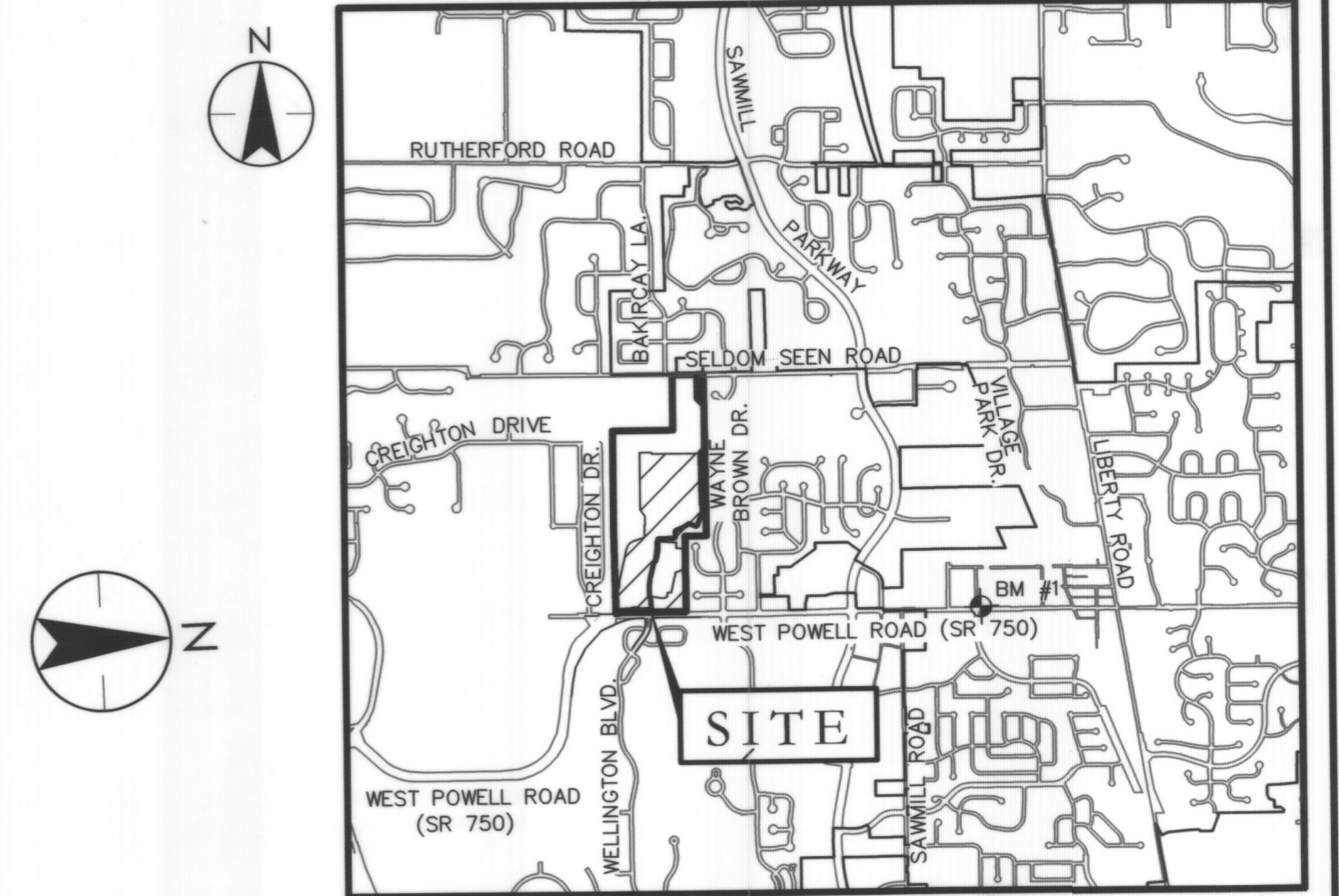


# DELAWARE COUNTY, OHIO VERONA SANITARY SEWER PUMPSTATION & FORCEMAIN IMPROVEMENTS 2016

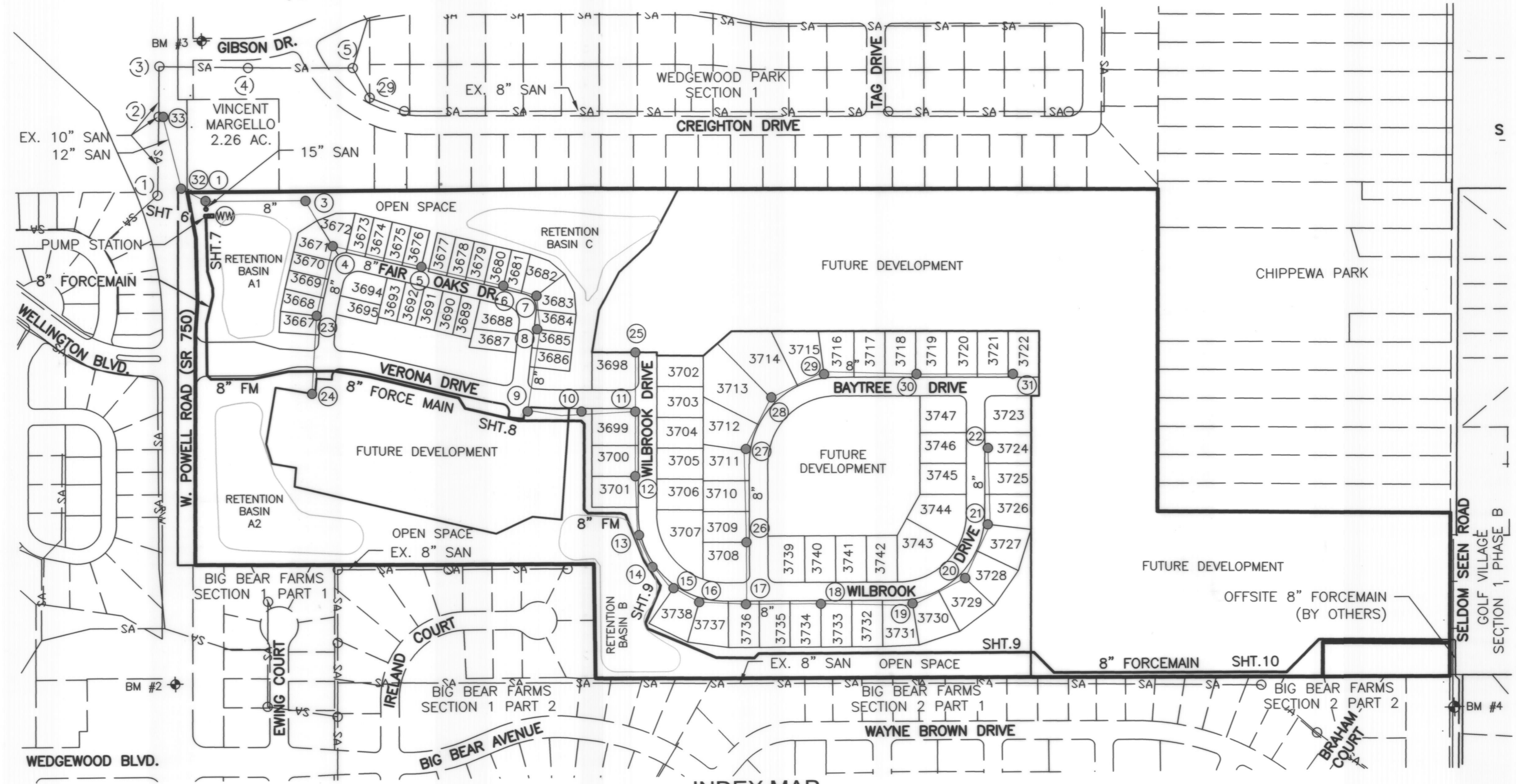
SITUATED IN THE TOWNSHIP OF LIBERTY, FARM LOTS 9 & 12,  
QUARTER TOWNSHIP 3, TOWNSHIP 3 NORTH, RANGE 19 WEST, U.S. MILITARY LANDS

ESTIMATE OF QUANTITIES			
ITEM	TOTAL	UNIT	DESCRIPTION
<b>FORCEMAIN AND PUMP STATION</b>			
203	1	HR	PROOF ROLLING
304	81	CY	AGGREGATE BASE
304	13	CY	AGGREGATE BERM
402	20	CY	ASPHALT CONCRETE, INTERMEDIATE COURSE
404	20	CY	ASPHALT CONCRETE, SURFACE COURSE
608	92	SO FT	4" CONCRETE WALK
SPEC	5275	LF	8" PVC C900 FORCEMAIN
SPEC	3	EA	BOLLARDS
SPEC	1	EA	BIOXIDE TANK AND PAD, COMPLETE
SPEC	1	EA	10' WET WELL, COMPLETE
SPEC	1	EA	CONTROL BUILDING AND VALVE VAULT, COMPLETE
SPEC	1	EA	AIR RELEASE VALVE, COMPLETE
SPEC	81	CY	NO. 1 AND NO. 2 STONE
<b>GRAVITY SEWER</b>			
207	833	SY	SEEDING AND MULCHING
207	67	CY	CONSTRUCTION ENTRANCE
604	2	EA	MANHOLE TYPE 'A'
901	342	LF	12" SANITARY SEWER PIPE
901	20	LF	15" SANITARY SEWER PIPE
SPEC	1	EA	CONCRETE WASHOUT

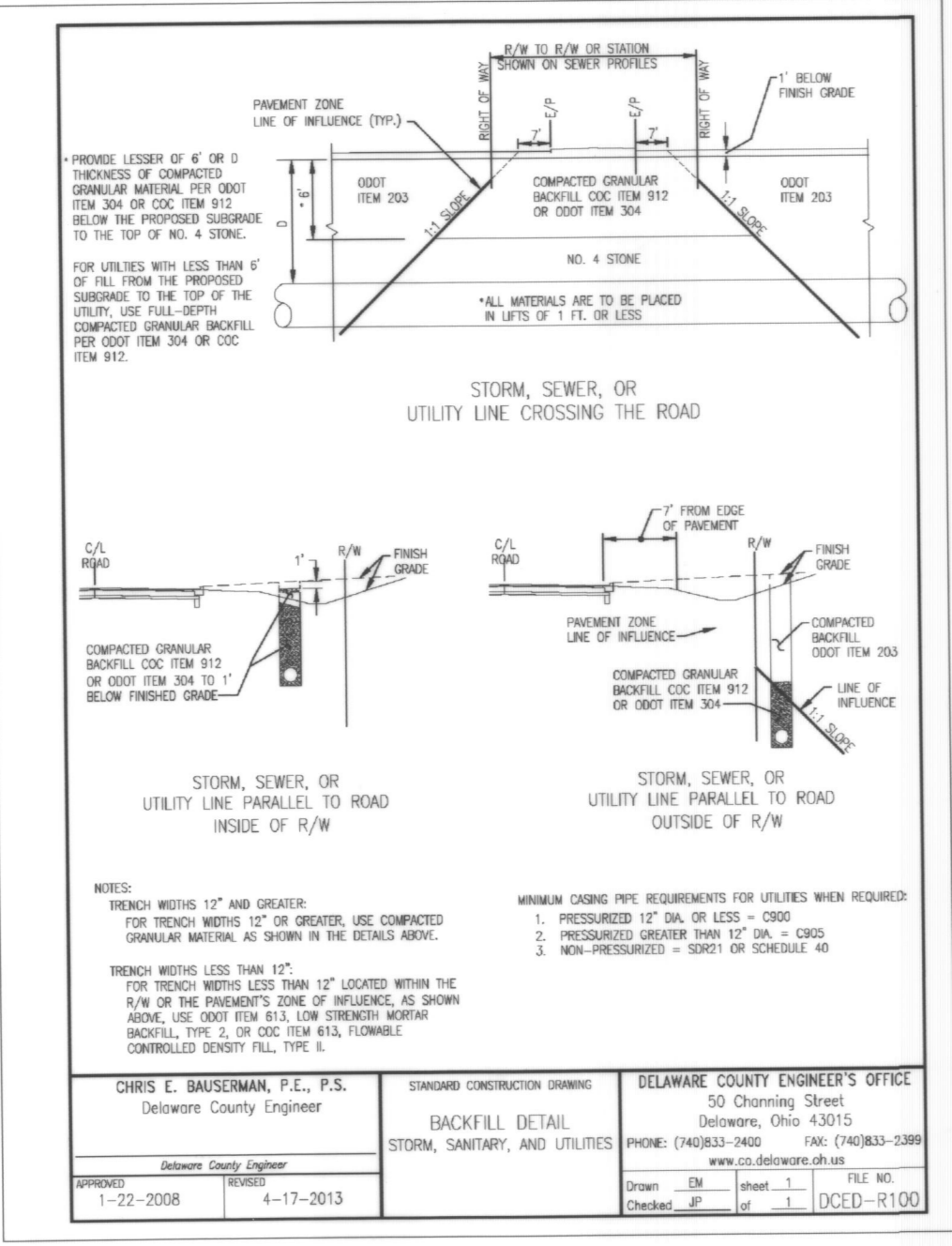


VICINITY MAP  
SCALE: 1" = 3000'  
BENCH MARKS  
(NAVD 1988 DATUM)

- SOURCE BENCH MARK:**
- BM #1 BRASS DISK SET STAMPED "97-038" LOCATED ON NORTH SIDE OF POWELL ROAD, 1400'± EAST OF SAWMILL ROAD. ELEV. = 915.90
  - BM #2 TOP OF PK AND WASHER IN CONCRETE BASE ON LIGHT POLE AT WEST SIDE OF WEDGEWOOD DRIVE, NORTH SIDE OF POWELL ROAD (PER ODOT PLAN DEL-750-1.23). ELEV. = 910.36
  - BM #3 TOP OF PK AND WASHER ON WEST SIDE OF GIBSON DRIVE AT STONE PAVEMENT WALK, NORTH SIDE OF POWELL ROAD (PER ODOT PLAN DEL-750-1.23). ELEV. = 900.96
  - BM #4 3/4" IRON PIPE SET WITH CAP "STANTEC" LOCATED ON NORTH SIDE OF SELDOM SEEN ROAD, 420'± WEST OF LAUREL VALLEY DRIVE. ELEV. = 939.98



INDEX MAP  
SCALE: 1" = 300'



STANDARD DRAWINGS DELAWARE COUNTY		
STREET	REGIONAL SEWER DISTRICT	MISCELLANEOUS
DCED-R100	01-SEWER INSTALLATION	ODOT MGS-4.3
DCED-R1441A	02-TYPICAL SERVICE CONNECTION	ODOT BP-4.1
DCED-R1441B	03-BRANCH CONNECTION AND RISER PIPE	
DCED-R1441C	04-OPTIONAL DUAL LATERAL EXTENSIONS	
DCED-R2180	05-MANHOLE CHANNEL DETAIL	
DCED-R2186A	08-MANHOLE TYPE "C"	
DCED-R2186B	15-TYPICAL WATERTIGHT MANHOLE CASTING	
DCED-R2202		
DCED-R2300		

THE STANDARD DRAWINGS LISTED ON THIS PLAN SHALL BE CONSIDERED A PART THEREOF.

CHANGE ORDER SCHEDULE						
CHANGE	PREPARED	DATE OF CHANGE	DESCRIPTION OF CHANGE	SHT NO	APPROVED	DATE OF APPROV.

**NOTICE TO CONTRACTORS:**  
THE ELECTRONIC FILES FOR THIS PROJECT ARE INSTRUMENTS OF SERVICE OF, AND ARE OWNED BY STANTEC CONSULTING SERVICES, INC. DATA FROM SUCH ELECTRONIC FILES CAN BE PROVIDED FOR CONSTRUCTION STAKING. CONTACT KEVIN KERSHNER, P.E., STANTEC'S PROJECT MANAGER FOR THIS PROJECT, FOR INFORMATION ABOUT THE FEES ASSOCIATED WITH PROVIDING SUCH DATA AND THE RELEASE AND INDEMNITY THAT MUST BE SIGNED BEFORE THE DATA IS RELEASED.

PREPARED FOR:  
**VERONA, LLC.**  
148 WEST SCHROCK ROAD  
WESTERVILLE, OHIO 43082  
(614) 891-2042

INDEX OF SHEETS	
COVER SHEET	1
GENERAL NOTES	2
TRIBUTARY AREA MAP	3
EROSION CONTROL PLAN	4
EROSION CONTROL NOTES	5
FORCEMAIN PLANS AND PROFILE	6-10
SITE PLAN AND DRIVE DETAILS	11
PUMP STATION DETAILS	12
BIOXIDE NOTES AND GENERAL DETAILS	13
BUILDING DETAILS	14-15
PUMP STATION ELECTRICAL POWER DIAGRAM	16
PUMP STATION POWER PLANS	17
PUMP STATION ELECTRICAL CONTROL DIAGRAM	18
PUMP STATION CONTROL PANEL DIAGRAMS	19
PUMP STATION ELECTRICAL DETAILS	20
PUMP STATION ELECTRICAL SPECIFICATIONS	21-25

THIS IS TO CERTIFY THAT GOOD ENGINEERING PRACTICES HAVE BEEN UTILIZED IN THE DESIGN OF THIS PROJECT AND THAT ALL OF THE MINIMUM STANDARDS FOR DELAWARE COUNTY HAVE BEEN MET, INCLUDING THOSE STANDARDS GREATER THAN MINIMUM WHERE, IN MY OPINION, THEY ARE NEEDED TO PROTECT THE SAFETY OF THE PUBLIC. ANY VARIANCES TO THE ABOVE STANDARDS ARE CONSISTENT WITH SOUND ENGINEERING PRACTICES AND ARE NOT DETRIMENTAL TO THE PUBLIC SAFETY AND CONVENIENCE. THESE VARIANCES HAVE BEEN LISTED HEREIN AND HAVE BEEN APPROVED BY THE DELAWARE COUNTY SANITARY ENGINEER.

PREPARED BY:  
**Stantec**  
1500 Lake Shore Drive, Suite 100  
Columbus, Ohio 43204  
(614) 486-4383  
(614) 486-4387

REGISTERED ENGINEER  
*Kevin D. Kershner* E-64492 4/5/16 DATE

**CITY OF POWELL APPROVALS**

THE SIGNATURES ON THIS PLAN SIGNIFIES APPROVAL ONLY WITH GENERAL PURPOSE AND GENERAL LOCATION OF THE PROJECT. ALL TECHNICAL DETAILS REMAIN THE RESPONSIBILITY OF THE PROFESSIONAL ENGINEER WHO PREPARED AND CERTIFIED THESE PLANS.

APPROVED THIS 24th DAY OF April, 2016  
*Kevin D. Kershner*  
CITY OF POWELL ENGINEER

APPROVED THIS 5th DAY OF May, 2016  
*David W. Pelt*  
CITY OF POWELL, DIRECTOR OF DEVELOPMENT

APPROVED THIS 5th DAY OF April, 2016  
*Benjamin L. ...*  
CITY OF POWELL MAYOR

**DELAWARE COUNTY APPROVALS**

THE SIGNATURES ON THIS PLAN SIGNIFIES APPROVAL ONLY WITH GENERAL PURPOSE AND GENERAL LOCATION OF THE PROJECT. ALL TECHNICAL DETAILS REMAIN THE RESPONSIBILITY OF THE PROFESSIONAL ENGINEER WHO PREPARED AND CERTIFIED THESE PLANS.

APPROVED THIS 11th DAY OF April, 2016  
*Kevin D. Kershner*  
DELAWARE COUNTY SANITARY ENGINEER

APPROVED THIS 18th DAY OF April, 2016  
*Kevin D. Kershner*  
DELAWARE COUNTY COMMISSIONER

APPROVED THIS 18th DAY OF APRIL, 2016  
*Kevin D. Kershner*  
DELAWARE COUNTY COMMISSIONER

APPROVED THIS \_\_\_ DAY OF \_\_\_, 2016  
DELAWARE COUNTY COMMISSIONER

EASEMENT REFERENCE		
CITY NO.	COUNTY RECORDER	GRANTOR
PLATTED		

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## GENERAL NOTES

THE COUNTY OF DELAWARE AND THE CITY OF POWELL REQUIREMENTS, TOGETHER WITH THE SPECIFICATIONS OF THE STATE OF OHIO, DEPARTMENT OF TRANSPORTATION INCLUDING ALL SUPPLEMENTS THERETO, SHALL GOVERN ALL CONSTRUCTION ITEMS THAT ARE A PART OF THIS PLAN. THE CONTRACTOR SHALL REFER TO THE "STANDARD PLANS AND SPECIFICATIONS FOR CONSTRUCTION OF SANITARY FACILITIES IN DELAWARE COUNTY, OHIO" FOR ALL NECESSARY CONSTRUCTION DETAILS.

APPROVAL OF THESE PLANS IS CONTINGENT UPON ALL REQUIRED SANITARY SEWER EASEMENTS BEING APPROVED BY THE COUNTY AND RECORDED WITH THE PROJECT FINAL PLAT OR AS DIRECTED BY THE DELAWARE COUNTY SANITARY ENGINEER PRIOR TO CONSTRUCTION.

THE CONTRACTOR SHALL NOTIFY THE COUNTY SANITARY ENGINEER'S OFFICE FORTY-EIGHT (48) HOURS PRIOR TO CONSTRUCTION.

ANY MODIFICATIONS TO THE WORK AS SHOWN ON THESE DRAWINGS MUST HAVE PRIOR WRITTEN APPROVAL BY THE COUNTY SANITARY ENGINEER.

THE CONTRACTOR IS RESPONSIBLE FOR THE INVESTIGATION, LOCATION, SUPPORT, PROTECTION, AND RESTORATION OF ALL EXISTING UTILITIES AND APPURTENANCES WHETHER SHOWN ON THESE PLANS OR NOT. THE CONTRACTOR SHALL EXPOSE ALL UTILITIES OR STRUCTURES PRIOR TO CONSTRUCTION TO VERIFY THE VERTICAL AND HORIZONTAL EFFECT ON PROPOSED CONSTRUCTION. THE CONTRACTOR SHALL CALL, TOLL FREE, THE OHIO UTILITIES PROTECTION SERVICE (1-800-362-2764) 48 HOURS PRIOR TO WORK IN THE VICINITY OF THEIR UNDERGROUND LINES. THE IDENTITY AND LOCATION OF THE EXISTING UNDERGROUND UTILITY FACILITIES KNOWN TO BE LOCATED IN THE CONSTRUCTION AREA HAVE BEEN SHOWN ON THE PLANS AS ACCURATELY AS PROVIDED BY THE OWNER OF THE UNDERGROUND UTILITY. THE COUNTY OF DELAWARE AND THE ENGINEER ASSUME NO RESPONSIBILITY AS TO THE ACCURACY OF THE UNDERGROUND FACILITIES SHOWN ON THE PLANS.

THE IDENTITY AND LOCATION OF THE EXISTING UNDERGROUND UTILITY FACILITIES KNOWN TO BE LOCATED IN THE CONSTRUCTION AREA HAVE BEEN SHOWN ON THE PLANS AS ACCURATELY AS PROVIDED BY THE OWNER OF THE UNDERGROUND UTILITY. THE COUNTY OF DELAWARE AND/OR ENGINEER ASSUME NO RESPONSIBILITY AS TO THE ACCURACY OF THE UNDERGROUND FACILITIES SHOWN ON THE PLANS.

THE FOLLOWING UTILITIES AND OR OWNERS ARE LOCATED WITHIN THE WORK LIMITS OF THIS PROJECT AND DO NOT SUBSCRIBE TO A REGISTERED UNDERGROUND UTILITY PROTECTION SERVICE.

UTILITY	OWNER	TELEPHONE
WATER MAINS	DEL-CO WATER COMPANY, INC. 6773 OLENTANGY RIVER ROAD DELAWARE, OHIO 43015	(740) 548-7746
STORM SEWERS	CITY OF POWELL 47 HALL STREET POWELL, OHIO 43065	(614) 885-5380
SANITARY SEWERS	DELAWARE COUNTY SANITARY ENGINEER 50 CHANNING STREET DELAWARE, OHIO 43015	(740) 833-2240
GAS COMPANY	COLUMBIA GAS 101 W. TOWN STREET COLUMBUS, OHIO 43215	(614) 460-2222
ELECTRIC COMPANY	AEP 870 TECH CENTER DRIVE GAHANNA, OHIO 43230	(614) 883-6800
TELEPHONE COMPANY	AT&T LOCAL SERVICES 10 WEST BROAD STREET, SUITE 400 COLUMBUS, OHIO 43215	

THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING ALL RESIDENTS OF INTERRUPTION TO THEIR UTILITIES THAT WILL BE CAUSED BY CONSTRUCTION AT LEAST 48 HOURS IN ADVANCE.

SUPPORTING AND/OR PROTECTING EXISTING WATER LINES, GAS MAINS, TELEPHONE CONDUIT, STORM SEWERS, ETC., SHALL BE INCLUDED IN PAYMENT FOR THE VARIOUS CONTRACT ITEMS OF WORK.

ALL WORK REQUIRED FOR THE MAINTENANCE OF SERVICE OF EXISTING UTILITIES SHALL BE DONE BY, AND AT THE EXPENSE OF THE CONTRACTOR.

ALL MAINTENANCE, REPAIR AND/OR REPLACEMENT OF EXISTING UTILITIES SHALL BE IN ACCORDANCE WITH THE RULES AND REGULATIONS OF THE VARIOUS UTILITY COMPANIES HAVING JURISDICTION. ALL EXISTING STORM SEWERS, DRIVEWAY DRAINS, AND OTHER SURFACE DRAIN PIPES, WHETHER SHOWN ON THE CONTRACT DRAWINGS OR NOT, REMOVED OR DAMAGED DURING CONSTRUCTION SHALL BE REPAIRED AND RECONNECTED BY THE CONTRACTOR AS DIRECTED BY THE ENGINEER, AT NO COST TO THE COUNTY.

## STORM SEWER

STORM SEWER ITEMS ARE TO BE PER DELAWARE COUNTY AND ODOT STANDARDS.

THE CONTRACTOR SHALL INCLUDE IN THE UNIT PRICE BID FOR ITEM 603, ALL TRENCHING, BACKFILLING PER PLAN, AND THE REMOVAL AND DISPOSAL OF BRUSH, TREES, AND STUMPS WITHIN THE AREA OF EXCAVATION OF THE TRENCH.

UNLESS OTHERWISE NOTED ON THE PLANS, STORM SEWERS SHALL BE AS HERINAFTER SPECIFIED. (1) STORM SEWERS LOCATED WITHIN OR ACROSS PROPOSED OR EXISTING PAVEMENT AREAS SHALL BE TYPE "B" CONDUIT, 706.02. (2) STORM SEWERS LOCATED OUTSIDE PAVEMENT AREAS, BUT WITHIN RIGHT-OF-WAYS SHALL BE TYPE "B" CONDUIT, 706.02. (3) STORM SEWERS LOCATED OUTSIDE OF RIGHT-OF-WAY AREAS SHALL BE TYPE "C" CONDUIT, 706.02. ALL TYPE "B" AND "C" CONDUIT SHALL HAVE JOINTS PER STATE OF OHIO SPECIFICATIONS 603.06. FOR PIPE CLASS REFER TO DELAWARE COUNTY "MAXIMUM" HEIGHT OF COVER FOR ROUND CONCRETE PIPE.

TYPE I BEDDING SHALL BE PROVIDED FOR ALL TYPE "B" AND TYPE "C" CONDUIT PER DELAWARE COUNTY SPECIFICATIONS.

ALL PIPE OUTSIDE THE RIGHT-OF-WAY SHALL HAVE A COVER OF 1.5 FEET MINIMUM. WHEREVER THIS IS NOT THE CASE, EMBANKMENT SHALL BE PLACED TO PROVIDE A MINIMUM COVER.

ROOF DRAINS, FOUNDATION DRAINS, AND OTHER CLEAN WATER CONNECTIONS TO THE SANITARY SEWER SYSTEM ARE PROHIBITED.

THE CONTRACTOR SHALL CONNECT EXISTING FIELD TILES (CLAY, PVC, ETC.) FOUND IN THE AREA, TO THE PROPOSED STORM SEWER SYSTEM. COST TO BE INCLUDED IN THE PRICE BID FOR THE VARIOUS SEWER ITEMS.

OPTIONAL FLEXIBLE STORM PIPE

707.33 PIPE MAY BE SUBSTITUTED FOR ANY CONCRETE PIPE PROVIDING THAT THE SUBSTITUTION EXTENDS FROM STRUCTURE TO STRUCTURE, AND THAT ONLY BELL AND SPIGOT OR PUSH JOINT PIPE MAY BE USED. 707.33 PIPE WILL BE CONSTRUCTED IN ACCORDANCE WITH DELAWARE COUNTY STANDARD DRAWING DCED-S149 AND MEET DELAWARE COUNTY BACKFILL REQUIREMENTS. FOR INSTALLATION OF PLASTIC PIPE, TRENCH EXCAVATION AND BEDDING REQUIREMENTS SHALL CONFORM TO DELAWARE COUNTY SPECIFICATIONS WHERE IT IS MORE RESTRICTIVE THAN SET FORTH ABOVE.

## ROADWAY

ROADWAY ITEMS ARE TO BE PER O.D.O.T. AND DELAWARE COUNTY STANDARDS.

THE CONTRACTOR SHALL INCLUDE IN THE UNIT PRICE BID FOR ITEM 203, EXCAVATION, THE REMOVAL AND DISPOSAL OF DESIGNATED TREES, BRUSH AND STUMPS WITHIN THE LIMITS OF THE WORK.

## SANITARY SEWERS

ANY FIELD TILE DISTURBED DURING CONSTRUCTION SHALL BE REPLACED AS DIRECTED BY DELAWARE COUNTY WITH PVC PIPE SPANNING THE TRENCH. THE TRENCH SHALL BE BACKFILLED PER DCED-R100.

FINISHED GRADE AT ALL SANITARY MANHOLES SHALL BE AT LEAST 6" BELOW TOP OF CASTING TO AVOID UNNECESSARY INFILTRATION INTO THE SANITARY SEWER SYSTEM.

THE IDENTITY AND LOCATION OF THE EXISTING UNDERGROUND UTILITY FACILITIES KNOWN TO BE LOCATED IN THE CONSTRUCTION AREA HAVE BEEN SHOWN ON THE PLANS AS ACCURATELY AS PROVIDED BY THE OWNER OF THE UNDERGROUND UTILITY. THE COUNTY OF DELAWARE AND/OR ENGINEER ASSUME NO RESPONSIBILITY AS TO THE ACCURACY OF THE UNDERGROUND FACILITIES SHOWN ON THE PLANS.

FINAL CONNECTION SHALL NOT BE MADE TO THE RECEIVING SANITARY SEWER SYSTEM UNTIL THE PHASE PROJECT HAS BEEN FULLY INSTALLED.

THE SURFACES WITH WHICH THE RUBBER GASKET COMES IN CONTACT SHALL BE CLEANED THOROUGHLY JUST PRIOR TO ASSEMBLY.

IN ADDITION TO DIRECT REQUIREMENTS OF THE CONTRACT SPECIFICATION, THE CONTRACTOR SHALL OBSERVE AND CONFORM TO THE SPECIFIC REQUIREMENTS OF ALL RIGHT-OF-WAY, INCLUDING EASEMENTS, COURT ENTRIES, RIGHT-OF-ENTRY, OR ACTION FILED IN COURT IN ACCORDANCE WITH THE CODE OF APPLICABLE GOVERNING AGENCY.

THE CONTRACTOR AND SUB-CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR COMPLYING WITH ALL FEDERAL, STATE AND LOCAL SAFETY REQUIREMENTS TOGETHER WITH EXERCISING PRECAUTIONS AT ALL TIMES FOR THE PROTECTION OF PERSONS INCLUDING EMPLOYEES AND PROPERTY. IT IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR AND SUB-CONTRACTOR TO INITIATE, MAINTAIN, AND SUPERVISE ALL SAFETY REQUIREMENTS, PRECAUTIONS, AND PROGRAMS IN CONNECTION WITH THE WORK.

ALL SANITARY SERVICES SHALL BE INSTALLED WITH A MINIMUM 1.00% SLOPE UNLESS OTHERWISE NOTED ON PLANS.

SERVICE RISERS SHALL BE INSTALLED WHERE DEPTHS FROM THE WYE TO THE EXISTING OR PROPOSED ELEVATION EXCEEDS 12'. THE TOPS OF RISERS SHALL BE NO MORE THAN 10' BELOW EXISTING OR PROPOSED SURFACE ELEVATION, WHICHEVER IS HIGHER, UNLESS OTHERWISE NOTED.

FINAL CONNECTION SHALL NOT BE MADE TO THE RECEIVING SANITARY SEWER SYSTEM UNTIL THE PROJECT HAS BEEN FULLY INSTALLED, TESTED, AND APPROVAL HAS BEEN GRANTED BY THE DELAWARE COUNTY SANITARY ENGINEER.

MANHOLES DEEPER THAN 12' SHALL HAVE A CONCRETE BASE USING CONCRETE ACCORDING TO DELAWARE COUNTY REGIONAL SEWER DISTRICT SPECIFICATIONS.

THE DELAWARE COUNTY SANITARY ENGINEER'S OFFICE SHALL RECEIVE A COPY OF THE SWPPP THAT HAS BEEN APPROVED BY THE GOVERNING STORMWATER AUTHORITY (I.E. DELAWARE COUNTY ENGINEER'S OFFICE, CITY OF POWELL, VILLAGE OF SUNBURY, ETC.) PRIOR TO THE PRECONSTRUCTION MEETING FOR THE SANITARY SEWER. ADDITIONAL EROSION AND SEDIMENTATION CONTROLS MAY BE REQUIRED AT THE DISCRETION OF THE DELAWARE COUNTY SANITARY ENGINEER BEFORE AND/OR DURING CONSTRUCTION ACTIVITIES.

THE CONTRACTOR SHALL NOT TRESPASS UPON OR IN ANY WAY DISTURB PROPERTY ADJACENT TO THE STREET RIGHT-OF-WAY WITHOUT FIRST OBTAINING WRITTEN PERMISSION FROM THE OWNER TO DO SO. A COPY OF SUCH WRITTEN PERMISSION SHALL BE FURNISHED TO THE ENGINEER AND SANITARY COUNTY ENGINEER.

IF THE CONTRACTOR FINDS IT NECESSARY TO OBTAIN ADDITIONAL WORKING AREA, IT SHALL BE HIS RESPONSIBILITY FOR ITS ACQUISITION. ALL REQUIREMENTS LISTED UNDER THE "USE OF PREMISES" SHALL APPLY IF ADDITIONAL AREA IS OBTAINED. COPIES OF EASEMENT SHALL BE FORWARD TO THE COUNTY SANITARY ENGINEER.

THE CONTRACTOR SHALL, AT HIS OWN EXPENSE, RESTORE SUCH PROPERTY TO THE FULL SATISFACTION OF THE OWNER, AND SHALL OBTAIN FROM THE OWNER A WRITTEN RELEASE STATING THAT RESTORATION HAS BEEN SATISFACTORILY MADE. A COPY OF THE WRITTEN RELEASE SHALL BE FURNISHED TO THE ENGINEER.

THE CONTRACTOR SHALL NOT WASTE ANY EXCESS EARTH, STONE, OR OTHER EXCAVATED MATERIAL ON ANY PROPERTY WITHOUT FIRST OBTAINING WRITTEN PERMISSION OF THE OWNER OF THE PROPERTY AND SECURING THE APPROVAL OF THE ENGINEER. ONE COPY OF THE OWNER'S WRITTEN PERMISSION AND ONE COPY OF A WRITTEN RELEASE FROM THE OWNER STATING AT THE WORK HAS BEEN COMPLETED SATISFACTORILY, SHALL BE FURNISHED TO THE ENGINEER.

ALL ITEMS WITHIN THE STREET RIGHT-OF-WAY SHALL BE REMOVED, OR REMOVED AND REPLACED, OR RESTORED AS REQUIRED BY THE CONTRACT DRAWINGS AND DETAILED PROVISIONS, AS DIRECTED BY THE ENGINEER.

SPECIAL CARE SHALL BE TAKEN TO AVOID DAMAGES TO TREES AND THEIR ROOT SYSTEM. MACHINE EXCAVATION SHALL NOT BE USED WHEN, IN THE OPINION OF THE ENGINEER, IT WOULD ENDANGER TREE ROOTS. IN GENERAL, WHERE THE LINE OF TRENCH FALLS WITHIN THE LIMITS OF THE LIMB SPREAD, THE LEAVING OF HEADERS ACROSS THE TRENCH TO PROTECT ROOTS WILL BE REQUIRED. THE OPERATION OF ALL EQUIPMENT, PARTICULARLY WHEN EMPLOYING BOOMS, THE STORAGE OF MATERIALS; AND THE DEPOSITION OF EXCAVATION SHALL BE CONDUCTED IN THE MANNER WHICH WILL NOT INJURE TREES, TRUNKS, BRANCHES OR THEIR ROOTS UNLESS SUCH TREES ARE DESIGNATED BY THE ENGINEER FOR REMOVAL.

ALL SANITARY MAINS (8" AND SMALLER) INCLUDING SERVICES (6") SHALL BE PVC SDR-35 PIPE MEETING THE REQUIREMENTS ASTM D-3034 AND A CELL CLASSIFICATION OF 12454C PER ASTM D-1784 UNLESS OTHERWISE NOTED. ALL SANITARY MAINS (8" AND LARGER) AND SERVICES (6") SHALL BE PVC PIPE MEETING THE REQUIREMENTS ASTM D-3034 CELL CLASSIFICATION OF 12454, UNLESS OTHERWISE NOTED. PVC PIPE SEWER JOINTS SHALL MEET ASTM D-3212 SPECIFICATIONS.

SANITARY SEWER FORCEMAINS SHALL BE DUCTILE IRON PIPE (DIP), CLASS 53, MEETING THE REQUIREMENTS OF AWWA C151 AND JOINT SPECIFICATIONS AWWA C111, OR C-900 MEETING THE REQUIREMENTS OF ASTM-D 2241 AND JOINT SPECIFICATIONS ASTM-D3139 AND SHALL BE A MINIMUM DR21. ALL FITTINGS (TEES, BENDS, ETC.) SHALL BE MECHANICAL JOINT DUCTILE IRON PIPE AND WITH A RUBBER GASKET FOR CONNECTION TO PVC PIPE. DUCTILE IRON FITTINGS SHALL CONFORM TO THE LATEST ANSI SPECIFICATIONS A21.10 (AWWA C110). FITTINGS FOR ALL PIPE SIZES 3"-24" SHALL BE SUITABLE FOR A WORKING PRESSURE OF 350 PSI. DUCTILE IRON PIPE AND FITTINGS SHALL BE LINED INSIDE WITH CERAMIC EPOXY (PROTECTO 401) OR APPROVED EQUAL BY THE SANITARY ENGINEER'S OFFICE.

ALL WATER MAINS SHALL BE SEPARATED A MINIMUM OF 10 FEET HORIZONTALLY AND 1.5 FEET VERTICALLY FROM ALL PARALLEL SANITARY SEWERS.

WHENEVER A WATER MAIN AND SEWER MUST CROSS, THE WATER MAIN SHALL BE AT SUCH AN ELEVATION THAT THE CROWN OF THE SEWER IS AT LEAST 18", MEASURED BETWEEN THE OUTSIDE PIPE WALLS, BELOW THE BOTTOM OF THE WATER MAIN.

ROOF DRAINS, FOUNDATION DRAINS, AND OTHER CLEAN WATER CONNECTIONS TO THE SANITARY SEWER ARE PROHIBITED.

ALL SEWER PIPE WYE FITTINGS SHALL HAVE A TEN FOOT (MINIMUM) SERVICE EXTENSION INSTALLED PRIOR TO THE SERVICE BEING CAPPED AND BACKFILL BEING PLACED OVER THE MAINLINE LATERAL SEWER.

SEWER TRENCHES SHALL BE DE-WATERED TO 2" BELOW BELL OF PIPE PRIOR TO INSTALLATION OF PIPE.

THE CONTRACTOR SHALL PROVIDE AND INSTALL WYE POLES AT ALL WYE LOCATIONS AS CONSTRUCTED. WYE POLES SHALL EXTEND ABOVE EXISTING OR PROPOSED GRADE, WHICHEVER IS HIGHER, A MINIMUM OF 2'-0".

SANITARY SEWERS SHALL BE TESTED BY THE EXFILTRATION METHOD, UNLESS PRIOR APPROVAL FOR AN INFILTRATION TEST OR AIR TEST IS OBTAINED FROM THE DELAWARE COUNTY SANITARY ENGINEER. THE ALLOWABLE LEAKAGE SHALL NOT EXCEED 100 GALLONS PER INCH DIAMETER PER MILE OF PIPE PER 24 HOURS FOR ANY METHOD OF TESTING. CONTRACTOR SHALL COOPERATE WITH THE DELAWARE COUNTY SANITARY ENGINEER AND PROVIDE ALL NECESSARY EQUIPMENT TO PERFORM THE TESTS. AN AIR TEST SHALL CONFORM TO THE TEST PROCEDURE DESCRIBED IN SECTION 5.1 OF THE STANDARD PLANS AND SPECIFICATIONS FOR CONSTRUCTION OF SANITARY FACILITIES IN DELAWARE COUNTY, OHIO FOR PLASTIC OR DUCTILE IRON PIPE BUT ALLOWABLE LEAKAGE SHALL NOT EXCEED 100 GALLONS PER INCH DIAMETER PER MILE OF PIPE PER 24 HOURS.

WHEN PVC PIPE IS USED, A DEFLECTION TEST SHALL BE PERFORMED. PIPE DEFLECTION SHALL NOT EXCEED 5% IF TESTED AFTER 30 DAYS, OR 7.5% IF TESTED AFTER 90 DAYS FROM THE TRENCH BEING BACKFILLED TO FINISH GRADE. THE METHOD OF TESTING SHALL BE SUBJECT TO THE APPROVAL OF THE DELAWARE COUNTY SANITARY ENGINEER. IF RIGID BALLS OR MANDRELS ARE USED TO TEST THE PIPE DEFLECTION, NO MECHANICAL PULLING DEVICES SHALL BE USED. ANY LINES WHICH FAIL THE TEST MUST BE REPAIRED AND RETESTED.

ALL SANITARY MANHOLES SHALL BE STAMPED "DELAWARE COUNTY REGIONAL SEWER DISTRICT". ALL WATERTIGHT MANHOLES SHALL HAVE A T-GASKET AND CONCEALED PICK HOLES. ALL SANITARY MANHOLES SHALL BE NEENAH R-1762 WITH "DELAWARE COUNTY REGIONAL SEWER DISTRICT" CAST IN THE MANHOLE PER NEENAH STANDARD DRAWING NF-1762 T13.

BACKFILLING (PER DELAWARE COUNTY ENGINEER STANDARD DRAWING DCED-R100).

FORCE MAINS SHALL BE TESTED IN ACCORDANCE WITH SECTION 5.2 OF THE STANDARD PLANS AND SPECIFICATIONS FOR CONSTRUCTION OF SANITARY FACILITIES IN DELAWARE COUNTY, OHIO.

AIR TESTING FOR CONCRETE SEWER MANHOLES SHALL CONFORM TO THE TEST PROCEDURES DESCRIBED IN ASTM C-1244.

## LIFT STATION GENERAL NOTES

THE CONTRACTOR SHALL COMPLY WITH THE MATERIAL AND CONSTRUCTION REQUIREMENTS OF THE DELAWARE COUNTY DOCUMENT ENTITLED STANDARD PLANS AND SPECIFICATIONS FOR CONSTRUCTION OF SANITARY FACILITIES. THE CONTRACTOR SHALL OBTAIN ANY AND ALL PERMITS REQUIRED BY THE BOARD OF HEALTH AND PAY ALL PERMIT FEES.

THE CONTRACTOR SHALL FURNISH ALL MATERIALS, LABOR, TOOLS, TRANSPORTATION, INCIDENTALS AND APPURTENANCES TO COMPLETE IN EVERY DETAIL, AND LEAVE IN WORKING ORDER, ALL ITEMS OF WORK CALLED FOR AND/OR SHOWN ON THE DRAWINGS. ANY MATERIALS OR WORK NOT SPECIFICALLY MENTIONED OR SHOWN ON THE DRAWINGS, BUT NECESSARY TO COMPLETE THE WORK, SHALL BE FURNISHED.

THE CONTRACTOR IS REQUIRED TO VISIT THE SITE AND FULLY INFORM HIMSELF CONCERNING ALL CONDITIONS AFFECTING THE SCOPE OF THE WORK. FAILURE TO VISIT THE SITE SHALL NOT RELIEVE THE CONTRACTOR FROM ANY RESPONSIBILITY IN THE PERFORMANCE OF THIS CONTRACT.

THE CONTRACTOR SHALL PROVIDE 6" OF SAND OR GRIT LEVELING BASE, DEPENDING ON SUBSURFACE SOIL CONDITIONS, UNDER EACH CONCRETE STRUCTURE FOLLOWED BY A MINIMUM OF 6" COMPACTED GRANULAR FILL.

THE CONTRACTOR SHALL GRADE THE AREA AROUND THE LIFT STATION TO DRAIN SURFACE WATER AWAY FROM THE STRUCTURES.


ALL DISTURBED AREAS SHALL BE SEEDED AND MULCHED AFTER FINAL GRADING ACCORDING TO THE LANDSCAPE PLAN.

ALL GENERAL NOTES SHOWN ON THIS SHEET, SHALL BE CONSIDERED A REQUIREMENT FOR THE CONSTRUCTION WORK OF THE LIFT STATION.

NOTE THAT ALL SHOP DRAWING SUBMITTALS ON THE SHOP DRAWING SUBMITTAL SCHEDULE MUST BE MADE TO THE DELAWARE COUNTY REGIONAL SEWER DISTRICT AND APPROVED.

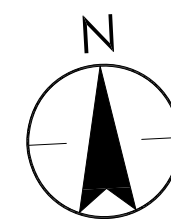
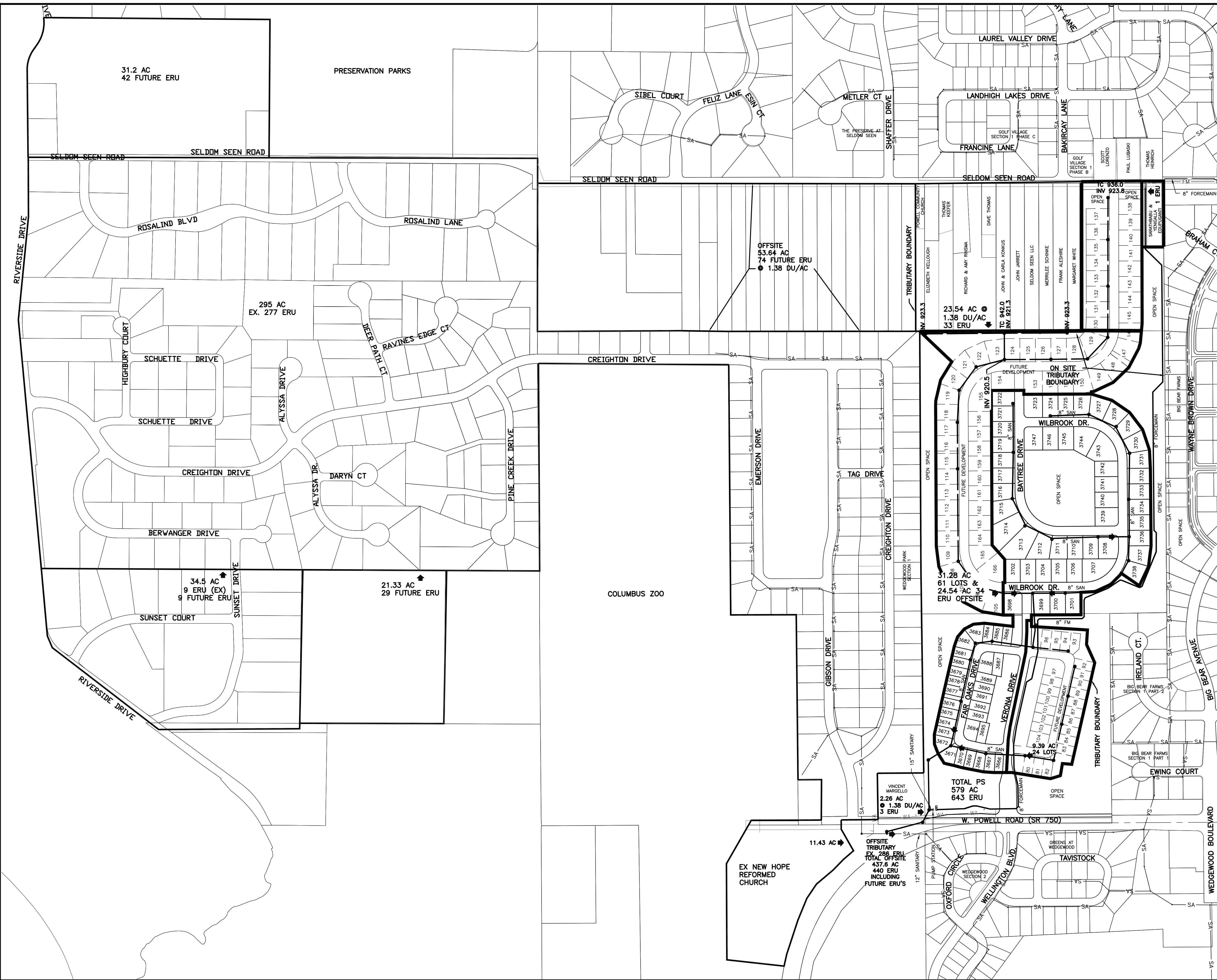
SHOP DRAWING SUBMITTAL SCHEDULE
• BIOXIDE TANK AND CHEMICAL FEED SYSTEM
• HYDRAULIC GRINDER SYSTEM
• PUMPS
• PLUG VALVE AND CHECK VALVES
• STEEL MAN DOOR
• POLYURETHANE CAULKING
• LOXON XP PAINT FOR CONCRETE BLOCK WALL
• HATCHES
• MULTI-TRODE LIQUID LEVEL CONTROL SYSTEM
• BIOXIDE WOOD GATE
• EXHAUST FAN
• ACTUATED DAMPER
• ROOF TRUSSES
• CELLULOSE INSULATION
• UNIT HEATER
• PUMP STATION CONTROL PANEL
• PUMP CONTROL PANEL
• TRANSFER SWITCH
• PANEL H
• CONCRETE MIX DESIGN
• ASPHALT PAVEMENT MIX DESIGN
• ELECTRICAL CONDUIT
• SWITCHES AND LIGHTING
• GATE AND FENCING
• STEEL DOOR AND HARDWARE

DELAWARE COUNTY  
VERONA SECTION 1  
FORCE MAIN AND PUMP STATION IMPROVEMENTS  
GENERAL NOTES

PREPARED BY:  
 **Stantec**  
1500 Lake Shore Drive, Suite 100  
Columbus, Ohio 43204  
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(614) 486-4387

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J:\173409010\Phase 1\Civil\Design\Foremain\Section 1\173409010\_SA\_MASTER\_PLAN\_EV.dwg TRIBUTARY AREA MAP & MASTER SANITARY SEWER PLAN Apr 08, 2016 10:54:35am dgrm1m

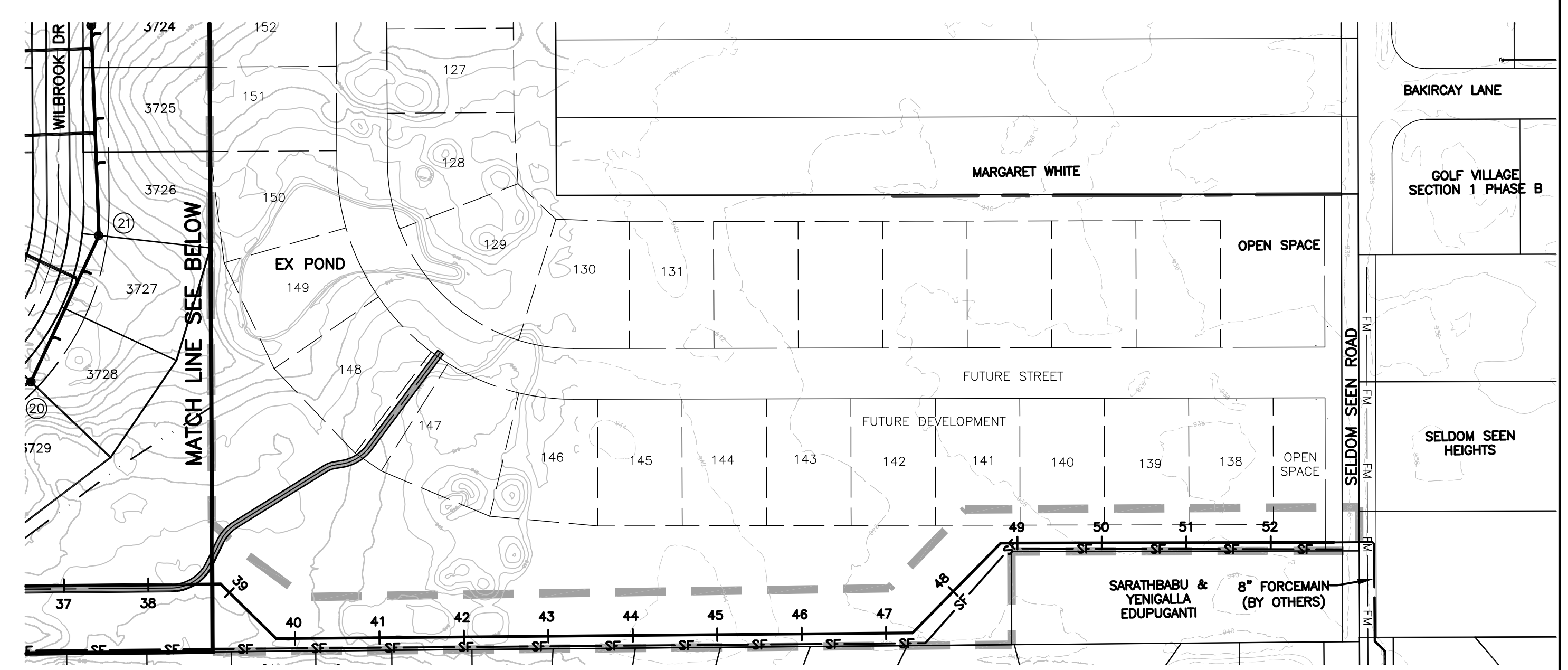
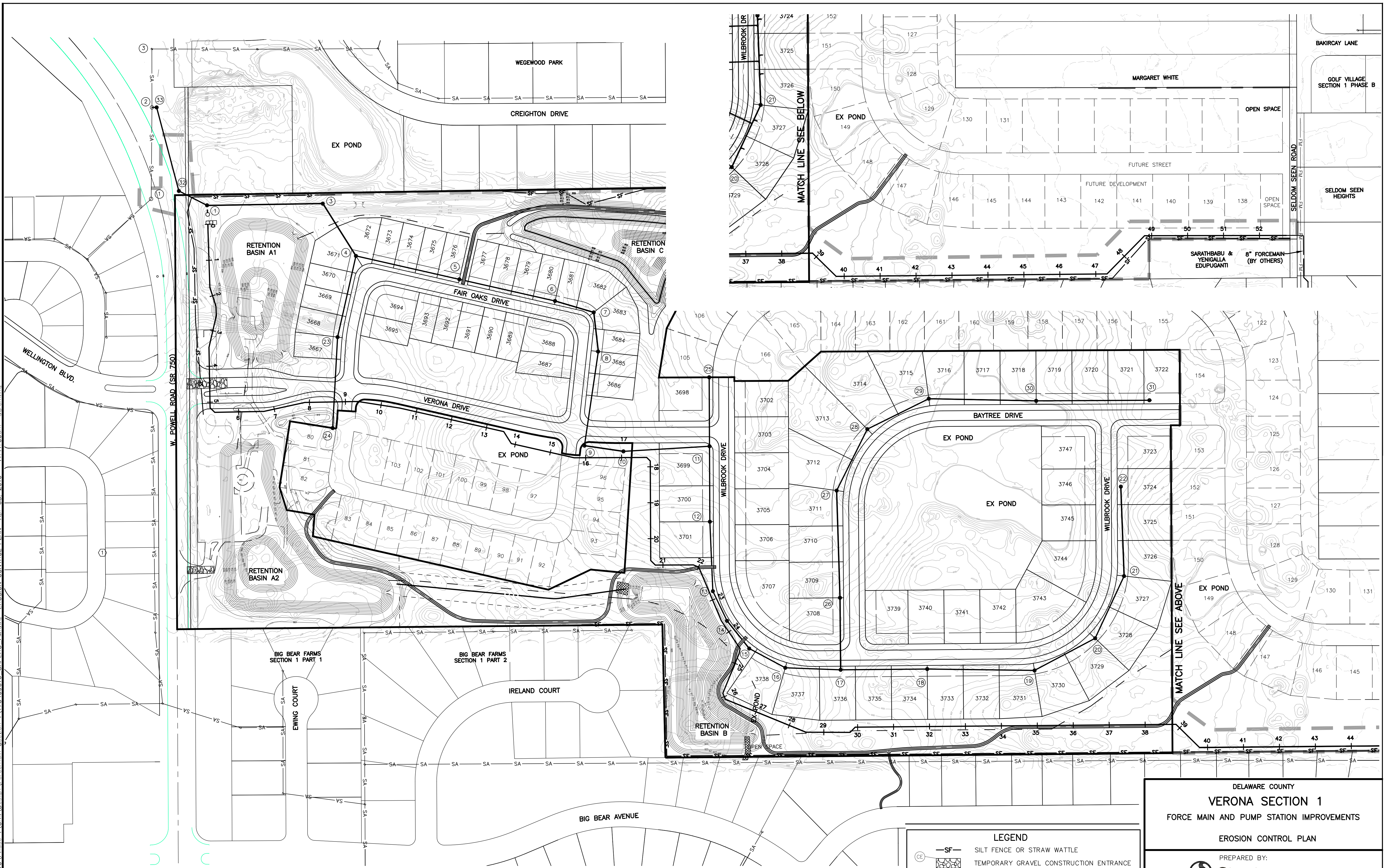


SCALE: 1"=300'

DELAWARE COUNTY  
**VERONA SECTION 1**  
FORCE MAIN AND PUMP STATION IMPROVEMENTS  
TRIBUTARY AREA MAP & MASTER SANITARY SEWER PLAN

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Columbus, Ohio 43204  
(614) 486-4383  
(614) 486-4387

U:\173409010\Phase 1\Civil\Design\ForceMain\Section 1\173409010\_SAPFPO\_FM.dwg EROSION CONTROL PLAN Apr 08, 2016 - 11:11:06am doremiling



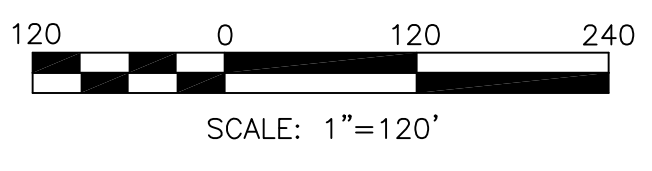
DELAWARE COUNTY  
**VERONA SECTION 1**  
 FORCE MAIN AND PUMP STATION IMPROVEMENTS  
 EROSION CONTROL PLAN

**LEGEND**

—SF—	SILT FENCE OR STRAW WATTLE
(CE)	TEMPORARY GRAVEL CONSTRUCTION ENTRANCE
—	LIMITS OF DISTURBANCE

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**Stantec**  
 1500 Lake Shore Drive, Suite 100  
 Columbus, Ohio 43204  
 (614) 486-4383  
 (614) 486-4387

① TEMPORARY CONSTRUCTION ENTRANCE WILL BE REMOVED AS A PART OF THE ODOT SR 750 PROJECT. CONSTRUCTION TRAFFIC SHALL USE THE VERONA DRIVE AT SUCH TIME.



**SITE DATA**

OWNER: VERONA, LLC  
148 WEST SCHROCK ROAD  
WESTERVILLE, OHIO 43082

PLAN DESIGNER: STANTEC CONSULTING SERVICES INC.  
1500 LAKE SHORE DRIVE, SUITE 100  
COLUMBUS, OHIO 43204

DEVELOPMENT TYPE: PUBLIC

SITE ACREAGE: 113.4 ACRES

DISTURBED ACREAGE: 32.0 ACRES

AVERAGE SLOPE: EXISTING - 2.0% - 33.0%  
PROPOSED - 2.0% - 33.0%

SITE VEGETATION: MIXED TREES AND MAINTAINED GRASS  
(GOLF COURSE)

ADJACENT AREAS: POWELL ROAD TO THE SOUTH, WEDGEWOOD PARK  
TO THE WEST, SELDOM SEEN ROAD TO THE  
NORTH, AND BIG BEAR FARMS TO THE EAST

STORM WATER MANAGEMENT: STORM WATER MANAGEMENT WILL BE PROVIDED  
BY TEMPORARY SUMP AND PROPOSED STORM  
WATER RETENTION BASINS WITH TEMPORARY  
SEDIMENT CONTROL STRUCTURES INSTALLED.

**GENERAL LAND CONSERVATION NOTES**

NO DISTURBED AREA WILL BE DENUDED FOR MORE THAN 30 DAYS IF IT IS TO RE-DORMANT FOR MORE THAN 21 DAYS UNLESS AUTHORIZED BY THE GOVERNING JURISDICTION'S INSPECTOR. PERMANENT OR TEMPORARY SOIL STABILIZATION SHALL BE APPLIED TO DISTURBED AREAS WITHIN 7 DAYS AFTER FINAL GRADE IS REACHED ON ANY PORTION OF THE SITE.

SEDIMENT CONTROLS SHALL BE INSTALLED AND IMPLEMENTED FOR RECEIVING DRAINAGE AREA WITHIN 7 DAYS OF EARTH DISTURBANCES. PERIMETER CONTROLS SHALL BE INSTALLED PRIOR TO ANY EARTH DISTURBING ACTIVITIES.

ANY AND/OR ALL DISTURBED AREAS SHALL BE SEEDED AND STRAW MULCHED IF TO REMAIN UNDISTURBED FOR 21 DAYS OR GREATER.

ANY AREA WITHIN 50 FEET OF A STREAM TO REMAIN UNDISTURBED GREATER THAN 21 DAYS SHALL BE SEEDED AND MULCHED WITH 2 DAYS ANY AREAS AT FINAL GRADE SHALL BE PERMANENTLY STABILIZED WITHIN 2 DAYS.

ADDITIONAL EROSION AND SEDIMENT CONTROLS SHALL BE INSTALLED AS DIRECTED BY DELAWARE COUNTY AND/OR OHIO EPA.

ALL STRUCTURAL EROSION AND SEDIMENT CONTROL PRACTICES SHALL BE PLACED PRIOR TO OR AS THE FIRST STEP IN GRADING FOR ALL SITES.

A INDIVIDUAL LOT DESC PERMIT IS REQUIRED FOR THIS PROJECT AND SHALL BE OBTAINED PRIOR TO BUILDING CONSTRUCTION.

ALL STORM SEWER, SANITARY SEWER, WATER MAIN AND SERVICE TRENCHES SHALL BE MULCHED AND SEEDED WITHIN 7 DAYS AFTER BACKFILL IF INSTALLATION IS THROUGH STABILIZED AREAS. NO MORE THAN 500 FEET OF TRENCH WILL BE OPEN AT ANY ONE TIME.

ELECTRIC POWER, TELEPHONE, CATV AND GAS SUPPLY TRENCHES SHALL BE COMPACTED, SEEDED AND MULCHED WITHIN 7 DAYS AFTER BACKFILL, IF INSTALLATION IS THROUGH STABILIZED AREAS.

ALL TEMPORARY DIVERSIONS, SEDIMENT BASIN EMBANKMENTS AND EARTH STOCKPILES SHALL BE SEEDED AND MULCHED FOR TEMPORARY VEGETATIVE COVER WITHIN 7 DAYS AFTER GRADING. STRAW, HAY MULCH OR EQUIVALENT IS REQUIRED.

ALL STORM SEWER INLETS SHALL BE PROTECTED BY SEDIMENT TRAPS (INLET PROTECTION) WHICH WILL BE MAINTAINED AND MODIFIED AS REQUIRED AS CONSTRUCTION PROGRESSES.

ANY DISTURBED AREA NOT STABILIZED WITH SEEDING, SODDING, PAVING OR BUILT UPON BY NOVEMBER 1ST, OR AREAS DISTURBED AFTER THAT DATE, SHALL BE MULCHED IMMEDIATELY WITH HAY OR STRAW AT THE RATE OF 2 TONS PER ACRE AND OVER-SEEDED BY APRIL 15TH.

AT THE COMPLETION OF CONSTRUCTION, ALL TEMPORARY SEDIMENT CONTROLS SHALL BE REMOVED AND ALL DENUDED AREAS SHALL BE STABILIZED.

**MAINTENANCE NOTES**

ALL EROSION AND SEDIMENT CONTROL MEASURES WILL BE CHECKED BY THE OWNER'S REPRESENTATIVE WEEKLY AND WITHIN 24 HOURS AFTER EACH RAINFALL TO ASSURE THAT THE MEASURES ARE FUNCTIONING ADEQUATELY. SEDIMENT THAT IS COLLECTED WILL BE DISTRIBUTED ON THE PROTECTED PORTION OF THE SITE AND STABILIZED. ALL STOCKPILES OF EARTH AND TOPSOILS WILL BE PROTECTED WITH TEMPORARY SEEDING OR OTHER MEANS TO PREVENT EROSION.

**CONSTRUCTION ROAD STABILIZATION / CONSTRUCTION ENTRANCE (CE)**

BOTH TEMPORARY AND PERMANENT ROADS AND PARKING AREAS MAY REQUIRE PERIODIC TOP DRESSING WITH NEW GRAVEL. SEEDED AREAS ADJACENT TO THE ROADS AND PARKING AREAS SHOULD BE CHECKED PERIODICALLY TO ENSURE THAT A VIGOROUS STAND OF VEGETATION IS MAINTAINED. ROADSIDE DITCHES AND OTHER DRAINAGE STRUCTURES SHOULD BE CHECKED REGULARLY TO ENSURE THAT THEY DO NOT BECOME CLOGGED WITH SILT OR OTHER DEBRIS.

**SILT FENCE (SF)**

SILT FENCES AND FILTER BARRIERS SHALL BE INSPECTED IMMEDIATELY AFTER EACH RAINFALL AND AT LEAST DAILY DURING PROLONGED RAINFALL. ANY REQUIRED REPAIRS SHALL BE MADE IMMEDIATELY. SHOULD THE FABRIC ON A SILT FENCE OR FILTER BARRIER DECOMPOSE OR BECOME INEFFECTIVE PRIOR TO THE END OF THE EXPECTED USABLE LIFE AND THE BARRIER IS STILL NECESSARY, THE FABRIC SHALL BE REPLACED PROMPTLY. SEDIMENT DEPOSITS SHOULD BE REMOVED AFTER EACH STORM EVENT. THEY MUST BE REMOVED WHEN DEPOSITS REACH APPROXIMATELY ONE-HALF THE HEIGHT OF THE BARRIER. ANY SEDIMENT DEPOSITS REMAINING IN-PLACE AFTER THE SILT FENCE OR FILTER BARRIER IS NO LONGER REQUIRED SHALL BE DRESSED TO CONFORM WITH THE EXISTING GRADE, PREPARED AND SEEDED.

**SEDIMENT BASIN(S)**

SEDIMENT SHALL BE REMOVED AND THE BASIN RESTORED TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO 40% (APPROXIMATELY 1/2 THE DESIGN DEPTH OF THE BASIN.) REMOVED SEDIMENT SHALL BE DEPOSITED IN A SUITABLE AREA AND IN SUCH A MANNER THAT IT WILL NOT ERODE. SEDIMENT BASINS AND RISER STRUCTURES SHALL BE REMOVED UPON SITE STABILIZATION.

**SEEDING & MULCHING**

**GENERAL:**

THE SEEDING, EITHER PERMANENT OR TEMPORARY, SHALL BE MADE WITHIN 2 DAYS AFTER FINAL GRADING IS COMPLETED OR FOLLOWING SEEDBED PREPARATION WITH A DISK OR OTHER SUITABLE EQUIPMENT.

THE CONTRACTOR SHALL FURNISH ALL LABOR, EQUIPMENT, AND MATERIALS REQUIRED TO ACCOMPLISH BOTH TEMPORARY AND PERMANENT SEEDING. ALL DITCHES, DIVERSIONS, SEDIMENT BASINS/TRAPS, RIGHT-OF-WAY AREAS, AND AREAS.

DISTURBED DURING CONSTRUCTION SHALL BE SEEDED AND MULCHED, OR SODDED. THE LIMITS OF SEEDING AND MULCHING ARE AS SHOWN ON THE PLAN. SEEDING HAS BEEN ASSUMED TO A DISTANCE OF 5 FEET OUTSIDE THE WORK LIMITS OR RIGHT-OF-WAY, WHICHEVER IS GREATER. ALL AREAS NOT DESIGNATED TO BE SODDED SHALL REMAIN UNDER EXISTING GROUND COVER. THOSE AREAS DISTURBED OUTSIDE THE SEEDING LIMITS SHALL BE SEEDED AND MULCHED AT THE CONTRACTOR'S EXPENSE.

PAYMENT FOR TEMPORARY SEEDING SHALL BE INCLUDED UNDER "EROSION CONTROL".

OTHER EROSION AND SEDIMENT CONTROL MEASURES SHALL REMAIN IN PLACE UNTIL THEY ARE ORDERED REMOVED BY THE ENGINEER OR AS DIRECTED BY THE "SEQUENCE OF CONSTRUCTION."

**MATERIALS:**

**PERMANENT SEEDING:**

KIND OF SEED	SEEDING DATES	PER 1000 SQ. FT.	PER ACRE
TALL FESCUE	MARCH 1 - SEPT. 15	2 lbs.	80 lbs.
ANNUAL RYEGRASS	MARCH 1 - SEPT. 15	1/2 lbs.	20 lbs.
SMALL GRAIN STRAW MULCH	MARCH 1 - SEPT. 15	100 lbs. OR 2 TO 3 BALES	2 TONS OR 50 BALES
FERTILIZER	MARCH 1 - SEPT. 15	25 lbs. OF 12-12-12 OR EQUIVALENT	1000 lbs. OF 12-12-12 OR EQUIVALENT

**TEMPORARY SEEDING:**

RYE OR WHEAT	SEPT. 15 - OCT. 30	3 lbs.	2 BUSHELS
SOIL PROTECTION:			
SMALL GRAIN STRAW MULCH	OCT. 30 - MARCH 1	2 TO 3 BALES	2 TONS

LIME: AGRICULTURAL GROUND LIMESTONE.

FERTILIZER: 12-12-12 ANALYSIS.

MULCH: SMALL GRAIN STRAW, PREFERABLY WHEAT OR RYE.

ASPHALT EMULSION: RAPID SETTING, RS1 OR RS2.

MULCH NETTING: JUTE, COTTON OR PLASTIC NETTINGS.

**INSTALLATION:**

- GRADE AS NEEDED AND FEASIBLE TO PERMIT THE USE OF CONVENTIONAL EQUIPMENT FOR SEEDBED PREPARATION, SEEDING, MULCH APPLICATION AND ANCHORING, AND MAINTENANCE. AFTER THE GRADING OPERATION SPREAD TOPSOIL WHERE NEEDED.
- WHERE COMPACTED SOILS OCCUR, THEY SHOULD BE BROKEN UP SUFFICIENTLY TO CREATE A FAVORABLE ROOTING DEPTH OF 6-8 INCHES.
- FOR PERMANENT SEEDING, PLACE TOPSOIL TO A DEPTH OF 4 INCHES MINIMUM.
- APPLY LIME AT A RATE AS RECOMMENDED BY SOIL TESTS, OR AT A RATE OF 100 POUNDS PER 1000 SQUARE FEET OR TWO TONS PER ACRE OF AGRICULTURAL GROUND LIMESTONE. FOR BEST RESULTS MAKE A SOIL TEST.
- APPLY FERTILIZER AT A RATE AS RECOMMENDED BY SOIL TESTS, OR AT A RATE OF 25 POUNDS PER 1000 SQUARE FEET OR 1000 POUNDS PER ACRE OF 10-10-10. FOR BEST RESULTS MAKE A SOIL TEST.
- WORK THE LIME AND FERTILIZER INTO THE SOIL WITH A DISK HARROW, SPRINGTOOTH HARROW, OR OTHER SUITABLE FIELD EQUIPMENT TO A DEPTH OF THREE INCHES. ON SLOPING LAND THE FINAL OPERATION SHALL BE ON THE CONTOUR.
- APPLY THE SEED UNIFORMLY WITH A CYCLONE SEEDER, DRILL, CULTIPACKER SEEDER OR HYDROSEEDER (SLURRY MAY INCLUDE SEED AND FERTILIZER) PREFERABLY ON A FIRM, MOIST SEEDBED. SEED WHEAT OR RYE NO DEEPER THAN ONE INCH. SEED RYEGRASS NO DEEPER THAN ONE-FOURTH INCH.

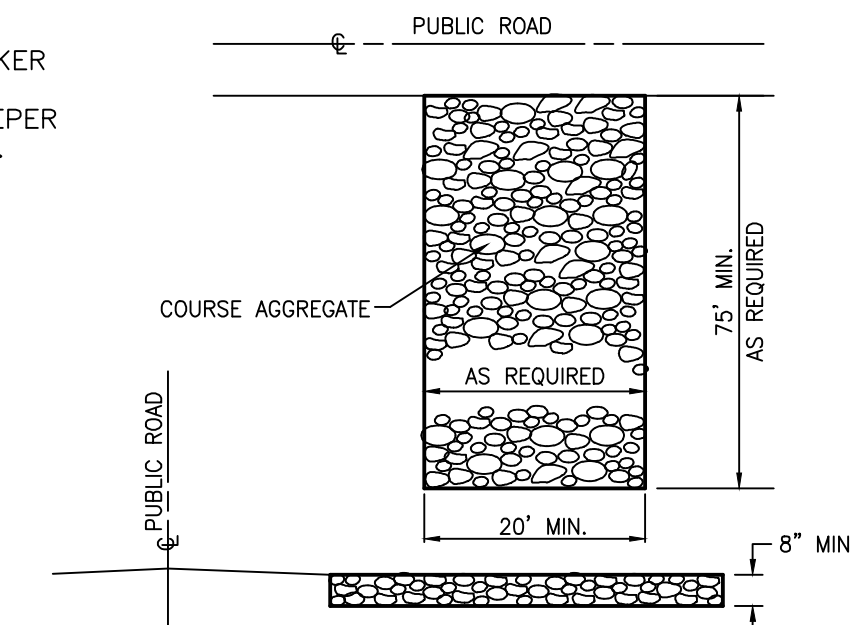
- WHEN FEASIBLE, EXCEPT WHERE A CULTIPACKER TYPE SEEDER IS USED, THE SEEDBED SHOULD BE FIRMED FOLLOWING SEEDING OPERATIONS WITH A CULTIPACKER, ROLLER, OR LIGHT DRAG. ON SLOPING LAND SEEDING OPERATIONS SHOULD BE ON THE CONTOUR WHEREVER POSSIBLE.
- APPLY MULCH AT A RATE OF TWO TONS PER ACRE OR 100 POUNDS (TWO TO THREE BALES) PER 1000 SQUARE FEET.
- SPREAD THE MULCH UNIFORMLY BY HAND OR MECHANICALLY SO THE SOIL SURFACE IS COVERED.
- ANCHOR MULCH BY ONE ONE OF THE FOLLOWING METHODS:
  - MECHANICAL - USE A DISK, CRIMPER, OR SIMILAR TYPE TOOL SET STRAIGHT TO PUNCH OR ANCHOR THE MULCH MATERIAL INTO THE SOIL.
  - ASPHALT EMULSION - APPLY AT THE RATE OF 160 GALLONS PER ACRE INTO THE MULCH AS IT IS BEING APPLIED.
  - MULCH NETTINGS - USE ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS. USE IN AREAS OF WATER CONCENTRATION TO HOLD MULCH IN PLACE.

**MAINTENANCE:**

- IRRIGATION - IF SOIL MOISTURE IS DEFICIENT, SUPPLY NEW SEEDING WITH ADEQUATE WATER FOR PLANT GROWTH UNTIL THEY ARE FIRMLY ESTABLISHED. THIS IS ESPECIALLY TRUE WHEN SEEDINGS ARE MADE LATE IN THE PLANTING SEASON, IN ABNORMALLY DRY AND HOT SEASONS, OR ON ADVERSE SITES.
- REPAIRS - INSPECT ALL SEEDED AREAS FOR FAILURES AND MAKE NECESSARY REPAIRS, REPLACEMENTS, RESEEDINGS, AND REMULCHING WITHIN THE PLANTING SEASON, IF POSSIBLE.
  - IF STAND IS INADEQUATE, OVERSEED AND FERTILIZE, USING HALF OF THE RATES ORIGINALLY APPLIED, AND MULCH.
  - IF STAND IS OVER 60 PERCENT DAMAGED, REESTABLISH FOLLOWING ORIGINAL LIME, FERTILIZER, SEEDBED PREPARATION, SEEDING RECOMMENDATIONS, AND MULCHING RECOMMENDATIONS.

**MAINTENANCE FERTILIZATION AND MOWING FOR PERMANENT SEEDING**

MIXTURE	FORMULA	LBS. /AC.	FERTILIZER RATE LBS./1000 SQ. FT.	TIME	MOWING
CREeping RED FESCUE RYEGRASS KENTUCKY BLUEGRASS	12-12-12 1000		24	FALL YEARLY OR AS NEEDED	NOT CLOSER THAN 3"
TALL FESCUE	12-12-12 1000		24	FALL YEARLY OR AS NEEDED	NOT CLOSER THAN 4"
DWARF (TURF-TYPE) FESCUE	12-12-12 1000		24	FALL YEARLY OR AS NEEDED	NOT CLOSER THAN 2"
FLATPEA AND CROWNVEtch WITH FESCUE	12-12-10 400		10	SPRING YEARLY FOLLOWING ESTABLISHMENT AND EVERY 4-7 YEARS THEREAFTER	DO NOT MOW



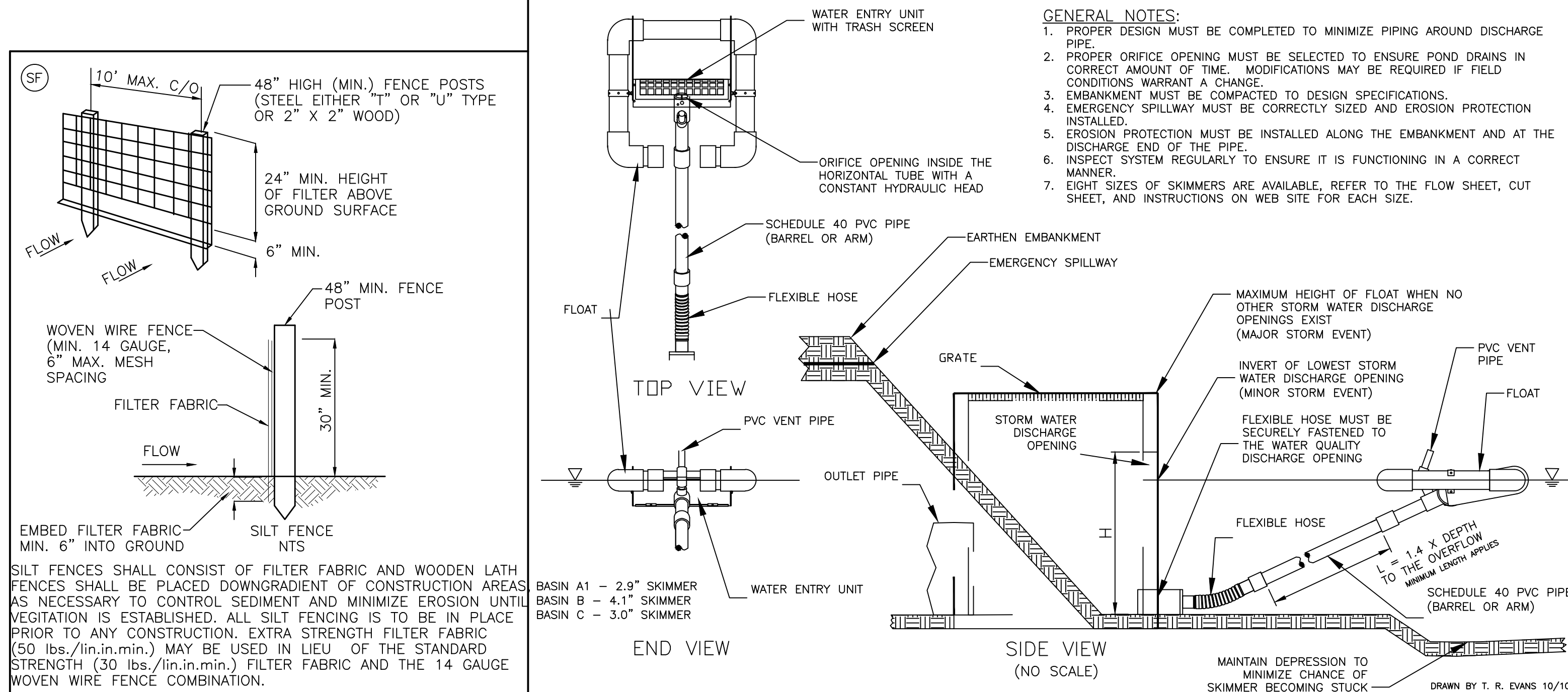
**GRAVEL CONSTRUCTION ENTRANCE**  
NOT TO SCALE

**SEQUENCE OF CONSTRUCTION**

- CLEAR AND GRUB FOR THE NECESSARY INSTALLATION OF EROSION CONTROL DEVICES.
- PRIOR TO THE COMMENCEMENT OF CONSTRUCTION INSTALL CONSTRUCTION ROAD STABILIZATION.
- INSTALL EROSION CONTROL DEVICES.
- CONSTRUCT SEDIMENT BASINS AND SEDIMENT CONTROL OUTLETS.
- PERFORM ROUGH EARTHWORK.
- BEGIN CONSTRUCTION OF SANITARY SEWER.
- CONSTRUCT STORM, PLACING INLET PROTECTION AS CATCH BASINS ARE CONSTRUCTED.
- GRADE SITE, REPAIR INLET PROTECTION AS NEEDED.
- BEGIN BUILDING CONSTRUCTION.
- CONSTRUCT UTILITY CONDUITS.
- CONSTRUCT ACCESS ROAD.
- FINAL GRADE AND PAVE ROADS.
- REMOVE EROSION CONTROL DEVICES UPON SITE STABILIZATION PER PERMIT REQUIREMENTS.

	BASIN A1	BASIN A2	BASIN C
OUTLET DIAMETER	24"	36"	24"
DEWATERING ORIFICE DIAMETER	2.9"	4.1"	3.0"
DEWATERING EL REQUIRED	901.55	904.75	913.03
DEWATERING EL PROVIDED	902.30	907.30	913.50

SEE APPROVED SITE SWP3 FOR SEDIMENT CALCULATIONS AND RISER DETAILS



**FAIRCLOTH SKIMMER® DISCHARGE SYSTEM WITH OUTLET STRUCTURE**

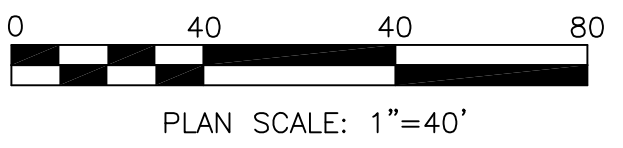
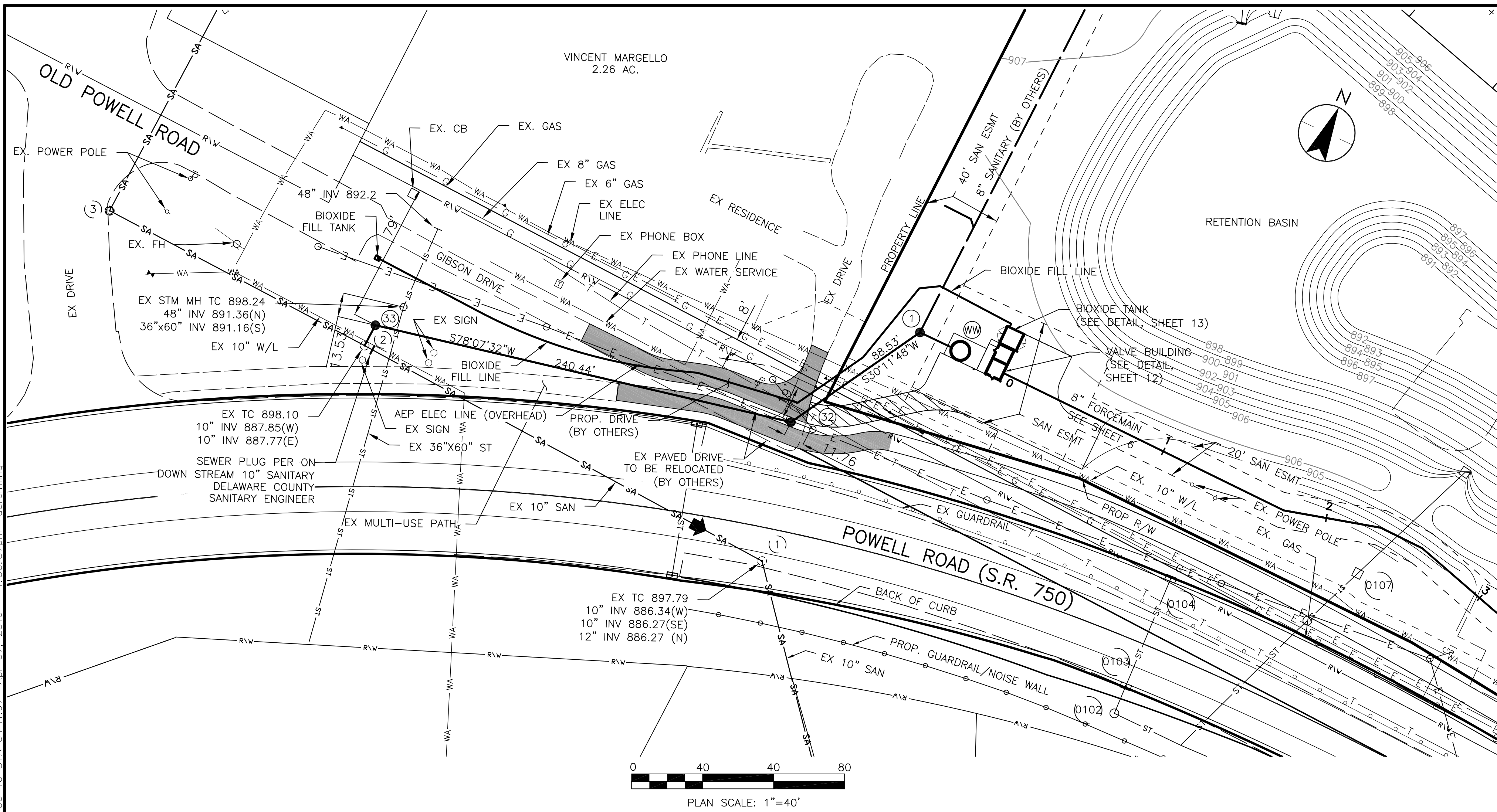
J. W. FAIRCLOTH & SON INC.  
WWW.FAIRCLOTHSKIMMER.COM  
TELEPHONE: (919) 732-1244  
FAX: (919) 732-1266  
EMAIL: WARREN@FAIRCLOTHSKIMMER.COM

DELAWARE COUNTY  
**VERONA SECTION 1**  
FORCE MAIN AND PUMP STATION IMPROVEMENTS

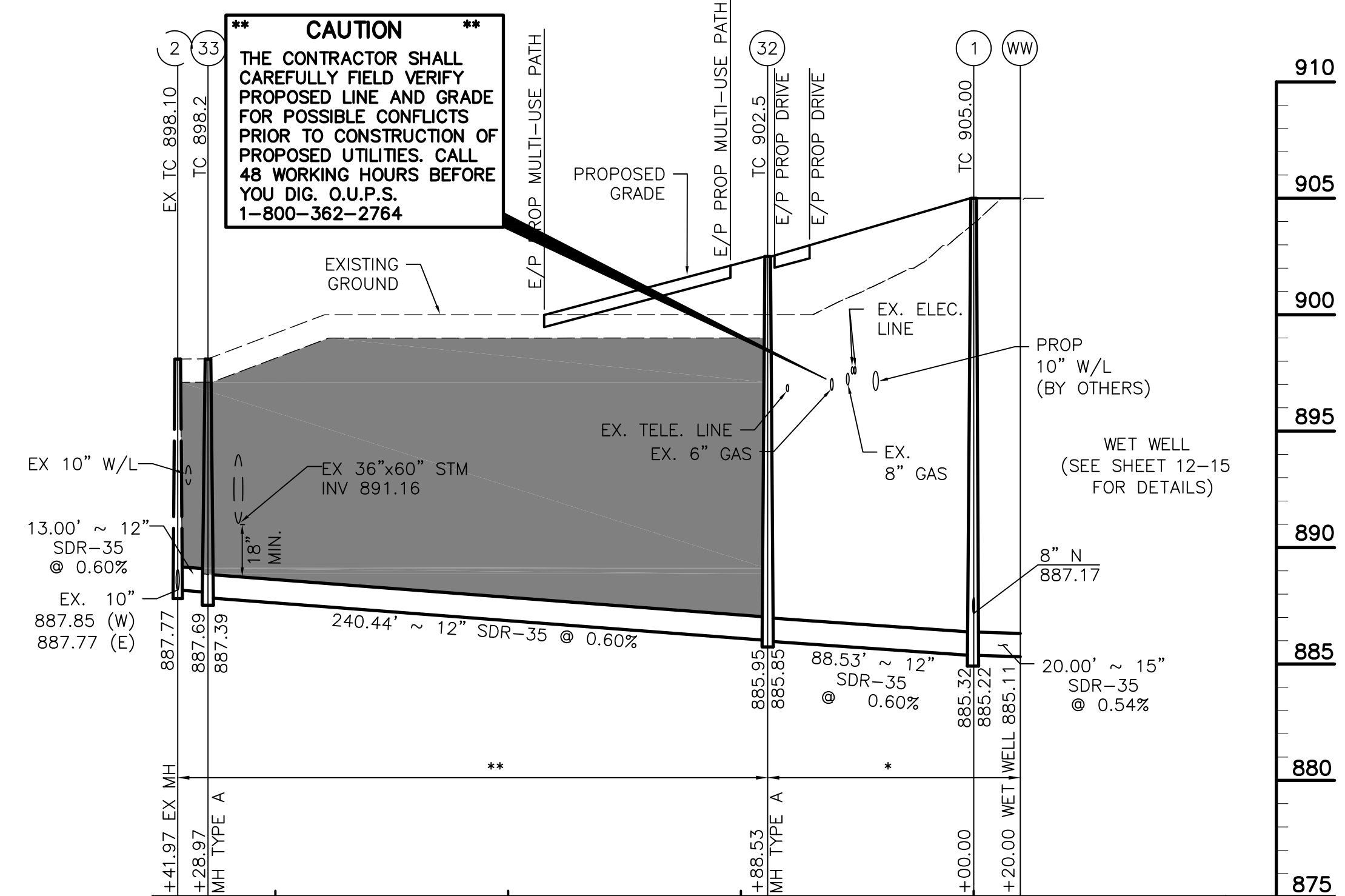
EROSION CONTROL NOTES

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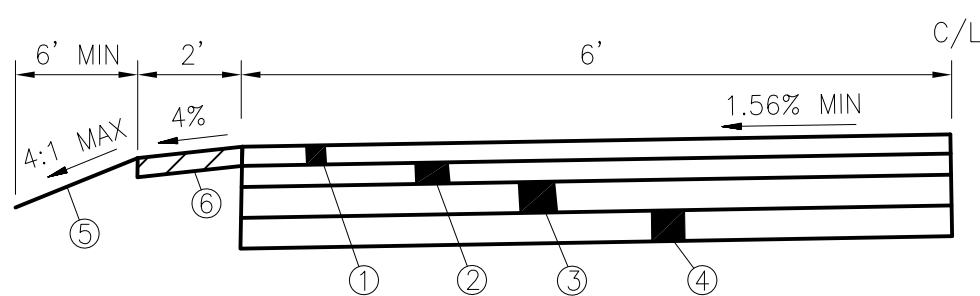
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**\*\* CAUTION \*\***  
 THE CONTRACTOR SHALL CAREFULLY FIELD VERIFY PROPOSED LINE AND GRADE FOR POSSIBLE CONFLICTS PRIOR TO CONSTRUCTION OF PROPOSED UTILITIES. CALL 48 WORKING HOURS BEFORE YOU DIG. O.U.P.S. 1-800-362-2764



STATION	3+00	2+00	1+00	0+00
EX. GRD.	899.2	899.8	900.0	903.9
INVERT	887.22	886.62	886.02	885.46
CUT	12.0	13.2	14.0	18.4



- ① 1 1/2" ASPHALT CONCRETE, SURFACE COURSE, O.D.O.T. ITEM 404
- ② 1 1/2" ASPHALT CONCRETE INTERMEDIATE COURSE, O.D.O.T. ITEM 402
- ③ 6" AGGREGATE BASE, O.D.O.T. ITEM 304
- ④ 6" #1 & #2 STONE
- ⑤ GRASS SHOULDER
- ⑥ ITEM 304 AGGREGATE BERM 8" DEEP AS SHOWN ON PLAN

**ASPHALT DRIVE PAVEMENT DETAIL**  
 NOT TO SCALE

**LEGEND**

BY VERONA, LLC

BY ODOT

**EXISTING EASEMENT RECORDING DATA**

12' DEL-CO WATER	
COLUMBIA GAS	

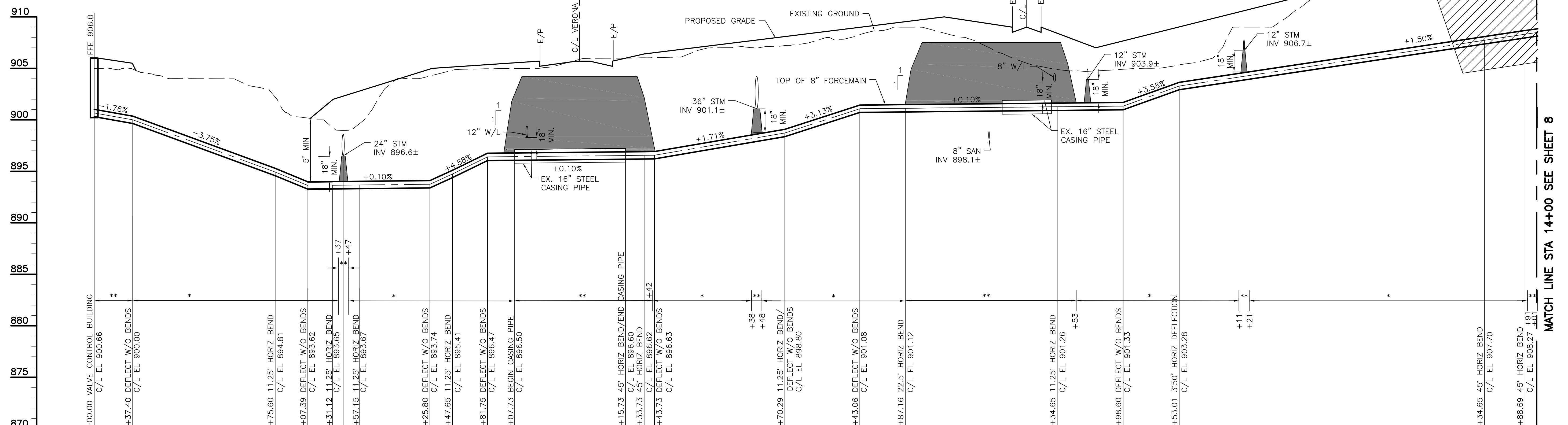
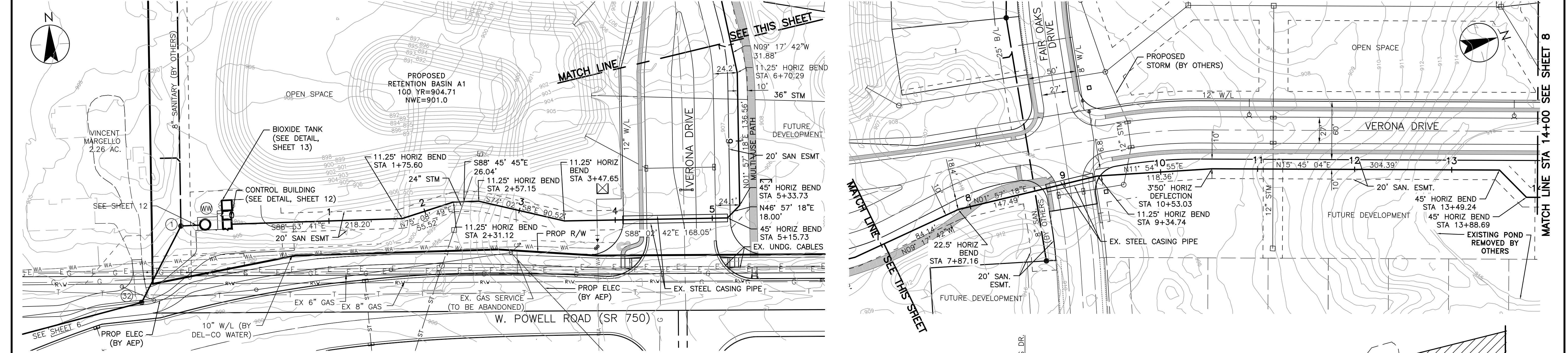
- NOTES:
- \* COMPACTED NATIVE BACKFILL PER DCED-R100 SEE DETAIL SHEET 1 & GENERAL NOTES SHEET 2.
  - \*\* COMPACTED GRANULAR BACKFILL PER DCED-R100 SEE DETAIL SHEET 1 & GENERAL NOTES SHEET 2.

RISERS INSTALLED @45° FROM VERTICAL UNLESS OTHERWISE NOTED. IF LESS THAN 45° THEN CONCRETE ENCASUREMENT SHALL BE PROVIDED PER STD DWG NO. 03.

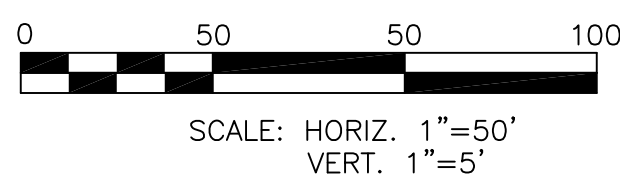
DELAWARE COUNTY  
**VERONA SECTION 1**  
 FORCE MAIN AND PUMP STATION IMPROVEMENTS  
 STA 34+00 TO STA 39+18.00  
 & STA 0+00 TO STA 3+41.97

PREPARED BY:  
  
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STATION	0+00	1+00	2+00	3+00	4+00	5+00	6+00	7+00	8+00	9+00	10+00	11+00	12+00	13+00	14+00
EX. GRD.	905.0	904.0	900.3	904.0	905.0	906.0	907.0	907.7	909.0	905.7	904.9	908.1	912.8	915.0	915.0
INVERT	900.31	897.35	893.57	893.36	896.06	896.16	897.17	899.33	900.78	900.88	901.03	903.63	905.11	906.60	908.09
CUT	4.7	6.6	6.7	10.7	8.9	9.8	9.8	8.3	8.2	4.8	3.9	4.5	7.7	8.4	6.9



- LEGEND:
- LIMITS OF COMPACTED GRANULAR BACKFILL (PER ITEM 912)
  - COMPACTED FILL OF EXISTING POND COMPLETED BY OTHERS

- NOTES:
- \* COMPACTED NATIVE BACKFILL PER DCED-R100 SEE DETAIL SHEET 2 & GENERAL NOTES SHEET 2.
  - \*\* COMPACTED GRANULAR BACKFILL PER DCED-R100 SEE DETAIL SHEET 2 & GENERAL NOTES SHEET 2.

DELAWARE COUNTY  
**VERONA SECTION 1**  
 FORCE MAIN AND PUMP STATION IMPROVEMENTS

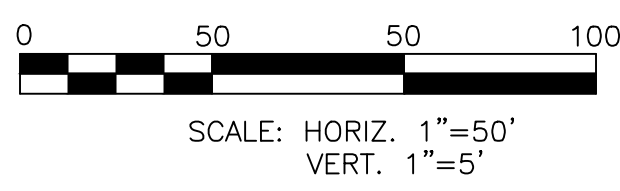
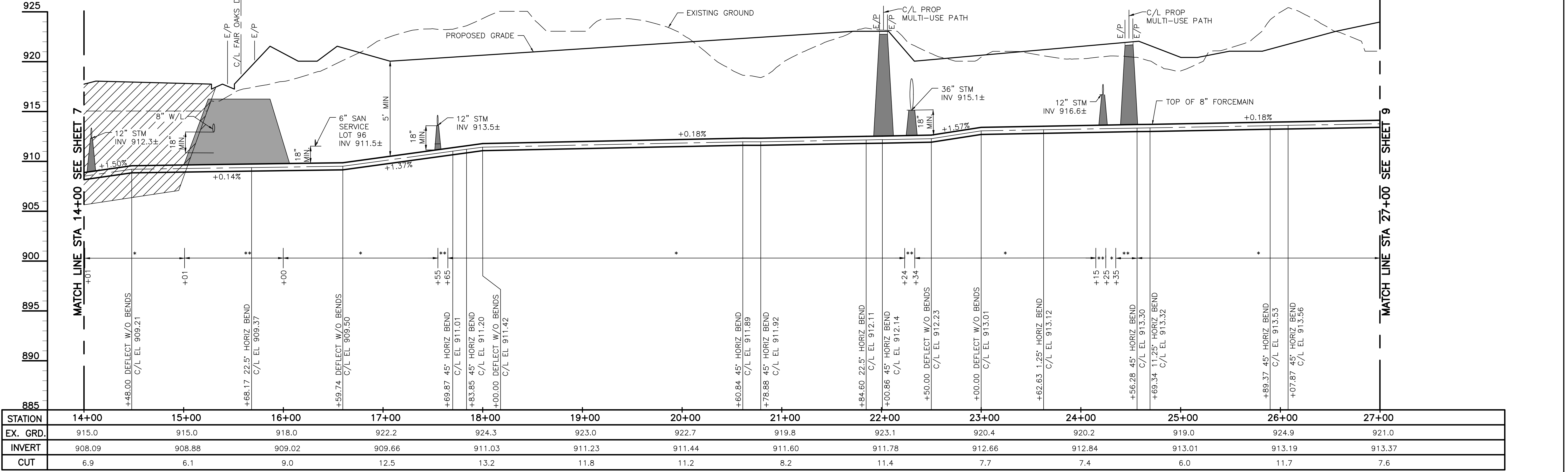
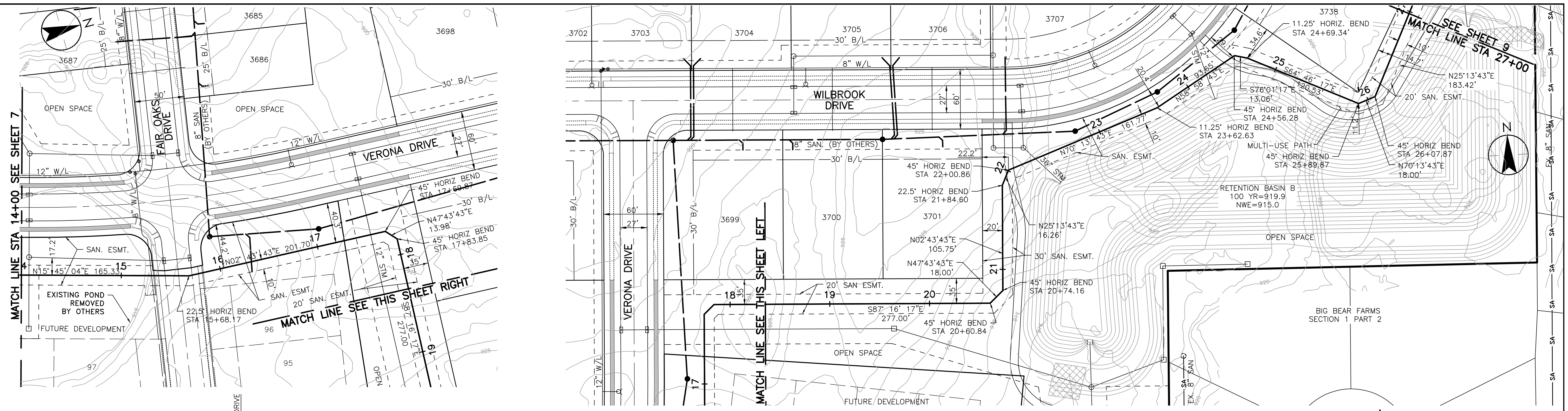
STA 0+00 TO STA 14+00

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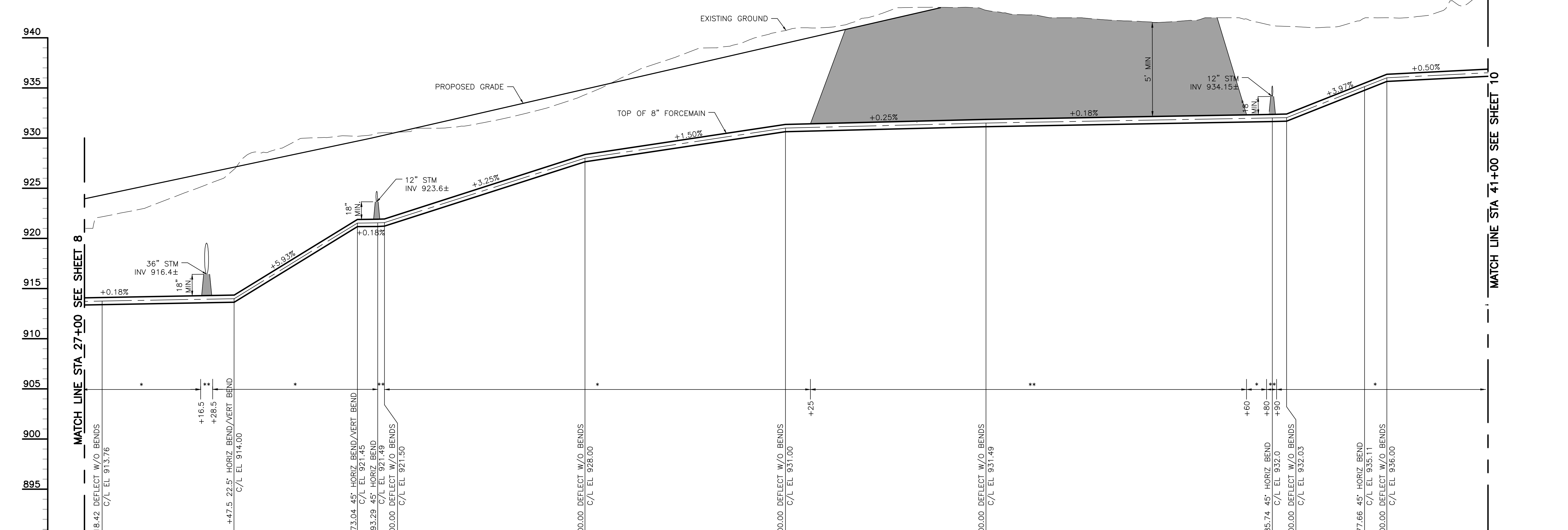
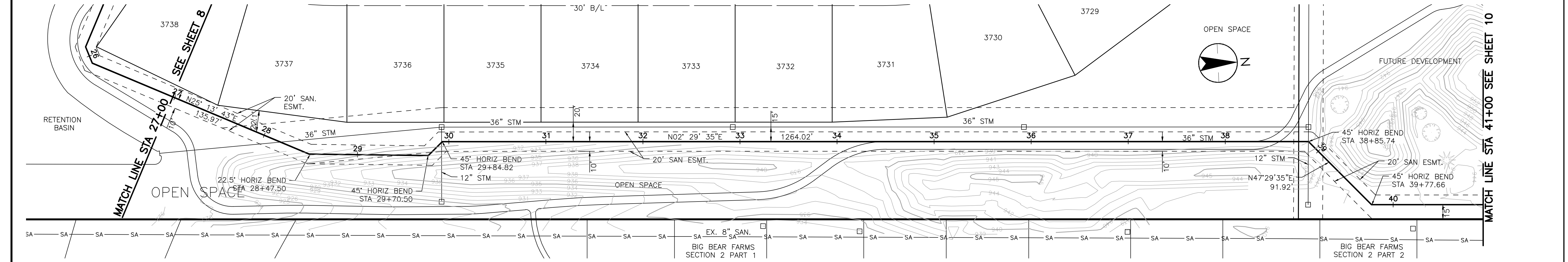
- LEGEND:
- LIMITS OF COMPACTED GRANULAR BACKFILL (PER ITEM 912)
  - COMPACTED FILL OF EXISTING POND COMPLETED BY OTHERS
- NOTES:
- \* COMPACTED NATIVE BACKFILL PER DCED-R100 SEE DETAIL SHEET 2 & GENERAL NOTES SHEET 2.
  - \*\* COMPACTED GRANULAR BACKFILL PER DCED-R100 SEE DETAIL SHEET 2 & GENERAL NOTES SHEET 2.

DELAWARE COUNTY  
**VERONA SECTION 1**  
 FORCE MAIN AND PUMP STATION IMPROVEMENTS  
 STA 14+00 TO STA 27+00

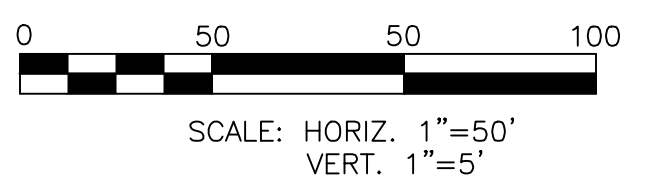
PREPARED BY:  
**Stantec**  
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 (614) 486-4383  
 (614) 486-4387

8  
25





STATION	27+00	28+00	29+00	30+00	31+00	32+00	33+00	34+00	35+00	36+00	37+00	38+00	39+00	40+00	41+00
EX. GRD.	921.0	924.5	929.1	930.5	931.6	934.3	938.4	940.7	942.6	942.8	942.0	941.7	941.1	942.0	943.8
INVERT	913.37	913.55	916.70	921.23	924.44	927.65	929.15	930.65	930.90	931.15	931.33	931.51	931.69	935.66	936.16
CUT	7.6	11.0	12.4	9.3	7.1	6.7	9.3	10.1	11.7	11.6	10.6	10.2	9.5	6.3	7.7



- LEGEND:
- LIMITS OF COMPACTED GRANULAR BACKFILL (PER ITEM 912)
  - COMPACTED FILL OF EXISTING POND COMPLETED BY OTHERS

- NOTES:
- \* COMPACTED NATIVE BACKFILL PER DCED-R100 SEE DETAIL SHEET 2 & GENERAL NOTES SHEET 2.
  - \*\* COMPACTED GRANULAR BACKFILL PER DCED-R100 SEE DETAIL SHEET 2 & GENERAL NOTES SHEET 2.

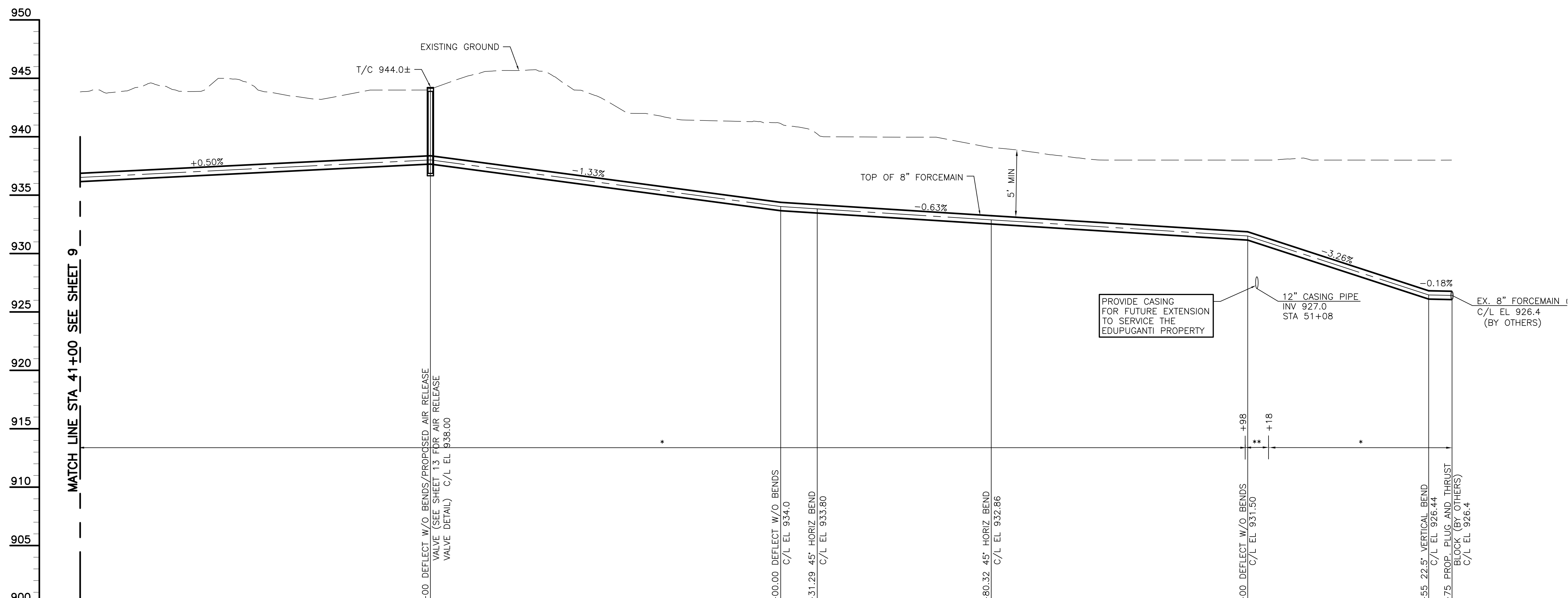
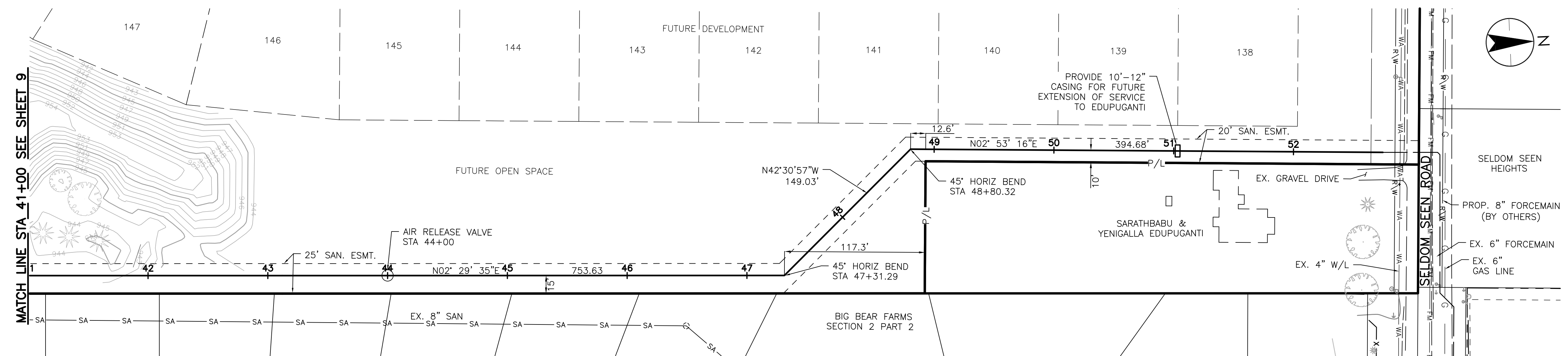
DELAWARE COUNTY  
**VERONA SECTION 1**  
 FORCE MAIN AND PUMP STATION IMPROVEMENTS  
 STA 27+00 TO STA 41+00

PREPARED BY:  
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 (614) 486-4387

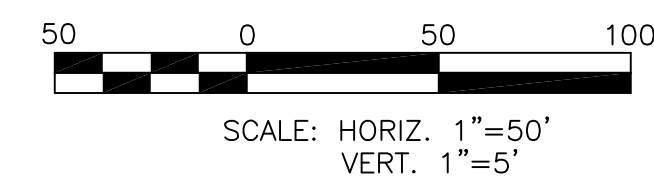
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U:\173409010\Phase 1\Civil\Design\Forcemain\Section 1\173409010\_SAFM4.dwg STA 41+00 TO STA 52+75 Mar 24, 2016 - 10:17:23am daramling



STATION	41+00	42+00	43+00	44+00	45+00	46+00	47+00	48+00	49+00	50+00	51+00	52+00
EX. GRD.	943.8	943.9	943.2	944.1	945.5	941.7	941.1	940.0	938.9	938.0	938.0	938.0
INVERT	936.16	936.66	937.16	937.66	936.33	935.00	933.67	933.04	932.41	931.78	931.15	927.89
CUT	7.7	7.2	6.1	6.4	9.2	6.7	7.5	6.9	6.5	6.2	6.9	10.1



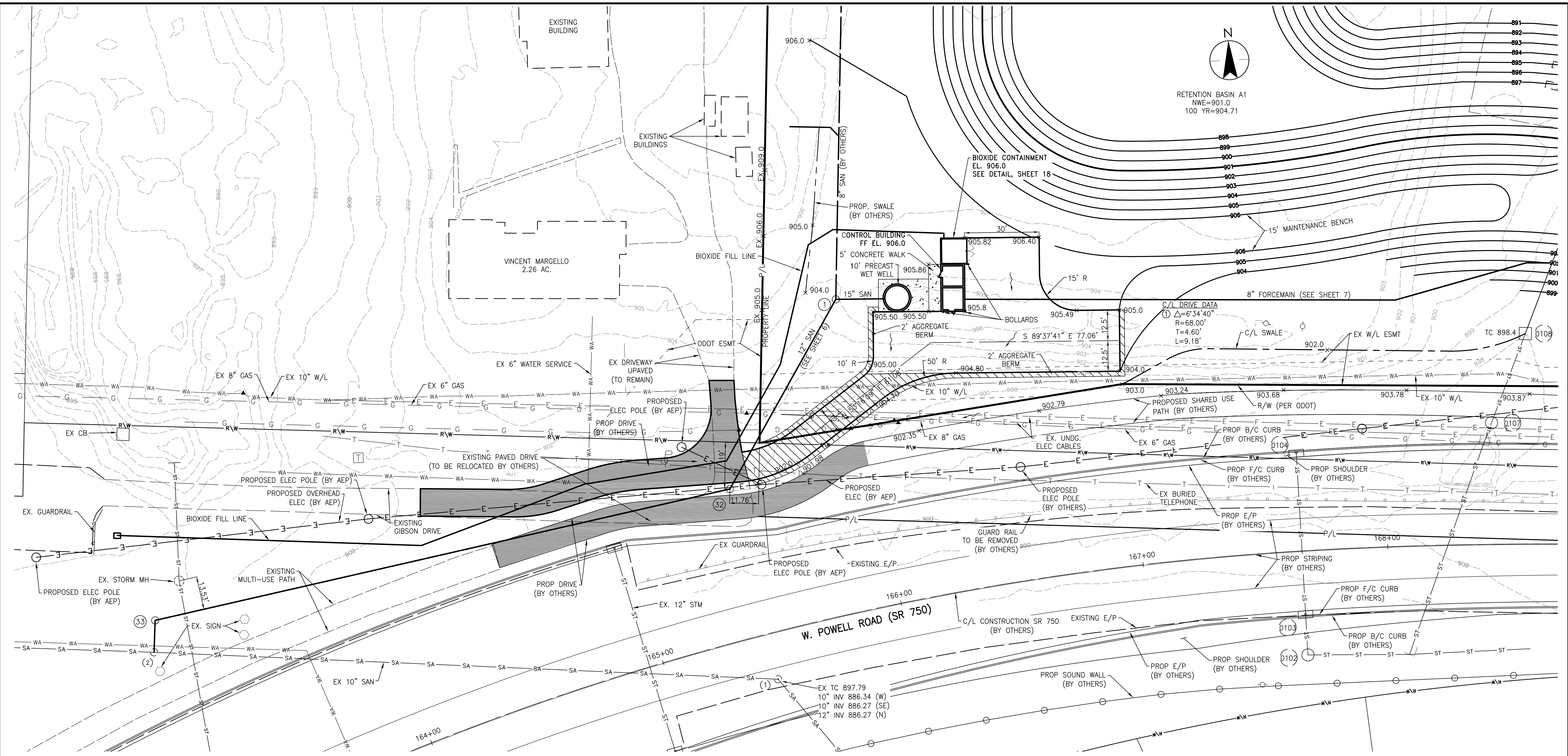
- LEGEND:
- LIMITS OF COMPACTED GRANULAR BACKFILL (PER ITEM 912)
  - COMPACTED FILL OF EXISTING POND COMPLETED BY OTHERS

- NOTES:
- \* COMPACTED NATIVE BACKFILL PER DCED-R100 SEE DETAIL SHEET 2 & GENERAL NOTES SHEET 2.
  - \*\* COMPACTED GRANULAR BACKFILL PER DCED-R100 SEE DETAIL SHEET 2 & GENERAL NOTES SHEET 2.

DELAWARE COUNTY  
**VERONA SECTION 1**  
 FORCE MAIN AND PUMP STATION IMPROVEMENTS  
 STA 41+00 TO STA 52+75

PREPARED BY:  
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 (614) 486-4387

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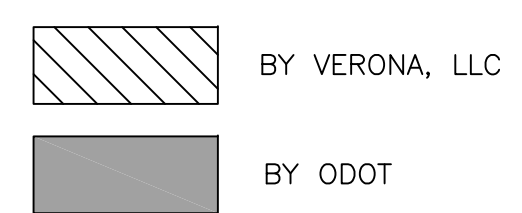
**SITE AND GRADING PLAN**

SCALE: 1"=20'

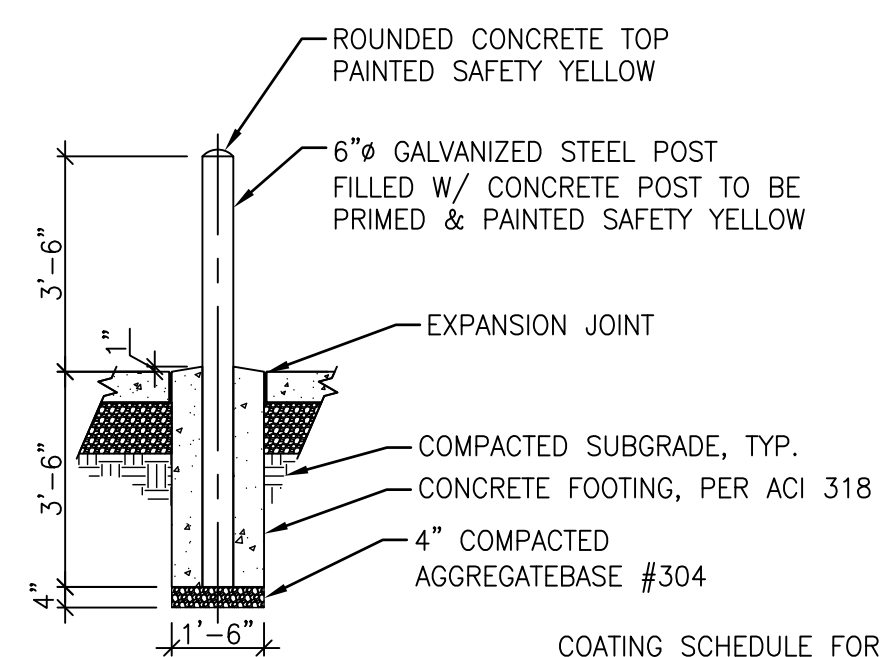


NOTE: CONNECT ALL SERVICE LINE WIRES TO MAIN LINE WIRES USING DURATRACE tm PART #3WB-01 (BLUE), COPPERHEAD ® LSC12-BLUE, OR PRO-TRACE ® #73901 WEATHERPROOF UNDERGROUND WIRE CONNECTORS.

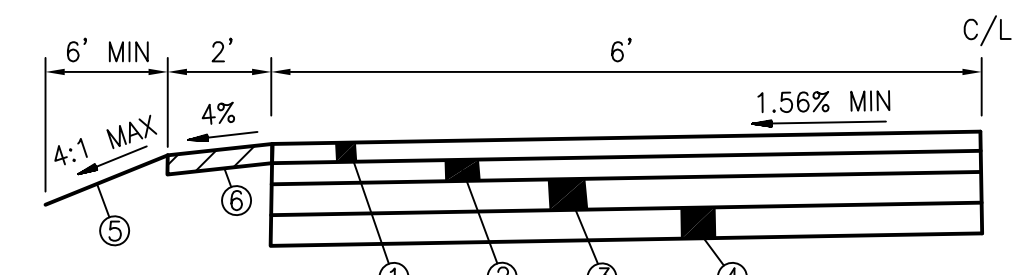
**LEGEND**



EXISTING EASEMENT RECORDING DATA	
12' DEL-CO WATER	
COLUMBIA GAS	



COATING SCHEDULE FOR BOLLARDS  
 BASE: 3-5 MILS POLYAMIDE EPOXY  
 INTERMEDIATE: 2.5-4 MILS POLYAMIDE EPOXY  
 FINISH COAT: 3-4 MILS ALIPHATIC ACRYLIC POLYURETHANE

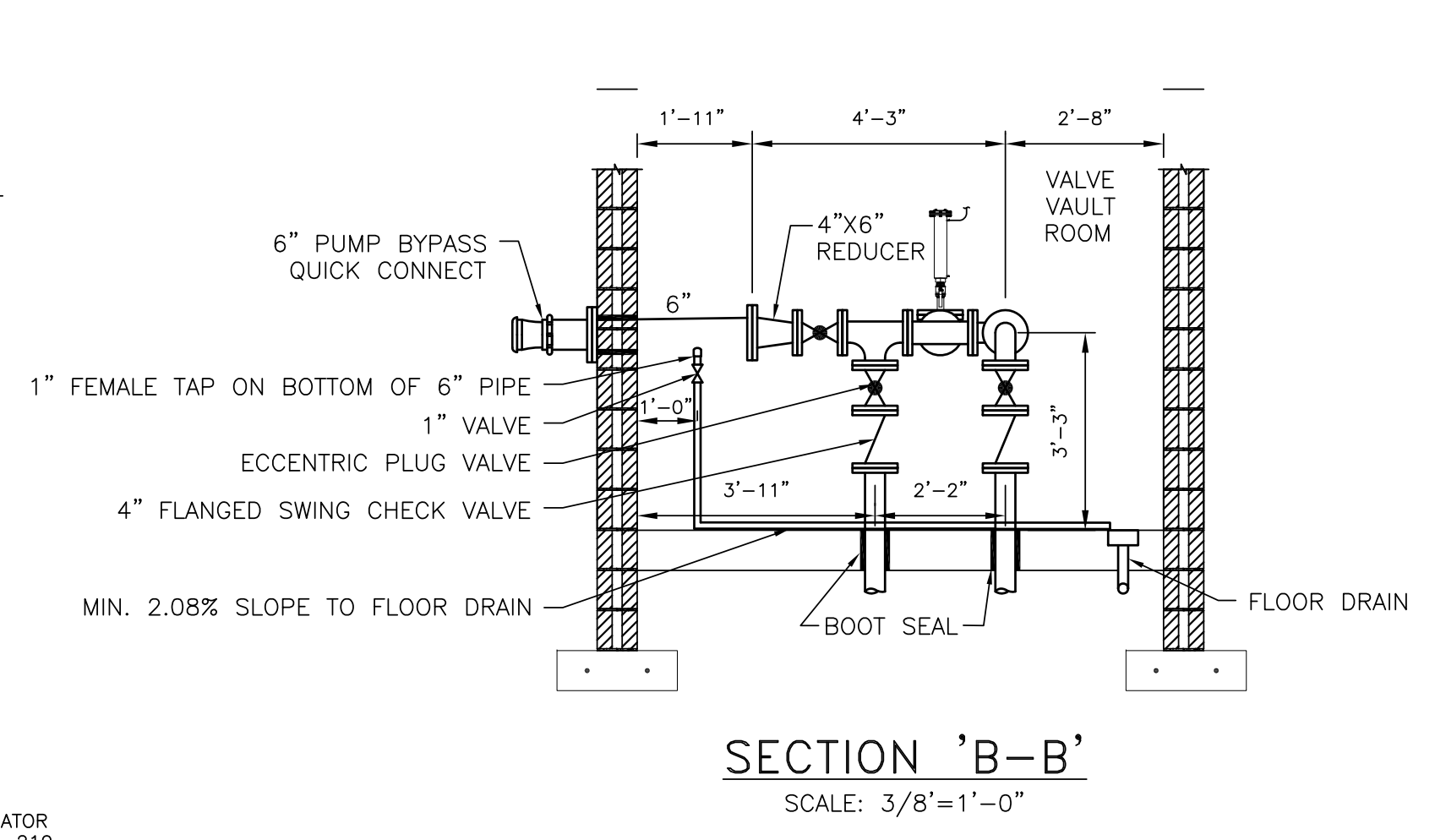
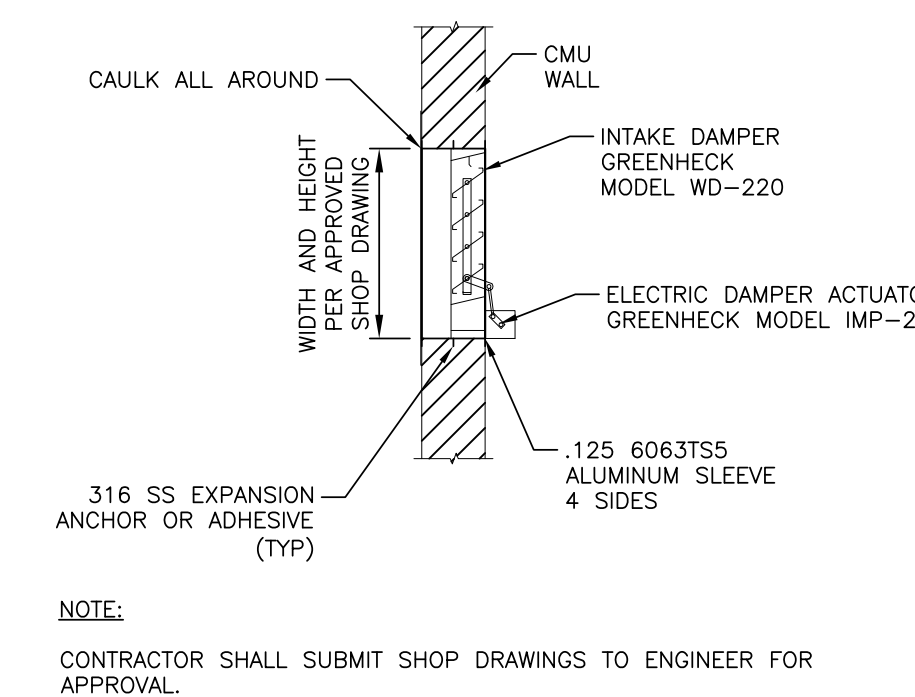
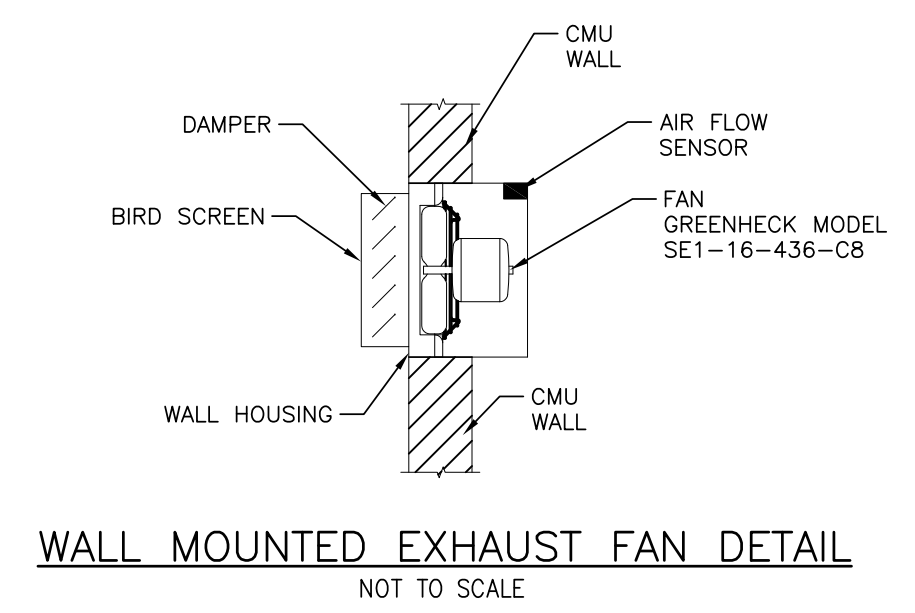


- ① 1 1/2" ASPHALT CONCRETE, SURFACE COURSE, O.D.O.T. ITEM 404
- ② 1 1/2" ASPHALT CONCRETE INTERMEDIATE COURSE, O.D.O.T. ITEM 402
- ③ 6" AGGREGATE BASE, O.D.O.T. ITEM 304
- ④ 6" #1 & #2 STONE
- ⑤ GRASS SHOULDER
- ⑥ ITEM 304 AGGREGATE BERM 8" DEEP AS SHOWN ON PLAN

DELAWARE COUNTY  
**VERONA SECTION 1**  
 FORCE MAIN AND PUMP STATION IMPROVEMENTS  
 SITE PLAN AND DRIVE DETAILS

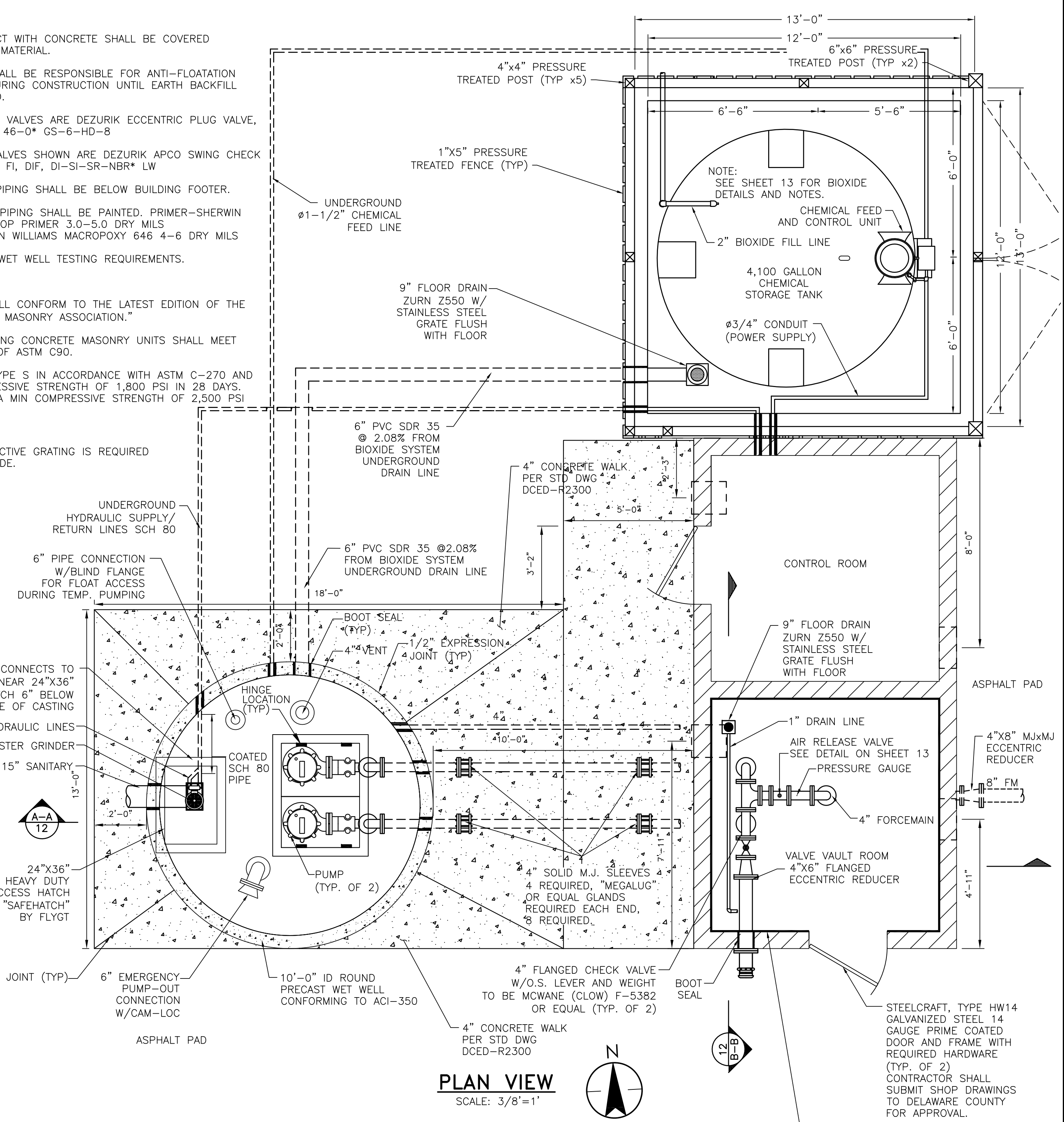
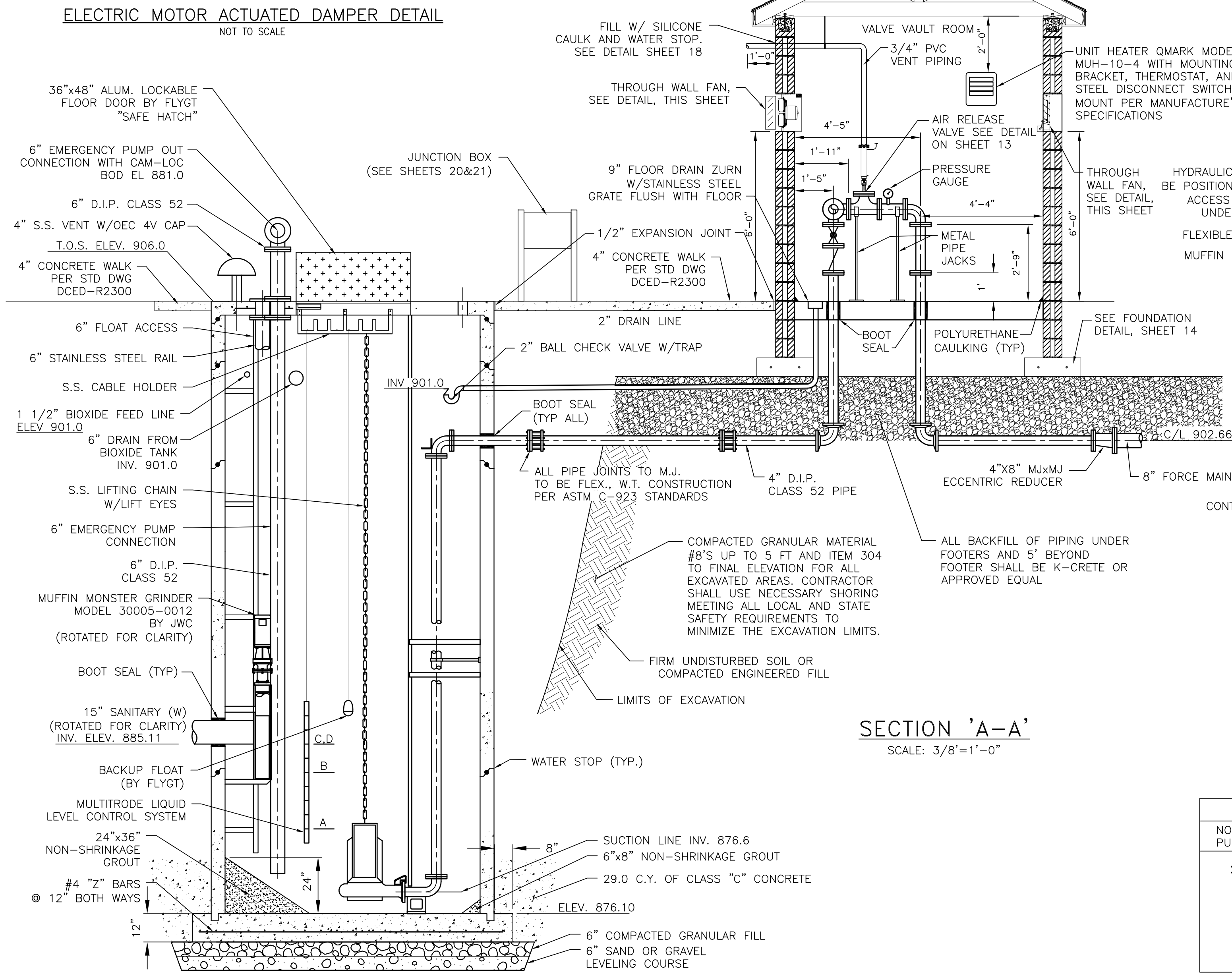
PREPARED BY:  
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U:\173409010\Phase 1\Civil\Design\Pump Station Section 1\PLANS\173409010\_PSD1.dwg PUMP STATION DETAILS Mar 25, 2016 4:42:32pm dgremling



- GENERAL NOTES:**
- ALUMINUM IN CONTACT WITH CONCRETE SHALL BE COVERED WITH A BITUMASTIC MATERIAL.
  - THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANTI-FLOATATION METHODS NEEDED DURING CONSTRUCTION UNTIL EARTH BACKFILL IS PROPERLY PLACED.
  - ALL ECCENTRIC PLUG VALVES ARE DEZURIK ECCENTRIC PLUG VALVE, PEC, 4, FI, DI, NBR, 46-0\* GS-6-HD-8
  - ALL SWING CHECK VALVES SHOWN ARE DEZURIK APCO SWING CHECK VALVE CVS, 4, 250A, FI, DIF, DI-SI-SR-NBR\* LW
  - ALL UNDERGROUND PIPING SHALL BE BELOW BUILDING FOOTER.
  - ALL ABOVE GROUND PIPING SHALL BE PAINTED. PRIMER-SHERWIN WILLIAMS COPOXY SHOP PRIMER 3.0-5.0 DRY MILS. FINISH COAT-SHERWIN WILLIAMS MACROPOXY 646 4-6 DRY MILS
  - SEE SHEET 15 FOR WET WELL TESTING REQUIREMENTS.
- BLOCK CONSTRUCTION**
- MASONRY WORK SHALL CONFORM TO THE LATEST EDITION OF THE "NATIONAL CONCRETE MASONRY ASSOCIATION."
  - HOLLOW LOAD-BEARING CONCRETE MASONRY UNITS SHALL MEET THE REQUIREMENTS OF ASTM C90.
  - MORTAR SHALL BE TYPE S IN ACCORDANCE WITH ASTM C-270 AND HAVE A MIN. COMPRESSIVE STRENGTH OF 1,800 PSI IN 28 DAYS. GROUT SHALL HAVE A MIN COMPRESSIVE STRENGTH OF 2,500 PSI IN 28 DAYS.
- ELECTRICAL**
- USE OF NON-CONDUCTIVE GRATING IS REQUIRED BY THE ELECTRIC CODE.

NOTE: SEE SHEET 14 FOR CONTROL BUILDING DETAILS.

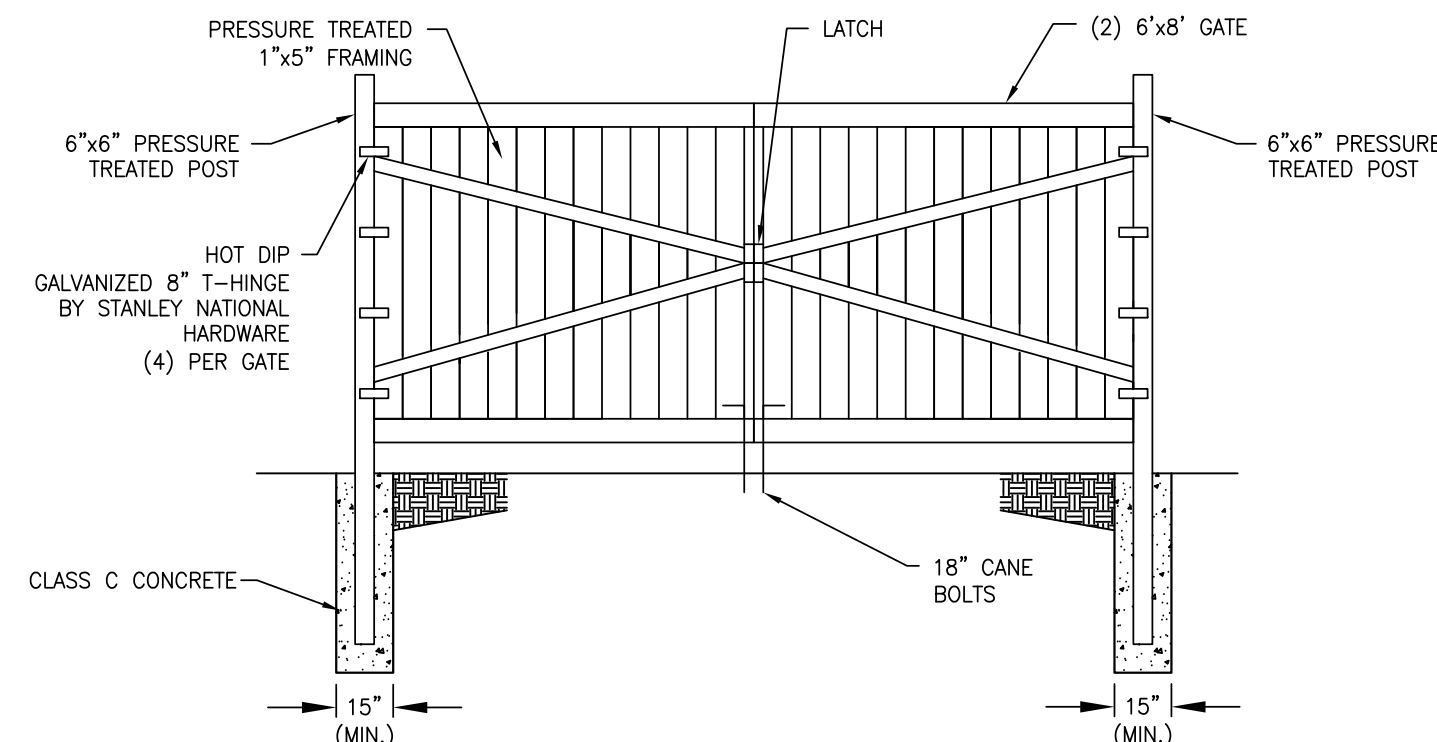


NO. OF PUMPS	TYPE	PUMP				REMARKS	PUMP CONTROL		
		DESIGN FLOW	TDH	MOTOR HP	RPM		FLOAT	FLOAT ACTION	ELEV
2	SUB'M EXPLOSION PROOF 4" Ø DISCHARGE	480 GPM	109 FT	25 MIN.	1765 MAX	NON-OVER LOADING FOR ALL POINTS ON THE CURVE FLYGT NP3171.185 IMPELLAR 270MM	A	PUMP OFF	879.1
							B	LEAD PUMP ON	882.1
							C	LAG PUMP ON	884.1
							D	ALARM ON	884.1

DELAWARE COUNTY  
**VERONA SECTION 1**  
FORCE MAIN AND PUMP STATION IMPROVEMENTS  
PUMP STATION DETAILS

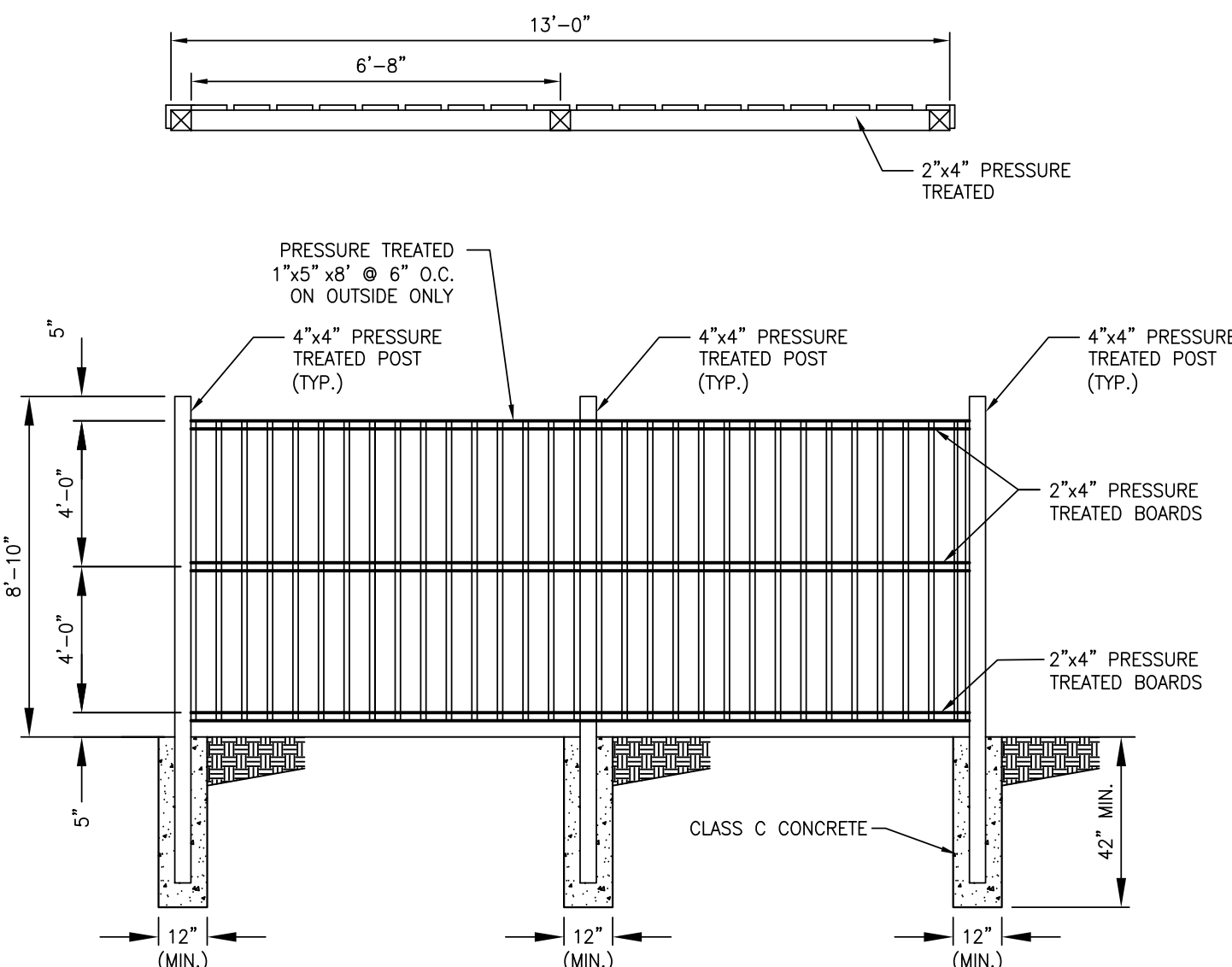
PREPARED BY:  
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(614) 486-4387

U:\173409010\Phase 1\Civil\Design\Pump Station Section 1\PLANS\173409010\_BNDT.dwg BIOXIDE NOTES AND GENERAL DETAILS Mar 25, 2016 4:41:10pm dgremling

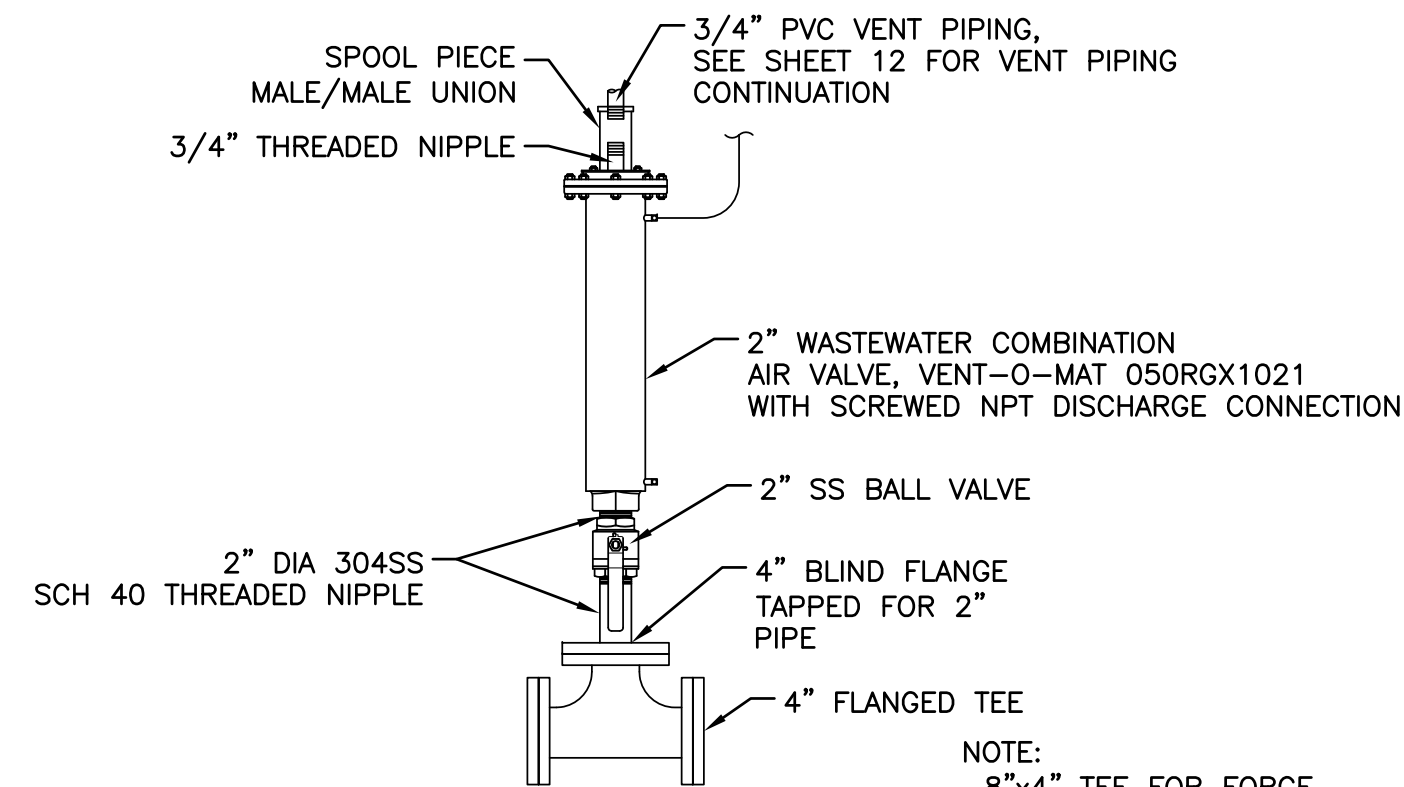


**BIOXIDE SYSTEM FENCE GATE**  
NOT TO SCALE

CONTRACTOR SHALL SUBMIT GATE SHOP DRAWINGS TO DELAWARE COUNTY FOR APPROVAL.



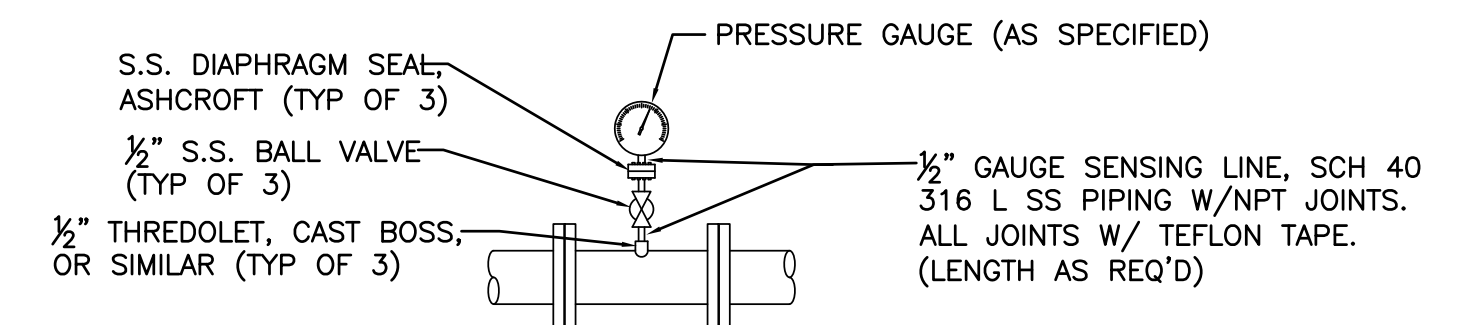
**BIOXIDE SYSTEM FENCE DETAIL**  
NOT TO SCALE



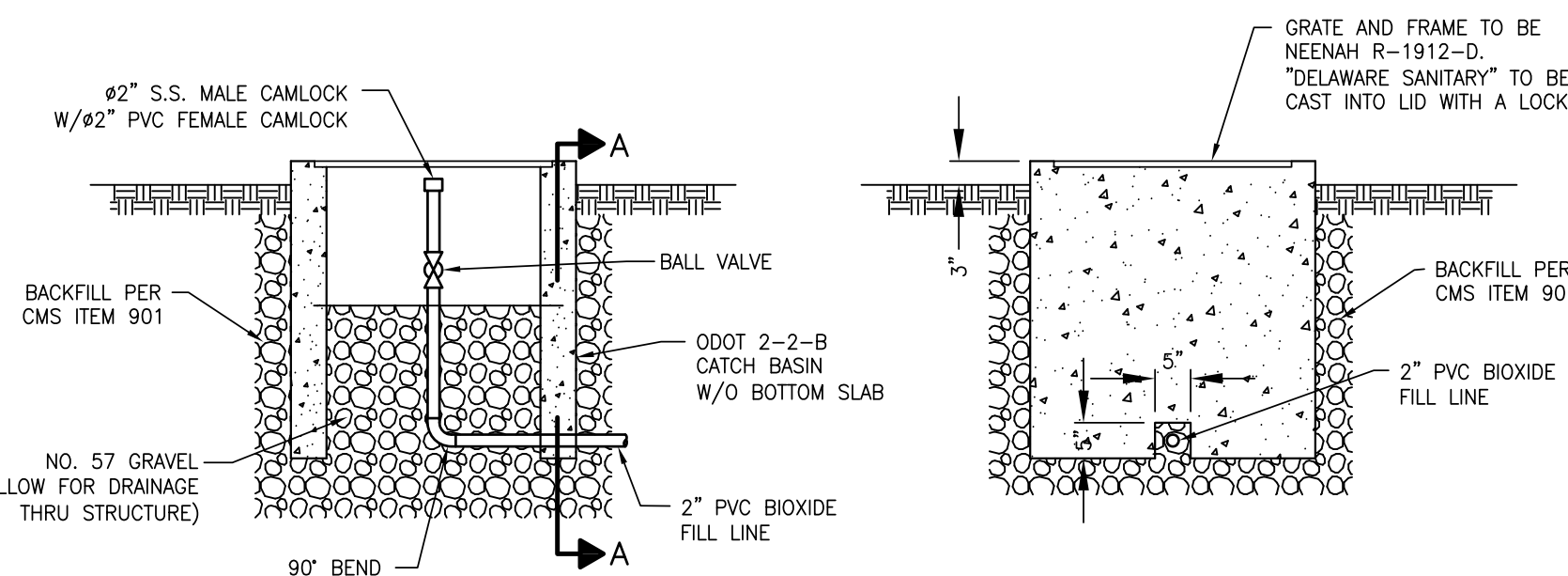
**TYPICAL AIR RELEASE VALVE DETAIL**  
NOT TO SCALE

**NOTES:**

- CONTRACTOR TO FURNISH CONCRETE PAD WITH ALL IN-SLAB PIPING AND CONDUIT.
- ALL PIPING AND APPURTENANCES SHALL BE PVC, SCH 80.
- ALL ELECTRICAL CONDUIT AND WIRING BY CONTRACTOR.
- UTILIZE SWEEPS ONLY (NO ELBOWS) FOR CONDUIT DIRECTIONAL CHANGES.
- CONTRACTOR TO FURNISH AND INSTALL ALL NECESSARY SLAB OPENINGS, SLEEVES AND SEALANT.
- CONTRACTOR TO FURNISH AND INSTALL ALL NECESSARY HANGERS, SUPPORTS AND BLOCKING FOR PIPING.
- ALL HARDWARE REQUIRED FOR INSTALLATION SHALL BE STAINLESS STEEL, FURNISHED AND INSTALLED BY CONTRACTOR.
- SEE SUPPLEMENTAL STANDARD DETAILS FOR CHEMICAL FEED UNIT, CALIBRATION PEDESTAL, PIPING SUPPORT, STORAGE TANK, LEVEL GAUGE AND VARIOUS OTHER COMPONENTS.
- TWO COATS OF WEATHER PROOFING SEALER SHALL BE APPLIED TO ALL WOOD SURFACES.
- ALL WOOD SHALL BE PRESSURE TREATED OR CEDAR.
- BIOXIDE TANK SHALL INCLUDE TWO VARIABLE FREQUENCY DRIVE PUMPS WITH ADJUSTABLE FEED RATE RANGE FROM 11-114 GPD AND A MAX DISCHARGE PRESSURE OF 40 PSI. CHEMICAL FEED SYSTEM FOR ODOR CONTROL SHALL BE BY AH WATER.
- BIOXIDE TANK SHALL INCLUDE A LEVELING DEVICE CONNECTED TO THE STATIONS SCADA SYSTEM THAT MONITORS TANK LEVEL.
- THE CONTRACTOR SHALL SUBMIT A SHOP DRAWING OF THE BIOXIDE GATE TO DELAWARE COUNTY FOR APPROVAL.
- CONNECT ALL SERVICE LINE WIRES TO MAIN LINE WIRES USING DURATRACE tm PART #SWB-01 (BLUE), COPPERHEAD @ LISC12-BLUE, OR PRO-TRACE @ #73901 WEATHERPROOF UNDERGROUND WIRE CONNECTORS.



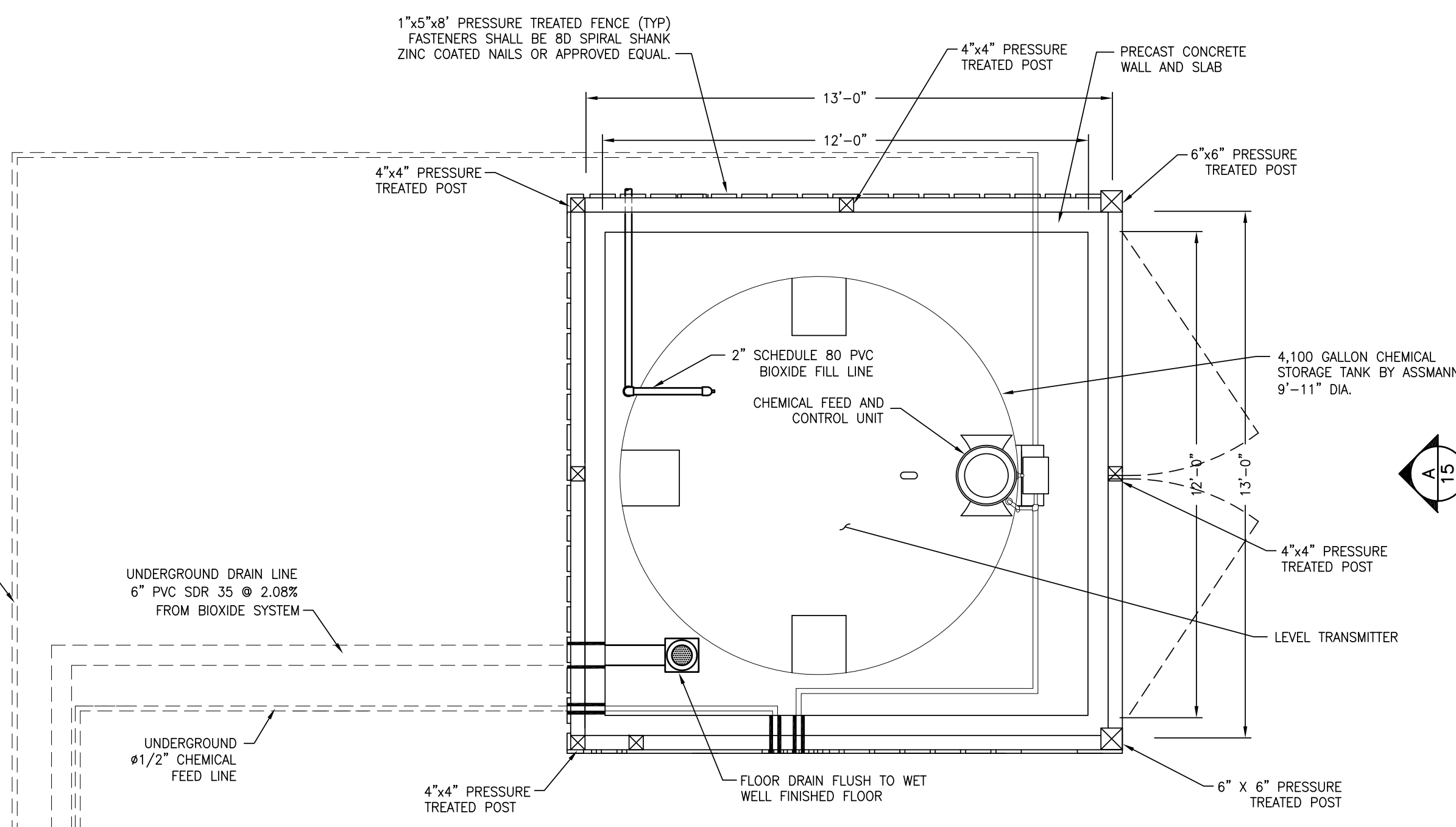
**TYPICAL GAUGE INSTALLATION DETAIL**  
NOT TO SCALE



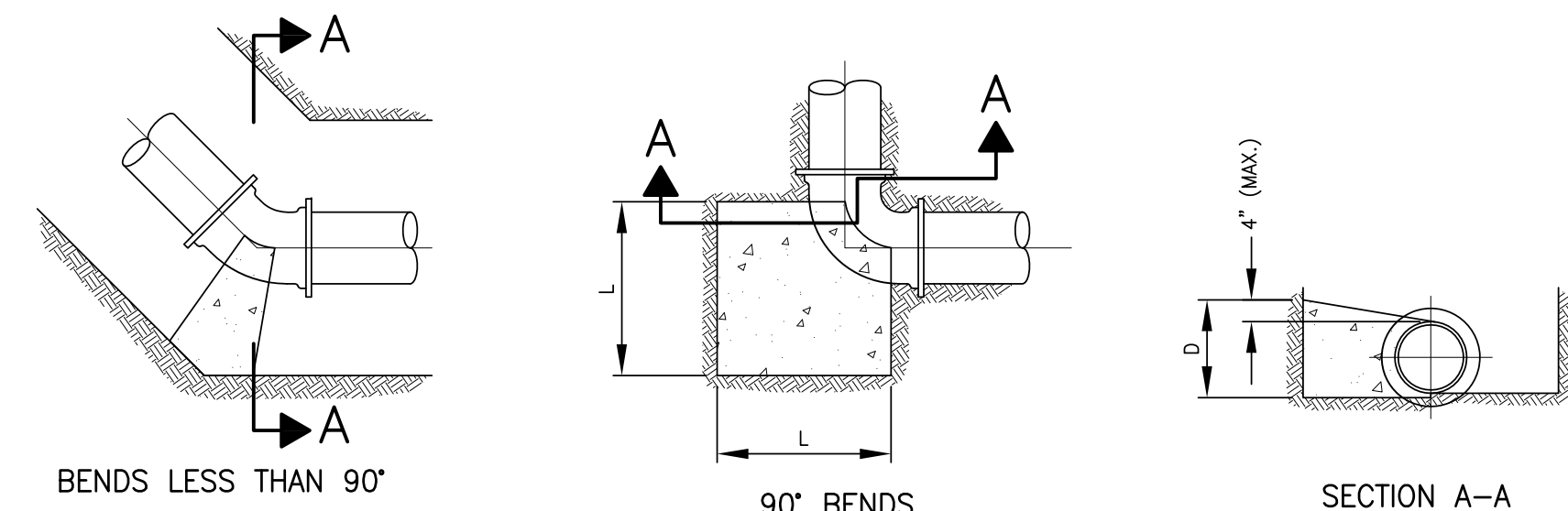
**VALVE BOX**

**SECTION A-A**

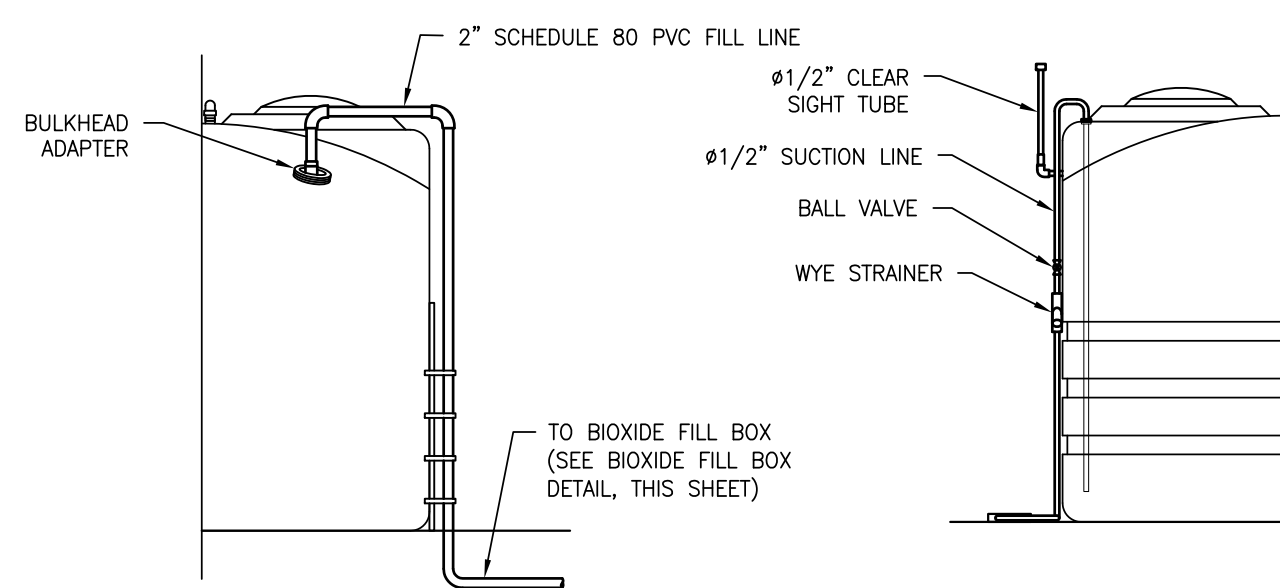
**BIOXIDE FILL BOX DETAIL AT EAST EDGE OF PUMP STATION ACCESS DRIVE**  
NOT TO SCALE



**PLAN VIEW**  
NOT TO SCALE



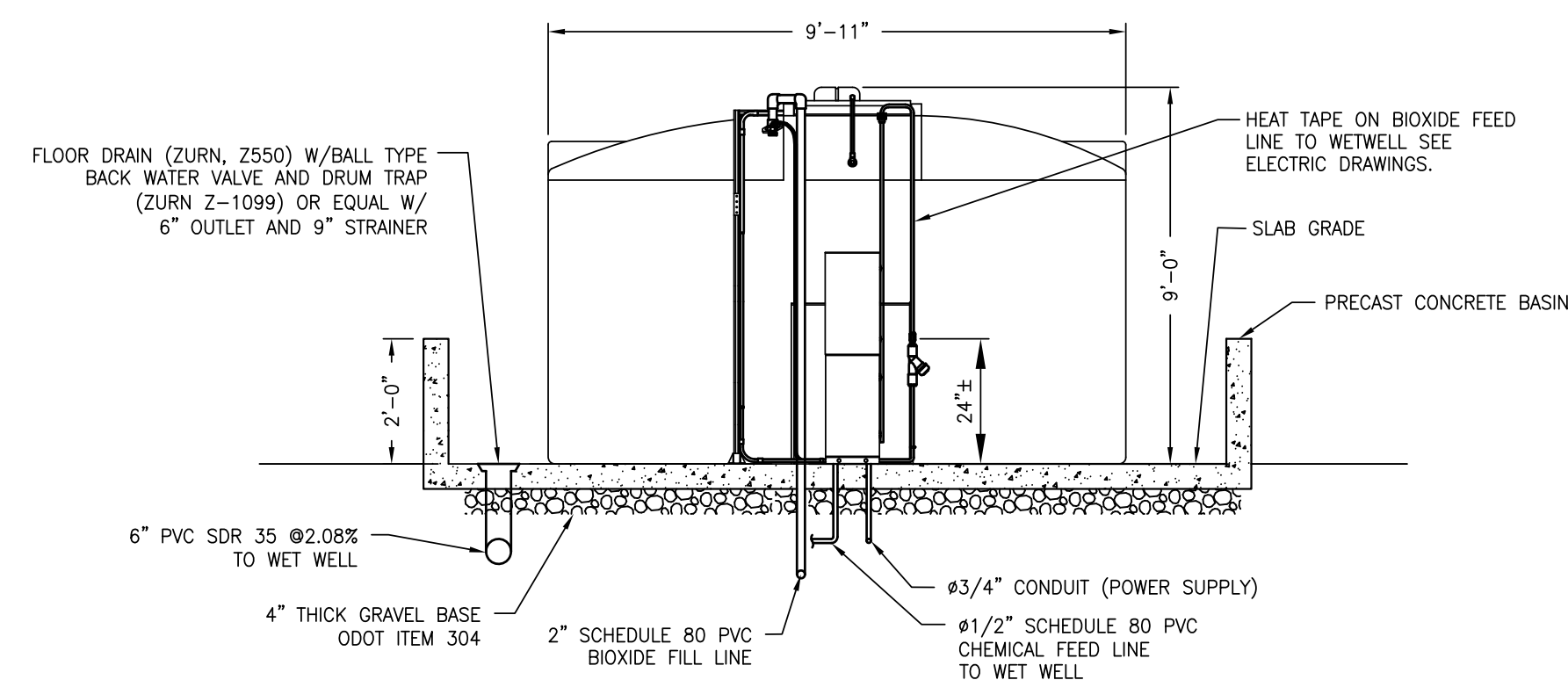
**BACKING FOR HORIZONTAL BENDS**  
NOT TO SCALE



**SECTION A-A**

**SECTION B-B**

**FILL LINE DETAILS**  
NOT TO SCALE



**ELEVATION VIEW**  
NOT TO SCALE

SIZE OF PIPE	11.25'			22.5'			45'			90'		
	L	D	VOLUME CU-FT	L	D	VOLUME CU-FT	L	D	VOLUME CU-FT	L	D	VOLUME CU-FT
3"	12"	18"	1.5	13"	26"	3.0	18"	30"	5.9	25"	30"	10.4
4"	12"	24"	2.6	16"	30"	5.0	22"	36"	11.0	27"	48"	18.7
6"	12"	48"	6.0	19"	43"	13.4	30"	55"	22.9	37"	54"	41.6
8"	12"	63"	10.5	18"	57"	20.2	36"	57"	39.2	47"	60"	75.0
12"	20"	54"	22.6	37"	62"	49.0	48"	62"	87.9	66"	66"	166.4
16"	31"	65"	44.3	60"	65"	88.1	65"	65"	159.2	72"	96"	288.0
20"	45"	70"	72.8	56"	70"	136.2	72"	76"	247.0	86"	108"	451.8
24"	41"	72"	92.3	67"	74"	198.0	88"	84"	359.1	96"	120"	640.0

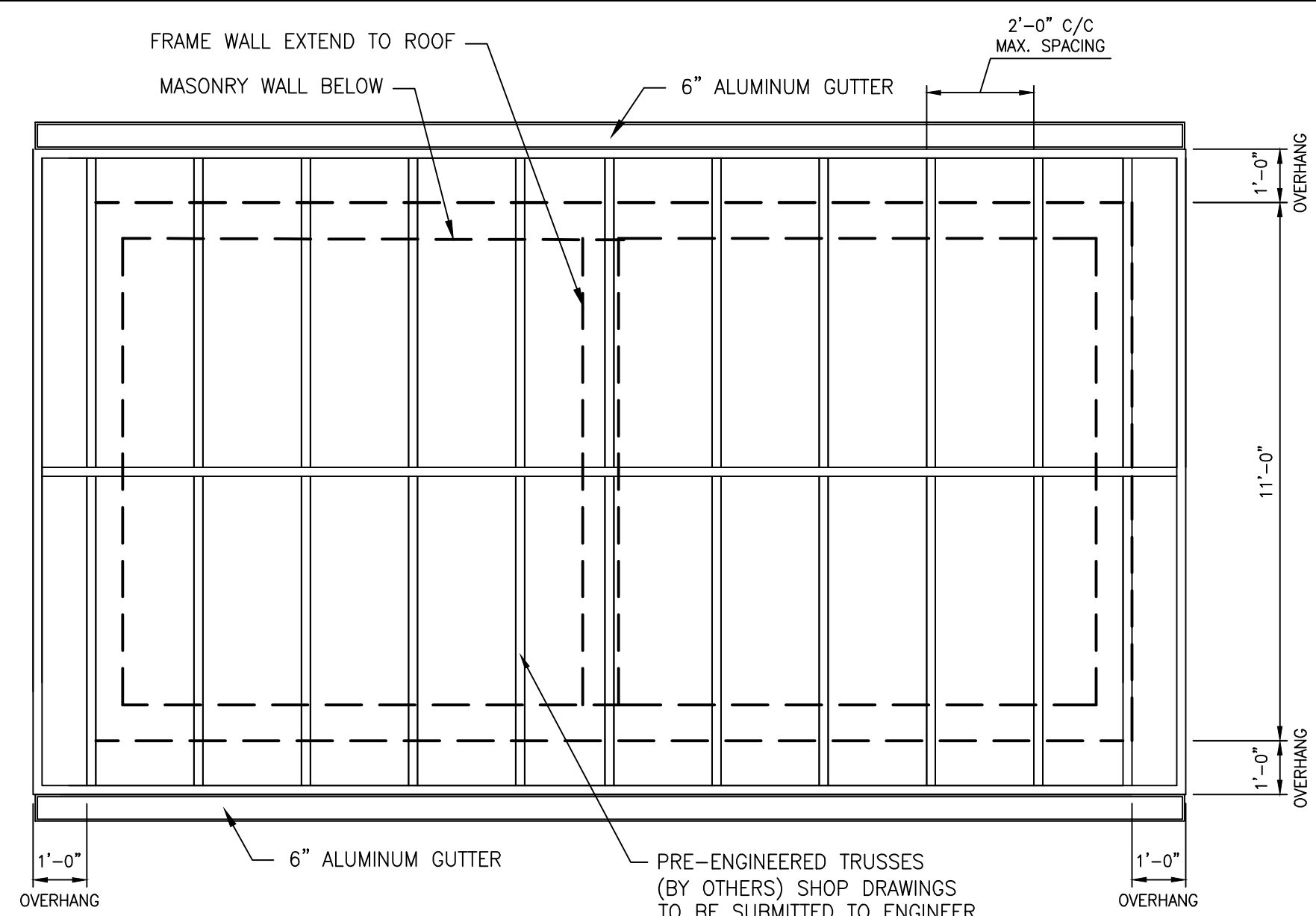
**NOTES**

- BACKER DESIGNED FOR 3000 PSF SOIL BEARING.
- CONCRETE TO BE PLACED AGAINST UNDISTURBED EARTH.

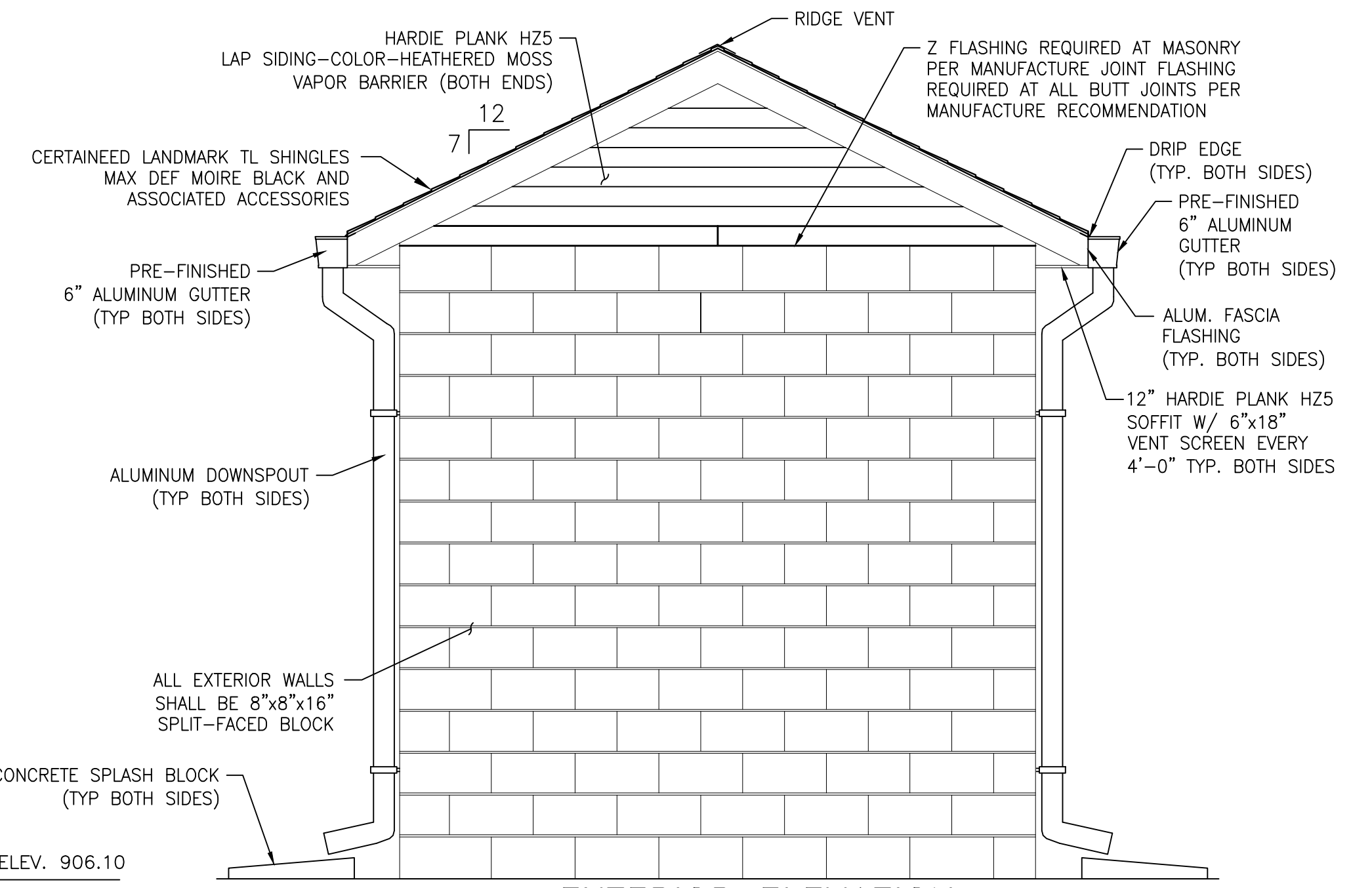
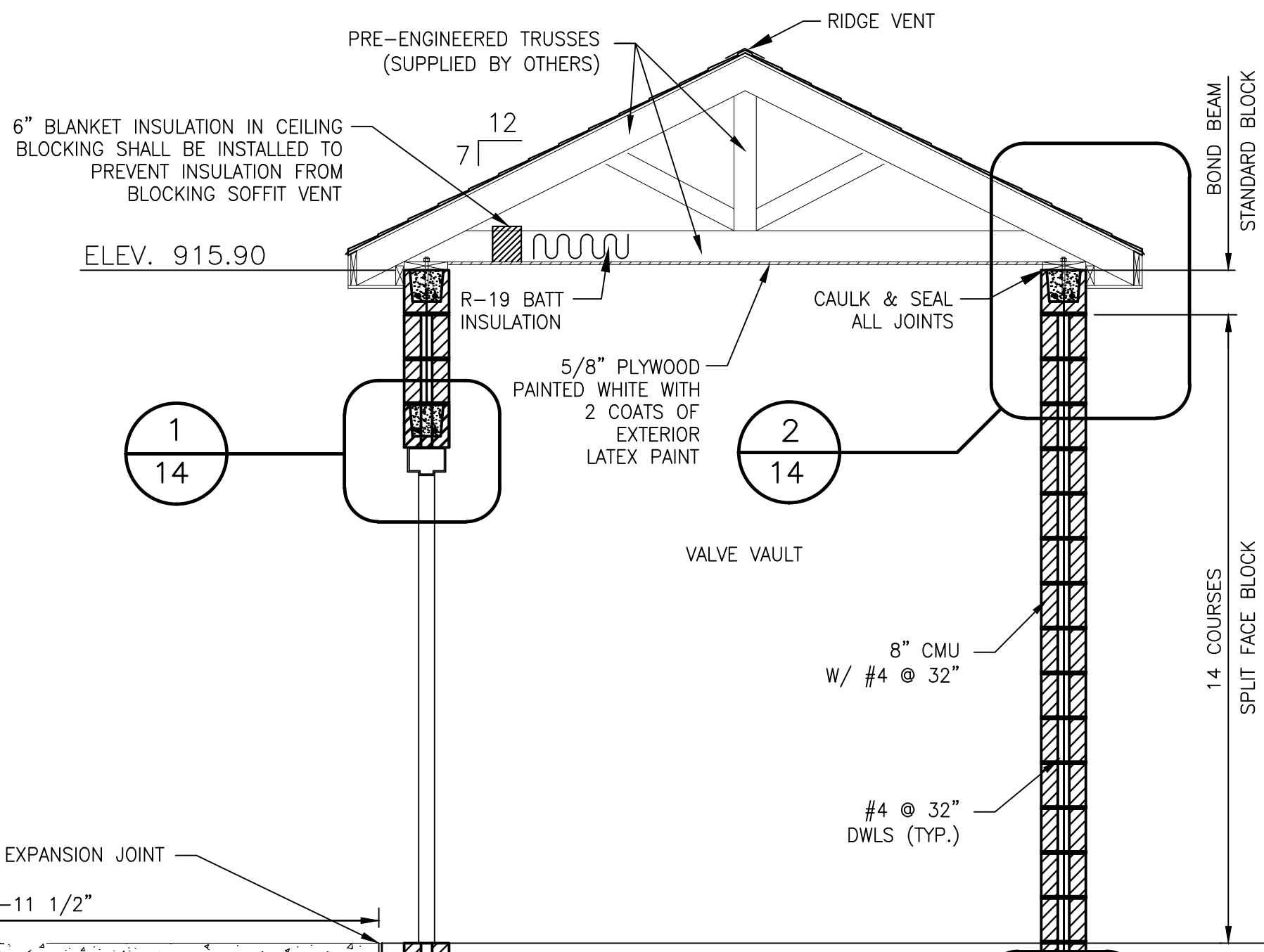
DELAWARE COUNTY  
**VERONA SECTION 1**  
FORCE MAIN AND PUMP STATION IMPROVEMENTS  
BIOXIDE NOTES AND GENERAL DETAILS

PREPARED BY:  
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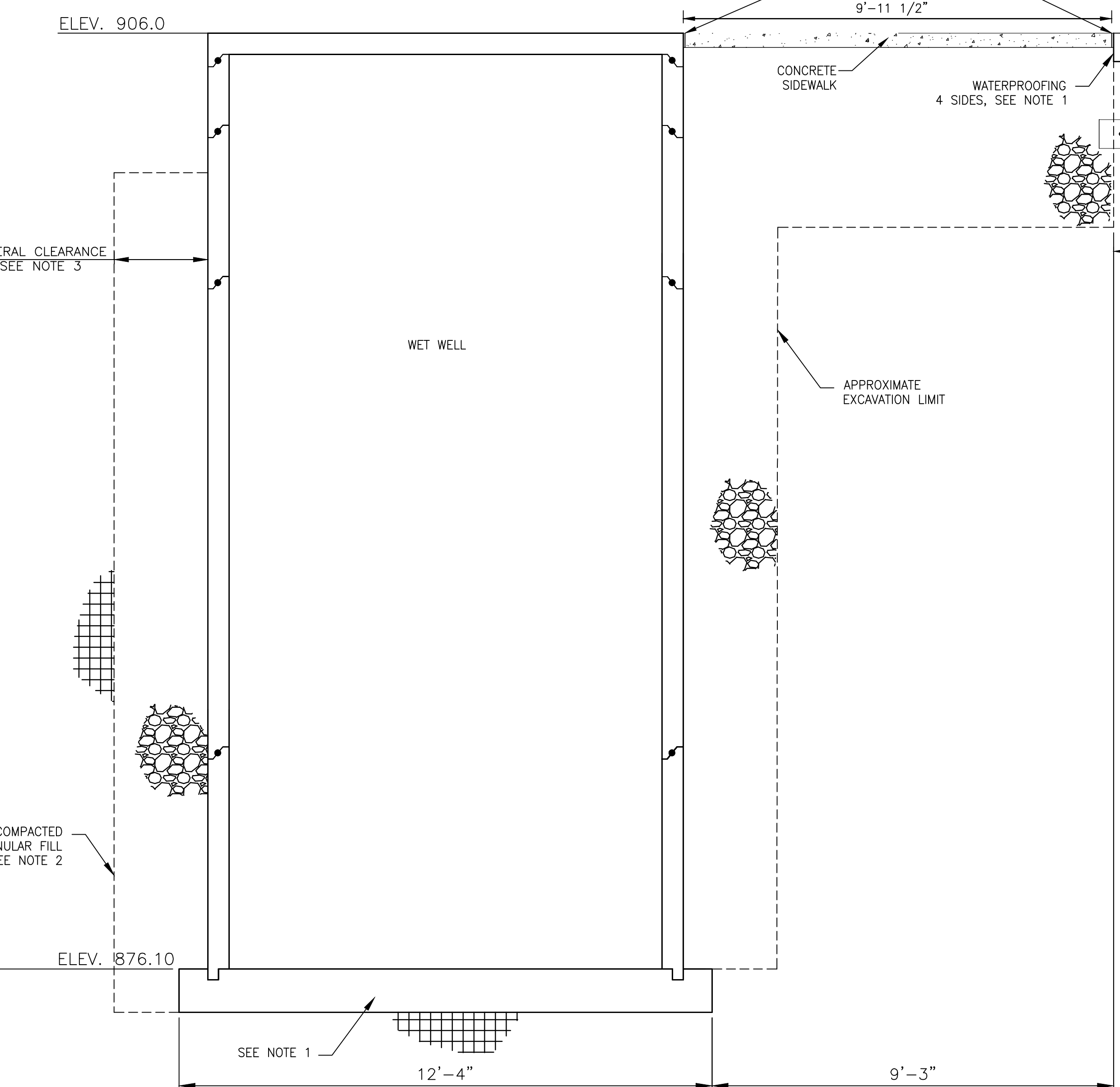
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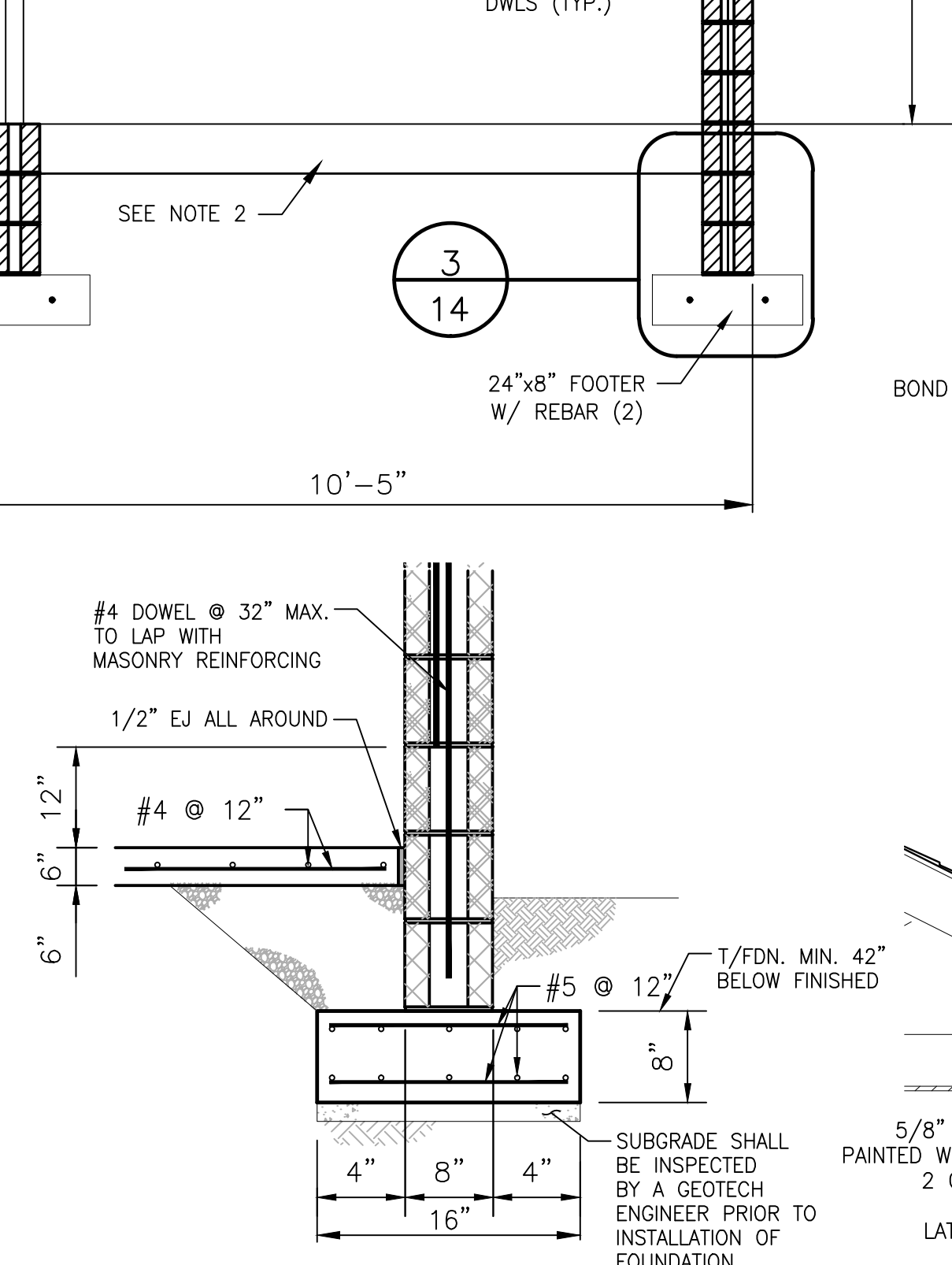
**ROOF FRAMING PLAN**  
NOT TO SCALE



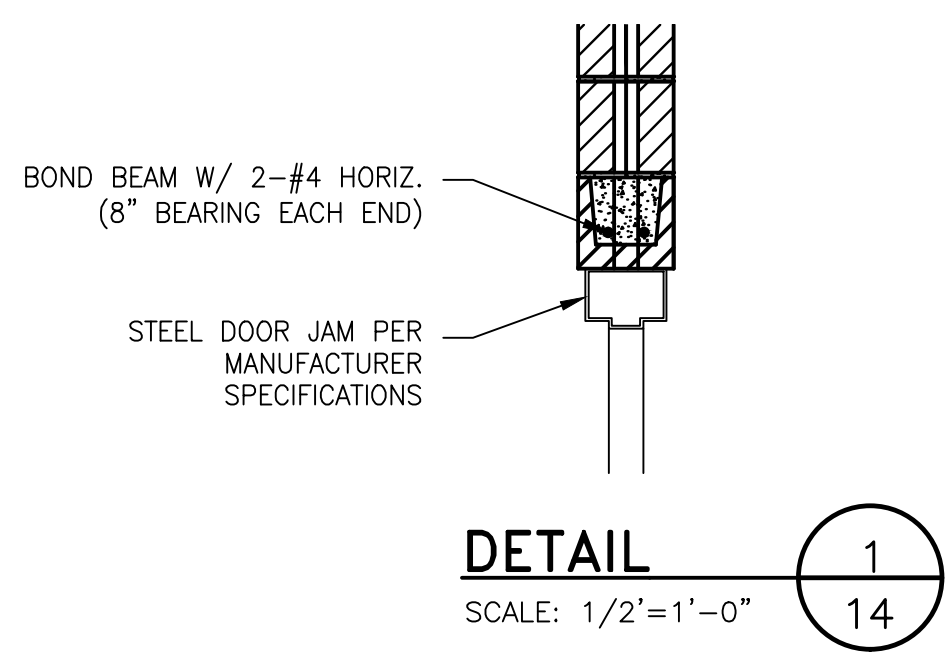
**EXTERIOR ELEVATION**  
SCALE: 1/2"=1'-0"



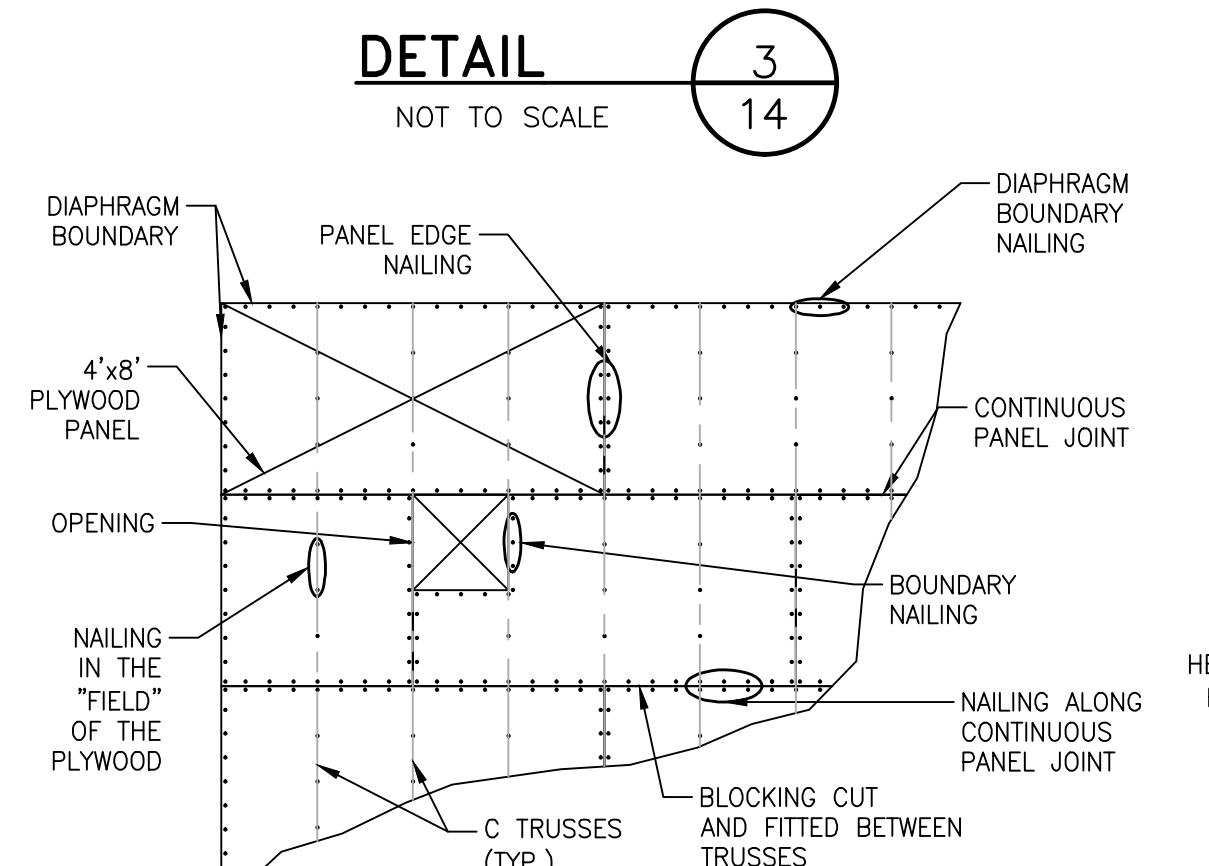
**SECTION 'A-A'**  
SCALE: 1/2"=1'-0"



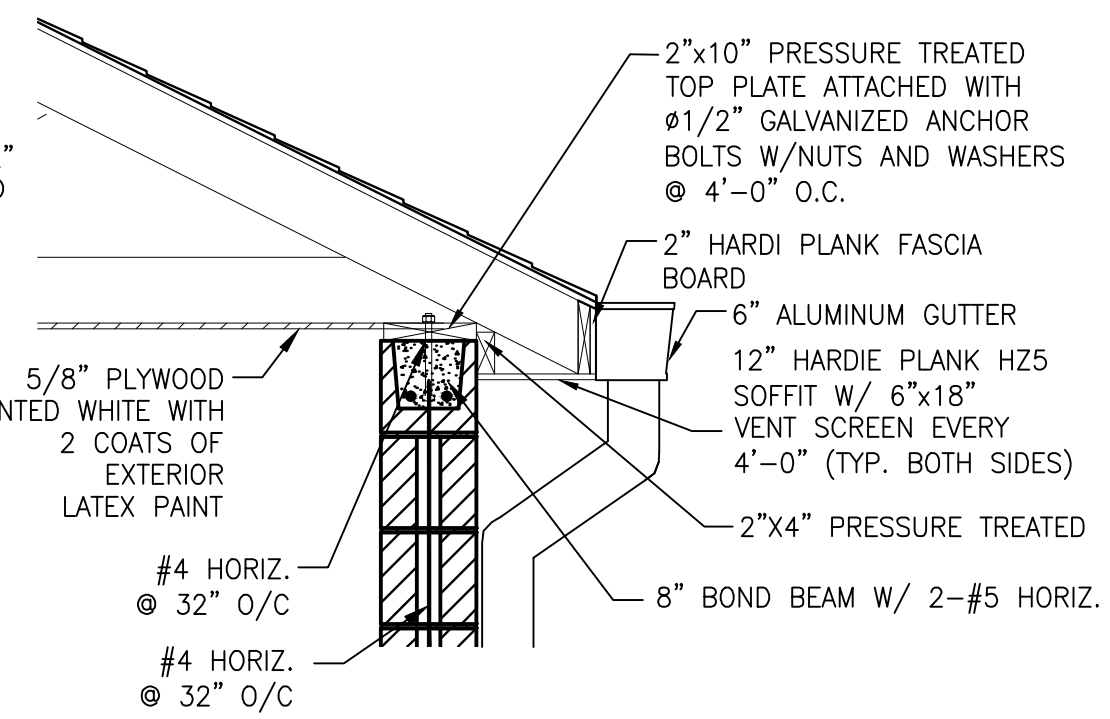
**PARTIAL BLOCKED TYPICAL PLYWOOD DIAPHRAGM PLAN**  
NOT TO SCALE



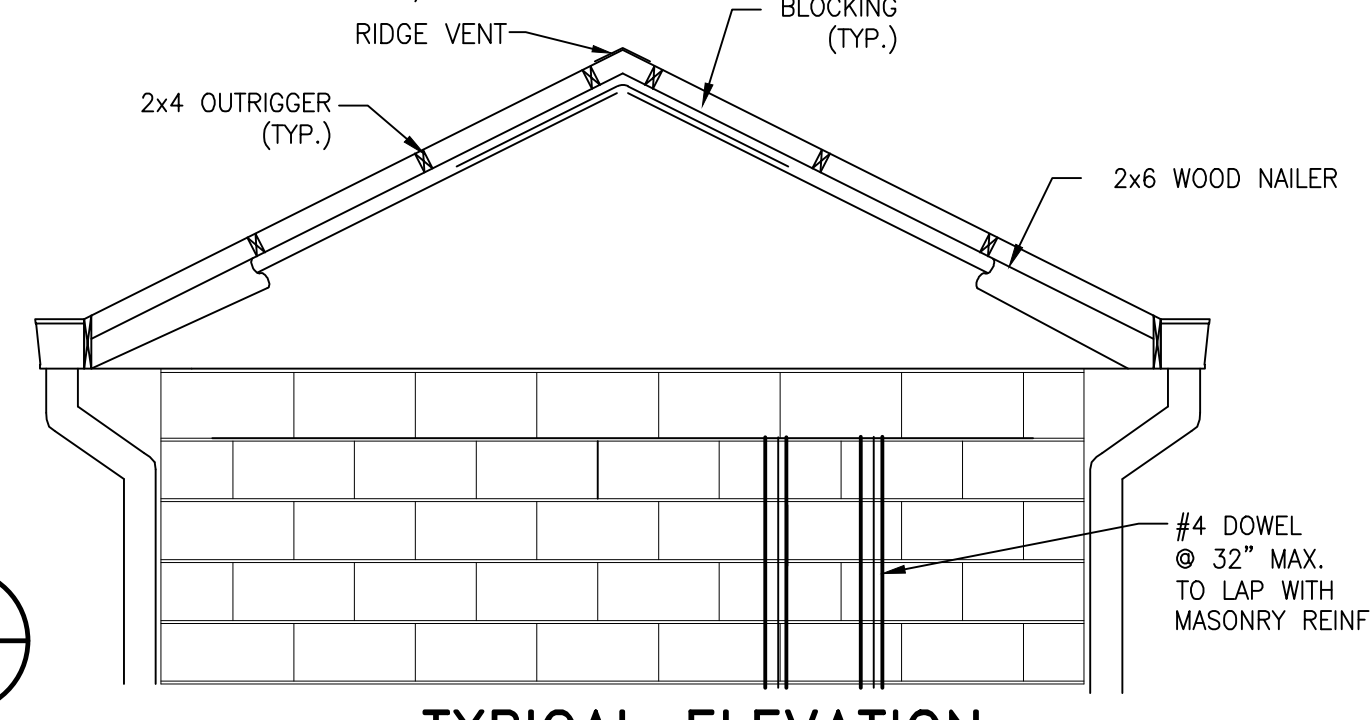
**DETAIL 1**  
SCALE: 1/2"=1'-0"



**DETAIL 2**  
SCALE: 1/2"=1'-0"



**DETAIL 3**  
NOT TO SCALE



**TYPICAL ELEVATION**  
NOT TO SCALE

- NOTES:**
1. PROVIDE BELOW SLAB WATER VAPOR RETARDER MEETING THE REQUIREMENTS OF ASTM E96 UNDER SLAB.
  2. BACKFILL STRUCTURE WITH COMPACTED GRANULAR MATERIAL. SEE SPECS SHEET 10.
  3. PROVIDE LATERAL CLEARANCE BETWEEN EXCAVATION FACE AND WALL TO MEET OSHA SAFETY REQUIREMENTS (CONSTRUCTION INDUSTRY 29 CFR 1926), TO PERMIT CONSTRUCTION OF FOUNDATION STRIP FOOTING AND WALLS, INCLUDING INSTALLATION AND REMOVAL OF WALL FORMS, INSPECTION AND TESTING.
  4. EXCAVATE TO BOTTOM OR SLIGHTLY BELOW BOTTOM SURFACE OF ALL EXCESS MATERIALS OR DEBRIS BEFORE CONSTRUCTION OF FOOTINGS.
  5. ALL BLOCK SHALL BE TREATED WITH HYDROZO ENVIROSEAL DOUBLE 7, BY HYDROZO COATINGS COMPANY PER THE MANUFACTURE'S SPECIFICATIONS.
  6. PROVIDE 7/16" THICK PS-1 RATED SHEATHING, EXTERIOR EXPOSURE, GRACE C-C WITH 8d NAILS FOR CONTROL BUILDING PLYWOOD DIAPHRAGM:
    - AT 6" C/C BOUNDARY AND CONTINUOUS ALONG PANEL JOINTS.
    - AT 12" C/C FIELD.
  7. BLOCKING REQUIRED, USE SAME LUMBER SIZE AS BOTTOM CHORD OF TRUSSES MINIMUM, ON EDGE.
  8. ALL MASONRY WALLS SHOWN ARE CLASSIFIED AS SHEAR WALLS AND CONSTITUTE A COMPONENT OF THE LATERAL FORCE RESISTANCE SYSTEM. ANY DEVIATION FROM WHAT IS SHOWN ON THE PLANS SHALL BE APPROVED BY THE ENGINEER PRIOR TO PROCEEDING WITH MASONRY.
  9. DESIGN ALLOWANCE BEARING PRESSURE= 2500 PSF.
  10. DESIGN ROOF LOADING:
    - ROOF LIVE LOAD = 30PSF
    - ROOF SNOW LOAD = 17PSF
    - COLLATERAL LOAD = 15 PSF
  11. ALL DIMENSIONS ARE HORIZONTAL.

DELAWARE COUNTY  
**VERONA SECTION 1**  
FORCE MAIN AND PUMP STATION IMPROVEMENTS  
BUILDING DETAILS 1

PREPARED BY:  
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14  
25

**TESTING CONCRETE STRUCTURES FOR LEAKAGE:**

A. ALL LIQUID RETENTION STRUCTURES SHALL BE MADE WATERTIGHT AND SHALL BE TESTED BY FILLING WITH LIQUID TO 6 INCHES BELOW THE TOP OF THE TANK.

B. BACKFILL AND WATERPROOFING SHALL NOT BE PLACED AROUND THE LIQUID RETENTION STRUCTURES UNTIL THE LEAKAGE TEST IS COMPLETED TO THE SATISFACTION OF THE ENGINEERS.

C. THE CONTRACTOR SHALL PROVIDE ALL LABOR, TOOLS, MATERIALS AND EQUIPMENT NECESSARY TO PERFORM THE LEAKAGE TESTS AND TO REPAIR ALL LEAKS.

D. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ALL LABOR, TOOLS, MATERIALS AND EQUIPMENT NECESSARY TO CONVEY THE LIQUID USED FOR THE TESTING. PAYMENT FOR THE LIQUID SHALL BE MADE AS DEFINED IN THE CONTRACT DOCUMENTS.

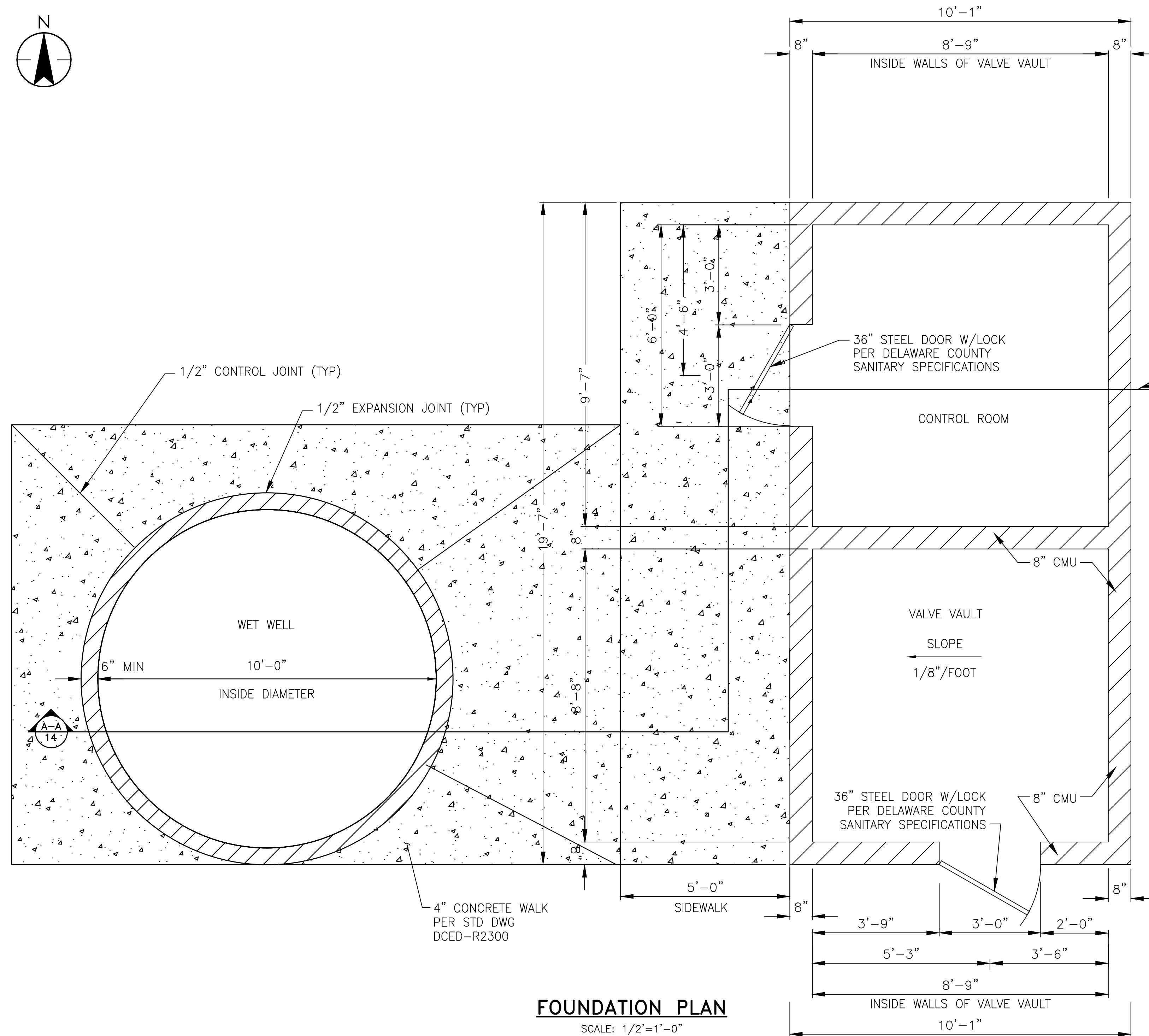
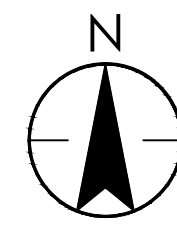
E. THE CONTRACTOR SHALL PROVIDE AND INSTALL ALL TEMPORARY AND WATERTIGHT PIPE PLUGS AND BULKHEADS AS REQUIRED TO PERFORM THE LEAKAGE TEST. THE PIPE PLUGS AND BULKHEADS SHALL REMAIN IN PLACE FOR THE DURATION OF THE TEST, AND REMOVED UPON SUCCESSFUL COMPLETION OF THE TEST.

F. THE CONTRACTOR SHALL PERFORM THE LEAKAGE TEST TO COMPLY GENERALLY WITH ANSI/AWWA D110 AS FOLLOWS:

1. FILL THE LIQUID RETENTION STRUCTURE WITH LIQUID TO THE REQUIRED LEVEL AND ALLOW THE LIQUID TO REMAIN FOR A PERIOD OF 24 HOURS.
2. RECORD THE LEVEL OF THE LIQUID AT THE END OF 24 HOURS.
3. OVER THE NEXT 72 HOURS, MEASURE THE DROP IN THE LIQUID LEVEL AT EACH 24 HOUR INTERVAL, TO DETERMINE THE LIQUID VOLUME LOSS FOR COMPARISON WITH THE ALLOWABLE LEAKAGE.
4. EVAPORATION LOSSES SHALL BE MEASURED OR CALCULATED BY THE CONTRACTOR DURING EACH 24-HOUR PERIOD, AND DEDUCTED FROM THE MEASURED LOSS TO DETERMINE NET LIQUID LOSS DURING EACH 24-HOUR PERIOD.

G. THE STRUCTURE WILL PASS THE LEAKAGE TEST BY MEETING THE FOLLOWING CRITERIA:

1. THE NET LIQUID LOSS FOR THE LAST 24-HOUR PERIOD OF THE 72-HOUR TEST PERIOD SHALL NOT EXCEED 0.2 OF 1 PERCENT OF THE LIQUID RETENTION STRUCTURE VOLUME CAPACITY.
2. VISIBLE LEAKAGE OF WATER SHALL NOT BE PERMITTED. ALL VISIBLE LEAKS SHALL BE REPAIRED.
3. DURING THE 72-HOUR TEST PERIOD, THE CONTRACTOR SHALL REPAIR ALL LEAKS AS OUTLINED IN THIS SECTION, AND AS REQUIRED TO MEET THE NET LIQUID LOSS CRITERIA.
4. IF THE MEASURED LEAKAGE EXCEEDS THE MAXIMUM ALLOWABLE, THE LEAKAGE TEST SHALL BE EXTENDED TO A MINIMUM OF 120 HOURS, AS REQUIRED TO COMPLETE AND SATISFY THE NET LIQUID LOSS CRITERIA.



**FOUNDATION PLAN**  
SCALE: 1/2"=1'-0"

**GENERAL STRUCTURAL NOTES**

**STRUCTURAL DESIGN CRITERIA**

1. CONCRETE 28 DAY COMPRESSIVE STRENGTH EQUALS 4,500 PSI. AND W/C=0.43, TYPE II CONCRETE.
2. REINFORCING STEEL GRADE 60, ASTM A615, A616 OR A617.
3. CONCRETE STRUCTURES DESIGNED IN ACCORDANCE WITH "CODE REQUIREMENTS FOR ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES AND COMMENTARY (ACI 350-06).
  - a. MIX DESIGN SHALL BE SUBMITTED TO DELAWARE COUNTY FOR APPROVAL.
  - b. DELAWARE COUNTY REPRESENTATIVE MUST BE NOTIFIED BY THE OWNER 48 HR. PRIOR TO MANUFACTURING THE PRECAST STRUCTURE.
4. WET WELL DESIGNED FOR BUOYANCY WITH 100 YEAR FLOOD ELEVATION EQUAL TO ELEVATION 910.5. FACTOR OF SAFETY (FOS) FOR THE FINAL CONDITION IS 1.32 WITH STRUCTURE EMPTY.
5. LATERAL EARTH PRESSURE PARAMETERS
  - a. DRAINED AT REST EQUIVALENT FLUID PRESSURE 51 PCF
  - b. UNDRAINED AT REST EQUIVALENT FLUID PRESSURE 86 PCF
6. FLOOR LIVE LOADS
  - a. WET WELL SLAB - 150 PSF
  - b. PUMP STATION SLAB CONTROL ROOM - 200 PSF
7. ROOF LIVE LOAD = 30 PSF
8. ROOF SNOW LOAD = 17 PSF

**STRUCTURE SPECIFICATIONS**

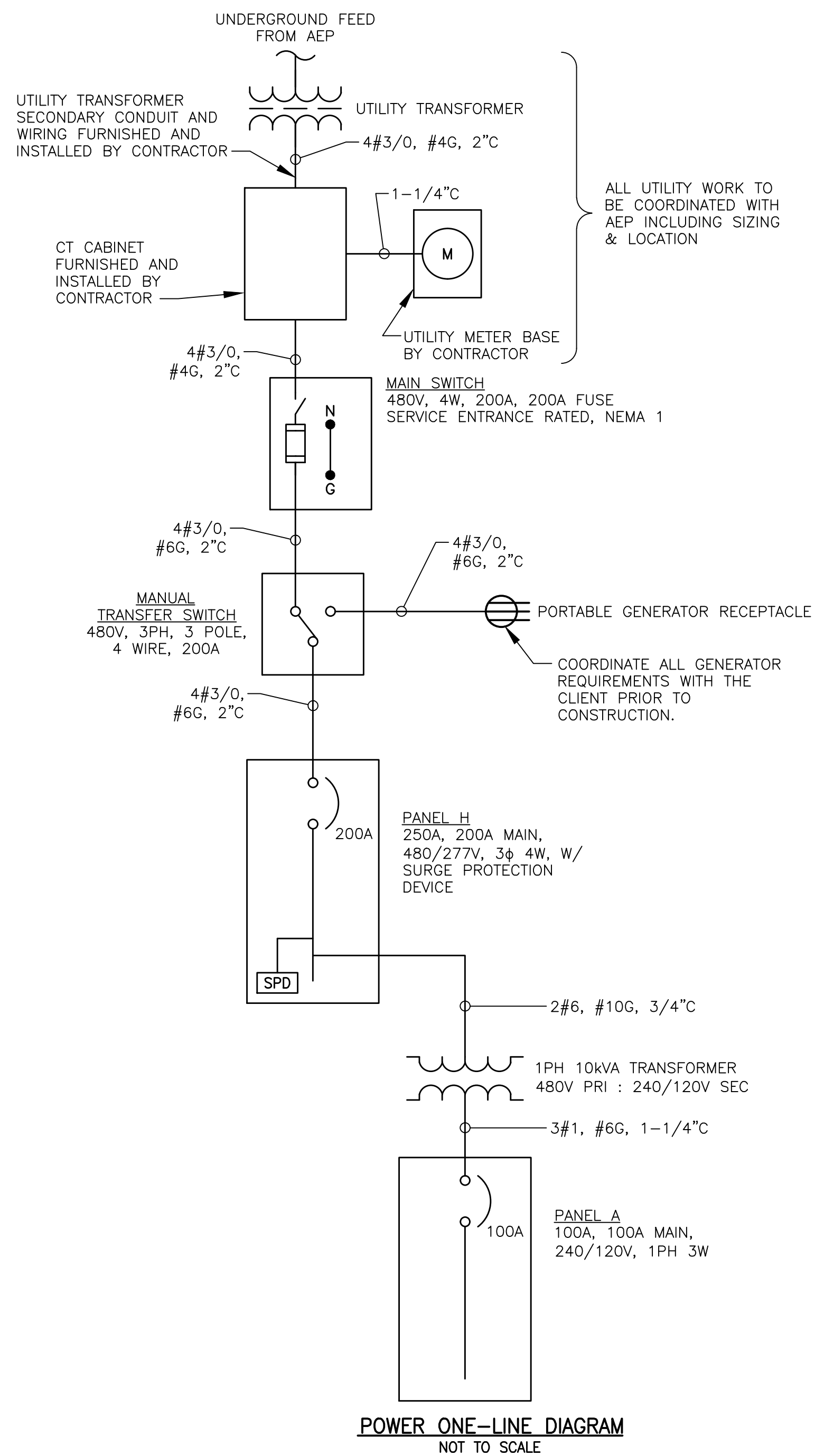
1. ODOT 2013 CONSTRUCTION AND MATERIAL SPECIFICATIONS
2. MASONRY
  - a. SPLIT FACE BLOCK ASTM C90
  - b. MORTAR - TYPE S
  - c. GROUT 3,000 PSI
  - d. COLOR SHALL BE LIGHT BUFF - OBERFIELD #1215
3. MANUFACTURED WOOD ROOF TRUSSES  
SHOP DRAWINGS REQUIRED WITH A SEAL OF AN OHIO P.E.
4. FIBERGLASS ASPHALT SHINGLES - 300 POUNDS PER SQUARE.
  - a. 50 YEAR WARRANTY FOR MATERIAL. (NON-PRORATED)
  - b. 20 YEAR WARRANTY FOR WORKMANSHIP.
  - c. CONTRACTOR MUST SUBMIT PROOF OF CERTIFIED INSTALLER TO MEET THE MANUFACTURES WARRANTY.
5. THE BUOYANCY UPLIFT (FOS) CALCULATED IS FOR THE FINAL CONDITION WITH THE WET WELL EMPTY. CONSTRUCTION CONDITIONS CAN OCCUR WHERE THE FOS MAY BE LESS THAN 1.2. THE CONTRACTOR SHALL TAKE SPECIAL MEANS DURING THESE EVENTS TO PREVENT FLOTATION FROM OCCURRING.
6. CONTRACTOR SHALL PROVIDE TEMPORARY SHORING AS NECESSARY TO SAFELY CONSTRUCT THESE STRUCTURES IN ACCORDANCE WITH OSHA 29 CFR 1926.0.
7. CONTRACTOR SHALL PROVIDE DEWATERING AS NECESSARY TO CONSTRUCT THESE STRUCTURES IN THE DRY.

SCALE: AS SHOWN

DELAWARE COUNTY  
**VERONA SECTION 1**  
FORCE MAIN AND PUMP STATION IMPROVEMENTS  
BUILDING DETAILS 2

PREPARED BY:  
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PANEL DESIGNATION: <b>PANEL H</b>		<b>480 /277 VOLTS</b>		<b>3 PHASE 4 WIRE</b>		SURFACE MTD <input checked="" type="checkbox"/>		
ROOM NAME OR #: <b>ELEC RM</b>		AMPS = 250		MAIN BKR <input checked="" type="checkbox"/> MLO <input type="checkbox"/>		FLUSH MTD <input type="checkbox"/>		
FLOOR: <b>GROUND</b>		DOUBLE LUGS <input type="checkbox"/>		FEED-THRU LUGS <input type="checkbox"/>		NEMA TYPE ENCLOSURE <b>12</b>		
FED FROM: <b>MTS</b>		18,000 AIC		200% NEUTRAL <input type="checkbox"/>		PROVIDE INTEGRAL SPD		
CKT NO	LOAD DESCRIPTION	KVA			AMP/ POLE		LOAD DESCRIPTION	CKT NO
		A	B	C	POLE	POLE		
1	PUMP CONTROL PANEL	20.1			100/3	20/3	GRINDER AND CONTROL PANEL	2
3			20.1					4
5				20.1				6
7	SPARE				100/3	20/3	UH-1 UNIT HEATER ELEC RM	8
9								10
11								12
13	SPARE				20/1	20/3	UH-2 UNIT HEATER VALVE RM	14
15	SPARE				20/1			16
17	SPARE				20/1			18
19	SPARE				20/1		SPACE	20
21	SPARE				20/1		SPACE	22
23	SPARE				20/1		SPACE	24
25	SURGE PROTECTIVE DEVICE	0.1			20/3		SPACE	26
27			0.1			50/3	PANEL A (10KVA TRANSFORMER)	28
29								30
SUBTOTAL KVA		20.2	20.2	20.2				
TOTAL CONNECTED KVA		29.9	32.8	31.3	94.0		TOTAL CONNECTED AMPS	113.2
TOTAL DEMAND KVA				94.0		TOTAL DEMAND AMPS		113.2

PANEL DESIGNATION: <b>PANEL A</b>		<b>240 /120 V</b>		<b>1 PH 3 WIRE</b>		SURFACE MTD <input checked="" type="checkbox"/>		
ROOM NAME OR #: <b>ELEC RM</b>		AMPS 100		MCB <input checked="" type="checkbox"/> MLO <input type="checkbox"/>		FLUSH MTD <input type="checkbox"/>		
FLOOR: <b>GROUND</b>		DBL LUGS <input type="checkbox"/>		FT LUGS <input type="checkbox"/>		NEMA TYPE ENCLOSURE <b>12</b>		
FED FROM: <b>PANEL H (VIA XFMR)</b>		10,000 AIC						
CKT NO	LOAD DESCRIPTION	KVA		AMP/ POLE		LOAD DESCRIPTION	CKT NO	
		A	B	POLE	POLE			
1	SITE LIGHTING	0.4		20/1	20/1	1.0	BIOXIDE PANEL	2
3	LIGHTING		0.3	20/1	20/1		BIOXIDE HEAT TRACE	4
5	LIGHTING	0.3		20/1	20/1	0.5	PS CONTROLLER/TELEMETRY PANEL	6
7	RECEPTACLES		0.2	20/1	20/1		CONTROL RM FAN AND LOUVER	8
9	RECEPTACLES	0.2		20/1	20/1	0.5	VALVE VAULT FAN AND LOUVER	10
11	RECEPTACLES		0.2	20/1	20/1		SPACE	12
13	SPARE			20/1	20/1		SPACE	14
15	SPARE			20/1	20/1		SPACE	16
17	SPARE			20/1	20/1		SPACE	18
19	SPARE			20/1	20/1		SPACE	20
SUBTOTAL KVA		0.8	0.7			2.0	0.7	
TOTAL CONNECTED KVA		2.9	1.4	4.2		TOTAL CONNECTED AMPS		17.7
TOTAL DEMAND KVA				4.2		TOTAL DEMAND AMPS		17.7

UNLESS NOTED OTHERWISE:  
ALL 1PH BRANCH CIRCUITS SHALL BE 2#12, #12G, IN 3/4" C.  
ALL 3PH BRANCH CIRCUITS SHALL BE 3#10, #10G, IN 3/4" C.  
\*PROVIDE 3#3, #8G, IN 1-1/4" C.

SCALE: NOT TO SCALE

DELAWARE COUNTY

VERONA SECTION 1

FORCE MAIN AND PUMP STATION IMPROVEMENTS

PUMP STATION ELECTRICAL POWER DIAGRAM

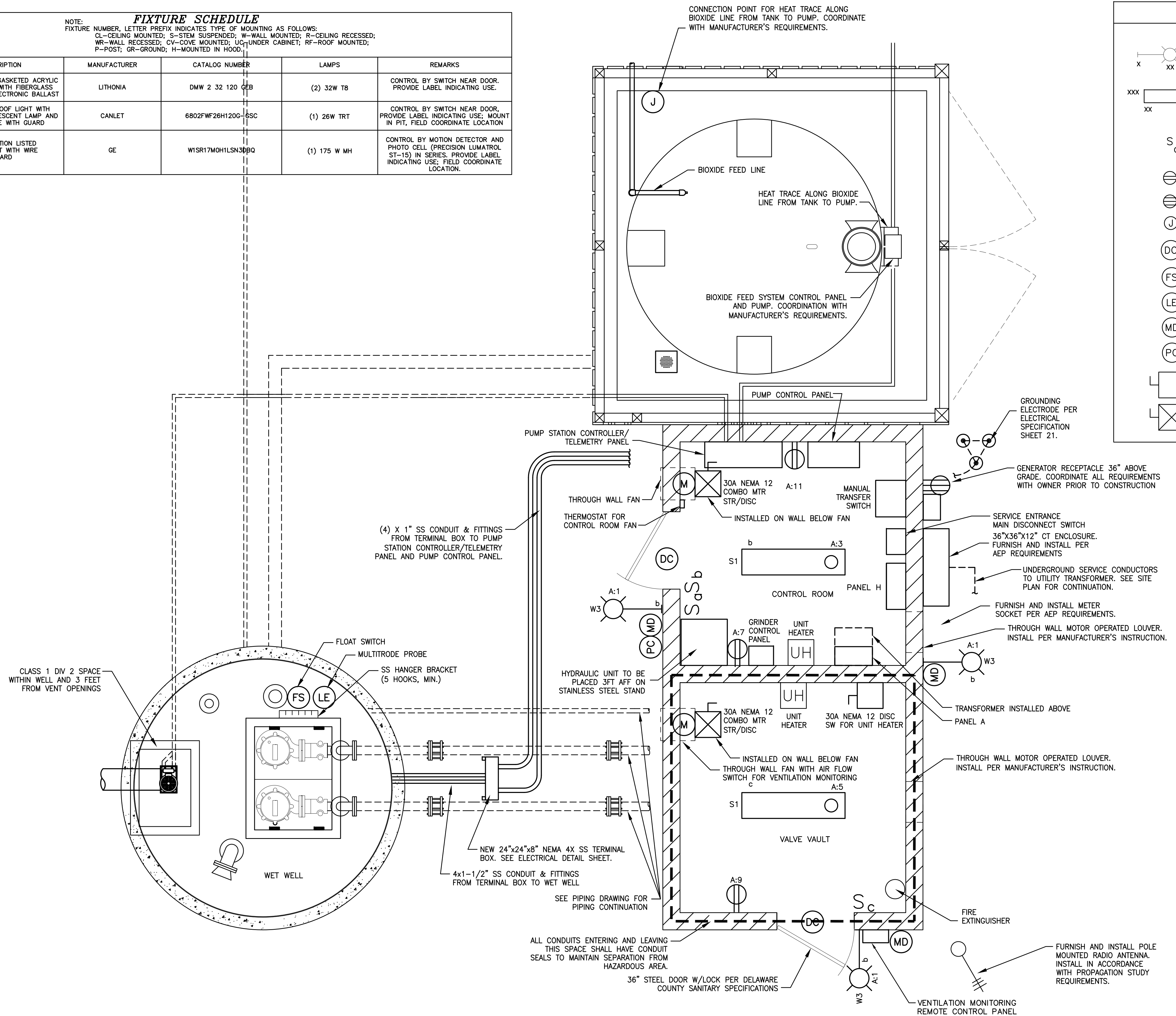
PREPARED BY:

**Stantec**  
1500 Lake Shore Drive, Suite 100  
Columbus, Ohio 43204  
(614) 486-4383  
(614) 486-4387



<b>FIXTURE SCHEDULE</b> <small>NOTE: FIXTURE NUMBER, LETTER PREFIX INDICATES TYPE OF MOUNTING AS FOLLOWS:            CL--CEILING MOUNTED; S--STEM SUSPENDED; W--WALL MOUNTED; R--CEILING RECESSED;            WR--WALL RECESSED; CV--COVE MOUNTED; UC--UNDER CABINET; RF--ROOF MOUNTED;            P--POST; GR--GROUND; H--MOUNTED IN HOOD.</small>					
FIXTURE NUMBER	DESCRIPTION	MANUFACTURER	CATALOG NUMBER	LAMPS	REMARKS
S1	ENCLOSED AND GASKETED ACRYLIC LENS FIXTURE WITH FIBERGLASS HOUSING AND ELECTRONIC BALLAST	LITHONIA	DMW 2 32 120 GEB	(2) 32W T8	CONTROL BY SWITCH NEAR DOOR. PROVIDE LABEL INDICATING USE.
W2	EXPLOSION PROOF LIGHT WITH COMPACT FLUORESCENT LAMP AND GLASS GLOBE WITH GUARD	CANLET	6802FWF26H120G-BSC	(1) 26W TRT	CONTROL BY SWITCH NEAR DOOR. PROVIDE LABEL INDICATING USE; MOUNT IN PIT, FIELD COORDINATE LOCATION
W3	WET LOCATION LISTED FLOODLIGHT WITH WIRE GUARD	GE	W1SR17MOH1LSN30PQ	(1) 175 W MH	CONTROL BY MOTION DETECTOR AND PHOTO CELL (PRECISION LUMATROL ST-15) IN SERIES. PROVIDE LABEL INDICATING USE; FIELD COORDINATE LOCATION.

ELECTRICAL SYMBOLS	
	WALL MOUNTED LIGHTING FIXTURE. RIGHT NOTATION INDICATES CIRCUIT NUMBER. LEFT NOTATION INDICATES LIGHTING PANEL. MIDDLE RIGHT NOTATION INDICATES TYPE OF FIXTURE. (SEE FIXTURE SCHEDULE)
	FLUORESCENT LIGHTING FIXTURE. UPPER LEFT NOTATION INDICATES TYPE OF FIXTURE. (SEE FIXTURE SCHEDULE) LOWER LEFT NOTATION INDICATES SWITCH. LOWER RIGHT NOTATION INDICATES CIRCUIT NUMBER.
	SWITCH, 1 POLE (LOWER CASE LETTER INDICATES CONTROL OF A CIRCUIT)
	DUPLEX CONVENIENCE RECEPTACLE,
	POWER RECEPTACLE - TYPE AS NOTED
	JUNCTION BOX - TYPE AS NOTED
	DOOR CONTROL - TYPE AS NOTED
	FLOAT SWITCH
	LEVEL SENSOR
	MOTION DETECTOR - TYPE AS NOTED
	PHOTO CELL - TYPE AS NOTED
	DISCONNECT SWITCH
	COMBINATION MOTOR STARTER DISCONNECT



GENERAL NOTES:  
 WET WELL CLASSIFICATION: 820-4.2-11a, CLASS 1 DIVISION 2, WITHIN WELL AND 3 FEET RADIUS AROUND VENTS.  
 VALVE VAULT: 820-4.2-30, CLASS 1 DIV 2 MITIGATED TO UNCLASSIFIED.  
 CONTROL ROOM: UNCLASSIFIED.

WET WELL POWER PLAN

GRADE LEVEL ELECTRICAL POWER PLAN

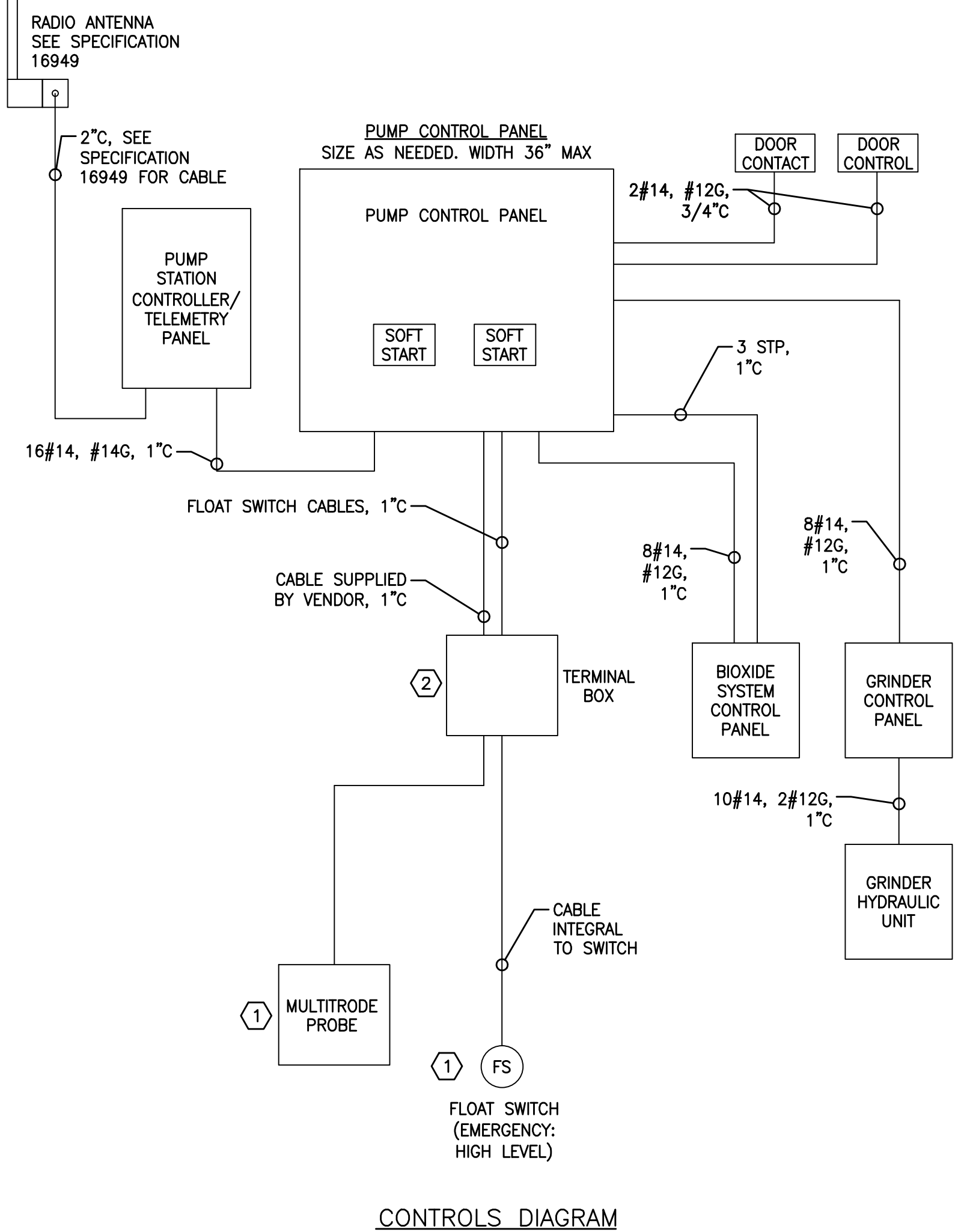
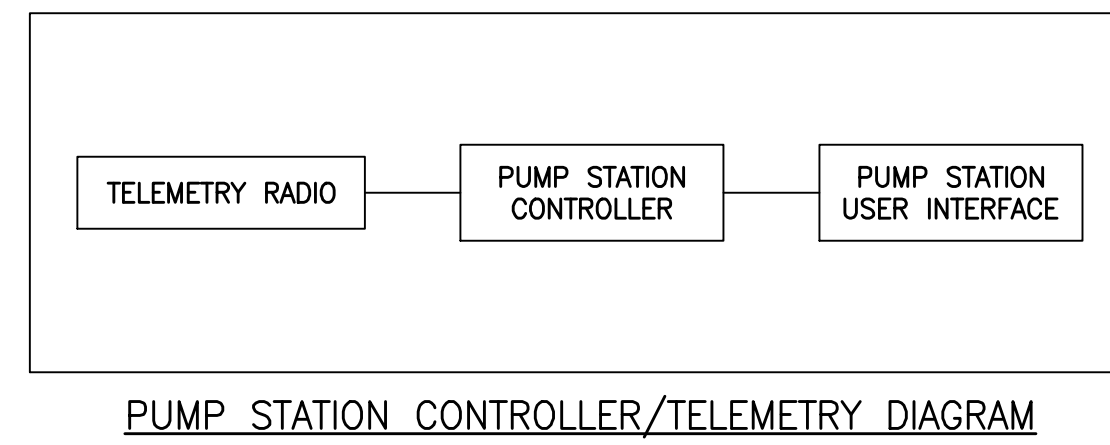
DELAWARE COUNTY  
**VERONA SECTION 1**  
 FORCE MAIN AND PUMP STATION IMPROVEMENTS  
 PUMP STATION POWER PLANS

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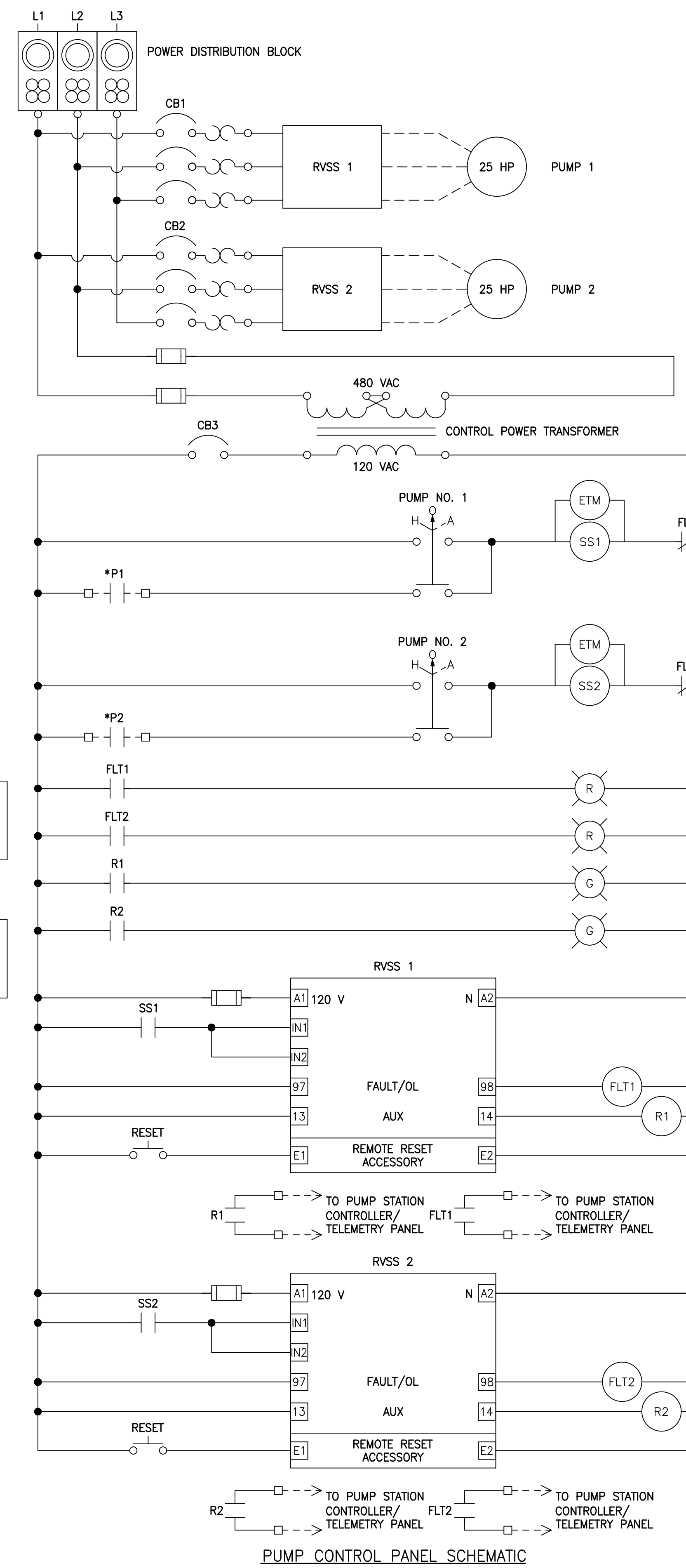
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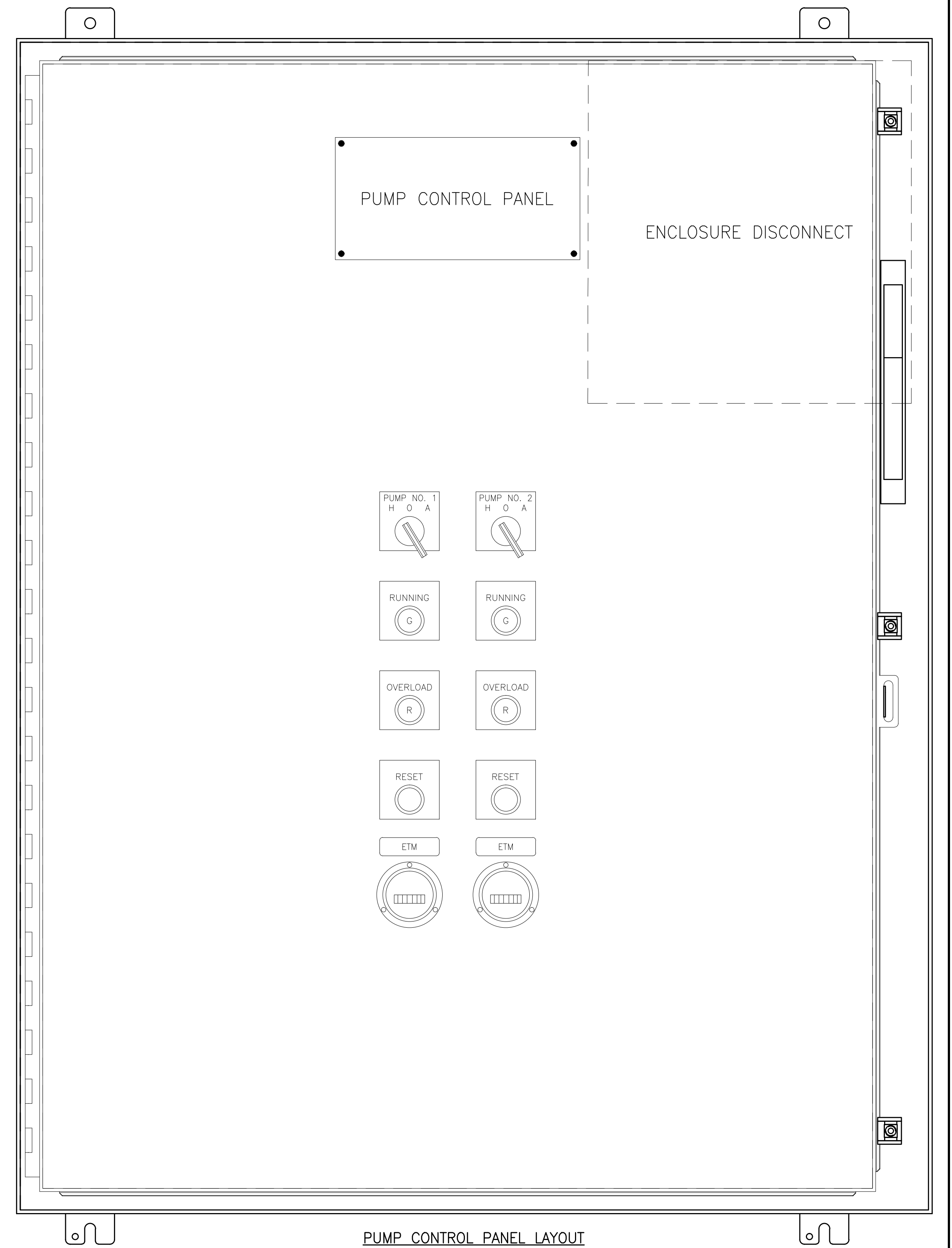


- CONTROL PANEL INSTALLATION REQUIREMENTS**
- WIRE ALL POWER AND DEVICES TO THE CONTROL PANELS AS DETAILED ON THE CONTRACT DRAWINGS.
  - CLEARLY IDENTIFY AND MARK ALL CONDUITS ENTERING AND LEAVING THE CONTROL PANELS AS TO THEIR DESTINATION.
  - KEEP ALL FIELD WIRING NEAT AND BUNDLED INSIDE THE CONTROL PANELS. ALL FIELD WIRING SHALL BE CONTAINED IN WIREWAY PROVIDED WITHIN THE CONTROL PANELS.
  - TAKE CARE TO KEEP CONDUIT FILINGS FROM ENTERING PANELS WHEN INSTALLING CONDUITS.

- CODED NOTES**
- ALL SIGNALS INTO AND OUT OF WET WELL TO BE SEALED PER NEC REQUIREMENTS.
  - NEMA 4X TERMINAL BOX TO BE MOUNTED AT TOP OF WET WELL. SIZE TO BE COORDINATED WITH WIRING REQUIREMENTS. ALL SENSOR CABLES (MULTITRODE AND FLOAT SWITCHES) SHALL PASS THROUGH TERMINAL BOX WITHOUT TERMINATING. TERMINALS NEED ONLY BE PROVIDED FOR MOTOR POWER LEADS.



**NOTES:**  
 1. ALL COMPONENTS LOCATED WITHIN PUMP CONTROL PANEL EXCEPT WHERE NOTED OTHERWISE.  
 \* INDICATES COMPONENTS LOCATED IN PUMP STATION CONTROLLER/TELEMETRY PANEL.

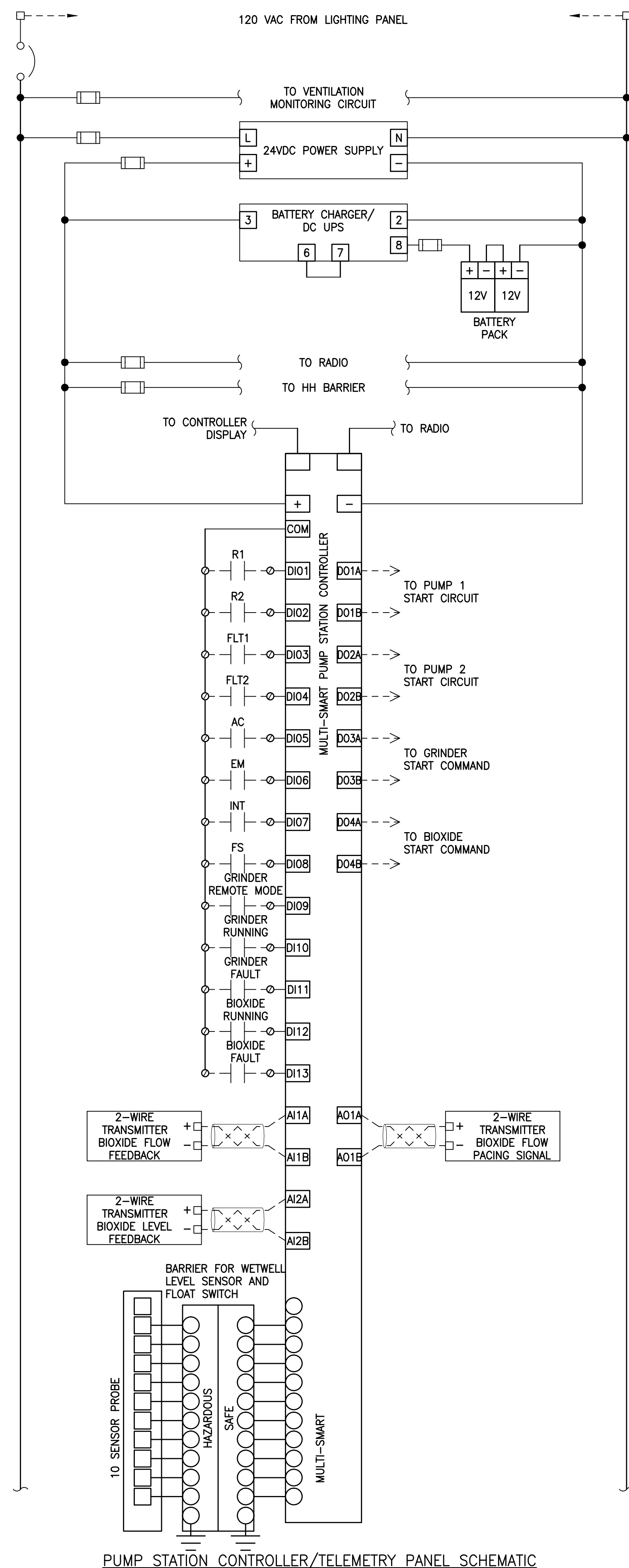


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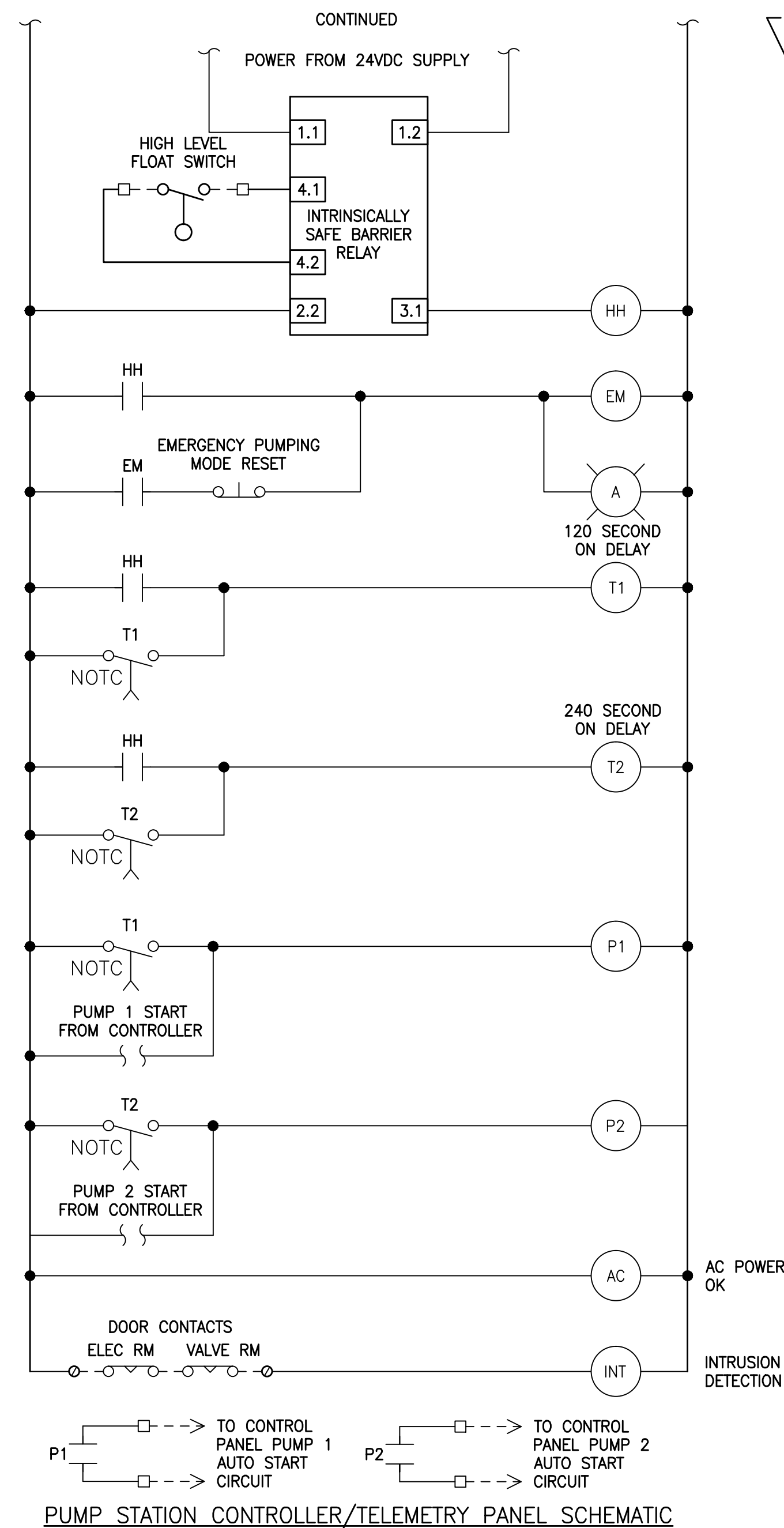
DELAWARE COUNTY  
**VERONA SECTION 1**  
 FORCE MAIN AND PUMP STATION IMPROVEMENTS  
 PUMP STATION ELECTRICAL CONTROL DIAGRAM

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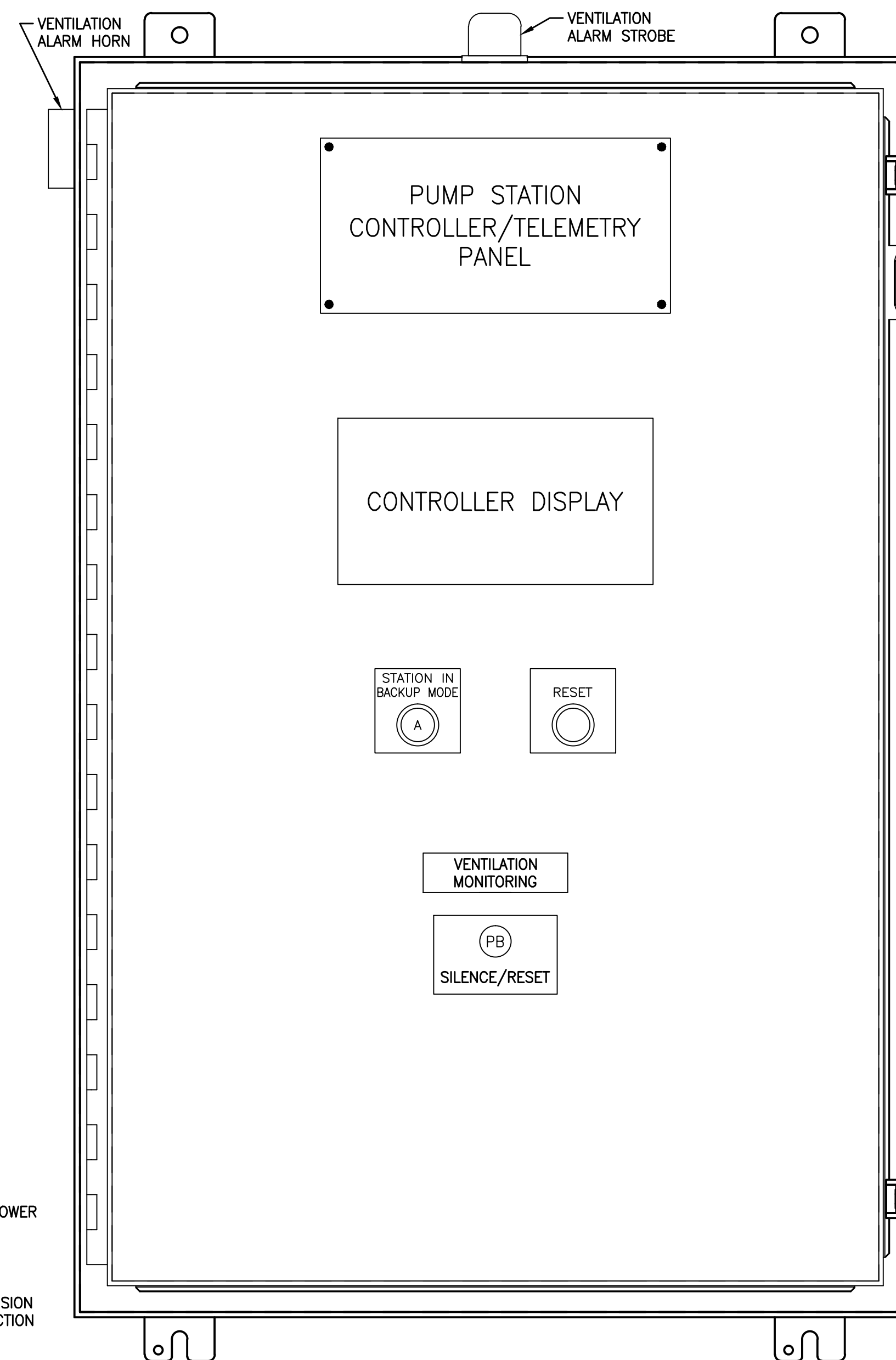
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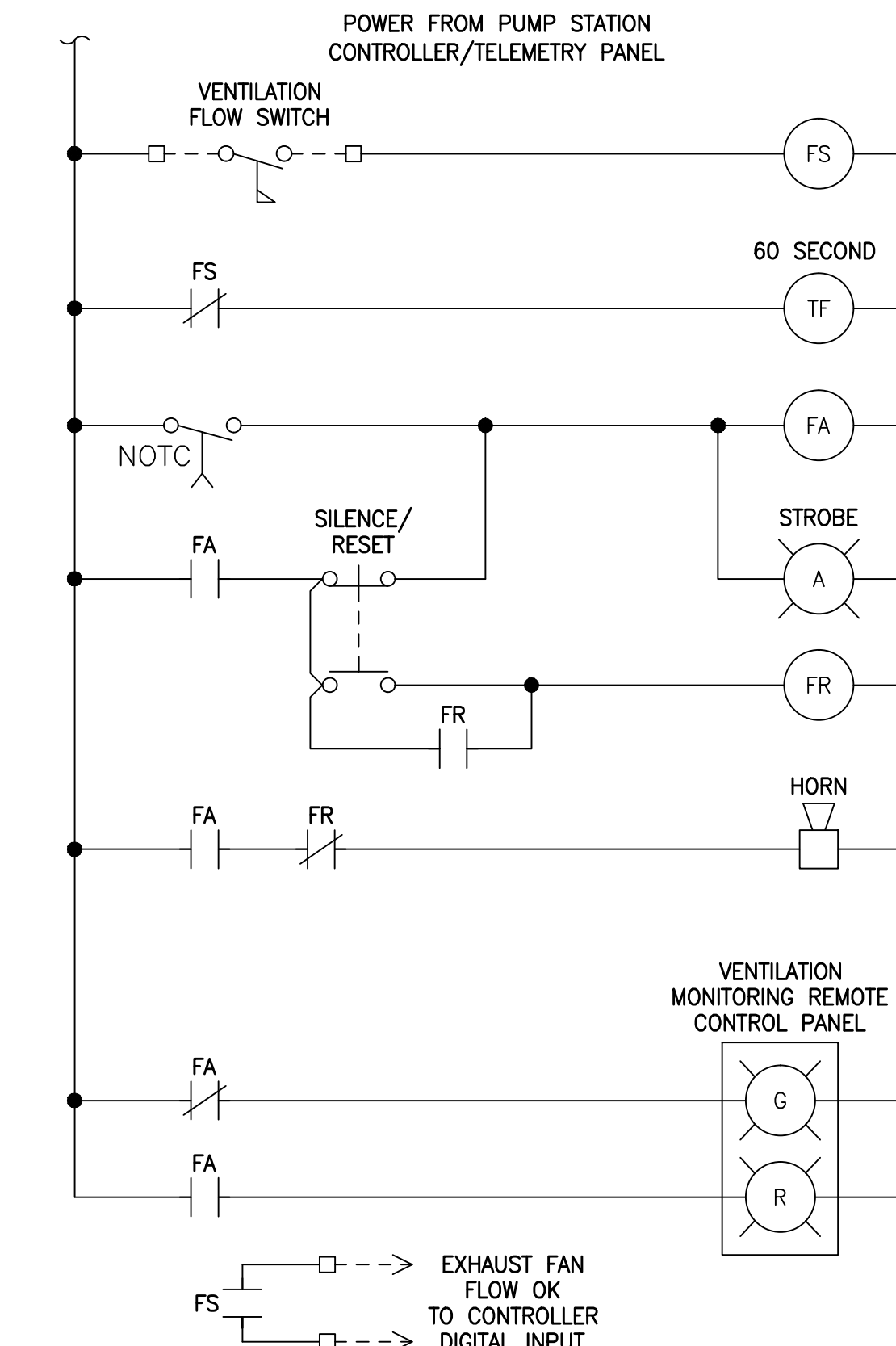
PUMP STATION CONTROLLER/TELEMETRY PANEL SCHEMATIC



PUMP STATION CONTROLLER/TELEMETRY PANEL SCHEMATIC

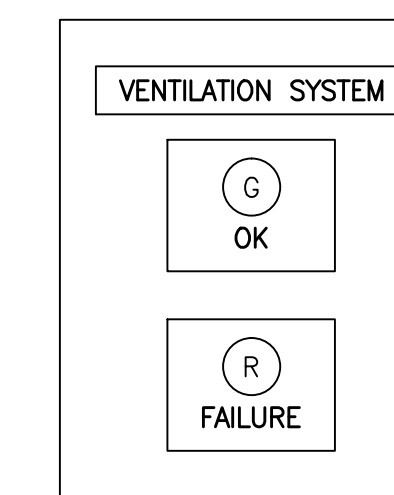


PUMP STATION CONTROLLER/TELEMETRY PANEL LAYOUT  
SCALE: 4" = 1"  
(NEMA 12 36"x24"x10")



VENTILATION MONITORING CIRCUIT

NOTES:  
ALL COMPONENTS CONTAINED IN PUMP STATION CONTROLLER/TELEMETRY PANEL EXCEPT WHERE DENOTED OTHERWISE.

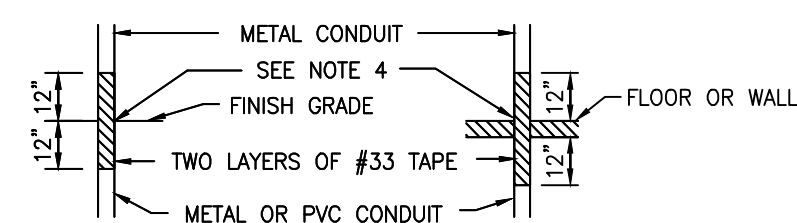
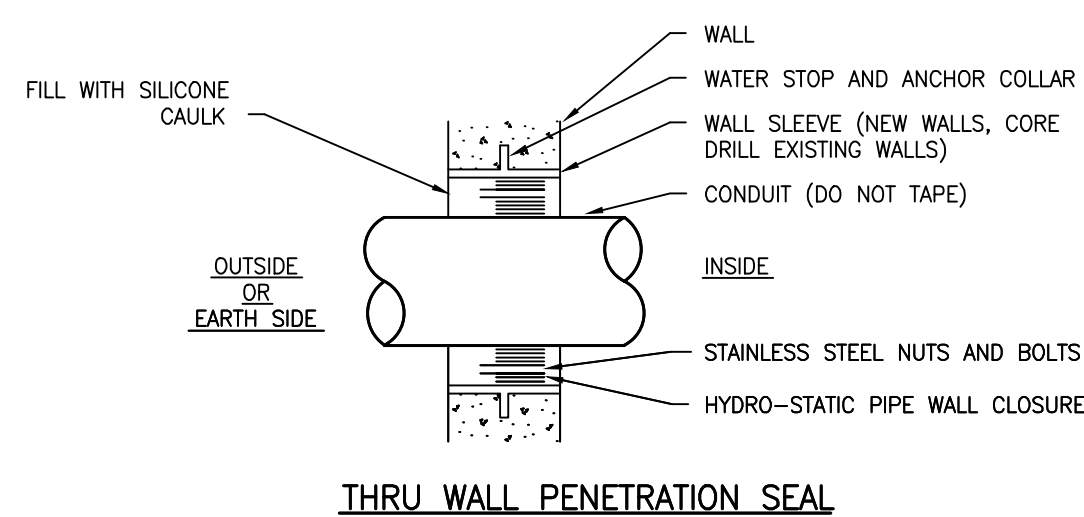
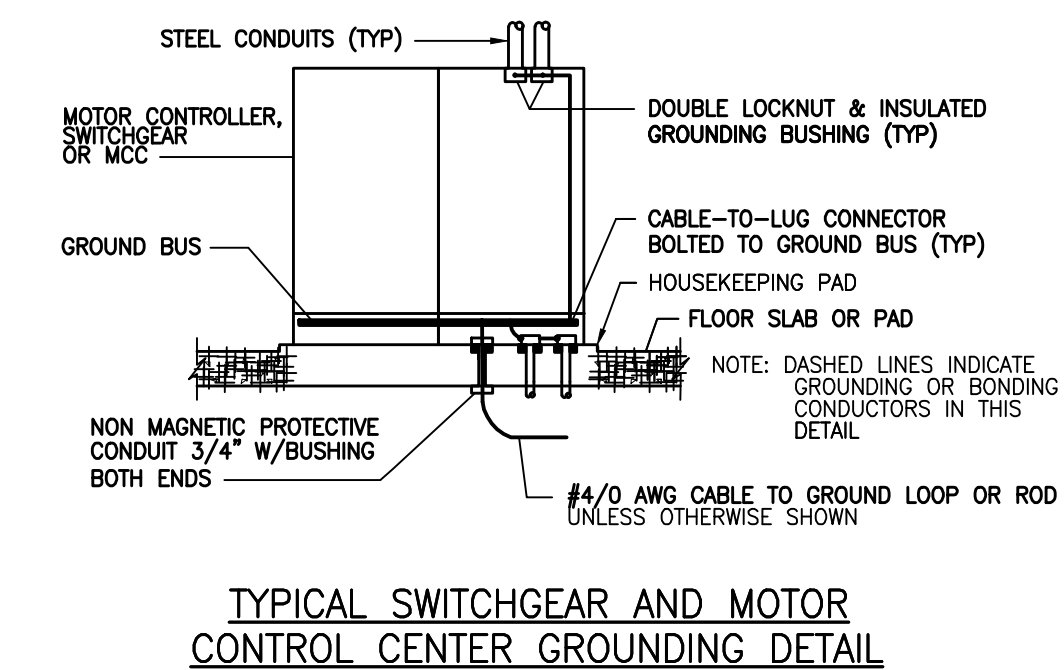
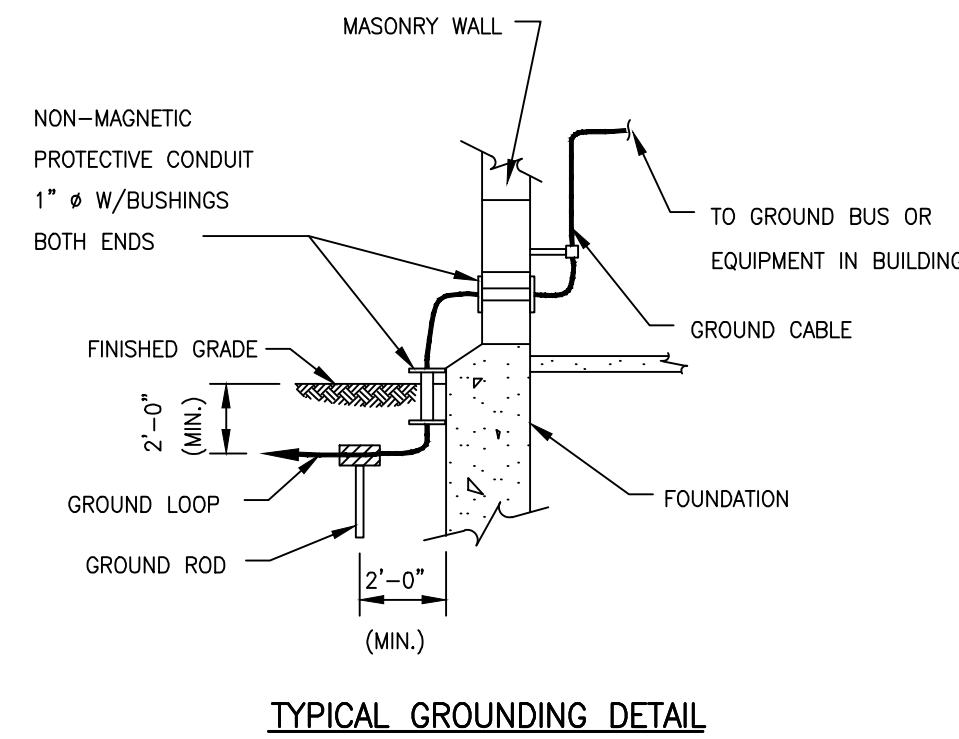
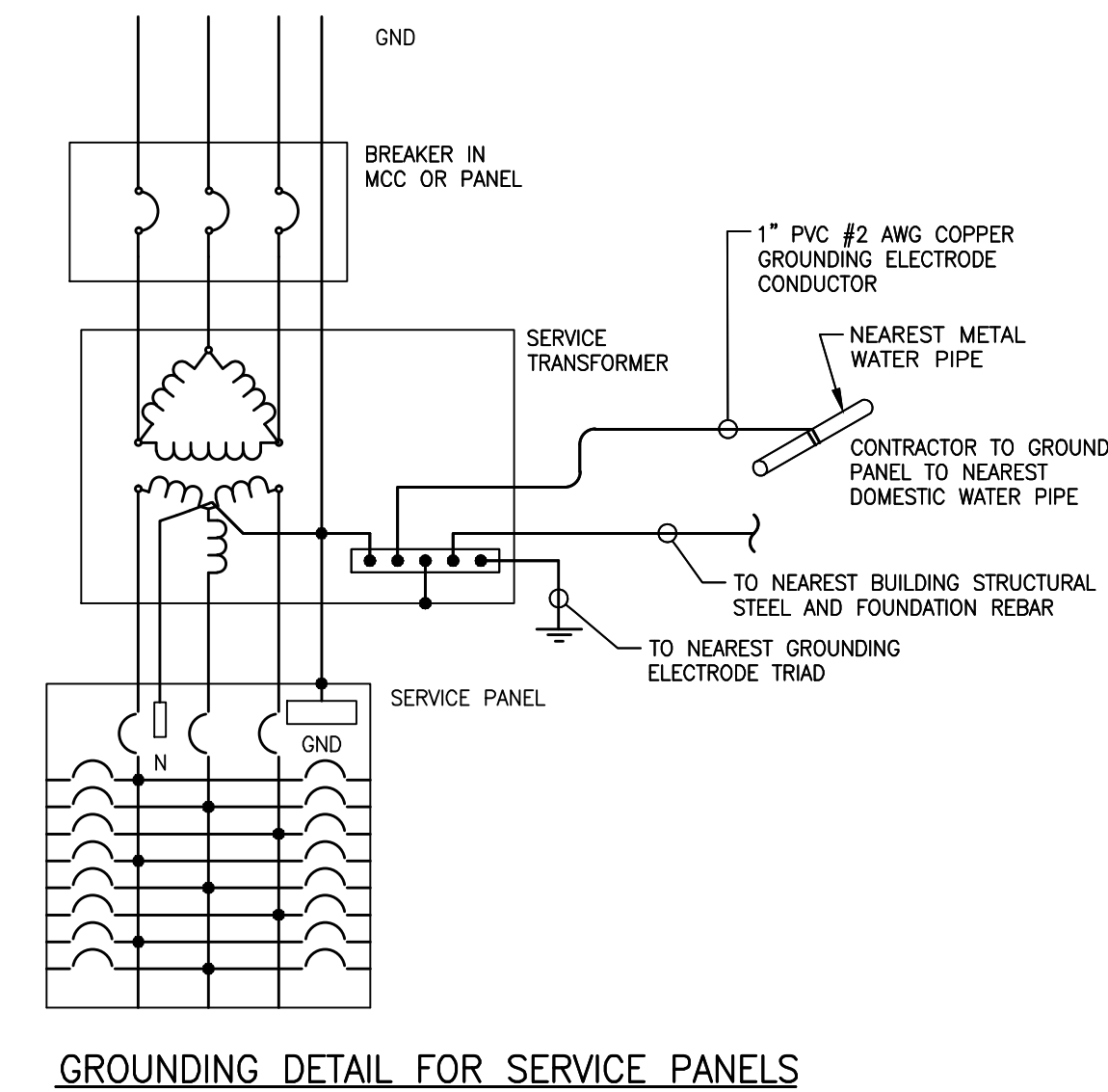
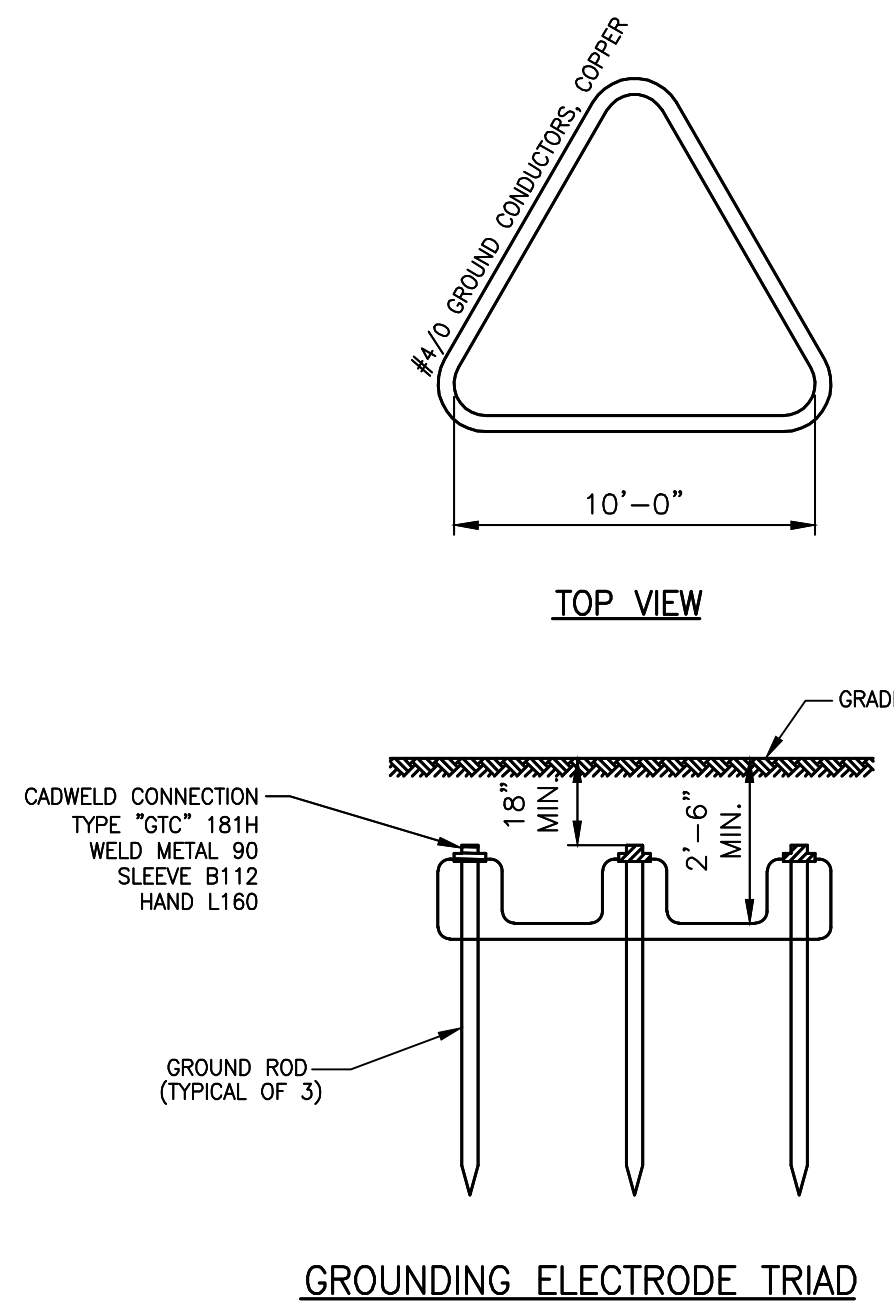
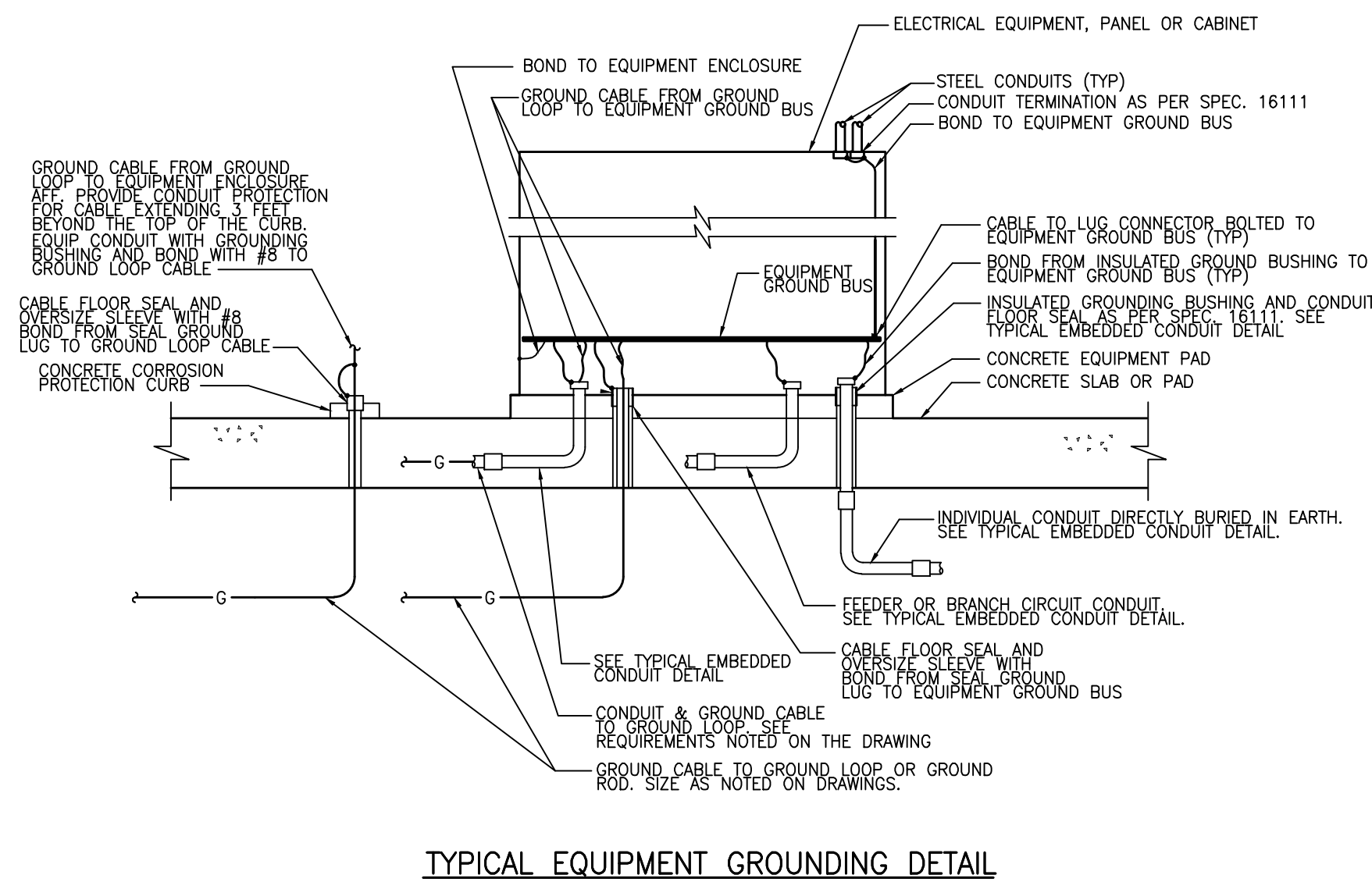


VENTILATION MONITORING REMOTE CONTROL PANEL

DELAWARE COUNTY  
VERONA SECTION 1  
FORCE MAIN AND PUMP STATION IMPROVEMENTS  
PUMP STATION CONTROL PANEL DIAGRAMS

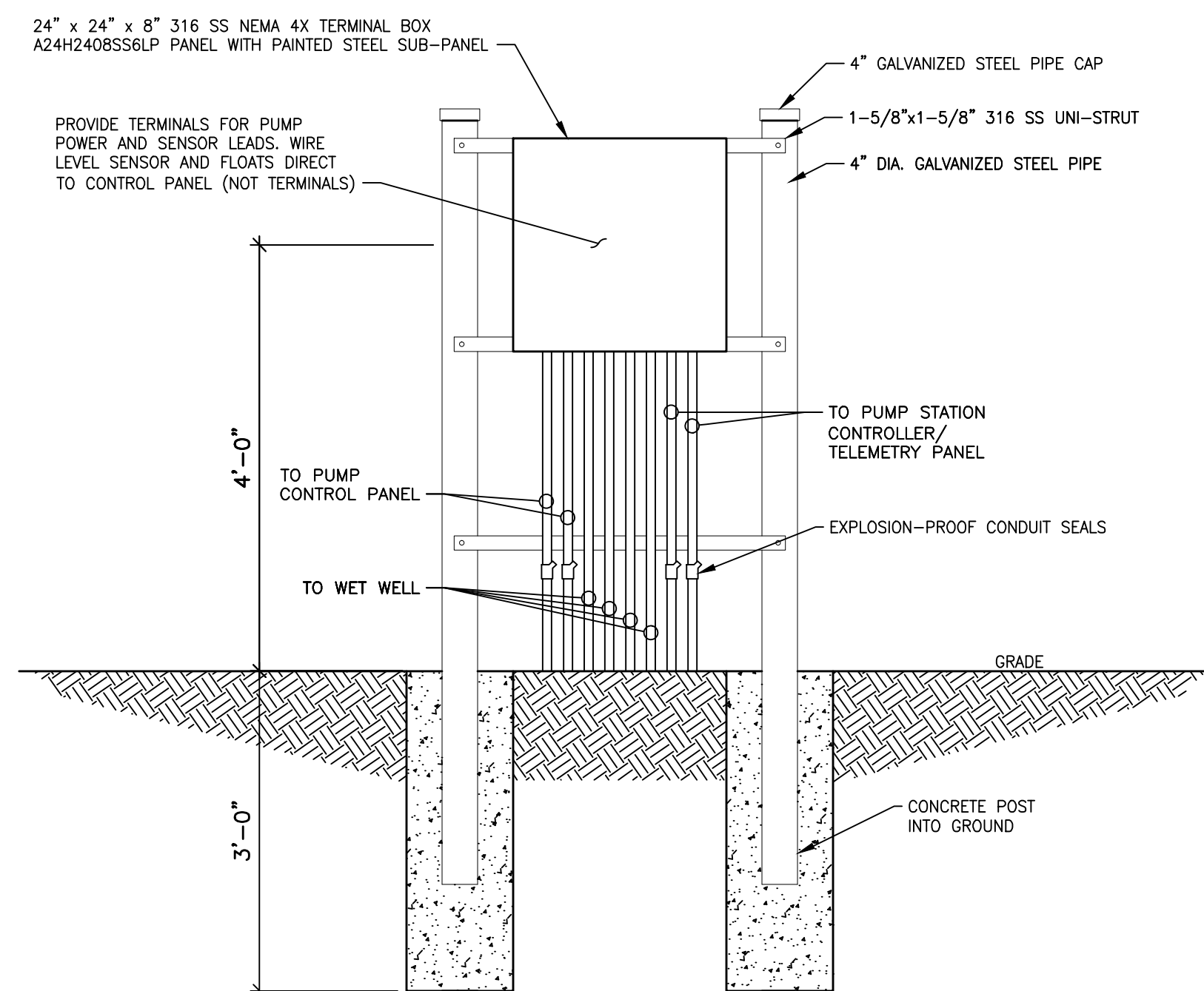
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**CONDUIT INSTALLATION DETAILS**

- NOTES:**
1. CONDUITS SHALL BE INSTALLED AS SHOWN, THRU FLOORS, BLOCK OR CONCRETE WALLS, AND EARTH.
  2. THIS INSTALLATION METHOD NOT REQUIRED FOR SLEEVED OPENINGS.
  3. TAPE TO 3" BEYOND TRANSITION IF BURIED CONDUIT IS PVC.
  4. TRANSITION FROM METAL TO PVC SHALL BE AT GRADE OR TOP OF FLOOR.



TYPE OF CONNECTION	BOLTED OR COMPRESSION		WELDED
	BURNDY CAT#	T&B CAT#	
CABLE TO LUG CABLE	YA	54000 SERIES	LA
CABLE TO ROD ROD	-	53000 SERIES	GT
ROD	GAR	-	GR
CABLE TO CABLE CABLE	GX	53000 SERIES	TV OR TA
CABLE TO PIPE PIPE OR CONDUIT	-	-	HA OR VS
CABLE TO FLAT SURFACE CABLE	GAR OR GD	3900 SERIES	-
BRAD TO PIPE CABLE	GB	-	HA OR HS
	GG	-	-

**GROUNDING CONNECTIONS**

DELAWARE COUNTY  
**VERONA SECTION 1**  
 FORCE MAIN AND PUMP STATION IMPROVEMENTS  
 PUMP STATION ELECTRICAL DETAILS

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GENERAL NOTES

SECTION 16010 GENERAL PROVISIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. DESCRIPTION OF PROJECT DRAWINGS AND SPECIFICATIONS.
B. GENERAL PRODUCT REQUIREMENTS.
C. REQUIREMENTS FOR SUBSTITUTIONS.

1.02 RELATED SECTIONS

- A. THE GENERAL CONDITIONS AND OTHER CONTRACT DOCUMENTS AS SET FORTH IN THE FOREGOING PAGES ARE HEREBY INCORPORATED INTO AND BECOME A PART OF THE SPECIFICATIONS FOR WORK UNDER THIS TITLE, INsofar AS THEY APPLY HERETO.
B. ALL SPECIFICATIONS UNDER THIS DIVISION TITLE ARE DIRECTED TO AND ARE THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR. UNLESS OTHER TRADES OR PERSONS ARE SPECIFICALLY MENTIONED, "ELECTRICAL CONTRACTOR" IS INFERRED AND INTENDED.
... F. THE LOCATION OF OUTLETS AND SWITCHES SHOWN ON THE DRAWINGS ARE APPROXIMATE, AND THE ENGINEER SHALL HAVE THE RIGHT TO RELOCATE ANY OUTLETS OR SWITCHES BEFORE THEY ARE INSTALLED WITHOUT ADDITIONAL COST.

1.04 SUBMITTALS

A. THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER FOR REVIEW, WITHIN SIX WEEKS AFTER DATE OF CONTRACT, SIX (6) COPIES OF MANUFACTURER'S DRAWINGS AND WIRING DIAGRAMS. THE ENGINEER WILL REVIEW CONTRACTOR'S SHOP DRAWINGS AND RELATED SUBMITTALS (AS INDICATED BELOW) WITH RESPECT TO THE ABILITY OF THE DETAILED WORK, WHEN COMPLETE, TO BE A PROPERLY FUNCTIONING INTEGRAL ELEMENT OF THE OVERALL SYSTEM DESIGNED BY THE ENGINEER.

Table with 2 columns: ITEMS, TYPE SUBMITTALS REQUIRED. Lists items like LIGHTING PANELS, FUSES, LIGHTING FIXTURES, TRANSFORMERS, etc., and their corresponding submittal requirements.

B. THE ENGINEER SHALL RETURN SHOP DRAWINGS AND RELATED MATERIALS WITH COMMENTS PROVIDED THAT EACH SUBMISSION HAS BEEN CALLED FOR AND IS STAMPED BY CONTRACTOR AS INDICATED ABOVE. THE ENGINEER SHALL RETURN WITHOUT COMMENT, ANY MATERIAL NOT CALLED FOR OR WHICH THE ENGINEER HAS NOT APPROVED.

C. ENGINEER'S REVIEW OF MANUFACTURER'S DRAWINGS OR SCHEDULES SHALL NOT RELIEVE THE CONTRACTOR FROM RESPONSIBILITY FOR ERRORS OR OMISSIONS IN MANUFACTURER'S DRAWINGS OR SCHEDULES AND DEVIATION FROM ENGINEER'S DRAWINGS OR SPECIFICATIONS.

D. AT THE COMPLETION OF THE JOB, BEFORE FINAL PAYMENT IS MADE, THE CONTRACTOR SHALL SUBMIT SIX (6) COPIES OF MANUFACTURER'S "AS-BUILT" DRAWINGS, INCLUDED WITH THE DRAWINGS SHALL BE THE OPERATING AND MAINTENANCE MANUALS AS CALLED FOR IN SECTION 16011.

E. MAINTAIN AT THE SITE, ONE COPY OF ALL DRAWINGS, SPECIFICATIONS, ADDENDA, APPROVED SHOP DRAWINGS, CHANGE ORDERS AND OTHER MODIFICATIONS, IN GOOD ORDER. THE DRAWINGS SHALL BE MARKED TO RECORD ALL CHANGES MADE DURING CONSTRUCTION ESPECIALLY DEVIATIONS MADE NECESSARY TO INCORPORATE EQUIPMENT DIFFERENT FROM BASE EQUIPMENT SPECIFIED. THESE SHALL BE AVAILABLE TO THE ENGINEER. THE DRAWINGS MARKED TO RECORD ALL CHANGES MADE DURING CONSTRUCTION SHALL BE DELIVERED TO THE ENGINEER FOR THE OWNER UPON COMPLETION OF THE WORK. THE ENGINEER WILL FURNISH AN ADDITIONAL SET OF DRAWINGS FOR THIS PURPOSE, UPON REQUEST.

PART 2 PRODUCTS

2.01 MATERIALS

A. ALL MATERIALS SHALL BE NEW AND UNDETERIORATED AND OF A QUALITY NOT LESS THAN THE MINIMUM SPECIFIED.

B. MATERIALS AND EQUIPMENT FOR WHICH THERE ARE UNDERWRITERS' LABORATORIES STANDARD REQUIREMENTS, LISTING AND LABELS, SHALL HAVE LISTING OF UNDERWRITERS' LABORATORIES AND BE SO LABELED.

2.02 SUBSTITUTIONS

- A. IT IS THE INTENT OF THIS ARTICLE TO MAKE THE SPECIFICATION OPEN IN EVERY RESPECT TO ALL AVAILABLE BRANDS OF MATERIAL OF EQUAL QUALITY DURING THE PERIOD OF BIDDING.
B. BID SHALL BE BASED ON FURNISHING THE BRANDS OF MATERIAL AND EQUIPMENT MENTIONED IN THE SPECIFICATIONS.
C. THE ELECTRICAL CONTRACTOR IS DIRECTED TO THE BASE BID EQUIPMENT LIST FOR THE LEVEL TRANSMITTERS AND PROGRAMMABLE LOGIC CONTROLLERS.
... F. WHERE THE CONTRACTOR FURNISHES EQUIPMENT OR MATERIAL SPECIFIED AS EQUAL OR WHICH IS ACCEPTED AS A SUBSTITUTION, HE IS RESPONSIBLE FOR ALL MODIFICATIONS REQUIRED FOR HIS WORK, AND WORK OF ALL OTHER TRADES TO INSTALL THE EQUIPMENT AND INSURE PERFORMANCE AS ORIGINALLY SPECIFIED.

2.03 GUARANTEES

- A. THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DEFECTS, REPAIRS AND REPLACEMENTS IN MATERIALS AND WORKMANSHIP FOR A PERIOD OF ONE (1) YEAR AFTER FINAL WRITTEN ACCEPTANCE BY THE OWNER. SEE SECTION 01740.
B. PRODUCT GUARANTEES GREATER THAN ONE (1) YEAR SHALL BE PASSED ALONG TO THE OWNER FOR FULL BENEFIT OF THE MANUFACTURER'S WARRANTY. SEE SECTION 01740.

2.04 QUANTITIES

A. ITEMS MAY BE REFERRED TO AS SINGULAR OR PLURAL ON THE DRAWINGS AND IN THE SPECIFICATIONS. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING QUANTITY OF EACH ITEM REQUIRED.

PART 3 EXECUTION

3.01 INSTALLATION

- A. FURNISH AND INSTALL ALL NECESSARY HANGERS, SUPPORTS, STRAPS, BOXES, FITTINGS AND OTHER SIMILAR APPURTENANCES NOT INDICATED ON THE DRAWINGS BUT WHICH ARE REQUIRED FOR A COMPLETE AND PROPERLY INSTALLED SYSTEM CONSISTENT WITH THE ARCHITECTURAL TREATMENT OF THE BUILDING.
B. CONTRACTOR SHALL INFORM HIMSELF FULLY REGARDING PECULIARITIES AND LIMITATIONS OF SPACE AVAILABLE FOR INSTALLATION OF MATERIALS AND APPARATUS UNDER THIS CONTRACT, AND SEE THAT ALL EQUIPMENT NECESSARY TO BE REACHED FROM TIME TO TIME FOR OPERATION AND MAINTENANCE ARE MADE EASILY ACCESSIBLE. CLEARANCES, WHEN POSSIBLE, SHALL BE GREATER THAN THOSE REQUIRED BY CODE.
... C. WORKING CLEARANCES: AT LEAST 6'-6" CLEARANCE MUST BE MAINTAINED IN FRONT OF ALL ELECTRICAL EQUIPMENT. PROVIDE AT LEAST 3'-6" FOR 480/277 VOLT AND 3'-0" FOR 208/120 VOLT CLEAR SPACE IN FRONT OF ALL ELECTRICAL EQUIPMENT AS WIDE AS THE EQUIPMENT WITH A MINIMUM OF 2'-6" WIDE. THE SAME CLEARANCE SHALL BE REQUIRED AT THE REAR OF REAR ACCESS EQUIPMENT.

3.02 WORKMANSHIP

- A. ELECTRICAL WORK SHALL MEET OR EXCEED THE STANDARDS OF INSTALLATION AND WORKMANSHIP SET FORTH IN THE LATEST EDITION OF THE NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION PUBLICATION ENTITLED NECA STANDARD OF INSTALLATION, EXCEPT AS OTHERWISE MODIFIED IN THESE SPECIFICATIONS OR SHOWN ON THE DRAWINGS.
B. THE ARCHITECT OR OWNER RESERVES THE RIGHT TO DIRECT THE REMOVAL AND REPLACEMENT OF ANY ITEM WHICH, IN HIS OPINION, DOES NOT PRESENT AN ORDERLY, NEAT OR WORKMANLIKE APPEARANCE, PROVIDED THAT SUCH ITEM CAN BE PROPERLY INSTALLED IN AN ORDERLY WAY BY METHODS USUAL IN SUCH WORK, OR WHICH DOES NOT COMPLY WITH THE CONTRACT DRAWINGS OR THESE SPECIFICATIONS. PERFORM SUCH REMOVALS OR REPLACEMENTS WHEN DIRECTED IN WRITING BY THE ARCHITECT AND AT THE CONTRACTOR'S EXPENSE.
... C. THE ELECTRICAL CONTRACTOR, INsofar AS THE WORK IS CONCERNED, SHALL AT ALL TIMES KEEP THE PREMISES IN A NEAT AND ORDERLY CONDITION, AND AT THE COMPLETION OF THE WORK SHALL PROPERLY CLEAN UP AND CART AWAY DEBRIS AND EXCESS MATERIALS.

SECTION 16011 OPERATION AND MAINTENANCE MANUALS AND TRAINING

PART 1 GENERAL

1.01 SECTION INCLUDES

DESCRIPTION OF PROJECT OPERATION AND MAINTENANCE MANUALS.

A. GENERAL FORMAT REQUIREMENTS.

1.02 RELATED SECTIONS

A. NOT USED.

1.03 DESCRIPTION

A. O&M MANUAL SHALL BE PROVIDED TO THE OWNER IN HARD COPY AND A CD-ROM. SUBMIT THREE (3) SOUND COPIES OF OPERATION AND MAINTENANCE MANUALS, 8- 1/2 IN. BY 11 IN. IN 3-RING HARDBACK BINDER. ALL DRAWINGS SHALL BE REDUCED TO 11 IN. X 17 IN, FOLDED AND PLACED INTO MANUALS. SUBMIT FOUR CD-ROM DISKS IN WORD FORMAT AND 4 CD-ROM DISKS IN PDF FORMAT.

B. FORMAT:

- 1. TITLE PAGE: TITLE OF PROJECT, OWNER, ADDRESS, DATE OF SUBMITTALS, NAME AND ADDRESS OF CONTRACTOR, NAME OF ENGINEER.
2. SECOND PAGE: INDEX OF MANUAL CONTENTS.
3. FIRST SECTION: A COPY OF EACH APPROVED SHOP DRAWING AND SUBMITTAL WITH AN INDEX AT THE BEGINNING OF THE SECTION.
4. SECOND SECTION: A LIST (SAME AS SUBMITTAL DRAWINGS) OF ALL EQUIPMENT USED ON THE PROJECT, TOGETHER WITH SUPPLIERS NAME AND ADDRESS.
... 8. PUMP CURVES AND SCADA SYSTEM MANUAL.

PART 2 PRODUCTS

NOT APPLICABLE

PART 3 EXECUTION

3.01 OWNER PERSONNEL INSTRUCTION

- A. AFTER PLACING SYSTEMS IN OPERATION, THOROUGHLY INSTRUCT DESIGNATED OWNER'S PERSONNEL ON OPERATION AND MAINTENANCE OF ALL EQUIPMENT AND SYSTEMS.
B. PROVIDE TRAINING AS CALLED FOR IN THE INDIVIDUAL SPECIFICATION SECTIONS. INSTRUCTIONS SHALL INCLUDE AT THE MINIMUM THE FOLLOWING:
1. LOCATION OF EQUIPMENT AND EXPLANATION OF FUNCTION.
2. REFER TO OPERATING INSTRUCTION MANUAL FOR RECORD AND CLARITY.
3. COORDINATION OF WRITTEN AND VERBAL INSTRUCTIONS SO THAT EACH IS COMPLETELY UNDERSTOOD BY FACILITY PERSONNEL.
... C. THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR ARRANGING FOR THE INSTRUCTION AND SUPERVISION AT A TIME CONVENIENT TO THE OWNER OR HIS REPRESENTATIVE AND FOR NOTIFYING THE OWNER OF THE TIME AT LEAST 48 HOURS IN ADVANCE.

SECTION 16020 WORK INCLUDED

PART 1 GENERAL

1.01 SECTION INCLUDES

A. DESCRIPTION OF WORK INCLUDED.

B. COORDINATION REQUIREMENTS.

1.02 RELATED SECTIONS

A. NOT USED.

1.03 DESCRIPTION

- A. FURNISH ALL MATERIALS, LABOR, TOOLS, TRANSPORTATION, INCIDENTALS AND APPURTENANCES TO COMPLETE IN EVERY DETAIL AND LEAVE IN WORKING ORDER ALL ITEMS OF WORK CALLED FOR HEREIN AND SHOWN ON THE ACCOMPANYING DRAWINGS.
B. IT IS THE INTENT THAT THE ENSUING WORK SHALL BE COMPLETE IN EVERY RESPECT AND THAT ANY MATERIAL OR WORK NOT SPECIFICALLY MENTIONED OR SHOWN ON THE DRAWINGS, BUT NECESSARY TO FULLY COMPLETE THE WORK, SHALL BE FURNISHED.
... C. CONTACT THE ENGINEER IMMEDIATELY IF THERE IS ANY QUESTION REGARDING THE MEANING OR INTENT OF EITHER PLANS OR SPECIFICATIONS, OR UPON NOTICING ANY DISCREPANCIES OR OMISSIONS IN EITHER PLANS OR SPECIFICATIONS.

PART 2 PRODUCTS

NOT APPLICABLE

PART 3 EXECUTION

3.01 CUTTING AND PATCHING

- A. AVOID CUTTING OF CONCRETE, MASONRY AND OTHER WORK BY USE OF INSERTS AND SLEEVES, AND WHEN NECESSARY SHALL BE DONE BY THE ELECTRICAL CONTRACTOR WITH SUCH TOOLS AND METHODS AS TO PREVENT UNNECESSARY DAMAGE TO SURROUNDING AREAS OR EQUIPMENT.
B. THIS CONTRACTOR SHALL GIVE THE GENERAL CONTRACTOR LOCATIONS AND SIZES OF ALL OPENINGS REQUIRED FOR THE INSTALLATION OF ELECTRICAL EQUIPMENT BEFORE WALLS, ETC., ARE STARTED. IF IT BECOMES NECESSARY TO CUT INTO NEW WORK BECAUSE OF THE FAILURE OF THIS CONTRACTOR TO NOTIFY THE GENERAL CONTRACTOR, THEN THE GENERAL CONTRACTOR SHALL COORDINATE ANY NECESSARY CUTTING BY THIS CONTRACTOR. PATCHING SHALL BE AT THIS CONTRACTOR'S EXPENSE.
... C. NO CUTTING SHALL BE DONE WHICH WILL IN ANY WAY REDUCE THE STRUCTURAL STRENGTH OF THE BUILDING. SHOULD SUCH CUTTING BE FOUND NECESSARY THE ENGINEER MUST FIRST BE FULLY INFORMED OF, AND CONSENT TO, THE PROPOSED OPERATION.

D. ALL CUTTING THROUGH POURED CONCRETE SLABS AND WALLS SHALL BE DONE WITH CORE DRILLS. NO JACKHAMMERS WILL BE ALLOWED.

E. REPAIR OF DAMAGES, BY THIS CONTRACTOR, TO NEWLY PATCHED AND REFINISHED AREAS SHALL BE DONE BY THE GENERAL CONTRACTOR AT THIS CONTRACTOR'S EXPENSE) IN KIND TO MATCH EXISTING CONDITION.

3.02 CLEANING AND PAINTING

A. ALL ELECTRICAL EQUIPMENT SHALL BE KEPT DRY AND CLEAN DURING THE CONSTRUCTION PERIOD. MOTOR CONTROL CENTERS, GENERATORS, ATS, PANELS ETC., SHALL BE COVERED WITH FIBERGLASS REINFORCED PLASTIC SHEETING AS A MINIMUM FORM OF PROTECTION. PROVIDE ADDITIONAL PROTECTION, IF JOB CONDITIONS SO REQUIRE.

B. INTERIORS OF ALL ENCLOSURES, MOTOR CONTROL CENTERS, ETC. SHALL BE THOROUGHLY VACUUMED, CLEANED AND ALL DIRT AND DEBRIS REMOVED BEFORE INSTALLING TERM OR COVERS.

C. ALL FINISHED SURFACES OF EQUIPMENT FURNISHED UNDER THIS CONTRACT SHALL BE THOROUGHLY CLEANED OF DIRT AND ALL SCRATCHED OR DAMAGED SURFACES SHALL BE TOUCHED UP WITH MATCHING MATERIALS BEFORE FINAL ACCEPTANCE OF THE WORK. NO EXPOSED FERROUS METAL SURFACES SHALL BE LEFT UNPAINTED. TOUCH-UP ALL GALVANIZED, IF SCRATCHED, WITH TWO COATS OF ALUMINUM PAINT.

D. PRIME AND PAINT BOTH SIDES AND EDGES OF ALL WOOD MOUNTING PANELS WITH TWO COATS OF GRAY FLAMEPROOF PAINT.

3.03 EXCAVATION AND BACKFILL

A. PROVIDE ALL EXCAVATION AND BACKFILL NECESSARY TO GET THE WORK IN PLACE. SUCH EXCAVATION SHALL BE CARRIED TO DIMENSIONS AND DEPTHS INDICATED OR AS NECESSARY FOR THE PROPER INSTALLATION AND COMPLETION OF THE WORK.

B. REMOVE ALL FORMWORK AND DEBRIS BEFORE BACKFILL IS PLACED. BACKFILL IS TO BE BROUGHT TO PROPER ELEVATION AND SHALL BE PUDDLED, TAMPED AND THOROUGHLY COMPACTED. FINISHED GRADE SHALL BE REPLACED IN KIND, I.E., SOD, GRAVEL, BLACKTOP, CONCRETE, ETC.

C. SURPLUS EARTH REMOVED FROM EXCAVATIONS SHALL BE REMOVED FROM THE SITE BY THIS CONTRACTOR, UNLESS THE GENERAL CONTRACTOR REQUESTS THAT IT BE RETAINED AS FILL TO ESTABLISH ROUGH GRADES.

SECTION 16025 CODES AND FEES

PART 1 GENERAL

1.01 SECTION INCLUDES.

A. DESCRIPTION OF APPLICABLE CODES, STANDARDS AND PERMIT REQUIREMENTS.

1.02 RELATED SECTIONS.

(NOT USED)

1.03 DESCRIPTION.

A. ALL WORK PERFORMED UNDER THIS SPECIFICATION SHALL BE DONE IN ACCORDANCE WITH THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE AS PREPARED AND PUBLISHED BY THE NATIONAL FIRE PROTECTION ASSOCIATION, NATIONAL ELECTRICAL SAFETY CODE, STANDARDS OF NATIONAL BUREAU OF FIRE UNDERWRITERS, AND ANY FEDERAL, STATE CODES OR LOCAL CODES APPLYING.

B. OBTAIN AND PAY FOR ALL PERMITS REQUIRED BY ALL LAWS AND REGULATIONS OR PUBLIC AUTHORITY HAVING SUCH JURISDICTION. FILE DRAWINGS NECESSARY TO OBTAIN PERMITS.

C. THE ELECTRICAL CONTRACTOR SHALL OBTAIN AND PAY FOR ALL METERING EQUIPMENT REQUIRED BY THE POWER COMPANY FOR SERVICE, IF REQUIRED.

PART 2 PRODUCTS

(NOT APPLICABLE)

PART 3 EXECUTION

(NOT APPLICABLE)

SECTION 16030 TESTS AND INSPECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES.

A. DESCRIPTION OF TESTS AND INSPECTIONS.

B. DESCRIPTION OF UNACCEPTABLE WORK CORRECTION PROCEDURE.

C. DESCRIPTION OF GUARANTEE.

1.02 RELATED SECTIONS.

A. SECTION 01690 - INSTRUCTION OF OPERATING PERSONNEL

1.03 DESCRIPTION.

A. OBTAIN ALL INSPECTIONS REQUIRED BY ALL LAWS, ORDINANCES, RULES, REGULATIONS OR PUBLIC AUTHORITY HAVING JURISDICTION AND OBTAIN CERTIFICATES OF SUCH INSPECTIONS AND SUBMIT IT TO THE ENGINEER. OWNER SHALL PAY FOR ALL SUBMITTAL FEES, CONTRACTOR SHALL PAY FOR OTHER EXPENSES IN CONNECTION THEREIN.

B. BEFORE ANY ELECTRICAL WORK IS COVERED, THE ENGINEER WILL INSPECT THE ELECTRICAL WORK COMPLETED AT THAT TIME.

C. WHEN THE ENGINEER MAKES FINAL INSPECTION OF ALL ELECTRICAL WORK HE WILL ORDER TESTS PERFORMED AS DEEMED NECESSARY. THESE TESTS MAY INCLUDE OPERATION OF LIGHTS AND EQUIPMENT, CONTINUITY OF CONDUIT SYSTEM, GROUNDING RESISTANCES AND INSULATION RESISTANCES AND CHECKING OUT THE OPERATION OF THE VARIOUS SYSTEMS. THE CONTRACTOR SHALL PROVIDE SUCH ASSISTANCE AS REQUIRED (INCLUDING MANPOWER AND TOOLS) TO START AND STOP THE VARIOUS SYSTEMS, ETC. AND SIMULATE CONTROL SEQUENCES. THE CONTRACTOR (NOT THE ENGINEER) IS RESPONSIBLE TO TURN ON THE SYSTEMS AND DEMONSTRATE THEY ARE OPERATING PROPERLY.

D. SUBMIT DATA TAKEN DURING SUCH TEST TO ENGINEER.

E. WORK SHALL BE UNACCEPTABLE WHEN FOUND TO BE DEFECTIVE OR CONTRARY TO THE PLANS, SPECIFICATIONS, AND CODES SPECIFIED OR ACCEPTED STANDARDS OF GOOD WORKMANSHIP.

F. THE CONTRACTOR SHALL PROMPTLY CORRECT ALL WORK FOUND UNACCEPTABLE BY THE ENGINEER WHETHER OBSERVED BEFORE OR AFTER SUBSTANTIAL COMPLETION AND WHETHER OR NOT FABRICATED, INSTALLED OR COMPLETED. THE CONTRACTOR SHALL BEAR ALL COSTS OF CORRECTING SUCH UNACCEPTABLE WORK, INCLUDING COMPENSATION FOR THE ENGINEER'S ADDITIONAL SERVICES MADE NECESSARY THEREBY.

G. THIS CONTRACTOR IS RESPONSIBLE FOR ALL DEFECTS, REPAIRS AND REPLACEMENTS IN MATERIALS AND WORKMANSHIP, FOR A PERIOD OF ONE (1) YEAR AFTER THE ENGINEER APPROVES FINAL PAYMENT. SEE SECTION 01740.

1.04 SUBMITTALS.

(NOT USED)

PART 2 PRODUCTS

(NOT APPLICABLE)

PART 3 EXECUTION

3.01 PERFORMANCE.

(NOT USED)

3.02 LIGHTING.

A. ALL LAMPS IN ALL FIXTURES SHALL BE INSTALLED NEW AND THE ENTIRE SYSTEM SHALL BE CHECKED FOR SATISFACTORY OPERATION.

3.03 PHASE ROTATION.

A. PROVE THAT THE PANEL BOARDS, ETC., ARE CONNECTED FOR CLOCKWISE (A-B-C) ROTATION AS MARKED BY THE MANUFACTURER.

B. PROVE THAT ALL ELECTRICAL EQUIPMENT IS CONNECTED FOR CLOCKWISE ROTATION (A-B-C).

3.04 LOAD BALANCE.

A. PROVE THAT LOADS ARE BALANCED ACROSS ALL PHASES OF PANEL BOARDS.

B. OBTAIN OPTIMUM PHASE BALANCE UNDER FULL LOAD CONDITION BY RECONNECTION OF PANEL BOARD FEEDERS AT THE MAIN SWITCHBOARD. ANY PANEL BOARDS REQUIRING CIRCUIT CHANGES FOR BALANCE SHALL REFLECT THESE CHANGES IN THE PANEL DIRECTORY AND WIRE COLOR IDENTIFICATION. COLOR CHANGE CAN BE MADE WITH COLORED TAPE AT PANEL.

C. PAY SPECIAL ATTENTION TO PREVENT REVERSE ROTATION OF MOTORS DURING LOAD BALANCE AND ADJUSTMENTS.

3.05 EQUIPMENT.

A. PROVIDE NECESSARY ELECTRICAL PERSONNEL AND TESTING INSTRUMENTS AS REQUIRED TO ASSIST IN TESTING OF INSTALLATION.

SECTION 16111 CONDUITS

PART 1 GENERAL

1.01 SECTION INCLUDES.

A. ALL CONDUITS, FITTINGS, HARDWARE, ETC., FOR A COMPLETE RACEWAY SYSTEM.

1.02 RELATED SECTIONS.

A. SEE SECTION 16130 - BOXES AND PLATES.

1.03 DESCRIPTION.

A. FURNISH AND INSTALL COMPLETE CONDUIT SYSTEM AS SPECIFIED HEREIN AND SHOWN ON THE DRAWINGS.

1.04 SUBMITTALS.

A. PRODUCT DATA:

1. MANUFACTURER'S CUTSHEETS ON ALL PRODUCTS PROPOSED FOR USE.

PART 2 PRODUCTS

2.01 CONDUIT - ELECTRICAL METALLIC TUBING (EMT)

A. ALL WIRING IN BUILDING INTERIOR INCLUDING FEEDERS, BRANCH CIRCUITS, AND AUXILIARY WIRING SHALL BE RUN IN THIN WALL (EMT) CONDUIT.

B. ALL STEEL CONDUITS SHALL BE GALVANIZED AND ALL CONDUITS SHALL HAVE THE MANUFACTURER'S NAME AND U.L. LABEL ATTACHED TO OR STAMPED ON EACH PIECE.

C. EACH SECTION OF CONDUIT FURNISHED SHALL BE STRAIGHT, FREE FROM BUSTERS AND OTHER DEFECTS AND IN 10'-0" LENGTHS. GALVANIZING SHALL BE OF SUCH NATURE AND SO APPLIED THAT IT WILL NOT CRACK OR FLAKE WHEN CONDUIT IS BENT.

D. ALL CONDUIT SIZES STATED HEREIN OR MARKED ON THE DRAWINGS IS MINIMUM SIZE AND SHALL BE NO LESS THAN 3/4" UNLESS OTHERWISE NOTED.

2.02 CONDUIT - RIGID METALLIC.

A. ALL CONDUITS ON BUILDING EXTERIOR, IN EXTERIOR PARTITIONS, IN POURED CONCRETE (NOT DUCT BANK), BURIED BENEATH CONCRETE SLABS OR IN FIRE PUMP ROOMS SHALL BE RIGID HEAVY WALL CONDUIT. ALL CONDUITS PASSING THROUGH EARTH SHALL BE FURTHER PROTECTED FROM CORROSION ALONG THEIR FULL LENGTH TO TERMINATION POINTS ABOVE GRADE BY INSTALLATION OF ANTI-CORROSION TAPE IDENTIFIED FOR SUCH USE BY THE MANUFACTURER.

B. ALL STEEL CONDUITS SHALL BE GALVANIZED AND ALL CONDUITS SHALL HAVE THE MANUFACTURER'S NAME AND U.L. LABEL ATTACHED TO OR STAMPED ON EACH PIECE.

C. EACH SECTION OF CONDUIT FURNISHED SHALL BE STRAIGHT, FREE FROM BUSTERS AND OTHER DEFECTS AND IN 10'-0" LENGTHS. GALVANIZING SHALL BE OF SUCH NATURE AND SO APPLIED THAT IT WILL NOT CRACK OR FLAKE WHEN CONDUIT IS BENT.

D. ALL CONDUIT SIZES STATED HEREIN OR MARKED ON THE DRAWINGS IS MINIMUM SIZE AND SHALL BE NO LESS THAN 3/4" UNLESS OTHERWISE NOTED.

2.03 CONDUIT - FLEXIBLE METALLIC

A. FLEXIBLE NEOPRENE-CLAD GALVANIZED STEEL CONDUIT SHALL BE USED FOR "MAKEUP" CONNECTIONS TO ROTATING MACHINERY AND HEATING ELEMENTS. LIGHTING FIXTURES MAY BE SUPPLIED WITH SHORT LENGTHS OF FLEXIBLE CONDUIT WITH GREEN GROUND WIRE.

B. MINIMUM SIZE SHALL BE 3/4" TRADE SIZE.

2.04 CONDUIT - RIGID NON-METALLIC.

A. NON-METALLIC CONDUIT AND FITTINGS FOR CONCRETE ENCASEMENT (DUCT BANK) SHALL BE RIGID PVC, POWER AND COMMUNICATION TYPE EB, UL LISTED.

B. NON-METALLIC CONDUIT AND FITTINGS FOR DIRECT BURIAL SHALL BE RIGID SCHEDULE 80 PVC.

C. NON-METALLIC CONDUIT AND FITTINGS SPECIFIED OR SHOWN ON THE DRAWINGS FOR INTERIOR APPLICATIONS SHALL BE RIGID SCHEDULE 40 PVC.

D. NON-METALLIC SUPPORTS FOR GROUNDING ELECTRODE CONDUITS SHALL BE BURNDY NYLOCLIP OR BY CLIC.

2.05 CONDUIT - STAINLESS STEEL.

A. STAINLESS STEEL CONDUIT AND FITTINGS FOR EXTERIOR USE WHERE SHOWN ON THE CONTRACT DRAWINGS SHALL BE TYPE 316 STAINLESS STEEL, UL LISTED.

B. STAINLESS STEEL CONDUIT AND FITTINGS SHALL BE RIGID HEAVYWALL SCHEDULE 40 CONDUIT.

C. EACH SECTION OF CONDUIT FURNISHED SHALL BE STRAIGHT, FREE FROM BUSTERS AND OTHER DEFECTS AND IN 10'-0" LENGTHS. CONDUIT SHALL BE THREADED ON BOTH ENDS WITH NPT THREADS.

D. ALL CONDUIT SIZES STATED HEREIN OR MARKED ON THE DRAWINGS IS MINIMUM SIZE AND SHALL BE NO LESS THAN 3/4" UNLESS OTHERWISE NOTED.

2.06 CONDUIT FITTINGS - METALLIC.

A. ALL CONNECTORS SHALL BE OF THE INSULATED THROAT TYPE. ALL FITTINGS SHALL BE STEEL. NO DIE CAST FITTINGS WILL BE ALLOWED. CONTRACTOR MAY USE THOMAS AND BETTS, RACO, STEEL CITY, OR MIDWEST FITTINGS. ALL RIGID CONDUIT SHALL HAVE THREADED CONNECTIONS.

B. "MINERALAC" TYPE SUPPORTS AND "UNISTRUT" TYPE ONE BOLT SUPPORTS WITH SQUARE ENDS SHALL NOT BE USED AT ANY LOCATION. "MINERALAC" TYPE SUPPORTS OR "UNISTRUT" TYPE ONE BOLT SUPPORTS OF ANY DESIGN SHALL NOT BE USED BELOW 9'-0" ABOVE THE FLOOR.

C. EXPLOSION-PROOF CONDUIT SEALS AND FITTINGS SHALL BE LABELED OR LISTED FOR HAZARDOUS LOCATIONS AS INDICATED ON THE DRAWINGS.

PART 3 EXECUTION

3.01 INSTALLATION.

A. ALL RIGID CONDUIT ENTERING CABINETS, PULL BOXES, JUNCTION BOXES OR OUTLET BOXES SHALL BE SECURED WITH THREAD, WEATHERPROOF, INSULATED BUSHING HUBS.

B. NO MORE THAN FOUR (4) 90 DEGREE BENDS WILL BE ALLOWED IN ANY ONE CONDUIT RUN. WHERE MORE BENDS ARE NECESSARY IN ANY SINGLE RUN, A PULL BOX SHALL BE INSTALLED; PULL BOXES SHALL ALSO BE INSTALLED IN LONG RUNS AT A MAXIMUM SEPARATION OF 100'-0". ALL CONDUITS EXCEPT IN CONCRETE SLAB OR EARTH SHALL BE ROUTED PARALLEL OR PERPENDICULAR TO THE LINES OF THE BUILDING AND NO OUT OF PLUMB OR DIAGONAL LINES WILL BE ACCEPTED.

C. ALL CONDUIT SHALL BE SUBSTANTIALLY SUPPORTED BY PIPE STRAPS OR SUITABLE CLAMPS OR HANGERS ATTACHED TO THE ELEMENTS OF THE BUILDING STRUCTURE TO PROVIDE RIGID INSTALLATION; IN NO CASE SHALL CONDUIT BE ATTACHED OR SUPPORTED FROM ADJOINING PIPE OR INSTALLED IN SUCH A MANNER AS TO PREVENT THE READY REMOVAL OF OTHER PIPE FOR REPAIRS.

D. STRAP IRON HANGERS AND WIRE WILL NOT BE APPROVED FOR CONDUIT SUPPORT.

E. RIGID CONDUIT IN POURED CONCRETE OR BURIED BENEATH CONCRETE SLABS SHALL HAVE A 2" MINIMUM COVER.

F. EXPOSED CONDUITS RISING FROM FLOOR TO SURFACE PANELS, OR BOXES, SHALL HAVE A 4" HIGH CONCRETE CURB ENCASEING THE CONDUITS AT THE FLOOR LINE. CURB TO HAVE CHAMFERED EDGES.

G. EXERCISE NECESSARY PRECAUTION TO PREVENT ACCUMULATION OF WATER, DIRT, OR CONCRETE IN CONDUITS DURING EXECUTION OF ELECTRICAL WORK. CONDUIT IN WHICH WATER OR FOREIGN MATERIAL HAS BEEN PERMITTED TO ACCUMULATE SHALL BE THOROUGHLY CLEANED, OR REPLACED WHERE SUCH ACCUMULATIONS CANNOT BE REMOVED.

H. ALL CONDUITS MUST BE KEPT DRY AND FREE OF WATER OR DEBRIS WITH APPROVED PIPE PLUGS OR CAPS. CARE SHALL BE GIVEN THAT PLUGS OR CAPS ARE INSTALLED BEFORE POURING OF CONCRETE.

I. FLEXIBLE CONDUIT MAY ONLY BE USED AS FOLLOWS:

1. LIGHTING FIXTURES MAY BE SUPPLIED WITH SHORT LENGTHS NOT LONGER THAN 6'-0". ALL OTHER LIGHTING FIXTURES MAY USE LIQUID TIGHT FLEXIBLE CONDUIT WITH SHORT LENGTHS NOT LONGER THAN 6'-0".

2. MAKE UP CONNECTIONS TO TRANSFORMERS IN LENGTHS NOT LONGER THAN 2'-0", SHALL BE IN LIQUID TIGHT FLEXIBLE CONDUITS.

3. ALL EXPANSION JOINTS, FLEXIBLE CONNECTIONS, AND VIBRATION ISOLATORS SHALL BE BRIDGED WITH SHORT LENGTHS OR LIQUID TIGHT FLEXIBLE CONDUIT NOT LONGER THAN 2'-0".

J. ALL CONNECTIONS TO ROTATING MACHINERY AND HEATING ELEMENTS SHALL BE MADE WITH SHORT LENGTHS (MINIMUM 12") OF LIQUID-TIGHT CONDUIT. WHERE MOTORS ARE MOUNTED ON SLIDING BASES, THE FLEXIBLE CONNECTION SHALL BE LONG ENOUGH TO ALLOW FULL TRAVEL OF THE MOTOR ON THE BASE (MAXIMUM 36").

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PART 3 EXECUTION

3.01 INSTALLATION.

A. ALL CONDUCTORS SHALL BE CONTINUOUS FROM BOX-TO-BOX. NO JOINTS SHALL BE PERMITTED IN THE CIRCUIT OTHER THAN IN JUNCTION BOXES OR FIXTURES.

B. EQUIPMENT GROUND CONDUCTORS SHALL BE SAME INSULATION TYPE AS THE ASSOCIATED CIRCUIT CONDUCTORS.

C. THE AMPACITY OF ALL CONDUCTORS SHALL BE AT LEAST AS GREAT AS THE RATING OF THE FUSE OR CIRCUIT BREAKER ON THE LINE SIDE OF THE CONDUCTORS. NOTE THE AMPACITY REDUCTION REQUIRED BY CODE WHEN MORE THAN THREE CONDUCTORS ARE PLACED IN A RACEWAY.

1. ALL CONDUCTORS FOR DISTRIBUTION AND CONTROL EQUIPMENT TERMINATIONS SHALL BE BASED ON FULL 75°C AMPACITY.
2. ALL CONDUCTORS FOR APPLIANCE AND UTILIZATION EQUIPMENT TERMINATIONS RATED 100 AMPERES OR LESS SHALL BE BASED ON 60°C AMPACITY.

D. PROVIDE CABLE SUPPORTS FOR VERTICAL RACEWAYS PER NEC TABLE 300-19 (A).

E. WIRING INSTALLED IN SEPARATE CONDUITS. THE FOLLOWING SIGNAL TYPES SHALL BE NOT SHARE THE SAME CONDUIT AS POWER CONDUCTORS.

1. CONTROL WIRING.
2. COMMUNICATIONS WIRING.

F. SWAB CONDUITS FREE OF MOISTURE, DIRT AND GREASE BEFORE PULLING WIRE. CARE SHALL BE EXERCISED WHILE INSTALLING WIRE IN CONDUITS SO THAT CONDUCTOR INSULATION WILL NOT BE INJURED. NO OILS, GREASE OR COMPOUNDS OTHER THAN IDEAL "WIRE LUBE", "YELLOW 77", OR EQUAL UL APPROVED WIRE PULLING LUBRICANTS SHALL BE USED FOR PULLING IN ANY CONDUCTORS.

G. REMOVE ALL WIRE CUT DEAD.

3.02 CONNECTIONS.

A. ALL CONNECTIONS ARE TO BE MADE USING PRESSURE TYPE TERMINALS, UNLESS NOTED BELOW

B. WHERE CONNECTIONS ARE TO BE MADE TO DEVICES OR EQUIPMENT UNDER SCREW HEADS ONLY, INSTALL INSULATED, CRIMP TYPE SPADE CLIPS ON THE WIRE ENDS BEFORE THE CONNECTIONS ARE MADE.

C. DEVICES SHALL NOT BE USED AS THROUGH CONNECTION POINTS. WHERE THROUGH CIRCUITS ARE INVOLVED THEY SHALL BE SPLICED IN THE BOX AND A PIGTAIL CONNECTED TO THE DEVICE.

D. CONNECTORS SHALL CONTAIN ONLY ONE WIRE UNLESS THEY ARE LISTED FOR MULTIPLE CONDUCTORS.

E. JOINTS IN #10 AND SMALLER WIRE SHALL BE MADE USING THE FOLLOWING TYPES OF CONNECTORS: MINNESOTA MINING AND MANUFACTURING "SCOTCH LOK", IDEAL INDUSTRIES, INC. "WING NUT", OR THOMAS AND BETTS CO. TYPE "PT". CONNECTORS SHALL BE USED ONLY WITHIN THEIR RANGE. OTHER THREADED-ON TYPES OF INSULATED CONNECTORS SHALL NOT BE USED.

F. JOINTS IN #8 AND LARGER WIRE OR JOINTS IN ANY WIRES ABOVE THE RANGE OF THREADED-ON CONNECTORS SHALL BE MADE USING PRESSURE TYPE MECHANICAL CONNECTORS APPLIED AFTER WIRES ARE CLEANED AND THEN INSULATED USING TWO (2) LAYERS OF "SCOTCHFIL" BRAND ELECTRICAL INSULATION PUTTY AND COVERED BY TWO (2) HALF- LAPPED LAYERS OF "SCOTCH 88", OR PLYMOUTH SUPNOT GRAY VINYL PLASTIC ELECTRICAL TAPE. CONNECTORS CAN BE INSTALLED AND SEALED AGAINST MOISTURE BY INSTALLING RAYCHEM "TCS (INDOOR) OR WCSM (EXTERIOR)" SEALANT COATED HEAT SHRINK TUBING.

3.03 WIRE COLOR CODE.

A. THE FOLLOWING COLOR CODE SHALL BE USED:

	208Y/120 VOLT	480Y/277 VOLT
PHASE A:	BLACK	BROWN
PHASE B:	RED	PURPLE
PHASE C:	BLUE	YELLOW
NEUTRAL:	WHITE	GRAY
EQUIPMENT GROUND:	GREEN	GREEN

ALL CONTROL CIRCUITS SHALL USE BLACK FOR POWER, RED FOR CONTROL, AND WHITE FOR NEUTRAL.

B. YELLOW WIRE IS TO BE USED FOR FOREIGN VOLTAGES IN ALL PANELS, ENCLOSURES AND CABINETS.

C. CONDUCTORS NO. 10 AWG OR SMALLER SHALL HAVE INSULATION COLORED AS NOTED ABOVE.

D. CONDUCTORS NO. 8 AWG OR LARGER SHALL HAVE INSULATION COLORED AS NOTED ABOVE OR COLORED TAPE, MINIMUM SIZE 1/2", WRAPPED TWICE AROUND AT THE FOLLOWING POINTS:

1. AT EACH TERMINAL.
2. AT EACH CONDUIT ENTRANCE.
3. AT INTERVALS NOT MORE THAN 12 INCHES APART IN ALL BOXES, PANEL TUBS, SWITCHBOARDS, ETC.

E. EQUIPMENT GROUNDING CONDUCTORS NO. 8 AWG AND LARGER SHALL BE GREEN OR GREEN TAPE APPLIED IN A CONTINUOUS WRAP WHERE VISIBLE AT PANELS AND JUNCTION BOXES, ETC.

3.04 MARKING.

A. ALL BRANCH CIRCUITS SHALL BE MARKED IN THE PANELBOARD GUTTERS. MARKERS SHALL INDICATE CORRESPONDING BRANCH-CIRCUIT NUMBERS.

B. ALL SIGNAL AND CONTROL WIRES SHALL BE MARKED AT ALL TERMINATION POINTS, SUCH AS CABINETS, TERMINAL BOXES, EQUIPMENT RACKS, CONTROL PANELS, CONSOLES, ETC.

C. THE WIRE MARKERS SHALL BE THOMAS AND BETTS VINYL TAPE TYPE WM WRAPPED ONCE AROUND THE WIRE AND THE ADHESIVE SIDES PLACED TOGETHER TO FORM A FLAG.

D. THESE WIRE MARKERS SHALL BE INSTALLED WHEN WIRE IS PULLED.

**SECTION 16130 BOXES AND PLATES**

PART 1 GENERAL

1.01 SECTION INCLUDES.

A. DESCRIPTION OF BOXES AND PLATES PROVIDED FOR THE CONTRACT WORK.

1.02 RELATED SECTIONS.

A. 16111 - CONDUITS.

B. 16140 - WIRING DEVICES.

1.03 DESCRIPTION.

A. FURNISH AND INSTALL ALL OUTLET, JUNCTION, AND PULL BOXES AS INDICATED ON THE DRAWINGS AND AS NECESSARY TO INSTALL THE REQUIRED CONDUIT AND WIRING IN A NEAT AND WORKMANLIKE MANNER.

B. FURNISH AND INSTALL ALL OUTLET AND JUNCTION BOX COVERS AND WIRING DEVICE PLATES.

1.04 SUBMITTALS.

(NOT USED)

PART 2 PRODUCTS

2.01 STANDARDS.

A. PULL BOXES AND JUNCTION BOXES SHALL BE GALVANIZED AND OF THE CORRECT SIZE AND GAUGE, IN ACCORDANCE WITH CODE REQUIREMENTS AND SHALL BE UNDERWRITERS' LABORATORIES LABELED.

2.02 BOXES FOR FLUSH WORK.

A. FLUSH OUTLET, JUNCTION AND PULL BOXES SHALL BE PRESSED STEEL GALVANIZED OR SHERARDIZED AND SHALL BE A MINIMUM OF 4" SQUARE OR OCTAGONAL SIMILAR TO APPLETON #40. STEEL BOXES CAST IN CONCRETE SHALL BE DESIGNED FOR CONCRETE INSTALLATION.

B. FLUSH WALL BOXES IN BRICK, OR OTHER FINISHED MASONRY WALLS SHALL BE STEEL CITY GW-135-C SERIES, OR RACO 695 SERIES.

2.03 BOXES FOR EXTERIOR WORK.

A. BOXES AT EXTERIOR AREAS TO BE WATERTIGHT AND DUST-TIGHT WITH GASKETED COVERS.

2.04 BOXES FOR EXPOSED WORK.

A. ALL BOXES FOR EXPOSED WORK SHALL BE "FD" TYPE WITH THREADED HUBS FOR RIGID CONDUIT RISER.

2.05 BOXES FOR HAZARDOUS LOCATIONS.

A. ALL EXPLOSION PROOF BOXES SHALL BE LISTED OR LABELED FOR THE HAZARDOUS LOCATION AS INDICATED ON THE DRAWINGS.

2.06 PLATES AND COVERS.

A. SWITCH COVERS USED IN WET LOCATIONS SHALL BE SINGLE GANG WITH SPRING LOADED, WEATHERPROOF COVERS, CAST COPPER FREE ALUMINUM WITH A NEOPRENE GASKET. SWITCH COVERS USED IN DRY LOCATIONS SHALL BE STAINLESS STEEL.

B. RECEPTACLE COVERS USED IN WET LOCATIONS SHALL BE SINGLE GANG WITH GASKETED WEATHERPROOF WHILE-IN-USE COVERS. RECEPTACLE COVERS USED IN DRY LOCATIONS SHALL BE STAINLESS STEEL.

C. BLANK OUTLETS WHERE REQUIRED IN FINISHED AREAS SHALL MATCH WIRING DEVICE COVERS IN THAT AREA.

D. PLATES OF SATIN FINISH #302 STAINLESS STEEL AS MANUFACTURED BY SLATER.

PART 3 EXECUTION

3.01 INSTALLATION.

A. ALL BOXES SHALL BE RIGIDLY SUPPORTED FROM BUILDING STRUCTURE INDEPENDENT OF THE CONDUIT SYSTEM. BOXES CAST INTO MASONRY OR CONCRETE ARE CONSIDERED TO BE RIGIDLY SUPPORTED.

B. CLOSE ALL UNUSED AND OPEN KNOCKOUTS AND HUBS WITH PLUGS OF THE PROPER SIZE.

**SECTION 16140 WIRING DEVICES**

PART 1 GENERAL

1.01 SECTION INCLUDES.

A. DESCRIPTION OF WIRING DEVICES FOR BRANCH CIRCUITS.

1.02 RELATED SECTIONS.

A. 16120 - WIRE AND CABLE.

B. 16130 - BOXES AND PLATES.

1.03 DESCRIPTION.

A. FURNISH AND INSTALL ALL WIRING DEVICES WHERE SHOWN ON THE DRAWINGS.

B. WIRING DEVICES SHALL BE FURNISHED IN STRICT ACCORDANCE WITH THE CATALOGUE NUMBERS AND MANUFACTURERS LISTED IN THE SCHEDULE, WHICH FOLLOWS. OTHER SPECIAL PURPOSE DEVICES SHALL BE AS SPECIFIED ON THE DRAWINGS.

1.04 SUBMITTALS.

(NOT USED)

PART 2 PRODUCTS

2.01 STANDARDS.

A. DUPLEX GROUNDING TYPE RECEPTACLE - 20 AMP, 125 VOLT - NEMA 5-20R.

- a. HUBBELL - 5352-1

B. DUPLEX GROUNDING TYPE RECEPTACLE - 15 AMP, 125 VOLT - NEMA 5-15R.

- a. HUBBELL - 5252-1

C. SINGLE POLE SWITCHES - 20 AMP, 120/277 VOLT.

- a. HUBBELL - 1221-1

D. DOUBLE POLE SWITCHES - 20 AMP, 120/277 VOLT.

- a. HUBBELL - 1222-1

E. WEATHERPROOF RECEPTACLE - 20 AMP, 125 VOLT - NEMA 5-20R.

- a. HUBBELL - GF 5362-1 WITH RW57300 WEATHERPROOF WHILE IN USE COVER

F. G.F.I. RECEPTACLE - 20 AMP, 125 VOLT - NEMA 5-20R.

- a. HUBBELL - GF 5362-1 WITH S26 OR RW57300 WEATHERPROOF WHILE IN USE COVER

G. G.F.I. RECEPTACLE - 15 AMP, 125 VOLT - NEMA 5-15R.

- a. HUBBELL - GF 5262-1 WITH S26 OR RW57300 WEATHERPROOF WHILE IN USE COVER

2.02 SUBSTITUTIONS.

A. THE ELECTRICAL CONTRACTOR MAY, UPON APPROVAL BY ENGINEER, FURNISH EQUAL DEVICES BY SLATER, HUBBELL, P & S, GENERAL ELECTRIC, LEVITON, EAGLE OR WOODHEAD.

PART 3 EXECUTION

3.0 INSTALLATION.

A. INSTALL WIRING DEVICES IN A NEAT AND WORKMANLIKE MANNER.

B. GROUND ALL RECEPTACLES IN ACCORDANCE WITH ARTICLE 250-146 OF NEC AND AS INDICATED IN THE GROUNDING SECTION OF THIS SPECIFICATION.

C. WIRING DEVICES SPECIFIED ARE SIDE AND BACK WIRED TYPE AND SHALL BE BACK WIRED.

D. GENERAL USE DUPLEX RECEPTACLES SHALL BE GROUNDING TYPE, 15 AMP, AND 125 VOLT. IF THERE IS ONLY ONE RECEPTACLE ON A 20 AMP CIRCUIT, THEN IT SHALL BE 20 AMP RATED.

SECTION 16150 MOTOR AND EQUIPMENT WIRING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. DESCRIPTION OF MOTOR AND EQUIPMENT WIRING.

1.02 RELATED SECTIONS

A. 16111 - CONDUITS

B. 16120 - WIRE AND CABLE

1.03 DESCRIPTION

A. PROVIDE POWER AND CONNECT ALL MOTORS AND MOTOR DRIVEN EQUIPMENT SHOWN ON THE PLANS.

B. FURNISH, INSTALL AND CONNECT ALL OVER CURRENT AND DISCONNECT MEANS AS REQUIRED BY THE NATIONAL ELECTRICAL CODE.

C. MOTORS AND MOTOR DRIVEN EQUIPMENT SHALL BE PROVIDED AND INSTALLED BY OTHERS. MOTOR STARTERS, CONTROLLERS AND DEVICES; OTHER THAN TEMPERATURE CONTROL EQUIPMENT AND DEVICES AND STARTERS FOR CONTROLLERS, FURNISHED AS PART OF PACKAGED EQUIPMENT; SHALL BE FURNISHED AND INSTALLED BY THE ELECTRICAL CONTRACTOR, EXCEPT AS OTHERWISE NOTED.

1.04 SUBMITTALS

A. NOT USED.

PART 2 PRODUCTS

NOT APPLICABLE

PART 3 EXECUTION

3.01 INSTALLATION

A. INSTALL AND WIRE ALL MOTOR CONTROL EQUIPMENT PER WIRING DIAGRAMS AND INSTRUCTIONS FURNISHED TO HIM, INCLUDING INTERLOCK WIRING BETWEEN EQUIPMENT.

B. MOTOR AND EQUIPMENT LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. OBTAIN EXACT LOCATIONS FROM THE CONTRACTOR CONCERNED.

C. REFER TO THE MECHANICAL AND PLUMBING SPECIFICATIONS FOR DESCRIPTION OF ELECTRICAL EQUIPMENT AND CONTROLS FURNISHED BY THEM.

D. VERIFY ALL CONTROL SEQUENCES, ETC. IN ACCORDANCE WITH SECTION 16030 - TESTS.

**SECTION 16155 MOTOR STARTERS AND CONTROLS**

PART 1 GENERAL

1.01 SECTION INCLUDES

A. DESCRIPTION OF MOTOR STARTERS AND CONTROLS.

1.02 RELATED SECTIONS

A. 16150 - MOTOR AND EQUIPMENT WIRING

B. 16902 - INSTRUMENTS AND CONTROLS

C. 16903 - CABINETS, CONSOLES, PANELS AND ENCLOSURES

1.03 DESCRIPTION

A. FURNISH AND INSTALL ALL MAGNETIC AND MANUAL MOTOR STARTERS AND CONTROLS AS SHOWN ON THE DRAWINGS AND SPECIFIED HEREIN.

1.04 SUBMITTALS

A. NOT USED.

PART 2 PRODUCTS

2.01 GENERAL

A. ALL STARTERS SHALL HAVE A MANUAL RESET OVERLOAD RELAY IN EACH PHASE CONDUCTOR. INTEGRAL ELECTRONIC OVERLOAD FUNCTIONS MAY BE PROVIDED FOR ELECTRONIC MOTOR CONTROLLERS SUCH AS REDUCED VOLTAGE SOFT STARTERS. ELECTRICAL CONTRACTOR SHALL USE ACTUAL MOTOR NAMEPLATE DATA TO PROPERLY ADJUST OVERLOADS.

2.02 REDUCED VOLTAGE SOFT STARTERS

A. REDUCED VOLTAGE SOFT STARTERS (RVSS) SHALL BE MOUNTED WITHIN THE PUMP CONTROL PANEL.

B. RVSS SHALL COMPLY WITH ALL APPLICABLE REQUIREMENTS OF THE LATEST STANDARDS OF ANSI, IEEE, NEMA, AND THE NATIONAL ELECTRIC CODE.

C. CONTROLLERS AND FACTORY-MOUNTED OPTIONS SHALL BE UL LISTED.

D. THE RVSS SHALL INCLUDE AN INTEGRAL MOTOR OVERLOAD RELAY.

E. THE RVSS SHALL BE RATED 480 VAC, THREE-PHASE. THE CONTROLLERS SHALL BE RATED AS SHOWN IN THE DRAWINGS. AS A MINIMUM, THE CONTINUOUS FULL LOAD OUTPUT CURRENT OF THE DRIVE SHALL BE EQUAL TO 1.15 TIMES THE FULL LOAD CURRENT OF THE EQUIVALENT MOTOR HORSEPOWER AS LISTED BY NATIONAL ELECTRIC CODE TABLE 430-150. THE CONTINUOUS FULL LOAD OUTPUT CURRENT RATING SHALL BE BASED ON 40C AMBIENT.

F. THE RVSS SHALL LIMIT MOTOR CURRENT TO 250% OF MOTOR NAMEPLATE THROUGHOUT THE ENTIRE MOTOR ACCELERATION PERIOD.

G. THE RVSS SHALL PROVIDE THE FOLLOWING FEATURES:

1. ADJUSTABLE ACCELERATION AND DECELERATION TIME VALUES THROUGH MULTIPLE MODES OF OPERATION.
2. PHASE LOSS DETECTION AND TRIP
3. MOTOR OVERLOAD PROTECTION
4. PHASE REVERSAL DETECTION AND TRIP
5. POWER UNIT OVER-TEMPERATURE PROTECTION

H. THE RVSS MANUFACTURER AND SUPPLIER SHALL COORDINATE ALL ASPECTS OF SOFT-START OPERATION WITH THE PUMP SUPPLIER, SUCH AS RECOMMENDATION FOR ACCELERATION AND DECELERATION AND PROTECTIVE SETPOINTS.

I. THE RVSS SHALL PROVIDE DRY TYPE CONTACTS RATED 120V AC 2A AS SHOWN IN THE DRAWINGS FOR INTERFACING TO EXTERNAL SYSTEMS.

J. THE RVSS MANUFACTURER SHALL PROVIDE AT NO ADDITIONAL COST TO THE OWNER, A START UP SERVICE PACKAGE FOR ALL RVSS PROVIDED. SERVICE SHALL INCLUDE INSPECTION, FINAL ADJUSTMENTS, OPERATIONAL CHECKS, AND A FINAL REPORT FOR RECORD PURPOSE. THE SERVICE PACKAGE SHALL INCLUDE A ONE-YEAR PARTS WARRANTY FROM DATE OF SHIPMENT FOR ALL RVSS PROVIDED.

K. THE RVSS MANUFACTURER SHALL PROVIDE AT NO ADDITIONAL COST TO THE OWNER, FOUR HOURS OF OPERATOR/MAINTENANCE TRAINING IN ACCORDANCE OF SECTION 01730.

L. THE MANUFACTURER SHALL PROVIDE COMPLETE DRAWINGS AND DOCUMENTATION THAT INCLUDES THE FOLLOWING INFORMATION:

1. ELEMENTARY OR CONTROLS SCHEMATICS, INCLUDING COORDINATION WITH OTHER ELECTRICAL CONTROL DEVICES OPERATING IN CONJUNCTION WITH THE VARIABLE FREQUENCY CONTROLLER.
2. PRODUCT DESCRIPTIVE LITERATURE TO DEMONSTRATE COMPLIANCE WITH THE WRITTEN SPECIFICATION.
3. INSTALLATION AND MAINTENANCE MANUALS SHALL BE SHIPPED WITH EACH RVSS THAT INCLUDES INSTALLATION, START UP AND CHECK OUT, ADJUSTMENT AND TROUBLESHOOTING INFORMATION.

M. MODEL: SMC-3 SERIES AS MANUFACTURED BY ALLEN BRADLEY; 150-C43NBD-8L WITH FAN 150-CF147, 480V PROTECTIVE MODULE 150-C84P, REMOTE RESET SOLENOID 193-ER1D.

PART 3 EXECUTION

3.01 INSTALL AND CONNECT EQUIPMENT IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

3.02 ALL WIRING TO BE DONE BY ELECTRICAL CONTRACTOR UNLESS OTHERWISE SPECIFIED.

3.03 NOT USED

3.04 MANUFACTURER'S CERTIFICATION

A. A QUALIFIED FACTORY-TRAINED MANUFACTURER'S REPRESENTATIVE SHALL CERTIFY IN WRITING THAT THE EQUIPMENT HAS BEEN INSTALLED, ADJUSTED, AND TESTED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

B. THE CONTRACTOR SHALL PROVIDE FOUR (4) COPIES OF THE MANUFACTURER'S REPRESENTATIVE'S CERTIFICATION.

3.05 INSTALLATION

A. INSTALL STARTERS AND CONTROLS AT LOCATIONS SHOWN ON DRAWINGS.

B. TOP OF STARTER, RELAY OR CONTACTOR SHALL BE INSTALLED 6'-0" ABOVE FLOOR UNLESS OTHERWISE SHOWN ON THE DRAWINGS.

C. ALL STARTERS AND CONTROLS SHALL BE IDENTIFIED IN ACCORDANCE WITH IDENTIFICATION SECTION 16195.

D. FURNISH CONTROL WIRING AS INDICATED ON THE DRAWINGS. REFER TO SECTION 16150 "MOTOR AND EQUIPMENT WIRING".

**SECTION 16163 LIGHTING PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES.

A. DESCRIPTION OF LIGHTING PANELS.

1.02 RELATED SECTIONS.

A. 16111 - CONDUITS.

B. 16195 - IDENTIFICATION.

C. 16280 - SURGE PROTECTIVE DEVICES.

1.03 DESCRIPTION.

A. FURNISH AND INSTALL, AS SCHEDULED AND SHOWN ON THE DRAWINGS, LIGHTING PANELS FOR OPERATION ON 480Y/277 AND 208Y/120 VOLT, 3 PHASE, 4-WIRE SERVICE.

B. EACH PANEL SHALL BE CONNECTED WITH A FEEDER AS SIZED ON THE DRAWINGS.

1.04 SUBMITTALS.

(NOT USED)

PART 2 PRODUCTS

2.01 STANDARDS.

A. THE PANELS SHALL BE SQUARE D, TYPE NF AND NOOD, UNLESS OTHERWISE NOTED, WITH BRANCH BREAKERS AS SCHEDULED ON THE DRAWINGS.

B. ALL TERMINATIONS SHALL BE MARKED "75C ONLY", "60/75C" OR LISTED FOR USE WITH 75C INSULATED CONDUCTORS AT FULL 75C AMPACITY.

C. EACH PANEL SHALL BE PROVIDED WITH A MAIN SURGE PROTECTIVE DEVICE PER SECTION 16280.

2.02 CONSTRUCTION.

A. ALL BUS BARS SHALL BE SILVER OR TIN PLATED COPPER.

B. CABINETS SHALL BE OF COMMERCIAL GALVANIZED SHEET STEEL, CODE GAUGE AND SIZE, SURFACE OR FLUSH MOUNTED AS CALLED FOR IN THE DRAWINGS. FLUSH PANELS SHALL BE FINISHED WITH PRIME COAT ONLY. DOORS SHALL BE FITTED WITH CHROME PLATED COMBINATION LOCK AND CATCH, AND ALL KEYS ALIKE.

NOTE: TUBS SHALL BE 20" WIDE.

C. DIRECTORY CARD AND FRAME INSIDE PANEL DOOR.

D. NEUTRAL ASSEMBLY SHALL HAVE INDIVIDUAL ANTI-TURN SOLDERLESS TERMINALS, SIMILAR TO SQUARE D TYPE PK, FOR CONNECTION OF ULTIMATE NUMBER OF NEUTRAL WIRES. SHEET METAL TERMINAL STRIPS AND CONNECTIONS WILL BE REJECTED.

E. PANEL SHALL HAVE A COPPER GROUND BAR SIMILAR TO NEUTRAL BAR IN NUMBER, SIZE, AND TYPE OF ANTI-TURN SOLDERLESS LUGS. THIS GROUND BAR SHALL BE FACTORY BONDED TO THE PANEL TUB IN THE GUTTER SPACE OPPOSITE THE MAINS AND THE NEUTRAL ASSEMBLY AND SHALL HAVE THE SCREWDRIVER SLOTS FACING THE FRONT OF THE PANEL. GROUND BARS IN PANEL SIDE GUTTERS WILL BE REJECTED. SHEET METAL TERMINAL STRIPS AND CONNECTIONS WILL BE REJECTED. NOTE THAT THE HEIGHT OF THE PANEL TUB MAY BE HIGHER THAN NORMAL BECAUSE OF THE GROUND BAR.

2.03 CIRCUIT BREAKERS.

A. THE BRANCH BREAKERS SHALL BE RATED 18,000 A.I.C. MINIMUM FOR NF AND 10,000 A.I.C. MINIMUM FOR NOOD, MOLDED CASE, TEMPERATURE COMPENSATED, QUICK-MAKE, QUICK-BREAK, WITH THERMAL-MAGNETIC TRIP AND PERMANENTLY BOLTED TO BUS BARS.

B. BREAKERS THAT ARE USED TO SWITCH FLUORESCENT LIGHTING SHALL BE TYPE SWD.

C. BREAKERS THAT FEED HEATING, AIR CONDITIONING AND REFRIGERATION EQUIPMENT SHALL BE LISTED AS "HACR" TYPE.

PART 3 EXECUTION

3.01 INSTALLATION.

A. PANELS SHALL BE MOUNTED WITH TOP OF PANEL AT 6'-0" ABOVE FLOOR.

B. DIRECTORY CARDS SHALL BE CORRECTLY FILLED IN BY TYPEWRITER FOR CIRCUITS AS INSTALLED, BEFORE FINAL PAYMENT IS MADE.

C. FURNISH AND INSTALL IDENTIFICATION NAMEPLATE THAT READS "CAUTION SERIES RATED SYSTEM", "IDENTICAL COMPONENT REPLACEMENT REQUIRED".

D. ADDITIONAL IDENTIFICATION SHALL BE FURNISHED AS SPECIFIED IN SECTION 16195.

**SECTION 16181 FUSES**

PART 1 GENERAL

1.01 SECTION INCLUDES.

A. DESCRIPTION OF FUSES.

1.02 RELATED SECTIONS.

A. 16901 - INSTRUMENTATION AND CONTROLS FUNCTIONAL REQUIREMENTS.

B. 16903 - CABINETS, CONSOLES, PANELS, AND ENCLOSURES.

1.03 DESCRIPTION.

A. PROVISIONS OF THIS SECTION SHALL APPLY TO ALL FUSES AND FUSED EQUIPMENT OF 600 VOLTS OR LESS AS SHOWN ON THE DRAWINGS.

B. FURNISH AND INSTALL ALL FUSES AS DESCRIBED BELOW.

1.04 SUBMITTALS.

(NOT USED)

PART 2 PRODUCTS

2.01 STANDARDS.

A. ALL FUSES 600 AMPERES AND BELOW SHALL BE UL CLASS RK-1, BUSSMANN "LO-PEAK" TYPE LPN/S-RK, GOULD/SHAWMUT "AMP-TRAP II" TYPE A2/6D-R OR LITTLEFUSE TYPE LLN/S-RK, OR APPROVED EQUAL. EXISTING FUSIBLE DISCONNECT REQUIRES NEW FUSES. FUSE TYPE REQUIRED IS UNKNOWN.

PART 3 EXECUTION

3.01 SPARE FUSES.

A. FURNISH ONE SET OF THREE SPARE FUSES FOR EACH SIZE AND TYPE OF FUSE USED. SPARE FUSES SHALL BE MOUNTED IN FUSE CABINET MOUNTED ADJACENT TO EACH PIECE OF SERVICE EQUIPMENT.

3.02 VOLTAGE RATING.

A. ALL FUSES SHALL HAVE PROPER VOLTAGE RATING FOR THE SYSTEM VOLTAGE IN WHICH THEY ARE USED.

**SECTION 16195 IDENTIFICATION**

PART 1 GENERAL

1.01 SECTION INCLUDES.

A. DESCRIPTION OF IDENTIFICATION.

1.02 RELATED SECTIONS.

A. 16163 - 480Y/277 VOLT LIGHTING PANELS.

B. 16170 - DISCONNECTS.

1.03 DESCRIPTION.

A. EACH PIECE OF SERVICE EQUIPMENT AND INDIVIDUAL SWITCHES, ALL DISCONNECTS, STARTERS, ALL EXHAUST FAN MANUAL STARTING SWITCHES, ALL POWER AND LIGHTING PANELS, ALL CABINETS AND PULL BOXES FOR AUXILIARY SYSTEMS, SUCH AS TELEPHONE, CLOCK EQUIPMENT, PUBLIC ADDRESS, FIRE ALARM AND EMERGENCY EXIT LIGHTS, ETC., SHALL BE IDENTIFIED ON THE FRONT COVER OR TRIM WITH ITS NAME AND/OR DESIGNATION NUMBER OR LETTER AS SHOWN ON THE DRAWINGS AND WITH THE VOLTAGE AVAILABLE WITHIN THE PANEL.

1.04 SUBMITTALS.

(NOT USED)

PART 2 PRODUCTS

2.01 GENERAL.

A. IDENTIFICATION SHALL BE IN THE FORM OF LAMINATED PLASTIC NAMEPLATES, WHITE FACE, WITH THE LETTERS ENGRAVED INTO THE BLACK BACKGROUND, MINIMUM 1/4" HIGH. PLATES SHALL BE DRILLED ON EACH END FOR STAINLESS STEEL SHEET METAL SCREW ATTACHMENT. "DYMO" OR SIMILAR TAPE TYPE LABELS WILL NOT BE ALLOWED.

PART 3 EXECUTION

3.01 INSTALLATION.


A. PLASTIC NAMEPLATES SHALL BE ATTACHED TO FACE OF ELECTRICAL DEVICE BY STAINLESS STEEL SHEET METAL SCREWS. LOCATE PLATE SO WORDING READS HORIZONTALLY AND PLATE DOES NOT OBSTRUCT OTHER IDENTIFICATION PLATES, LATCHES OR OPERATORS.

B. INSTALL NAMEPLATE AT POWER RECEPTACLES WHERE THE NOMINAL VOLTAGE BETWEEN ANY PAIR OF CONTACTS IS GREATER THAN 150 VOLT.

C. BRANCH-CIRCUIT PANEL BOARDS: PER NEC 210-4D, A PHASE COLOR-CODE NAMEPLATE SHALL BE MOUNTED ON THE INSIDE TRIM ADJACENT TO THE MANUFACTURER'S NAMEPLATE. REFER TO SECTION 16120, 3.03A FOR PROPER COLOR CODE FOR VOLTAGE UTILIZED.

D. WHERE CIRCUIT BREAKERS OR FUSES ARE APPLIED IN COMPLIANCE WITH THE SERIES COMBINATION RATINGS MARKED ON THE EQUIPMENT BY THE MANUFACTURER, THE EQUIPMENT ENCLOSURE(S) SHALL BE LEGIBLY MARKED IN THE FIELD TO INDICATE THE EQUIPMENT HAS BEEN APPLIED WITH A SERIES COMBINATION RATING. THE MARKING SHALL BE READILY VISIBLE AND STATE "CAUTION - SERIES RATED SYSTEM."

DELAWARE COUNTY  
**VERONA SECTION 1**  
FORCE MAIN AND PUMP STATION IMPROVEMENTS  
PUMP STATION ELECTRICAL SPECIFICATION

PREPARED BY:  
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**SECTION 16280 SURGE PROTECTIVE DEVICES**

PART 1 GENERAL

1.01 DESCRIPTION

A. FURNISH AND INSTALL SURGE PROTECTIVE DEVICE (SPD) UNITS AS SHOWN ON THE DRAWINGS AND HEREIN SPECIFIED.

1.02 SUBMITTALS

A. FOR REVIEW:

1. PRODUCT DATA SHEETS OF ALL COMPONENTS
2. ALL OPERATING PARAMETERS INCLUDING UL 1449 VOLTAGE CATEGORY
3. INDEPENDENT TEST DATA ON MAXIMUM SINGLE AND REPETITIVE SURGE CURRENT.

B. TO BE INCLUDED IN OPERATION AND MAINTENANCE MANUALS:

1. ONE COPY OF EACH APPROVED SUBMITTAL

1.03 MANUFACTURERS

A. SURGE PROTECTIVE DEVICES

1. LIGHTING PANELS: INTEGRAL BY PANEL MANUFACTURER

PART 2 PRODUCTS

2.01 SURGE PROTECTIVE DEVICES

A. SURGE PROTECTIVE DEVICE (SPD) UNITS SHALL BE INTEGRATED DIRECTLY INTO THE EQUIPMENT BEING PROTECTED.

B. SPD UNITS SHALL CONSIST OF AN ENGINEERED SYSTEM TO ACHIEVE SUPPRESSION USING ONE OR MORE OF THE FOLLOWING COMPONENTS:

1. DOPED SELENIUM PLATES
2. METAL OXIDE VARISTERS (MOV) IN ENCLOSED REPLACEABLE MODULES
3. SILICON AVALANCHE DIODES (SAD) IN ENCLOSED REPLACEABLE MODULES

C. SPD UNIT COMPONENTS SHALL BE ARRANGED TO OPERATE BI-DIRECTIONALLY, IN PARALLEL WITH THE LINE, HAVE SINE WAVE TRACKING CHARACTERISTICS, AND HAVE TEN MODES OF PROTECTION AS FOLLOWS:

1. EACH PHASE: LINE TO LINE
2. EACH PHASE: LINE TO NEUTRAL
3. EACH PHASE: LINE TO GROUND
4. NEUTRAL - GROUND

D. SPD UNITS SHALL BE CLASSIFIED BY U.L. WITH THE FOLLOWING RATINGS:

MAXIMUM CLAMPING VOLTAGE L-N	MAXIMUM CLAMPING VOLTAGE N-G
480/277 VOLT 3 PHASE "WYE" UNITS	800 VOLT 800

E. SPD UNITS SHALL BE CAPABLE OF SURVIVING THE FOLLOWING SURGE CURRENT ON A SINGLE IMPULSE BASIS WITHOUT PERFORMANCE DEGRADATION OF MORE THAN 10%:

1. SPD UNITS LOCATED AT MOTOR CONTROL CENTERS 120,000 AMPS PER MODE
2. SPD UNITS LOCATED AT POWER DISTRIBUTION PANELS 80,000 AMPS PER MODE
3. SPD UNITS LOCATED AT DOWNSTREAM PANELBOARDS 60,000 AMPS PER MODE

F. SPD UNITS SHALL HAVE FORM C SUMMARY OUTPUT CONTACTS FOR REMOTE MONITORING CAPABILITY.

G. SPD UNITS SHALL HAVE INTEGRAL NOISE FILTERING OF THE FOLLOWING MINIMUM ATTENUATION LEVEL:

1. 10 KHZ THROUGH 100 MHZ- 34 DB

H. SPD UNITS SHALL HAVE INTEGRAL DIAGNOSTIC INDICATING LIGHTS.

I. SPD SHALL BE LISTED IN ACCORDANCE WITH UL 1449 SECOND EDITION TO INCLUDE SECTION 37.3 HIGHEST FAULT CURRENT CATEGORY. SPD SHALL BE UL 1283 LISTED. SPD SHALL BE TESTED TO ANSI 682.41 AND 682.45 STANDARDS.

J. SPD SHALL INCLUDE A FUSED DISCONNECT SWITCH OR CIRCUIT BREAKER WHERE A DEDICATED FUSED SWITCH OR CIRCUIT BREAKER IS NOT FURNISHED.

PART 3 EXECUTION

3.01 INSTALLATION

A. INSTALL SURGE SUPPRESSORS WHERE SHOWN ON THE DRAWINGS, AND IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS.

B. UNITS SHALL BE INSTALLED AS CLOSE AS POSSIBLE TO THE EQUIPMENT BEING PROTECTED (PREFERABLY CLOSE NIPPLED). CONDUCTORS AND CONDUIT SHALL BE RUN HORIZONTALLY DIRECTLY FROM ELECTRICAL EQUIPMENT TO SURGE SUPPRESSOR ENCLOSURE.

3.02 EQUIPMENT DEMONSTRATION

A. AFTER ALL SYSTEM TESTS HAVE BEEN COMPLETED, SCHEDULE AN INSTRUCTION PERIOD WITH THE OWNER. INSTRUCTION TO BE PROVIDED BY MANUFACTURER'S AUTHORIZED FIELD TECHNICIAN.

B. INSTRUCTION SHALL INCLUDE:

1. LOCATION OF ALL COMPONENTS OF THE SYSTEM AND EXPLANATION OF THEIR FUNCTION
2. DEMONSTRATION OF EQUIPMENT
3. MAINTENANCE AND REPAIR PROCEDURES
4. PROGRAMMING PROCEDURES
5. REVIEW OF DOCUMENTS IN RECORD AND INFORMATION MANUALS

3.03 EXTENDED WARRANTY/SPARE PARTS

A. PROVIDE A FIVE-YEAR EXTENDED WARRANTY UPON FINAL ACCEPTANCE OR A COMPLETE SPARE PARTS PACKAGE IN ACCORDANCE WITH MANUFACTURER'S STANDARD ARRANGEMENT IN ACCORDANCE WITH SECTION 01740.

PART 3 EXECUTION

3.01 INSTALLATION.

A. SWITCHES SHALL BE INSTALLED TO PROVIDE CODE REQUIRED CLEARANCE AND SHALL BE GENERALLY WALL MOUNTED AT 6'-0" TO TOP.

B. DISCONNECTS MOUNTED NEAR EQUIPMENT SHALL BE FIELD COORDINATED AND LOCATED TO CLEAR ANY ACCESS OPENINGS OR PATHS.

C. PROVIDE FREE STANDING UNISTRUT SUPPORT FRAME FOR SWITCHES THAT CANNOT BE WALL OR EQUIPMENT MOUNTED. FRAME SHALL BE FULL HEIGHT AND ATTACHED AT THE FLOOR AND CEILING, OR ANGLE BRACED TO FLOOR OR POURED INTO CONCRETE EQUIPMENT PAD IN ORDER TO PROVIDE RIGID STRUCTURE. MINIMUM HEIGHT TO TOP OF FLOOR MOUNTED SWITCHES SHALL BE 36".

**SECTION 16451 GROUNDING (WIRED SYSTEM)**

PART 1 GENERAL

1.01 SECTION INCLUDES.

A. DESCRIPTION OF MAIN SWITCHBOARD.

1.02 RELATED SECTIONS.

A. 16111 - CONDUIT.

B. 16120 - WIRE AND CABLE.

1.03 DESCRIPTION.

A. GROUNDING OF THE SERVICE AND SERVICE ENTRANCE EQUIPMENT SHALL BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE.

B. ALL FEEDERS AND BRANCH CIRCUITS OVER 100 VOLTS SHALL INCLUDE A GROUNDING CONDUCTOR SIZED IN ACCORDANCE WITH NEC TABLE 250-122, EXCEPT NOT BE SMALLER THAN #12 FOR POWER AND LIGHTING CIRCUITS AND #14 FOR CONTROL CIRCUITS. ALL GROUND CONDUCTORS SHALL BE GREEN, OR AS SPECIFIED UNDER SECTION 16120, "WIRE AND CABLE".

1.04 SUBMITTALS.

(NOT USED)

PART 2 PRODUCTS

2.01 GENERAL.

A. ALL GROUND CLAMPS SHALL BE PENN-UNION "GPL" TYPE OR SIMILAR BY O.Z. OR BURNDY.

B. ALL CABLE CONNECTIONS TO GROUND RODS SHALL BE BY "CADWELD", "THERMOWELD", OR "HELARC" WELDING PROCESS BY USING RECOMMENDED MOLDS, COMPOUND AND CORRECT GAS MIXTURES.

C. CONDUIT GROUNDING TYPE BUSHING SHALL BE T & B SERIES 3870 WITH APPROPRIATE SIZE GROUND WIRE TERMINAL.

D. CONDUIT FOR SOLITARY GROUND CONDUCTORS SHALL BE RIGID PVC NON-METALLIC ELECTRICAL CONDUIT WITH U.L. LABEL.

E. ALL PANELS SHALL BE FURNISHED WITH A COPPER GROUND BAR SIMILAR TO THE NEUTRAL BAR AND HAVING THE SAME NUMBER, SIZE AND TYPE OF LUGS. THE GROUND BAR SHALL BE FACTORY BONDED TO THE PANEL TUB ABOVE OR BELOW THE NEUTRAL ASSEMBLY, BUT SHALL NOT BE IN A GUTTER.

F. ENCLOSURES, JUNCTION AND PULL BOXES SHALL UTILIZE A "PANEL" TYPE GROUND BAR OR U.L. LISTED GROUNDING LUGS OR SCREWS, AS THE NUMBER OF GROUND CONDUCTORS DICTATES.

PART 3 EXECUTION

3.01 INSTALLATION.

A. NEUTRAL SHALL BE BONDED TO GROUND AT SERVICE ENTRANCE THROUGH A BONDING JUMPER SIZED PER NEC 250-. CONNECT THE SERVICE ENTRANCE GROUND TO BUILDING STEEL VIA THE MAIN SERVICE GROUND BUS BAR AS DETAILED ON THE DRAWINGS. IN ADDITION, FROM THE SERVICE ENTRANCE GROUND CONNECT AN APPROPRIATELY SIZED GROUNDING ELECTRODE CONDUCTOR TO THE GROUNDING ELECTRODE SYSTEM WHERE SHOWN ON THE DRAWINGS. DRIVEN GROUND SYSTEM SHALL CONSIST OF A 5/4" X 10'-0" COPPERWELD GROUND ROD. ALL CONNECTIONS TO GROUND RODS SHALL BE BY SPECIFIED WELDING PROCESS.

B. THE GROUND CONDUCTOR SHALL BE CONNECTED TO THE NEUTRAL IN ONLY TWO LOCATIONS -- ON THE SUPPLY SIDE OF THE SERVICE DISCONNECT MEANS PER NEC 250-24 AND ON SEPARATELY DERIVED SYSTEMS PER NEC 250-30. BECAUSE THE GROUND IS LOST THROUGH THE TRANSFORMER, IT MUST BE RE-ESTABLISHED BY USE OF A GROUNDING CONDUCTOR, MINIMUM SIZE PER NEC TABLE 250-66, CONNECTING THE TRANSFORMER SECONDARY NEUTRAL POINT TO THE TRANSFORMER ENCLOSURE AND TO THE INTERIOR COLD WATER SYSTEM OR TO BUILDING STRUCTURE GROUND.

C. ALL SOLITARY GROUND CONDUCTORS SHALL BE RUN IN RIGID PVC NON-METALLIC CONDUIT. SOLITARY GROUND CONDUCTORS SHALL NOT BE PLACED THROUGH METALLIC SLEEVES OR CONDUITS AND SHALL NOT BE COMPLETELY ENGIRCLED BY METALLIC HANGERS OR SUPPORTS.

D. ALL CONDUITS ENTERING SWITCHBOARDS AND SUBSTATIONS SHALL BE BONDED TOGETHER WITH APPROPRIATELY SIZED WIRE CONNECTED TO A CONDUIT GROUNDING BUSHING. THESE SHALL THEN BE BONDED TO THE GROUND BUS IN THE EQUIPMENT.

E. ALL ENCLOSURES, BOXES, FIXTURES, RECEPTACLES, ETC., SHALL BE GROUNDED BY BEING SECURELY BONDED TO THE GROUNDING CONDUCTOR. BOXES, CONDUIT, ETC., SHALL NOT BE USED AS PART OF THE GROUNDING "CONDUCTOR" SYSTEM.

F. ENCLOSURES NOT REQUIRING A GROUND BAR SHALL HAVE ALL GROUND CONDUCTORS CONNECTED TOGETHER AND A PIGTAIL THE SIZE OF THE LARGEST CONDUCTOR BONDED TO THE ENCLOSURE WITH A SINGLE GROUND CONNECTOR USED FOR NO OTHER PURPOSE.

G. AT EACH RECEPTACLE BOX, THE GROUND CONDUCTOR SHALL ENTER AND CONNECT, WITH NORMAL WIRING CONNECTOR, TO: 1) THE GROUND PIGTAIL TO RECEPTACLE; 2) THE GROUND PIGTAIL TO BOX GROUND SCREW; AND 3) THE OUTGOING GROUND CONDUCTOR TO NEXT DEVICE, IF NOT AT END OF RUN. METAL TO METAL CONTACT BETWEEN THE DEVICE YOKES AND THE OUTLET BOX IS NOT ACCEPTABLE AS A BOND FOR EITHER SURFACE MOUNTED BOXES OR FLUSH TYPE BOXES.

H. MOTOR TERMINAL BOXES SHALL BE GROUNDED BY THE USE OF MANUFACTURER SUPPLIED GROUND LUG OR BY DRILLING AND TAPPING A HOLE FOR A GROUND SCREW. REMOVE PAINT PRIOR TO MAKING THE CONNECTION.

I. LIGHTING FIXTURES SHALL BE GROUNDED BY THE USE OF A MANUFACTURER SUPPLIED GROUND LUG OR PIGTAIL OR BY THE USE OF GROUND CLIPS FASTENED ON BARE METAL THAT IS FREE OF PAINT.

J. CONDUIT SYSTEM SHALL BE ELECTRICALLY CONTINUOUS. ALL LOCKNUTS SHALL CUT THROUGH ENAMELED OR PAINTED SURFACES ON ENCLOSURES. WHERE ENCLOSURES AND NON-CURRENT CARRYING METALS ARE ISOLATED FROM THE CONDUIT SYSTEM, USE BONDING JUMPERS WITH APPROVED CLAMPS. WHERE REDUCING WASHERS ARE USED AND WHERE CONCENTRIC OR EXCENTRIC KNOCKOUTS ARE NOT COMPLETELY REMOVED BONDING BUSHINGS SHALL BE REQUIRED.

**SECTION 16460 DRY TYPE TRANSFORMERS**

PART 1 GENERAL

1.01 SECTION INCLUDES.

A. DESCRIPTION OF DRY TYPE TRANSFORMERS.

1.02 RELATED SECTIONS.

A. 16111 - CONDUITS.

B. 16120 - WIRE AND CABLE.

1.03 DESCRIPTION.

A. FURNISH AND INSTALL AS INDICATED ON THE PLANS, SINGLE AND THREE PHASE, 60 HERTZ, DRY TYPE, AIR COOLED, TWO WINDING, INSULATED, HIGH EFFICIENCY, LOW SOUND LEVEL TRANSFORMERS AS HEREIN SPECIFIED.

B. TRANSFORMERS SHALL BE RATED FOR USE WITH SYSTEMS OF 600 VOLTS OR BELOW.

1.04 SUBMITTALS.

(NOT USED)

PART 2 PRODUCTS

2.01 STANDARDS.

A. TRANSFORMERS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE LATEST STANDARDS OF IEEE, ANSI, AND NEMA.

B. TRANSFORMERS SHALL BE UNDERWRITERS' LABORATORIES, INC., APPROVED AND SHALL CARRY THE U.L. LABEL. THE DRAWINGS SHALL SHOW THE UNDERWRITERS' LABORATORIES FILE NUMBERS FOR BOTH THE INSULATED SYSTEM APPROVED AND THE TRANSFORMER APPROVED.

C. TRANSFORMERS SHALL BE SCHNEIDER SQUARE D OR APPROVED EQUAL.

2.02 CONSTRUCTION.

A. COILS MUST BE WOUND CONTINUOUS (NO SPLICES) AND SHALL BE VACUUM IMPREGATED WITH NON-HYDROSCOPIC THERMO-SETTING VARNISH. COILS SHALL USE AN UNDERWRITERS' LABORATORY APPROVED 220C INSULATION SYSTEM AND THE AVERAGE TEMPERATURE RISE SHALL NOT EXCEED 115C ABOVE A 40C MAXIMUM AMBIENT WITH 100% OF RATED LOAD CONNECTED ON THE SECONDARY. OVERSIZING OF TRANSFORMERS TO MEET THE TEMPERATURE RISE WILL NOT BE ACCEPTABLE.

B. CORES SHALL BE MANUFACTURED WITH A HIGH GRADE, NON-AGING SILICON STEEL STACKED WITHOUT GAPS AND FIRMLY CLAMPED WITH STRUCTURAL ANGLES. THE CORE AND COIL ASSEMBLY SHALL BE MOUNTED ON VIBRATION PADS AND BOLTED TO THE ENCLOSURE. COILS MOUNTED VERTICALLY, ONE ABOVE THE OTHER, WILL NOT BE ACCEPTABLE.

C. THE ENCLOSURE SHALL BE PROVIDED WITH LIFTING EYES OR BRACKETS AND VENTILATED OPENINGS DESIGNED TO PREVENT ACCESS TO LIVE PARTS. TOP OF CASE TEMPERATURES SHALL NOT EXCEED U.L. ACCEPTABLE LEVELS.

D. THE TERMINAL COMPARTMENT SHALL BE SO DESIGNED TO PERMIT THE USE OF 75C WIRE. ALL TERMINATIONS SHALL BE MARKED "75C ONLY", "60/75C" OR LISTED FOR USE OF 75C INSULATED CONDUCTORS AT FULL 75C AMPACITY.

E. TRANSFORMER KVA CAPACITY AND VOLTAGE SHALL BE AS SHOWN ON THE DRAWINGS. ALL 3-PHASE TRANSFORMERS SHALL HAVE 480 VOLT, 3 PHASE, 3- WIRE DELTA CONNECTED PRIMARIES AND 208-WYE/120 VOLT, 3 PHASE, 4-WIRE CONNECTED SECONDARIES. TRANSFORMERS 15 KVA AND LARGER SHALL HAVE SIX (6) 2-1/2" FULL CAPACITY PRIMARY TAPS 2 AN AND 4 BN.

F. DESIGN SOUND LEVELS SHALL NOT EXCEED THE FOLLOWING:

10 TO 50 KVA 45 DB
51 TO 150 KVA 50 DB

PART 3 EXECUTION

3.01 INSTALLATION.

A. ALL TRANSFORMERS EXCEPT WALL MOUNTED SHALL BE MOUNTED ON 4" CONCRETE PADS. NEOPRENE RUBBER VIBRATION ISOLATION SHALL BE PROVIDED BETWEEN TRANSFORMER CASE AND CONCRETE PAD. CONNECTIONS SHALL BE MADE WITH FLEXIBLE CONDUIT. VIBRATION ISOLATION PADS SHALL BE RIBBED NEOPRENE RUBBER, CONSOLIDATED KINETICS "NPD" OR APPROVED EQUAL.

**SECTION 16501 LIGHTING FIXTURES**

PART 1 GENERAL

1.01 SECTION INCLUDES.

A. DESCRIPTION OF LIGHTING FIXTURES.

1.02 RELATED SECTIONS.

A. 16111 - CONDUITS.

B. 16120 - WIRE AND CABLE.

1.03 DESCRIPTION.

A. CONTRACTOR SHALL FURNISH AND INSTALL LIGHTING FIXTURES AND LAMPS AS INDICATED IN FIXTURE SCHEDULE SHOWN ON DRAWINGS, AND SPECIFIED HEREIN.

B. ALL LIGHTING FIXTURES ARE INDICATED ON THE DRAWINGS WITH AN IDENTIFYING LETTER AND NUMBER, I.E., L1, P1, EX1, ETC. REFER TO THE FIXTURE SCHEDULE ON THE DRAWINGS THAT IDENTIFIES THE FIXTURE IN ACCORDANCE WITH LETTER AND NUMBER AND INDICATES THE TYPE OF MOUNTING OF THE FIXTURE IN ACCORDANCE WITH THE LEGEND SECTION OF THE SCHEDULE.

1.04 SUBMITTALS.

A. CATALOG CUTS.

PART 2 PRODUCTS

2.01 STANDARDS.

A. LIGHTING FIXTURES SCHEDULED ON THE DRAWINGS ARE SPECIFIED AS STANDARDS FOR DESIGN, QUALITY, AND APPEARANCE. FIXTURES OF OTHER MANUFACTURERS WILL BE CONSIDERED BY THE ARCHITECT PROVIDED THEY ARE EQUAL TO OR BETTER THAN THE STANDARD. REFER TO SECTION 16010, GENERAL PROVISIONS.

B. FIXTURE MATERIALS GIVEN WITH THE STANDARD FIXTURES SHALL BE MAINTAINED IF ALTERNATE MANUFACTURERS ARE USED, I.E., METAL SIDES FOR METAL SIDES, ACRYLIC PLASTIC LOUVERS FOR ACRYLIC PLASTIC LOUVERS, ETC.

C. LAMP SOCKETS FOR BARE TUBE FLUORESCENT FIXTURES SHALL BE SPRING-LOADED TURRET TYPE.

2.02 BALLASTS.

A. ALL BALLASTS OF NON-COMPACT FLUORESCENT FIXTURES SHALL BE ELECTRONIC NON-DIMMING (UNLESS OTHERWISE INDICATED), RAPID START CBM AND UL APPROVED AND OF THE HPT TYPE. THEY SHALL BE SOUND RATED "A" CLASS P, AS MANUFACTURED BY ADVANCE, MARK V; ETA INDUSTRIES, E2P TYPE; OR MAGNETEK-TRIAD, B SERIES.

B. ALL COMPACT LAMP BALLASTS SHALL BE ELECTRONIC, UL APPROVED, HIGH POWER FACTOR, THD LESS THAN 1% AND METAL CONTAIN END OF LAMP LIFE FAILURE MODE SHUTDOWN PROTECTION, CLASS P, ENERGY SAVING, BY VALMONT ELECTRIC, UNIVERSAL, OR ADVANCE COMPANY.

C. ALL HIGH INTENSITY DISCHARGE (HID) BALLASTS SHALL BE HIGH POWER FACTOR TYPE, SHALL HAVE FUSED PRIMARIES AND HAVE LINE STARTING CURRENT THAT IS LOWER THAN THE OPERATING CURRENT. CURRENT CREST FACTOR SHALL NOT EXCEED 1.8.

1. HIGH-PRESSURE SODIUM - VALMONT ELECTRIC - AUTO REGULATING, HOLOPHANE -LEAD OR WIDELITE - REGULATING.

2.03 LAMPS.

A. ALL LAMP HOLDERS INSTALLED BY THE ELECTRICAL CONTRACTOR SHALL BE FURNISHED COMPLETE WITH NEW LAMPS OF THE SIZE INDICATED ON THE FIXTURE SCHEDULE.

B. FLUORESCENT LAMPS SHALL BE COOL WHITE FOR FIXTURES WITH LOW TEMPERATURE BALLASTS AND FIXTURES IN LOCATIONS BELOW 60F. ALL OTHER FLUORESCENT LAMPS SHALL BE ENERGY SAVING COOL WHITE GENERAL ELECTRIC WATT-MISER, SYLVANIA SUPER SAVER, OR PHILIPS ECONO-WATT.

C. INCANDESCENT LAMPS SHALL BE DESIGNED TO OPERATE ON 125 VOLTS.

D. METAL HALIDE LAMPS SHALL HAVE 20,000-HOUR LIFE RATING (VERTICAL) AND 15,000 HOURS FOR ALL OTHER MOUNTING. LAMP CURRENT CREST FACTOR SHALL NOT EXCEED 1.8 AND SHALL BE COMPATIBLE WITH BALLAST BEING UTILIZED. ALL HID LAMPS NOT ENCLOSED SHALL BE T-RATED (SELF EXTINGUISHING).

PART 3 EXECUTION

3.01 GENERAL.

A. FURNISH ALL MOUNTING STRAPS, FRAMES, RINGS AND OTHER ACCESSORIES REQUIRED FOR A COMPLETE LIGHTING INSTALLATION. SHOULD ANY CONFLICT OCCUR WITH THE BUILDING STRUCTURE THAT WILL NOT ALLOW PROPER INSTALLATION OF FIXTURES, THE ARCHITECT SHALL BE CONTACTED BEFORE PROCEEDING.

B. ALL LIGHT FIXTURES SHALL BE INSTALLED WITH CENTERLINES SYMMETRICAL TO THE BUILDING, OR AT ANGLES SO DESIGNATED BY THE PLANS. FIXTURES NOT SET THUS SHALL BE REMOVED AND REINSTALLED AT THIS CONTRACTOR'S EXPENSE.

C. ANY FIXTURES SCRATCHED, BENT, CRACKED OR IN ANY WAY DAMAGED BEFORE ACCEPTANCE BY OWNER SHALL BE REPLACED AT THIS CONTRACTOR'S EXPENSE.

D. ALL LAMPS SHALL BE IN WORKING ORDER AT THE TIME OF FINAL ACCEPTANCE OF THE WORK BY THE OWNER AND ENGINEER.

E. ALL LIGHTING FIXTURES ARE TO BE GROUNDED ON THE INTERIOR OF THE FIXTURE HOUSING, ON CLEAN BARE METAL (FREE OF PAINT), BY USE OF A PIGTAIL AND FASTENED BY A SCREW USED FOR NO OTHER PURPOSE.

**SECTION 16601 LIGHTNING PROTECTION SYSTEM**

PART 1 GENERAL

1.01 SECTION INCLUDES

A. DESCRIPTION OF LIGHTNING PROTECTION SYSTEM.

1.02 RELATED SECTIONS

A. 16111 - CONDUITS

B. 16451 - GROUNDING

1.03 DESCRIPTION

A. PROVIDE AND INSTALL A COMPLETE BUILDING AND ROOF-MOUNTED EQUIPMENT LIGHTNING PROTECTION SYSTEM.

B. PROVIDE AND INSTALL A COMPLETE STRUCTURE AND EQUIPMENT LIGHTNING PROTECTION SYSTEM.

1.04 SUBMITTALS

A. CATALOG CUT SHEETS.

B. SHOP DRAWINGS.

PART 2 PRODUCTS

2.01 STANDARDS

A. SYSTEM SHALL BE DESIGNED FOR INSTALLATION IN ACCORDANCE WITH U.L. MASTER LABEL STANDARDS BY A LICENSED INSTALLER, AND THE INSTALLED SYSTEM SHALL CARRY AN UNDERWRITERS' LABORATORY MASTER LABEL.

B. CABLE TO BE #28X14, ALL COPPER, AND POINTS SHALL BE 5/8" X 12" (10") MINIMUM.

C. ALL LIGHTNING PROTECTION COMPONENTS, CABLES AND SUPPORTS SHALL BE TIN OR LEAD COATED.

D. GROUND RODS SHALL BE 3/4" X 10'.

PART 3 EXECUTION

3.01 INSTALLATION

A. ALL WORK TO BE PERFORMED BY A LICENSED INSTALLER.

B. RISERS TO BE CONCEALED IN BUILDINGS.

C. RISERS TO RUN ON EXTERIOR OF BUILDING.

D. CONTRACTOR IS TO SUBMIT EIGHT (8) COPIES OF SHOP DRAWINGS FOR APPROVAL PRIOR TO START OF INSTALLATION.

**SECTION 16771 HEAT TRACE**

PART 1 GENERAL

1.01 SUMMARY

A. SCOPE: PROVIDE ALL LABOR, MATERIAL, TOOLS, EQUIPMENT AND INCIDENTALS REQUIRED TO FURNISH, INSTALL, AND PLACE INTO SATISFACTORY OPERATION HEAT TRACING SYSTEMS, COMPLETE WITH APPURTENANCES AS SHOWN, SPECIFIED, AND AS REQUIRED.

1.02 SUBMITTALS

A. PRODUCT DATA:

1. MANUFACTURER'S LITERATURE, ILLUSTRATIONS, SPECIFICATIONS AND ENGINEERING DATA INCLUDING DIMENSIONS, MATERIALS, SIZE, WEIGHT, PERFORMANCE DATA INCLUDING EFFICIENCIES.

B. SHOP DRAWINGS:

1. ELECTRIC AND CONTROL WIRING DIAGRAMS.
2. LAYOUT DRAWINGS SHOWING LOCATIONS OF POWER TAPS AND THERMOSTATS.
3. SIZING CALCULATIONS FOR EACH RUN OF HEAT TRACE. CALCULATIONS SHALL SHOW:
  - a. AMBIENT TEMPERATURE AND WIND LOSS USED.
  - b. TEMPERATURE MAINTAINED IN MATERIAL.
  - c. RUNNING AND STARTUP CURRENT VALUES.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. HEAT TRACE:

1. SELF-REGULATING HEATING CABLE BY RAYCHEM CORPORATION.
2. OR APPROVED EQUAL.

2.02 MANUFACTURED UNITS

A. SERVICE CONDITIONS

1. PIPE HEAT TRACING SYSTEM SHALL BE PROVIDED FOR THE PIPING AS SHOWN ON THE DRAWINGS AND SHALL BE CAPABLE OF PREVENTING FREEZING OF THE PIPES OR OBJECTS PROTECTED THROUGHOUT THE AMBIENT TEMPERATURE RANGE OF MINUS 20F TO PLUS 45F.
2. POWER SUPPLY SHALL BE 120 VOLTS.
3. DESIGN THE HEAT TRACING SYSTEM WITH THE ASSUMPTION THAT THE CARRIED FLUID OR GAS IN THE PIPING IS NOT MOVING.

B. PIPE HEAT TRACING MATERIALS

1. TYPE: SELF-REGULATING, DESIGNED SO THAT IT CAN BE CUT TO ANY LENGTH WITHOUT SIGNIFICANTLY CHANGING THE HEATER OUTPUT PER UNIT LENGTH.
2. THE HEATER OUTPUT SHALL VARY IN RESPONSE TO TEMPERATURE CHANGES ALONG THE PIPE.
3. CONSTANT WATTAGE HEATERS SHALL NOT BE USED.
4. HEATER CABLE SHALL BE RATED FOR 225F. CABLE MAKE-UP SHALL INCLUDE A FIVE COMPONENT SYSTEM CONSISTING OF STRANDED COPPER BUS WIRE, SELF-REGULATING SEMI-CONDUCTIVE CORE, FLUOROPOLYMER JACKET, TINNED COPPER SHIELD AND FLUOROPOLYMER OUTER JACKET.
5. THE OUTER JACKET OF FLUOROPOLYMER SHALL BE PROVIDED OF SUITABLE THICKNESS AND CORROSION RESISTANT PROPERTIES TO PREVENT CORROSION FROM THE SURROUNDING ENVIRONMENT.
6. PROVIDE THERMOSTATIC CONTROL FOR EACH CIRCUIT. THERMOSTAT SHALL INCLUDE NEMA 4X ENCLOSURE WITH SP-DT SWITCH RATED 22 AMPS 125/250/480 VAC, 10 FOOT LONG STAINLESS STEEL CAPILLARY AND SENSING BULB.
7. THE HEATING SYSTEM SHALL ALSO INCLUDE ALL NECESSARY COMPONENTS FOR PROPER INSTALLATION OF EACH CIRCUIT AS REQUIRED. COMPONENTS SHALL INCLUDE THE FOLLOWING:
  - a. POWER CONNECTION KIT WITH JUNCTION BOX FOR CONNECTING EACH HEATER TO THE POWER CIRCUIT.
  - b. FIBROUS CLASS TAPE TO FIX HEATER TO PIPE EVERY 2 FEET.
  - c. LIQUID CABLE END SEAL KIT FOR TERMINATION OF CABLE.
  - d. PEEL-OFF SELF-STICKING BLACK ON YELLOW LABELS "ELECTRIC TRACED". LABELS SHALL BE PROVIDED FOR EACH TEN FEET OF PIPE.

PART 3 EXECUTION

3.01 INSTALLATION

A. INSPECT ALL ITEMS IMMEDIATELY UPON DELIVERY TO SITE FOR DAMAGE.

B. EACH REEL OF HEATER SHALL BE TESTED TO DETERMINE THAT THE HEATER HAS NOT BEEN DAMAGED IN SHIPMENT.

C. INSTALL ITEMS IN COMPLETE CONFORMANCE WITH THE SHOP DRAWINGS AND MANUFACTURER'S INSTALLATION INSTRUCTIONS AND LEAVE IN PROPER WORKING CONDITION.

D. PROVIDE ALL REQUIRED MOUNTING AND CONTROL ACCESSORIES, INCLUDING ALL BOLTS, NUTS, TIES, JUNCTION BOXES AND ADHESIVES.

E. INSTALL HEATING ELEMENTS DIRECTLY AGAINST METAL PIPE BEFORE INSULATION IS INSTALLED. INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

**SECTION 16901 INSTRUMENTATION AND CONTROL SYSTEMS FUNCTIONAL REQUIREMENTS**

PART 1 GENERAL

1.01 SUMMARY

A. THIS SECTION DESCRIBES THE FUNCTIONAL REQUIREMENTS OF THE INSTRUMENTATION AND CONTROL (I & C) SYSTEMS TO BE PROVIDED. THESE SYSTEMS SHALL BE PROVIDED AS COMPLETE, INTEGRATED, COMMISSIONED AND OPERATIONAL I & C SYSTEMS. ADDITIONAL REQUIREMENTS MAY BE INCLUDED IN OTHER SECTIONS OF THE CONTRACT DOCUMENTS.

B. ALL SYSTEMS SHALL BE FULLY COORDINATED WITH MANUFACTURER'S EQUIPMENT AND INCORPORATE ALL SUPPLIED FEATURES OF THE EQUIPMENT.

C. THE SPECIFICATIONS IN THIS SECTION ARE SUBJECT TO THE ADMINISTRATIVE AND PROCEDURAL REQUIREMENTS SPECIFIED IN DIVISION 1, AS WELL AS THE BROADER REQUIREMENTS OF THE GENERAL CONDITIONS.

D. THE INSTRUMENTATION AND CONTROLS SYSTEM SUPPLIER QUALIFICATIONS

1. THE INSTRUMENTATION AND CONTROLS SYSTEM SUPPLIER SHALL BE WITHIN 150 MILES OF THE JOBSITE.
2. SHALL DEMONSTRATE PREVIOUS EXPERIENCE SUPPLYING SIMILAR SYSTEMS.

1.02 RELATED SECTIONS

A. 16030 - TEST AND INSPECTIONS

B. 16902 - INSTRUMENTS AND CONTROLS

C. 16903 - CABINETS, CONSOLES, PANELS AND ENCLOSURES

1.03 SUBMITTALS. SUBMITTALS SHALL MEET THE REQUIREMENTS OF SECTIONS 01300 AND 01340.

A. SHOP DRAWINGS

1. LOOP DIAGRAMS, USING THE ISA 5.4 STANDARD AND STANDARD ISA SYMBOLS.
2. PROCESS AND INSTRUMENTATION DRAWINGS.

B. PRODUCT DATA

1. SYSTEM SUPPLIER QUALIFICATIONS

1.04 SYSTEM DESCRIPTION

A. PUMPING STATION

1. RAW SEWAGE PUMPS: THE PUMPS ARE CONTROLLED BY REDUCED VOLTAGE SOFT STARTERS IN THE PUMP CONTROL PANEL. EACH PUMP WILL HAVE A HAND-OFF-AUTO (HOA) SWITCH TO ENABLE LOCAL CONTROL IN HAND MODE THE OPERATOR CAN RUN THE SELECTED PUMP. WHEN THE SWITCH IS IN REMOTE MODE THE PUMP CONTROLLER (AND EMERGENCY PUMPING CIRCUIT, AS DESCRIBED BELOW) HAS CONTROL OF THE PUMP. THE PUMP CONTROLLER WILL PROVIDE LEVEL CONTROL OF THE WELL BY STARTING THE PUMP WHEN LEVEL EXCEEDS PUMP START LEVEL SETPOINT. IN THE EVENT OF A MORE SIGNIFICANT FAILURE (FOR EXAMPLE, THE PUMP CONTROLLER FAILS), A BACKUP HIGH LEVEL FLOAT WILL ACTIVATE TO RUN THE PUMP. THIS EMERGENCY PUMPING CIRCUIT IS TO BE HARDWIRED AS SHOWN IN THE DRAWINGS. IN THE EVENT UTILITY POWER IS LOST, THE PUMP STATION OPERATION SHOULD RESUME NORMAL OPERATION WITHIN 120 SECONDS OF RESTORATION OF POWER (WHETHER THE RESTORATION IS FROM GENERATOR OR FROM NORMAL UTILITY POWER).
2. PUMP STATION CONTROLLER/TELEMETRY PANEL: THIS PANEL CONTAINS THE PUMP STATION CONTROLLER, OPERATOR INTERFACE, RADIO TELEMETRY SYSTEM, EMERGENCY PUMPING CIRCUIT, INTRINSICALLY SAFE BARRIERS FOR LEVEL SENSING, AND VARIOUS OTHER CIRCUITS AND COMPONENTS TO PROVIDE FOR OPERATION, MONITORING, AND ALARMS FOR THE PUMP STATION. THE PUMP STATION CAN BE MONITORED AND CONTROLLED REMOTELY VIA RADIO TELEMETRY SYSTEM.

PART 2 PRODUCTS

2.01 GENERAL: ALL SYSTEMS ARE TO BE SUPPLIED AS COMPLETE AND OPERABLE SYSTEMS AS DESCRIBED IN THE CONTRACT DOCUMENTS.

2.02 CONDITIONS: ALL EQUIPMENT SUPPLIED SHALL BE SUITABLE FOR OPERATION UNDER THE FOLLOWING ENVIRONMENTAL CONDITIONS.

A. CONDITIONED SPACES SHOWN ON DRAWINGS.

1. AMBIENT TEMPERATURE: 60 TO +104 DEGREES F.
2. RELATIVE HUMIDITY: 50 TO 90 PERCENT.

2.03 FACTORY TESTING

A. CONTRACTOR SHALL ENERGIZE AND TEST ALL INSTRUMENTATION AND CONTROL PRIOR TO SHIPPING. THE ENGINEER SHALL BE GIVEN WRITTEN NOTIFICATION OF TESTING AND HAVE THE OPPORTUNITY TO WITNESS TESTING AT HIS OWN EXPENSE. THE ENGINEER SHALL BE SUPPLIED WITH THE TEST RESULTS FROM THE REQUIRED FACTORY TESTING BEFORE THE PANEL IS SHIPPED TO THE SITE.

PART 3 EXECUTION

3.01 GENERAL

A. INSTALL ALL INSTRUMENTATION AND CONTROL SYSTEM EQUIPMENT AND COMPONENTS IN ACCORDANCE WITH THE DRAWINGS, APPROVED SHOP DRAWINGS, AND INSTALLATION INSTRUCTIONS FURNISHED BY THE MANUFACTURER.



B. DO NOT BEGIN INSTALLATION OF FIELD INSTRUMENTS, PANELS, CONSOLES AND CABINETS UNTIL BUILDING CONSTRUCTION IS COMPLETED AND MAJOR PIPING AND EQUIPMENT HAVE BEEN INSTALLED. INSTALL IN-LINE PIPING PRIMARY ELEMENTS AS MAJOR PIPING IS INSTALLED.

C. INSPECT EACH INSTRUMENT, PANEL, CONSOLE, CABINET AND OTHER ITEMS FOR DAMAGE AND DEFECTS BEFORE INSTALLATION. REPLACE DEFICIENT ITEMS.

3.02 TRAINING

A. ON-SITE TRAINING:

1. ELECTRICAL AND INSTRUMENTATION.

DELAWARE COUNTY		
VERONA SECTION 1		
FORCE MAIN AND PUMP STATION IMPROVEMENTS		
PUMP STATION ELECTRICAL SPECIFICATIONS		
PREPARED BY:		
		
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**SECTION 16902 INSTRUMENTS AND CONTROLS**

PART 1 GENERAL

1.01 SECTION INCLUDES

A. DESCRIPTION OF INSTRUMENTS AND CONTROLS.

1.02 RELATED SECTIONS

A. 16195 – IDENTIFICATION  
B. 16901 – INSTRUMENTATION AND CONTROL SYSTEMS FUNCTIONAL REQUIREMENTS  
C. 16903 – CABINETS, CONSOLES, PANELS AND ENCLOSURES

1.03 DESCRIPTION

A. WORK UNDER THIS SECTION INCLUDES LABOR, MATERIALS, EQUIPMENT AND INCIDENTALS REQUIRED TO PROVIDE INSTRUMENTS AND CONTROL EQUIPMENT AS SHOWN AND SPECIFIED.

B. COORDINATION OF ELECTRICAL WORK IS SPECIFIED IN SECTION 16010.

C. INSTRUMENTATION AND CONTROL SYSTEMS FUNCTIONAL REQUIREMENTS ARE SPECIFIED IN SECTION 16901.

D. CABINETS, CONSOLES, PANELS AND ENCLOSURES ARE SPECIFIED IN SECTION 16903.

E. THE SPECIFICATIONS IN THIS SECTION ARE SUBJECT TO THE ADMINISTRATIVE AND PROCEDURAL REQUIREMENTS SPECIFIED IN DIVISION 1, AS WELL AS THE BROADER REQUIREMENTS OF THE GENERAL CONDITIONS.

1.04 SUBMITTALS. SUBMITTALS SHALL MEET THE REQUIREMENTS OF SECTIONS 01300 AND 01340:

A. SHOP DRAWINGS

B. PRODUCT DATA. COMPLY WITH SECTION 01340.

1. MANUFACTURER OF THE INSTRUMENTATION AND CONTROL SYSTEM SHALL NOT RELEASE FOR MANUFACTURE ANY DEVICE UNTIL RELATED SUBMITTALS HAVE BEEN APPROVED.

2. MANUFACTURERS' SPECIFICATIONS AND TECHNICAL DATA FOR EACH ITEM PROPOSED FOR INCORPORATION INTO THE WORK.

3. MANUFACTURER'S INSTRUCTIONS FOR EACH ITEM PROPOSED FOR INCORPORATION INTO THE WORK

C. SAMPLES OR MOCK-UPS: NOT USED.

D. MAINTENANCE AND OPERATING INSTRUCTIONS: SUBMIT IN ACCORDANCE WITH ALL PROVISIONS OF SECTION 01730. DISTRIBUTOR LEVEL DOCUMENTATION APPLIES TO THIS SECTION.

E. PERSONNEL QUALIFICATIONS: NOT USED.

F. OPERATOR TRAINING/LESSON PLANS

1. SEE SECTION 16901

G. WARRANTIES AND GUARANTEES: COMPLY WITH SECTION 01740 AND PROVIDE THE FOLLOWING:

1. CONTRACTORS EXPRESS WARRANTY.

H. SPECIAL TOOLS AND REPAIR PARTS: COMPLY WITH SECTION 01750.

I. INSTALLATION DATA AND INSPECTION DATA: THE FOLLOWING SUBMITTALS MEETING THE REQUIREMENTS OF SECTIONS 01300 AND 01340 SHALL BE PROVIDED:

1. FIELD INSTALLATION MANUAL FOR EACH ITEM PROPOSED FOR INCORPORATION INTO THE WORK.

J. PERFORMANCE REPORTS AND TEST DATA: THE FOLLOWING SUBMITTALS MEETING THE REQUIREMENTS OF SECTIONS 01300 AND 01340 SHALL BE PROVIDED:

1. PERFORMANCE AND TEST DATA REPORTS FOR EACH ITEM PROPOSED FOR INCORPORATION INTO THE WORK.

K. PRODUCT/MATERIAL CERTIFICATIONS: NOT USED.

L. CONSTRUCTION PHOTOGRAPHS: NOT USED.

M. PROJECT RECORD DOCUMENTS: COMPLY WITH SECTION 01340.

N. OTHER: NOT USED.

1.05 QUALITY ASSURANCE NOT USED.

1.06 DELIVERY, STORAGE AND HANDLING

A. TRANSPORTATION AND HANDLING SHALL MEET THE REQUIREMENTS OF SECTION 01610.

B. FULLY PROTECTED STORAGE MEETING THE REQUIREMENTS OF SECTION 01620 SHALL BE PROVIDED.

1.07 PROJECT/SITE CONDITIONS NOT USED.

1.08 SCHEDULE NOT USED.

1.09 SPECIAL WARRANTY NOT USED.

**PART 2 PRODUCTS**

2.01 LIQUID LEVEL SENSING PROBE

A. GENERAL: PROVIDE LEVEL PROBE AS SHOWN ON THE DRAWINGS. THE INSTALLATION SHALL ALLOW FOR REMOVAL OF PROBE WITHOUT ENTERING THE TANK.

B. REQUIRED FEATURES:

1. TEMPERATURE RANGE: 32 TO 212 DEGREES F.  
2. CABLE: PVC/PVC MULTICORE  
3. HOUSING: SENSING ELEMENT SHALL BE HIGH-GRADE SS ALLOY. PROBE CASING TO BE UPVC PREMIUM QUALITY EXTRUDED TUBE.  
4. MOUNTING: MOUNTING BRACKETS AND HARDWARE TO BE PROVIDED AS SHOWN ON THE DRAWINGS AND AS NEEDED. ALL MATERIAL SHALL BE 316 STAINLESS STEEL.  
5. TECHNOLOGY TYPE: PROVIDE 10-POINT CONDUCTIVE SENSORS SPACED AT 6" INTERVALS.  
6. ACCESSORIES: PROVIDE ALL REQUIRED INTERFACING RELAYS INCLUDING INTRINSICALLY SAFE BARRIER. PROVIDE CONTACT CLOSURE TYPE INTERFACE FOR THE 10-POINT SENSOR.

C. MANUFACTURERS / PRODUCT: MULTITRODE CONDUCTIVE LEVEL SENSOR.

2.02 FLOAT SWITCH

A. GENERAL: PROVIDE FLOAT SWITCH AS SHOWN ON THE DRAWINGS. THE INSTALLATION SHALL ALLOW FOR REMOVAL OF THE FLOAT WITHOUT ENTERING THE TANK.

B. REQUIRED FEATURES:

1. TEMPERATURE RANGE: 32 TO 140 DEGREES F.  
2. CABLE: PVC/PVC MULTICORE.  
3. HOUSING: CASING SHALL BE POLYPROPYLENE. IP68 RATED..  
4. MOUNTING: MOUNTING BRACKETS AND HARDWARE TO BE PROVIDED AS SHOWN ON THE DRAWINGS AND AS NEEDED. ALL MATERIAL SHALL BE 316 STAINLESS STEEL.

C. MANUFACTURERS / PRODUCT: FLYGT ENM-10 LEVEL REGULATOR.

2.03 BATTERY CHARGER/DC UPS MODULE

A. GENERAL: PROVIDE BATTERY CHARGER/DC UPS MODULE AS SHOWN ON THE DRAWINGS.

B. REQUIRED FEATURES:

1. ELECTRICAL RATING: 30VDC INPUT; 10A LOAD AT 28 VDC; 10-14VDC SUPPLIED.  
2. PROTECTION: DIODE PROTECTED FOR REVERSE AND OVER-VOLTAGE CONDITIONS.  
3. POWER CONSUMPTION 500MW MAX; 24MA AT 13.6VDC, 17MA AT 10VDC.  
4. TEMPERATURE RANGE: 32 TO 140 DEGREES F.  
5. HOUSING: 2.75 X 1.75 X 2.735 IN. EXCLUDING PINS.  
6. MOUNTING: DIN RAIL MOUNTABLE.

C. MANUFACTURERS / PRODUCT: TRANSTRONICS BVUPS24.

2.04 SEALED LEAD-ACID BATTERY

A. GENERAL: PROVIDE SEALED LEAD-ACID BATTERY AS SHOWN ON THE DRAWINGS.

B. REQUIRED FEATURES:

1. ELECTRICAL RATING: 12VDC; 7AH.  
2. FLOAT VOLTAGE: 13.8VDC  
3. TEMPERATURE RANGE: -4 TO 140 DEGREES F.  
4. HOUSING: 2.56 X 5.945 X 3.84 IN.

C. MANUFACTURERS / PRODUCT: TRANSTRONICS BAT12V7AH YUASA NP7-12.

2.05 POWER SUPPLY

A. GENERAL: PROVIDE POWER SUPPLY AS SHOWN ON THE DRAWINGS.

B. REQUIRED FEATURES:

1. ELECTRICAL RATING: 100-240V VAC, 45-65HZ INPUT; 4A, 24VDC OUTPUT.  
2. EFFICIENCY: 88%  
3. PROTECTION: TRANSIENT SURGE PROTECTION VIA VARISTOR  
4. TEMPERATURE RANGE: -13 TO 140 DEGREES F.  
5. HOUSING: 67.5MM X 99MM X 107MM, IP20.  
6. MOUNTING: DIN RAIL MOUNTABLE.

C. MANUFACTURERS / PRODUCT: PHOENIX CONTACT MINI-PS-100-240AC/24DC/4.

2.06 INTRINSICALLY SAFE BARRIER

A. GENERAL: PROVIDE INTRINSICALLY SAFE BARRIER AS SHOWN ON THE DRAWINGS.

B. REQUIRED FEATURES:

1. ELECTRICAL RATING: 24VDC VOLTAGE SUPPLY.  
2. MAX CURRENT CONSUMPTION: 21MA (24VDC)  
3. CONTACT MATERIAL: AGSNO2, HARD GOLD-PLATED  
4. TEMPERATURE RANGE: -4 TO 140 DEGREES F.  
5. HOUSING: 12.5MM X 99MM X 114.5MM, IP20.  
6. MOUNTING: DIN RAIL MOUNTABLE.  
7. CLASSIFICATION RATING: IS FOR CLASS 1, 2, 3 DIV 1

C. MANUFACTURERS / PRODUCT: PHOENIX CONTACT MACX MCR-EX-SL-NAM-R-2865434.

**SECTION 16903 CABINETS, CONSOLES, PANELS AND ENCLOSURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

A. DESCRIPTION OF CABINETS, CONSOLES, PANELS AND ENCLOSURES.

B. DESCRIPTION OF CONTROL AND CONTROL PANEL FABRICATION.

1.02 RELATED SECTIONS

A. 16195 – IDENTIFICATION  
B. 16901 – INSTRUMENTS AND CONTROLS SYSTEMS FUNCTIONAL REQUIREMENTS  
C. 16902 – INSTRUMENTS AND CONTROLS

1.03 DESCRIPTION

A. WORK UNDER THIS SECTION INCLUDES LABOR, MATERIALS, EQUIPMENT AND INCIDENTALS REQUIRED TO FURNISH AND INSTALL CABINETS, CONSOLES, PANELS AND ENCLOSURES AS SHOWN, SPECIFIED OR REQUIRED.

B. COORDINATION OF ELECTRICAL WORK IS SPECIFIED IN SECTION 16010.

C. CAST-IN-PLACE CONCRETE FOR MOUNTING PADS IS SPECIFIED IN SECTION 03300.

D. ELECTRICAL IDENTIFICATION AND COLOR CODING REQUIREMENTS ARE SPECIFIED IN SECTION 16195.

E. GROUNDING SYSTEMS ARE SPECIFIED IN SECTION 16451.

F. THE SPECIFICATIONS IN THIS SECTION ARE SUBJECT TO THE ADMINISTRATIVE AND PROCEDURAL REQUIREMENTS SPECIFIED IN DIVISION 1, AS WELL AS THE BROADER REQUIREMENTS IN THE GENERAL CONDITIONS.

1.04 SUBMITTALS. SUBMITTALS SHALL MEET THE REQUIREMENTS OF SECTIONS 01300

A. SHOP DRAWINGS. COMPLY WITH SECTION 01300 AND SUBMIT THE FOLLOWING:

1. LOCATION PLAN AND IDENTIFICATION INCLUDING LAYOUT PLANS OF CONTROL ROOMS.  
2. INTERNAL AND EXTERNAL PLANS, ELEVATIONS AND SECTIONS OF PANELS, COMPLETE WITH MATERIALS OF CONSTRUCTION, DIMENSIONS, FINISH AND NEMA RATING PER NEMA 250.  
3. PANEL COMPONENT MOUNTING AND INSTALLATION DETAILS INCLUDING NAMEPLATE SIZE AND LOCATION.  
4. LOCATION OF EXTERNAL WIRING AND PIPING ENTRIES, EXITS AND CONNECTIONS.  
5. LOCATION, DESCRIPTION, IDENTIFICATION, DIMENSIONS AND MANUFACTURER'S CATALOG NUMBER OF ITEMS MOUNTED IN OR ON PANEL.  
6. NAMEPLATE SCHEDULE INCLUDING SIZE, TEXT, LETTER SIZE, COLORS AND MATERIALS.  
7. PANEL WIRING AND PIPING DRAWINGS SHOWING POINT-TO-POINT WIRING AND DISCRETE PIPING DETAILS.

B. PRODUCT DATA. COMPLY WITH SECTION 01300.

1. FOR EACH PANEL, A LIST OF ALL PANEL COMPONENTS, INCLUDING INSTRUMENTS, CONTROLS, ANNUNCIATORS, ELECTRICAL AND PNEUMATIC EQUIPMENT AND HARDWARE, AND SUPPORTING SYSTEMS.  
2. FOR EACH PANEL COMPONENT LISTED, THE FOLLOWING:  
a. MANUFACTURER'S PRODUCT NAME, MODEL NUMBER AND CATALOG OR STOCK NUMBER.  
b. TAG NUMBER, IF APPLICABLE.  
c. FUNCTIONAL NAME (PROCESS APPLICATION).  
d. STANDARD CATALOG CUT SHEETS.  
e. DESCRIPTION OF CONSTRUCTION AND FEATURES.  
f. DIMENSIONS AND MOUNTING/INSTALLATION DETAILS AND REQUIREMENTS.  
g. OPERATIONAL CHARACTERISTICS AND FUNCTIONAL CAPABILITIES.  
h. SERVICE REQUIREMENTS, E.G. POWER, WATER, AIR SUPPLY.  
i. APPLICATION DATA.

C. PROJECT RECORD DOCUMENTS: COMPLY WITH SECTION 01720.

1. AS-BUILT SHOP DRAWINGS UPDATED TO SHOW IDENTIFICATION OF FIELD WIRING.

**PART 2 PRODUCTS**

2.01 MATERIALS

A. SQUARE D, ALLEN BRADLEY, OR CUTLER HAMMER-WESTINGHOUSE CONTROLS MAY BE FURNISHED AT CONTRACTOR'S OPTION.

B. CONTROL RELAYS: RELAYS SHALL BE SIMILAR TO ALLEN BRADLEY 700-HB. PROVIDE MANUAL OPERATOR AND PILOT LIGHT OPTION. FURNISH WITH COILS AND CONTACTS AS INDICATED ON THE DRAWINGS.

C. PILOT LIGHTS: LIGHTS FOR 24 VAC OPERATION SHALL BE FULL VOLTAGE. LIGHTS 120 VAC SHALL BE LONG LIFE TRANSFORMER TYPE. ALLEN BRADLEY TYPE 800H.

D. PUSH-BUTTONS: SHALL BE ROUND, FLUSH HEAD, BOOTLESS, HEAVY DUTY WATER TIGHT AND CORROSION RESISTANT. ALLEN BRADLEY TYPE 800H.

E. SELECTOR SWITCHES: SHALL BE HEAVY DUTY WATER TIGHT AND CORROSION RESISTANT. ALLEN BRADLEY TYPE 800H.

F. TERMINAL BLOCKS: RAIL MOUNTED, TERMINAL BLOCKS, FUSE HOLDERS AND KNIFE SWITCHES SHALL BE PROVIDED AS SHOWN AND NEEDED. ALLEN BRADLEY TYPE FINGER SAFE TERMINALS.

G. WIRE: SHALL BE COPPER, STRANDED #14 AWG MINIMUM FOR CONTROL AND #12 AWG MINIMUM FOR POWER. TYPE THWN, 600 VOLT INSULATION.

H. SHIELDED INSTRUMENTATION CABLE: BELDEN 9316

I. ENCLOSURES

1. FABRICATION:

a. PANELS PROVIDED UNDER OTHER DIVISIONS OF THE CONTRACT, AS WELL AS PANELS PROVIDED UNDER DIVISION 16, SHALL CONFORM TO THE REQUIREMENTS OF THIS SECTION.  
b. PANELS SHALL BE OF THE SIZE AND QUANTITY REQUIRED TO HOUSE THE EQUIPMENT.  
c. PANELS SHALL MEET THE REQUIREMENTS OF NEMA 250 AND NEMA ICS 6 FOR THE TYPE SHOWN OR SPECIFIED.  
d. A PANEL WITH NO EXTERIOR DIMENSION (LENGTH, WIDTH, DEPTH) GREATER THAN 60 INCHES SHALL BE CLASSIFIED AS A SMALL PANEL. SMALL PANELS SHALL BE FABRICATED USING 14 GAUGE MINIMUM 316 STAINLESS STEEL UNLESS OTHERWISE SHOWN OR SPECIFIED.  
e. A PANEL WITH ANY EXTERIOR DIMENSION (LENGTH, WIDTH, DEPTH) 60 INCHES OR GREATER SHALL BE CLASSIFIED AS A LARGE PANEL. LARGE PANELS SHALL BE FABRICATED USING 11 GAUGE MINIMUM 316 STAINLESS STEEL UNLESS OTHERWISE SHOWN OR SPECIFIED.  
f. PANELS SHALL HAVE SUFFICIENT STRENGTH AND STRUCTURAL INTEGRITY TO SUPPORT PANEL COMPONENTS AND MAINTAIN PANEL RIGIDITY AND SQUARENESS. PANEL CONSTRUCTION SHALL PRECLUDE RESONATE VIBRATIONS, DEFLECTIONS, WARPS, AND OUT-OF-PLANE SURFACES.  
g. LARGE PANELS SHALL BE PROVIDED WITH INTERIOR FRAMING CONSISTING OF WELDED 304 OR 316 STAINLESS STEEL ANGLE. FRAMING SHALL CONSIST OF A 3-INCH BY 3-INCH ANGLE BASE WITH 2-INCH BY 2-INCH OR LARGER ANGLE SIDE AND TOP MEMBERS.  
h. EXTERIOR SEAMS SHALL BE CONTINUOUSLY WELDED, GROUND SMOOTH AND POLISHED TO A NO. 4 FINISH. WELDS SHALL HAVE A MINIMUM RADIUS OF 1/4-INCH.  
i. PANEL DOORS SHALL BE PAN TYPE CONSTRUCTION. UNLESS OTHERWISE SHOWN OR SPECIFIED PANELS SHALL HAVE FULL HEIGHT REAR ACCESS DOORS. DOOR WIDTH SHALL NOT EXCEED 36 INCHES.  
j. DOORS SHALL BE MOUNTED WITH FULL LENGTH 316 STAINLESS STEEL PIANO HINGES.  
k. DOOR HINGES SHALL BE WELDED.  
l. DOOR SHALL HAVE A SEAMLESS GASKET, WHICH SHALL PROVIDE WATERTIGHT SEAL AROUND EACH DOOR OPENING.  
m. A HANDLE-OPERATED, PADLOCKABLE, THREE POINT, STAINLESS STEEL LATCHING SYSTEM SHALL BE PROVIDED FOR ALL DOORS ON LARGE PANELS.  
n. NEMA 4X RATED PANELS SHALL HAVE CLAMPS ON THREE SIDES OF EACH DOOR. CLAMPS SHALL BE SCREWED-ON, STAINLESS STEEL, FAST OPERATING, OVER-CENTER TYPE, HOFFMAN OR APPROVED EQUAL.  
o. ALL DOORS ON ALL PANELS SHALL BE PADLOCKABLE.  
p. ALL PANELS THAT ARE TO BE WALL MOUNTED SHALL HAVE AN ADEQUATE NUMBER OF WALL MOUNTING TABS WELDED TO THE PANEL AS REQUIRED AND/OR AS SHOWN ON THE DRAWINGS.  
q. SUBPANELS  
r. INTERIOR SUBPANELS  
s. INTERIOR SUBPANELS SHALL BE PROVIDED AND SHALL BE CONSTRUCTED OF 12 GAUGE STEEL WITH WHITE ENAMEL FINISH.  
t. INNER DOOR PANELS  
u. WHERE CALLED FOR ON THE DRAWINGS INNER DOOR PANELS SHALL BE PROVIDED. THEY SHALL BE 12 GAUGE STEEL WITH WHITE ENAMEL FINISH. THE INNER DOOR PANEL SHALL HAVE A CONTINUOUS STAINLESS STEEL PIANO HINGE ON ONE SIDE SO THE PANEL CAN SWING OUT. THE OTHER SIDE WILL HAVE CLAMPS FOR SECURING THE PANEL. WHEN THE PANEL IS SECURE AND THE OUTER DOOR IS CLOSED THERE SHALL BE 4 INCHES OF CLEARANCE BETWEEN THEM.  
v. PRINT POCKET SHALL BE PROVIDED.  
w. FINISH:  
1. EXTERIOR STAINLESS STEEL SURFACES SHALL BE CLEANED AND POLISHED TO A NO. 4 FINISH.  
2. INTERIOR STAINLESS STEEL SURFACES SHALL BE CLEANED, DEGREASED AND FREE OF WELDING RESIDUE.  
3. NON-STAINLESS STEEL SURFACES SHALL BE GROUND SMOOTH, CLEANED AND DEGREASED. SURFACES SHALL BE PHOSPHATIZED OR ZINC CHROMATED AND THEN HAVE TWO COATS OF PRIMER AND TWO COATS OF ENAMEL FINISH APPLIED. UNLESS OTHERWISE SHOWN OR SPECIFIED, COLOR SHALL BE SELECTED BY CMT.

2. PRODUCTS & MANUFACTURERS:

a. ALL PANELS SHALL BE HOFFMAN OR APPROVED EQUAL.

1. NEMA 4X ENCLOSURES NUMBER CHNFS5 TYPE 316 WITH SUBPANEL. APPLIES TO ALL OUTDOOR ENCLOSURES INCLUDING DISCONNECTS.  
2. NEMA 12 A- SERIES ENCLOSURES. APPLIES TO ALL INDOOR ENCLOSURES.

J. CORROSION INHIBITOR DEVICES: ONE (1) UNIT PER 10 CUBIC FEET OF VOLUME SHALL BE PROVIDED FOR ALL PANELS.

1. HOFFMAN A-HCL-10E.  
2. OR APPROVED EQUAL.

**PART 3 EXECUTION**

3.01 CONTROL PANEL FABRICATION AND DEVICES

A. ALL PANELS SHALL BE FULLY ASSEMBLED AS COMPLETE AND OPERABLE UNITS.

1. EQUIPMENT, PANEL COMPONENTS, INSTRUMENTATION AND ELECTRICAL HARDWARE SHALL BE INSTALLED AND INTERCONNECTED TO PROVIDE THE SPECIFIED INDICATING AND CONTROL FUNCTIONS.  
2. MISCELLANEOUS PANEL COMPONENTS INCLUDING BUT NOT LIMITED TO ELECTRICAL HARDWARE, CIRCUIT PROTECTORS, MAIN POWER TERMINALS, WIRING, SUPPORT HARDWARE, FASTENERS AND TRIM, SHALL BE PROVIDED AS SHOWN, SPECIFIED OR REQUIRED.  
B. UNLESS OTHERWISE SHOWN OR SPECIFIED, WIRING AND PIPING PENETRATIONS SHALL BE THROUGH THE BOTTOM OF THE PANEL.  
C. PANEL COMPONENTS SHALL BE MOUNTED AS FOLLOWS:  
1. PANEL COMPONENTS SHALL BE SUPPORTED AND RESTRAINED TO PREVENT UNDESIED MOVEMENT. SUPPORT AND RESTRAINT SHALL BE PROVIDED USING 304 OR 316 STAINLESS STEEL ANGLE, CHANNEL, STRUT AND HARDWARE.  
2. PANEL COMPONENTS SHALL BE INSTALLED IN AND ON THE PANEL TO ALLOW SERVICE OR REMOVAL OF ANY COMPONENT WITHOUT DISTURBING OTHER PANEL COMPONENTS.  
3. MOUNTING ELEVATIONS:  
a. BOTTOMS OF INDICATORS AND CONTROLLERS SHALL BE LOCATED NO LOWER THAN 48 INCHES ABOVE THE FLOOR ON A PANEL FACE.  
b. TOPS OF INDICATORS AND CONTROLLERS SHALL BE LOCATED NO HIGHER THAN 70 INCHES ABOVE THE FLOOR ON A PANEL FACE.  
c. BOTTOMS OF LIGHTS, SELECTOR SWITCHES AND PUSHBUTTONS SHALL BE LOCATED NO LOWER THAN 32 INCHES ABOVE THE FLOOR ON A PANEL FACE.  
d. TOPS OF LIGHTS, SELECTOR SWITCHES AND PUSHBUTTONS SHALL BE LOCATED NO HIGHER THAN 70 INCHES ABOVE THE FLOOR ON A PANEL FACE.  
e. TOPS OF ANNUNCIATORS SHALL BE LOCATED NO HIGHER THAN 86 INCHES ABOVE THE FLOOR ON A PANEL FACE.  
f. INSTALLATION OF PANEL COMPONENTS SHALL CONFORM WITH COMPONENT MANUFACTURERS' GUIDELINES.  
A. WIRING SHALL BE INSTALLED IN RUNS ALONG HORIZONTAL OR VERTICAL ROUTES. ANGLED RUNS ARE NOT ACCEPTABLE.  
B. POWER AND CONTROL WIRING SHALL BE SEPARATED FROM SIGNAL WIRING BY A MINIMUM DISTANCE OF 4 INCHES.  
C. ALL SIGNAL WIRING ENTERING AND LEAVING PANELS SHALL GO THROUGH SURGE ARRESTERS.  
D. OPEN SLOT PLASTIC WIRE TROUGHS WITH SCREW DOWN COVERS SHALL BE PROVIDED FOR PARALLEL RUNS OF WIRE.  
1. FILL SHALL BE LIMITED TO 25 PERCENT OF TROUGH CROSS SECTION AREA EXCLUDING FIELD WIRING.  
E. ALL WIRING SHALL BE SUPPORTED AND SECURED TO PREVENT EXCESSIVE STRAIN, SAGGING OR UNDESIRABLE MOVEMENT.  
F. CABLE TIE MOUNTING PLATES SHALL BE BOLTED OR SCREWED INTO PLACE.  
G. PANEL CONSTRUCTION SHALL MAINTAIN THE NEMA RATING OF THE SPECIFIED ENCLOSURE.  
H. FURNISH PANELS WITH ENGRAVED NAMEPLATES IN CONFORMANCE WITH IDENTIFICATION SECTION OF THIS SPECIFICATION. NAMEPLATES AND DEVICE LEGEND PLATES SHALL BE AS SHOWN ON THE DRAWINGS AND SPECIFIED HEREIN.  
I. SELF-ADHESIVE NAMEPLATES SHALL BE USED TO IDENTIFY DEVICES ON THE SUBPANEL.  
J. NEMA 4X ENCLOSURE SHALL BE 316 STAINLESS STEEL, NEMA 4X CONSTRUCTION. PANELS SHALL BE FURNISHED WITH SUB-PANELS. FRONT DOORS OF PANELS TO BE HINGE MOUNTED. PANELS SHALL BE FURNISHED WITH ADEQUATE SPACE ON THE BOTTOM OF THE ENCLOSURE FOR CONDUIT ENTRY.  
K. ALL DEVICE WIRING SHALL BE TERMINATED ON TERMINAL BLOCKS WITH NO MORE THAN TWO (2) WIRES PER SCREW. TERMINALS SHALL BE INSTALLED SUCH THAT A MINIMUM OF 20% ADDITIONAL TERMINALS CAN BE ADDED IN THE FIELD AND 20% SPARE TERMINALS SHALL BE INSTALLED BY THE PANEL MANUFACTURER. ALL TERMINALS AND WIRES SHALL BE MARKED WITH WIRE NUMBERS AS ASSIGNED ON CONTROL DIAGRAMS. WIRING SHALL BE GENERAL PURPOSE OPEN TYPE, NEATLY BUNDLED AND LACED AND SECURELY FASTENED, OR INSTALLED IN PLASTIC WIRING TROUGHS.  
1. SPARE TERMINALS BLOCKS SHALL BE PROVIDED EQUAL IN NUMBER TO A MINIMUM OF 20 PERCENT OF THE NUMBER OF TERMINAL BLOCKS USED (INCLUDING GROUND TERMINAL BLOCKS). SPARES SHALL BE DISTRIBUTED PROPORTIONATELY AMONG THE FOLLOWING CATEGORIES OF TERMINAL BLOCKS:  
a. SIGNAL  
b. POWER  
c. CONTROL  
L. ALL CONTROL WIRING SHALL HAVE AN IDENTIFYING NUMBER ON A PLASTIC FLAG TYPE MARKER ATTACHED TO THE WIRE AT EACH TERMINAL POINT. WRAP ONCE AROUND, STICK THE ADHESIVE SIDES TOGETHER TO FORM A FLAG. EACH WIRE SHALL HAVE THE SAME IDENTIFICATION ON BOTH ENDS. EACH WIRE SHALL HAVE IDENTIFICATIONS DIFFERENT FROM ALL OTHER WIRES. WIRE MARKING SHALL INDICATE PHASE, POTENTIAL, CURRENT, CONTROL, ETC. THE WIRE IDENTIFICATION USED SHALL BE SHOWN ON THE SHOP DRAWINGS WIRING DIAGRAM. SLEEVE TYPE WIRE MARKERS MAY BE USED.  
M. ALL CONTROL AND POWER FUSES SHALL BE MOUNTED SO THEY ARE EASILY ACCESSIBLE. POWER FUSES SHALL BE BUSSMANN LOW PEAK RK-1 AND CONTROL FUSES SHALL BE BUSSMANN LOW PEAK LP-CC AND SHALL BE IDENTIFIED WITH LAMICOID NAMEPLATES 1" HIGH AND 1/4" HIGH LETTERS, ATTACHED WITH TWO SCREWS. SEE IDENTIFICATION SECTION.  
N. THE PANELS SHALL BE FACTORY-TESTED PRIOR TO SHIPMENT. FIELD INSTALLATION SHALL CONSIST ONLY OF SETTING AND CONNECTIONS.  
O. PANEL MANUFACTURER SHALL SUPPLY A SYSTEM SCHEMATIC DRAWING ILLUSTRATING ALL COMPONENTS BEING SUPPLIED, COMPLETE WITH ELECTRICAL INTER-CONNECTIONS ALL OF WHICH SHALL BE CLEARLY IDENTIFIED AND COMPLETE WITH TERMINAL NUMBERS. LITERATURE SHALL BE SUBMITTED IN SIX (6) COMPLETE SETS.

3.02 EXAMINATION AND VERIFICATION OF CONDITION

A. ITEMS SHALL BE INSPECTED FOR DAMAGE IMMEDIATELY UPON DELIVERY TO THE SITE.  
B. DAMAGED ITEMS SHALL NOT BE USED.

3.03 PREPARATION

A. NO PANEL SHALL BE INSTALLED UNTIL THE ENVIRONMENTAL CONDITIONS SPECIFIED IN SECTION 15885 FOR THE AREA IN WHICH IT IS TO BE INSTALLED HAVE BEEN PROVIDED.

3.04 ERECTION/INSTALLATION/APPLICATION

A. PANELS SHALL BE PROVIDED AS SHOWN OR SPECIFIED. PROVIDED PANELS SHALL BE COMPLETE AND OPERABLE.  
B. INSTALLATION:  
1. PANELS SHALL BE INSTALLED IN CONFORMANCE WITH NEC.  
2. PANEL MOUNTING:  
a. INTERIOR FREE STANDING PANELS SHALL BE MOUNTED ON SOLID, 4-INCH CAST-IN-PLACE CONCRETE MOUNTING PADS, MEETING THE REQUIREMENTS OF SECTION 03300. PANEL ANCHORS SHALL BE 316 STAINLESS STEEL MEETING THE REQUIREMENTS OF SECTION 05501.  
b. FLOOR STAND MOUNTED PANELS SHALL BE MOUNTED ON 316 STAINLESS STEEL STANDS MEETING THE REQUIREMENTS OF SECTION 16190.  
c. PANELS OTHER THAN INTERIOR FREE STANDING AND FLOOR STAND MOUNTED SHALL BE MOUNTED USING SUPPORTING SYSTEMS MEETING THE REQUIREMENTS OF SECTION 16190.  
3. FLOOR MOUNTED PANELS SHALL BE INSTALLED ON 1/4-INCH THICK RESILIENT BLACK NEOPRENE PADS. PADS SHALL COVER THE AREA OF THE PANEL BASE THAT IS AGAINST THE FLOOR OR CONCRETE MOUNTING PAD.  
4. FIELD WIRING TO AND FROM PANELS SHALL BE PROVIDED AS SHOWN, SPECIFIED OR REQUIRED.  
a. UNLESS OTHERWISE SHOWN OR SPECIFIED, WIRING AND PIPING PENETRATIONS SHALL BE THROUGH THE BOTTOM OF THE PANEL.  
5. INCOMING POWER CONDUCTORS (EXCEPT NEUTRALS) SHALL BE TERMINATED ON THE LINE SIDE OF A CIRCUIT BREAKER OR A FUSED DISCONNECT SWITCH.  
6. INCOMING CONTROL WIRING POWERED FROM A SOURCE EXTERNAL TO THE PANEL SHALL BE TERMINATED ON A FUSED TERMINAL BLOCK.  
7. SIGNAL WIRING ENTERING OR EXITING THE PANEL SHALL BE TERMINATED ON A KNIFE SWITCH TERMINAL BLOCK.  
8. PANELS SHALL BE KEPT CLEAN. PANEL DOORS SHALL BE KEPT CLOSED EXCEPT WHEN ACTUALLY WORKING IN THE PANEL. PANEL COMPONENTS SHALL BE PROTECTED DURING INSTALLATION, INCLUDING HOLE PUNCHING FOR CONDUIT CONNECTION. FILINGS AND THREAD CUTTINGS SHALL BE REMOVED FROM PANELS.  
9. CORROSION INHIBITOR DEVICES SHALL BE INSTALLED IN PANELS IMMEDIATELY PRIOR TO SUBSTANTIAL COMPLETION AT LOCATIONS DESIGNATED BY THE CMT.  
10. CONDUIT ENTRIES SHALL BE BY THREADED HUBS MEETING THE REQUIREMENTS OF SECTION 16111.

3.05 FIELD QUALITY CONTROL

A. SYSTEM TESTING SHALL BE PERFORMED AND NECESSARY ADJUSTMENTS SHALL BE MADE IN ACCORDANCE WITH THIS SECTION AND WITH THE REQUIREMENTS OF SECTION 16901.

3.06 CLEANING

A. INTERIOR OF PANEL SHALL BE VACUUM CLEANED AND EXTERIOR OF PANEL SHALL BE CLEANED IMMEDIATELY PRIOR TO SUBSTANTIAL COMPLETION.

3.07 INSTRUCTION OF PERSONNEL


A. FACTORY TRAINING: NOT USED.  
B. ON-SITE TRAINING: NOT USED.

3.08 STARTING OF SYSTEMS/COMMISSIONING NOT USED.

3.09 OPERATIONAL DEMONSTRATION NOT USED.

3.10 MAINTENANCE NOT USED.

DELAWARE COUNTY  
**VERONA SECTION 1**  
FORCE MAIN AND PUMP STATION IMPROVEMENTS  
PUMP STATION ELECTRICAL SPECIFICATIONS

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SECTION 16949 REMOTE TELEMETRY UNIT, PUMP CONTROLLER, AND RADIO MODEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. FURNISH ALL LABOR, MATERIAL, EQUIPMENT AND INCIDENTALS TO PROVIDE FULLY FUNCTIONAL PUMP CONTROL PANEL AND PUMP STATION CONTROLLER/TELEMETRY PANEL INCLUDING OPERATOR INTERFACE TERMINAL, RADIO MODEM, AND ANTENNA AS SHOWN ON THE DRAWINGS AND AS SPECIFIED HEREIN. INCLUDE ALL ITEMS NOT SHOWN OR SPECIFIED BUT REQUIRED FOR PROPER INSTALLATION AND OPERATION OF THE SYSTEM.
- B. PROVIDE ALL REQUIRED APPLICATION PROGRAMMING/CONFIGURATION AND CONTROL SYSTEM START UP AND TRAINING.

1.02 RELATED SECTIONS

- A. 16010 - ELECTRICAL GENERAL PROVISIONS
- B. 16030 - TESTS AND INSPECTIONS
- C. 16901 - INSTRUMENTATION AND CONTROL SYSTEMS FUNCTIONAL REQUIREMENTS
- D. 16902 - INSTRUMENTS AND CONTROLS
- E. 16903 - CABINETS, CONSOLES, PANELS AND ENCLOSURES

1.03 DESCRIPTION

- A. CONTRACTOR SHALL FURNISH ALL HARDWARE, PROGRAMMING SOFTWARE PACKAGES AND APPLICATION PROGRAMMING/CONFIGURATION AS INDICATED IN THE CONTRACT DOCUMENTS AND AS MAY BE NEEDED TO SUPPLY A COMPLETE SYSTEM.

1.04 SUBMITTALS. SUBMITTALS SHALL MEET THE REQUIREMENTS OF SECTIONS 01300.

A. SHOP DRAWINGS

- 1. SYSTEM ARCHITECTURE DRAWING INCLUDING ALL NETWORK CONNECTIONS, PROTOCOLS, CONTROL SCREENS.
- 2. PANEL DRAWINGS PER 16903
- 3. LOOP DRAWINGS PER 16901
- 4. TEST REPORTS
- 5. RADIO TELEMETRY PAPER STUDY REPORT
- 6. RADIO TELEMETRY FIELD PROPAGATION STUDY REPORT

B. PRODUCT DATA

- 1. THE CONTRACTOR SHALL SUBMIT THE PROPOSED PROGRAMMING SOFTWARE LITERATURE, MANUAL AND CUT SHEETS FOR APPROVAL WITHIN 30 DAYS OF THE NOTICE TO PROCEED.
- 2. HARDWARE PRODUCT DATA SHALL BE SUBMITTED WITH THE PANELS UNDER SECTION 16903.
- 3. RADIO TELEMETRY PAPER STUDY REPORT SHALL BE SUBMITTED PRIOR TO COMPLETING A FIELD STUDY. THE PAPER STUDY REPORT SHALL IDENTIFY THE PLANNED DESIGN OF THE RADIO COMMUNICATIONS SYSTEM, INCLUDING LOCATIONS, ELEVATIONS, RADIO SYSTEM LINE/MODEL PERFORMANCE DATA INCLUDING EXPECTED SIGNAL LOSS, AND A STATEMENT ON THE FEASIBILITY OF RADIO COMMUNICATIONS WITH ANY RESTRICTING CONDITIONS OR ASSUMPTIONS NOTED (EG: LOSS DUE TO FOLIAGE). THE REPORT SHALL BE REVIEWED AND APPROVED BY THE OWNER PRIOR TO THE CONTRACTOR COMMENCING WITH THE FIELD STUDY. THE REPORT SHALL BE SUBMITTED WITHIN 30 DAYS OF THE NOTICE TO PROCEED.
- 4. THE RADIO TELEMETRY FIELD PROPAGATION STUDY REPORT SHALL BE SUBMITTED PRIOR TO FINALIZING THE RADIO SYSTEM DESIGN AND PURCHASING ANY COMPONENTS ASSOCIATED WITH THE RADIO SYSTEM INCLUDING FOR EXAMPLE THE TELEMETRY PANEL, ITS CONTENTS, AND ANTENNA. THE REPORT SHALL PROVIDE A SUMMARY OF THE PARAMETERS OF THE TESTING, INCLUDING THE LOCATIONS, ELEVATIONS, RADIO SYSTEM LINE/MODEL ACTUALLY USED DURING TESTING, PERFORMANCE DATA INCLUDING ACTUAL SIGNAL LOSS, AND A STATEMENT ON THE FEASIBILITY OF RADIO COMMUNICATIONS WITH ANY RESTRICTING CONDITIONS OR ASSUMPTIONS NOTED, NOTING ANY DEVIATIONS FROM THE EXPECTATIONS OBTAINED FROM THE PAPER STUDY. THE REPORT SHALL BE SUBMITTED WITHIN 30 DAYS OF THE CONTRACTOR RECEIVING THE APPROVED RADIO TELEMETRY PAPER STUDY REPORT.

PART 2 PRODUCTS

2.01 GENERAL

- A. DESIGNED TO OPERATE CONTINUOUSLY IN AN AMBIENT TEMPERATURE OF 0 TO 104 ° F WITHOUT COOLING FANS.
- B. DESIGNED TO OPERATE CONTINUOUSLY IN A RELATIVE HUMIDITY RANGE OF 5 TO 95 PER CENT NON-CONDENSING.
- C. DESIGNED TO OPERATE IN A HIGH ELECTRICAL NOISE ENVIRONMENT.

2.02 OPERATOR INTERFACE TERMINAL

- A. 320X240 RESOLUTION BACKLIT LCD DISPLAY
- B. MEMORY: 256 MB RAM
- C. NEMA 4 DISPLAY RATING
- D. MANUFACTURER: MULTISMART PUMP STATION MANAGER BY MULTITRODE

2.03 PUMP CONTROLLER

- A. PROGRAMMABILITY
  - 1. THE PUMP CONTROLLER SHALL PROVIDE USER READY AUTOMATIC CONTROL OF PUMPS WITH AN INTUITIVE HMI INTERFACE. THE PUMP CONTROLLER SHALL CONTAIN PRE-DESIGNED OPERATIONAL PARAMETERS THAT ARE SELECTED AND CONFIGURED VIA THE OPERATOR INTERFACE TERMINAL (OIT). THE MINIMUM FEATURES AVAILABLE IN THE PUMP CONTROLLER SHALL INCLUDE:
    - a) PUMP CONTROL OF UP TO 6 PUMPS; INCLUDING PUMP GROUPING AND PUMP ALTERNATION.
    - b) INTELLIGENT HAND-OFF-AUTO CONTROL.
    - c) LEVEL SET POINT ADJUSTMENT FOR PUMP ACTIVATION, DEACTIVATION AND STATION LEVEL ALARMS.
    - d) LEVEL DEVICE INPUT CAPABILITY SHALL INCLUDE: 4-20MA ANALOG SIGNAL, CONDUCTIVE PROBE OR FLOATS.
    - e) REDUNDANT LEVEL DEVICE INPUT CAPABILITY WITH AUTOMATIC INPUT FAULT CONTROL (INPUT DEVICE SWITCHING).
    - f) SELECTABLE CHARGE (FILL) OR DISCHARGE (EMPTY) MODES.
    - g) PRE-CONFIGURED STATION OPTIMIZATION FEATURES INCLUDING: MAXIMUM PUMP OFF TIME, MAXIMUM PUMPS TO RUN, MAXIMUM STARTS PER HOUR, INTER-PUMP START AND STOP TIME DELAYS, MAXIMUM PUMP RUN TIME, BLOCKED PUMP DETECTION, WELL WASHER CONTROL CAPABILITY, WELL CLEAN OUT CONTROL CAPABILITY, PUMP OPERATION CONTROL (PROFILE PROGRAMMING) CAPABILITY.
    - h) "LOCKED LEVEL" ALARM FUNCTION TO INDICATE A LEVEL DEVICE FAULT.
    - i) PUMP ALTERNATION MODES.
    - j) PUMP DECOMMISSIONING.
    - k) UP TO (6) UNIQUE USER DEFINED PROFILES OF SET POINTS SHALL BE AVAILABLE TO CONTROL PUMPS DURING SPECIFIC SITE CONDITIONS OR EVENTS.
    - l) DATALOGGER FOR USER-DEFINED FAULTS AND EVENTS.
    - m) 3-PHASE SUPPLY VOLTAGE MONITORING AND SUPPLY FAULT MANAGEMENT FOR THE FOLLOWING CONDITIONS:
      - n) MONITORING OF DC POWER SUPPLY, BATTERY VOLTAGE, AND INTERNAL CONTROLLER TEMPERATURE.
      - o) ENERGY, POWER AND PUMP EFFICIENCY MONITORING.
      - p) MOTOR PROTECTION FEATURES INCLUDING: 3-PHASE CURRENT MONITORING FOR EACH PUMP, OVER- AND UNDER-CURRENT TRIP, GROUND/EARTH FAULT, CURRENT PHASE IMBALANCE FAULT, I2T FAULT, INSULATION RESISTANCE TESTING FOR MOTOR WINDINGS.
      - q) FLOW MEASUREMENT: CALCULATED FLOW VIA LIQUID LEVEL DRAW DOWN DATA
      - r) FTD SPEED CONTROL CAPABILITY.
      - s) FAULT MODULE CAPABILITY AS FOLLOWS: PUMP HOLD OUT FUNCTION, AUTOMATIC RESTART FUNCTION AFTER FAULT CONDITION IS NO LONGER PRESENT, MANUAL RESET OF FAULT REQUIRED (IF USER INTERVENTION OF FAULT RESET IS SELECTED)
      - t) REMOTE CONTROL VIA REMOTE TELEMETRY MONITORING TO INCLUDE THE FOLLOWING:
        - u) SECURITY
        - v) SD/USB PORTS SHALL BE AVAILABLE FOR THE FOLLOWING OPERATIONS: FIRMWARE UPGRADES, SAVE AND LOAD PUMP CONTROLLER CONFIGURATION, DOWNLOAD DATA LOGS, EXPORT OR IMPORT MODBUS AND DNP3 POINTS LIST

B. FUNCTIONALITY

- 1. PUMP MODE. FOR EACH PUMP, OPERATOR SHALL HAVE ONE HAND-OFF-AUTO SWITCH TO LOCALLY START AND STOP EACH PUMP. CONTROL FROM THE PUMP CONTROLLER SHALL BE DISABLED IF THE PHYSICAL SELECTOR SWITCH IS NOT IN THE AUTO POSITION. IN REMOTE AUTO, PUMP SHALL OPERATE AS DESCRIBED IN THE AUTOMATIC SEQUENCE BELOW. PUMP SHUTDOWN ALARMS SHALL BE ACTIVE REGARDLESS OF THE SELECTED MODE. ANY TIME A PUMP IS RETURNED FROM HAND OR OFF TO AUTO, PUMP SHALL TRANSITION TO REMOTE AUTOMATIC MODE (EX: POWER FAILURE) AND BECOME AVAILABLE TO BE CALLED TO RUN BY THE CONTROLLER.
- 2. AUTOMATIC CONTROL
  - a) IN AUTOMATIC MODE, LEAD PUMP OPERATION SHALL BE INITIATED WHEN WET WELL LEVEL EXCEEDS SP 1. UNDER NORMAL CIRCUMSTANCES, THE LEVEL WILL THEN DROP AND THE PUMP OPERATION STOPS WHEN THE LEVEL DROPS BELOW SP 2.
  - b) IN THE EVENT OF A FAILURE OF THE LEAD PUMP, THE LEVEL WILL RISE ABOVE SP1 TO SP3. AT THIS TIME, THE LAG PUMP SHALL BE STARTED AND CONTINUE TO RUN UNTIL THE LEVEL DROPS BELOW SP 2. A LEAD PUMP FAILED ALARM SHALL BE GENERATED IN THIS CASE.
  - c) THE OPERATOR SHALL HAVE THE ABILITY TO ENABLE AND DISABLE AUTOMATIC PUMP ROLE ALTERNATION.
  - d) IN THE EVENT OF A CONTROLLER OR LEVEL TRANSMITTER FAILURE, EMERGENCY BACKUP FLOATS WILL ATTEMPT TO START AND STOP BOTH PUMPS (ONE AT A TIME) ON A HARDWIRED BASIS. ANY FAULTS THAT CAN BE DETECTED BY LOGIC SHALL BE GENERATED (EX: LEVEL SENSOR FAILURE, HIGH HIGH PROBE LEVEL ACTIVATED, EMERGENCY PUMPING CIRCUIT ACTIVATED).
- 3. ALL LEVEL SETPOINTS FOR OPERATION AND ALARMS SHALL BE ADJUSTABLE FROM THE DISPLAY OR REMOTELY MEANING THE USER CAN CHOOSE WHICH PROBE ELEMENT TRIGGERS EACH CONDITION.
- 4. ALL MONITORING AND ALARM SIGNALS SHOWN WITHIN CONTRACT DRAWINGS SHALL BE DISPLAYED ON THE DISPLAY AND REMOTELY FOR MONITORING AND TROUBLESHOOTING PURPOSES. ALL ALARMS SHALL BE PROGRAMMED TO LATCH UPON ALARM CONDITION, AND SHALL REQUIRE ACKNOWLEDGEMENT EITHER AT THE DISPLAY OR REMOTELY IN ORDER TO RESET THE ALARM.

C. COMMUNICATIONS

- 1. PHYSICAL
  - THE PUMP CONTROLLER SHALL INCLUDE THE FOLLOWING DATA COMMUNICATION PORTS:
    - a) TWO ETHERNET PORTS (10MBIT/S)
    - b) TWO RS232 PORTS (115KBIT/S)
    - c) TWO RS485 PORTS (115KBIT/S)
    - d) USB DEVICE PORT
    - e) SD CARD PORT
- 2. COMMUNICATION TYPES
  - THE PUMP CONTROLLER SHALL SUPPORT THE FOLLOWING COMMUNICATION TYPES:
    - a) TCP/IP
    - b) UDP
    - c) RS232
    - d) RS485
    - e) PRIVATE RADIO OVER RS232
    - f) PSTN
    - g) WIRELESS LAN
    - h) CELLULAR DATA (VIA INTEGRAL PPM MODULE)
    - i) CELLULAR VOICE
- 3. COMMUNICATION PROTOCOLS
  - DNP3 (MASTER & SLAVE, LEVEL 2 COMPLIANT), INCLUDING:
    - a) CHANGE OF STATE REPORTING
    - b) NATIVE DATE/TIME AND QUALITY STAMPS FOR EACH DATA POINT
    - c) EVENT BUFFERING FOR DIFFERENT CLASSES OF DATA
    - d) SUPPORT FOR MULTIPLE MASTERS AND SLAVES TO BE CONFIGURED ON THE UNIT
    - e) DNP SECURITY (FOR SECURING COMMUNICATIONS BETWEEN MASTER STATION AND RTU)
  - MODBUS (MASTER & SLAVE) INCLUDING:
    - a) MODBUS TCP
    - b) MODBUS RTU
    - c) MODBUS ASCII
    - d) SUPPORT FOR MULTIPLE MASTERS AND SLAVES

D. MANUFACTURER

- 1. MULTISMART BY MULTITRODE.

2.04 RADIO COMMUNICATION EQUIPMENT

A. RADIO MODEM

- 1. 902 - 928 UNLICENSED SPREAD SPECTRUM FREQUENCY HOPPING TRANSCEIVER.
- 2. RS232 DATA INTERFACE
- 3. GE MDS TRANSNET 900 SERIES

B. POWER SUPPLY

- 1. PROVIDE AND INSTALL 24V DC POWER SUPPLY WITH CURRENT RATING APPROPRIATE FOR THE RADIO UNIT. INSTALL POWER SUPPLY IN THE PUMP STATION CONTROLLER/TELEMETRY PANEL. POWER SUPPLY SHALL BE POWERED FROM THE UPS CIRCUIT ORIGINATING IN THE PUMP STATION CONTROLLER/TELEMETRY PANEL.
- 2. MANUFACTURER: PHOENIX CONTACT

C. ANTENNA AND ACCESSORIES

- 1. 6-ELEMENT ALUMINUM YAGI ANTENNA WITH 9 DB GAIN.
- 2. FOR 900 MHZ SYSTEMS, FACTORY TUNED TO 915 MHZ.
- 3. WITH STAINLESS STEEL HARDWARE.
- 4. MVA-9156 PRODUCED BY MAXRAD OR APPROVED EQUAL.
- 5. WATER-TIGHT CABLE LMR-400-08 PRODUCED BY TIMES MICROWAVE SYSTEMS OR APPROVED EQUAL.
- 6. MISCELLANEOUS CONNECTORS TO CONNECT ANTENNA TO RADIO WHILE MAINTAINING WATERTIGHT INTEGRITY THROUGHOUT CABLE.
- 7. ALL CONNECTIONS TO BE SOLDERED TO CABLE TO PREVENT LOOSENING OF CABLE FROM CONNECTOR AND SIGNAL DEGRADATION OVER TIME.
- 8. ANTENNA MAST TO BE GALVANIZED STEEL AND CAPPED AT TOP END.

D. SURGE PROTECTION

- 1. FREQUENCY RANGE OF SURGE PROTECTOR 125 MHZ TO 1000 MHZ.
- 2. LESS THAN 220 UJ OF THROUGHPUT ENERGY.
- 3. IS-BS0LN-C2 PRODUCED BY POLYPHASER CORPORATION OR APPROVED EQUAL.

2.05 APPLICATION PROGRAMMING

- A. PROVIDE ALL REQUIRED APPLICATION PROGRAMMING AND/OR CONFIGURATION FOR A FULLY FUNCTIONAL PUMP STATION CONTROLLER AS SHOWN ON THE DRAWINGS AND AS SPECIFIED HEREIN.
- B. SUPPLY OPERATOR INTERFACE TERMINAL (OIT) APPLICATION PROGRAMMING AND /OR CONFIGURATION TO PROVIDE CONTROL OF THE PUMP STATION CONTROLLER/TELEMETRY PANEL LOCALLY. THE OIT SHALL PROVIDE COMPLETE MONITORING AND CONTROL OF ALL EQUIPMENT AT THE PUMP STATION. AT A MINIMUM OIT PROGRAMMING/CONFIGURATION SHALL INCLUDE MONITORING AND CONTROL OF:
  - 1. RUNNING / STOPPED / ALARM STATUS OF ALL PUMPS, INCLUDING INDIVIDUAL ALARMS, MANUAL OR AUTOMATIC STATUS CONTROL FOR EACH PUMP.
  - 2. AUTOMATIC / LEAD / LAG SWITCHING FOR EACH PUMP.
  - 3. EMERGENCY PUMPING CIRCUIT ACTIVATED
  - 4. WET WELL LEVELS
  - 5. GRINDER STATUS AND ALARM
  - 6. ODOR CONTROL SYSTEM (BIOXIDE) STATUS, LEVEL, AND ALARM.
  - 7. AC POWER STATUS
  - 8. INTRUSION DETECTION
  - 9. STATUS OF THE RADIO CONNECTION TO OLENTANGY ENVIRONMENTAL CONTROL CENTER. THIS SHALL BE ACCOMPLISHED BY MONITORING A FREE-RUNNING COUNTER PROGRAMMED AT THE OECC.

- C. ALL APPLICATION PROGRAMMING FEATURES DESCRIBED ABOVE SHALL ALSO BE PROGRAMMED TO BE AVAILABLE FROM THE OECC VIA RADIO TELEMETRY LINK.

PART 3 EXECUTION

3.01 GENERAL

- B. THE SYSTEM SUPPLIER SHALL PROVIDE THE HARDWARE AND SOFTWARE AS DESCRIBED IN THIS SECTION AND AS SHOWN ON THE DRAWINGS.
- C. NO HARDWARE OR SOFTWARE SHALL BE PURCHASED PRIOR TO APPROVAL OF SUBMITTALS.
- D. THE PANELS CONTAINING SHALL BE CONSTRUCTED PER THE APPROVED SECTION 16903 SHOP DRAWINGS.
- E. THE SYSTEM SUPPLIER SHALL FULLY TEST THE PUMP CONTROL PANEL AND PUMP STATION CONTROLLER/TELEMETRY PANEL PER THIS SECTION PRIOR TO SHIPMENT TO THE JOBSITE. THE ENGINEER SHALL BE NOTIFIED PRIOR TO SHIPMENT OF THE PANELS AND GIVEN THE OPPORTUNITY TO INSPECT THE PANEL AT HIS OWN EXPENSE.
- F. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE TO CORRECT ANY DEFECTS IN WORKMANSHIP AND MATERIALS AND CORRECT ANY WIRING ISSUES.
- G. THE PUMP STATION SHALL BE MONITORED BY THE SCADA SYSTEM LOCATED AT THE ALUM CREEK WATER RECLAMATION FACILITY. THE OWNER HAS AN EXISTING MULTIPoint GE MDS TRANSNET 900, UNLICENSED, 900 MHZ RADIO SYSTEM. THE OWNER SHALL IDENTIFY UP TO TWO REPEATER SITES TO ALLOW COMMUNICATIONS BETWEEN THE PUMP STATION AND THE ACWRF. CURRENTLY THE OWNER HAS IDENTIFIED ONE WATER TOWER NEAR HOME RD. AND WOODCUTTER RD. AND ANOTHER WATER TOWER NEAR W. CASE ST. AS POSSIBLE REPEATER SITES. THE OWNER HAS AN AGREEMENT IN PLACE THAT ALLOWS THEM TO COLLOCATE RADIO EQUIPMENT ON FACILITIES OWNED BY DELCO WATER. THE CONTRACTOR SHALL ASSUME THAT HARDWARE CHANGES (SUCH AS ADDING RADIOS OR ANTENNAS, ADJUSTING ANTENNAS) WILL NOT BE REQUIRED AT THE REPEATER LOCATION. THE CONTRACTORS SCOPE OF WORK SHALL INCLUDE THE FOLLOWING:
  - 1. COORDINATING WITH THE OWNER TO OBTAIN ANY REQUIRED INFORMATION FOR RADIO SYSTEM DESIGN, PROGRAMMING, INSTALLATION, AND COMMISSIONING.
  - 2. PROVIDING BOTH A PAPER AND FIELD RADIO PROPAGATION STUDY TO CONFIRM THE SYSTEM CAN FUNCTION AS REQUIRED AND DESIGNED. THE STUDIES SHALL EVALUATE THE RADIO PATHS TO BOTH PROPOSED REPEATER STATIONS; THE OWNER WILL SELECT ONE OF THE TWO STATIONS ONCE THE FIELD STUDY IS COMPLETE.
  - 3. FINALIZING THE DESIGN OF THE RADIO ANTENNA INSTALLATION. BASED ON ELEVATION PROFILE EXAMINATION, IT IS EXPECTED A 70 FOOT WOOD CLASS 1 POLE AUGMENTED WITH 30 FOOT OF SCHEDULE 80 PIPE MAY PROVIDE A SUITABLE MOUNTING ELEVATION FOR THE ANTENNA. IT IS POSSIBLE A LOWER ELEVATION MAY WORK OR THAT A HIGHER ELEVATION MAY BE REQUIRED. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE REQUIREMENTS AND ALSO ASSUME RESPONSIBILITY OF THIS ASPECT OF DESIGN. THE CONTRACTOR SHALL CONFIRM THE LEVEL OF LIGHTNING SURGE PROTECTION IDENTIFIED IN SECTIONS ABOVE IS APPROPRIATE FOR THE INSTALLATION AND AUGMENT IF NECESSARY.
  - 4. PROVISION AND INSTALLATION OF THE NEW PUMP STATION RADIO POLE, ANTENNA, ASSOCIATED CABLING AND ACCESSORIES, RADIO TELEMETRY CONTROL PANEL INCLUDING RADIO UNIT AND POWER SUPPLY, AS REQUIRED FOR A COMPLETE FUNCTIONAL RADIO SYSTEM.
  - 5. RECONFIGURING THE REPEATER AND ACWRF RADIO UNITS IF REQUIRED, TO PROVIDE COMMUNICATIONS TO THE PUMP STATION.
  - 6. RECONFIGURING THE EXISTING ACWRF SCADA COMMUNICATIONS SCHEME, IF REQUIRED, TO ALLOW SUCCESSFUL COMMUNICATIONS TO THE PUMP STATION. SUCCESSFUL COMMUNICATIONS IS DEFINED AS THE ABILITY TO POLL (MONITOR) THE PUMP STATION FROM THE ACWRF SCADA SYSTEM AT A RATE OF AT LEAST ONCE EVERY 10 SECONDS.
  - 7. PROGRAMMING REQUIRED TO MONITOR THE NEW PUMP STATION FROM THE EXISTING ACWRF SCADA APPLICATION. THE CONTRACTOR SHALL COORDINATE WITH THE OWNER REGARDING SOFTWARE MANUFACTURER, PRODUCT LINE, AND VERSION. THE POINTS OF MONITORING AND CONTROL (STATUS, COMMANDS, AND ALARMS) SHALL BE IDENTICAL TO THOSE DEFINED TO BE AVAILABLE FROM THE LOCAL OPERATOR INTERFACE TERMINAL AS DESCRIBED IN SECTIONS ABOVE.
  - 8. THE CONTRACTOR SHALL BE SENSITIVE TO THE LIMITED BANDWIDTH AVAILABLE IN THE RADIO SYSTEM LINK AND MAKE ANY REQUIRED ACCOMMODATIONS IN PROGRAMMING TO OBTAIN THE REQUIRED SYSTEM PERFORMANCE. THIS MAY INCLUDE PACKING DATA INTO ARRAYS OR OTHER APPROPRIATE DATA STRUCTURES, LIMITING DATA UPDATE RATES, OPTIMIZING SERIAL PROTOCOL SETTINGS, FOR EXAMPLE.

- 3.02 STARTING OF SYSTEMS/COMMISSIONING
- A. FACTORY TESTING
  - 1. ALL SYSTEM HARDWARE AND SOFTWARE COMPONENTS SHALL BE TESTED TO VERIFY PROPER OPERATION OF THE EQUIPMENT AS STAND ALONE UNITS. TEST SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING:
    - a. AC/DC POWER CHECKS
    - b. POWER FAIL/RESTART TEST
    - c. DIAGNOSTICS CHECK
    - d. COMPLETE FUNCTIONAL CAPABILITIES
  - 1. ALL PROGRAMMING SOFTWARE REQUIRED TO PERFORM I/O TESTING, AS SPECIFIED BELOW, SHALL BE PROVIDED BY THE CONTRACTOR.
  - 2. ALL I/O DEVICES SHALL BE TESTED TO VERIFY PROPER OPERATION AND BASIC CALIBRATION. ALL I/O POINTS SHALL BE TESTED PRIOR TO NOTIFICATION OF THE ENGINEER FOR INSPECTION. PROVIDE SIGNED AND CERTIFIED CHECK LIST DEMONSTRATING THE COMPLETION OF THE I/O CHECK OUT, AS IDENTIFIED BELOW.
    - a. SIMULATE EACH ANALOG AND DIGITAL INPUT AT THE TERMINAL BLOCK AND VERIFY ITS PRESENCE AT THE PUMP STATION CONTROLLER REGISTER.
    - b. FORCE EACH ANALOG AND DIGITAL OUTPUT POINT FROM THE PUMP CONTROLLER AND VERIFY ITS PRESENCE AT THE TERMINAL STRIP.
- B. FIELD SERVICES
  - 1. THE SYSTEM SUPPLIER SHALL VERIFY ALL CONNECTIONS BETWEEN FIELD DEVICES AND PUMP CONTROLLER.
  - 2. THE SYSTEM SUPPLIER SHALL CONFIRM ALL CALIBRATION OF INSTRUMENTATION CONNECTED TO THE PUMP CONTROL PANEL.
  - 3. PROVIDE CONTROL SYSTEM START UP AND COMMISSIONING INCLUDING THE PUMP CONTROL PANEL AND OPERATOR INTERFACE.
  - 4. PROVIDE RADIO SYSTEM START UP AND COMMISSIONING INCLUDING THE PUMP STATION CONTROLLER/TELEMETRY PANEL AND ASSOCIATED EQUIPMENT. START UP SHALL ALSO INCLUDE FIELD SERVICES AS REQUIRED AT THE SELECTED RADIO REPEATER SITE AND THE OECC.
  - 5. PROVIDE SCADA SYSTEM PROGRAMMING ADDITIONS, START UP AND COMMISSIONING AT THE OECC.
  - 6. AFTER THE ABOVE CHECK OUT AND SYSTEM START UP HAS BEEN COMPLETED THE CONTRACTOR SHALL NOTIFY THE ENGINEER SO THAT SYSTEM COMMISSIONING CAN BEGIN.
  - 7. THE APPLICATION ENGINEERS PROVIDED SHALL MAKE AVAILABLE TO THE ENGINEER A SERVICE REPRESENTATIVE KNOWLEDGEABLE IN THE PROGRAMMING OF THE PROJECT TO ASSIST DURING COMMISSIONING AND PROVIDE MINOR PROGRAMMING MODIFICATIONS. THIS SHALL BE FOR A MINIMUM OF 60 HOURS. THIS IS IN ADDITION TO OTHER CONTRACT REQUIREMENTS FOR START-UP.

3.06 INSTRUCTION OF PERSONNEL

A. SYSTEM TRAINING PER 16901.

DELAWARE COUNTY  
**VERONA SECTION 1**  
 FORCE MAIN AND PUMP STATION IMPROVEMENTS  
 PUMP STATION ELECTRICAL SPECIFICATION

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