

FARM LOT 6, QUARTER TOWNSHIP 2, TOWNSHIP 4, RANGE 18
 FARM LOTS 8 & 9, QUARTER TOWNSHIP 3, TOWNSHIP 4, RANGE 18
 UNITED STATES MILITARY LANDS
 BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
 SANITARY SEWER IMPROVEMENT PLAN
 FOR
THE PINES, SECTION 1
PHASE A & B

2018

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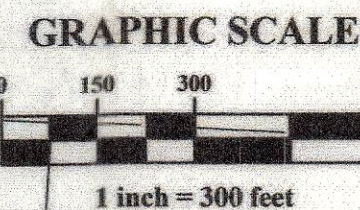
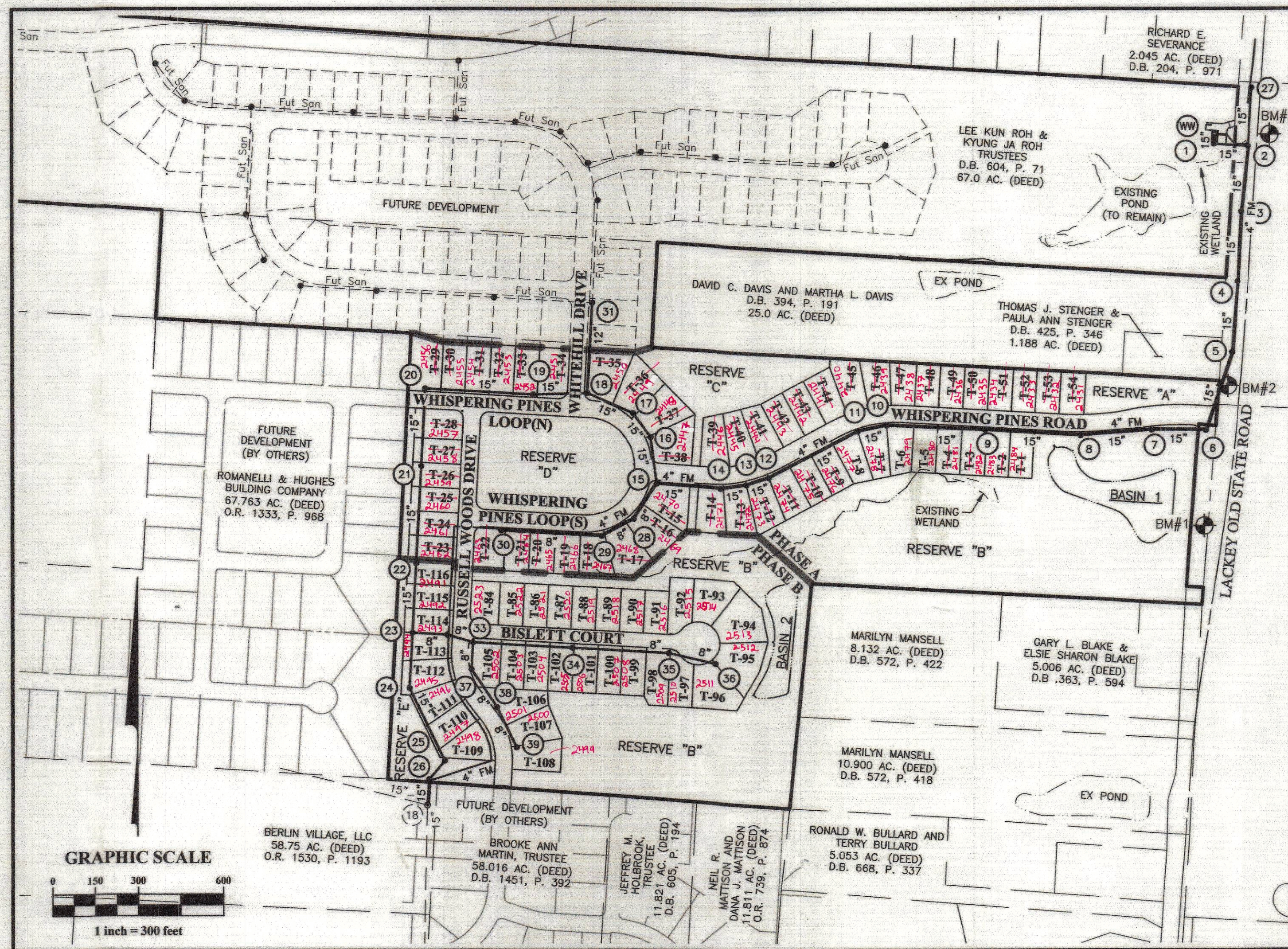
BENCH MARKS
(NAVD 1988)

- BM#1** Chiseled "X" on the west flange bolt of a fire hydrant, located on the west side of Lackey Old State Road and being approximately 1800 feet south of the intersection of Lackey Old State Road with Berlin Station Road.
Elev = 919.10
- BM#2** Railroad spike set in the east side of a wooden utility pole, located on the west side of Lackey Old State Road and the south side of the paved driveway of residence #2000.
Elev = 921.16
- BM#3** Chiseled "X" on the top bolt on the south end of a guard rail, located on the east side of Lackey Old State Road approximately 500 feet south of the intersection of Lackey Old State Road with Berlin Station Road.
Elev = 913.65

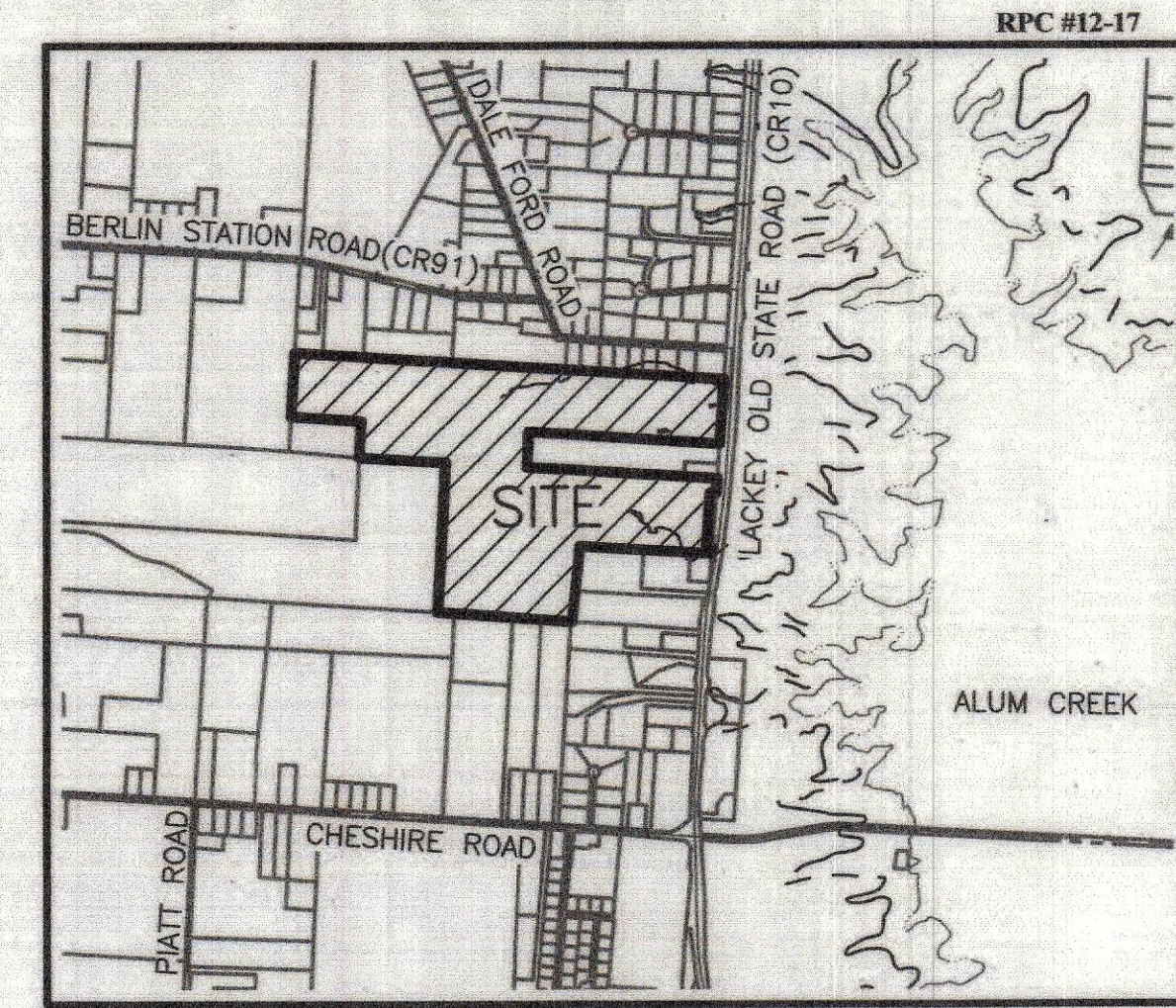
STANDARD CONSTRUCTION DRAWINGS

The Standard Drawings listed on these plans shall be considered a part thereof: "Standard Plans and Specifications for Construction of Sanitary Facilities in Delaware County, Ohio"

Sa.S-1	Sa.S-7	Sa.S-11	Sa.S-20	Sa.S-26
Sa.S-2	Sa.S-8	Sa.S-12	Sa.S-21	Sa.S-36
Sa.S-3	Sa.S-9	Sa.S-13	Sa.S-23	
Sa.S-5	Sa.S-10	Sa.S-15	Sa.S-24	



INDEX MAP
Scale: 1" = 300'



LOCATION MAP
Not to Scale

DEVELOPER/OWNER

M/I Homes of Central Ohio, LLC
 Jason Francis
 3 Easton Oval, Suite 540
 Columbus, Ohio 43219
 Tel: 614-418-8000
 Fax: 614-418-8030

DELAWARE COUNTY APPROVAL

The signatures below signify only concurrence with the general purpose and location of the proposed improvements. All technical details remain the responsibility of the Professional Engineer who prepared and certified these plans.

- Approved this 20th day of May, 2018 *M.A. Fran*
 Delaware County Sanitary Engineer
- Approved this 21st day of May, 2018 *Jeff Benton*
 County Commissioner
- Approved this 21st day of May, 2018 *Paul Lewis*
 County Commissioner
- Approved this 21st day of May, 2018 *Larry Merrill*
 County Commissioner
- Approved this 11th day of May, 2018 *Chris Bauer II*
 Delaware County Engineer

PREPARED BY



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The work product shown on Sheets No. 20 through 32 was prepared and provided by TriTech Engineering, who is the sole party responsible for this work. EMH&T does not represent or warrant the work performed or the work product provided.

ENGINEER'S CERTIFICATION

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 practice 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.

Steve D. Schehl
 Registered Engineer No. E-67549
 State of Ohio Professional Engineer Seal

4-20-18
 Date

RECORD DOCUMENTS

THESE DOCUMENTS HAVE BEEN PREPARED BASED ON MARKED-UP DRAWINGS, ADDENDA, CHANGE ORDERS, OR OTHER INFORMATION PROVIDED BY THE CONTRACTOR AND/OR OTHER THIRD PARTIES. EMH&T HAS NOT VERIFIED THE ACCURACY AND/OR COMPLETENESS OF THIS INFORMATION AND IS NOT RESPONSIBLE FOR ANY DEFICIENCIES OR DISCREPANCIES HEREIN.

PREPARED: 09-06-2019

CHANGE ORDER SCHEDULE						
CHANGE	PREPARED	DATE OF CHANGE	DESCRIPTION OF CHANGE	SHEET NO.	APPROVED	DATE OF APPROVAL
Δ	PLM	7-13-2018	MOVED MH 6 AND ADJACENT FM, ADJUST INV 2-5	4, 5 & 11	<i>MRF</i>	7-16-18

REVISIONS	MARK	DATE	DESCRIPTION

BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
 SANITARY SEWER IMPROVEMENT PLAN
 FOR
THE PINES, SECTION 1
PHASE A & B
 TITLE SHEET

DATE	April 2018
SCALE	As Noted
JOB NO.	20170824
SHEET	1/32

- GENERAL NOTES**
 THE CURRENT COUNTY OF DELAWARE REQUIREMENTS, TOGETHER WITH THE SPECIFICATIONS OF THE STATE OF OHIO, DEPARTMENT OF TRANSPORTATION, INCLUDING ALL SUPPLEMENTS THERETO, AND THE DCRSD CONSTRUCTION AND MATERIAL SPECIFICATIONS (CMS) AND STANDARD DRAWINGS SHALL GOVERN ALL MATERIALS, METHODS OF CONSTRUCTION AND WORKMANSHIP INVOLVED IN THE IMPROVEMENTS THAT ARE A PART OF THIS PLAN.
 1. APPROVAL OF THESE PLANS IS CONTINGENT UPON ALL REQUIRED SANITARY SEWER EASEMENTS BEING APPROVED BY THE DCRSD AND RECORDED WITH THE PROJECT FINAL PLAT OR AS DIRECTED BY THE SANITARY ENGINEER PRIOR TO CONSTRUCTION.
 2. THE CONTRACTOR SHALL NOTIFY THE SANITARY ENGINEER'S OFFICE FORTY-EIGHT (48) HOURS PRIOR TO CONSTRUCTION.
 3. ANY MODIFICATIONS TO THE WORK AS SHOWN ON THESE DRAWINGS SHALL HAVE PRIOR WRITTEN APPROVAL BY THE SANITARY ENGINEER.
 4. 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 (1-800-382-2764) FORTY-EIGHT (48) HOURS PRIOR TO CONSTRUCTION AND SHALL NOTIFY ALL UTILITY COMPANIES AT LEAST FORTY-EIGHT (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 SANITARY ENGINEER ASSUME NO RESPONSIBILITY AS TO THE ACCURACY OF THE UNDERGROUND FACILITIES SHOWN ON THE PLANS.
 5. 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	CONTACTING AGENT	TELEPHONE
SANITARY SEWER:	DELAWARE COUNTY SANITARY ENGINEER 50 CHANNING STREET, DELAWARE, OH 43015	(740) 833-2240
WATER FACILITIES:	DEL-CO WATER COMPANY 6773 OLENTANGY RIVER ROAD, DELAWARE, OH 43015	(740) 548-7746
STORM SEWER:	DELAWARE COUNTY ENGINEER'S OFFICE 50 CHANNING STREET, DELAWARE, OH 43015	(740) 833-2400
ELECTRIC:	AMERICAN ELECTRIC POWER 850 TECH CENTER DRIVE, GAHANNA, OH 43230	614-883-6968
GAS:	COLUMBIA GAS 1600 DUBLIN ROAD, COLUMBUS, OH 43215	614-460-2172
TELEPHONE:	AT&T RON HARRISON	614-883-6862
CABLE:	CHARTER COMMUNICATIONS 3760 INTERCHANGE ROAD, COLUMBUS, OH 43204	614-481-5047

6. THE CONTRACTOR SHALL CONFINE HIS ACTIVITIES TO THE PROJECT SITE UNDER DEVELOPMENT, EXISTING RIGHTS-OF-WAY, CONSTRUCTION EASEMENTS AND PERMANENT EASEMENTS, AND SHALL NOT TRESPASS UPON OTHER PRIVATE PROPERTY WITHOUT THE WRITTEN CONSENT OF THE PROPERTY OWNER.
 7. COMPLIANCE WITH THE OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970, AS AMENDED, AND APPLICABLE OSHA REGULATIONS IS REQUIRED OF ALL CONTRACTORS ON THE PROJECT. EACH CONTRACTOR AND SUBCONTRACTOR IS RESPONSIBLE FOR IMPLEMENTING, MAINTAINING, AND SUPERVISING ALL SAFETY REQUIREMENTS, PRECAUTIONS, AND PROGRAMS IN CONNECTION WITH THE WORK.
 8. THE TRACKING OF MUD, DIRT, AND DEBRIS UPON ANY PUBLIC ROADWAY IS PROHIBITED AND ANY SUCH OCCURRENCE SHALL BE CLEANED UP IMMEDIATELY BY THE CONTRACTOR. THE CONTRACTOR SHALL CLEAN UP ALL DEBRIS AND MATERIALS RESULTING FROM CONSTRUCTION OPERATIONS AND RESTORE ALL SURFACES, STRUCTURES, DITCHES, AND PROPERTY TO ITS ORIGINAL CONDITION AND TO THE SATISFACTION OF THE SANITARY ENGINEER.
 9. ANY TREES OR LANDSCAPING IN EXISTING EASEMENTS OR PUBLIC RIGHT-OF-WAY SHALL BE PROTECTED AND NOT IMPACTED BY CONSTRUCTION ACTIVITIES UNLESS PRIOR APPROVAL IS OBTAINED BY THE SANITARY ENGINEER. ANY TREES OR LANDSCAPING THAT ARE APPROVED TO BE REMOVED ARE REQUIRED TO BE REPLACED TO THE SATISFACTION OF THE SANITARY ENGINEER.
 10. THE CONTRACTOR SHALL OBTAIN ANY AND ALL NECESSARY PERMITS PRIOR TO BEGINNING CONSTRUCTION. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE APPLICABLE FEDERAL, STATE, AND LOCAL REGULATIONS AND REQUIREMENTS.

11. WHERE IT IS ANTICIPATED THAT THE UTILITY WORK WILL CLOSE A STREET, THE CONTRACTOR SHALL INFORM RESIDENTS TO BE AFFECTED, THE COUNTY SHERIFF'S OFFICE OR LOCAL POLICE DEPARTMENT, THE FIRE DEPARTMENT, THE SANITARY ENGINEER, THE COUNTY ENGINEER, THE APPLICABLE SCHOOL DISTRICT, AND OTHER APPLICABLE ENTITIES AS TO THE EXTENT, NATURE, AND TIME OF THE ANTICIPATED WORK.
 12. PROHIBITED CONSTRUCTION ACTIVITIES: THE FOLLOWING CONSTRUCTION ACTIVITIES ARE PROHIBITED ON THE PROJECT:
 -USING ANY SUBSTANCE OTHER THAN WATER TO CONTROL DUST.
 -TRACKING OF MUD, DIRT AND DEBRIS ONTO ANY PUBLIC ROADWAY.
 -OPEN BURNING OF PROJECT DEBRIS WITHOUT A PERMIT. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING THE PERMIT OR DISPOSING OF TREES AND STUMPS.
 -PUMPING OF SEDIMENT-LADEN WATER FROM TRENCHES OR OTHER EXCAVATIONS INTO ANY SURFACE WATERS, ANY STREAM CORRIDORS, ANY WETLANDS, OR STORM SEWERS.
 -DISCHARGING POLLUTANTS, SUCH AS CHEMICALS, FUELS, LUBRICANTS, BITUMINOUS MATERIALS, RAW SEWAGE, AND OTHER HARMFUL WASTE INTO OR ALONGSIDE RIVERS, STREAMS, IMPOUNDMENTS, OR INTO NATURAL OR MAN-MADE CHANNELS LEADING THERETO.
 -STORING CONSTRUCTION EQUIPMENT AND VEHICLES AND/OR STOCKPILING CONSTRUCTION MATERIALS ON PROPERTY, PUBLIC OR PRIVATE, NOT PREVIOUSLY SPECIFIED FOR SAID PURPOSES.
 -DISPOSING OF EXCESS OR UNSUITABLE EXCAVATED MATERIAL IN WETLANDS OR FLOODPLAINS, EVEN WITH THE PERMISSION OF THE PROPERTY OWNER.
 -INDISCRIMINATE, ARBITRARY, OR CAPRICIOUS OPERATION OF EQUIPMENT IN ANY STREAM CORRIDORS, WETLANDS, SURFACE WATERS, OR OUTSIDE THE EASEMENT AREA.
 -PERMANENT OR UNSPECIFIED ALTERATION OF THE FLOW LINE OF A STREAM.
 -REMOVAL OF TREES AND SHRUBS, OR DAMAGING VEGETATION OUTSIDE THE LIMITS OF THE CONSTRUCTION AREA.
 -DISPOSAL OF TREES, BRUSH AND OTHER DEBRIS IN STREAM CORRIDORS, WETLANDS, SURFACE WATERS, OR AT UNSPECIFIED LOCATIONS.

14. SEDIMENT AND EROSION CONTROL: THE CONTRACTOR SHALL SUBMIT A COPY OF THE STORMWATER POLLUTION PREVENTION PLAN (SWPPP) TO THE SANITARY ENGINEER THAT HAS BEEN APPROVED BY THE GOVERNING STORM WATER AUTHORITY (I.E., DELAWARE COUNTY ENGINEER'S OFFICE, CITY OF POWELL, VILLAGE OF SUNBURY, ETC.) PRIOR TO THE PRE-CONSTRUCTION MEETING FOR THE SANITARY SEWER. ADDITIONAL EROSION AND SEDIMENTATION CONTROLS MAY BE REQUIRED AT THE DISCRETION OF THE SANITARY ENGINEER BEFORE AND/OR DURING CONSTRUCTION ACTIVITIES.

- SANITARY SEWER NOTES:**
 1. ALL SANITARY SEWERS SHALL BE SEPARATED A MINIMUM OF 10 FEET HORIZONTALLY AND 1.5 FEET VERTICALLY FROM ALL WATER MAINS.
 2. WHEREVER A SANITARY SEWER MUST CROSS AN EXISTING WATER MAIN, THE ELEVATION OF THE CROWN OF THE SEWER SHALL BE AT LEAST 1.5 FEET MINIMUM, MEASURED BETWEEN THE OUTSIDE PIPE WALLS, BELOW THE BOTTOM OF THE WATER MAIN.
 3. ALL GRAVITY SANITARY MAINS (8 INCHES THROUGH 15 INCHES) AND SERVICES (6 INCH) SHALL BE PVC PIPE MEETING THE REQUIREMENTS OF ASTM D-3034, SDR 35, CELL CLASS 12454, UNLESS OTHERWISE NOTED. PVC SEWER JOINTS SHALL MEET ASTM 3212 SPECIFICATIONS. FOR PIPE SIZES 18 INCHES AND LARGER, PVC PIPE SHALL CONFORM TO ASTM F 679, WITH A CELL CLASSIFICATION OF 12454. PIPE AND FITTINGS SHALL BE SDR 26 OR PS 115 FOR DEPTHS GREATER THAN 20 FEET. FOR PIPES WITH DEPTHS GREATER THAN 28 FEET, PLEASE SEE THE DISTRICT CMS.
 4. THERE SHALL BE NO STORM OR CLEAN WATER CONNECTIONS TO THE SANITARY SEWER (ROOF DRAINS, FOOTER DRAINS, ETC.)
 5. ALL SANITARY SEWER WYE FITTINGS SHALL HAVE A 10-FOOT MINIMUM SERVICE EXTENSION INSTALLED PRIOR TO THE SERVICE BEING GAPPED AND BACKFILL BEING PLACED OVER THE MAINLINE AND LATERAL SEWER.
 6. TRENCH DAMS ARE REQUIRED FOR ALL SANITARY SERVICES AND SHALL BE CONSTRUCTED OF NATIVE CLAY OR IMPERVIOUS SOIL ABOVE THE TRENCH UPSTREAM OF THE MAIN LINE SEWER TO RETARD AND RESIST THE MOVEMENT OF GROUNDWATER THROUGH THE TRENCH BEDDING OR BACKFILL MATERIAL. COMPACT THE TRENCH DAMS TO 6 FEET IN LENGTH, AS MEASURED ALONG THE SERVICE CENTERLINE TO A LIMIT OF 36 INCHES ABOVE THE TOP OF PIPE.
 7. SEWER TRENCHES SHALL BE DE-WATERED TO 2 INCHES BELOW THE BELL OF PIPE PRIOR TO INSTALLATION OF PIPE.
 8. THE CONTRACTOR SHALL PROVIDE AND INSTALL WYE POLES AT ALL WYE LOCATIONS AS CONSTRUCTED. WYE POLES SHALL EXTEND ABOVE THE EXISTING OR PROPOSED GRADE, WHICHEVER IS HIGHER, A MINIMUM OF 2 FEET.
 9. ANY FIELD TILE DISTURBED DURING CONSTRUCTION SHALL BE REPLACED AS DIRECTED BY THE SANITARY ENGINEER WITH PVC PIPE SPANNING THE TRENCH. THE TRENCH SHALL BE FILLED WITH COMPACTED GRANULAR BACKFILL.
 10. FINISH GRADE AT ALL SANITARY MANHOLES SHALL BE AT LEAST 6 INCHES BELOW TOP OF CASTING TO AVOID UNNECESSARY INFILTRATION INTO THE SANITARY SEWER SYSTEM.
 11. ALL SANITARY SERVICES SHALL BE INSTALLED WITH A MINIMUM 2.0% SLOPE UNLESS OTHERWISE NOTED ON PLANS.
 12. BACKFILL SHALL BE INSTALLED PER TYPICAL TRENCH DETAIL SA.S-2.
 13. SERVICE RISERS SHALL BE INSTALLED WHERE DEPTHS FROM THE WYE TO THE EXISTING OR PROPOSED ELEVATION

- EXCEEDS 12 FEET. THE TOPS OF RISERS SHALL BE NO MORE THAN 10 FEET BELOW EXISTING OR PROPOSED SURFACE ELEVATION, WHICHEVER IS HIGHER, UNLESS OTHERWISE NOTED.
 14. CONTRACTOR SHALL INSTALL PLUGS IN THE UPSTREAM AND DOWNSTREAM INVERTS OF THE CONNECTION MANHOLE. THE PLUGS SHALL BE INSPECTED BY THE CONTRACTOR ON A WEEKLY BASIS AND AFTER RAINFALL EVENTS.
 15. SANITARY SEWERS SHALL BE TESTED BY AIR TESTING METHOD. AIR TESTING SHALL BE MADE IN ACCORDANCE WITH ASTM F1417-92. ALLOWABLE LEAKAGE SHALL NOT EXCEED THE LIMITS AS SHOWN IN CMS ITEM 409.01. CONTRACTOR SHALL COOPERATE WITH THE SANITARY ENGINEER AND PROVIDE ALL NECESSARY EQUIPMENT TO PERFORM THE TESTING.
 16. SANITARY MANHOLES SHALL BE TESTED USING VACUUM TEST METHODS PER CMS ITEM 409.02.
 17. WHEN PVC PIPE IS USED A DEFLECTION TEST SHALL BE PERFORMED. PIPE DEFLECTION SHALL NOT EXCEED 5 PERCENT IF TESTED AFTER 30 DAYS, OR 7.5 PERCENT 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 SANITARY ENGINEER. IF RIGID BALLS OR MANDELS 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 BY THE CONTRACTOR AT NO COST TO THE DCRSD.
 18. ALL SANITARY MANHOLES SHALL BE STAMPED "DELAWARE COUNTY REGIONAL SEWER DISTRICT". ALL WATER TIGHT MANHOLES SHALL HAVE A T-GASKET AND CONCEALED PICK HOLES. ALL SANITARY MANHOLES SHALL BE NEENAH R-1760A WITH DELAWARE COUNTY REGIONAL SEWER DISTRICT CAST IN THE MANHOLE.
 19. THE FOLLOWING SET OF TOOLS AND SPARE PARTS SHALL BE DELIVERED TO THE SANITARY ENGINEER'S OFFICE PRIOR TO FINAL ACCEPTANCE OF THE PROJECT: FIVE (5) CONCRETE GRADE RINGS; ONE (1) MANHOLE LIFTING HOOK; AND ONE (1) COMPLETE MANHOLE CASTING (FRAME AND LID). AN ADDITIONAL SET OF SPARE PARTS SHALL BE PROVIDED FOR EVERY TEN (10) MANHOLES.

SITE VISIT
 THE CONTRACTOR SHALL PERFORM FIELD RECONNAISSANCE TO BECOME ACQUAINTED WITH THE EXISTING SITE CONDITIONS AND THE POTENTIAL AFFECTS UPON THE WORK SCOPE. ANY PERFORMANCE OF ADDITIONAL SITE SUBSURFACE INVESTIGATIONS (TEST HOLES) SHALL BE COORDINATED IN ADVANCE WITH THE OWNER AS WARRANTED. EXCAVATED MATERIAL SHALL BE REPLACED IN A CONTROLLED MANNER TO MINIMIZE IMPACT ON FIELD EARTHWORK OPERATIONS.

CONSTRUCTION LAYOUT
 ALL CONSTRUCTION LAYOUT STAKES FOR THE SANITARY SEWER REFERENCED AS A PART OF THIS PLAN IMPROVEMENT SHALL BE PROVIDED BY THE OWNER'S REPRESENTATIVE.

THE CONTRACTOR SHALL CAREFULLY PRESERVE BENCH MARKS, PROPERTY CORNERS, REFERENCE POINTS, STAKES AND OTHER SURVEY REFERENCE MONUMENTS OR MARKERS. IN CASE OF WILLFUL OR CARELESS DESTRUCTION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR RESTORATION. RESETTling OF MARKERS SHALL BE PERFORMED BY AN OHIO PROFESSIONAL SURVEYOR AS APPROVED BY THE ENGINEER.

EXISTING UTILITIES
 UTILITY POLES WITHIN THE INFLUENCE OF THE UTILITY OPERATIONS SHALL BE REINFORCED BY THE UTILITY COMPANY PRIOR TO THESE CONSTRUCTION ACTIVITIES. NOTIFICATION OF THE UTILITY COMPANY PRIOR TO CONSTRUCTION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

TRAFFIC
 ALL TRAFFIC CONTROL DEVICES SHALL BE FURNISHED, ERECTED, MAINTAINED AND REMOVED BY THE CONTRACTOR IN ACCORDANCE WITH THE "OHIO MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES FOR CONSTRUCTION AND MAINTENANCE OPERATIONS", COPIES OF WHICH ARE AVAILABLE FROM THE OHIO DEPARTMENT OF TRANSPORTATION, BUREAU OF TRAFFIC, 400 E. WILLIAM STREET, DELAWARE, OHIO 43015.

ALL PERMANENT TRAFFIC CONTROLS NOT IN CONFLICT WITH THE TEMPORARY TRAFFIC CONTROLS SHALL BE MAINTAINED THROUGHOUT THIS PROJECT BY THE CONTRACTOR. PERMANENT TRAFFIC CONTROLS MAY BE TEMPORARILY RELOCATED, AS APPROVED BY THE ENGINEER. THE CONTRACTOR SHALL ASSUME ALL LIABILITY FOR MISSING, DAMAGED AND IMPROPERLY PLACED SIGNS.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REINSTALLATION AND/OR REPLACEMENT OF ALL PERMANENT TRAFFIC CONTROL DEVICES DAMAGED OR REMOVED DURING THE CONSTRUCTION. PERMANENT TRAFFIC CONTROL NO LONGER IN CONFLICT WITH TEMPORARY TRAFFIC CONTROL SHALL BE REPLACED IMMEDIATELY.

INGRESS AND EGRESS SHALL BE MAINTAINED AT ALL TIMES TO PUBLIC AND PRIVATE PROPERTY.

PAYMENT FOR ALL TRAFFIC MAINTENANCE ITEMS SHALL BE INCLUDED WITHIN THE PRICE BID FOR THE SANITARY SEWER IMPROVEMENTS.

ROCK EXCAVATION
 THIS WORK SHALL BE DEFINED IN ACCORDANCE WITH THE DELAWARE COUNTY SPECIFICATIONS. REFERENCE THE SOILS REPORT FOR DISCUSSION OF GENERAL GEOTECHNICAL EVALUATION.

SITE CLEARING
 CLEARING & GRUBBING MAY BE REQUIRED AS A PART OF THIS CONTRACT IMPROVEMENT WORK.

THE CONTRACTOR SHALL FIELD REVIEW THE EXTENT OF SITE CLEARING WITH THE OWNER AND/OR ENGINEER. NO CLEARING SHALL BE PERFORMED UNTIL FORMAL AUTHORIZATION HAS BEEN OBTAINED FROM THE OWNER.

ESTABLISHMENT OF THIS WORK SHALL INCLUDE THE OFFSITE REMOVAL AND DISPOSAL OF ALL STUMPS AND CLEARING DEBRIS UNLESS OTHERWISE DIRECTED BY THE OWNER.

TEMPORARY SOIL EROSION AND SEDIMENT CONTROL
 EROSION AND SEDIMENTATION CONTROL HAS BEEN ESTABLISHED THROUGHOUT THE PROJECT LIMITS AS A PART OF THE STORMWATER POLLUTION PREVENTION PLAN PREPARED FOR THE PINES SECTION 1, PHASE A&B, SITE IMPROVEMENT PLAN SET. GENERAL MAINTENANCE OF THE EXISTING EROSION AND SEDIMENTATION CONTROL FEATURES SHALL BE THE OBLIGATION OF THE EARTHWORK CONTRACTOR.

THE SITE UTILITY CONTRACTOR SHALL BE RESPONSIBLE FOR SUPPLEMENTING AND / OR REPLACING SITE EROSION AND SEDIMENTATION CONTROL AS REQUIRED TO ACCOMMODATE INSTALLATION OF THE SANITARY SEWER. TEMPORARY REMOVAL OF THE EROSION AND SEDIMENTATION CONTROL FEATURES SHALL BE COORDINATED WITH THE CONSTRUCTION MANAGER.

LAND-DISTURBING ACTIVITIES MUST COMPLY WITH ALL PROVISIONS OF DELAWARE COUNTY. ALL LAND-DISTURBING ACTIVITIES SHALL BE SUBJECT TO INSPECTION AND SITE INVESTIGATION BY DELAWARE COUNTY AND THE OHIO EPA. FAILURE TO COMPLY WITH THESE REGULATIONS IS SUBJECT TO LEGAL ENFORCEMENT ACTION.

DEWATERING
 THE CONTRACTOR IS RESPONSIBLE TO PROVIDE ALL DEWATERING OPERATIONS AS REQUIRED TO ACCOMPLISH THE PROPOSED CONSTRUCTION OPERATIONS. REFERENCE THE SOILS REPORT FOR GROUND WATER CONSIDERATIONS.

INSTALLATION OF ANY WELL, WELL POINT, PIT OR OTHER DEVICE USED FOR THE PURPOSE OF REMOVING GROUNDWATER FROM AN AQUIFER SHALL BE IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF THE OHIO DEPARTMENT OF NATURAL RESOURCES.

IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT TURBID WATER ENCOUNTERED WITHIN THE UTILITY TRENCH SHALL BE MANAGED APPROPRIATELY ON SITE. ALL TURBID WATER SHALL BE PUMPED INTO A SEDIMENT CONTROL STRUCTURE SUCH AS A SEDIMENT TRAP OR BASIN.

THE USE OF FILTER BAGS IS NOT PERMITTED WITHOUT A DETAILED SITE LAYOUT AND VEGETATIVE BUFFERS. A 50 FOOT MINIMUM VEGETATIVE BUFFER BETWEEN THE FILTER BAG AND A STORMWATER CONVEYANCE SYSTEM MUST BE PRESENT IN ORDER TO USE FILTER BAGS AS A SEDIMENT CONTROL FEATURE DURING DEWATERING OPERATIONS. FILTER BAGS USED ON SITE SHALL REQUIRE ADDITIONAL SEDIMENT CONTROL FEATURES ON ORDER TO PROPERLY MANAGE THE TURBID WATER ASSOCIATED WITH TRENCH DEWATERING ACTIVITIES.

THE CONTRACTOR SHALL CONTACT THE ENGINEER FOR CONSULTATIVE SERVICES PRIOR TO TRENCH DEWATERING OPERATIONS.

THE CONTRACTOR SHALL BE RESPONSIBLE TO PLACE AND MAINTAIN THE NECESSARY SEDIMENT CONTROL MEASURES TO FILTER THE DEWATERING DISCHARGE. COST FOR THE ABOVE SHALL BE INCLUDED IN THE BID PRICE FOR THE SANITARY SEWER IMPROVEMENTS.

MAINTAIN DRAINAGE
 THE FLOW IN ALL SEWERS, DRAINS, FIELD TILES AND WATERCOURSES ENCOUNTERED SHALL BE MAINTAINED BY THE CONTRACTOR AT HIS EXPENSE, AND WHENEVER SUCH WATERCOURSES AND DRAINS ARE DISTURBED OR DESTROYED DURING THE PROSECUTION OF THE WORK, THEY SHALL BE RESTORED BY THE CONTRACTOR AT HIS OWN COST AND EXPENSE TO A CONDITION SATISFACTORY TO THE CONSTRUCTION MANAGER.

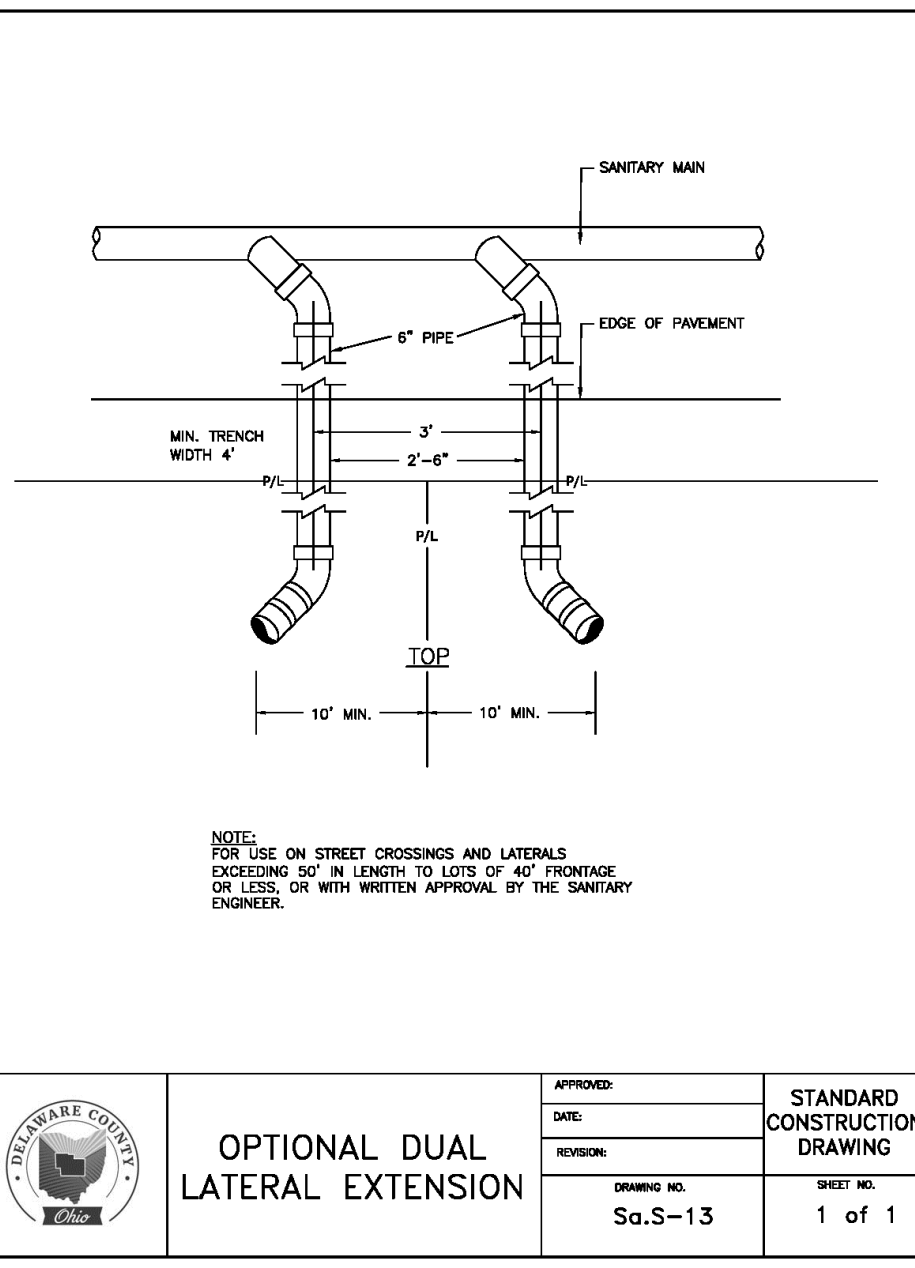
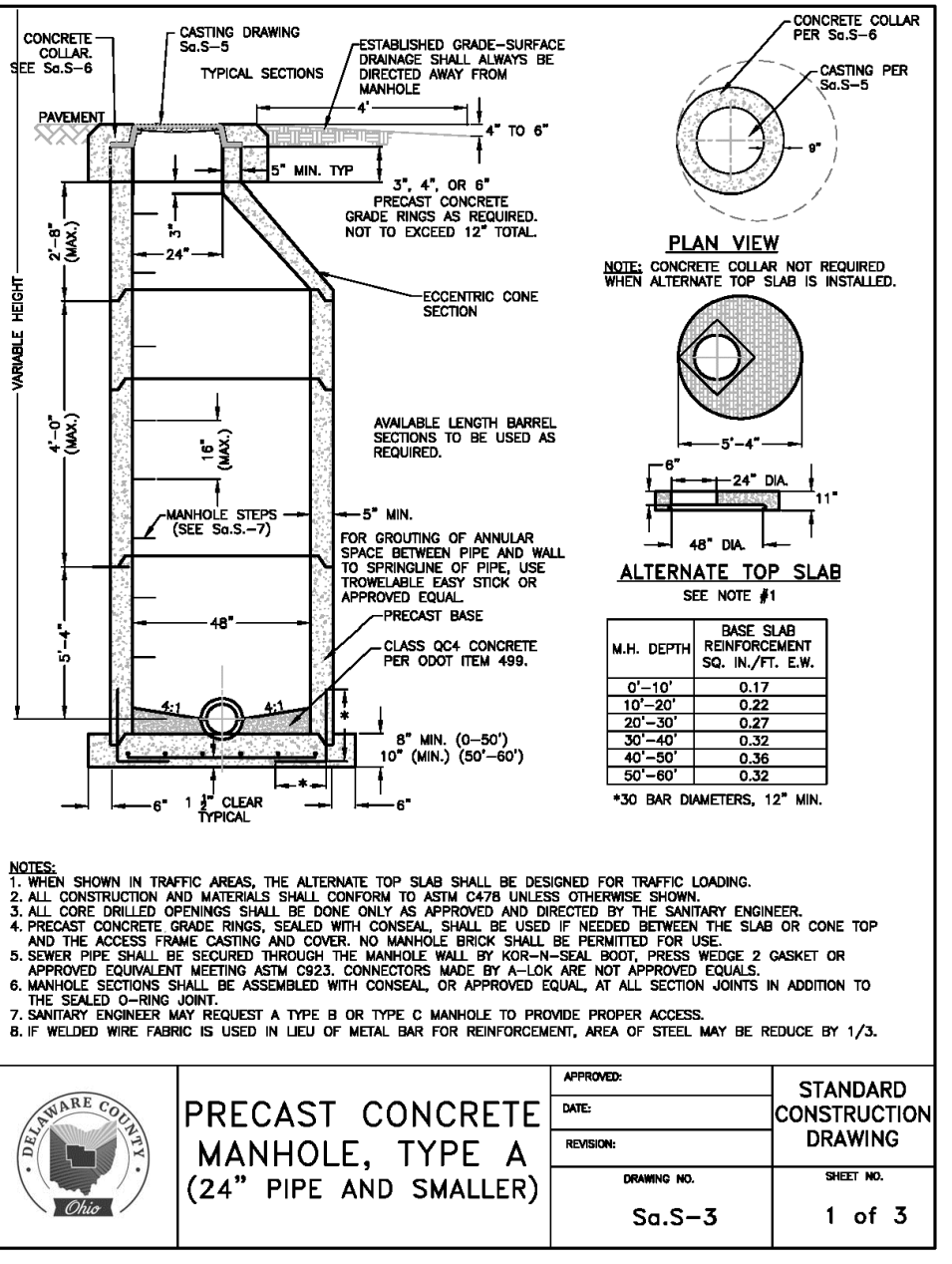
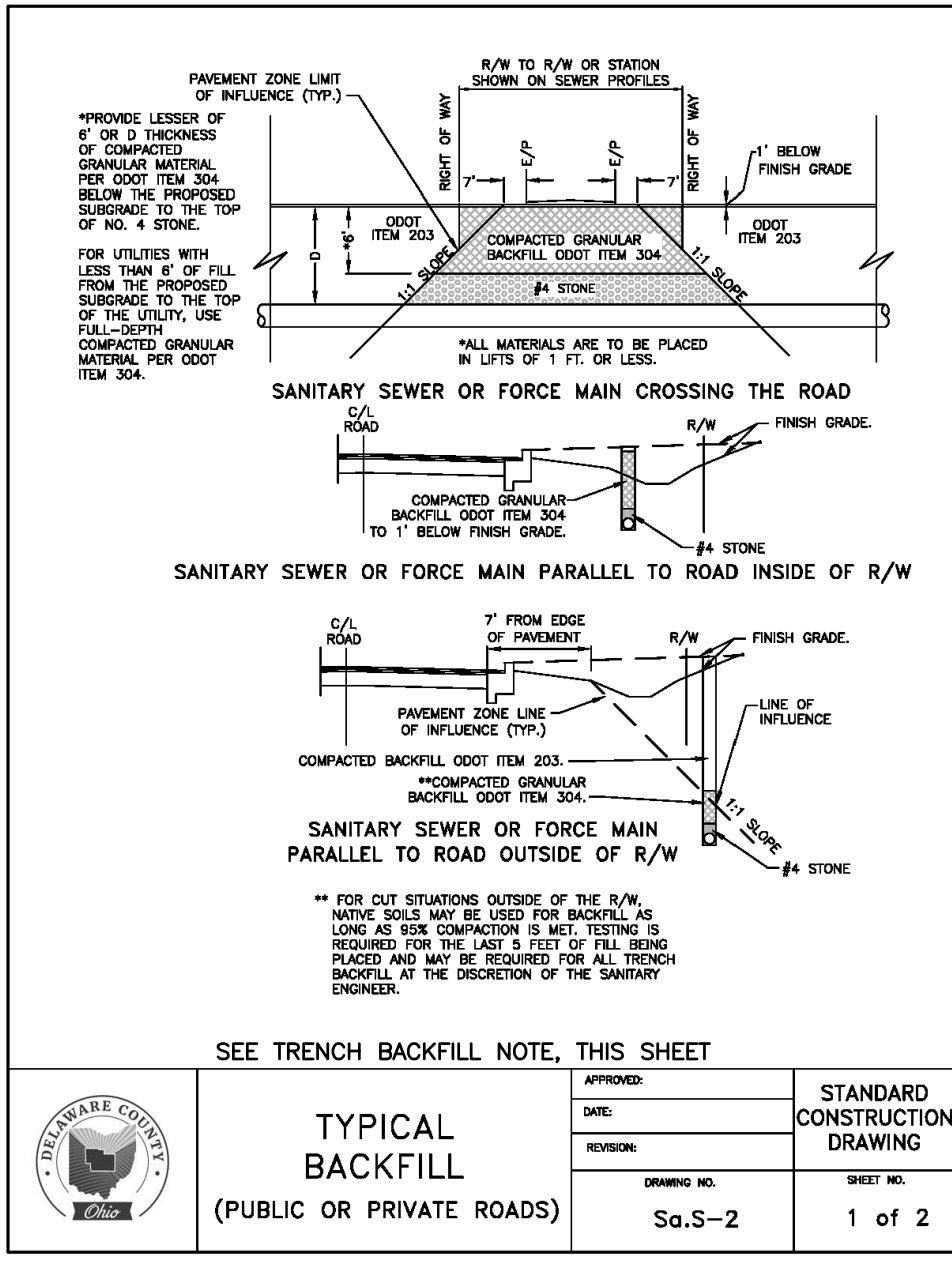
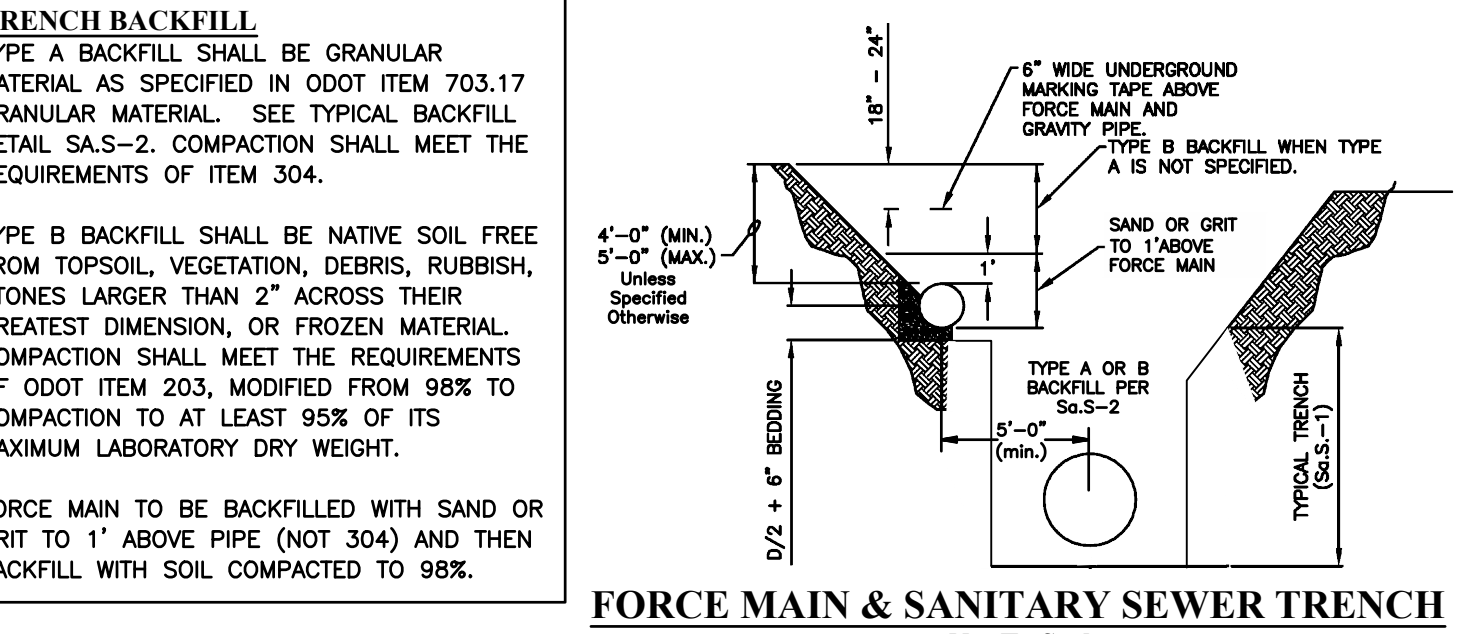
NON-RUBBER TIRED VEHICLES
 NON-RUBBER TIRED VEHICLES SHALL NOT BE MOVED ON PUBLIC STREETS, PRIVATE ROADWAYS OR PARKING LOTS. NO EXCEPTIONS SHALL BE GRANTED.

STORAGE OF EQUIPMENT AND MATERIALS
 NO MATERIALS OR EQUIPMENT SHALL BE STORED WITHIN THE RIGHT-OF-WAY OR WITHIN ONE HUNDRED(100) FEET OF ANY INTERSECTING STREET OR DRIVEWAY. COMPLIANCE WITH THESE REQUIREMENTS ALONG WITH ADDITIONAL PROVISIONS OF THE CONTRACT SPECIFICATIONS SHALL NOT IN ANY WAY RELIEVE THE CONTRACTOR OF HIS LEGAL RESPONSIBILITIES OR LIABILITIES FOR THE SAFETY OF THE PUBLIC. THE CONTRACTOR SHALL INDICATE HIS INTENT WITH REGARD TO STORAGE OF MATERIAL AT THE PRE-CONSTRUCTION MEETING.

CONVENIENCE FACILITIES
 THE CONTRACTOR SHALL FURNISH AND MAINTAIN SANITARY CONVENIENCE FACILITIES FOR THE WORKMEN AND INSPECTORS FOR THE DURATION OF THE WORK. COST SHALL BE INCLUDED IN THE PRICE BID FOR THE SANITARY SEWER IMPROVEMENTS.

ESTIMATE OF QUANTITIES							
Note: The quantities shown on this plan are the Engineers best determination of the work to be performed. The quantities are for use by Delaware County to estimate the necessary development fees. The Contractor should make his own determination and shall be solely responsible for determining the required bid quantities necessary for							
ITEM	QUANTITY			UNIT	DESCRIPTION		
	PHASE A	PHASE B	TOTAL				
208	628	322	950	LF	8" SEWER PIPE (SDR 35) W/TYPE I BEDDING (8'-12" DEEP)		
208	0	254	254	LF	8" SEWER PIPE (SDR 35) W/TYPE I BEDDING (12'-16" DEEP)		
208	0	340	340	LF	8" SEWER PIPE (SDR 35) W/TYPE I BEDDING (16'-20" DEEP)		
208	0	567	567	LF	8" SEWER PIPE (SDR 26) W/TYPE I BEDDING (20'-24" DEEP)		
208	316	0	316	LF	12" SEWER PIPE (C900) W/TYPE I BEDDING (28'-32" DEEP)		
208	474	0	474	LF	15" SEWER PIPE (SDR 35) W/TYPE I BEDDING (8'-12" DEEP)		
208	535	0	535	LF	15" SEWER PIPE (SDR 35) W/TYPE I BEDDING (12'-16" DEEP)		
208	442	0	442	LF	15" SEWER PIPE (SDR 35) W/TYPE I BEDDING (16'-20" DEEP)		
208	675	457	1132	LF	15" SEWER PIPE (SDR 26) W/TYPE I BEDDING (20'-24" DEEP)		
208	1252	436	1687	LF	15" SEWER PIPE (SDR 26) W/TYPE I BEDDING (24'-28" DEEP)		
208	908	0	908	LF	16" SEWER PIPE (C905) W/TYPE I BEDDING (28'-32" DEEP)		
208	666	0	666	LF	16" SEWER PIPE (C905) W/TYPE I BEDDING (32'-36" DEEP)		
**208	844	313	1157	LF	6" DIAMETER RISER PIPE		
**208	258	115	373	LF	6" DIA. PIPE, SANITARY HOUSE CONNECTION SERVICE (1/TRENCH OUTSIDE R/W)		
**208	474	84	558	LF	6" DIA. PIPE, SANITARY HOUSE CONNECTION SERVICE (1/TRENCH INSIDE R/W)		
**208	791	873	1664	LF	6" DIA. PIPE, SANITARY HOUSE CONNECTION SERVICE (2/TRENCH INSIDE R/W)		
208	8	25	33	EA	8"x 6" WYE FITTING (SDR 35) (LESS THAN 20' DEEP)		
208	3	0	3	EA	12"x 6" WYE FITTING (C900) (GREATER THAN 28' DEEP)		
208	15	0	15	EA	15"x 6" WYE FITTING (SDR 35) (LESS THAN 20' DEEP)		
208	28	8	36	EA	15"x 6" WYE FITTING (SDR 26) (20'-28' DEEP)		
208	4	0	4	EA	16"x 6" WYE FITTING (C905) (GREATER THAN 28' DEEP)		
209	23	10	33	EA	MANHOLE, TYPE A (Sa.5-3)		
209	4	2	6	EA	MANHOLE, TYPE A (Sa.5-3) W/OUTSIDE DROP (Sa.5-8)		
210	5094	0	5094	LF	4" SEWER PRESSURE PIPE (PVC AWWA C900), COMPLETE		
210	36	0	36	LF	12" SEWER PRESSURE PIPE (PVC AWWA C900), COMPLETE		
SPEC	1	0	1	LS	PUMP STATION, COMPLETE		
SPEC	1	0	1	LS	PUMP STATION ELECTRICAL BUILDING STRUCTURE, COMPLETE		
SPEC	1	0	1	LS	PUMP STATION ELECTRICAL SERVICE, COMPLETE		

ALL ITEMS ARE DELAWARE COUNTY UNLESS OTHERWISE NOTED
 * THE LENGTH OF RISER PIPE NOTED WITHIN PLAN IS THE ACTUAL LENGTH OF RISER PIPE LAID AT SPECIFIED ANGLE
 ** QUANTITY LISTED REPRESENTS ACTUAL LENGTH OF SERVICE REQUIRED, NOT TRENCH LENGTH.
 ALL MANHOLE LIDS SHALL BE STAMPED "DELAWARE COUNTY REGIONAL SEWER DISTRICT". ALL WATER TIGHT LIDS SHALL HAVE A T-GASKET WITH CONCEALED PICK HOLES. ALL MANHOLES DEEPER THAN 12' REQUIRE A CONCRETE BASE USING CLASS "B" CONCRETE PER DELAWARE COUNTY SANITARY ENGINEER'S SPECIFICATIONS.

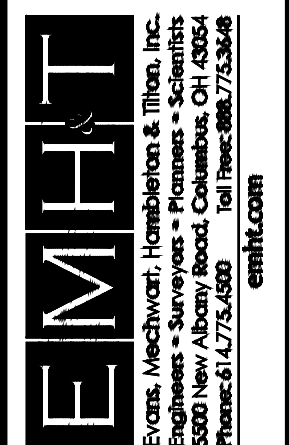


MARK	DATE	DESCRIPTION

M/I HOMES
Move Up
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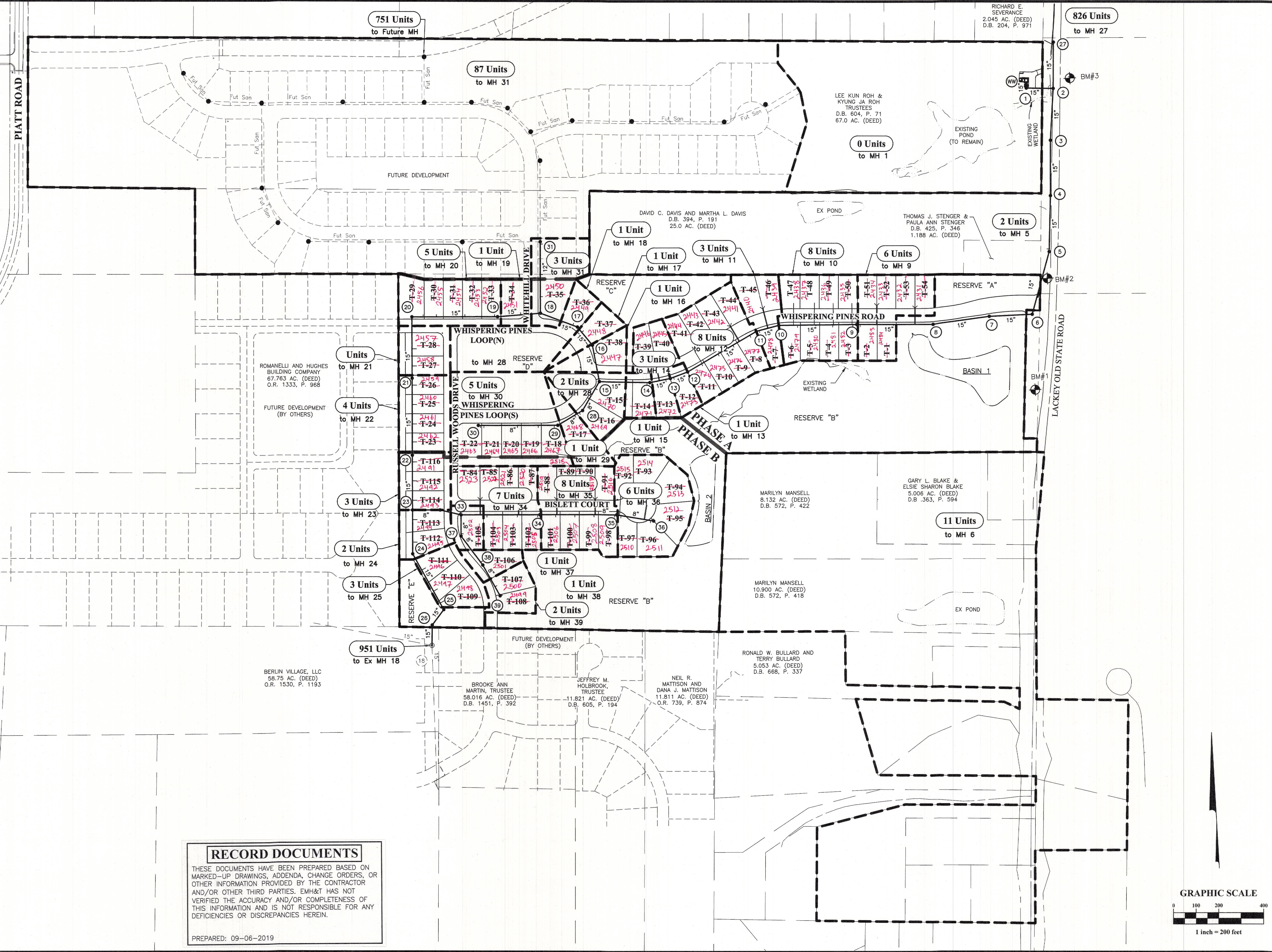
BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
 SANITARY SEWER IMPROVEMENT PLAN
 FOR
THE PINES, SECTION 1
PHASE A & B
 GENERAL NOTES & DETAILS

DATE	SCALE	JOB NO.	SHEET
April 2018	As Noted	20170824	2/32

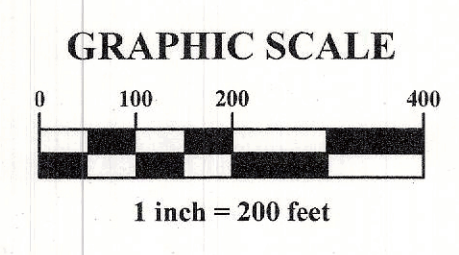


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RECORD DOCUMENTS
 THESE DOCUMENTS HAVE BEEN PREPARED BASED ON MARKED-UP DRAWINGS, ADDENDA, CHANGE ORDERS, OR OTHER INFORMATION PROVIDED BY THE CONTRACTOR AND/OR OTHER THIRD PARTIES. EMH&T HAS NOT VERIFIED THE ACCURACY AND/OR COMPLETENESS OF THIS INFORMATION AND IS NOT RESPONSIBLE FOR ANY DEFICIENCIES OR DISCREPANCIES HEREIN.
 PREPARED: 09-06-2019



REVISIONS	
MARK	DATE DESCRIPTION
BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO SANITARY SEWER IMPROVEMENT PLAN FOR THE PINES, SECTION 1 PHASE A & B SANITARY TRIBUTARY AREA MAP	
DATE: April 2018 SCALE: 1" = 200' JOB NO.: 20170824 SHEET: 3/32	

STRUCTURE COORDINATES				
STRUCTURE #	NORTHING - PLAN	EASTING - PLAN	NORTHING - AS BUILT	EASTING - AS BUILT
WW	213553.8495	1832680.7750	213550.3890	1832680.8760
Ex 18			211235.3718	1829907.3863
1	213541.8773	1832679.9570	213541.4310	1832679.1180
2	213533.6968	1832799.8215	213532.8000	1832800.8990
3	213305.5912	1832774.6528	213305.4630	1832775.6770
4	213061.1833	1832760.6271	213059.8080	1832761.6010
5	212814.2343	1832740.7467	212813.1800	1832741.9220
6	212544.1942	1832649.6533	212551.4420	1832710.2260
7	212543.5764	1832458.7684	212544.4280	1832458.3090
8	212524.0205	1832208.5273	212522.9230	1832208.2730
9	212543.7110	1831870.7523	212542.5780	1831870.5010
10	212559.7406	1831525.1980	212560.2740	1831522.2210
11	212539.1191	1831423.1049	212540.3590	1831424.0610
12	212377.7391	1831109.5052	212375.8110	1831107.8970
13	212353.5668	1831030.7196	212352.4600	1831031.3360
14	212340.5919	1830939.2028	212340.8220	1830939.9410
15	212357.0722	1830716.1515	212359.4820	1830716.4580
16	212519.2610	1830694.6615	212520.4350	1830693.6390
17	212602.9443	1830633.1543	212602.5720	1830633.0050
18	212672.7091	1830472.4207	212673.3270	1830469.5620
19	212668.0251	1830281.8824	212666.8940	1830281.9570
20	212688.7309	1829902.4470	212689.4170	1829900.3140
21	212418.1335	1829887.6805	212418.2110	1829888.9730
22	212078.6383	1829869.1542	212079.6110	1829869.9370
23	211836.9982	1829855.9679	211836.7160	1829854.9420
24	211643.5221	1829845.4099	211646.3530	1829844.6320
25	211390.1054	1829868.7665	211387.9140	1829870.5290
26	211325.2446	1829913.8867	211326.7780	1829914.0430
27	213737.7288	1832812.3598	213738.7240	1832810.9950
28	212233.3695	1830634.5843	212232.7330	1830635.3030
29	212174.2597	1830521.0488	212173.4890	1830520.9960
30	212193.4788	1830168.8570	212194.0370	1830167.9260
31	212988.1164	1830489.6324	212986.9930	1830491.5020
32	211830.3505	1829977.7866	211831.0660	1829977.1610
33	211803.3157	1830069.4497	211804.9340	1830069.1740
34	211784.2633	1830418.5861	211784.8310	1830418.6560
35	211765.7371	1830758.0810	211766.7330	1830757.7390
36	211729.2897	1830920.6163	211728.7630	1830921.5830
37	211709.6477	1830064.3383	211710.6310	1830063.6280
38	211576.4935	1830153.0511	211577.1400	1830153.3150
39	211436.7807	1830221.8788	211435.9970	1830222.2630

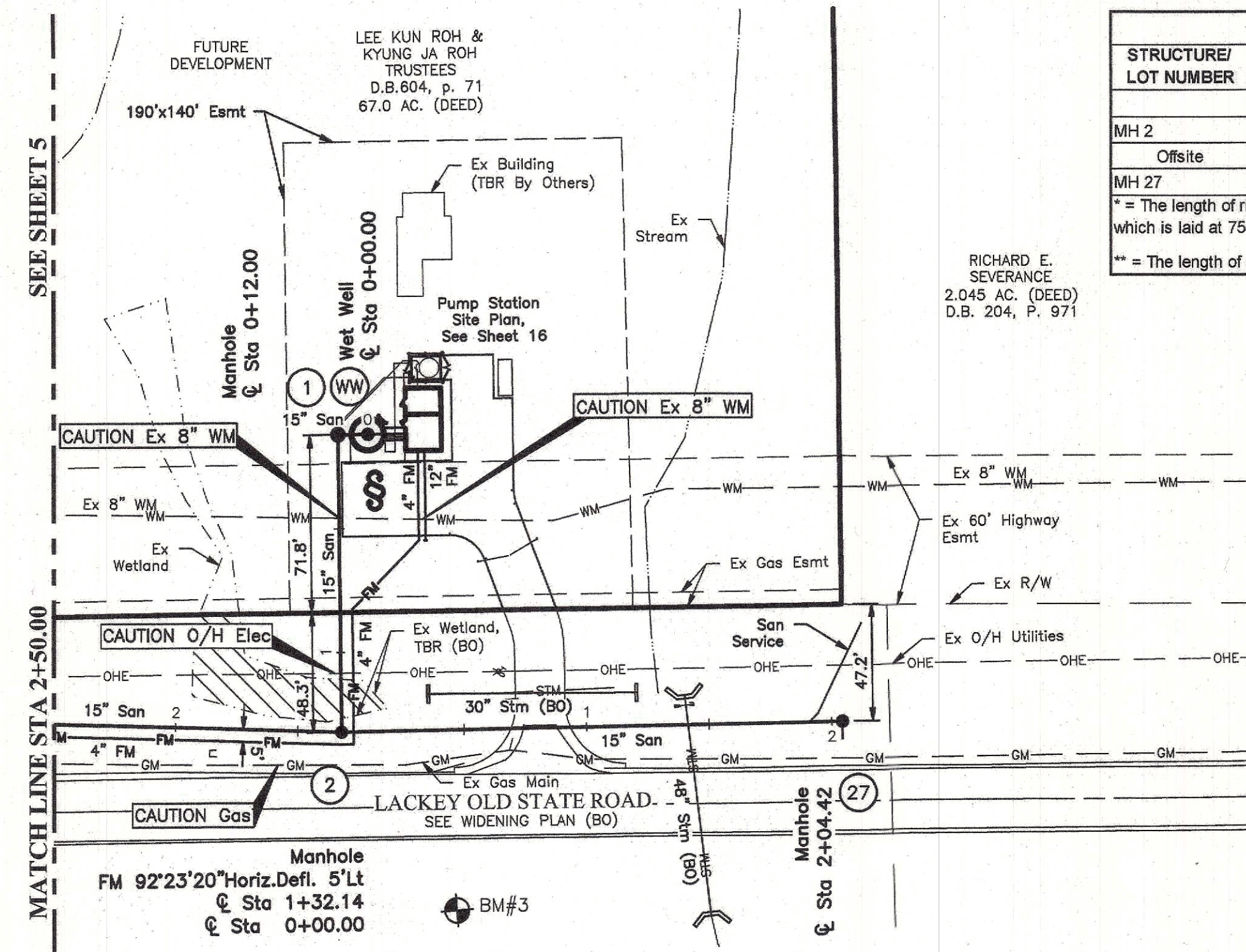
SANITARY SEWER TABLE			
LINE	BEARING	LENGTH	SIZE
WW-1	S03°54'33"W	12.00'	15"
1-2	S86°05'45"E	120.14'	15"
2-3	S06°17'47"W	229.49'	15"
3-4	S03°17'04"W	244.81'	15"
4-5	S04°36'09"W	247.75'	15"
5-6	S48°36'44"W	286.91'	15"
6-7	N89°34'34"W	190.89'	15"
7-8	S85°31'53"W	251.00'	15"
8-9	N86°39'49"W	338.35'	15"
9-10	N87°20'39"W	345.93'	15"
10-11	S78°34'50"W	104.15'	15"
11-12	S62°46'10"W	352.69'	16"
12-13	S72°56'36"W	82.41'	16"
13-14	S81°55'50"W	92.43'	16"
14-15	N85°48'28"W	223.66'	16"
15-16	N07°32'52"W	163.61'	16"
16-17	N36°18'57"W	103.86'	16"
17-18	N66°32'14"W	175.22'	16"
18-19	S88°35'30"W	190.60'	15"
19-20	N86°52'35"W	380.00'	16"
20-21	S03°07'25"W	271.00'	15"
21-22	S03°07'25"W	340.00'	15"

SANITARY SEWER TABLE			
LINE	BEARING	LENGTH	SIZE
22-23	S03°07'25"W	242.00'	15"
23-24	S03°07'25"W	193.76'	15"
24-25	S25°57'20"E	281.85'	15"
25-26	S40°14'08"W	84.96'	15"
26-Ex 18	S04°08'13"W	90.11'	15"
2-27	N03°31'00"E	204.42'	15"
15-28	S33°24'00"W	148.17'	8"
28-29	S62°29'50"W	128.00'	8"
29-30	N86°52'35"W	352.72'	8"
18-31	N03°07'25"E	315.88'	12"
23-32	S86°52'35"E	122.00'	8"
32-33	S73°34'02"E	95.57'	8"
33-34	S86°52'35"E	348.66'	8"
34-35	S86°52'35"E	340.00'	8"
35-36	S77°21'39"E	166.57'	8"
33-37	S03°07'25"W	93.81'	8"
37-38	S33°40'24"E	160.00'	8"
38-39	S26°13'36"E	155.75'	8"

RECORD DOCUMENTS

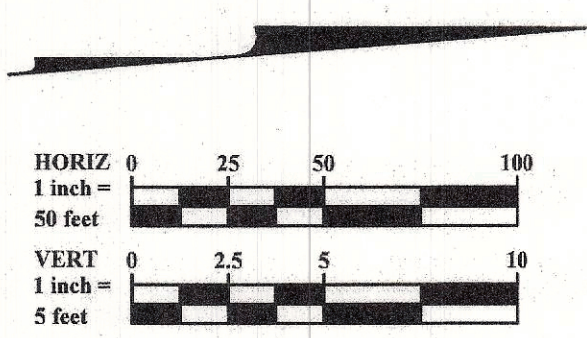
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PREPARED: 09-06-2019

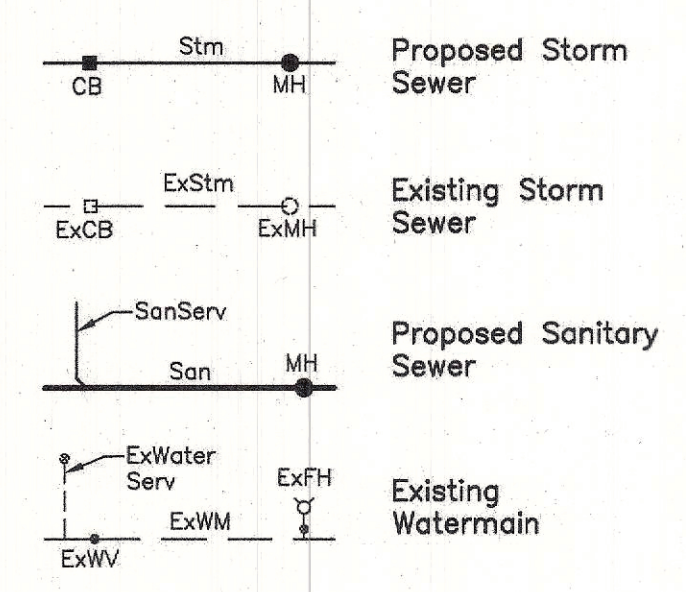


SANITARY SERVICE SCHEDULE						
STRUCTURE/ LOT NUMBER	WYE STATION	RISER LENGTH*	SERVICE LENGTH**	SERVICE SLOPE	END OF SERVICE ELEV.	DEPTH
MH 2	0+00.00					
Offsite	1+94	9'	38'	2.08%	900.5	9.2 ft
MH 27	2+04.42					

* = The length of riser represents the actual length of riser laid at 40° unless noted with [°] which is laid at 75° and requires concrete backing per Sa.S-15
 ** = The length of service is the horizontal distance between the E.O.S. & mainline/riser.



LEGEND



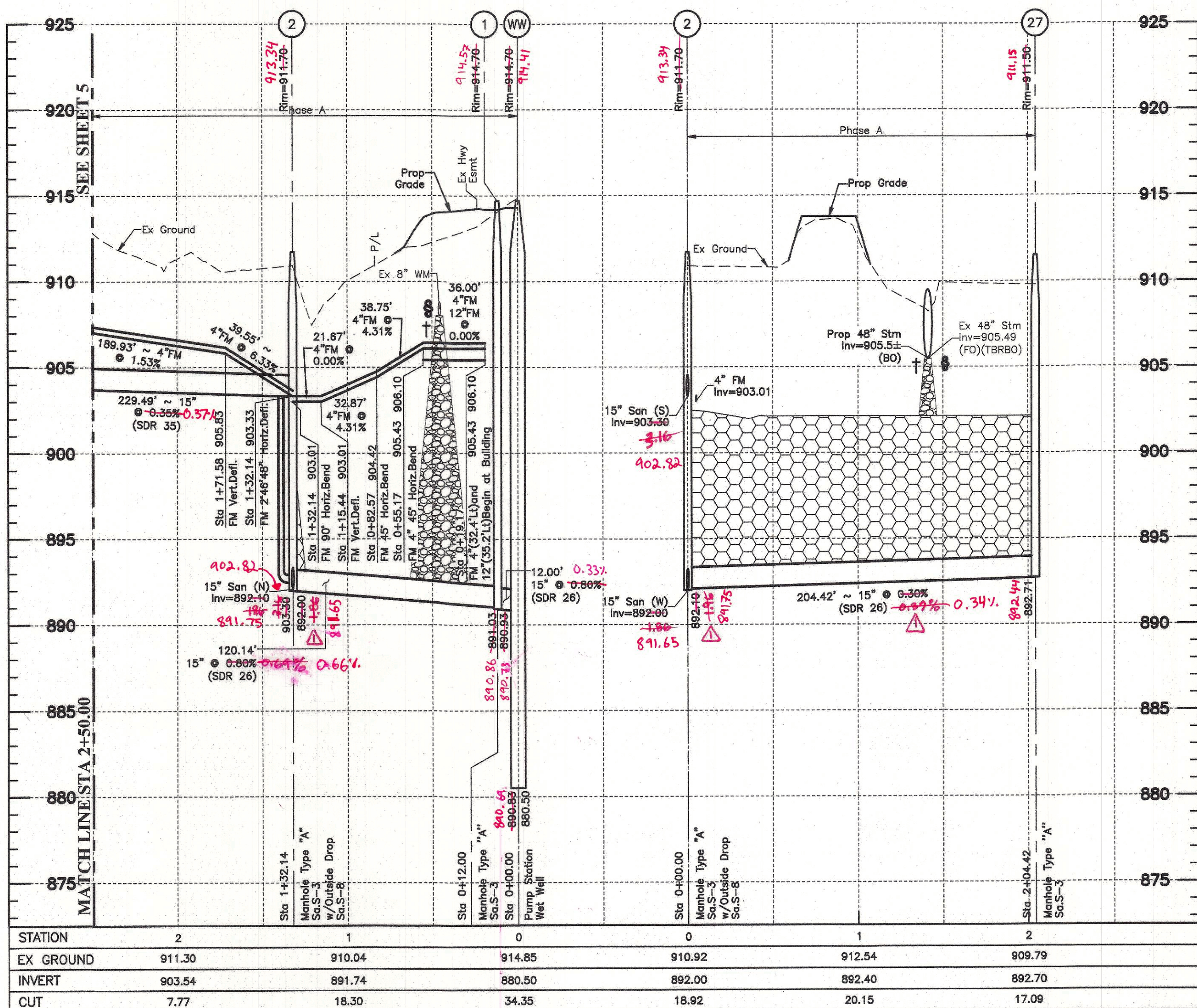
CAUTION:
O.S.H.A. clearance requirements to be maintained during construction between equipment & overhead utility lines.

NOTES:
Trench Backfill is Type B per Sa.S-2 unless otherwise noted (See Detail Sheet 2).
For Utility Crossings: Compacted Granular Backfill.
Denoted thus:

** For Areas within the R/W: Type A Backfill per ODOT Item 304, see Sa.S-2 (Sheet 2).
Denoted thus:

For Areas outside the R/W within line of influence: Type A Backfill per ODOT Item 304 or Type B Backfill with testing, see Sa.S-2 (Sheet 2).
Denoted thus:

All sanitary sewers/force main shall have a minimum separation of 10 feet horizontally to all utilities and 18 inches vertically (outside edge to outside edge) (No utility shall be laid closer than 10' to any sanitary sewer/force main).
All sanitary services to be constructed per Standard Drawings Sa.S-11 & Sa.S-12. See Detail Sheet 2.
For Force Main & Sanitary Sewer Trench Detail, See Sheet 2.
Contractor to verify invert and location of existing utility before construction. If there is a discrepancy between the contractor's information and the plan information shown, the contractor is to contact the engineer of record prior to the start of construction.
Contractor shall maintain a 1.5' minimum clearance from outside of pipe to outside of pipe for all utility crossings unless otherwise noted.
All Manhole lids shall be stamped "Delaware County Regional Sewer District". All watertight lids shall have a T-gasket with concealed pick holes. All manholes 12" or deeper require a concrete base per Delaware County Sanitary Engineer's specifications.
See This Sheet For Structure & Sanitary Sewer Table.



MARK	DATE	DESCRIPTION
1	7/15/18	Lowwater indices MH 2

BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
SANITARY SEWER IMPROVEMENT PLAN
FOR
THE PINES, SECTION 1
PHASE A & B
COORDINATE TABLES AND PLAN & PROFILE

EM&HT
Evans, McWhorter, Hombelton & Tillon, Inc.
Engineers • Surveyors • Planners • Scientists
8000 Rockwood Road, Cincinnati, OH 45248
Phone: 513.755.6500 Fax: 513.755.6508
emht.com

DATE
April 2018

SCALE
Horiz: 1" = 50'
Vert: 1" = 5'

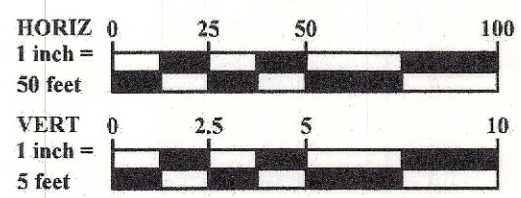
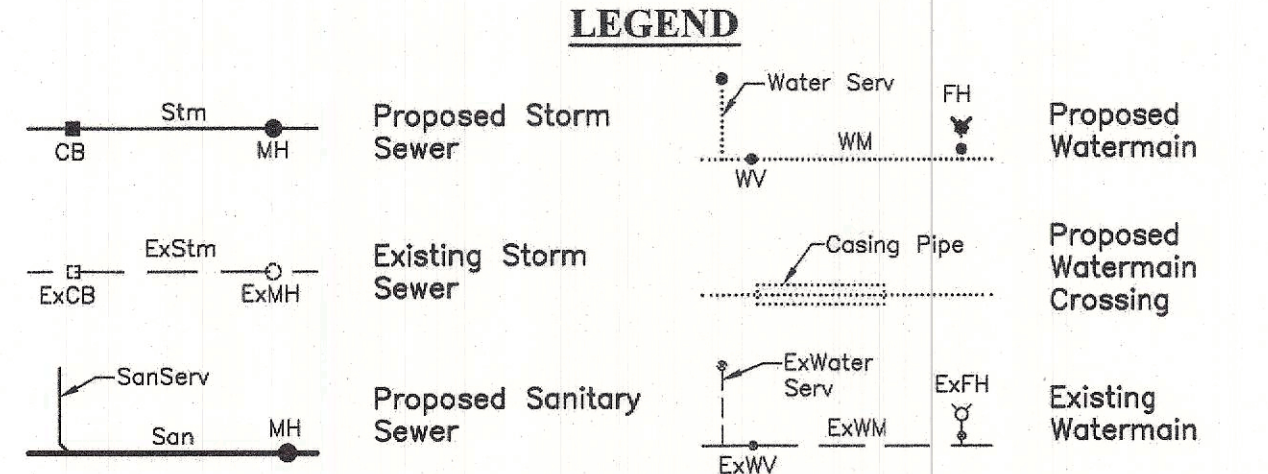
JOB NO.
20170824

SHEET
4/32

Note:
Contractor Shall Provide Temporary Driveway Replacement Where Existing Driveways are Impacted by Sanitary Sewer and Forceman Construction Activity. Permanent Driveway Replacement By Others, See Widening Plan.

SANITARY SERVICE SCHEDULE					
STRUCTURE/ LOT NUMBER	WYE STATION	RISER LENGTH*	SERVICE LENGTH**	SERVICE SLOPE	END OF SERVICE ELEV. DEPTH
MH 4	8+06.44				
Offsite	8+42	2'	8'	2.08%	908.7 9.6 ft
MH 5	8+54.19				

* = The length of riser represents the actual length of riser laid at 40° unless noted with [°] which is laid at 75° and requires concrete backing per Sa.S-15
** = The length of service is the horizontal distance between the E.O.S. & mainline/riser.



RECORD DOCUMENTS
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PREPARED: 09-06-2019

CAUTION:
O.S.H.A. clearance requirements to be maintained during construction between equipment & overhead utility lines.

NOTES:

- Trench Backfill is Type B per Sa.S-2 unless otherwise noted (See Detail Sheet 2).
- For Utility Crossings: Compacted Granular Backfill.
- Denoted thus:
- ** For Areas within the R/W: Type A Backfill per ODOT Item 304, see Sa.S.-2 (Sheet 2).
- Denoted thus:
- For Areas outside the R/W within line of influence: Type A Backfill per ODOT item 304 or Type B Backfill with testing, see Sa.S.-2 (Sheet 2).
- Denoted thus:
- All sanitary sewers/forceman shall have a minimum separation of 10 feet horizontally to all utilities and 18 inches vertically (outside edge to outside edge) (No utility shall be laid closer than 10' to any sanitary sewer/forceman).
- All sanitary services to be constructed per Standard Drawings Sa.S-11 & Sa.S-12. See Detail Sheet 2.
- For Force Main & Sanitary Sewer Trench Detail, See Sheet 2.
- Contractor to verify invert and location of existing utility before construction. If there is a discrepancy between the contractor's information and the plan information shown, the contractor is to contact the engineer prior to the start of construction.
- Contractor shall maintain a 1.5' minimum clearance from outside of pipe to outside of pipe for all utility crossings unless otherwise noted.
- All Manhole lids shall be stamped "Delaware County Regional Sewer District". All watertight lids shall have a T-gasket with concealed pick holes. All manholes 12' or deeper require a concrete base per Delaware County Sanitary Engineer's specifications.
- See Sheet 4 for Structure & Sanitary Sewer Table.

REVISIONS

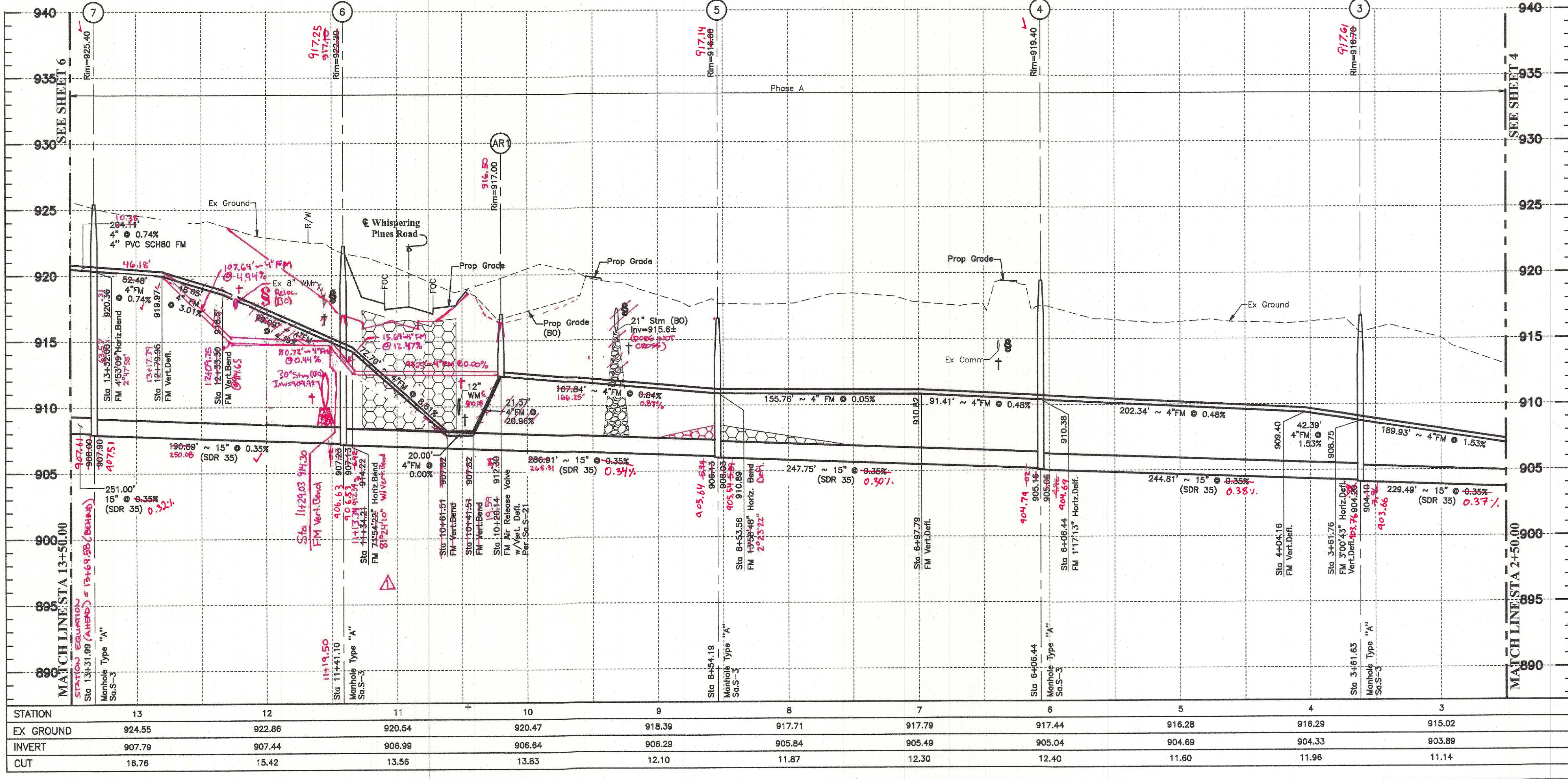
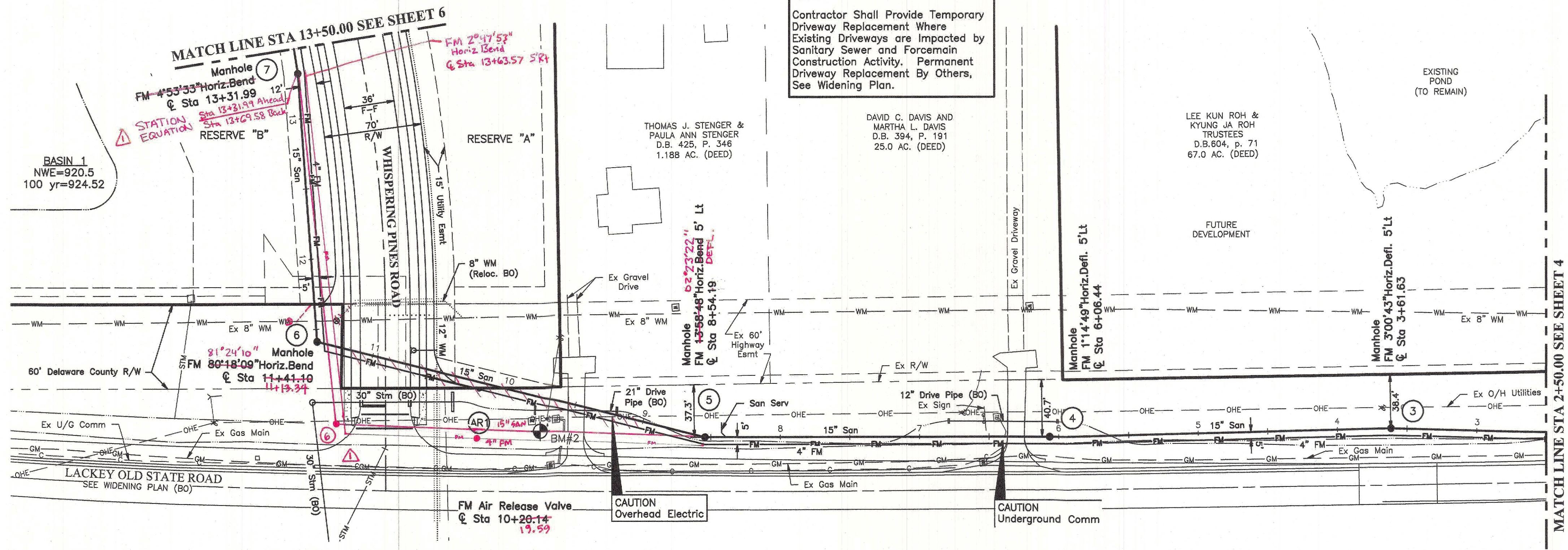
MARK	DATE	DESCRIPTION
Δ	3/7/19	ADD MANHOLE 7, ADD SANITARY SERVICE SCHEDULE, SEE SHEET 4

M/I HOMES
Move Up
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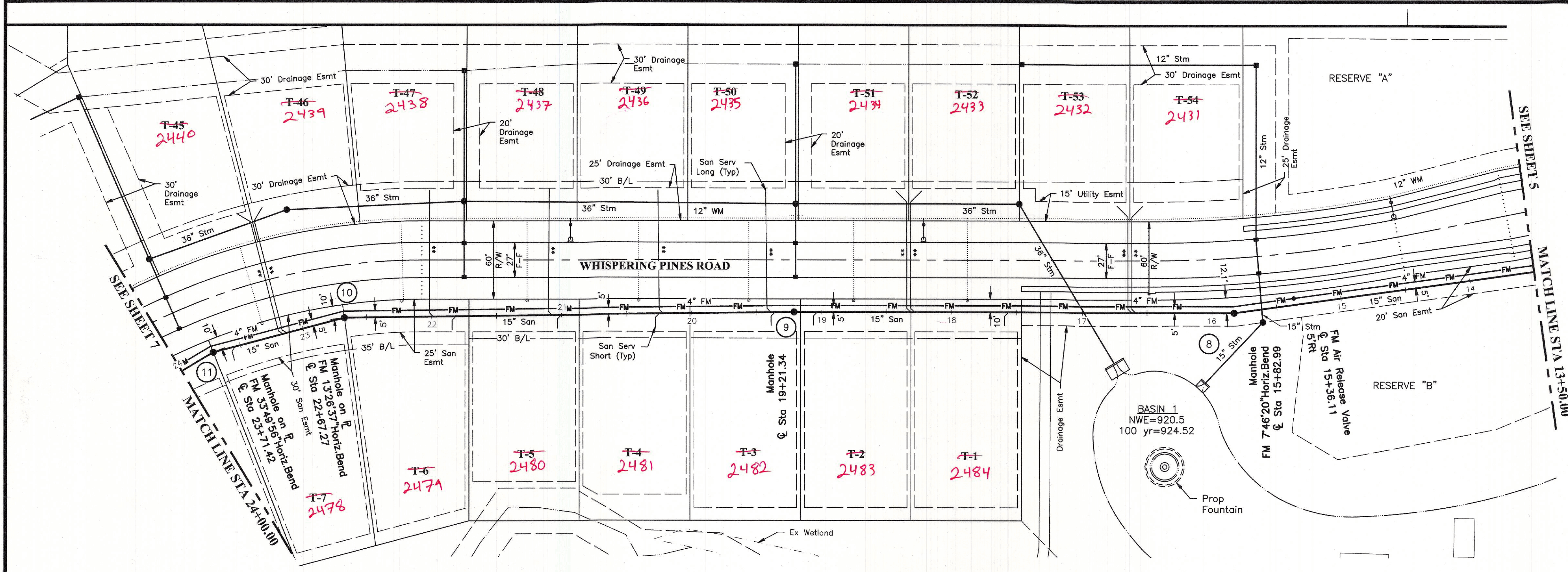
BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
SANITARY SEWER IMPROVEMENT PLAN
FOR
THE PINES, SECTION 1
PHASE A & B
PLAN & PROFILE

EMH&T
Engineers, Surveyors, Planners & Scientists
5800 New Albany Road, Columbus, OH 43245
Phone: 614.775.2600 Fax: 614.775.3268 emht.com

DATE	April 2018
SCALE	Horiz: 1" = 50' Vert: 1" = 5'
JOB NO.	20170824
SHEET	5/32



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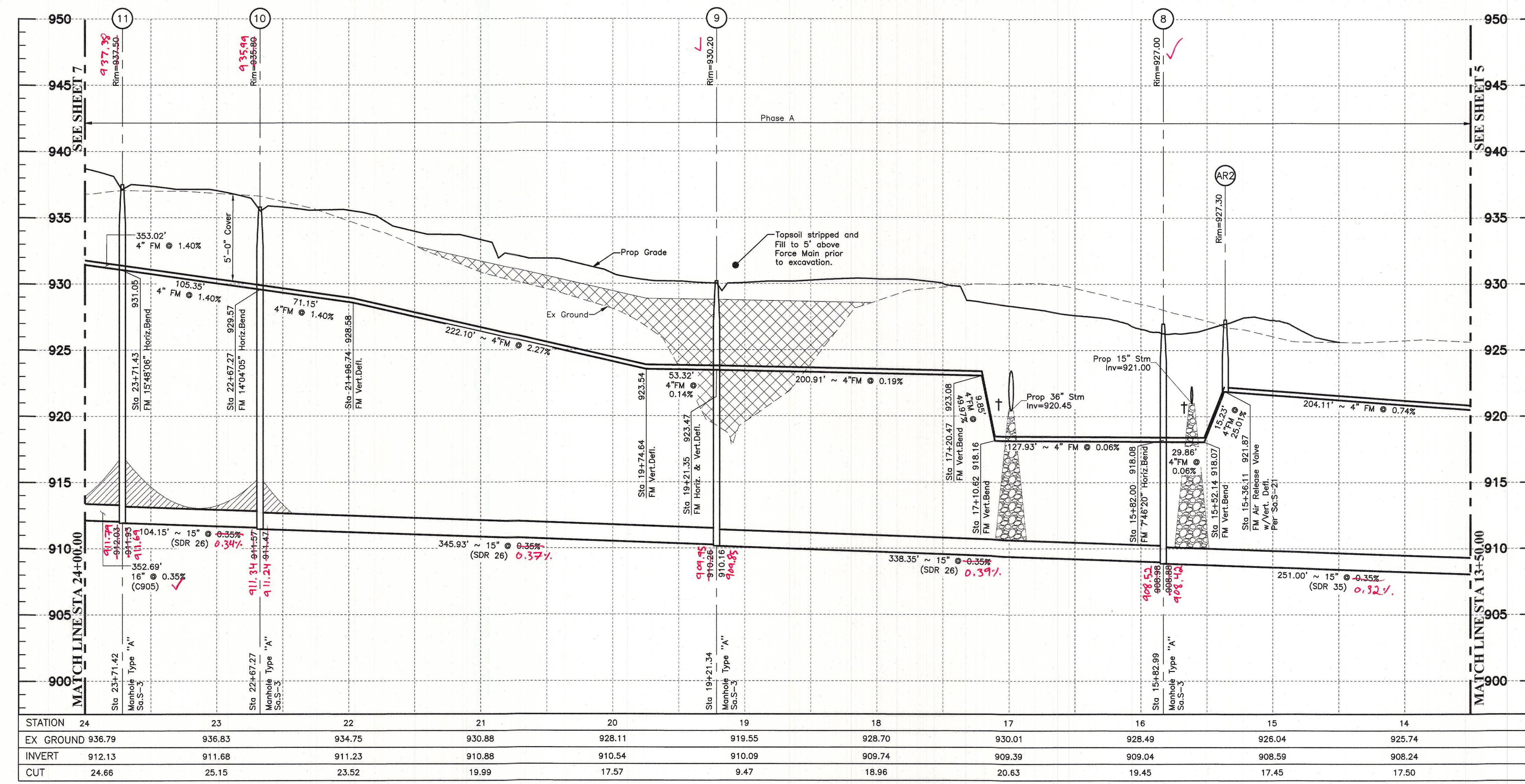
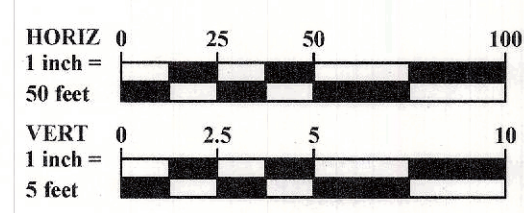
SANITARY SERVICE SCHEDULE						
STRUCTURE/ LOT NUMBER	WYE STATION	RISER LENGTH*	SERVICE LENGTH**	SERVICE SLOPE	END OF SERVICE ELEV.	DEPTH
MH 8	15+82.99					
2431 T-54	16+62	✓ 10'	✓ 77'	2.08%	918.54	9.5 ft
2432 T-53	16+65	✓ 10'	✓ 77'	2.08%	918.5	9.7 ft
2434 T-1	17+59	✓ 9' [†]	✓ 2'	2.08%	919.6	9.6 ft
2433 T-52	18+32	✓ 9' [†]	✓ 88'	2.08%	920.1	9.5 ft
2434 T-51	18+35	✓ 10' [†]	✓ 88'	2.08%	920.1	9.4 ft
2483 T-2	19+06	✓ 13'	✓ 0'	2.08%	919.76	9.3 ft
MH 9	19+21.34					
2482 T-3	19+39	✓ 12'	✓ 0'	2.08%	919.3	9.8 ft
2435 T-50	19+42	✓ 10'	✓ 86'	2.08%	919.8	9.3 ft
2436 T-49	20+25	✓ 11'	✓ 86'	2.08%	920.7	9.6 ft
2481 T-4	20+28	✓ 9' [†]	✓ 7'	2.08%	920.1	9.7 ft
2480 T-5	21+03	✓ 11' [†]	✓ 7'	2.08%	922.8	9.2 ft
2437 T-48	21+08	✓ 14'	✓ 86'	2.08%	922.8	9.3 ft
2479 T-6	21+85	✓ 12' [†]	✓ 6'	2.08%	924.1	9.9 ft
2438 T-47	22+00	✓ 16'	✓ 84'	2.08%	924.0	9.8 ft
MH 10	22+67.27					
2439 T-46	23+15	✓ 18'	✓ 88'	2.08%	926.4	9.6 ft
2440 T-45	23+18	✓ 18'	✓ 88'	2.08%	926.4	9.8 ft
2478 T-7	23+57	✓ 14' [†]	✓ 6'	2.08%	926.85	9.9 ft
MH 11	23+71.42					

* = The length of riser represents the actual length of riser laid at 40° unless noted with [†] which is laid at 75° and requires concrete backing per Sa.S-15
 ** = The length of service is the horizontal distance between the E.O.S. & mainline/riser.

RECORD DOCUMENTS

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PREPARED: 09-06-2019



LEGEND

- Proposed Storm Sewer: Stm, MH
- Proposed Sanitary Sewer: SanServ, San, MH
- Proposed Watermain: Water Serv, WM, FH
- Proposed Watermain Crossing: Casing Pipe

NOTES:

Trench Backfill is Type B per Sa.S-2 unless otherwise noted (See Detail Sheet 2).

For Utility Crossings: Compacted Granular Backfill.

Denoted thus:

** For Areas within the R/W: Type A Backfill per ODOT Item 304, see Sa.S-2 (Sheet 2).

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For Areas outside the R/W within line of influence: Type A Backfill per ODOT item 304 or Type B Backfill with testing, see Sa.S-2 (Sheet 2).

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For Force Main & Sanitary Sewer Trench Detail, See Sheet 2.

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All Manhole lids shall be stamped "Delaware County Regional Sewer District". All watertight lids shall have a T-gasket with concealed pick holes. All manholes 12" or deeper require a concrete base per Delaware County Sanitary Engineer's specifications.

See Sheet 4 For Structure & Sanitary Sewer Table.

REVISIONS

MARK	DATE	DESCRIPTION

M/I HOMES
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BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
SANITARY SEWER IMPROVEMENT PLAN
FOR
THE PINES, SECTION 1
PHASE A & B
PLAN & PROFILE

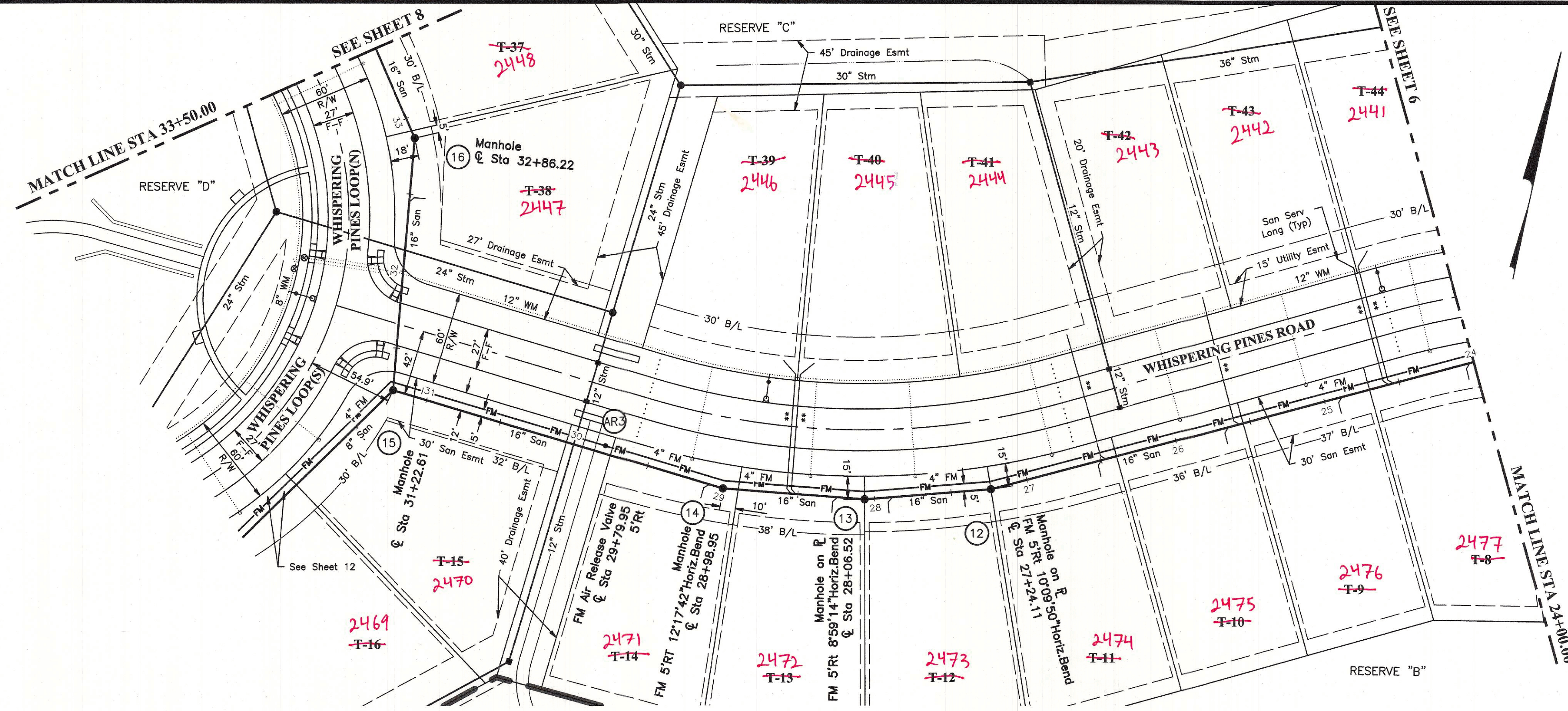
DATE: April 2018

SCALE: Horiz: 1" = 50'
Vert: 1" = 5'

JOB NO.: 20170824

SHEET: 6/32

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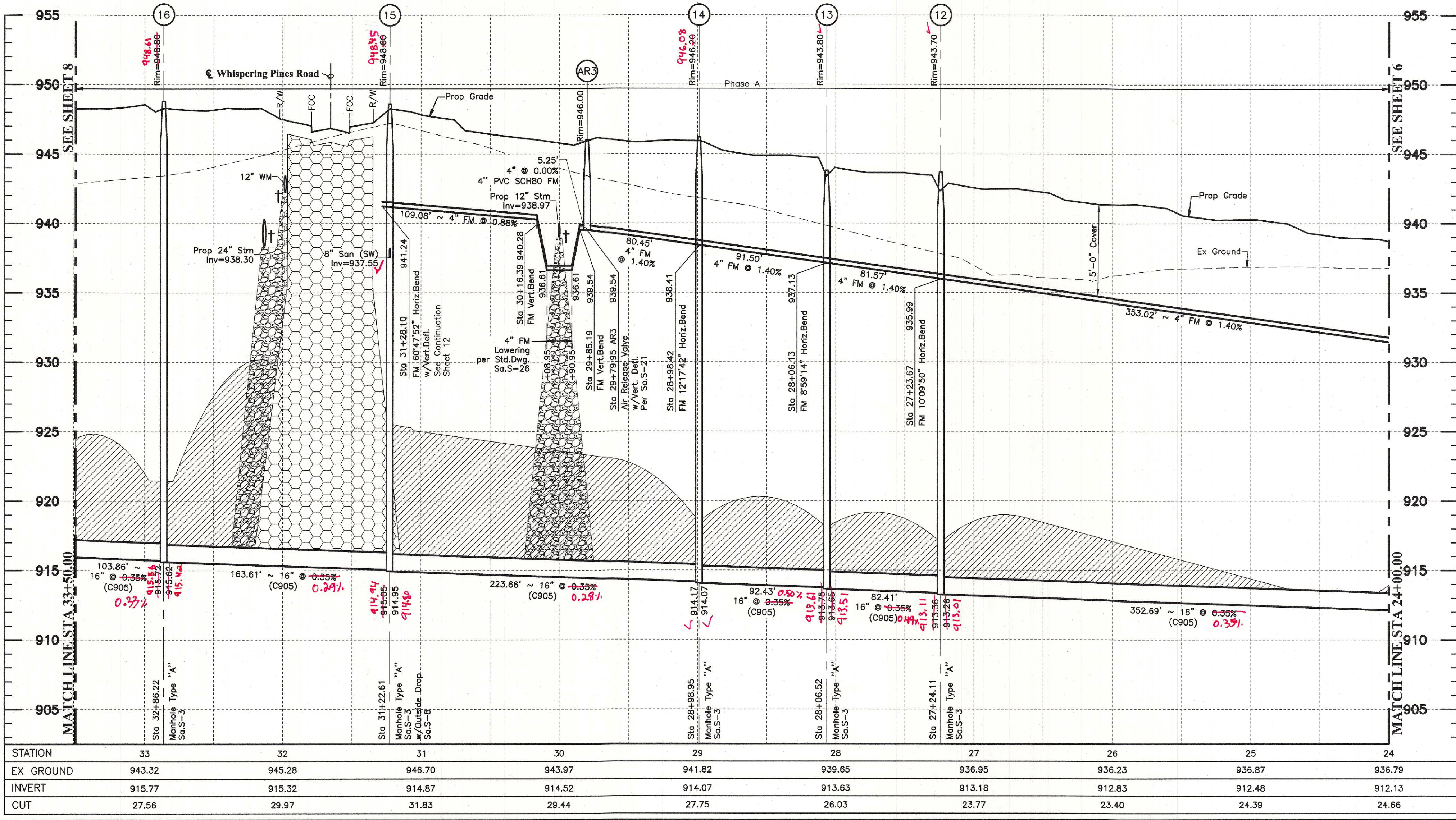
LEGEND

- Proposed Storm Sewer: Strm, MH
- Proposed Sanitary Sewer: SanServ, San, MH
- Proposed Watermain: Water Serv, WM, FH, WV
- Proposed Watermain Crossing: Casing Pipe

Scale: 1 inch = 50 feet (Horizontal), 1 inch = 5 feet (Vertical)

SANITARY SERVICE SCHEDULE						
STRUCTURE/ LOT NUMBER	WYE STATION	RISER LENGTH*	SERVICE LENGTH**	SERVICE SLOPE	END OF SERVICE ELEV.	DEPTH
MH 11	23+71.42					
2477 F-8	✓ 24+05	15' [✓]	8' 10"	2.08%	928.024	9.4 ft
2441 F-4	24+52.58	21' [✓]	24' 7"	2.08%	928.61	9.5 ft
2442 F-4	24+80.61	21' [✓]	24' 7"	2.08%	928.61	9.7 ft
2476 F-9	✓ 24+91	16' [✓]	5' 10"	2.08%	929.523	9.4 ft
2443 F-2	25+80.63	23' [✓]	67' 7"	2.08%	930.044	9.5 ft
2475 F-4	✓ 25+68	17' [✓]	8' 11"	2.08%	930.52	9.3 ft
2444 F-4	26+34.48	24' [✓]	65' 7"	2.08%	934.035	9.9 ft
2474 F-4	26+38.52	18' [✓]	5' 10"	2.08%	931.82	9.2 ft
MH 12	27+24.12					
2473 F-12	✓ 27+91	19' [✓]	5' 9"	2.08%	933.3	9.4 ft
MH 13	28+06.52					
2472 F-13	✓ 28+27	19' [✓]	5' 10"	2.08%	933.54	9.7 ft
2445 F-4	✓ 28+54	26' 2"	68' 7"	2.08%	933.31	10.1 ft
2446 F-3	✓ 28+57	27' 2"	68' 7"	2.08%	933.2	9.8 ft
MH 14	28+98.96					
2471 F-14	✓ 29+11	20' [✓]	4' 10"	2.08%	934.8	9.4 ft
MH 15	31+22.62					
2447 F-3	✓ 32+48	22' [✓]	4' 11"	2.08%	938.13	9.5 ft
MH 16	32+86.23					

* = The length of riser represents the actual length of riser laid at 40° unless noted with [✓] which is laid at 75° and requires concrete backing per Sa.S-15
 ** = The length of service is the horizontal distance between the E.O.S. & mainline/riser.



RECORD DOCUMENTS

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PREPARED: 09-06-2019

- NOTES:**
- Trench Backfill is Type B per Sa.S-2 unless otherwise noted (See Detail Sheet 2).
 - For Utility Crossings: Compacted Granular Backfill.
 - Denoted thus:
 - ** For Areas within the R/W: Type A Backfill per ODOT Item 304, see Sa.S-2 (Sheet 2).
 - Denoted thus:
 - For Areas outside the R/W within line of influence: Type A Backfill per ODOT item 304 or Type B Backfill with testing, see Sa.S-2 (Sheet 2).
 - Denoted thus:
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 - All sanitary services to be constructed per Standard Drawings Sa.S-11 & Sa.S-12. See Detail Sheet 2.
 - For Storm Main & Sanitary Sewer Trench Detail, See Sheet 2.
 - † Contractor shall maintain a 1.5' minimum clearance from outside of pipe to outside of pipe for all utility crossings unless otherwise noted.
 - All Manhole lids shall be stamped "Delaware County Regional Sewer District". All watertight lids shall have a T-gasket with concealed pick holes. All manholes 12' or deeper require a concrete base per Delaware County Sanitary Engineer's specifications.
 - See Sheet 4 For Structure & Sanitary Sewer Table.

REVISIONS

MARK	DATE	DESCRIPTION

MI HOMES
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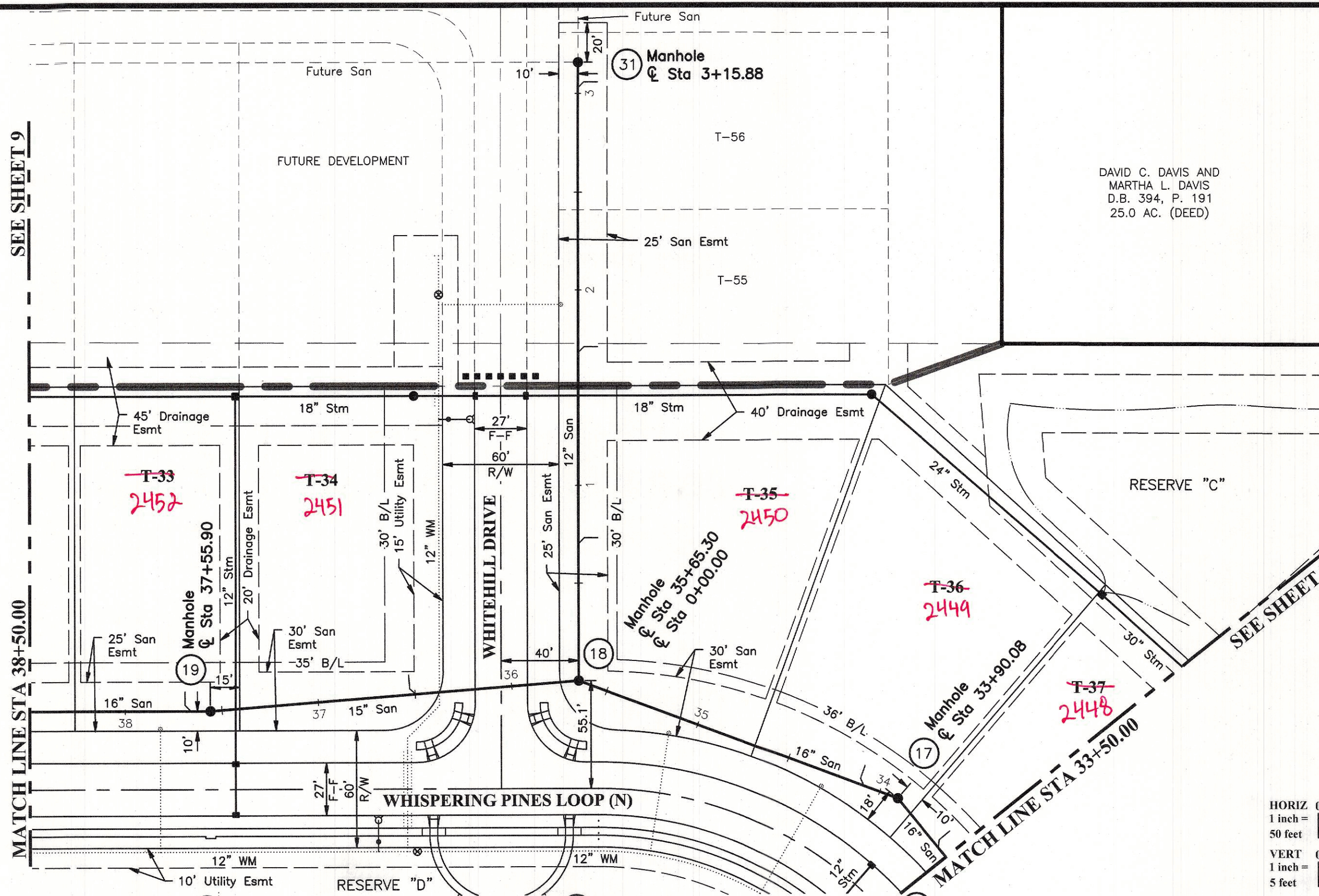
BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
SANITARY SEWER IMPROVEMENT PLAN
FOR
THE PINES, SECTION 1
PHASE A & B
PLAN & PROFILE

DATE: April 2018

SCALE: Horiz: 1" = 50', Vert: 1" = 5'

JOB NO.: 20170824

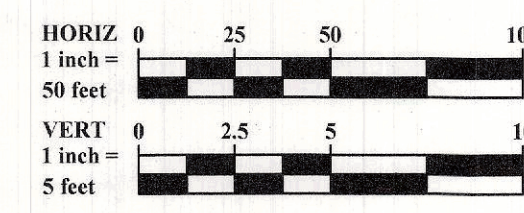
SHEET: 7/32



SANITARY SERVICE SCHEDULE						
STRUCTURE/ LOT NUMBER	WYE STATION	RISER LENGTH*	SERVICE LENGTH**	SERVICE SLOPE	END OF SERVICE ELEV.	DEPTH
MH 16	32+88.23					
2448 T-97	✓ 33+60	21' [1] ✓	4' 11'	2.08%	937.85	9.5 ft
MH 17	33+90.08					
2449 T-98	✓ 34+12	21' [1] ✓	4' 10'	2.08%	937.93	9.4 ft
MH 18	35+65.30					
2451 T-94	✓ 36+53	18' [1] ✓	8' 4'	2.08%	939.80	9.7 ft
MH 19	37+55.90					
2452 T-33	✓ 37+69	18' [1] ✓	8' 5'	2.08%	939.86	9.7 ft
MH 18	0+00.00					
2450 T-35	✓ 0+73	21' [1] ✓	4' 12'	2.08%	938.85	9.2 ft
T-55	✓ 1+71	20' [1] ✓	4' 15'	2.08%	938.07A	9.9 ft
T-56	✓ 3+06	18' [1] ✓	5' 7'	2.08%	937.42	10.9 ft
MH 31	3+15.88					

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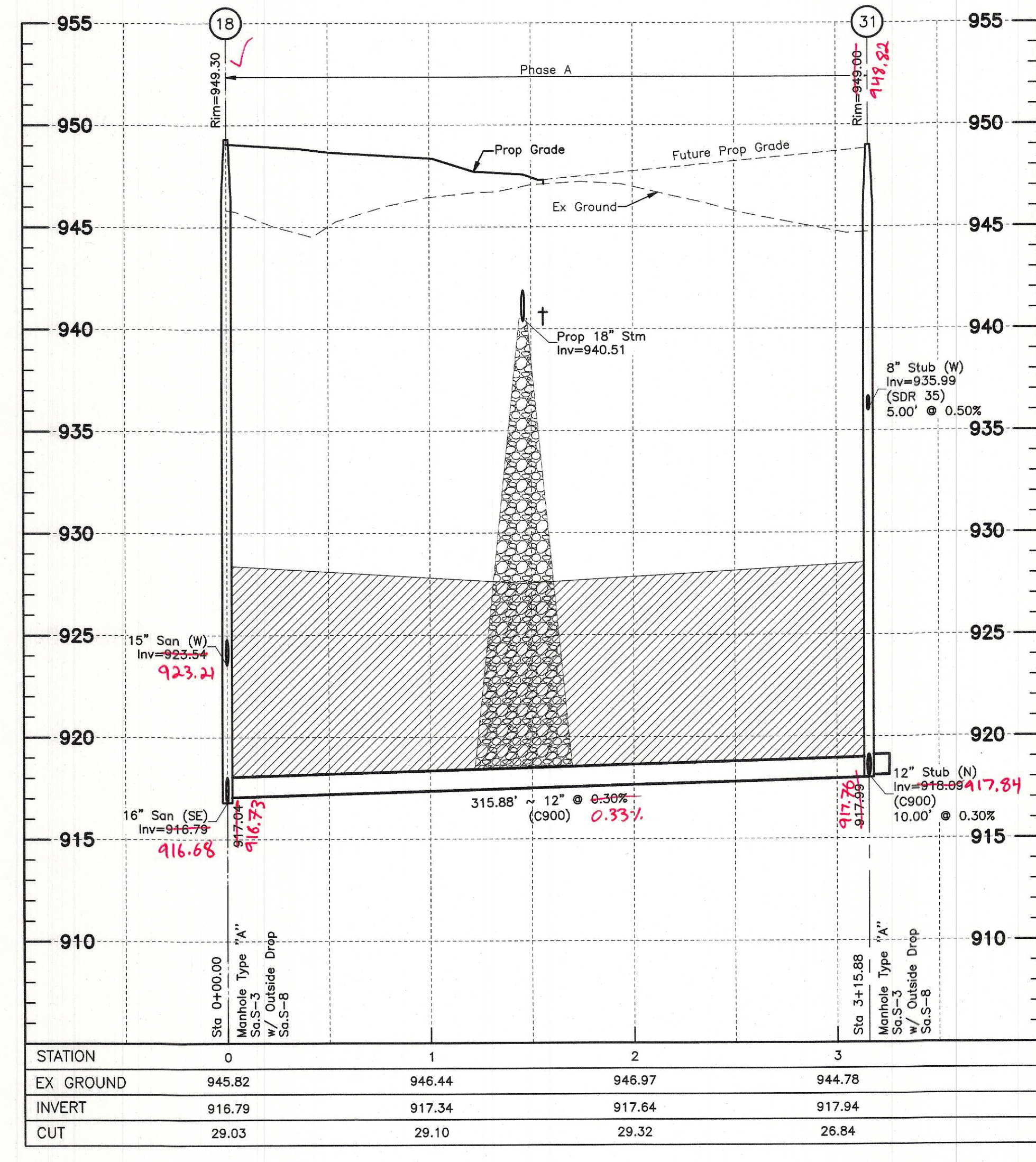
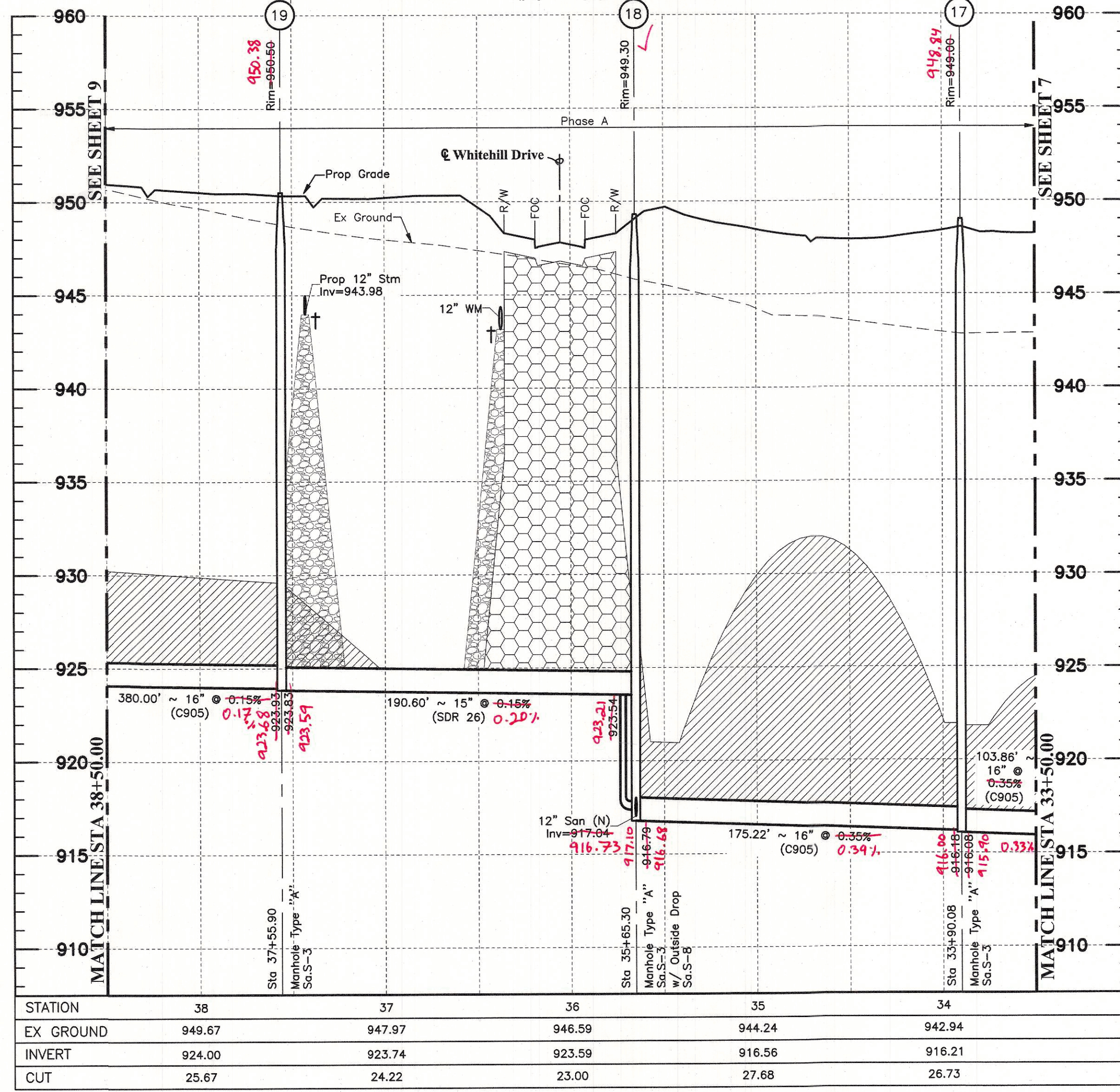
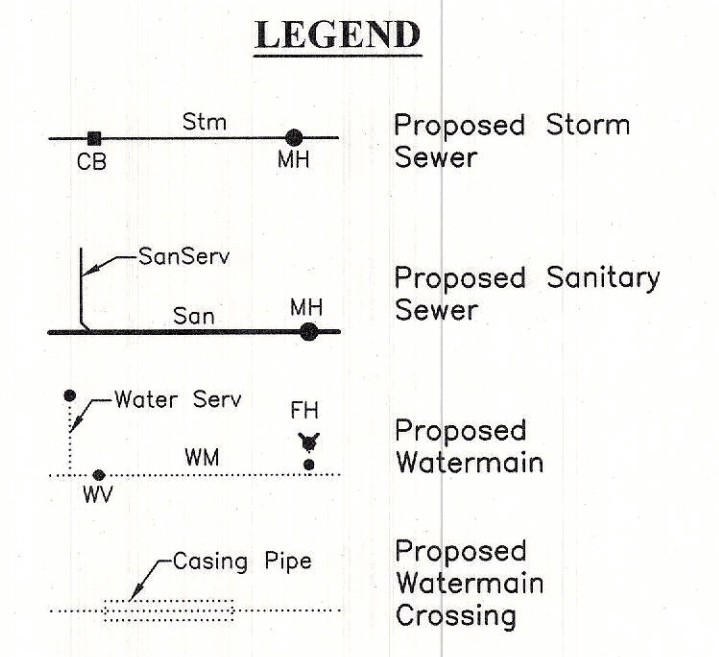
** = The length of service is the horizontal distance between the E.O.S. & mainline/riser.



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PREPARED: 09-06-2019



NOTES:

Trench Backfill is Type B per Sa.S-2 unless otherwise noted (See Detail Sheet 2).

For Utility Crossings: Compacted Granular Backfill.

Denoted thus:

** For Areas within the R/W: Type A Backfill per ODOT Item 304, see Sa.S-2 (Sheet 2).

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See Sheet 4 For Structure & Sanitary Sewer Table.

REVISIONS

MARK	DATE	DESCRIPTION

MI HOMES
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BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
SANITARY SEWER IMPROVEMENT PLAN
FOR
THE PINES, SECTION 1
PHASE A & B
PLAN & PROFILE

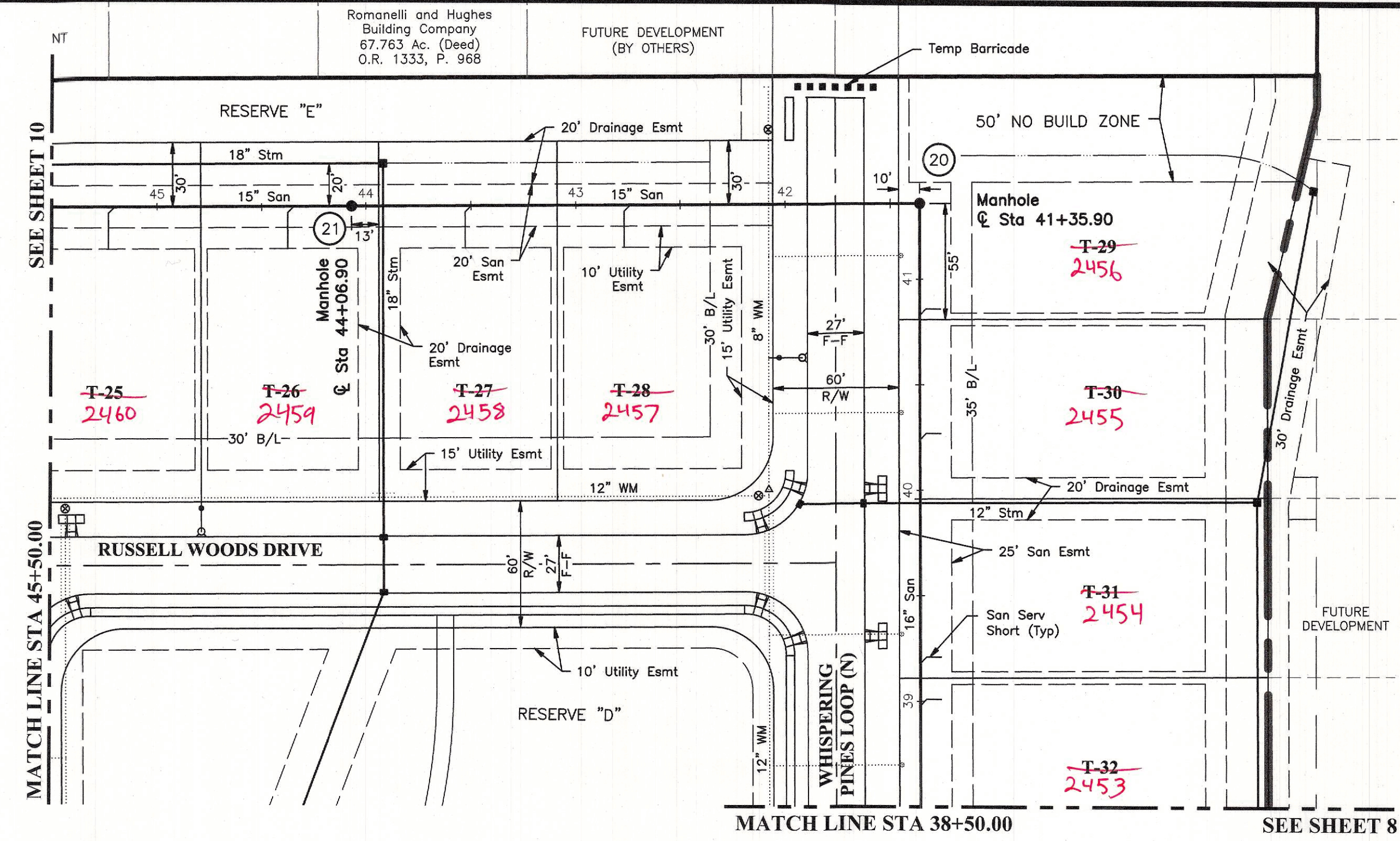
EMH&T
Engineering, Measurement, Investigation & Technology, Inc.
Engineers • Surveyors • Planners • Scientists
5500 New Albany Road, Columbus, OH 43254
Phone: 614.775.5500
Fax: 614.775.5500
emht.com

DATE
April 2018

SCALE
Horiz: 1" = 50'
Vert: 1" = 5'

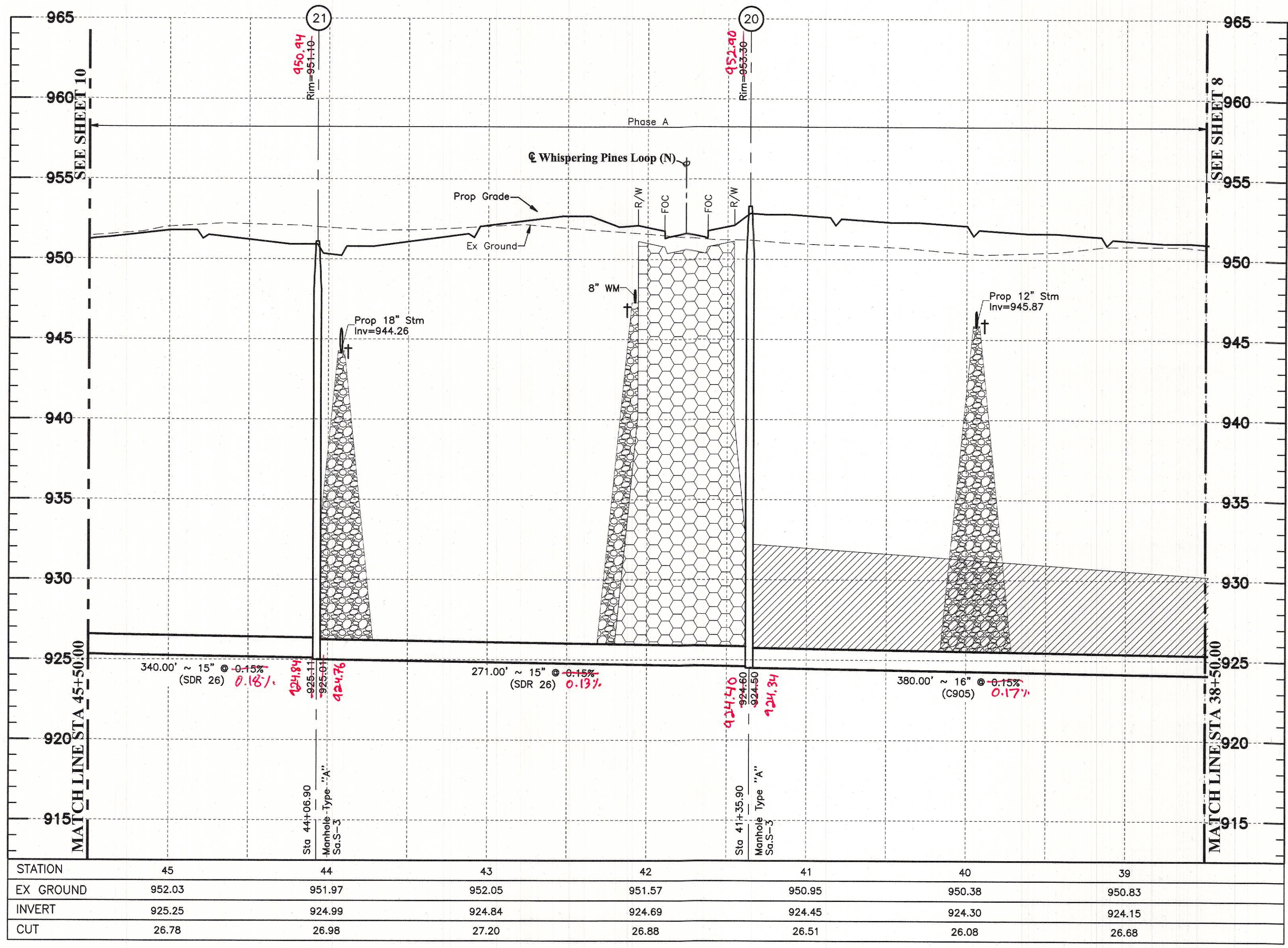
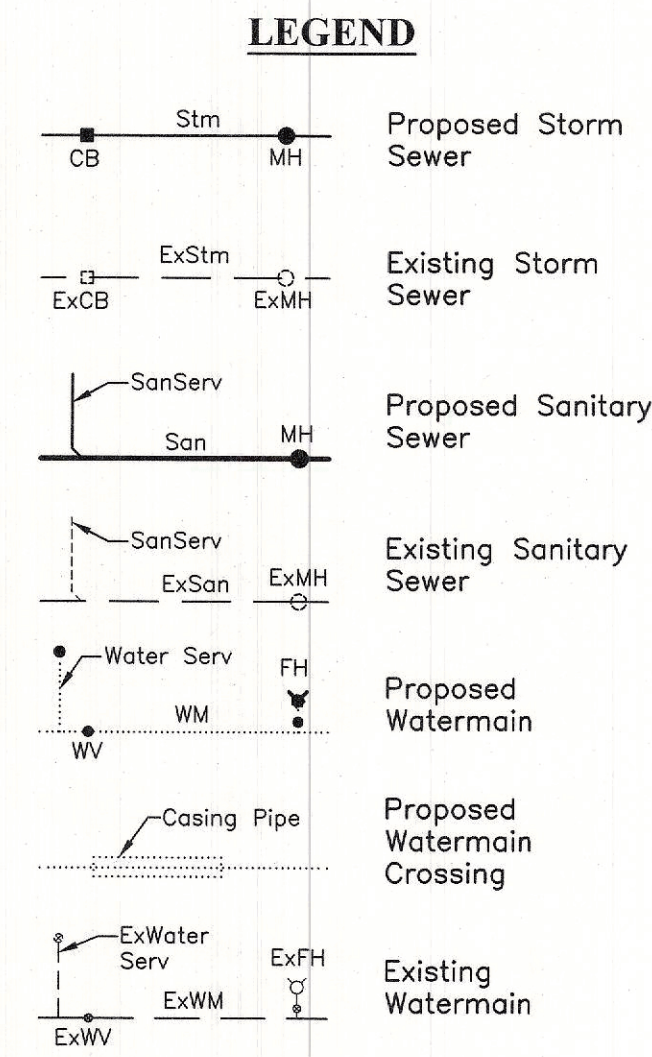
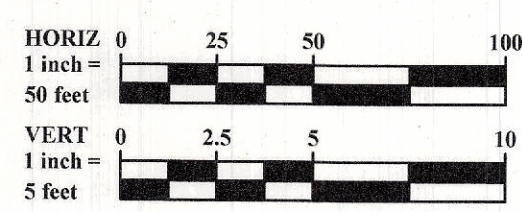
JOB NO.
20170824

SHEET
8/32



STRUCTURE/ LOT NUMBER	WYE STATION	RISER LENGTH*	SERVICE LENGTH**	SERVICE SLOPE	END OF SERVICE ELEV.	DEPTH
2453 T-32	39+01 ✓	18' [17']	5' 4'	2.08%	941.0 ✓	9.5 ft
2454 T-31	39+21.23	18' [18']	5' 10'	2.08%	941.02 ✓	9.6 ft
2455 T-30	40+27.28	17' [18']	5' 12'	2.08%	942.10	9.2 ft
2456 T-29	40+86 ✓	17' [18']	5' 10'	2.08%	942.21	9.6 ft
MH 20	41+35.90					
2457 T-28	42+77 ✓	23' [14']	2' 10'	2.08%	940.95	9.4 ft
2458 T-27	43+53 ✓	22' [14']	3' 10'	2.08%	940.4	9.6 ft
MH 21	44+06.90					
2459 T-26	44+38 ✓	22' [14']	3' 10'	2.08%	940.65	9.4 ft
2460 T-25	45+23 ✓	24' [14']	1' 10'	2.08%	942.01 ✓	9.6 ft

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STATION	45	44	43	42	41	40	39
EX GROUND	952.03	951.97	952.05	951.57	950.95	950.38	950.83
INVERT	925.25	924.99	924.84	924.69	924.45	924.30	924.15
CUT	26.78	26.98	27.20	26.88	26.51	26.08	26.68

NOTES:

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PREPARED: 09-06-2019

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M/I HOMES
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BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
FOR
THE PINES, SECTION 1
PHASE A & B
PLAN & PROFILE

EMH&T
ENGINEERS, ARCHITECTS, SURVEYORS & PLANNERS
5800 New Albany Road, Columbus, OH 43054
Phone: 614.775.5000 Fax: 614.775.3448
emht.com

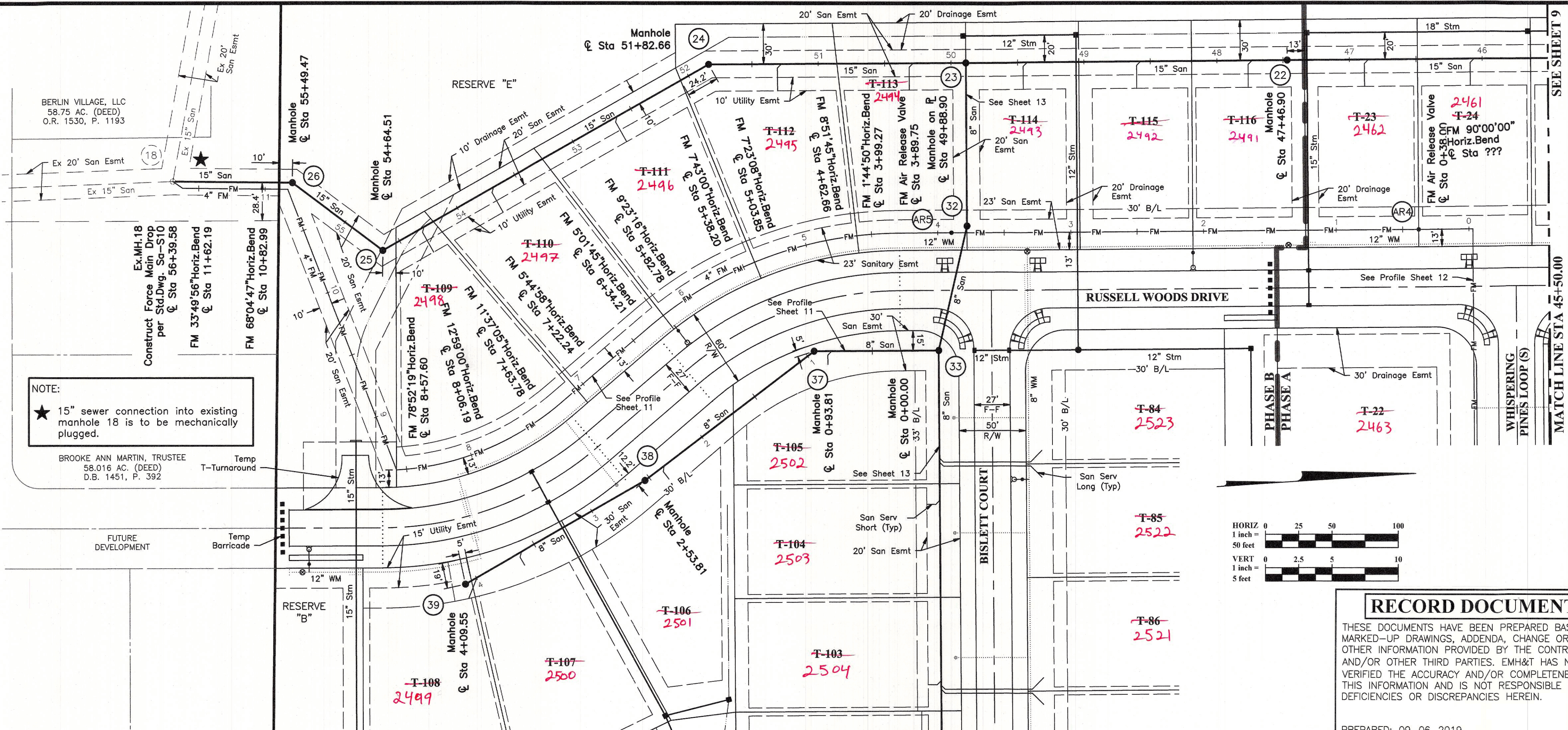
DATE: April 2018

SCALE: Horiz: 1" = 50' Vert: 1" = 5'

JOB NO.: 20170824

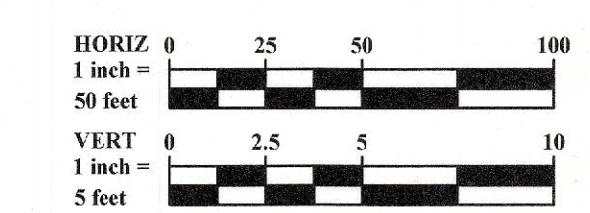
SHEET: 9/32

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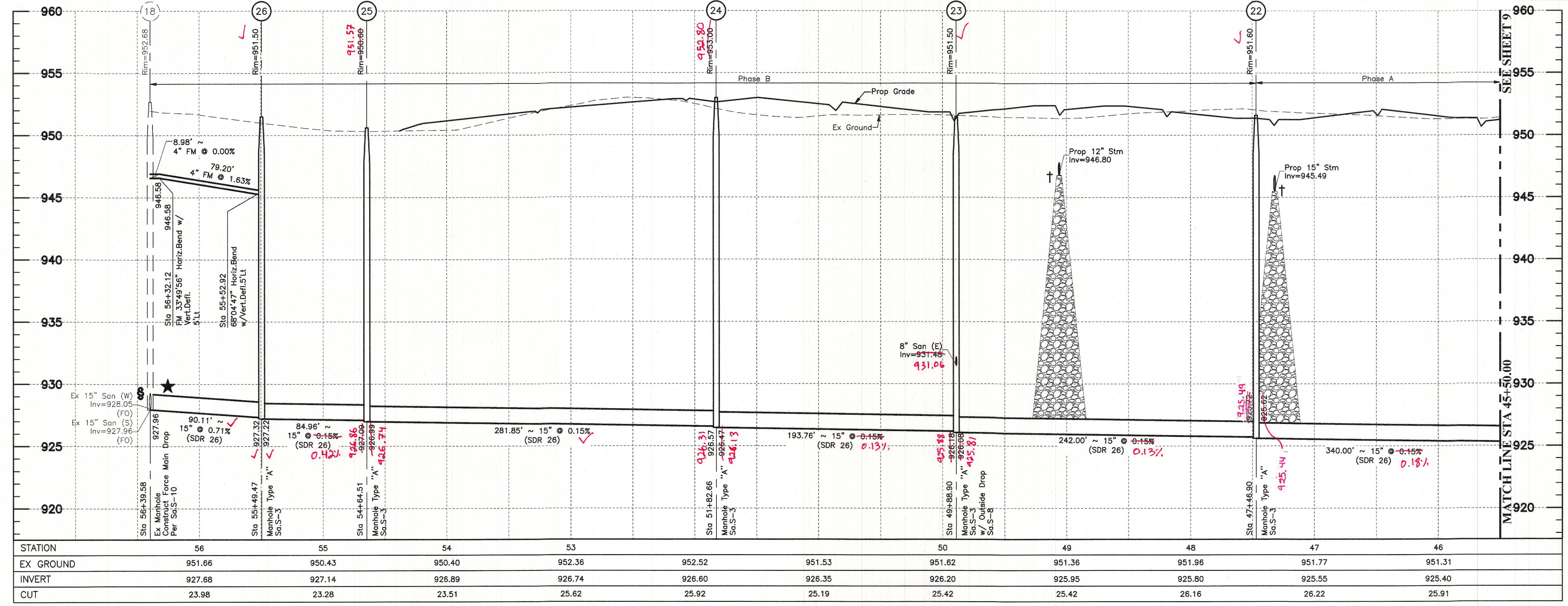
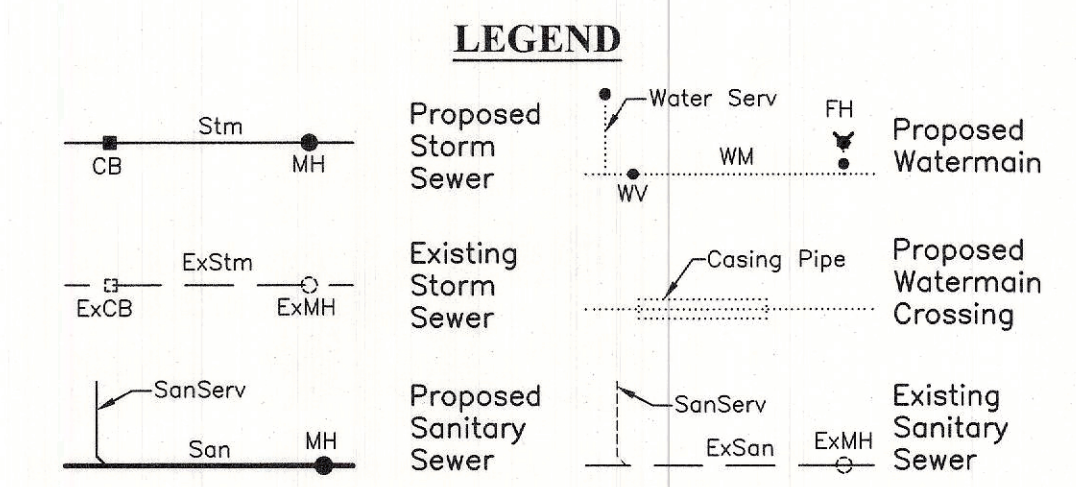


SANITARY SERVICE SCHEDULE					
STRUCTURE/LOT NUMBER	WYE STATION	RISER LENGTH*	SERVICE LENGTH**	SERVICE SLOPE	END OF SERVICE ELEV. DEPTH
2461 T-24	46+09	24' 14"	2' 10"	2.08%	942.70 9.6 ft
2462 T-23	46+89	25' 14"	2' 10"	2.08%	941.62 9.8 ft
MH 22	47+46.90				
2491 T-116	47+76	23' 14"	2' 10"	2.08%	941.7 9.7 ft
2492 T-115	48+60	24' 14"	2' 10"	2.08%	942.65 9.6 ft
2493 T-114	49+45.49	25' 14"	2' 10"	2.08%	943.3 9.6 ft
MH 23	49+88.90				
2494 T-113	50+32	25' 14"	2' 10"	2.08%	943.6 9.9 ft
2495 T-112	51+31	25' 14"	2' 10"	2.08%	943.7 9.6 ft
MH 24	51+82.66				
2496 T-111	52+65	23' 14"	2' 10"	2.08%	942.73 9.7 ft
2497 T-110	53+72	22' 14"	2' 10"	2.08%	942.3 9.4 ft
2498 T-109	54+32	21' 14"	2' 10"	2.08%	941.7 10.0 ft
MH 25	54+64.51				
MH 26	55+49.47				
EX MH 18	56+39.58				
MH 33	0+00.00				
2502 T-105	0+84	3' 0"	2' 12"	2.08%	943.76 9.4 ft
MH 37	0+93.81				
2501 T-104	2+39	0' ✓	10' 12"	2.08%	942.65 9.1 ft
MH 38	2+53.81				
2500 T-107	3+64	0' ✓	10' ✓	2.08%	943.4 8.1 ft
2499 T-108	4+00	0' ✓	17' 12"	2.08%	943.87 7.8 ft
MH 39	4+09.55				

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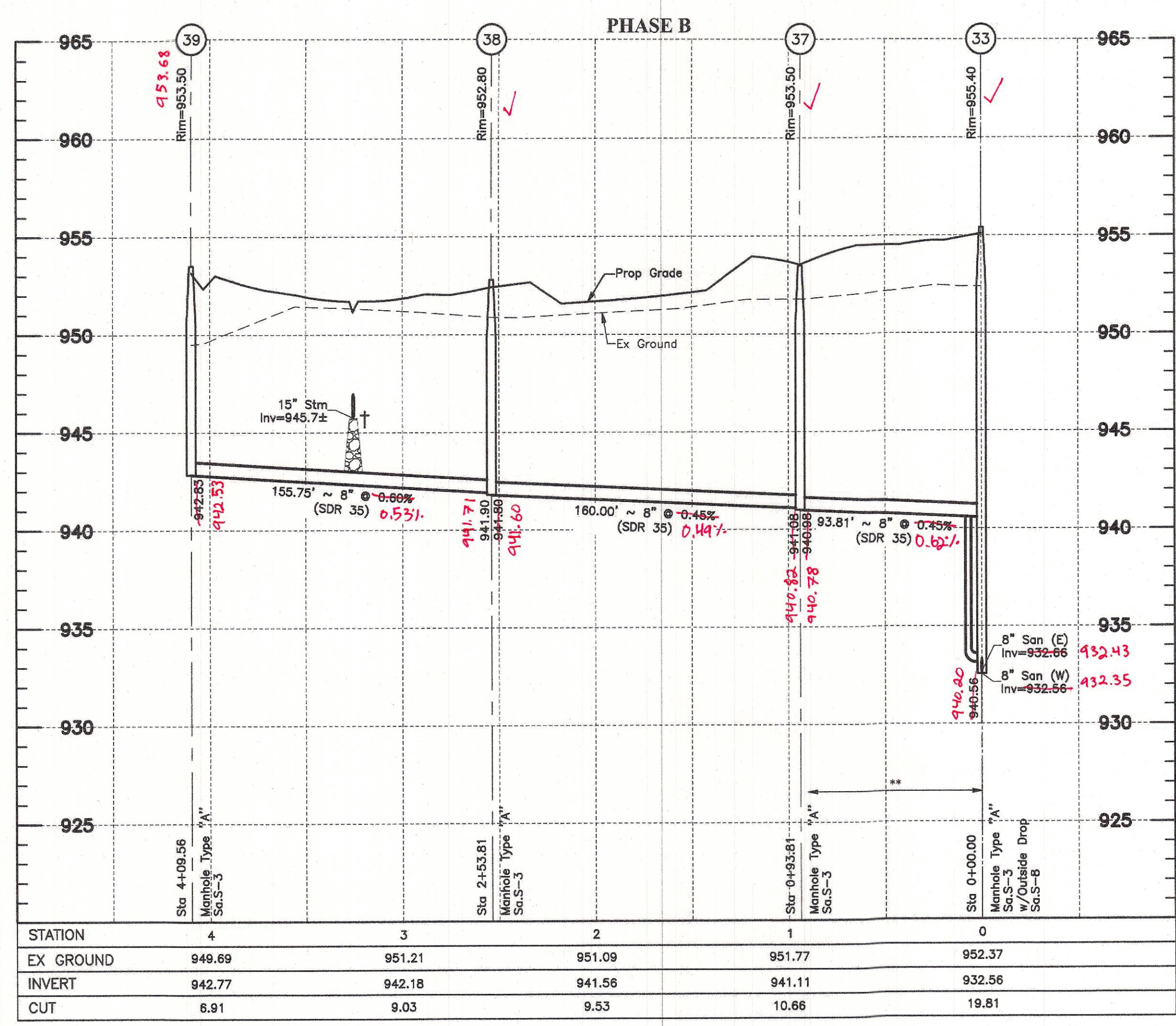
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 For Force Main & Sanitary Sewer Trench Detail, See Sheet 2.
 § Contractor to verify invert and location of existing utility before construction. If there is a discrepancy between the contractor's information and the plan information shown, the contractor is to contact the engineer of record prior to the start of construction.
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 FO Field Observed

REVISIONS
 MARK DATE DESCRIPTION

BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
 SANITARY SEWER IMPROVEMENT PLAN
 FOR
THE PINES, SECTION 1
PHASE A & B
PLAN & PROFILE

EMH&T
 Evans, Mechwart, Hambleton & Tilton, Inc.
 Engineers • Surveyors • Planners • Scientists
 11000 W. Main Street, Suite 200
 Columbus, Ohio 43240
 Phone: 614.275.4520 Fax: 614.275.4548
 emht.com

DATE: April 2018
 SCALE: Horiz: 1" = 50'
 Vert: 1" = 5'
 JOB NO.: 20170824
 SHEET: 10/32



STATION	4	3	2	1	0
EX GROUND	949.69	951.21	951.09	951.77	952.37
INVERT	942.77	942.18	941.56	941.11	932.56
CUT	8.91	9.03	9.53	10.66	19.81

FORCEMAIN COORDINATE TABLE PUMP STATION TO MANHOLE 15 (SEE SHEETS 4-7)

PLAN STATION	FM STATION	DESCRIPTION	NORTHING	EASTING	INVERT ELEV
0+19.17	0+00.00	4" Begin at Building	213573.7208	1832689.3196	905.43
0+19.17	0+00.00	12" Begin at Building	213576.4769	1832689.5080	906.10
0+55.17	0+36.00	4" 45" Horiz. Bend	213571.2665	1832725.2359	905.43
0+55.17	0+36.00	12" Blind Flange	213574.0226	1832725.4242	906.10
0+82.57	0+74.75	45" Horiz. Bend	213542.0637	1832750.7030	904.42
1+15.44	1+07.62	Vert. Defl.	213539.8237	1832783.4970	903.01
1+32.14	1+34.38	90" Horiz. Bend	213538.3469	1832805.1166	903.01
1+32.14	1+29.29	2"46"48" Horiz. Defl.	213533.2657	1832804.8044	903.33
1+71.58	1+73.93	Vert. Defl.	213493.9532	1832800.4667	905.83
3+61.76	3+63.86	3"00"43" Horiz. Defl. Vert. Defl.	213305.1735	1832779.6370	908.75
4+04.16	4+06.25	Vert. Defl.	213262.8485	1832777.2082	909.40
6+06.44	6+08.59	1"17"13" Horiz. Defl.	213060.8425	1832765.6158	910.38
6+97.79	7+00.00	Vert. Defl.	212969.7166	1832758.3940	910.82
8+53.56	8+55.76	45" Horiz. Bend w/Vert. Defl.	212814.4389	1832746.0880	910.89
10+19.59	10+22.01	Air Release Valve w/Vert. Defl.	212649.4002	1832726.0557	912.364
11+13.34	11+15.76	Vert. Bend 9"24"10" Horiz. Bend w/Vert. Defl.	212556.3369	1832714.7471	912.34
11+29.03	11+31.45	Vert. Bend	212555.8801	1832694.0481	914.30
11+34.21	11+37.67	7"15"42" Horiz. Bend	212547.1160	1832666.8844	914.22
12+09.75	12+12.17	Vert. Bend	212553.5242	1832618.3899	914.65
13+17.39	13+19.81	Vert. Defl.	212550.3842	1832510.7860	919.97
13+63.57	13+65.99	45" Horiz. Bend	212549.0493	1832464.6242	920.31
15+36.11	15+40.00	Air Release Valve w/Vert. Defl.	212532.6583	1832254.8824	921.87
15+36.91	15+40.80	Vert. Bend	212532.5960	1832254.0848	921.88
15+52.14	15+56.03	Vert. Bend	212531.4096	1832238.9011	918.07
15+82.00	15+85.89	7"48"20" Horiz. Bend	212529.0838	1832209.1345	918.08
17+10.62	17+13.82	Vert. Bend	212536.3994	1832081.4112	918.16
17+20.47	17+23.67	Vert. Bend	212537.0238	1832071.5808	923.08
19+21.35	19+24.58	Horiz. & Vert. Defl.	212548.7042	1831871.0136	923.47
19+74.64	19+77.90	Vert. Defl.	212551.1700	1831817.7458	923.54
21+96.74	22+00.00	Vert. Defl.	212561.4359	1831595.8844	928.58
22+67.27	22+71.15	14"04"05" Horiz. Bend	212564.7247	1831524.8064	929.57
23+71.43	23+76.50	15"48"06" Horiz. Bend	212543.8676	1831421.5417	931.05
27+23.67	27+29.53	10"09"50" Horiz. Bend	212382.3886	1831107.6131	935.99
28+06.13	28+11.10	8"59"14" Horiz. Bend	212358.4621	1831029.6287	937.13
28+98.42	29+02.60	12"17"42" Horiz. Bend	212345.8180	1830939.0341	938.41
29+79.95	29+83.05	Air Release Valve w/Vert. Defl.	212351.5458	1830858.8050	939.54
29+85.19	29+88.30	Vert. Bend	212351.9323	1830853.5740	939.54
29+90.95	29+94.05	Vert. Bend	212352.3563	1830847.8349	936.61
30+08.95	30+12.05	Vert. Bend	212353.6826	1830829.8838	936.61
30+16.39	30+19.49	Vert. Bend	212354.2308	1830822.4638	940.28

FORCEMAIN COORDINATE TABLE MANHOLE 15 TO RUSSELL WOODS DRIVE (SEE SHEET 12)

STATION	FM STATION	DESCRIPTION	NORTHING	EASTING	INVERT ELEV
-0+02.98	31+28.57	60"47"52" Horiz. Bend w/Vert. Defl.	212362.2687	1830713.6755	941.24
1+46.88	32+78.43	29"04"10" Horiz. Bend	212237.2052	1830631.1243	941.55
2+74.81	34+03.76	30"37"35" Horiz. Bend w/Vert. Defl.	212179.3268	1830519.9542	941.79
4+49.89	35+76.11	Vert. Defl.	212188.7179	1830347.8634	942.31

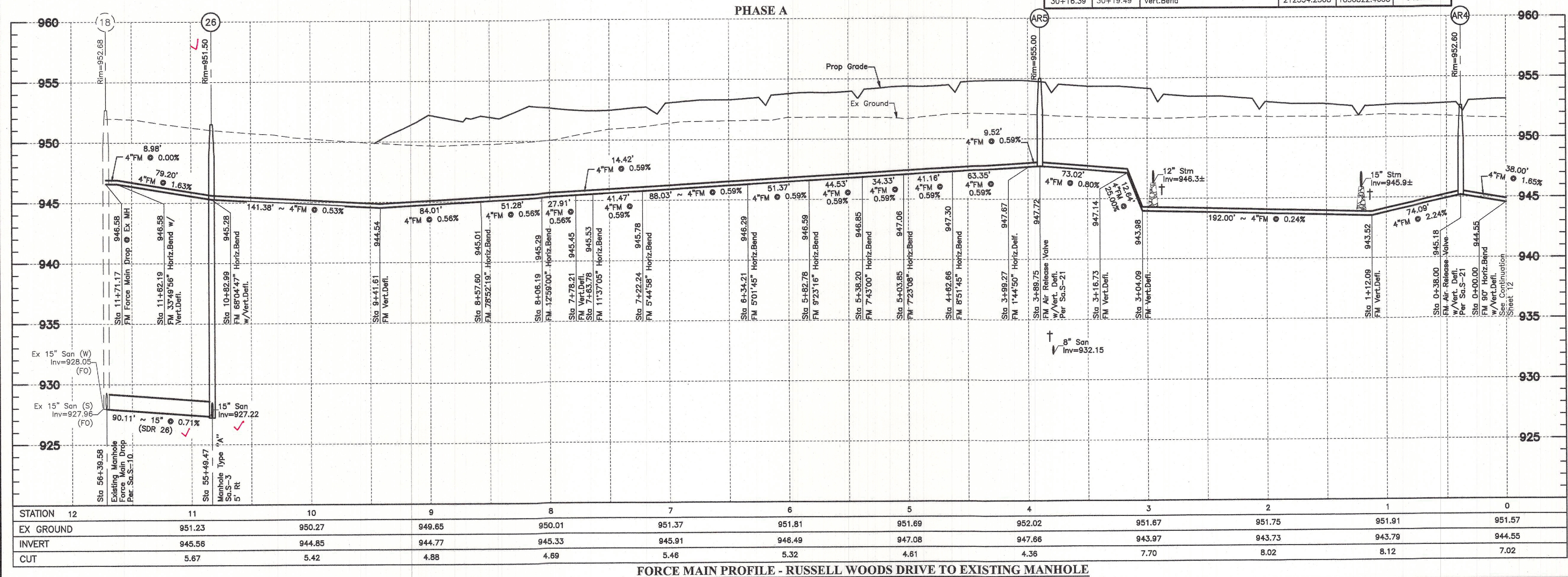
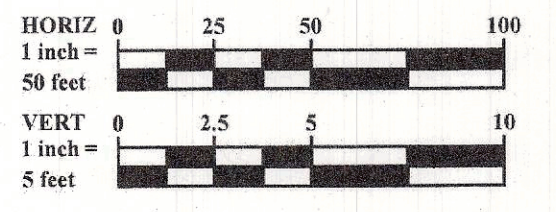
FORCEMAIN COORDINATE TABLE RUSSELL WOODS DRIVE TO EX MANHOLE (SEE SHEETS 10-11)

STATION	FM STATION	DESCRIPTION	NORTHING	EASTING	INVERT ELEV
0+00.00	39+21.08	90" Horiz. Bend w/Vert. Defl.	212207.5165	1830003.3760	944.55
0+38.00	39+59.08	Air Release Valve w/Vert. Defl.	212169.5730	1830001.3055	945.18
1+12.09	40+33.17	Vert. Defl.	212095.5929	1829997.2684	943.52
3+04.09	42+25.17	Vert. Defl.	211903.8782	1829986.8065	943.98
3+16.73	42+37.81	Vert. Defl.	211891.2569	1829986.1177	947.14
3+89.75	43+10.83	Air Release Valve w/Vert. Defl.	211818.3454	1829982.1390	947.72
3+99.27	43+20.35	1"44"50" Horiz. Defl.	211808.8412	1829981.6203	947.67
4+62.66	43+83.70	8"51"45" Horiz. Bend	211745.5108	1829980.0988	947.30
5+03.85	44+24.86	7"23"08" Horiz. Bend	211704.7054	1829985.4610	947.06
5+38.20	44+59.18	7"43"00" Horiz. Bend	211671.5274	1829994.2716	946.85
5+82.78	45+03.72	9"23"16" Horiz. Bend	211630.4103	1830011.3775	946.59
6+34.21	45+55.09	5"01"45" Horiz. Bend	211586.8340	1830038.5819	946.29
7+22.24	46+43.11	5"44"58" Horiz. Bend	211516.5375	1830091.5649	945.78
7+63.78	46+84.59	11"37"05" Horiz. Bend	211481.0838	1830113.0840	945.53
7+78.21	46+99.01	Vert. Defl.	211467.4989	1830117.9315	945.45
8+06.19	47+26.92	12"59"00" Horiz. Bend	211441.2153	1830127.3105	945.29
8+57.60	47+78.18	78"52"19" Horiz. Bend	211390.2835	1830133.2528	945.01
9+41.61	48+62.20	Vert. Defl.	211364.6246	1830053.2521	944.54
10+82.99	50+03.58	68"04"47" Horiz. Bend w/Vert. Defl.	211321.4453	1829918.6256	945.28
11+62.19	50+82.78	33"49"56" Horiz. Bend w/Vert. Defl.	211242.4515	1829912.9115	946.58
11+71.17	50+91.76	Force Main Drop @ Ex MH	211235.3718	1829907.3863	946.58

RECORD DOCUMENTS

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PREPARED: 09-06-2019



STATION	12	11	10	9	8	7	6	5	4	3	2	1	0
EX GROUND	951.23	950.27	949.85	950.01	951.37	951.81	951.69	952.02	951.67	951.75	951.91	951.57	
INVERT	945.56	944.85	944.77	945.33	945.91	946.49	947.08	947.66	943.97	943.73	943.79	944.55	
CUT	5.67	5.42	4.88	4.69	5.46	4.61	4.36	7.70	8.02	8.12	7.02		

NOTES:

- * Trench Backfill is Type B per Sa.S-1 unless otherwise noted.
- For Utility Crossings: Compacted Granular Backfill.
- Denoted thus:
- For Areas outside the R/W within line of influence: Type A Backfill per ODOT item 304 or Type B Backfill with testing, see Sa.S-2 (Sheet 2).
- Denoted thus:
- All sanitary sewers/forcemain shall have a minimum separation of 10 feet horizontally to all utilities and 18 inches vertically (outside edge to outside edge) (No utility shall be laid closer than 10' to any sanitary sewer/forcemain).
- For Force Main & Sanitary Sewer Trench Detail, See Sheet 2.
- Contractor to verify invert and location of existing utility before construction. If there is a discrepancy between the contractor's information and the plan information shown, the contractor is to contact the engineer of record prior to the start of construction.
- Contractor shall maintain a 1.5' minimum clearance from outside of pipe to outside of pipe for all utility crossings unless otherwise noted.
- All manhole lids shall be stamped "Delaware County Regional Sewer District". All watertight lids shall have a T-gasket with concealed pit holes. All manholes 12' or deeper require a concrete base per Delaware County Sanitary Engineer's specifications.
- See Sheet ## For Structure & Sanitary Sewer Table.
- FO Field Observed

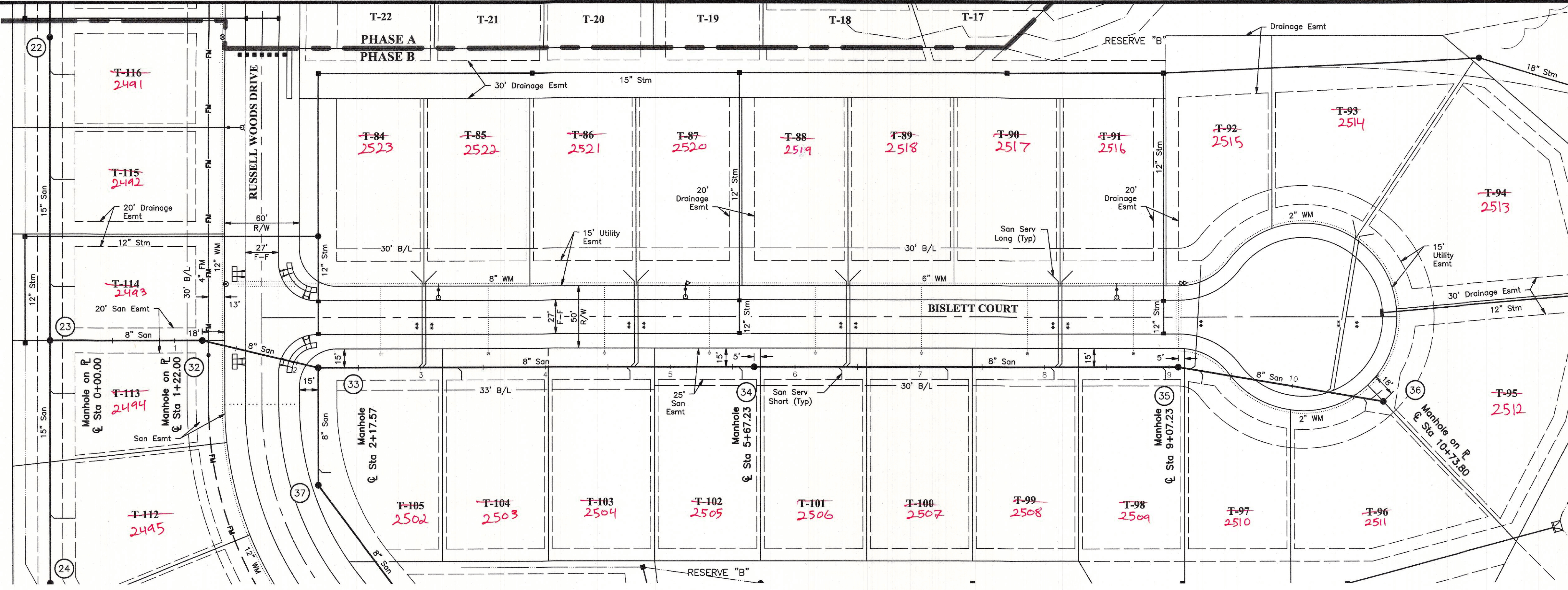
REVISIONS
 MARK DATE DESCRIPTION
 1 10-10-19 UPDATING PER CONSULTING ENGINEER

BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
 FOR
THE PINES, SECTION 1
PHASE A & B
PLAN & PROFILE

EM&HT
 Evans, Meschery, Hambleton & Tilton, Inc.
 Engineers • Surveyors • Planners • Scientists
 6800 New Albany Road, Columbus, OH 43230
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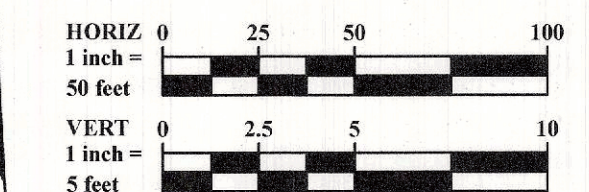
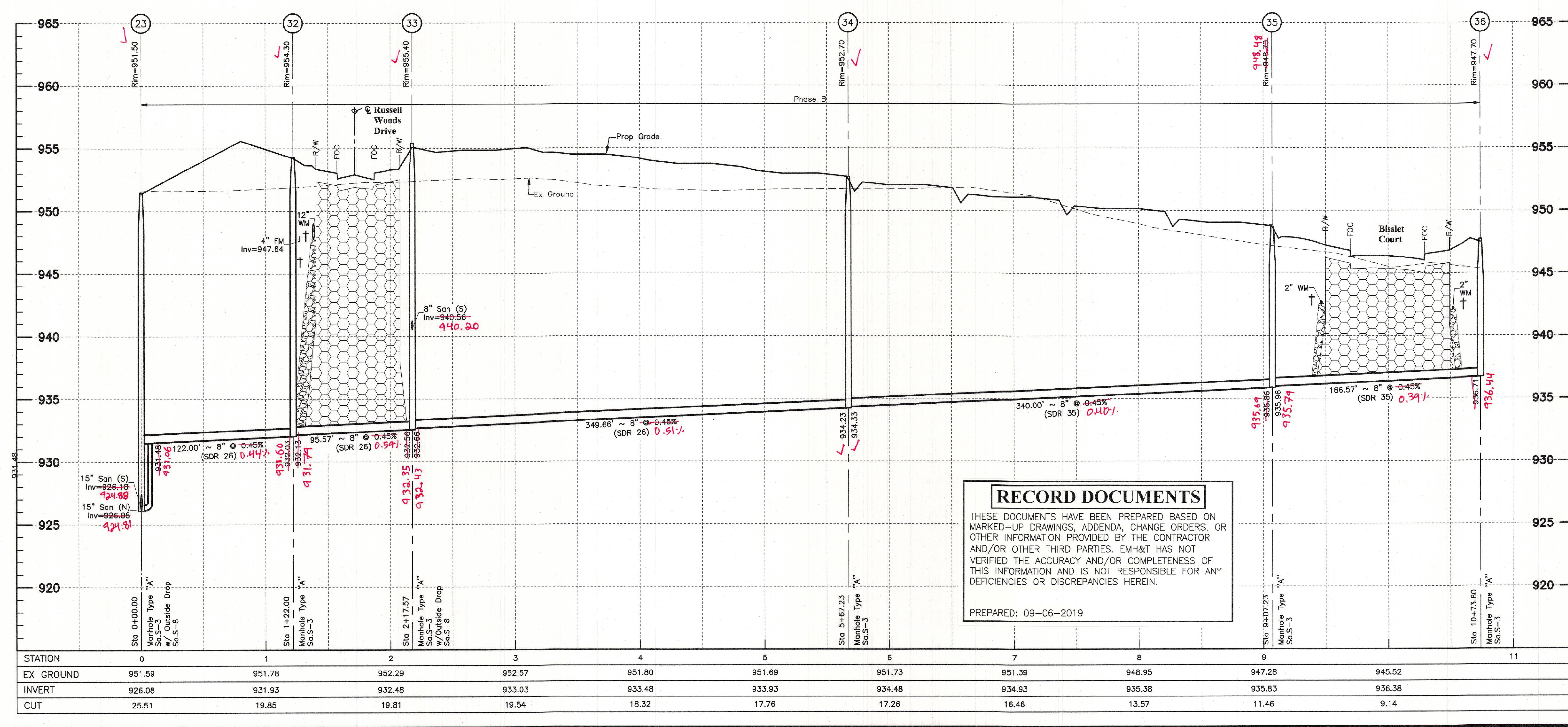
M/I HOMES
 Move Up
 mihomes.com

DATE: April 2018
 SCALE: Horiz: 1" = 50' Vert: 1" = 5'
 JOB NO.: 20170824
 SHEET: 11/32



SANITARY SERVICE SCHEDULE					
STRUCTURE/ LOT NUMBER	WYE STATION	RISER LENGTH*	SERVICE LENGTH**	SERVICE SLOPE	END OF SERVICE ELEV. DEPTH
MH 23	0+00.00				
MH 32	1+22.00				
MH 33	2+17.57				
2523 T-84	3+01	14' 11"	70' 85"	2.08%	944.20 9.5 ft
2522 T-85	3+04	14' 11"	70' 85"	2.08%	944.20 9.6 ft
2507 T-104	3+33	10' 11"	7' 11"	2.08%	943.70 10.0 ft
2504 T-103	4+68	13' 11"	8' 10"	2.08%	942.65 9.4 ft
2521 T-86	4+71	11' 7"	22' 86"	2.08%	943.01 9.2 ft
2520 T-87	4+74	10' 7"	73' 86"	2.08%	942.4 9.6 ft
2505 T-102	5+58	11' 12"	1' 10"	2.08%	942.01 9.3 ft
MH 34	5+67.22				
2506 T-104	6+38	9' 12"	2' 9"	2.08%	941.2 9.2 ft
2514 T-88	6+41	8' 4"	76' 85"	2.08%	940.87 9.6 ft
2518 T-89	6+44	6' 4"	76' 85"	2.08%	940.8 9.4 ft
2507 T-100	7+23	8' 11"	5' 10"	2.08%	939.7 9.7 ft
2508 T-99	8+08	11' 11"	8' 10"	2.08%	938.87 9.7 ft
2517 T-90	8+11	2' 0"	78' 82"	2.08%	939.08 9.5 ft
2516 T-91	8+14	2' 0"	78' 82"	2.08%	939.08 9.3 ft
2509 T-98	8+97	2' 0"	8' 10"	2.08%	937.63 9.6 ft
MH 35	9+07.22				
2515 T-92	9+21	0' 11"	84' 85"	2.08%	938.4 8.9 ft
2510 T-97	9+28	2' 0"	8' 10"	2.08%	938.21 9.1 ft
2514 T-93	10+30	0' 11"	140' 11"	1.10%	938.76 8.2 ft
2513 T-94	10+33	0' 11"	138' 11"	1.10%	938.76 8.2 ft
2511 T-96	10+61	0' 11"	10' 11"	2.08%	937.5 9.5 ft
2512 T-95	10+64	0' 11"	12' 11"	2.08%	937.6 9.3 ft
MH 36	10+73.89				

* = The length of riser represents the actual length of riser laid at 40° unless noted with [] which is laid at 75° and requires concrete backing per Sa.S-15
 ** = The length of service is the horizontal distance between the E.O.S. & mainline/riser.



LEGEND			
Stm	Proposed Storm Sewer	Water Serv	Proposed Watermain
MH	Proposed Sanitary Sewer	PMFS	Proposed Watermain Crossing
San	San Serv	PMDS	
San	San Serv	Casing Pipe	

NOTES:

Trench Backfill is Type B per Sa.S-2 unless otherwise noted (See Detail Sheet 2).

For Utility Crossings: Compacted Granular Backfill.

Denoted thus:

** For Areas within the R/W: Type A Backfill per ODOT Item 304, see Sa.S-2 (Sheet 2).

Denoted thus:

For Areas outside the R/W within line of influence: Type A Backfill per ODOT item 304 or Type B Backfill with testing, see Sa.S-2 (Sheet 2).

Denoted thus:

All sanitary sewers/forcemain shall have a minimum separation of 10 feet horizontally to all utilities and 18 inches vertically (outside edge to outside edge) (No utility shall be laid closer than 10' to any sanitary sewer/forcemain).

All sanitary services to be constructed per Standard Drawings Sa.S-11 & Sa.S-12. See Detail Sheet 2.

For Force Main & Sanitary Sewer Trench Detail, See Sheet 2.

† Contractor shall maintain a 1.5' minimum clearance from outside of pipe to outside of pipe for all utility crossings unless otherwise noted.

All Manhole lids shall be stamped "Delaware County Regional Sewer District". All watertight lids shall have a T-gasket with concealed pick holes. All manholes 12" or deeper require a concrete base per Delaware County Sanitary Engineer's specifications.

See Sheet 4 For Structure & Sanitary Sewer Table.

RECORD DOCUMENTS

THESE DOCUMENTS HAVE BEEN PREPARED BASED ON MARKED-UP DRAWINGS, ADDENDA, CHANGE ORDERS, OR OTHER INFORMATION PROVIDED BY THE CONTRACTOR AND/OR OTHER THIRD PARTIES. EMH&T HAS NOT VERIFIED THE ACCURACY AND/OR COMPLETENESS OF THIS INFORMATION AND IS NOT RESPONSIBLE FOR ANY DEFICIENCIES OR DISCREPANCIES HEREIN.

PREPARED: 09-06-2019

REVISIONS

MARK	DATE	DESCRIPTION

MI HOMES
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BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
SANITARY SEWER IMPROVEMENT PLAN
FOR
THE PINES, SECTION 1
PHASE A & B
PLAN & PROFILE

DATE: April 2018

SCALE: Horiz: 1" = 50'
Vert: 1" = 5'

JOB NO.: 20170824

SHEET: 13/32

EMH&T
Engineers, Architects, Surveyors & Planners • Scientists
5500 New Albany Road, Columbus, OH 43054
Phone: 614.775.6500
Fax: 614.775.6501
emh.com

PUMP STATION GENERAL NOTES

The County of Delaware requirements, together with the current iteration of the specifications of the Delaware County Regional Sewer District Construction and Materials Specifications (DCRSD CMS), including all supplements thereto, shall govern all construction items that are an integral part of the pump station plan. The contractor shall refer to the "Standard Plans and Specifications for Construction of Sanitary Facilities in Delaware County, Ohio" and the current iteration of the Delaware County Sanitary Sewer Standard Drawings (SaS-##) for all necessary construction details. Any variations, including plan requirements, must have written approval from the Design Engineer and the Delaware County Sanitary Engineer.

All Sewer Plan General Notes on sheet 2 of the complete sanitary sewer plan are to be hereby considered for the construction work of the pump station, where applicable.

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 accompanying Pump Station and Force Main drawings. Any material or work not specifically mentioned or shown on the drawings, but necessary to complete the work, shall be furnished with no additional payment.

Roof drains, foundation drains, and other clean water connections to the sanitary system are prohibited.

PERMITS

The Contractor shall obtain any and all permits required for the project and pay all permit fees, including, but not limited to, permits by the various Boards of Health of the State of Ohio and/or Delaware County, including all permits required by Delaware County to work and to construct the utility within the County right-of-way.

SITE VISIT

The Contractor is required to visit the site to be fully informed and aware of concerning all conditions affecting the scope of the work. Failure to visit the site shall not relieve him from any responsibility in the performance of this contract.

EXISTING UTILITIES

The Contractor shall cause notice to be given to the Ohio Utilities Protection Service (Telephone 800-362-2764 toll-free) and to the owners of the underground utilities who are not members of a registered underground protection service in accordance with section 153.64 of the revised code. The above mentioned notice shall be given at least forty eight (48) hours prior to start of construction.

Investigation, location, support, protection and restoration of all existing utilities and appurtenances shall be the responsibility of the Contractor. This work includes maintenance of adequate depth on all existing utility facilities. The Contractor is responsible to identify and coordinate field stakeout of all locations of possible grade conflicts with existing utilities prior to construction. The cost of this work shall be included in the bid price for the sanitary sewer improvements.

The identify and location of the existing underground utility facilities known to be located in the construction area, as provided by the owner of the underground utility, have been shown on the plans as accurately as possible. Delaware County and/or the Design Engineer assumes no responsibility to the accuracy or the depths of the underground facilities shown on the plans.

See Existing Utilities section of General Notes on Plan Sheet 2 for further requirements.

SHOP DRAWINGS AND SUBMITTAL INFORMATION:

The Contractor shall provide Shop Drawings to the Delaware County Sanitary Engineer for review, evaluation, and approval by the Delaware County Sanitary Engineer, prior to order, purchase, fabrication or delivery of any pump station, odor control, electrical or force main items.

The Contractor shall submit the copies of material data sheets and product cut sheets for every material or equipment item to be installed with the construction of the pump station project, including, but not limited to the following:
1. Electrical schematics with sequence of operations
2. Dimensioned component layout of inner-door and back panel
3. Bill of materials
4. Manufacturers component catalog sheets
5. Programming documentation for the telemetry system that will be provided to the Delaware County Sanitary Regional Sewer District by the supplier of said system.

PUMP STATION SPECIFICATIONS

Work under this section includes furnishing, constructing and installing the pump station, as a whole and being complete as shown on the drawings and as specified herein.

WET WELL AND VALVE & CONTROL AREA BUILDING STRUCTURES

The wet well shall be constructed of round, twelve foot (12') inside diameter, precast concrete unit. Concrete surface finish shall be free of spalls, chips, and honeycombs and shall meet the requirements of ASTM C478 and minimum wall thickness shall be equal to ASTM C-76 WALL B. All joints shall comply with ASTM C443. Design of wall thickness and reinforcing to be provided by and the responsibility of the precast manufacturer. Openings for piping, sumps, access hatches, electrical conduit and sensor lines shall be cast smoothly into the structure. Chipping or punching openings will not be allowed under any circumstances.

The Contractor shall provide a leveling base, depending on subsurface conditions, under the precast concrete structure per the DCRSD CMS and the DCRSD Standard Drawing SAS-36.

The Contractor to construct valve and control room building per the construction methods and details on the various sheets of SAS-36 to the dimensions given on this plan. The Contractor shall submit shop drawings for roof truss design and other building components, as required by the DCRSD CMS and DCRSD Standard Drawings. The Contractor shall construct the electrical to the design specifications and layout of the electrical plan.

ANTI-FLOATATION

The Contractor shall provide whatever anti-floatation measures are necessary during construction to prevent floatation of the structure until concrete encasement and backfill is placed.

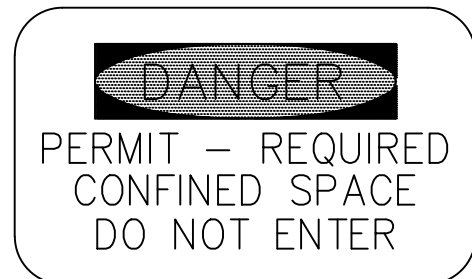
ACCESS HATCHES

The Contractor shall provide access hatches per the requirements and standards of the DCRSD CMS and DCRSD Standard Drawings to the dimensions shown on the plan. The Contractor shall submit shop drawings for the access hatches as required by the DCRSD CMS and DCRSD Standard Drawings.

The Contractor shall install all access hatches per the manufacturer's specifications.

CONFINED SPACE ENTRY SIGNS

Confined space entry signs shall be provided and installed on both sides of all entry hatches on the Wet Well. Signs shall meet the requirements of ODOT ITEM 630 and be as follows:
1. Sign material shall be 0.063" thick aluminum.
2. Paint colors shall be red and black on white, non-reflective.
3. Approximate sign size: 11" x 16" wide.
4. Text and style: as follows:



AIR VENT

The Contractor shall provide and install air vents per the requirements and standards of the DCRSD CMS and DCRSD Standard Drawings to the dimensions shown on the plan. The Contractor shall submit shop drawings for the air vents as required by the DCRSD CMS and DCRSD Standard Drawings.

QUICK DISCHARGE CONNECTOR & GUIDE RAILS

The pump elbow and the pump retrieval system, including, but not limited to, the rails, chain and brackets, shall be provided by the pump manufacturer/supplier unless otherwise agreed upon in writing between the pump manufacturer/supplier and the Contractor.

The Contractor shall install all components per the manufacturer's/supplier's requirements.

WET WELL & VALVE BUILDING PIPING

The Contractor shall supply and install all piping and valves required in the pump station and the valve area as shown on the drawings and not provided by the pump or grinder manufacturer. Pump station and valve area pipe shall be flanged joint, ductile iron pipe shall be Class 52 per the DCRSD CMS and conforming to AWWA C-110, C-150 and C-151 with rubber gaskets per C-111.

At all wall penetrations, use a modular, mechanical seal, consisting of rubber links shaped to continuously fill the annular space between the pipe and the wall opening. Hardware shall be mild steel with a 60,000 PSI minimum tensile strength and 2-part zinc dichromate coating per ASTM b-633 and organic coating, tested in accordance with ASTM B-117 to pass a 1,500-hour salt spray test (or 316 stainless steel).

Mechanical couplings shall be installed on all piping sections between structures. These couplings shall have a minimum working pressure of 150 PSI. The middle ring shall be comprised of stainless steel or equivalent with grade 42 BUNA N gasket and bolts shall conform to ASTM A307 and A563.

Dismantling joints, which allow for longitudinal adjustment in the piping system, shall be installed as shown on the plans. Dismantling joints shall consist of a double-ended flanged adapter, a telescoping slip pipe, and tie bars. The joint shall be fabricated of stainless steel with BUNA S rubber gasket and shall have a minimum working pressure of 150 PSI.

PLUG VALVES

The Contractor shall provide plug valves per the requirements and standards of the DCRSD CMS and DCRSD Standard Drawings to the dimensions and sizes shown on the plan. The Contractor shall submit shop drawings for the plug valves as required by the DCRSD CMS and DCRSD Standard Drawings.

The Contractor shall install all plug valves per the manufacturer's specifications.

CHECK VALVES

The Contractor shall provide check valves per the requirements and standards of the DCRSD CMS and DCRSD Standard Drawings to the dimensions and sizes shown on the plan. The Contractor shall submit shop drawings for the check valves as required by the DCRSD CMS and DCRSD Standard Drawings.

The Contractor shall install all check valves per the manufacturer's specifications.

PRESSURE GAUGE

The Contractor shall provide pressure gauges per the requirements and standards of the DCRSD CMS and DCRSD Standard Drawings (Cerabar M PMP51 Model #PMP51-4MMFO/101) to the dimensions and sizes shown on the plan. The Contractor shall submit shop drawings for the pressure gauges as required by the DCRSD CMS and DCRSD Standard Drawings.

The Contractor shall install all pressure gauges per the manufacturer's specifications.

PAINTING

All valve area piping and valves shall be painted (except flanges and machined edges). All painting preparations and application shall be in accordance with standard practice and per paint manufacturer's recommendations and specifications.

Paint brand type shall be: Sherwin-Williams - Color to be approved by Delaware County Sanitary Engineer.

- 1. Primer coat: COPOXY shop primer
 - a. Applied Piping - One (1) coat, 3.0-5.0 dry mils.
 - b. Applied Valves - One (1) coat, 3.0-5.0 dry mils.
- 2. Finish coat: MACROPOXY 646
 - a. Applied Piping and Valves - Two (2) coats, 4.0-6.0 dry mils.

WET WELL TESTING

A. All liquid retention structures shall be made watertight and shall be tested by filling with liquid to 6" below the top of the tank.

B. Backfill shall not be placed around the liquid retention structures until the leakage test is completed to the satisfaction of the Delaware County Sanitary Engineer. Where special reasons make this impractical, the Sanitary Engineer may permit backfilling to proceed before the test is made. Permission to backfill shall not relieve the Contractor of any responsibility for watertightness of the structures and if upon making the test the need to remove backfill arises, it shall be done by and at the expense of the Contractor.

C. The Contractor shall provide all labor, tools, materials, and equipment necessary to perform the leakage test as well as to repair any leaks. The Contractor shall also provide 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.

D. 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 be removed upon successful completion of the test.

E. 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 after 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 hours period.

F. The structure will pass the leakage test by meeting the following criteria:
1. The net liquid loss for the last 24 hour period for the 72 hour test shall not exceed 0.2% 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.

STARTUP

The Contractor shall arrange and conduct a pump station start-up meeting with the Delaware County Sanitary Regional Sewer District prior to discharge of sewerage to pump station.

All aspects of the pump station operation shall be tested and documented as described within the plan.

MANUALS

The Contractor shall provide a minimum of 3 bound copies and one electronic copy of the operation and maintenance manuals for each item of equipment installed in the pump station to the Delaware County Sanitary Engineer.

PUMP GENERAL NOTES:

The Contractor and pump supplier shall furnish FLYGT pump system per the requirements and specifications of the DCRSD CMS.

The Contractor shall be responsible for the installation of the complete pump system within the wet well to the manufacturer's/supplier's requirements and specifications and all necessary controls and power supply to operate the system per manufacturer's specifications.

The Contractor shall reference the pump station electrical plans for additional pump control and power supply information.

The Pump Station is being designed for two stages of flow:

Initial Build: Onsite flow from the The Pines development.
Build Out: Regional flow from the area and flows designated by the Delaware County Regional Sewer District.

The Pump Station structures are designed and sized to allow for future pump station upgrades.

PUMPS SPECIFICATIONS:

The following information was provided by Xylem Water Solutions USA, Inc. for the pump requirements. EMH&T will not be responsible for the provided information. The Contractor shall verify the information with the supplier for shop drawing submittal and prior to ordering any project items.

Initial Build:
NUMBER OF UNITS: 2
MODEL: NP 3127 SH 3~ Adaptive 249
ELECTRIC: 460 Volt, 3 Phase, 60 Hz
HP: 11
MAX. MOTOR RPM: 3500

PUMP DESIGN SPECIFICATIONS:

Pumps shall conform to the following requirements:

Initial Build:
FLOW: 113 GPM (0.163 MGD)
STATIC HEAD: 64.2 ft.
DESIGN TDH: 97.2 ft.

PUMP CONTROLS

The Contractor and pump supplier shall furnish pump controls per the requirements and specifications of the DCRSD CMS.

The Contractor shall be responsible for the installation of the pump controls to the manufacturer's/supplier's requirements and specifications and all necessary controls and power supply to operate the system per manufacturer's specifications.

The Contractor shall reference the pump station electrical plans for additional pump control and power supply information.

CONTROL PANEL DESCRIPTION

Refer to control panel description and details, included herein, for a complete description of the requirements for the control panel materials and installation.

Control panel shall be provided as specified. Refer to the electrical notes and control panel details.

The control panel must comply with the National Electric Code including a listing of the panel short circuit protection and arc flash hazard warning signs.

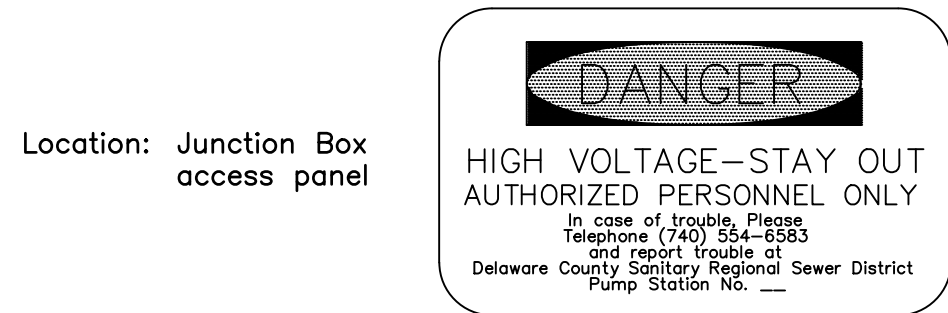
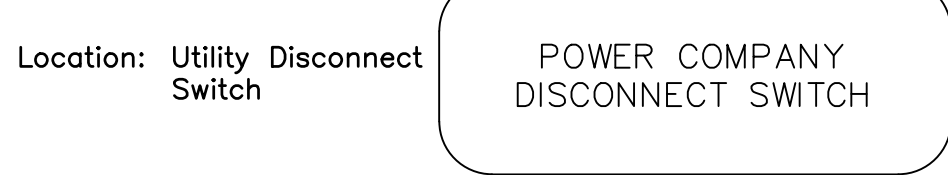
ADDITIONAL ELECTRICAL SIGNS:

Electrical signs shall be provided and installed at the following locations:

- 1. Utility Disconnect Switch
- 2. Junction Box access panel

Signs shall meet the requirements of ODOT ITEM 630 and be as follows:

- 1. Sign material shall be 0.063" thick aluminum.
- 2. Paint colors shall be red and black on white, non-reflective.
- 3. Approximate sign size: 11" x 16" wide.
- 4. Text and style: as follows:
- 5.



Contractor to coordinate with Delaware County Regional Sewer District as to the Pump Station number for Junction Box access panel sign.

EFFLUENT GRINDER

The Contractor and JWC Environmental shall furnish a "Muffin Monster" effluent grinder system per the requirements and specifications of the (DCRSD CMS).

The Contractor shall be responsible for the installation of the complete "Muffin Monster" system to the manufacturer's/supplier's requirements and specifications.

The Contractor shall reference the electrical plans for additional "Muffin Monster" control and power supply information.

GRINDER SPECIFICATIONS:

The following information was provided by JWC Environmental for the requirements of the "Muffin Monster". EMH&T will not be responsible for the provided information. The Contractor shall verify the information with the supplier for shop drawing submittal and prior to ordering any project items.

Initial Build:
NUMBER OF UNITS: 1
MODEL: 30K Series "Muffin Monster"
30005-0032
FLOW: 1470 GPM
WEIGHT: 480 LBS
MOTOR: 5 HP XPNV IMMERSIBLE GRINDER MOTOR W/50' POWER CABLE
CONTROLLER: PC2200 CONTROLLER, NEMA 4XFRP ENCLOSURE
GRINDER WALL FRAME: 304SS

ODOR CONTROL SPECIFICATIONS (BIOXIDE DRIP):

The Contractor and Evqua shall furnish a complete Bioxide odor control system per the requirements and specifications of the DCRSD CMS.

The Contractor shall be responsible for the installation of the complete odor control system to the manufacturer's/supplier's requirements and specifications.

The Contractor shall reference the electrical plans for additional odor control system control and power supply information.

The Contractor shall provide the complete concrete containment structure including concrete and fence, all tubing, and mountings required for the proper installation and operation of the odor control system, as required by the drawings, manufacturer's/supplier's requirements and specifications, and any supplemental specifications.

WET WELL MISCELLANIOUS NOTES:

Contractor to provide precast concrete structures per the DCRSD CMS. Design of wall thickness and reinforcing are the responsibility of and shall be provided by the precast manufacturer.

Contractor shall furnish shop drawings of the Wet Well, the Valve and Electrical Control Building, the "Muffin Monster" and the Bioxide odor control system to the Delaware County Sanitary Engineer for approval prior to fabrication. The Wet Well shall be designed for the additional weight of all the installed items. The shop drawings will be reviewed for dimensional conformance only. The design and construction of the structures remains the sole responsibility of the precast manufacturer and the Contractor.

Contractor shall be responsible for anti-floatation sizing and methods needed during construction until earth backfill is properly and completely placed.

Precast Contractor to furnish and install all necessary structure openings, gaskets and/or sleeves per the DCRSD CMS and the pertinent Standard Drawings except as modified within the plan.

Contractor to furnish and install all necessary hangers, supports and blocking for piping.

All electrical conduit and wiring shall be completed by the Contractor and constructed per the design and specifications of the Pump Station Electrical Plans.

All Wet Well and Valve Building piping & fittings shall meet the requirements of the DCRSD CMS and the Standard Drawings.

Contractor shall seal all openings between pipes/conduits per the requirements of the DCRSD CMS and the Standard Drawings.

All hardware required for installation shall be stainless steel and shall be furnished and installed by Contractor.

ITEM 801, 4" FORCE MAIN, COMPLETE AND ITEM 801, 12" FORCE MAIN, COMPLETE :

Proposed force main pressure pipe within and between the pump station structures and to the first fitting outside from the valve building shall be ductile iron pipe, Class 52 and conform to AWWA C151 with a minimum working pressure of 350psi with joints conforming to AWWA C111. All PVC non-pressure drain pipes and fittings within and between the pump station structures shall be SCH 80 PVC.

Proposed force main pressure pipe constructed beyond the first fitting outside from the valve room shall be PVC AWWA C900 or approved equal. Conforming to the "Delaware County Regional Sewer District Construction and Material Specifications" manual.

Force Main fittings shall be ductile iron conforming to either ANSI/AWWAC110/A21.10 or ANSI/AWWA C153/A21.53. Fittings shall have a standard asphaltic coating on the exterior.

Contractor shall maintain a 1.5' minimum vertical clearance from outside of pipe to outside of pipe, for all proposed and existing utility crossings, unless otherwise noted.

Contractor shall be responsible for the location, protection and support of all existing utilities during all phases and types of construction of the force main. The cost to be included in the unit unit price bid for Items 801, 4" Force Main, Complete & 12" Force Main, Complete.

Contractor to provide Force Main Utility Markers per the DCRSD CMS,

The cost of all labor, equipment and materials necessary to construct, complete and set-up for operations the components, including, but not limited to, all pipe, fittings, casing pipes, backings, jacking, boring, installation and receiving pits, the location, protection and support of all existing utilities and any other appurtenance from the wall of the Valve Building to the termination at the existing manhole of the 4" Force Main to be installed by various means and methods, shall be included in the total price bid for Item 801, 4" Force Main, Complete.

The cost of all labor, equipment and materials necessary to construct, complete and set-up for operations the components, including, but not limited to, all pipe, fittings, casing pipes, backings, jacking, boring, installation and receiving pits, the location, protection and support of all existing utilities and any other appurtenance from the wall of the Valve Building to the termination at the proposed 12" Blind Flange of the 12" Force Main to be installed by various means and methods, shall be included in the total price bid for Item 801, 12" Force Main, Complete.

ITEM SPEC, PUMP STATION, COMPLETE:

The cost of all labor, equipment and materials necessary to construct, complete and set-up for operations the components, including, but not limited to, the structures, fencing, piping, various valves and fittings, brackets, mounts, gaskets, gauges, hatches, vents, the components of the grinder system, pumps and any other of the appurtenances of the Wet Well, the Valve and Electrical Control Building, sidewalks and the Odor Control (Bioxide) System, including the electric and electrical components, shall be included in the total price bid for Item Spec, Pump Station, Complete.

MARK	DATE	DESCRIPTION

BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
SANITARY SEWER IMPROVEMENT PLAN
FOR
**THE PINES, SECTION 1
PHASE A & B**
PUMP STATION & FORCE MAIN GENERAL NOTES

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DATE
April 2018

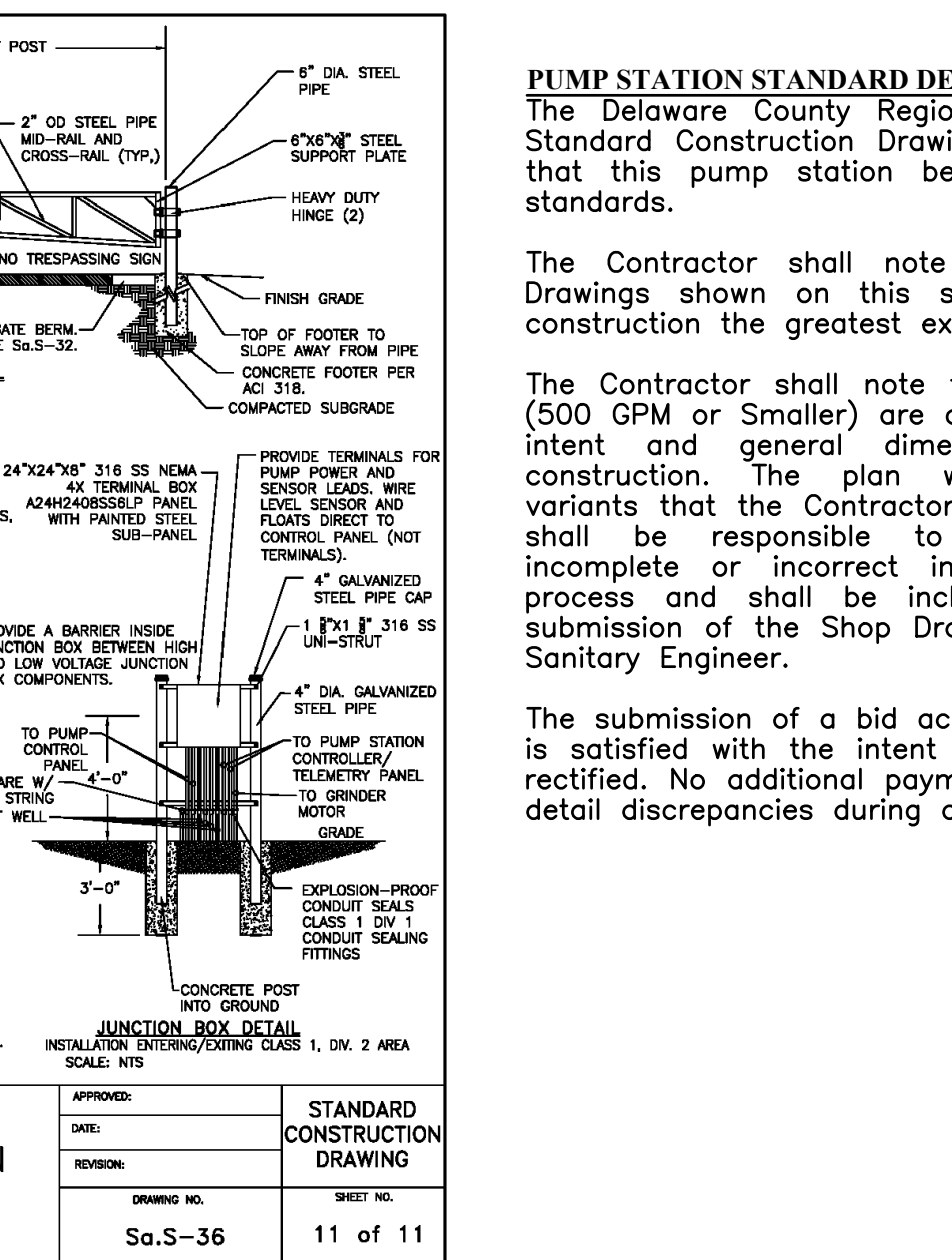
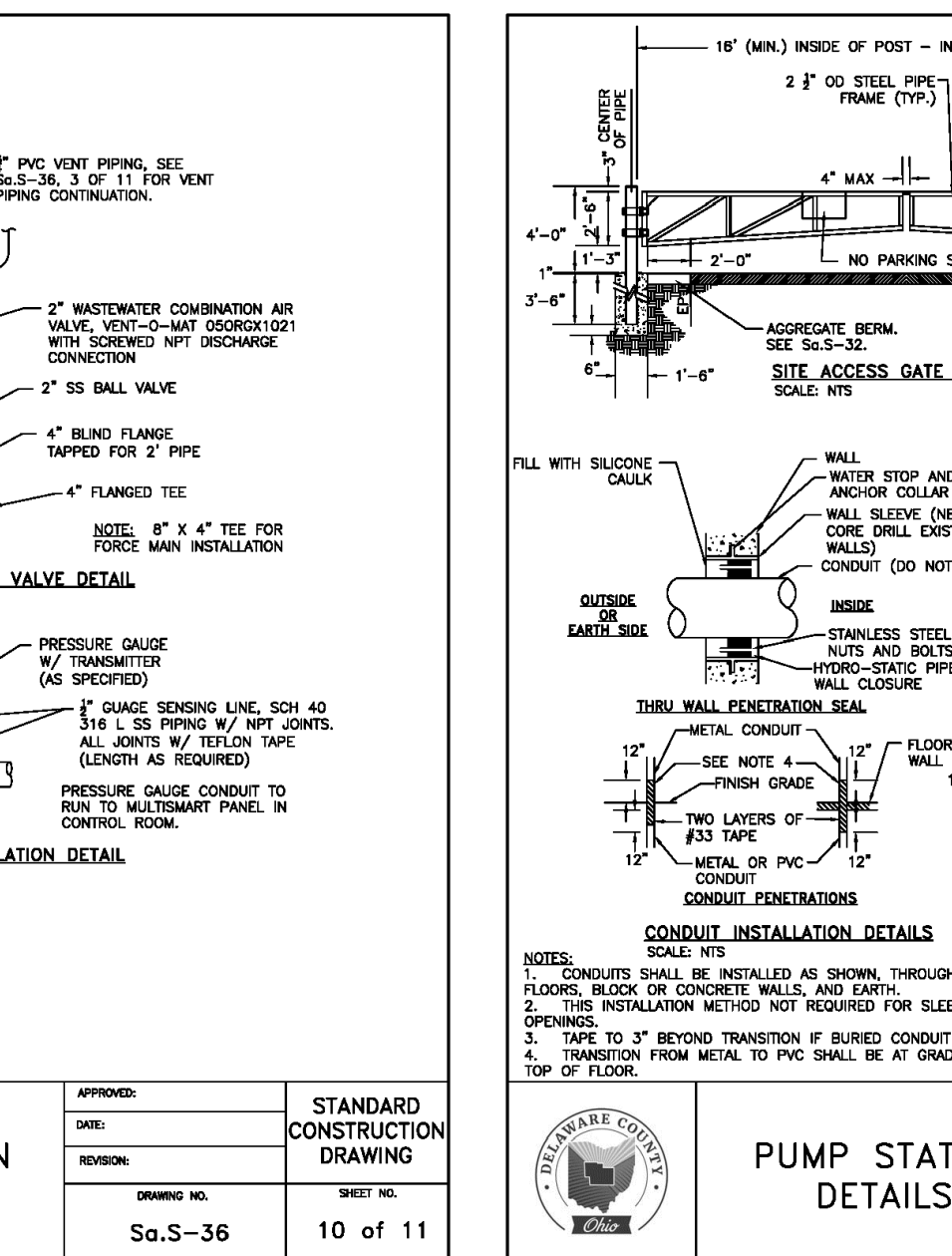
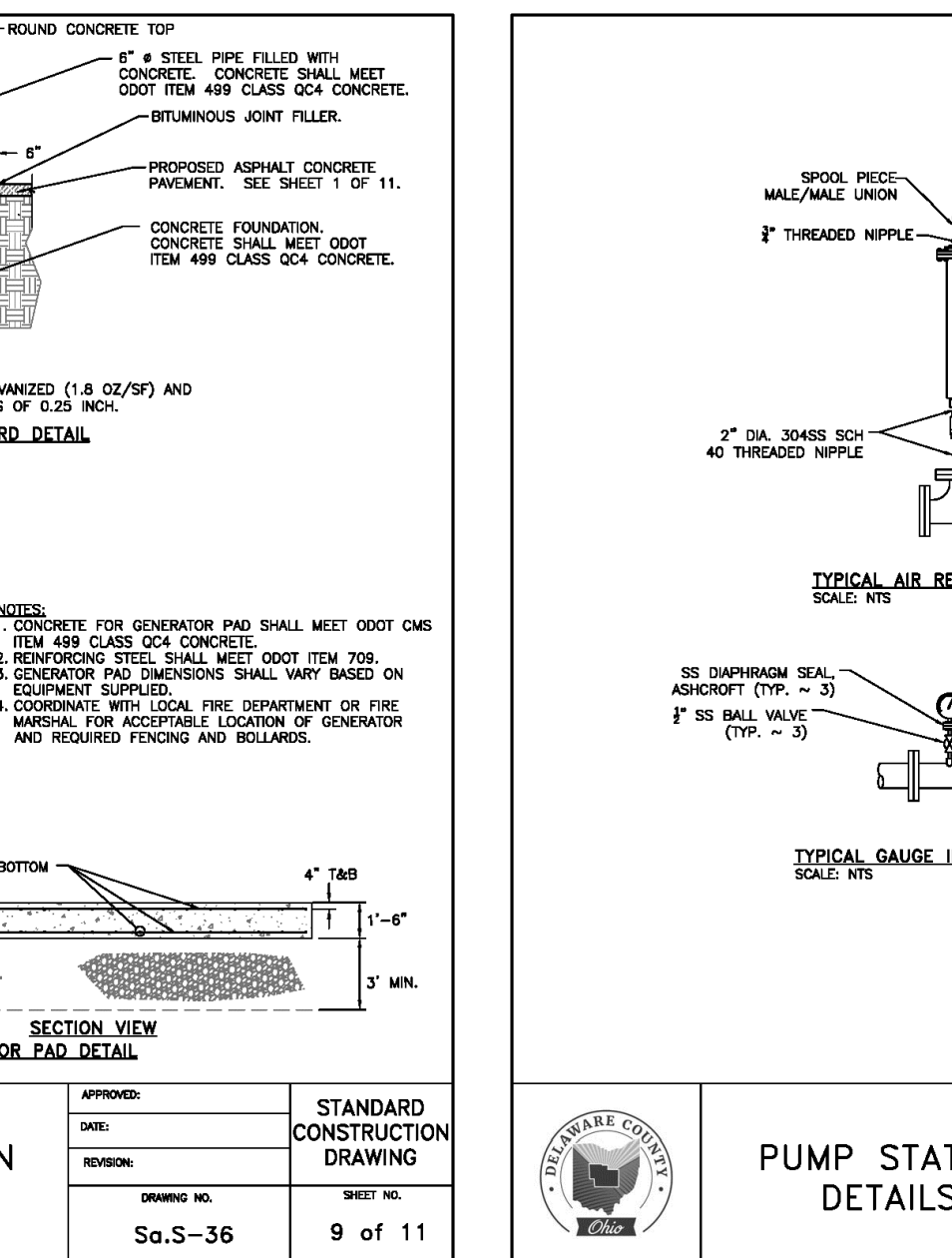
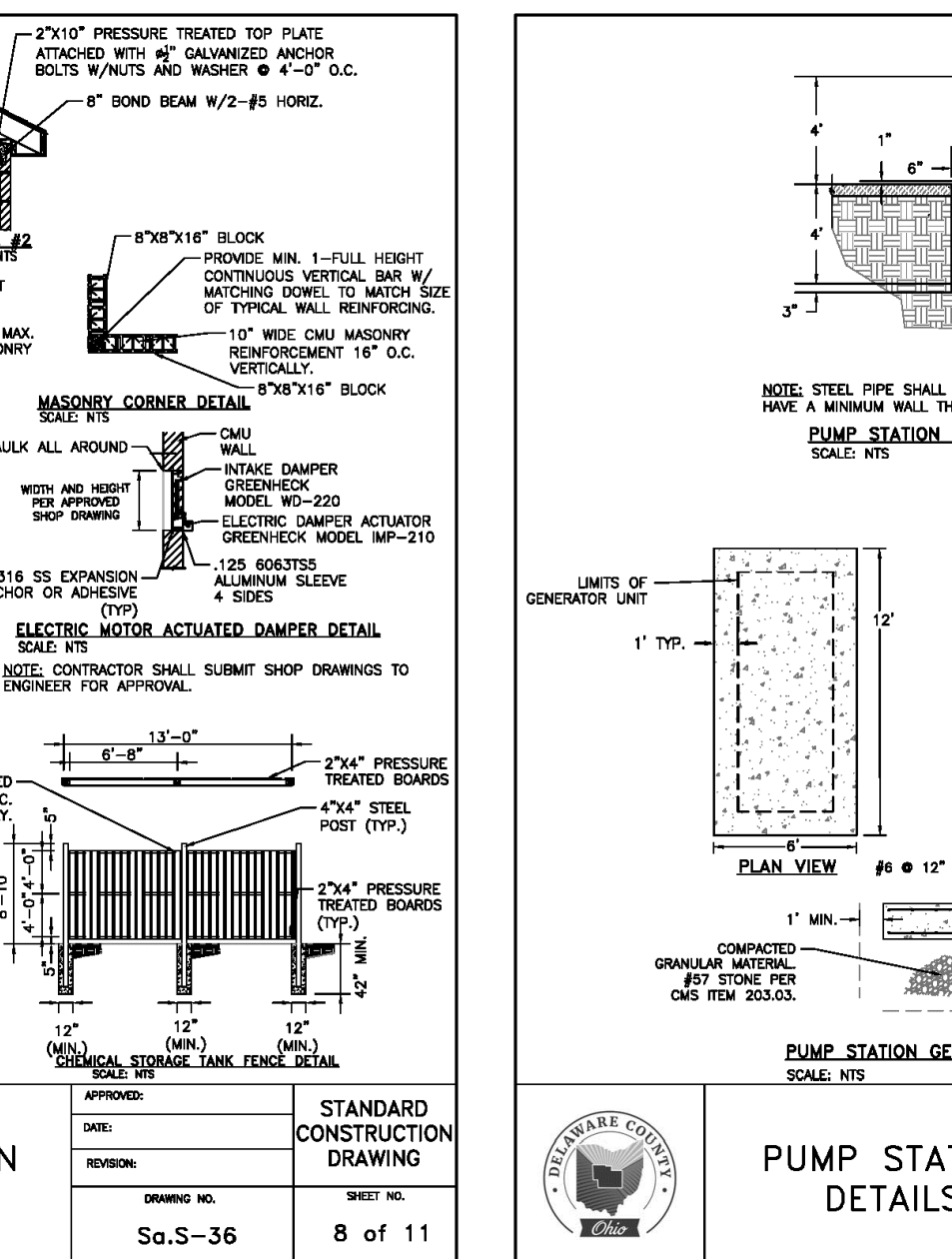
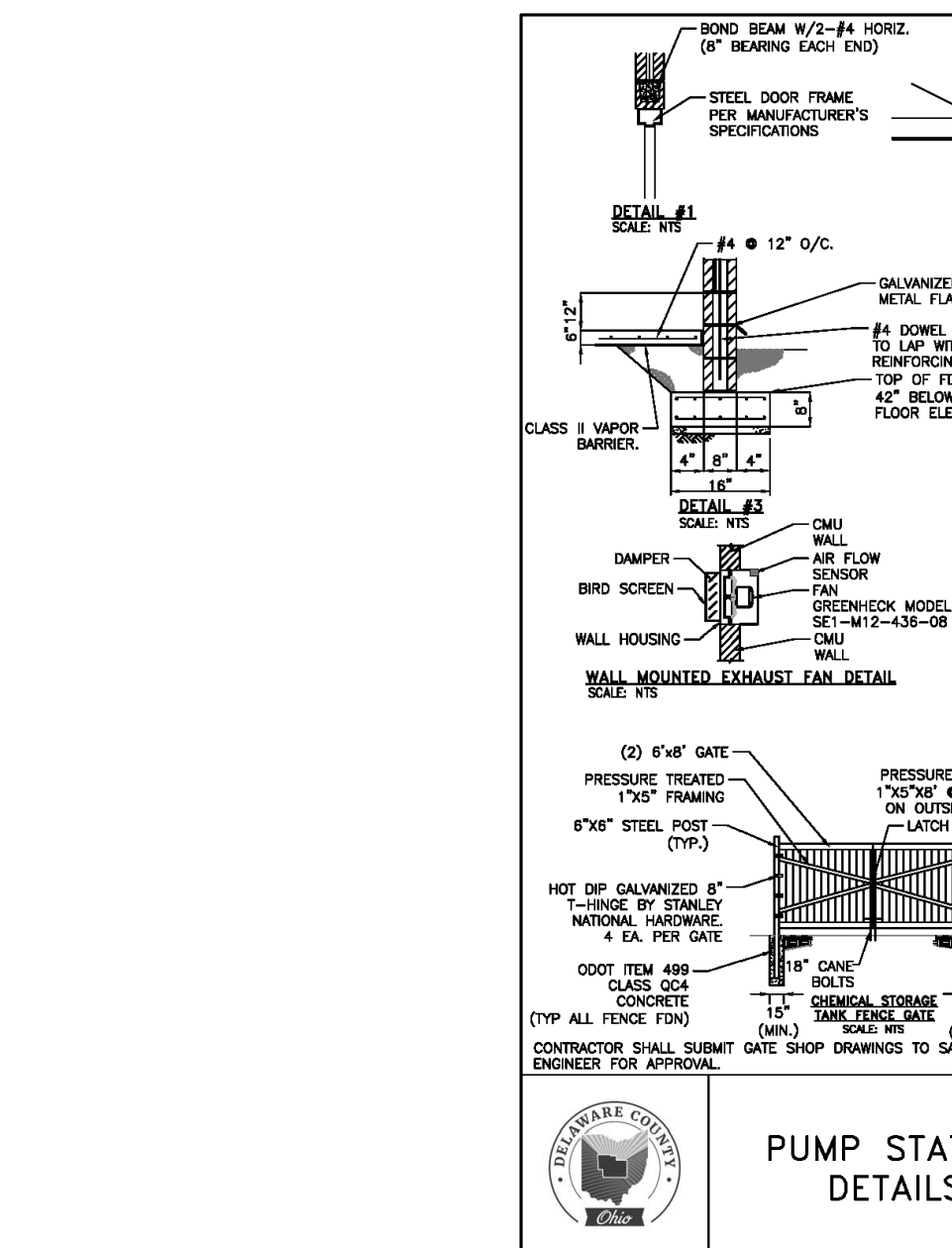
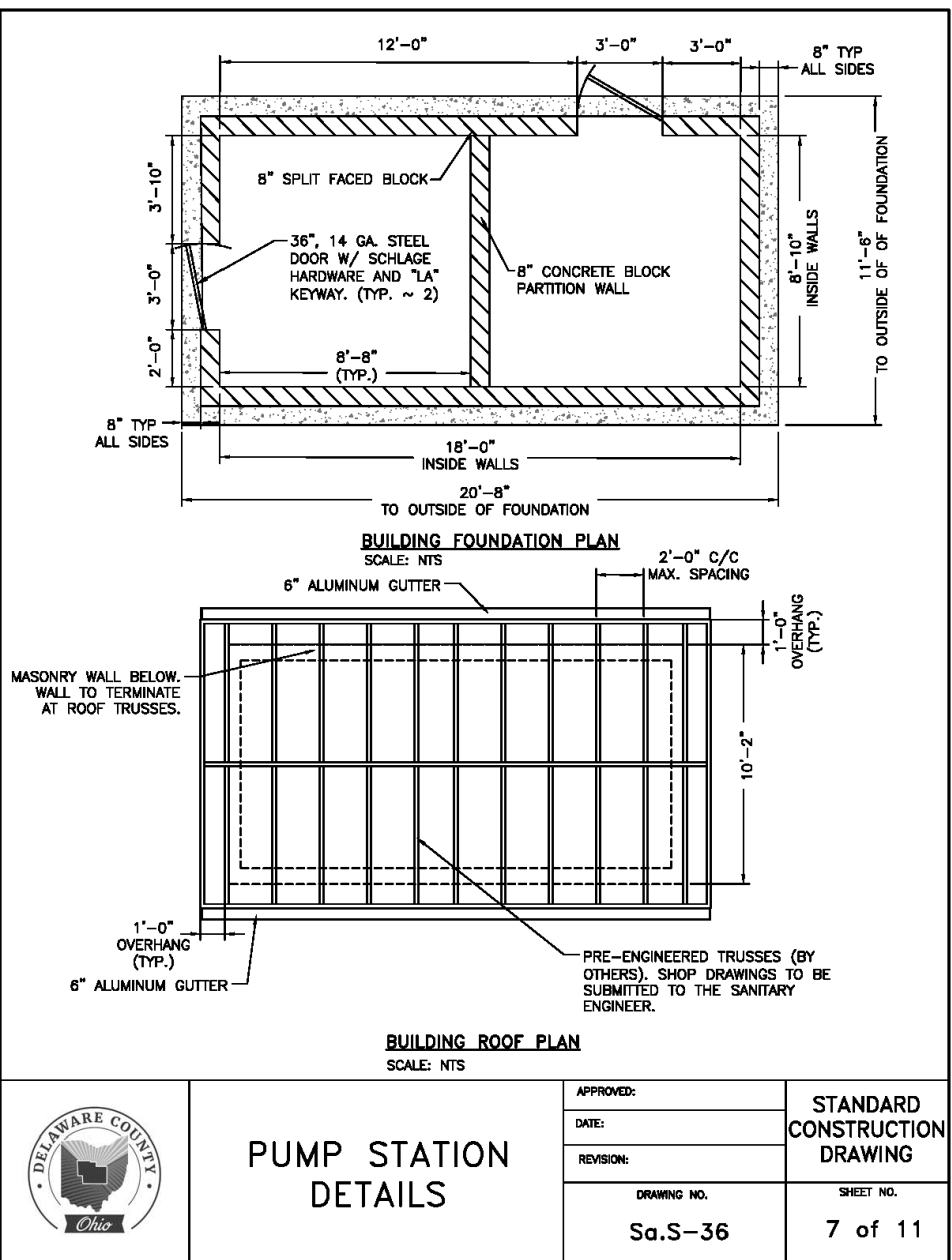
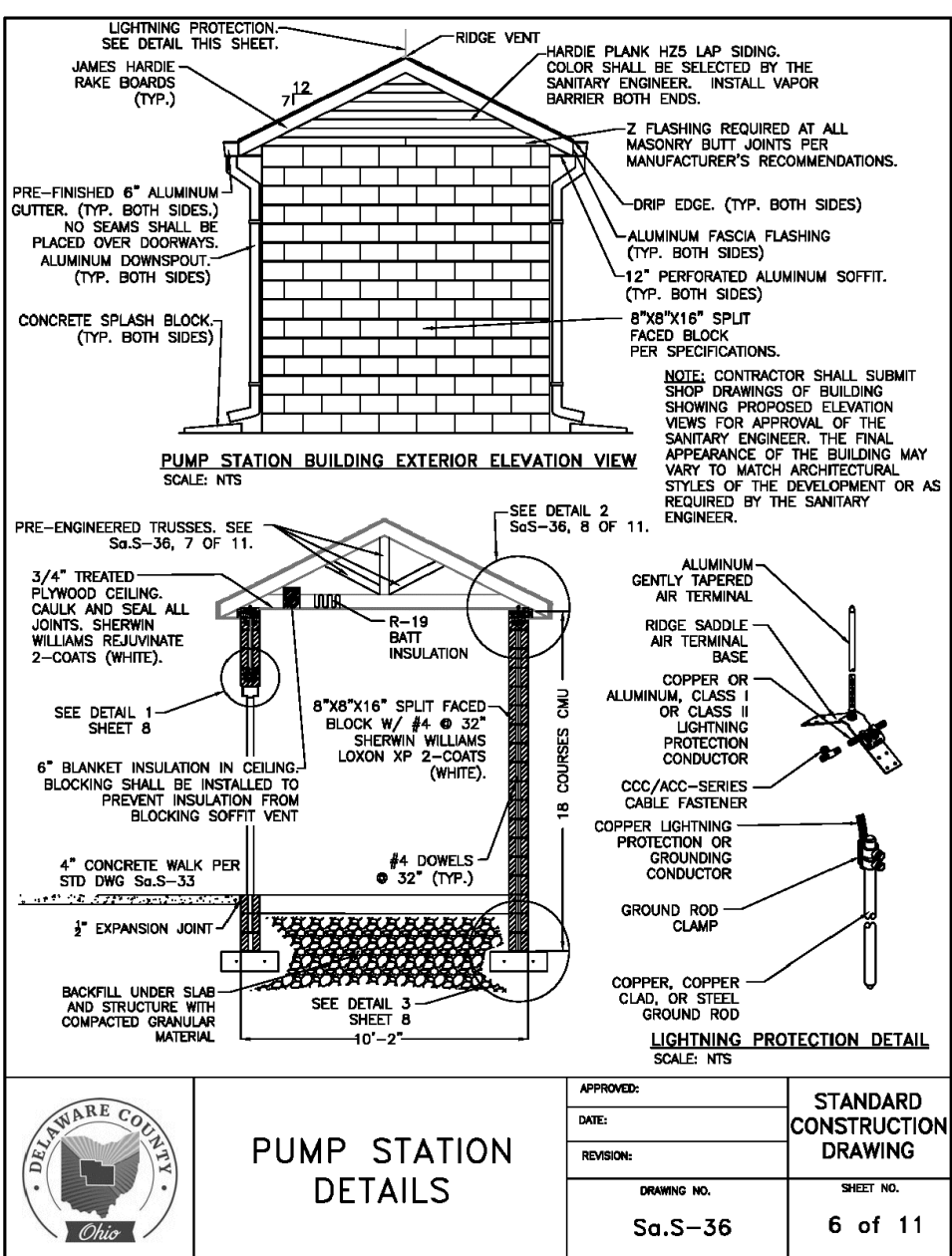
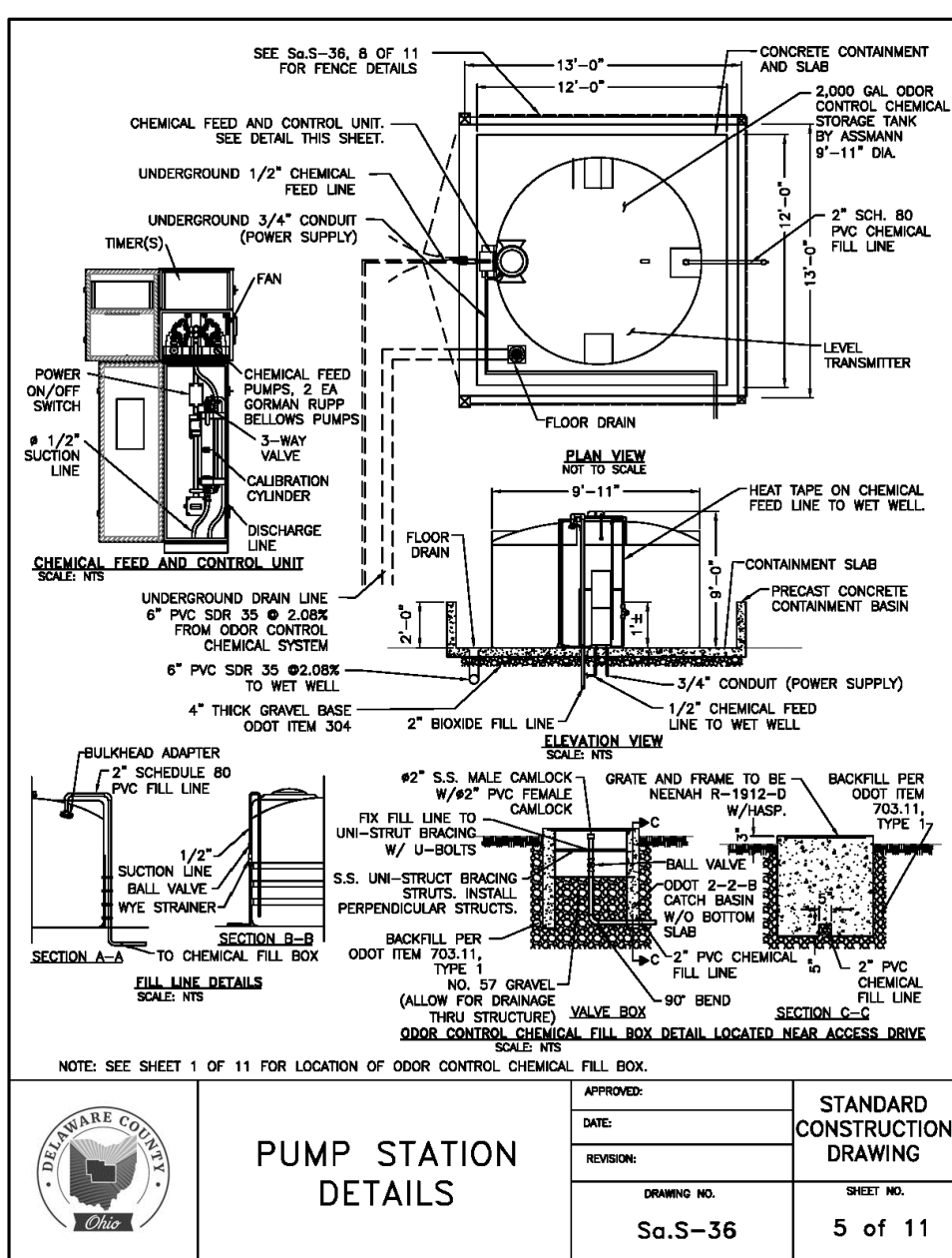
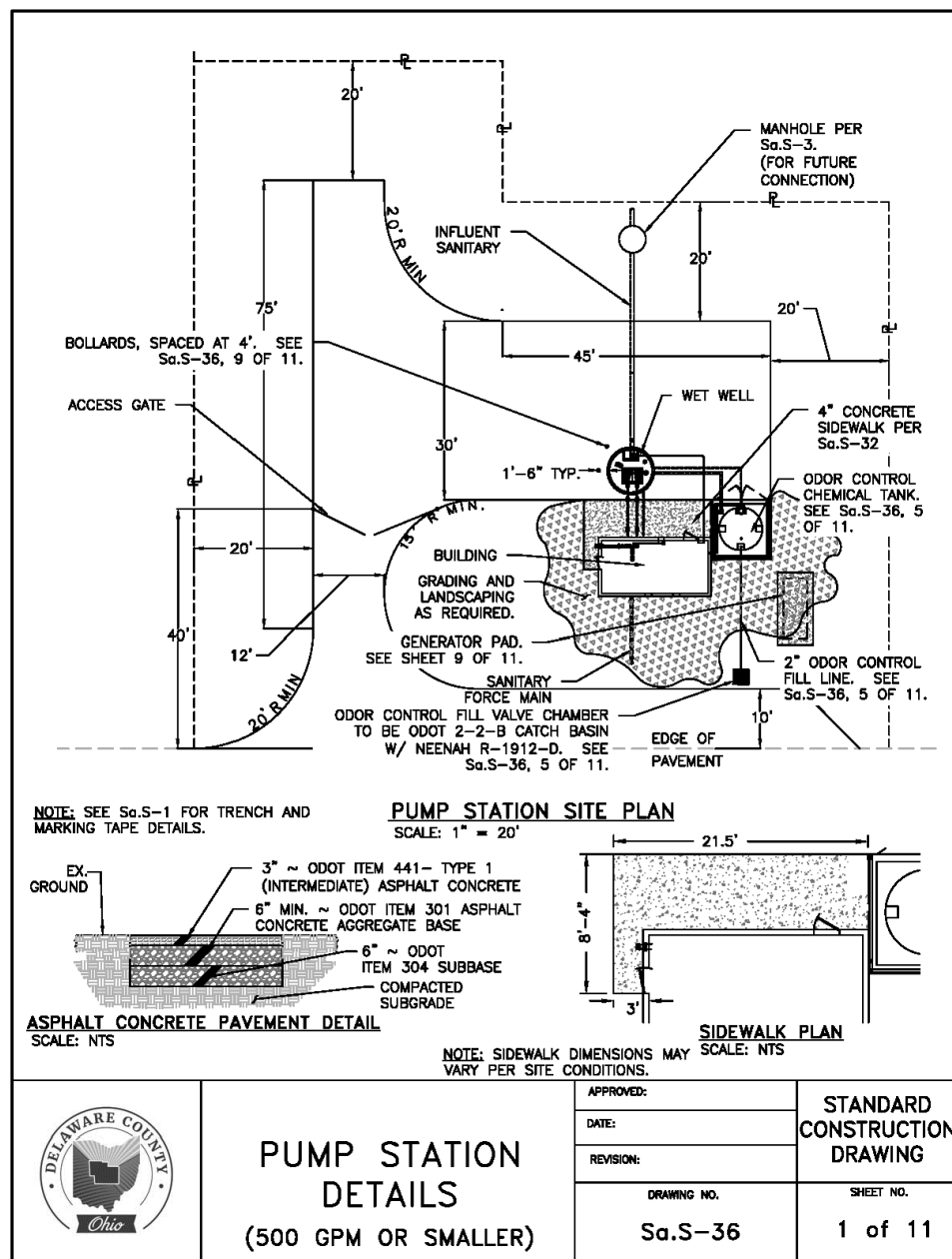
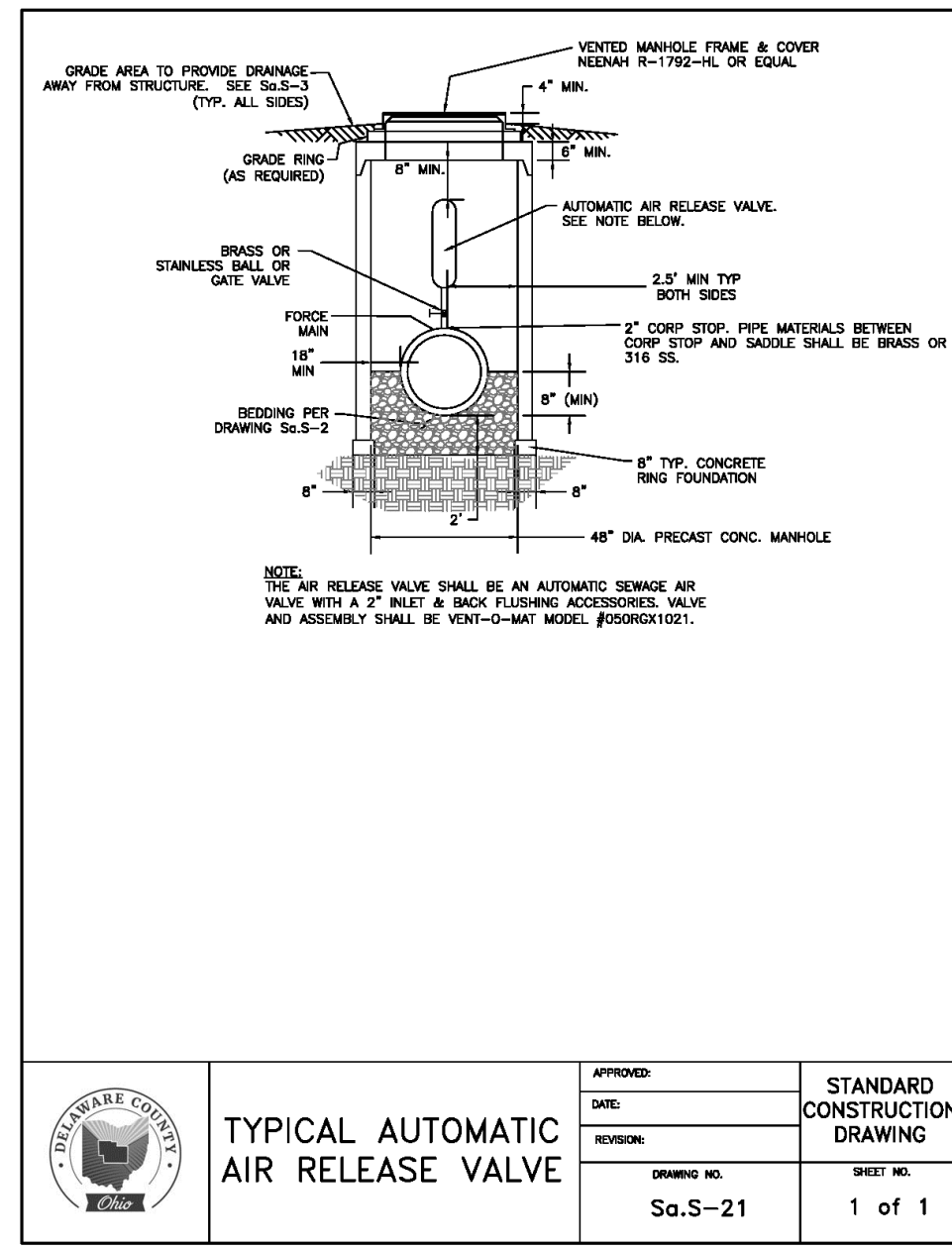
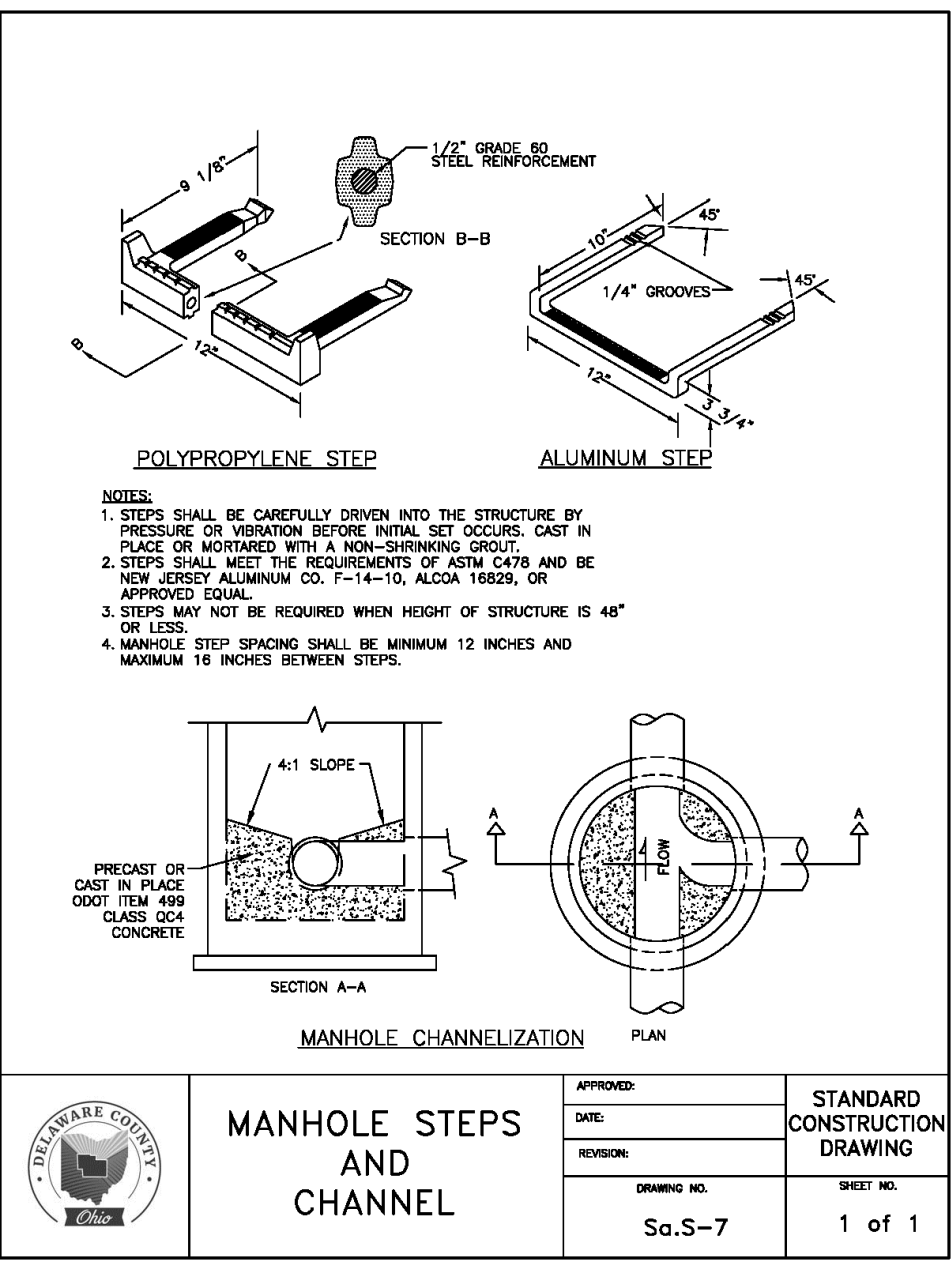
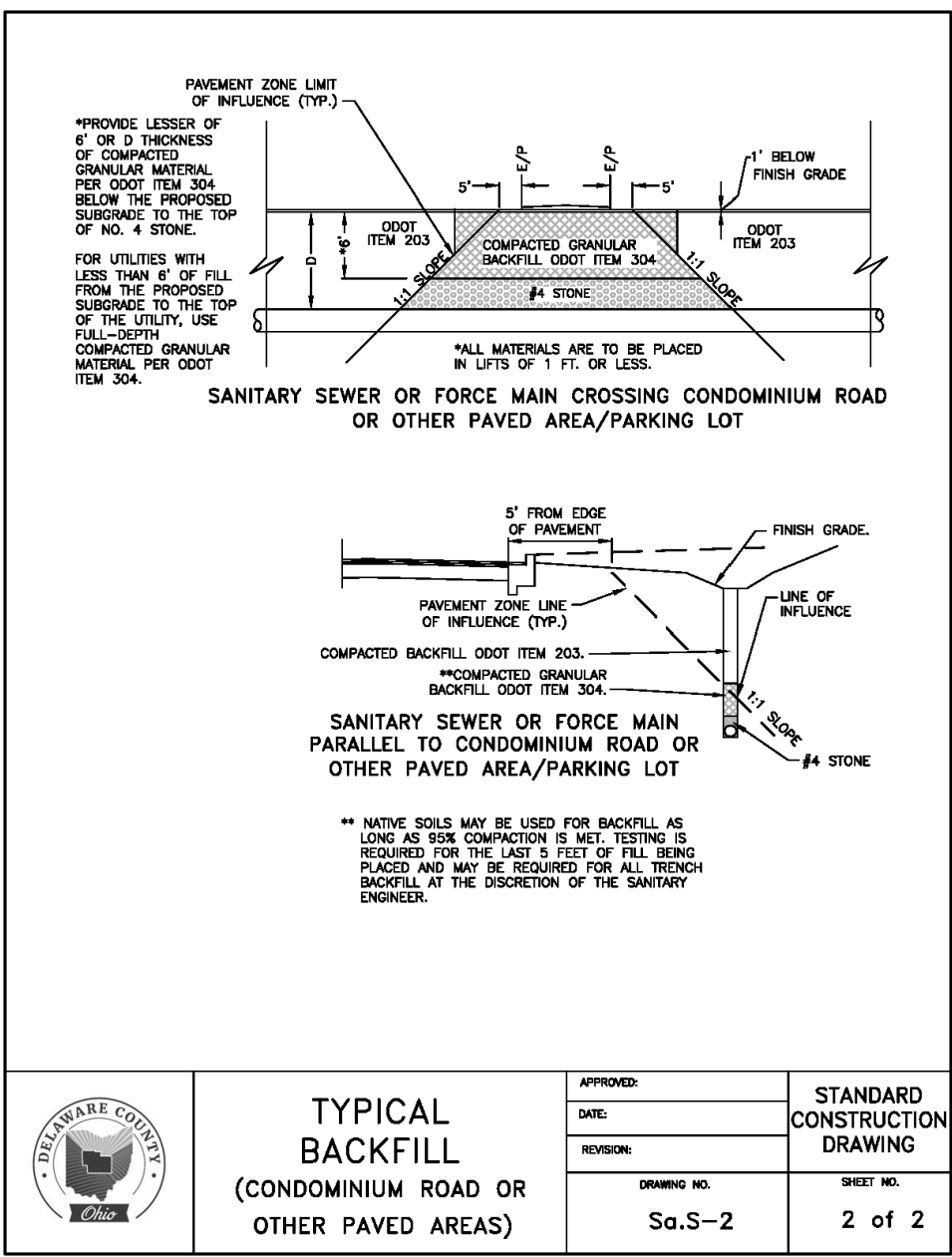
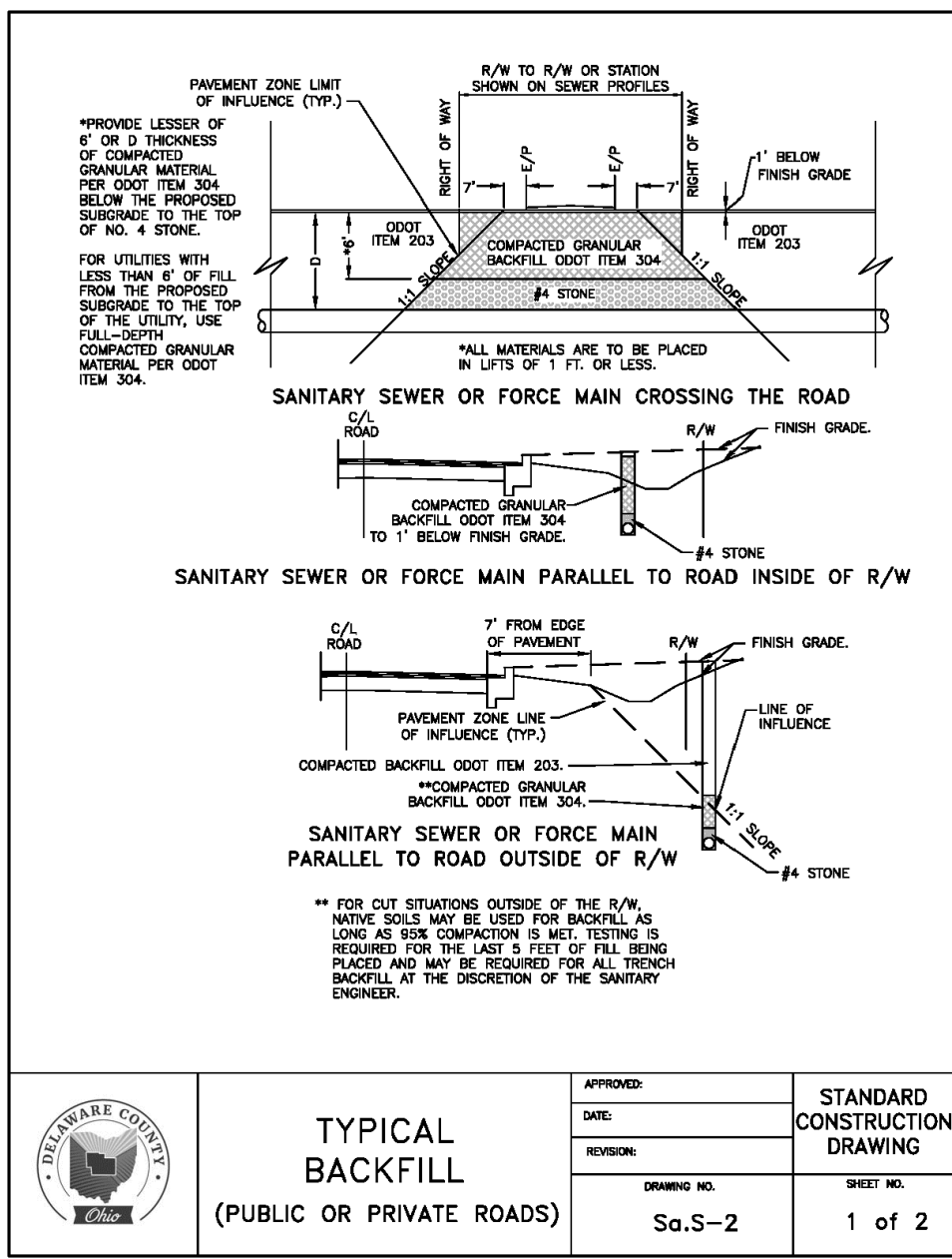
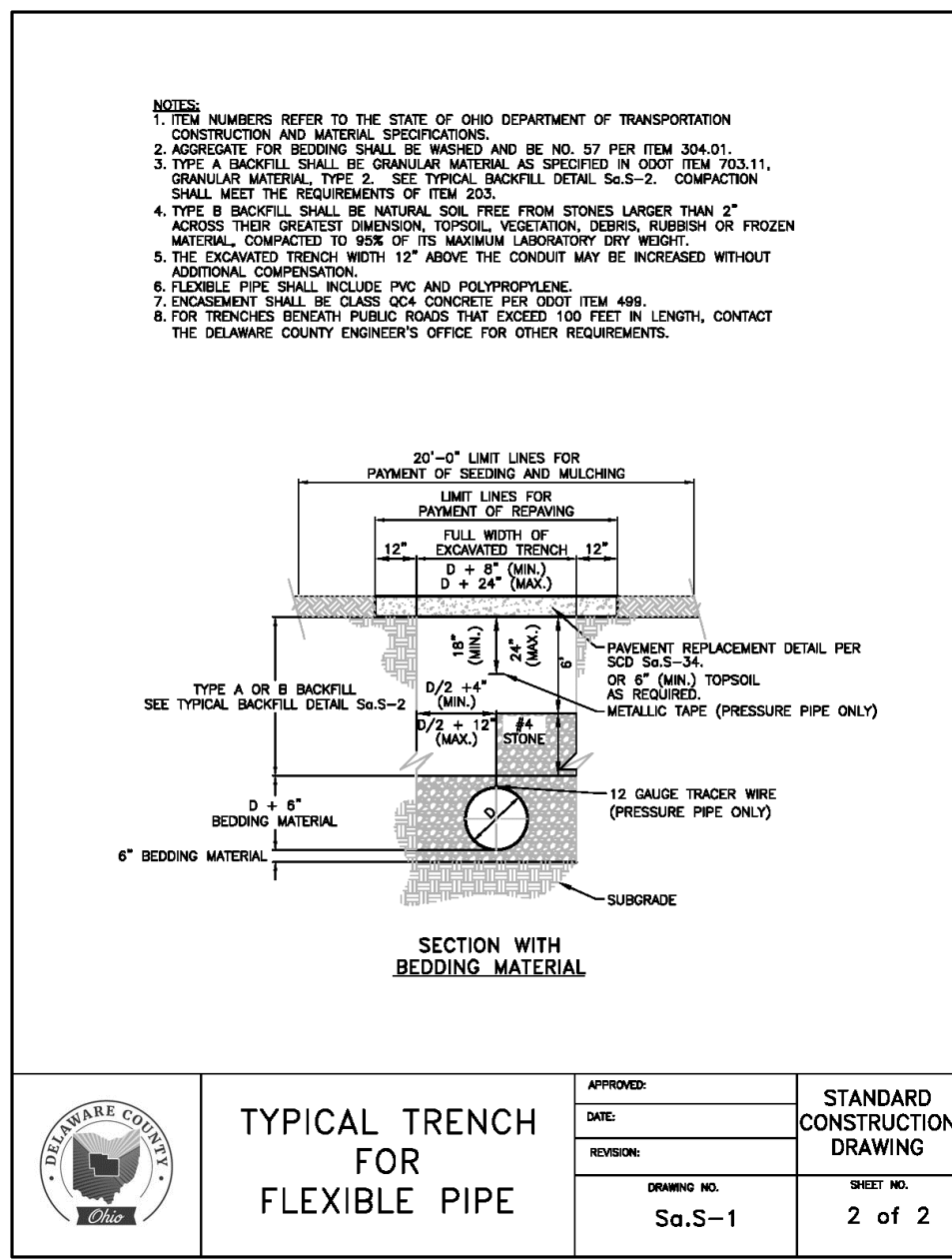
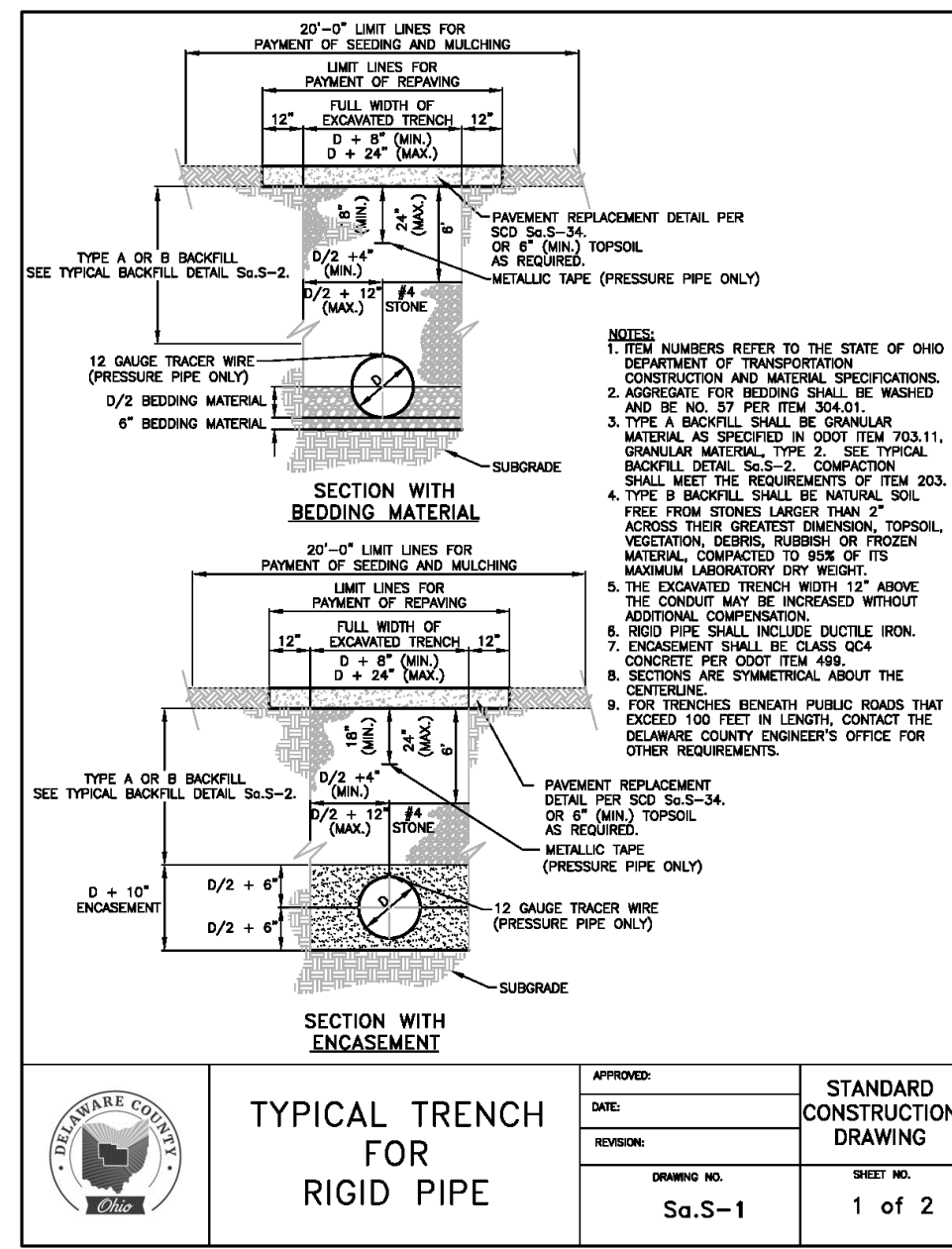
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JOB NO.
20170824

EMH&T
Ernie M. Heston & Thomas, Inc.
5800 New Albany Road, Columbus, OH 43264
Phone: 614-775-6500 Fax: 614-775-3348
emht.com

SHEET
14/32

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REVISIONS

MARK	DATE	DESCRIPTION

BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
FOR
THE PINES, SECTION 1
PHASE A & B
PUMP STATION DETAILS

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EMIT
Ernie M. Iversen, Inc.
5000 New Albany Road, Columbus, OH 43254
Phone: 614-775-6300 Fax: 614-775-7348

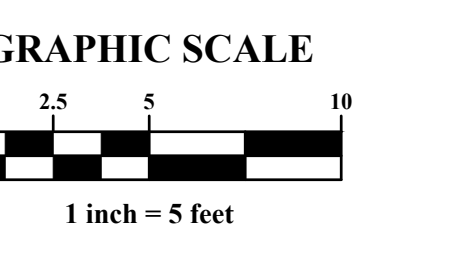
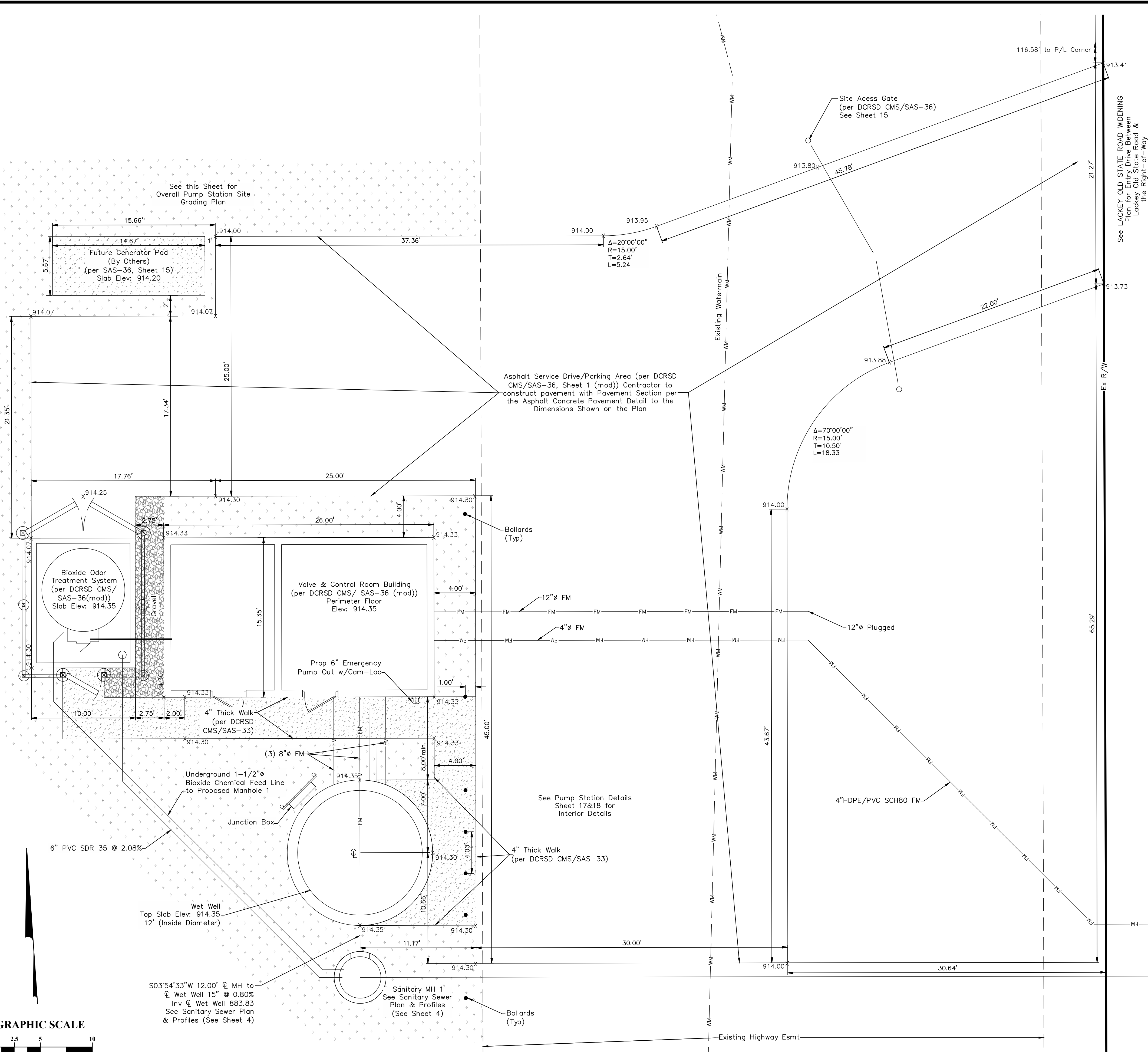
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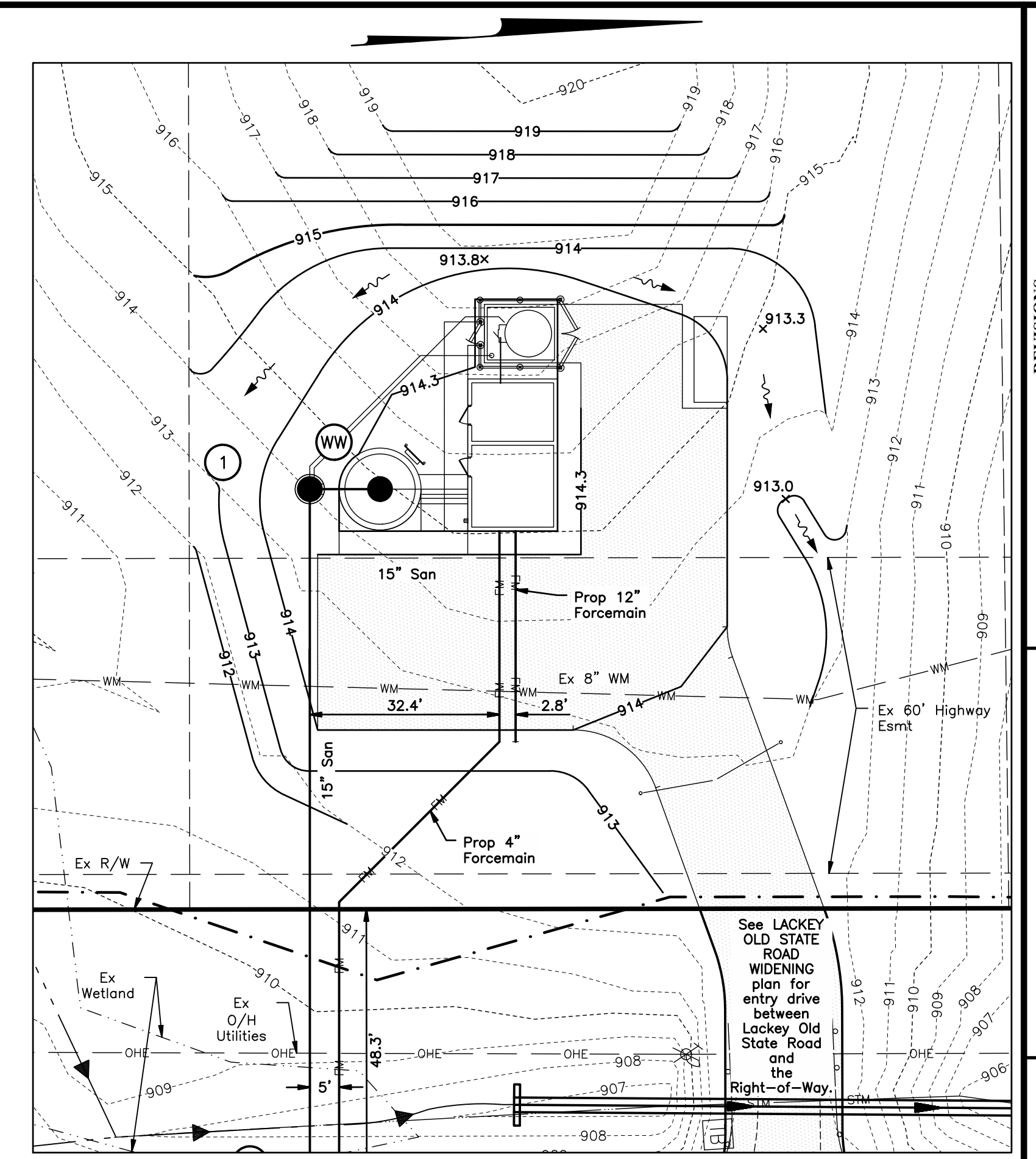
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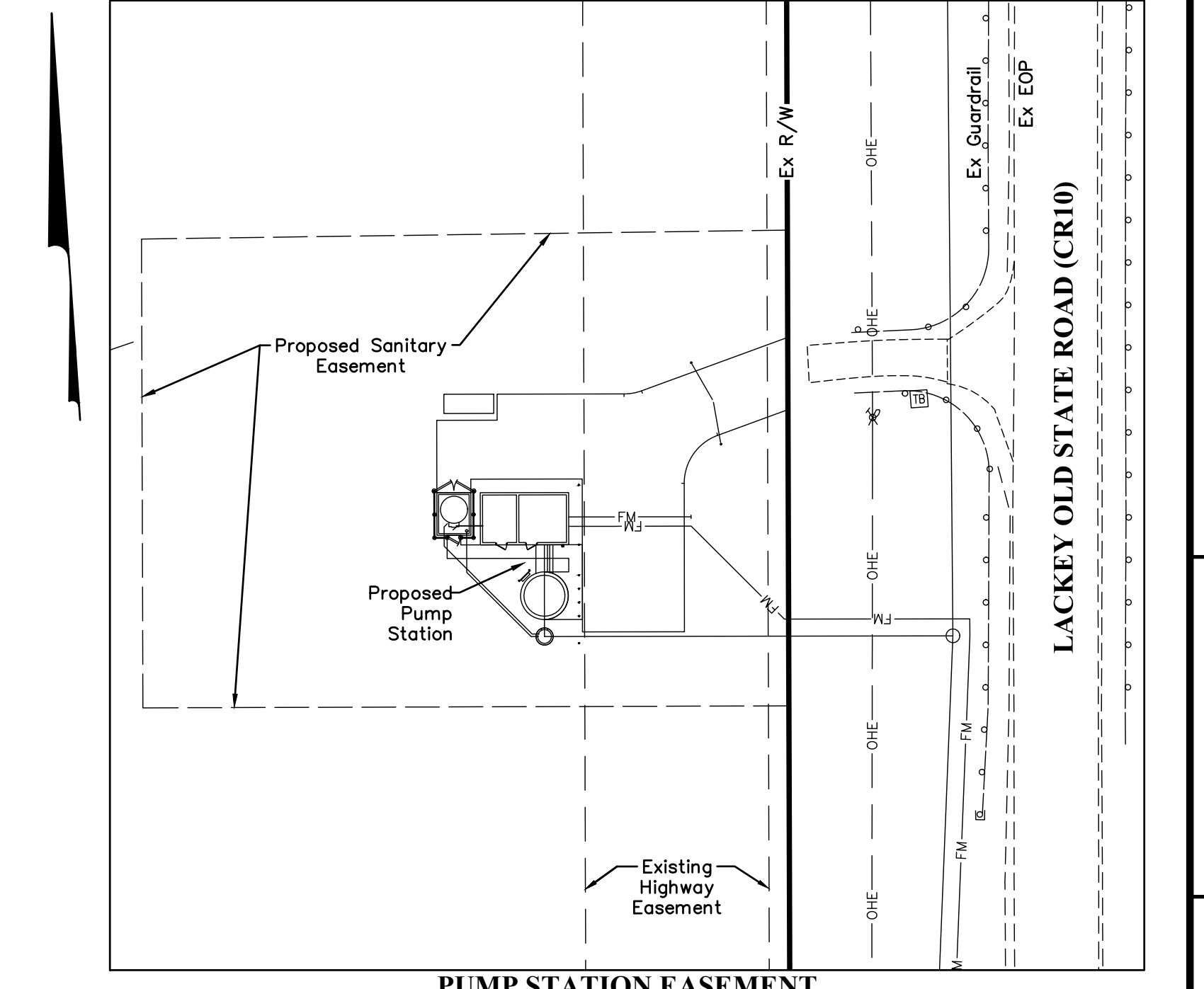
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PUMP STATION SITE PLAN
Scale: 1" = 5'



OVERALL PUMP STATION SITE GRADING PLAN
Scale: 1" = 20'



PUMP STATION EASEMENT
Scale: 1" = 40'

- NOTES:**
1. Roof drains, foundation drains, and other clean water connections to the sanitary system are prohibited.
 2. The Contractor shall grade the area around the pump station to drain surface water away from station structures.
 3. The Contractor shall seed and mulch all disturbed areas after final grading.
 4. All General Notes on Plan Sheets 2 and 14 shall be considered in the construction of the Pump Station.
 5. O.S.H.A. clearance requirements to be maintained during construction between equipment & overhead utility lines.

MARK	DATE	DESCRIPTION

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BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
 SANITARY SEWER IMPROVEMENT PLAN
 FOR
THE PINES, SECTION 1
PHASE A & B
PUMP STATION SITE PLAN

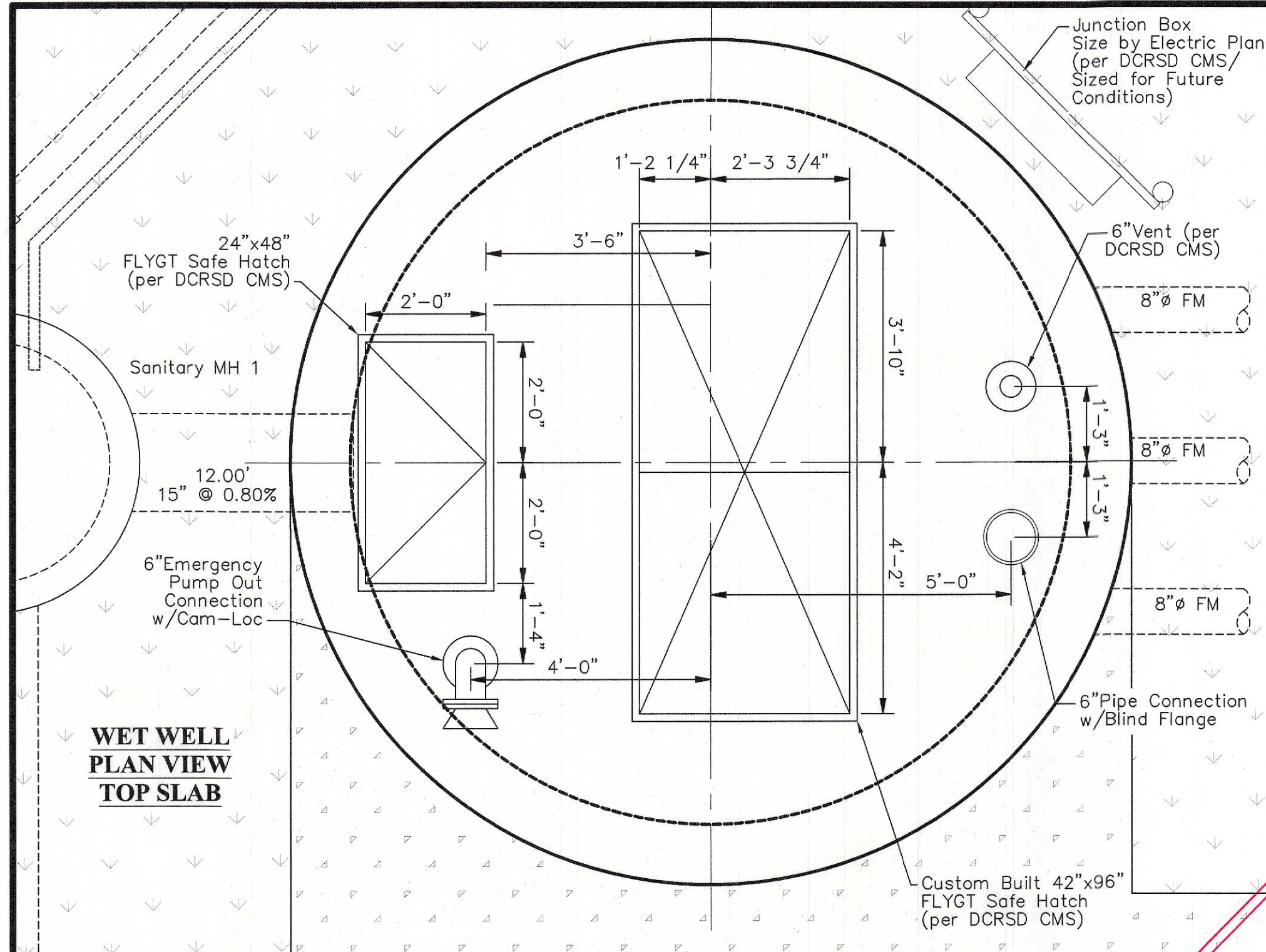
EMHT
 Ernie M. Heston & Thomas, Inc.
 5300 New Albany Road, Columbus, OH 43254
 Phone: 614.775.6500 Fax: 614.775.3348
 emht.com

DATE
April 2018

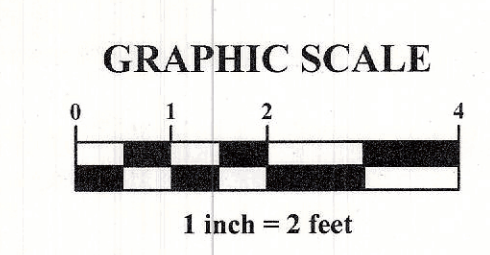
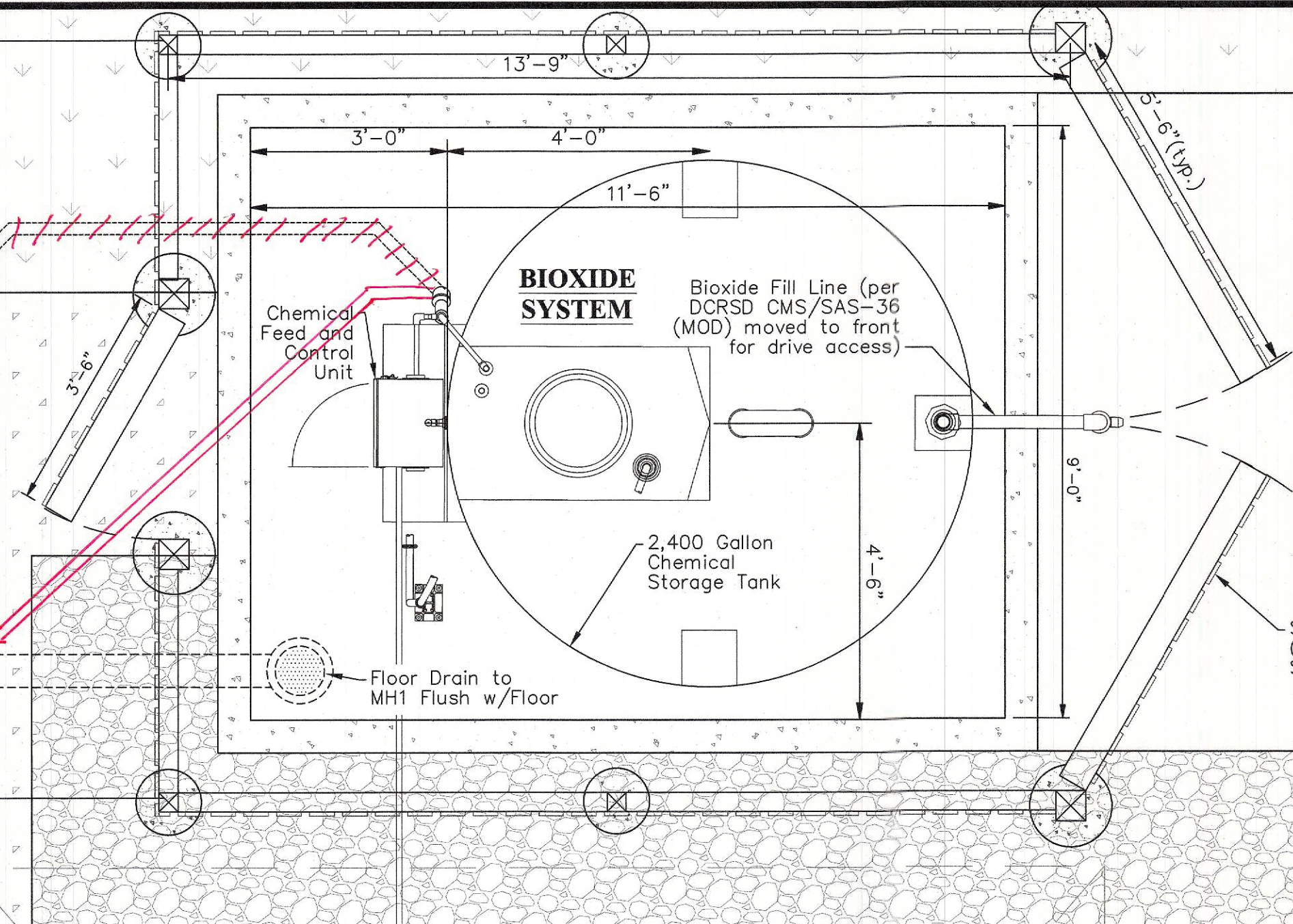
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20170824

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Contractor to Construct the Bioxide Odor Control System as Designed and Provided by EVOQUA as per the DCRSD CMS and the Various Sheets of SCRSD STD DWG SAS-36 to the Dimensions and Modifications given on this Plan. The Contractor shall Submit Shop Drawings as required by the DCRSD CMS. The Contractor shall Construct the Electrical to the Design Specifications and Layout of the Electrical Plan.

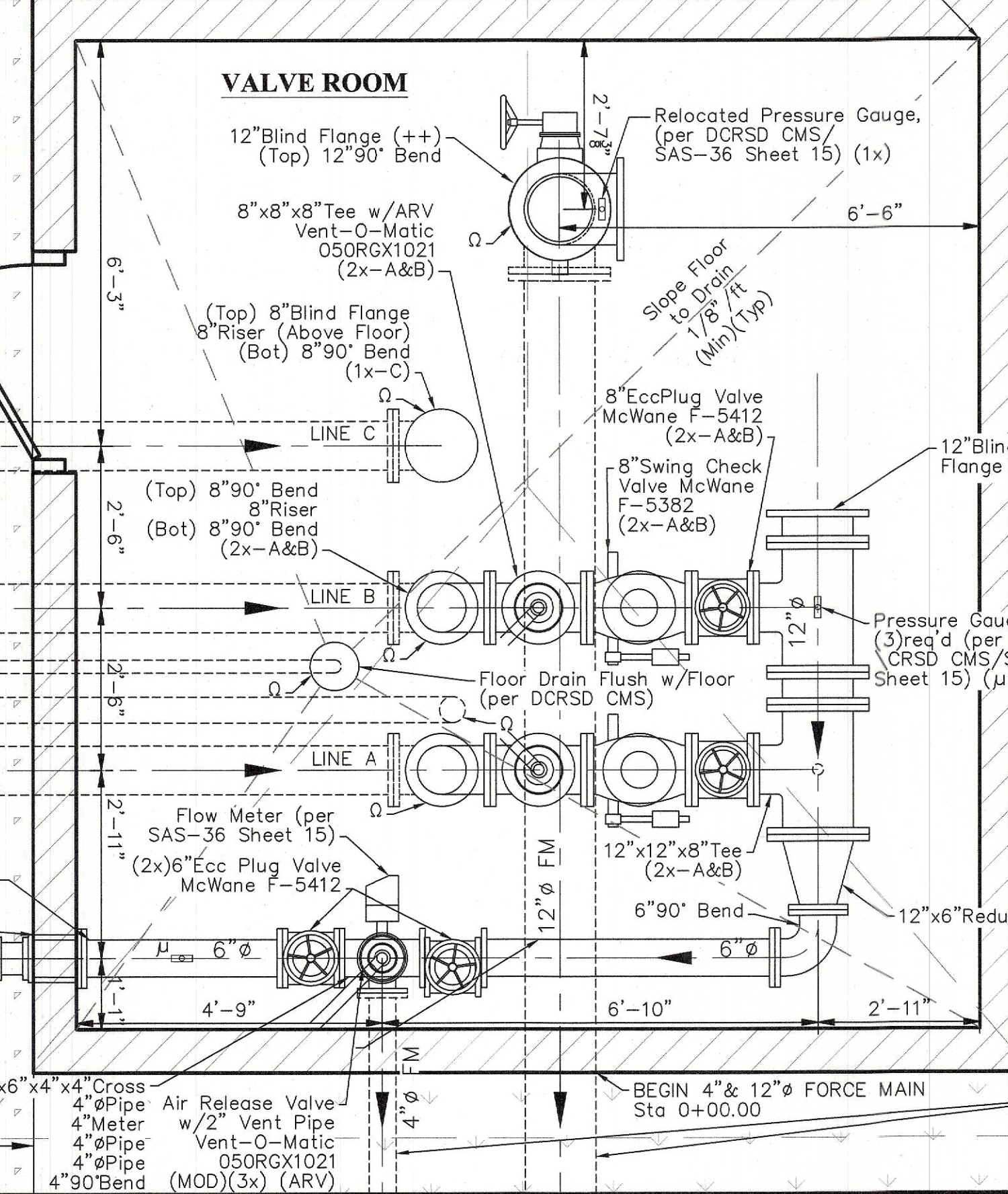
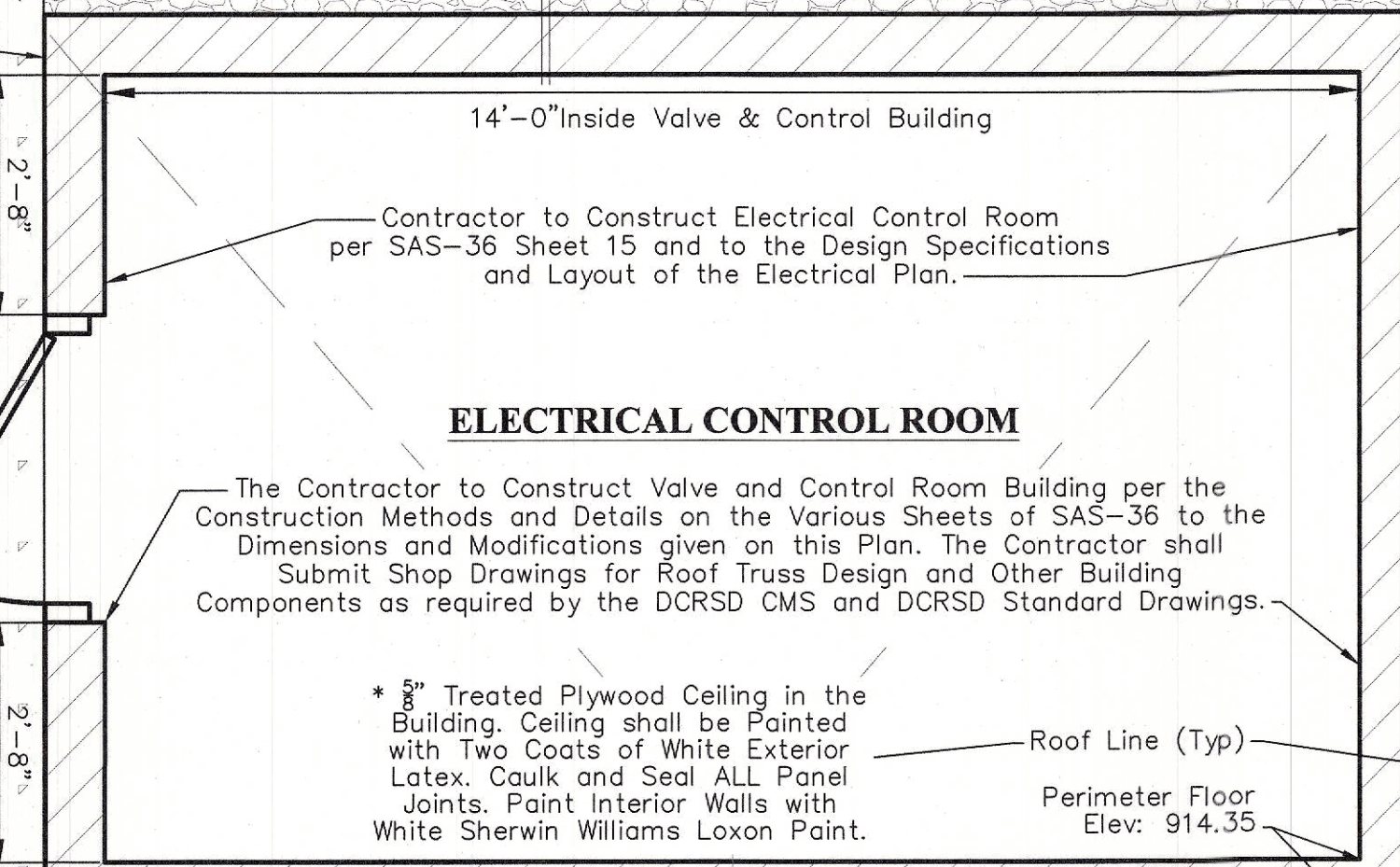
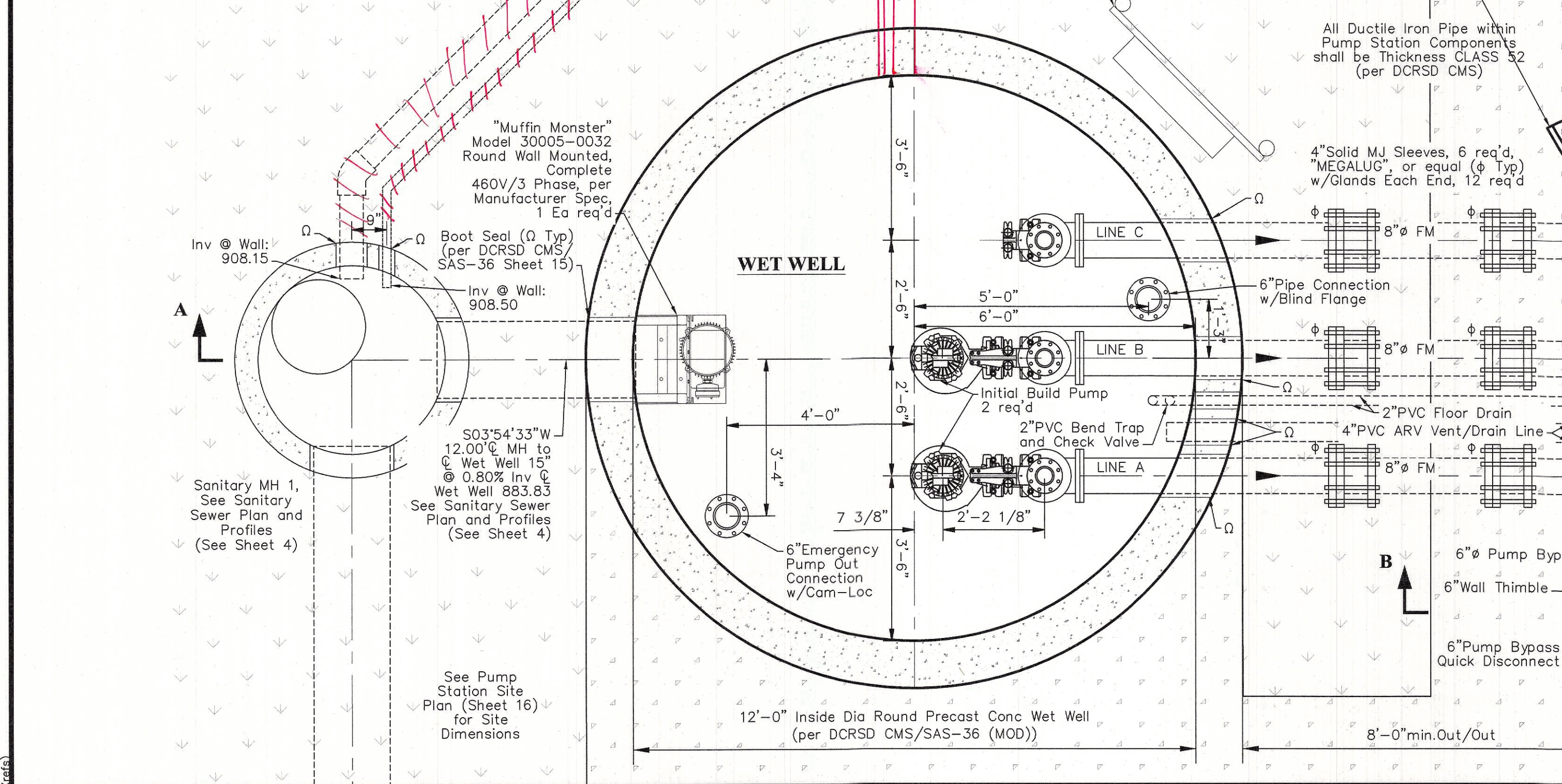


**WET WELL
PLAN VIEW
TOP SLAB**

LEGEND

- ∅ Boot Seal (per DCRSD CMS/ SAS-36 Sheet 15)
- ∅ 4" Solid MJ Sleeves, "MEGALUG", or Equal, w/Glands Each End
- μ Pressure Gauge (per DCRSD CMS/ SAS-36 Sheet 15)
- ARV - Air Release Valve (per DCRSD CMS/ SAS-36 Sheet 15)
- ++ Part to be Installed in Initial Build and Removed for Build Out Installations

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RECORD DOCUMENTS
 THESE DOCUMENTS HAVE BEEN PREPARED BASED ON MARKED-UP DRAWINGS, ADDENDA, CHANGE ORDERS, OR OTHER INFORMATION PROVIDED BY THE CONTRACTOR AND/OR OTHER THIRD PARTIES. EMH&T HAS NOT VERIFIED THE ACCURACY AND/OR COMPLETENESS OF THIS INFORMATION AND IS NOT RESPONSIBLE FOR ANY DEFICIENCIES OR DISCREPANCIES HEREIN.
 PREPARED: 09-06-2019

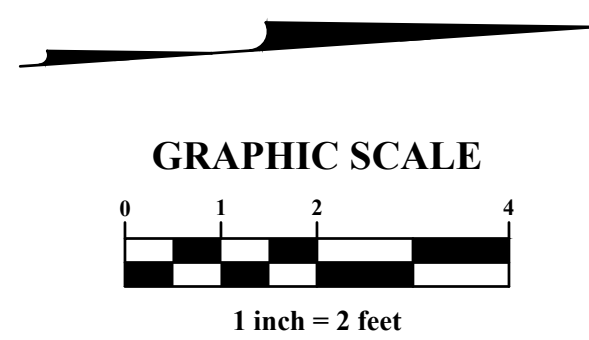
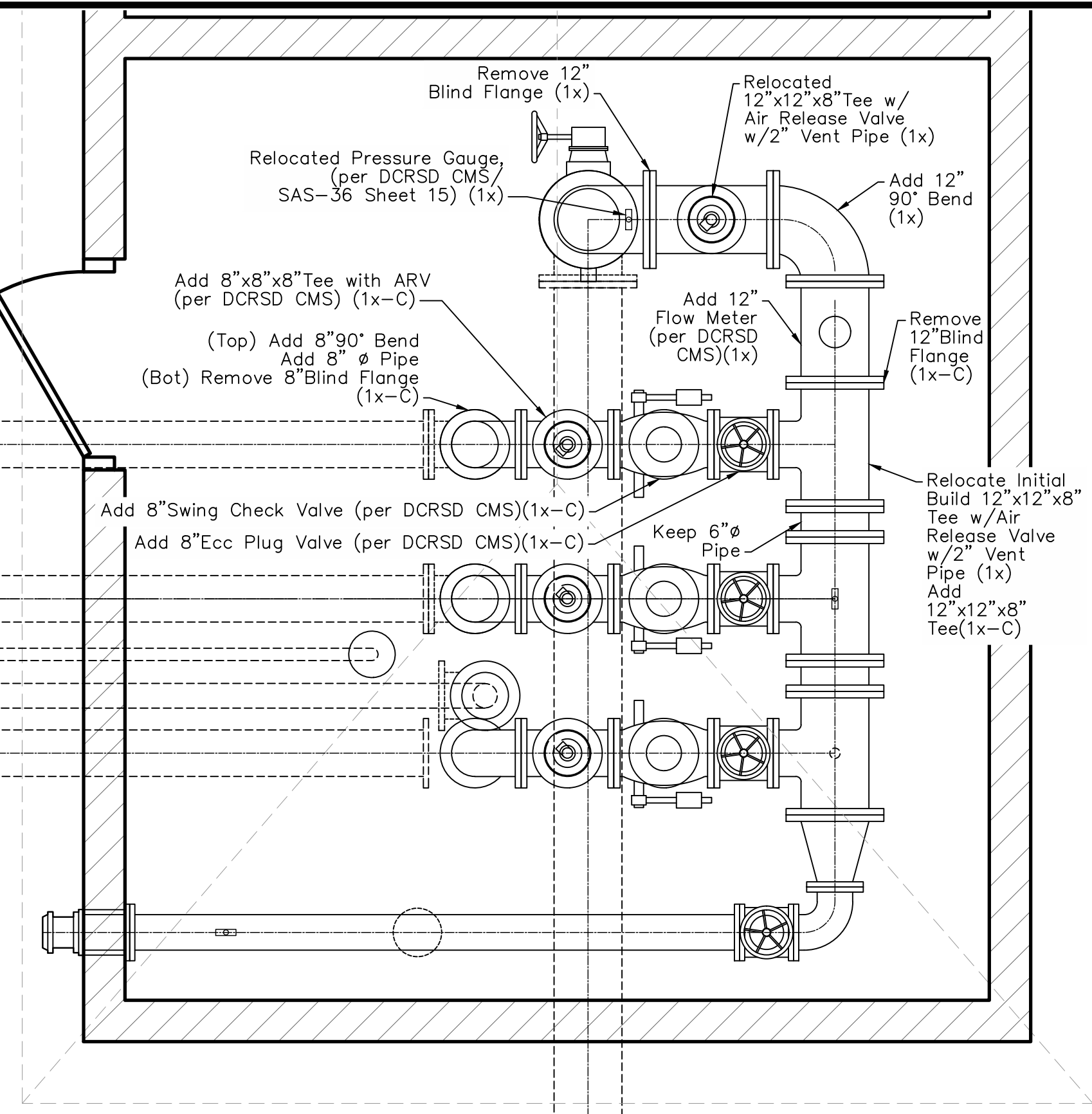
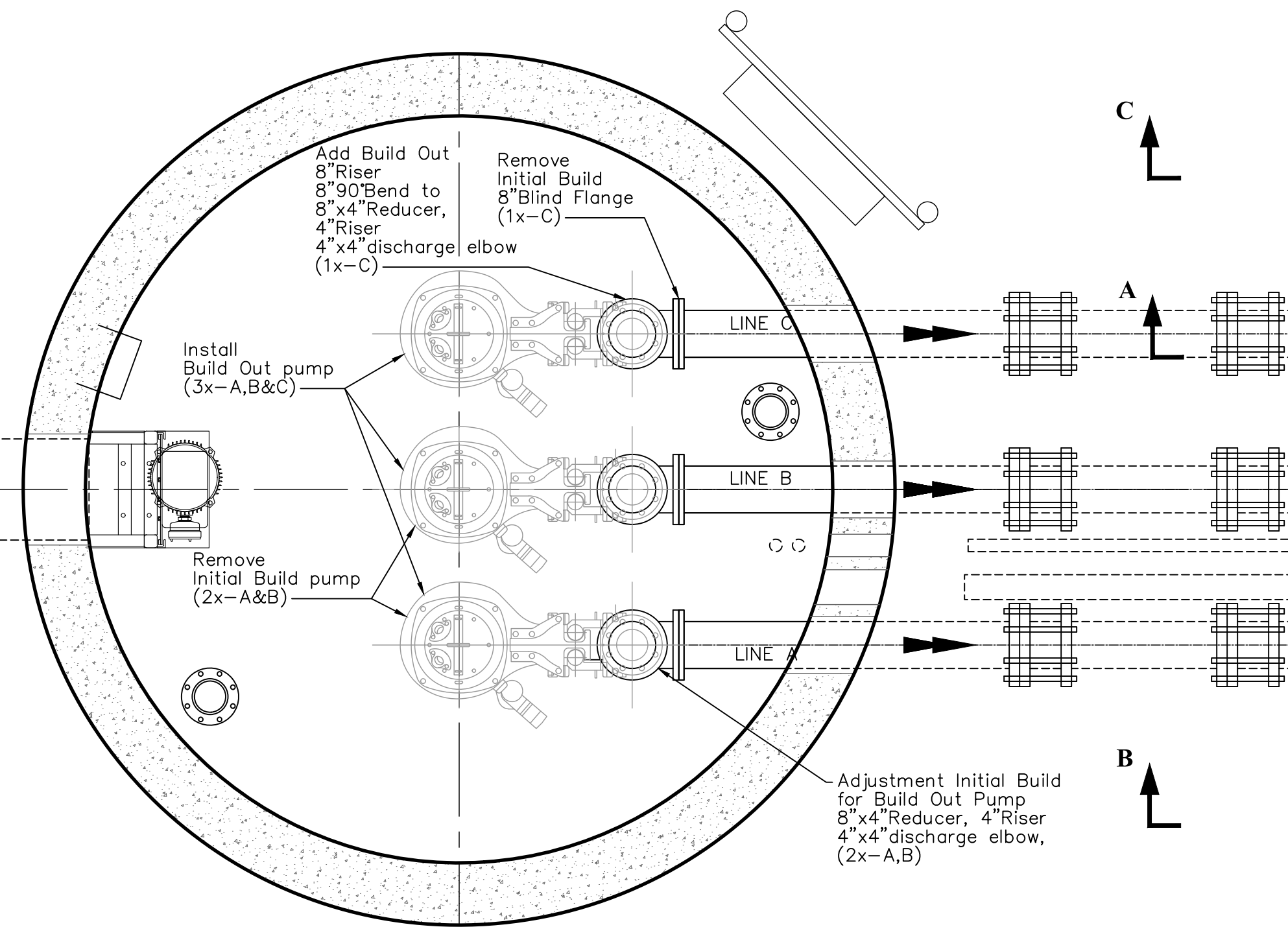
REVISIONS	MARK	DATE	DESCRIPTION

BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
 SANITARY SEWER IMPROVEMENT PLAN
 FOR
THE PINES, SECTION 1
PHASE A & B
 PUMP STATION PLAN VIEW DETAIL



DATE	April 2018
SCALE	1" = 2'
JOB NO.	20170824
SHEET	17/32

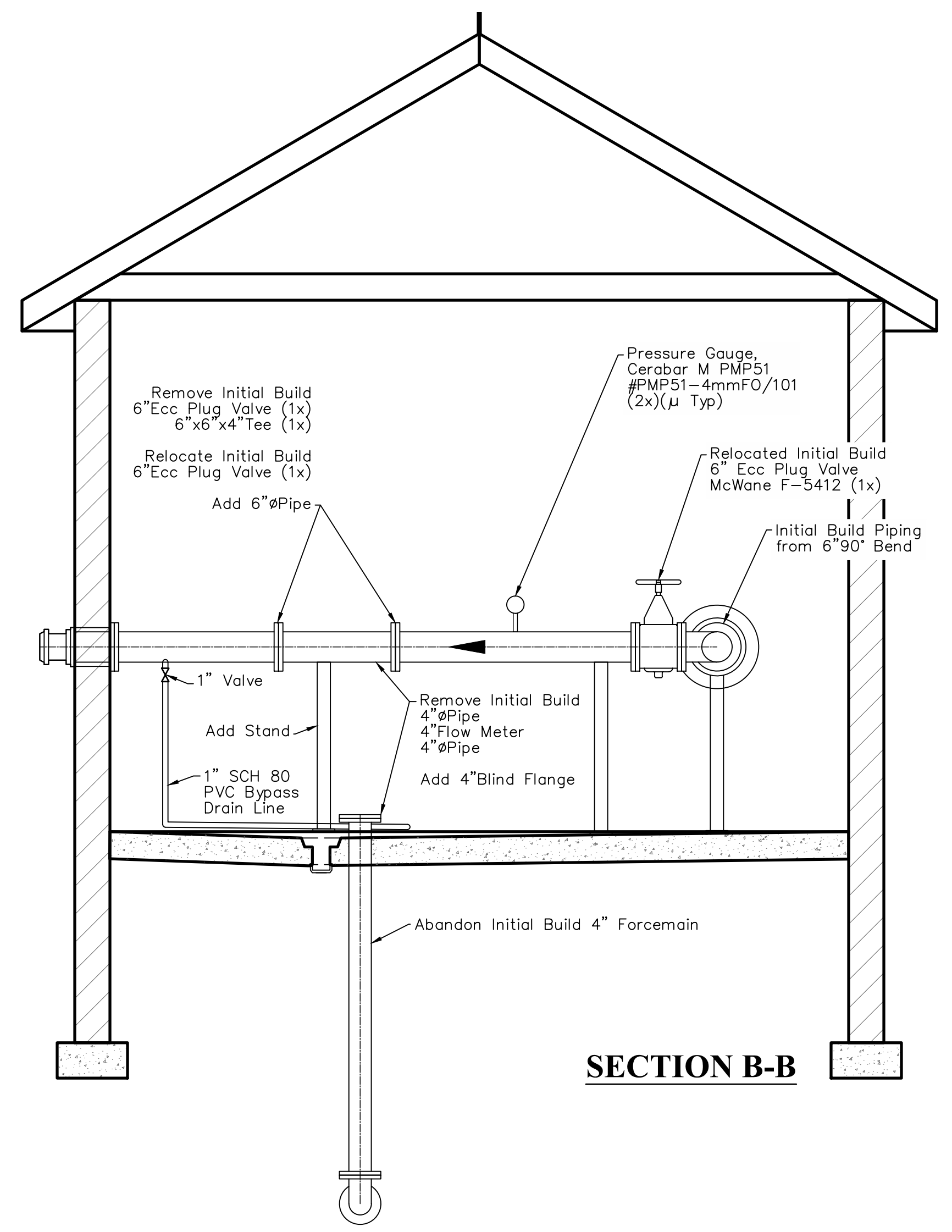
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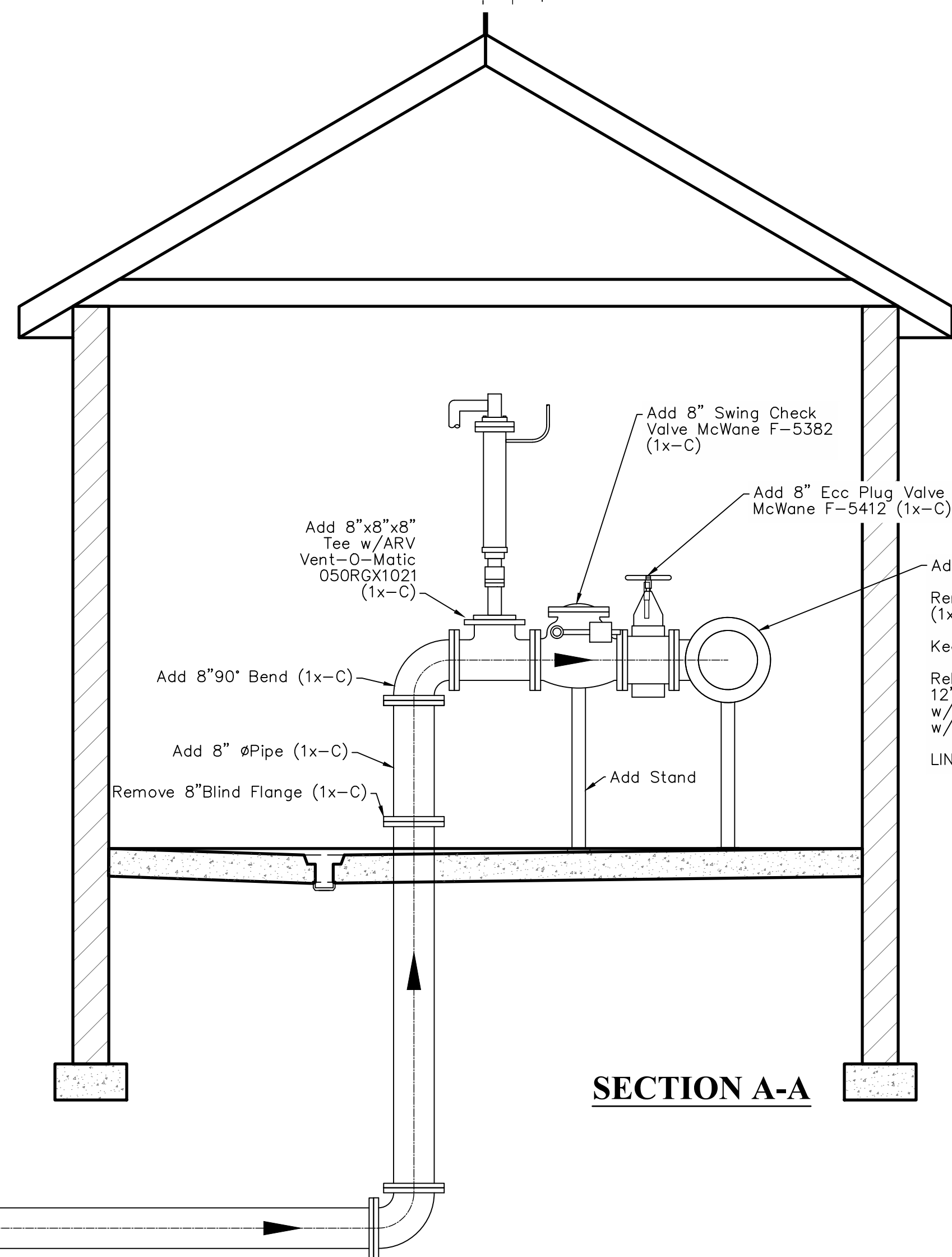
NOTE:
 The Contractor shall order and install all Piping to complete the 12-inch Forcemain prior to port floor to verify proper alignment of future Forcemain. Then Contractor shall then remove the 12-inch Flow Meter and 90° Bend and install the Air Release Valve as shown on the current layout. Two Blind Flanges will be placed as shown on existing layout.

MARK	DATE	DESCRIPTION

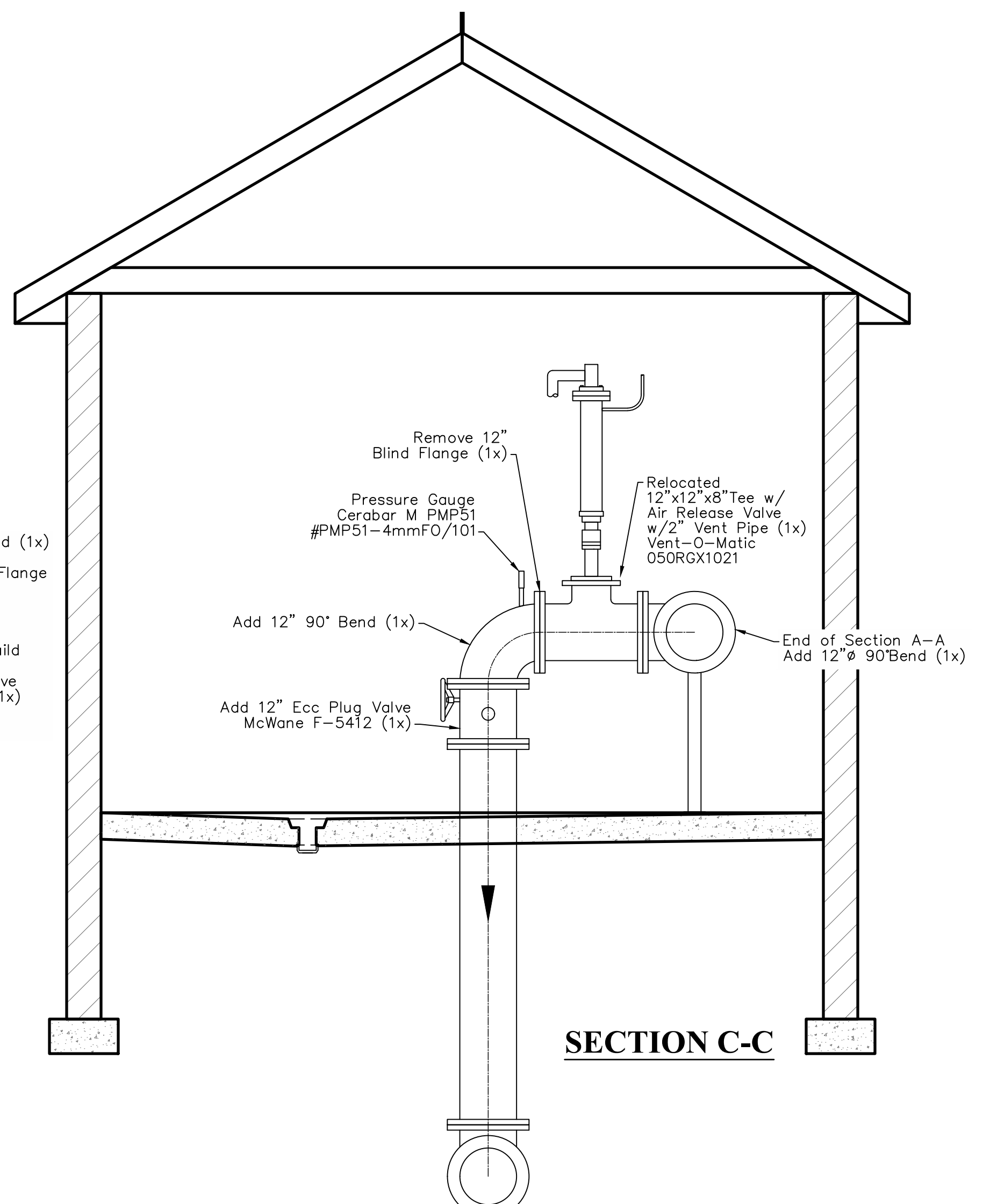
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SECTION B-B

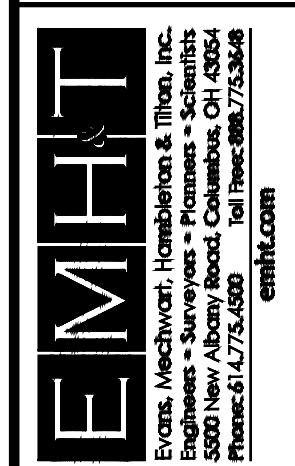


SECTION A-A



SECTION C-C

BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
 SANITARY SEWER IMPROVEMENT PLAN
 FOR
THE PINES, SECTION 1
PHASE A & B
 PUMP STATION PLAN BUILD OUT VIEW DETAIL



DATE	April 2018
SCALE	Horiz: 1" = 2' Vert: 1" = 2'
JOB NO.	20170824
SHEET	19/32

ELECTRICAL INSTALLATION NOTES:

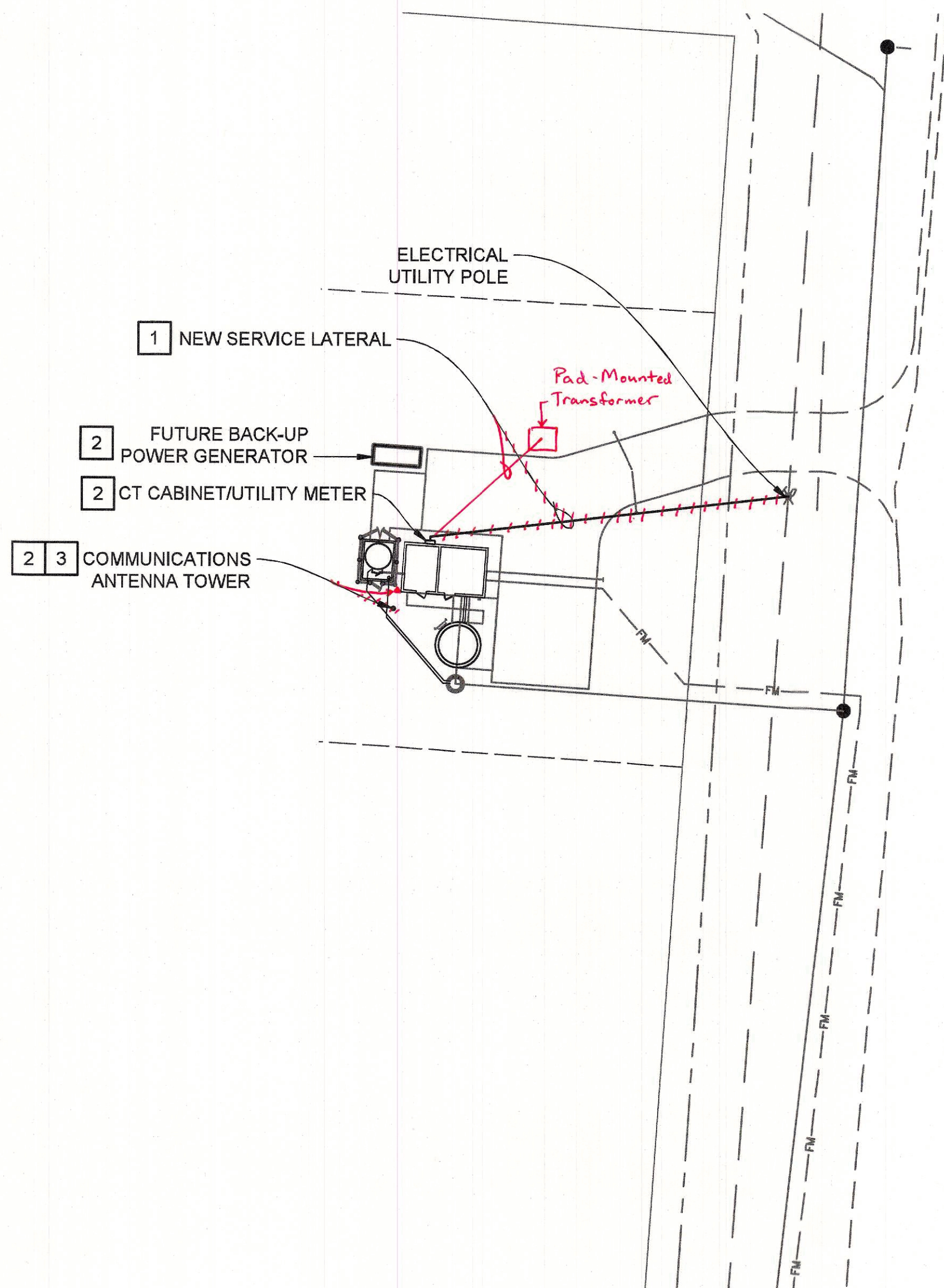
1. PROVIDE (2)-4" CONDUITS IN ELECTRICAL TRENCH FROM CT CABINET TO UTILITY POLE. PROVIDE CONDUCTORS IN ONE CONDUIT (CAP AND MAINTAIN OTHER CONDUIT WITH A PULLSTRING FOR SPARE). TURN UP CONDUITS AT POLE AND MAKE PROVISIONS FOR CONNECTION TO UTILITY SERVICE. COORDINATE EXACT LOCATION AND REQUIREMENTS WITH UTILITY COMPANY PRIOR TO ROUGH-IN. REFER TO SINGLE LINE DIAGRAM, ELECTRICAL TRENCH DETAIL AND ELECTRICAL SERVICE DETAIL FOR ADDITIONAL INFORMATION.
2. PROVIDE AND INSTALL ALL ELECTRICAL SERVICE, DISTRIBUTION, AND CONTROLS EQUIPMENT, PANELS, DEVICES, AND WIRING AS SHOWN OR NOTED. REFERENCE SINGLE LINE DIAGRAM, ELECTRICAL PROFILE, PUMP STATION P&ID AND SPECIFICATIONS.
3. FINAL LOCATION OF COMMUNICATIONS ANTENNA TOWER SHALL BE COORDINATED WITH OWNER AND OWNER'S RADIO PATH STUDY.

GENERAL ELECTRICAL NOTES:

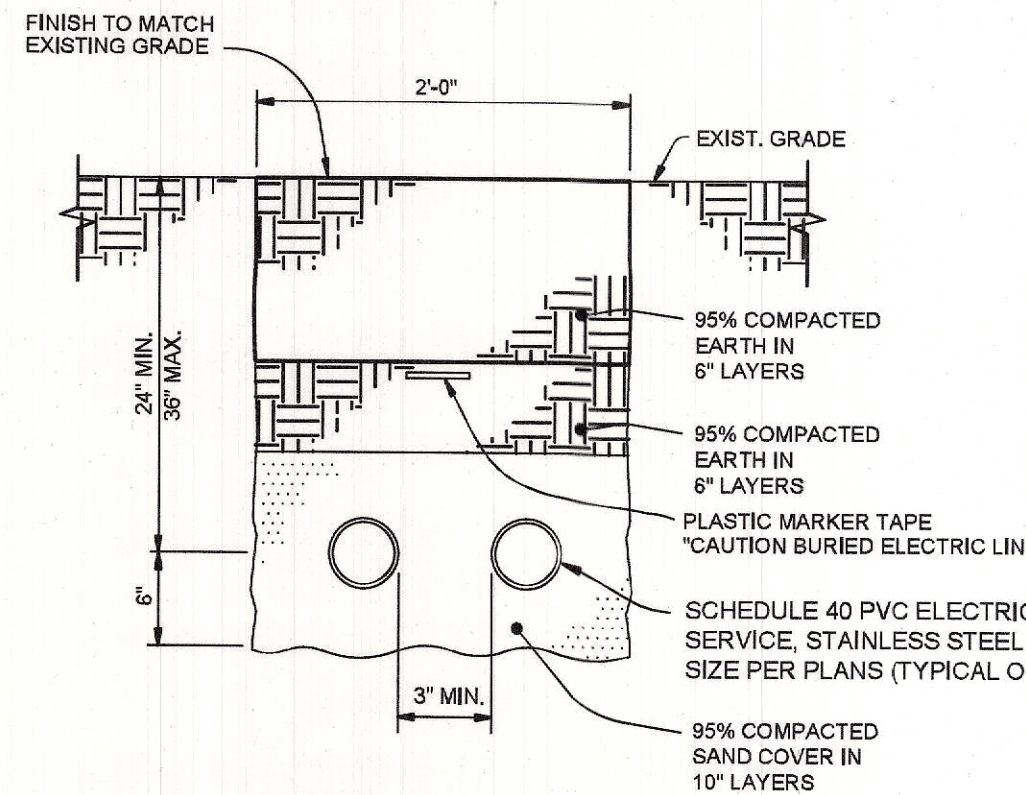
1. THE ELECTRICAL CONTRACTOR SHALL:
 - 1.1. PERFORM ALL WORK SHOWN ON THE DRAWINGS OR REQUIRED TO PROVIDE A COMPLETE INSTALLATION, READY FOR THE OWNER'S USE.
 - 1.2. FURNISH ALL LABOR, MATERIAL, SERVICES AND SKILLED SUPERVISION NECESSARY FOR THE CONSTRUCTION.
 - 1.3. TEST AND ADJUST ALL CIRCUITS AND ELECTRICAL EQUIPMENT SPECIFIED, SHOWN OR NOTED ON THE DRAWINGS.
2. ELECTRICAL CONTRACTOR SHALL SECURE ALL ELECTRICAL PERMITS AS REQUIRED, MAKE ALL NECESSARY APPLICATIONS AND COORDINATE WORK WITH THE LOCAL ELECTRICAL UTILITY COMPANY, INCLUDING METER INSTALLATION, SERVICE ENTRANCE, ETC. FOR A COMPLETE ELECTRICAL INSTALLATION.
3. CONTRACTOR SHALL CONTACT OHIO UTILITIES PROTECTION SERVICE (OUPS) TWO WORKING DAYS PRIOR TO ANY FIELD WORK AT (800)-362-2784. CONTRACTOR SHALL CONTACT ANY NON-OUPS MEMBER UTILITIES DIRECTLY.
4. ALL WORK SHALL BE DONE IN ACCORDANCE WITH ALL LOCAL, STATE AND NATIONAL CODES.
5. ELECTRICAL CONTRACTOR SHALL VISIT SITE AND FAMILIARIZE HIMSELF WITH THE EXISTING CONDITIONS AND WORK TO BE DONE. ELECTRICAL CONTRACTOR SHALL CAREFULLY CHECK PLANS OF ALL DISCIPLINES; THESE ELECTRICAL DRAWINGS ARE TO BE USED AS A GUIDE. ELECTRICAL CONTRACTOR SHALL ASSUME RESPONSIBILITY FOR A COMPLETE AND FUNCTIONING SYSTEM.
6. ALL ITEMS SHALL BE NEW UNLESS OTHERWISE NOTED.
7. ELECTRICAL CONTRACTOR SHALL MAKE ALL NECESSARY WIRING AND CONNECTIONS TO ALL EQUIPMENT FURNISHED BY OTHERS AS NOTED OR SHOWN.
8. INSTALL ALL EQUIPMENT IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS, DETAILS AND DESIGN. EQUIPMENT CALLED OUT BY CERTAIN MANUFACTURERS IS INTENDED TO CREATE A STANDARD. EQUALS WILL BE ACCEPTED UPON APPROVAL.
9. PROVIDE FLEXIBLE CONNECTIONS OF SHORT LENGTH FOR EQUIPMENT SUBJECT TO VIBRATION OR MOVEMENT AND FOR ALL MOTORS. USE LIQUID-TIGHT FLEXIBLE CONDUIT IN WET LOCATIONS. PROVIDE A SEPARATE GROUND CONDUCTOR WITHIN ALL FLEXIBLE CONNECTIONS.
10. PROVIDE AND INSTALL ELECTRICAL DISCONNECTS, CIRCUIT BREAKERS, ETC. SPECIFIED OR REQUIRED.
11. ALL GROUNDING SHALL BE PER NEC ARTICLE 250. PROVIDE SEPARATE GREEN GROUND CONDUCTOR WITH ALL CIRCUITS.
12. UNLESS NOTED OTHERWISE, ALL NEW WIRING SHALL BE COPPER WITH THWN-THHN INSULATION, MINIMUM SIZE #12 AWG. ALL NEW CONDUITS SHALL BE RIGID GALVANIZED STEEL (UNLESS NOTED OTHERWISE), MINIMUM 3/4".
13. PROVIDE PULL STRING IN ALL EMPTY CONDUITS.
14. FINAL LOCATION OF ALL DEVICES SHALL BE COORDINATED WITH CIVIL ENGINEERING PLANS, LAYOUTS AND SPECIFICATIONS.
15. PUMP PACKAGE IS PROVIDED BY OTHERS. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE TO MAKE ALL POWER AND CONTROL WIRING FIELD CONNECTIONS. COORDINATE REQUIREMENTS WITH PUMP PACKAGE SUPPLIER PRIOR TO COMMENCING WORK.
16. CONTRACTOR SHALL ADHERE TO REQUIREMENTS OF TECHNICAL SPECIFICATIONS PROVIDED AS PART OF THIS DRAWING SET.

LEGEND:

- - - SWITCH LEG WIRING
- ⤴ CIRCUIT HOME RUN, LABEL INDICATES PANEL AND CIRCUIT NUMBER.
- ⊕ 240V RECEPTACLE, COORDINATE EXACT TYPE AND NEMA CONFIGURATION.
- ⊕ NEMA 5-20R, 20A, 125V AC STRAIGHT BLADE DUPLEX RECEPTACLE WITH GROUND FAULT CIRCUIT INTERRUPTER (GFCI) PROTECTION.
- ⊕ EXHAUST FAN.
- ⊕ DOOR SWITCH.
- ⊕ SURFACE MOUNT LED FIXTURE W/ WRAP-AROUND PRISMATIC LENS, TAM-LITE NIMROD 17W LED.
- ⊕ EXTERIOR WALL-MOUNTED LED LIGHT FIXTURE, TAM-LITE MODEL #W2LED, 80W, BOROSILICATE LENS.
- ⊕ EMERGENCY LIGHT WEATHER-PROOF REMOTE HEAD.
- ⊕ EMERGENCY BATTERY BACK-UP WITH TWO EMERGENCY LIGHTS. WHERE INSTALLED IN EXTERIOR APPLICATIONS, PROVIDE BATTERY UNIT MOUNTED HIGH ON INTERIOR WALL WITH TWO REMOTE HEADS RATED FOR WET LOCATIONS. PROVIDE SUFFICIENT CAPACITY TO POWER ONE (1) EXTERIOR REMOTE HEAD.
- ⊕ SINGLE-POLE TOGGLE SWITCH, 120V, 20A, WITH WALL PLATE.
- ⊕ HEAVY DUTY WALL MOUNTED PHOTO SENSOR, WEATHERPROOF, 120V, 1800 WATT, SWIVEL MOUNTED, INTERMATIC K4221C OR EQUAL.
- ⊕ HEAVY DUTY WALL MOUNTED OUTDOOR WALL MOUNTED OCCUPANCY SENSOR, 120V, 1000 WATT, WEATHERPROOF, PIR, 200°, COMMERCIAL GRADE, LEVITON PS200-10W OR EQUAL.



ELECTRICAL SITE PLAN
SCALE: 1/32" = 1'-0"



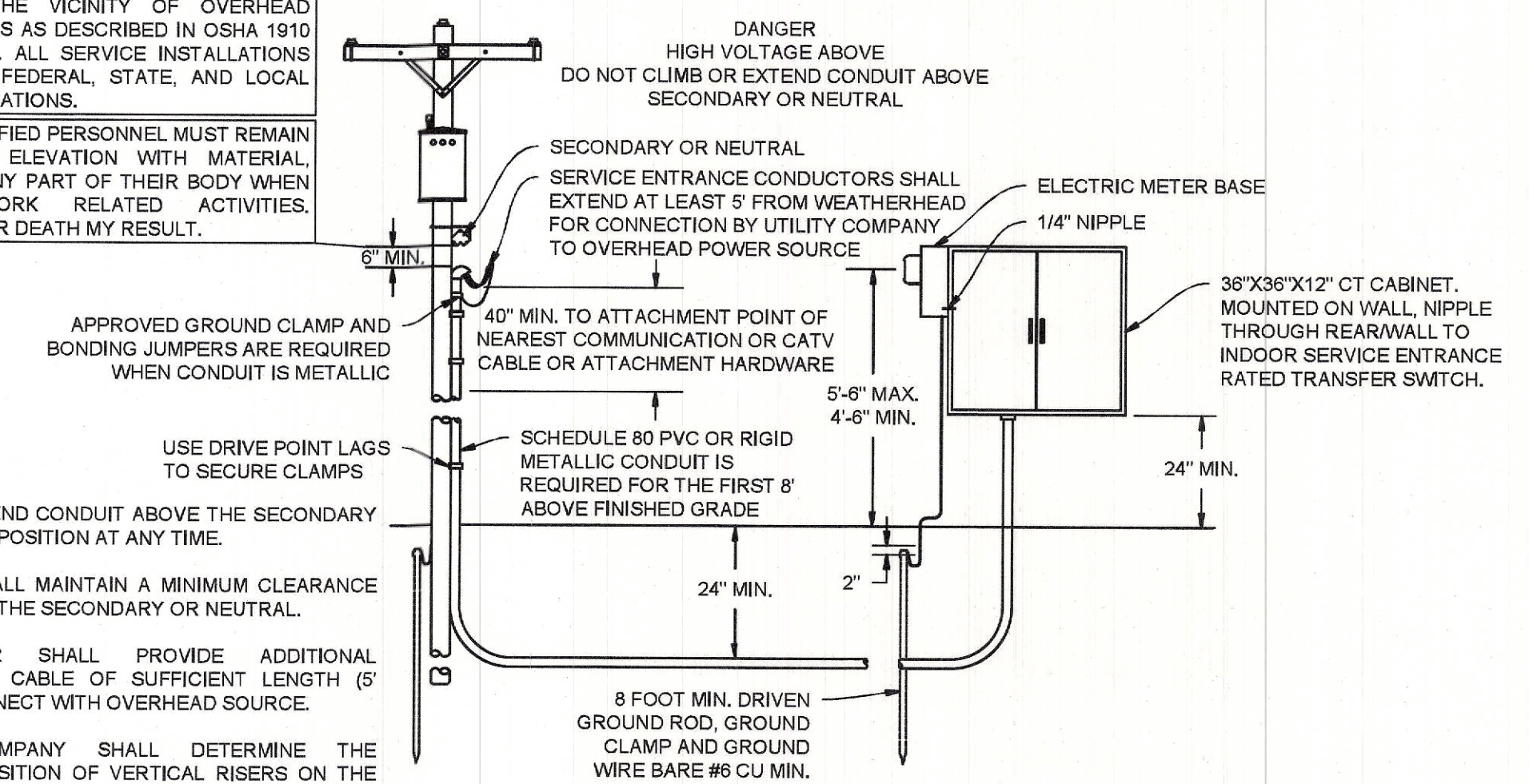
ELECTRICAL TRENCH DETAIL
SCALE: NONE

IT IS THE RESPONSIBILITY OF THE INSTALLER TO BE "QUALIFIED" TO INSTALL ELECTRICAL EQUIPMENT IN THE VICINITY OF OVERHEAD DISTRIBUTION LINES AS DESCRIBED IN OSHA 1910 SUBPARTS R & S. ALL SERVICE INSTALLATIONS SHALL MEET ALL FEDERAL, STATE, AND LOCAL CODES AND REGULATIONS.

CAUTION: UNQUALIFIED PERSONNEL MUST REMAIN 10' BELOW THIS ELEVATION WITH MATERIAL, EQUIPMENT, OR ANY PART OF THEIR BODY WHEN PERFORMING WORK RELATED ACTIVITIES. SERIOUS INJURY OR DEATH MAY RESULT.

NOTES:

1. DO NOT EXTEND CONDUIT ABOVE THE SECONDARY OR NEUTRAL POSITION AT ANY TIME.
2. CONDUIT SHALL MAINTAIN A MINIMUM CLEARANCE OF 6" BELOW THE SECONDARY OR NEUTRAL.
3. CONTRACTOR SHALL PROVIDE ADDITIONAL CONTINUOUS CABLE OF SUFFICIENT LENGTH (5' MIN.) TO CONNECT WITH OVERHEAD SOURCE.
4. UTILITY COMPANY SHALL DETERMINE THE LOCATION/POSITION OF VERTICAL RISERS ON THE POLE BASED ON TRAFFIC FLOW AND LOCATION OF CATV, OR TELEPHONE CO. ATTACHMENTS.

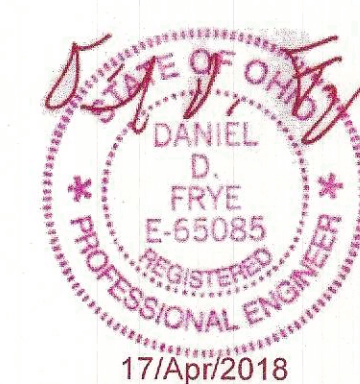


ELECTRICAL SERVICE DETAIL
SCALE: NONE

RECORD DOCUMENTS

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PREPARED: 09-06-2019



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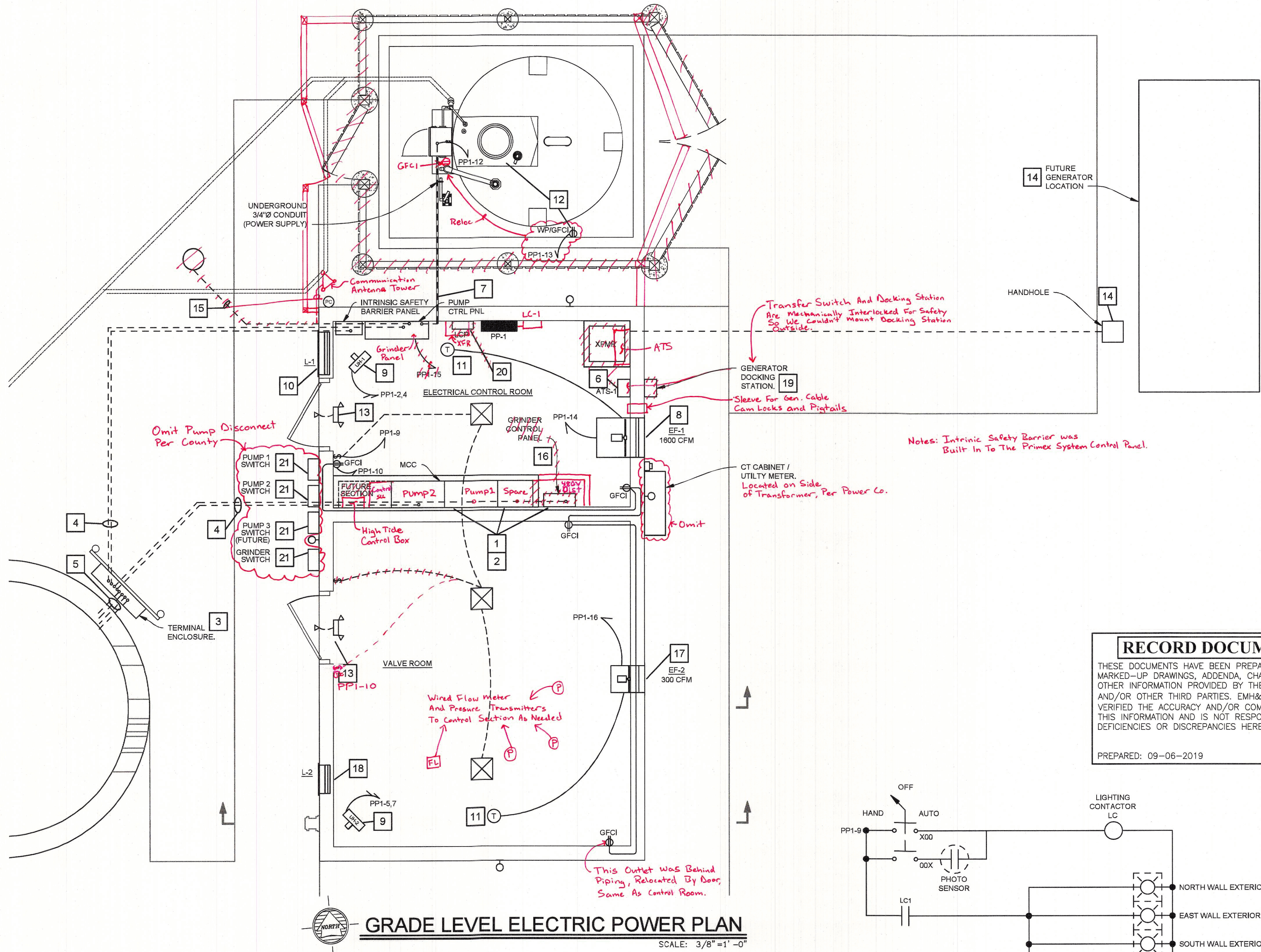
REVISIONS	
MARK	DATE DESCRIPTION

BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
SANITARY SEWER IMPROVEMENT PLAN
FOR
**THE PINES, SECTION 1
PHASE A & B**
ELECTRICAL PLANS AND DETAILS

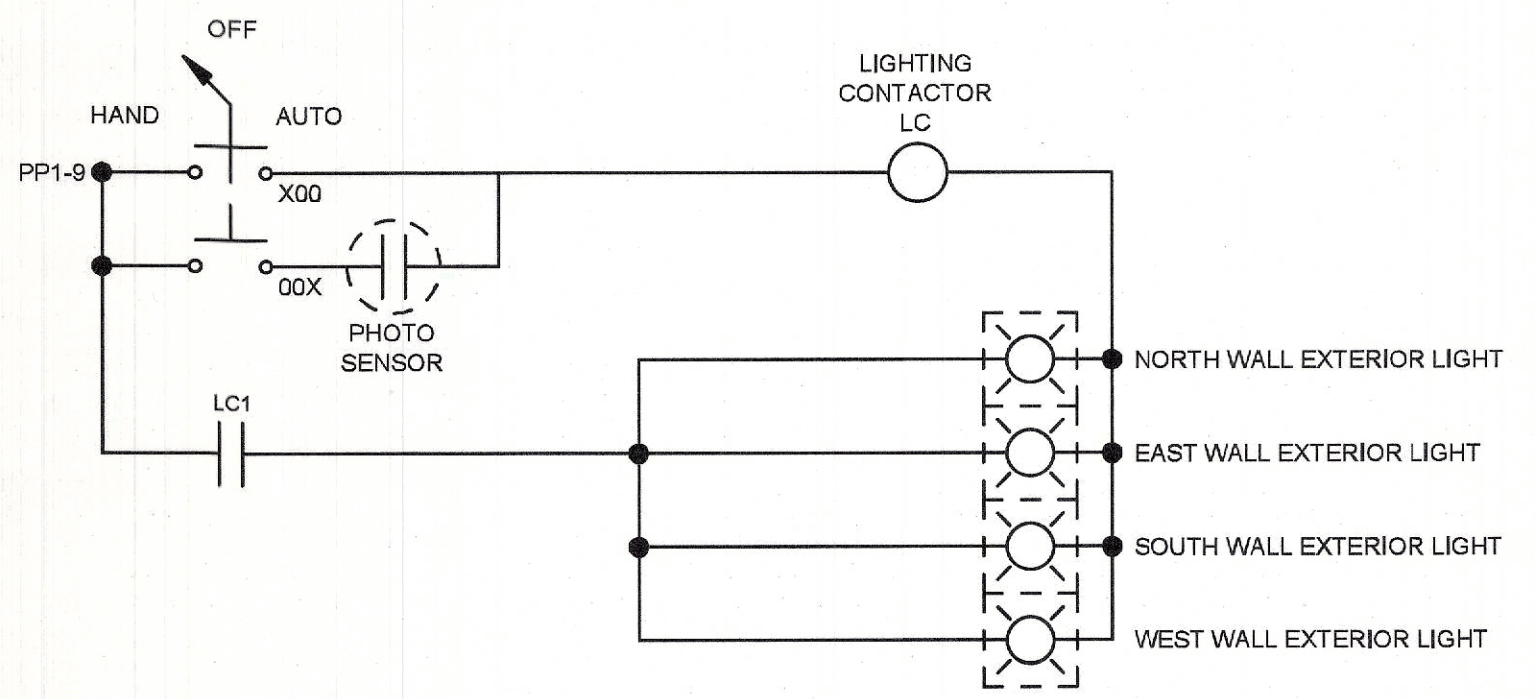
DATE: APRIL 2018
SCALE: As Noted
JOB NO.: 20170824
SHEET: 20/32

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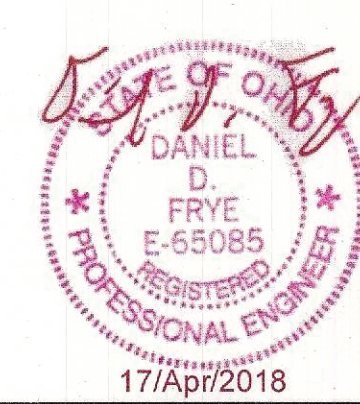
GRADE LEVEL ELECTRIC POWER PLAN
SCALE: 3/8" = 1' - 0"



EXTERIOR BUILDING LIGHTING CONTROL
NO SCALE

ELECTRICAL INSTALLATION NOTES:

- CONNECT ALL POWER AND CONTROL WIRING FOR LEVEL TRANSDUCER AND FLOAT SWITCH TO INPUTS IN CONTROL PANEL. COORDINATE CONDUIT ENTRY INTO PUMP STATION AND CONNECTION REQUIREMENTS TO CONTROL PANEL WITH EQUIPMENT MANUFACTURER.
- PROVIDE AND INSTALL CONTROL PANEL. PROVIDE AND INSTALL MOTOR CONTROL CENTER (MCC). ALL DISCONNECTS IN MCC SHALL HAVE LOCKABLE OPERATORS ACCESSIBLE WITHOUT OPENING ENCLOSURE. INSTALL ON 3" CONCRETE HOUSEKEEPING PAD. DO NOT PROVIDE OR INSTALL THIRD DUTY PUMP SECTION AT THIS TIME, BUT LEAVE SPACE ON PAD. PROVIDE PROVISIONS IN MCC FOR ADDITION OF THE SECTION IN FUTURE AND PROVIDE ALL CONDUITS NECESSARY FOR FUTURE WIRING, CAPPED AT BOTH ENDS.
- PROVIDE AND INSTALL A NEMA 4X, STAINLESS STEEL ENCLOSURE WITH WIRE TERMINALS FOR ACCESSIBLE TERMINATION OF PUMP LEADS, LEVEL TRANSDUCER CONNECTIONS, AND FLOAT SWITCH CONNECTION AT THE WET WELL. THE ENCLOSURE DEPICTED MEASURES 27"W X 39"W X 12"D. IT IS THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR TO SIZE THE ENCLOSURE TO ALLOW FOR THE PUMP CABLES AS WELL AS ALL OTHER CABLING AND WIRING. SIZE TO ACCOMMODATE ALL FUTURE PUMP WIRING SHOWN ON DRAWING AS WELL. SUBMIT ENCLOSURE CUT SHEET AND SIZING CALCULATIONS FOR REVIEW. MOUNT ON 1-5/8" STAINLESS STEEL UNISTRUT POSTS THAT ARE CAST INTO CONCRETE OR BOLTED TO THE WET WELL CONCRETE CASING. LOCATION SHOWN IS APPROXIMATE. CONTRACTOR MAY ADJUST POSITION AROUND PERIMETER OF WET WELL TO BEST AVOID INTERFERENCES.
- ROUTE STAINLESS STEEL RIGID CONDUITS TO UNDERGROUND AS SHOWN. SIZE ACCORDING TO N.E.C., MINIMUM SIZE IS 3/4". VERIFY ROUTING WITH OWNER AND ALL OTHER TRADES IN ORDER TO AVOID INTERFERENCES. NOTE: QUANTITY OF CONDUITS SHOWN ON PLAN IS NOT NECESSARILY ACCURATE, BUT IS ONLY REPRESENTATIVE OF SUGGESTED ROUTES OF CONDUITS IN QUANTITIES AS NECESSARY FOR THE WIRING BETWEEN POINTS. CONTRACTOR SHALL PROVIDE CONDUITS FOR FUTURE WIRING AS WELL, CAPPED AT BOTH ENDS.
- ROUTE STAINLESS STEEL RIGID CONDUITS FROM TERMINAL ENCLOSURE DOWN INTO THE WET WELL, THROUGH SIDE WALL OF WET WELL. ROUTE ALL WIRING FROM THE WET WELL THROUGH THESE CONDUITS. ROUTE PUMP MOTOR CABLES EACH THROUGH A SEPARATE DEDICATED CONDUIT, SIZED TO ALLOW EASY REPLACEMENT OF THE PUMP. ROUTE THE FLOAT SWITCH THROUGH A DEDICATED CONDUIT, SIZED TO ALLOW EASY REPLACEMENT. ROUTE THE CAPACITANCE PROBE CABLE THROUGH A DEDICATED CONDUIT, SIZED TO ALLOW EASY REPLACEMENT. PROVIDE GAS SEALS AND SEALING WYES IN EACH CONDUIT BETWEEN THE TERMINATION ENCLOSURE AND THE WET WELL. INSTALL EXPLOSION PROOF SEALING COMPOUND AND PACKING/WADDING MADE BY APLETON PER MANUFACTURERS INSTRUCTIONS AFTER ALL WIRING IS IN PLACE AND HAS BEEN THOROUGHLY TESTED. NOTE: QUANTITY OF CONDUITS SHOWN ON PLAN IS NOT NECESSARILY ACCURATE. CONTRACTOR SHALL PROVIDE CONDUITS FOR FUTURE WIRING AS WELL, CAPPED AT BOTH ENDS.
- PROVIDE AND INSTALL NEW AUTOMATIC TRANSFER SWITCH. PLACE ATS INTO MANUAL OPERATING MODE.
- PROVIDE AND INSTALL (1) 1" STAINLESS STEEL RIGID CONDUIT FROM THE BIOXIDE CONTROL PANEL TO THE PUMP STATION CONTROL PANEL WITH LOW LEVEL ALARM WIRING.
- PROVIDE AND INSTALL (1) GREENHECK MODEL SE1-16-428-B6 EXHAUST FAN EF-1 WITH BACKDRAFT DAMPER MODEL WD-320 OR APPROVED EQUAL. COORDINATE MOUNTING HEIGHT AND LOCATION WITH OTHER TRADES PRIOR TO ROUGH-IN.
- PROVIDE AND INSTALL (2) QMARK MODEL MUH35 ELECTRIC FAN FORCED UNIT HEATERS, UH-1 AND UH-2, WITH FACTORY MANUFACTURED MOUNTING BRACKETS AND HARDWARE, OR APPROVED EQUAL.
- PROVIDE AND INSTALL (1) GREENHECK MODEL ECD-801 24"W X 32"H COMBINATION DRAINABLE BLADE LOUVER AND DAMPER L-1. PROVIDE WITH MOTORIZED ACTUATOR. COORDINATE WITH ARCHITECT FOR LOUVER COLOR. COORDINATE MOUNTING HEIGHT AND LOCATION WITH OTHER TRADES PRIOR TO ROUGH-IN.
- PROVIDE HEATING/COOLING THERMOSTAT TO ENERGIZE FAN WHEN ROOM TEMPERATURE EXCEEDS 80°F AND OPEN INTAKE DAMPER. THERMOSTAT SHALL ENERGIZE UNIT HEATER WHEN ROOM TEMPERATURE IS BELOW 60°F.
- PROVIDE AND INSTALL SELF REGULATING HEAT TRACE ALONG ENTIRE LENGTH OF ALL ABOVE GROUND CHEMICAL FEED PIPING.
- CONNECT EMERGENCY LIGHT TO LOCAL LIGHTING CIRCUIT AHEAD OF ALL SWITCHING.
- PROVIDE ALL CONDUITS SHOWN IN SINGLE LINE DIAGRAM FOR FUTURE GENERATOR. RUN OUT OF BUILDING UNDERGROUND, ADDENDA, CHANGE ORDERS, OR OTHER INFORMATION PROVIDED BY THE CONTRACTOR AND/OR OTHER THIRD PARTIES. EMH&T HAS NOT VERIFIED THE ACCURACY AND/OR COMPLETENESS OF THIS INFORMATION AND IS NOT RESPONSIBLE FOR ANY DEFICIENCIES OR DISCREPANCIES HEREIN.
PREPARED: 09-06-2019
- INSTALL CONTROL PANEL PROVIDED BY GRINDER SUPPLIER.
- PROVIDE AND INSTALL (1) GREENHECK MODEL SE1-10-428-P EXHAUST FAN EF-2 WITH BACKDRAFT DAMPER MODEL WD-320 OR APPROVED EQUAL. COORDINATE MOUNTING HEIGHT AND LOCATION WITH OTHER TRADES PRIOR TO ROUGH-IN.
- PROVIDE AND INSTALL (1) GREENHECK MODEL ECD-801 16"W X 24" H COMBINATION DRAINABLE BLADE LOUVER AND DAMPER L-2. PROVIDE WITH MOTORIZED ACTUATOR. COORDINATE WITH ARCHITECT FOR LOUVER COLOR. COORDINATE MOUNTING HEIGHT AND LOCATION WITH OTHER TRADES PRIOR TO ROUGH-IN.
- PROVIDE AND INSTALL GENERATOR DOCKING STATION. REFERENCE SINGLE LINE DIAGRAM, MODEL NUMBER IN SINGLE LINE CALLS FOR CAM-LOK RECEPTACLES FOR GENERATOR. PROVIDE DOCKING STATION INSTEAD WITH CROUSE-HINDS AR1041-S22100A, 600V PIN AND SLEEVE REVERSE SERVICE RECEPTACLE.
- PROVIDE AND INSTALL LIGHTING CONTROL PANEL FOR EXTERIOR LIGHTING. REFERENCE CONTROL DIAGRAM. SUBMIT CONTROL PANEL SHOP DRAWINGS FOR APPROVAL.
- PROVIDE AND INSTALL NEMA 4X STAINLESS STEEL HEAVY DUTY NON-FUSIBLE DISCONNECT SWITCH WITH AUXILIARY CONTACT. ROUTE PUMP POWER WIRING THROUGH SWITCH. PROVIDE CONDUIT PROVISIONS NOW FOR FUTURE SWITCH. SUBMIT SWITCH CUT SHEETS FOR APPROVAL.



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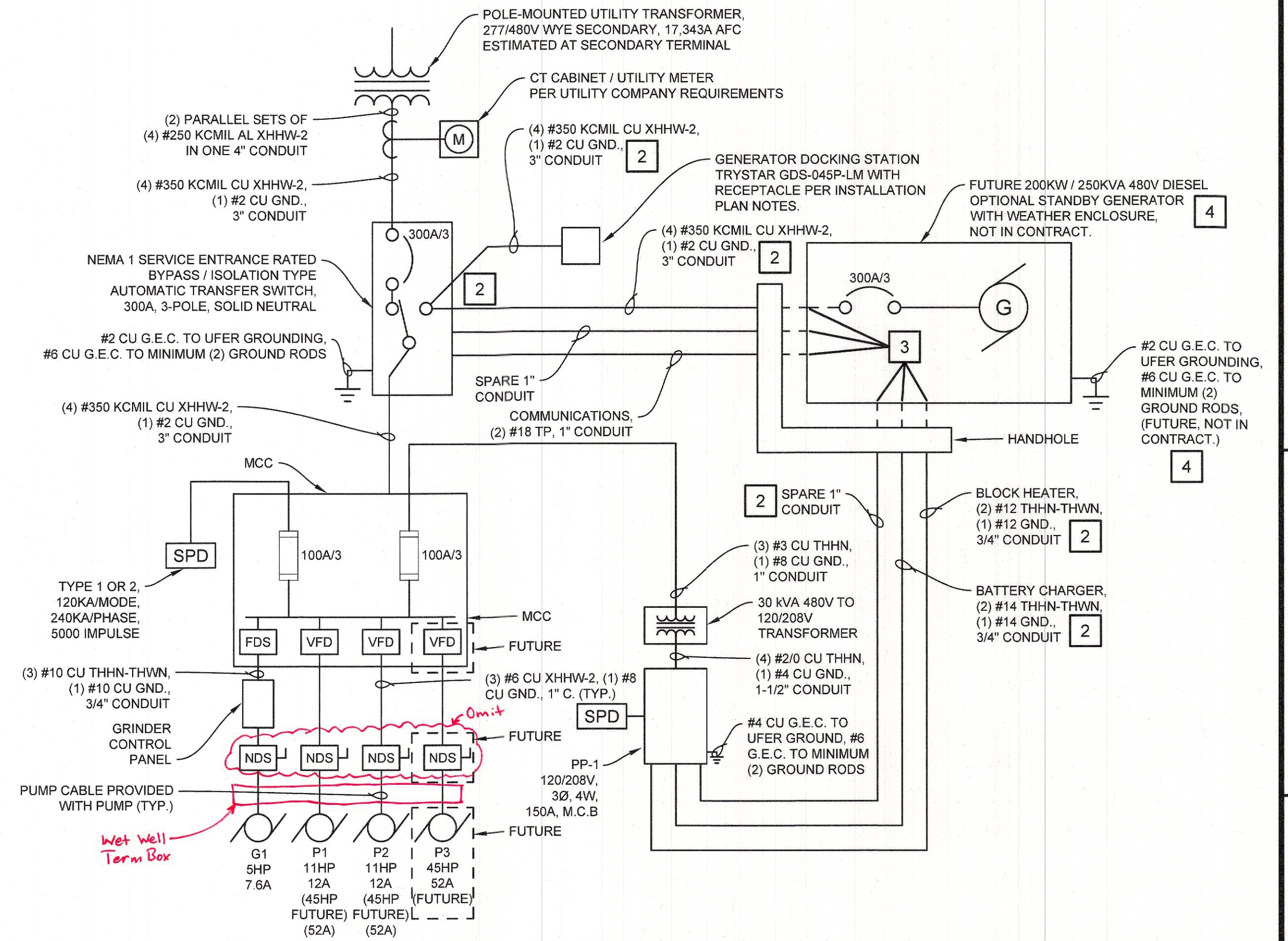
REVISIONS	MARK	DATE	DESCRIPTION

BRELL TOWNSHIP, DELAWARE COUNTY, OHIO
SANITARY SEWER IMPROVEMENT PLAN
FOR
**THE PINES, SECTION 1
PHASE A & B**
ELECTRICAL POWER PLAN AND PROFILE

DATE	APRIL 2018
SCALE	As Noted
JOB NO.	20170824
SHEET	21/32

ELECTRICAL INSTALLATION NOTES:

1. PROVIDE AND INSTALL ALL ELECTRICAL SERVICE, DISTRIBUTION, AND CONTROLS EQUIPMENT, PANELS, DEVICES, AND WIRING AS SHOWN OR NOTED. REFERENCE SINGLE LINE DIAGRAM, ELECTRICAL PROFILE AND SPECIFICATIONS.
2. INSTALL CONDUITS FOR FUTURE GENERATOR FROM CABINETS INSIDE BUILDING TO HANDHOLE OUTSIDE BUILDING. CONDUCTORS SHOWN ARE FUTURE, NOT IN CONTRACT.
3. FUTURE CONDUIT EXTENSIONS TO FUTURE GENERATOR, NOT IN CONTRACT.
4. FUTURE GENERATOR, NOT IN CONTRACT.



1 ELECTRICAL SINGLE-LINE DIAGRAM
NO SCALE

Panel: PP1		Size: 200 Amps	Interior: CU	Main Breaker: 150A	AIC Rating: 10,000 A					
		Voltage: 120/208 VOLTS, 3PH, 4W.	Box: NEMA 1	Eq.Gr.Bar: CU	Series Rating: N/A					
		Mains: M.C.B.	Cover: NEMA 1	IG Bar: N/A	Mounting: SURFACE					
CKT NO	BRKR	DESCRIPTION	TAG NO	LOAD (KW) CONNECTED			LOAD (KW) CALCULATED			Comments
				A	B	C	DF	A	B	
1				0.00			1.00	0.00		
3	30/3	SURGE PROTECTIVE DEVICE					1.00	0.00		
5							1.00		0.00	
7	20/2	VALVE ROOM UH-2		1.87			1.00	1.87		
9					1.87		1.00	1.87		
11	20/1	LIGHTING				0.26	1.25		0.33	
13	20/1	RECEPTACLE, BIOXIDE HEAT TRACE		0.13			1.00	0.13		
15	20/1	SPARE							0.00	
17	20/1	SCADA / PUMP CONTROL PANEL				0.50	1.00		0.50	
19	20/1	SPARE							0.00	
21		SPACE							0.00	
23		SPACE							0.00	
25		SPACE							0.00	
27		SPACE							0.00	
29		SPACE							0.00	
2	20/2	ELECTRIC ROOM UH-1		1.87			1.00	1.87		
4					1.87		1.00	1.87		
6	20/1	SPARE							0.00	
8	20/1	SPARE							0.00	
10	20/1	INTERIOR RECEPTACLES				0.72	1.00		0.72	
12	20/1	BIOXIDE CONTROL PANEL				0.50	1.00		0.50	
14	20/1	ELECTRIC ROOM EF-1		0.69			1.00	0.69		
16	20/1	VALVEROOM EF-2				0.08	1.00		0.08	
18	20/1	SPARE							0.00	
20	20/1	SPARE							0.00	
22		SPACE							0.00	
24		SPACE							0.00	
26		SPACE							0.00	
28		SPACE							0.00	
30		SPACE							0.00	
ALL PANELBOARD EQUIPMENT IS SPECIFIED USING S.Q.D MODEL NUMBERS.				Total KW (CONNECTED)			Total Kw (Calculated)			Total
				4.56	4.54	1.26	4.56	4.54	1.33	10.43
				Total Amps (CONNECTED)			Total Amps (Calculated)			
				38.00	37.83	10.50	38.00	37.83	11.04	

PANEL SCHEDULE
SCALE: NONE

RECORD DOCUMENTS

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PREPARED: 09-06-2019

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17/APR/2018
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MARK	DATE	DESCRIPTION

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BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
SANITARY SEWER IMPROVEMENT PLAN
FOR
THE PINES, SECTION 1
PHASE A & B
PUMP STATION P&ID AND SINGLE LINE DIAGRAM

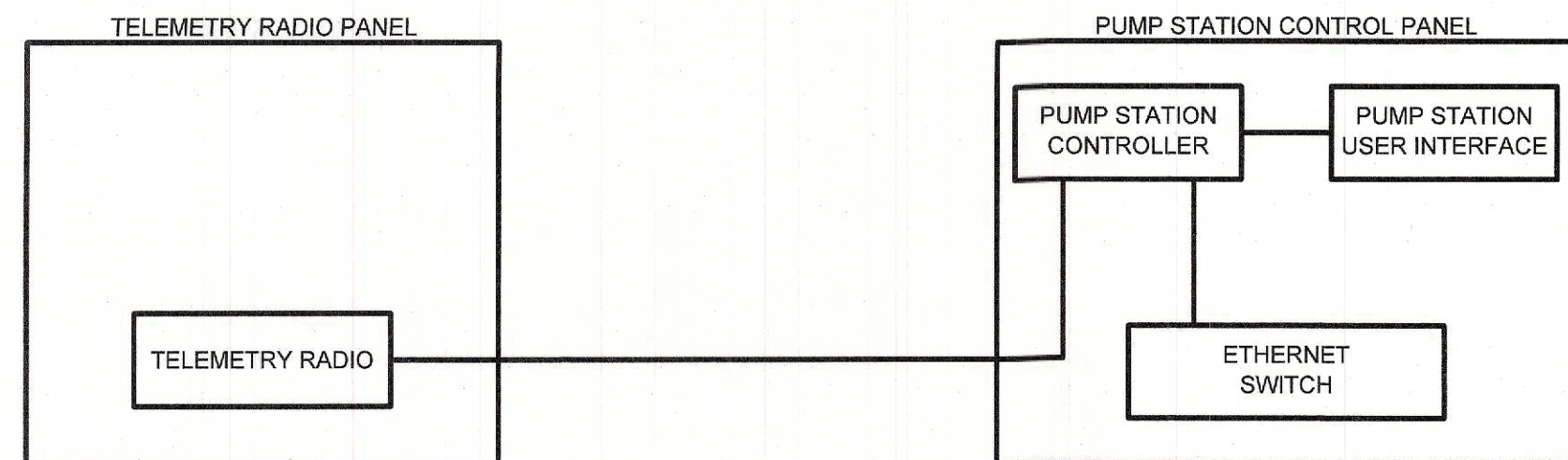
DATE
APRIL 2018

SCALE
As Noted

JOB NO.
20170824

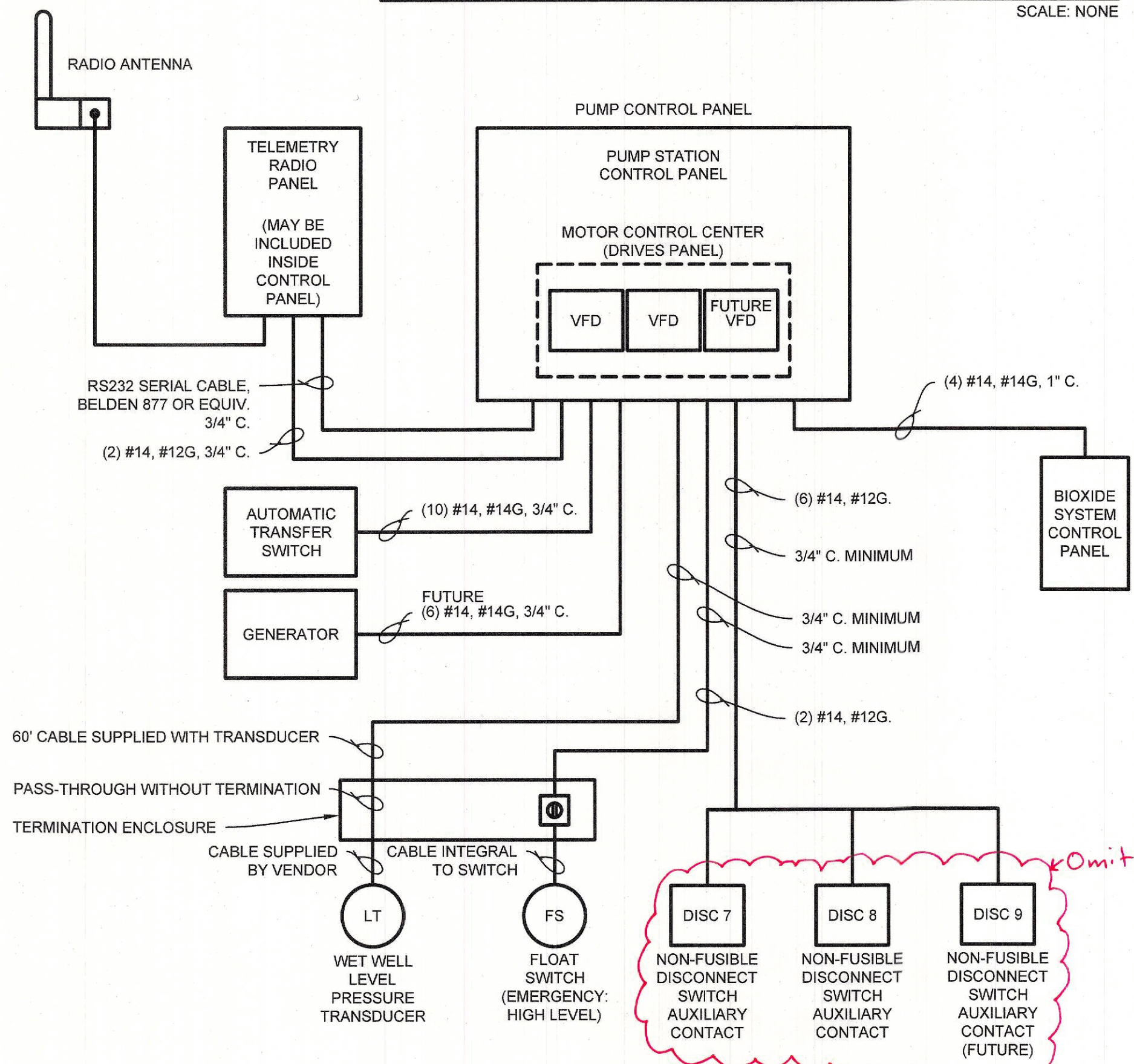
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PUMP STATION NETWORK DIAGRAM

SCALE: NONE



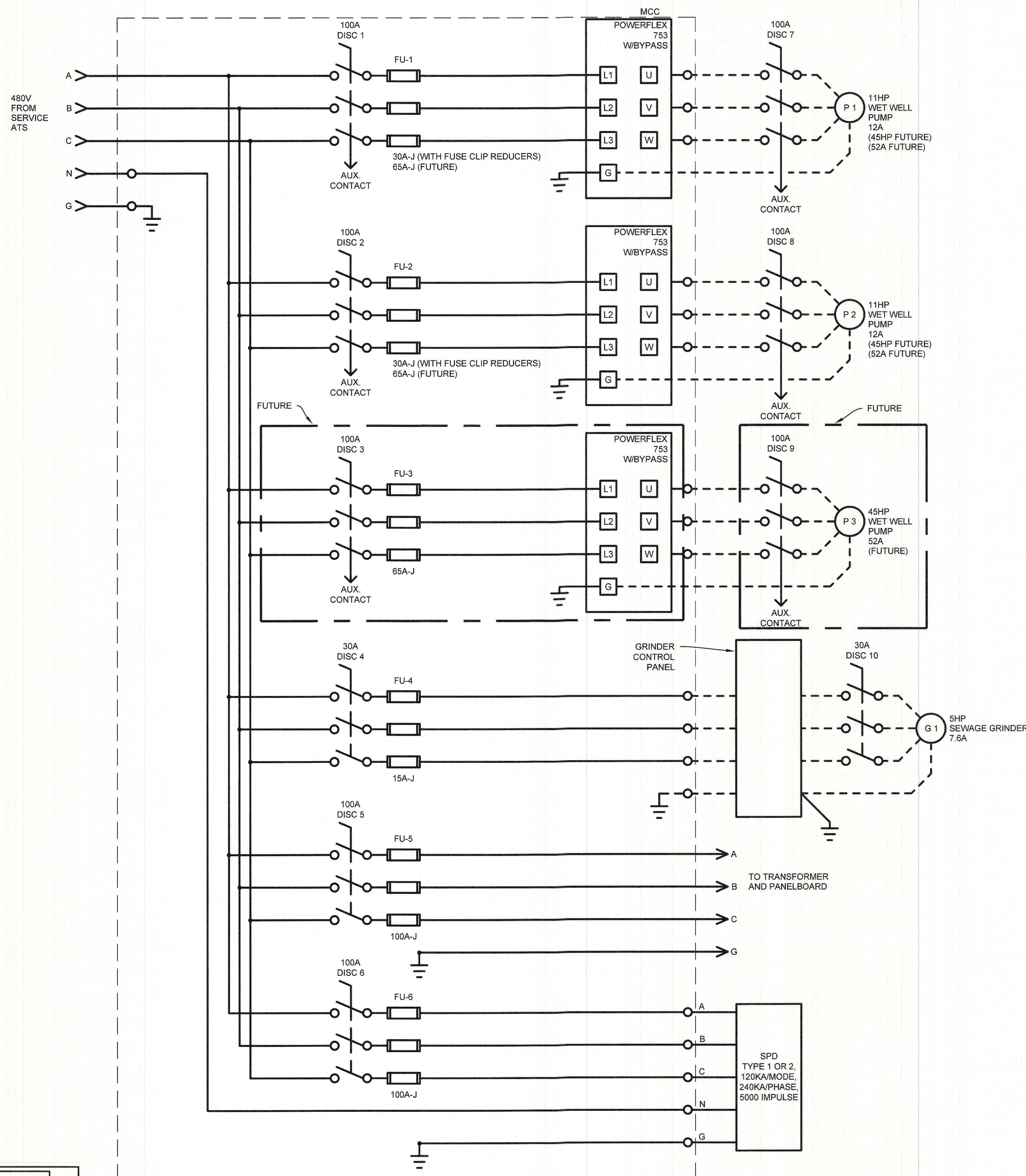
CONTROLS DIAGRAM

SCALE: NONE

RECORD DOCUMENTS

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PREPARED: 09-06-2019



MCC POWER WIRING DIAGRAM

SCALE: NONE

NOTE: REFERENCE PUMP STATION P&ID AND CONTROL DIAGRAMS FOR ADDITIONAL REQUIREMENTS, SUCH AS RELAYS FOR SEQUENCING STARTUP OF PUMPS.



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BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
SANITARY SEWER IMPROVEMENT PLAN
FOR
THE PINES, SECTION 1
PHASE A & B
CONTROL DIAGRAMS

DATE

APRIL 2018

SCALE

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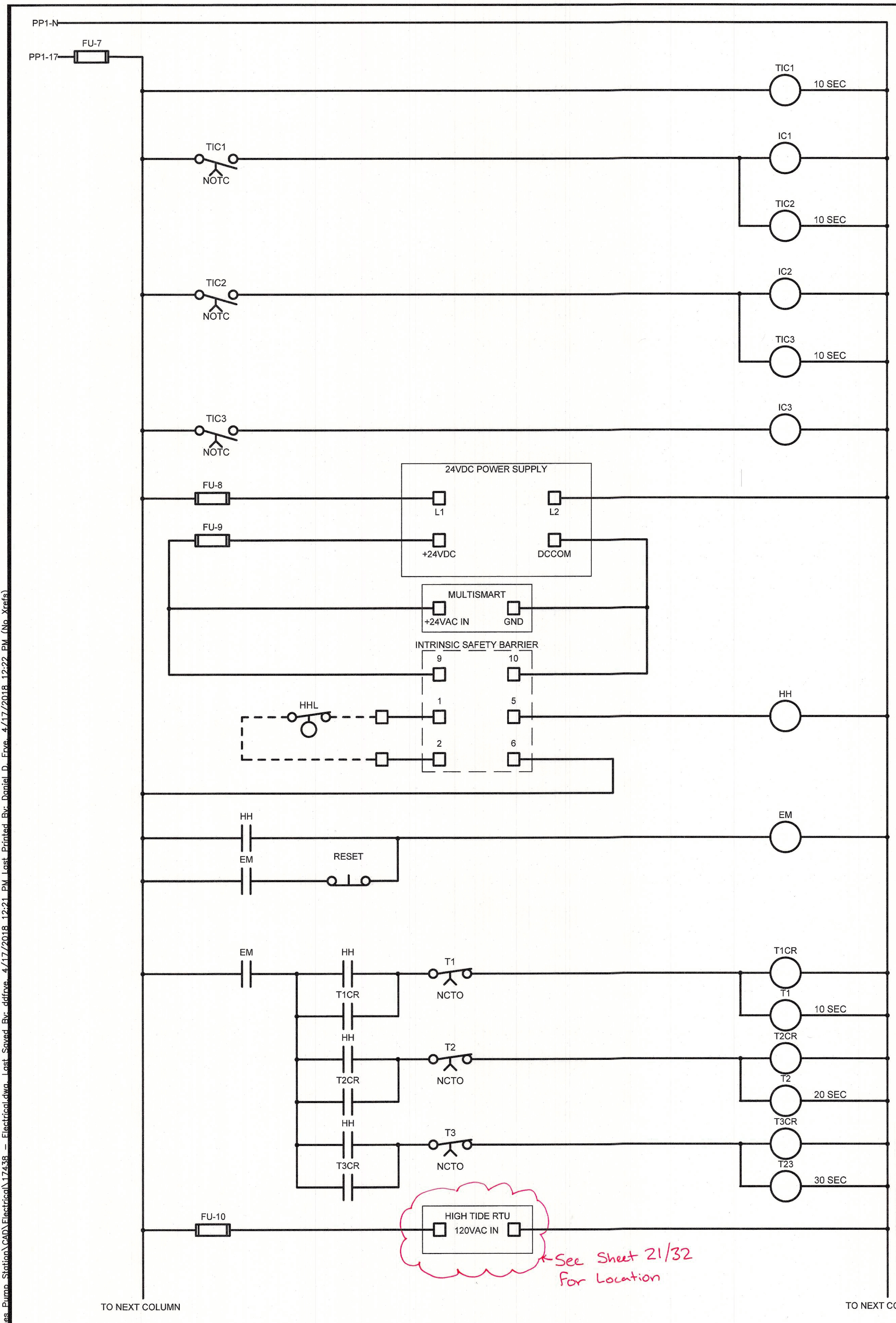
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SHEET

24/32

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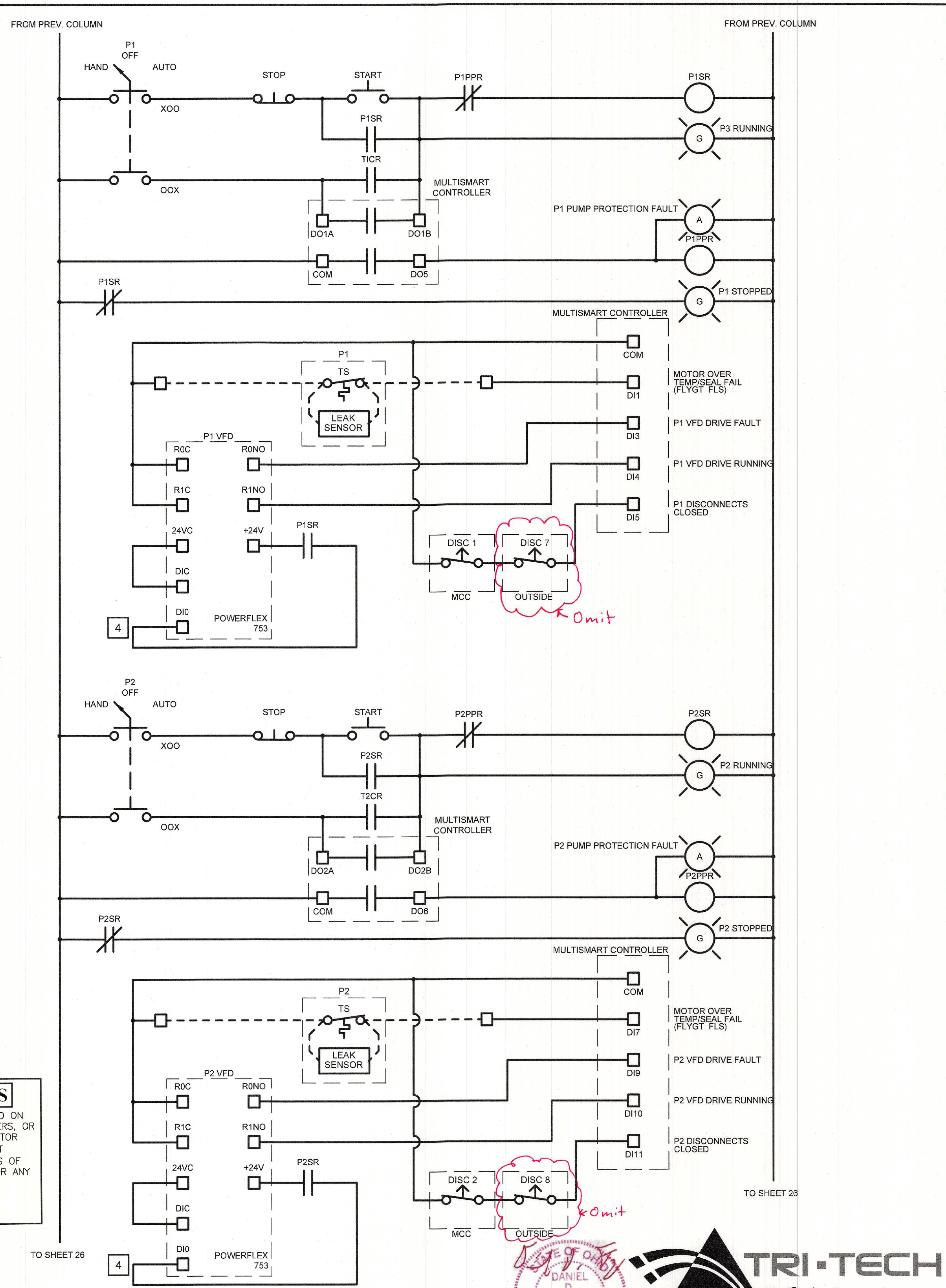
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- REFERENCE ELECTRICAL INSTALLATION NOTES ON SHEET 26/32

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PUMP CONTROL WIRING DIAGRAM
 SCALE: NONE



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 17/Apr/2018

DANIEL D. FRYE
 E-65085
 REGISTERED PROFESSIONAL ENGINEER

MARK	DATE	DESCRIPTION

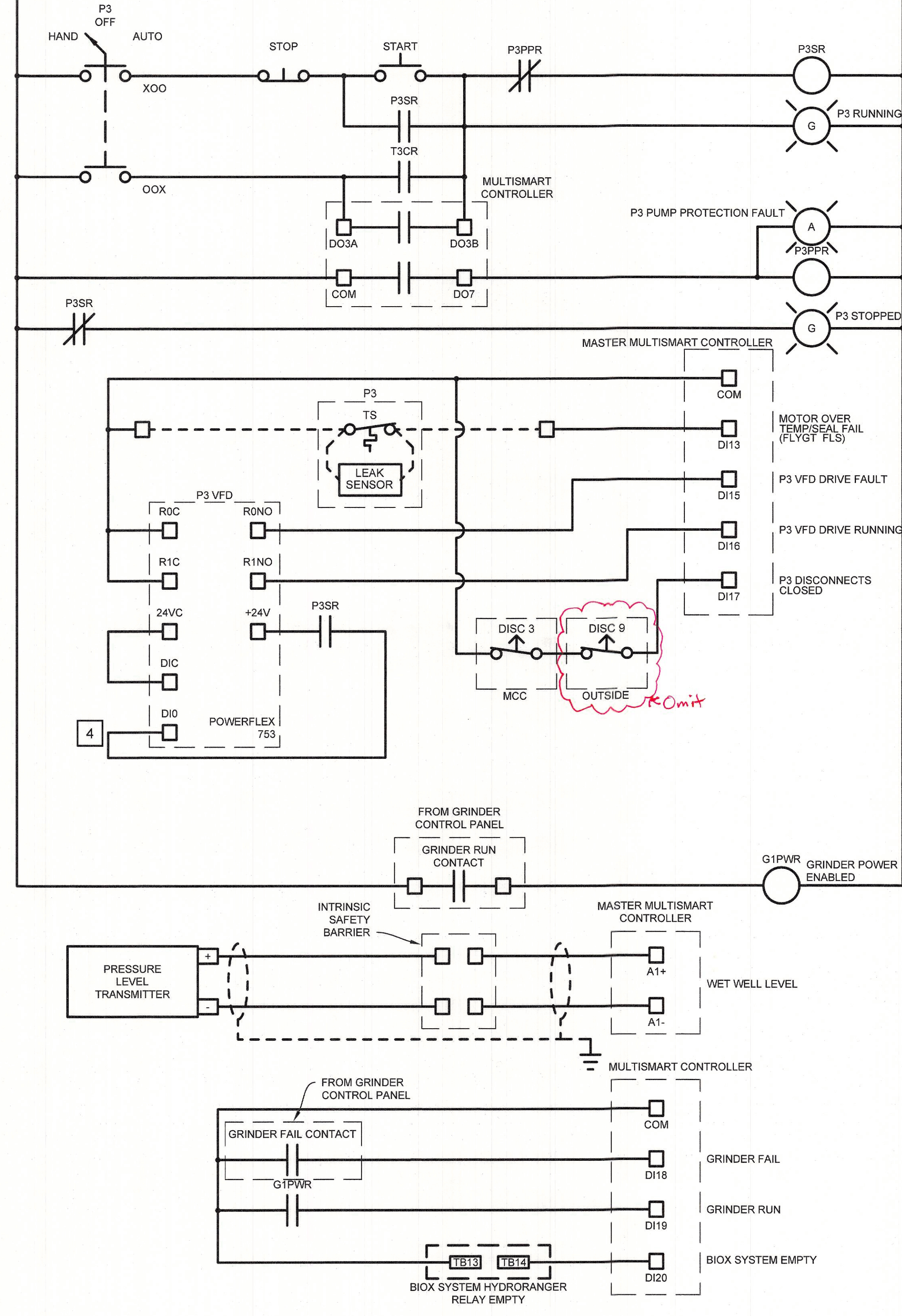
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BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
 SANITARY SEWER IMPROVEMENT PLAN
 FOR
THE PINES, SECTION 1
PHASE A & B
 CONTROL DIAGRAMS

DATE	APRIL 2018
SCALE	As Noted
JOB NO.	20170824
SHEET	25/32

FROM SHEET 25

FROM SHEET 25



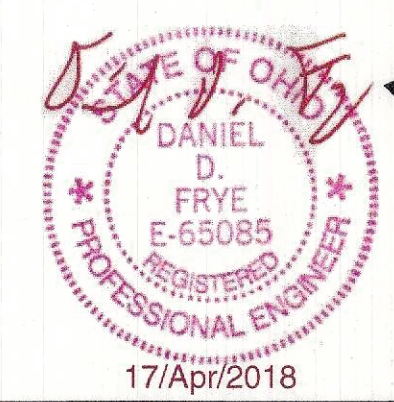
ELECTRICAL INSTALLATION NOTES:

1. NOT USED.
2. NOT USED.
3. NOT USED.
4. SET PARAMETER FOR A PRESET RUN FREQUENCY OF 60HZ.
5. NOT USED.

RECORD DOCUMENTS

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PREPARED: 09-06-2019



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**THE PINES, SECTION 1
PHASE A & B
CONTROL DIAGRAMS**

DATE
APRIL 2018

SCALE
As Noted

JOB NO.
20170824

SHEET
26/32

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SECTION 23 09 93
SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.01SECTION INCLUDES

- A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.
B. Sequence of operation for:
1. Electrical rooms and telephone rooms.
2. Unit heaters.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRICAL ROOMS AND TELEPHONE ROOMS

- A. On room temperatures above 80 degrees F (27 degrees C) open intake damper and start exhaust fan.

3.02 UNIT HEATERS

- A. Single temperature room thermostat set at 60 degrees F (16 degrees C) maintains constant space temperature by cycling unit fan motor and energizing electric heating elements.

END OF SECTION

SECTION 23 34 13

AXIAL HVAC FANS

PART 1 GENERAL

1.01SECTION INCLUDES

- A. Propeller fans.
B. Motors and drives.
C. Accessories.

1.02SUBMITTALS

- A. Product Data: Provide data on axial fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
B. Shop Drawings: Indicate assembly of axial fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
B. Provide fixed sheaves required for final air balance.
C. Provide safety screen where inlet or outlet is exposed.

END OF SECTION

SECTION 23 37 00

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01SECTION INCLUDES

- A. Louvers.

1.02SUBMITTALS

- A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
B. Project Record Documents: Record actual locations of air outlets and inlets.

PART 2 PRODUCTS

2.01 LOUVERS

- A. Type: 6 inch (150 mm) deep with blades on 45 degree slope with integral damper blades, channel frame, and insect screen over intake.
B. Color: To be selected by Engineer from manufacturer's standard range.
C. Control: 120V motorized actuator to control damper blades.
D. Mounting: Furnish with exterior angle flange for installation.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

END OF SECTION

SECTION 23 81 01

TERMINAL HEAT TRANSFER UNITS

PART 1 GENERAL

1.01SECTION INCLUDES

- A. Electric heaters.

1.02RELATED REQUIREMENTS

- A. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections. Installation of room thermostats. Electrical supply to units.

1.03SUBMITTALS

- A. Product Data: Provide typical catalog of information including arrangements.
B. Shop Drawings:
1. Indicate mechanical and electrical service locations and requirements.
C. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.

PART 2 PRODUCTS

2.01 ELECTRIC UNIT HEATERS

- A. Assembly: UL listed and labeled assembly with terminal box and cover, and built-in controls.
B. Heating Elements: Electric resistance style heating element.
C. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard.
D. Electrical Characteristics:
1. 3.3 kW.
2. 240 volts, single phase, 60 Hz.
3. Disconnect Switch: Factory mount disconnect switch.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Do not damage equipment or finishes.
C. Install electric heating equipment including devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal. Install electrical wiring in accordance with manufacturer's submittals and Section 26 05 83.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01SECTION INCLUDES

- A. Single conductor building wire.
B. Wiring connectors.
C. Electrical tape.
D. Heat shrink tubing.
E. Wire pulling lubricant.

1.02SUBMITTALS

- A. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.03QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

1.04FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F (-10 degrees C), unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Engineer and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
B. Provide products listed, classified, and labeled as suitable for the purpose intended.
C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
D. Comply with NEMA WC 70.
E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
F. Thermost-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
G. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.
H. Conductor Material:
1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.
I. Minimum Conductor Size:
1. Branch Circuits: 12 AWG.
2. Control Circuits: 14 AWG.
J. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
K. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
a. 480Y/277 V, 3 Phase, 4 Wire System:
1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral/Grounded: Gray.
b. 240/120 V, 1 Phase, 3 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Neutral/Grounded: White.
c. Equipment Ground, All Systems: Green.
d. For control circuits, comply with manufacturer's recommended color code.

2.02 SINGLE CONDUCTOR BUILDING WIRE

- A. Description: Single conductor insulated wire.
B. Conductor Stranding:
1. Feeders and Branch Circuits:
a. Size 10 AWG and Smaller: Solid.
b. Size 8 AWG and Larger: Stranded.
2. Control Circuits: Stranded.
C. Insulation Voltage Rating: 600 V.
D. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
a. Size 4 AWG and Larger: Type XHHW-2.
b. Installed Underground: Type XHHW-2.

2.03 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.
C. Wiring Connectors for Splices and Taps:
1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
D. Wiring Connectors for Terminations:
1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
H. Mechanical Connectors: Provide bolted type or set-screw type.
I. Compression Connectors: Provide circumferential type or hex type crimp configuration.

2.04 ELECTRICAL ACCESSORIES

- A. Electrical Tape:
1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil (0.76 mm); suitable for continuous temperature environment up to 194 degrees F (90 degrees C) and short-term 266 degrees F (130 degrees C) overload service.
4. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil (3.2 mm); suitable for continuous temperature environment up to 176 degrees F (80 degrees C).
5. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil (2.3 mm).
B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive, rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
B. Verify that work likely to damage wire and cable has been completed.
C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
D. Verify that field measurements are as indicated.
E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:
1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
B. Install products in accordance with manufacturer's instructions.
C. Perform work in accordance with NECA 1 (general workmanship).
D. Installation in Raceway:
1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

- F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
G. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.
H. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet (1.5 m) of slack.
I. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
J. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
K. Make wiring connections using specified wiring connectors.
1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminants. Do not use wire brush on plated connector surfaces.
5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
L. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
a. For taped connectors, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
3. Wet Locations: Use heat shrink tubing.
M. Insulate ends of spare conductors using vinyl insulating electrical tape.
N. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
O. Identify conductors and cables in accordance with Section 26 05 53.
P. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
B. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01SECTION INCLUDES

- A. Grounding and bonding requirements.
B. Conductors for grounding and bonding.
C. Connectors for grounding and bonding.
D. Ground rod electrodes.

1.02ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
2. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
B. Sequencing:
1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.03SUBMITTALS

- A. Field quality control test reports.
B. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.04QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
D. Grounding System Resistance:
1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Engineer. Precipitation within the previous 48 hours does not constitute normally dry conditions.
2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.
E. Grounding Electrode System:
1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
a. Provide continuous grounding electrode conductors without splice or joint.
b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
2. Metal In-Ground Support Structure:
a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
3. Concrete-Encased Electrode:
a. Provide connection to concrete-encased electrode consisting of not less than 20 feet (6.0 m) of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
4. Ground Rod Electrode(s):
a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
b. Space electrodes not less than 10 feet (3.0 m) from each other and any other ground electrode.
5. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

F. Service-Supplied System Grounding:

- 1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

G. Bonding and Equipment Grounding:

- 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.
B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:
1. Use insulated copper conductors unless otherwise indicated.
a. Exceptions:
1) Use bare copper conductors where installed underground in direct contact with earth.
2) Use bare copper conductors where directly encased in concrete (not in raceway).
C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.

- 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
a. Exceptions:
1) Use exothermic welded connections for connections to metal building frame.
D. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 5/8 inch (16 mm) diameter by 8 feet (2.4 m) length, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
B. Verify that field measurements are as indicated.
C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches (150 mm) below finished grade.
D. Make grounding and bonding connections using specified connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
E. Identify grounding and bonding system components in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS except Section 4.
B. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
C. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.
D. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01SECTION INCLUDES

- A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
b. Outdoor and Damp or Wet Indoor Locations: Use 304 stainless steel unless otherwise indicated.
c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type, steel, 304 stainless in damp or wet locations.
2. Conduit Clamps: Bolted type unless otherwise indicated.
C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.
2. Channel Material:
a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
b. Outdoor and Damp or Wet Indoor Locations: Use 304 stainless steel.
3. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch (2.66 mm).
4. Minimum Channel Dimensions: 1-5/8 inch (41 mm) width by 13/16 inch (21 mm) height.
E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
F. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use 304 stainless steel anchor and fastener types.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
a. Comply with MFMA-4.
b. Channel Material: Use galvanized steel in indoor, dry locations, 304 stainless steel in damp or wet locations.
c. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch (2.66 mm) minimum base metal thickness.
d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
10. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

REVISIONS

MARK	DATE	DESCRIPTION



BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
SANITARY SEWER IMPROVEMENT PLAN
FOR
THE PINES, SECTION 1
PHASE A & B
MECHANICAL / ELECTRICAL SPECIFICATIONS

DATE

APRIL 2018

SCALE

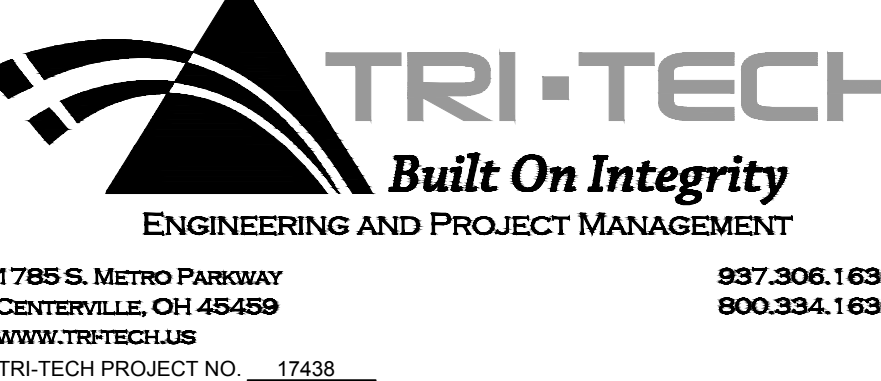
As Noted

JOB NO.

20170824

SHEET

27/32



937.306.1630 800.334.1630

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TRI-TECH PROJECT NO. 17438

17/Apr/2018

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PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
E. Unless specifically indicated or approved by Engineer, do not provide support from suspended ceiling support system or ceiling grid.
F. Unless specifically indicated or approved by Engineer, do not provide support from roof deck.
G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
H. Equipment Support and Attachment:
1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strengths not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
I. Conduit Support and Attachment: Also comply with Section 26 05 33.13.
J. Box Support and Attachment: Also comply with Section 26 05 33.16.
K. Interior Luminaire Support and Attachment: Also comply with Section 26 51 00.
L. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
M. Secure fasteners according to manufacturer's recommended torque settings.
N. Remove temporary supports.

3.02 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

**SECTION 26 05 33.13
CONDUIT**

PART 1 GENERAL

1.01SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
B. Stainless steel rigid metal conduit.
C. Aluminum rigid metal conduit (RMC).
D. Intermediate metal conduit (IMC).
E. PVC-coated galvanized steel rigid metal conduit (RMC).
F. Flexible metal conduit (FMC).
G. Liquidtight flexible metal conduit (LFMC).
H. Electrical metallic tubing (EMT).
I. Rigid polyvinyl chloride (PVC) conduit.
J. Conduit fittings.
K. Accessories.

1.02SUBMITTALS

- A. Project Record Documents: Record actual routing for conduits installed underground and conduits 2 inch (53 mm) trade size and larger.

1.03QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
C. Underground:
1. Under Slab on Grade: Use stainless steel rigid metal conduit.
2. Exterior, Direct-Buried: Use rigid PVC conduit for service lateral, stainless steel rigid metal conduit for all other feeders and power and control circuits.
3. Where rigid polyvinyl (PVC) conduit is provided, transition to PVC-coated galvanized steel rigid metal conduit where emerging from underground.
4. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use PVC-coated galvanized steel rigid metal conduit elbows or concrete encased PVC elbows for bends.
5. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches (100 mm) on either side of where conduit emerges.
D. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
E. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
F. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or stainless steel rigid metal conduit.
G. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
H. Exposed, Exterior: Use stainless steel rigid metal conduit.
I. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
J. Hazardous (Classified) Locations: Use stainless steel rigid metal conduit.
K. Connections to Vibrating Equipment:
1. Dry Locations: Use flexible metal conduit.
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.

2.02 CONDUIT REQUIREMENTS

- A. Electrical Service Conduits: Also comply with Section 26 21 00.
B. Fittings for Grounding and Bonding: Also comply with Section 26 05 26.
C. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
D. Provide products listed, classified, and labeled as suitable for the purpose intended.
E. Minimum Conduit Size, Unless Otherwise Indicated:
1. Branch Circuits: 1/2 inch (16 mm) trade size.
2. Branch Circuit homeruns: 3/4 inch (21 mm) trade size.
3. Control Circuits: 1/2 inch (16 mm) trade size.
4. Underground, Interior: 3/4 inch (21 mm) trade size.
5. Underground, Exterior: 1 inch (27 mm) trade size.
F. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
B. Fittings:
1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.
C. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conical bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
D. Underground Installation:
1. Minimum Cover, Unless Otherwise Indicated or Required:

- 2. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
3. Material: Use aluminum.
4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.
2.06 INTERMEDIATE METAL CONDUIT (IMC)
A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
B. Fittings:
1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.
2.07 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)
A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil (1.02 mm).
C. PVC-Coated Fittings:
1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
4. Material: Use steel or malleable iron.
5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil (1.02 mm).
D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil (0.38 mm).

2.08 FLEXIBLE METAL CONDUIT (FMC)

- A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed and used in classified firestop systems to be used.
B. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
2.09 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)
A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
B. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.

2.10 ELECTRICAL METALLIC TUBING (EMT)

- A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
B. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use compression (gland) or set-screw type.
a. Do not use indenter type connectors and couplings.
4. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
2.11 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT
A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
B. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.
2.12 ACCESSORIES
A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil (0.51 mm).
B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force (890 N).
E. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.
F. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
B. Verify that mounting surfaces are ready to receive conduits.
C. Verify that conditions are satisfactory for installation prior to starting work.
3.02 INSTALLATION
A. Install products in accordance with manufacturer's instructions.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
D. Install stainless steel rigid metal conduit in accordance with NECA 101.
E. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
F. Install intermediate metal conduit (IMC) in accordance with NECA 101.
G. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
H. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
I. Conduit Routing:
1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated without specific routing, determine exact routing required.
3. Arrange conduit to maintain adequate headroom, clearances, and access.
4. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
5. Arrange conduit to provide no more than 150 feet (46 m) between pull points.
J. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Use conduit strap to support single surface-mounted conduit.
a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
4. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
K. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
L. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conical bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
D. Underground Installation:
1. Minimum Cover, Unless Otherwise Indicated or Required:

- a. Underground, Exterior: 24 inches (610 mm).
b. Under Slab on Grade: 12 inches (300 mm) to bottom of slab.
2. Provide underground warning tape in accordance with Section 26 05 53 along entire conduit length for service entrance where not concrete-encased.
N. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete with minimum concrete cover of 3 inches (76 mm) on all sides unless otherwise indicated.
O. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.
P. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where conduits are subject to earth movement by settlement or frost.
Q. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
R. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.
S. Provide grounding and bonding in accordance with Section 26 05 26.
3.03 FIELD QUALITY CONTROL
A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
B. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
C. Correct deficiencies and replace damaged or defective conduits.
3.04 CLEANING
A. Clean interior of conduits to remove moisture and foreign matter.
3.05 PROTECTION
A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

**SECTION 26 05 33.16
BOXES**

- PART 1 GENERAL**
1.01SECTION INCLUDES
A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.
B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).
C. Boxes for hazardous (classified) locations.
D. Underground boxes/enclosures.
1.02ADMINISTRATIVE REQUIREMENTS
A. Coordination:
1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
1.03SUBMITTALS
A. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.
B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Keys for Lockable Enclosures: Two of each different key.

1.04QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
PART 2 PRODUCTS
2.01 BOXES
A. General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
2. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
3. Use cast aluminum boxes where aluminum rigid metal conduit is used.
4. Use nonmetallic boxes where exposed rigid PVC conduit is used.
5. Use suitable concrete type boxes where flush-mounted in concrete.
6. Use suitable masonry type boxes where flush-mounted in masonry walls.
7. Use raised covers suitable for the type of wall construction and device configuration where required.
8. Use shallow boxes where required by the type of wall construction.
9. Do not use "through-wall" boxes designed for access from both sides of wall.
10. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
11. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A, furnish with threaded hubs.
12. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
13. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
14. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
15. Minimum Box Size, Unless Otherwise Indicated:
a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
17. Wall Plates: Comply with Section 26 27 26.
C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
a. Indoor Clean, Dry Locations: Type 1, painted steel.
b. Outdoor Locations: Type 4X, stainless steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
b. Boxes 6 square feet (0.56 sq m) and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
b. Back Panels: Painted steel, removable.
c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
D. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.
E. Underground Boxes/Enclosures:
1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
2. Size: As indicated on drawings.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches (300 mm).
4. Provide logo on cover to indicate type of service.
5. Applications:

- a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77, Tier 8 load rating.
b. Parking Lots in Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77, Tier 15 load rating.
c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
a. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
E. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
F. Box Locations:
1. Locate boxes as required for devices installed under other sections or by others.
2. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 33.13.
G. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
H. Install boxes plumb and level.
I. Install boxes as required to preserve insulation integrity.
J. Underground Boxes/Enclosures:
1. Install enclosure on gravel base, minimum 6 inches (150 mm) deep.
2. Flush-mount enclosures located in concrete or paved areas.
3. Mount enclosures located in landscaped areas with top at 1 inch (25 mm) above finished grade.
4. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.
K. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
L. Close unused box openings.
M. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
N. Provide grounding and bonding in accordance with Section 26 05 26.

3.02 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.03 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

**SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01SECTION INCLUDES

- A. Electrical identification requirements.
B. Identification nameplates and labels.
C. Wire and cable markers.
D. Voltage markers.
E. Underground warning tape.
F. Warning signs and labels.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
a. Motor Control Centers:
1) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
b. Panelboards:
1) Identify power source and circuit number. Include location when not within sight of equipment.
2) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
3) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
2. Service Equipment:
a. Use identification nameplate to identify each service disconnecting means.
3. Emergency System Equipment:
a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
c. Use identification nameplate to identify emergency operating instructions for emergency system equipment.
4. Use voltage marker to identify high voltage present for each piece of electrical equipment.
5. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
6. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
7. Available Fault Current Documentation: Use identification label or identification nameplate to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.
a. Service equipment.
b. Industrial control panels.
c. Motor control centers.
d. Industrial machinery.
8. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
a. Minimum Size: 3.5 by 5 inches (89 mm by 127 mm).
b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard"; Appropriate PPE Required: Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
a. At each source and load connection.
b. Within boxes when more than one circuit is present.
c. Within equipment enclosures when conductors and cables enter or leave the enclosure.

Table with 2 columns: MARK, DATE, and 10 empty rows.

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BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
SANITARY SEWER IMPROVEMENT PLAN
FOR
THE PINES, SECTION 1
PHASE A & B
MECHANICAL / ELECTRICAL SPECIFICATIONS

Table with 2 columns: DATE, SCALE, JOB NO., SHEET. Values: APRIL 2018, As Noted, 20170824, 28/32.

TRI-TECH ENGINEERING AND PROJECT MANAGEMENT. Built On Integrity. 1785 S. METRO PARKWAY CENTERVILLE, OH 45459 WWW.TRI-TECH.US 937.306.1630 800.334.1630. 17/Apr/2018

C:\E\H\17438_The Pines_Pumps_Station\CADD\Electrical\17438 - Electrical.dwg, Last Saved By: Daniel D. Frye, 4/17/2018 12:22:22 PM, (No. Xrefs)

- C. Identification for Raceways:
 - 1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet (6.1 m).
 - 2. Use underground warning tape to identify underground raceways.
- D. Identification for Boxes:
 - 1. Use voltage markers to identify highest voltage present.
- E. Identification for Devices:
 - 1. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
 - 1. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 - 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
 - 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
 - 4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
 - 5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.
- B. Identification Labels:
 - 1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 - 2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
 - 1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
 - 2. Legend:
 - a. Equipment designation or other approved description.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height:
 - a. Equipment Designation: 1/2 inch (13 mm).
 - b. Normal Power System: White text on black background.
 - c. Emergency Power System: White text on red background.
- D. Format for General Information and Operating Instructions:
 - 1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
 - 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height: 1/4 inch (6 mm).
 - 5. Color: Black text on white background unless otherwise indicated.
- E. Format for Caution and Warning Messages:
 - 1. Minimum Size: 2 inches (51 mm) by 4 inches (100 mm).
 - 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height: 1/2 inch (13 mm).
 - 5. Color: Black text on yellow background unless otherwise indicated.
- F. Format for Control Device Identification:
 - 1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
 - 2. Legend: Load controlled or other designation indicated.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height: 3/16 inch (5 mm).
 - 5. Color: Black text on clear background.

2.03 WIRE AND CABLE MARKERS

- A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- C. Legend: Power source and circuit number or other designation indicated.
- D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- E. Minimum Text Height: 1/8 inch (3 mm).
- F. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

- A. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.
- B. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- C. Minimum Size:
 - 1. Markers for Equipment: 1 1/8 by 4 1/2 inches (29 by 110 mm).
 - 2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
 - 3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches (29 by 110 mm).
 - 4. Markers for Junction Boxes: 1/2 by 2 1/4 inches (13 by 57 mm).
- D. Legend:
 - 1. Markers for Voltage Identification: Highest voltage present.
- E. Color: Black text on orange background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

- A. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- B. Foil-backed Detectable Type Tape: 3 inches (76 mm) wide, with minimum thickness of 5 mil (0.1 mm), unless otherwise required for proper detection.
- C. Legend: Type of service, continuously repeated over full length of tape.
- D. Color:
 - 1. Tape for Buried Power Lines: Black text on red background.
 - 2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.06 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
 - 1. Materials:
 - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
 - b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
 - 2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
 - 3. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.
- C. Warning Labels:
 - 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 - 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
 - 3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 - 1. Surface-Mounted Equipment: Enclosure front.
 - 2. Flush-Mounted Equipment: Inside of equipment door.
 - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 - 4. Elevated Equipment: Legible from the floor or working platform.
 - 5. Branch Devices: Adjacent to device.
 - 6. Interior Components: Legible from the point of access.
 - 7. Conduits: Legible from the floor.
 - 8. Boxes: Outside face of cover.
 - 9. Conductors and Cables: Legible from the point of access.
 - 10. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches (75 mm) below finished grade.

- G. Secure rigid signs using stainless steel screws.
- H. Mark all handwritten text, where permitted, to be neat and legible.

3.02 FIELD QUALITY CONTROL

- A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 05 83

WIRING CONNECTIONS

- PART 1 GENERAL**
- 1.01SECTION INCLUDES**
 - A. Electrical connections to equipment.
- PART 2 PRODUCTS**
- 2.01 EQUIPMENT CONNECTIONS**
 - A. Electrical requirements shown on drawings.:
- PART 3 EXECUTION**
- 3.01 ELECTRICAL CONNECTIONS**
 - A. Make electrical connections in accordance with equipment manufacturer's instructions.
 - B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
 - C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
 - D. Provide receptacle outlet to accommodate connection with attachment plug.
 - E. Provide cord and cap where field-supplied attachment plug is required.
 - F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
 - G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
 - H. Install terminal block jumpers to complete equipment wiring requirements.
 - I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROL DEVICES

- PART 1 GENERAL**
- 1.01 SECTION INCLUDES**
 - A. Outdoor motion sensors.
 - B. Outdoor photo controls.
- 1.02 SUBMITTALS**
 - A. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
 - B. Field Quality Control Reports.
 - C. Operation and Maintenance Data: Include detailed information on device programming and setup.
 - D. Project Record Documents: Record actual installed locations and settings for lighting control devices.

- PART 2 PRODUCTS**
- 2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS**
 - A. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.
- 2.02 OUTDOOR MOTION SENSORS**
 - A. Description: Factory-assembled wet location listed device suitable for wall or ceiling/leave mounting, with integral swivel for field adjustment of coverage, capable of detecting motion for automatic control of load indicated.
 - B. Sensor Technology: Passive Infrared (PIR) designed to detect occupancy by sensing movement of thermal energy between zones.
 - C. Operation: Unless otherwise indicated, motion sensor to turn load on when motion is detected and to turn load off when no motion is detected during an adjustable turn-off delay time interval.
 - D. Turn-Off Delay: Field adjustable, with time delay settings available up to 15 minutes.
 - E. Integral Photocell: For dusk to dawn operation.
 - F. Manual Override: Activated by switching power off to unit and then back on.
 - G. Load Rating: 1,000 W incandescent and fluorescent load at 120 V ac.
 - H. Coverage: Capable of detecting motion within a distance of 50 feet (15 m) at a mounting height of 8 feet (2.4 m), with a field of view of 270 degrees.

- 2.03 OUTDOOR PHOTO CONTROLS**
 - A. Stem-Mounted Outdoor Photo Controls:
 - 1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
 - 2. Housing: Weatherproof, impact resistant polycarbonate.
 - 3. Photo Sensor: Cadmium sulfide.
 - 4. Provide external sliding shield for field adjustment of light level activation.
 - 5. Light Level Activation: 1 to 5 footcandles (10.8 to 53.8 lux) turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
 - 6. Voltage: As required to control the load indicated on the drawings.
 - 7. Failure Mode: Fails to the on position.
 - 8. Load Rating: As required to control the load indicated on the drawings.

- PART 3 EXECUTION**
- 3.01 INSTALLATION**
 - A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
 - B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of lighting control devices provided under this section.
 - C. Install lighting control devices in accordance with manufacturer's instructions.
 - D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 - E. Install lighting control devices plumb and level, and held securely in place.
 - F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 27 26.
 - G. Provide required supports in accordance with Section 26 05 29.
 - H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
 - I. Outdoor Photo Control Locations:
 - 1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
 - 2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.
 - J. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.
- 3.02 FIELD QUALITY CONTROL**
 - A. Inspect each lighting control device for damage and defects.
 - B. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
 - C. Test outdoor photo controls to verify proper operation, including time delays where applicable.
 - D. Correct wiring deficiencies and replace damaged or defective lighting control devices.
- 3.03 ADJUSTING**
 - A. Adjust devices and wall plates to be flush and level.
 - B. Adjust position of outdoor motion sensors to achieve optimal coverage as required.
 - C. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Engineer.
- 3.04 CLOSEOUT ACTIVITIES**
 - A. Demonstration: Demonstrate proper operation of lighting control devices to Engineer, and correct deficiencies or make adjustments as directed.

END OF SECTION

SECTION 26 22 00

LOW-VOLTAGE TRANSFORMERS

- PART 1 GENERAL**
- 1.01SECTION INCLUDES**
 - A. General purpose transformers.
- 1.02SUBMITTALS**
 - A. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.
 - B. Field Quality Control Test Reports.
 - C. Project Record Documents: Record actual locations of transformers.
- PART 2 PRODUCTS**
- 2.01 TRANSFORMERS - GENERAL REQUIREMENTS**
 - A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.
 - B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
 - 1. Altitude: Less than 3,300 feet (1,000 m).
 - 2. Ambient Temperature:
 - a. Greater than 10 kVA: Not exceeding 104 degrees F (40 degrees C).
 - b. Less than 10 kVA: Not exceeding 77 degrees F (25 degrees C).
 - C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core-letting.
 - D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.
 - E. Basic Impulse Level: 10 kV.
 - F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
 - G. Isolate core and coil from enclosure using vibration-absorbing mounts.
 - H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.
- 2.02 GENERAL PURPOSE TRANSFORMERS**
 - A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.
 - B. Insulation System and Allowable Average Winding Temperature Rise:
 - 1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
 - 2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.
 - C. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.
 - D. Winding Taps:
 - 1. Less than 3 kVA: None.
 - 2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
 - 3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
 - E. Energy Efficiency: Comply with 10 CFR 431, Subpart K.
 - F. Sound Levels: Standard sound levels complying with NEMA ST 20.
 - G. Mounting Provisions:
 - 1. Less than 15 kVA: Suitable for wall mounting.
 - 2. 15 kVA through 75 kVA: Suitable for wall or floor mounting.
 - H. Transformer Enclosure: Comply with NEMA ST 20.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor clean, dry locations: Type 2.
 - b. Outdoor locations: Type 3R.
 - 2. Construction: Steel.
 - a. Less than 15 kVA: Totally enclosed, non-ventilated.
 - b. 15 kVA and Larger: Ventilated.
 - 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
 - 4. Provide lifting eyes or brackets.

- PART 3 EXECUTION**
- 3.01 INSTALLATION**
 - A. Verify that field measurements are as indicated.
 - B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.
 - C. Verify that conditions are satisfactory for installation prior to starting work.
- 3.02 PREPARATION**
- 3.03 INSTALLATION**
 - A. Install products in accordance with manufacturer's instructions and Utility Company requirements.
 - B. Perform work in accordance with NECA 1 (general workmanship).
 - C. Arrange equipment to provide minimum clearances and required maintenance access.
 - D. Provide required support and attachment components in accordance with Section 26 05 29.
 - E. Provide grounding and bonding for service entrance equipment in accordance with Section 26 05 26.
 - F. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 05 53.

- 3.04 PROTECTION**
 - A. Protect installed equipment from subsequent construction operations.

END OF SECTION

SECTION 26 26 16

PANELBOARDS

- PART 1 GENERAL**
- 1.01 SECTION INCLUDES**
 - A. Electrical service requirements.

- 1.02 DEFINITIONS**
 - A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.
- 1.03 ADMINISTRATIVE REQUIREMENTS**
 - A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.
 - B. Coordination:
 - 1. Verify the following with Utility Company representative:
 - a. Utility Company requirements, including division of responsibility.
 - b. Exact location and details of utility point of connection.
 - c. Utility easement requirements.
 - d. Utility Company charges associated with providing service.
 - 2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
 - 3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 4. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
 - C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.
 - D. Utility Company charges associated with providing permanent service to be paid by Owner.
 - E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.
 - F. Scheduling:
 - 1. Arrange for inspections necessary to obtain Utility Company approval of installation.

- 1.04 SUBMITTALS**
 - A. Project Record Documents: Record actual locations of equipment and installed service routing.
- 1.05 QUALITY ASSURANCE**
 - A. Comply with the following:
 - 1. IEEE C2 (National Electrical Safety Code).
 - 2. NFPA 70 (National Electrical Code).
 - 3. The requirements of the Utility Company.

- PART 2 PRODUCTS**
- 2.01 ELECTRICAL SERVICE REQUIREMENTS**
 - A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.
 - B. Electrical Service Characteristics: As indicated on drawings.
 - C. Utility Company: AEP Ohio.
 - D. Division of Responsibility: Per Utility Company requirements.
 - E. Products Furnished by Contractor: Comply with Utility Company requirements.

- PART 3 EXECUTION**
- 3.01 EXAMINATION**
 - A. Verify that field measurements are as indicated.
 - B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.
 - C. Verify that conditions are satisfactory for installation prior to starting work.
- 3.02 PREPARATION**
- 3.03 INSTALLATION**
 - A. Install products in accordance with manufacturer's instructions and Utility Company requirements.
 - B. Perform work in accordance with NECA 1 (general workmanship).
 - C. Arrange equipment to provide minimum clearances and required maintenance access.
 - D. Provide required support and attachment components in accordance with Section 26 05 29.
 - E. Provide grounding and bonding for service entrance equipment in accordance with Section 26 05 26.
 - F. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 05 53.

- 3.04 PROTECTION**
 - A. Protect installed equipment from subsequent construction operations.

END OF SECTION

SECTION 26 22 00

LOW-VOLTAGE TRANSFORMERS

- PART 1 GENERAL**
- 1.01SECTION INCLUDES**
 - A. General purpose transformers.
- 1.02SUBMITTALS**
 - A. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.
 - B. Field Quality Control Test Reports.
 - C. Project Record Documents: Record actual locations of transformers.
- PART 2 PRODUCTS**
- 2.01 TRANSFORMERS - GENERAL REQUIREMENTS**
 - A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.
 - B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
 - 1. Altitude: Less than 3,300 feet (1,000 m).
 - 2. Ambient Temperature:
 - a. Greater than 10 kVA: Not exceeding 104 degrees F (40 degrees C).
 - b. Less than 10 kVA: Not exceeding 77 degrees F (25 degrees C).
 - C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core-letting.
 - D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.
 - E. Basic Impulse Level: 10 kV.
 - F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
 - G. Isolate core and coil from enclosure using vibration-absorbing mounts.
 - H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.
- 2.02 GENERAL PURPOSE TRANSFORMERS**
 - A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.
 - B. Insulation System and Allowable Average Winding Temperature Rise:
 - 1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
 - 2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.
 - C. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.
 - D. Winding Taps:
 - 1. Less than 3 kVA: None.
 - 2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
 - 3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
 - E. Energy Efficiency: Comply with 10 CFR 431, Subpart K.
 - F. Sound Levels: Standard sound levels complying with NEMA ST 20.
 - G. Mounting Provisions:
 - 1. Less than 15 kVA: Suitable for wall mounting.
 - 2. 15 kVA through 75 kVA: Suitable for wall or floor mounting.
 - H. Transformer Enclosure: Comply with NEMA ST 20.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor clean, dry locations: Type 2.
 - b. Outdoor locations: Type 3R.
 - 2. Construction: Steel.
 - a. Less than 15 kVA: Totally enclosed, non-ventilated.
 - b. 15 kVA and Larger: Ventilated.
 - 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
 - 4. Provide lifting eyes or brackets.

- PART 3 EXECUTION**
- 3.01 INSTALLATION**
 - A. Verify that field measurements are as indicated.
 - B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.
 - C. Verify that conditions are satisfactory for installation prior to starting work.
- 3.02 PREPARATION**
- 3.03 INSTALLATION**
 - A. Install products in accordance with manufacturer's instructions and Utility Company requirements.
 - B. Perform work in accordance with NECA 1 (general workmanship).
 - C. Arrange equipment to provide minimum clearances and required maintenance access.
 - D. Provide required support and attachment components in accordance with Section 26 05 29.
 - E. Provide grounding and bonding for service entrance equipment in accordance with Section 26 05 26.
 - F. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 05 53.

- 3.04 PROTECTION**
 - A. Protect installed equipment from subsequent construction operations.

- END OF SECTION**
- SECTION 26 26 16**
- PANELBOARDS**

- PART 1 GENERAL**
- 1.01SECTION INCLUDES**
 - A. Lighting and appliance panelboards.
 - B. Overcurrent protective devices for panelboards.
- 1.02SUBMITTALS**
 - A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
 - B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 - C. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- PART 2 PRODUCTS**
- 2.01 PANELBOARDS - GENERAL REQUIREMENTS**
 - A. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet (2,000 m).
 - 2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
 - C. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
 - D. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
 - E. Bussing: Sized in accordance with UL 87 temperature rise requirements.
 - 1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 - F. Conductor Terminations: Suitable for use with the conductors to be installed.
 - G. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 - c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
 - d. Lockable Doors: All locks keyed alike unless otherwise indicated.
 - H. Future Provisions: Provide all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
 - I. Load centers are not acceptable.
- 2.02 LIGHTING AND APPLIANCE PANELBOARDS**
 - A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
 - B. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 2. Main and Neutral Lug Type: Mechanical.
 - C. Bussing:
 - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 - 2. Phase and Neutral Bus Material: Aluminum.
 - 3. Ground Bus Material: Aluminum.
 - D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
 - E. Enclosures:
 - 1. Provide surface-mounted or flush-mounted enclosures as indicated.
 - 2. Provide clear plastic circuit directory holder mounted on inside of door.
- 2.03 OVERCURRENT PROTECTIVE DEVICES**
 - A. Molded Case Circuit Breakers:
 - 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating as required by the available fault current, but not less than
 - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 3. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - 5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

- 3.01 INSTALLATION**
 - A. Perform work in accordance with NECA 1 (general workmanship).
 - B. Install products in accordance with manufacturer's instructions.
 - C. Install transformers in accordance with NECA 409 and IEEE C57.94.
 - D. Use flexible conduit, under the provisions of Section 26 05 33.13, 2 feet (600 mm) minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
 - E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.
 - F. Provide grounding and bonding in accordance with Section 26 05 26.
 - G. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.
 - H. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.
- 3.02 FIELD QUALITY CONTROL**
 - A. Inspect and test in accordance with NETA ATS, except Section 4.
- 3.03 ADJUSTING**
 - A. Measure primary and secondary voltages and make appropriate tap adjustments.
 - B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

- PART 1 GENERAL**
- 1.01SECTION INCLUDES**
 - A. Lighting and appliance panelboards.
 - B. Overcurrent protective devices for panelboards.
- 1.02SUBMITTALS**
 - A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
 - B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 - C. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- PART 2 PRODUCTS**
- 2.01 PANELBOARDS - GENERAL REQUIREMENTS**
 - A. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet (2,000 m).
 - 2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
 - C. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
 - D. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
 - E. Bussing: Sized in accordance with UL 87 temperature rise requirements.
 - 1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 - F. Conductor Terminations: Suitable for use with the conductors to be installed.
 - G. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 - c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
 - d. Lockable Doors: All locks keyed alike unless otherwise indicated.
 - H. Future Provisions: Provide all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
 - I. Load centers are not acceptable.
- 2.02 LIGHTING AND APPLIANCE PANELBOARDS**
 - A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings,

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PART 3 EXECUTION

- 3.01 INSTALLATION**
- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required supports in accordance with Section 26 05 29.
- F. Install panelboards plumb.
- G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.
- H. Provide grounding and bonding in accordance with Section 26 05 26.
- I. Install all field-installed branch devices, components, and accessories.
- J. Provide filler plates to cover unused spaces in panelboards.

END OF SECTION

**SECTION 26 24 19
MOTOR-CONTROL CENTERS**

PART 1 GENERAL

- 1.01SECTION INCLUDES**
- A. Low-voltage (600 V and less) standard (non-arc-resistant) NEMA motor control centers.
- B. Motor control center units:
 1. Feeder units.
 2. Combination magnetic motor starter units.
- C. Overcurrent protective devices for motor control centers and associated units, including overload relays.
- D. Motor control accessories:
 1. Auxiliary contacts.
 2. Pilot devices.
 3. Control and timing relays.
 4. Control power transformers.
 5. Control terminal blocks.

- 1.02SUBMITTALS**
- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor control centers, enclosures, units, overcurrent protective devices, and other installed components and accessories.
- B. Shop Drawings: Indicate dimensions, voltage, bus ampacities, unit arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
- C. Field Quality Control Test Reports.
- D. Project Record Documents: Record actual installed locations of motor control centers and final equipment settings.

PART 2 PRODUCTS

- 2.01 MANUFACTURERS**
- A. Motor Control Centers:
 1. Rockwell Automation, Inc.; Allen-Bradley Products: ab.rockwellautomation.com.
- 2.02 MOTOR CONTROL CENTERS**
- A. Provide motor control centers consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Dead-front standard (non-arc-resistant) type motor control center assemblies complying with NEMA ICS 18, and listed and labeled as complying with UL 845; ratings, configurations and features as indicated on the drawings.
- D. Configuration:
 1. Arrangement: Front-mounted units only (no rear-mounted units or back-to-back configuration).
 2. NEMA Classification and Wiring Type: NEMA ICS 18, Class I, Type B (B-T for units size 3 or smaller).
- E. Service Conditions:
 1. Provide motor control centers and associated components suitable for operation under the following service conditions without derating:
 - a. Altitude:
 - 1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet (1,000 m).
 - 2) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet (2,000 m).
 - b. Ambient Temperature: Between 32 degrees F (0 degrees C) and 104 degrees F (40 degrees C).
 2. Provide motor control centers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
- F. Short Circuit Current Rating:
 1. Provide motor control centers and associated units with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- G. Bussing:
 1. Horizontal Main Bus: Size for a maximum temperature rise of 117 degrees F (65 degrees C) over an ambient temperature of 104 degrees F (40 degrees C), in compliance with NEMA ICS 18 and UL 845 requirements.
 2. Vertical Bus: Minimum size of 300 A, in compliance with NEMA ICS 18 requirements.
 3. Provide fully rated neutral lug pad in incoming section where neutral is indicated, with a suitable lug for each feeder and branch circuit requiring a neutral connection.
 4. Provide solidly bonded equipment ground bus through full length of motor control center, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 5. Phase and Neutral Bus Material: Copper.
 6. Ground Bus Material: Copper.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
 1. Line Conductor Terminations:
 - a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - b. Main and Neutral Lug Type: Mechanical.
- I. Enclosures:
 1. Comply with NEMA ICS 6.
 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 12.
 - 3. Finish: Manufacturer's standard unless otherwise indicated.
- J. Future Provisions:
 1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- K. Surge Protective Devices: Comply with Section 26 43 00.
- L. Owner Metering:
 1. Provide microprocessor-based digital electrical metering system including all instrument transformers, wiring, and connections necessary for measurements specified.
- M. Measured Parameters:
 - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
 - b. Current (Amps): For each phase and neutral.
 - c. Frequency (Hz).
 - d. Real power (KW): For each phase, 3-phase total.
 - e. Reactive power (kVAR): For each phase, 3-phase total.
 - f. Apparent power (kVA): For each phase, 3-phase total.
 - g. Power factor.
 3. Meter Accuracy: Plus/minus 1.0 percent.

- 2.03 MOTOR CONTROL CENTER UNITS**
- A. Feeder Units: Fusible switch type.
- B. Combination Magnetic Motor Starter Units:
 1. Description: NEMA ICS 2, Class A combination motor controllers with magnetic contactor(s), externally operable disconnect and overload relays).
 2. Configuration: Full-voltage non-reversing type unless otherwise indicated.
 3. Disconnects: Fusible switch type.
 - a. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
 - b. Provide auxiliary interlock for disconnection of external control power sources where applicable.
 4. Overload Relays: Bimetallic thermal type unless otherwise indicated.
 5. Variable-Frequency AC Drive Units: Comply with Section 26 29 23.

- 2.04 OVERCURRENT PROTECTIVE DEVICES**
- A. Overload Relays:
 1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
 2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
 3. Trip-free operation.
 4. Visible trip indication.
 5. Resettable.
 - a. Employ manual reset unless otherwise indicated.
 - b. Do not employ automatic reset with two-wire control.
 6. Bimetallic Thermal Overload Relays:
 - a. Interchangeable current elements/heaters.
 - b. Adjustable trip; plus/minus 10 percent of nominal, minimum.
 - c. Trip test function.
- B. Fusible Devices:
 1. Fusible Switches:
 - a. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
 - b. Fuse Clips: As required to accept indicated fuses.
 - c. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

- 2.05 MOTOR CONTROL ACCESSORIES**
- A. Auxiliary Contacts:
 1. Comply with NEMA ICS 5.
 2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each starter unit, minimum.
- B. Pilot Devices:
 1. Comply with NEMA ICS 5; heavy-duty type.
 2. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
 3. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
 4. Indicating Lights: Push-to-test type unless otherwise indicated.
 5. Provide LED lamp source for indicating lights and illuminated devices.
- C. Control and Timing Relays:
 1. Comply with NEMA ICS 5.
 2. Provide number and type of relays indicated or required to perform necessary functions.
- D. Control Power Transformers:
 1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices, plus 25 percent spare capacity.
 2. Include primary and secondary fuses.
- E. Control Terminal Blocks: Include 25 percent spare terminals.

- PART 3 EXECUTION**
- 3.01 INSTALLATION**
- A. Install products in accordance with manufacturer's instructions.
- B. Install motor control centers in accordance with NECA 1 (general workmanship), NECA 402, and NEMA ICS 2.3.
- C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
- D. Provide required support and attachment components in accordance with Section 26 05 29.
- E. Install motor control centers plumb and level.
- F. Unless otherwise indicated, mount motor control centers on properly sized 4 inch (100 mm) high concrete pad constructed in accordance with Section 03 30 00.
- G. Provide grounding and bonding in accordance with Section 26 05 26.
- H. Install all field-installed devices, components, and accessories.
- I. Provide fuses complying with Section 26 28 13 for fusible switches as indicated.
- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Set field-adjustable motor controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.
- L. Provide filler plates to cover unused spaces.

- 3.02 FIELD QUALITY CONTROL**
- A. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.
- B. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
- C. Before energizing motor control center, perform insulation resistance testing in accordance with NECA 402 and NEMA ICS 2.3.
- D. Inspect and test in accordance with NETA ATS, Section 7.16.1.1.
- E. Perform inspections and tests listed in NETA ATS, Section 7.16.2.1.
- F. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.
- G. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- H. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.
- I. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10.
- J. Correct deficiencies and replace damaged or defective motor control centers or associated components.

- 3.03 ADJUSTING**
- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of motor control center covers and doors.

- 3.04 CLEANING**
- A. Clean dirt and debris from motor control center enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred surfaces to match original factory finish.

- 3.05 CLOSEOUT ACTIVITIES**
- A. Demonstration: Demonstrate proper operation of motor controllers to Owner, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's personnel on operation, adjustment, and maintenance of motor control center and associated devices.
 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

**SECTION 26 27 28
WIRING DEVICES**

- PART 1 GENERAL**
- 1.01SECTION INCLUDES**
- A. Wall switches.
- B. Receptacles.
- C. Wall plates.
- 1.02SUBMITTALS**
- A. Project Record Documents: Record actual installed locations of wiring devices.
- PART 2 PRODUCTS**
- 2.01 WIRING DEVICE APPLICATIONS**
- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- 2.02 WIRING DEVICE FINISHES**
- A. Provide wiring device finishes as described below unless otherwise indicated.

- B. Wiring Devices Installed in Unfinished Spaces: White with galvanized steel wall plate.
- C. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover.

- 2.03 WALL SWITCHES**
- A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-996; types as indicated on the drawings.
 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

- 2.04 RECEPTACLES**
- A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-996; types as indicated on the drawings.
 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 2. NEMA configurations specified are according to NEMA WD 6.
- B. Convenience Receptacles:
 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
 2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
- C. GFCI Receptacles:
 1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
 2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
 3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

- 2.05 WALL PLATES**
- A. Wall Plates: Comply with UL 514D.
 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 2. Size: Standard, _____.
 3. Screws: Metal with slotted heads finished to match wall plate finish.
- B. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- C. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- D. Weatherproof Covers for Damp Locations: Gasketed, thermoplastic, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.
- E. Weatherproof Covers for Wet Locations: Gasketed, thermoplastic, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

- 3.01 INSTALLATION**
- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.
 1. Mounting Heights: Unless otherwise indicated, as follows:
 - a. Wall Switches: 48 inches (1200 mm) above finished floor.
 - b. Receptacles: 18 inches (450 mm) above finished floor or 6 inches (150 mm) above counter.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtail not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- I. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- J. Install wall switches with OFF position down.
- K. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- L. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- M. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

- 3.02 FIELD QUALITY CONTROL**
- A. Inspect each wiring device for damage and defects.
- B. Operate each wall switch with circuit energized to verify proper operation.
- C. Test each receptacle to verify operation and proper polarity.
- D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- E. Correct wiring deficiencies and replace damaged or defective wiring devices.

END OF SECTION

**SECTION 26 28 13
FUSES**

- PART 1 GENERAL**
- 1.01SECTION INCLUDES**
- A. Fuses.
- B. Spare fuse cabinet.
- 1.02SUBMITTALS**
- A. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. Extra Fuses: One set(s) of three for each type and size installed.
 2. Fuse Pullers: One set(s) compatible with each type and size installed.
 3. Spare Fuse Cabinet Keys: Two.

- PART 2 PRODUCTS**
- 2.01 FUSES**
- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.
- H. Class J Fuses: Comply with UL 248-8.
- I. Class CC Fuses: Comply with UL 248-4.
- 2.02 SPARE FUSE CABINET**
- A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.
- PART 3 EXECUTION**
- 3.01 INSTALLATION**
- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.
- C. Install spare fuse cabinet where indicated.

END OF SECTION

**SECTION 26 29 23
VARIABLE-FREQUENCY MOTOR CONTROLLERS**

- PART 1 GENERAL**
- 1.01SECTION INCLUDES**
- A. Variable frequency controllers.
- 1.02RELATED REQUIREMENTS**
- A. Section 26 28 13 - Fuses.

- 1.03SUBMITTALS**
- A. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
- PART 2 PRODUCTS**
- 2.01 MANUFACTURERS**
- A. Rockwell Automation; Model Powerflex 753 with bypass.
- 2.02 DESCRIPTION**
- A. Variable Frequency Controllers: Enclosed controllers suitable for operating the indicated loads, in conformance with requirements of NEMA ICS 7. Select unspecified features and options in accordance with NEMA ICS 3.1.
 1. Employ microprocessor-based inverter logic isolated from power circuits.
 2. Employ pulse-width-modulated inverter system.
 3. Design for ability to operate controller with motor disconnected from output.
 4. Design to attempt five automatic restarts following fault condition before locking out and requiring manual restart.
- B. Enclosures: NEMA 250, Type 1, suitable for equipment application in places accessible only to qualified personnel.

- 2.03 OPERATING REQUIREMENTS**
- A. Rated Input Voltage: 480 volts, three phase, 60 Hertz.
 1. VFD shall be capable of converting single phase 480V input power to three phase output power.
- B. Motor Nameplate Voltage: 460 volts, three phase, 60 Hertz.
- C. Volts Per Hertz Adjustment: Plus or minus 10 percent.
- D. Current Limit Adjustment: 60 to 110 percent of rated.
- E. Acceleration Rate Adjustment: 0.5 to 30 seconds.
- F. Deceleration Rate Adjustment: 1 to 30 seconds.
- G. Input Signal: 4 to 20 mA DC.
- 2.04 COMPONENTS**
- A. Display: Provide integral digital display to indicate output voltage, output frequency, and output current.
- B. Furnish HAND-OFF-AUTOMATIC selector switch and manual speed control.
- C. Control Power Source: Separate circuit.
- D. Safety Interlocks: Furnish terminals for remote contact to inhibit starting under both manual and automatic mode.
- E. Control Interlocks: Furnish terminals for remote contact to allow starting in automatic mode.
- F. Manual Bypass: Furnish contactor, motor running overload protection, and short circuit protection for full voltage, non-reversing operation of the motor. Include isolation switch to allow maintenance of inverter during bypass operation.
- G. Disconnecting Means: Include integral fused disconnect switch on the line side of each controller.

PART 3 EXECUTION

- 3.01 INSTALLATION**
- A. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.
- B. Tighten accessible connections and mechanical fasteners after placing controller.
- C. Provide fuses in fusible switches; refer to Section 26 28 13 for product requirements.
- 3.02 ADJUSTING**
- A. Make final adjustments to installed controller to assure proper operation of load system. Obtain performance requirements from installer of driven loads.
- 3.03 CLOSEOUT ACTIVITIES**
- A. Demonstrate operation of controllers in automatic and manual modes.

END OF SECTION

**SECTION 26 36 00
TRANSFER SWITCHES**

- PART 1 GENERAL**
- 1.01SECTION INCLUDES**
- G. Transfer switches for low-voltage (600 V and less) applications and associated accessories:
 1. Automatic transfer switches.
 2. Includes service entrance rated transfer switches.
 3. Includes bypass/isolation transfer switches.
 4. Remote annunciators.
- 1.02SUBMITTALS**
- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, service condition requirements, and installed features.
- B. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.
- C. Manufacturer's detailed field testing procedures.
- D. Maintenance contracts.
- E. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

- 1.03WARRANTY**
- A. Provide minimum two year manufacturer warranty covering repair or replacement due to defective materials or workmanship.
- PART 2 PRODUCTS**
- 2.01 TRANSFER SWITCHES**
- A. Provide complete power transfer system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Construction Type: Either "contactor type" (open contact) or "breaker type" (enclosed contact) transfer switches complying with specified requirements are acceptable.
- D. Automatic Transfer Switch:
 1. Transfer Switch Type: Service entrance rated bypass/isolation automatic transfer switch.
 2. Transition Configuration: Open-transition (no neutral position), utilizing in-phase monitor.
 3. Voltage: As indicated on the drawings.
 4. Ampere Rating: As indicated on the drawings.
 5. Neutral Configuration: Solid neutral (unswitched), except as indicated.
 6. Load Served: As indicated on the drawings.
 7. Primary Source: As indicated on the drawings.
 8. Alternate Source: As indicated on the drawings.
 9. Features:
 - a. Manual operation mode.
- E. Comply with NEMA ICS 10 Part 1, and list and label as complying with UL 1008 for the classification of the intended application (e.g. emergency, optional standby).
- F. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.
- G. Load Classification: Classified for total system load (any combination of motor, electric discharge lamp, resistive, and tungsten lamp loads with tungsten lamp loads not exceeding 30 percent of the continuous current rating) unless otherwise indicated or required.
- H. Switching Methods:
 1. Open Transition:
 - a. Provide break-before-make transfer without a neutral position that is not connected to either source, and with interlocks to prevent simultaneous connection of the load to both sources.
 - b. Where in-phase transfer is indicated, utilize in-phase monitor to initiate transfer when phase angle difference between sources is near zero to limit in-rush currents.
 2. Obtain control power for transfer operation from line side of source to which the load is to be transferred.
- I. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.

MARK	DATE	DESCRIPTION	REVISIONS



BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
SANITARY SEWER IMPROVEMENT PLAN
FOR
**THE PINES, SECTION 1
PHASE A & B**
MECHANICAL / ELECTRICAL SPECIFICATIONS

DATE
APRIL 2018

SCALE
As Noted

JOB NO.
20170824

SHEET
30/32



J. Enclosures:

1. Environment Type per NEMA 250. Unless otherwise indicated, as specified for the following installation locations:

- a. Indoor Clean, Dry Locations: Type 1 or Type 12.
b. Outdoor Locations: Type 3R or Type 4.
2. Finish: Manufacturer's standard unless otherwise indicated.

K. Short Circuit Current Rating:

1. Withstand and Closing Rating: Provide transfer switches, when protected by the supply side overcurrent protective devices to be installed, with listed withstand and closing rating not less than the available fault current at the installed location as indicated on the drawings.

L. Automatic Transfer Switches:

1. Description: Transfer switches with automatically initiated transfer between sources; electrically operated and mechanically held.

2. Control Functions:

- a. Automatic mode.
b. Test Mode: Simulates failure of primary/normal source.
c. Voltage and Frequency Sensing:

- 1) Undervoltage sensing for each phase of primary/normal source; adjustable dropout/pickup settings.
2) Undervoltage sensing for alternate/emergency source; adjustable dropout/pickup settings.
3) Underfrequency sensing for alternate/emergency source; adjustable dropout/pickup settings.

d. Outputs:

- 1) Contacts for engine start/shutdown (except where direct generator communication interface is provided).
2) Auxiliary contacts; one set(s) for each switch position.

e. Adjustable Time Delays:

- 1) Engine generator start time delay; delays engine start signal to override momentary primary/normal source failures.
2) Transfer to alternate/emergency source time delay.
3) Retransfer to primary/normal source time delay.
4) Engine generator cooldown time delay; delays engine shutdown following retransfer to primary/normal source to permit generator to run unloaded for cooldown period.

f. In-Phase Monitor (Open Transition Transfer Switches): Monitors phase angle difference between sources for initiating in-phase transfer.

g. Engine Exerciser: Provides programmable scheduled exercising of engine generator selectable with or without transfer to load; provides memory retention during power outage.

h. Retransfer to Normal Switch: Bypasses time delays for retransfer to primary/normal source.

3. Status Indications:

- a. Connected to alternate/emergency source.
b. Connected to primary/normal source.
c. Alternate/emergency source available.
d. Primary/normal source available.

4. Automatic Sequence of Operations:

a. Upon failure of primary/normal source for a programmable time period (engine generator start time delay), initiate starting of engine generator where applicable.

b. When alternate/emergency source is available, transfer load to alternate/emergency source after programmable time delay.

c. When primary/normal source has been restored, retransfer to primary/normal source after a programmable time delay. Bypass time delay if alternate/emergency source fails and primary/normal source is available.

d. Where applicable, initiate shutdown of engine generator after programmable engine cooldown time delay.

M. Service Entrance Rated Transfer Switches:

1. Furnished with integral disconnecting and overcurrent protective device on the primary/normal source and with ground-fault protection where indicated.

2. Listed and labeled as suitable for use as service equipment according to UL 869A.

N. Bypass/Isolation Transfer Switches:

1. Description: Factory-assembled units consisting of interconnected transfer switch and bypass/isolation switch that permits manual bypass and isolation of the transfer switch with connection of the load to either source.

2. Bypass/Isolation Switch Type: Provide overlapping (make-before-break) switches with no interruption of power to load. Load break (break-before-make) switches that interrupt power to load are not acceptable.

3. Bypass/Isolation Operation:

- a. Operable from exterior of enclosure.
b. Normal Mode: Provides for normal operation of transfer switch.
c. Test Mode: Provides for operational testing of bypassed transfer switch without affecting power to load.
d. Isolate Mode: Provides for complete isolation of transfer switch from all power sources, permitting removal from unit.

O. Remote Annunciators:

1. Remote Annunciator Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.

2. Transfer Switch Status Indications:

- a. Connected to alternate/emergency source.
b. Connected to primary/normal source.
c. Alternate/emergency source available.
d. Primary/normal source available.

P. Interface with Other Work:

1. Interface with pump station controller as noted on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
B. Verify that the ratings and configurations of transfer switches are consistent with the indicated requirements.
C. Verify that rough-ins for field connections are in the proper locations.
D. Verify that mounting surfaces are ready to receive transfer switches.
E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
B. Install products in accordance with manufacturer's instructions.
C. Arrange equipment to provide minimum clearances and required maintenance access.
D. Provide required support and attachment in accordance with Section 26 05 29.
E. Install transfer switches plumb and level.
F. Provide grounding and bonding in accordance with Section 26 05 26.
G. Identify transfer switches and associated system wiring in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

- A. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.
B. Prepare and start system in accordance with manufacturer's instructions.
C. Automatic Transfer Switches:
1. Inspect and test in accordance with NETA ATS, except Section 4.
2. Perform inspections and tests listed in NETA ATS, Section 7.22.3. The control wiring insulation-resistance tests listed as optional are not required.
D. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.04 MAINTENANCE

A. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of transfer switches for two years from date of Substantial Completion. Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

END OF SECTION

SECTION 40 91 02.02 LEVEL MEASUREMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. General. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.

1.02 DESCRIPTION OF WORK

- A. General. The Contractor shall provide the labor, tools, equipment, and materials necessary to install level measurement equipment in accordance with the Contract Drawings and as specified herein.
B. Types. The types of equipment specified in this section include the following:
1. Submersible transducer.
2. Float switches.

1.03 QUALITY ASSURANCE

A. Codes and Standards. Perform all work associated with level measurement equipment in compliance with applicable requirements of governing agencies having jurisdiction and in accordance with these plans and as specified herein.

- 1. National Electrical Manufacturers Association (NEMA) Compliance.
2. National Electrical Code (NEC) Compliance.
3. Underwriters' Laboratories, Inc. (UL) Compliance and Labeling. Comply with provisions of UL safety standards pertaining to level measurement equipment. Provide products and components which have been UL listed and labeled.

B. Qualifications

- 1. Manufacturer's Qualifications. Firms regularly engaged in manufacturing of level measurement equipment whose products have been in satisfactory use in similar service for not less than 3 years.
2. Installer's Qualifications. Qualified with at least 5 years of successful installation experience on projects with level measurement equipment similar to that required for this project.

1.04 SUBMITTALS

- A. General. Furnish manufacturer's product data, test reports, and material certifications as required.
B. Materials List. Submit a list of materials giving quantities, manufacturer's name, and catalog numbers.
C. Wiring Diagrams. Submit wiring diagrams showing all connections for all equipment furnished under this section.
D. Calibrations. Furnish two certified copies of calibrations.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping. Deliver equipment properly packaged and mounted on pallets or skids to facilitate handling of heavy items. Utilize factory fabricated type containers or wrappings for components which protect equipment from damage.

1.06 SPECIAL WARRANTY

A. General. The Contractor shall retain the services of factory trained service personnel to provide repair services for instruments for 1 year commencing with the time the system equipment is complete and including all repair and replacement parts needed during warranty period.

PART 2 - PRODUCTS

2.01 LEVEL SENSING DEVICE

A. Submersible Level Transducer

- 1. One analog submersible level transducer shall be supplied with the control panel. The transducer shall have the following characteristics:
a. 4-20 millamp level signal
b. Sealed unit, non-fouling
c. Large diameter 316 stainless steel diaphragm
d. Abrasion resistant
e. Built in lightning arrester
f. UL approved intrinsically safe for use in hazardous locations when used with proper barrier
2. Component shall be Dwyer Mercoid series PBLTX, with measurement range and cable length to suit installation conditions.

B. Back up float switches

- 1. One mechanical control float switch shall be supplied with the control panel in order to operate the backup float circuitry, plus one spare (total two).
a. Mechanically activated, snap-action contacts
b. No mercury
c. High impact corrosion resistant polypropylene or stainless steel housing
d. UL listed for use in non-potable water and sewage
e. Five-year limited warranty
2. Component shall be SJE-Rhombus, MillampMaster™, Flygt ENM-10, or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
B. Discrepancies. In the event any discrepancies are discovered, immediately notify the Engineer/Architect in writing. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 PREPARATION

- A. Protection
1. All equipment and materials shall be packaged at the factory to protect each item from damage during shipment and storage.
2. Provide blocking and cushioning materials to prevent damage during shipment.
3. Provide temporary lifting lugs on shipping package as needed.
4. Include approximately 1 pint of touch-up paint for each finish color in shipment.
B. Surface Preparation. The work shall be carefully laid out in advance. Where cutting, drilling, etc. of floors, walls, ceilings, or other surfaces is necessary, this work shall be carefully done. Any damage to building, piping, or equipment shall be repaired by skilled mechanics of the trades involved, and at no additional cost to the Owner.

3.03 INSTALLATION

A. General

- 1. Install equipment as indicated in accordance with manufacturer's written instructions and in compliance with recognized industry practices.
2. Mount instruments so that they may be readily approached and easily serviced.
3. Level Measurement Installation.
a. Coordinate the installation of level sensing devices with the process equipment and Contract drawings.
b. Install manufacturer's supplied cable between level element and transmitter. If flexible conduit is not provided or where conditions dictate, furnish and install rigid conduit sized according to manufacturer's recommendations.
c. Install ground references as required for the application.

3.04 FIELD QUALITY CONTROL

- A. Inspection. Upon completion of this portion of the work, the Contractor shall provide for services of a qualified representative of the manufacturer to inspect and approve installation.
B. Tests. Upon completion of all inspections and prior to acceptance by Owner, perform field tests outlined in the "Instrumentation Systems Basic Requirements" section.
C. Demonstration. When all required tests have been performed and final approval has been given, a qualified representative of the supplier shall thoroughly demonstrate to Owner's personnel operation and maintenance of all items installed under this section.

END OF SECTION

SECTION 40 95 13.01 PUMP STATION CONTROL PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes all elements required to furnish and install a complete electrical control system to control, operate, and display information as indicated in the plans and specifications. The control system shall include all equipment, devices, wiring, and incidental materials to operate the system and display or relay information in accordance with these specifications. The intention of this section is to secure a complete control system that will operate equipment in accordance with narratives and requirements indicated in the plans, specifications, and manufacturer's literature for the equipment installed. All circuits and devices for protection of installed equipment shall be included in the lump sum bid.

1.02 SCOPE OF WORK

A. The contractor shall furnish and install with each pump station, one control panel. The pump station control panel shall house the complete electrical system to operate the pump station. The control panel shall be manufactured by a UL certified panel facility and shall meet all UL698A standards (Industrial control equipment with circuit extensions into hazardous locations). All components shall be UL recognized or listed including those supplied by the pump manufacturer and the control panel shall house all necessary controls including circuit breakers, and other equipment specified herein. The enclosure(s) shall be built to meet NEMA ratings (Control compartment), (Service and MCC compartments), and shall in all respects conform to the National Electric Code and all other state and local codes which may apply.

1.03 DEFINITIONS

- A. AIC - Amps Interrupting Current is the maximum current that is produced upon a fault to ground or a fault between phases.
B. Arc Flash - An electrical explosion that can occur when there is an uncontrolled conduction of electrical current to ground or to another phase. An Arc Flash occurs very rapidly and produces intense heat and energy that can harm personnel and destroy equipment.
C. Control Compartment - A compartment or enclosure in the control panel assembly that contains all control components of the pump station including the PLC (controller), communications and other devices.
D. FLA - Full Load Amps
E. GFCI - Ground Fault Circuit Interrupter
F. GPM - Gallons Per Minute
G. HMI - Human Machine Interface
H. HOA - Hand-Off-Auto operator switch
I. kW - Kilowatts (power)
J. MCC - Motor Control Center
K. MCC Compartment - A compartment or enclosure in the control panel assembly that contains components related to motor starting. Some components include variable frequency drives, pump breakers, the control power transformer, and the voltage monitor.
L. Service Compartment - A compartment or enclosure in the control panel assembly that contains service entrance or incoming power feeder equipment for the station. Some components include main incoming terminal blocks, main service or incoming feeder circuit breaker, and phase monitor and other protective devices.
M. PID - Proportional Integral and Derivative
N. PID Mode - A mode in the controller that keeps a constant wet well level by varying the pump speed.

O. PLC - Programmable Logic Controller

P. Skirt Compartment - A vented compartment, enclosure, or wireway under the control panel assembly that is reserved for routing of cables into various compartments.

Q. UPS - Uninterruptible Power Supply

R. VFD - Variable Frequency Drive

1.04 REFERENCES

- A. ANSI/NFPA@ 70 - National Electrical Code® (NEC®)
B. IEC 61000 - Electromagnetic Compatibility
C. NEMA 250 - Enclosures for Electrical Equipment
D. NEMA ICS7 - Industrial Control and Systems Adjustable Speed Drives
E. UL@ 50 - Enclosures for Electrical Equipment
F. UL 98 - Disconnect Switches
G. UL 507 - Electric Fans
H. UL 508 - Industrial Control Equipment
I. UL 508C - Power Conversion Equipment
J. UL 698A - Circuit extension into hazardous locations
K. UL 991 - Safety Tests
L. IEEE-519 - Harmonic levels
M. NFPA 70E - National Fire Protection Association

1.05 SUBMITTALS

A. Shop Drawings

1. The Engineer reserves the right to approve or disapprove any and all equipment based upon evaluation. Approval for fabrication and installation will be made only after submittal and review of all shop contract documents. The information required for approval shall include the following items and be provided to the Engineer for approval.

- a. Electrical schematics
b. Enclosure dimensional drawings
c. Complete layout drawing with dimensions
d. Environmental calculations in MCC compartment
e. Environmental calculations in Control compartment
f. Manufacturer data sheet for all components
g. Complete bill of material
h. User operating manual
i. Installation instructions
j. 2 year warranty certificate

B. All submittals shall be made in electronic PDF format, in addition to any other format required by other specification sections.

1.06 SUBSTITUTIONS

A. The Engineer will consider proposals for substitution of materials, equipment, methods and services only when proposals are accompanied by full and technical data and all other information required by the Engineer for the proposed substitution. Substitution of materials, equipment, methods and/or services is not allowed unless such substitution has been specifically approved by the Engineer. The Contractor shall allow 15 days for approval after receipt by the Engineer.

1.07 QUALITY ASSURANCE

A. Control panel

- 1. Control panel shall be manufactured in a UL508A facility and be UL certified to manufacture panels with UL698A intrinsically safe components.
2. Factory shall conduct full operational tests with appropriate voltage applied to the panel.

1.08 DELIVERY, HANDLING, STORAGE

A. All materials relating to this section individually and as completed panels shall be handled as fragile equipment and stored only inside closed buildings and protected from moisture entry. All openings shall be continuously sealed until the moment that connections thereto are actually made.

1.09 WARRANTY

A. Warranty: 24 Months from date of manufacture. The warranty shall apply to being free of defects in material and workmanship.

PART 2 - PRODUCTS

2.01 ENCLOSURE

A. The enclosure shall be one freestanding enclosure consisting of four different compartments within one footprint, or one assembly of four separate enclosures mounted on a common support frame with all enclosures connected flush or with pipe nipples, or, where installed indoors, the enclosure may consist of separate freestanding or wall mounted enclosures connected together as necessary by conduits or wireways.

2.02 COMPARTMENT REQUIREMENTS

- A. The Service compartment shall house the main service power components.
1. This compartment function is satisfied by the service entrance rated automatic transfer switch for this project.
B. The MCC compartment shall house the motor starter components.
1. This compartment is a separate motor control center assembly for this project.
C. The Control compartment shall house all controls associated with the panel. The maximum voltage within this compartment is to be 120vac.
D. The Cable entrance compartment is a nonrated vented compartment that provides an area for the entry of cables from the wet well. All cables with the exception of line power will come through the cable entrance compartment.
1. This compartment is not necessary for control panel assemblies installed indoors.
E. Conduit and mounting template - A drawing shall be provided with each enclosure to provide anchoring locations and conduit locations entering the enclosure. This drawing shall be available at the time of conduit and foundation layout.

2.03 ENCLOSURE CONSTRUCTION

- A. All compartments are fabricated as one complete unit with singular common separation walls resulting in one complete enclosure, or as separate enclosures connected flush or with pipe nipples and mounted on a common frame, or, where installed indoors, as separate enclosures connected by conduits or wireways. The NEMA Type rating integrity of each compartment or enclosure shall be maintained at all times from the factory manufactured enclosure through final installation.
B. The entire panel enclosure when mounted indoors shall be NEMA 12, painted steel.
C. Interior wall construction: all common walls shall consist of one sheet of painted steel with a minimum 16-gauge thickness, or 14-gauge where any dimension is greater than 24 inches.
D. Interior mounting: all mounting plates, hinges and other components mounted onto the enclosure walls shall be held in place by stainless steel studs.
E. Exterior door handles to be steel powder coated black. Door handles to be fully lockable and able to accommodate a #21 Master padlock. Each door handle must be NEMA Type rated to maintain the rating of the associated compartment.
F. Exterior door hinges shall be continuous steel piano type hinges.
G. Mechanical door stops to be mounted on the Control and MCC compartment doors to secure the door in the open position at 110 degrees. Door may be closed by manually lifting up on the door stop arm. They shall be located at the bottom of each cabinet door.
H. A fold out aluminum 3-ring binder shall hold the Electrical schematic and all job specific documentation. All documentation shall be laminated
I. Back panels shall be constructed of painted or stainless steel, 12-gauge minimum. Back panels to have 1/2" mounting hole at a minimum at each corner. Back panels are to be mounted to the enclosure with a minimum of 3/8" studs and nuts.
J. The Control compartment shall have a dead front inner door for mounting the controller, indicators, and switches. The inner door shall be constructed out of 12-gauge steel, minimum. The door shall be mounted to the enclosure via a continuous steel piano hinge. Two twist lock latches are to be used to secure the inner door in the closed position. The latches are to be T-handle type constructed from polyamide-6 nylon plastic 30% glass reinforced material or material of equal durability. They shall be mountable through square holes to prevent rotation of the entire mechanism.

2.04 GENERAL ENCLOSURE REQUIREMENTS

- A. The reduction of the Arc Flash potential shall be reduced by isolating high voltage into specific compartments.
B. The Service and MCC compartments may contain components that operate at a voltage that is capable of creating an Arc Flash condition. Personnel Protection Equipment (PPE) is required. Accessibility should be limited to qualified electricians only.
C. The Control compartment only contains control voltage (maximum of 120vac). Minimal Personnel Protection Equipment (PPE) is required for operators and maintenance personnel. See NFPA 70E for proper PPE requirements.
D. All penetrations through compartments shall be performed to maintain the NEMA Type ratings of each individual compartment.
E. The enclosure shall be constructed so that no screws or bolt heads are visible when viewed from any external portion of the enclosure.
F. Punch cutouts for instruments and other devices shall be cut, punched, or drilled and smoothly finished with rounded edges.
G. No holes shall be drilled in the top (rain cap) of the cabinet.
H. Electrical schematic shall be permanently affixed to inside of the outer door of the Control and MCC compartments. The schematic shall resist water and prevent removal and discoloration from heat, gasses, and ultraviolet light.

2.05 SERVICE COMPARTMENT COMPONENT AND REQUIREMENTS

- A. Reference Transfer Switch specifications.
B. Surge Protective Device
1. Provide surge protective devices (SPD's) as shown on drawings and per specifications.
C. Phase Monitor
1. The phase loss monitor shall be supplied from the load side of the main service disconnect. It may be mounted in a separate enclosure or in a common enclosure with other components.

2.06 MCC COMPARTMENT COMPONENT AND REQUIREMENTS

- A. Reference Motor Control Center specifications.
B. Line reactors

1. A line reactor shall be connected to the input of each VFD power circuit. The line reactor shall be located in the MCC compartment and selected according VFD manufacturer and the motor FLA. One line reactor shall be installed per VFD to provide a reduction of harmonics.

C. Variable Frequency Drives

- 1. VFD's shall be located in the MCC compartment and connected to the load side of a dedicated line reactor.
2. VFD's Requirement are to follow specification as stated in this Section.

2.07 CONTROLS COMPARTMENT COMPONENT AND REQUIREMENTS

A. Operator Interface Terminal (OIT)

- 1. 320x240 minimum resolution backlit LED display
2. Memory: minimum 256 MB RAM
3. NEMA 4 display rating
4. Manufacturer: Multismart pump station manager by Multitrode

B. Pump Controller

- 1. Programmability
a. 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 OIT.
2. Minimum Features
a. Pump control of up to six 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 six 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. Supply voltage monitoring and supply fault management.
n. Monitoring of DC power supply, battery voltage, and internal controller temperature.
o. Energy, power, and pump efficiency monitoring.
p. Motor protection features including: current monitoring for each pump, over- and under-current trip, ground/earth fault, current phase imbalance fault, i2t fault, and insulation resistance testing for motor windings.
q. Flow measurement: calculated flow via liquid level draw down data.
r. VFD 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 including security.
u. 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.

3. Functionality

a. 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, e.g. from power failure, and become available to be called to run by the controller.

4. Automatic Control

- A. In automatic mode, lead pump operation shall be initiated when wet well level exceeds lead pump set point. Under normal circumstances, the level will then drop and the pump operation stops when the level drops below the pumps off set point.
b. In the event of a failure of the lead pump, the level will rise above the lead pump set point to the alarm set point, at which point a lead pump failed alarm shall be generated, and then to the lag pump set point. At this time the lag pump shall be started and continue to run until the level drops below the pumps off set point.
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, e.g. level sensor failure, high level level set point activated, emergency pumping circuit activated.
5. All level set points for operation and alarms shall be adjustable from the display or remotely, meaning the user can choose what levels trigger each condition.
6. All monitoring and alarm signals shown with 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 acknowledgment either at the display or remotely in order to reset the alarm.

7. Communications

- a. Physical - The pump controller shall include the following data communication ports:
1) Two ethernet ports (10 Mb/s)
2) Two RS232 ports (115 Kb/s)
3) Two RS485 ports (115 Kb/s)
4) USB device port
5) SD card port
b. Communications Types - The pump controller shall support the following communication types:
1) TCP/IP
2) UDP
3) RS232
4) RS485
5) Private radio over RS232
6) PSTN
7) Wireless LAN
8) Cellular data via integral PPMF module
9) Cellular voice
c. Communications Protocols
1) DNP3 (master and slave, level 2 compliant), including: change of state monitoring, native date/time and quality stamps for each data point, event buffering for different classes of data, support for multiple masters and slaves to be configured on the unit, and DNP security (for securing communications between master station and RTU).
2) Modbus (master and slave), including: modbus TCP, modbus RTU, modbus ASCII, and support for multiple masters and slaves.
8. Manufacturer
a. Multismart by Multitrode

REVISIONS

MARK DATE DESCRIPTION



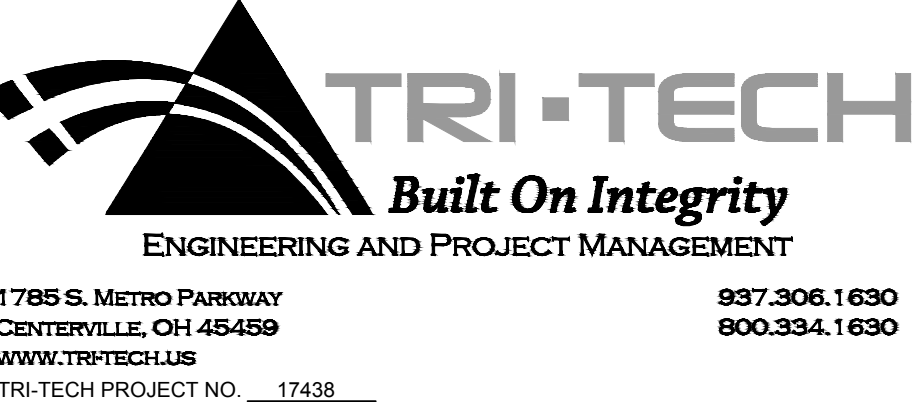
BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO SANITARY SEWER IMPROVEMENT PLAN FOR THE PINES, SECTION 1 PHASE A & B MECHANICAL / ELECTRICAL SPECIFICATIONS

DATE APRIL 2018

SCALE As Noted

JOB NO. 20170824

SHEET 31/32



1785 S. METRO PARKWAY CENTERVILLE, OH 45459 WWW.TRI-TECH.US TRI-TECH PROJECT NO. - 17438 937.306.1630 800.334.1630 17/Apr/2018

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C. Radio Communications Equipment

- 1. Radio Modem
a. 902-928 unlicensed spread spectrum frequency hopping transceiver.
b. RS232 data interface
c. GE MDS Transnet 900 series
2. Power Supply
a. Provide and install 24Vdc power supply with current rating appropriate for the radio unit.
b. Manufacturer: Phoenix Contact
3. Antenna and Accessories
a. 6-element aluminum Yagi antenna with 9 dB gain.
b. For 900 MHz systems, factory tuned to 915 MHz.
c. With stainless steel hardware.
d. MYA-9156 produced by Maxrad or approved equal.
e. Watertight cable LMR-400-DB produced by Times Microwave Systems or approved equal.
f. Miscellaneous connectors to connect antenna to radio while maintaining watertight integrity throughout cable.
g. All connections to be soldered to cable to prevent loosening of cable from connector and signal degradation over time.
h. Antenna mast to be galvanized steel and capped top end.
4. Surge Protection
a. Frequency range of surge protector 125 MHz to 1000 MHz.
b. Less than 220 micro-joules of throughput energy.
c. IS-B50LN-C2 produced by Polyphaser Corporation or approved equal.

D. Remote Terminal Unit (RTU)

- 1. RTU shall be a High Tide model HTT-900.
2. RTU shall include high level backup functionality.
3. General: RTUs shall be A/C or Solar powered depending on the model, as designated by the Owner.
4. The Manufacturer shall have the following types of RTUs available or equivalent:
Option HTT201 HTT900 HTT1100 HTT3100 HTT4100 GPG
D's 2 12 8 28 28+ 2
A's 4 inc + 4 opt 6 inc + 4 opt 12+
DO's 4 4 2 8
AO's 4 4 2 8 opt.
Networks Sat, Cell, IP Sat, Cell, IP Sat, Cell, IP Cell, IP Mesh Radio
a. Solar power shall be available as requested for HTT201 and HTT1100.
1) Solar power options include 10W,20W,60W,120W power systems.
2) Batteries for each of the solar power options is also sized appropriately between 10Ah and 180Ah capacity.
b. Back-up battery power shall be available for all but HTT4100 and GPG in the event that AC power is lost.
5. The Manufacturer shall have the following types of Inputs and Outputs available:
a. Digital inputs compatible with either open collector or dry contact sources.
b. Counter inputs.
c. Analog inputs configurable to accept either 0-5V or 4-20ma or 0-20ma inputs.
d. Digital Outputs.
e. Analog Outputs.
f. Modbus Master.
6. Two-way Communications.
7. Digital Alarm Functions.
8. The RTU shall have the following Analog Input Monitoring Functions.
9. Local Pump Alternator/Controller.
10. Flow Meter Functions.
11. Rain Gauge Monitoring.
12. Wastewater Pump Station Functions.
13. Power Monitoring.

- removed from the terminals.
c. The same basic RTU shall be used for all communications options with no I/O configuration changes.
15. Antenna Options.
a. Cellular options shall include an antenna that is internal to the enclosure, an omnidirectional antenna external to the enclosure or a directional (higher gain) antenna external to the enclosure.
b. Satellite RTUs shall require an external 3-inch stub antenna with a bracket and either a 15, 30 or 50-foot external cable.
c. IP units shall only require standard 10baseT RG6 internet patch cable connection.
16. Expansion and Accessories.
a. Din-rail mounted main power surge arrester.
b. Din-rail mounted Analog or Digital signal surge arresters.
c. RTUs with four Analog inputs shall have an optional expansion module to add four additional 4-20ma analog inputs.
d. Enclosure heaters and thermostats.
e. Local digital displays for analog inputs.
f. RTUs with a programming port through which qualified installers may upgrade internal software without returning the equipment to the factory.
17. Communication Platforms.
a. RTU's may be configured with either low earth orbit satellite (Iridium), GSM cellular (ATT or International), CDMA cellular (Verizon) or IP (Internet) as designated by the Owner to communicate bi-directionally from the RTU to the Central Server.
18. Customer Service.
a. The Manufacturer shall provide 24-hour, seven days a week phone support access to the Owner by the Manufacturer's customer support personnel.
2.08 SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)
A. The SCADA system used shall be manufactured by High Tide Technologies, LLC, or pre-approved equal.
B. Qualifications
1. The SCADA System shall be furnished by a single Supplier who shall assume responsibility for providing a complete and integrated system.
2. Manufacturer must have been regularly engaged in the supply of SCADA equipment for at least 10 years and must be capable of meeting the following criteria:
a. Have completed a minimum of three (3) satellite telemetry systems and three (3) cellular telemetry systems.
b. Provide the Owner with reference names and phone numbers for a minimum of two Satellite Telemetry System customers and two Cellular Telemetry system customers.
c. Acknowledge that shipment of the SCADA RTU units and related equipment shall be authorized only by the Owner.
d. Utilize only UL listed and rated components in enclosure manufacture.
e. Provide 100 percent of all hardware and software technical manuals to the Owner in digital format (Adobe PDF).
f. Provide a complete bill-of-materials (BOM) and enclosure layouts that are numerically cross-referenced together for each SCADA unit.
g. Provide a warranty and customer support for a period of not less than one (1) year after the Owner accepts each SCADA unit.
h. Provide primary technical support to the Owner by full-time qualified staff members only.
3. Central Server
a. The Central Server core shall be configured as a cluster of servers, each performing different tasks.
4. Web-Based User Interface Software
a. Compatibility.
b. Access and Security.
c. Levels of Access.
d. OPERATORS shall be able to view and acknowledge alarms.
e. User Limits.
f. Seal fail sensitivity to be adjustable between 4.7K ohm to 100K ohm via an adjustable potentiometer.

E. Application Programming

- 1. Provide all required application programming and/or configuration for a fully functional pump station controller as shown on the drawings and as specified herein.
2. Supply Operator Interface Terminal (OIT) application programming and/or configuration to provide control of the pump station controller/telemetry panel locally.
a. Running / stopped / alarm status of all pumps, including individual alarms and manual or automatic status control for each pump.
b. Automatic / lead / lag switching for each pump.
c. Emergency pumping circuit activated.
d. Wet well levels.
e. Grinder status and alarm.
f. Odor control system (bioxide) status, level (if used), and alarm.
g. AC power status.
h. Intrusion detection.
i. All other functionality indicated on the drawings.
3. All application programming features described above shall also be programmed to be available from the central SCADA system web interface.

F. DC Power Supply/UPS

- 1. The power supply shall convert 120 Vac to 24 Vdc power for control circuits and supply an uninterrupted 24Vdc power via a battery if 120Vac is lost.
2. The power supply shall have the following characteristics:
a. Output minimum 155 watts
b. Over current protection
c. Over voltage protection
d. DC voltage adjustment
e. Short circuit protection
G. Battery
1. The battery backup power shall consist of two 12 VDC batteries configured in series to provide an output voltage of 24 VDC.
H. Over Temperature and Seal Fail Monitoring Relay
1. The relay shall be compatible with the pump that is installed in the wet well.
2. There shall be one relay per pump that is present in the system.
3. The relay shall have the following requirements:
a. Molded relay bezel to allow for door mounting.
b. Power on light.
c. Over temperature and Seal Leak fault light.
d. Selector switch for Auto or Manual mode.
e. Provide an over temperature reset pushbutton for Manual reset mode.
f. Seal fail sensitivity to be adjustable between 4.7K ohm to 100K ohm via an adjustable potentiometer.

I. Intrinsically safe barrier

- 1. The intrinsic safety barriers shall be DIN rail mounted and located in a UL approved isolated Safety Barrier location.
a. Analog IS barrier
b. Back up float switches IS barrier
J. Control circuit breakers
1. The control circuit breakers shall be located in the Control compartment and used to protect all 120 volt and 24 volt circuits.
2. There shall be six single pole control circuit breakers as follows:
a. Main control power
b. Fan
c. GFI Receptacle
d. Heater
e. Control wiring
f. 24vdc Power supply
K. Control Relays
1. Control relays shall have the following characteristics:
2. 4 pole, 8 A, 1/3 hp (IEC rating = 6 A)
3. Coil: 120 VAC or 24 VAC
4. DIN rail mounting
5. Terminal screw type socket
6. Voltage rating: 300 volts
7. Mechanical status flag
8. Pilot light indicating status
9. Manual operator
10. Protection module mounted in base (diode, RC circuit or varistor)
11. Metal hold down clip
L. Environmental Control
1. Controls compartment shall be furnished with insulation, air conditioner, exhaust fans, and/or ventilation louvers as necessary to maintain environmental conditions inside the Control compartment suitable for its components.
2. A compartment heater shall be supplied and mounted at the bottom portion of the Control compartment.
3. All environmental control components shall be selected to maintain the NEMA rating of the Control compartment.
4. Heat load calculations and other calculations used to select the environment control equipment shall be included with equipment submittals.

M. Utility receptacle

- 1. A GFCI receptacle shall be mounted on the Control compartment inner door.
N. Selector Switches
1. Switches shall be mounted on the Control compartment inner door.
a. HOA Switches
1) There shall be a HOA selector switch for each individual pump.
b. ON-OFF Light Switch
1) There shall be a ON-OFF selector switch to allow the operator to turn on and off the cabinet lights.
O. Indicator Lights
1. Alarm lights shall be mounted on the Control compartment inner door.
2. The pilot lights shall be minimum 22 mm in diameter 24Vdc.
P. Push Buttons
1. An alarm test button shall be mounted on the Control compartment inner door.
2. An alarm silence button shall be mounted on the side of the enclosure below the horn/light assembly.
Q. Submersible Level Transducer
1. One analog submersible level transducer shall be supplied with the control panel.
a. Reference level measurement specification section.
R. Back up float switches
1. Two mechanical control float switches (including spare) shall be supplied with the control panel in order to operate the backup float circuitry.
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a. Reference level measurement specification section.
2.08 SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)
A. The SCADA system used shall be manufactured by High Tide Technologies, LLC, or pre-approved equal.
B. Qualifications
1. The SCADA System shall be furnished by a single Supplier who shall assume responsibility for providing a complete and integrated system.
2. Manufacturer must have been regularly engaged in the supply of SCADA equipment for at least 10 years and must be capable of meeting the following criteria:
a. Have completed a minimum of three (3) satellite telemetry systems and three (3) cellular telemetry systems.
b. Provide the Owner with reference names and phone numbers for a minimum of two Satellite Telemetry System customers and two Cellular Telemetry system customers.
c. Acknowledge that shipment of the SCADA RTU units and related equipment shall be authorized only by the Owner.
d. Utilize only UL listed and rated components in enclosure manufacture.
e. Provide 100 percent of all hardware and software technical manuals to the Owner in digital format (Adobe PDF).
f. Provide a complete bill-of-materials (BOM) and enclosure layouts that are numerically cross-referenced together for each SCADA unit.
g. Provide a warranty and customer support for a period of not less than one (1) year after the Owner accepts each SCADA unit.
h. Provide primary technical support to the Owner by full-time qualified staff members only.
3. Central Server
a. The Central Server core shall be configured as a cluster of servers, each performing different tasks.
4. Web-Based User Interface Software
a. Compatibility.
b. Access and Security.
c. Levels of Access.
d. OPERATORS shall be able to view and acknowledge alarms.
e. User Limits.
f. Seal fail sensitivity to be adjustable between 4.7K ohm to 100K ohm via an adjustable potentiometer.

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2.09 VARIABLE FREQUENCY DRIVES

- A. VFD Requirements
1. Two required (third is future)
2. Provide VFD's meeting the requirements of Section 26 29 23.
PART 3 - EXECUTION
3.01 GENERAL
A. All work shall be done in accordance with appropriate Divisions and Sections and shall be performed in a workmanlike manner.
B. The pump station shall be monitored by the SCADA system located at the Alum Creek Water Reclamation Facility.
1. Coordinate with the owner to obtain any required information for radio system design, programming, installation, and commissioning.
2. Obtain radio path study report for study performed by Owner.
3. Finalize the design of the radio antenna installation.
4. Provide and install the new pump station radio pole, antenna, associated cabling and accessories, radio telemetry controls including radio unit and power supply, as required for a complete and functional radio system.
5. Reconfigure the repeater and ACWRF radio units if required, to provide communications to the new pump station.

- 6. Reconfigure the existing ACWRF SCADA communications scheme, if required, to allow successful communications to the pump station.
7. Provide programming required to monitor the new pump station from the existing ACWRF SCADA application.
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.
3.02 FABRICATION
A. All control panels shall be shop assembled and factory tested prior to delivery to the site.
3.03 EQUIPMENT INSTALLATION
A. All equipment shall be installed in accordance with approved drawings and the manufacturer's written instructions.
3.04 WIRING AND TERMINATIONS
A. All wiring shall follow NEC color coding scheme.
3.05 IDENTIFICATION
A. All conductors shall be labeled at each end with numbers matching submittals data sheets and all wire terminations shall be identified by the component terminal numbers as shown on appropriate panel drawings.
3.06 FIELD SERVICES
A. The system supplier shall verify all connections between field devices and pump controller.
B. The system supplier shall confirm all calibrations of instrumentation connected to the pump control panel.
C. Provide control system startup and commissioning including the pump control panel and operator interface.
D. Provide radio system startup and commissioning including the pump station controller/telemetry panel, and associated equipment.
E. Provide SCADA system programming additions, startup and commissioning at the ACWRF.
F. After the above check out and system startup has been completed, the Contractor shall notify the Engineer so that system commissioning can begin.
G. The application engineering 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.
H. Provide training for Owner personnel.
3.07 TESTING
A. Performance Verification Test.
B. Notify the Owner of any defective products and workmanship disclosed by the tests.
C. Testing will include the field and the performance verification tests.
D. Test each device such that each item will function not less than five times.
E. Tests are subject to oversight and approval by the Owner.

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END OF SECTION

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REVISIONS table with columns: MARK, DATE, DESCRIPTION.
DATE: APRIL 2018
SCALE: As Noted
JOB NO.: 20170824
SHEET: 32/32
Logo: TRI-TECH ENGINEERING AND PROJECT MANAGEMENT
Address: 1785 S. METRO PARKWAY, CENTERVILLE, OH 45459
Phone: 937.306.1630, 800.334.1630
Website: WWW.TRI-TECH.US
Project: TRI-TECH PROJECT NO. 17438
Date: 17/Apr/2018
Professional Engineer Seal: DANIEL D. FOX, E-65085

Table with 3 columns: MARK, DATE, DESCRIPTION. Header: REVISIONS.

BERLIN TOWNSHIP, DELAWARE COUNTY, OHIO
SANITARY SEWER IMPROVEMENT PLAN
FOR
THE PINES, SECTION 1
PHASE A & B
MECHANICAL / ELECTRICAL SPECIFICATIONS
M/I HOMES Move Up mihomes.com

DATE: APRIL 2018
SCALE: As Noted
JOB NO.: 20170824
SHEET: 32/32

Logo: TRI-TECH ENGINEERING AND PROJECT MANAGEMENT
Address: 1785 S. METRO PARKWAY, CENTERVILLE, OH 45459
Phone: 937.306.1630, 800.334.1630
Website: WWW.TRI-TECH.US
Project: TRI-TECH PROJECT NO. 17438
Date: 17/Apr/2018
Professional Engineer Seal: DANIEL D. FOX, E-65085