify groundwater and to develop sufficient plans for dewatering.
- C. Related Sections:
  - 1. Division 01 Section "Construction Progress Documentation" for recording preexisting conditions and dewatering system progress.
  - 2. Division 31 Section "Earth Moving" for excavating, backfilling, site grading, and for site utilities.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
  - 1. Delegated Design: Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
  - 2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
  - 3. Prevent surface water from entering excavations by grading, dikes, or other means.
  - 4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
  - 5. Remove dewatering system when no longer required for construction.

#### 1.4 ACTION SUBMITTALS

- A. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
  - 1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
  - 2. Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.
- B. Delegated-Design Submittal: For dewatering system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Other Informational Submittals:
  - 1. Photographs: Show existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that has specialized in dewatering work.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.

#### 1.7 PROJECT CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
  - 1. Notify Engineer no fewer than three days in advance of proposed interruption of utility.
  - 2. Do not proceed with interruption of utility without Engineer's written permission.
- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
  2. The geotechnical report is included elsewhere in the Project Manual.
- C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Engineer if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
  2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Monitor dewatering systems continuously.
- E. Promptly repair damages to adjacent facilities caused by dewatering.

### 3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.



1. Space well points or wells at intervals required to provide sufficient dewatering.
  2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
- E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- F. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
1. Remove dewatering system from Project site on completion of dewatering.
- G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

### 3.3 FIELD QUALITY CONTROL

- A. Observation Wells: Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated; additional observation wells may be required by authorities having jurisdiction.
1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
  2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.

3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.
- B. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

END OF SECTION 31 23 19

## **SECTION 32 12 16 - HOT MIX ASPHALT PAVING**

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Hot-mix asphalt paving.
  - 2. Hot-mix asphalt patching.
  - 3. Hot-mix asphalt paving overlay.
  - 4. Asphalt surface treatments.
  - 5. Pavement-marking paint.
  - 6. Cold milling of existing hot-mix asphalt pavement.

#### 1.2 DEFINITIONS

- A. Hot-Mix Asphalt Paving Terminology: Refer to the standard specification for definitions of terms.
- B. DOT: Department of Transportation.
- C. ALDOT: Alabama Department of Transportation.

#### 1.3 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of the standard specifications of the state DOT.
  - 1. Standard Specification: Standard Specifications for Highway Construction, Alabama Department of Transportation, 2001 Edition.
  - 2. Standard Specification for Mix Design: Standard Specifications for Highway Construction, Alabama Department of Transportation, 1992 Edition.
  - 3. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- C. Job-Mix Designs: For each job mix proposed for the Work.
- D. Product Data: For each type of product indicated. B. Shop Drawings: Include the following.
  - 1. Detail each equipment assembly, include make, model weight, and indicate installation details, dimensions, required clearances, method of field assembly, components, and location and size of each field connection.

2. Complete catalog information, descriptive literature, materials of construction, wheels, gears and bearing, trolley drive system, brakes, starting system, variable speed drive system, conductors (bus bar, festoon, cable reel), controls, remote control system, and accessories.
3. Power and control wiring diagrams, including terminals and numbers.
4. Motor nameplate data in accordance with NEMA MG 1 and include any motor modifications.
5. Factory finish system.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
  1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.
- B. Regulatory Requirements: Comply with Alabama Department of Transportation for asphalt paving work, delivery, storage, and handling.
- C. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- D. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or frozen or if the following conditions are not met:
  1. Prime and Tack Coats: Minimum surface temperature of 40 deg F (4 deg C).
  2. Asphalt Base Course: Minimum surface temperature of 45 deg F (8 deg C) and rising at time of placement.
  3. Asphalt Surface Course: Minimum surface temperature of 55 deg F (13 deg C) at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4 deg C).

## PART 2 - PRODUCTS

### 2.1 AGGREGATES

- A. Crushed Aggregate: Conforming to ALDOT Standard Specifications Section 825 for crushed aggregate base materials, Type A.

### 2.2 ASPHALT MATERIALS

- A. Binder Course: Conforming to ALDOT Specifications Section 410.
- B. Wearing Surface Course: Conforming to ALDOT Specifications Section 410.

- C. Prime Coat: Conforming to ALDOT Specifications Section 401.
- D. Tack Coat: Conforming to ALDOT Specifications Section 405.

## 2.3 AUXILIARY MATERIALS

- A. Pavement-Marking Paint: Class 1, Type B (non-reflectorized) designating paint conforming to ALDOT Specifications Section 856.
- B. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

## 2.4 MIXES

- A. Hot-Mix Asphalt: Provide dense, hot-laid, hot-mix asphalt plant mixes in accordance with ALDOT Specifications Section 410:
  - 1. Binder Course: Mix 2.
  - 2. Wearing Surface Course: Mix 3.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll subgrade using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- C. Notify Engineer in writing of any unsatisfactory subgrade conditions.
- D. Proceed with paving only after unsatisfactory conditions have been corrected.

### 3.2 PLANING (MILLING)

- A. Plane existing pavement surface in accordance with ALDOT Specification Section 408. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
  - 1. Repair or replace curbs, manholes, and other construction damaged during cold milling.
  - 2. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
  - 3. Transport milled hot-mix asphalt to asphalt recycling facility or lawful disposal facility.

### 3.3 PAVEMENT REPLACEMENT

- A. Replaced pavement:

1. Shall be of the same type and thickness as the original pavement
2. However, the replaced pavement shall be at least equal to that specified herein.

B. Materials for base course under pavement shall be:

1. Crushed stone meeting the requirements of Alabama Department of Transportation Specifications Section 825.
2. Premixed in accordance with the requirements of Alabama Department of Transportation Specifications Section 301.03(c) And shall conform to the following requirements:
  - a. Material shall be uniform in color and gradation
  - b. Material shall have moisture content suitable for attainment of the desired compacted density.

C. Base course for replaced pavement shall conform to the following requirements:

1. Thickness:
  - a. Not less than that of the original pavement,
  - b. Or a minimum acceptable compacted thickness of not less than 6".
  - c. If the thickness of the existing pavement base should be greater than 6", the new base material shall be placed in layers not exceeding 6" in thickness.
2. Each layer of base material shall be compacted to approximately 98% of Standard Proctor Density.
3. Protection and maintenance of base layers prior to the placement of bituminous pavement shall be the responsibility of the Contractor.

D. Where the original pavement was of the bituminous plant mixed type:

1. The Contractor shall replace the original pavement with hot bituminous plant mix meeting the requirements of Alabama Department of Transportation Specifications Section 411, Articles 411.01 - 411.02.
2. Construction of the replaced pavement shall conform to the requirements of Alabama Department of Transportation Specifications Section 410, Articles 410.01 - 410.07.
3. A prime coat shall be placed prior to the placement of the bituminous plant mix, and prime coat shall conform to the requirements of Alabama Department of Transportation Specifications, Section 401.
4. Thickness of layer of plant mix (Mix A) shall be equal to that of the original pavement, but shall not be less than 2½" (+-1/4") in thickness.

E. Where the original pavement was of the bituminous surface treatment type:

1. The Contractor shall replace the original pavement with double surface treatment type conforming to the requirements of Alabama Department of Transportation Specifications Section 401, Articles 401.01 - 401.04
2. Pavement shall be of Type AL in accordance with Bituminous Treatment Table, Article 401.01(b).

3. The Contractor, at his or her option, may elect to replace the surface treatment type with plant mix type as specified hereinabove.
  4. In such case, thickness of replaced pavement shall be approximately 1" (approximately 105#/SY).
- F. Replacement of bituminous surface course in the City of right-of-ways or Highways shall conform to the following requirements:
1. The Contractor shall pour an eight (8") inch concrete slab in accordance with details shown on the Drawings.
  2. Backfill under this eight (8") concrete slab shall be crushed stone as described in BACKFILL FOR TRENCHES.
  3. Concrete shall be Class "A" concrete, as defined in these Specifications.
  4. If the pavement is to be opened to traffic in less than 14 days,
    - a. High-Early Strength Portland Cement shall be used in the concrete mixture.
    - b. If Type I Portland Cement is used, the cement factor shall be increased to 7 bags per cubic yard and the quantity of water set to give slump of 2" or less.
  5. Where bituminous pavement is cut in private drives or areas outside of public Right-of-Ways, the eight (8") inch slab may be omitted if approval of the Public Authority having jurisdiction over such matters is obtained in writing.
    - a. If the concrete slab is omitted, the Contractor shall replace bituminous surface courses in accordance with these Specifications.
  6. Upon placement of the concrete slab, and after allowance of sufficient time for curing:
    - a. The surface of the concrete slab be primed in accordance with Section 402 of the ALDOT Specifications.
    - b. A tack coat shall be thoroughly applied to the edge of the existing pavement at the sides of the patch by utilizing the same material used for prime coat on the concrete slab.
- G. Should the Contractor delay or postpone the final paving over the trenches, he shall provide a temporary wearing surface for service until such time as the final paving replacement is performed.
1. Temporary paving shall conform to the following requirements:
    - a. Paving shall be bituminous surface treatment type, single or double, or layer of bituminous mix, according to the Contractor's judgment as to the time interval between temporary and final paving.
    - b. It shall be the Contractor's responsibility to maintain the temporary paving in such condition as to prevent hindrance or hazard to traffic.
    - c. When final paving is undertaken:
      - 1) The temporary surfacing materials shall be removed to accommodate final paving of types and thicknesses as specified hereinabove.
      - 2) The edges of the existing paving shall be neatly and uniformly trimmed
      - 3) The permanent pavement shall be placed.

- 4) No extra compensation will be allowed for provision and maintenance of temporary paving.

H. Where the pipelines traverse or cross streets, highways, roads or driveways:

1. The Contractor shall conduct his construction operations in such a manner as to minimize interference with traffic and public convenience.
2. All travelways (highways, roads, streets, driveways, etc.) adjacent to or in the vicinity of the construction work shall be kept free from soil or mud resulting from wash or other movement of stored excavated materials or from transport of materials associated with the construction work.
3. It shall be the responsibility of the Contractor to employ such measures as would reasonably prevent the development of traffic hazards and/or air pollution resulting from his construction operations, such as:
  - a. Cleaning and washdown of paved surfaces.
  - b. Sprinkling of unpaved streets affected by his construction operations.

I. Paving replacement on Public Rights-of-Way:

1. Shall meet the requirements of the Public Authority having jurisdiction
2. Shall be subject to inspection and acceptance by the Public Authority having jurisdiction.

### 3.4 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Pump hot undersealing asphalt under rocking slabs until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Patching Single Course Asphalt: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

E. Patching Multi-Course Asphalt: Partially fill excavated pavements with hot-mix asphalt



base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

### 3.5 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
  - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
- C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course in accordance with ALDOT Standard Specification Section 401.
- D. Tack Coat: Apply uniformly to surfaces of existing pavement or binder course in accordance ALDOT Standard Specification Section 405.
  - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

### 3.6 PAVING GEOTEXTILE INSTALLATION

- A. Paving geotextiles shall be placed shall be placed in accordance with ALDOT Standard Specification 607.

### 3.7 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface in accordance with ALDOT Standard Specification Section 410. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

### 3.8 JOINTS

- A. Construct joints in accordance with ALDOT Standard Specification Section 410. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
  - 1. Clean contact surfaces and apply tack coat to joints.
  - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
  - 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
  - 4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."
  - 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
  - 6. Compact asphalt at joints to a density within 2 percent of specified course density.

### 3.9 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
  - 1. Complete compaction before mix temperature cools to 180 deg F (82 deg C).
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
  - 1. Average Density: 94 percent of reference laboratory density according to AASHTO T 209, but not less than 92 percent nor greater than 96 percent.
  - 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 1559 (Marshall Method), but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.10 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  - 1. Binder Course: Plus or minus 1/4 inch.
  - 2. Surface Course: Plus or minus 1/4 inch.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 16-foot straightedge applied transversely or longitudinally to paved areas:

1. Surface Course: 1/4 inch.

### 3.11 SURFACE TREATMENTS

- A. Slurry Seals: Apply slurry coat in accordance with ALDOT Standard Specification Section 402.

### 3.12 PAVEMENT MARKING

- A. Apply pavement-marking paint using layout, colors, and placement indicated.
- B. Allow paving to cure before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply, in two coats, at manufacturer's recommended rates.

### 3.13 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
  1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to [ASTM D 979] [or] [AASHTO T 168].
  1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
  2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188, ASTM D 1559 or ASTM D 2726.
    - a. One core sample will be taken for every 500 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
    - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188, ASTM D 1559 or ASTM D 2726.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.14 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
  - 1. Do not allow excavated materials to accumulate on-site.

END OF SECTION 32 12 16

## **SECTION 321313 - CONCRETE PAVING**

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Curb and Gutter

#### 1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

#### 1.3 SUBMITTALS

- 1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

#### 1.4 QUALITY ASSURANCE

- A. The Owner will engage a testing agency.
- B. ACI Publications: Comply with ACI 301 unless otherwise indicated.

### PART 2 - PRODUCTS

#### 2.1 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
  - 1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less.
  - 2. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

#### 2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60; deformed.
- B. Steel Bar Mats: ASTM A 184; with ASTM A 615, Grade 60, deformed bars; assembled with clips.

- C. Joint Dowel Bars: ASTM A 615, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.
- D. Tie Bars: ASTM A 615, Grade 60, deformed.
- E. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
  - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

## 2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
  - 1. Portland Cement: ASTM C 150, portland cement Type I/II. Supplement with the following:
    - a. Fly Ash: ASTM C 618, Class C or Class F.
    - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4S, Class 4M, Class 1N, uniformly graded. Provide aggregates from a single source.
  - 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: Potable and complying with ASTM C.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- F. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- G. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

- H. Water: Potable.

## 2.4 RELATED MATERIALS

- A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.
- B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
  - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

## 2.5 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
  - 2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
  - 1. Compressive Strength (28 Days): 4000 psi.
  - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
  - 3. Slump Limit: 4 inches, plus or minus 1 inch.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
  - 1. Air Content 5 percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing admixture in concrete as required for placement and workability.

2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash or Pozzolan: 25 percent.

## 2.6 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Furnish batch certificates for each batch discharged and used in the Work.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
  2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
  3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

### 3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.



- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

### 3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

### 3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
  - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
  - 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
  - 2. Provide tie bars at sides of paving strips where indicated.
  - 3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  - 4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
  - 5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
  - 1. Locate expansion joints at intervals of 20 feet unless otherwise indicated.
  - 2. Extend joint fillers full width and depth of joint.

3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
  4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
  5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
  6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
    - a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.
  2. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

### 3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
  1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

- H. Screed paving surface with a straightedge and strike off.
- I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
  - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.
- K. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
  - 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
  - 2. Do not use frozen materials or materials containing ice or snow.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- L. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
  - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  - 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
  - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

### 3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
  - 1. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

### 3.8 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing moisture-retaining-cover curing curing compound or a combination of these as follows:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

### 3.9 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
  - 1. Elevation: 3/4 inch.
  - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
  - 3. Surface: Gap below 10-foot long, unlevelled straightedge not to exceed 1/4 inch. Concrete panels holding water (puddling) due to surface depressions from poor installation shall be torn out and replaced.
  - 4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
  - 5. Lateral Alignment and Spacing of Dowels: 1 inch.
  - 6. Vertical Alignment of Dowels: 1/4 inch.
  - 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
  - 8. Joint Spacing: 3 inches.
  - 9. Contraction Joint Depth: Plus 1/4 inch, no minus.

- 10. Joint Width: Plus 1/8 inch, no minus.
- B. All joints shall be constructed flush. No trip hazards will be accepted.
- C. All slopes shall stay within ADA tolerances.

### 3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a testing agency to perform tests and inspections.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
  - 1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  - 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  - 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  - 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
  - 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
  - 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
    - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
- E. Additional Tests: Testing and inspecting agency shall make additional tests of concrete at Contractor's expense when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met.
- F. Concrete paving will be considered defective if it does not pass tests and inspections.
- G. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- H. Prepare test and inspection reports.

### 3.11 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Engineer.
- B. Drill test cores, where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

## SECTION 32 92 00 - LAWNS AND GRASSES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Topsoil Placement and Preparation
  - 2. Temporary Seeding
  - 3. Permanent Seeding.
  - 4. Sodding.
  - 5. Mulching.

#### 1.2 SUBMITTALS

- A. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging, as well as the name and telephone number of supplier.
- B. Qualification Data: For landscape Installer.
- C. Planting Schedule: Indicating anticipated planting dates for each type of planting.

#### 1.3 QUALITY ASSURANCE

- A. Qualifications: A qualified landscape installer whose work has resulted in successful lawn establishment. Require Contractor to maintain an experienced full-time supervisor on Project site when planting is in progress.
- B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of topsoil. Report suitability of topsoil for lawn growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory topsoil.

#### 1.4 CONTRACTOR RESPONSIBILITIES

- A. It shall be the responsibility of the Contractor to do each of the following:
  - 1. Remove all rocks and other debris, furnish and install topsoil and otherwise prepare ground for planting.
  - 2. Secure a satisfactory stand of grass of such uniformity and cover as to at least match what existed prior to his construction operations;

3. Secure a stand of grass such as will minimize loss of soil by erosion;
4. Maintain all seeded areas until final acceptance of the work including irrigation of approximately 1" per week.
5. Restore or replace any portion of the grassing work that is found to be defective, or which results in an unsatisfactory stand of grass, or which becomes damaged prior to acceptance of the work.
6. Should all other work at the site have been completed and accepted, and should the Contractor have removed all forces and equipment from the plant site, he shall nevertheless, in the event of failure or partial failure of the grassing work, be obliged under the terms of the Bond given to the Owner to return such forces and equipment to the plant site as are necessary to insure the satisfactory completion of this item of work under the Contract.
7. The Contractor shall dispose of excess material as specified herein above, and shall remove all rubbish and surplus construction materials from the site.
8. The Contractor shall restore all areas (including grassing, paving, landscaping, etc.) of the [ENTER PROJECT LOCATION] which are affected by any of his construction operations to original condition or in accordance with these Specifications, whichever is the more stringent requirement. Final payment will not be made until such restoration is achieved to the satisfaction of the Owner.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.
- B. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding."
- C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

### PART 2 - PRODUCTS

#### 2.1 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 6 percent organic material content; free of stones ½ or larger in any dimension and other extraneous materials harmful to plant growth.
  1. Topsoil Source: Reuse surface soil, if any, stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
    - a. Amend existing in-place surface soil to produce topsoil meeting the requirements described above. Verify suitability of surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
    - b. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.



2. Contractor shall be responsible for furnishing a topsoil analysis for review by the Engineer unless the Contractor receives written permission to waive the requirement from the Engineer.
3. Contractor shall amend the topsoil to correct deficiencies based on the results of the test(s).

2.2 SEED

- A. Seed shall meet the requirements of ALDOT Specification Section 860.01 and seed shall be furnished and installed according to the following tables.

TABLE 2 - PART 1 - MIXED SEEDING FOR RELATIVELY FLAT AREAS (POUNDS PER ACRE OF PURE LIVE SEED)							
Planting Zone	ZONE 1 – NORTH ALABAMA (no planting Jan 16 - Feb 28)						
Mix Number	1A		1AT	1B		1BT	
Planting Dates	Mar 1 Until May 15	May 16 Until Aug 1	Aug 2 Until Jan 15	Mar 1 Until May 15	Sept 1 Until Nov 15	May 16 Until Aug 31	Nov 16 Until Jan 15
Annual Rye Grass			25				25
Hulled bermuda Grass	15	20		10			
Unhulled Bermuda Grass	10			10			
Brown Top Millet						20	
Tall Fescue				50	50		
Weeping Love Grass							
Annual Lespedeza (Kobe)		30					
Sericea Lespedeza							
White Dutch Clover	5			5			
Centipede Grass							
Reseed Crimson Clover					30		
Pensacola Bahia Grass							
Required Permanent Grass	Common Bermuda Grass	Common Bermuda Grass	None	Tall Fescue	Tall Fescue	None	None

TABLE 2 - PART 2: MIXED SEEDING FOR RELATIVELY FLAT AREAS  
(POUNDS PER ACRE OF PURE LIVE SEED)

Planting Zone	ZONE 2 - CENTRAL AL. No Planting Jan 2 - Feb 14			ZONE 3 - SOUTH ALABAMA					
	2A	2A	2AT	3A	3AT	3B	3BT	3C	3CT
Planting Dates	Feb 15 Until Apr 15	Apr 16 Until Aug 15	Aug 16 Until Jan 1	Feb 15 Until Aug 31	Sept 1 Until Feb 14	Mar 15 Until Aug 15	Aug 16 Until Feb	Mar 1 Until Aug 15	Aug 16 Until Feb 14
Annual Rey Grass			25		25		25		25
Hulled Bermuda Grass	15	20		15		10			
Unhulled Bermuda	10			10				10	
Brown Top Millet									
Tall Fescue									
Weeping Love Grass									
Annual Lespedeza		30		30		20		20	
Sericea Lespedeza									
White Dutch Clover	5								
Centipede Grass						20			
Reseed Crimson Clover									
Pensacola Bahia Grass								40	
Required Permanent Grass	Common Bermuda Grass	Common Bermuda Grass	Common Bermuda Grass	None	Tall Fescue	Tall Fescue	None	None	Common Bermuda Grass

TABLE 3 - PART 1: MIXED SEEDING FOR SLOPES  
AND AREAS NOT SUBJECT TO FREQUENT MOWING  
(POUNDS PER ACRE OF PURE LIVE SEED)

Planting Zone	1		1	2		
Mix Number	1D		1DT	2D		
Planting Dates	Mar 1 Until Jul 31	Aug 1 Until Nov 15	Aug 2 Until Jan 15	Feb 15 Until Jun 15	Jul 1 Until Aug 31	Sept 1 Until Nov 15
Annual Rye Grass			25			
Hulled Bermuda Grass					15	15
Unhulled Bermuda Grass					10	
Brown Top Millet						30
Tall Fescue		30				
Weeping Love Grass	4			4	4	
Annual Lespedeza (Kobe)						
Sericea Lespedeza	50	75		50	75	75
White Dutch Clover						
Reseed Crimson Clover						
Pensacola Bahia Grass						
Required Permanent Plant	Sericea Lespedeza (Interstate Variety (3))	Sericea Lespedeza (Interstate Variety (1))	None - 1st Stage (2)	Sericea Lespedeza (Interstate Variety (3))	Sericea Lespedeza (Interstate Variety (3))	Sericea Lespedeza (Interstate Variety (1))

TABLE 3 - PART 2: MIXED SEEDING FOR SLOPES  
AND AREAS NOT SUBJECT TO FREQUENT MOWING  
(POUNDS PER ACRE OF PURE LIVE SEED)

Planting Zone	2	3	3	1		
Mix Number	2DT	3D	3DT	1E		
Planting Dates	Nov 16 Until Jan 15	Feb 15 Until Aug 31	Sept 1 Until Jan 1	Mar 1 Until Jul 31	Aug 1 Until Nov 15	Nov 16 Until Feb 28
Annual Rye Grass	25		25			15
Hulled Bermuda Grass				15		
Unhulled Bermuda Grass				10	15	30
Brown Top Millet						
Tall Fescue				30	30	30
Weeping Love Grass		4		2		
Annual Lespedeza (Kobe)						
Sericea Lespedeza		50		30	30	
White Dutch Clover						
Reseed Crimson Clover					25	
Pensacola Bahia Grass						
Required Permanent Plant	None - 1st Stage (2)	Sericea Lespedeza (Interstate Variety) (3) (4)	None - 1st Stage (2)	Mixed Species (3)	Mixed Species	Mixed Species

TABLE 3 - PART 3: MIXED SEEDING FOR SLOPES  
AND AREAS NOT SUBJECT TO FREQUENT MOWING  
(POUNDS PER ACRE OF PURE LIVE SEED)

Planting Zone	2			3		
Mix Number	2E			3E		
Planting Dates	Feb 15 Until Aug 31	Sept 1 Until Nov 15	Nov 16 Until Feb 14	Feb 15 Until Aug 31	Sept 1 Until Nov 30	Dec 1 Until Feb 14
Annual Rye Grass	5	10	10		10	10
Hulled Bermuda Grass	15	10		10	10	
Unhulled Bermuda Grass	10	10	20	15	10	25
Brown Top Millet						
Tall Fescue		30	25		30	25
Weeping Love Grass	2	2		2	2	
Annual Lespedeza (Kobe)	40			40		
Sericea Lespedeza						
White Dutch Clover						
Reseed Crimson Clover		25	25		25	25
Pensacola Bahia Grass	25	25	25	20	25	25
Required Permanent Plant	Mixed Species (3)	Mixed Species (3)	Mixed Species	Mixed Species (3)	Mixed Species (3)	Mixed Species

### 2.3 TURFGRASS SOD

- A. Turfgrass Sod: Sod shall meet the requirements of ALDOT Specification Section 860.05.

### 2.4 FERTILIZER AND MULCH

- A. Fertilizer: Fertilizer shall meet the requirements of ALDOT Specification Section 860.12.
1. Fertilizer shall be uniformly applied to all areas to be planted at the time of seeding or sodding; and the rate of application shall be a minimum of 900 lbs. of 13-13-13 per acre.
  2. The rate of application shall be adjusted based on the results of soil tests.
- B. Mulch: Mulch shall meet the requirements of ALDOT Specification Section 860.03, Class A [Class B].
1. Mulch for hydroseeding shall consist of specially prepared wood cellulose or a natural wood fiber containing clean whole cut chips.
  2. It shall be processed in such a manner that it will contain no growth or germination inhibiting factors and shall be dyed an appropriate color to facilitate a uniform spread of the slope by visual inspection.

3. It shall be manufactured in such a manner that after addition and agitation in slurry tanks with fertilizers, grass seeds, water, and other additives, the fibers in the material will become uniformly suspended to form a homogenous slurry; and that when hydraulically sprayed on the ground, the material will form a blotter like ground cover impregnated uniformly with grass seed.
4. All such mixtures shall be used with eight (8) hours from time of mixing.

## 2.5 EROSION-CONTROL MATERIALS

- A. Erosion Control Blankets or Netting: Blankets or netting shall meet the requirements of ALDOT Specification Section 860.11.
- B. Contractor shall meet all other erosion control measures as described elsewhere in the Contract Documents.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Permanent grass seeding and mulching, or sodding, should be provided in all disturbed areas upon completion of grading and other construction activities.
- B. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
- D. Protect adjacent and adjoining areas from hydroseeding overspray.
- E. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways in accordance with Division 2 Section "Site Clearing".

### 3.2 SUBGRADE PREPARATION

- A. Before placement of topsoil the subgrade shall be prepared as follows:
  1. Shall be loosened to depth of not less than four (4) inches but not greater than eight (8) inches;
  2. The surfaces shall be cleared of all rock one (1) inch or larger in size, all construction debris, or other objectionable material.
- B. Limit lawn subgrade preparation to areas to be planted.

### 3.3 TOPSOIL PLACEMENT

- A. The topsoil, previously removed and stored, shall then be placed over the prepared subgrade.
- B. The depth of the topsoil shall be sufficient to allow for natural settlement, so that after such settlement has taken place the surface of the topsoil layer will conform to the finished elevations and contours shown on the Drawings.
- C. After placement of topsoil the surface shall be raked to remove clods, stones over one (1) inch in diameter, brush, roots, construction debris, or other objectionable material.
- D. Should the stockpile of topsoil accumulated from the trenching operations not be adequate for supplying the quantities of topsoil required for preparation of the areas described herein above, the Contractor shall furnish, at his expense, topsoil from other sources to meet any deficiencies.
- E. The Contractor shall not proceed with grassing work until receipt of written approval of topsoil preparation and confirmation of topsoil depth by Engineer. All rocks and debris must be removed from topsoil prior to beginning grassing work.

### 3.4 TOPSOIL PREPARATION

- A. Topsoil preparation shall be performed immediately prior to seeding, and shall consist of the following:
  - 1. Loosening of the topsoil by discing, harrowing or other approved methods.
  - 2. On areas having a slope of 3:1 or flatter, the topsoil shall be loosened to a depth of approximately three (3) inches;
  - 3. On slopes steeper than 3:1, the topsoil shall be merely roughened to a depth of approximately one (1) inch.
  - 4. All clods and other foreign materials which are larger than one (1) inch in any dimension shall be removed.
  - 5. All rocks ½ inch or larger shall be removed.
  - 6. All gullies and washes that develop in the loosened topsoil prior to seeding shall be repaired.
  - 7. Seeding shall immediately follow soil preparation so as to avoid both compaction and/or wash by heavy rainfall and crust formation by sunbaking.
  - 8. Seeding will not be permitted on hard or crusted topsoil surfaces.
- B. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:
  - 1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
  - 2. Loosen surface soil to a depth of at least of 6 inches. Prepare soil as described for topsoil in Part 2 of this specification.
  - 3. Till soil to a homogeneous mixture of fine texture.
  - 4. Remove stones larger than 1 inch in any dimension and remove sticks, roots, trash, and other extraneous matter.

- 5. Legally dispose of waste material, including grass, vegetation, and turf, off of Owner's property unless specific written permission is received from Owner for on-site disposal.
- C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- D. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- E. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

### 3.5 SEEDING

- A. Seeding: Seeding shall meet the requirements of ALDOT Specification Section 652.

### 3.6 HYDROSEEDING

- A. Hydroseeding: Hydroseeding shall meet requirements of ALDOT Specification Section 658.
- B. Hydroseeding shall be accomplished with approved equipment, and all mixtures shall be constantly agitated from the time that they are mixed until they are finally applied to the seed bed.
- C. Nozzles or sprays shall not be directed toward the ground in such a manner as to cause erosion or runoff.
- D. One-step Process: Apply slurry uniformly to all areas to be seeded. Apply mulch at a minimum rate of 1500-lb/acre dry weight but not less than the rate required to obtain specified seed-sowing rate.
- E. Two-step Process: Apply slurry uniformly to all areas to be seeded. Apply first slurry application at a minimum rate of 500-lb/acre dry weight but not less than the rate required to obtain specified seed-sowing rate. Apply slurry cover coat of fiber mulch at a rate of 1000 lb/acre.

### 3.7 SOLID SODDING

- A. Solid Sodding: Solid Sodding shall meet the requirements of ALDOT Specification Section 654.
- B. Do not lay sod if dormant or if ground is frozen or muddy.
- C. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure



contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

- D. Saturate sod with fine water spray within two hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

### 3.8 MULCHING

- A. Mulching: Mulching shall meet the requirements of ALDOT Specification Section 656.
- B. When hay or straw is used for mulch, it shall conform to the following requirements:
  - 1. It shall be spread over all seeded areas at the rate of approximately two (2) tons per acre.
  - 2. It shall be applied to a uniform depth by an approved method, and in such a manner that not more than ten (10) percent of the soil surface is exposed.
  - 3. The use of wet hay or straw will not be permitted.
  - 4. Mulch shall be applied within 48 hours after the seeding operation.
  - 5. Mulch shall be anchored to the seeded surface by discing or punching the mulch partially into the soil, by use of approved netting, or by use of other methods or materials approved by the Engineer.

### 3.9 FERTILIZING

- A. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
  - 1. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
  - 2. Mix lime with dry soil before mixing fertilizer.
- B. Fertilizer shall be uniformly applied to the designated area at the time of seeding; and rate of application shall be 900 lbs. of 13-13-13 per acre.
- C. Fertilizer shall be applied using any approved method.
  - 1. If liquid fertilizer should be used, it shall be kept agitated during application and shall be applied in amounts sufficient to provide the same value of nutrients per acre as that specified for dry fertilizer.
  - 2. Should the Contractor elect to use liquid fertilizer in a hydroseeder, the materials shall be applied on a poundage basis, mixed with the same volume of water that would be used with dry fertilizer.

### 3.10 TEMPORARY GRASSING

- A. Areas, sections, or portions of the work site within which construction work has been completed prior to beginning of final grading and grassing, shall be protected from erosion by employment of temporary control measures such as seeding and mulching or seeding and netting. Temporary grass seeding and mulching is required in disturbed areas that are unused for extended periods of time.

- B. All temporary erosion control and pollution control features installed by the Contractor shall be maintained by the Contractor until the site is ready for final grading and grassing.
- C. Temporary grassing required to be removed so as to permit the performance of final grading and grassing work shall be removed and ground preparation for final grassing shall be undertaken immediately after the removal of temporary grassing or other temporary erosion control measures.
- D. The Contractor must maintain temporary grassing under all circumstances until the installation of permanent grassing.

### 3.11 LAWN RENOVATION

- A. Renovate existing lawn(s) including lawns damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
  - 1. Reestablish lawn where settlement or washouts occur or where minor regrading is required.
  - 2. Remove sod and vegetation from diseased or unsatisfactory lawn areas; do not bury in soil.
  - 3. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, fuel spills, stone, gravel, and other construction materials, and replace with new topsoil.
  - 4. Mow, dethatch, core aerate, and rake existing lawn.
  - 5. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
  - 6. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
  - 7. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.
  - 8. Apply soil amendments and initial fertilizers required for establishing new lawns and mix thoroughly into top 4 inches of existing soil. Provide new planting soil to fill low spots and meet finish grades.
- B. Where existing lawns consist of bermuda, zoysia, centipede or other types of lawn grasses, the top soil shall be dressed and fertilized, and the top of the trench shall be covered with sod of the same type as that removed.
- C. Other areas such as raw land, undeveloped areas, pastureland, grassed areas, etc., shall be seeded and mulched.
- D. Water newly planted areas and keep moist until new lawn is established.

### 3.12 LAWN MAINTENANCE

- A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
  - 1. Seeded Lawns: 60 days from date of Substantial Completion; When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.

2. Sodded Lawns: 30 days from date of Substantial Completion.

- B. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.
- C. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch. Anchor as required to prevent displacement.
- D. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawn uniformly moist to a depth of 4 inches. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
- E. Water lawn at a minimum rate of 1 inch per week.
- F. Mow lawn as soon as grass blades reach 4 inches in length, or as appropriate for specific types of grass. Repeat mowing to maintain specified height without cutting more than 40 percent of grass height until project is accepted by Owner. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet.
- G. Lawn Postfertilization: Apply fertilizer after initial mowing and when grass is dry. Use fertilizer that will provide actual nitrogen of at least 1 lb per 1,000 sq. ft. to lawn area.

### 3.13 SATISFACTORY LAWNS

- A. Satisfactory Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of rocks, weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
- B. Satisfactory Sodded Lawn: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of rocks, weeds, open joints, bare areas, and surface irregularities.
- C. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

### 3.14 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after lawn is established.

C. Remove erosion-control measures after grass establishment period.

END OF SECTION 32 92 00

## **SECTION 33 11 16.11 - PLASTIC PIPE AND FITTINGS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes requirements for Plastic pipe and fittings including the following:
  - 1. Plastic pipe and fittings

#### **1.3 SUBMITTALS**

- A. Product Data: For each type of product indicated. B. Shop Drawings: Include the following.
  - 1. Detail each equipment assembly, include make, model weight, and indicate installation details, dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Complete catalog information, descriptive literature, materials of construction, wheels, gears and bearing, trolley drive system, brakes, starting system, variable speed drive system, conductors (bus bar, festoon, cable reel), controls, remote control system, and accessories.
  - 3. Power and control wiring diagrams, including terminals and numbers.
  - 4. Motor nameplate data in accordance with NEMA MG 1 and include any motor modifications.
  - 5. Factory finish system.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- A. The Contractor shall provide the proper equipment, tools and facilities necessary for the efficient prosecution of the work.
  - 1. Materials damaged in unloading, handling or installation shall be promptly discarded and removed from the area of the work.
  - 2. No pipe shall be unloaded or moved by allowing the pipe to roll, slide or fall to the ground or to cushions placed on the ground.
  - 3. No pipe, fittings, valves, etc., shall be unloaded by inserting loader blades, teeth, etc., into the pipe interior.
- B. Pipe shall be stored on racks or timbers in such a manner that pipe ends are above the ground surface.
  - 1. When pipe is to be moved it shall not be dragged or rolled but shall be lifted by use of a sling designed to prevent damage to the pipe coatings.

2. Should an intermediate placement of the pipe along the side of the trench be required, the pipe shall be placed on racks or timbers along the side of the trench in manner as specified hereinabove.
- C. Each length or section of pipe shall be cleaned immediately before being placed in the trench and joined.
1. Cleaning shall be accomplished by use of a tight swab or other suitable cleaning device.
  2. If necessary a brush pig shall be run through the section of pipe prior to final swabbing.
  3. Pipe ends shall be wiped clean before the pipe is joined.

## PART 2 - PRODUCTS

### 2.1 PIPE MATERIAL AND FITTINGS

- A. The contractor shall carefully examine all pipe and piping materials before placing them in the work. If any such pipe or materials should be found to be defective, the Contractor shall promptly notify the Engineer and discard such pipe and materials.
- B. The interior of all pipe, fittings, valves and accessories shall be kept free from dirt and foreign material.
1. Suitable bulkheads shall be used to block or plug ends of piping at the close of each work day and when work on a particular section of piping is temporarily discontinued.
  2. Should dirt, mud, concrete, latence, paint or other foreign materials be allowed to enter the piping or any section of piping, such piping or section of piping shall immediately be cleaned.
- C. Piping materials shall be of the types, classes and sizes shown or as specified in the piping schedule.

### 2.2 PLASTIC PIPE AND FITTINGS

- A. General Service
1. Insulation: Furnish and install pipe insulation for all outdoor, exposed, small-diameter piping (6-inch diameter or smaller) that is pressurized and/or that remains full of water or chemical, unless otherwise shown on drawings.
  2. Plastic pipe shall be of types as hereinafter specified or as shown on the Drawings.
  3. The particular Type, Grade and Schedule of pipe used for a particular installation shall be suitable for the service intended.
  4. PVC pipe shall be manufactured from rigid polyvinylchloride compounds meeting the requirements of ASTM D1784, latest revision, Class 12454-B.
  5. Pipe shall meet requirements of ASTM D1785 latest revision Type 1.
  6. Pipe shall be Schedule 80 unless otherwise indicated, and shall be furnished with threaded ends suitable for connection to fittings, companion flanges, and flanged valves.

7. Fittings shall meet the requirements of ASTM D2464, latest revision.
8. All pipe, fittings and valves shall be manufactured from molding compounds meeting the requirements of ASTM D1784, latest revision, Class 12454-B as specified hereinabove so as to ensure compatibility of materials.
9. Materials from which pipe, fittings and valves are manufactured shall have been tested and approved by the National Sanitation Foundation and shall be suitable for service associated with the production of potable water.
10. PVDF pipe shall be manufactured from natural polyvinylidene fluoride compound meeting the requirements of ASTM D3222, latest revision, and having a minimum tensile strength of 7100 psi at 73°F when tested in accordance with ASTM D638, latest revision.
11. Pipe shall have nominal pipe sizes and wall thicknesses as given for Schedule 80 pipe in Table 2 of ASTM D1785, latest revision, unless otherwise indicated.
12. Fittings may be either socket fusion type meeting the requirements of ASTM D2657, latest revision, or threaded type having dimensions and tolerances in accordance with ASTM D2464, latest revision, according to the manufacturer's recommendations.
13. If the socket fusion type method of joining the pipe should be used, disassembly of pipe shall be provided for at changes of direction of pipe and at valves by use of companion flanges or threaded couplings or other means as recommended by the manufacturer.
14. All pipe, fittings and valves shall be manufactured from molding compounds meeting the requirements of ASTM D3222, latest revision, as specified hereinabove so as to ensure compatibility of materials, and all materials (including joining materials) shall be suitable for service associated with the production of potable water.
15. **Magnetic locator tape shall be provided for all plastic piping installed underground.**

B. Gravity Service

1. PVC gravity sewer pipe shall conform in all respects to Standard Specifications for Type PSM Polyvinylchloride (PVC) Sewer Pipe and Fittings ASTM D 3034, latest revision, (sizes 4" - 15"); ASTM F679, latest revision, (sizes 18" - 27"); covering requirements and test methods for materials, dimensions, workmanship, flattening resistance, impact resistance, pipe stiffness, extrusion quality, joining systems and a form of marking.
2. Pipe conforming to ASTM D3034, latest revision, shall have a minimum wall thickness of SDR 35.
3. Pipe conforming to ASTM F679, latest revision, shall have a minimum pipe stiffness (PS) of 46 psi and minimum T-1 wall.
4. Pipe shall be furnished in sections not less than ten (10) feet in length and not greater than thirteen (13) feet in length.
5. Pipe and fittings shall be inspected and tested in accordance with ASTM D 3034 or ASTM F679, latest revisions, by a testing laboratory acceptable to the Owner and certified copies of the test reports and test results shall be furnished to the Owner.
6. Pipe and fittings shall be clearly marked in accordance with Section 12 of ASTM D 3034, or Section 11 of ASTM F679.
7. Pipe shall be furnished with bell and spigot end with elastomeric seals.
8. Spigot (plain) ends shall be marked to indicate when a "full-home" position of spigot in bell has been attained.

9. Seal rings or gaskets shall be continuous elastomeric rings meeting the requirements of ASTM D 3212, latest revision.
10. Material for seal ring shall be specifically formulated for wastewater service.
11. The joints shall meet all test requirements of ASTM D 3212, latest revision, and certificates of compliance shall be furnished to the Owner.

## PART 3 - EXECUTION

### 3.1 JOINING OF PIPE

- A. Pipe joining procedure shall be in accordance with these Specifications and in accordance with the recommendations of the manufacturer of the particular type of joint.
- B. Push-On Joint Pipe
  1. The joining of Push-On Joint pipe shall be performed in accordance with the AWWA Standard for Underground Installation of PVC Pressure Pipe and Fittings for Water, C606 and in accordance with the manufacturer's instructions and/or recommendations for the particular joint furnished.
  2. The inside of the bell and the outside of the spigot end shall be thoroughly cleaned to remove oil, grit, excess coating and other foreign matter.
  3. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the socket.
  4. A thin coat of gasket lubricant shall be applied to either the inside surface of the gasket or outside surface of the spigot, or both.
  5. Gasket lubricant shall be as supplied by the particular manufacturer and reviewed by the Engineer.
  6. The spigot end of the pipe shall be carefully inserted in the socket so that the joining surfaces will not come in contact with the ground, trench bed or trench sides.
  7. The joint shall then be completed by forcing the spigot end to the bottom of socket by methods as recommended by the particular manufacturer and concurred with by the Engineer.
  8. All pipe shall be furnished with a depth mark to indicate a 'full-home' assembly.
  9. The Contractor shall provide special transition sleeves or transition pieces of pipe for connecting pipe of different classes; and those special pieces shall be clearly identified with suitable marking.
  10. If the Contractor desires to cut lengths in the field to make closures, he shall have on hand an adequate number of lengths of pipe of the various classes having the exterior of the barrel gauged to fit the socket of pipe.

### 3.2 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. PVC Sewer Pipe and Fittings shall be as follows:
  1. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
  2. Install according to ASTM D 2321.



### 3.3 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extension from sewer pipe to cleanout at grade.
  - 1. Use PVC sewer pipe fittings in sewer pipes at branches for cleanouts and PVC sewer pipe for riser extensions to cleanouts.
  - 2. Install piping so cleanouts open in direction of flow in sewer pipe.
- B. Set cleanout frames and covers located in unpaved areas in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding finished grade.
- C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

**END OF SECTION 33 11 16.11**

## **SECTION 334100 - STORM DRAINAGE**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes storm drainage outside the building.

#### 1.3 PROJECT CONDITIONS

- A. Site Information: Verify existing utility locations.
- B. Locate existing structures and piping to be closed and abandoned.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Owner's written permission.

### PART 2 - PRODUCTS

#### 2.1 CONCRETE FOR CAST-IN-PLACE DRAINAGE STRUCTURES

- A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
  - 1. Cement: ASTM C 150, Type II.
  - 2. Fine Aggregate: ASTM C 33, sand.
  - 3. Coarse Aggregate: ASTM C 33, crushed gravel.
  - 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious ratio.
  - 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
  - 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

#### 2.2 PIPE OUTLETS

- A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.
- B. Flared End Sections: Precast reinforced concrete per details of applicable state DOT.
- C. Special Outlet Structures: Cast-in-place reinforced concrete as indicated.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

### 3.2 INSTALLATION, GENERAL

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.
- C. Use manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.
- D. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. If applicable, install gravity-flow piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.
  - 1. Install piping sloped down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
  - 2. Install piping with 36-inch minimum cover.
- F. If applicable, extend storm drainage piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

### 3.3 STORM DRAINAGE INLET AND OUTLET INSTALLATION

- A. Construct inlet head walls, aprons, special outlet structure and sides of reinforced concrete, as indicated.
- B. Install outlets that spill onto grade, anchored with concrete, where indicated.

### 3.4 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to Division 3 Section "Cast-in-place Concrete."

### 3.5 PIPELAYING

- A. Minimum depth of cover for all pipe shall be 3'-0" unless otherwise shown. The Contractor shall excavate the trenches to such depths so as to obtain the cover specified hereinabove or as indicated.
- B. Reinforced Concrete Drainpipe
  - 1. Installation of reinforced concrete drain pipe shall be performed in accordance with the requirements of these Specifications.
  - 2. In the case where tongue-and-groove pipe may be installed, the joint surfaces shall be thoroughly cleaned, and the annular space shall then be completely filled with a plastic joining material similar and equal to Ram-Nek.
  - 3. The joint shall be made in accordance with the recommendations of the manufacturer of the joining material.
  - 4. Where pipe is furnished with ends suitable for an O-ring joint, all joint surfaces and gasket recesses shall be thoroughly cleaned, the gaskets shall be first thoroughly cleaned and then lubricated, and the joints shall be made-up in accordance with the pipe manufacturer's recommendations.

### 3.6 BRACING OF PIPE AND FITTINGS

- A. All piping shall be braced against internal thrust by means of restrained joints and/or poured-in-placed concrete bracing where changes in direction occur or where branches from the line are located.
- B. Braced underground piping shall be securely braced against movement with concrete thrust blocks and bearing against solid, undisturbed ground.
  - 1. Where solid or undisturbed ground cannot be obtained for bracing or where indicated on the Drawings restrained joint pipe and/or fitting shall be required.
- C. Concrete braces shall be constructed in accordance with details shown on the Drawings; and shall be plain or reinforced as indicated or required.
  - 1. All reinforced concrete used in underground bracing shall be "Class A" concrete in accordance with the requirements of these Specifications.
- D. Special bracing for particular locations identified on the Drawings and/or described herein shall be in accordance with details shown on the Drawings for the particular special brace and shall be complete with reinforcing steel and miscellaneous metal work.
- E. Piping installed above ground in buildings, galleries, tunnels, piping trenches and chases shall be supported and braced as indicated on the Drawings and specified herein.

1. Where pipes are braced or supported above ground piping by means of concrete piers or thrust blocks, the concrete used for construction of such piers or thrust blocks shall be:
  - a. Class "A" as specified in these Specifications
  - b. Reinforced
  - c. Anchored to slabs and/or walls by dowels
  - d. Finished to match adjacent concrete surfaces or finished surfaces of adjacent walls or floors, whichever is applicable

### 3.7 FIELD QUALITY CONTROL

- A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.
  1. In large, accessible piping, brushes and brooms may be used for cleaning.
  2. Place plug in end of incomplete piping at end of day and when work stops.
  3. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.
- B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.
  1. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  3. Reinspect and repeat procedure until results are satisfactory.
- C. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  1. Do not enclose, cover, or put into service before inspection and approval.
  2. Test completed piping systems according to authorities having jurisdiction.
  3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  4. Submit separate reports for each test.

**END OF SECTION 334100**

## **SECTION 334114.10 - CONCRETE PIPE AND FITTINGS**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes requirements for Concrete pipe and fittings including the following:
  - 1. Reinforced Concrete Drainage Pipe.

#### 1.3 DEFINITIONS

- A. RCP: Reinforced Concrete Pipe.
- B. RCPA: Reinforced Concrete Pipe-Arch.

#### 1.4 DELIVERY, STORAGE AND HANDLING

- A. The Contractor shall provide the proper equipment, tools, and facilities necessary for the efficient prosecution of the work.
  - 1. Materials damaged in unloading, handling or installation shall be promptly discarded and removed from the area of the work.
  - 2. No pipe shall be unloaded or moved by allowing the pipe to roll, slide or fall to the ground or to cushions placed on the ground.
  - 3. No pipe, fittings, valves, etc., shall be unloaded by inserting loader blades, teeth, etc., into the pipe interior.
- B. Pipe shall be stored on racks or timbers in such a manner that pipe ends are above the ground surface.
  - 1. When a pipe is to be moved it shall not be dragged or rolled but shall be lifted by use of a sling designed to prevent damage to the pipe coatings.
  - 2. Should an intermediate placement of the pipe along the side of the trench be required, the pipe shall be placed on racks or timbers along the side of the trench in manner as specified hereinabove.
- C. Each length or section of pipe shall be cleaned immediately before being placed in the trench and joined.

1. Cleaning shall be accomplished by use of a tight swab or other suitable cleaning device.
2. If necessary, a brush pig shall be run through the section of pipe prior to final swabbing.
3. Pipe ends shall be wiped clean before the pipe is joined.

## PART 2 - PRODUCTS

### 2.1 PIPE MATERIAL AND FITTINGS

- A. The contractor shall carefully examine all pipe and piping materials before placing them in the work.
  1. If any such pipe or materials should be found to be defective, the Contractor shall promptly notify the Engineer and discard such pipe and materials.
- B. The interior of all pipe, fittings, valves and accessories shall be kept free from dirt and foreign material.
  1. Suitable bulkheads shall be used to block or plug ends of piping at the close of each work day and when work on a particular section of piping is temporarily discontinued.
  2. Should dirt, mud, concrete, laitance, paint or other foreign materials be allowed to enter the piping or any section of piping, such piping or section of piping shall immediately be cleaned.
- C. Piping materials shall be of the types, classes and sizes shown or as specified in the piping schedule.
- D. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, Class III, Wall B, for gasketed or mortared joints.
  1. Gaskets: ASTM C 443, rubber.
  2. Joint Mortar: A mixture of Portland cement, sand, and water. One part Portland cement and two parts sand by volume. Add water sufficient for a stiff, workable mortar without exceeding 5½ gallons per sack of cement.
  3. Sand shall conform to ASTM C144. Portland cement shall conform to ASTM C150.
- E. Reinforced Concrete Sewer Pipe-Arch: ASTM C 506, Class A-III, for mortared joints.
  1. Joint mortar: Same as for round RCP.

### 2.2 REINFORCED CONCRETE DRAINAGE PIPE

- A. Reinforced concrete drain pipe shall conform to the requirements of ASTM Specification C 76, latest revision.
- B. Reinforced concrete drain pipe shall be:

1. Class III for depths of 0-10 feet of cover.
  2. Class IV for depths of 10-20 feet of cover.
  3. Class V for any depth greater than 20 feet of cover.
- C. Fittings for use with reinforced concrete drain pipe shall be equal to the requirements of ASTM C76.
- D. In pipe furnished with tongue-and-groove ends, the joints shall be sealed with a flexible plastic gasket meeting the requirements of Federal Specifications SS-S-00210, Type 1, Rope Form and of AASHTO Designation M-198 75 1, Type B, Flexible Plastic Gasket (Bitumen).
1. The gasket shall be manufactured by one of the following:
    - a. RAM-NEK Gasket Division of K. T. Snyder Company, Inc.
    - b. Approved equivalent.
- E. In pipe furnished with bell-and-spigot ends, the pipe shall be equipped with rubber O-ring seals fitted in recesses on the spigot ends of the pipe.
1. O-rings shall be solid rubber conforming to the requirements of ASTM C443.
  2. Joints shall be made up in accordance with the recommendations and instructions of the manufacturer.

## PART 3 - EXECUTION

### 3.1 JOINING OF PIPE

- A. Pipe joining procedure shall be in accordance with these Specifications and in accordance with the recommendations of the manufacturer of the particular type of joint.
- B. Tongue-and Groove Pipe.
1. The joint surfaces shall be thoroughly cleaned
  2. The annular space shall then be completely filled with a plastic joining material similar and equal to Ram-Nek.
- C. O-Ring Joint.
1. All joint surfaces and gasket recesses shall be thoroughly cleaned.
  2. The gaskets shall be first thoroughly cleaned and then lubricated.

### 3.2 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. Concrete Pipe and Fittings: Install according to ACPA's "Concrete Pipe Installation Manual" Using mortared tongue and groove joints. If gaskets or seals are indicated, they shall conform to the following:



1. Round Pipe and Fittings: ASTM C 443, rubber gaskets.
  2. Elliptical Pipe: ASTM C 877, Type I, sealing bands.
  3. Arch Pipe: ASTM C 877, Type I, sealing bands.
- B. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

**END OF SECTION 334114.10**

## **SECTION 44 44 13 – WATER CHEMICAL FEED EQUIPMENT**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Descriptions of Chemical Systems
  - 2. Metering pumps, rotameters and appurtenances
  - 3. Bulk storage tanks
  - 4. Day tanks and solution tanks
  - 5. Day tank scales

#### 1.3 SUBMITTALS

- A. Submit product data including, but not limited to, furnished specialties, size, accessories, details of construction, dimensions of individual components, profiles, finishes, descriptions of all materials, complete bill of materials, description of surface preparation, shop priming, and finish painting.
- B. Shop Drawings Showing:
  - 1. Complete dimensional data.
  - 2. Mounting details.
  - 3. Equipment locations.
  - 4. Chemical system layouts
  - 5. Characteristic performance curve showing flow rate as a function of RPM and pressure.
  - 6. Chemical Metering System Arrangement & Installation drawings.
  - 7. Operating, maintenance, programming, and wiring instructions for all equipment
  - 8. Detail each equipment assembly, include make, model weight, and indicate installation details, dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
  - 9. Complete catalog information, descriptive literature, materials of construction, wheels, gears and bearing, trolley drive system, brakes, stator system, variable speed drive system, conductors (bus bar, festoon, cable reel), controls, remote control system, and accessories.
  - 10. Power and control wiring diagrams, including terminals and numbers.
  - 11. Motor nameplate data in accordance with NEMA MG 1 and include any motor modifications.
  - 12. Factory finish system.
- C. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent professional engineer, indicate compliance of equipment for applicable codes, based on comprehensive testing within the last two years of current products.

- D. Maintenance Data: Include name, address, and telephone number of manufacturer's nearest authorized service representative.
- E. Comply with all safety regulations for equipment and chemicals used in these applications.
- F. Product Data: For each type of product indicated.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each chemical system component as a complete unit from one source and by a single manufacturer.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store equipment in a manner to avoid significant or permanent damage to equipment.
  - 1. In general, comply with the manufacturer's written instructions for storage of equipment.
  - 2. The equipment shall be stored in a clean, dry location free from construction dust, precipitation.

#### 1.6 WARRANTY

- A. Warranty Period: One year from date of Substantial Completion.
  - 1. Warranty shall be for unlimited usage of the equipment.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Metering Pumps:
  - 1. Watson-Marlow
- B. Storage and Solution Tanks:
  - 1. Poly Processing
  - 2. Snyder
  - 3. Assman
  - 4. Approved equivalent
- C. Ultrasonic Level Indication:
  - 1. Siemens EchoMax ST-H

#### 2.2 DESCRIPTIONS OF CHEMICAL FEED SYSTEMS

A. Sodium Hypochlorite Feed System (Base Bid):

1. The Contractor shall furnish and install all associated equipment of the Sodium Hypochlorite Feed System.
2. The Sodium Hypochlorite Feed System shall consist of One (1) cross-linked double walled HDPE bulk storage tank, one (1) cross-linked HDPE day tank, one (1) duplex skid mounted metering pump system (to filtered water) and one (1) triplex skid mounted metering pump system (to settled water, filter basins 1-3 and filter basins 4-6) and all associated piping and appurtenances. All chemical skid feed lines are to be connected to existing chemical feed piping.
3. All appurtenances and equipment shall meet or exceed the specifications.
4. The Sodium Hypochlorite Feed System shall be capable of dosing chemicals at the filtered water chemical feed vault and Sedimentation Basin Nos. 1 - 3, and Sedimentation Basin Nos. 4 - 6.
5. **All valves, pipes, and pumps shall be vented to prevent the collection of off-gas.**
6. The Owner shall fill the chemical storage tanks after they have been installed.

B. Alum Feed System (Alternate No. 1 – Bulk Storage):

1. The existing Aluminum Sulfate tank shall be demolished prior to the new tank installation.
2. The Owner will provide temporary facilities for the construction period.
3. The Contractor shall furnish and install all associated equipment of the Alum Feed System.
4. The Alum Feed System shall consist of One (1) cross-linked double walled HDPE Bulk storage tank, one (1) ultrasonic level indicator, and all associated piping and appurtenances.
5. All appurtenances and equipment shall meet or exceed the specifications.
6. The Owner shall fill the chemical storage tanks after they have been installed.

C. Alum Feed System (Alternate No. 2 – Day Tank):

1. The Contractor shall furnish and install all associated equipment of the Alum Feed System.
2. The Alum Feed System shall consist of one (1) cross-linked HDPE day tank, one (1) ultrasonic level indicator, and all associated piping and appurtenances.
3. All appurtenances and equipment shall meet or exceed the specifications.
4. The Owner shall fill the chemical storage tanks after they have been installed.

D. Fluoride Feed System (Alternate No. 1):

1. The existing fluoride tank shall be demolished prior to the new tank installation.
2. Temporary fluoride facilities are not required for the construction period. The Owner will stop fluoride addition during the construction period, after the stored fluoride has been used to the greatest extent possible.
3. The Contractor shall furnish and install all associated equipment of the Fluoride Feed System.
4. The Fluoride Feed System shall consist of one (1) double wall cross-linked HDPE bulk storage tank, and all associated piping and appurtenances.
5. All appurtenances and equipment shall meet or exceed the specifications.
6. The Owner shall fill the chemical storage tanks after they have been installed.

## 2.3 CHEMICAL METERING SYSTEM

### A. General:

1. Chemical Metering System (skid) must be manufactured by the chemical metering pump manufacturer and must provide pumps and accessories as a complete turnkey system. Skids manufactured by third parties such as separate skid fabricators, pump distributors or pump representatives are not acceptable.
2. This specification is the basis for design of peristaltic metering pumps. All pumps, whether named as an acceptable supplier or submitted as an equal must, at a minimum, meet the following critical design requirements.
  - a. Maximum two compressing rollers for two compressions per revolution.
  - b. Tube wall thickness of 2.4 mm and material specified
  - c. Large diameter spring-loaded roller set for 2.4mm wall thickness tubing
  - d. Max base drive speed of 220 RPM for 2.4mm wall thickness tubing.
  - e. Track geometry of no less than 180 degrees and rotor geometry with rollers 180 degrees apart.
  - f. For quality purposes, pump tubing must be manufactured by the pump manufacturer themselves. Pumps utilizing third party tubing not manufactured by the pump manufacturer is not acceptable.
  - g. For chemical compatibility with a broad spectrum of chemicals, the pump housing shall have powder coating. Pumping system shall be specifically compatible for sodium hypochlorite.
  - h. Pumps to be manufacturer's standard product. Manufacturer of tubing pumps must have at least 20 operating installations in domestic water or wastewater treatment plants located in the United States over a period of at least seven years in the same service and size as specified.
  - i. Drive and pumpheads shall be 24 hr continuous duty rated and have a five-year manufacturer's warranty from date of shipment.
  - j. Pumps must be manufactured under ISO 9001-2000.
  - k. Pumps shall be meet all applicable CE and C ETL US standards per UL610101A
  - l. Pumps shall be 100 % integral in design with the pumphead, motor, controls, and pump case being manufactured by the pump manufacturer themselves. All controls, motors, and gear reduction shall be housed in a single chemically resistant pump case. Pumps that require separate base plates, external gear reducers and /or gear motors, and separate controls– even if mounted on a base plate and pre-wired to the motor- are not acceptable.

### B. Peristaltic Chemical Metering Pump

1. Pumps shall be positive displacement peristaltic type complete with spring-loaded pumphead, self-contained variable speed drive, and flexible extruded tube as specified.
2. Peristaltic pumping action is created by the compression of the flexible tube between the pumphead rollers and track, induced forward fluid displacement within the tube by the rotation of the pump rotor, and subsequent vacuum-creating restitution of the tube.
3. Pumps shall be dry self-priming, capable of being run dry without damaging effects to pump or tube, and shall have a maximum suction lift capability of up to 30' vertical water column. Maximum pressure rating: 60psi.
4. Pump shall not use check valves or diaphragms and shall not require dynamic seals in contact with the pumped fluid. Process fluid shall be contained within

- pump tubing and shall not directly contact any rotary or metallic components.
5. Flow shall be in the direction of the rotor rotation, which can be reversed and shall be proportional to rotor speed.
  6. Pump Process Schedule

Quantity of Chemical Metering Systems	<b>1 – Duplex Skid for Filtered Water 1 – Triplex Skid for Settled Water Basins 1-6</b>
Chemical Metering System Configuration	<b>Filtered Water - Duplex-Duty/Standby, Settled Water – Triplex – Two Seperate Duty (Basins 1-3 &amp; Basins 4-6), One Standby</b>
Tubing Material	<b>Marprene</b>
Max – Min Capacity (GPH)	<b>55 – 0.0006 GPH</b>
Max Pump RPM for Application	<b>220</b>
Suction Head	<b>&lt;5'</b>
Power (VAC, Frequency, Phase)	115VAC, 60 Hz, 1 Phase

7. Pump Construction

a. Pumphead

- 1) Pumphead shall consist of a fixed track, a hinged guard door, and spring-loaded roller rotor assembly. Pump tubing shall be in contact with the inside diameter of the track through an angle of 180 degrees. At all times, one roller shall be fully engaged with the tubing providing complete compression and preventing back flow or siphoning. Tube occlusion and spring tension shall be factory set to accommodate 2.4mm wall thickness tubing and shall not require adjustment.
- 2) Pumphead guard shall be transparent for the purpose of viewing the direction of rotation. When closed, the pump head guard shall seal against the pump track for leak containment and controlled waste through the pump head waste port in the event of a tube failure.
- 3) For operator and environmental safety, pumps in which the direction of rotation cannot be visually verified and/or do not have a controlled waste port are not acceptable.
- 4) Pumphead Assembly
  - a) Pump Track Geometry must have a minimum 96.6mm swept diameter through a minimum track angle of 180 degrees
  - b) Provide high corrosion/impact materials as specified
  - c) Track Construction: polyphenylene sulfide (PPS)
  - d) Guard Construction: hinged impact-resistant polycarbonate breakaway guard, tool un-lockable for operator safety.
  - e) Rotor Construction: polyphenylene sulfide (PPS)

b. Rotor Assembly

- 1) Provide rotor assembly that ensures gradual tube occlusion and compensates for tube tolerance.
  - a) Twin spring-loaded roller arms located 180 degrees apart, each fitted with stainless steel helical springs and compressing roller for occlusion of the tube twice per rotor revolution
  - b) Compressing Rollers: 316SS with low friction stainless steel bearings and PTFE seals, minimum diameter of 18mm
  - c) Provide non-compressing guide rollers constructed of corrosion resistant Nylatron

- d) Clutch: Equip rotor with a central handgrip hub and manually activated clutch to disengage the rotor from the drive for manual rotor rotation during tube loading. Clutch shall automatically reengage the rotor to the gearbox upon one complete revolution.
- e) Mounting: To prevent slips, the rotor assembly shall be axially secured to the dogged output shaft of the gearmotor via a slotted collet and central retaining screw.
- f) Pumpheads requiring disassembly or special tools for tube changing are not acceptable.

c. Tubing

- 1) Pump shall be supplied with a LoadSure tubing element with molded fittings, which shall be self-locating when fitted into the pumphead. Tube element shall be in contact with the inside diameter of the track (housing) through an angle of 180 degrees and be held in place on the suction and discharge by the element fittings. The tubing shall be replaceable without the use of tools and with no disassembly of the pumphead. To achieve maximum service life, pump heads with a track angle of less than 180 degrees and/or without tube elements are not acceptable.
- 2) Tubing must be replaceable with the rotor in the stopped position. For operator safety, pumps that require the rotor to be rotating and/or requiring special pulling tools are not acceptable.
- 3) For quality purposes, pump tubing must be manufactured by the pump manufacturer themselves. Pumps utilizing third party tubing not manufactured by the pump manufacturer is not acceptable.
- 4) LoadSure Element shall be constructed with Marprene tubing with male PVDF Quick Release Connectors.
- 5) Supply One (1) tube element of the specified size per pump.
- 6) Supply Two (2) one-meter long flexible reinforced PVC hoses for connection of pump to suction and discharge process lines. Flexible hose shall have a PVDF female Quick Release fitting for connection to the LoadSure Element and male Quick Release fitting for connection to NPT adaptor with built in shut off valve for ease of maintenance and connection to process lines.
- 7) Supply Two (2) Quick Release to ½" NPT Adaptors.

d. Drive

- 1) Rating: Continuous 24 hour operation, 40° C ambient.
- 2) Supply: 110-120V 50/60 Hz and 220-240V 50/60 Hz, 1-Phase field switchable. Supply nine-foot length mains power cord with standard 115V three-prong plug.
- 3) Max drive power consumption: 135VA.
- 4) Enclosure: NEMA 4X
- 5) Housing: Pressure cast aluminum with Alocrom pre-treatment and exterior grade corrosion resistant polyester powder coat. By nature of the environmental conditions, unpainted housings, including 316SS are not acceptable.
- 6) Drive motor- brushless DC motor with integral gearbox and tachometer feedback.
  - a) Speed Control Range of 2200:1 from 0.1 to 220 rpm +/- 0.1 rpm throughout the range.
  - b) Closed loop microprocessor controlled drive with pulse width

- modulation at speeds above 35 rpm and synchronous mode with magnetic field rotation control below 35 rpm
    - c) Circuitry complete with temperature and load compensation and protection.
  - 7) Leak Detector: Pump manufacturer shall supply optical type leak sensor mounted to the drain port of the pump head for leak detection and pump shut down in the event of a tubing failure
  - 8) Mounting: Drive shall be self-supporting and shall not require anchoring.
- e. Manual Interface & Control
  - 1) Pumps must meet the following minimum requirements for operator interface functionality. Pumps not meeting this minimum functionality will not be accepted.
    - a) Display: Backlit graphical TFT Display capable of up to 8 lines of text with up to 26 characters per line to display flow rate and programming instructions. Display shall also provide visual indication of running status via screen color: Grey = Running, White = Stopped and Red = Warning.
    - b) Keypad: Keypad for start, stop, speed increment, speed decrement, forward/reverse direction, rapid prime, and programming.
    - c) Flow units: Programmable in following units:  $\mu\text{l}/\text{min}$ , ml/min, ml/hr, l/min, l/hr, l/day, gallons/hr, gallons/day, g/min, kg/hr, or lb/day.
    - d) Security: Programmable keypad lock and PIN security for optional lockout of all keys except emergency start/stop.
    - e) Auto Restart: feature to resume pump status in the event of power outage interruption.
    - f) Multilingual menu: include programming menus in ten languages, including at a minimum English, Spanish, and French.
    - g) Programmable "Maximum Speed" to allow operator to set the maximum speed of the pump within 0.1-220 rpm
  - 2) Supply auto control features to meet the following minimum functionality requirements. Pumps not meeting this minimum functionality will not be accepted.
    - a) Remote Control Inputs
    - b) Speed Control:
      - i) Primary Analog 4-20mA or 0-10VDC speed input, with input signal trim able and speed scaleable over any part of the drive speed range.
      - ii) Provisions for alternative remote accessory potentiometer (if supplied by others)
    - c) Start/Stop Control: via 5V TTL, 24V industrial logic, dry contact, or powered 110VAC contact as required per the process and instrumentation drawings- Configurable command sense allowing open to equal run or open to equal stopped.
    - d) Forward/Reverse Control: via 5V TTL, 24V industrial logic, dry contact, or powered 110VAC contact as required per the process and instrumentation drawings.
    - e) Auto/Man Mode Control: via 5V TTL, 24V industrial logic, dry contact, or powered 110VAC contact as required per the process and instrumentation drawings.
    - f) Leak Detector Run/Stop Control
  - 3) Status Outputs
    - a) Four relay contacts rated for 30 VDC with a maximum load of 30W,



NO or NC or four relay contacts rated for 130VAC as required by the process and instrumentation drawings software configurable to indicate the following:

- i) Running/Stopped status
  - ii) Forward/Reverse status
  - iii) Auto/Manual status
  - iv) General Alarm status
  - v) Leak Detected status
- b) Speed output –
- i) Analog 4-20mA or 0-10 VDC
- 4) Termination: supply screw down terminals suitable for up to 18 AWG field wire and accessible through four glanded cable entry points on the pump

f. Spares

- 1) Supply four spare tube elements of the specified size per pump.
- 2) Supply one spare pumphead assembly and rotor.
- 3) Supply one 10 ml syringe of Ultralube for periodic pumphead maintenance per pump

C. Calibration Columns

- 1. Supply Calibration Column made of clear PVC or Acrylic cylinder materials, sealed on both ends with appropriately sized NPT threaded ports both top and bottom. Graduation markings shall be in fractions of gallons or milliliters in proportion to the size of the column.
- 2. Column shall be sized to allow a minimum 30-second draw down at maximum pump speed.

D. Pressure Relief Valve

- 1. Supply Pressure Relief Valve with PVC Body and PTFE/EPDM Diaphragm.
- 2. Relief Pressure shall be adjustable from 0-150 psi.
- 3. Connections shall be designed with unions & Socket Welded

E. Discharge Gauge with Diaphragm Seal

- 1. Discharge Pressure Gauge shall have a 2.5" dial with a liquid filled case, stainless steel tube and socket with a pressure range of 0-100 psig
- 2. Discharge Gauge shall be assembled to a Diaphragm Seal with a Teflon Diaphragm and 1/2" NPT PVC process connection.

F. Fabricated HDPE Skid with Back Panel

- 1. HDPE Shelf with Back Panel shall be fabricated out 1/2" & 3/4" HDPE sheet stock.
- 2. The Skid and Back Panel shall be fusion welded together maintaining a 1" containment lip completely around the surface in which the pump sits.
- 3. All necessary piping to incorporate the above equipment into a single turnkey chemical metering system will be secured to the Skid and Back Panel.
- 4. HDPE Skid and Back Panel shall be designed to be free standing with fork lift slots.

G. Isolation Valves

- 1. All Ball Valves, sizes 1/2" to 4", shall be of true union design with two-way blocking capability.
- 2. Ball valves shall be vented to prevent airlocking caused by Sodium Hypochlorite off-gassing.
- 3. All O-rings shall be EPDM or FPM based on chemical being pumped.
- 4. Seats shall have elastomeric backing cushion of the same material as the valve

- seals.
5. Stem shall have double O-rings and be of blowout-proof design.
  6. The SCH 80 PVC & CPVC ball valves shall have a pressure rating of 250 psi for sizes 1/2" to 2" and 235 psi for 2-1/2" to 4" at 70 ° F.
  7. Ball Valves shall carry a two-year guarantee.
  8. Ball valves shall be equal to Hayward TB series as manufactured by Hayward Flow Control.
- H. Piping
1. Polyvinylchloride (PVC) Pipe and fittings shall be manufactured of Rigid Poly Vinyl Chloride (PVC) schedule 80.
  2. Fittings shall be heavy-duty Schedule 80 molded fittings.
- I. Junction Box(es).
1. The chemical feed skid manufacturer shall be responsible for providing a Nema 4x interface box with labeled terminal strips per pump for input and output control wires.
  2. The chemical feed skid manufacturer is also responsible for installing all control wiring from the pumps to the Nema 4x interface box.
  3. The electrical contractor is responsible for running conduit into the Nema 4X interface Box and installing input and output control wires on the terminal strips.
  4. The chemical feed skid manufacturer shall be responsible for providing a prewired and piped 120V receptacle with weatherproof cover for each skid mounted pump completely independent from the control wiring.
  5. Each skid will have an electrical junction box that has been prewired from the 120V receptacle for the electrical contractor to tie into. The electrical contractor is responsible for running conduit and tying into skid mounted electrical junction box and installing 120V supply power to the skid.

## 2.4 BULK STORAGE TANKS

### A. General:

1. The Contractor shall furnish and install the chemical storage tanks in the locations and with the capacities shown on the Drawings. Tanks shall have closed dome tops, and shall be of diameters and heights as shown on the Drawings.
2. Tanks shall be furnished all required flexible connectors. Contractor required to modify piping as required for installation of flexible connectors. Layout shall be approved by the Engineer and shall not present a tripping hazard.
3. The tanks shall be installed on a reinforced concrete foundation with three layers of felt between the bottom of the tank and the concrete, in accordance with details shown on the Drawings.
4. Storage tanks shall be clearly marked on the exterior for the type of intended chemical use to include chemical name and warning placards.
5. All tanks shall be equipped with fittings, appurtenances and accessories as hereinafter specified and/or as shown on the Drawings, and/or required by the manufacturer. All tanks shall be vented as shown on the plans. All tanks shall be restrained with straps, wires or other methods approved by the engineer. Tanks shall not be bolted to their concrete pedestals.
6. Chemical storage tanks shall in all respects equal or exceed the requirements of:
  - a. American Society of Testing Materials (ASTM).

- 1) D638 - Tensile Properties of Plastics
  - 2) D883 - Standard Definitions of Terms Relating to Plastics
  - 3) D1505 - Density of Plastics by the Density-Gradient Technique
  - 4) D1525 - Test Method for Vicat Softening Temperature of Plastics
  - 5) D1693 - ESCR Specification Thickness 0.125" F50-10% Igepal
  - 6) F412 - Standard Terminology Relating to Plastic Piping Systems
- b. ANSI Standards: B-16.5, Pipe Flanges and Flanged Fittings
  - c. ARM: Low Temperature Impact Resistance (Falling Dart Test Procedure).
  - d. NSF/ANSI Standard 61, AWWA – Drinking Water System Components
  - e. ASTM D-1998, Standard Specification for Polyethylene Upright Storage Tanks
7. The bulk storage tanks shall be equipped with an ultrasonic level sensor which shall transmit the tank level via a 4-20mA signal and chemical fill station.
  8. Each tank shall be certified to be safe and satisfactory for the storage of the intended chemical/liquid, and to be suitable for service associated with the production of potable water.
  9. Polyethylene Tanks:
    - a. Tanks shall be manufactured of cross-linked high density polyethylene.
    - b. Tanks shall be manufactured by the Rotomolding process and shall be of one piece construction.
    - c. The minimum wall thickness of the cylindrical shell at any fluid level shall be determined by the Barlow Hoop Stress formula using a design hoop stress of 600 psi.
    - d. Tanks shall include a manway, flanged fill pipe, vent with screen, flanged outlet, flanged recirculation connection, spare flanged outlet, and flanged ultrasonic level assembly connection, as described below.
10. Restraint System:
    - a. Metal components to be stainless steel, edge softeners, and tension ring with stainless steel cables and clamps.
    - b. Tank restraint system shall be designed and supplied by the tank manufacturer.
11. All tanks shall be equipped with a ladder.
    - a. Fiberglass access ladders shall be provided with the polyethylene chemical storage tanks at locations as shown. Safety cages shall be added to ladders as required, per OSHA.
    - b. Ladders must be secured to the tank and secured to the concrete to allow for tank expansion/contraction due to temperature and loading changes.
    - c. Use proper chemical resistant materials when anchoring to tank dome or sidewall.

**B. Alum Bulk and Sodium Hypochlorite Storage Tanks:**

1. Tank shall be double wall HDPE and shall be a minimum of 10' diameter and 15' tall with a capacity of 6,500 gallons. Tanks shall be equipped as follows:
  - a. 2" flanged and gusseted top fill connection
  - b. 3" flanged and gusseted top vent connection

- c. 3" flanged and gusseted spare fill connection
  - d. 3" flanged and gusseted overflow connection
  - e. 2" flanged and gusseted bottom feed connection
  - f. Flanged and gusseted connection for Ultrasonic Level Indicator
  - g. 22" (clear opening) top access manway with cover
  - h. All seals shall be compatible with intended stored chemical
  - i. There shall also be encapsulated in the wall of the tank a liquid level gauge reading in gallons. The gauge shall be marked at 250 gallon intervals, with increment indication for each 50 gallons. The wall of the tank shall be of such translucency as to allow the level of liquid within the tank to be visible through the wall.
  - j. Required lifting lugs.
  - k. All non-specified accessories or appurtenances as required by the manufacturer, such as flexible connections, chemical-specific bulkheads, etc.
  - l. Tie-down restraint system
  - m. Sodium Hypochlorite tank(s) shall have Viton gaskets and vented valves.
2. Fill line piping for liquid alum and sodium hypochlorite storage tanks shall be PVC pipe conforming to the requirements of these Specifications, and pipe shall be Schedule 80. Fittings shall conform to the same specification. Valves shall meet the requirements of these Specifications. Vent piping and fittings shall be as specified for fill piping.

C. Fluoride Bulk Storage Tank:

- 1. Tanks shall be cross-linked polyethylene and shall be a minimum of 8'-6" diameter and 15'-8" tall with a capacity of 5,000 gallons.
- 2. Tanks shall be equipped as follows:
  - a. 2" flanged and gusseted top fill connection
  - b. 3" flanged and gusseted top vent connection
  - c. 3" flanged and gusseted spare feed connection
  - d. 3" flanged and gusseted side overflow connection
  - e. 2" flanged and gusseted bottom feed connection
  - f. Flanged and gusseted connection for Ultrasonic Level Indicator
  - g. 22" (clear opening) top access manway with cover
  - h. All seals shall be compatible with intended stored chemical
  - i. There shall also be encapsulated in the wall of the tank a liquid level gauge reading in gallons. The gauge shall be marked at 250 gallon intervals, with increment indication for each 50 gallons. The wall of the tank shall be of such translucency as to allow the level of liquid within the tank to be visible through the wall.
  - j. Tie-down restraint system
- 3. Fill line piping for fluoride storage tanks shall be 2" PVDF pipe conforming to the requirements of these Specifications, and pipe shall have wall thicknesses as specified therein. Fittings shall conform to the requirements of the same specifications. Valves shall meet the requirements of these Specifications. Vent piping and fittings shall be as specified for fill piping.

2.5 DAY TANKS:

A. General:

1. The Contractor shall furnish and install chemical day tanks, in the locations as shown on the Drawings. Tanks shall have capacities, diameters, and heights as shown on the Drawings. Tanks shall be top access covers as described below.
2. Tanks shall be equipped with integral stubouts for fill piping, vent piping, and outlet piping. Connections to tank fill and vent piping shall be flexible, and vent piping shall be run to the outside of buildings.
3. Tanks shall be furnished all required flexible connectors. Contractor required to modify piping as required for installation of flexible connectors. Layout shall be approved by the Engineer and shall not present a tripping hazard.
4. Tank shall be fabricated from premium grade materials as specified under general portion of these Specifications, and shall be certified to be suitable for the intended chemical service and to be suitable for service associated with the production of potable water.

B. Alum Day Tank:

1. Contractor shall furnish and install one alum day tank.
2. Tank shall be constructed of double wall HDPE.
3. Tank shall be 4' diameter, 4' tall, and shall have a 300 gallon capacity.
4. Tanks shall be equipped as follows:
  - a. 2" flanged and gusseted top fill connection
  - b. 3" flanged and gusseted top vent connection
  - c. 2" flanged and gusseted bottom feed connection
  - d. Flanged and gusseted connection for Ultrasonic Level Indicator
  - e. 22" (clear opening) top access manway with cover

C. Sodium Hypochlorite Day Tank:

1. Contractor shall furnish and install one 250 gallon sodium hypochlorite day tank.
2. A Containment base, as specified in the plans, shall be provided underneath the day tank. The day tank must not be raised to such a height that the chemical fill line can not fill the tank to it's intended capacity.
3. Tanks shall be constructed of double wall HDPE.
4. Tanks shall be 4'-6" diameter, 4' tall, and shall have a 365 gallon capacity.
5. Tanks shall be equipped as follows:
  - a. 2" flanged and gusseted top fill connection
  - b. 3" flanged and gusseted top vent connection
  - c. 2" flanged and gusseted bottom feed connection
  - d. Flanged and gusseted connection for Ultrasonic Level Indicator
  - e. 22" (clear opening) top access manway with cover

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. General: Comply with manufacturer's detailed written instructions for installing

equipment.

C. Testing and Adjustment:

1. Following the completion of each chemical feed system, the systems and equipment shall be operated and tested for conformance to the specifications.
2. Adjust pumps, piping, valves and appurtenances per manufacturer's recommendations.
3. Tanks and piping shall be tested for leakage according to the requirements in this specification.
  - a. Pipeline Testing – Tested in accordance with Specification Section 22 11 13 at 25 psi.
  - b. Storage Tank Hydrostatic Test
    - 1) A hydrostatic test shall be performed for a 24 hour period.
    - 2) After 24 hours the tank level shall be checked and the tank observed for any leaks or wet/damp locations.
    - 3) No allowable leakage or damp areas. Contractor responsible for all repairs to address leaks and/or damp spots.
    - 4) Test water shall remain in the tank until the Owner provides the chemical for filling the tank.
    - 5) The Contractor is responsible for filling and draining the test water for the storage tank.

3.2 DELIVERY, STORAGE, AND HANDLING

- A. Equipped shall be shipped, stored, and handled in accordance with the manufacturer's written instructions.
- B. Tanks shall be shipped upright or lying down on their sides with blocks and slings to keep them from moving. AVOID sharp objects on trailers.
- C. Upon arrival at the destination, inspect the equipment and accessories for damage in transit. If damage has occurred, notify manufacturer and Owner.

3.3 INSTALLATION

- A. Install the equipment in strict accordance with Manufacturer's Installation Manual and shop drawings.
- B. Installation will be inspected by manufacturer to verify system flexible connections, venting and fittings are properly installed.

3.4 CLEANING AND PROTECTING

- A. Restore marred, abraded surfaces to their original condition.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer, and ensure that equipment is without damage or deterioration at the time of Substantial Completion.

3.5 START-UP ASSISTANCE AND TRAINING

- A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:

1. A factory authorized service representative (for each system and/or piece of equipment) from the manufacturer shall perform all necessary on-site assistance and installation supervision for each chemical system.
2. Once the chemical systems have been installed correctly and are operating as intended, the service representative(s) shall perform sixteen (16) hours of on-site start-up assistance/operator training.
3. Train Owner's maintenance personnel on procedures and schedules related to troubleshooting, servicing, and preventive maintenance.
4. Schedule training with Owner with at least seven days' advance notice.

END OF SECTION 44 44 13

APPENDIX A

Geotechnical Report



**REPORT OF GEOTECHNICAL EXPLORATION  
CHEMICAL STORAGE BUILDING – NORTHPORT WTP**  
Northport, Tuscaloosa County, Alabama  
Contour Project No: AG23KRE02

March 30, 2023

**Prepared For:**  
City of Northport Utilities  
c/o Mr. Scott Lee  
**Krebs Engineering, Inc**

March 30, 2023

City of Northport Utilities  
c/o Mr. Scott Lee  
**Krebs Engineering, Inc**  
Via email: [scott.lee@krebseng.com](mailto:scott.lee@krebseng.com)


Reference: Report of Geotechnical Exploration  
**CHEMICAL STORAGE BUILDING – NORTHPORT WTP**  
Northport, Tuscaloosa County, Alabama  
Contour Project No: AG23KRE02

Gentlemen,

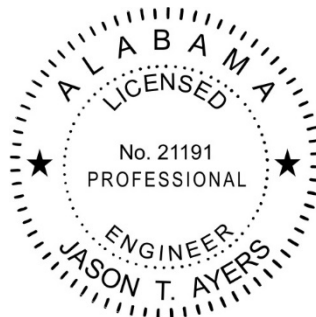
*Contour Engineering, LLC* (Contour) has completed the geotechnical exploration for the referenced project in general accordance with our proposal AG23KRE-120 dated February 21, 2023. The following report includes a summary of the project information and the findings from our subsurface investigation and evaluation.

We appreciate the opportunity to work with you on this project and look forward to assisting you with any future projects. Should you have any questions regarding this report or if we may be of further service, please contact our office.

Sincerely,  
***Contour Engineering, LLC***



Walker Peoples  
Staff Engineer



Jason T. Ayers, P.E.  
Senior Engineer

Copies Submitted Via Email: Addressee

## PROJECT SUMMARY

### **Site and Project Description**

The subject site is located at the existing Northport Water Treatment Plant off of Lary Lake Road in Northport, Alabama. Proposed for construction will include a pre-engineered, slab-on-grade building with chemical storage tanks covering approximately 6,000 square feet. We have assumed maximum column and wall loads are assumed to be 60 kips and 2 to 3 kips per linear foot, respectively.

## FINDINGS

### **Area Geology**

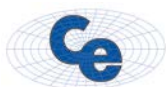
According to published geologic information, the site lies within the East Gulf Coastal Plain Province. Specifically, the site is underlain by the Coker formation. The formation consists of light-colored lenticular beds of clays, sands and gravel in southern and western parts of the county. Gravel is mainly quartz. Maximum thickness of formation is 500 feet. Contains most extensive aquifers in the country. Basal gravel beds will yield several hundred gallons per minute to wells in many places. Flowing artesian wells average 30 gpm from aquifers in Coker formation at depths 200 to 500 feet in Black Warrior River Valley. Water generally good quality but locally can be high in iron. The dissolution may progress and form cavities. Sinkholes may form as the overburden soils filter into the solution cavities. Sinkholes are difficult to predict and even an extensive subsurface investigation could not eliminate the potential of sinkhole occurrence. At the time of our investigation, no evidence of sinkholes was encountered in the borings.

### **Subsurface Conditions**

A total of three (3) soil test borings were drilled for the new building. In general, the soil test borings encountered an initial layer of topsoil and/or gravel, underlain by fill materials and residual soils.

*Fill materials*, or materials placed by man, were encountered across the site. The fill materials are clays, fat clays, and sandy clays, typically brown, and extended to depths on the order of 0 to 3 feet. Standard penetration test (SPT) values ranged from 7 to 17 blows per foot (bpf) in the fill, indicating variable consistencies.

Underlying the fill materials, *residual soils* consisting of medium to very stiff, brown, tan and white, sandy Clays (CL) and clayey Sands (SC).



### **Groundwater Conditions**

Groundwater was not encountered during the field exploration. Groundwater levels in this area will fluctuate in response to local variations of precipitation and temperature and may be different at other times and areas.

Individual soil boring profiles are depicted on the Boring Records included in the Appendix. Additionally, stratification lines represent the approximate boundaries between soil types. The actual transitions may be more gradual than depicted

## **RECOMMENDATIONS**

### **Site Preparation**

Prior to the commencement of construction, all vegetation, topsoil, pits, foundations, utilities and any other non-soil deleterious materials that fall within the limits of the proposed construction should be removed from the site. A geotechnical engineer should carefully evaluate the areas intended to support floor slabs, pavements, any new fill, and foundations after the necessary clearing and stripping. Any unsuitable materials observed during the evaluation and/or proofrolling operations should be undercut and replaced with compacted fill or stabilized in-place.

***Fill materials were encountered across the site in the upper 2-3 feet and may require remedial measures for foundation and slab support.*** Typically remedial measures include undercutting any soft soils and replacing with properly compacted, structural fill. The undercut should extend a minimum of 5 feet beyond the perimeter of the foundations and slab footprint.

### **Excavation Conditions**

The borings extended to planned termination depths of 20 feet bgs with conventional, earth auger techniques.

### **Structural Fill Placement**

All structural fill should be free of organic materials; have a liquid limit (LL) and a plastic index (PI) not exceeding 45 and 20 percent, respectively; and moisture conditioned to maintain a moisture content within two percentage points above and below the optimum moisture contents as determined by the Standard Proctor tests (ASTM D-698). Soils with moisture contents in excess of their optimum, and soils excavated near to or below the groundwater table will require significant drying efforts prior to reuse as structural fill.

Off-site borrow materials may also be used as structural fill provided that they have a liquid limit (LL) and a plastic index (PI) not exceeding 45 and 20 percent, respectively. All structural fill should



be free of organics and moisture conditioned to maintain a moisture content within two percentage points above and below the soil's optimum moisture content. Therefore, the grading contractor should be prepared to moisture condition the soil as required during fill placement.

#### On Site Soils Suitability

The existing residual soils appear suitable for reuse as structural fill. The existing fill materials which contain organics are not suitable for reuse as structural fill.

All structural fill to be used on site should be evaluated and approved by the geotechnical engineer to confirm that the material meets the specified requirements.

#### Placement and Compaction Requirements

Structural fill should be placed in thin loose lifts not exceeding 8 inches in thickness and tested by a soils technician to determine the compaction percentage. We recommend that the following minimum level of compaction and density testing frequency per lift be achieved:

- Building and Pavement Areas - Compact the fill to 98 percent of the soil's maximum standard Proctor density value (ASTM D-698). Field density testing frequency should be performed as one test per lift for every 5,000 square feet.

#### Foundation Support

Provided that the site is prepared in accordance with our recommendations, the building can be supported on conventional shallow foundation system. A maximum allowable bearing pressure of 2,500 pounds per square foot (psf) may be used in the design of the shallow foundations.

Bottoms of foundation excavations should be evaluated by a geotechnical engineer prior to placement of reinforcing steel and concrete to verify that adequate bearing materials are present and that all debris, mud, and loose, frozen or water-softened soils are removed.

Based on our experience with similar type of soils and structural loading, we anticipate that differential and total settlement will be less than ½-inch and 1-inch, respectively. Careful field control will contribute substantially to minimizing potential settlements.

Foundation excavations should be concreted as soon as practical after they are excavated. Water should not be allowed to pond in any excavation. If an excavation is left open for an extended period, a thin mat of lean concrete should be placed over the bottom to minimize damage to the bearing surface from weather or construction activities. Foundation concrete should not be placed on frozen or saturated subgrades.

#### Slab-On-Grade Support

Upon completion of the recommended site preparation, the building floor slabs may be directly supported on approved subgrade soils and/or structural fill. Provided the slab subgrade is prepared in accordance with our recommendations and slab loads do not exceed 200 pounds per



square foot, a subgrade modulus reaction (K) of 90 pounds per square inch per in (psi/in) may be used for slab design.

If a higher modulus of subgrade reaction is required, then we recommend that a 4-inch layer of compacted crushed stone be placed underneath the concrete building slab. The 4 inches of crushed stone will provide a protective cover as well as a uniform working surface. The crushed stone should consist of crushed aggregate base meeting the requirements of ALDOT Section 825 Type B. Slabs underlain by 4 inches of stone are expected to have K-values of 130 psi/in.

### **Seismic Site Classification**

Based on the known geological features of the East Gulf Coast Plain Physiographic Province, the site data, and as described in Section 1613.5.2 of the 2009 International Building Code, it is our opinion that the Site Class Definition for the site is “D”. The soil profile named “Stiff Soil Profile” was determined from Table 1613.5.2 of the IBC 2018.

### **CLOSING**

We appreciate the opportunity to work with you on this project. Should you have any questions regarding this report or if we may be of further service, please contact our office.

Sincerely,  
Contour Engineering, LLC



Jason T. Ayers, P.E.  
Senior Engineer



Copies Submitted Via Email: Addressee (1)

### **APPENDIX**

Figure 1 – Site Vicinity Map

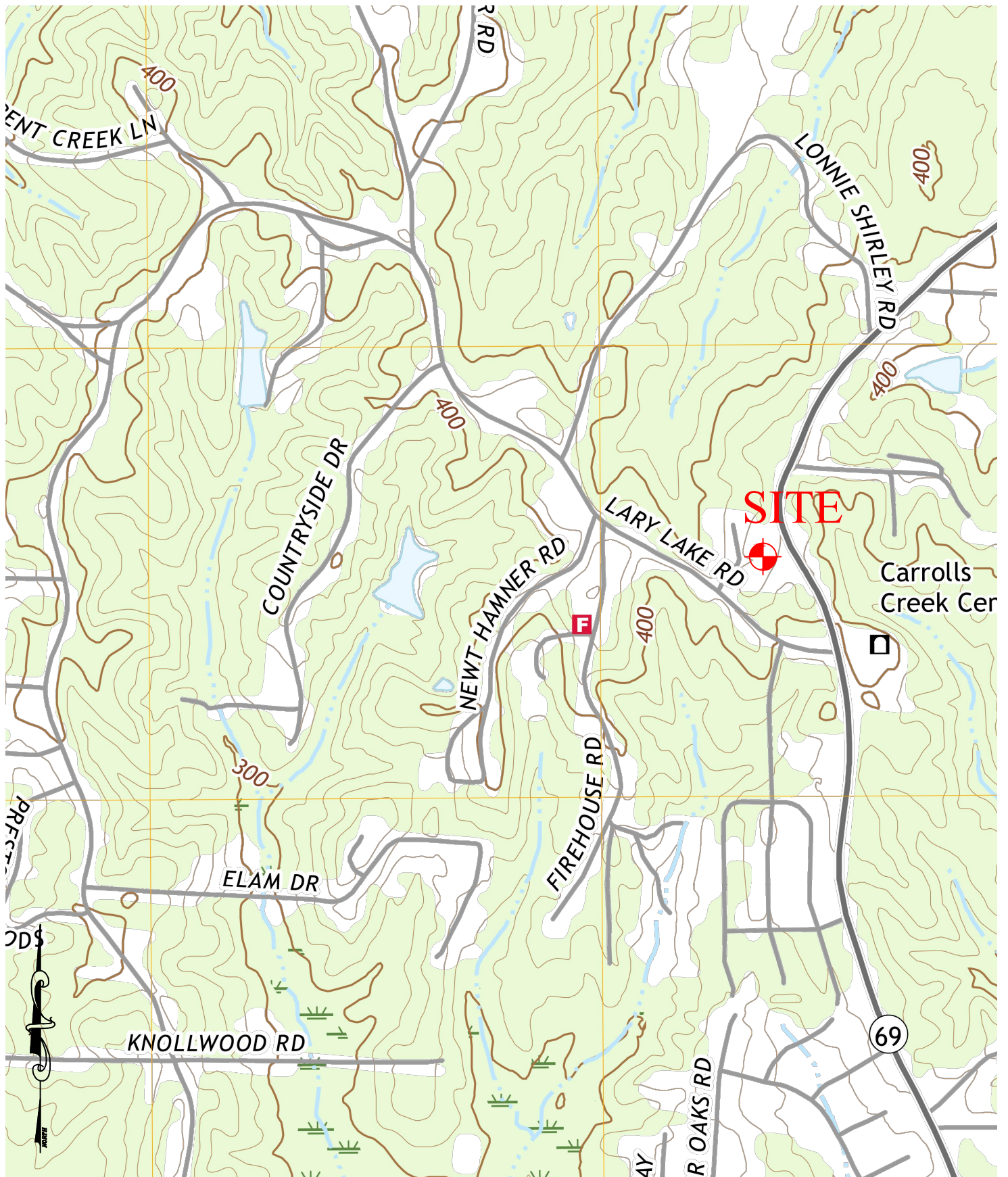
Figure 2 – Aerial View

Figure 3 – Boring Location Plan

Boring Logs (3)

Soil Classification Chart and Important Information About the Geotechnical Report





**FIGURE 1: SITE VICINITY MAP**



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Company

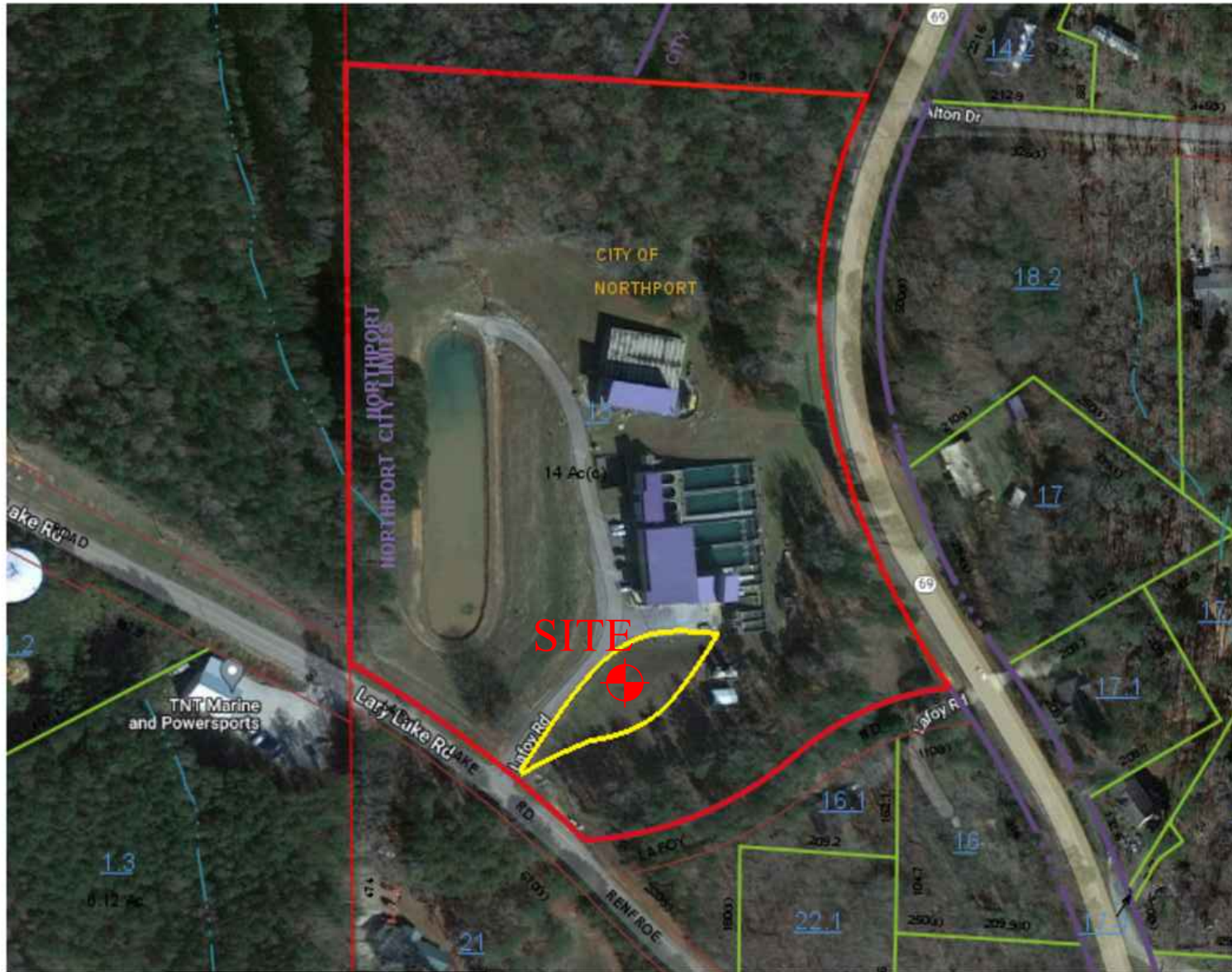
**LEGEND**

Source: USGS Topographic Map -  
"Lake Tuscaloosa, AL" Quadrangle

Scale: Not to Scale

**PROJECT**

CHEMICAL STORAGE BUILDING  
NORTHPORT WTP  
Northport, Tuscaloosa County, Alabama  
Project No.: AG23KRE02



**FIGURE 2: AERIAL VIEW**

**LEGEND**

Tuscaloosa County GIS 2023

Scale: Not to Scale

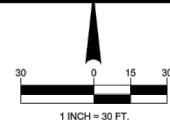
**PROJECT**

CHEMICAL STORAGE BUILDING  
 NORTHPORT WTP  
 Northport, Tuscaloosa County, Alabama  
 Project No.: AG23KRE02



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 Sciences  
 Company





**LEGEND**  
 B-1 SOIL TEST BORING

**FIGURE 3: BORING LOCATION PLAN**

**LEGEND**

- Boring Location

Scale: Not to Scale

**PROJECT**  
 CHEMICAL STORAGE BUILDING  
 NORTHPORT WTP  
 Northport, Tuscaloosa County, Alabama  
 Project No.: AG23KRE02



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PROJECT: **CHEMICAL STORAGE BUILDING - NORTHPORT AL**

BORING DESIGNATION: **B-1**  
SECTION: TOWNSHIP:

SHEET: **1 of 1**  
RANGE:

Northport, Alabama

CLIENT: Krebs Engineering, Inc

G.S. ELEVATION (ft):

DATE STARTED: 3/16/23

LOCATION:

WATER TABLE (ft):

DATE FINISHED: 3/16/23

REMARKS:

DATE OF READING:

DRILLED BY: Smith Drilling Company

TYPE OF SAMPLING: Split Spoon  
Sampling

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		K (FT./ DAY)	POCKET PEN. (tsf)
									LL	PI		
0												
		5-8-7	15			<b>FILL:</b> Medium dense, brown black, clayey SAND (SC) w/ gravel						
		5-7-9	16			<b>RESIDUAL:</b> Very stiff, red brown, sandy CLAY (CL)						
5		6-9-11	20									
		5-8-10	18									
10		6-8-8	16									
15		4-6-5	11			Medium dense, brown tan white, clayey SAND (SC)						
20		3-4-5	9			Stiff, brown orange, sandy CLAY (CL)						
						Boring terminated at 20.0 ft.						

PROJECT: **CHEMICAL STORAGE BUILDING - NORTHPORT AL**

BORING DESIGNATION: **B-2**  
SECTION: TOWNSHIP:

SHEET: **1 of 1**  
RANGE:

Northport, Alabama

CLIENT: Krebs Engineering, Inc

G.S. ELEVATION (ft):

DATE STARTED: 3/16/23

LOCATION:

WATER TABLE (ft):

DATE FINISHED: 3/16/23

REMARKS:

DATE OF READING:

DRILLED BY: Smith Drilling Company

TYPE OF SAMPLING: Split Spoon  
Sampling

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		K (FT./ DAY)	POCKET PEN. (tsf)
									LL	PI		
0						<b>FILL:</b> Stiff to very stiff, brown, CLAY (CL-CH) w/ trace organics						
		5-5-4	9									
		3-7-10	17									
5						<b>RESIDUAL:</b> Medium dense, brown, sandy CLAY (SC)						
		7-9-10	19									
		5-7-7	14									
10						Medium dense, tan, sandy CLAY (SC)						
		5-6-5	11									
15						Medium dense, brown tan white, sandy CLAY (CL)						
		6-7-7	14									
20		7-8-10	18									
						Boring terminated at 20.0 ft.						

PROJECT: **CHEMICAL STORAGE BUILDING - NORTHPORT AL**

BORING DESIGNATION: **B-3**  
SECTION: TOWNSHIP:

SHEET: **1 of 1**  
RANGE:

Northport, Alabama

CLIENT: Krebs Engineering, Inc

G.S. ELEVATION (ft):

DATE STARTED: 3/16/23

LOCATION:

WATER TABLE (ft):

DATE FINISHED: 3/16/23

REMARKS:

DATE OF READING:

DRILLED BY: Smith Drilling Company

TYPE OF SAMPLING: Split Spoon  
Sampling

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		K (FT./ DAY)	POCKET PEN. (tsf)
									LL	PI		
0						<b>FILL:</b> Medium stiff, brown, fat CLAY (CH) w/ organics						
		2-3-4	7			<b>RESIDUAL:</b> Stiff, tan brown, CLAY (CL-CH)						
		2-4-6	10									
						Very stiff, brown, sandy CLAY (CL)						
5		9-10-11	21									
						Medium dense, tan, clayey SAND (SC)						
		5-6-6	12									
10		4-5-5	10									
		5-6-8	14									
15												
		5-11-10	21									
20						Boring terminated at 20.0 ft.						

# SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS	
			GRAPH	LETTER		
<p><b>COARSE GRAINED SOILS</b></p> <p>MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE</p>	<p><b>GRAVEL AND GRAVELLY SOILS</b></p>	<p>CLEAN GRAVELS</p>		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
		<p>(LITTLE OR NO FINES)</p>		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
		<p>GRAVELS WITH FINES</p>		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES	
		<p>(APPRECIABLE AMOUNT OF FINES)</p>		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES	
	<p><b>SAND AND SANDY SOILS</b></p>	<p>CLEAN SANDS</p>		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
		<p>(LITTLE OR NO FINES)</p>		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES	
		<p>SANDS WITH FINES</p>		SM	SILTY SANDS, SAND - SILT MIXTURES	
		<p>(APPRECIABLE AMOUNT OF FINES)</p>		SC	CLAYEY SANDS, SAND - CLAY MIXTURES	
		<p><b>FINE GRAINED SOILS</b></p>	<p><b>SILTS AND CLAYS</b></p> <p>LIQUID LIMIT LESS THAN 50</p>		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
					CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL			ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY		
<p><b>SILTS AND CLAYS</b></p> <p>LIQUID LIMIT GREATER THAN 50</p>			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS		
			CH	INORGANIC CLAYS OF HIGH PLASTICITY		
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS		
<p><b>HIGHLY ORGANIC SOILS</b></p>				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS	

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

# Important Information about This

# Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

**The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.**

## **Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects**

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

## **Read this Report in Full**

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

## **You Need to Inform Your Geotechnical Engineer about Change**

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

## **This Report May Not Be Reliable**

*Do not rely on this report* if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be, and, in general, if you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying it.* A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

## **Most of the "Findings" Related in This Report Are Professional Opinions**

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

## This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

## This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

## Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may

perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

## Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

## Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old*.

## Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration*. Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. *Geotechnical engineers are not building-envelope or mold specialists*.



Telephone: 301/565-2733

e-mail: [info@geoprofessional.org](mailto:info@geoprofessional.org) [www.geoprofessional.org](http://www.geoprofessional.org)