COUNTY OF WESTCHESTER
NEW YORK

DEPARTMENT OF PUBLIC WORKS
AND TRANSPORTATION

DIVISION OF ENGINEERING

ADDENDUM NO. 2

CONTRACT NO. 22-526

FOR

REHABILITATION OF WEAVER STREET PUMPING STATION
MAMARONECK VALLEY SANITARY SEWER DISTRICT
TOWN OF MAMARONECK,
NEW YORK

The attention of the bidders is directed to the following changes, additions, and/or substitutions affecting the above-referenced contract(s).

A. RE: GENERAL CONTRACT INFORMATION:

ITEM 1: BIDDERS' QUESTIONS AND RESPONSES

Attached hereto.

ITEM 2: PROPOSAL PAGES

DELETE Proposal Pages 6.1 and 6.2 and **REPLACE** with those included in Attachment 1

ITEM 3: SPECIFICATION TABLE OF CONTENTS

Under Division 2 – Existing Conditions, **ADD**:

"Section 02 82 33 Removal and Disposal of ACM 02 82 33-1 to -24"

ITEM 4: SPECIFICATION TABLE OF CONTENTS

Under Section 26 32 13 Packaged Engine Generator System **DELETE** the words "125kW" and **REPLACE** with "150kW".

ITEM 5: BORING LOG AND GEOTECHNICAL TESTING RESULTS

Included as Attachment 2 for informational and reference purposes only.

B. RE: THE SPECIFICATIONS:

ITEM 1: Section 01 22 13 MEASUREMENT AND PAYMENT

After paragraph 1.4, H, **INSERT** new paragraph I as follows and renumber subsequent paragraphs accordingly:

"I. Item 9 – Concrete Drilled Piers:

1. Measurement: Quantity of concrete drilled pier installation that will be paid under this item will be the computed vertical linear footage completed as shown, indicated, or directed by ENGINEER.
2. Payment: Unit price per vertical linear foot for Item 9 will be full compensation for all concrete drilled pier installation, complete as directed by ENGINEER, and not specifically included under other items or contracts."

ITEM 2: Section 02 82 33 REMOVAL AND DISPOSAL OF ASBESTOS-CONTAINING MATERIAL

ADD "Section 02 82 33 Removal and Disposal of Asbestos-Containing Material" in its entirety included in Attachment 3.

ITEM 3: Section 07 11 13 BITUMINOUS DAMPPROOFING, Paragraph 1.1.A.2

DELETE "Extent of bituminous dampproofing is shown." and **REPLACE** with: "Contractor shall apply bituminous dampproofing to the exterior surfaces of the backup CMU block walls of the Electrical Building/Room."

ITEM 4: Section 26 32 13 PACKAGED ENGINE GENERATOR SYSTEMS – 125Kw DIESEL

DELETE Section in its entirety and **REPLACE** with "Section 26 32 13 – Packaged Engine Generator Systems – 150 kW" included in Attachment 4.

ITEM 5: Section 40 60 05 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS, Paragraph 1.3.A.1.f

ADD paragraph 1.3.A.1.f.3) as follows:

"3) Or equal."

C. RE: THE DRAWINGS:

ITEM 1: Drawing S-001, GENERAL NOTES AND ABBREVIATIONS, FOUNDATIONS NOTES:

DELETE Note F-1 A) and REPLACE with "REFER TO BORING LOG AND GEOTECHNICAL TESTING RESULTS PERFORMED BY JERSEY BORING THAT SERVED AS A BASIS FOR FOUNDATION DESIGN CRITIERA."

ITEM 2: Drawing S-006, SECTIONS, SECTION 1:

DELETE "4'-MIN EMBEDMENT" callout on Section 1 and **REPLACE** with: "PROVIDE 6-INCH EMBEDMENT PER DRILLED PIER DETAIL ON S-007".

ALL PROVISIONS OF THE CONTRACT NOT AFFECTED BY THE FOREGOING SHALL REMAIN IN FULL FORCE AND EFFECT.

COUNTY OF WESTCHESTER
DEPARTMENT OF PUBLIC WORKS
AND TRANSPORTATION

By: Hugh J. Greechan, Jr., P.E.
Commissioner

Dated: September 20, 2024
WHITE PLAINS, NEW YORK

BIDDERS' QUESTIONS AND RESPONSES

BIDDERS' QUESTIONS AND RESPONSES

CONTRACT NO. 22-526
REHABILITATION OF WEAVER STREET PUMPING STATION
MAMARONECK VALLEY SANITARY SEWER DISTRICT
TOWN OF MAMARONECK, NEW YORK

To All Contractors:

Contractors submitting proposals for the above-named project shall take note of the following changes, additions, deletions, clarifications, etc., in the Contract Documents, which shall become a part of and have precedence over anything contrarily shown or described in the Contract Documents, and all such shall be taken into consideration and be included in the Contractor's bid proposal.

Below are the ***Questions*** that have been submitted with **Responses**:

Question 1: Please provide subsurface geotechnical information for the work area.
Response: Please see Attachment 2 for boring log and testing results. This information is being provided for reference only and is expressly excluded from the Contract.

Question 2: The bid sheet provided on Proposal Page 6.2 does not include a dollar value for the Miscellaneous Additional Work bid item W800.
Response: Please see Attachment 1 for the re-issued Proposal Page.

Question 3: There are no proposed MWBE or DBE goals provided in the bid documents. Please confirm the contract requirements.
Response: There is no set goal for this project, however, MWBE and DBE participation is encouraged. Please refer to the "Minority Participation Policy" included in the Special Notices of the Contract and Information for Bidders Article 36.

Question 4: There are no American Iron & Steel (AIS) or Build America Buy America (BABA) requirements provided in the bid documents. Please confirm the contract requirements.
Response: The project is not subject to American Iron & Steel (AIS) or Build American Buy America Act (BABAA) requirements.

Question 5: Drawing S-005, S-006 & S-007 Show the proposed Drilled Concrete Piles. Could you please Clarify the proposed Depth? Will Sacrificial pile be required for this project? will load test be required for this project? if yes how many? Any boring Log or soil Details?
Response: The drilled piles shall be installed such that they are embedded 5' into bedrock as shown on the "Typical Drilled Concrete Pier Detail" on Drawing S-007. The driller encountered bedrock at 15 feet depth during the design phase. Please refer to the revised Specifications of this Addendum for added unit prices to cover the drilled concrete piles. Sacrificial piles will not be required. One load test is required as outlined in Section 31 63 29 paragraph 3.3. Please see Attachment 2 for boring log and testing results. This information is being provided for reference only and is expressly excluded from the Contract.

Question 6: The technical specifications for the Weaver Street Pumping Station include an Exhibit A titled *Hazardous Materials Inventory Report for the Fenimore Road, Weaver Street, Archville, and Country Club Lane Pumping Stations*. This exhibit notes areas of the Weaver Street Pump station that contain asbestos and lead. The specifications include Section 02 83 19 titled Lead Management but no specifications relating to asbestos management. Please provide information/specification on removing and managing the asbestos

Response: Please see Attachment 3 for specification Section 02 82 33 - Removal and Disposal of Asbestos-Containing Material.

Question 7: Please indicate the minority participating goals (MBWE participation percentages) for this project.

Response: There is no set goal for this project, however, MWBE and DBE participation is encouraged. Please refer to the "Minority Participation Policy" included in the Special Notices of the Contract and Information for Bidders Article 36.

Question 8: Please indicate if this project is funded under the NY State Revolving Fund and, if so, please provide the SRF information related to minority participation requirements, American Iron and Steel requirements, etc.

Response: No - the project is not funded by the NY State Revolving Fund.

Question 9: Drawing S-007 shows a detail titled "TYPICAL DRILLED CONCRETE PIER DETAIL" that calls for "min 5'-0" embedment in bedrock". Please provide a soils report or other information with approximate depth to bedrock in order for us to properly estimate the cost of the drilled concrete piers. It's impossible to bid this work without an approximate depth to bedrock.

Response: The drilled piles shall be installed such that they are embedded 5' into bedrock as shown on the "Typical Drilled Concrete Pier Detail" on Drawing S-007. The driller encountered bedrock at 15 feet depth during the design phase. Please refer to the revised Specifications of this Addendum for added unit prices to cover the drilled concrete piles. Please see Attachment 2 for boring log and testing results. This information is being provided for reference only and is expressly excluded from the Contract.

Question 10: Please provide a soils report that includes approximate depth to groundwater in order for us to price the groundwater dewatering system (if any) required to facilitate the excavation work required for the new concrete structure.

Response: Please see Attachment 2 for boring log and testing results. This information is being provided for reference only and is expressly excluded from the Contract. Please refer to Section 31 63 29 paragraph 3.2.B.3 for direction on protecting the drilled concrete piers from water intrusion.

Question 11: In the drawing 205-03-E-128-0, it states 150 KW, however in the specs, section 263213, page 7, paragraph 2.1, it states the Cummins model C125D6C which is a 125 KW. Can you please send the required ratings?

Response: A 150 kW generator shall be provided. Refer to the revised Specifications of this Addendum.

Question 12: Please provide the pipe material and static pressure of the existing 12" force main.

Response: The existing force main is 12” cast iron pipe.

Question 13: The table in Specification 01 51 41, page 4, provides the pump capacity of the bypass system. Please provide the expected minimum and average flow rates.

Response: The expected average flow rate is between 0.4 and 0.6 MGD.

Question 14: Refer to contract drawings S-005 thru S-007. Regarding the new concrete slab below the electrical building and generator, please confirm the design intent is a self-supported slab, and we are not to backfill within the foundation area and pour the slab on grade.

Response: The slab under the electrical and the generator is self-supported and does not require backfill under it.

Question 15: Will Verizon relocate their overhead service or is the contractor responsible to relocate the wires and install a new pole?

Response: Contractor is responsible to coordinate relocation of existing overhead telephone services with Verizon. Contractor is responsible for furnishing and installing the new utility pole.

Question 16: Please provide the estimate weight of the existing 125kW Emergency generator.

Response: The weight of the existing 125kW generator is not known. Contractor shall verify in field. Engineer's estimate is 10,000 lbs.

Question 17: Please clarify the surfaces which require the application of the bituminous dampproofing, as specified in 07 11 13. There are no surfaces shown on the contract drawings.

Response: Provide dampproofing specified under specification 07 11 13 to exterior surfaces of backup CMU block walls at the Electrical Building. Coordinate with specification 07 11 13, articles 3.3, C & 3.4, A.

Question 18: Please provide the Arcadis Geotechnical Report as referenced on drawing S-001 (sheet 24 of 103), note F-1 A).

Response: Please see Attachment 2 for boring log and testing results. This information is being provided for reference only and is expressly excluded from the Contract.

Question 19: Section 1/S-004 on Dwg #29 indicates a minimum 4" top of pile embedment into the foundation slab, while the Typical Drilled Concrete Pier Detail on Dwg #30 shows a 6" embedment. Please confirm which is the required embedment.

Response: The minimum required embedment is 6 inches per the Typical Drilled Concrete Pier Detail shown on sheet S-007.

Question 20: Per Special Notice on Minority Participation Policy, Contractors must comply with the County's Minority Participation Policy, including, but not limited to, the requirement that contractors make a demonstrated good faith effort to utilize M/WBE. The link provided (http://mwbe.westcestergov.com) does not work. Please provide updated Link.

Response: Please reference the updated link: https://publicworks.westchestergov.com/contractors/mbe-and-wbe-contractors

Question 21: Per Special Notice on Minority Participation Policy, Contractors must comply with the County's Minority Participation Policy, including, but not limited to, the requirement that contractors make a demonstrated good faith effort to utilize M/WBE. Please advise if there is a participation percent requirement for M/WBE on this project.

Response: There is no set goal for this project, however, MWBE and DBE participation is encouraged. Please refer to the "Minority Participation Policy" included in the Special Notices of the Contract and Information for Bidders Article 36.

Question 22: There are 2 controls vendors specified in section 50 60 05. Will an equivalent I&C subcontractor be allowed if they can meet the qualifications listed?

Response: An 'or-equal' can be submitted in accordance with the General Clauses.

ATTACHMENTS

ATTACHMENT 1 – PROPOSAL PAGE 6

ITEMIZED PROPOSAL

ITEM NO.	DESCRIPTION	QUANTITY	PAY UNIT	UNIT BID PRICE		AMOUNT BID	
				DOLLARS	CENTS	DOLLARS	CENTS
1	Restoration Work: For providing all labor, material and equipment necessary to complete all Work to replace items damaged by Hurricane Ida as outlined in Section 01 22 23, Measurement and Payment and as shown on the Contract Drawings and Specifications	NEC	L.S.			$	
2	Mitigation Work: For providing all labor, material and equipment necessary to complete all Work to provide future resiliency as outlined in Section 01 22 23, Measurement and Payment and as shown on the Contract Drawings and Specifications	NEC	L.S.			$	
3	All Other Work: For providing all labor, material and equipment necessary to complete all other Work as outlined in Section 01 22 23, Measurement and Payment and as shown on the Contract Drawings and Specifications	NEC	L.S.			$	
4	Typical Concrete Surface Repair – Type 1	300	S.F.	$		$	
5	Non Structural Crack Repair – Type 2	20	L.F.	$		$	
6	Structural Crack Repair – Type 3	10	L.F.	$		$	

ITEM NO.	DESCRIPTION	QUANTITY	PAY UNIT	UNIT BID PRICE		AMOUNT BID	
				DOLLARS	CENTS	DOLLARS	CENTS
7	Typical Exposed Aggregate Repair – Type 4	20	S.F	$		$	
8	Typical Expansion Joint Repair – Type 5	10	L.F.	$		$	
9	Concrete Drilled Piers	210	V.L.F.	$		$	
SUBTOTAL OF ALL ABOVE ITEMS							
W699.020001	Mobilization (Must not exceed 2.00% of Subtotal Shown Above)	NEC	L.S.				
W699.040002	Contract Bonds and Insurance (Must not exceed 3.00% of Subtotal Shown Above)	NEC	L.S.				
W800	Necessary for Miscellaneous Additional Work per Article "Miscellaneous Additional Work (Item W-800)" of Information for Bidders, as directed	NEC	L.S.			$600,000	00
						DOLLARS	CENTS
				GROSS SUM OF TOTAL BID		$	

CONTRACTOR: _____

ADDRESS: _____

_____

BY: _____

Signature/Title

ATTACHMENT 2 – BORING LOG AND GEOTECHNICAL TESTING RESULTS

JERSEY BORING & DRILLING CO., INC.	TEST BORING LOGS	BORING NO. B-1

PROJECT: Weaver Pump Station — SHT. NO. 1 of
CLIENT: Aradis — JOB NO. 21-077
LOCATION: Cargill Rock Rd Leechmere NY — ELEVATION
GROUND WATER — PERMIT NO.

DATE	TIME	DEPTH	CASING	TYPE	CAS.	SAMP.	CORE	TUBE
		4'	well	DIA.	4	2		
				WT.	140	140		
				FALL	Auto	Auto		

DATE START 3-29-22
DATE FINISH 3-29-22
DRILLER Flynn
INSPECTOR

DEPTH FEET	CASING BLOWS	SAMPLE NO.	BLOWS ON SAMPLE SPOON PER 6"	SAMPLE RECOVERY	IDENTIFICATION	REMARKS
1					6" Black Top	
2		1	3		Grey m-f Sand & Silt	
3			6 4 4		Some F-m GVL	
4						NOTE: Incomplete boring logs as prepared by the driller in the field.
5						
6		2	5 15		Br m-f Sand & c Sand	
7			9 14		& Silt some m-f GVL	
8						All boreholes grouted to completion. No
9						2 hole plugs
10						
11		3	1 2		Same	
12			2 2			
13						
14						
15						
16					C#1 15 to 20' Rec 60"	
17						
18						
19					EOB 20'	
20						
21						
22						
23						
24						
25						
26						
27						

TerraSense

45H Commerce Way, Totowa, NJ 07512
973.812.1818
terrasenselab.com

07/06/2022
TerraSense Project Number: 22005504A

Chelsea F. Catchpole, PE, CDT®
Senior Water Engineer
ARCADIS of New York, Inc.
44 South Broadway, Suite 1200
White Plains, NY 10601

Dear Ms. Catchpole:

Re: Laboratory Test Results for 30108362 – Weaver St. Pumping Station

The purpose of this letter is to present the results of the laboratory tests performed on a sample delivered to the TerraSense laboratory on 06/16/2022 by Jersey boring and Drilling Co., Inc. Testing was performed based on an assignment dated 06/15/2022 by Mr. Michael Musso (ARCADIS).

Test Results
Test results are reported on the accompanying test pages.

Test Comments
Testing was performed in general accordance with ASTM or other methods as listed on the test pages. Deviations from the test standards are noted on these pages.

Limitations
Our professional services for this project have been performed in accordance with generally accepted engineering practices; no other warranty, expressed or implied, is made.

Sample Disposition
If we do not receive other instructions from you within thirty days, this material will be disposed.

If you have any questions concerning the test results reported in this letter, please call us.
Sincerely,

Drew Mazujian
Project Manager

Attachment: (2 sheets)

220005504A-8051

LABORATORY TEST ASSIGNMENT AND TRACKING SHEET

Project Number: 30108362 Task Number: 250 Assigned by: Michael Musso, Arcadis Office: Date Assigned: 6/15/22

Project Name: Weaver St Pumping Station Assignment Number: Due Date:

Any known or suspected contamination of the material (yes or no)? No If yes, HASP required for testing to proceed.

SAMPLE IDENTIFICATION				INDEX TESTS										ENGINEERING PROPERTY TESTS												
Exploration (1) Number	Run Number	Sample (2) Depth (ft)	Sample Type (3)	Visual Classification	Moh's Hardness	Water Content	Unit Weight	Saturated Water Content (absorption/apparent porosity)	Bulk Specific Gravity	Porosity	Rebound hardness (Schmidt Hammer)	Cerchar Abrasion Index			Slake Durability	Brazilian Splitting Tensile test	Direct Tensile Test	Point Load Test	Unconfined Compression	Unconfined Compression with Modulus	Direct Shear	Normal Stresses	Triaxial Strength	Normal Stresses	Permeability with Air	Normal Stresses	
				D2488		D2216						D7625			D4644	D2967	D2936		D7012	D7012	D5607		D7012		D4525		
				VC	Mo	w	UW	w_{sat}	Gb	Po	R_H	CA			SL				UCr	Ucm							
B-1	C#1	15-20'	C																							

Send invoices to:
Chelsea Catchpole
Chelsea.Catchpole@arcadis.com

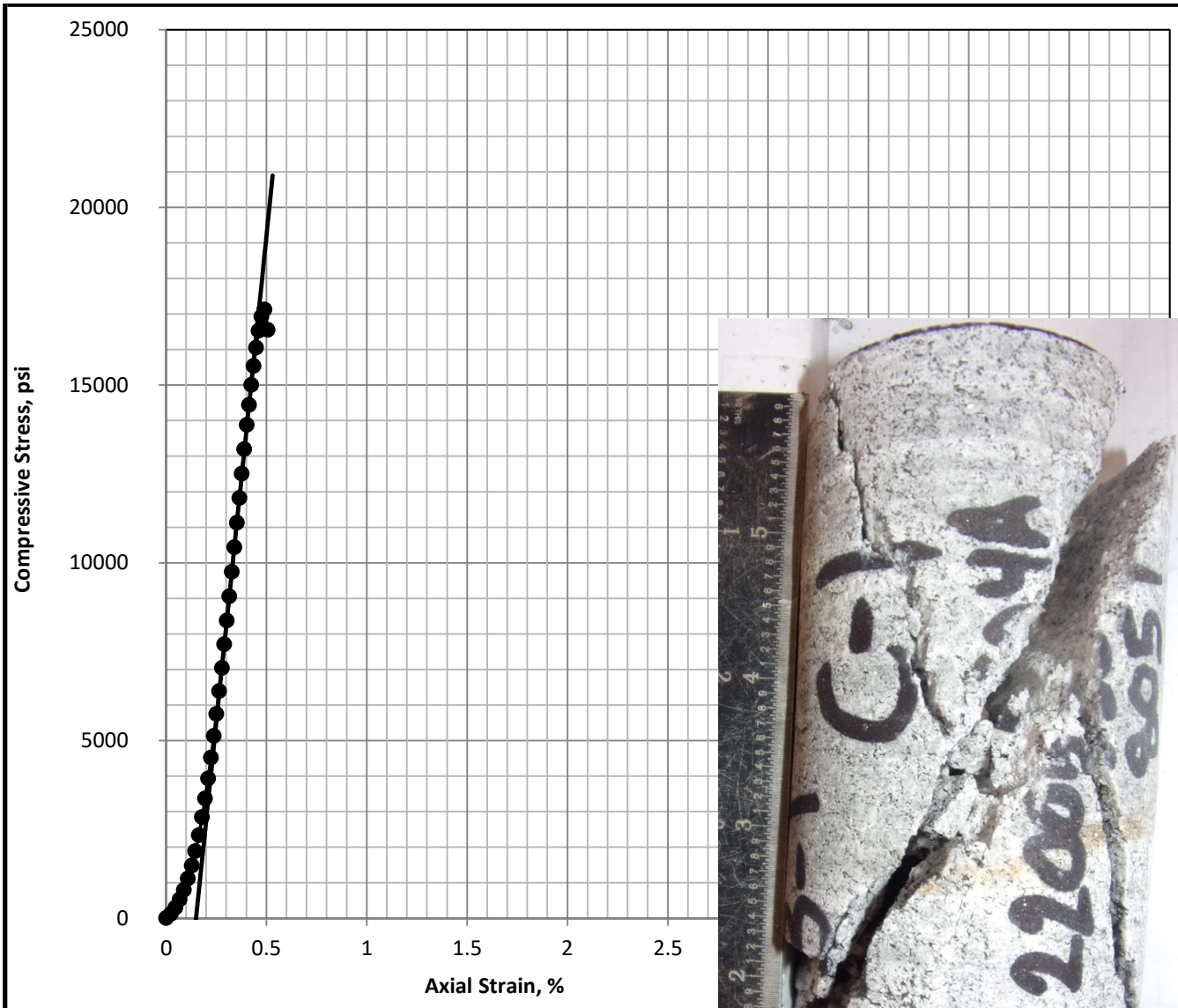
NOTES: 1. Exploration Number = designation for boring, test pit, etc. 2. Give range or average depth. 3. See details

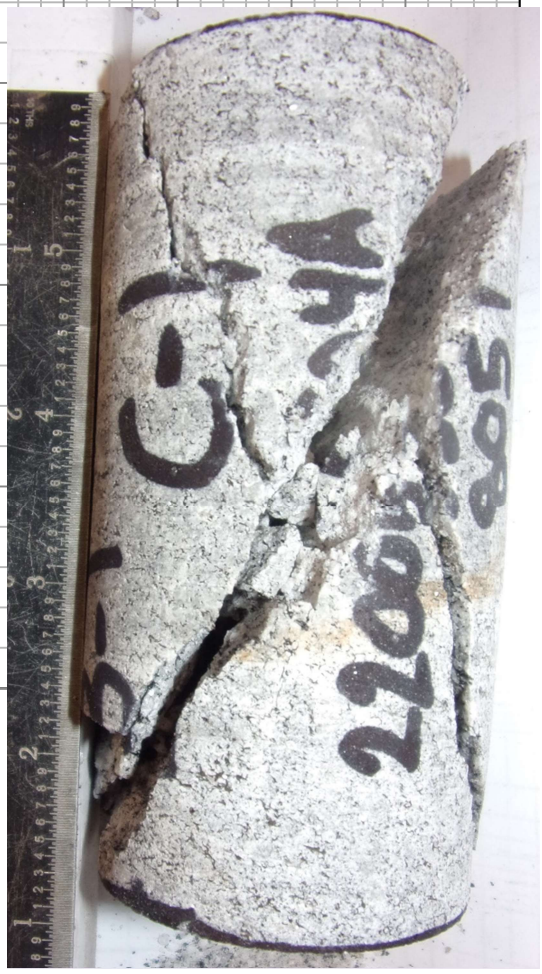
Key: Test Status Key (shown by symbol or letter key): Guide to Test Specifications and Instructions

TEST ASSIGNED (1) TEST IN PROGRESS (1) TEST COMPLETED (1) TEST FINALIZED (1)

Relinquished by:	Date:	Received by:	Track#	Date:	Received at lab by: AZ	Date: 6/16/22

TerraSense, LLC
45H Commerce Way, Totowa, NJ 07512
(973)-812-1818





Specimen Information

Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Length (inch)	Diameter (inch)
0.07	166	166	4.457	2.039

Specimen does not meet ASTM D4543 shape tolerances for side straightness

FAILURE PHOTO

Test Summary

Strain Rate (%/min)	Corrected Strain to Peak (%)	q_u (psi)	Estimated (shown) Elastic Modulus (psi)
0.11	0.34	17130	5E+06

Test by: RT
Test Date: Jun-28-22
Reviewed by: DM

ARCADIS
Project # 30108362

TerraSense
Project # 22005504A

Weaver St Pumping Station

COMPRESSIVE STRESS VS STRAIN
UNCONFINED COMPRESSIVE STRENGTH TEST

Boring: B-1 Run: C-1
Depth 16.8-17.2 ft.

ATTACHMENT 3 – SPECIFICATION 02 82 33 – REMOVAL AND DISPOSAL OF ASBESTOS CONTAINNG MATERIAL

SECTION 02 82 33

REMOVAL AND DISPOSAL OF ASBESTOS-CONTAINING MATERIAL

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Contractor shall provide all labor, equipment, tools, materials, notifications, and permits required to remove and dispose of asbestos-containing material (ACM) specified, or required to complete the Work, in accordance with Laws and Regulations.
   2. ACM identified at the Site is indicated in the Hazardous Materials Inventory Report for the Fenimore Road, Weaver Street, and Country Club Lane Pumping Stations as included in Exhibit A.
   3. ACM Evaluation, Removal, and Disposal Work under Lump Sum:
      a. Engineer's consultant performed evaluations and testing for ACM. The following areas of the Site that involve Work found to contain ACM that shall be removed and disposed of under the appropriate pumping station lump sum:
         1) None.
      b. Under Bid Item No. 3,retain services of a qualified testing laboratory licensed to perform testing to determine whether materials in the Work contain ACM, including, but not limited to the materials listed for Weaver Street Pumping Station in Table 6 of the Fenimore Road, Weaver Street, and Country Club Lane Pumping Stations as included in Exhibit A.
   4. Potential ACM Removal and Disposal Under Bid Item W800, Miscellaneous Additional Work:
      a. The following areas of the Work, if found to contain ACM, shall be removed and disposed of under Bid Item W800, Miscellaneous Additional Work:
         1) The materials listed for Weaver Street Pumping Station in Table 6 of the Fenimore Road, Weaver Street, and Country Club Lane Pumping Stations as included in Exhibit A.
      b. If ACM is found to exist in the above areas or other areas of the Project, prepare and submit MAW Request to Engineer for costs associated with removing and disposal of the associated ACM. Such Work, when authorized, will be under Bid Item W800, Miscellaneous Additional Work.
   5. Contractor shall remove all ACM in materials and equipment to be demolished or removed as part of the Work, in accordance with this Section, related work specified under other Sections, and Laws and Regulations.
   6. Perform removal and disposal of ACM, including preparation, removal, cleaning, storage, transport, and disposal of ACM without damaging or

contaminating adjacent work areas. Where such work areas are damaged or contaminated, Contractor shall restore the work areas to their original condition.

7. Contractor shall be responsible for the safe and proper handling of friable and non-friable materials containing or contaminated with asbestos, and take all necessary precautions to protect workers, work areas, and others at the Site from contact with asbestos fibers, whether airborne or otherwise.

B. Coordination:
   1. Coordinate and review subsequent demolition Work specified under other Sections and coordinate such work with the Work under this Section.

1.2 REFERENCES

A. Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. ANSI/AIHA Z9.2, Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems.
   2. ANSI/ISEA Z87.1, Occupational and Educational Eye and Protection Devices.
   3. ANSI Z88.2, Respiratory Protection.
   4. ASTM D4397, Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
   5. ASTM E84, Test Method for Surface Burning Characteristics of Building Materials.
   6. ASTM E119, Test Methods for Fire Tests of Building Construction and Materials.
   7. ASTM E1368, Practice for Visual Inspection of Asbestos Abatement Projects.
   8. NFPA 10, Portable Fire Extinguishers.
   9. NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
   10. NFPA 101, Life Safety Code.
   11. NFPA 701, Methods of Fire Tests for Flame Propagation of Textiles and Films.
   12. NIOSH NMAM, NIOSH Manual of Analytical Methods.
   13. UL 586, High-Efficiency, Particulate, Air Filter Units.
   14. USEPA 340/1-90-018, Asbestos/NESHAP Regulated Asbestos Containing Materials Guidance.
   15. USEPA 340/1-90-019, Asbestos/NESHAP Adequately Wet Guidance.
   16. USEPA 560/5-85-024, Guidance for Controlling Asbestos Containing Materials in Building.

1.3 TERMINOLOGY

A. The following words or terms are not defined but, when used in this Section, have the following meaning:
   1. “Adequately wet”: A term as defined in 40 CFR Part 61, Subpart M and USEPA 340/1-90-019 that means to sufficiently mix or penetrate with liquid to prevent the release of particulates. If visible emissions are observed coming

from ACM, then that material has not been adequately wetted. However, the absence of visible emissions is not sufficient evidence of being adequately wetted.

2. "Amended water": Water containing a wetting agent or surfactant with a surface tension of at least 29 dynes per square centimeter when tested in accordance with ASTM D1331.
3. "Area air monitoring": Sampling of asbestos fiber concentrations within the asbestos control area and outside of the asbestos control area, which is representative of the airborne concentrations of asbestos fibers that may reach the breathing zone.
4. "Asbestos" is a term defined in the General Conditions.
5. "Asbestos-containing material" or "ACM": Material composed of asbestos of any type in an amount greater than one percent by weight, either alone or mixed with other fibrous or non-fibrous materials, as determined using the method specified in 40 CFR Part 763, Appendix A, Subpart F, Section 1, Polarized Light Microscopy.
6. "Asbestos control area": An area where asbestos removal operations are performed which is isolated by physical boundaries to prevent the spread of asbestos dust, fibers, and debris.
7. "Class I Asbestos Work": Activities involving the removal of thermal systems insulation, surfacing ACM and PACM.
8. "Class II Asbestos Work": Means activities involving the removal of ACM, that is not thermal system insulation or surfacing material. Class II includes, but is not limited to, removal of asbestos-containing wallboard, floor tile, and sheeting, roofing and siding shingles, and construction mastics.
9. "Class III Asbestos Work": Means repair and maintenance operations, where ACM, including TSI and surfacing ACM and PACM, may be disturbed.
10. "Class IV Asbestos Work": Means maintenance and custodial activities during which employees contact but do not disturb ACM and PACM and activities to clean up dust, waste, and debris resulting from Class I, II, and III asbestos Work.
11. "Competent person": In addition to the definition in 29 CFR 1926.32(f), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f). In addition, for Class I and Class II asbestos Work, one who is specially trained in a training course that complies with the criteria of USEPA's Model Accreditation Plan (40 CFR 763) for supervisor, or its equivalent; for Class II asbestos roofing Work who is specially trained in a comprehensive course for the roofing trade that has been conducted by a USEPA or state-approved trainer, certified by the USEPA or MDCIS; and for Class II and IV asbestos Work, who is trained in an operations and maintenance (O&M) course developed by USEPA under 40 CFR 763.92 (a)(2).
12. "Controlled demolition": Contractor operations or activities abiding by the asbestos control protocols of the Contract Documents. Such operations or activities include those that have the potential to disturb asbestos-containing

materials.

13. "Encapsulant": An agent that seals the surface (bridging encapsulant) or penetrates the bulk (penetrating encapsulant) of ACM.
14. "Excursion limit": No person at any time, shall be exposed to airborne concentrations of asbestos fibers that are equal to or greater than 1.0 fibers per cubic centimeter of air (cm^3), averaged over a 30-minute time weighted average.
15. "Friable Asbestos": As defined in 40 CFR Part 61, Subpart M and USEPA 340/1-90-018, meaning any and all ACM that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure, including previously non-friable material that becomes damaged to the extent that when dry, may be easily crumbled, pulverized, or reduced to powder by hand pressure.
16. "HEPA filter": A high-efficiency particulate air filter capable of removing particles 0.3 microns or larger in diameter with 99.97 percent efficiency.
17. "Negative pressure enclosure" or "NPE": An asbestos abatement-regulated area in which critical barriers, polyethylene sheeting walls and floor are installed and sealed air-tight. A minimum pressure differential of minus 0.02 inches of water column relative to adjacent unsealed areas and four air charges per hour shall be maintained within the NPE continuously 24 hours per day.
18. "Non-friable Asbestos": As defined in CFR 40 Part 61, Subpart M and USEPA 340/1-90-018 that means asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products.
19. "Non-Friable ACM Category I": As defined in CFR 40 Part 61, Subpart M and USEPA 340/1-90-018 that means ACM material, excluding Category 1 non-friable ACM that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.
20. "Personal air monitoring": Sampling of asbestos fiber concentrations within the breathing zone of a person to establish OSHA PEL values.
21. "Permissible exposure limit" or "PEL": No person shall be exposed to airborne concentrations of asbestos fibers that are equal to or greater than 0.1 fibers per cubic centimeter of air (cm^3), averaged over an eight-hour time weighted average.
22. "Presumed ACM" or "PACM": Presumed ACM that is thermal system insulation and surfacing material found in buildings constructed no later than 1980. The designation of a material as "PACM" may be rebutted pursuant to paragraph (k)(4) of 29 CFR 1926.1101.
23. "Regulated area": Area established by the employer to demarcate areas where Class I, II, and III asbestos Work is conducted, and adjoining area(s) where debris and waste from such asbestos Work accumulate; and a work area within which airborne concentrations of asbestos, exceed or there is a reasonable possibility they may exceed the permissible exposure limit. Requirements for regulated areas are in paragraph (e)(6) of 29 CFR 1926.1101.
24. "Time weighted average" or "TWA": The average concentration of a contaminant in the air during a specific time period.
25. "Thermal system insulation" or "TSI": ACM applied to piping, valves, boilers, breaching, tanks, ducts or other equipment or structural components to prevent heat loss or gain. TSI ACM is thermal system insulation which contains more

than one percent asbestos.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Testing Laboratory:
      a. Testing laboratory shall be experienced with inspection of and testing and evaluation for ACM, and shall be licensed for asbestos work in the jurisdiction where the Project is located.
      b. Testing laboratory shall be AIHA- and NVLAP-accredited, and shall use ELAP 198.4, and NIOSH 7400 and PAT methodologies.
      c. Submit name, address, phone number, and website address for testing laboratory, including copies of associated certifications of laboratory by accrediting agencies.
   2. ACM Removal and Disposal Subcontractor:
      a. ACM removal and disposal Subcontractor engaging in asbestos removal and disposal shall be certified in accordance with New York Codes, Rules and Regulations, Title 12, Part 56, Subpart 56-3.
      b. Subcontractor shall have successfully completed at least three projects of comparable size and scope as the ACM removal and disposal Work on this Project within the past three years.
      c. Submit Subcontractor qualifications including listing of completed past asbestos removal and disposal projects, and current, ongoing projects, with the following submitted for each such project: name, address, and phone number for responsible individual of owner of facility, type of facility, name, address, and phone number of prime contractor that hired Subcontractor (as applicable) with name of the competent person in responsible charge of the work for that contractor, volume of ACM removed, and approximate value of the ACM removal and disposal work for which Subcontractor was responsible.
      d. Competent Person:
         1) Subcontractor shall have on staff as a full-time employee and shall assign to the Project a competent person with not less than three years experience in removing and disposing of ACM, and who has at least five years experience in construction trades, and who has served as the competent person in responsible charge of not less than three ACM removal and disposal projects of comparable scope (or larger) and methodology to this Project. Submit the name of the proposed person and proof of training as a supervisor for asbestos-related work.
         2) The competent person, having qualifications and authority to ensure worker health and safety required by Subpart C, General Safety and Health Provisions for Construction (29 CFR 1926.20 through 1926.32). Competent person shall conduct frequent and regular inspections of the Site relative to asbestos removal and disposal, materials, and equipment as required by 29 CFR Part 1926, Section 1926.20 and as described below.
         3) The competent person shall perform or supervise the following duties,

as applicable:

a) Set up the regulated area, enclosure, or other containment.
b) Supervise all employee exposure monitoring.
c) Ensure that employees working within the regulated area wear protective clothing and respiratory protection.
d) Ensure through Site supervision, that employees use work practices and personal protective equipment in compliance with all requirements.
e) Ensure that employees use the hygiene facilities and observe the decontamination procedures.

4) The competent person shall be trained in all aspects of asbestos removal and handling, including: abatement, installation, removal and handling; the contents of Laws and Regulations and the Contract Documents; identification of asbestos; removal procedures, where appropriate; and other practices for reducing the hazard. Such training shall be obtained in a comprehensive course for supervisors, such as a course conducted by a USEPA or state-approved training provider, certified by the USEPA or the jurisdiction where the Project is located, or a course equivalent in stringency, content, and length.

e. ACM Subcontractor Employees:

1) Each employee working on asbestos removal and disposal in the State of New York shall possess valid asbestos handling certification in accordance with 12 NYCRR 56-3.2.
2) Within one year prior to commencement of ACM removal and disposal Work on the Project, each worker directly involved in handling ACM and ACM generated wastes, including packaging and transporting such wastes for disposal, shall have successfully completed a course of asbestos training as required by USEPA revised asbestos Model Accreditation Plan (MAP), as mandated by the asbestos School Hazard Abatement Reauthorization Act (ASHARA).
3) Prior to the commencement of ACM removal and disposal Work, each worker shall be instructed by Contractor's CIH and Contractor's "competent person" supervisor in the following Project-specific training: Hazards and health effects of the specific types of ACM to be removed; content and requirements of the AHAP accepted by Engineer; work practices; the use requirements and limitations of the personal protective clothing, equipment, and respirators to be used; hands-on training for each asbestos removal and disposal technique to be employed; heat and cold stress monitoring specific to this Project; personal hygiene and housekeeping requirements; air monitoring procedures; and additional requirements of 29 CFR Part 1926.1101.
4) Maintain all employee training records for one year beyond the last date of employee's employment by that employer. Use of competent organizations such as industry trade associations and employee associations to maintain the records required by this Section is acceptable. Copy of the required training records and fit test certificates for each employee shall be maintained on file at the Site

for review as requested by Owner.

5) ACM removal and disposal Subcontractor shall furnish for the Project a sufficient number of properly-trained and experienced asbestos removal and disposal workers each of whom shall: have completed training as an asbestos removal worker; have at least one year experience in asbestos removal; and have worked on at least three projects of comparable scope to (or larger than) this Project.
6) Submit employee qualifications and certifications.
7) Prior assigning personnel to asbestos Work, instruct each employee in the hazards of asbestos, safety, and health precautions, as well as the use and requirements for personal protective equipment, including clothing and respirators. Training shall cover engineering and other hazard control techniques and procedures. Establish a respirator program as required by Laws and Regulations.

3. Certified Industrial Hygienist (CIH):
   a. ACM removal and disposal operations shall be under the oversight of a CIH. CIH shall have at least five years of experience with ACM removal and disposal on projects similar in size to, or larger than, this Project.
   b. CIH shall be accredited by the American Board of Industrial Hygiene (ABIH).
   c. CIH Responsibilities:
      1) Assist Subcontractor with preparing the asbestos removal and disposal plan submittal. CIH shall sign and date the submittal.
      2) Prepare protocols and procedures for, and review with Subcontractor and testing laboratory, the field quality control measures required for the Project.
      3) Review field quality control results and advise Contractor and Subcontractor on measures to be taken.
      4) CIH shall visit the Site not less than weekly during ACM removal and disposal Work, and shall inspect the asbestos control areas and related ACM facilities prior to the start of ACM removal operations, and shall also inspect the ACM control areas and adjacent areas upon completion of all ACM removal and disposal Work. Prepare and submit to Engineer a written report of each visit to the Site by CIH detailing actives observed, problems encountered, and recommended procedures to resolve problems.
   d. Submit proposed CIH's name, address, and telephone number, and record of CIH's experience relative to ACM removal and disposal, and copy of accreditation from ABIH.

B. Regulatory Requirements:
   1. Comply with Laws and Regulations regarding asbestos removal and disposal, including but not limited to the USEPA, New York State Department of Environmental Protection (DEP), and OSHA. Maintain at the Site copies of applicable Laws and Regulations and guidelines, make such documents immediately available to Engineer.
   2. Federal Regulations:

a. 29 CFR 1910.1001, Asbestos Standard for General Industry
b. 29 CFR 1910.134/ 29 CFR 1926.103 Respiratory Protection Standard
c. 29 CFR 1910.1200/ 29 CFR 1926.59, Hazard Communication Standard
d. 29 CFR 1926.1101, Asbestos Standard for the Construction Industry
e. 40 CFR 61, National Emission Standards for Hazardous Air Pollutants (NESHAP), Subpart M - National Emission Standards for Asbestos
f. 40 CFR 763, Asbestos Hazard Emergency Response Act (AHERA), Subpart E - Asbestos-Containing Materials in Schools, and Subpart G - Worker Protection Rule.
g. 49 CFR Parts 106 - Transportation Standards 107, 171 to 180.

3. State of New York Regulations:
   a. Title 12, New York Codes, Rules and Regulations, Part 56, Asbestos (12 NYCRR Part 56).
   b. Title 6, New York Codes, Rules and Regulations, Part 364, Waste Transporter Permits (6 NYCRR Part 364).
   c. Title 6, New York Codes, Rules and Regulations, Part 360, Solid Waste Management Facilities (6 NYCRR Part 360).

C. Medical Requirements
   1. Examinations: Before anticipated exposure to airborne asbestos fibers, provide workers with a comprehensive medical examination as required by 29 CFR 1926.1101, 29 CFR 1910.120, and other Laws and Regulations. Examination is not required if adequate records demonstrate that employee was examined in accordance with 29 CFR 1926.1101, 29 CFR 1910.120, and other Laws and Regulations within the past year. The same medical examination shall be given on an annual basis to employees engaged in an occupation that has the potential to expose the employee to asbestos in any amount, within 30 calendar days before and after the termination of employment in such an occupation.
   2. Medical Records: Maintain complete and accurate records of each employee's medical examinations for a period of 30 years after termination of employment.

1.5 SUBMITTALS

A. Informational Submittals: Submit the following:
   1. Certificates.
      a. Certifications from authorities having jurisdiction, including state and local authorities as applicable, for each supervisor and worker employed on ACM removal and disposal.
      b. Submit certificate for each employee working on ACM removal and disposal Work, said certificate to be signed by the associated employee, that the employee has received training in the proper handling of materials that contain asbestos; understands the health implications and risks involved, including the possible illnesses that may develop from exposure to asbestos fibers; understands the use and limitations of the respiratory equipment to be used; and understands the results of any air monitoring activities that will occur, in relation to his or her health and use of respiratory equipment.

2. Test and Evaluation Reports:
    a. Test and evaluation report prepared by testing laboratory to determine presence of ACM in areas indicated in Paragraph 1.1.A.2.b of this Section.
3. Procedural Submittals:
    a. Asbestos Removal and Disposal Plan (Asbestos Hazard Abatement Plan (AHAP)):
        1) Submit a detailed Project-specific plan of the work procedures to be used in the removal and disposal of ACM. Submittal shall be prepared by, signed, and sealed including certification number, and dated by Contractor's certified industrial hygienist (CIH).
        2) Submittal shall include: a floor plan diagram showing the boundaries of asbestos control areas, locations of decontamination facilities and HEPA filtration unit exhausts; locations of temporary electrical panels and hookups; the sequencing of asbestos-related Work; ACM disposal plan; the type of wetting agent and asbestos encapsulant proposed for use; air monitoring (both area and personal); and detailed description of the ACM containment and removal procedures to be used, type of wetting agent and asbestos encapsulant to be used, planned air monitoring strategies, and detailed description of the method to be employed to control spread of ACM wastes and airborne fiber concentrations.
        3) Current and valid medical examinations and respirator fit-tests for each person employed in ACM removal and disposal operations.
        4) Copy of each Project permit relative to ACM, and variances (if any).
        5) Asbestos removal and disposal plan shall clearly indicate the starting and completion dates for each activity and each asbestos control area, and shall allow adequate time for clean-up, observation, and monitoring activities.
        6) Transporter: Submit documentation that the transporter to be used for conveying ACM to the landfill is permitted for such services in the jurisdiction where the Project is located.
        7) Landfill: Submit documentation that the landfill to be used for ACM disposal is approved and permitted for asbestos disposal by the USEPA and other authorities having jurisdiction, including the state environmental authority.
        8) Notarized Statement: Submit signed notarized statements from Contractor and ACM Subcontractor disclosing all OSHA and USEPA citations on asbestos removal projects during the previous three years.
        9) Obtain Engineer's acceptance of the plan prior to starting of asbestos-related work activities, other than performing testing and evaluation report.
4 Field Quality Control Submittals:
    a. Reports of visits to Site by CIH.
    b. Report of initial air monitoring results prior to start of ACM removal Work, and daily air monitoring results and calibration data.
5. Qualifications Statements: Obtain Engineer's acceptance of qualifications

prior to utilizing the following on the Project:

a. Testing laboratory.
b. ACM removal and disposal Subcontractor, including name and qualifications of competent person to be assigned to the Project.
c. Certified industrial hygienist.

B. Closeout Submittals: Submit the following:
   1. Log:
      a. Maintain a permanently-bound log book that contains the Project name, as well as the names, addresses, and phone numbers of the air testing entity, and the ACM Subcontractor. Log book shall contain emergency contact information required in the General Requirements. Log book shall contain a list of personnel approved for entry into the asbestos control area. Upon completion of ACM removal and disposal Work, submit the log book containing a day-to-day record of personnel entering the asbestos control area, and description of significant events occurring during the ACM removal and disposal operations.
   2. Record Information:
      a. Certification of completion of ACM removal and disposal Work, signed by Contractor and ACM Subcontractor, indicating the date that all ACM removal and disposal Work was completed, and stating that all ACM removal and disposal Work was performed in accordance with the Contract Documents, Laws and Regulations, applicable permits (if any), and requirements of authorities having jurisdiction.
      b. Quantities of ACM removed and disposed.
      c. Copy of completed waste manifest sheet for disposal of asbestos, indicating name of disposal location and date of disposal.
      d. Asbestos Waste Shipment: Final completed copies of the Waste Shipment Record for all shipments of ACM waste material as specified in 40 CFR Part 61, Subpart M and other required state waste manifest shipment records. Detailed information of asbestos waste disposal on the "MANDATORY WASTE SHIPMENT RECORD" form in accordance with revised 40 CFR Part 61, Subpart M.
      e. Copy of notifications of USEPA and other authorities having jurisdiction.

PART 2 – PRODUCTS

2.1 PERSONAL PROTECTIVE EQUIPMENT

A. General:
   1. Provide workers with personal protective clothing and equipment as specified in this Section and as required by Laws and Regulations.
   2. Ensure that protective clothing and equipment is worn properly.
   3. CIH and competent person shall select and approve the required personal protective clothing and equipment to be used.
   4. In addition to protective work clothing for ACM removal workers, make

available at the Site four additional sets of protective work clothing and required respiratory equipment, each day for authorized personnel to enter and observe the asbestos control area.

B. Respirators:
   1. Respirators shall be selected and used in accordance with manufacturer's recommendations, 29 CFR Part 1926.1101, and shall be approved by the Mine Safety and Health Administration and NIOSH (MSHA/NIOSH) for use in environments containing airborne asbestos fibers.
   2. Personnel who handle ACM, enter asbestos-regulated Work areas that require wearing of a respirator, or who are otherwise carrying out asbestos abatement activities that require wearing a respirator, shall be provided with respirators that are fully protective of the worker at measured or anticipated airborne asbestos concentration level to be encountered.
   3. For air-purifying respirators, the particulate filter portion of the cartridges or canister suitable for use in airborne asbestos environments shall be Type H, high-efficiency particulate air (HEPA). As a minimum a powered-air purifying respirator (PAPR) equipped with HEPA cartridges shall be worn during startup of asbestos removal activities, unless otherwise approved in writing by the CIH.
   4. Upgrading or downgrading of respirator type, from the minimum requirements specified for start-up, shall be made by the CIH based on the measured or airborne asbestos fiber concentrations to be encountered.
   5. Respiratory protection shall comply with 29 CFR Part 1926, CFR 11 Part 30, and 29 CFR Part 1910.
   6. Fit Test:
      a. Competent person shall perform qualitative or quantitative fit test complying with 29 CFR Part 1926, Appendix B, for each worker required to wear a respirator, and for Owner and authorized visitors who enter an asbestos-regulated Work area where respirators are required to be worn.
      b. Perform respirator fit test for each worker prior to initially wearing a respirator on the Project and annually thereafter. If physical changes in a worker develops that will affect the fit, or a new size, make, or model of respirator is used, perform a new fit test.
      c. Perform functional fit checks by employees each time a respirator is put on and in accordance with the respirator manufacturer's recommendation.

C. Whole Body Protection:
   1. Provide personnel exposed to asbestos with whole body protection as specified in this Section; such protection shall be worn properly.
   2. CIH and competent person shall select and approve the whole body protection to be used.
   3. Dispose of disposable whole body protection as asbestos-contaminated waste upon exiting from the asbestos-regulated Work area. Reusable whole body protection worn shall be either disposed of as asbestos-contaminated waste upon exiting the asbestos-regulated Work area or be properly laundered in accordance with 29 CFR Part 1926 and the AHAP accepted by Engineer.

4. Do not remove asbestos abatement whole body protection from the Site.
5. Comply with the following:
    a. Coveralls: Use disposable, zippered front coveralls with attached head and foot coverings. Sleeves shall be secured at the wrists.
    b. Gloves: Use disposable plastic or rubber gloves to protect hands. Cloth gloves may be worn inside the plastic or rubber gloves for comfort, but shall not be used alone. Where there is potential for hand injuries (such as scrapes, punctures, cuts) use suitable outer gloves.
    c. Under Clothing: Use disposable underwear, worn next to the skin or cloth under clothing.
    d. Work Clothing: Use an additional coverall when asbestos abatement and control method employed does not provide for the exit from the asbestos-regulated Work area directly into an attached decontamination unit. Cloth work clothes shall be provided for wear under the protective coverall and foot coverings when work is being conducted in low-temperature conditions. Cloth work clothes shall be either disposed of as asbestos-contaminated material or properly laundered in accordance with 29 CFR Part 1926 and AHAP accepted by Engineer.
    e. Foot Coverings: Provide cloth socks, worn next to the skin. If rubber boots are not used, provide footwear and disposable foot coverings. Use rubber boots in moist or wet areas. Only rubber boots shall be removed from the asbestos-regulated Work area after being thoroughly decontaminated. Dispose of other protective foot coverings as ACM.
    f. Head Covering: Use hood type disposable head covering. Provide and use protective head gear (hard hats) as required. Remove hard hats from the asbestos-regulated Work area only after thorough decontamination.
    g. Protective Eye Wear: Do not wear contact lenses in asbestos-regulated Work areas. When vision correction is necessary to perform the Work, use prescription safety eye wear. Safety glasses shall be worn by personnel engaged in asbestos abatement activities in the asbestos regulated work area when use of full face-piece respirator is not required. Eye protection provided shall be in accordance with ANSI Z87.1. Remove eyewear from asbestos-regulated Work area only after thorough decontamination.
    h. Other Items: Provide other items of whole body protection as required and approved by the CIH.

2.2 DECONTAMINATION

A. Decontamination Units – General:
    1. Provide temporary decontamination unit for all Class I Asbestos Work abatement activities in which greater than 25 linear feet or 10 square feet of ACM are removed from a regulated area.
    2. Decontamination units shall be adjacent to and contiguous with the asbestos-regulated Work area. Remote decontamination units may be used if adjacent decontamination units are not feasible. Use of prefabricated units or remote

units shall be reviewed and approved by the CIH. Remote decontamination systems shall be in accordance with Laws and Regulations.

3. Decontamination unit shall be attached in a leak-tight manner to each asbestos-regulated Work area.
4. Decontamination unit shall have a separate equipment locker room and a clean locker room with a shower in between (complying with 29 CFR Part 1910.141 and other Laws and Regulations).
5. Upon exiting from the asbestos-regulated Work area to the equipment room, respirators shall be worn while asbestos-contaminated protective clothing is HEPA-vacuumed, removed, and placed in approved labeled containers for disposal.

B. Use of Decontamination Units and Wastewater Discharge:
   1. Workers shall shower before changing into street clothes.
   2. Collect and filter used shower water to remove asbestos contamination. Dispose of filters and residue as asbestos-contaminated material. Discharge filtered water to the sanitary sewer system or haul filtered water off-Site for proper disposal.
   3. Provide separate hot and cold water services for decontamination unit. Provide not less than 40-gallon electric hot water heater with minimum recovery rate of 20 gallons per hour and temperature controller for each showerhead. Instantaneous type in-line water heater may be incorporated at each shower head in lieu of hot water heaters. Locate functional flow and temperature controls within the shower, to be easily adjusted by user.
   4. Size shower wastewater pump for 1.25 times the showerhead flow rate at a pressure head sufficient to satisfy the filter head loss and discharge line head losses.
   5. Provide wastewater filters in series with first stage pore size of 50 micrometer (microns) and second stage pore size of five microns.

C. Decontamination Unit – Miscellaneous:
   1. Keep floor of decontamination unit's clean room dry and clean at all times. Water from the shower shall not wet the floor in the clean room.
   2. Surfaces of the clean room and shower shall be wet-wiped two times after each shift change with a disinfectant solution.
   3. Maintain proper housekeeping and hygiene.
   4. Provide soap, shampoo, and clean towels for showering, washing, and drying in sufficient quantities to accommodate the number of asbestos abatement workers.
   5. Dispose of cloth towels as ACM waste or launder in accordance with 29 CFR Part 1926 and AHAP accepted by Engineer.
   6. Surfaces of the equipment room shall be wet-wiped two times after each shift change. Dispose of materials used for wet wiping as asbestos-contaminated waste.

2.3 WARNING SIGNS AND TAPE

A. Warning Signs and Tape:
   1. Provide temporary warning signs for asbestos-related Work.
   2. Ensure that workers and others at the Site understand the warning signs.
   3. Provide warning signs and tape at the regulated boundaries and entrances to asbestos-regulated Work areas. Provide signs at a distance that personnel may read the sign and take necessary protective steps before entering the area.
   4. Warning signs shall comply with 29 CFR Part 1926.58(k)(l)(ii).
   5. Warning signs shall be written in English, and in the predominant language spoken by the workers if other than English.

2.4 WARNING LABELS

A. Signs and Markings:
   1. Provide temporary caution signs at all approaches to asbestos control areas as required in 29 CFR 1926.1101 and 29 CFR 1910.1200. Locate signs at such a distance that personnel may read the signs and avoid the areas, or if allowed to enter the areas, take the necessary precautions before entering.
   2. At minimum provide the following temporary signage:
      a. Caution Sign: Vertical format complying with 29 CFR 1910.145 (d) (4), minimum 20 inches by 14 inches displaying the following legend in the lower panel:

Legend	Characters/Type
ASBESTOS	1-inch high Sans Serif Gothic or block
DANGER	1-inch high Sans Serif Gothic or block
CANCER & LUNG DISEASE HAZARD	3/4-inch high Gothic
AUTHORIZED PERSONNEL ONLY	3/4-inch high Gothic
RESPIRATORS & PROTECTIVE CLOTHING REQUIRED IN THIS AREA	3/4-inch high Gothic

   3. Warning Labels:
      a. Provide labels affixed to all disposal bags and storage containers, as used for storage and transporting asbestos materials, scrap, waste debris, and other materials contaminated with asbestos, in accordance with OSHA 29 CFR 1926.1101(k)(8) and other Laws and Regulations.
      b. Containers with preprinted warning labels complying with requirements specified in this Section are acceptable.
      c. Labels shall include the name, address, and telephone number of the waste generator (Owner) and the location at which the waste was generated in accordance with 40 CFR 61.150(a)(1).
      d. Labels shall comply with 29 CFR 1910.1200(f), and shall include:

"DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD
BREATHING AIRBORNE ASBESTOS FIBERS
IS HAZARDOUS TO YOUR HEALTH"

4. No other signage related to ACM removal is allowed at the Site without approval of Owner.
5. Upon completion of the ACM removal Work, remove temporary signage associated with ACM removal.

2.5 TOOLS AND LOCAL EXHAUST SYSTEM

A. Vacuum Capability for Asbestos Removal Equipment and Tools:
   1. Vacuums shall be leak-proof to the filter, equipped with HEPA filters, of sufficient capacity, and provide necessary capture velocity at the nozzle or nozzle attachment to efficiently collect, transport and retain ACM waste material.
   2. Do not use power tools to remove ACM unless the power tool is equipped with effective, integral HEPA filtered exhaust ventilation capture and collection system.
   3. Remove residual asbestos from reusable tools prior to storage and reuse. Decontaminate reusable tools prior to removal from asbestos-regulated Work area in accordance with Laws and Regulations.

B. Local Exhaust System:
   1. Provide local exhaust system in NPEs. Local exhaust systems, including filters, shall comply with ANSI/AIHA Z9.2.
   2. Air filtration devices shall have HEPA filters.
   3. Quantity of air filtration devices shall be sufficient to maintain a minimum pressure differential of minus 0.02 inch of water column relative to adjacent, unsealed areas, at an air flow rate not less than four air changes per hour.
   4. Provide continuous, 24-hour per day monitoring of the pressure differential.
   5. At start of asbestos removal operations, open the units to verify filter integrity.
   6. Use new flex duct for local exhaust system and one flex duct per HEPA unit.
   7. Replace filters for air filtration devices in accordance with manufacturer's recommendations and Laws and Regulations.
   8. Obtain required licenses and pay all fees that are associated with existing patent(s) on asbestos exhaust systems.

2.6 RENTAL EQUIPMENT

A. If rental equipment is used, give written notification to rental entity concerning the intended use of the equipment, the possibility of asbestos contamination of equipment, and steps that will be taken to decontaminate such equipment. Obtain written acceptance of the terms of Contractor's notification from rental entity and submit a copy to Owner.

2.7 EXPENDABLE SUPPLIES

A. Glove Bag: Provide glove bags as described in 29 CFR Part 1926. Glove bag assembly shall be prefabricated of six-mil thick transparent polyethylene or PVC sheeting with preprinted OSHA warning label, and shall typically be constructed of at least two inward projecting long sleeves and an internal pouch. Glove bag shall be constructed and installed in such a manner that it surrounds the object or material to be removed and contains all asbestos fibers released during glove removal. Glove bag shall have sufficient capacity to hold removed materials and allow leak-tight sealing.

B. Duct Tape: Provide industrial-grade duct tape in two-inch and three-inch widths, suitable for bonding sheet plastic and disposal containers required for the asbestos Work.

C. Disposal Containers: Provide leak-tight disposal containers for ACM generated wastes. Leak-tight means that solids, liquids, and dust cannot escape or spill out. Disposal containers shall be either pre-labeled or affixed with OSHA warning label in accordance with 29 CFR Part 1926.

D. Disposal Bags: Shall be six-mil thick or thicker, leak-tight, pre-labeled with OSHA warning label, for placement of asbestos generated waste.

E. Leak-tight Wrapping: Use two layers of polyethylene sheet stock not less than six mils thick for containment of removed ACM such as reactor vessels, large tanks, boilers, insulated pipe segments, and other materials too large to be placed in disposal containers. Upon placement of ACM in wrapping, each layer shall be individually sealed leak-tight using duct tape.

F. Fiberboard Drums: Provide fiberboard drums when required by Laws or Regulations, or authorities having jurisdiction.

G. Sheet Plastic:
   1. Provide sheet plastic in the largest sheet size necessary to minimize seams.
   2. Not less than six-mil thick polyethylene film, clear or frosted, complying with ASTM D4397.

H. Wetting Agents:
   1. Amended Water: Comply with ASTM D1331.
   2. Removal Encapsulant: Provide removal encapsulant (penetrating encapsulant) when conducting asbestos removal activities that require a longer removal time or are subject to rapid evaporation of amended water. Removal encapsulant shall be capable of wetting ACM and retarding fiber release during disturbance of ACM equal to or greater than provided by amended water.

2.9 OTHER ITEMS

A. Provide sufficient quantity of other items that may include, but not be limited to, the following: scrapers, brushes, brooms, staple guns, tarpaulins, shovels, rubber

squeegees, dust pans, other tools, scaffolding, staging, enclosed chutes, non-conductive ladders, lumber necessary for constructing asbestos-regulated containment work areas, UL-approved temporary electrical equipment, material and cords, ground fault circuit interrupters (GFCI), water hoses of sufficient length, fire extinguishers, first aid kits, logbooks, log forms, markers with indelible ink, spray paint in bright color to mark areas and temporary fencing where required.

B. Scaffolding: Provide scaffolding of the type necessary to perform the Work, subject to requirements of Laws and Regulations.

C. Air Monitoring Test Equipment: Furnish the following test equipment to be delivered to the Resident Project Representative:
   1. Two portable high-volume area air sampling pumps, which shall be Gilian Model AirCon-2DC with appropriate power module, or equal. Each unit shall be in kit form containing a monitoring pump, hose, and clip assembly, three-part filter holder, 50-mm extension cowl, spare hose fitting, and 100 25-mm filter membranes. Test equipment shall remain property of Subcontractor and shall be maintained by Subcontractor.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Testing and Evaluation:
   1. Perform testing and evaluation of suspected potential ACM as indicated in Paragraph 1.1.A of this Section.
   2. Testing and evaluation, including obtaining of samples, shall be by the qualified testing agency.
   3. Procedure:
      a. After demolition has proceeded to a point where potential ACM listed in Paragraph 1.1.A of this Section is uncovered, the potential ACM shall be inspected by an asbestos inspector, who is an employee of the testing laboratory, in accordance with ASTM E1368 and procedures and guidelines commonly used and accepted in the jurisdiction where the Project is located for identifying approximate locations and quantities of ACM.
      b. Testing laboratory's asbestos inspector shall obtain samples of suspected ACM and transport samples to the testing laboratory for evaluation.
      c. All samples shall be tested using polarized light microscopy (PLM).
      d. Samples for which results are, or are suspected to be, inconclusive shall be tested using quantitative transmission electron microscopy (TEM).
      e. Testing laboratory shall, within ten days of obtaining samples, prepare and submit to Contractor, who shall review and submit to Engineer, the testing laboratory's report on the sampling and evaluation results.
   4. Identification of Removal and Disposal Costs: Following completion of the testing laboratory's evaluation report, prepare and submit to Engineer change

order proposal for removing and disposing of the ACM, if any, found to exist by the testing laboratory.

B. Examine conditions under which removal and disposal of ACM will be performed and advise Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Location of temporary facilities for removal and disposal of ACM shall be subject to acceptance of Owner. Prior to starting the Work obtain Owner's acceptance of proposed location of temporary facilities required for the Work.

B. Prepare the asbestos control areas and post temporary signage required in Part 2 of this Section.

3.3 REMOVAL OF ASBESTOS-CONTAINING MATERIAL

A. Exposure Control:
   1. Design, erect, install, and maintain temporary airtight enclosures and partitions suitable for asbestos removal activities, to eliminate exposures to operations and maintenance employees, others, and the environment.
   2. Personnel working on removal and disposal of ACM shall wear and utilize protective clothing and protective equipment as required.
   3. Eating, smoking, drinking, applying cosmetics, and similar activities are not allowed in asbestos-regulated Work areas.
   4. Perform hot work in asbestos-regulated Work area, such as burning, cutting, and welding, under controlled conditions in accordance with 29 CFR Part 1926 and other Laws and Regulations.
   5. Personnel of other trades not engaged in asbestos removal and disposal activities shall not be exposed to airborne asbestos unless required training, administrative, and personal protective requirements are complied with.
   6. If an asbestos spill or release occurs outside of asbestos-regulated Work area, work shall be halted and immediately notify Owner. Correct the spill or release to satisfaction of Owner prior to resuming the Work.
   7. Perform personal air sampling. An independent third-party industrial hygiene consultant hired by Contractor shall complete perimeter, work area, and final clearance air sampling.
   8. Immediately halt ACM removal and disposal Work in asbestos-regulated Work area when measured airborne total fiber concentration exceeds 0.01 fibers per cubic centimeter or the pre-removal concentration, whichever is greater, outside the asbestos-regulated Work area. Correct the condition to the satisfaction of Contractor's CIH at no cost to Owner. Contractor shall document corrective actions taken.
   9. Protection of Adjacent Areas:
      a. Removal and disposal of ACM shall be performed without contaminating

adjacent work and areas. Where such work or area is damaged or contaminated as verified by Engineer by visual inspection or sample analysis, decontaminate and restore the affected area to its original condition at no expense to Owner, as deemed appropriate by Owner and Engineer.

10. Critical Barters: Isolate all openings to asbestos-regulated Work areas with airtight seals that prevent contaminant spread in accordance with Laws and Regulations. Provide such critical barriers of six-mil thick polyethylene, sealed air-tight. Cover and seal wall, ceiling, and floor surfaces in accordance with Laws and Regulations.
11. Asbestos Control Area Requirements:
    a. General: Establish and maintain NPEs for Class I Asbestos Work other than glove bag removal or wrap and cut removal. Provide a viewing window in the wall of the NPE at a location from which the ACM removal Work may be observed. Perform the following sequentially, completing each activity before proceeding to the next activity:
        1) Place tools, scaffolding, staging, and similar activities necessary for the ACM removal Work in the area to be isolated prior to erecting critical barriers.
        2) Pre-clean surface.
        3) Install decontamination units.
        4) Install critical barriers.
        5) Install local exhaust system and appurtenances.
        6) Remove ACM and perform monitoring.
        7) Perform required cleaning.
        8) After inspection and cleaning, remove barriers and containment materials.

B. Removal – General:
    1. Perform ACM removal and disposal, including handling, storing, and transporting asbestos waste materials, in accordance with the asbestos removal and disposal plan (asbestos hazard abatement plan (AHAP)) submittal accepted by Engineer; the Contract Documents; Laws and Regulations; applicable permits; and requirements of authorities having jurisdiction. Among the applicable requirements, comply with applicable requirements of 29 CFR Part 1910, 29 CFR Part 1926, 40 CFR Part 61, Subpart A and Subpart M, NFPA 10, NFPA 70, NFPA 90A, and NFPA 101. Matters of interpretation of standards shall be submitted to the appropriate administrative agency for resolution before starting Work. Where the requirements of the Contract Documents and Laws and Regulations differ, the most-stringent requirement as defined by Engineer shall apply.
    2. Wastewater from asbestos removal operations, including amended water, shall be collected and filtered through a system in the same manner specified in Part 2 of this Section for personnel decontamination shower discharge water. Discharge filtered wastewater in accordance with Laws and Regulations and requirements of the Owner. Properly dispose of contaminated filters as asbestos waste.

3. Prior to moving ACM from the asbestos control area, double-bag all ACM in polyethylene bags or wrapping, as appropriate, in accordance with Part 2 of this Section.
4. Use corrugated cartons or drums for disposal of ACM having sharp-edged components such as nails, screws, tin sheeting, and other pointed or sharp surfaces, that may tear polyethylene bags. ACM within the drums or cartons shall be double-bagged.
5. Transport bagged ACM to an appropriate disposal site in either thirty gallon capacity metal/fiber drums with tight lids, or in locked steel dumpsters.
6. Do not dump ACM, whether or not bagged, down chutes. Do not drop or toss ACM, whether or not bagged.

C. Compatibility:
1. Use only removal and cleaning materials and equipment that are compatible with the surface from which ACM is being removed and cleaned, as recommended by the manufacturer of the materials.
2. All vacuums used shall be equipped with HEPA filtration system, such as Model #GA-73 by "NILFISK" and Model #75ASA by Pullman/Holt, or equal.

D. Storage and Removal from the Site:
1. Retain all stored items in an orderly arrangement allowing maximum access, without impeding traffic, and providing the required protection of materials.
2. When ACM is kept in the asbestos control area or adjacent work areas overnight or longer, ACM shall be double-bagged and stored in metal, fully-enclosed waste containers (dumpsters) that are securely locked. Do not store ACM at the Site outside of the asbestos control area.
3. At least twice a week, and more often if necessary, completely remove all ACM scrap, debris, and waste material from the Site.
4. Work Areas: Daily, and more often if necessary, inspect the work areas and adjoining spaces, and remove and dispose of all ACM scrap, debris, and waste materials.

E. Cleaning Immediately Following Removal: Following the careful double-bagging of ACM, label each bag appropriately.
1. Wipe each exposed bag surface with clean, damp cloths prior to transportation to disposal site. Wipe-cloths shall be disposed of as ACM.
2. Plastic sheeting used for containment or shielding of asbestos control area shall be carefully removed, folded inward, and double bagged for disposal. Critical barriers are not to be removed until the asbestos control area has passed a visual inspection by Engineer at conclusion of ACM removal operations, and acceptable final clearance air sample results are obtained and accepted by Engineer.
3. After all asbestos waste is removed from the asbestos-regulated Work area, and final clean-up is completed, Contractor and Contractor's CIH will visually inspect all surfaces within the asbestos-regulated Work area for residual material or accumulated debris. Re-clean all areas showing dust or residual materials. Contractor's CIH shall certify in writing that the area is safe before

the warning signs and boundary warning tape are removed and prior to unrestricted entry is allowed.

4. Encapsulant: Prior to removal of plastic barriers and after clean-up of gross asbestos contamination and final visual inspection, spray-apply a post-removal (lockdown) encapsulant to ceilings, walls, floors, and other surfaces in the asbestos removal area in accordance with Laws and Regulations.
5. Refer to cleaning requirements in Article 3.5 of this Section.

F. Results of air sampling, testing, and monitoring during ACM removal and disposal Work shall not exceed the limits indicated in Article 3.4 of this Section.

3.4 FIELD QUALITY CONTROL

A. Site Tests and Monitoring:
   1. When performing ACM removal and disposal, and when airborne asbestos dust or fibers are emitted, retain the services of a certified industrial hygienist (CIH), and testing laboratory for monitoring asbestos exposure levels.
   2. Responsibilities of the Testing Laboratory and CIH Relative to Site Tests and Monitoring:
      a. Equipment: Collect samples of Airborne asbestos concentrations using appropriate air monitoring pumps and asbestos sampling filters. Pumps shall be calibrated before each sampling cycle.
      b. Perform asbestos work area air monitoring and personal air monitoring for personnel.
      c. Obtain personal air monitoring samples for the greater of the following: 25 percent of the ACM removal and disposal workers in each shift, or two workers per shift.
      d. Work Area Sampling Procedures:
         1) Initial background air samples shall be taken prior to beginning preparation of the asbestos control area or containment construction activities. Where proper sealing is not feasible, obtain initial air samples of the ambient conditions prior to installing barriers. Initial air monitoring described in this paragraph will establish the "reference" TWA.
         2) From start to completion of ACM removal operations, continuously monitor air quality in the asbestos control area. Change filters in sampling devices not greater than every four hours of actual operation.
         3) Final clearance air sample results shall not exceed the limited indicated in this Article.
         4) Location of Sampling Devices: Locate sampling devices within each Work areas, immediately outside all major openings, in both the clean room and decontamination room, downwind of equipment producing a negative pressure (if any), and in the vicinity of temporary asbestos storage areas. Samples shall represent, with reasonable accuracy, the airborne concentrations of asbestos fibers that may reach the breathing zones of personnel.
      e. Personal Monitoring: Perform personal sampling and monitoring in

accordance with 29 CFR Part 1926.1101 and other Laws and Regulations, and Contractor's AHAP accepted by Engineer.

f. Methods of Measurement: Determination of airborne concentrations of asbestos fibers shall be made using phase contrast microscopy (PCM) and transmission electron microscopy (TEM). PCM is the OSHA Reference Method specified in Appendix A of 29 CFR 1926.1101, and include NIOSH Pub No. 84-100 Method 7400. TEM is the USEPA (AHERA) method specified in 40 CFR 763, Subpart E, Appendix A.

g. Reporting:
   1) Calculate air monitoring results at the 95 percent confidence level.
   2) Submit to Engineer documentation of fiber counts not more than 24 hours after completing each sampling cycle. Submit with monitoring results data from sampling equipment calibrations. Submit each sample's TWA average count, and the time, date, and exact location where each sample was obtained. Locations of air monitors shall be described by referencing major building locations and features near the monitoring equipment.
   3) Post at a conspicuous location at the Site results of personal samples within 24 hours of sampling.
   4) Personal sampling results shall be made available to Owner upon request.

h. Local Exhaust System: Pressure differential recordings for each workday shall be reviewed by the CIH on a daily basis, and submitted to Engineer within 24 hours from the end of each workday. CIH shall notify Contractor, Subcontractor, and Engineer immediately when a variance in the pressure differential could allow migration of asbestos fibers outside of the asbestos control area.

i. Acceptable Limits:
   1) Maintain asbestos fiber concentrations outside NPEs equal to or less than the greater of the following: 0.01 fibers per cubic centimeter or background levels, during asbestos removal and disposal Work.
   2) When fiber concentrations rise above the required limit, immediately halt the Work and immediately investigate work procedures to determine the cause. Restart the Work when air quality is within specified limits.
   3) Personnel shall not be exposed to airborne fiber concentrations in excess of 0.1 fiber per cubic centimeter in an eight-hour TWA (OSHA PEL) and 1.0 fiber per cubic centimeter averaged over a sampling period of 30 minutes (OSHA excursion limit).
   4) If the PEL or excursion limit is exceeded inside the asbestos-regulated Work area, immediately halt the Work and notify Owner, and Engineer. Implement additional engineering controls and work practice controls to reduce airborne asbestos fiber levels below prescribed limits in the work areas. Do not restart the Work until air monitoring indicates fiber counts within required limits.
   5) When air testing and monitoring following final cleaning indicate a fiber count greater than the limit indicated in this Article in the Work

areas, re-clean the areas with unacceptable monitoring results. Retest re-cleaned areas at Contractor's expenses; Engineer reserves the right to require use of a third-party testing laboratory for such re-testing, at Contractor's expense. Perform repeated cycles of cleaning and clearance testing until fiber count is within limit indicated in this Article within the Work areas. All costs of re-cleaning and retesting will be at no additional cost to Owner.

j. Sampling After Final Clean-up (Clearance Sampling):
   1) Prior to conducting final air clearance monitoring, conduct final visual inspection of final clean-up of each asbestos-regulated Work area, accompanied by Engineer.
   2) Final clearance air monitoring shall not begin until final cleaning is acceptable to the CIH. CIH and Contractor's testing laboratory shall perform area sampling for airborne fibers using aggressive air sampling techniques as defined in Appendix A of 40 CFR Part 763, Subpart E, or as otherwise required by Laws and Regulations.
   3) Use PCM method as indicated in this Article.
   4) Submit results to Engineer. Results shall be within the limit indicated in this Article.

3.5 CLEANING

A. Throughout the removal and disposal of ACM, maintain the asbestos control area and adjacent work areas in a standard of cleanliness in accordance with the Contract Documents.
   1. Prevent areas other than the asbestos control area from becoming contaminated with asbestos-containing dust and debris. Should areas outside the asbestos control area become contaminated with asbestos-containing dust or debris as a consequence of Contractor's actions, Contractor shall be responsible for all cleaning required to comply with Laws and Regulations.
   2. All costs incurred in the cleaning or otherwise decontaminating of non-work areas and the contents thereof, shall be paid by Contractor at no additional cost to Owner.
   3. Work areas shall not be blown clean with compressed air. Dry sweeping of asbestos Work areas is prohibited.

B. Progress Cleaning:
   1. Keep asbestos control area and adjacent work areas clean on a daily, ongoing basis, to the extent practicable.
   2. Prepare loose ACM for disposal by packaging the waste and removing it from the work area to the ACM load-out area.
   3. Inspect and repair polyethylene sheeting and other critical barriers.

C. Final Cleaning:
   1. Except as specified otherwise, "clean" (for the purpose of this Section) means the level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials.

2. After final cleaning, air monitoring results shall indicate fiber concentration in the work areas within the limit specified in Article 3.4 of this Section.
3. Prior to completing the ACM removal and disposal Work, remove all tools, surplus materials, equipment, scrap, debris, and waste from the Site.
4. Cleaning shall progress from the point most remote from the intakes of the negative pressure exhaust units towards the units, as well as from the highest point of the surface being cleaned towards the lowest point.

3.6 DISPOSAL

A. ACM removed by Contractor, is Contractor's property and shall be disposed of as specified and in accordance with Laws and Regulations. Dispose of ACM at an asbestos-approved and asbestos-permitted landfill.

+ + END OF SECTION + +

ATTACHMENT 4 – SPECIFICATION 26 32 13 – PACKAGED ENGINE GENERATOR SYSTEM – 150kW DIESEL

SECTION 26 32 13

PACKAGED ENGINE GENERATOR SYSTEMS – 150kW Diesel

PART 1 GENERAL

1.1 WORK INCLUDED

A. Furnish and install packaged, 150kW, diesel, outdoor generator in custom, semi-walk-in, sound attenuating enclosure at the Weaver Street Pump Stations.

1.2 CODES AND STANDARDS

A. The generator set installation and on-site testing shall conform to the requirements of the following codes and standards:
   1. CSA 282, 1989 Emergency Electrical Power Supply for Buildings.
   2. IEEE446 Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
   3. NFPA37
   4. NFPA70 National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
   5. NFPA99 Essential Electrical Systems for Health Care Facilities.
   6. NFPA110 Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.

B. The generator set and supplied accessories shall meet the requirements of the following standards:
   1. NEMA MG1-1998 part 32. Alternator shall comply with the requirements of this standard.
   2. UL142 B Sub-base Tanks.
   3. UL1236 B Battery Chargers.
   4. UL2200. The generator set shall be listed to UL2200 or submit to an independent third party certification process to verify compliance as installed.

C. The control system for the generator set shall comply with the following requirements.
   1. CSA C22.2, No. 14 B M91 Industrial Control Equipment.
   2. EN50082-2, Electromagnetic Compatibility B Generic Immunity Requirements, Part 2: Industrial.
   3. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical

Equipment.

4. FCC Part 15, Subpart B.
5. IEC8528 part 4. Control Systems for Generator Sets.
6. IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.
7. UL508. The entire control system of the generator set shall be UL508 listed and labeled.
8. UL1236 BBattery Chargers.

D. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.3 SUBMITTALS

A. Shop Drawings: Indicate electrical characteristics and connection requirements. Show plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, and electrical diagrams including schematic and interconnection diagrams.

B. Product Data: Provide data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, microprocessor control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, fuel tank, trailer and radiator.

C. Prototype Test Reports: Submittals will not be received without submission of prototype test report as specified herein.

D. Manufacturer’s Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

E. Manufacturer’s Certificate: Certify that Products meet or exceed specified requirements.

F. Alternator data indicating sub transient reactance and temperature rise rating to meet requirements specified herein.

1.4 OPERATION AND MAINTENANCE

A. Submit complete Installation, Operation and Maintenance Manuals, including, test reports, maintenance data and schedules, description of operation, and spare parts information. Include instructions for routine maintenance requirements,

service manuals for engine and day tank, oil sampling and analysis for engine wear, and emergency maintenance procedures.

B. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 01 78 23, Operations and Maintenance Data.

1.5 QUALITY ASSURANCE

A. To provide proven reliability of the Generator set, three series of tests shall be performed, no exceptions taken:
   1. Prototype model tests
   2. Fully assembled factory production model tests
   3. Field acceptance tests

B. The manufacturer shall provide documentation demonstrating satisfactory prototype and production test results. Generator sets that have not been prototype tested and Factory Production tested as described herein shall not be acceptable.

C. Generator set Prototype Tests: These tests and evaluations must have been performed on a prototype generator set representative of the model specified. A summary of the generator set testing results shall be submittal for review. The manufacturer's standard series of components development tests on the generator system, engine and other major components shall be performed and available for review, but shall not be acceptable as a substitute for a prototype testing on the complete representative generator set prototype.

D. Torsiograph Analysis and Test: The manufacturer of the generator set shall verify that the engine generator set, as configured, is free from harmful torsional stresses. The analysis shall include correlation of empirical data from tests on a representative prototype. The empirical data must include spectrum analysis of the torsional transducer output within the operating speed range of the engine generator set. Calculations based on engine and generator separately are not acceptable.

E. Temperature Rise Test: Complete thermal evaluation of a prototype generator rotor and starter must include actual measurement of internal generator and exciter temperatures by embedded detector method, and measurement of average temperature rise by resistance method. No position measured any place in the windings may exceed the temperature rise limits of NEMA for the particular type of insulation system used. Resistance method temperature rise data shall be confirmed by a full load test on the generator set prototype to include conducted and radiated heat from the engine.

F. Short Circuit Test: A test on a prototype generator set shall have demonstrated that the generator set is designed to withstand the mechanical forces associated with a short circuit condition. With the generator set operating at rated load and speed, the generator terminals must be short circuited on all three phases for a

duration of 20 seconds. At the conclusion of this test, the generator set must be capable of full load operation.

G. Endurance Run Test: A minimum of 500 continuous hours of endurance testing with a representative generator set prototype operating as defined by the manufacturer=s standby rating shall have been performed. Endurance testing shall be used to verify structural soundness and durability.

H. Maximum Power Test: With the prototype generator set at normal operating temperature and with all power consuming auxiliaries in place, the maximum power available at rated speed shall be determined with the governor set at its fuel stop. The generator set shall maintain this power for a minimum of two (2) minutes.

I. Linear Vibration Test: A test for in-line motion of components occurring along a repeatable path shall meet the manufacturer=s acceptable criteria.

J. Cooling System Test: A cooling system test shall demonstrate the ability of the generator set cooling system to maintain normal operating temperature while operating at full rated load and power factor at the highest ambient temperature (122 °F) of the system rating. Cooling air requirements, radiator air flow and maximum allowable restriction at radiator discharge shall be verified by this test.

K. Maximum Motor Starting KVA Test: Motor starting KVA shall be determined by test, based on a sustained RMS recovery voltage of at least 90 percent on no load voltage with the specified load KVA at near zero power factor applied to the generator set.

L. Transient Response, Steady State Speed Control and Voltage Regulation Test: Prototype generator set tests shall demonstrate consistent performance as follows; stable voltage and frequency at all loads from no load to full rated load, consistent frequency kp on load acceptance and rejection and restoration to steady state after sudden load changes. Transient response is a complete generator set (engine, generator, exciter, and regulator) performance criteria and cannot be established on generator data alone.

M. Witness-Generator Set Factory Production Tests: On the equipment to be shipped, a Five (5) hour test shall be performed at rated load and 0.8 PF. These tests shall include certified data to document the following: run at full load, maximum power, voltage regulation, transient and steady state governing, single step load pickup and safety shutdowns. Provide a factory test record of the production testing. The equipment supplier at their expense shall coordinate and provide all transportation and lodging for the owner and Owner’s engineering representatives, minimum of four to witness the above stated factory test. Tests performed at facilities other than the manufacturer’s factory shall not be acceptable.

N. Factory Test: The unit shall completely assembled and all preliminary adjustments made before the test is initiated. 150 KW genset shall be tested with the complete radiator and fan assembly to be shipped. Outside radiator, heat exchanger attachments shall not be acceptable.

O. Testing Procedure:
1. Test diesel-alternator unit at 0.8 PF in the following sequence:
2. 0.5 hour at 1/4 load.
3. 0.5 hours at 1/2 load.
4. 0.5 hours at 3/4 load.
5. 2 hours at full load.

P. Above testing shall be strip chart recorded and certified. During this test, the following measurements shall be taken and recorded on a certified report format:
1. Barometric Pressure.
2. Intake Air Pressure.
3. RPM.
4. Output voltage per phase.
5. Output amperes per phase.
6. Power Factor.
7. KW.
8. Winding temperature.
9. Transient response testing sequence:
10. 0-25%, 25%-0.
11. 0-50%, 50%-0.
12. 0-75%, 75%-0.
13. 0-100%, 100%-0.

Q. Above testing shall be strip chart recorded. Provide necessary equipment and instruments to measure voltage dips and frequency dips. Comparison shall be made to the herein specified alternator performance characteristics prior to acceptance.

R. Field Acceptance Tests: Generator supplier shall provide and conduct a two (2) hour load bank test at unity power factor for the generator set. Contractor must provide portable load bank for testing generator set at 100% load. Load bank test shall test each generator at full nameplate KW ratings. Generator manufacturer's representative shall record test data, as described below. Test data shall be tabulated and typed for submission and approval by the engineer for final acceptance. No handwritten field notes will be allowed.

S. Initial start up and field acceptance tests are to be conducted by the authorized representative of the system manufacturer who supplies the equipment. Contractor responsible for protection of testing equipment and any additional cable, etc., required if equipment cannot be located internally during testing.

T. Test data shall be collected and recorded on the following: Time of day, coolant temperature, operating oil pressure, battery charging rate, cranking time, crank-to-rated frequency time, voltage and frequency overshoot, load assumption-to-steady state voltage and frequency stabilization time, operating voltage, frequency, current, kilowatts and power factor. All data shall be taken every fifteen (15) minutes.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten (10) years documented experience, and with an authorized distributor offering 24 hour parts and service availability within 50 miles of the project. Proposed engine/generator combination shall have been in production a minimum of five (5) years.

B. Supplier: Authorized distributor of specified manufacturer with minimum five (5) years documented experience with specified products and factory-trained service technicians.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70, NFPA 110, and NFPA 101.

B. Furnish Products listed and classified by Underwriters Laboratories as suitable for purpose specified and indicated.

1.8 PRE-INSTALLATION CONFERENCE

A. Convene one (1) week prior to commencing work of this Section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site.

B. Accept unit on site mounted on trailer. Inspect for damage. Provide written verification that Genset tested and Genset received are one and the same.

C. Protect equipment from dirt and moisture by securely wrapping in heavy plastic during construction.

1.9 EXTRA MATERIALS

A. Provide two (2) of each fuel, oil and air filter element, engine belts and hoses.

1.10 WARRANTY

A. A no deductible comprehensive warranty shall be provided for all products against defects in materials and workmanship for a five-year or 1500 hour period from the start-up date. Warranty shall cover all costs of covered repairs, including travel expenses.

1.11 SERVICE AGREEMENT

A. Manufacturer shall provide Owner with a One (1) year service agreement that includes changing all fluids and filters once a year and a minor inspection six (6) months after each change.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Approved manufacturer:
   1. Cummins Power Generation, model C150D6D rated for STANDBY POWER with UCD3J Frame Alternator as distributed by Cummins Sales & Service. 890 Zerega Avenue, Bronx, NY 10473. Contact Ed Cheung: 718-892-2400, ext. 217.

B. It is intended that all products specified herein be of standard ratings, therefore, the KW and KVA, starting KVA and maximum allowable voltage dip, ratings, etc., shall be the manufacturer's next size or rating to exactly meet the specifications. No exceptions.

2.2 DIESEL ENGINE-GENERATOR SET

A. Ratings
   1. The generator set shall operate at 1800 rpm and at a voltage of: 208 Volts AC, 3-phase, 4-wire, 60 hertz.
   2. The generator set shall be rated at 150 kW, 187.5 kVA at 0.8 PF, standby rating, based on site conditions of: Altitude 1,000 ft., ambient temperatures up to 122 degrees F (50 degrees C).

B. Performance
   1. Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.
   2. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.

3. The diesel engine-generator set shall accept a single step load of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.
4. Motor starting capability shall be a minimum of 920 kVA. The generator set shall be capable of recovering to a minimum of 90% of rated no load voltage following the application of the specified kVA load at near zero power factor applied to the generator set.
5. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic, and no 3rd order harmonics or their multiples. Telephone influence factor shall be less than 40.
6. The generator set shall be certified by the engine manufacturer to be suitable for use at the installed location and rating, and shall meet all applicable exhaust emission requirements at the time of commissioning.

C. Construction
1. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.
2. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight. All active control components shall be installed within a UL/NEMA 3R enclosure. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.

D. Connections
1. The generator set load connections shall be composed of silver- or tin-plated copper bus bars, drilled to accept mechanical or compression terminations of the number and type as shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.
2. Power connections to auxiliary devices shall be made at the devices, with required protection located at a wall-mounted common distribution panel if walk-in enclosure.
3. Generator set control interfaces to other system components shall be made on a permanently labeled terminal block assembly. Labels describing connection point functions shall be provided.

2.3 ENGINE AND ENGINE EQUIPMENT

A. The engine shall be diesel, minimum EPA TIER 3, 4 cycle, radiator and fan cooled. Minimum displacement shall be 408 cubic inches. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable.

B. A digital electronic governor system shall provide automatic isochronous

frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed. The governing system shall include a programmable warm up at idle and cooldown at idle function. While operating in idle state, the control system shall disable the alternator excitation system.

C. Skid-mounted radiator and cooling system rated for full load operation in 122 degrees F (50 degrees C) ambient as measured at the alternator air inlet. Radiator fan shall be suitable for use in a system with 0.5 in H_2O restriction. Radiator shall be sized based on a core temperature that is 20F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The equipment manufacturer shall fill the cooling system with a 50/50-ethylene glycol/water mixture prior to shipping. Rotating parts shall be guarded against accidental Electric starter(s) capable of three complete cranking cycles without overheating.

2.4 ENGINE ACCESSORY EQUIPMENT

A. The engine for the generator shall include the following accessories:
   1. Positive displacement, contact.
   2. Mechanical, full pressure, lubrication oil pump.
   3. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.
   4. An engine driven, mechanical, positive displacement fuel pump. Fuel filter with replaceable spin-on canister element. Fuel cooler, suitable for operation of the generator set at full rated load in the ambient temperature specified shall be provided if required for operation due to the design of the engine and the installation.
   5. Replaceable dry element air cleaner with restriction indicator.
   6. Flexible supply and return fuel lines.
   7. Engine mounted battery charging alternator, 40-ampere minimum, and solid-state voltage regulator.

B. Coolant heater
   1. Engine mounted, thermostatically controlled, coolant heater(s) for each engine. Heater voltage shall be as shown on the project drawings. The coolant heater shall be UL499 listed and labeled.
   2. The coolant heater shall be installed on the engine with silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper

venting of the system. The coolant heaters shall provisions to isolate the heater for replacement of the heater element without draining the coolant from the generator set. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.

3. The coolant heater shall be provided with a 24VDC thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the coolant heater system.
4. The coolant heater(s) shall be 208/240V, 2000 watts and sized as recommended by the engine manufacturer to warm the engine to a minimum of 104F (40C) in a 40F (4C) ambient, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this specification.

C. Provide vibration isolators, internal pad type, quantity as recommended by the generator set manufacturer.

D. Starting and Control Batteries shall be calcium/lead antimony type, 12 volt DC, sized as recommended by the engine manufacturer, complete with battery cables and connectors. The batteries shall be capable of a minimum of three complete 15-second cranking cycles at 40F ambient temperature when fully charged.

E. Provide exhaust silencer(s) for each engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. The mufflers shall be critical grade installed inside enclosure.

F. A UL listed/CSA certified 6 amp voltage regulated battery charger shall be provided for each engine-generator set. The charger shall be located inside the automatic transfer switch. Input AC voltage and DC output voltage shall be as required. Chargers shall be equipped with float, taper and equalize charge settings.

G. Provide Alternator Anti-Condensation heater – 120 VAC, 100W.

H. Provide Engine Oil heater – 120 VAC, 150W.

2.5 AC ALTERNATOR

A. The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system and shall be UL1446 listed. Actual temperature rise measured by resistance method at full load shall not exceed 80 degrees Centigrade.

B. The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.

C. The subtransient reactance of the alternator shall not exceed 7.3 percent, based on the 80°C rise rating.

D. Alternator shall be rated for a minimum of 170 KW at 80°C, 120/208 VAC standby.

2.6 ENGINE GENERATOR SET CONTROL

A. Generator set Control. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.

B. The control shall be mounted on the generator set, or may be mounted in a free-standing panel next to the generator set if adequate space and accessibility is available. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

C. Control Switches

1. Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or MANUAL position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. A separate push-button to initiate starting is acceptable. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
2. EMERGENCY STOP switch. Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
3. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
4. PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

D. Generator Set AC Output Metering. The generator set shall be provided with a

metering set including the following features and functions:

1. Digital metering set, .5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.
2. Analog voltmeter, ammeter, frequency meter, power factor meter, and kilowatt (KW) meter. Voltmeter and ammeter shall display all three phases. Meter scales shall be color coded in the following fashion: green shall indicate normal operating condition, amber shall indicate operation in ranges that indicate potential failure, and red shall indicate failure impending. Metering accuracy shall be within 1% at rated output. Both analog and digital metering are required.
3. The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.
4. The control system shall log total number of operating hours, total kWH, and total control on hours, as well as total values since reset.

E. Generator Set Alarm and Status Display.

1. The generator set control shall include LED alarm and status indication lamps. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. Functions indicated by the lamps shall include:
    a. The control shall include five configurable alarm-indicating lamps. The lamps shall be field adjustable for any status, warning, or shutdown function monitored by the genset. They shall also be configurable for color, and control action (status, warning, or shutdown).
    b. The control shall include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at the generator set. The running signal shall be based on actual sensed voltage and frequency on the output terminals of the generator set.
    c. The control shall include a flashing red lamp to indicate that the control is not in automatic state, and red common shutdown lamp.
    d. The control shall include an amber common warning indication lamp.
2. The generator set control shall indicate the existence of the warning and shutdown conditions on the control panel. All conditions indicated below for warning shall be field-configurable for shutdown. Conditions required to be annunciated shall include:
    low oil pressure (warning)
    low oil pressure (shutdown)

oil pressure sender failure (warning)
low coolant temperature (warning)
high coolant temperature (warning)
high coolant temperature (shutdown)
high oil temperature (warning)
engine temperature sender failure (warning)
low coolant level (warning)
fail to crank (shutdown)
fail to start/overcrank (shutdown)
overspeed (shutdown)
low DC voltage (warning)
high DC voltage (warning)
weak battery (warning)
low fuel-daytank (warning)
high AC voltage (shutdown)
low AC voltage (shutdown)
under frequency (shutdown)
over current (warning)
over current (shutdown)
short circuit (shutdown)
ground fault (warning) (optional--when required by code or specified)
over load (warning)
emergency stop (shutdown)
(4) configurable conditions

3. Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

F. Engine Status Monitoring.

1. The following information shall be available from a digital status panel on the generator set control
   engine oil pressure (psi or kPA)
   engine coolant temperature (degrees F or C)
   engine oil temperature (degrees F or C)
   engine speed (rpm)
   number of hours of operation (hours)
   number of start attempts
   battery voltage (DC volts)
2. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a

percent of the standby rating of the generator set.

3. Provide and install a 20-light LED type remote alarm annunciator with horn, located as shown on the Drawings or in a location that can be conveniently monitored by facility personnel. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems for the local generator control panel. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA110 3-5.6.2. The interconnecting wiring between the annunciator and other system components shall be monitored and failure of the interconnection between components shall be displayed on the annunciator panel.

   The annunciator shall include the following alarm labels, audible annunciation features, and lamp colors:

Condition	Lamp Color	Audible Alarm
Genset Supplying Load	Amber	No
Charger AC Failure	Amber	Yes
Low Coolant Level	Amber	Yes
Low Fuel Level	Red	Yes
Check Genset	Amber	No
Not In Auto	Red	Yes
Genset Running	Amber	No
High Battery Voltage	Amber	Yes
Low Battery Voltage	Red	Yes
Weak Battery	Red	Yes
Fail to Start	Red	Yes
Low Coolant Temperature	Red	Yes
Pre-High Engine Temperature	Amber	Yes
High Engine Temperature	Red	Yes
Pre-Low Oil Pressure	Red	Yes
Low Oil Pressure	Red	Yes
Overspeed	Red	Yes
(4) Spares	Configurable	Configurable

2.7 ENGINE CONTROL FUNCTIONS

A. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.

B. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled. Total duration of operating time in the idle mode shall be controlled by the system, to prevent degradation of the engine capabilities due to excess operating time at idle.

C. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.

D. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.

E. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

2.8 ALTERNATOR CONTROL FUNCTIONS

A. The generator set shall include a full wave rectified automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase line to neutral RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.

B. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.

C. Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.

D. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

E. An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

2.9 OTHER CONTROL FUNCTIONS

A. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC. During engine cranking (starter engaged), the low voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

2.10 GENERATOR MAIN LINE CIRCUIT BREAKERS & ADDITIONAL PROTECTION

A. The generator set shall be provided with genset mounted, quantity two (2) 400 amp main line circuit breakers. The circuit breaker shall incorporate an electronic trip unit that operates to protect the alternator under all overcurrent conditions, or a thermal-magnetic trip with other overcurrent protection devices that positively protect the alternator under overcurrent conditions. Electronic trip unit shall include adjustable long-time, short-time and instantaneous trip settings. The supplier shall submit time overcurrent characteristic curves and thermal damage

curve for the alternator, demonstrating the effectiveness of the protection provided.

B. The generator set shall be provided with a utility grade protective relay, designed to provide thermal overload protection for the alternator, and performance certified for that purpose by a 3rd party testing organization. The supplier shall submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided. Relay shall be installed to allow shutdown of the generator excitation system on an alternator overload condition, with the engine operating for a cool-down period before shutdown. The relay shall not include an instantaneous trip function

2.11 WALK IN SOUND ENCLOSURE & 500 GALLON UL SUB-BASE TANK

A. Semi walk-in sound enclosure & 500 gallon sub-base tank shall be as manufactured by Acoustical Sheetmetal, Inc., 2600 Production Road, Virginia Beach, VA 23454.

B. Structure: Frame of enclosure to be fabricated of structural steel tubing. All steel material to conform to A.S.T.M. A-36. All connections to be full welds by technicians certified under A.S.M.E. Section IX. All steel to be free from rust and defects. Entire frame to be primed and painted with two coats of epoxy paint. All members to be straight, true and at right angles to connecting parts. Overall dimensional tolerance to be plus or minus 1/8".

C. Aluminum Skin: Enclosure to be covered with 14 gauge (0.063") pre-painted aluminum, color white, bronze, or mill finish marine grade aluminum. Aluminum to be separated from steel with 1/8" closed cell rubber foam insulation. All fasteners to be made of non-corrosive materials. All panel fasteners will not be visible on the exterior. Solid aluminum rub rails will surround the top and bottom perimeters, caulked with silicone sealant and secured with stainless steel self-tapping screws. Roof panel joints to have continuous covers, sealed and secured to steel frame with corrosion resistant fasteners. Color to be selected from manufacturer's standard options by Owner.

D. Insulation: Three inch (3") thick panels double wall construction filled 100% with sound absorbing Fiberglass insulation with a flame spread of 10, fuel contributed of 0 and a smoke developed 0, to be placed at walls and ceiling covered with 18 gauge (.040) mill-finished perforated aluminum. Air intake and discharge chambers to be insulated to restrict the transmission of generator set noise. Entire assembly shall be able to reduce generator set noise in free field to 65 dB/A at a distance of 7 meters from enclosure in any direction.

E. Access: All doors to be made of the same material as the enclosure skin, two solid double doors, 30"wide x 48"high on side of enclosure. Hinges to be butt hinges of solid stainless steel. Door handles to be three-point latch type, with panic release from inside of enclosure keyed alike. Lock materials to be made of non-corrosive materials. Stainless steel door holders will be installed on swinging

doors. Rain gutters to be placed over all doors. Lift out type doors to be used in areas of reduced access.

F. Air Intake: External sound absorbing rear mounted hood with internal sound absorbing baffle system with galvanized motor operated dampers. Size of louver to be sufficient to meet combustion and cooling air movement requirements. Air intake louvers to have bird screen mesh to prevent ingestion of debris. Air velocity shall not exceed 1000 feet per minute. An internal motor operated damper shall be installed and wired to the generator set.

G. Air Discharge**:** External sound absorbing vertical plenum with internal sound absorbing baffle system, birdscreen, and gravity louvers.

H. Accessories: Muffler brackets to be solid aluminum structural angle, welded as one piece for internal installation from a super critical sound absorber muffler. Muffler straps provided to be custom fit for the muffler. Insulation for interior muffler/flex and exhaust pipe provided and installed. Aluminum rain caps and collars made to prevent rain intrusion at roof penetration. Engine oil and water drains to be extended to exterior of enclosure**.**

I. Electrical Accessories:
1 Power Panelboard to be 100 Amp, three phase, 120/208 VAC
2 LDE type lights.
2 Light switches.
2 Duplex receptacles.
2 Junction boxes for battery charger and jacket water heater connection.
2 Connection for motor operated damper to junction box or generator control panel.
3 Connection for low alarm, high alarm, leak alarm.
1 Exhaust fan with thermostat and gravity louver.
1 Space heater with thermostat, 5 KW.
2 External emergency break glass station
1 18” Exhaust fan with thermostat
2 Exterior LED lights
1 Photocell
2 Emergency Break glass stations
2 Emergency Dual head lights
1 Automatic Transfer Switch
1 Manual Transfer Switch
1 Portable generator connection cabinet, exterior mounted

All electrical accessories shall be pre-installed by the enclosure manufacturer and pre-wired in rigid steel conduit.

J. Steel Base to be fabricated of structural steel channel with 3/16: thick diamond plate floor conforming to the requirements of A.S.T.M. A-36. All steel to be new and free from rust and scaling. All steel members to be primed and painted with no less than two coats of epoxy paint. Steel cross members to be of structural steel channel. Strategically placed to support the generator set. Steel angle will be placed under the seams of the floor material to provide continuous support.

K. Plates to be welded in such a manner as to prevent buckling. All welds to be performed by technicians certified under A.S.M.E. Section IX. Top and bottom of floor to be primed and painted with no less than two coats of epoxy paint. Floor cutouts (electrical stub-up area) shall be provided as necessary to provide access to the electrical connections area of the generator set. Fuel storage compartments under floor shall be designed and fabricated in compliance with Underwriter's Laboratories Standard UL 142 Specifications. The rupture tank shall meet the same specifications for integrity and strength.

L. Provide a sub-base nominal 500 gallon fuel tank for the generator set. The sub-base fuel tank shall be UL142 listed and labeled. Installation shall be in compliance to NFPA 37. The fuel tank shall be a double-walled, steel construction and include the following features:

1. Emergency tank and basin vents.
2. Mechanical level gauge.
3. Fuel supply and return lines, connected to generator set with flexible fuel lines as recommended by the engine manufacturer and in compliance to NFPA 37 requirements.
4. Leak detection provisions, wired to the generator set control for local and remote alarm indication.
5. Low level float switches to indicate fuel level. Wire switches to generator control for local and remote indication of fuel level.
6. Basin drain.
7. Integral lifting provisions.

M. COUPLING/VENTS AND ALARM SWITCHES FOR FUEL BASE STORAGE TANK

A: 3/4" Fuel pickup and return piping
B: 2" Vent to outside from enclosure
C: 1 ½" Mechanical fuel level gauge
D: 2" Lockable fuel fill cap with 7 Gallon spill container
E: 1" Drain coupling with plug
F: 1 1/4" High/low fuel level alarm switch
G: 8” Emergency vent with 2” Spare Couplings with plugs

N. COUPLING/VENTS AND ALARM SWITCHES FOR RUPTURE TANK

A: 1" Drain coupling with plug
B: 1 1/4" Leak alarm switch
C: 8” Emergency vent

O. Supports and "D" type lifting rings shall be provided at such location as to provide for balanced lifting at the enclosure, generator set and base assembly.

P. Two inch (2") high environmental protection barrier placed around electrical stub-up area and enclosure interior wall to help prevent liquid spill-over to the environment.

Q. Provide galvanized steel access platforms with stairs and railings. Height as required and as shown on the drawings.

PART 3 EXECUTION

3.1 ACCEPTANCE

A. Equipment shall be initially started and operated by representatives of the manufacturer.

B. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to final testing of the system.

C. Contractor shall provide all fuel for testing and fill fuel tank complete prior to turnover to Owner.

3.2 TRAINING

A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than two (2) four (4) hours sessions in duration and the class size shall be limited to five (5) persons. Training date shall be coordinated with the facility owner.

3.3 DEMONSTRATION

A. Provide systems demonstration. Electric Contractor shall provide fuel for testing and shall fill tank complete after all testing is done and before turning over to Owner.

B. Describe loads connected to standby system and restrictions for future load additions.

C. Simulate power outage by interrupting normal source and demonstrate that system operates to provide standby power.

+ + END OF SECTION + +