FC-21-0002
Revision 0

Description of Embedded Piping, Penetrations, and Buried Pipe to Remain in Fort Calhoun End State

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Acronyms and Initialisms

AB	Auxiliary Building
ALARA	As Low as Reasonably Achievable
BOP	Balance of Plant
CB	Containment Building
CE	Combustion Engineering
CoC	Chain-of-Custody
DA	Deconstruction Area
DQO	Data Quality Objectives
FCS	Fort Calhoun Station
FSS	Final Status Survey
GPS	Global Positioning System
HSA	Historical Site Assessment
HTD	Hard-to-Detect
LT	License Termination
LTP	License Termination Plan
MARLAP	Multi-Agency Radiological Laboratory Analytical Protocol Manual
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
MDCR	Minimum Detectable Count Rate
NMNT	New Millennium Nuclear Technologies
NIST	National Institute of Standards and Technology
NRC	United States Nuclear Regulatory Commission
OPPD	Omaha Public Power District
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RA	Radiological Assessment
ROC	Radionuclides of Concern
SAF	Security Access Facility
SOF	Sum of Fractions
TB	Turbine Building
TSC	Technical Support Center

1 Issue Statement

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 (i.e., below 1001 foot elevation) at the Fort Calhoun Nuclear Generating Station (FCS). The document provides a basis for the estimated lengths and diameters, and also estimates the surface areas and void spaces associated with them. The document also provides the current planned end state (e.g., pipe removed from penetration or pipe remains in penetration). Piping and penetrations, along with elevation and reference drawings for the Yard Piping, Containment Building, Auxiliary Building, Turbine Building and Intake Structure are summarized in Appendices A thru G.

2 Background

2.1 Embedded Piping

Within the building structures to remain in the end state, all accessible piping and some smaller embedded piping will be removed. The larger embedded piping will remain in the end state as they cannot be removed without more extensive demolition of the structure beyond what is planned. The embedded piping to remain is almost entirely comprised of drainage piping in the Turbine Building and Auxiliary Building

2.2 Buried Piping

Buried piping throughout the FCS site consists of multiple systems which support various functions. During the initial investigation of buried piping for this report, all existing piping systems were identified and then it was determined if that system would be removed or left in place. A summary of the identified piping systems and their corresponding material type are shown below in Table 1.

Table 1: Summary of Buried Piping Systems

Piping System	Material Type	Include in TSD
Waste Drain	Stainless Steel	No
Service Water		No
	Copper	Yes/No
Potable Water		No
	Carbon Steel	No
	Fiberglass reinforced	No
	PVC	No
Forced Main		No
Sanitary Sewer (Plumbing/Drainage)		No
	VCP	No

	Cast Iron	No
Storm Drain	CMP	Yes/No
	RCP	Yes/No
	PVC	Yes/No
	CHDPE	Yes/No
	HDPE	Yes/No
Fire Protection	Ductile Iron	No
	Asbestos Cement Lined	No
Fuel Oil	Carbon Steel	No
Instrument Air		No
Compressed Air		No
Raw Water		No
Vent Drain		No
Auxiliary Steam		No
Acid		No

After each piping system was identified, it was then determined if that system would remain. In general, only select storm drain and service water piping would remain. Other systems (sanitary sewer, fire protection, etc.) would be removed in their entirety, and are therefore not included in this TSD. Table 1 also provides a summary of piping systems that are included in this TSD.

It is also noted that any buried electrical or structural commodities are outside the scope of this TSD.

2.3 Penetrations

Defined as a pipe (or remaining pipe sleeve, if the pipe is removed, or concrete, if the pipe and pipe sleeve is removed) that runs through a concrete wall and/or floor, between two buildings, and is open at the wall or floor surface of each building. A penetration could also be a pipe that runs through a concrete wall and/or floor and opens to a building on one end and the outside ground on the other end.

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 removed the outer diameter is used unless it is through a larger sleeve, in which case the inside diameter of the sleeve is used. The equation used for the inside surface area is Equation 1.

$$SA = 2\pi rh \quad \text{(Equation 1)}$$

Where

SA = Surface area of opening

r = The pipe radius used (inner or outer as described above) or the sleeve radius used.

h = Pipe length in same units as r.

The equation for the void space volume is Equation 2.

$$V = \pi r^2 h \quad \text{(Equation 2)}$$

Where

V = Void space volume of opening

r = The pipe radius used (inner or outer as described above) or the sleeve radius used.

h = Pipe length in same units as r.

3.2 Preliminary MARSSIM Classification

Preliminary MARSSIM classifications are assigned to the piping and penetrations evaluated in this document. Classifications are based upon knowledge of Pressurized Water Reactor systems and system contamination levels at FCS. Class 1 systems are those that have a high probability of a Derived Concentration Guideline Level (DCGL) concentration being exceeded. Class 2 MARSSIM lines are those that have a probability of exceeding 50% of the DCGL. These are generally secondary systems with the potential for cross contamination from primary system to secondary system leaks. Class 3 systems are not expected to exceed 50% of the DCGL. These are generally secondary systems with very low probabilities of significant cross contamination due to the volumes of the systems and potential decrees of cross contamination. These classifications are generally based upon the classification of the survey unit in which they originate in and as described in the FCS Historical Site Assessment. MARSSIM classifications are described in Chapter 5 of the License Termination Plan.

4 Assumptions

4.1 Embedded Piping

The following assumptions were made regarding the embedded piping:

1. Start and End Elevations are for the pipe invert elevations for the Turbine Building and centerline elevation for the Auxiliary Building.
2. All embedded piping will be removed from Containment and the Intake Structure.

4.2 Buried Piping

The following assumptions were made regarding the buried piping:

3. Start and End Elevations are for the pipe invert elevations.
4. Wall thickness for Corrugated Metal Piping (CMP) was assumed based on 16 gage, 2 2/3" x ½" corrugation, in accordance with AASHTO M36. Diameters specified on drawings were taken as the inside diameter of CMP.
5. Wall thickness for Reinforced Concrete Piping (RCP) was assumed based on "B" Wall for Class II, III, IV, and V in accordance with ASTM C-76. Diameters specified on drawings were taken as the inside diameter of RCP.
6. Wall thickness for Polyvinyl Chloride Pipe (PVC) was assumed based on Schedule 40 piping in accordance with ASTM D1785. Diameters specified on drawings were taken as the nominal pipe size.

4.3 Penetrations

The following assumptions were made regarding the penetrations:

1. Start and End Elevations are for the pipe centerline elevations.
2. Penetrations were not listed or considered if they were included in FC-20-006, End State Concrete Surface Areas and Volumes.

5 Results

5.1 Embedded Piping

A summary of all embedded piping is presented below in Table 2. A large majority of the remaining embedded piping will be drainage lines, along with a couple safety injection lines.

Table 2: Total Length, Surface Area, and Void Space of Embedded Piping

Piping	Length (ft)	Interior Surf. Area (ft^2)	Void Space Vol. (ft^3)	Length (m)	Interior Surf. Area (m^2)	Void Space Vol. (m^3)
Drainage	2,585.5	3,504.7	425.8	788.1	325.6	12.1
Safety Injection	17.0	83.7	32.8	5.2	7.8	0.9
Total	2,602.5	3,588.4	458.6	793.2	333.4	13.0

A final breakdown of all embedded piping with estimated lengths, surface areas, and void space is provided in Appendices B&D.

5.2 Buried Piping

A summary of all buried piping is presented below in Table 3. There were only two systems that would contain buried piping as part of the final end state; storm drain and service water. All other buried piping would be removed from the site. The total surface area and void space volume calculated for these systems is presented in Table 3.

Table 3: Total Length, Surface Area, and Void Space of Buried Piping

Piping	Length (ft)	Interior Surf. Area (ft^2)	Void Space Vol. (ft^3)	Length (m)	Interior Surf. Area (m^2)	Void Space Vol. (m^3)
Storm Drain	3,136.0	23,333.9	17,209.8	955.9	2,167.8	487.3
Service Water	180.0	137.0	8.3	54.9	12.7	0.2
Total	3,316.0	23,470.9	17,218.0	1,010.7	2,180.5	487.6

A final breakdown of all buried piping with estimated lengths, surface areas, and void space is provided in Appendix A.

5.3 Penetrations

A final breakdown of all penetrations with estimated lengths, surface areas, and void space is provided in Appendices C,E,F & G.

6 Calculations

6.1 Embedded Piping

6.1.1 Turbine Building

All piping will be removed from the Turbine Building except for the asbestos-cement drainage lines running below the Turbine Building slab. In 2013, EC46706 installed CIPP inside all of the TB drain piping. A 6mm thick liner or alternate 4.5mm CoREZYN liner was used for the 6" and 10" piping, and a 3mm thick liner was used for the 4" piping. The thinner CoREZYN liner is conservatively assumed for this calculation as it would yield a higher surface area and void volume than the thicker liner. Table 4 presents the resulting inside diameter for each sized pipe with the liner installed.

Table 4: Reduced Drain Piping Inside Diameter with Liner Installed

Nom. Pipe Dia. (in)	4	6	10
Min. Inside Dia. (in)	3.750	5.750	9.750
Liner Thickness (mm)	3.000	4.500	4.500
Liner Thickness (in)	0.120	0.177	0.177
Min. Inside Dia. w/ Liner (in)	3.510	5.396	9.396

See Appendix B for a summary of Turbine Building embedded piping information, along with the corresponding Figure 1 below.

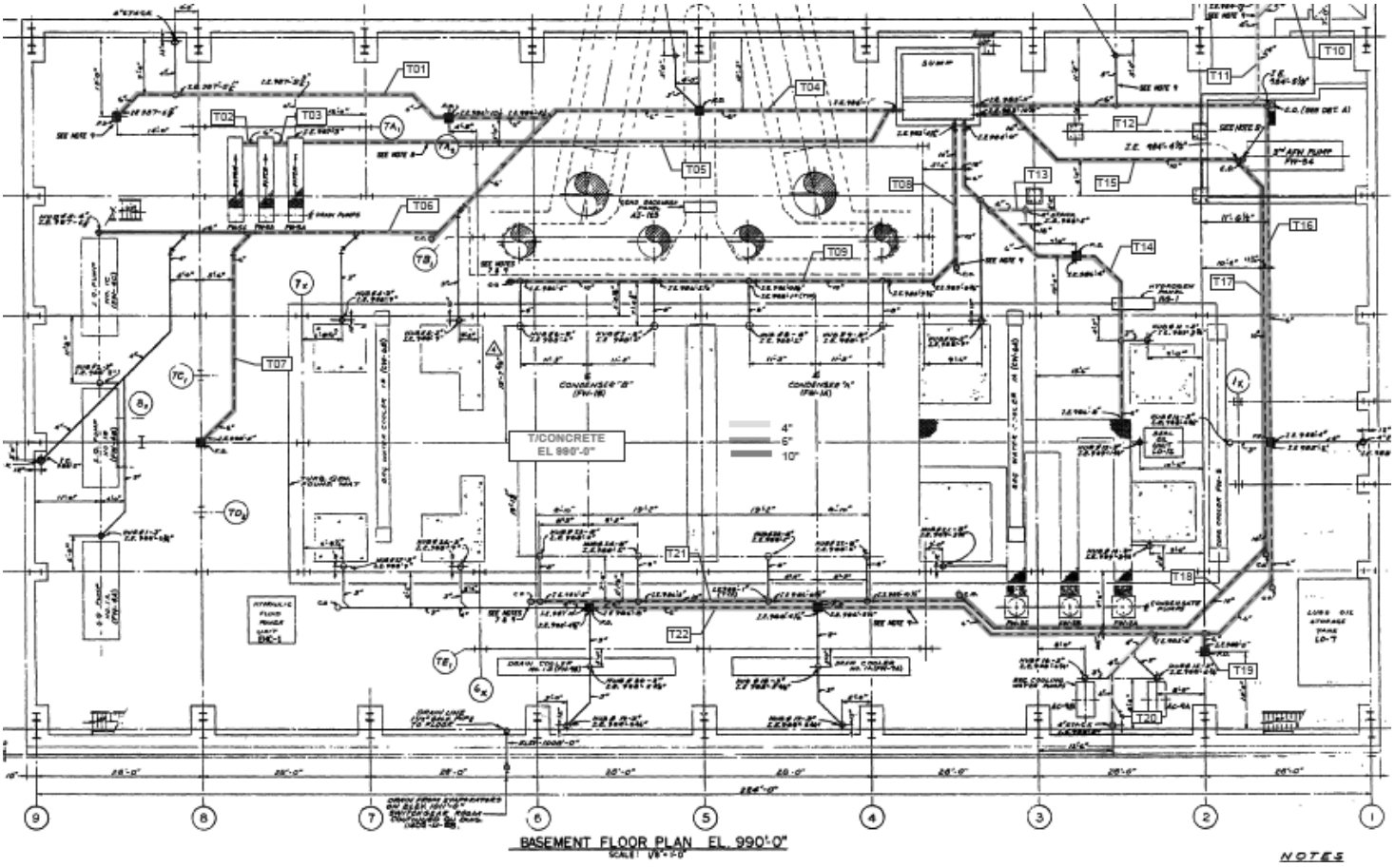


Figure 1 – Embedded Turbine Building Drain Piping to Remain (10768)

6.1.2 Auxiliary Building

All embedded piping in the Auxiliary Building basement and sub-basement smaller than 4” will be removed. The only piping to remain is 4” drain piping and two 20” safety injection pipes running through the basement floor and into the sub-basement. See Figures below for details. See Appendix D for a summary of all embedded piping to remain along with the corresponding Figures 2-4 below.

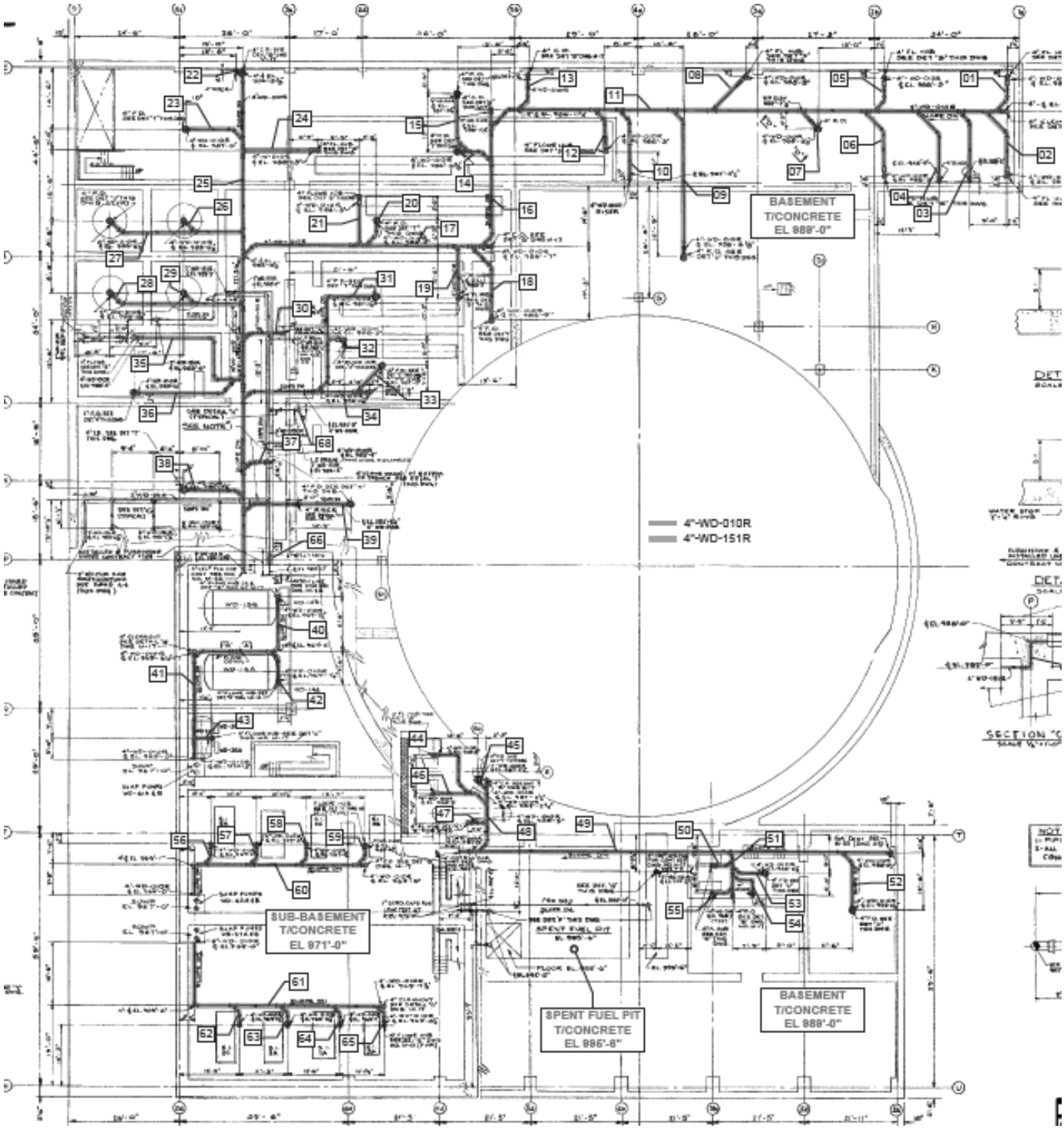


Figure 2 – Embedded Auxiliary Drain Piping to Remain (10592)

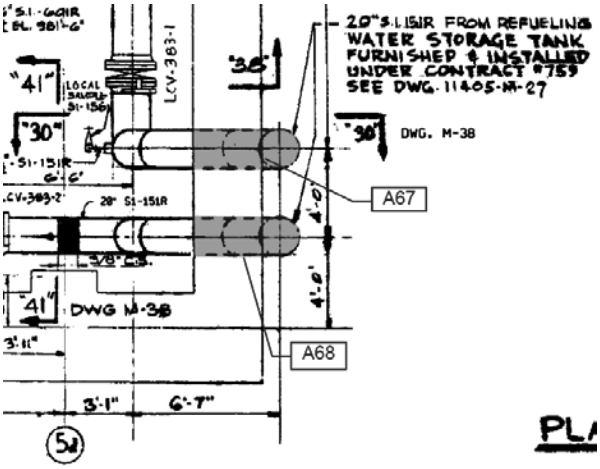


Figure 3 – Plan View 20" SI Piping (10593)

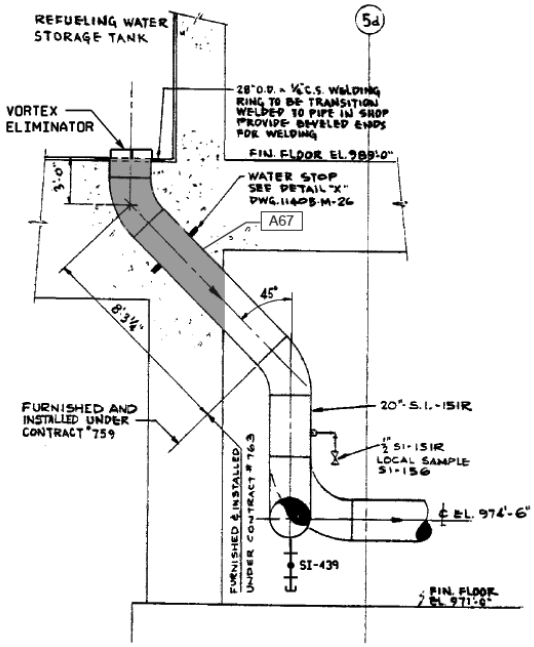


Figure 4 – Section View, 20" SI Piping (10603)

6.1.3 Containment

All piping will be removed from Containment. No abandoned piping will remain.

6.1.4 Intake Structure

All piping will be removed from the Intake Structure. No abandoned piping will remain.

6.2 Buried Piping

6.2.1 Yard Drainage

Yard drainage piping can be found throughout the entire site and is intended to direct stormwater runoff away from the site and towards the Missouri review. Yard drainage piping consists of several material types such as CMP, RCP, PVC, CDPE, and HDPE piping. Figure 5 provides an overview of the location of the yard drainage piping throughout the site. Additional details for drainage piping near the Administration building is provided in Figure 6.

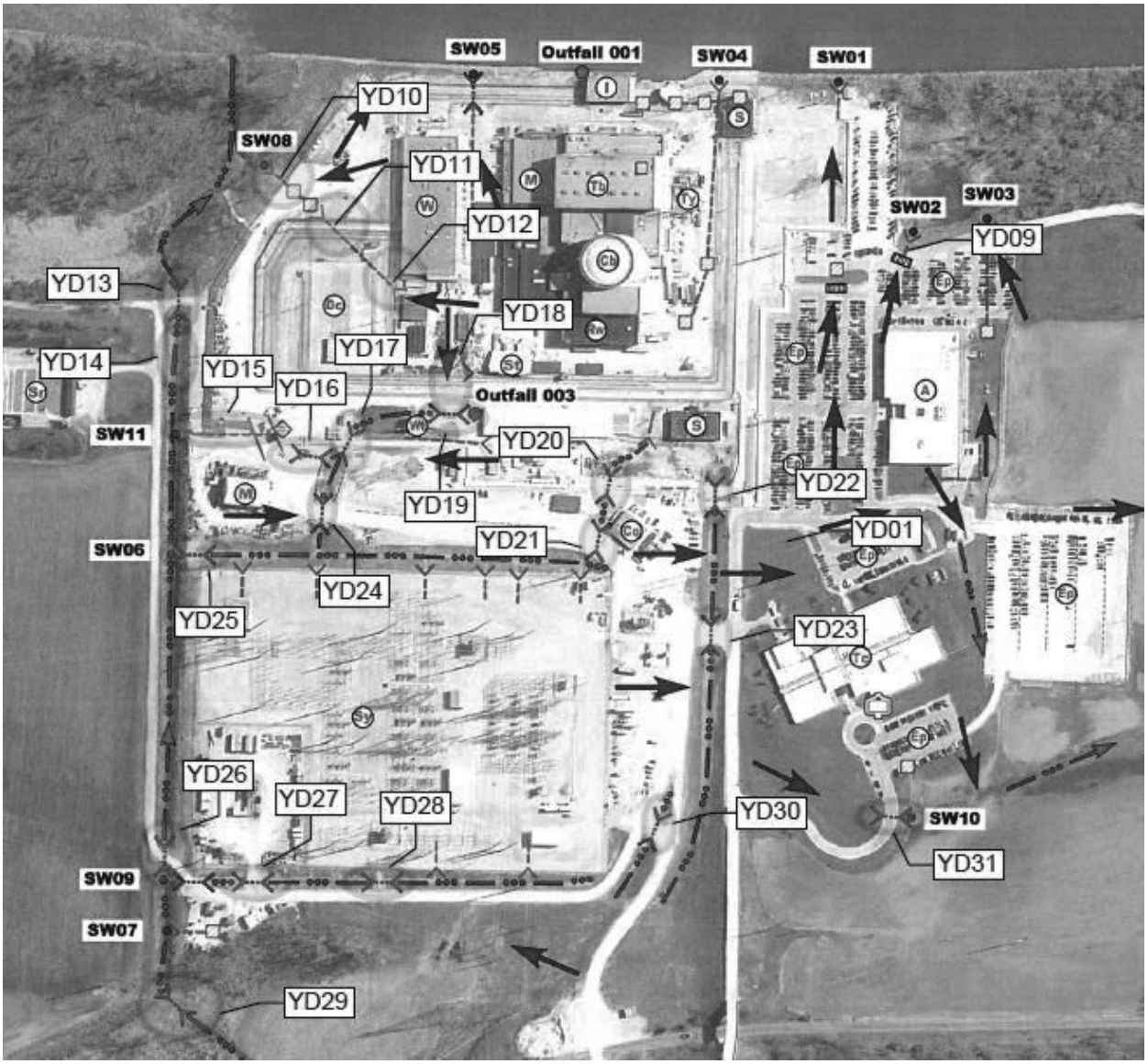


Figure 5 - Yard Drainage - Site Overview

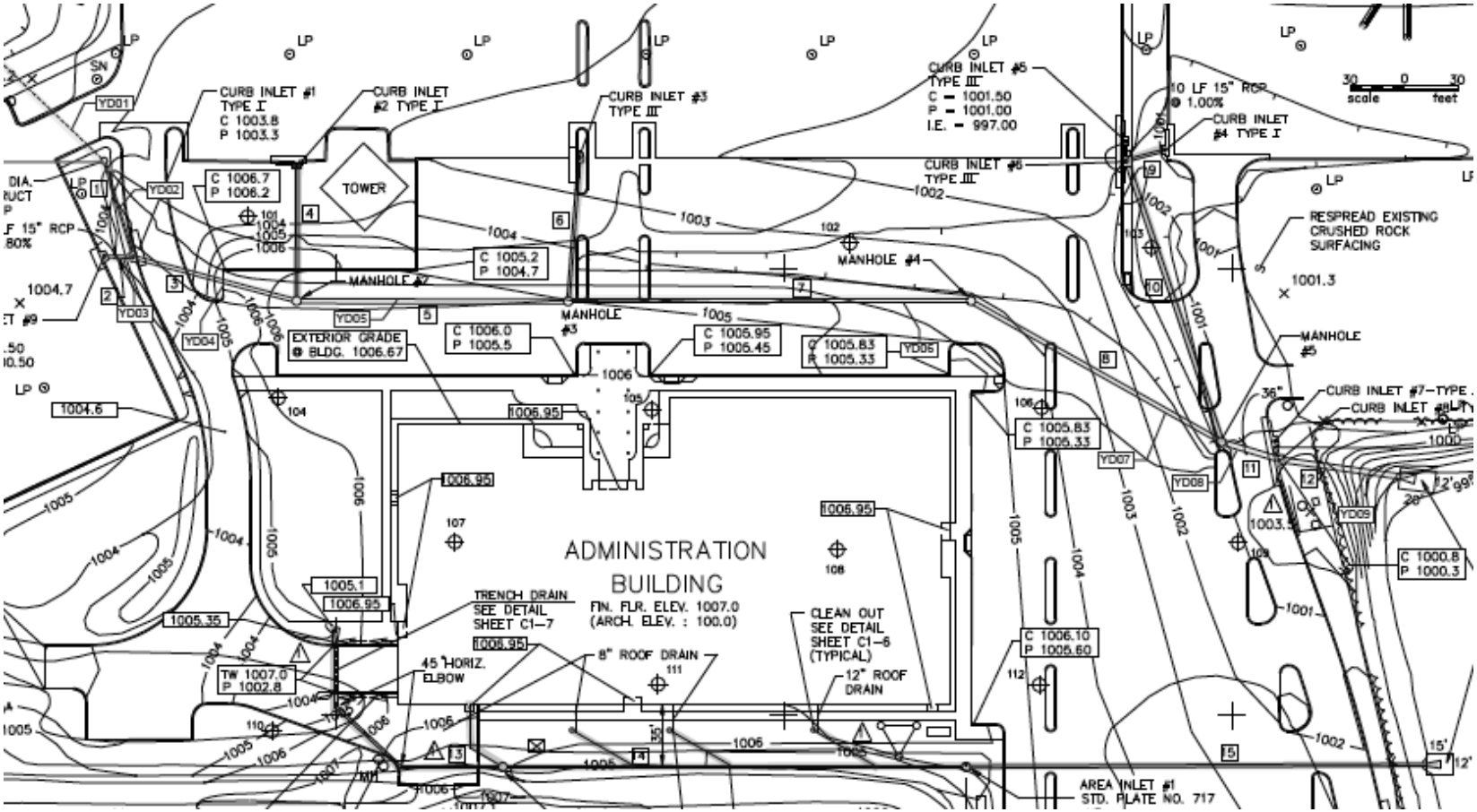


Figure 6: Yard Drainage – Administration Building

Throughout the life of the site, several upgrades and modifications were made within the property. One example of this was the installation of the Independent Spent Fuel Storage Installation (ISFSI) operation facility located North of the Containment Building. During construction of the facility the original site drainage system was modified to include the installation of several additional pips as shown in Figure 7.

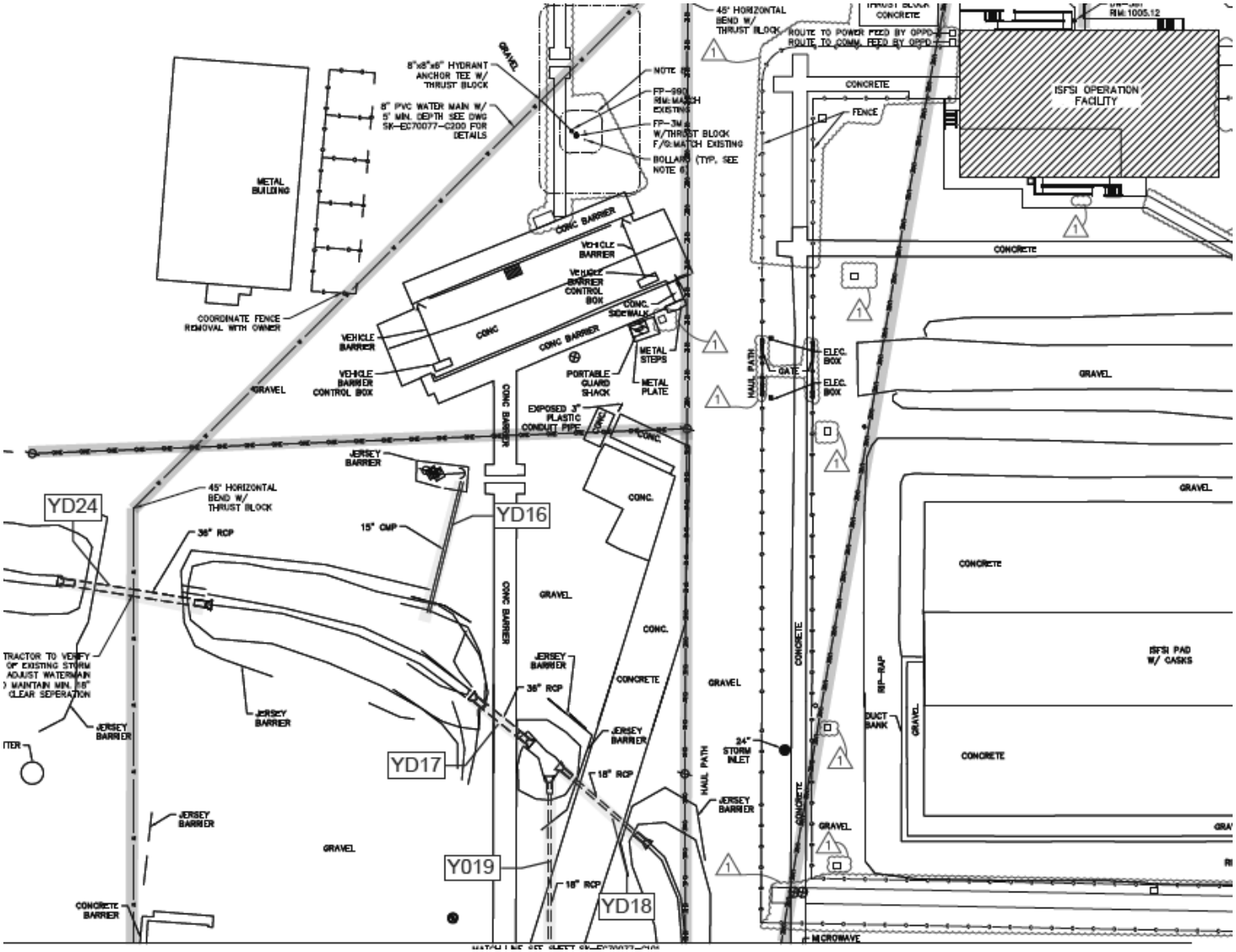


Figure 7: Yard Drainage – Near ISFSI

Another modification to the site occurred away from the power block and adjacent to the rail spur near Highway 75. For the decommissioning effort of the site, a temporary building was constructed to assist in the processing and shipment of material from the site via railroad. This structure is commonly called the Waste Processing Structure and was located near the existing rail as shown in Figure 8 and Figure 9.

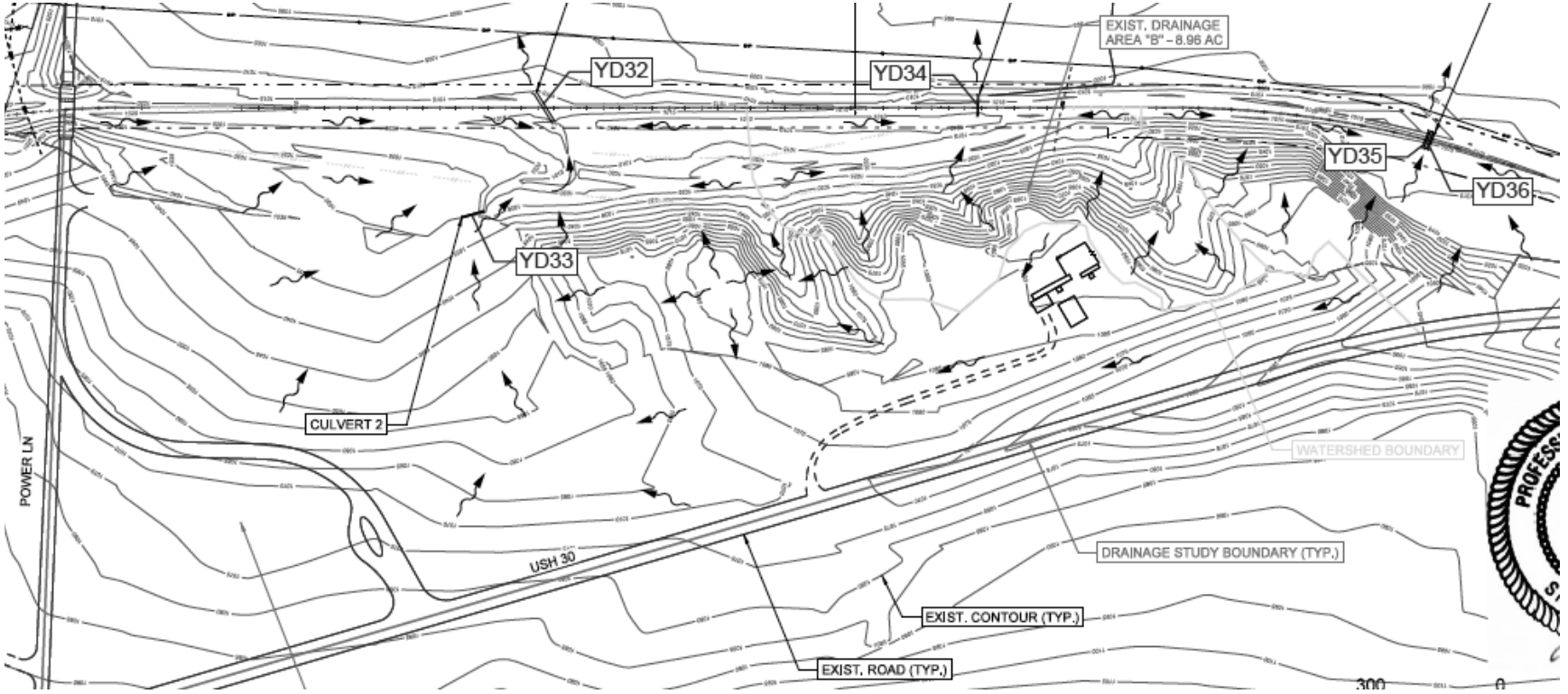


Figure 8: Yard Drainage – Near Waste Processing Tent

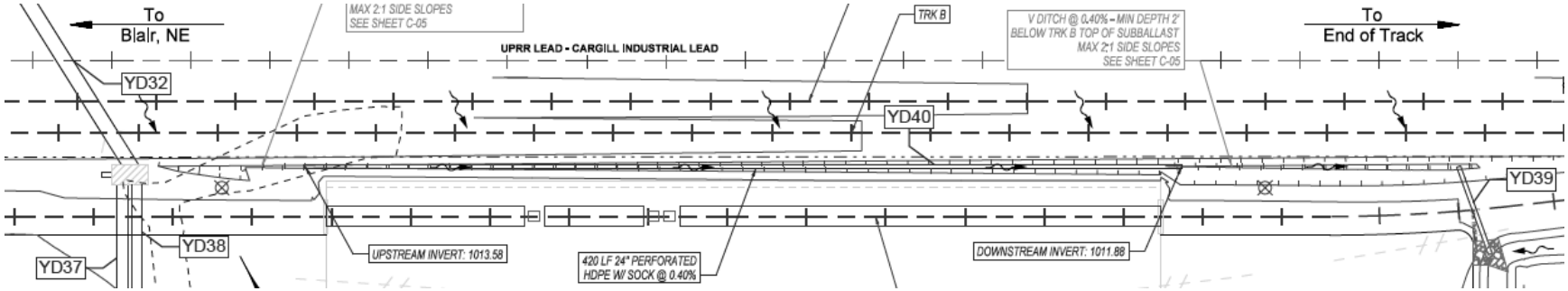


Figure 9: Yard Drainage – Near Waste Processing Tent (Continued)

There is a total of 9 drainage pipes that consisted of both new and existing lines. The size of the pipes varied from 24" to 84" and consisted entirely of CMP. Details of these pipes can be found on drawings C-01 through C-06 as provided by VIA rail.

The total surface area and void space calculated for this all storm drain piping is provided in Table 5.

Table 5: Total Length, Surface Area, and Void Space of Buried Storm Drain Piping

Piping	Length (ft)	Interior Surf. Area (ft^2)	Void Space Vol. (ft^3)	Length (m)	Interior Surf. Area (m^2)	Void Space Vol. (m^3)
Storm Drain	3,136.0	23,333.9	17,209.8	955.9	2,167.8	487.3

6.2.2 Service Water

There was only 1 buried piping identified as service water piping and it was located between the maintenance shop and warehouse. The line was shown on drawing E-4093 Sheet 1 and is also included below as Figure 6.

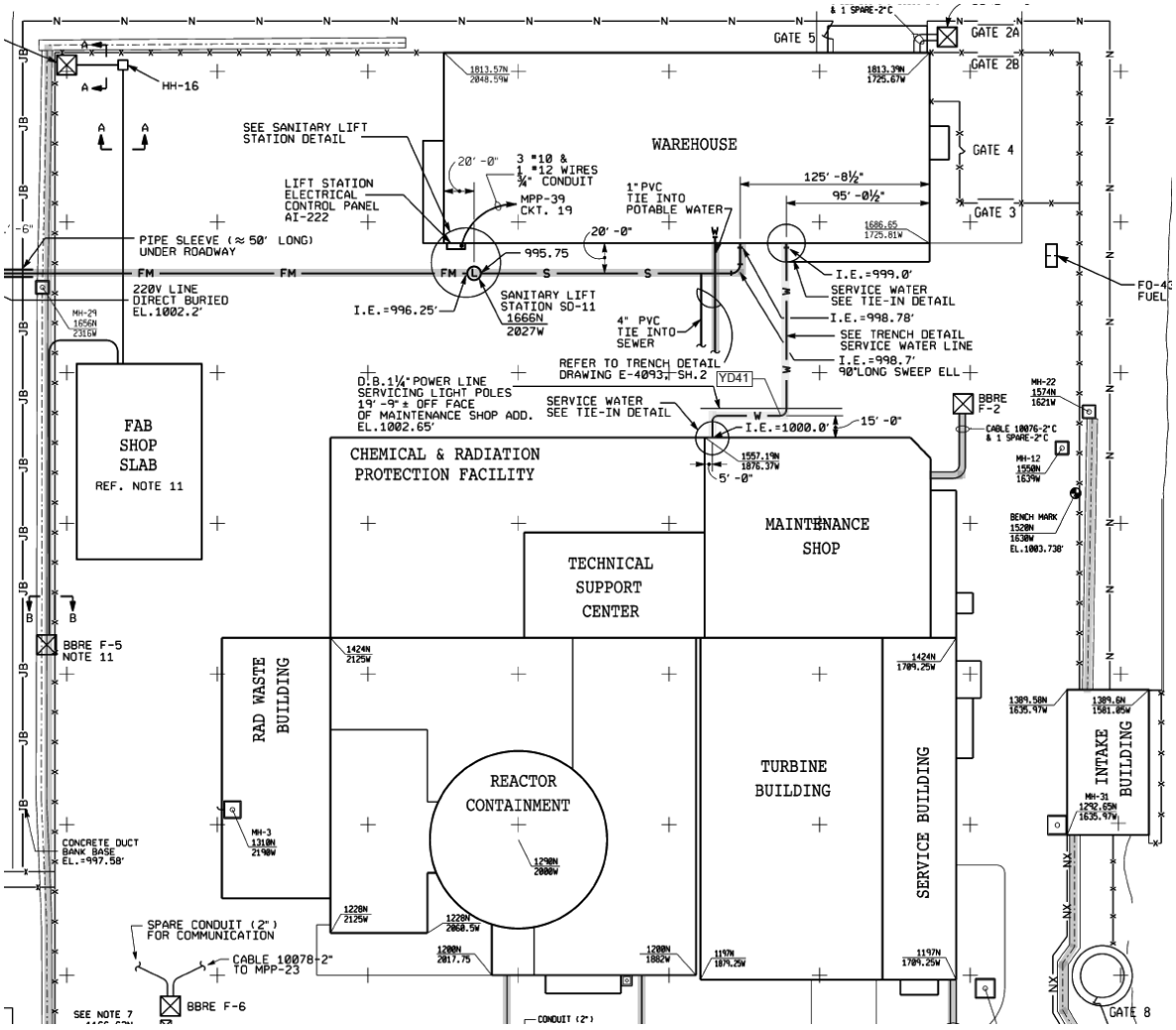


Figure 10: Service Water – Between Warehouse and Maintenance Shop

The line consisted of 3" copper tubing and extended for a length of approximately 180 ft. The total surface area and void space calculated for this pipe is provided in Table 6.

Table 6: Total Length, Surface Area, and Void Space of Buried Service Water Piping

Piping	Length (ft)	Interior Surf. Area (ft^2)	Void Space Vol. (ft^3)	Length (m)	Interior Surf. Area (m^2)	Void Space Vol. (m^3)
Service Water	180.0	137.0	8.3	54.9	12.7	0.2

6.3 Penetrations

6.3.1 Turbine Building

The following Figures 11-19 identify each of the penetrations present in the Turbine Building below EL1001'. Refer to Appendix C for a summary of information pertaining to each penetration identified.

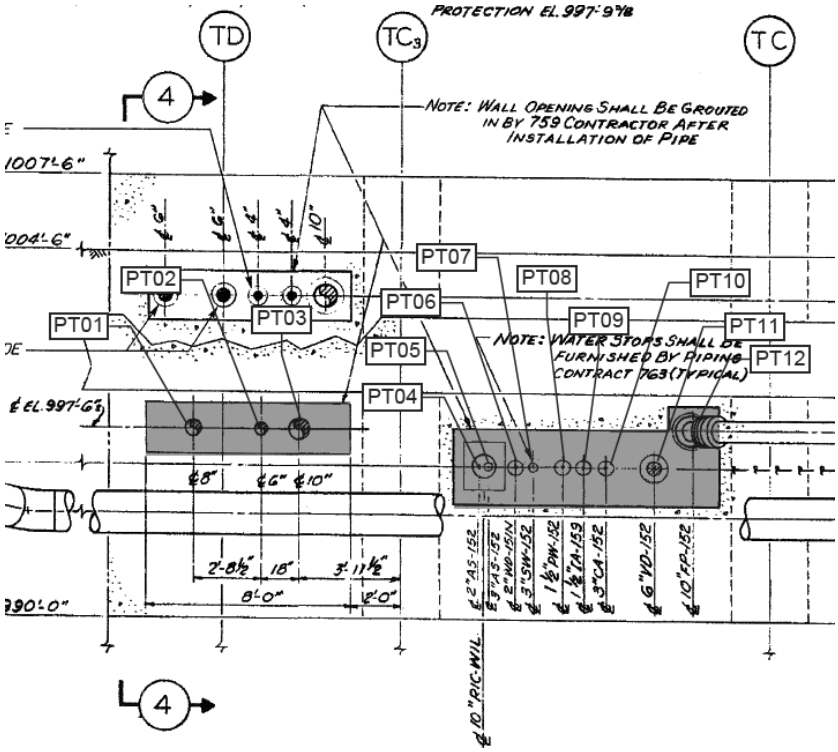


Figure 11 – TB South Wall Penetrations (10753)

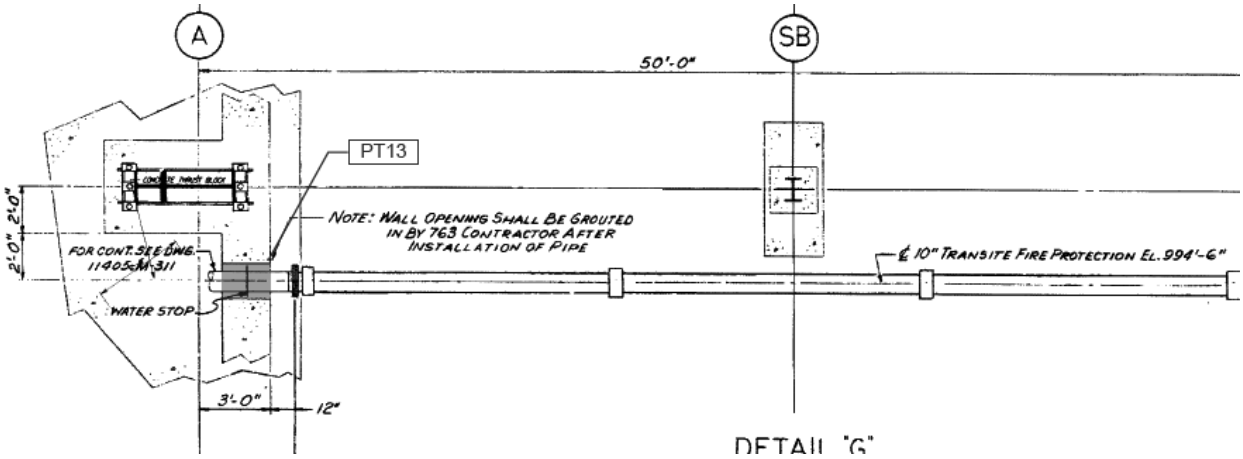


Figure 12 – Fire Protection Penetration at A-Line (10755)

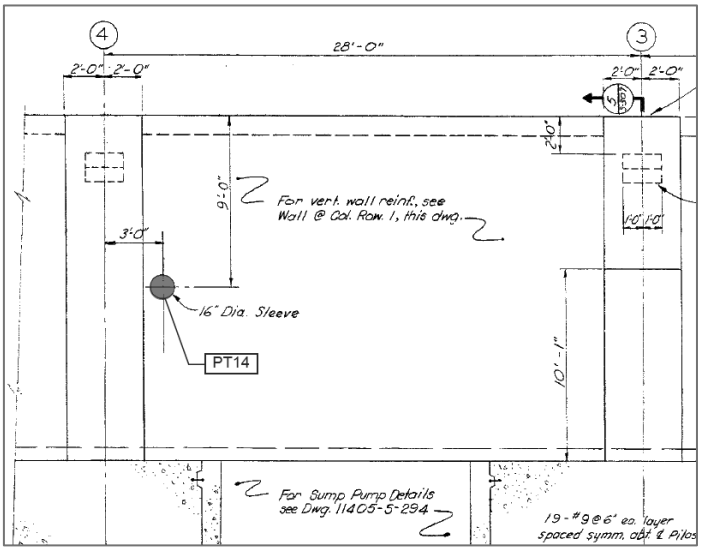


Figure 13 – Unknown Penetration (16526)

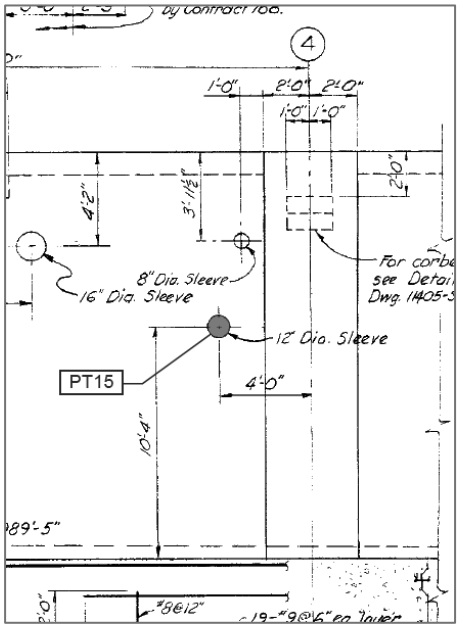


Figure 14 – Unknown Penetration (16526)

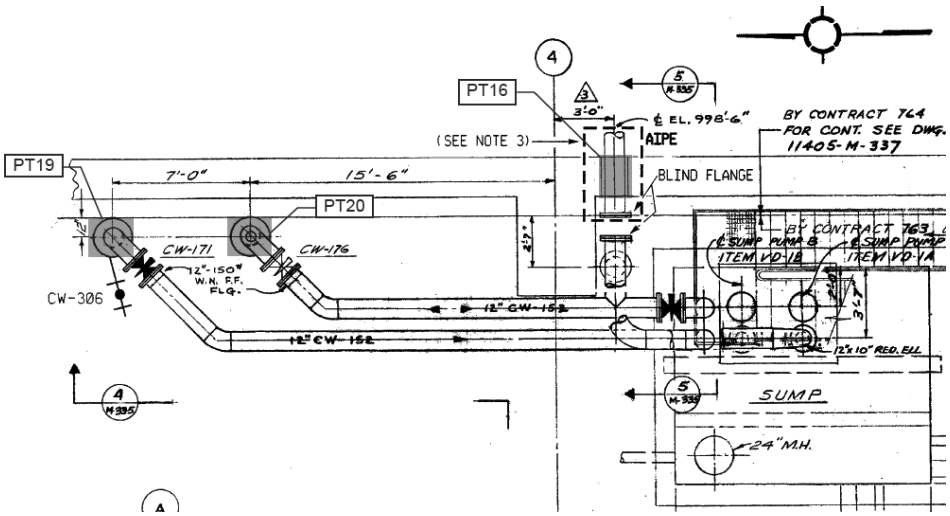


Figure 15 – Sump Pump Discharge Piping (10771)

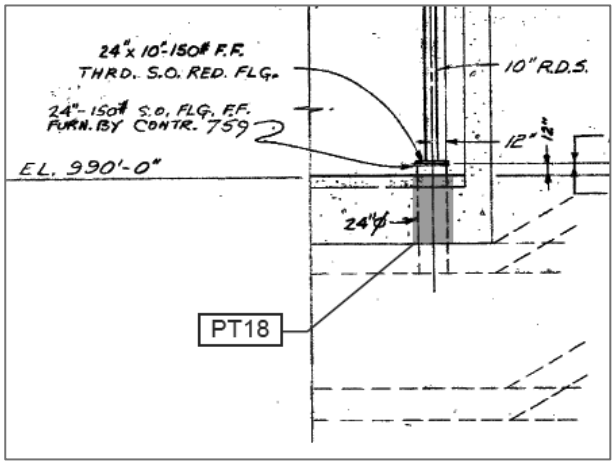


Figure 16 – RDS Floor Penetration (10771)

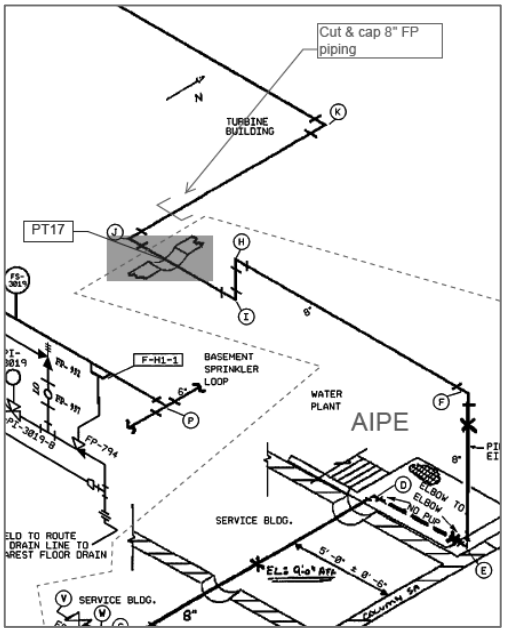


Figure 17 – Fire Protection from Service Bldg (44726)

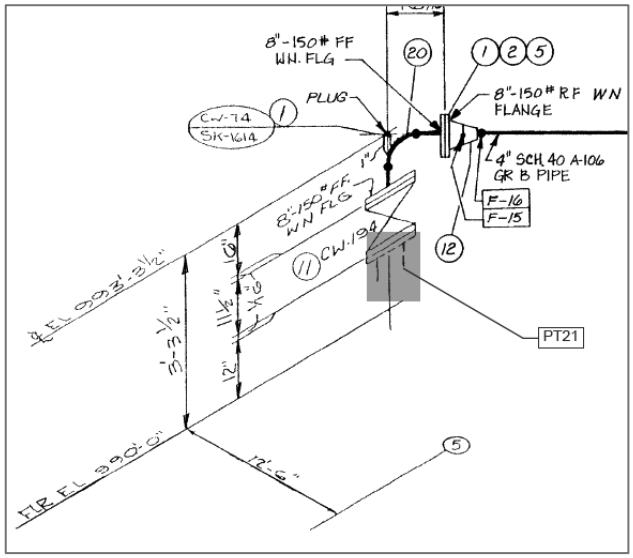


Figure 18 – Circ Water Floor Pen. (35665)

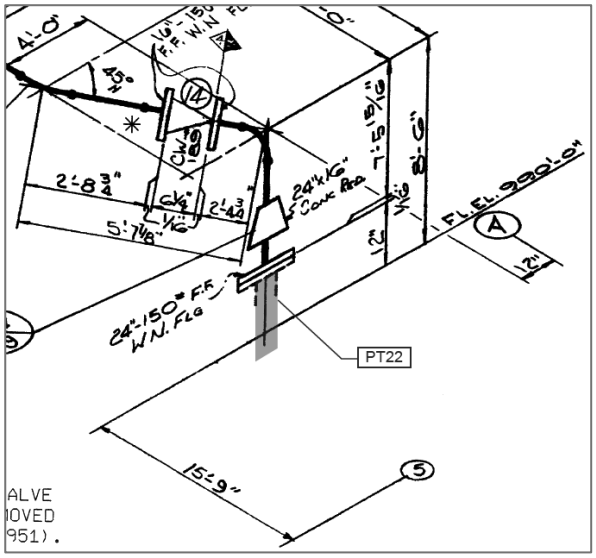


Figure 19 – Raw Water Floor Pen (35667)

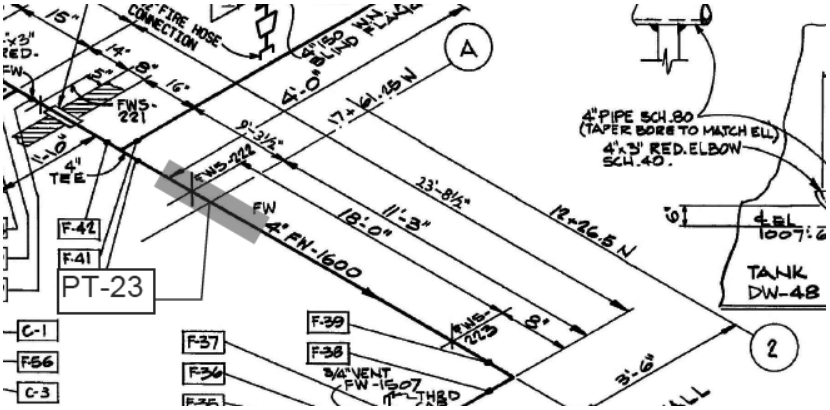


Figure 20 – Recirculation Piping of Feedwater Pump FW-54 (54058)

6.3.2 Auxiliary Building

The following Figures 21-23 identify each of the penetrations present in the Auxiliary Building below EL1001'. Refer to Appendix E for a summary of information pertaining to each penetration identified.

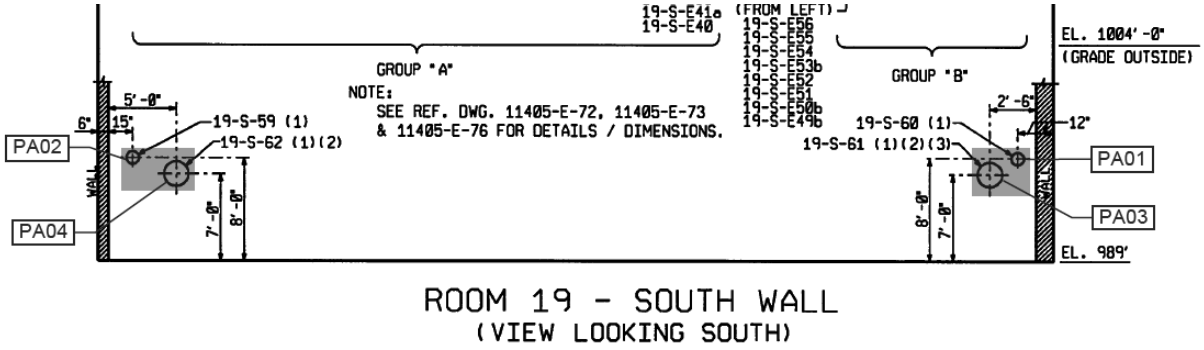


Figure 21 – Aux Bldg Room 19 South Wall Penetrations (60139)

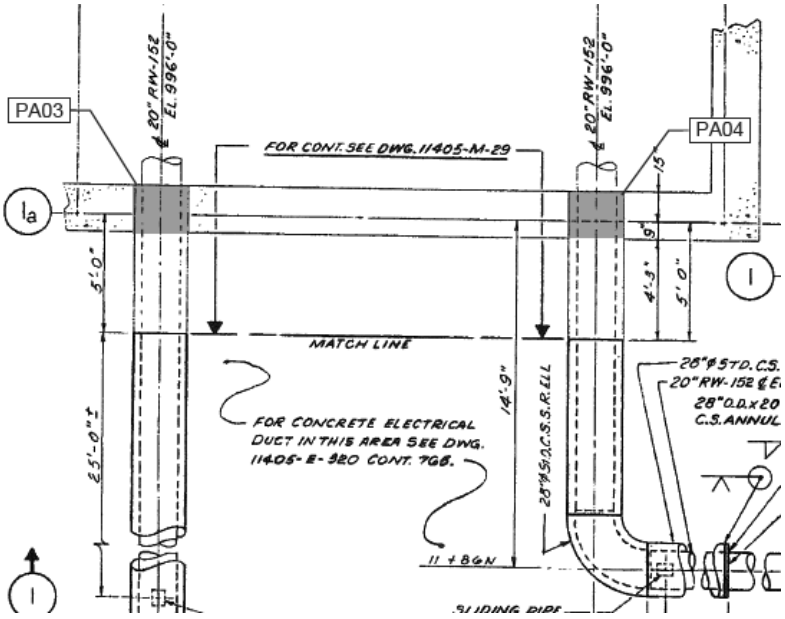


Figure 22 – Raw Water Penetrations at Room 19 South Wall, Plan View (10753)

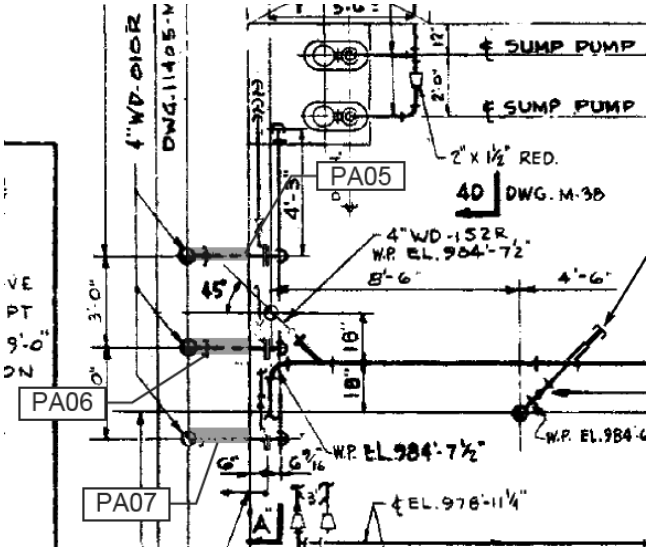


Figure 23 – Sub-basement North Wall Penetrations (10593)

6.3.3 Containment

The following Figures 24-27 identify each of the penetrations present in Containment below EL1001'. There are several Containment wall penetrations that are located at or close to the EL1001' cut line that will be exposed with the cut and thus not considered an abandoned penetration in this report. See Figure 27 for an example. Refer to Appendix F for a summary of information pertaining to each penetration identified.

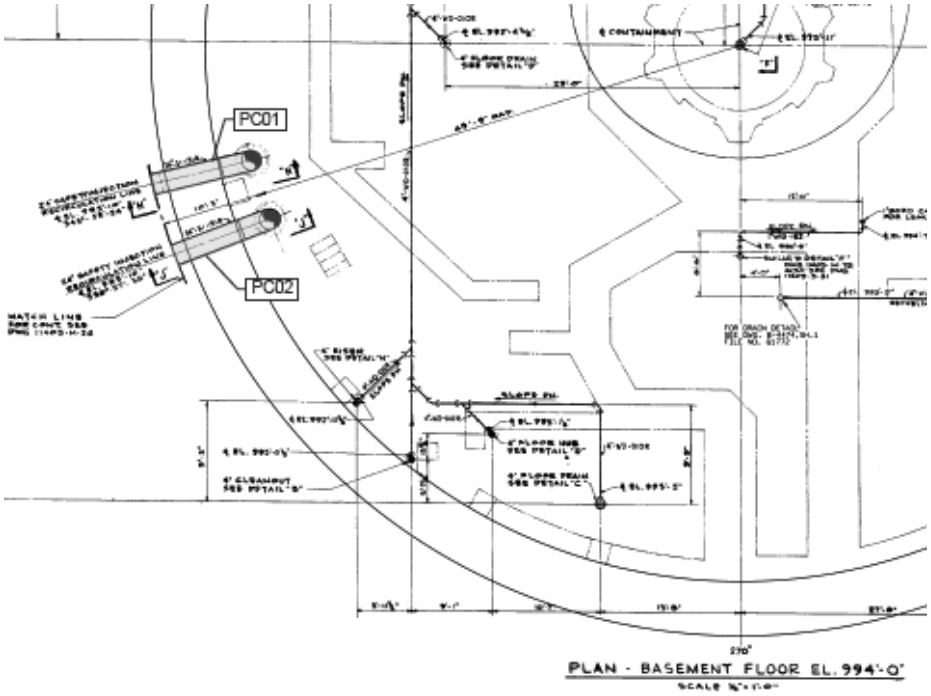


Figure 24 – Safety Injection from Containment to Aux Bldg (10585)

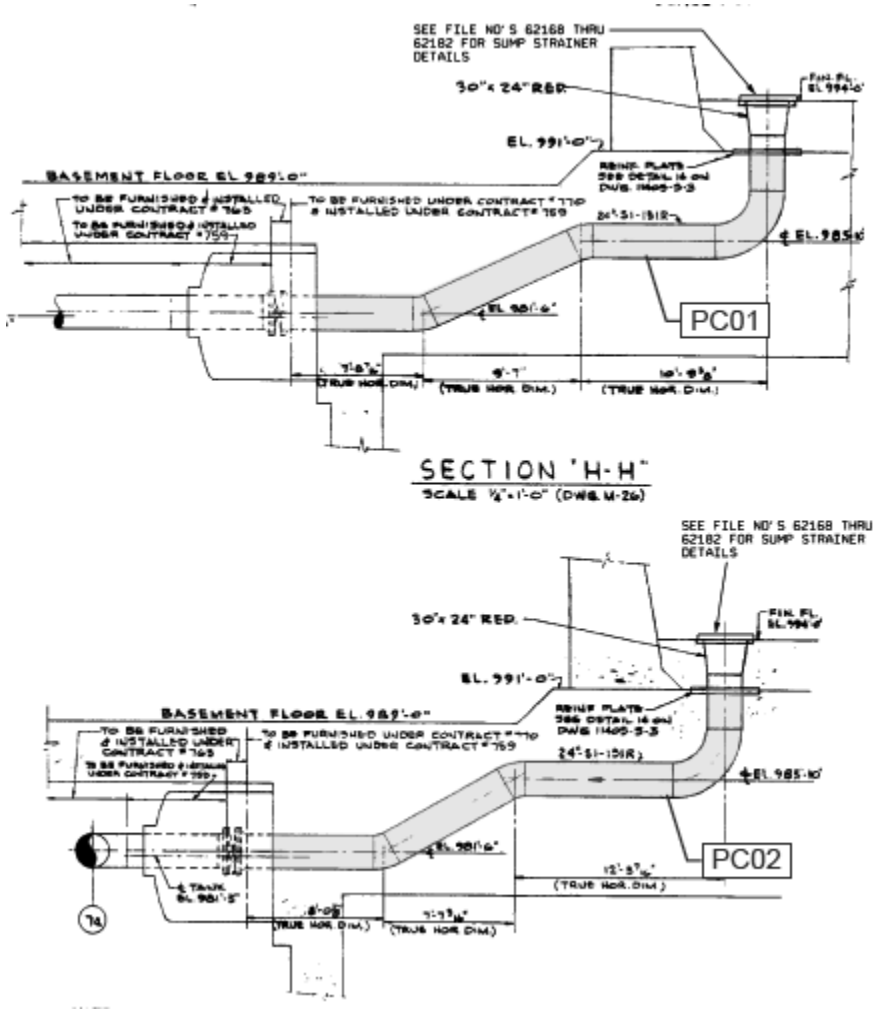


Figure 25 – Safety Injection Section Views (10585)

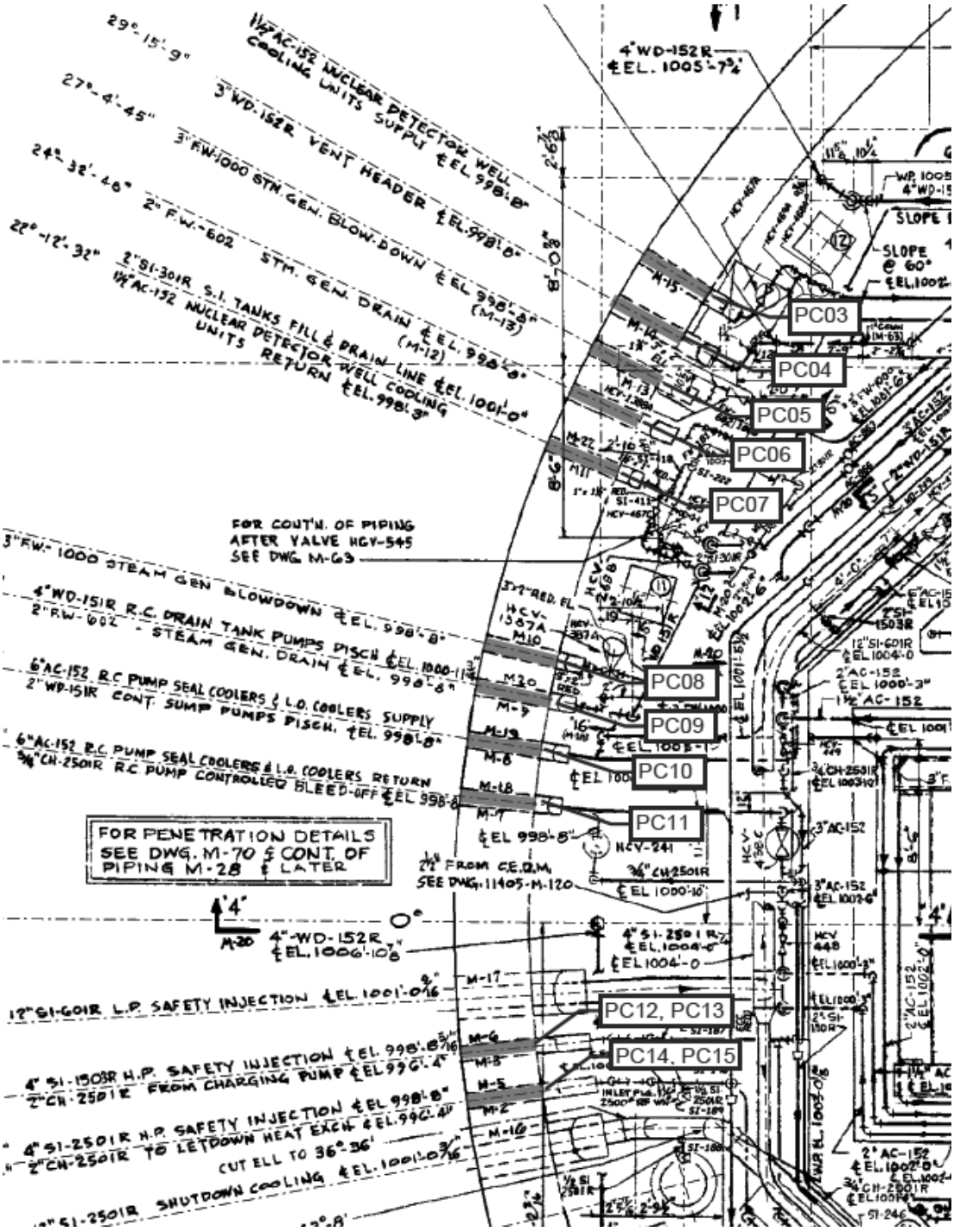


Figure 26 – Containment Wall Northern Penetrations (10582)

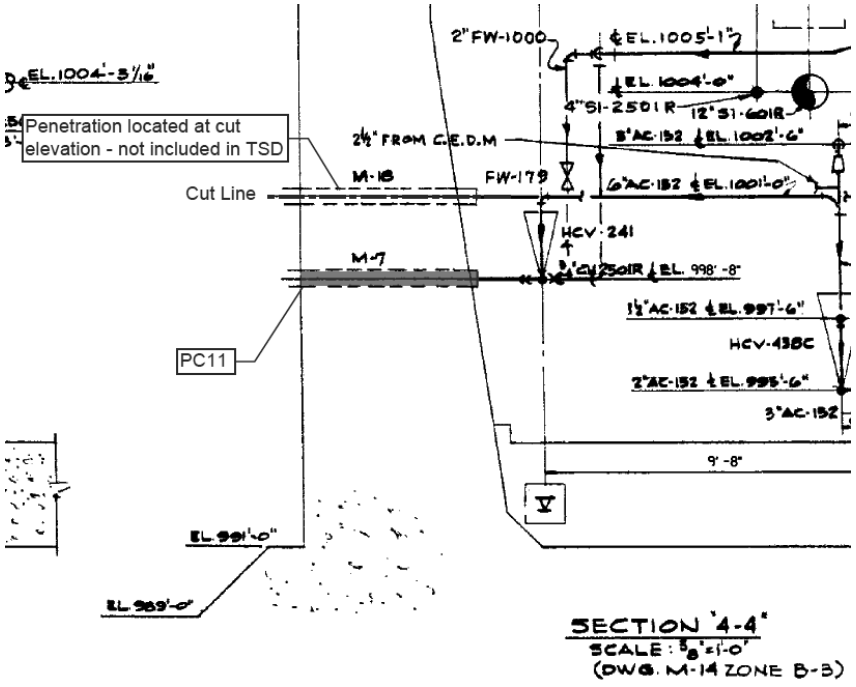
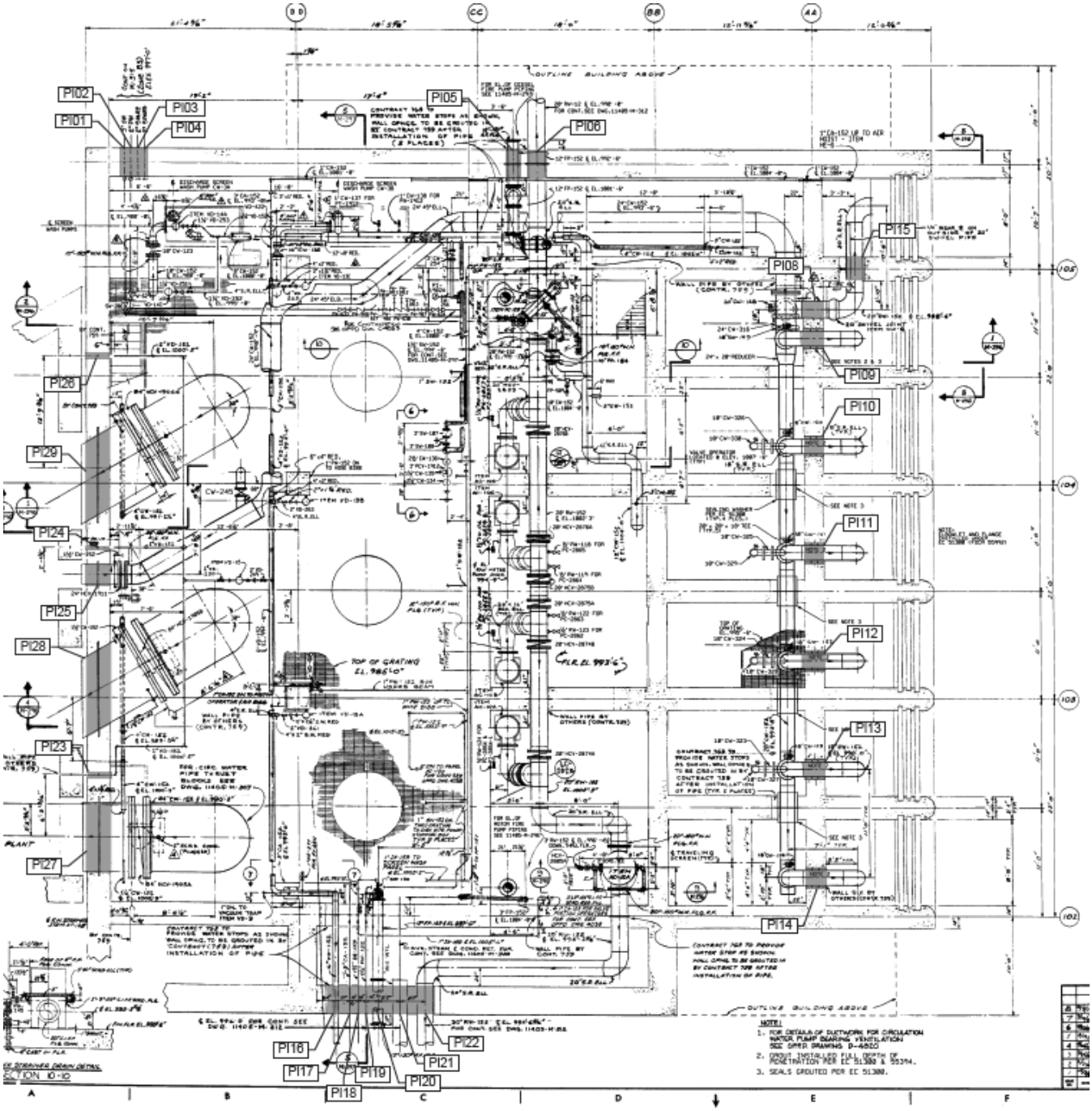


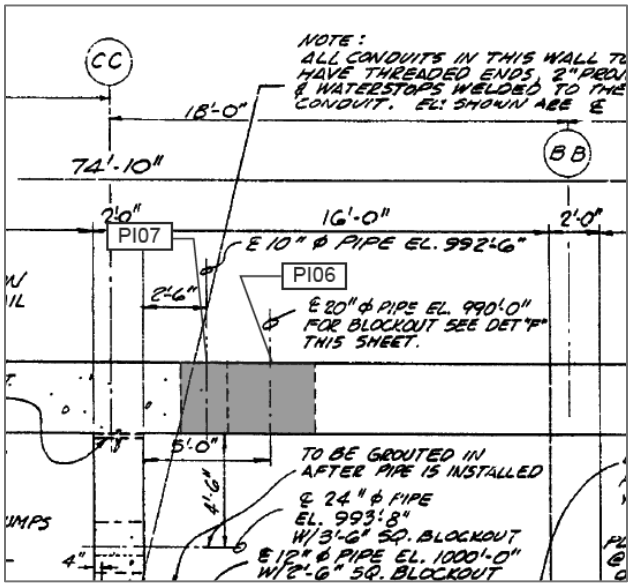
Figure 27 – Containment Wall Penetration Section 4-4 View (10588)

6.3.4 Intake Structure

The following Figures 28-31 identify each of the penetrations present in the Intake Structure below EL1001'. Refer to Appendix G for a summary of information pertaining to each penetration identified.



<u>Figure 28</u> – Intake Structure, Main Structure Penetrations (10723)



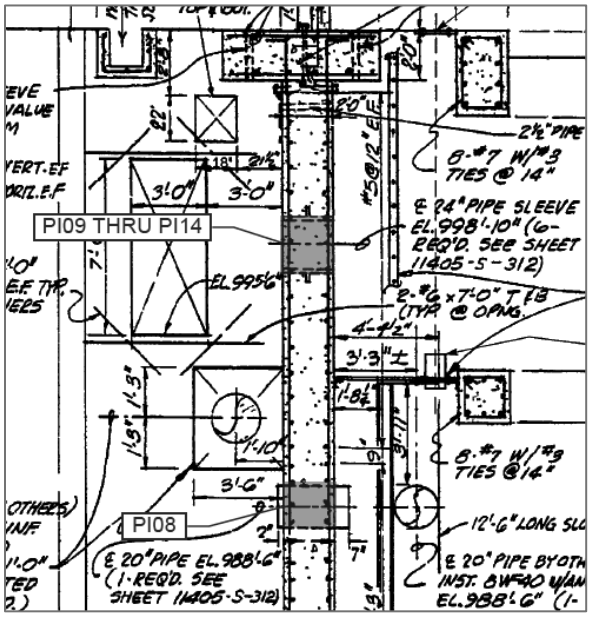


Figure 29 – Unknown 10" Pipe (16532)

Figure 30 – Elevation View, AA Wall Penetrations (16535)

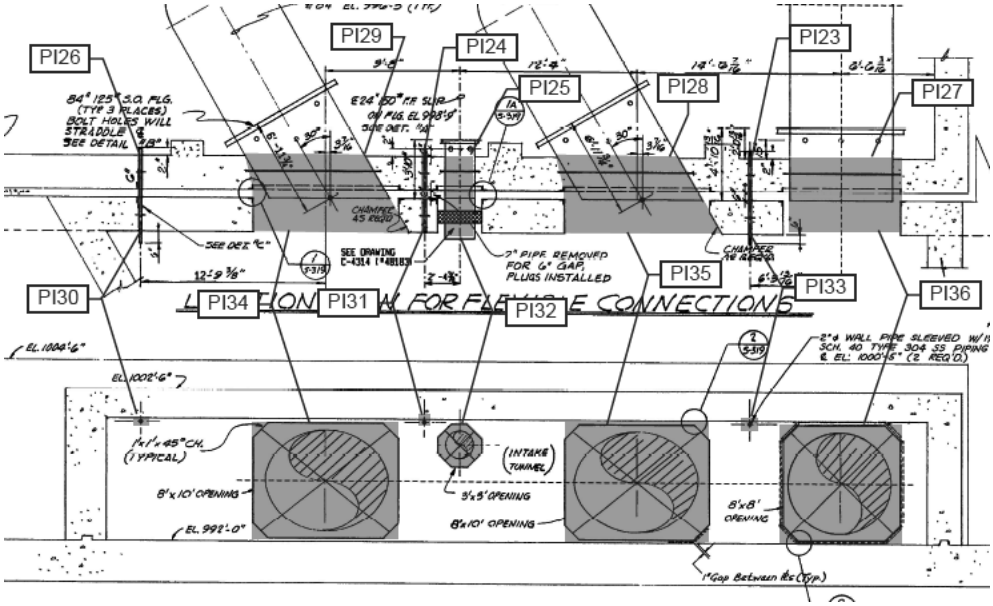


Figure 31 – Penetrations at Intake Tunnel (16539)

7 References

1. Figure No. 2 (OPPD File: N/A), Rev 5/7/19, “Stormwater Drainage & Controls”
2. C1-2 (OPPD File: N/A), Rev Record Drawing, “Fort Calhoun Administration Building – Site Grading & Storm Sewer Plan”
3. C1-6 (OPPD File: N/A), Rev Record Drawing, “Fort Calhoun Administration Building – Pipe Profiles”
4. C-2 (OPPD File: N/A), Rev Construction Issue, “Fort Calhoun Training Center – Layout Plan”
5. C-3 (OPPD File: N/A), Rev Construction Issue, “Fort Calhoun Training Center – Grading and Utility Plan”
6. C-8 (OPPD File: N/A), Rev Construction Issue, “Fort Calhoun Training Center – Grading and Utility Plan – Area B”
7. SKE-09-05-01 (OPPD File: N/A), Rev 1, “Grading Plan GSU XFMR Access Road”
8. C-01 (OPPD File: N/A), Rev 1, “Existing Drainage Map”
9. C-03 (OPPD File: N/A), Rev 1, “Proposed Culverts & Junction Box”
10. C-04 (OPPD File: N/A), Rev 1, “36” Culvert Extension”
11. C-05 (OPPD File: N/A), Rev 1, “24” CMP Culvert & V Ditch”
12. C-06 (OPPD File: N/A), Rev 1, “24” Perforated HDPE Drain”

Additional drawing references included in Appendices by OPPD file number.

8 Appendices

See attached

APPENDIX A – ABANDONED YARD PIPING

ID No.	Drawing Ref.	System	End State	From	To	Description	Pipe OD (in)	Wall Thickness (in)	Pipe ID (in)	Length (ft)	Start Elevation	End Elevation	Interior Surf. Area (ft^2)	Void Space Vol. (ft^3)	Length (m)	Interior Surf. Area (m^2)	Void Space Vol. (m^3)
1	C1-2, C-2, C-3, C-8	Yard Drain	Buried Pipe	Admin Building	N/A	RCP	16.500	2.250	12.000	90.00	1003.05	1002.25	282.74	70.69	27.43	26.27	2.00
2	C1-2, C1-6	Yard Drain	Buried Pipe	Admin Building	N/A	RCP	16.500	2.250	12.000	55.00	1000.65	1000.10	172.79	43.20	16.76	16.05	1.22
3	C1-2	Yard Drain	Buried Pipe	Admin Building	N/A	RCP	19.500	2.250	15.000	16.00	1000.50	1000.20	62.83	19.63	4.88	5.84	0.56
4	C1-2, C1-6	Yard Drain	Buried Pipe	Admin Building	N/A	RCP	30.000	3.000	24.000	105.00	999.27	998.95	659.73	329.87	32.00	61.29	9.34
5	C1-2, C1-6	Yard Drain	Buried Pipe	Admin Building	N/A	RCP	30.000	3.000	24.000	152.00	998.95	998.34	955.04	477.52	46.33	88.73	13.52
6	C1-2, C1-6	Yard Drain	Buried Pipe	Admin Building	N/A	RCP	37.000	3.500	30.000	225.00	997.88	996.75	1767.15	1104.47	68.58	164.17	31.27
7	C1-2, C1-6	Yard Drain	Buried Pipe	Admin Building	N/A	RCP	37.000	3.500	30.000	160.00	996.75	995.38	1256.64	785.40	48.77	116.75	22.24
8	C1-2, C1-6	Yard Drain	Buried Pipe	Admin Building	N/A	RCP	44.000	4.000	36.000	33.00	994.98	994.78	311.02	233.26	10.06	28.89	6.61
9	C1-2, C1-6	Yard Drain	Buried Pipe	Admin Building	N/A	RCP	44.000	4.000	36.000	62.00	994.78	994.22	584.34	438.25	18.90	54.29	12.41
10	E-4096 (42554)	Yard Drain	Buried Pipe	ISFSI	N/A	PVC	8.625	0.322	7.981	10.00	1001.90	1001.62	20.89	3.47	3.05	1.94	0.10
11	E-4096 (42554)	Yard Drain	Buried Pipe	ISFSI	N/A	RCP	23.000	2.500	18.000	98.00	1001.29	1000.31	461.81	173.18	29.87	42.90	4.90
12	E-4096 (42554)	Yard Drain	Buried Pipe	ISFSI	N/A	RCP	30.000	3.000	24.000	75.00	997.00	996.00	471.24	235.62	22.86	43.78	6.67
13	Figure No. 2	Yard Drain	Buried Pipe	Shooting Range	N/A	RCP	44.000	4.000	36.000	65.00	994.20	994.00	612.61	459.46	19.81	56.91	13.01
14	Figure No. 2	Yard Drain	Buried Pipe	Shooting Range	N/A	RCP	44.000	4.000	36.000	75.00	994.50	994.20	706.86	530.14	22.86	65.67	15.01
15	Figure No. 2	Yard Drain	Buried Pipe	Maintenance	N/A	RCP	23.000	2.500	18.000	200.00	994.50	994.00	942.48	353.43	60.96	87.56	10.01
16	SK-EC70077-C100 (90064)	Yard Drain	Buried Pipe	Maintenance	N/A	CMP	16.000	0.500	15.000	62.00	998.50	998.00	243.47	76.09	18.90	22.62	2.15
17	SK-EC70077-C100 (90064)	Yard Drain	Buried Pipe	Maintenance	N/A	RCP	44.000	4.000	36.000	30.00	999.00	998.50	282.74	212.06	9.14	26.27	6.00
18	SK-EC70077-C100 (90064)	Yard Drain	Buried Pipe	Storage Building	N/A	RCP	23.000	2.500	18.000	50.00	1001.20	1000.00	235.62	88.36	15.24	21.89	2.50
19	SK-EC70077-C100 (90064)	Yard Drain	Buried Pipe	Water Tower	N/A	RCP	23.000	2.500	18.000	32.00	1001.50	1001.00	150.80	56.55	9.75	14.01	1.60
20	C-3 (42731), C-7 (42751)	Yard Drain	Buried Pipe	Maintenance	N/A	RCP	23.000	2.500	18.000	50.00	999.39	998.05	235.62	88.36	15.24	21.89	2.50
21	11405-S-283 (16513)	Yard Drain	Buried Pipe	Contractor Office	N/A	RCP	23.000	2.500	18.000	50.00	999.50	998.25	235.62	88.36	15.24	21.89	2.50
22	48488-S005 (67218)	Yard Drain	Buried Pipe	Access Road	N/A	RCP	16.500	2.250	12.000	16.00	1002.39	1002.28	50.27	12.57	4.88	4.67	0.36
23	11405-S-283 (16513), C-3 (42731), C-7 (42751)	Yard Drain	Buried Pipe	Access Road	N/A	RCP	23.000	2.500	18.000	50.00	1001.10	1000.60	235.62	88.36	15.24	21.89	2.50
24	SK-EC70077-C100 (90064)	Yard Drain	Buried Pipe	Maintenance	N/A	RCP	44.000	4.000	36.000	66.00	1000.70	1000.30	622.04	466.53	20.12	57.79	13.21
25	11405-S-283 (16513)	Yard Drain	Buried Pipe	Switch Yard	N/A	RCP	51.000	4.500	42.000	58.00	995.00	994.50	637.74	558.03	17.68	59.25	15.80
26	Figure No. 2	Yard Drain	Buried Pipe	Switch Yard	N/A	RCP	44.000	4.000	36.000	56.00	995.50	995.00	527.79	395.84	17.07	49.03	11.21
27	Figure No. 2	Yard Drain	Buried Pipe	Switch Yard	N/A	RCP	37.000	3.500	30.000	60.00	996.50	996.00	471.24	294.52	18.29	43.78	8.34
28	Figure No. 2	Yard Drain	Buried Pipe	Switch Yard	N/A	RCP	37.000	3.500	30.000	70.00	998.00	997.00	549.78	343.61	21.34	51.08	9.73
29	Figure No. 2	Yard Drain	Buried Pipe	Switch Yard	N/A	RCP	30.000	3.000	24.000	70.00	996.50	997.00	439.82	219.91	21.34	40.86	6.23
30	SKE-09-05-01	Yard Drain	Buried Pipe	Switch Yard	N/A	CHDPE	15.000	0.615	13.770	50.00	1000.40	1000.10	180.25	51.71	15.24	16.75	1.46
31	C-3	Yard Drain	Buried Pipe	Training Building	N/A	RCP	19.500	2.250	15.000	44.00	999.66	999.10	172.79	54.00	13.41	16.05	1.53
32	45001 C-01	Yard Drain	Buried Pipe	Waste Processing Tent	N/A	CMP	85.000	0.500	84.000	83.00	1007.63	1006.31	1825.27	3194.21	25.30	169.57	90.45
33	45001 C-01	Yard Drain	Buried Pipe	Waste Processing Tent	N/A	CMP	25.000	0.500	24.000	50.00	1022.64	1021.73	314.16	157.08	15.24	29.19	4.45
34	45001 C-01, C-04	Yard Drain	Buried Pipe	Waste Processing Tent	N/A	CMP	37.000	0.500	36.000	91.00	1005.22	1004.61	857.65	643.24	27.74	79.68	18.21
35	45001 C-01	Yard Drain	Buried Pipe	Waste Processing Tent	N/A	CMP	49.000	0.500	48.000	40.00	1003.59	1002.10	502.65	502.65	12.19	46.70	14.23
36	45001 C-01	Yard Drain	Buried Pipe	Waste Processing Tent	N/A	CMP	49.000	0.500	48.000	40.00	1003.50	100.86	502.65	502.65	12.19	46.70	14.23
37	45001 C-03	Yard Drain	Buried Pipe	Waste Processing Tent	N/A	CMP	61.000	0.500	60.000	66.00	1008.79	1008.00	1036.73	1295.91	20.12	96.31	36.70

38	45001 C-03	Yard Drain	Buried Pipe	Waste Processing Tent	N/A	CMP	61.000	0.500	60.000	66.00	1008.79	1008.00	1036.73	1295.91	20.12	96.31	36.70
39	45001 C-05	Yard Drain	Buried Pipe	Waste Processing Tent	N/A	CMP	25.000	0.500	24.000	45.00	1011.43	1010.60	282.74	141.37	13.72	26.27	4.00
40	45001 C-06	Yard Drain	Buried Pipe	Waste Processing Tent	N/A	HDPE with sock	24.000	0.923	22.154	420.00	1013.58	1011.88	2435.96	1124.30	128.02	226.31	31.84
41	E-4093 SH 1 (42620)	Service Water	Buried Pipe	Maintenance Shop	Warehouse	Copper Tube, Type K	3.125	0.109	2.907	180.00	1000.00	999.00	136.99	8.30	54.86	12.73	0.23
									Yard Drain	3136.0			23333.9	17209.8	955.9	2167.8	487.3
									Service Water	180.0			137.0	8.3	54.9	12.7	0.2
									Total	3316.0			23470.9	17218.0	1010.7	2180.5	487.6

Data for cells highlighted in yellow could not be located on any plant drawing; therefore, conservative assumptions were made for these values.

APPENDIX B – TURBINE BUILDING ABANDONED PIPING

ID No.	Drawing Ref.	System	Category	Description	Nom. Pipe Dia. (in)	Pipe ID (in)	Length (ft)	Start Elevation	End Elevation	Interior Surf. Area (ft^2)	Void Space Vol. (ft^3)	Length (m)	Interior Surf. Area (m^2)	Void Space Vol. (m^3)
T01	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 4.5mm liner	6	5.40	81.54	990.00	987.55	115.19	12.95	24.85	10.70	0.37
T02	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 4.5mm liner	6	5.40	2.54	987.25	987.25	3.59	0.40	0.77	0.33	0.01
T03	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 4.5mm liner	6	5.40	2.54	987.25	987.25	3.59	0.40	0.77	0.33	0.01
T04	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 4.5mm liner	6	5.40	94.55	990.00	987.00	133.56	15.01	28.82	12.41	0.43
T05	M-332	Plumbing & Drainage	in & below slab	Asbestos-cement sewer pipe w/ 4.5mm liner	6	5.40	101.12	987.25	987.25	142.85	16.06	30.82	13.27	0.45
T06	M-332	Plumbing & Drainage	in & below slab	Asbestos-cement sewer pipe w/ 4.5mm liner	6	5.40	59.21	990.00	987.57	83.65	9.40	18.05	7.77	0.27
T07	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 4.5mm liner	6	5.40	40.37	990.00	988.42	57.03	6.41	12.31	5.30	0.18
T08	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 4.5mm liner	10	9.40	29.18	990.00	985.70	71.78	14.05	8.89	6.67	0.40
T09	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 4.5mm liner	10	9.40	79.74	990.00	986.42	196.15	38.40	24.30	18.22	1.09
T10	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 3mm liner	4	3.51	10.83	985.00	985.00	9.95	0.73	3.30	0.92	0.02
T11	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 3mm liner	4	3.51	24.44	990.00	984.59	22.46	1.64	7.45	2.09	0.05
T12	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 4.5mm liner	6	5.40	55.51	990.00	984.43	78.42	8.82	16.92	7.29	0.25
T13	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 3mm liner	4	3.51	7.42	990.00	988.42	6.82	0.50	2.26	0.63	0.01
T14	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 4.5mm liner	6	5.40	70.52	986.67	986.67	99.62	11.20	21.49	9.25	0.32
T15	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 4.5mm liner	10	9.40	53.83	990.00	984.38	132.42	25.92	16.41	12.30	0.73
T16	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 4.5mm liner	6	5.40	90.64	990.00	985.42	128.05	14.39	27.63	11.90	0.41
T17	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 4.5mm liner	10	9.40	71.71	990.00	986.64	176.40	34.53	21.86	16.39	0.98
T18	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 4.5mm liner	10	9.40	63.32	990.00	986.03	155.75	30.49	19.30	14.47	0.86
T19	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 4.5mm liner	6	5.40	4.56	990.00	988.42	6.45	0.72	1.39	0.60	0.02
T20	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 3mm liner	4	3.51	19.51	990.00	988.50	17.93	1.31	5.95	1.67	0.04
T21	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 4.5mm liner	10	9.40	76.40	990.00	986.42	187.94	36.79	23.29	17.46	1.04
T22	M-332	Plumbing & Drainage	below slab	Asbestos-cement sewer pipe w/ 4.5mm liner	6	5.40	127.20	990.00	986.67	179.69	20.20	38.77	16.69	0.57
						TOTAL:	**1166.69**			**2009.28**	**300.33**	**355.61**	**186.67**	**8.50**

APPENDIX C – TURBINE BUILDING PENETRATIONS

ID No.	Drawing Ref.	Line ID No.	System	Category	End State	From	To	Description	Sleeve Size (in)	Pipe OD (in)	Wall Thickness (in)	Pipe ID (in)	Length (ft)	Elevation	End Elevation	Interior Surf. Area (ft^2)	Void Space Vol. (ft^3)	Length (m)	Interior Surf. Area (m^2)	Void Space Vol. (m^3)
PT-01	10751, 10753	---	FP	south wall pen.	pipe in pen.	TB	Yard	8" C.S. Sch40	N/A	8.63	0.322	7.99	2.00	997.50	997.50	4.18	0.70	0.61	0.39	0.02
PT-02	10751, 10753	---	FP	south wall pen.	pipe in pen.	TB	Yard	6" C.S. Sch40	N/A	6.63	0.280	6.07	2.00	997.50	997.50	3.18	0.40	0.61	0.30	0.01
PT-03	10751, 10753	---	FP	south wall pen.	pipe in pen.	TB	Yard	10" C.S. Sch40	N/A	10.75	0.365	10.02	2.00	997.50	997.50	5.25	1.10	0.61	0.49	0.03
PT-04	10753	2"AS-152	AS	south wall pen.	open sleeve	TB	Yard		10.00	2.38	---	10.00	2.00	996.00	996.00	5.24	1.09	0.61	0.49	0.03
PT-05	10753, 7531	3"AS-152, AS-5199	AS	south wall pen.	open sleeve	TB	Yard		10.00	3.50	---	10.00	2.00	996.00	996.00	5.24	1.09	0.61	0.49	0.03
PT-06	10753	2"WD-151N	WD	south wall pen.	pipe in pen.	TB	Yard		N/A	2.38	0.154	2.07	2.00	996.00	996.00	1.08	0.05	0.61	0.10	0.00
PT-07	10753, 10748	3"SW-152	SW	south wall pen.	pipe in pen.	TB	Yard		N/A	3.50	0.216	3.07	2.00	996.00	996.00	1.61	0.10	0.61	0.15	0.00
PT-08	10753, 10748	1 1/2"PW-152	PW	south wall pen.	pipe in pen.	TB	Yard		N/A	1.90	0.145	1.61	2.00	996.00	996.00	0.84	0.03	0.61	0.08	0.00
PT-09	10753, 16939	1 1/2"IA-159	IA	south wall pen.	pipe in pen.	TB	Yard		N/A	1.90	0.145	1.61	2.00	996.00	996.00	0.84	0.03	0.61	0.08	0.00
PT-10	10730, 10753	3"CA-152	CA	south wall pen.	pipe in pen.	TB	Yard		N/A	3.50	0.216	3.07	2.00	996.00	996.00	1.61	0.10	0.61	0.15	0.00
PT-11	10753	6"VD-152	VD	south wall pen.	pipe in pen.	TB	Yard		N/A	6.63	0.280	6.07	2.00	996.00	996.00	3.18	0.40	0.61	0.30	0.01
PT-12	10753, 10748	10"FP-152	FP	south wall pen.	pipe in pen.	TB	Yard	10" C.S. Sch40	N/A	10.75	0.365	10.02	2.00	996.00	996.00	5.25	1.10	0.61	0.49	0.03
PT-13	10751, 10755, 16526	---	FP	east wall pen.	pipe in pen.	TB	Service Bldg	transite fire protection	N/A	10.75	0.365	10.02	2.00	994.50	994.50	5.25	1.10	0.61	0.49	0.03
PT-14	16526	---	unknown	east wall pen.	open sleeve	TB	Service Bldg		16.00	---	---	16.00	2.00	998.50	998.50	8.38	2.79	0.61	0.78	0.08
PT-15	16526	---	unknown	east wall pen.	open sleeve	TB	Service Bldg		12.00	---	---	12.00	2.00	999.75	999.75	6.28	1.57	0.61	0.58	0.04
PT-16	35969, 10771	12"CW-152, IC-425	CW	east wall pen.	pipe in pen.	TB	Service Bldg	A-106B Sch40	N/A	12.75	0.375	12.00	2.00	998.50	998.50	6.28	1.57	0.61	0.58	0.04
PT-17	44726	---	FP	east wall pen.	pipe in pen.	TB	Service Bldg	8" C.S. Sch40	N/A	8.63	0.322	7.98	2.00	998.00	998.00	4.18	0.69	0.61	0.39	0.02
PT-18	10771	---	RDS	floor pen.	pipe in pen.	TB	Yard		N/A	24.00	0.375	23.25	2.58	990.00	987.42	15.70	7.61	0.79	1.46	0.22
PT-19	35969, 10771	IC-425	CW	floor pen.	pipe in pen.	TB	Yard	A-106B Sch20	N/A	24.00	0.375	23.25	2.58	990.00	987.42	15.70	7.61	0.79	1.46	0.22
PT-20	35969, 10771	IC-425	CW	floor pen.	pipe in pen.	TB	Yard	A-106B Sch20	N/A	24.00	0.375	23.25	2.58	990.00	987.42	15.70	7.61	0.79	1.46	0.22
PT-21	35665, 54091	IC-110	CW	floor pen.	pipe in pen.	TB	Yard	A-106B Sch40	N/A	8.63	0.322	7.98	2.58	990.00	987.42	5.39	0.90	0.79	0.50	0.03
PT-22	35667	IC-112	RW	floor pen.	pipe in pen.	TB	Yard	24" A-106B SCH40	N/A	24.00	0.375	23.25	2.58	990.00	987.42	15.70	7.61	0.79	1.46	0.22
PT-23	54058	4"FW-1600	FW	east wall pen.	pipe in pen.	TB	Service Bldg		N/A	4.50	0.237	4.03	2.00	998.00	998.00	2.11	0.18	0.61	0.20	0.01
												TOTAL:	**48.90**			**138.17**	**45.40**	**14.90**	**12.84**	**1.29**

APPENDIX D – AUXILIARY BUILDING ABANDONED PIPING

ID No.	Drawing Ref.	Line ID No.	System	Category	Pipe OD (in)	Wall Thickness (in)	Pipe ID (in)	Length (ft)	Start Elevation	End Elevation	Interior Surf. Area (ft^2)	Void Space Vol. (ft^3)	Length (m)	Interior Surf. Area (m^2)	Void Space Vol. (m^3)
A01	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	9.97	989.00	988.25	10.51	0.88	3.04	0.98	0.02
A02	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	17.99	989.00	988.25	18.96	1.59	5.48	1.76	0.05
A03	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	18.12	989.00	988.17	19.10	1.60	5.52	1.77	0.05
A04	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	19.54	989.00	988.00	20.60	1.73	5.96	1.91	0.05
A05	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	9.59	989.00	988.25	10.11	0.85	2.92	0.94	0.02
A06	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	17.89	989.00	988.25	18.86	1.58	5.45	1.75	0.04
A07	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	6.24	989.00	988.51	6.58	0.55	1.90	0.61	0.02
A08	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	12.21	989.00	988.25	12.87	1.08	3.72	1.20	0.03
A09	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	35.96	989.00	988.51	37.90	3.18	10.96	3.52	0.09
A10	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	18.86	989.00	987.38	19.87	1.67	5.75	1.85	0.05
A11	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	123.91	989.00	988.04	130.60	10.95	37.77	12.13	0.31
A12	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	11.59	989.00	988.25	12.22	1.02	3.53	1.13	0.03
A13	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	11.16	989.00	987.06	11.76	0.99	3.40	1.09	0.03
A14	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	11.06	989.00	986.89	11.66	0.98	3.37	1.08	0.03
A15	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	16.78	989.00	987.06	17.68	1.48	5.11	1.64	0.04
A16	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	35.17	989.00	986.93	37.07	3.11	10.72	3.44	0.09
A17	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	61.75	989.00	986.58	65.08	5.46	18.82	6.05	0.15
A18	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	21.46	989.00	986.75	22.62	1.90	6.54	2.10	0.05
A19	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	13.33	989.00	988.25	14.05	1.18	4.06	1.31	0.03
A20	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	9.73	989.00	986.33	10.25	0.86	2.96	0.95	0.02
A21	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	12.64	989.00	988.25	13.32	1.12	3.85	1.24	0.03
A22	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	4.68	989.00	986.45	4.93	0.41	1.43	0.46	0.01
A23	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	16.55	989.00	987.00	17.44	1.46	5.04	1.62	0.04
A24	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	18.33	989.00	988.25	19.32	1.62	5.59	1.79	0.05
A25	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	120.47	989.00	986.45	126.98	10.65	36.72	11.80	0.30
A26	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	4.35	989.00	988.51	4.58	0.38	1.33	0.43	0.01
A27	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	32.82	989.00	988.51	34.59	2.90	10.00	3.21	0.08
A28	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	32.83	989.00	988.51	34.60	2.90	10.01	3.21	0.08
A29	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	4.22	989.00	988.51	4.45	0.37	1.29	0.41	0.01
A30	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	13.10	989.00	986.00	13.81	1.16	3.99	1.28	0.03
A31	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	36.98	989.00	987.09	38.97	3.27	11.27	3.62	0.09
A32	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	4.71	989.00	988.25	4.96	0.42	1.44	0.46	0.01
A33	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	10.66	989.00	987.00	11.24	0.94	3.25	1.04	0.03
A34	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	32.31	989.00	986.93	34.06	2.86	9.85	3.16	0.08
A35	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	36.16	989.00	988.25	38.11	3.20	11.02	3.54	0.09

A36	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	25.72	989.00	988.51	27.11	2.27	7.84	2.52	0.06
A37	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	10.35	989.00	985.33	10.91	0.91	3.15	1.01	0.03
A38	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	18.39	989.00	985.40	19.39	1.63	5.61	1.80	0.05
A39	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	29.51	989.00	985.35	31.10	2.61	8.99	2.89	0.07
A40	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	37.83	971.00	969.59	39.87	3.34	11.53	3.70	0.09
A41	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	27.01	971.00	969.27	28.47	2.39	8.23	2.64	0.07
A42	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	9.84	971.00	969.60	10.37	0.87	3.00	0.96	0.02
A43	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	4.81	971.00	970.25	5.07	0.43	1.47	0.47	0.01
A44	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	16.61	989.00	988.25	17.51	1.47	5.06	1.63	0.04
A45	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	5.11	989.00	987.21	5.39	0.45	1.56	0.50	0.01
A46	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	14.36	989.00	988.25	15.14	1.27	4.38	1.41	0.04
A47	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	5.22	989.00	988.25	5.50	0.46	1.59	0.51	0.01
A48	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	19.31	989.00	987.21	20.35	1.71	5.89	1.89	0.05
A49	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	102.25	989.00	988.04	107.77	9.04	31.17	10.01	0.26
A50	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	5.86	989.00	988.25	6.18	0.52	1.79	0.57	0.01
A51	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	11.40	989.00	988.25	12.02	1.01	3.47	1.12	0.03
A52	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	14.95	989.00	988.51	15.76	1.32	4.56	1.46	0.04
A53	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	8.77	989.00	988.51	9.24	0.78	2.67	0.86	0.02
A54	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	9.50	989.00	988.25	10.01	0.84	2.90	0.93	0.02
A55	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	6.08	989.00	988.25	6.41	0.54	1.85	0.60	0.02
A56	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	7.41	971.00	969.17	7.81	0.66	2.26	0.73	0.02
A57	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	7.30	971.00	969.28	7.69	0.65	2.22	0.71	0.02
A58	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	7.18	971.00	969.40	7.57	0.64	2.19	0.70	0.02
A59	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	7.04	971.00	969.54	7.42	0.62	2.15	0.69	0.02
A60	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	48.90	971.00	969.50	51.54	4.32	14.90	4.79	0.12
A61	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	60.61	971.00	969.65	63.89	5.36	18.48	5.94	0.15
A62	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	7.31	971.00	969.27	7.70	0.65	2.23	0.72	0.02
A63	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	7.15	971.00	969.43	7.54	0.63	2.18	0.70	0.02
A64	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	7.00	971.00	969.58	7.37	0.62	2.13	0.69	0.02
A65	11405-M-25 (10592)	4"-WD-010R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	6.89	971.00	969.69	7.26	0.61	2.10	0.67	0.02
A66	11405-M-25 (10592)	4"-WD-151R	Waste Disposal	Embedded Pipe	4.50	0.24	4.03	6.00	988.00	985.00	6.32	0.53	1.83	0.59	0.02
A67	10593	20"SI-151R	SI	Embedded Pipe	20.00	0.59	18.81	8.50	989.00	983.00	41.86	16.41	2.59	3.89	0.46
A68	10593	20"SI-151R	SI	Embedded Pipe	20.00	0.59	18.81	8.50	989.00	983.00	41.86	16.41	2.59	3.89	0.46
							TOTAL:	**1435.78**			**1579.13**	**158.24**	**437.63**	**146.71**	**4.48**

APPENDIX E – AUXILIARY BUILDING PENETRATIONS

ID No.	Drawing Ref.	Line ID No.	System	Category	End State	From	To	Description	Sleeve Size (in)	Pipe OD (in)	Wall Thickness (in)	Pipe ID (in)	Length (ft)	Start Elevation	End Elevation	Interior Surf. Area (ft^2)	Void Space Vol. (ft^3)	Length (m)	Interior Surf. Area (m^2)	Void Space Vol. (m^3)
PA-01	60139	19-S-59	flood barrier pen.	wall pen.	unknown	Rm 19 south wall	yard	assumed 12" sleeve	12.00	---	---	12.00	2.00	997.00	997.00	6.28	1.57	0.61	0.58	0.04
PA-02	60139	19-S-60	flood barrier pen.	wall pen.	unknown	Rm 19 south wall	yard	assumed 12" sleeve	12.00	---	---	12.00	2.00	997.00	997.00	6.28	1.57	0.61	0.58	0.04
PA-03	60139, 10753, 10596	20"RW-152	RW	wall pen.	open sleeve	Rm 19 south wall	yard	28"OD Sch40 sleeve	28.00	20.00	---	27.25	2.00	996.00	996.00	14.27	8.10	0.61	1.33	0.23
PA-04	60139, 10753, 10596	20"RW-152	RW	wall pen.	open sleeve	Rm 19 south wall	yard	28"OD Sch40 sleeve	28.00	20.00	---	27.25	2.00	996.00	996.00	14.27	8.10	0.61	1.33	0.23
PA-05	10593	4"WD-010R	WD	wall pen.	pipe in pen.	sub-basement north wall	yard		N/A	4.50	0.24	4.03	2.00	977.50	977.50	2.11	0.18	0.61	0.20	0.01
PA-06	10593	4"WD-010R	WD	wall pen.	pipe in pen.	sub-basement north wall	yard		N/A	4.50	0.24	4.03	2.00	977.50	977.50	2.11	0.18	0.61	0.20	0.01
PA-07	10593	4"WD-010R	WD	wall pen.	pipe in pen.	sub-basement north wall	yard		N/A	4.50	0.24	4.03	2.00	977.50	977.50	2.11	0.18	0.61	0.20	0.01
												TOTAL:	**14.00**			**47.43**	**19.87**	**4.27**	**4.41**	**0.56**

APPENDIX F – CONTAINMENT PENETRATIONS

ID No.	Drawing Ref.	Line ID No.	System	Category	End State	From	To	Sleeve Size (in)	Pipe OD (in)	Wall Thickness (in)	Pipe ID (in)	Length (ft)	Start Elevation	End Elevation	Interior Surf. Area (ft^2)	Void Space Vol. (ft^3)	Length (m)	Interior Surf. Area (m^2)	Void Space Vol. (m^3)
PC-01	10585	24"-SI-151R	Safety Injection	floor/wall pen.	pipe in pen.	Containment	Aux. Bldg	N/A	24.00	0.69	22.62	39.21	991.00	981.50	232.24	109.46	11.95	21.58	3.10
PC-02	10585	24"-SI-151R	Safety Injection	floor/wall pen.	pipe in pen.	Containment	Aux. Bldg	N/A	24.00	0.69	22.62	40.20	991.00	981.50	238.10	112.23	12.25	22.12	3.18
PC-03	10582	1 1/2"AC-152	Nuc. Detector Well	floor/wall pen.	pipe in pen.	Containment	Aux. Bldg	N/A	1.90	0.15	1.61	4.85	998.67	998.67	2.04	0.07	1.48	0.19	0.00
PC-04	10582	3"WD-152R	Vent Header	floor/wall pen.	pipe in pen.	Containment	Aux. Bldg	N/A	3.50	0.22	3.07	4.85	998.67	998.67	3.90	0.25	1.48	0.36	0.01
PC-05	10582	3"FW-1000	Stm Gen Blowdown	floor/wall pen.	pipe in pen.	Containment	Aux. Bldg	N/A	3.50	0.22	3.07	4.85	998.67	998.67	3.90	0.25	1.48	0.36	0.01
PC-06	10582	2"FW-602	Stm Gen Drain	floor/wall pen.	pipe in pen.	Containment	Aux. Bldg	N/A	2.38	0.15	2.07	4.85	998.67	998.67	2.62	0.11	1.48	0.24	0.00
PC-07	10582	1 1/2"AC-152	Nuc. Detector Well	floor/wall pen.	pipe in pen.	Containment	Aux. Bldg	N/A	1.90	0.15	1.61	4.85	998.25	998.25	2.04	0.07	1.48	0.19	0.00
PC-08	10582	3"FW-1000	Stm Gen Blowdown	floor/wall pen.	pipe in pen.	Containment	Aux. Bldg	N/A	3.50	0.22	3.07	4.85	998.67	998.67	3.90	0.25	1.48	0.36	0.01
PC-09	10582	2"FW-602	Stm Gen Drain	floor/wall pen.	pipe in pen.	Containment	Aux. Bldg	N/A	2.38	0.15	2.07	4.85	998.67	998.67	2.62	0.11	1.48	0.24	0.00
PC-10	10582	2"WD-151R	Cont Sump Pumps Disch.	floor/wall pen.	pipe in pen.	Containment	Aux. Bldg	N/A	2.38	0.15	2.07	4.85	998.67	998.67	2.62	0.11	1.48	0.24	0.00
PC-11	10582, 10588	3/4"CH-2501R	RC Pump Bleed Off	floor/wall pen.	pipe in pen.	Containment	Aux. Bldg	N/A	1.05	0.11	0.82	4.85	998.67	998.67	1.05	0.02	1.48	0.10	0.00
PC-12	10582	4"SI-1503R	HP Safety Injection	floor/wall pen.	pipe in pen.	Containment	Aux. Bldg	N/A	4.50	0.24	4.03	4.85	998.69	998.69	5.11	0.43	1.48	0.47	0.01
PC-13	10582	2"CH-2501R	Charging Pump	floor/wall pen.	pipe in pen.	Containment	Aux. Bldg	N/A	2.38	0.15	2.07	5.16	996.33	996.33	2.79	0.12	1.57	0.26	0.00
PC-14	10582	4"SI-2501R	HP Safety Injection	floor/wall pen.	pipe in pen.	Containment	Aux. Bldg	N/A	4.50	0.24	4.03	4.85	998.67	998.67	5.11	0.43	1.48	0.47	0.01
PC-15	10582	2"CH-2501R	Letdown Heat Exch.	floor/wall pen.	pipe in pen.	Containment	Aux. Bldg	N/A	2.38	0.15	2.07	5.16	996.33	996.33	2.79	0.12	1.57	0.26	0.00
											TOTAL:	**143.08**			**510.84**	**224.03**	**43.61**	**47.46**	**6.34**

APPENDIX E – INTAKE STRUCTURE PENETRATIONS

ID No.	Drawing Ref.	Line ID No.	System	Category	End State	From	To	Sleeve Size (in)	Pipe OD (in)	Wall Thickness (in)	Pipe ID (in)	Length (ft)	Start Elevation	End Elevation	Interior Surf. Area (ft^2)	Void Space Vol. (ft^3)	Length (m)	Interior Surf. Area (m^2)	Void Space Vol. (m^3)
PI-01	10723, 21002	---	SW	wall pen.	pipe in pen.	north wall	yard	---	3.50	0.22	3.07	2.83	997.00	997.00	2.27	0.15	0.86	0.21	0.00
PI-02	10723, 21002	---	PW	wall pen.	pipe in pen.	north wall	yard	---	2.38	0.15	2.07	2.83	997.00	997.00	1.53	0.07	0.86	0.14	0.00
PI-03	10723, 21002	---	Spare/Capped	wall pen.	pipe in pen.	north wall	yard	---	2.38	0.15	2.07	2.83	997.00	997.00	1.53	0.07	0.86	0.14	0.00
PI-04	10723, 21002	---	Spare/Capped	wall pen.	pipe in pen.	north wall	yard	---	2.38	0.15	2.07	2.83	997.00	997.00	1.53	0.07	0.86	0.14	0.00
PI-05	10723	12"FP-152	FP	wall pen.	pipe in pen.	north wall	yard	---	12.75	0.38	12.00	2.83	992.50	992.50	8.89	2.22	0.86	0.83	0.06
PI-06	10723, 16532	20"RW-12	RW	wall pen.	pipe in pen.	north wall	yard	---	20.00	0.38	19.25	2.83	990.00	990.00	14.26	5.72	0.86	1.32	0.16
PI-07	16532	---	unknown	wall pen.	pipe in pen.	north wall	yard	---	10.75	0.37	10.02	2.83	992.50	992.50	7.42	1.55	0.86	0.69	0.04
PI-08	10723, 16532, 16535	20"CW-152	CW	wall pen.	pipe in pen.	east AA wall	river	---	20.00	0.38	19.25	2.00	988.50	988.50	10.08	4.04	0.61	0.94	0.11
PI-09	10723, 16532, 16535	18"CW-152	CW	wall pen.	open sleeve	east AA wall	river	24.00	18.00	0.38	24.00	2.00	988.83	988.83	12.57	6.28	0.61	1.17	0.18
PI-10	10723, 16532, 16535	18"CW-152	CW	wall pen.	open sleeve	east AA wall	river	24.00	18.00	0.38	24.00	2.00	988.83	988.83	12.57	6.28	0.61	1.17	0.18
PI-11	10723, 16532, 16535	18"CW-152	CW	wall pen.	open sleeve	east AA wall	river	24.00	18.00	0.38	24.00	2.00	988.83	988.83	12.57	6.28	0.61	1.17	0.18
PI-12	10723, 16532, 16535	18"CW-152	CW	wall pen.	open sleeve	east AA wall	river	24.00	18.00	0.38	24.00	2.00	988.83	988.83	12.57	6.28	0.61	1.17	0.18
PI-13	10723, 16532, 16535	18"CW-152	CW	wall pen.	open sleeve	east AA wall	river	24.00	18.00	0.38	24.00	2.00	988.83	988.83	12.57	6.28	0.61	1.17	0.18
PI-14	10723, 16532, 16535	18"CW-152	CW	wall pen.	open sleeve	east AA wall	river	24.00	18.00	0.38	24.00	2.00	988.83	988.83	12.57	6.28	0.61	1.17	0.18
PI-15	10723, 16532	20"CW-152	CW	wall pen.	pipe in pen.	105 wall	105 wall	---	20.00	0.38	19.25	2.33	988.50	988.50	11.74	4.71	0.71	1.09	0.13
PI-16	10723, 10726	6"VD-152	VD	wall pen.	pipe in pen.	south wall	yard	---	6.63	0.28	6.07	2.83	996.00	996.00	4.49	0.57	0.86	0.42	0.02
PI-17	10723, 10726	3"CA-152	CA	wall pen.	pipe in pen.	south wall	yard	---	3.50	0.22	3.07	2.83	996.00	996.00	2.27	0.15	0.86	0.21	0.00
PI-18	10723	1-1/2"IA-159	IA	wall pen.	pipe in pen.	south wall	yard	---	1.90	0.15	1.61	2.83	996.00	996.00	1.19	0.04	0.86	0.11	0.00
PI-19	10723	1-1/2"PW-152	PW	wall pen.	pipe in pen.	south wall	yard	---	1.90	0.15	1.61	2.83	996.00	996.00	1.19	0.04	0.86	0.11	0.00
PI-20	10723	12"FP-152	FP	wall pen.	pipe in pen.	south wall	yard	---	12.00	0.38	11.25	2.83	996.00	996.00	8.34	1.95	0.86	0.77	0.06
PI-21	10723, 11405-M-320, 10760	10"RIC-WIL	RIC-WIL	wall pen.	pipe in pen.	south wall	yard	---	10.75	0.37	10.02	2.83	996.00	996.00	7.42	1.55	0.86	0.69	0.04
PI-22	10723	20"RW-152	RW	wall pen.	pipe in pen.	south wall	yard	---	20.00	0.38	19.25	2.83	994.53	994.53	14.26	5.72	0.86	1.32	0.16
PI-23	10723, 10726, 16539	2"VD-152	VD	wall pen.	pipe in pen.	west wall	intake tunnel	---	2.38	0.15	2.07	2.33	1000.42	1000.42	1.26	0.05	0.71	0.12	0.00
PI-24	10723, 10726, 16539	2"VD-152	VD	wall pen.	pipe in pen.	west wall	intake tunnel	---	2.38	0.15	2.07	2.33	1000.42	1000.42	1.26	0.05	0.71	0.12	0.00
PI-25	10723, 10726, 16539	24"CW-152	CW	wall pen.	pipe in pen.	west wall	intake tunnel	---	24.00	0.38	23.25	2.33	998.75	998.75	14.18	6.87	0.71	1.32	0.19
PI-26	10723, 10726, 16539	2"VD-152	VD	wall pen.	pipe in pen.	west wall	intake tunnel	---	2.38	0.15	2.07	2.33	1000.42	1000.42	1.26	0.05	0.71	0.12	0.00
PI-27	10723, 10726, 16539	84"I.D. CW-152	CW	wall pen.	pipe in pen.	west wall	intake tunnel	---	---	---	84.00	2.33	996.25	996.25	51.24	89.67	0.71	4.76	2.54
PI-28	10723, 10726, 16539	84"I.D. CW-152	CW	wall pen.	pipe in pen.	west wall	intake tunnel	---	---	---	84.00	2.33	996.25	996.25	51.24	89.67	0.71	4.76	2.54

PI-29	10723, 10726, 16539	84"I.D. CW-152	CW	wall pen.	pipe in pen.	west wall	intake tunnel	---	---	---	84.00	2.33	996.25	996.25	51.24	89.67	0.71	4.76	2.54
PI-30	16539	2"VD-152	VD	wall pen.	pipe in pen.	intake tunnel	west wall	---	2.38	0.15	2.07	2.33	1000.42	1000.42	1.26	0.05	0.71	0.12	0.00
PI-31	16539	2"VD-152	VD	wall pen.	pipe in pen.	intake tunnel	west wall	---	2.38	0.15	2.07	2.33	1000.42	1000.42	1.26	0.05	0.71	0.12	0.00
PI-32	16539, 48183	24"CW-152	CW	wall pen.	3'x3' opening	intake tunnel	west wall	---	---	---	---	2.33	998.75	998.75	27.96	20.97	0.71	2.60	0.59
PI-33	16539	2"VD-152	VD	wall pen.	pipe in pen.	intake tunnel	west wall	---	2.38	0.15	2.07	2.33	1000.42	1000.42	1.26	0.05	0.71	0.12	0.00
PI-34	16539	84"I.D. CW-152	CW	wall pen.	8'x10' opening	intake tunnel	west wall	---	---	---	---	2.33	996.25	996.25	83.88	186.40	0.71	7.79	5.28
PI-35	16539	84"I.D. CW-152	CW	wall pen.	8'x10' opening	intake tunnel	west wall	---	---	---	---	2.33	996.25	996.25	83.88	186.40	0.71	7.79	5.28
PI-36	16539	84"I.D. CW-152	CW	wall pen.	8'x8' opening	intake tunnel	west wall	---	---	---	---	2.33	996.25	996.25	74.56	149.12	0.71	6.93	4.22
											TOTAL:	**88.57**			**619.58**	**885.39**	**27.00**	**57.56**	**25.07**