

TSD 24-004
KPS End State Buried Piping / Penetrations /
Embedded Piping

Revision 0

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Non-Quality Document: ☐

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RECORD OF REVISIONS

Revision	Revision Title Description and Reason for Change
0	Initial issue. New project document.

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Abbreviations/Acronyms

ATF	Administration & Training Facility
AFHB (or AB)	Auxiliary and Fuel Handling Building
CW	Circulating Water System
D&D	Decommissioning and Decontamination
DG	Diesel Generator
DI	Ductile Iron
FP	Fire Protection
FRP	Fiberglass Reinforced Pipe
FSS	Final Status Survey
HDPE	High Density Polyethylene
ISFSI	Independent Spent Fuel Storage
KPS	Kewaunee Power Station
LTP	License Termination Plan
PVC	Polyvinyl Chloride
PW	Potable Water System
RCP	Reinforced Concrete Pipe
RSCS	Radiation Safety and Control Services, Inc.
RB	Reactor Building
RHR	Residual Heat Removal System
STP	Sewage Treatment Plant
SW	Service Water System
SWPT	Service Water Pretreatment System
TSC	Technical Support Center
TSD	Technical Support Document
TB	Turbine Building
VC	Vitrified Clay Pipe

1. PURPOSE

The purpose of this document is to provide an inventory of the embedded piping, buried piping, and penetrations that will remain in the end state structures at the Kewaunee Power Station (KPS). The document provides a basis for the estimated lengths and diameters and also estimates the surface areas and void spaces associated with them. The scope includes piping and penetrations in the Yard areas, Administration Building, Auxiliary and Fuel Handling Building (AFHB), Turbine Building (TB), Technical Support Center (TSC), Administration and Training Facility (ATF), Sewage Treatment Plant (STP), Training Building and Screenhouse. Penetrations were not listed or considered if they were included in TSD-24-005, End State Concrete Surface Areas and Volumes. The scope is bounded by the impacted area as shown on Figure 4-1 of KS-FS-PN-200, Kewaunee Solutions Characterization Survey Plan, and below in Figure 1.1. Therefore, piping that is fully within the ISFSI fence is not included in this document. Items within the ISFSI vehicle boundary are included in this scope. Manholes, elevator shaft pits, pump casings and sump pits are considered buried or embedded piping for this document.

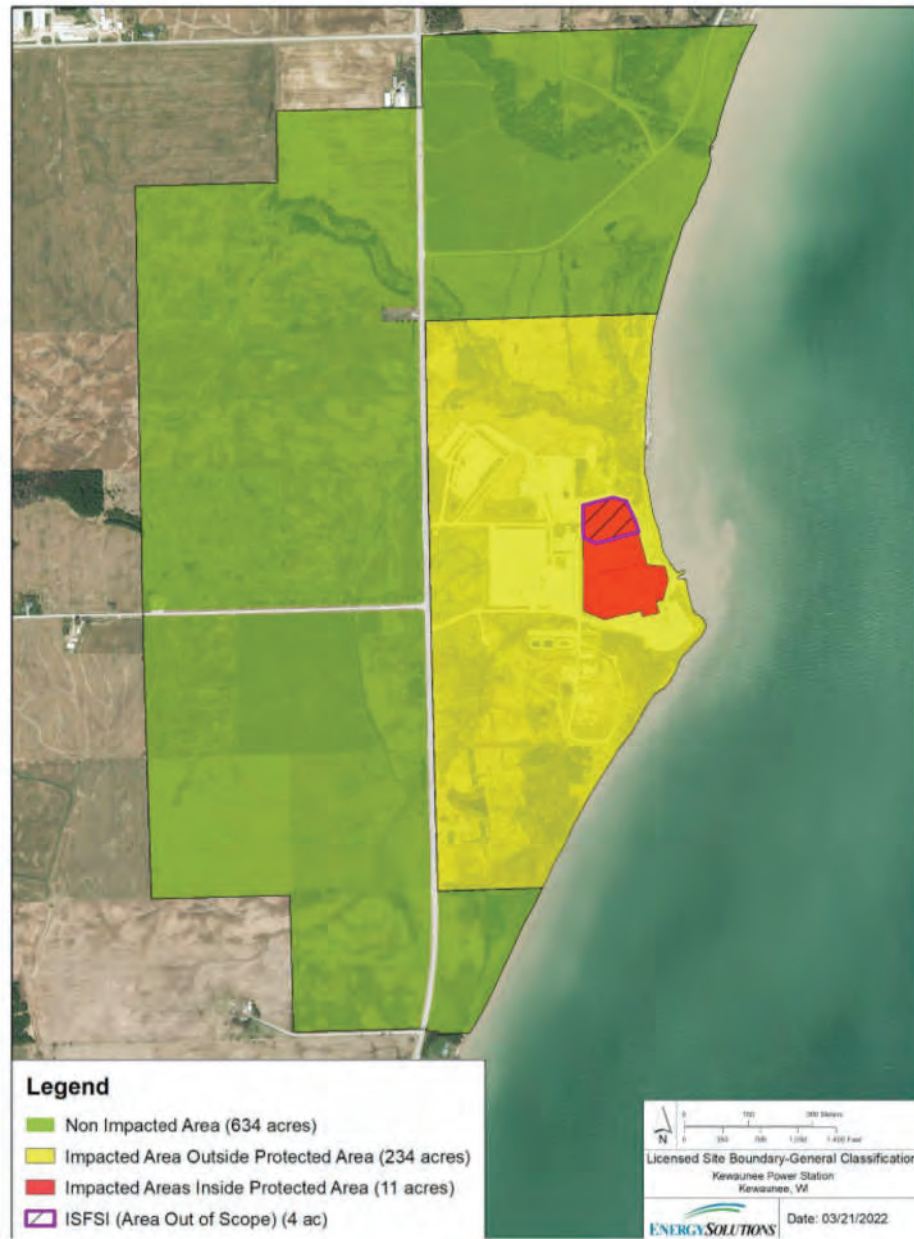


Figure 1.1 Impacted Areas

2. PROCESS OVERVIEW

A detailed 3D model of buried and embedded piping for the KPS site was assembled by Radiation Safety and Control Services, Inc. (RSCS) and is used for the determination of the embedded and buried pipe lengths and diameters. Pipe diameters, buried or embedment depths, and materials used in the 3D model are typically obtained from plant drawings however, plant walkdowns were also used to develop the model. The model was verified and validated by RSCS as documented in Appendix B.

2.1 Embedded Piping

Embedded pipe is defined as pipe that runs vertically through a concrete wall or horizontally through a concrete floor.

2.2 Buried Piping

Buried pipe is defined as pipe that runs through the soil. Also, a pipe that runs through the soil and penetrates a building wall and the pipe is cut inside the wall and grouted shut, is considered buried pipe including the wall penetration. Buried piping throughout the KPS site consists of multiple systems which support various functions. Buried piping mainly consists of sections of the Sanitary, Circulating Water, Service Water, Fire Protection, Well / Potable Water, Storm Drains / Tiles and Service Water Pretreatment systems.

Buried electrical and structural commodities are outside the scope of this TSD. Field drainage tile installed throughout the site during original construction is outside the scope of this TSD. This field drain tile also did not communicate with any plant systems during operation.

2.3 Penetrations

A penetration is defined as a pipe, conduit, cable tray (or remaining pipe sleeve or concrete if the pipe / conduit / cable tray is removed) that traverses a wall remaining at end state. Unless the removal is impractical, the pipe that contained the process fluid is removed from the penetration.

Electrical conduits or cable trays grouted in walls are not required to be removed since they do not contain any process fluids. However, the surface area and volume of the penetrations are included in this TSD for conservatism.

Mechanical systems (piping and ventilation ducts) that pass through penetrations sleeves / openings will be removed and the inside diameter or perimeter of the opening / sleeve will be used for the surface area and volume calculation.

Mechanical systems (piping and ventilation ducts) that pass through walls and are grouted to the wall will be removed. The resulting opening is approximated as the nominal pipe or duct size plus an additional 6 inches required to removed surrounding concrete to support the removal. The RHR Sump B piping is 14 inch diameter pipe inside a 18 inch diameter pipe sleeve. The removal of the pipe sleeve is not practical due to the embedment depth in concrete. The 14" pipe will also remain inside this penetration. For conservatism, the 18" diameter sleeve is used for the surface area and volume calculation for these penetrations.

Surface areas and volumes for penetrations through two adjacent building walls (e.g. Turbine to TSC) are calculated based on the thickness of both walls and the totals are assigned to one building.

3. METHODOLOGY

3.1 General Surface Area and Void Space Method

The use of the inside versus outside diameter varies depending on whether or not the piping is embedded and cannot be removed but will be left in place and surveyed. If the piping is required

to remain in place, the inside diameter will be used. If the pipe is removed from a sleeve, the inside diameter of the sleeve is used. If concrete removal is required, the diameter is based on the approximated opening to remove the pipe as previously discussed. The equation used for the inside surface area of a pipe or circular penetration is Equation 1.

$$SA = \pi dh \quad (\text{Equation 1})$$

Where;

SA = Surface area of opening

d = The pipe diameter is used (inner or outer as described above) or the sleeve inside diameter used.

h = Pipe length in same units as d.

The equation for the void space volume of a pipe or circular penetration is Equation 2.

$$V = (\pi/4)d^2h \quad (\text{Equation 2})$$

Where;

V = Void space volume of opening

d = The pipe diameter used (inner or outer as described above) or the sleeve diameter is used.

h = Pipe length in same units as d.

Many penetrations are rectangular openings. The equation used for the inside surface area of a rectangular pipe / penetration opening is Equation 3.

$$SA = (2l + 2w)h \quad (\text{Equation 3})$$

Where

SA = Surface area of opening

l = length of the opening.

w = width of the opening.

h = depth of the opening (typically the thickness of the wall)

The equation for the void space volume of a rectangular opening is shown in Equation 4.

$$V = lwh \quad (\text{Equation 4})$$

Where;

V = Void space volume of opening

l = length of the opening.

w = width of the opening.

h = depth of the opening (typically the thickness of the wall)

Inside and outside pipe diameters are obtained from standard industry references such as the NAVCO Piping Datalog for carbon steel and stainless steel pipes. Manufacturer's literature and industry standards as shown in Appendix A were used for other material types.

3.2 Buried / Embedment Depth

The start and end elevations of the slab or soil are shown in the tables. These values are obtained from plant drawings or recent topographical data and provided as input to for the AutoCAD 3D model. The pipe elevations are based on the invert or centerline elevation of the remaining pipe as shown on plant drawings of field measurements. The difference in these values is used to determine the embedded or buried depth of the pipe.

Centerline elevations of the pipe are preferred versus invert elevations as it provides a more conservative (i.e. shallower) embedment or buried depth. However, invert elevations are acceptable for pipe diameters up to 8 inches since the difference is considered negligible. Centerline elevations can be approximated by adding half of the nominal pipe diameter to the invert elevation.

For embedded drains, the elevation at the floor opening is not used since it does not represent the true embedment depth of the pipe unless otherwise noted in the tables.

For typical culvert pipe installations, the buried depth at the ends of the pipe are typically negligible due to the slope of the ground. Therefore, they don't provide an actual representation of the buried depth of the pipe. Therefore, the road / drive elevation is used to determine the buried depth.

3.3 Pipe Length

Lengths of buried and embedded piping are not typically available on plant drawings. The scaling feature of the AutoCAD 3D model was used in most instances to provide pipe lengths. The pipe lengths represent the approximate length of pipe that will remain at end state.

4. ASSUMPTIONS

Generic assumptions are listed below. Assumptions for specific pipes are also identified in the specific pipe sections.

4.1 Piping Elevations / Embedment

Centerline elevations of the pipe are preferred versus invert elevations as it provides a more conservative (i.e. shallower) embedment or buried depth. However, invert elevations are acceptable for pipe diameters up to 8 inches since the difference is negligible. Centerline elevations can be approximated by adding half of the nominal pipe diameter to the invert elevation.

4.2 Pipe Materials and Sizes

1. Wall thickness for piping was assumed to be Schedule 40 if not specified. This results in a larger surface area which is more conservative. Smaller schedule piping (i.e. thinner wall, larger inside diameter) is not typical for embedded or buried pipe applications. The material type is not significant with respect to the final dose calculations.
2. For corrugated pipe (metal or plastic), the outside diameter is not required since these pipes are typically used for drains or culverts and would not be used for penetrations or passed through penetrations. The actual wall thickness of the pipe is not required for any calculations in this TSD. The nominal pipe size will be used as the inside diameter unless vendor literature is available with specific inside diameters.
3. Extra Strength Vitrified Clay pipe and perforated pipe is typically manufactured in accordance with ASTM C-700. Pipe sizes, specifically wall thickness, vary by vendor but not significantly. The inside diameter is only utilized in the associated calculations and the inside diameter is approximately the nominal diameter of the pipe. If the outside diameter is required for calculations, the dimension provided from the vendor's information in Appendix A.4 provides a reasonable result for the purposes of this evaluation.
4. HDPE pipe referred to on drawings or observed in the field without indication of the pipe schedule will be assigned dimensions for SDR 21 (100 psi) since this results in a larger inside pipe diameter than higher pressure rated classes and more conservative surface area values. Ductile Iron Pipe Sizes (DIPS) will be used for pipe diameters 4" and greater and Iron Pipe Sizes (IPS) will be used for pipe diameters less than 4". This results in are reasonable and more conservative (larger) inside and outside pipe diameters which is conservative for the intent of this calculation.

5. RESULTS

5.1 Embedded Piping

A summary of all embedded piping with estimated lengths, surface areas, and void spaces is presented below in Section 6.1 of the Calculations section.

5.2 Buried Piping

A summary of all buried piping with estimated lengths, surface areas, and void spaces is presented below in Section 6.2 of the Calculations section.

5.3 Penetrations

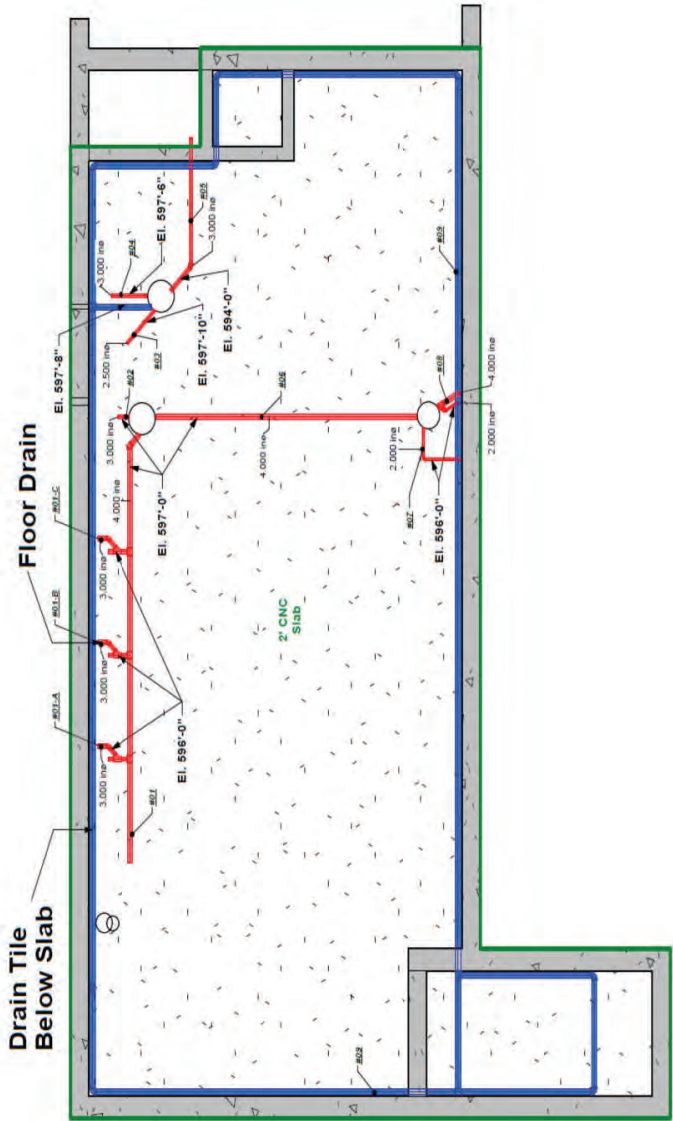
A final breakdown of all penetrations with estimated lengths, surface areas, and void space is provided in Section 6.3 of the Calculations section.

6. CALCULATIONS

6.1 Embedded Piping

6.1.1 ATF Embedded Piping

All piping in the ATF was removed except for embedded drain lines in the basement floor and drain tile located below the building foundation. The embedded drain lines are shown schematically on plant drawings XK-54167-28 and XK-54167-33. These drawings lack specific line lengths and material specifications. The drain tile is not shown on any drawings. Based on plant walkdowns, piping lengths and depths were estimated. Per plant walkdowns, the material was identified as PVC [Appendix A.8] for the embedded drains lines and corrugated plastic [Appendix A.5] for the drain tiles. The drain lines are embedded in the concrete floor. The elevation of the top of the floor / slab is 599 ft. The slab is conservatively assumed to be 1 foot thick. The corrugated plastic drain tile runs below the floor / slab. The ATF elevator ram casing is addressed in a later section.



ATF PIPE SCHEDULE

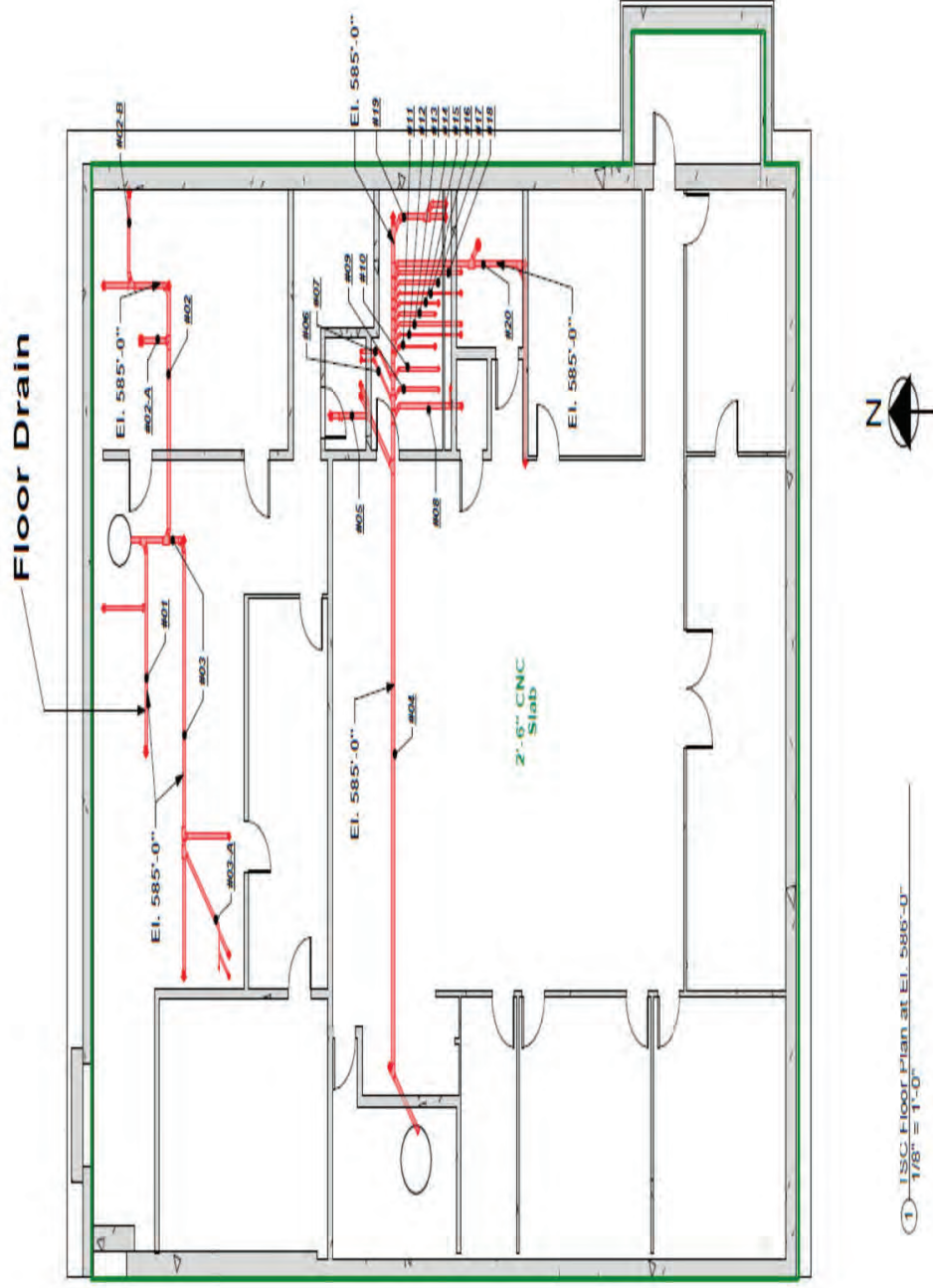
Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft²)	Void Space Volume (ft³)	Start Elevation	End Elevation	Start Grade	Start Depth	End Grade	End Depth
#01	4.00 inØ	27.976	PVC	4.026	4.5	29.487	2.47	597'	597'	599'-0"	2'-0"	599'-0"	2'-0"
#01-A	3.00 inØ	2.615	PVC	3.068	3.5	2.100	0.13	596'	596'	599'-0"	3'-0"	599'-0"	3'-0"
#01-B	3.00 inØ	2.615	PVC	3.068	3.5	2.100	0.13	596'	596'	599'-0"	3'-0"	599'-0"	3'-0"
#01-C	3.00 inØ	2.615	PVC	3.068	3.5	2.100	0.13	596'	596'	599'-0"	3'-0"	599'-0"	3'-0"
Fittings		5.91	PVC			5.43	0.411						
Branch Total	41.731					41.218	3.287						
#02	3.00 inØ	1	PVC	3.068	3.5	0.803	0.05	597'	597'	599'-0"	2'-0"	599'-0"	2'-0"
Fittings			N/A			N/A	N/A						
Branch Total	1					0.803	0.051						
#03	2.50 inØ	3.167	PVC	2.469	2.875	2.047	0.11	597'-10"	597'-10"	599'-0"	1'-2"	599'-0"	1'-2"
Fittings			N/A			N/A	N/A						
Branch Total	3.167					2.047	0.105						
#04	3.00 inØ	3	PVC	3.068	3.5	2.410	0.15	597'-6"	597'-6"	599'-0"	1'-6"	599'-0"	1'-6"
Fittings			N/A			N/A	N/A						
Branch Total	3					2.410	0.154						
#05	3.00 inØ	15.833	PVC	3.068	3.5	12.717	0.81	594'	594'	599'-0"	5'-0"	599'-0"	5'-0"
Fittings		0.375	PVC			0.29	0.018						
Branch Total	15.833					12.717	0.813						
#06	4.00 inØ	21.5	PVC	4.026	4.5	22.661	1.90	597'	597'	599'-0"	2'-0"	599'-0"	2'-0"
Fittings			N/A			N/A	N/A						
Branch Total	21.5					22.661	1.901						
#07	2.00 inØ	5.058	PVC	2.067	2.375	2.737	0.12	597'	597'	599'-0"	2'-0"	599'-0"	2'-0"
Fittings		0.3	PVC			0.15	0.006						
Branch Total	5.058					2.737	0.118						
#08	2.00 inØ	1.286	PVC	2.067	2.375	0.696	0.03	596'	596'	599'-0"	3'-0"	599'-0"	3'-0"
#08	4.00 inØ	2	PVC	4.026	4.5	2.108	0.18	596'	596'	599'-0"	3'-0"	599'-0"	3'-0"
Fittings		1.12	PVC			1.26	0.113						
Branch Total	1.286					0.696	0.030						
#09	4.00 inØ	230.299	Corrugated HDPE	4.1	4.78	247.198	21.115	596'-6"	596'-6"	599'-0"	2'-6"	599'-0"	2'-6"
Fittings			5.52			5.921	0.506						
Branch Total	230.299					247.198	21.115						
Grand Total		322.874				332.487	27.573						

6.1.2 TSC Embedded Piping

All piping in the TSC was removed except for embedded drain and vent lines in the basement floor. The drain lines are shown on drawings M-514, M-515 and M-516. Pipe lengths were estimated based on field walkdowns of their start and finish locations and AutoCAD scaling. Based on M-514 and plant walkdowns, invert elevations of the piping vary but can be conservatively estimated at 585 ft. Since the floor elevation is 586 ft, the embedment depth is 1 foot. Per M-514, the pipe material is High Silicon Iron Alloy (DURIRON), extra heavy, plain end ASTM A-518 and ASTM A74 [Appendix A.1]. Some discrepancies between the plant drawings and as-built conditions were identified during Phase 1 demolition activities. An updated cumulative drawing of the embedded drains was developed by RCSC and ES Engineering for the preparation of TSD 23-012. This drawing was also used for this TSD.

TSC PIPE SCHEDULE

Branch ID	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation	End Elevation	Start Grade	Start Depth	End Grade	End Depth
#01	3.00 in	6.316	ASTM A74 Extra Heavy High Silicon Iron Alloy	3.5	4	4.961	0.310	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings	4.00 in	12.27	ASTM A74 Extra Heavy High Silicon Iron Alloy	4.5	4	12.849	1.071	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Branch Total						17.87	0.144						
#02-A	4.00 in	22.545	ASTM A74 Extra Heavy High Silicon Iron Alloy	4.5	4	19.597	23.609	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
#02-B	4.00 in	3.071	ASTM A74 Extra Heavy High Silicon Iron Alloy	4.5	4	3.216	0.268	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings	4.00 in	5.213	ASTM A74 Extra Heavy High Silicon Iron Alloy	4.5	4	5.459	0.455	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Branch Total						7.635	0.686						
#03	3.00 in	6.39	ASTM A74 Extra Heavy High Silicon Iron Alloy	3.5	3	5.019	0.314	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
#03-A	4.00 in	30.753	ASTM A74 Extra Heavy High Silicon Iron Alloy	4.5	4	32.204	2.684	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
#03-B	3.00 in	3.014	ASTM A74 Extra Heavy High Silicon Iron Alloy	2.38	2	2.625	0.1109	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings	3.00 in	8.24	ASTM A74 Extra Heavy High Silicon Iron Alloy	3.5	3	8.139	0.675	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Branch Total						7.635	8.139	0.675					
#04	4.00 in	48.484	ASTM A74 Extra Heavy High Silicon Iron Alloy	4.5	4	50.772	4.231	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings						21.1	1.895						
Branch Total						71.872	6.126						
#05	3.00 in	5.593	ASTM A74 Extra Heavy High Silicon Iron Alloy	3.5	3	4.393	0.275	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings	4.00 in	9.003	ASTM A74 Extra Heavy High Silicon Iron Alloy	4.5	4	9.428	0.786	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Branch Total						13.821	1.061						
#06	2.00 in	5.65	ASTM A74 Extra Heavy High Silicon Iron Alloy	2.38	2	2.958	0.123	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings						0.309	0.013						
Branch Total						6.25	0.136						
#07	2.00 in	5.286	ASTM A74 Extra Heavy High Silicon Iron Alloy	2.38	2	2.768	0.115	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings						0.309	0.013						
Branch Total						5.886	0.128						
#08	3.00 in	1.729	ASTM A74 Extra Heavy High Silicon Iron Alloy	2.38	2	0.905	0.038	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings	3.00 in	9.366	ASTM A74 Extra Heavy High Silicon Iron Alloy	3.5	3	7.356	0.460	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Branch Total						12.815	0.572						
#09	2.00 in	6.749	ASTM A74 Extra Heavy High Silicon Iron Alloy	2.38	2	3.534	0.147	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings						0.309	0.013						
Branch Total						7.349	0.160						
#10	2.00 in	7.214	ASTM A74 Extra Heavy High Silicon Iron Alloy	2.38	2	3.777	0.157	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings						0.309	0.013						
Branch Total						7.814	0.170						
#11	2.00 in	6.368	ASTM A74 Extra Heavy High Silicon Iron Alloy	2.38	2	3.334	0.139	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings						0.309	0.013						
Branch Total						6.968	0.152						
#12	2.00 in	9.847	ASTM A74 Extra Heavy High Silicon Iron Alloy	2.38	2	5.156	0.215	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings						0.309	0.013						
Branch Total						10.447	0.228						
#13	2.00 in	9.856	ASTM A74 Extra Heavy High Silicon Iron Alloy	2.38	2	5.161	0.215	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings						0.309	0.013						
Branch Total						10.456	0.228						
#14	2.00 in	6.307	ASTM A74 Extra Heavy High Silicon Iron Alloy	2.38	2	3.302	0.138	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings						0.309	0.013						
Branch Total						6.907	0.151						
#15	2.00 in	6.715	ASTM A74 Extra Heavy High Silicon Iron Alloy	2.38	2	3.516	0.146	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings						0.309	0.013						
Branch Total						7.315	0.159						
#16	2.00 in	9.86	ASTM A74 Extra Heavy High Silicon Iron Alloy	2.38	2	5.163	0.215	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings						0.309	0.013						
Branch Total						10.46	0.228						
#17	2.00 in	6.715	ASTM A74 Extra Heavy High Silicon Iron Alloy	2.38	2	3.516	0.146	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings						0.309	0.013						
Branch Total						7.315	0.159						
#18	2.00 in	9.861	ASTM A74 Extra Heavy High Silicon Iron Alloy	2.38	2	5.163	0.215	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings						0.309	0.013						
Branch Total						10.461	0.228						
#19	4.00 in	9.741	ASTM A74 Extra Heavy High Silicon Iron Alloy	4.5	4	10.201	0.850	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings						3.818	0.343						
Branch Total						13.571	1.193						
#20	4.00 in	28.971	ASTM A74 Extra Heavy High Silicon Iron Alloy	4.5	4	30.338	2.528	585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
Fittings						5.83	0.523						
Branch Total						34.141	3.051						
Grand Total						395.571	311.083						
Branch Total						30.929	3.029						



6.1.3 Turbine Building Embedded Piping

All piping in the TB basement floor will be removed except for:

- embedded drain and vent lines in the basement floor 3 inch and greater in diameter.
- 18" SW Return Standpipe (Note 2)
- Two 24" SW Return Standpipes (Note 2)
- 6" Waste Neutralization Tank Drain to the CW Discharge Pipe (Note 1)
- Four 3/4" chlorination lines inside the inlet CW pipes to the Condenser (Note 3)

A summary and drawing of the total embedded piping within the TB are provided below. The drawing was developed based on plant drawings S-500, M-303, S-506, M-244, M-236 and M-237. Drain pipe materials are identified on S-500 as ASTM A 53 Gr A, Schedule 40. Drain lines shown on M-303 do not have specific materials identified but can be assumed to be ASTM A 53 Gr A based on engineering judgment and similar application as the lines shown on S-500. Unless otherwise noted below, the piping is embedded horizontally in the TB basement elevation, 586 ft.

Note 1: Branch #01 is the 6" Waste Neutralization Tank standpipe shown on S-301, S-501 and S-507. It penetrates the 586 ft AB basement floor and travels to the CW discharge pipe in the TB. It penetrates the CW discharge pipe at the 573'-9" elevation as shown on S-507, Section 29-29. The majority of the pipe run is at the 582'-9 1/2" elevation however, a section of this pipe includes an approximate 9 foot vertical run.

Note 2: Branches #65, #66 and #68 are SW return standpipes. The material for these pipes is ASTM A 53 Gr B Standard (STD) Schedule. The embedded lengths for these pipes are shown on S-506. Branch #68 is mainly a vertical run from the 586 ft elevation to 574 ft elevation through a 6 foot basement slab. Branch #66 is mainly a vertical run from the 586 ft elevation to 574 ft elevation through a 5 foot basement slab. Branch #65 is mainly a horizontal run at the 582 ft elevation from the AB standpipe to the CW discharge pipe.

Note 3: The four 3/4" diameter chlorination lines inside the inlet CW pipes to the Condenser are shown as Branch #72 and they are shown on plant drawing XK-571 72-1. Piping of this size is typically Sch 80. The lines enter the CW piping at approximately the 586 ft elevation and travel down the pipe to the 576 ft elev. Therefore, the pipe is not embedded in concrete but the CW pipe is embedded is concrete.

Note that internal piping (#67) inside the TB sump was removed during demolition even though it was greater than 3" diameter.

6.1.4 Administration (Admin) Building Embedded Piping

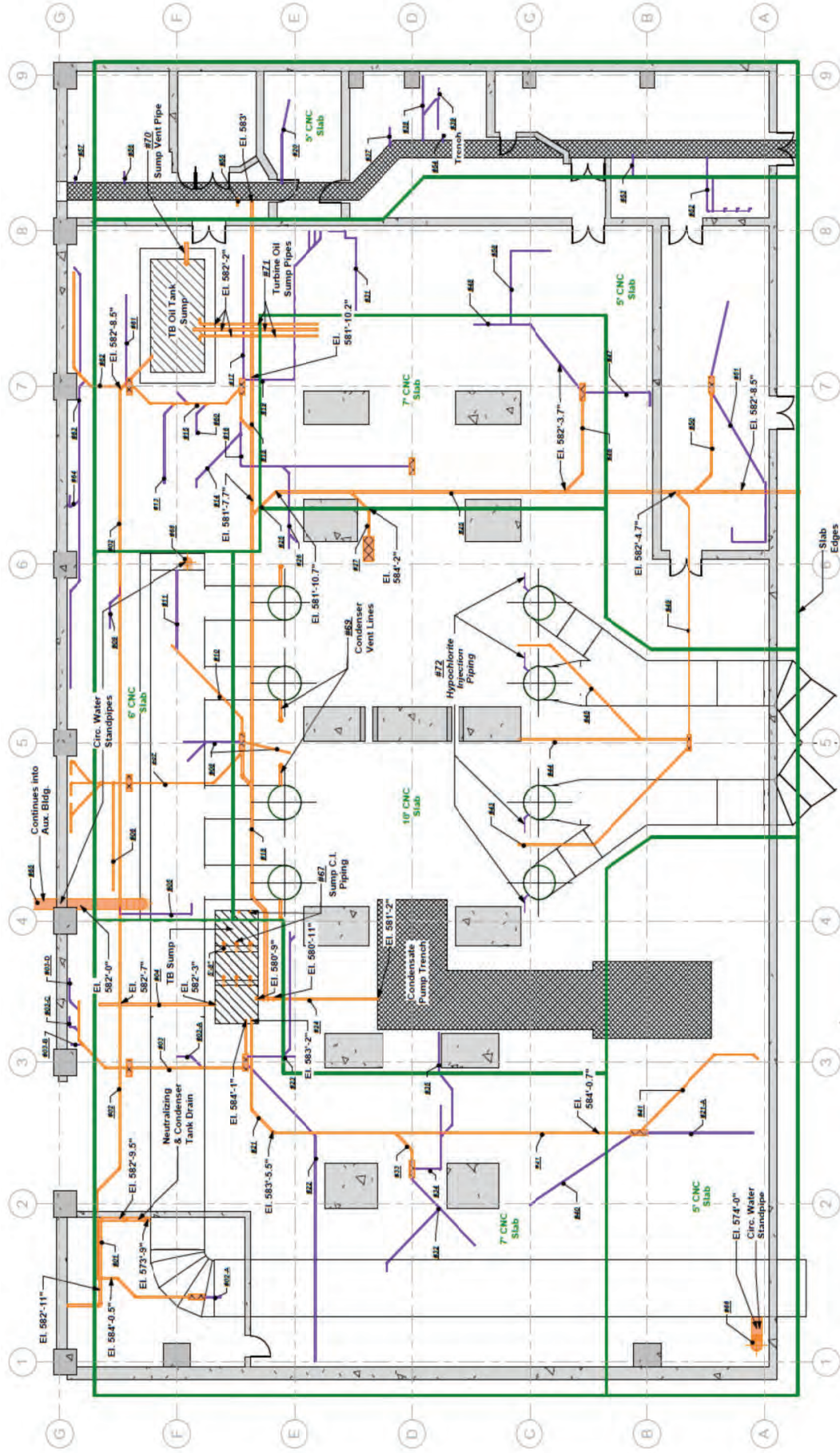
All piping in the Admin Building will be removed except for:

- embedded drain and vent lines in the basement floor 3 inch and greater in diameter (shown in orange on the drawing below).

A summary of the total remaining embedded piping within the Admin Building is provided in the TB summary and applicable drawings as shown below. The drawing is based on plant drawings S-500, S-508 and M-303. Although the material is not specified on these drawings, the pipe does connect and drain to the TB sump. Therefore, the drain line materials listed for the TB drains remain applicable to these drains.

TURBINE AND ADMINISTRATION BUILDING PIPE SCHEDULE

Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft²)	Start Elevation	End Elevation	Start Grade	Start Depth	End Grade	End Depth
#01	6.00 inø	36.904	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	6.07	6.63	58.592	7.4 572'-9"	582'-11"	586'-0"	12'-3"	586'-0"	3'-1"
#02	Fittings		4.1 ASTM A-53 Grade "A" Schedule 40 Carbon Steel			6.52	0.82					
#03	4.00 inø	185.03	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	195.023	16.36 584'-0.5"	582'-7"	586'-0"	1'-11.5"	586'-0"	3'-5"
#03	Fittings		10.5 ASTM A-53 Grade "A" Schedule 40 Carbon Steel			6.78	0.57					
#03	3.00 inø	38.52	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	3.07	3.5	38.52	16.36 584'-6"	584'-1"	586'-0"	1'-6"	586'-0"	1'-11"
#03	4.00 inø	65.12	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	65.12	0.58 584'-6"	584'-1"	586'-0"	1'-6"	586'-0"	1'-11"
#04	6.00 inø	21.5	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	6.07	6.63	34.166	4.32 582'-3"	582'-7"	586'-0"	3'-9"	586'-0"	3'-5"
#06	Fittings	N/A	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			0.49	0.02					
#06	3.00 inø	18.949	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	3.07	3.5	15.22	0.97 585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
#07	Fittings	N/A	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			N/A	N/A					
#07	3.00 inø	53.19	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	3.07	3.5	42.723	2.73 585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
#08	Fittings	5.5	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			4.42	0.28					
#08	3.00 inø	8.836	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	3.07	3.5	7.097	0.45 584'-6"	584'-6"	586'-0"	1'-6"	586'-0"	1'-6"
#10	Fittings	23.085	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			18.542	1.19 585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
#10	3.00 inø	21.085	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	3.07	3.5	18.542	1.19 585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
#15	Fittings	20.995	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	3.07	3.5	16.863	1.08 585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
#18	Fittings	4.84	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			4.23	0.3					
#18	4.00 inø	59.401	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	62.609	5.25 581'-7"	583'	586'-0"	4'-5"	586'-0"	3'-0"
#18	6.00 inø	91.97	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	6.07	6.63	145.031	18.45 580'-6"	581'-8"	586'-0"	5'-6"	586'-0"	4'-4"
#21	Fittings	9.1	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			13.11	1.54					
#21	4.00 inø	85.76	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	90.481	7.597 583'-2"	584'-2"	586'-0"	2'-10"	586'-0"	1'-10"
#24	Fittings	6.13	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			8.03	0.88					
#24	4.00 inø	4.34	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	4.34	0.87 580'-2"	580'-11"	586'-0"	4'-10"	586'-0"	5'-1"
#24	6.00 inø	4.34	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	6.07	6.63	6.9	0.87 580'-11"	580'-9"	586'-0"	6'-1"	586'-0"	5'-3"
#25	Fittings	67.658	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	71.312	5.98 581'-8"	582'-5.5"	586'-0"	4'-4"	586'-0"	3'-3.5"
#25	4.00 inø	31.049	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	49.3	6.23 582'-4"	582'-8.5"	586'-0"	3'-8"	586'-0"	3'-3.5"
#27	Fittings	5.55	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			7.87	0.91					
#27	4.00 inø	14.089	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	14.865	1.248 581'-10.7"	584'-2"	586'-0"	4'-1.3"	586'-0"	1'-10"
#33	Fittings	1.28	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			1.31	0.11					
#33	4.00 inø	7.304	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	7.706	0.647 583'-5.5"	583'-5.5"	586'-0"	2'-6.5"	586'-0"	2'-6.5"
#41	Fittings	1.11	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			1.17	0.1					
#41	3.00 inø	26.75	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	3.07	3.5	21.6	3.18 585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
#43	Fittings	40.076	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	3.07	3.5	32.189	2.06 585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
#44	Fittings	30.938	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	3.07	3.5	24.85	1.59 585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
#45	Fittings	0.8	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			0.64	0.04					
#45	3.00 inø	29.126	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	3.07	3.5	23.394	1.5 585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
#46	Fittings	0.375	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			0.3	0.02					
#46	4.00 inø	18.419	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	19.414	1.63 582'-3.7"	585'	586'-0"	1'-0"	586'-0"	1'-0"
#49	Fittings	0.53	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			0.56	0.05					
#49	4.00 inø	44.5	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	48.5	3.98 582'-4.7"	582'-4.7"	586'-0"	3'-7.3"	586'-0"	3'-7.3"
#50	Fittings	21.301	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	22.474	1.887 582'-4.7"	585'	586'-0"	3'-7.3"	586'-0"	1'-0"
#55	Fittings	2.51	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			2.35	0.18					
#55	3.00 inø	1.417	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	3.07	3.5	1.138	0.07 585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
#62	Fittings	N/A	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			N/A	N/A					
#62	3.00 inø	24.5	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	3.07	3.5	19.964	1.26 585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
#65	Fittings	35.328	ASTM A-53 Grade "B" Sched STD Carbon Stl	23.25	24	215.03	104.1 586'	574'-0"	586'-0"	0'-0"	586'-0"	12'-0"
#66	Fittings	12.425	ASTM A-53 Grade "B" Sched STD Carbon Stl	23.25	24	75.63	36.6	586'	586'-0"	12'-0"	586'-0"	0'
#66	24.00 inø	13.14	ASTM A-53 Grade "B" Sched STD Carbon Stl	23.25	24	9.2	43.5 574'-0"	586'	586'-0"	12'-0"	586'-0"	0'
#68	Fittings	12.712	ASTM A-53 Grade "B" Sched STD Carbon Stl	17.25	18	57.41	20.62 574'-0"	586'	586'-0"	12'-0"	586'-0"	0'
#69	Fittings	3.11	ASTM A-53 Grade "B" Sched STD Carbon Stl			14.04	5.04					
#69	3.00 inø	46.568	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	3.07	3.5	37.44	2.39 577'-10"	586'	586'-0"	8'-2"	586'-0"	0'
#70	Fittings	2.73	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			2.19	0.14					
#70	6.00 inø	4.725	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	6.07	6.63	7.503	0.95 585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
#71	Fittings	0.68	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			1.09	0.14					
#71	4.00 inø	44.945	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	47.372	3.97 585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
#71	6.00 inø	23.167	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	6.07	6.63	36.784	4.65 585'	585'	586'-0"	1'-0"	586'-0"	1'-0"
#72	Fittings	86.33	Hastelloy C	0.937	1.05	21.174	0.41 576'	587'	586'-0"	10'-0"	586'-0"	+1'-0"
#73 Admin.	Fittings	1.3	Hastelloy C			0.062						
#73 Admin.	4.00 inø	20.455	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	21.313	1.79 582'-8.5"	584'	586'-0"	3'-3.5"	586'-0"	2'-0"
#74 Admin.	Fittings	2.22	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			2.1	0.16					
#74 Admin.	4.00 inø	24.929	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	26.276	2.2 582'-8.5"	583'	586'-0"	3'-3.5"	586'-0"	3'
#82	Fittings	0.53	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			0.56	0.05					
#82	4.00 inø	9.929	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	10.488	0.48 582'-8.5"	583'	586'-0"	3'-3.5"	586'-0"	3'
Grand Total		1,556.421				1,871.004	348.815					



AUXILIARY AND FUEL HANDLING BUILDING PIPE SCHEDULE

Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation	End Elevation	Start Grade	Start Depth	End Grade	End Depth
#01	4.00 inø	74.002	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	77.998	6.54 583'-8"	583'-8"	586'-0"	2'-4"	2'-4"	586'-0"	2'-4"
	6.00 inø	34.715	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	6.07	6.63	55.122	6.96 583'-8"	583'-8"	586'-0"	2'-4"	2'-4"	586'-0"	2'-4"
Fittings			4.1 ASTM A-53 Grade "A" Schedule 40 Carbon Steel			0.423	4.61						
#02	4.00 inø	1.761	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	1.856	0.16 583'-8"	583'-8"	586'-0"	2'-4"	2'-4"	586'-0"	2'-4"
		0.375	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			0.3	0.019						
#03	4.00 inø	45.354	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	47.803	4.01 583'-8"	583'-8"	586'-0"	2'-4"	2'-4"	586'-0"	2'-4"
		4.125	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			3.42	0.25						
#05	6.00 inø	13.734	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	6.07	6.63	21.807	2.76 583'-8"	583'-8"	586'-0"	2'-4"	2'-4"	586'-0"	2'-4"
		1.36	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			2.172	0.275						
#06	4.00 inø	53.317	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	56.196	4.71 583'-8"	583'-8"	586'-0"	2'-4"	2'-4"	586'-0"	2'-4"
		5.7	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			5.03	0.38						
#07	4.00 inø	3.648	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	3.845	0.32 583'-8"	583'-8"	586'-0"	2'-4"	2'-4"	586'-0"	2'-4"
	6.00 inø	42.983	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	6.07	6.63	68.249	8.62 583'-8"	586'-0"	586'-0"	2'-4"	2'-4"	586'-0"	2'-4"
#07-A	4.00 inø	36.45	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	38.457	3.229 584'-10"	585'-0"	586'-0"	1'-2"	1'-2"	586'-0"	1'-0"
		3.475	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			5.08	0.6						
#08	4.00 inø	12.201	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	12.86	1.08 585'-6"	585'-6"	586'-0"	0'-6"	0'-6"	586'-0"	0'-6"
		0.53	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			0.56	0.05						
#12	4.00 inø	84.158	Type 304 Schedule 10 Stainless Steel	4.26	4.5	93.858	8.33 582'-1.5"	579'-4"	586'-0"	3'-10.5"	3'-10.5"	586'-0"	6'-8"
		1.06	Type 304 Schedule 10 Stainless Steel			1.13	0.09						
#13	4.00 inø	71.435	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	75.293	6.32 584'-10"	584'-10"	586'-0"	1'-2"	1'-2"	586'-0"	1'-2"
		8.26	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			7.31	0.55						
#14	4.00 inø	54.6	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	57.548	4.83 584'-10"	580'	586'-0"	1'-2"	1'-2"	586'-0"	6'
		10.01	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			10.56	0.89						
#15	4.00 inø	9.494	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	10.007	0.84 580'	584'-8.6"	586'-0"	6'	6'	586'-0"	1'-3.4"
		3.92	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			3.98	0.33						
#19	4.00 inø	46.448	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	48.957	4.11 584'-10"	584'-10"	586'-0"	1'-2"	1'-2"	586'-0"	1'-2"
	4.00 inø	38.457	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	40.57	3.4 586'	584'-8"	586'-0"	0'	0'	586'-0"	1'-4"
#20-A	4.00 inø	13.244	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	13.959	1.17 586'	585'-0.3"	586'-0"	0'	0'	586'-0"	0'-11.7"
	4.00 inø	15.708	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	16.557	1.39 584'-8"	584'-0.3"	586'-0"	1'-4"	1'-4"	586'-0"	1'-11.7"
#20-B	Fittings	7.8	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			0.53	0.38						
#26	4.00 inø	52.533	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	55.37	4.64 584'-7.1"	585'-0.3"	586'-0"	1'-4.9"	1'-4.9"	586'-0"	0'-11.7"
		5.03	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			4.84	0.39						
#27	4.00 inø	75.86	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	79.957	6.71 584'-9.3"	583'-9"	586'-0"	1'-2.7"	1'-2.7"	586'-0"	2'-3"
		8.53	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			8.84	0.74						
#28	4.00 inø	106.7	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	112.462	9.43 583'-9"	585'-0.3"	586'-0"	2'-3"	2'-3"	586'-0"	0'-11.7"
	4.00 inø	9.91	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	10.445	0.88 583'-9"	585'-0.3"	586'-0"	2'-3"	2'-3"	586'-0"	0'-11.7"
#28-A	4.00 inø	6.07	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			5.94	0.48						
		20.599	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	21.711	1.82 583'-9"	585'-0.3"	586'-0"	2'-3"	2'-3"	586'-0"	0'-11.7"
#29	4.00 inø	3.38	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			3.57	0.3						
		35.349	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	37.258	3.12 584'-9.3"	585'-0.3"	586'-0"	1'-2.7"	1'-2.7"	586'-0"	0'-11.7"
#430	4.00 inø	4.98	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			5.26	0.44						
		27.592	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	4.03	4.5	29.082	2.44 584'-9.3"	585'-0.3"	586'-0"	1'-2.7"	1'-2.7"	586'-0"	0'-11.7"
#431	4.00 inø	6.23	ASTM A-53 Grade "A" Schedule 40 Carbon Steel			6.58	0.55						
		Grand Total		1,065.187			1,166.903	104.956					



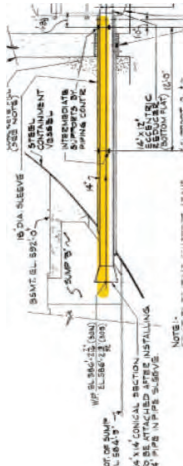
6.1.6 Reactor Building Embedded Piping

All piping in the RB including floor drains will be removed except for:

- Two 14" RHR Sump B Suction pipes

The pipes are 14 inch nominal pipe size. The piping is shown on plant drawing M-324. The pipes are routed from Sump B in Containment / Reactor building through the Auxiliary Building / Shield Building wall in an 18 inch diameter sleeve. The pipes will be cut nearly flush with the Auxiliary Building / Shield Building wall. Since this configuration satisfies the definition of a penetration, these lines are addressed in a later section of this TSD.

The piping embedment depth varies from 0 to approximately 17 ft (603 – 586). Where the piping is not covered by concrete it is covered in soil to a depth of approximately 20 ft (606' – 586').



6.1.7 Screenhouse Embedded Piping

All piping in the Screenhouse will be removed except for:

- Two 2" CW Pump Drain Lines (Branches #01 and #02)
- Two 8" CW Pump Recirc lines (Branches #03 and #04)
- Four 1" Chlorination lines (Branches #05, #06, #07, #08)

A summary and drawing of the total remaining embedded piping is provided below. The piping is shown on plant drawings M-231, M-232 and M-233. Per ES-2002, material for Branches #01 and #02 is Schedule 80 carbon steel, A 106 Gr. B and for branches #03 and #04 Schedule 40, carbon steel, A 106 Gr. B. Branches #05 through #08 are 1" PVC.

Note 1:

Branches #01 and #02 are embedded in floor elevation 569 ft. The CW pump discharge pipe is also embedded in the slab directly above these branches.

Note 2:

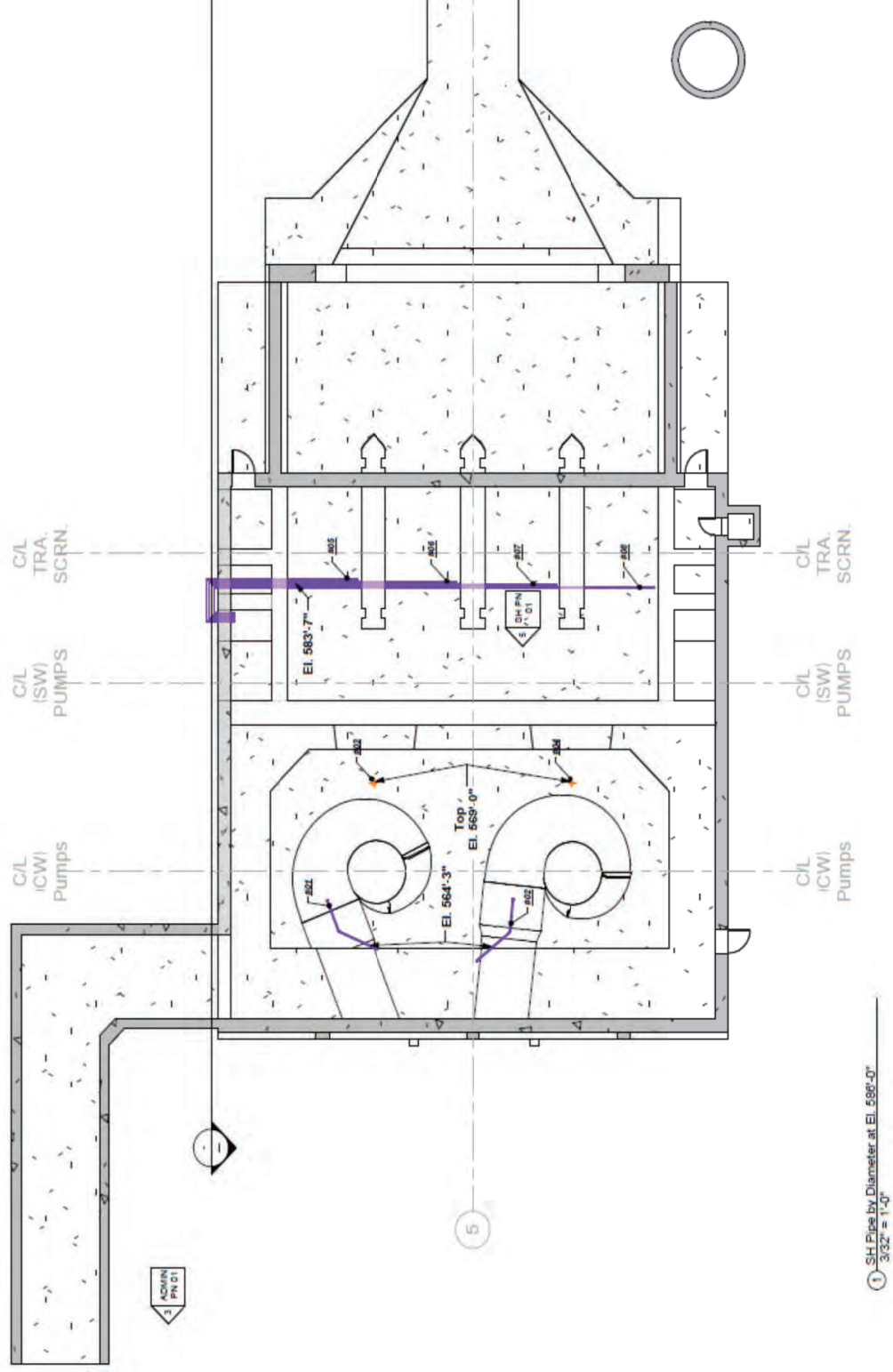
Branches #03 and #04 pass vertically through the 569' floor slab to the 561'-6" elevation.

Note 3:

Branches #05 through #08 have a centerline elevation is 583'-7" per M-231 and they pass through pillars / piers and a forebay wall. The shallowest embedment after the removal of the 586 ft floor will be approximately the 1 foot. These pipes are 1" PVC per M-232.

SCREENHOUSE PIPE SCHEDULE

Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Bar Elevation	End Elevation	Start Grade	Start Depth	End Grade	End Depth
#01 (Note 1)	2.00 in	15.372	ASTM A-53 Grade "A" Schedule 80 Carbon Steel	1.94	2.38	7.81	7.81	0.316	564'-3"	569'-0"	4'-9"	569'-0"	4'-9"
Branch Total		15.372				7.81	0.316						
#02 (Note 1)	2.00 in	15.372	ASTM A-53 Grade "A" Schedule 80 Carbon Steel	1.94	2.38	7.81	7.81	0.316	564'-3"	569'-0"	4'-9"	569'-0"	4'-9"
Branch Total		15.372				7.81	0.316						
#03 (Note 2)	8.00 in	7.5	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	7.98	8.63	15.67	15.67	2.6	569'-0"	569'-0"	0'	569'-0"	7'-6"
Branch Total		7.5				15.67	2.6						
#04 (Note 2)	8.00 in	7.5	ASTM A-53 Grade "A" Schedule 40 Carbon Steel	7.98	8.63	15.67	15.67	2.6	569'-0"	569'-0"	0'	569'-0"	7'-6"
Branch Total		7.5				15.67	2.6						
#05 (Note 3)	1.00 in	35.344	Polyvinyl Chloride, Rigid	1.05	1.32	9.706	9.706	0.21	586'-0"	586'-0"	2'-5"	586'-0"	2'-5"
Branch Total		35.344				9.706	0.21						
#06 (Note 3)	1.00 in	48.99	Polyvinyl Chloride, Rigid	1.05	1.32	13.454	13.454	0.29	586'-0"	586'-0"	2'-5"	586'-0"	2'-5"
Branch Total		48.99				13.454	0.29						
#07 (Note 3)	1.00 in	62.677	Polyvinyl Chloride, Rigid	1.05	1.32	17.213	17.213	0.38	586'-0"	586'-0"	2'-5"	586'-0"	2'-5"
Branch Total		62.677				17.213	0.38						
#08 (Note 3)	1.00 in	76.177	Polyvinyl Chloride, Rigid	1.05	1.32	20.92	20.92	0.46	586'-0"	586'-0"	2'-5"	586'-0"	2'-5"
Branch Total		76.177				20.92	0.46						
Grand Total		268.932				108.513	71.72						



6.2 Buried Piping

A list and drawing of buried piping that will remain at end state is shown. The piping is broken down by system and summarized below. At KPS, buried piping followed specification ES-2017 which required piping to conform to AWWA C151/A21.51, Ductile Iron Pipe Centrifugally Cast. The inside and outside diameters are the same regardless of the pressure class. Many drawings refer to buried piping as "cast iron" but no design specification is identified. A review of cast iron specification ASTM A74 (Appendix A.1) and AWWA C151/A21.51 (Appendix A.3) for ductile iron showed that the ductile iron specification has slightly larger outside and inside diameters. Therefore, the buried piping table will use the AWWA C151 dimensions for any piping identified as cast iron or ductile iron unless a specification is identified. The resulting larger surface areas are more conservative for dose calculations.

6.2.1 Sanitary System Piping

Branch #00 is the old STP discharge from the settling pond effluent manhole to the south unnamed stream. The pipe is 6" extra strength vitrified clay [Appendix A.4] as shown on M-659.

Branches #03, #03-A, #03-B, #03-C and #03-D are shown on drawing DECM-662. The drawing identified the pipe size as 4" or 6". Branches #03 and #03-A are shown on the drawing as vitrified clay pipe (extra strength). Branches #03-B and C are cast iron. Per Note 2 on DECM-662, cast iron pipe meets ASTM A-74 [Appendix A.1]. Branch #03-D is the abandoned sanitary line for the Maintenance Bldg. The size, 4" diameter, material, PVC, and invert elevations are referenced in work order KW100917204 and design change DC KW-12-01045.

Branch #05 is shown on drawing M-659. This branch runs from manholes near the old Simulator Bldg. to the STP. The piping is 4" and 8" diameter extra strength vitrified clay pipe [Appendix A.4] to the STP lift station and 6" diameter cast iron from the STP lift station to the STP. At the STP, the piping will be removed at least 3 feet below the approximate grade elevation of 612'. The pipe exits the lift station at approximately the 595 ft elevation. The minimum buried depth is below the south stream / ditch is approximately 5 feet therefore, this is reflected in the table for the start depth / grade for the 8" diameter line. Per WO KW100827079, 4" diameter PVC, was installed for Branch #05-A from the Warehouse to Manhole 4. Per drawing A-357, the pipe is buried 6 to 7 feet below grade.

Branches #31, #32 and #50 are shown on drawing XK-54167-2. The pipe elevations shown on that drawing are limited. Per XK-54167-2, Branch #31 exits the ATF at approximately the 601' elevation and its invert elevation at the first Manhole (#5) is approximately 602' -10". It was identified via walkdown to be PVC material [Appendix A.8] in the ATF. Elevations for lines #32 and #50 also are not shown on a plant drawing but they were estimated using the scaling features of the AutoCAD program.

Branch #33 is currently in service and will remain in service to serve the ISFSI. The piping material is PVC SDR 35 [Appendix A.11] and the elevations are specified on plant drawing A-5101.

Branch #39 connects the Training Bldg. to the plant sanitary system. The line is shown on plant drawings XK-70157914-4 and -51. Per the drawing, the material is PVC-SDR 35 [Appendix A.11]. Only the piping up to the ISFSI barrier rocks will remain.

Branch #51 connects the Maintenance Bldg. to its septic tank. The line will remain in service at End State. The line is shown on plant drawing XK-70235001-20. Per the drawing, the piping is 4" PVC [Appendix A.8] and the invert elevation at the building is approximately 600' -4". No other elevations are available and since this is a gravity feed application to the septic tank this elevation can be used as a conservative value to determine the bury depth. The line was installed via work order KW2018-0033 and design change KW 16-02019.

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Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation (CL)	End Elevation (CL)	Start Grade	Start Depth	End Grade	End Depth
#00	6 in. ø	83.048	Vitrified Clay Pipe	6	7.75	7.75	130.45	600.00	602.00	608.00	8.00	612.00	10.00
#03	6 in. ø	228.467	Vitrified Clay	6	7.75	7.75	358.88	593.25	594.58	606.00	12.75	606.00	11.42
#03-A	4 in. ø	92.151	Vitrified Clay	4	5.45	5.45	96.50	600.33	600.75	606.00	5.67	606.00	5.25
#03-B	4 in. ø	222	Cast Iron	4	4.5	4.5	232.48	599.83	598.33	606.00	6.17	606.00	7.67
#03-B	6 in. ø	385.5	Cast Iron	6	6.5	6.5	605.54	598.33	594.58	606.00	7.67	606.00	9.42
#03-C	6 in. ø	155.699	Cast Iron	6	6.5	6.5	244.57	598.33	599.42	606.00	7.67	606.00	6.58
#03-D	4 in. ø	15	PVC	4.026	4.5	4.5	15.81	601.00	600.58	606.00	5.00	606.00	5.42
Branch #03 Total		1098.817				1,553.78	179.86						
#05	4 in. ø	169.063	Vitrified Clay	4	5.31	5.31	177.04	598.00	603.50	607.00	9.00	607.00	3.50
#05	6 in. ø	19.678	Ductile Iron	6	6.5	6.5	30.91	609.00	595.00	612.00	3.00	612.00	17.00
#05	8 in. ø	743.849	Vitrified Clay	8	10.02	10.02	1,557.91	591.00	598.00	596.00	5.00	607.00	9.00
#05-A	4 in. ø	40	PVC	4.03	4.5	4.5	42.20	601.00	601.00	607.00	6.00	607.00	6.00
Branch #05 Total		972.59				1,808.07	281.81						
#31	4 in. ø	8.325	PVC	3.998	4.5	4.5	8.71	602.83	602.83	606.00	3.17	606.00	3.17
#31	6 in. ø	52.46	PVC	6.031	6.625	6.625	82.83	602.83	602.83	606.00	3.17	606.00	3.17
#31	8 in. ø	464.24	PVC	7.98	8.625	8.625	969.87	598.92	602.83	606.00	7.08	606.00	3.17
Branch #31 Total		525.025				1,061.41	172.37						
#32	4 in. ø	141.463	PVC	4.026	4.5	4.5	149.10	601.67	601.67	606.00	4.33	607.00	5.33
#33	4 in. ø	290.498	PVC SDR 35	3.975	4.8	4.8	302.31	598.67	601.42	607.00	8.33	607.00	5.58
#39	8 in. ø	527	PVC SDR 35	7.92	8.625	8.625	1,092.71	599.75	604.79	607.00	7.25	612.00	7.21
#50	4 in. ø	63.161	PVC	4.026	4.5	4.5	66.57	601.67	601.67	606.00	4.33	606.00	4.33
#51	4 in. ø	70.107	PVC	4.026	4.5	4.5	73.89	600.33	600.33	606.00	5.67	606.00	5.67
Total		3,771.71					6,238.29						

6.2.2 Storm Sewer

Branch IDs #18, #18-A and #18-B are building foundation drain tiles shown on A-265. Per the drawing, these lines are perforated clay tile. [Appendix A.4] Branch #18 runs along the main building walls. Branches #18A and #18B are the discharge lines to the Screenhouse forebay at the 583 ft elevation where the grade elevation is approximately 592 ft elevation as shown on S-606.

Branch IDs #12, #13, #16 and #70 are storm sewers serving the west area of the plant and Switchyard. Based on walkdowns these are concrete pipes [Appendix A.2] with one section Branch #12-A corrugated 4" diameter HDPE [Appendix A.5] based on visual observation. Branch #12 is shown on drawing M-229. Invert measurements of the north side of main line of Branch #12 were approximately 6 to 7 feet below the surrounding grade and a 24 inch diameter conservatively bounds all the piping in this branch and branches #13, #16 and #70 unless otherwise specified. They discharge to the ditch area around the Switchyard. For conservatism, the ditch elevation is taken as 610' elevation and the grade elevation of the Switchyard is 612' resulting in a typical buried depth of 2' and only a negligible portion exposed.

Branch IDs #28 and #30 are storm sewer lines that discharge to the unnamed south stream and Lake Michigan. Portions of this pipe will remain to prevent disturbing the shoreline topography. They are shown on drawing A-267, XK-54167-2 and S-867. Per S-867, Branch #30 is PVC [Appendix A.8] and reduces from a 12 inch diameter to 10 inch diameter at the lake discharge. 12 inch diameter will be used for this evaluation since it results in a larger surface area and void space which is more conservative. Branch #28 is assumed to be corrugated HDPE [Appendix A.5] which provides a relatively conservative inside diameter will respect to other materials which results in a larger, more conservative surface area and volume.

Branch #37 is not shown on any plant drawings. The piping will be added just prior to backfill of the TB to allow the collection and removal of water and prevent leakage into the AB. A 4" diameter perforated HDPE pipe [Appendix A.5] will be installed along the TB/AB wall on the 586 ft elevation. A HDPE [Appendix A.5] riser will be connected to this pipe to allow the use of a sump pump to remove collected water.

Branch ID #38 consists of 10 storm sewer lines serving the ISFSI. They are shown on drawing XK-70155348-5, -6, -8 and XK-70162025-3. Their material is corrugated HDPE [Appendix A.5].

Branch #40 is the outlet for the Training Bldg. retention pond. Per drawing XK-70157914-3, the pipe is 24" diameter, PVC or HDPE culvert pipe. Corrugated HDPE [Appendix A.5] is a typical storm sewer material therefore, that specification is applied to this pipe and the large inside diameter provides more conservative results.

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Branch #45 serves the east road area and portions of the ISFSI. Based on walkdowns and an installation date near plant construction, it is concrete pipe. [Appendix A.2] It is shown on drawing M-229. Branch #45 elevation was determined by field measurements and survey data since plant drawings don't have this information. Per inspection of catch basin CB-AK, the pipe input from the industrial area is less than 12" diameter however, it will remain modeled as a 12" diameter pipe as this is more conservative.

Branch #53 is buried drain piping for the Maintenance Bldg. downspouts. Currently, they are capped and not in use. They will remain at end state. They are shown as 4" diameter on drawing XK-70235001-20 and per a walkdown they are PVC [Appendix A.8].

Branch #58 is shown on drawing XK-54103-4. It will remain to prevent disturbing the south unnamed stream. Due to the relatively recent installation and service application, the pipe material is likely PVC material [Appendix A.8] but other materials that could be used in this application. HDPE pipe and PVC would have similar inside diameters such that the material assumption is not significant.

Branch #67 is an ISFSI catch basin drain below the ISFSI fence that day lights inside the ISFSI vehicle barrier. The catch basin is identified on XK-70155348-5 but no design details are available. Per walkdown, the piping connected to the catch basin is PVC. A surveyor walkdown was utilized to determine the invert elevation, 596.6 ft, of the day lighted pipe in order to determine the bury depth and approximate length.

Branch #68 is not shown on any plant drawing. It is a 12" corrugated metal pipe that runs from inside the ISFSI vehicle barrier rocks out to the Lake Michigan bluff. A surveyor walkdown was conducted to identify the invert elevations and coordinates of both day lighted ends of the pipe. The piping runs below sloped terrain to the beach and the depths are conservatively estimated based on start and end elevations.

Branch ID	Size	Length (ft)	Material	Inside Diameter (in)	Outside Diameter (in)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation (CL)	End Elevation (CL)	Start Depth	End Grade	End Depth From	To	System		
#18	6 in. ø	697	Perforated Clay Drain Tile	6	7.75	1,094.85	136.86	597.42	597.17	695.00	695.00	18.83	Drain Tile Surrounding Power Block Structure	Storm Sewer		
	12 in. ø	591.91	Perforated Clay Drain Tile	12	14.6	1,859.55	464.89	597.17	593.00	695.00	695.00	21.00	Drain Tile Surrounding Power Block Structure	Storm Sewer		
	#19-A	203.65	Perforated Clay Drain Tile	12	14.6	639.79	159.95	595.75	593.00	695.00	695.00	9.00	Drain Tile Surrounding Power Block Structure	Storm Sewer		
	#19-B	165.99	Perforated Clay Drain Tile	12	14.6	521.48	130.37	595.75	593.00	695.00	695.00	9.00	Drain Tile Surrounding Power Block Structure	Storm Sewer		
Branch #19 Total		1,658.556				892.06										
#12	12 in. ø	398.52	Reinforced Concrete	12	16	1,292.00	313.00	603.00	603.00	6.00	609.00	6.00	Unnamed Stream	Storm Sewer		
	#12	24 in. ø	708.82	Reinforced Concrete	24	30	4,453.67	2,226.83	603.00	603.00	699.00	699.00	Switchyard	Storm Sewer		
#12-A	4 in. ø	162.59	HDPE	4.1	4.7	174.49	14.90	603.75	603.75	3.25	607.00	3.25	Catch Basin CB-Bk at branch #12	Storm Sewer		
	Branch #12 Total		1,269.906			5,880.15	2,554.74									
#13	24 in. ø	96.44	Reinforced Concrete	24	30	665.99	302.99	610.00	610.00	2.00	610.00	0.00	Switchyard	Storm Sewer		
	#16	24 in. ø	45	Reinforced Concrete	24	30	282.74	141.37	610.00	612.00	610.00	610.00	0.00	Unnamed Stream	Storm Sewer	
	#28	12 in. ø	79.52	25 Corrugated HDPE	12.15	14.45	79.52	20.13	597.83	597.83	604.00	617.00	63.00	5.17 Storm Sewer Piping	Storm Sewer	
	#30	12 in. ø	125.18	PVC	11.94	12.75	381.10	97.29	600.00	600.00	606.00	606.00	6.00	Lake Michigan bluff	Storm Sewer	
#37		4 in. ø	300	Corrugated HDPE	4.1	4.78	322.01	27.51	586.00	586.00	20.00	696.00	20.00	TB South Wall	Storm Sewer Drain Tile	
#37	18 in. ø	25	Corrugated HDPE	18	21.2	117.81	44.18	583.00	606.00	23.00	696.00	0.00	TB Drain Tile Riser	Storm Sewer Drain Tile		
	Branch #37 Total		325.000			439.82	71.68									
#38	10 in. ø	1156.326	Corrugated HDPE	9.9	11.36	2,996.98	618.13	602.42	602.92	5.58	608.00	5.08	ISFSI	Storm Sewer		
	#40	24 in. ø	542.04	Corrugated HDPE	24.08	27.8	3,417.13	1,714.26	623.00	620.00	624.00	4.00	Pond	Storm Sewer		
	#45	4 in. ø	21	Perforated Clay Drain Tile	4	5.25	21.99	1.83	604.75	603.75	607.75	3.00	606.75	MtHd ISFSI	Storm Sewer	
		#45	18 in. ø	22	Corrugated HDPE	18.07	21.2	104.08	39.18	601.37	600.52	605.50	4.13	606.50	5.88 CB-4	Storm Sewer
#45	12 in. ø	415.485	Reinforced Concrete	12	16	1,305.28	326.32	597.50	597.50	9.50	607.00	9.50	Catch Basins	Storm Sewer		
	#45	24 in. ø	864.035	Reinforced Concrete	24	30	5,428.89	2,714.45	597.50	597.00	607.00	10.00	Unnamed Stream	ISF'S Parking Lot Menhole	Storm Sewer	
	#45	36 in. ø	126.695	Reinforced Concrete	36	44	1,194.07	895.55	596.83	597.50	607.00	607.00	9.50	Unnamed Stream	ISF'S Parking Lot Menhole	Storm Sewer
		Branch #45 Total		1,406.215			8,064.32	3,977.33								
#53	4 in. ø	246.688	PVC	4.026	4.5	260.01	21.81	601.25	601.50	695.00	695.00	4.75	4.50 MTN Bldg. Capped Downspouts	Storm Sewer		
	8 in. ø	30	PVC	7.981	8.625	62.68	10.42	595.50	593.67	603.50	8.00	603.50	9.83	Sewage Treatment Plant	Storm Sewer	
	#67	8 in. ø	100	PVC	7.942	8.625	207.92	34.40	596.92	596.92	698.00	9.08	600.00	Lake Michigan bluff	Storm Sewer	
		#68	12 in. ø	94.5	Corrugated Metal	12	12.019	298.88	74.22	601.33	598.50	602.00	0.67	590.00	Lake Michigan bluff	Storm Sewer
#70	24 in. ø	30	Reinforced Concrete	24	30	168.50	54.25	610.00	610.00	2.00	612.00	2.00	Switchyard	Storm Sewer		
	Total		7,150.80			27,279.41	10,625.09									

6.2.3 Service Water

Branch #06 is a 1-1/2" diameter SW line to the STP. To prevent disturbing the south unnamed stream, the pipe will not be removed from this area. The line is shown on drawings M-229 and M-230, Section F-F. The pipe material is Yolo, standard weight, as shown on M-230.

Branch IDs #22, #23 and #24 are shown on M-236, M-237, S-601, S-606 and OPERM-215. Per ES-2003, these pipes are carbon steel and the 24" diameter pipe has a 3/8" wall and the 10 inch pipe is Schedule 40. Branch #22 runs from the Warm Water Pit at the 558'-6" elevation per M-237 to the Screenhouse forebay at the 558'-6" elevation per S-606.

Branch #23 runs from a tee connection in the 30" diameter recirculation pipe to the Warm Water Pit. The elevation of the tee connection is not shown on a drawing. Since the run is relatively short, the 562'-9" elevation of the 30" pipe in the vicinity of the warm water pit as shown on M-237 will be used for the start and end elevation.

Branch #24 leaves the Screenhouse at approximately the 570'-7" elevation per M-236, Section M-M, and travels to the Intake Structure in Lake Michigan. The approximate elevation as it crosses the property is 567'-6" per M-236.

Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation (CL)	End Elevation (CL)	Start Grade	Start Depth	End Grade	End Depth
#06	1.5 in. ø	214.074	YOLOY (Generic)	1.61	1.9	84.07	2.63	605.67	600.00	612.00	6.33	608.00	8.00
#22	24 in. ø	29.535	Carbon Steel	22.62	24	174.90	82.42	588.50	584.00	594.00	35.50	592.00	33.50
#23	24 in. ø	4.75	Carbon Steel	22.62	24	28.13	13.26	562.75	562.75	592.00	29.25	592.00	29.25
#24	10 in. ø	135.096	Carbon Steel	10.02	10.75	354.39	73.98	570.58	567.50	605.00	34.42	590.00	22.50
Total		383.455				641.49	172.28						

6.2.4 Service Water Pretreatment

Branch ID #01 and #02 are covered by ES-2002 and based on visual inspection of piping in the AFHB basement, the piping is carbon steel. Per Note 18 on drawing M-229, two 2 foot sections of the 4" line (Branch ID #01) were replaced with schedule 40, PVC pipe however, these sections are expected to be removed. Per DECM-399, the shallowest depth of bury for these pipes is where it crosses the unnamed south stream. Therefore, the elevations in that location were used in the table.

Per drawing M-562, Branch ID #11 is a 6" diameter SDR 11 Polyethylene pipe [Appendix A.6]. It is buried approximately 6 feet below grade for the entire run. This section of pipe is not being removed to prevent disturbing unnamed south stream.

Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation (CL)	End Elevation (CL)	Start Grade	Start Depth	End Grade	End Depth
#01	4 in. ø	568.747	Carbon Steel	4.03	4.5	600.06	50.38	591.00	591.00	597.00	6.00	605.00	6.00
#02	3 in. ø	568.597	Carbon Steel	3.07	3.5	457.00	29.23	591.00	591.00	597.00	6.00	605.00	6.00
#11	6 in. ø	456.968	Polyethylene SDR11	5.671	6.9	666.48	77.35	600.00	607.00	606.00	6.00	613.00	6.00
Total		1,594.31				1,723.53	156.96						

6.2.5 Waste Disposal (Circulating Water)

Branch IDs #19 and #21 are shown on M-236, M-237 and OPERM-215. Per drawing M-236, the 4" pipe (#19) is schedule 40, Tp 304 stainless steel. Per ES-2002, the 18" diameter pipe (#21) is carbon steel with an exterior coating and a 3/8" wall. Both pipe penetrations in the Screenhouse south wall will remain in place.

Branch #19 exits the Screenhouse at elevation 598'-6" where the ground elevation is approximately 606 ft. The line drops down to the 572'-9" before entering the discharge structure.

Per M-237, Section L-L, and S-602, Branch #21 exits the Screenhouse at approximately elevation 576'-5" where the ground elevation is approximately 605 ft. The line drops down to approximately the 574' elevation and transfers from concrete to steel pipe. The grade elevation at this transition is approximately 601'. The pipe elevation at the discharge structure location is 571' per S-622 where the grade elevation is conservatively 582'.

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Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation (CL)	End Elevation (CL)	Start Grade	Start Depth	End Grade	End Depth
#19	4 in. ø	286.166	Stainless Steel	4.026	4.5	301.62	25.30	598.50	572.75	606.00	7.50	582.00	9.25
#21	18 in. ø	32.882	Reinforced Concrete	18	23	154.95	58.11	576.42	574.00	605.00	31.25	601.00	27.00
#21	18 in. ø	172.718	Carbon Steel	17.25	18	780.00	280.31	574.00	571.00	601.00	27.00	582.00	11.00
Branch #21 Total		205.6				934.95	338.42						
Total		491.768				1,236.58	363.72						

6.2.6 Potable Water

Branch #04 is a 4" line that runs under the unnamed south stream. The pipe is 4" diameter, HDPE, per drawing M-229 and DCR 1705. The buried depth is not shown on any plant drawing but it is likely buried to the same depth, 6 feet, as described for the buried Branch #06 SW line below the same south unnamed stream. It is modeled as SDR 21 (100 psi) [Appendix A.6] piping since this results in a larger ID for a minimum pressure class applicable to this service.

Branch #34 is a 3" abandoned water line. Sections that run below the ISFSI will remain. The piping is ductile iron [Appendix A.3] per ES-2017.

Branch #43 will remain in service to provide potable water service to the ISFSI. Per DECM-5001 and A-5101, the 4" piping is mostly ductile iron and the 2" line is HDPE, modeled as SDR 11 (200 psi) [Appendix A.6] since this results in a larger ID for a minimum pressure class applicable to this service.

Per Note 2 of DECM-5001, the 2" piping is routed at least 6'-6" below grade. Per M-230, Sections B-B and K-K, this depth can also be conservatively applied to the 4" line.

Branch #52 will remain in service to provide potable water / well water to the Maintenance Bldg. The line is shown on XK-70235001-20 and M-229. M-229 identifies the pipe as 1-1/4" diameter poly. The depth is not shown. Schedule 40 wall would be typical for this diameter and provide a conservative inside diameter for surface area and volume determinations. An installation depth of 5'-6" to prevent freezing is applied which also results in a shallow bury depth which is conservative for this evaluation.

Branch #59 provided potable water to the Training Building. It will be removed except for the section of pipe that is routed inside the ISFSI vehicle barrier. The piping is shown on drawing XK-70157914-4. Per the drawing, the pipe material is PVC SDR 18 [Appendix A.10] and the minimum cover is 6 feet. Based on the lack of specific pipe elevations, a 6 ft depth will be applied. Grade elevations inside the ISFSI will not change at end state.

Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation (CL)	End Elevation (CL)	Start Grade	Start Depth	End Grade	End Depth
#04	4 in. ø	252.64	HDPE SDR 21	4.315	4.8	285.40	25.65	606.00	601.00	612.00	6.00	607.00	6.00
#34	3 in. ø	223.022	Ductile Iron	3.46	3.96	202.02	14.56	598.17	598.17	606.00	7.83	607.00	8.83
#43	2 in. ø	343.459	HDPE SDR 11	1.917	2.375	172.37	6.88	600.75	600.75	609.50	8.75	608.50	7.75
#43	4 in. ø	128.108	Ductile Iron	4.3	4.8	144.22	12.92	606.75	600.75	612.25	7.25	609.50	8.25
Branch #43 Total		471.567				316.59	19.80						
#52	1-1/4 in. ø	10	Poly	1.34	1.66	3.51	0.10	599.00	599.00	605.50	5'-6"	605.50	5'-6"
#59	6 in. ø	474.5	PVC SDR 18	6.1	6.9	757.76	96.29	601.50	606.00	607.50	6.00	612.00	6.00
Total		1,431.73				1,565.28	156.41						

6.2.7 Instrument Air

A 2" air line runs from the Screenhouse out to the Intake Structure. Per drawing M-236, the pipe material is fiberglass [Appendix A.7]. The pipe penetration in the Screenhouse south wall will remain.

Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation (CL)	End Elevation (CL)	Start Grade	Start Depth	End Grade	End Depth
#25	2 in. ø	140	Fiberglass	2	2.187	73.30	3.05	567.50	576.00	590.00	22.50	605.00	29.00
Total		140				73.30	3.05						

6.2.8 Recirculating Water (Circulating Water)

Branch #26 is a 30" diameter line runs from the Discharge Structure to the Screenhouse. Per drawing M-236, the pipe specification is A155 Gr C55 and it is modeled as standard wall (STD) pipe thickness. STD wall is expected to be used based on size and application. Reference S-606 for depth (562'-9") at the Screenhouse penetration and S-622 for the penetration depth (566'-9") at the Discharge Structure.

The 12" diameter line runs from the CW discharge line to the Screenhouse. Per drawing M-236, the pipe is coated steel. STD wall is expected to be used based on pipe size and application. Both pipe penetrations will remain in the south wall of the Screenhouse.

Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation (CL)	End Elevation (CL)	Start Grade	Start Depth	End Grade	End Depth
#20	12 in. Ø	42.468	Carbon Steel	12	12.75	133.42	33.35	571.25	571.25	605.00	33.75	605.00	33.75
#26	30 in. Ø	184.5	Carbon Steel	29.25	29.25	1,412.83	860.89	562.75	566.75	597.00	34.25	582.00	15.25
Total		226.968				1,546.25	894.24						

6.2.9 Fire Protection

Two 6" diameter lines are routed to the ISFSI protected area. Per DC 16-02020 and drawing M-2036, the pipe is AWWA/ ANSI C151 A21.51, Class 350 [Appendix A.3] buried to a minimum depth of 4'-6".

Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation (CL)	End Elevation (CL)	Start Grade	Start Depth	End Grade	End Depth
#35	6 in. Ø	52.021	Ductile Iron	6.4	6.9	87.16	11.62	601.50	601.50	606.00	4.50	606.00	4.50
#36	6 in. Ø	52.021	Ductile Iron	6.4	6.9	87.16	11.62	601.50	601.50	606.00	4.50	606.00	4.50
Total		104.042				174.32	23.24						

6.2.10 Culverts

The majority of these Branch IDs are culverts under roads or in ditches that will remain at End State. Material and sizes are based on plant walkdowns and the site survey map M-7104 that was prepared for this project. A culvert will inherently have ends that are not covered by soil. This is not taken into consideration when determining the buried depth. Depth for these items was determined by the difference between the elevation at the top of the pipe and the grade elevation which is typically the elevation of the road / drive that the culvert serves.

Branch IDs #07, #08, #09 and #10 are located in the unnamed south stream. The road above is at the conservatively at the 605' elevation and will be used as the start and end grade elevations. Since the culverts have 48 inch diameter, 2 feet was added to the invert elevations to determine the bury depth.

Branch IDs #17 is located below the road to the south hill area. The road above is at the 611' elevation approximately and that will be used as the start and end grade elevations. Since the culvert has an 18 inch diameter, 9 inches was added to the invert elevation to determine the bury depth.

Branch ID #27 is a discharge storm sewer culvert from the south parking lot to the unnamed south stream. It will remain to prevent disturbing the stream. The parking lot is at approximately 604' elevation and that will be used as the start and end grade elevations. Since the culvert has a 24 inch diameter, 1 foot was added to the invert elevation at AD-45 shown on drawing A-267 to determine the bury depth which will be more conservative than using the invert elevation where the pipe day lights to the bluff above the south unnamed stream.

Branch ID #29 is a discharge storm sewer culvert from the south parking lot to Lake Michigan. A short section of this line will remain to prevent disturbing the lake bluff. The parking lot is at approximately 604' elevation in this location and that will be used as the start and end grade elevations. The culvert has a 10 inch diameter per surveyor walkdown, 5 inches was added to the invert elevation to obtain the centerline elevation used to determine the bury depth.

Branch IDs #41 and #42 are drain culverts that serve the ISFSI. Per drawing XK-70162025-3, Branch ID #41 is 12" diameter HDPE pipe [Appendix A.6]. The invert elevation at the pond is approximately 602 ft and the outlet invert elevation is 601 ft per XK-70162025-3. Therefore, the centerline elevation of the pipe at the start is 602'-6" and 601'-6" at the end. Grade elevations are approximately 605 ft and 603 ft per drawing XK-70162025-3. Branch #42 is an 8" corrugated metal culvert not shown on any original plant drawings. Approximated pipe and grade elevations are determined from a site survey and walkdowns.

Branch #49 is an ISFSI storm sewer drain that day lights to the sloped bluff for Lake Michigan inside the ISFSI vehicle barrier. Per drawings XK-70155348-5 and -8, the line consists of 3 – 10 inch diameter corrugated HDPE [Appendix A.5] pipes approximately 135 feet long. The ISFSI grade elevation in this location is 606 ft. The pipe centerline was determined based on the site survey data of the pipe invert elevation.

Branches #54 through #57, #66, #71 through #74 materials, elevations and grades were obtained from plant survey walkdown. The grade elevations are the road / drive that the culvert serves. The invert is either listed from the site survey walkdown or taken as the low point of the ditch / swell topography. Half of the pipe diameter is then added to this value to obtain the pipe elevation.

Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation (CL)	End Elevation (CL)	Start Grade	Start Depth	End Grade	End Depth
#07	48 in. ø	52.838	Reinforced Concrete	48	48	58	663.98	597.92	597.42	605.00	7.08	605.00	7.58
#08	48 in. ø	52.838	Reinforced Concrete	48	48	58	663.98	598.00	597.42	605.00	7.00	605.00	7.58
#09	48 in. ø	52.838	Reinforced Concrete	48	48	58	663.98	598.00	597.42	605.00	7.00	605.00	7.58
#10	48 in. ø	52.838	Reinforced Concrete	48	48	58	663.98	598.00	597.50	605.00	7.00	605.00	7.50
#17	18 in. ø	16.091	Reinforced Concrete	18	18	18	75.83	609.25	609.42	611.00	1.75	611.00	1.58
#27	24 in. ø	16.065	Reinforced Concrete	24	24	24	100.94	597.00	597.00	604.00	7.00	604.00	7.00
#29	10 in. ø	10.4	PVC	9.976	10.75	27.16	5.65	597.25	597.25	604.00	6.75	604.00	6.75
#41	12 in. ø	107.8	HDPE SDR 21 DIPs	11.867	13.2	334.91	82.80	602.50	601.50	605.00	2.50	603.00	1.50
#42	8 in. ø	103.988	Corrugated Metal	8	8.109	217.79	36.30	606.00	605.00	606.00	0.00	606.00	1.00
#49	10 in. ø	60.67	Corrugated HDPE	9.9	11.36	157.25	32.43	603.67	602.33	606.00	2.33	606.00	3.67
#49	10 in. ø	60.67	Corrugated HDPE	9.9	11.36	157.25	32.43	603.67	602.33	606.00	2.33	606.00	3.67
#49	10 in. ø	60.67	Corrugated HDPE	9.9	11.36	157.25	32.43	603.67	602.33	606.00	2.33	606.00	3.67
Branch #49 Total							97.30						
#54	24 in. ø	35.62	Reinforced Concrete	24	24	30	223.81	609.25	609.42	612.00	2.75	612.00	2.58
#55	12 in. ø	38.73	PVC	11.889	12.75	29.86	111.90	609.50	609.50	611.00	1.50	611.00	1.50
#56	18 in. ø	60.35	Corrugated Metal	18	18.109	284.39	106.65	608.00	607.08	610.00	2.00	609.00	1.92
#57	18 in. ø	83.86	Corrugated Metal	18	18.109	395.18	148.19	606.92	607.50	608.00	1.08	608.00	0.50
#66	42 in. ø	60.85	Corrugated Metal	42	42.109	669.08	585.45	597.08	588.33	599.67	2.58	599.67	11.33
#71	30 in. ø	16.28	Corrugated Metal	30	30.109	127.86	79.91	628.33	628.33	630.00	1.67	629.00	0.75
#72	24 in. ø	44.16	Corrugated Metal	24	24.109	277.47	138.73	610.92	608.75	614.00	3.08	613.00	4.25
#73	48 in. ø	49.06	Reinforced Concrete	48	48	58	616.51	606.33	605.42	609.00	2.67	609.00	3.58
#74	48 in. ø	49.06	Reinforced Concrete	48	48	58	616.51	606.00	605.08	609.00	3.00	609.00	3.92
Total		903.664					6,743.90						
Branch #49 Total							97.30						
Branch #49 Total							97.30						

6.2.11 Sewage Treatment Plant

All piping in the STP will be removed except for 3 lines (Branches, #44, #47 and #48) that are below the concrete slab of the Chlorination Tank as shown on plant drawing XK-54103-9. The material and schedule are not provided on the plant drawing. Schedule 40 carbon steel dimensions provide a reasonable and conservative representation of this piping. As found dimension of the 5" pipe on the drawing was actually 6" diameter.

Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation (CL)	End Elevation (CL)	Start Grade	Start Depth	End Grade	End Depth
#44	3 in. ø		8 Generic	3.068		3.5	6.43	602.75	602.75	612.00	9.25	611.00	9.25
Total		8					6.43						

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Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation (CL)	End Elevation (CL)	Start Grade	Start Depth	End Grade	End Depth
#47	3 in. ø		8 Generic	3.068		3.5	6.43	0.41	604.50	612.00	7.50	612.00	7.50
Total		8					6.43	0.41					
Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation (CL)	End Elevation (CL)	Start Grade	Start Depth	End Grade	End Depth
#48	6 in. ø		8 Generic	6.065		6.625	12.70	1.60	606.00	612.00	6.00	612.00	6.00
Total		8					12.70	1.60					

6.2.12 Switchyard Oil Collection

The TST, T-20 and spare transformers are equipped with oil collection systems that include buried pipe and sumps, basins and vault for collection and discharge to the West access road ditch. The piping is shown on drawings E-10142, E-10143, E-10169, E-10170 and E-10513.

Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation (CL)	End Elevation (CL)	Start Grade	Start Depth	End Grade	End Depth
#14, #15, #65	2.00 inø	18.5	PVC, rigid	2.067	2.38	2.38	10.01	0.43	611.00	612.00	1.00	612.00	1.00
#65	4.00 inø		198 PVC, perforated	3.9	4.3	4.3	200.12	16.26	607.75	612.00	4.25	612.00	4.25
#14	6.00 inø	30	PVC	6.031	6.625	6.625	47.37	5.95	611.50	612.00	0.50	611.50	0.00
#15	6.00 inø	30	PVC	6.031	6.625	6.625	47.37	5.95	611.50	612.00	0.50	611.50	0.00
#15	8.00 inø	175	PVC, perforated	7.9	8.6	8.6	361.94	59.57	610.17	612.00	1.83	612.00	2.25
#14	8.00 inø	110	PVC, perforated	7.9	8.6	8.6	227.50	37.44	609.50	612.00	2.50	612.00	3.33
#15	12.00 inø		50 PVC, rigid	11.938	12.75	12.75	156.27	38.86	608.25	612.00	3.75	612.00	4.50
Grand Total		609.5					1,050.57	164.46					

6.2.13 Elevator Shaft Casings

The ATF, OWA and AFHB contained hydraulic operated elevators. The elevator shaft casings are considered buried piping. There is no drawing for the ATF elevator (#62), but field dimensions were verified during the FSS of the casing and documented in survey plan 43/00-F.

The OWA has two elevator ram casings – a personnel elevator casing (#60) and a freight elevator casing (#61). Both casings are assumed to be a 16-inch diameter Schedule 40 PVC pipe based on walkdowns and the sizes of the ram and jack cylinder provided on plant drawings. The personnel elevator casing depth is not shown on any plant drawing but it is estimated to be approximately 14" based on travel of the hydraulic ram as shown on drawing A-386. Removal of the hydraulic ram resulted in surrounding fill / sand accumulating in the casing therefore, accurate field measurements of the depth were not obtainable. The freight elevator casing extends 25' - 11.25" into the ground. The elevator shafts and casings are based on KPS drawings A-285, A-288, and XK-139-28.

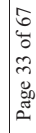
The AFHB has two elevators. The jack casings can't be removed in either configuration. Therefore, a jack cylinder and auxiliary casing for each elevator will remain at end state. The elevator details are shown on plant drawings XK-139-3 and XK-139-4.

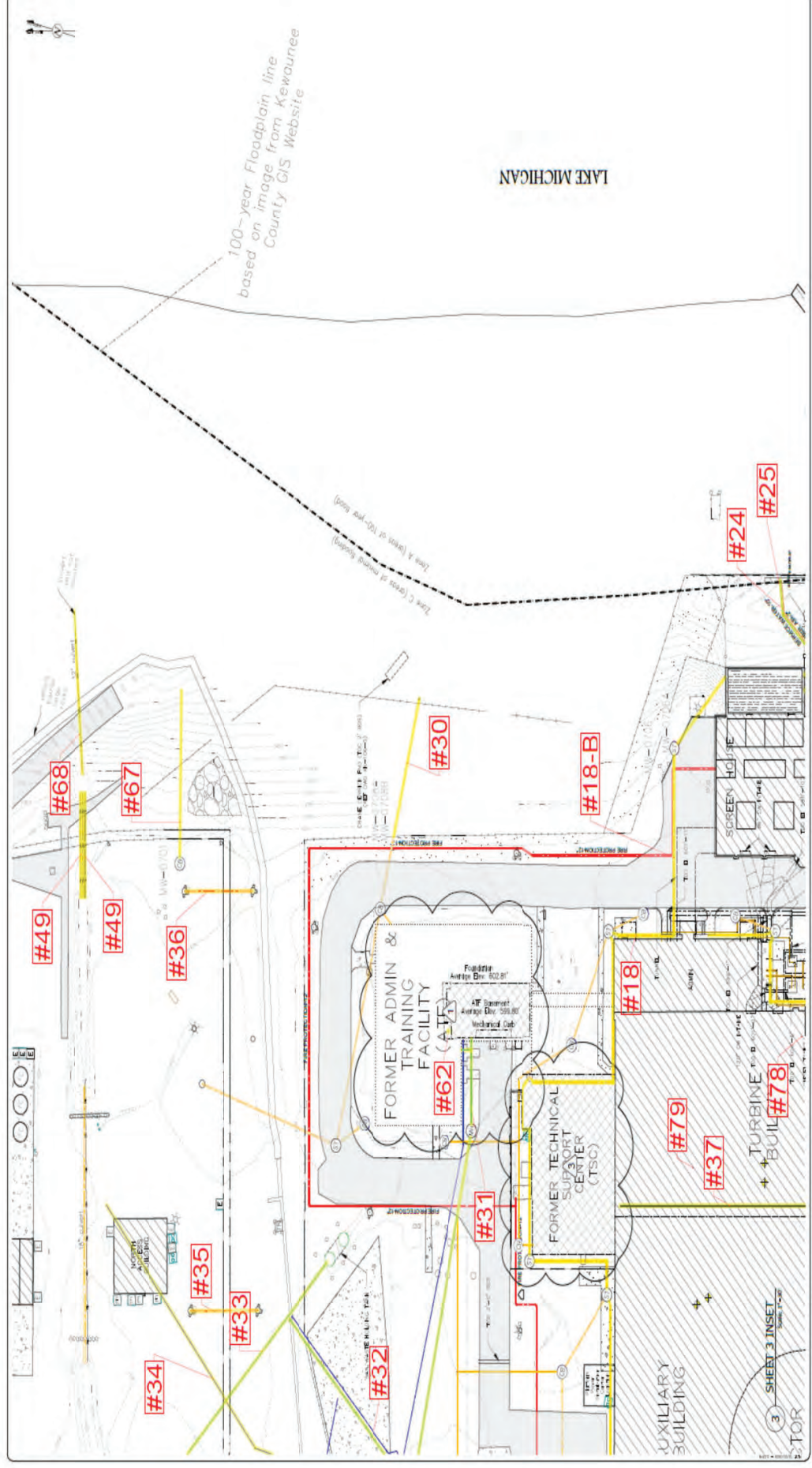
Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation (CL)	End Elevation (CL)	Start Grade	Start Depth	End Grade	End Depth	From	To
#60	18 in. ø	14.94	14 PVC	18	14.94	54.756	17.04	602'-0"	586'-0"	602'-0"	0'	602'-0"	14'	OWA	Buried/Vertically
#61	18 in. ø	23.906	PVC	18	14.94	101.326	31.54	600'-6"	574'-0.75"	600'-6"	0'	600'-6"	25'-11.25"	OWA	Buried/Vertically
#62	17 in. ø	20	Schedule 40 Carbon Steel	17	15.88	83.147	27.51	595'	575'	595'	0'	595'	20'	ATF	Buried/Vertically
#63	10.25 in. ø	42	Generic	10.25	10.25	112.705	24.07	581'	540'	581'	0'	581'	42'	AFHB	Buried/Vertically
#63-A	18 in. ø	42	Generic	18	18	197.930	74.22	581'	540'	581'	0'	581'	42'	AFHB	Buried/Vertically
Branch #63 Total	84			310.515		98.281									
#64	10.25 in. ø	26	Generic	10.25	10.25	68.770	14.90	581'	556'	581'	0'	581'	26'	AFHB	Buried/Vertically
#64-A	18 in. ø	26	Generic	18	18	122.522	45.94	581'	556'	581'	0'	581'	26'	AFHB	Buried/Vertically
Branch #64 Total	52			192.292		83.841									
Total		59.906				238.251	76.864								

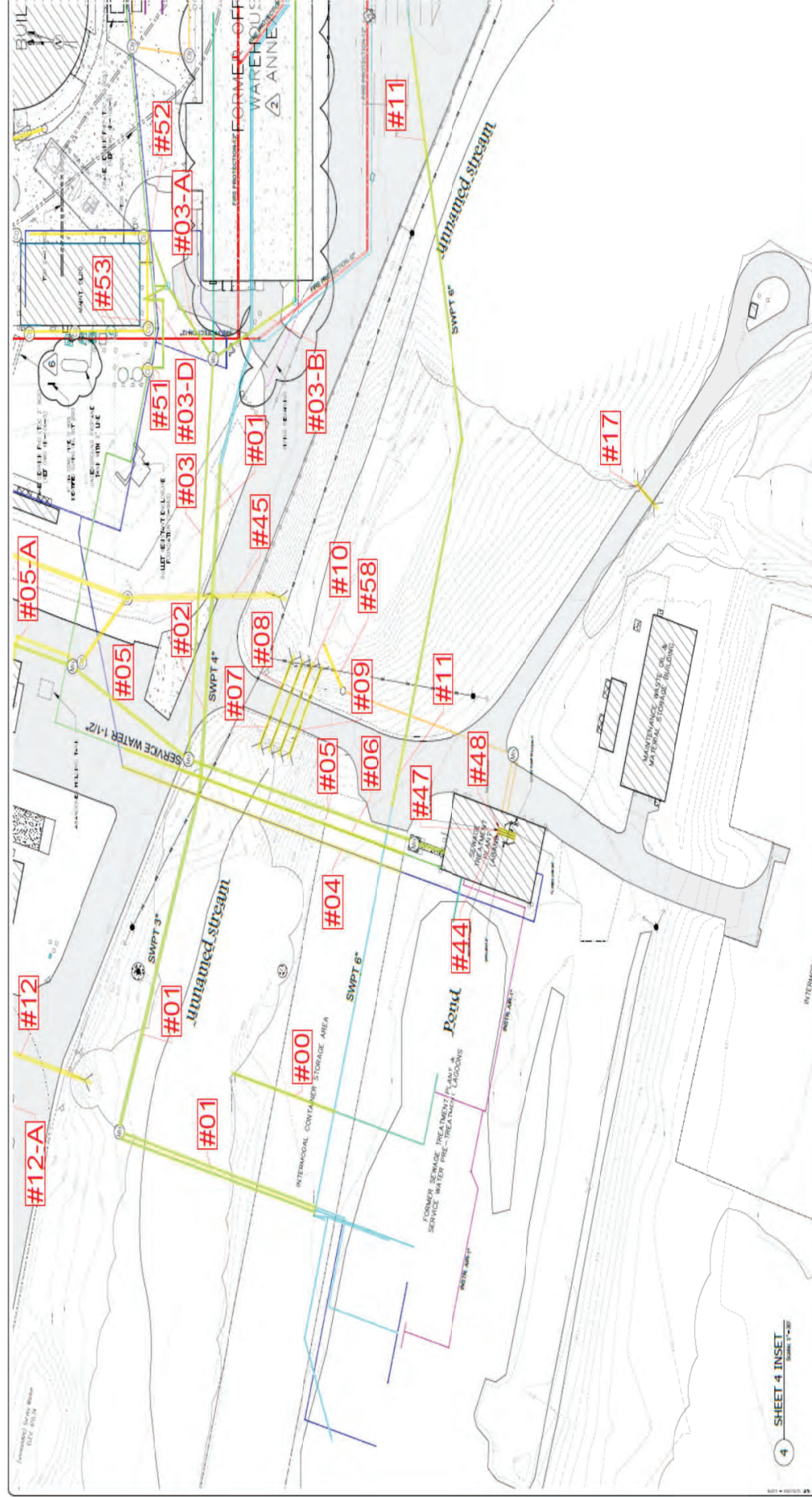
6.2.13 Pump Casings

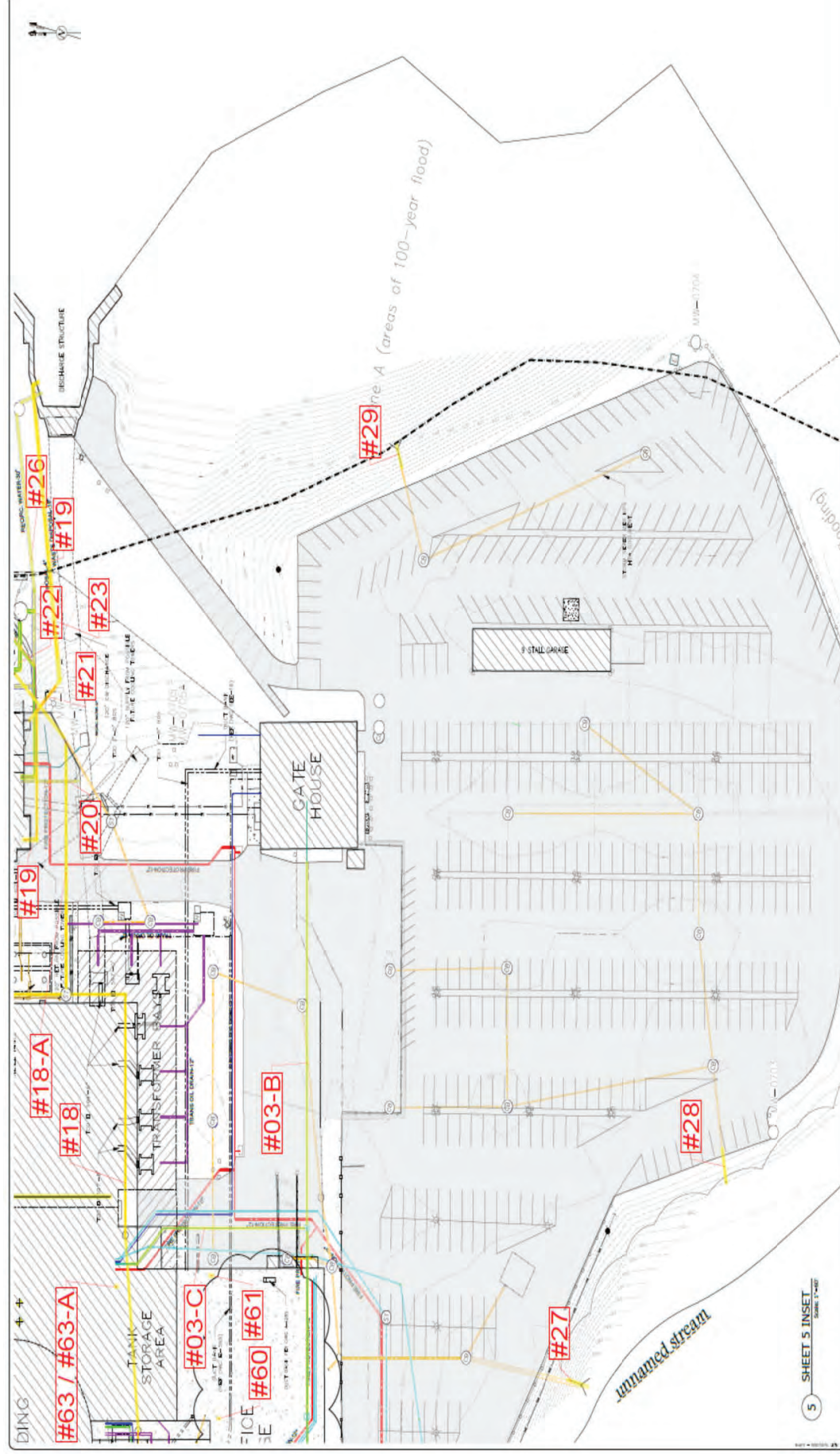
The Heater Drain and Condensate pumps are deep well style pumps. To prevent the intrusion of groundwater into the TB, the pump casings will be left in place and treated as buried piping. The inside diameters and lengths for these pump casings are shown on drawings XK-114-1 and XK-70207920-46.

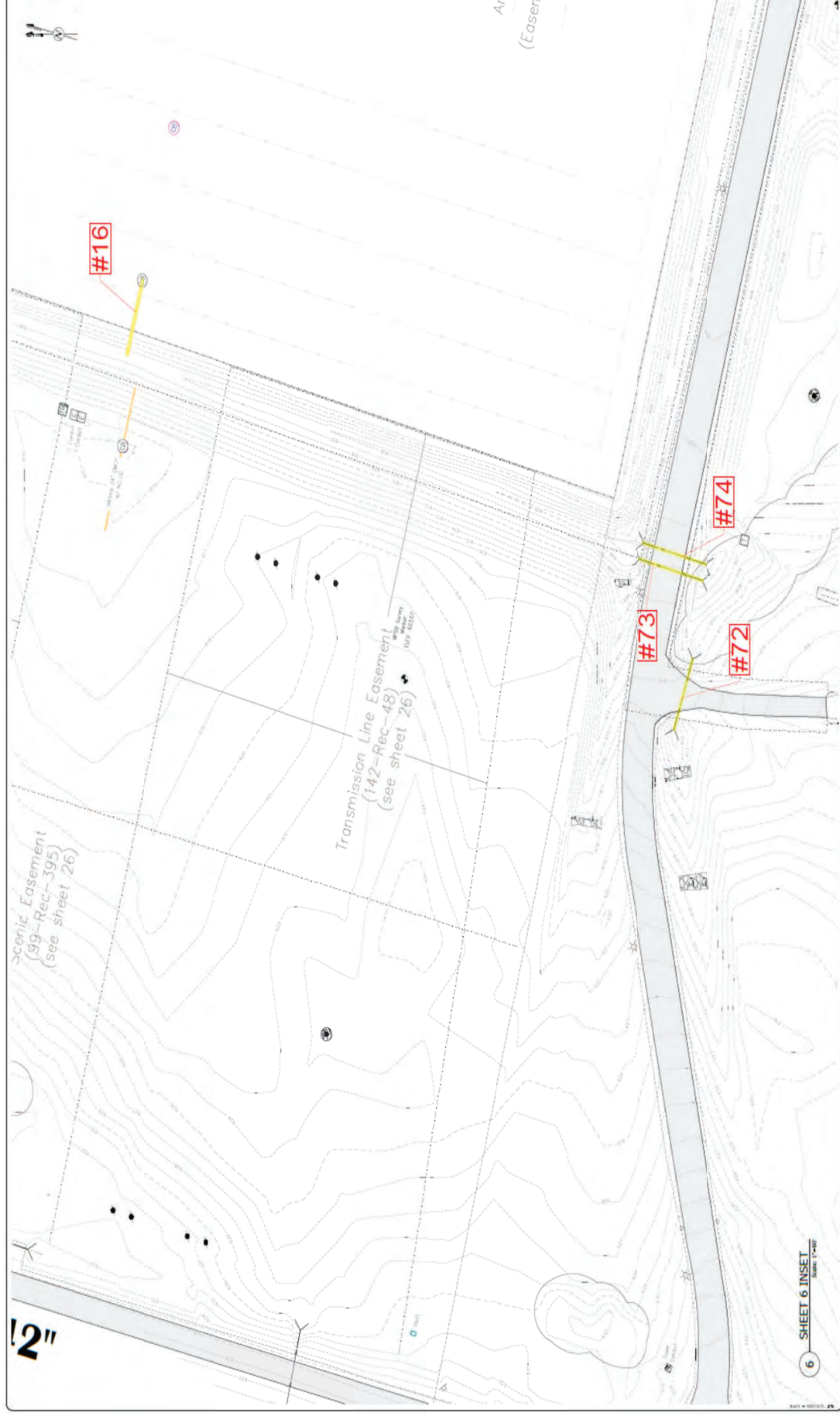
Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation (CL)	End Elevation (CL)	Start Grade	Start Depth	End Grade	End Depth
#79	30.00 inø	22	Carbon Steel Pump Casing	30	30.25	172.79	107.99	575.00	586.08	586.08	0"	586.08	11.00
Total		22				172.79	107.99						
Branch I.D.	Size	Length (ft)	Material	Inside Diameter (in.)	Outside Diameter (in.)	Interior Surface Area (ft ²)	Void Space Volume (ft ³)	Start Elevation (CL)	End Elevation (CL)	Start Grade	Start Depth	End Grade	End Depth
#78	44.00 inø	35.83	Carbon Steel Pump Casing	44	44.25	412.73	378.31	581.58	581.58	581.58	0"	581.58	17.92
Total		35.83				412.73	378.31						













6.2.14 Manholes

This section calculates the surface area and volume of concrete associated with manholes that will remain (fully or partially) at end state for KPS. The manhole locations and dimensions are shown below. They are mainly associated with the Sanitary and Storm Sewer systems at KPS. A common, simplified manhole and catch basin design for the surface area and volume calculations for all manholes and catch basins was utilized to bound the various manhole designs used at KPS and is shown below. This is a less complicated design than the typical conical top which many of the manholes utilize. The inside diameter of 48" for all calculations which bounds typical catch basins / manholes which are 36" or 42" diameter. Other inputs used in these calculations included:

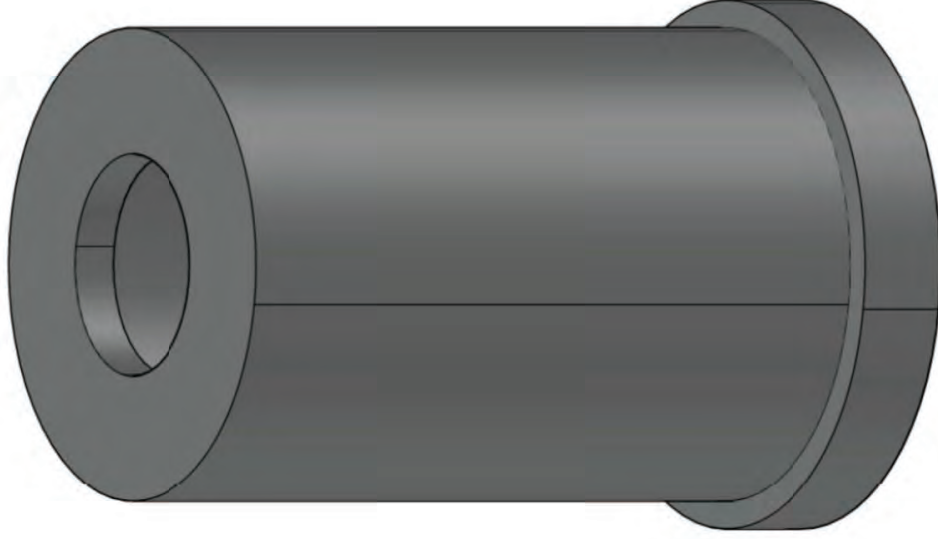
- 5" concrete walls and 9" thick concrete bases
- 24" diameter top opening.
- Storm manholes and catch basins have 1.5 ft sump below lowest pipe invert unless otherwise noted.
- Sanitary manholes do not have sump below lowest invert unless otherwise noted
- Where invert depths are not known, a 6' pipe invert was used since this was typical of most manholes and catch basins. A shallower depth / invert was used if the catch basin / manholes was at the end of a branch. These are noted in the spreadsheet below.

Some of the sanitary manholes were filled with concrete to cover the piping connections to the manhole. The result of adding the concrete would reduce the surface area, SA, of the manhole and increase the concrete volume, V. Since the radiological concentration is proportional to the SA / V ratio, the additional concrete would lower the radiological concentration. Thus, neglecting this additional concrete is conservative.

The manholes and their end state configuration are shown below.







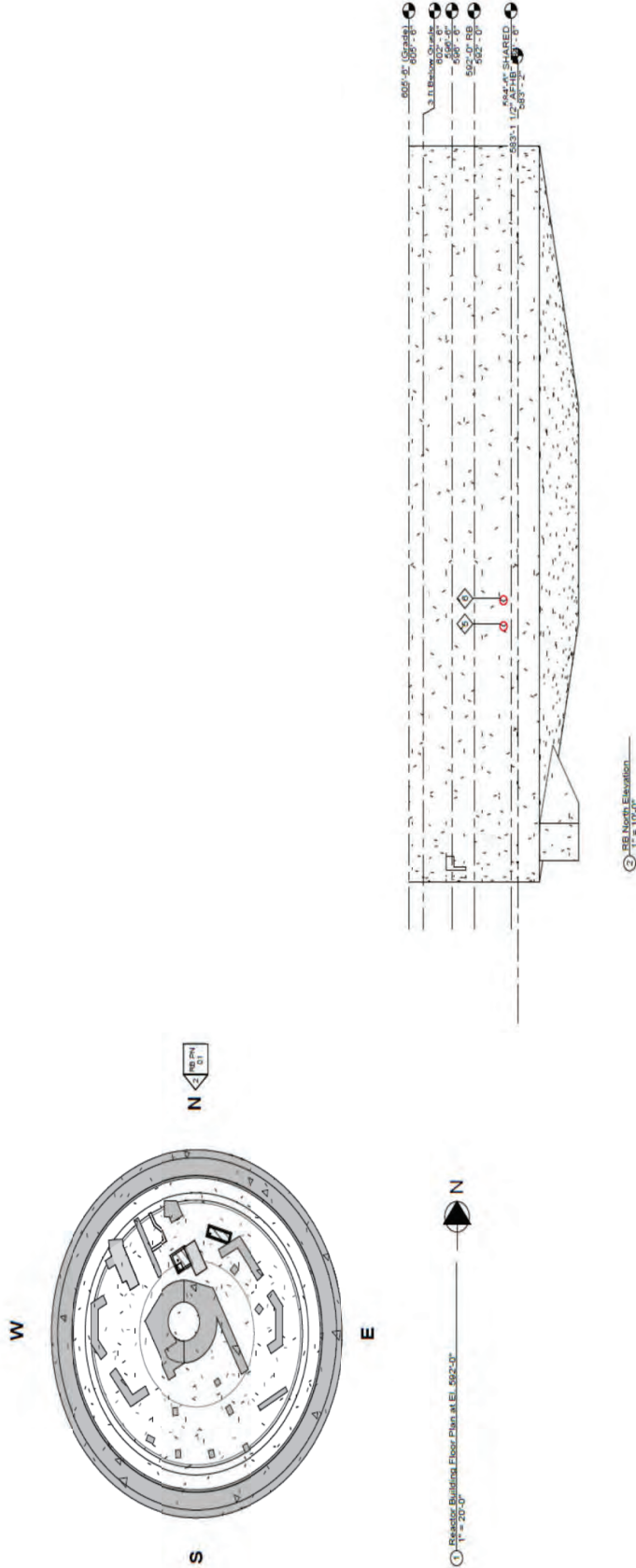
Typical Manhole Configuration

KPS End State Buried Piping/Penetrations/Embedded Piping

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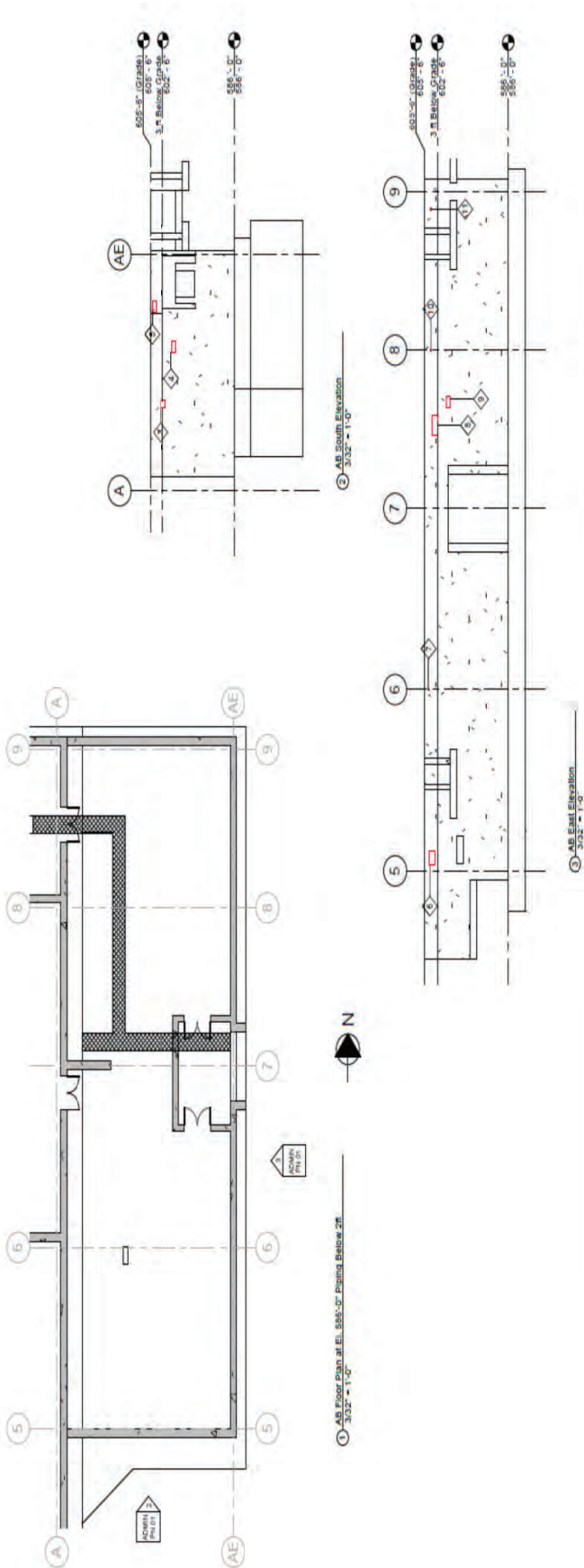
Map Label	Storm	Type	Demo 3 BGS	Top Elev. (ft)	Inv. Elev. (ft)	Depth (ft)	Volume (cu ft)	Interior SA (sq ft)	Source	
CB-4	Storm	Catchbasin	NO	604.92	599.62	5.30	51.32	85.98	Mau Survey; XK-70155348-8	
MH-1	Sanitary	Manhole	YES	608.71	598.50	10.21	58.44	103.17	M-658; M-659; Mau Survey	
MH-10	Sanitary	Manhole	YES	605.5	600.54	4.96	28.08	37.17	M-682	Rim elevation assumed
MH-10S	Storm	Manhole	YES	605.973	594.33	21.64	124.52	246.79	A-265/ Mau Survey	
MH-11S	Storm	Manhole	YES	605.4	596.88	18.53	106.51	207.65	A-265; A-267	
MH-12S	Storm	Manhole	YES	605.5	596.54	18.96	109.01	213.09	S-729	Rim elevation assumed
MH-2S	Storm	Manhole	YES	608.5	597.17	21.33	122.75	242.94	A-265	
MH-3	Sanitary	Manhole	YES	607.883	596.68	10.92	61.57	112.15	M-688	
MH-3S	Storm	Manhole	YES	605.637	585.75	18.89	114.39	224.77	A-265; Mau Survey	
MH-4	Sanitary	Manhole	YES	606.916	595.75	11.17	63.97	115.18	M-686	
MH-4S	Storm	Manhole	YES	605.5	597.17	18.33	105.40	205.24	A-265; A-269	
MH-4'S	Storm	Manhole	YES	605.5	591.42	14.08	80.83	151.84	A-265	Rim elevation assumed
MH-5	Sanitary	Manhole	YES	606.39	591.00	15.39	88.39	168.26	M-688	
MH-5S	Storm	Manhole	YES	605.5	598.98	16.92	97.21	187.44	A-265	Rim elevation assumed
MH-6	Sanitary	Manhole	YES	605	592.21	12.79	73.36	135.61	M-682	
MH-6(B)	Sanitary	Manhole	YES	604.241	598.83	5.41	30.69	42.86	XK-54167-2; Mau Survey	
MH-6(C)	Sanitary	Manhole	YES	606.36	603.01	5.35	30.34	42.10	sk-70157914-4	
MH-6S	Storm	Manhole	YES	606.329	590.00	16.33	93.82	180.06	A-265; Mau Survey	
MH-7	Sanitary	Manhole	YES	608.236	598.60	9.64	55.12	95.95	XK-54167-2	
MH-7A	Sanitary	Manhole	YES	605.5	595.75	9.75	55.78	97.39	A-377	Rim elevation assumed
MH-7S	Storm	Manhole	YES	605.15	588.58	16.57	95.19	183.04	A-265; Mau Survey	
MH-8	Sanitary	Manhole	YES	605.5	597.71	7.79	44.46	72.78	M-682	Rim elevation assumed
MH-8'	Sanitary	Manhole	YES	608.174	598.04	10.13	57.99	102.19	M-685; Mau Survey	
MH-8S	Storm	Manhole	YES	605.814	557.17	18.65	107.22	209.19	A-265; Mau Survey	
MH-9	Sanitary	Manhole	YES	605.5	598.29	7.21	41.09	65.45	M-682	Rim elevation assumed
MH-9S	Storm	Manhole	YES	608.5	585.75	22.75	130.94	260.74	A-265	
MH-AA	Sanitary	Manhole	YES	620.5	616.56	3.94	22.19	24.38	sk-70157914-4	
MH-AB	Sanitary	Manhole	YES	620.5	613.90	6.60	37.57	57.80	sk-70157914-4	
MH-AC	Sanitary	Manhole	YES	617.5	612.46	5.04	28.55	38.20	sk-70157914-4	
MH-AD	Sanitary	Manhole	YES	616.5	609.95	6.55	37.28	57.17	sk-70157914-4	
MH-AE	Sanitary	Manhole	YES	614	607.20	6.80	38.72	60.32	sk-70157914-4	
MH-AF	Sanitary	Manhole	NO	608	603.75	4.25	45.25	72.78	sk-70157914-4	
CB-AG	Storm	Manhole	NO	603.64	599.77	7.50	64.04	113.63	M-229; XK-70155348-5, -8	Unknown depth; Assumed 6' to invert + assumed 1.5' to bottom of catch basin
CB-AH	Storm	Catchbasin	NO	606.72	599.77	7.50	64.04	113.63		Unknown depth; Assumed 6' to invert + assumed 1.5' to bottom of catch basin
CB-AI	Storm	Catchbasin	NO	608.04	596.24	11.80	88.90	167.66	sk-70157914-4	
CB-AJ	Storm	Catchbasin	NO	607.66		7.50	64.04	113.63	Site Personnel	Measured 77" from grating to bottom.
CB-AK	Storm	Catchbasin	NO	603.475	7.50	64.04	64.04	113.63	Site Personnel	
CB-AL	Storm	Catchbasin	NO	603.955	6.00	55.37	94.78		Site Personnel	Rim elevation approx 2ft below grade. Depth from rim to bottom of CB was 6'
CB-AM	Storm	Catchbasin	NO	606.68	7.50	64.04	64.04	113.63	Site Personnel	64" from grating to bottom; top of grill recessed below road grade recently to eliminate ponding
CB-AN	Storm	Catchbasin	NO		7.50	64.04	64.04	113.63	Site Personnel	Unknown depth; Assumed 6' to invert + assumed 1.5' to bottom of catch basin
CB-AO	Storm	Catchbasin	NO	606.79	7.50	64.04	64.04	113.63	Site Personnel	Measured 77" from grating to bottom.
CB-AP	Storm	Catchbasin	NO	603.44	7.50	64.04	64.04	113.63	Site Personnel	Measured 108" from grating to bottom
CB-AQ	Storm	Catchbasin	NO		4.16	44.73	71.65		Site Personnel	Measured 32" to invert + assumed 1.5' to bottom of catch basin
CB-AR	Storm	Catchbasin	NO	609	601.33	7.67	65.01	115.72	Unknown depth; Assumed 32" to invert + 1.5' to bottom of catch basin	
CB-AS	Storm	Catchbasin	NO		7.50	64.04	64.04	113.63	Site Personnel	Unknown depth; Assumed 6" to invert + assumed 1.5' to bottom of catch basin
CB-AT	Storm	Catchbasin	NO	606.839		7.50	64.04	113.63	Site Personnel	Measured 64" from grating to bottom;
CB-AU	Storm	Catchbasin	NO	607.281	7.50	64.04	64.04	113.63	Mau Survey	Measured 64" from grating to bottom;
CB-AV	Storm	Catchbasin	NO	606.648		7.50	64.04	113.63	Site Personnel	Measured 78" from grating to bottom
CB-AW	Storm	Catchbasin	NO	606.89		4.16	44.73	71.65	Site Personnel	Measured 80" from grating to bottom
CB-AX	Storm	Catchbasin	NO	606.909		7.50	64.04	113.63	Site Personnel	Measured 80" from grating to bottom
CB-AY	Storm	Catchbasin	NO	606.491		4.16	44.73	71.65	Mau Survey	Measured 82" from grating to bottom
CB-AZ	Storm	Catchbasin	NO	606.974		7.92	66.45	118.85	Site Personnel	Measured 84" to invert + assumed 1.5' to bottom of catch basin
CB-BA	Storm	Catchbasin	NO	606.625		8.50	69.82	126.19	Site Personnel	Measured 68" to invert + assumed 1.5' to bottom of catch basin
CB-BB	Storm	Catchbasin	NO	606.783		7.17	62.12	109.44	Mau Survey	Unknown depth; Assumed 6' to invert + assumed 1.5' to bottom of catch basin
CB-BC	Storm	Catchbasin	NO	609	604.71	4.29	45.49	73.30		Unknown depth; Assumed 6' to invert + assumed 1.5' to bottom of catch basin
CB-BD	Storm	Catchbasin	NO	607	606.83	0.17	21.64	21.46		Unknown depth; Assumed 6' to invert + assumed 1.5' to bottom of catch basin
CB-BE	Sanitary	Manhole	YES	597	589.00	8.00	45.66	73.40	M-229	Cleanout Manhole
CB-BF	Storm	Catchbasin	NO	607	605.67	1.33	28.39	36.12	XK-54103-4	
CB-BH	Storm	Catchbasin	NO	605.929	5.00	49.99	82.21	79.16	Site Personnel; Mau Survey	Unknown depth; Assumed 6' to invert + assumed 1.5' to bottom of catch basin
MH-BT	Storm	Manhole	YES	603.5	595.20	8.30	47.40	69.64	E-10513	Measured 42" to invert + assumed 1.5' to bottom of catch basin
T-20 Sump		Sump	NO		9.25	4.00	43.81	69.64	E-10443	
OC Sump A		Sump	NO		4.00	4.00	43.81	69.64	E-10443	
OC Sump A		Sump	NO		4.00	4.00	43.81	69.64	E-10443	
OC Sump A		Sump	NO		4.00	4.00	43.81	69.64	E-10443	
Space Trans. Sump		Sump	NO		5.50	52.48	88.49		E-10170	
Total							4,110	7,325		

6.3.2 Reactor Building Penetrations



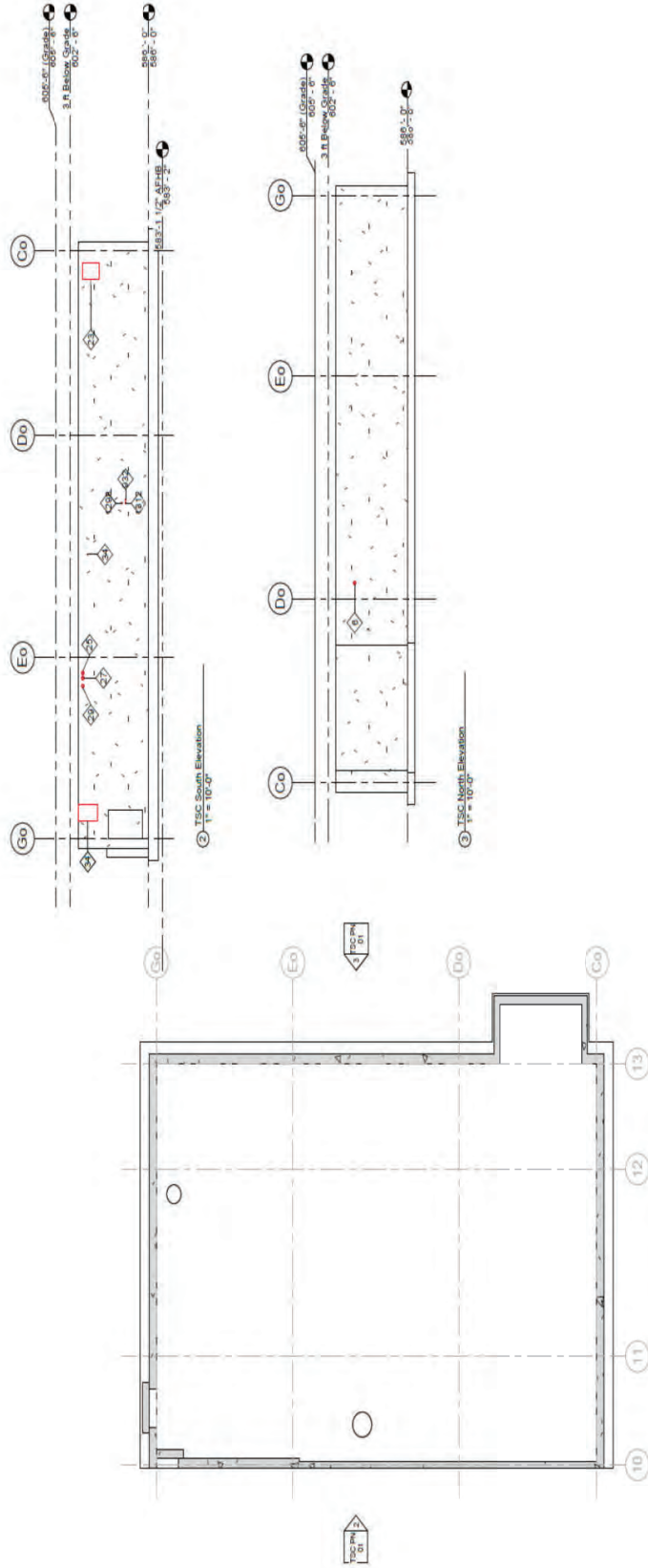
Reactor Bldg. Penetration Schedule					
Type	Surface Area	Volume	Wall Thickness	System	ID
18" Opening	122.52 sq ft	45.54 cu ft	24 in.	Sump B L Lines	5
18" Opening	122.52 sq ft	45.54 cu ft	24 in.	Sump B L Lines	6
Grand Total 2	245.04 sq ft	91.08 cu ft			

6.3.4 Administration Building Penetrations



Administration Building Penetration Schedule				
Type	Surface Area	Volume	Wall Thickness	System
1-3"x1" Opening	5.32 R ²	2.56 R ³	2 R	Electrical Conduit
2"x1" Opening	12 R ²	4 R ³	2 R	Diesel Fuel Oil
1-2"x2'-6" Opening	10.588 R ²	4.375 R ³	1.5 R	Electrical Conduit
3-5"x1'-5" Opening	14 R ²	6.122 R ³	1.5 R	Electrical Conduit
2"x1" Opening	9 R ²	3 R ³	1.5 R	Diesel Fuel Oil
3"x Opening	1.178 R ²	0.0758 R ³	1.5 R	Electrical Conduit
3"x Opening	1.178 R ²	0.0758 R ³	1.5 R	Electrical Conduit
Grand Total: 9	76.822 R ²	24.38 R ³		

6.3.5 TSC Building Penetrations



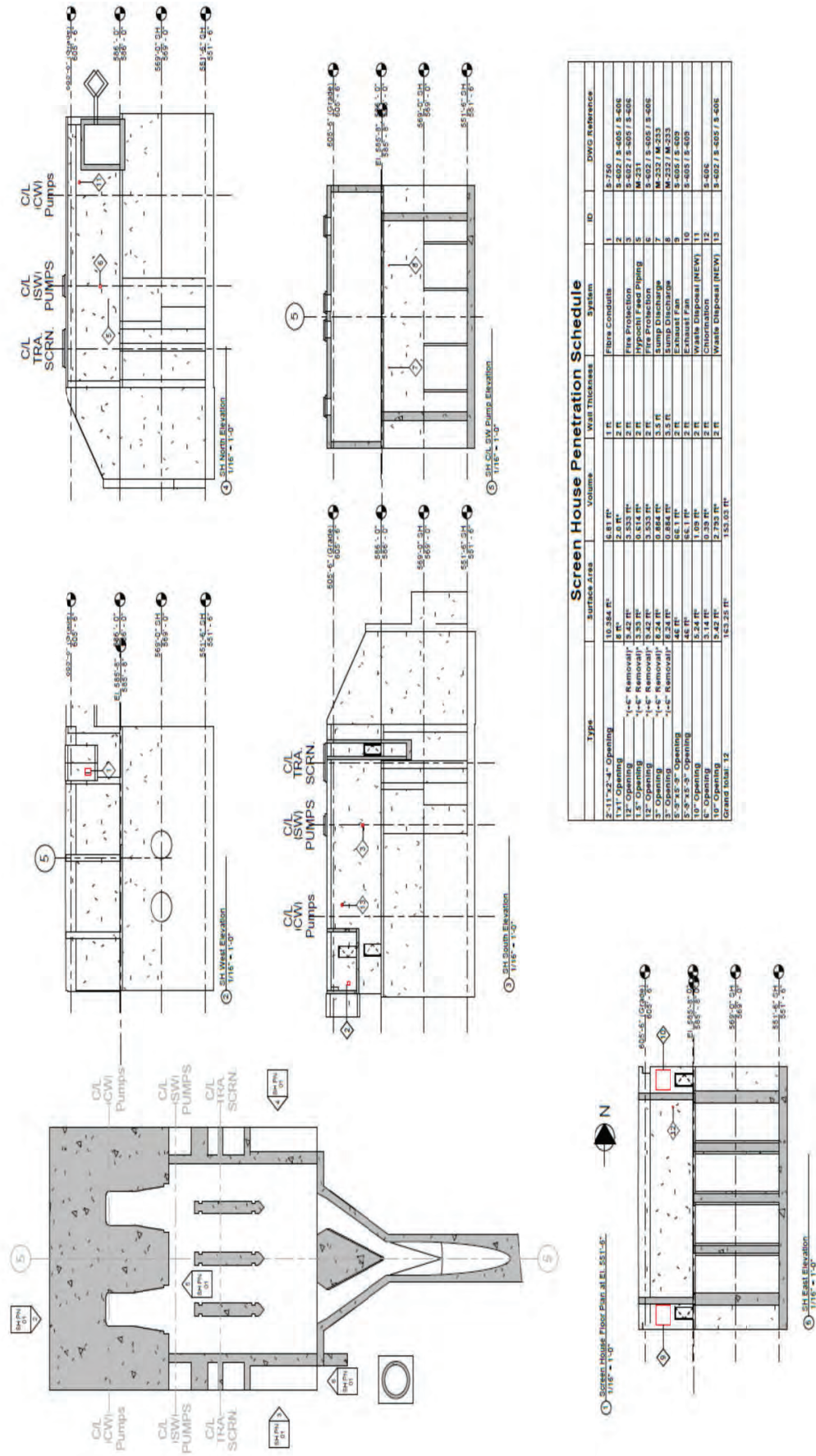
1 TSC Floor Plan at EL. 580'-0"

2 TSC South Elevation

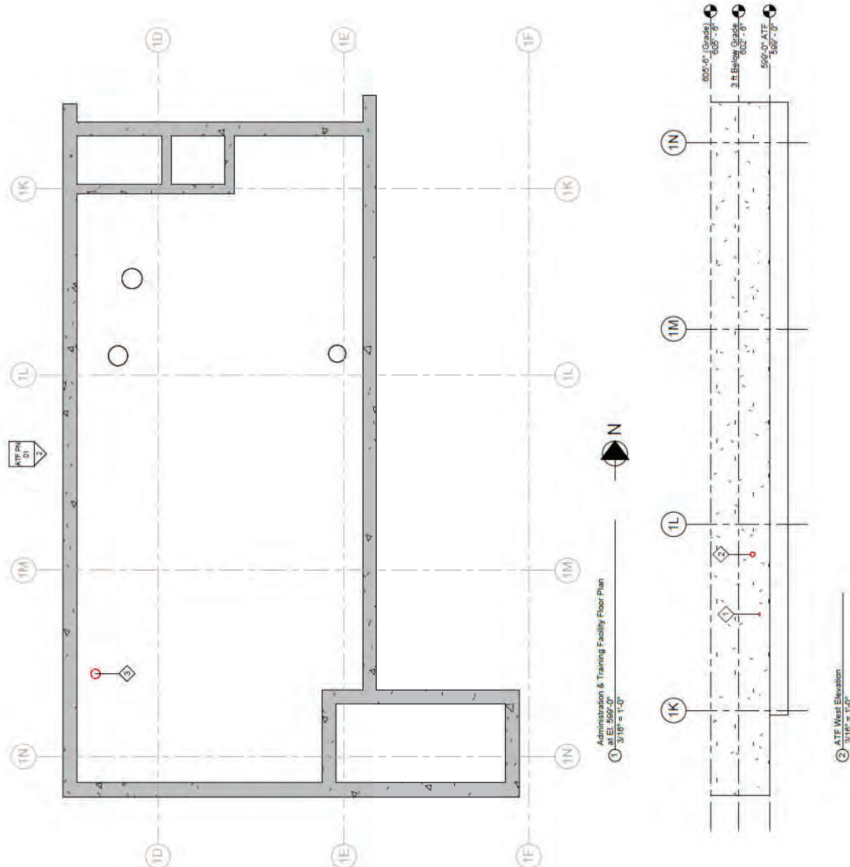
3 TSC North Elevation

Technical Support Center Penetration Schedule					
Type	Surface Area	Volume	Wall Thickness	System	DWG Reference
6" Opening	14'-0" Removal ¹	1.178 R ²	1.5 R	Fire Protection	M-512
2'-6"x3'-6" Opening	Quantified with Turbine Building	Quantified with Turbine Building		Electrical Cable Trays	E-297
6" Opening	Quantified with Turbine Building	Quantified with Turbine Building			
6" Opening	Quantified with Turbine Building	Quantified with Turbine Building			
2'-6" x 4' Opening	Quantified with Auxiliary Building	Quantified with Auxiliary Building		Electrical Cable Trays	E-297
3/8" Opening	Quantified with Turbine Building	Quantified with Turbine Building			
2" Opening	Quantified with Turbine Building	Quantified with Turbine Building			
2" Opening	Quantified with Turbine Building	Quantified with Turbine Building			
Grand total: 10	4.71 R ²	1.178 R ³			1312

6.3.6 Screenhouse Penetrations

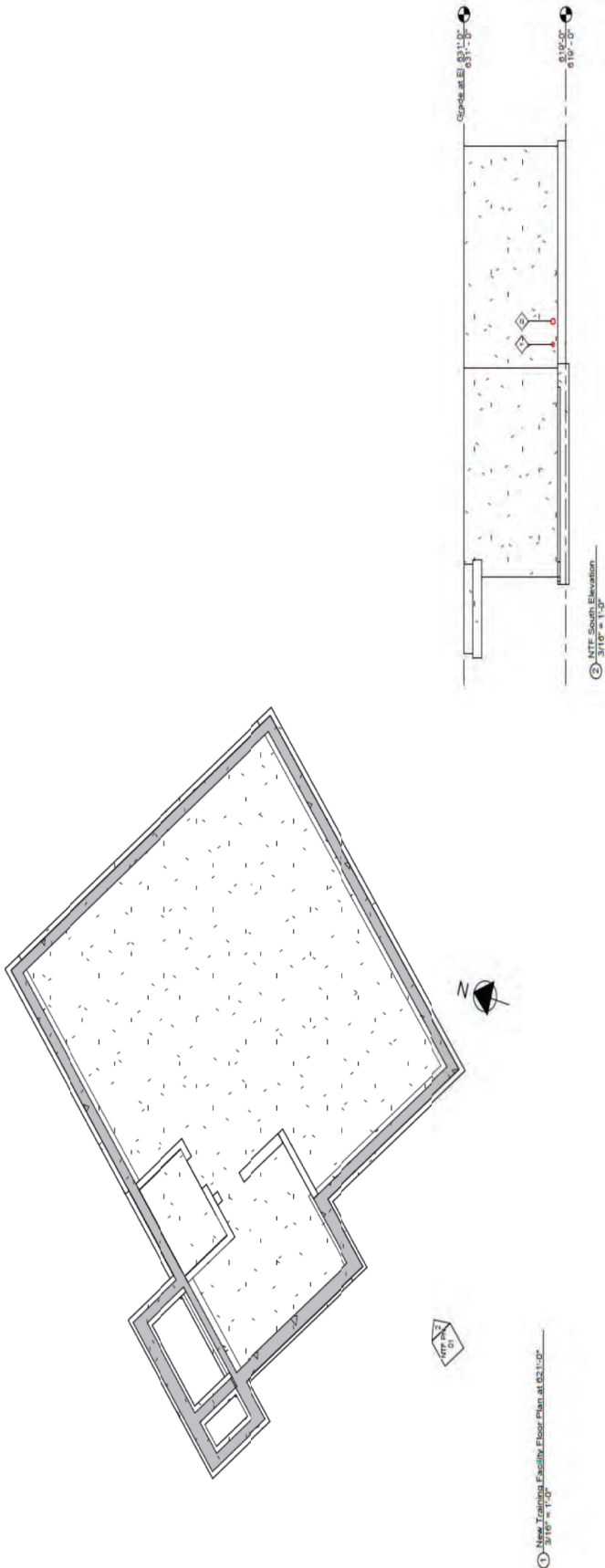


6.3.7 ATF Penetrations



Administration & Training Facility Penetration Schedule					
Type	Surface Area	Volume	Floor / Wall Thickness	System	DWG Reference
4" Opening	1/4" Removal: 1.53 sq ft	0.818 cu ft	1.5 ft	Potable Water	AK-54167 / Verified in Field
6" Opening	1/4" Removal: 4.71 sq ft	1.178 cu ft	1.5 ft	San. Sewer	AK-54167
12" Opening	1/4" Removal: 6.25 sq ft	1.571 cu ft	2 ft	Fire Protection	AK-54167
Grand Total	14.52 sq ft	3.567 cu ft			

6.3.8 Training Building Penetrations



New Training Facility Penetration Schedule					
Type	Surface Area	Volume	Wall Thickness	System	ID
4" Opening	2.62 ft ²	0.545 ft ³	1 ft	San. Sewer	1
6" Opening	3.14 ft ²	0.785 ft ³	1 ft	Potable Water	2
Ground Level S	5.76 ft ²	1.33 ft ³			

DWG Reference	
KK-70157914-51	1
KK-70157914-4	2
Unknown entry into building	

ATTACHMENT A

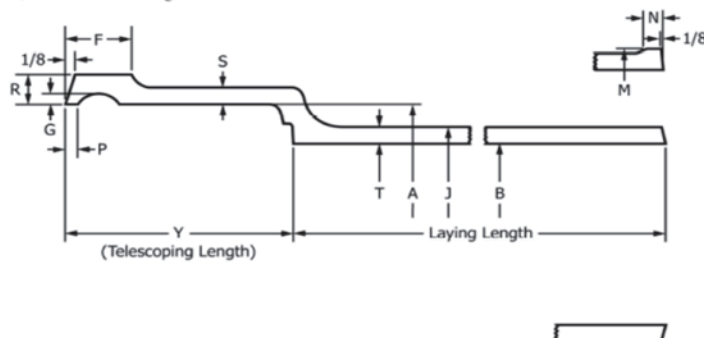
PIPE MATERIAL / SCHEDULE REFERENCES

A.1 ASTM A74 -15 Excerpt



TABLE 1 Dimensions of Hubs, Spigots, and Barrels for Extra-Heavy and Service Cast Iron Soil Pipe and Fittings, in.

NOTE 1—1 in. = 25.4 mm; 1 ft = 0.3 m throughout tables.



Service Cast Iron Soil Pipe:

Size ^A Availability ^B	Inside Diameter of Hub ^B	Outside Diameter of Barrel ^C	Telescoping Length ^C	Inside Diameter of Barrel ^C	Thickness of Barrel ^C	
					Nom	Min
20	2.94 [74.68]	2.30 [58.42]	2.50 [63.5]	1.96 [49.78]	0.17 [4.32]	0.14 [3.56]
30	3.94 [100.08]	3.30 [83.82]	2.75 [69.85]	2.96 [75.18]	0.17 [4.32]	0.14 [3.56]
40	4.94 [125.48]	4.30 [109.22]	3.00 [76.2]	3.94 [100.08]	0.18 [4.57]	0.15 [3.81]
50	5.94 [150.88]	5.30 [134.62]	3.00 [76.2]	4.94 [125.48]	0.18 [4.57]	0.15 [3.81]
60	6.94 [176.28]	6.30 [160.02]	3.00 [76.2]	5.94 [150.88]	0.18 [4.57]	0.15 [3.81]
80	9.25 [234.95]	8.38 [212.85]	3.50 [88.9]	7.94 [201.68]	0.23 [5.84]	0.17 [4.32]
100	11.38 [289.05]	10.50 [266.70]	3.50 [88.9]	9.94 [252.40]	0.28 [6.86]	0.22 [5.59]
120	13.50 [342.9]	12.50 [317.5]	4.25 [107.95]	11.94 [303.28]	0.28 [6.86]	0.22 [5.59]
150	16.95 [430.53]	15.88 [403.35]	4.25 [107.95]	15.16 [385.06]	0.36 [9.14]	0.30 [7.62]

Size ^A	Thickness of Hub		Width of Hub Bead ^C	Distance from Lead Groove to End, Pipe and Fittings ^D	Depth of Lead Groove	
	Hub Body	Over Bead			G (min)	G (max)
	S (min)	R (min)	F (min)	P	G (min)	G (max)
2	0.13 [3.30]	0.34 [8.64]	0.75 (0.63) [19.05] (16.00)	0.22 [5.59]	0.10 [2.54]	0.19 [4.83]
3	0.16 [4.06]	0.37 [9.40]	0.81 (0.63) [20.57] (16.00)	0.22 [5.59]	0.10 [2.54]	0.19 [4.83]
4	0.16 [4.06]	0.37 [9.40]	0.88 (0.63) [22.35] (16.00)	0.22 [5.59]	0.10 [2.54]	0.19 [4.83]
5	0.16 [4.06]	0.37 [9.40]	0.88 (0.63) [22.35] (16.00)	0.22 [5.59]	0.10 [2.54]	0.19 [4.83]
6	0.18 [4.57]	0.37 [9.40]	0.88 (0.63) [22.35] (16.00)	0.22 [5.59]	0.10 [2.54]	0.19 [4.83]
8	0.19 [4.83]	0.44 [11.26]	1.19 (1.06) [30.23] (26.92)	0.38 [9.65]	0.15 [3.81]	0.22 [5.59]
10	0.27 [6.86]	0.53 [13.46]	1.19 (1.06) [30.23] (26.92)	0.38 [9.65]	0.15 [3.81]	0.22 [5.59]
12	0.27 [6.86]	0.53 [13.46]	1.44 (1.31) [36.58] (33.27)	0.47 [11.94]	0.15 [3.81]	0.22 [5.59]
15	0.30 [7.62]	0.58 [14.73]	1.44 (1.31) [36.58] (33.27)	0.47 [11.94]	0.15 [3.81]	0.22 [5.59]

Extra-Heavy Cast Iron Soil Pipe and Fittings:

Size ^A Availability	Inside Diameter of Hub ^B	Outside Diameter of Barrel ^B	Telescoping Length ^B	Inside Diameter of Barrel ^B	Thickness of Barrel ^B	
					Nom	Min
2*	3.06 [77.72]	2.38 [60.45]	2.50 [63.5]	2.00 [50.8]	0.19 [4.83]	0.16 [4.06]
3*	4.19 [106.43]	3.50 [88.9]	2.75 [69.85]	3.00 [76.2]	0.25 [6.35]	0.22 [5.59]
4*	5.19 [131.83]	4.50 [114.3]	3.00 [76.2]	4.00 [101.6]	0.25 [6.35]	0.22 [5.59]
5*	6.19 [157.23]	5.50 [139.7]	3.00 [76.2]	5.00 [127]	0.25 [6.35]	0.22 [5.59]
6*	7.19 [182.63]	6.50 [165.1]	3.00 [76.2]	6.00 [152.4]	0.25 [6.35]	0.22 [5.59]
8*	9.50 [241.30]	8.62 [218.5]	3.50 [88.9]	8.00 [203.2]	0.31 [7.87]	0.25 [6.35]
10*	11.62 [295.15]	10.75 [273.05]	3.50 [88.9]	10.00 [254]	0.37 [9.40]	0.31 [7.87]

A.2 Reinforced Concrete Pipe ASTM C76

TONGUE & GROOVE JOINT

PIPE SIZE ID (IN)	WALL THICKNESS (IN)	PIPE SIZE OD (IN)	WEIGHT (LBS/FT)	LAY LENGTHS (FT)	PIPE JOINT DIMENSIONS (IN)						
					A	B	C	AS1	AS2	E	H
12 TONGUE & GROOVE	2	16	92	4, 6	0.750	2.000	1.375	0.250	0.125	0.625	1.125
15 TONGUE & GROOVE	2.25	19.5	127	4, 6, 8	0.875	2.250	1.500	0.250	0.125	0.750	1.250
18 TONGUE & GROOVE	2.5	23	168	4, 6, 8	1.000	2.500	1.625	0.250	0.125	0.875	1.375
21 TONGUE & GROOVE	2.75	26.5	214	4, 6, 8	1.063	2.750	1.750	0.250	0.125	0.938	1.500
24 TONGUE & GROOVE	3	30	265	4, 6, 8	1.063	3.000	1.938	0.250	0.125	0.938	1.688
27 TONGUE & GROOVE	3.25	33.5	322	4, 6, 8	1.188	3.250	2.063	0.250	0.125	1.063	1.813
30 TONGUE & GROOVE	3.5	37	384	4, 6, 8	1.313	3.500	2.250	0.313	0.125	1.188	1.938
36 TONGUE & GROOVE	4	44	524	4, 6, 8	1.063	2.969	1.938	0.313	0.125	0.938	1.625
42 TONGUE & GROOVE	4.5	51	685	4, 6, 8	1.688	4.000	2.625	0.375	0.125	1.563	2.250
48 TONGUE & GROOVE	5	58	867	4, 6, 8	1.938	4.250	2.875	0.375	0.188	1.750	2.500
54 TONGUE & GROOVE	5.5	65	1071	4, 6, 8	2.125	4.500	3.063	0.375	0.188	1.938	2.688
60 TONGUE & GROOVE	6	72	1296	4, 6, 8	2.313	5.000	3.500	0.500	0.188	2.125	3.000
66 TONGUE & GROOVE	6.5	79	1542	4, 6, 8	2.500	5.500	3.875	0.625	0.188	2.313	3.250
72 TONGUE & GROOVE	7	86	1810	4, 6, 8	2.844	5.500	4.125	0.625	0.250	2.594	3.500

AVAILABLE IN CLASS III, IV, & V

4/7/2017

**REINFORCED CONCRETE PIPE
ASTM C76**

**Product Data Sheet –
Tongue & Groove Joint**

A.3 DUCTILE IRON PIPE



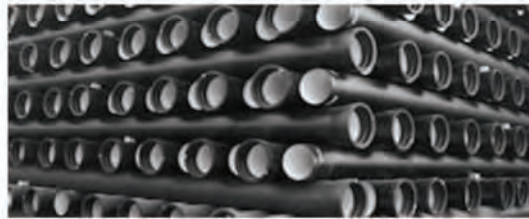
AWWA C151 - Ductile-Iron Pipe Centrifugally Cast - Dimensions

Dimensions of ductile-iron pipes according AWWA C151/A.21.51.

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Typical dimensions of ductile-iron pipes according AWWA C151/A.21.51 Ductile-Iron Pipe, Centrifugally Cast.

Nominal Size (inches)	Outside Diameter (inches) (mm)	Pressure Class				
		150	200	250	300	350
		Wall Thickness (inches) (mm)				
3	3.96	0.25	0.25	0.25	0.25	0.25
4	4.80	0.26	0.26	0.26	0.26	0.26
6	6.90	0.25	0.25	0.25	0.25	0.25
8	9.05	0.27	0.27	0.27	0.27	0.27
10	11.10	0.29	0.29	0.29	0.29	0.29
12	13.20	0.31	0.31	0.31	0.31	0.31
14	15.30	0.33	0.33	0.33	0.33	0.33
16	17.40	0.34	0.34	0.34	0.34	0.34
18	19.50	0.35	0.35	0.35	0.35	0.35
20	21.60	0.36	0.36	0.36	0.36	0.39

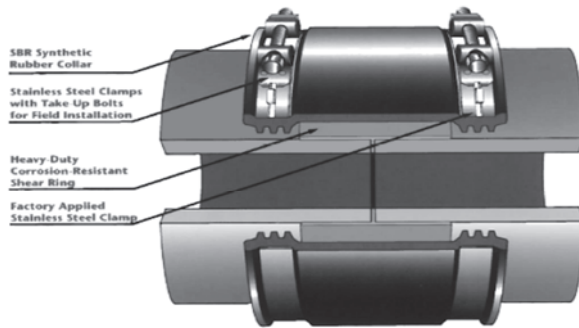
A.4 VITRIFIED CLAY PIPE



Pipe Dimensions & Specifications

Mission Clay Products Band-Seal® Mainline Vitrified Clay Pipe and Couplings meet or exceed the following standards:

- ASTM C 700 and ASTM C 425 which supersede Federal specifications SS-P-361e and SS-P-359b
- SSPWC, Standard Specifications for Public Works Construction, also known as "Greenbook"
- International Association of Plumbing and Mechanical Officials



Band-Seal® Coupling Detail

SPECIFICATIONS

Vitrified Clay Sewer Pipe	ASTM C 700	SSPWC* Sec. 207-8
Method for Testing Clay Sewer Pipe	ASTM C 301	SSPWC* Sec. 207-8.5

Installation of Vitrified Clay Sewer Pipe	ASTM C 12	
Joint, Type D	ASTM C 425	SSPWC* Sec. 208-2.2
Stainless Steel	ASTM A 167	
Clamp	300 Series, Type 316	
Bolt	300 Series	
Nut	300 Series	

*Standard Specifications for Public Works Construction

All Mission Band-Seal® Vitrified Clay Pipe is extra strength and plain end

- Type 1 does not include shear ring and is available in 4" and 6" diameter
- Type 2 includes shear ring and is available in 6", 8", 10", and 12" diameter
- Highly resistant to attack from sewer gases, acids, alkalis, and most other corrosive products
- Quick and easy assembly in the trench; cut and fit with less waste
- Chemically inert and unaffected by decomposition and abrasion common to other pipe materials
- Will not deform under constant load conditions

Nominal I.D. (inches)	Nominal Laying Length (feet)	Approximate Weight (Lbs. per lineal foot)	Minimum ASTM 3-Edge Bearing (Lbs. per lineal foot)	Minimum SSPWC* 3-Edge Bearing (Lbs. per lineal foot)	Nominal Wall Thickness (inches)	Nominal O.D. Barrel (inches)
4	4-6	10	2000	2000	11/16	5.45
6	4 ½-6	20	2000	2000	7/8	7.75
8	4 ½-6	30	2200	2200	1 1/16	9.90
10	4 ½-6	45	2400	2400	1 1/8	12.40
12	4 ½-6	60	2600	2600	1 5/16	14.60

Dimensions subject to normal variations as defined by ASTM C 700.

A.5 CORRUGATED HDPE

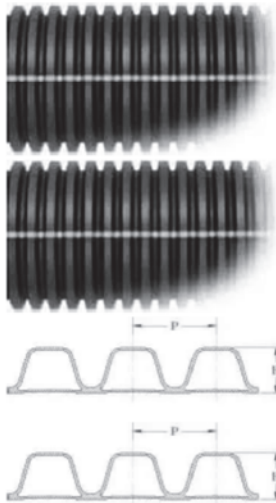


[HOME](#) > [PIPE SPECIFICATIONS](#) > ADS N-12 PIPE REFERENCE

ADS N-12 HDPE Pipe Dimensions

Petersen Does Not Sell Pipe

Select Mechanical or Inflatable Pipe Plugs based on the below pipe ID and along with the pressure to be blocked



ADS N-12™ pipe is smooth inside and available in 4" - 60" diameters, in nominal 20-ft. lengths. Pipe can be solid or perforated/slotted. Configuration is N-12™ (corrugated outside/smooth inside) in 4" - 60" diameters.

Pipe meets the requirements of AASHTO M-252 (3" - 10"), M-294 (12" and larger), Type S (corrugated outside-smooth)

The following tables represent the ADS N-12 pipe dimension and size specifications for ASTM D3035, ASTM F714 and ASTM F2160 for OD controlled inner duct.

Size	ID IN	OD IN	Pitch P IN	Corrugation Hgt H
4"	4.10	4.78	0.66	.34
6"	6.00	6.92	.77	.46
8"	7.90	9.11	.96	.61
10"	9.90	11.36	1.26	.73
12"	12.15	14.45	1.92	1.15
15"	14.98	17.57	2.59	1.30
18"	18.07	21.20	2.66	1.57

24"	24.08	27.80	3.15	1.86
30"	30.00	35.10	4.12	2.55
36"	36.00	41.70	5.14	2.85
42"	41.40	47.70	5.19	3.15
48"	47.60	53.50	5.25	3.00
60"	59.50	66.30	6.00	3.40

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Pipe Plugs for Testing, Blocking, Bypassing, Line Stopping, and More



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sales@petersenproducts.com

ACCEPT

CUSTOM SETTINGS

A.6 HDPE PIPE

High Density Polyethylene (HDPE) Pipe Chart							
PE4710 - Ductile Iron Pipe Size (DIPS)							
Gajeske							
DIPS	SDR	7	9	11	13.5	17	21
OD	Pressure	335 psi	250 psi	200 psi	160 psi	125 psi	100 psi
4	Wall (minimum)	0.686	0.533	0.436	0.356	0.282	0.229
	ID (Average)	3.346	3.670	3.876	4.045	4.202	4.315
	Weight (lbs./ft.)	3.870	3.130	2.620	2.180	1.760	1.440
6	Wall (minimum)	0.986	0.767	0.627	0.511	0.406	0.329
	ID (Average)	4.810	5.274	5.571	5.817	6.039	6.203
	Weight (lbs./ft.)	8.000	6.470	5.420	4.500	3.640	2.980
8	Wall (minimum)	1.293	1.006	0.823	0.670	0.532	0.431
	ID (Average)	6.309	6.917	7.305	7.630	7.922	8.136
	Weight (lbs./ft.)	13.760	11.130	9.320	7.750	6.260	5.130
10	Wall (minimum)	1.586	1.233	1.009	0.822	0.653	0.529
	ID (Average)	7.738	8.486	8.961	9.357	9.716	9.979
	Weight (lbs./ft.)	20.070	16.740	14.030	11.660	9.420	7.720
12	Wall (minimum)	1.886	1.467	1.200	0.978	0.776	0.629
	ID (Average)	9.202	10.090	10.656	11.127	11.555	11.867
	Weight (lbs./ft.)	29.270	23.670	19.840	16.480	13.320	10.920
14	Wall (minimum)	2.186	1.700	1.391	1.133	0.900	0.729
	ID (Average)	10.666	11.696	12.351	12.898	13.392	13.755
	Weight (lbs./ft.)	39.330	31.800	26.650	22.150	17.890	14.670
16	Wall (minimum)	2.486	1.933	1.582	1.289	1.024	0.829
	ID (Average)	12.130	13.302	14.046	14.667	15.229	15.643
	Weight (lbs./ft.)	50.870	41.130	34.470	28.640	23.140	18.970
18	Wall (minimum)	2.786	2.167	1.773	1.444	1.147	0.929
	ID (Average)	13.594	14.906	15.742	16.439	17.068	17.531
	Weight (lbs./ft.)	63.890	51.660	43.290	35.970	29.070	23.830
20	Wall (minimum)	3.086	2.400	1.964	1.600	1.271	1.029
	ID (Average)	15.058	16.512	17.436	18.208	18.905	19.419
	Weight (lbs./ft.)	78.390	63.380	53.120	44.140	35.660	29.240
24	Wall (minimum)	3.686	2.867	2.345	1.911	1.518	1.229
	ID (Average)	17.986	19.722	20.829	21.749	22.582	23.195
	Weight (lbs./ft.)	111.830	90.430	75.780	62.970	50.880	41.720
30	Wall (minimum)		3.556	2.909	2.370	1.882	1.524
	ID (Average)		24.462	25.833	26.975	28.009	28.770
	Weight (lbs./ft.)		139.120	166.580	96.870	78.280	64.170
36	Wall (minimum)				2.837	2.253	1.824
	ID (Average)				32.285	33.524	34.434
	Weight (lbs./ft.)				138.770	112.130	91.920
42	Wall (minimum)						2.119
	ID (Average)						40.008
	Weight (lbs./ft.)						124.090
48	Wall (minimum)						2.419
	ID (Average)						131.950
	Weight (lbs./ft.)						161.720

Gajeske, Inc. - 2019

All dimensions are shown in inches.

Chart is condensed to display common sizes and SDRs. Additional sizes and SDRs are available. IPS dimensions provided on separate chart.

Pressure ratings shown are applicable to aqueous solutions including up to 2% hydrocarbons at 80°F.

Gajeske HDPE may confirm to these standards: ASTM F714, F2619, D2513, D3350, API 15LE, AWWA C906, AWWA C901, ASTM D3035

A.6 HDPE PIPE (Cont'd)



JM Eagle *Building essentials
for a better tomorrow™*

POLYETHYLENE WATER & SEWER

SUBMITTAL AND DATA SHEET



**50-YEAR
WARRANTY**
on JM Eagle
Plastic Pipe
GUARANTEED

HDPE IRON PIPE SIZE (I.P.S.) PRESSURE PIPE

ANSI/NSF-61, 14 LISTED

PE 4710		DR 7 (333 psi)			DR 9 (250 psi)			DR 11 (200 psi)		
PIPE SIZE	AVG. O.D.	MIN. T.	AVG. I.D.	WEIGHT LB/FT	MIN. T.	AVG. I.D.	WEIGHT LB/FT	MIN. T.	AVG. I.D.	WEIGHT LB/FT
1/2	0.840	0.120	0.586	0.12	0.093	0.643	0.10	0.076	0.679	0.08
3/4	1.050	0.150	0.732	0.19	0.117	0.802	0.15	0.095	0.849	0.12
1	1.315	0.188	0.916	0.29	0.146	1.005	0.23	0.120	1.061	0.20
1-1/4	1.660	0.237	1.158	0.46	0.184	1.270	0.37	0.151	1.340	0.31
1-1/2	1.900	0.271	1.325	0.61	0.211	1.453	0.49	0.173	1.533	0.41
2	2.375	0.339	1.656	0.95	0.264	1.815	0.77	0.216	1.917	0.64
3	3.500	0.500	2.440	2.06	0.389	2.675	1.66	0.318	2.826	1.39
4	4.500	0.643	3.137	3.40	0.500	3.440	2.75	0.409	3.633	2.30
5-3/8	5.375	0.768	3.747	4.85	0.597	4.109	3.92	0.489	4.338	3.29
5	5.563	0.795	3.878	5.20	0.618	4.253	4.20	0.506	4.490	3.52
6	6.625	0.946	4.619	7.36	0.736	5.065	5.96	0.602	5.349	4.99
7	7.125	0.976	5.056	8.52	0.792	5.446	6.89	0.648	5.751	5.78
8	8.625	1.232	6.013	12.48	0.958	6.594	10.09	0.784	6.963	8.46
10	10.750	1.536	7.494	19.40	1.194	8.219	15.68	0.977	8.679	13.14
12	12.750	1.821	8.889	27.28	1.417	9.746	22.07	1.159	10.293	18.49
14	14.000	2.000	9.760	32.90	1.556	10.107	26.61	1.273	11.301	22.30
16	16.000	2.286	11.154	42.97	1.778	12.231	34.75	1.455	12.915	29.12
18	18.000	2.571	12.549	54.37	2.000	13.760	43.97	1.636	14.532	36.84
20	20.000	2.857	13.943	67.13	2.222	15.289	54.28	1.818	16.146	45.49
22	22.000	3.143	15.337	81.23	2.444	16.819	65.68	2.000	17.76	55.05
24	24.000	3.429	16.732	96.67	2.667	18.348	78.18	2.182	19.374	65.52
26	26.000	—	—	—	2.889	19.875	91.75	2.364	20.988	76.90
28	28.000	—	—	—	3.111	21.405	106.40	2.545	22.605	89.15
30	30.000	—	—	—	3.333	22.934	122.13	2.727	24.219	102.35
32	32.000	—	—	—	—	—	—	2.909	25.833	116.46
34	34.000	—	—	—	—	—	—	3.091	27.447	131.48
36	36.000	—	—	—	—	—	—	3.273	29.061	147.41

Revised 3/7/2013. This information may have been updated. Please download the latest version at www.jmeagle.com

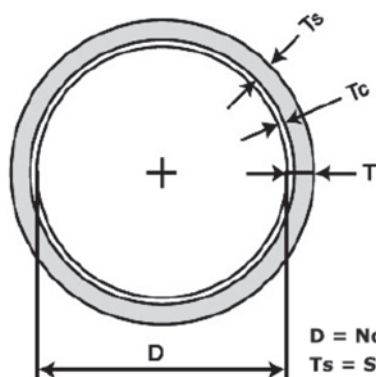
I.D. : Inside Diameter
O.D. : Outside Diameter
T. : Wall Thickness

* For data, sizes, or classes not reflected in these charts, please contact JM Eagle™ for assistance.

A.7 FIBERGLASS REINFORCED PIPE

FRP Pressure Pipe

Technical Information



Fabco GR-Kor® FRP Spooled Piping Components

D = Nominal Inside Diameter
Ts = Structural Wall Thickness
Tc = Corrosion Liner
T (Total) = Tc + Ts

NOMINAL PIPE SIZE	LINER THICKNESS	HAND LAY UP						FILAMENT WOUND					
		T (TOTAL)						T (TOTAL)					
		75 PSI		100 PSI		150 PSI		75 PSI		100 PSI		150 PSI	
D	Tc	IN	MM	IN	MM	IN	MM	IN	MM	IN	MM	IN	MM
1/2	15	0.1	2.54	0.187	4.75	0.187	4.75	0.187	4.75				
3/4	20	0.1	2.54	0.187	4.75	0.187	4.75	0.187	4.75				
1	25	0.1	2.54	0.187	4.75	0.187	4.75	0.187	4.75				
1-1/4	32	0.1	2.54	0.187	4.75	0.187	4.75	0.187	4.75				
1-1/2	40	0.1	2.54	0.187	4.75	0.187	4.75	0.187	4.75				
2	50	0.1	2.54	0.187	4.75	0.187	4.75	0.187	4.75				
2-1/2	65	0.1	2.54	0.187	4.75	0.187	4.75	0.25	6.35				
3	90	0.1	2.54	0.187	4.75	0.187	4.75	0.25	6.35				
4	100	0.1	2.54	0.187	4.75	0.25	6.35	0.25	6.35	0.19	4.83	0.19	4.83
5	125	0.1	2.54	0.25	6.35	0.25	6.35	0.375	9.53	0.19	4.83	0.19	4.83
6	150	0.1	2.54	0.25	6.35	0.25	6.35	0.375	9.53	0.19	4.83	0.19	4.83
8	200	0.1	2.54	0.25	6.35	0.313	7.95	0.438	11.13	0.19	4.83	0.24	6.1
10	250	0.1	2.54	0.313	7.95	0.375	9.53	0.5	12.7	0.24	6.1	0.24	6.1
12	315	0.1	2.54	0.375	9.53	0.438	11.13	0.625	15.88	0.24	6.1	0.28	7.11
14	355	0.1	2.54	0.375	9.53	0.5	12.7	0.75	19.05	0.24	6.1	0.28	7.11
16	400	0.1	2.54	0.438	11.13	0.563	14.3	0.813	20.65	0.28	7.11	0.28	7.11
18	450	0.1	2.54	0.5	12.7	0.625	15.88	0.938	23.83	0.28	7.11	0.33	8.38
20	500	0.1	2.54	0.5	12.7	0.688	17.48	1	25.4	0.28	7.11	0.33	8.38
24	600	0.1	2.54	0.625	15.88	0.813	20.65	1.25	31.75	0.33	8.38	0.42	10.67
26	650	0.1	2.54	0.688	17.48	0.875	22.22	1.313	33.35	0.33	8.38	0.42	10.67
28	700	0.1	2.54	0.75	19.05	0.938	23.83	1.438	36.51	0.37	9.4	0.46	11.68
30	755	0.1	2.54	0.75	19.05	1	25.4	1.5	38.1	0.42	10.67	0.46	11.68
32	810	0.1	2.54	0.813	20.65	1.063	27	1.625	41.27	0.42	10.67	0.5	12.7
34	860	0.1	2.54	0.875	22.22	1.125	28.58	1.75	44.45	0.42	10.67	0.5	12.7
36	910	0.1	2.54	0.938	23.83	1.25	31.75	1.813	46.05	0.46	11.68	0.55	13.97
38	960	0.1	2.54	1	25.4	1.313	33.35	1.937	49.2	0.46	11.68	0.55	13.97
42	1050	0.1	2.54	1.063	27	1.438	36.51	2.125	53.97	0.5	12.7	0.6	15.24

A.8 PVC Drain, Vent and Waste Pipe

PVC and CPVC Pipes - Schedule 40

Nominal Pipe Size (inches)	Outside Diameter (inches) (mm)	Minimum Wall Thickness (inches) (mm)	Inside Diameter ^{*)} (inches) (mm)	Weight (lb/ft) (kg/m)	
				PVC	CPVC
1/2	0.840	0.109	0.622	0.16	0.17
3/4	1.050	0.113	0.824	0.21	0.23
1	1.315	0.133	1.049	0.32	0.34
1 1/4	1.660	0.140	1.380	0.43	0.46
1 1/2	1.900	0.145	1.610	0.51	0.55
2	2.375	0.154	2.067	0.68	0.74
2 1/2	2.875	0.203	2.469	1.07	1.18
3	3.500	0.216	3.068	1.41	1.54
4	4.500	0.237	4.026	2.01	2.20
5	5.563	0.258	5.047	2.73	
6	6.625	0.280	6.065	3.53	3.86
8	8.625	0.322	7.981	5.39	5.81
10	10.750	0.365	10.020	7.55	8.24
12	12.750	0.406	11.938	10.01	10.89
14	14.000	0.437	13.124	11.80	
16	16.000	0.500	15.000	15.43	

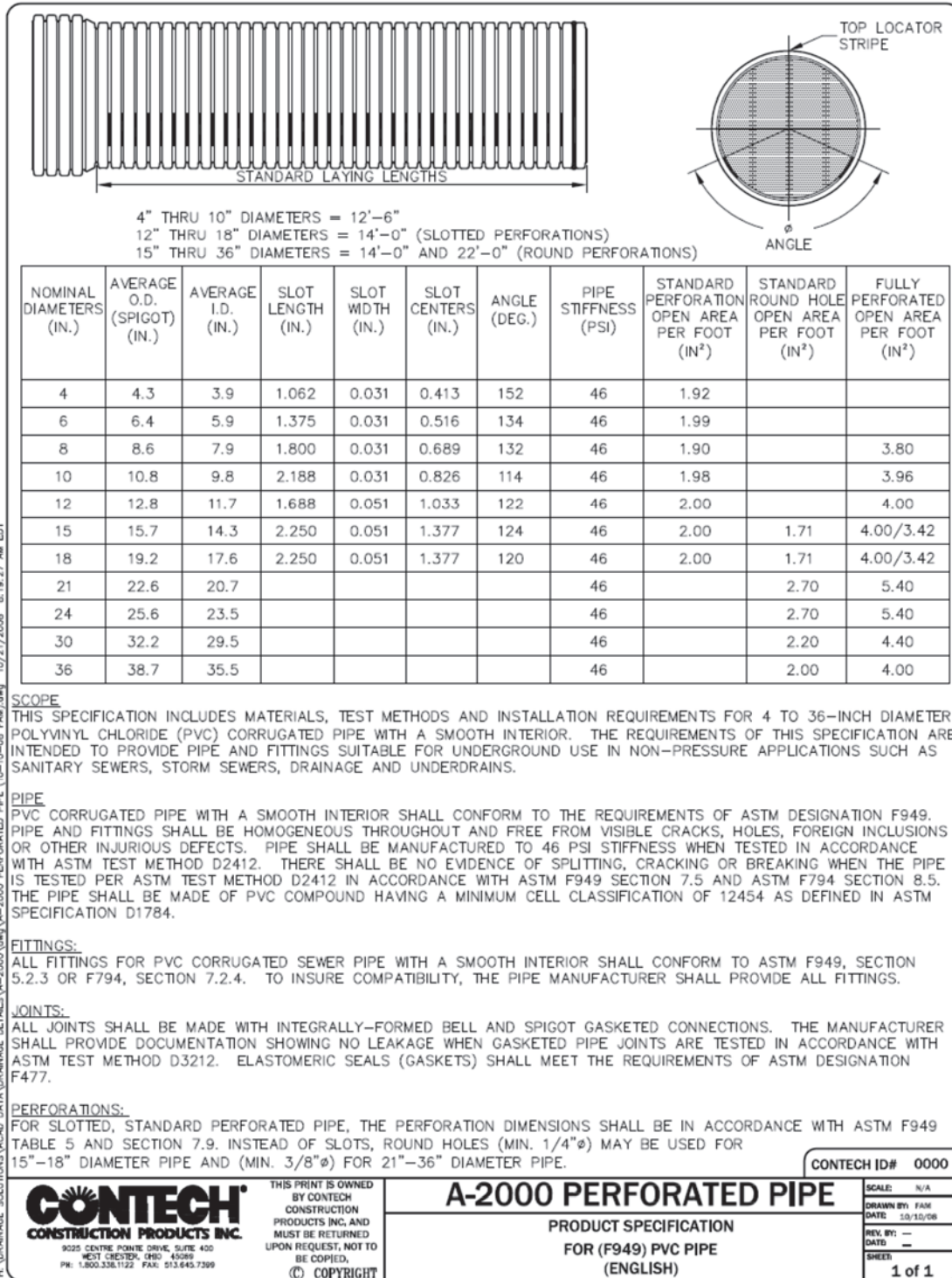
For sizes 1 1/4" and larger ASTM D1785 Schedule 40 pipe is comparable to [ASTM D2665 for DWV applications](#).

Dimensions of PVC pipes according [ASTM D2665 Standard Specification for Poly\(Vinyl Chloride\) \(PVC\) Plastic Drain, Waste, and Vent Pipe and Fittings](#).

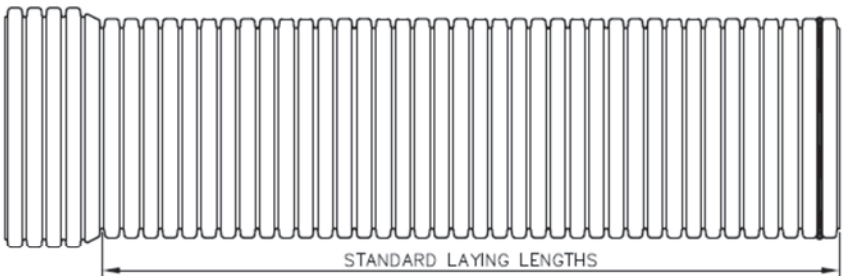
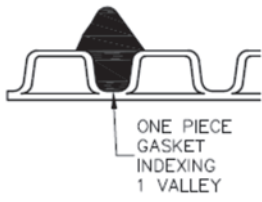
ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings - Dimensions

Nominal Pipe Size (in)	Average Outside Diameter (in) (mm)	Wall Thickness (in) (mm)	Weight (lb/ft) (kg/m)
1 1/4	1.660	0.140	0.65
1 1/2	1.900	0.145	0.78
2	2.375	0.154	1.1
3	3.500	0.216	2.2
4	4.500	0.237	3.1
6	6.625	0.280	5.4
8	8.625	0.322	8.2
10	10.750	0.365	11.6
12	12.750	0.406	15.3
14	14.000	0.437	18.1
16	16.000	0.500	23.7
18	18.000	0.562	30.1

A.9 Corrugated PVC Pipe



A.9 Corrugated PVC Pipe (Cont'd)

4" THRU 10" DIAMETERS = 12'-6"
12" THRU 36" DIAMETERS = 22'-0" OR 14'-0"

NOMINAL DIAMETERS (IN.)	AVERAGE O.D. (SPIGOT) (IN.)	AVERAGE O.D. (BELL) (IN.)	AVERAGE I.D. (IN.)	PIPE STIFFNESS (PSI)	MINIMUM FLATTENING (%)
4	4.3	4.9	3.9	46	40
6	6.4	6.9	5.9	46	40
8	8.6	9.3	7.9	46	40
10	10.8	11.7	9.8	46	40
12	12.8	13.9	11.7	46	40
15	15.7	16.9	14.3	46	40
18	19.2	20.6	17.6	46	40
21	22.6	24.6	20.7	46	40
24	25.6	27.9	23.5	46	40
30	32.2	35.1	29.5	46	40
36	38.7	42.3	35.5	46	40

SCOPE
THIS SPECIFICATION INCLUDES MATERIALS, TEST METHODS AND INSTALLATION REQUIREMENTS FOR 4 TO 36-INCH DIAMETER POLYVINYL CHLORIDE (PVC) CORRUGATED PIPE WITH A SMOOTH INTERIOR. THE REQUIREMENTS OF THIS SPECIFICATION ARE INTENDED TO PROVIDE PIPE AND FITTINGS SUITABLE FOR UNDERGROUND USE IN NON-PRESSURE APPLICATIONS SUCH AS SANITARY SEWERS, STORM SEWERS, DRAINAGE AND UNDERDRAINS.

PIPE
PVC CORRUGATED PIPE WITH A SMOOTH INTERIOR SHALL CONFORM TO THE REQUIREMENTS OF ASTM DESIGNATION F949. PIPE AND FITTINGS SHALL BE HOMOGENEOUS THROUGHOUT AND FREE FROM VISIBLE CRACKS, HOLES, FOREIGN INCLUSIONS OR OTHER INJURIOUS DEFECTS. PIPE SHALL BE MANUFACTURED TO 46 PSI STIFFNESS WHEN TESTED IN ACCORDANCE WITH ASTM TEST METHOD D2412. THERE SHALL BE NO EVIDENCE OF SPLITTING, CRACKING OR BREAKING WHEN THE PIPE IS TESTED PER ASTM TEST METHOD D2412 IN ACCORDANCE WITH ASTM F949 SECTION 7.5 AND ASTM F794 SECTION 8.5. THE PIPE SHALL BE MADE OF PVC COMPOUND HAVING A MINIMUM CELL CLASSIFICATION OF 12454 AS DEFINED IN ASTM SPECIFICATION D1784.

FITTINGS:
ALL FITTINGS FOR PVC CORRUGATED SEWER PIPE WITH A SMOOTH INTERIOR SHALL CONFORM TO ASTM F949, SECTION 5.2.3 OR F794, SECTION 7.2.4. TO INSURE COMPATIBILITY, THE PIPE MANUFACTURER SHALL PROVIDE ALL FITTINGS.

JOINTS:
ALL JOINTS SHALL BE MADE WITH INTEGRALLY-FORMED BELL AND SPIGOT GASKETED CONNECTIONS. THE MANUFACTURER SHALL PROVIDE DOCUMENTATION SHOWING NO LEAKAGE WHEN GASKETED PIPE JOINTS ARE TESTED IN ACCORDANCE WITH ASTM TEST METHOD D3212. ELASTOMERIC SEALS (GASKETS) SHALL MEET THE REQUIREMENTS OF ASTM DESIGNATION F477.



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A-2000 PVC DRAINAGE PIPE
PRODUCT SPECIFICATION
FOR (F949) PVC PIPE
(ENGLISH)

CONTECH ID# 0000

SCALE: N/A

DRAWN BY: FAM

DATE: 10/10/08

REV. BY: —

DATE: —

SHEET: 1 of 1

H:\DRAINAGE SOLUTIONS\ACAD DATA\DRAINAGE (DETAILS)\A-2000\dwg\A-2000 DRAINAGE PIPE (10-10-08 FAM).dwg 10/21/2008 8:17:01 AM EDT

A.10 PVC DR 18



► ANSI/AWWA C900 WATER DISTRIBUTION PIPE | Pipe Specifications (4" - 12")

Northern Pipe Products PVC ANSI/AWWA C900 PVC Pressure Pipe is manufactured from compounds conforming to cell classification of 12454 as defined in ASTM D1784. The pipe meets the requirements of the ANSI/AWWA C900 standard specification for polyvinyl chloride water distribution pipe. The integral bell joint system meets the requirements of ASTM D3139 and utilizes an elastomeric seal meeting the specification defined in ASTM F477.

Northern Pipe Products ANSI/AWWA C900 pressure pipe for potable water carries:

- NSF Standard 14 and NSF Standard 61 listings (marked "NSF-PW-G")
- Certification under NSF/ANSI 327 Annex G "lead-free" (marked "NSF-PW-G")
- Underwriters Laboratories Inc. Standard 1285 mark of acceptance
- Canadian Standards Association Standard B137.3 mark of acceptance

ANSI/AWWA C900 (4" - 12") DR-18 and DR-14 distribution pipe carries the Factory Mutual Research Water Distribution Pipe for Underground Fire Protection Service mark of acceptance.

The pipe is furnished in 20' laying lengths.

► ANSI/AWWA C900 | Cell Classification 12454

NOMINAL PIPE SIZE (IN.)	PIPE OUTSIDE DIAMETER (IN.)	DR-25 (165 PSI)		DR-18 (235 PSI)		DR-14 (305 PSI)	
		MINIMUM WALL (IN.)	POUNDS PER FOOT	MINIMUM WALL (IN.)	POUNDS PER FOOT	MINIMUM WALL (IN.)	POUNDS PER FOOT
4"	4.80"	.192"	1.87 lbs.	.267"	2.55 lbs.	.343"	3.22 lbs.
6"	6.90"	.276"	3.90 lbs.	.383"	5.29 lbs.	.493"	6.70 lbs.
8"	9.05"	.362"	6.69 lbs.	.503"	9.15 lbs.	.646"	11.55 lbs.
10"	11.10"	.444"	10.11 lbs.	.617"	13.82 lbs.	.793"	17.46 lbs.
12"	13.20"	.528"	14.32 lbs.	.733"	19.56 lbs.	.943"	24.75 lbs.

A.11 PVC SDR 35

DIMENSIONS AND WEIGHTS

SUBMITTAL AND DATA SHEET

PIPE SIZE (IN)	AVERAGE O.D. (IN)	NOM. I.D. (IN)	MIN. T. (IN)	MIN. E (IN)	APPROX. D* (IN)	APPROX. WEIGHT (LBS/FT)
SDR 35 (PS46) ASTM D3034						
4	4.215	3.975	0.120	3.50	4.695	1.05
6	6.275	5.915	0.180	4.25	6.995	2.36
8	8.400	7.920	0.240	4.75	9.360	4.24
10	10.500	9.900	0.300	6.00	11.700	6.64
12	12.500	11.780	0.360	6.25	13.940	9.50
15	15.300	14.426	0.437	7.25	17.048	14.19
SDR 26 (PS115) ASTM D3034						
4	4.215	3.891	0.162	3.50	4.863	1.40
6	6.275	5.793	0.241	4.25	7.239	3.11
8	8.400	7.754	0.323	4.75	9.692	5.63
10	10.500	9.692	0.404	6.00	12.116	8.84
12	12.500	11.538	0.481	6.25	14.424	12.56
15	15.300	14.124	0.588	7.25	17.652	18.90
PS46, ASTM F678						
18	18.701	17.629	0.499	8.00	20.845	21.43
21	22.047	20.783	0.588	9.50	24.575	29.88
24	24.803	23.381	0.661	9.60	27.647	38.96
27	27.953	26.351	0.745	10.10	31.157	49.47
30 CIOD	32.000	30.194	0.853	16.75	35.612	64.18
36 CIOD	38.300	36.042	1.021	19.02	42.816	93.00
42 CIOD	44.500	41.948	1.187	22.43	49.604	—
48 CIOD	50.800	47.888	1.355	24.78	56.624	—
PS115, ASTM F678						
18	18.701	17.261	0.671	8.00	21.581	28.49
21	22.047	20.349	0.791	9.50	25.443	—
24	24.803	22.891	0.889	9.60	28.627	—
27	27.953	25.799	1.002	10.10	32.261	—
30 CIOD	32.000	29.070	1.148	16.75	36.348	—
36 CIOD	38.300	35.464	1.373	19.02	45.438	—
42 CIOD	44.500	41.072	1.596	22.43	51.356	—
48 CIOD	50.800	46.886	1.822	24.78	58.628	—

* For data, sizes, or classes not reflected in these charts, please contact JM Eagle™ for assistance.

Appendix B – RSCS Verification of Piping Model



L25-090

November 28, 2025

RE: Quantification & Verification of Buried Piping, Embedded Piping and Structural Penetrations

Letter to File

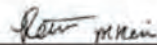
This letter certifies that Radiation Safety & Control Services (RSCS) has validated and verified the surface area and volume calculations provided to Energy Solutions to the extent reasonably achievable.

The scope of these calculations included:

- Surface area and volume of proposed remaining structural penetrations
- Surface area and volume of proposed remaining buried piping and depths below grade
- Surface area and volume of proposed remaining embedded piping and depths below slab

All calculations were performed using a three-dimensional digital model developed by RSCS within the Autodesk software platform. The model was constructed based on interpretations of site construction drawings and supplemented by field measurements in certain limited areas of the plant. Calculation results were generated using the native computational tools within the Autodesk software platform.

RSCS affirms that all work was carried out in accordance with applicable standards and practices, to the best of our professional ability.

Signature: 

Peter McNeil, Environmental & Engineering Technical Manager

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