ADDENDUM #3

CONSTRUCTION OF:
THE NATIONAL GUARD READINESS CENTER

at

Pinehurst Road RT. 539 Lakehurst, NJ 08759

DMAVA Project # LH132
DRG Project # 1948

LISA J. HOU, D.O
BRIGADIER GENERAL
NJARNG
THE ADJUTANT GENERAL

STATE OF NEW JERSEY
DEPARTMENT OF MILITARY
AND VETERANS AFFAIRS
101 EGGERTS CROSSING ROAD
LAWRENCEVILLE, NEW JERSEY 08648

DATE OF ISSUE: September 1, 2021

INTENT: This ADDENDUM supersedes all conflicting and contrary information in said Contract Documents, and said documents are hereby amended in certain particulars as described below. Bidder must acknowledge receipt of this addendum on the bid form.

CLARIFICATIONS:

RESPONSES TO BIDDERS' QUESTIONS:

Alternate 5: Assumed C1/S-303 and C2/S-303 are part of Alternate 5. Please give positions of callouts for C1/S-303 and C2/S-303 . See attached.
C1 / S303 and C2 / S303 sections are clearly shown on Dwg S101A - Crane Steel Framing Plan Alternate Bid. The crane schematic is shown on Dwg A-404. See 142213 - Overhead Bridge Crane, 1.2, C. for design requirements.

Alternate 5: P-503 shows two trench drains at the overhead doors and no under slab drainage piping from them. Please provide drainage piping from the trench drains and where piping is to terminate.
These trench collection structures are intended to be dry and to to be periodontally cleaned manually. No connection to the storm drainage system is required.

Plan E-301, rooms 117 and 118 have "F" light fixtures which are not listed in the lighting schedule. Please provide fixture data.
Substitute "F" and "F – EM" (2 fixtures) with (one fixture) type "K" with an EM pack.

There is a fixture type "F" and "F EM" shown in the Admin Men's and Admin Women's restroom, however, there is no such fixture on the Fixture Schedule.
Substitute "F" and "F – EM" (2 fixtures) with (one fixture) type "K" with an EM pack.

Type "H" fixture is a 96" long fixture, however, there is a symbol for a 4' long type "H" fixture depicted in Lobby 102
The contractor should reference the lengths as shown on plan and not the 4' catalog nomenclature.
There are 4' individual fixtures, 8' individual fixtures x 2 resulting in a 16' configuration.
The 8' individual fixtures will have singular housing body 8' long.

Key Note #7 states see Roof Details A-105. We do not have a drawing A-105 in our documents. Please provide.
Revise reference on Dwg A-105 to read "G-201". Completed roof detail are shown on G-201 and G-202 for the base bid and alternate bid.

To be consistent and clear regarding pavement. Sheet C-103 calls out Rigid, HD Flex, HD, LD and HMA pavement. Addendum 1 Section 012310 Alternates, Allowances and Unit Prices revises the narrative to Alternates 3 & 4, which is not clear regarding Rigid, HD Flex, HD, LD and HMA pavement. Please give details of Base Bid Paving showing Rigid, HD Flex, HD, LD and HMA pavement. Please see attached C-103 for paved areas in question.
HMA represents HD & LD pavements if Alternates are awarded. ĐD Flex is the same as HD. There are only 3 pavement sections: Rigid, HD, and LD. All details are shown on C-112. Đote the response to RFI #6 that clarifies Base Bid vs. Alternate for HD & LD sections. "Per Detail on C-112, Notes: BASE BID INCLUDES STRIPING AND PAVING FOR HANDICAP ACCESSIBLE PARKING ONLY. FOR ALL OTHER AREAS, BASE BID SUBSTITUTES ASPHALT COURSES FOR DENSE GRADED AGGREGATE" To clarify the above note further, as a part of the base bid: 1. The 'Heavy Duty' Section includes 14" of Compacted thickness DGA. If Alternate 3 is

awarded, the top 8" of DGA is replaced with asphalt. 2. The 'Light Duty' Section includes 12" of Compacted thickness DGA. If Alternate 4 is awarded, the top 6" of DGA is replaced with asphalt."

Electrical Questions:

1. Sheet E-301 Admin Women's T 117 and Admin Mens T 118 show a fixture Type F. Per sheet E-702 lighting fixture schedule there is no Fixture Type F.
Can you please provide manufacture and catalog number for these (4) fixtures?
Substitute "F" and "F – EM" (2 fixtures) with (one fixture) type "K" with an EM pack.

2. Sheet E-702 Lighting Fixture Schedule indicates a Type K1 fixture. Sheet E-301 does not show any lighting fixture Type K1. Are any type K1 lighting fixtures required?
All type "K" fixtures indicated on the lighting plan drawing E-301 are 4' linear fixtures. All "K" type fixtures located on the electrical lighting plan E-301 shall be that of type "K1". Type "K" does not exist on this drawing.

3. Sheet E-101 would it be safe to assume that the two W4A lighting fixtures shown on the Readiness Center South wall next to Alternate #5 training center will be deleted if Alternate #5 accepted?
The base bid fixture locations in question can be omitted upon the acceptance of alternate bid #5.

4. Sheet E-101 shows two CCTV cameras shown on alternate 5 South wall. There is only one CCTV camera shown on the South wall of the Readiness Center.
Should the two CCTV cameras that are shown on Alternate #5 Training Center South wall also be shown on the Readiness center South Wall under the base bid?
If yes would it be safe to assume that these fixtures would be deleted if Alternate #5 accepted?
These two camera's should also be shown and included under the base bid located on the South Wall of the Readiness Center. The base bid locations can be omitted upon acceptance of alternate bid #5.

5. Who will be responsible for the furnishing and installation of the car charging station as indicated on sheet C-103 and C-110?
Drawing No. C-103 and C-110 indicate EV charging station model number. Drawing No. E-101 indicates two circuits to power charging station.

6. Sheet E-702 detail 8 Access Control system equipment schedule. Would it be safe to assume that there are only (2) locations that will require access control, door opening EXT3 and SF1.
The two locations that require Access Control are back door EXT3 and at the front entrance door SF2.

7. Per specification, Fire alarm and Voice Communications 284600-7, 2.1 Manufacturers paragraph E.
a. Will any other manufactures besides Edwards be acceptable?
Edwards shall be considered the basis of design. Contractors may substitute in accordance with the specifications.

8. Per Drawing E-702 detail 6 CCTV system equipment. Will other manufacturers besides AI Phone be acceptable?
Equipment for ESS (Electronic Security System) cannot be substituted as these manufacturers are the only ones that is authorized by NGB at the moment.

9. Per Drawing E-702 detail 5 IX block diagram. Will other manufactures besides HANWHA be acceptable?
Equipment for ESS (Electronic Security System) cannot be substituted as these manufacturers are the only ones that is authorized by NGB at the moment.

Specs state the Contractor is responsible for all permits including DCA, Pinelands, etc. Is it possible to have an allowance to cover all permitting costs?
There will be no DCA permits as we are on Federal Land. There will be no permits / fees for Pinelands on behalf of the contractor.

What is the maintenance period and % required for this project?
The maintenance period shall be 1 year. There is no maintenance bond required for the project?

Drawing C-103; How thick is the asphalt to be removed and is there DGA underneath?
The thickness is unknown. For the purposes of the bid, it is assumed to be 6" thick with 6" of stone underneath that does not meet the graduation requirements of DGA.

Drawing C-107 Fire Line; Is there a PIV needed and if so, is there an Electric Position Sensor?
A Post Indicator Valve has been added to the scope of the project. See associated note on revised C-107 for detail.

Drawing C-107 Fire Line; Is the 4" Fire Line plastic C-900 or ductile iron?
As shown on C-107, the fire line is C900.

Drawing C-105; Is there a detail for the trash grate for the 6" orifice on the outflow structure?
There is no detail. Bar spacing must be less than or equal to 2" and must meet the following requirements: Constructed of rigid, durable and corrosion-resistant material; and Designed to withstand a perpendicular live loading of 300 lbs/sf. During submittal process, shop drawings should be provided.

What is the height of the wall to be provided?
The height of the folding partition under the alternate bid shall match the adjacent ceiling = +10'-0"

Site JB boxes shown on C-110 for Primary and Communication feeds should be Utility Rated manholes? Please confirm required Utility Structure to be used.
Manholes shall be furnished/installed by the contractor, along with the primary electrical conduits, and run as noted on plans to be provided to electrical utility agency. Manhole manufacturer's and specifications shall be per jcp&l / first energy requirements. For the purposes of this bid the contractor shall assume that the electrical utility agency plans shall call for two 6' x 8' x 7' concrete manholes to be furnished and installed by the contractor along the run of primary raceway. Manhole installation, grounding, construction type and lid shall be per jcp&l / first energy standards.

From Pre-Bid Meeting:
Is the incoming tele/data fiber or copper?
Drawing E-101 & Detail #3 on E-702 indicate that the contractor shall provide (4) 4" empty PVC conduits with pull cord to be furnished and installed between the existing site utility pole and the new main IT/Tele-data room for the new incoming telephone/it service. Fiber and/or copper will be provided by Verizon, Xfinity, or other selected service provider from the utility pole to the demark in IT room 143.

Please clarify exactly what bid documents are required by the prime subcontractors? Page 1 of Addendum 1 under BMB indicates that "**All bid documents** are required from both the General Contractor and all Prime subcontractors". Please clarify the specific documents that are required from the Prime Subs per the Bid Document Submission Checklist that requires 12 items. Most of the items on the checklist are not normally required of subs.
See attached highlighted document from Section 009100 provided at the end of this addendum.

Expanded from Addendum #2

Please confirm Owner Provided Furniture final electrical and data connections are by the General Contractor's electrician.

Key notes 1 & 2 on drawing E-201 shall read as follows:

1. Contractor shall furnish and install a 12"x12"x6" pull box located above the ceiling. Contractor shall safe off & coil 20' of electrical conductors for the shown circuits from main electrical room in this junction box for connection to modular furniture. When furniture is installed, contractor shall furnish and install dual-channel tele-power pole and extend wiring from pull box to furniture and make final power connections. Coordinate installation with furniture manufacturer and owner.

2. Contractor shall furnish and install a 12"x12"x6" pull box located above the ceiling. Contractor shall safe off & coil 20' of CAT 6 cable, 8 separate cables for this box, from the main IT/Data patch panel in this junction box for connection to modular furniture. When furniture is installed, contractor shall run the CAT 6 cables through one of the tele-power pole channels to the modular furniture and terminate at RJ-45 to be furnished and installed by this contractor in the furniture cabling channel. Coordinate installation with furniture manufacturer and owner.

We see the "Entrance mats" on the plans, but do not see any specific call outs anywhere. Please provide the specs (12 48 00) as required for bidding purposes.
GC will be responsible to procure for the owner a service contract for 3 years for LEED level portable matts.

Concrete Finishing Spec #03 01 30 (Addendum #2): As per Addendum #2 for Polished/Sealed concrete, we were advised by our vendors that specified ARDEX product is suited for existing floor not new concrete floor. Please advise. Thank you
A/E team has confirmed with the ADREX manufacturer's representative that the specified product can be used for new concrete floors.

SPECIFICATIONS:

From Pre-Bid Meeting:
Section 00 72 13 – General Conditions
Page 30, Paragraph 41., (9.), medical waste
This will not be part of the base bid. If there should be any discovered during construction, this will be handled as a Change Order.

Section 00 91 00 – Bid Document Submission Checklist
"Remove" Bid Document Submission Checklist and
"Replace" with Bid Document Submission Checklist provided at the end of this addendum.
Document has been highlighted is response to contractor question.

Section 00 41 13 – Bid Form
"Remove" Bid Form and
"Replace" with Bid Form provided at the end of this addendum.
An allowance for soil removal has been added to the project. The contractor will be responsible for generating the total allowance amount by using the companion unit price.

Section - 01 23 10 - ALTERNATES, ALLOWANCES AND UNIT PRICES
"Remove" SECTION 01 23 10 - ALTERNATES, ALLOWANCES AND UNIT PRICES and
"Replace" with SECTION 01 23 10 - ALTERNATES, ALLOWANCES AND UNIT PRICES provided at the end of this addendum.
An allowance for removal of unsuitable soil has been added to the project. The contractor will be responsible for generating the total allowance amount by using the companion unit price.

"Add" specification section - 019100 – General Commissioning Requirements provided at the end of this addendum.
This section was inadvertently left out of the project manual.

Section 03 01 30 - Concrete Finishing and
Section 09 67 23 - Resinous Flooring (issued under Addendum #2)
"Add" the following LEED language to these sections:
LEED Submittals:
The contractor, subcontractor, and/or product manufacturer shall submit the following LEED BUILDING certification items:
1) An ENVIRONMENTAL BUILDING MATERIALS CERTIFICATION FORM, per Section 01 81 12 – Sustainable Design Requirements under the LEED Submittals of these specifications. Information to be supplied includes: product name, product manufacturer, material only cost, provision of EPD, provision of CSR, provision of EPR, % Recycled Content, provision of MCI, provision of HPD, C2C compliance status, GSB compliance status, provision of SCO, location of manufacturing, origin of raw material extraction, CDPH compliance (e.g FloorScore), emissions in mg/m3, VOC content, Volume, and Area to be provided per the requirements of the ENVIRONMENTAL BUILDING MATERIALS CERTIFICATION FORM.
2) Third-party Certification including testing reports shall be provided from the product manufacturer to verify the product information supplied for the ENVIRONMENTAL BUILDING MATERIALS CERTIFICATION FORM.
3) Product Cut Sheets for all materials that meet the LEED BUILDING Performance criteria, as stated in LEED Performance Item below. Cut sheets shall be submitted with the Contractor or Subcontractor's stamp, as confirmation that the submitted products are the products installed in the project.
LEED BUILDING Performance Criteria:
The following criteria are REQUIRED for the products included in this section:

1) All resinous flooring products must be certified as compliant with the FloorScore standard SCSEC10.3-2014, September 2015 (CDPH compliance).
2) Adhesives or sealants used for interior work in this section shall meet the requirements of Division 1 Section "Volatile Organic Compound (VOC) Emission and Content Limits for Adhesives and Sealants (LEED Building)", where applicable.
3) All coatings shall comply with the low VOC and emission requirements called out in Section 09 91 23, Painting (i.e. maximum of 50 g/l of VOC for floor coating).

DRAWINGS:
Drawing G-002 – 2nd column Part 2 – Products – 2.1 Materials A. 1.
"Revise" 01 81 13.13
"To Read" 01 81 12
The original reference was mis noted
Disregard sections 01 81 13.16, 01 81 13.19 & 01 81 13.23 which are not applicable to this project.

"Remove" drawing C-107 Utility Plan and
"Replace" with revised drawing C-107 Utility Plan provided at the end of this addendum
Additional Junction Boxes to separate electrical and emergency feeds have been added to the scope of the project.
A Post Indicator Valve has been added to the scope of the project. See associated note on revised C-107 for detail.

"Remove" drawing C-110 Lighting and Electrical Plan and
"Replace" with revised drawing C-110 Lighting and Utility Plan provided at the end of this addendum
Additional Junction Boxes to separate electrical and emergency feeds have been added to the scope of the project.
Removed references to conduit quantities and sizes. Conduit quantities and sizes shall be determined by sheet E-101 – Electrical Site Plan.

End of Addendum No. 3

BID DOCUMENT SUBMISSION CHECKLIST

Bidder Initials

1. Bid Form (Section 004113) _____
2. Bid Bond/Consent of Surety (Section 004313) _____
3. Notice of Classification (Section 004513) _____
4. Non-Collusion Affidavit (Section 004519) _____
5. Certification of Non-Segregated Facilities (Section 004533) _____
6. Disclosure Affidavit (Section 004547) _____
7. Certification of Uncompleted Contracts (Section 004548) _____
8. Certification of McBride Principles (Section 004550) _____
9. Disclosure of Investment Activities in Iran (Section 04551) _____
10. Certification Pursuant to Executive Order 117 (Section 004553) _____
11. Certification Pursuant to PL 2005, Chapter 51 (Section 004554) _____
12. NJSTART registration _____

SIGNATURE: The undersigned hereby acknowledges and has submitted the above listed requirements.

FIRM NAME:_____

SIGNATURE: _____

PRINTED NAME: _____

PRINTED TITLE: _____

DATED: _____

BID FORM

STATE OF NEW JERSEY
DEPARTMENT OF MILITARY AND VETERANS' AFFAIRS
BUSINESS MANAGEMENT BUREAU
For
CONSTRUCTION OF THE NATIONAL GUARD READINESS CENTER
At
Pinehurst Road RT. 539 Lakehurst, NJ 08759

Date: _____

State of New Jersey
Department of Military and Veterans' Affairs
Business Management Bureau
101 Eggert Crossing Road
Lawrenceville, New Jersey 08648

This Bid Form is to be returned in the self-addressed envelope in accordance with the Specifications.

BASE BID*: Construction of an Army National Guard Readiness Center according to the plans and specifications.

The CONTACTOR shall perform all work listed in this Project Manual and the Terms and Conditions of the CONTRACT described herein for the total sum of:

Written Amount_____

_____($_____)

ADD ALTERNATE BIDS:

ALTERNATE BID #1: Folding Partition

Written Amount_____

_____($_____)

ALTERNATE BID #2: Tile Wainscoting in the Gang of Toilet Rooms, Admins. Toilet Rooms and Lactation Room

Written Amount_____

_____($_____)

ALTERNATE BID #3: Asphalt Paving - Roadway

Written Amount_____

_____($_____)

ALTERNATE BID #4: Asphalt Paving – Parking Lot

Written Amount_____

_____($_____)

ALTERNATE BID #5: General Purpose Work Bay (GPWB)

Written Amount_____

_____($_____)

Detailed description of Alternate Bid items is located in Section 01-23- 10 ALTERNATES, ALLOWANCES, AND UNIT PRICES.

ALLOWANCES:

ALLOWANCE GC-1:	**GENERAL ALLOWANCE**	**$85,000**
ALLOWANCE GC-2:	**GENERAL ALLOWANCE - STRUCTURAL STEEL**	**$25,000**
ALLOWANCE GC-3:	**GENERAL ALLOWANCE - CAST PLAQUE**	**$10,000**
ALLOWANCE GC-4:	**UNSUITABLE SOIL 500 cu yrds X UNIT PRICE GC#1**	**$**

***All allowances "SHALL BE INCLUDED" in the base bid.**

UNIT PRICES:

GC#1 UNSUITABLE SOIL **$_____PER CU YRD**

SUBCONTRACTORS: The undersigned proposes to subcontract work in conjunction with this bid submitted pursuant to N.J.S.A 52:32-2 to the following named sub-contractors qualified in accordance with N.J.S.A. 52:35-1 et seq:

Plumbing _____

HVAC _____

Electrical _____

Structural _____

Specialties please list as required (Environmental, asbestos abatement, lead abatement, mold abatement, etc):

_____

NOTE: Award shall be made in accordance with DMAVA guidelines. In the case of Additional Bid Items the lowest responsible bidder for the Base Bid and Additive Bid Items (as needed) in priority order subject to the availability of construction funds and DMAVA guidelines will determine the low bid. The amount of construction funding available will be announced at the bid opening subsequent to the bid closing date and time and prior to opening of the submitted bids.

The bidder, having examined the project manual with related documents and the sites of the proposed work and being familiar with all of the conditions surrounding the proposed project including the availability of materials and labor, hereby proposes to furnish all labor, materials and supplies, and to complete the work in accordance with the Contract Documents within the time set forth herein, and at the prices stated above. These prices are to cover all expenses incurred in performing the work required under the Contract Documents, of which this proposal is a part. Allowances are part of the Base Bid.

Bidder hereby agrees to commence work under this CONTRACT only after receiving the written "Notice to Proceed" from the Owner and to fully complete the project within the **SPECIFIED PERFORMANCE PERIOD** 540 days – 18 Months. Bidder further agrees to pay as liquidated damages, a sum for each consecutive working day thereafter as provided in the Project Manual.

BID FORMS MUST BE SUBMITTED IN ORIGINAL

Refer to CONTRACT NUMBER and/or ACCOUNT NUMBER IN ALL CORRESPONDENCE.
Bidder acknowledges receipt of the following Minutes and Addenda

Pre-bid Minutes	Date of Minutes
_____	_____

Addendum Number	Date of Addendum
_____	_____
_____	_____
_____	_____
_____	_____

Upon receipt of written notice of the acceptance of this bid, bidder will execute the formal contract within fourteen (14) calendar days.

Complete and submit with bid package the following forms:

1. Bid Form
2. Bid Bond/Consent of Surety
3. Notice of Classification
4. Non-Collusion Affidavit
5. Certification of Non-Segregated Facilities
6. Disclosure Affidavit
7. Certification of Uncompleted Contracts
8. Certification MacBride Principals
9. Disclosure of Investment Activities in Iran
10. Executive Order No. 117 (2008)
11. PL 2005 Ch. 51 Contractor Certification and Disclosure
12. NJSTART Proof of Registration

The State of New Jersey reserves the right to accept or reject any or all bids in accordance with applicable laws if it is felt to be in the public interest to do so.

This bid shall be valid for ninety (90) calendar days from date of bid opening.

NOTE: If the bidder is a corporation, indicate State of Incorporation and if a partnership, give full names of partners.

Respectfully submitted:

(Seal – If bid is by a corporation) By

_____
Name of Firm

_____
Signature & Title

_____
Business Address

_____
Business Phone

PART 1 - GENERAL

1.01 SUMMARY

A. Wright Commissioning has been selected as the Commissioning Authority.

This specification section describes the commissioning platform for each of the systems to be commissioned within the commissioning scope, and shall apply to any related division-specific specification sections.

1.02 DEFINITIONS AND ABBREVIATIONS

A. Definitions set forth in the General Conditions, AIA Document A201, are applicable to this Section. In addition, the following definitions shall apply to the terms used in this section.

1. **"Acceptance Phase"** Phase of construction after startup and functional performance tests, when performance verification, O&M documentation review and training occurs.
2. **"Approval"** Acceptance that a piece of equipment or a system has been properly installed and is functioning in the tested modes according to the Contract Documents.
3. **"Architect/Engineer (A/E)"** The prime consultant (architect) and sub-consultants who comprise the design team, generally the mechanical designer/engineer and the electrical designer/engineer.
4. **"Basis of Design (BOD)"** The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the owner's performance requirements. The basis of design describes the systems, components, conditions and methods chosen to meet the requirements. Some reiterating of the requirements may be included.
5. **"Commissioning Authority (CxA)"** Directs and coordinates the day-to-day commissioning activities. The CxA does not take an oversight role like the Construction Manager. The CxA is part of the Construction Management team and shall report directly to the Owner.
6. **"Commissioning Plan"** An overall plan, developed before and typically revised after bidding, that provides the structure, schedule and coordination planning for the Commissioning platform.
7. **"Contract Documents"** The documents binding on parties involved in the construction of the project (drawings, specifications, change orders, amendments, contracts, Cx plan, etc.)
8. **"Contractor"** The Construction Manager or authorized representative.
9. **"Control system"** The central building automation/energy management control system.
10. **"Datalogging"** Monitoring flows, currents, status, pressures, etc. of equipment using standalone dataloggers separate from the control system.
11. **"Deferred Tests"** Commissioning tests that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the test from being performed initially.
12. **"Deficiency"** A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the owner's performance requirements or basis of design).
13. **"Design Narrative"** Section of the Basis of Design.
14. **"Factory Testing"** Testing of equipment on-site or at the factory by factory personnel with an Owner's representative present.
15. **"Field Installation Verification (FIV)"** Verification of all installed systems for compliance to plans and specifications. These inspections are to be described in detail in the commis-

sioning plan. They are primarily static inspections and procedures to prepare the equipment or systems for initial operation (e.g., the belt tension, oil levels OK, labels affixed, gauges in place, sensors calibrated, etc.).

16. **"Construction Manager (CM)"** The prime contractor for this project. Generally refers to all the CM's subcontractors as well. Can also be referred to as the Contractor.
17. **"Indirect Indicators"** Indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed.
18. **"Manual Test"** Using handheld instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the observation).
19. **"Monitoring"** The recording of parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of control systems.
20. **"Non-Compliance"** See Deficiency.
21. **"Non-Comformance"** See Deficiency.
22. **"Over-written Value"** Writing over a sensor value in the control system to see the response of a system (e.g. changing the outside air temperature value from 50F to 75F to verify economizer operation.) See also Simulated Signal.
23. **"Owner-Contracted Tests"** Tests paid for by the Owner outside the CM's contract and which the CxA does not oversee. These tests will not be repeated during performance verification if properly documented.
24. **"Owner's Performance Requirements (OPR)"** A dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the Owner. It is initially the outcome of the programming and schematic design phases.
25. **"Performance Verification Testing (PVT)"** Testing of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Performance verification is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure set point). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or hydronic testing and balancing (TAB) work is setting up the system flows and pressures as specified, while performance verification is verifying that which has already been set up. The Commissioning Authority develops the performance verification test scripts in a sequential written form, and coordinates, oversees and documents the actual testing. PVTs are performed after Field Installation Verification (FIV) and start-up functional testing are complete.
26. **"Phased Commissioning"** Commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order to minimize the total construction time.
27. **"Post Occupancy Phase"** Commissioning activity that occurs after the end users occupy the facility.
28. **"Project Manager (PM)"** The contracting and managing authority for the owner over the design and/or construction project, a staff position.
29. **"Seasonal Performance Tests"** PVTs that are deferred until the system(s) will experience conditions closer to their design conditions.
30. **"Simulated Conditions"** Conditions that are created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box.)

31. **"Simulated Signal"** Disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.
32. **"Specifications"** The construction specifications of the Contract Documents.
33. **"Startup"** The initial starting or activating of dynamic equipment, including functional testing of all components and verification of the calibration of all devices.
34. **"Subs"** The subcontractors to the CM who provide and install building components and systems.
35. **"Test Procedures"** The step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CxA.
36. **"Trending"** Monitoring using the building control system (after all points are verified to be functional, calibrated and mapped correctly).
37. **"Vendor"** Supplier of equipment.
38. **"Warranty Period"** Warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

B. Abbreviations. The following are common abbreviations used in the Specifications and in the Commissioning Plan.
1. A/E: Architect and design engineers.
2. CxA: Commissioning Authority.
3. CC: Controls Contractor.
4. Cx: Commissioning.
5. Cx Plan: Commissioning Plan document.
6. EC: Electrical Contractor
7. FIV: Field Installation Verification
8. CM: Construction Manager –or- General Contractor
9. HC: HVAC Contractor
10. PC: Plumbing Contractor
11. PM: Project Manager (of the Owner)
12. PVT: Performance Verification Testing
13. Subs: Subcontractors to General
14. TAB: Test and Balance

SYSTEM DESCRIPTION

A. Commissioning - Commissioning is a systematic process of ensuring that building systems perform interactively according to the owner's performance requirements and operational needs, and the design intent. This is achieved by beginning in the design phase, documenting the requirements, and continuing through construction, acceptance and the post-occupancy/warranty period with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.

B. The commissioning platform does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

C. Commissioning services shall conform to the scope of work as outlined in the project specifications and shall comply with NEBB Procedural Standards and WCx's professional methodology of performing commissioning.

D. Systems to be commissioned: The following systems shall be commissioned for this project.

- **Building Automation System** – the HVAC system controls will be tested and verified, including device calibration, point-to-point mapping, sequences of operation and graphics

- **HVAC Equipment, Components and Systems**
  - Two (2) variable volume packaged rooftop air handling units (RTU-1,2)
  - Two (2) variable volume packaged rooftop energy recovery units (ERU-1,2)
  - One (1) 2,200 CFM variable volume heating & ventilating unit (HV-1)
  - One (1) 2-ton ductless split-system A/C indoor unit (AC-1)
  - One (1) 2-ton ductless split-system A/C outdoor air-cooled condenser unit (CU-1)
  - Twenty (20) VAV terminal units
  - Heat exchangers
  - Destratification fans
  - Unit heaters
  - Boilers
  - Hot water pumps
  - Packaged terminal heat pump units
  - Flat panel radiators

- **Exhaust Equipment, Components and Systems**
  - Ten (10) exhaust fans (EF-1 through EF-10)

- **Air and Hydronic Test and Balance Verification**

- **Electrical Systems**
  - Lighting and daylighting controls
  - Emergency power generator
  - Automatic transfer switching
  - Emergency lighting and egress signage
  - Panelboards

- **Plumbing Systems**
  - Domestic water pumping and distribution
  - Gas-fired domestic water heaters
  - Electric storage domestic water heaters
  - Sanitary piping
  - Wastewater pumping
  - Fixtures

- **Fire Protection Systems**
  - Fire alarm system, including integration with HVAC system and BAS
  - Fire sprinkler system, including integration with emergency power system

1.03 COORDINATION

A. Commissioning Team. The members of the Commissioning team consist of the Commissioning Authority (CxA), the Project Manager (PM), the Construction Manager (CM or Contractor), the architect and design engineers (particularly the mechanical and electrical engineer), the HVAC Contractor (HC), the Plumbing Contractor (PC), the Electrical Contractor (EC), the TAB representative, the Controls Contractor (CC) and any other installing subcontractors or suppliers of equipment. If known, the Owner's building or plant operator/engineer is also a member of the commissioning team.

B. Management. The CxA is hired by the Owner. The CxA directs and coordinates the commissioning activities and reports to the Owner. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.

C. Scheduling.
1. The CxA will work with the CM according to the established protocols to schedule the commissioning activities. The CxA will provide sufficient notice to the CM for scheduling commissioning activities. The CM will integrate all commissioning activities into the master schedule. All parties will address scheduling issues and make necessary notifications in a timely manner in order to facilitate the commissioning process.
2. The CxA will provide the initial schedule of primary commissioning events at a commissioning meeting. As construction progresses, more detailed schedules are developed by the CxA.

1.04 COMMISSIONING PLATFORM

A. Commissioning Plan. A draft Commissioning Plan shall be developed by the CxA and will be provided at a meeting. The commissioning plan provides guidance in the execution of the commissioning platform. Just after the initial commissioning meeting, the CxA will update the plan. This is considered to be the "final" plan, though it will continue to evolve and expand as the project progresses. The final commissioning plan is binding on the Contractor. The Specifications will take precedence over the Commissioning Plan.

B. Commissioning Platform. The following narrative provides a brief overview of the typical commissioning tasks during the design, construction, acceptance and post occupancy/warranty phases and the general order in which they occur.
1. Design Phase - Design Document Review. The CxA shall provide a complete review of all design documents for commissioning requirements. The CxA shall provide a sheet-by-sheet narrative indicating any areas that may prevent a complete and successful commissioning project. A Cx Design Review comment log will be maintained throughout the design phase of the project. The A/E design team will provide responses to each line item in the log, and final approval of the responses/resolutions will be provided by the Owner. Major areas of review are: equipment access and maintainability, equipment and system "testability," installation clearances and available space, and any specific layout or design issue that would prevent its ability to be commissioned.
2. Design Phase - Construction Document Review (pre-construction). The CxA shall provide a pre-construction review of all drawings, specifications, and equipment and vendor submittals. The documents shall be reviewed for any conflicts or design details that would hinder or prevent the equipment/systems from being tested, balanced, commis-

sioned and maintained. In addition to the Design Review comment log, a documented review report will be furnished to the A/E design professionals that details any areas of concern. Final acceptance shall be provided by the Owner.

3. Commissioning during construction begins with a kick-off meeting conducted by the CxA where the commissioning process is reviewed with the commissioning team members.
4. Additional meetings will be required throughout construction, scheduled by the CxA with necessary parties attending, to plan, scope, coordinate and schedule future activities, and resolve problems.
5. Equipment documentation is submitted to the CxA during normal submittals, including detailed start-up procedures.
6. The CxA works with the Subs in planned startups and startup documentation formats.
7. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with FIV and functional testing being completed before performance verification. The CxA shall provide field installation inspection for each system and subsystem covered in the scope of work for the project and provide installation observation reports to the commissioning team. The report shall cover any installation deficiencies from plans and specifications.
8. The Subs perform startup per the project specifications. The CxA documents that the startup was completed according to the approved plans. This shall include the CxA witnessing start-up of all equipment.
9. The CxA develops specific equipment and system performance verification test procedures.
10. During the acceptance phase, any manipulation of the equipment or systems is done at the direction of the CxA and documented.
11. Items of non-compliance in material, installation or setup are identified by the CxA and corrected at the Sub's expense and the system retested.
12. The CxA reviews the O&M documentation for completeness.
13. Commissioning is completed before Substantial Completion.
14. The CxA reviews the training provided by the Subs and verifies that it was completed and documented.
15. During the Post Occupancy/Warranty Phase, the CxA prepares a Systems Manual for the project.
16. The CxA oversees opposite-season functional testing and performance verification.
17. The CxA provides a warranty visit approximately ten months after occupancy.

1.05 RESPONSIBILITIES

A. The responsibilities of various parties in the commissioning platform are provided in this section.

B. All Parties
   1. Assist in the development of the Final Commissioning Plan.
   2. Follow the Final Commissioning Plan.
   3. Attend commissioning kick-off meeting and additional meetings as necessary.

C. Architect (of A/E)
   1. Design, Construction, and Acceptance Phases:
      a. Attend the commissioning kick-off meeting and selected commissioning team meetings.

b. Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc. as contracted.
c. Provide any design narrative documentation requested by the CxA.
d. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
e. Prepare and submit final record drawing documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.

2. Post Occupancy/Warranty Period: Coordinate resolution of design non-conformance and deficiencies identified during warranty-period commissioning activities.

D. Mechanical and Electrical Designers/Engineers (of the A/E)

1. Design, Construction, and Acceptance Phases:
a. Perform normal submittal review, construction observation, as-built drawing preparation, etc. as contracted. At least one site observation should be completed prior to system startup.
b. Provide any design narrative and sequence of operation documentation requested by the CxA. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
c. Attend commissioning kick-off meeting and other selected commissioning team meetings.
d. Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.
e. Prepare and submit the final as-built and operating parameters documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.
f. From the Contractor's red-line drawings, edit and update one-line diagrams developed as part of the design narrative documentation and those provided by the vendor as shop drawings for the chilled and hot water, condenser water, domestic water, steam and condensate systems; supply, return, exhaust and relief air systems, and normal and emergency power systems.
g. Provide a presentation at one of the training sessions for the Owner's personnel.

2. Post Occupancy/Warranty Period: Participate in the resolution of non-compliance, non-conformance and design deficiencies identified during warranty-period commissioning activities.

E. Commissioning Authority (CxA): The CxA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating or construction management. The CxA assists with resolving non-conformance or deficiencies, but ultimately that responsibility resides with the CM and the A/E. The primary role of the CxA is to develop and coordinate the execution of testing plans, observe and document performance - that systems are functioning in accordance with the documented requirements and in accordance with the Contract Documents.

1. All Phases:
a. Coordinate and direct the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules, and technical expertise.

b. Coordinate the commissioning work and, with the CM, ensure that commissioning activities are being scheduled into the master schedule.
c. Revise, as necessary, the draft Commissioning Plan
d. Plan and conduct a commissioning kick-off meeting and other commissioning meetings as appropriate.
e. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.
f. Before startup, gather and review the current control sequences and interlocks and work with the contractors and design engineers until sufficient clarity has been obtained to be able to write detailed testing procedures.
g. Review approved Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.
h. Develop a start-up and functional test plan with the Subs.
i. Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.
j. Witness the HVAC piping test and flushing procedures, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in the O&M manuals. Notify owner's PM of any deficiencies in results or procedures.
k. Witness ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in the O&M manuals. Notify owner's PM of any deficiencies in results or procedures.
l. Witness startup of all equipment being commissioned.
m. Review TAB execution plan
n. Perform complete point-to-point checkout of the control system and approve it to be used for TAB, before TAB is executed.
o. Witness TAB activity for compliance to the procedural standards and verify the systems are, in fact, balanced within acceptable tolerences.
p. With necessary assistance and review from the installing contractors, write the performance verification procedures and scripts for equipment and systems. This may include building automation/energy management control system trending, stand-alone datalogger monitoring or manual performance verification.
q. Analyze performance verification trend logs and monitoring data to verify performance.
r. Coordinate, witness and approve manual performance verification tests. Coordinate retesting as necessary until satisfactory performance is achieved.
s. Maintain a master issues and resolution log and a separate testing record. Provide the commissioning team with written progress reports and test results with recommended actions.
t. Witness and assist with training of the Owner's operating personnel.
u. Compile and maintain a commissioning record.
v. Review and assist in the preparation of the O&M manuals.
w. Provide a final commissioning report (as described in this section).
x. Prepare a Systems Manual.

y. Oversee opposite-season/deferred testing.
z. Perform ten-month warranty visit.

F. Owner's Project Manager (PM)
1. Design, Construction, and Acceptance Phases:
a. Manage the contract of the A/E and of the CM.
b. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions according to the Commissioning Plan.
c. Provide final approval for the completion of the commissioning work.
2. Post Occupancy/Warranty Period: Ensure that Post Occupancy, seasonal or deferred testing is completed and any deficient items are addressed.

G. Construction Manager (CM)
1. Construction and Acceptance Phases:
a. Facilitate the coordination of the commissioning work by the CxA, and with the CxA ensure that commissioning activities are being scheduled into the master schedule.
b. Review the final Commissioning Plan.
c. Attend a commissioning kick-off meeting and other commissioning team meetings.
d. Perform the normal review of Contractor submittals.
e. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CxA.
f. In each purchase order or subcontract written, include requirements for submittal data, O&M data and training per their specific specification sections.
g. When necessary, observe and witness FIV, startup, functional testing and performance verification of selected equipment.
h. Review commissioning progress and deficiency reports.
i. Facilitate issues log corrective actions by instructing the contractors that are responsible for the item.
j. Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.
k. Coordinate the training of owner personnel.
l. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

2. Post Occupancy/Warranty Period:
a. Assist the CxA as necessary in the Post Occupancy, seasonal or deferred testing and deficiency corrections required by the specifications.
b. Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

H. HVAC Contractor (HC)
1. The HC is responsible only for supplying submittal and other data, operating their purchased/installed equipment and performing the startups that the design professionals' specifications call for them to provide for the project. Other commissioning information

gathering, and commissioning testing performed, will be accomplished by the CxA's qualified personnel.

I. Plumbing Contractor (PC)
1. The PC is responsible only for supplying submittal and other data, operating their purchased/installed equipment and performing the startups that the design professionals' specifications call for them to provide for the project. Other commissioning information gathering, and commissioning testing performed, will be accomplished by the CxA's qualified personnel.

J. Electrical Contractor (EC)
1. The EC is responsible only for supplying submittal and other data, operating their purchased/installed equipment and performing the startups that the design professionals' specifications call for them to provide for the project. Other commissioning information gathering, and commissioning testing performed, will be accomplished by the CxA's qualified personnel.

K. Controls Contractor (CC)
1. The CC is responsible only for supplying submittal and other data, demonstrating their purchased/installed equipment, including calibration of devices and programmed sequences of operations, and performing the 100% point-to-point tests that the design professionals' specifications call for them to provide for the project. Other commissioning information gathering, and commissioning testing performed, will be accomplished by the CxA's qualified personnel.

L. TAB Firm (TAB)
1. The TAB firm is responsible only for supplying submittal and other data, proving that any instruments used are calibrated per their certifying organization's standards, demonstrating to the CxA that the TAB work was performed in accordance with their certifying organization's standards, and providing what the design professionals' specifications call for them to provide for the project. Other commissioning information gathering, and commissioning testing performed, will be accomplished by the CxA's qualified personnel.

M. Equipment Suppliers
1. Provide all requested submittal data, including detailed startup procedures and specific responsibilities of the Owner to keep warranties in force.
2. Assist with testing of equipment per contracts with Subs.
3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to the Contract Documents in the base bid price to the Contractor, except for stand-alone datalogging equipment that may be used by the CxA.
4. Through the contractors to whom products are supplied, analyze specified products and verify that the designer has specified the newest, most updated equipment that is reasonable for this project's scope and budget.
5. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.
6. Review test procedures for equipment installed by factory representatives.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. All standard tools required to perform startup, functional testing and required performance verification shall be provided by the Division contractor for the equipment. For example, the HVAC contractor shall ultimately be responsible for all standard testing tools for the HVAC and controls system, except for tools specific to and used by the TAB firm in its commissioning responsibilities.

B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment, according to these Contract Documents) shall be included in the base bid price to the Contractor and left on site, except for stand-alone datalogging equipment that may be used by the CxA.

C. Datalogging equipment/software required to test equipment will be provided by the CxA, but shall not become the property of the Owner.

D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of .05F and a resolution of + or – 0.1F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of the meter) and have been calibrated within the last year. All instruments shall be calibrated according to the manufacturer's recommended intervals and if dropped or damaged. For all instruments, current calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.01 MEETINGS

A. Kick-Off Meeting. Within 60 days of commencement of construction, the CxA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CxA. Information gathered from this meeting will allow the CxA to revise the draft Commissioning Plan to its "final" version, which will also be distributed to all parties.

B. Miscellaneous Meetings. Other meetings will be planned and conducted by the CxA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular parties. The CxA will plan these meetings and will minimize unnecessary time being spent by the contractors. For large projects, these meetings may be held monthly, until the final months of construction when they may be held as frequently as one per week.

3.02 REPORTING

A. The CxA will provide regular reports to the Commissioning team, depending on the management structure, with increasing frequency as construction and commissioning progresses. Standard forms are provided and referenced in the Commissioning Plan.

B. The CxA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through e-mails, memos, progress reports, etc.

C. Testing or review approvals and non-conformance and deficiency reports are made regularly as review and testing occur.

3.03 SUBMITTALS

A. The CxA will provide the appropriate contractors with a specific request for the type of submittal documentation that the CxA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At minimum, the request will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings, user interface graphics for each system and details of owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Authority. All documentation requested by the CxA will be included by the Subs in their O&M manual contributions.

B. The Commissioning Authority will review approved submittals related to the commissioned equipment for conformance to the Contract Documents and as they relate to the commissioning platform, to the performance verification of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing and performance verification procedures and only secondarily to verify the compliance with equipment specifications. The Commissioning Authority will notify the CM, PM and A/E as requested, of items missing or areas that are not in conformance with the Contract Documents, and which require resubmission.

C. The CxA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the documentation and sequences provided with the Specifications.

D. These submittals to the CxA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CxA will review them.

3.04 FIELD INSTALLATION VERIFICATION AND FUNCTIONAL PERFORMANCE TESTS

A. The following procedures apply to the equipment and systems to be commissioned.

B. General. FIVs and functional tests are important events to ensure that the equipment and systems are hooked up and operational. It ensures that performance verification can proceed without unnecessary delays or equipment failures. Each piece of equipment receives full FIV checkout. No sampling strategies are to be used. FIVs and functional tests for a given system must be successfully completed prior to performance verification of equipment or subsystems of a given system.

C. Startup Plan. The CxA shall assist the commissioning team members responsible for startup of any equipment in developing detailed startup plans. The primary role of the CxA in this process is to ensure that there is written documentation that each of the manufacturer-recommended pro-

cedures have been completed. The contractor or factory representative is responsible for performing the equipment startup procedures in the presence of the CxA.

1. The subcontractor responsible for the purchase of the equipment assists in the development of the full startup plan by combining (or adding to) the CxA's procedures with the manufacturer's detailed startup and checkout procedures. The full startup plan shall consist of the following:
   a. The CxA's checkout procedures.
   b. The manufacturer's standard written startup procedures from the installation manuals.
   c. The manufacturer's normally used field checkout sheets.
2. The CxA reviews the procedures and the format for documenting them, noting any procedures that need to be added.

D. Controls System Verification

1. The operation of all control system components and devices shall be verified in the presence of the CxA.
2. All procedures used shall be fully documented on the point-to-point checkout report, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.
3. All control point-to-point tests shall be verified through the graphic front end software. The graphics shall be complete prior to performing the point-to-point checks.
4. All sensors and analog inputs shall be calibrated by the manufacturer's standard procedures and to project calibration tolerances.
5. All analog outputs, actuators and valves shall be ranged for correct action to the controls signal.

E. Execution of FIV and functional test procedures

1. The CxA shall perform FIVs throughout the construction period.
2. Approximately four weeks before startup, the Subs and vendors schedule startup and checkout with the CM and CxA. The performance of startup and checkout are executed by the Sub or vendor in the presence of the CxA.
3. The CxA shall observe the startup procedures for each piece of equipment.

F. Deficiency issues log

1. The CxA shall provide a periodic commissioning issues log clearly listing any deficiencies or areas of concern from any FIV or functional test.
2. The issues log shall be provided to the commissioning team for distribution to the appropriate parties for review, response and action. All actions and results will be listed on the issues log for future reference.

3.05 PHASED COMMISSIONING

A. The project may require startup and functional testing to be executed in phases. This phasing will be planned and scheduled in a coordination meeting of the PM, CxA, HVAC, plumbing, TAB and controls contractors, and the CM. Results will be added to the master and commissioning schedule.

3.06 PERFORMANCE VERIFICATION TESTING

A. This sub-section applies to commissioning performance verification for all divisions.

B. Objectives and Scope.
   1. The objective of performance verification testing is to demonstrate that each system is operating according to the documented requirements and Contract Documents, and to optimize system performance. Performance verification will identify areas of deficient performance so they can be corrected, improving the operation and functioning of the systems.
   2. In general, each system is operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part-, full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested and verified.

C. Development of Test Procedures
   1. Before test procedures/scripts are written, the CxA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. The CxA shall develop specific test procedures and scripts to verify and document proper operation of each piece of equipment and system. Each responsible Sub or vendor shall provide assistance as requested by the CxA to develop the procedures, i.e. answering questions about equipment, operation, sequences, etc. and, prior to testing, review the tests for feasibility, safety, equipment and warranty protection. The CxA may also submit the tests to the A/E for review, if requested.
   2. The CxA shall review owner-contracted, factory testing or required owner acceptance tests which the CxA is not responsible to oversee, including documentation format, and shall determine what further testing or format changes may be required to comply with the Specification. Redundancy of testing shall be minimized.
   3. The purpose of any specific test is to verify and document compliance with the stated criteria of acceptance given.

D. Test Methods
   1. Performance verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities, or by stand-alone dataloggers. The CxA may substitute specified methods or require an additional method to be executed, other than what was specified, with the approval of the Owner or CM. The CxA will determine which method is most appropriate for tests that do not have a method specified.

E. Coordination and Scheduling
   1. The Subs shall provide sufficient notice to the CxA regarding their schedule for the startup of all equipment/systems. The CxA will schedule performance verification through the CM and affected Subs. The CxA shall direct, witness and document the performance verification of equipment and systems.
   2. In general, performance verification is conducted after FIVs and functional tests have been satisfactorily completed. The control system is sufficiently tested and approved by

the CxA before it is used for TAB or to verify performance of other components or systems. The air and hydronic balancing are completed and "debugged" before performance verification of air-related or hydronic-related equipment/systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

F. Problem Solving. The CxA will recommend, troubleshoot and assist in solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the CM, Subs and A/E.

3.07 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Documentation. The CxA shall witness and document the results of all performance verification tests using specific procedural forms and scripts developed for that purpose. The CxA will include the completed forms in the final Commissioning report.

B. Non-Conformance.
1. The CxA will record the results of performance verification on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the Commissioning Team on the standard commissioning issues log.
2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases, the deficiency and resolution will be documented.
3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the Owner.
4. As tests progress and a deficiency is identified, the CxA discusses the issue with the responsible contractor.
    a. When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:
        1. If the deficiency can be corrected easily, it shall be corrected and the commissioning shall proceed.
        2. The CxA reschedules the test and the test is repeated.
    b. If there is a dispute about a deficiency regarding whether it is a deficiency or who is responsible or the repair will take more than one hour:
        1. The deficiency shall be documented on the issues log or the test report form with the Sub's response and a copy given to the CM, or Commissioning Team including the Owner, and the Sub representative assumed to be responsible.
        2. Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Owner.
        3. The CxA documents the resolution process.
        4. Once the interpretation or resolution has been decided, the appropriate party corrects the deficiency, signs off and provides it to the CxA. The CxA reschedules the test and the test is repeated until satisfactory performance is achieved.

5. Cost of Retesting.
   a. The cost for the Sub to retest, if they are responsible for the deficiency or issue, shall be theirs.
6. The contractor shall respond in writing to the CxA and Owner at least as often as commissioning meetings are scheduled concerning the status of each outstanding discrepancy identified during commissioning. Discussion shall cover explanations or any disagreements and proposals for their resolution.
7. Required retesting by a contractor shall not be considered a justified reason for a claim of delay or for a time extension by the prime contractor.

C. Failure Due to Manufacturer Defect. If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance specification, all identical units may be considered unacceptable by the CxA or owner.

D. Approval. The CxA documents each satisfactorily demonstrated function. Formal approval of performance verification is made later after review by the CxA and by the Owner, as necessary.

3.08 OPERATION AND MAINTENANCE MANUALS

A. Standard O&M Manuals
1. Special requirements for the controls contractor and TAB contractor shall be as specified in Division 23 specification sections.
2. CxA Reviews. Prior to substantial completion, the CxA shall review the O&M manuals, documentation and final as-builts for systems that were commissioned to verify compliance with the Specifications. The CxA will communicate deficiencies in the manuals to the PM, CM or A/E as requested. Upon a successful review of the corrections, the CxA recommends acceptance of these sections of the O&M manuals to the PM, CM or A/E. The CxA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E's contract.

B. Commissioning Final Report
1. Final Report Details. The final commissioning report shall include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the completed FIV, functional and performance verification reports. The report shall also include the issues logs and pertinent commissioning communications.
2. Other documentation will be retained by the CxA.

3.09 TRAINING OF OWNER PERSONNEL

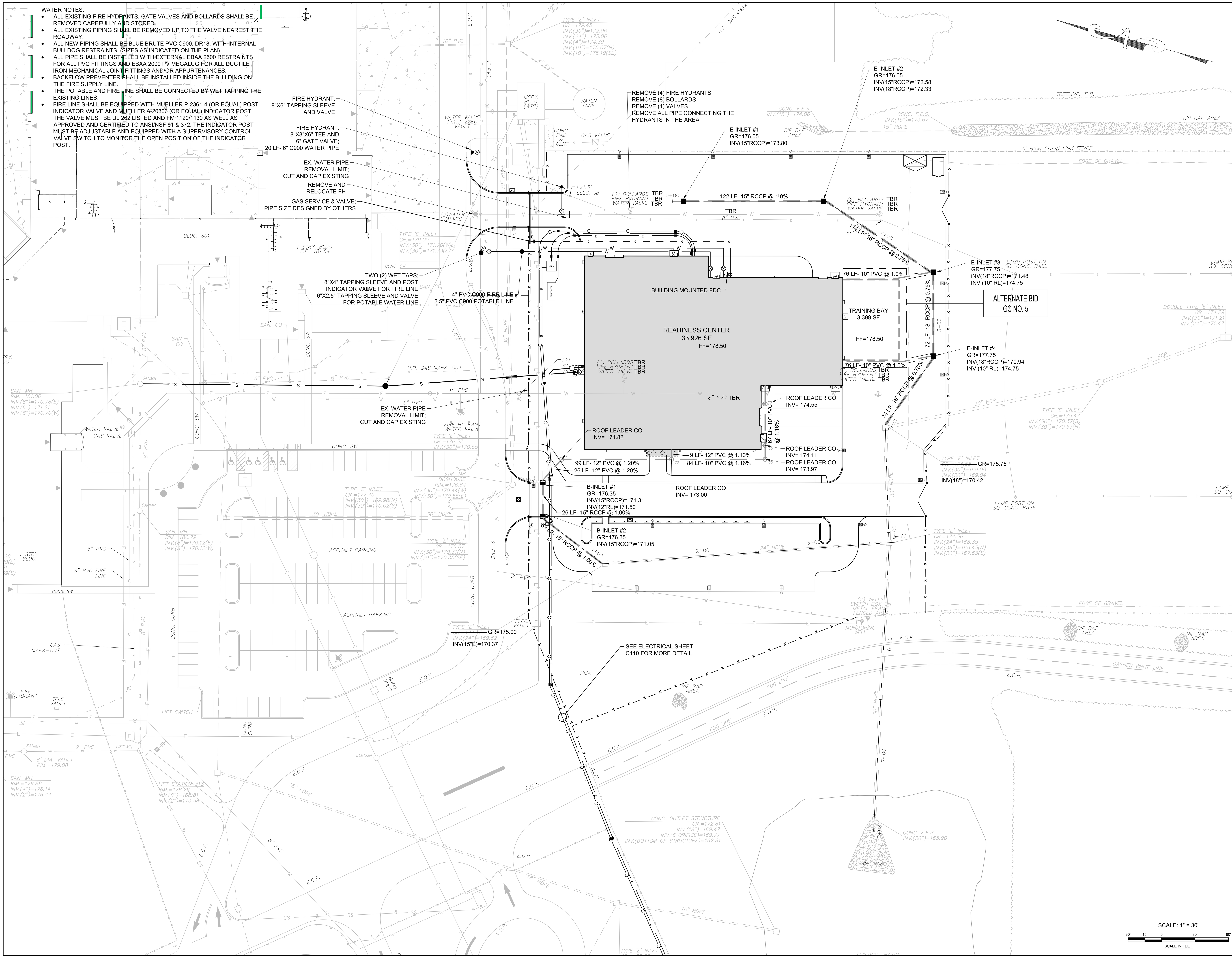
A. The CM shall be responsible for training coordination and scheduling, and ultimately for ensuring that training is completed.
B. The CxA shall be responsible for reviewing the content and adequacy of the training of Owner personnel for commissioned equipment.

1. The CxA shall interview the facility manager and lead engineer to determine the special needs and areas where training will be most valuable. The CxA and owner shall decide how rigorous the training should be for each piece of commissioned equipment. The CxA shall communicate the results to the Subs and vendors who have training responsibilities.
2. Each Sub and vendor responsible for training will submit a written training plan to the CxA for review and approval prior to training. The plan will cover the following elements:
   a. Equipment (included in training)
   b. Intended audience
   c. Location of training
   d. Objectives
   e. Subjects covered (description, duration of discussion, special methods, etc.)
   f. Duration of training of each subject
   g. Instructor for each subject and instructor's qualifications
   h. All training methods shall include a classroom lecture and an actual operational demonstration of start up, turn down and maintenance procedures.
3. For the primary HVAC equipment, the Controls Contractor shall provide training on the control of the equipment during the mechanical or electrical training conducted by others.
4. The mechanical design engineer shall attend the first training session to present the overall system design concept and the design concept of each equipment section. This presentation shall include a review of all systems using the simplified system schematics (one-line drawings).

END OF SECTION 019100

WATER NOTES:

- ALL EXISTING FIRE HYDRANTS, GATE VALVES AND BOLLARDS SHALL BE REMOVED CAREFULLY AND STORED.
- ALL EXISTING PIPING SHALL BE REMOVED UP TO THE VALVE NEAREST THE ROADWAY.
- ALL NEW PIPING SHALL BE BLUE BRUTE PVC C900, DR18, WITH INTERNAL BULLDOG RESTRAINTS. (SIZES AS INDICATED ON THE PLAN)
- ALL PIPE SHALL BE INSTALLED WITH EXTERNAL EBAA 2500 RESTRAINTS FOR ALL PVC FITTINGS AND EBAA 2000 PV MEGALUG FOR ALL DUCTILE IRON MECHANICAL JOINT FITTINGS AND/OR APPURTENANCES.
- BACKFLOW PREVENTER SHALL BE INSTALLED INSIDE THE BUILDING ON THE FIRE SUPPLY LINE.
- THE POTABLE AND FIRE LINE SHALL BE CONNECTED BY WET TAPPING THE EXISTING LINES.
- FIRE LINE SHALL BE EQUIPPED WITH MUELLER P-2361-4 (OR EQUAL) POST INDICATOR VALVE AND MUELLER A-20806 (OR EQUAL) INDICATOR POST. THE VALVE MUST BE UL 262 LISTED AND FM 1120/1130 AS WELL AS APPROVED AND CERTIFIED TO ANSI/NSF 61 & 372. THE INDICATOR POST MUST BE ADJUSTABLE AND EQUIPPED WITH A SUPERVISORY CONTROL VALVE SWITCH TO MONITOR THE OPEN POSITION OF THE INDICATOR POST.



RESERVED FOR NJDCA'S ELECTRONIC STAMP

ARH ASSOCIATES

ADAMS, REHMANN & HEGGAN ASSOCIATES, INC.
215 BELLEVUE AVENUE
PO BOX 579
HAMMONTON, NJ 08037-2019
TEL (609) 561-0482
FAX (609) 567-8909

DAVID J. CELLA
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 47269

NO	DATE	DESCRIPTION
2	08/31/21	PIV ADDENDUM
1	08/26/21	ELECTRICAL & COMM ADDENDUM

STATUS/REVISIONS

BID SET

07/02/2021

PROJECT TITLE

LAKEHURST NATIONAL GUARD READINESS CENTER

TO THE:

NATIONAL GUARD READINESS CENTER

PINEHURST ROAD ROUTE 539
LAKEHURST, NJ 08759

FOR THE:

DEPARTMENT OF MILITARY AND VETERANS AFFAIRS
PO BOX 340
TRENTON NJ, 08625

ARNG PROJECT #	DRG NO.	ARH NO.
85478/34012	1948	50-52740

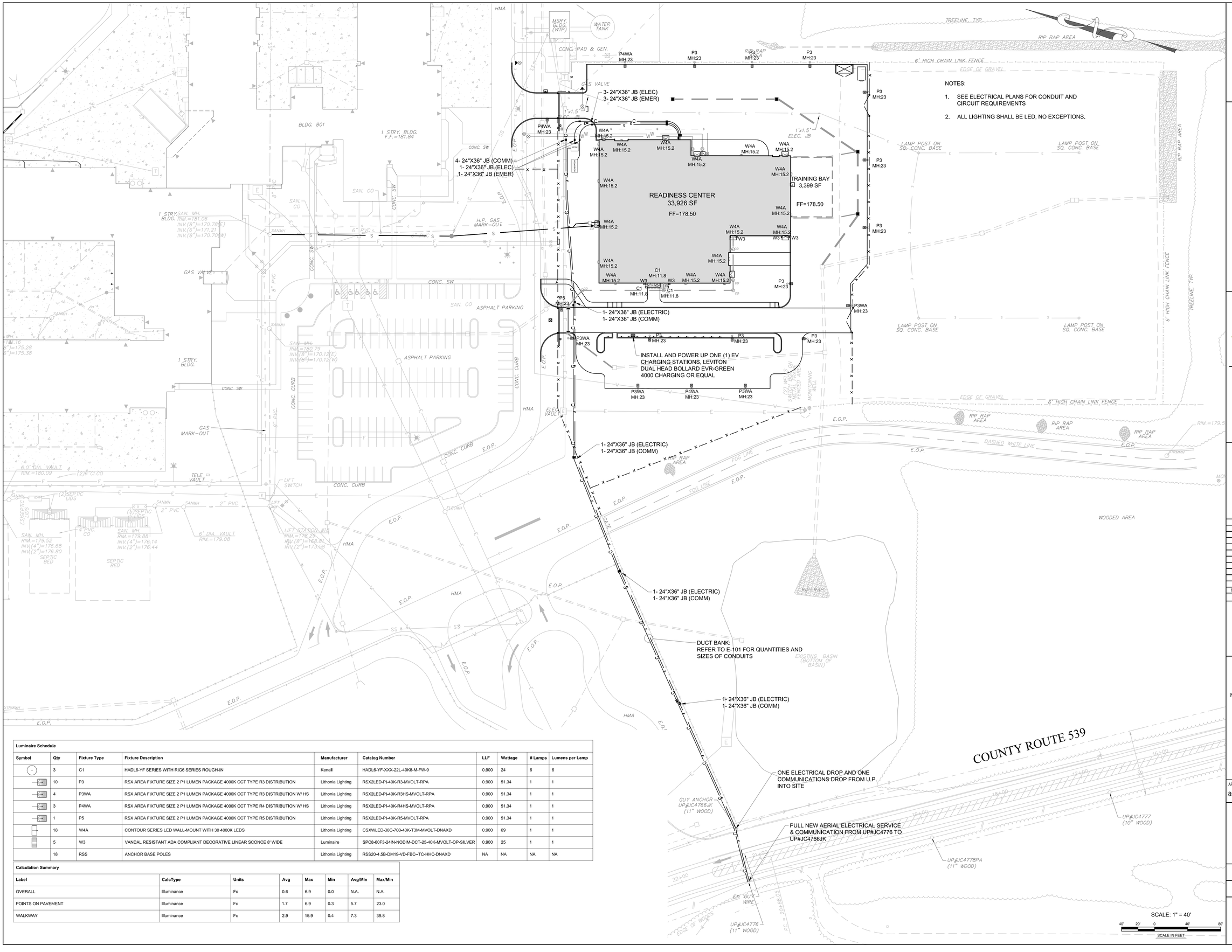
SHEET TITLE

UTILITY PLAN

SCALE	DRAWN
AS NOTED	RH
DATE	CHECKED
06/07/2021	DC

SHEET NO.

C-107



Luminaire Schedule

Symbol	Qty	Fixture Type	Fixture Description	Manufacturer	Catalog Number	LLF	Wattage	# Lamps	Lumens per Lamp
	3	C1	HADL6-YF SERIES WITH RIG6 SERIES ROUGH-IN	Kenall	HADL6-YF-XXX-22L-40K8-M-FW-9	0.900	24	6	6
	10	P3	RSX AREA FIXTURE SIZE 2 P1 LUMEN PACKAGE 4000K CCT TYPE R3 DISTRIBUTION	Lithonia Lighting	RSX2LED-PI-40K-R3-MVOLT-RPA	0.900	51.34	1	1
	4	P3WA	RSX AREA FIXTURE SIZE 2 P1 LUMEN PACKAGE 4000K CCT TYPE R3 DISTRIBUTION W/ HS	Lithonia Lighting	RSX2LED-PI-40K-R3HS-MVOLT-RPA	0.900	51.34	1	1
	3	P4WA	RSX AREA FIXTURE SIZE 2 P1 LUMEN PACKAGE 4000K CCT TYPE R4 DISTRIBUTION W/ HS	Lithonia Lighting	RSX2LED-PI-40K-R4HS-MVOLT-RPA	0.900	51.34	1	1
	1	P5	RSX AREA FIXTURE SIZE 2 P1 LUMEN PACKAGE 4000K CCT TYPE R5 DISTRIBUTION	Lithonia Lighting	RSX2LED-PI-40K-R5-MVOLT-RPA	0.900	51.34	1	1
	18	W4A	CONTOUR SERIES LED WALL-MOUNT WITH 30 4000K LEDS	Lithonia Lighting	CSXWLED-30C-700-40K-T3M-MVOLT-DNAXD	0.900	69	1	1
	5	W3	VANDAL RESISTANT ADA COMPLIANT DECORATIVE LINEAR SCONCE 8' WIDE	Luminaire	SPC8-60F3-24IN-NODIM-DCT-25-40K-MVOLT-OP-SILVER	0.900	25	1	1
	18	RSS	ANCHOR BASE POLES	Lithonia Lighting	RSS20-4.5B-DM19-VD-FBC--TC-HHC-DNAXD	NA	NA	NA	NA

Calculation Summary

Label	CalcType	Units	Avg	Max	Min	Avg/Min	Max/Min
OVERALL	Illuminance	Fc	0.6	6.9	0.0	N.A.	N.A.
POINTS ON PAVEMENT	Illuminance	Fc	1.7	6.9	0.3	5.7	23.0
WALKWAY	Illuminance	Fc	2.9	15.9	0.4	7.3	39.8

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FAX (609) 567-8909

DAVID C. DELLA
LICENSED PROFESSIONAL ENGINEER

NO	DATE	DESCRIPTION
1	08/26/2021	ELECTRICAL & COMM ADDENDUM

STATUS/REVISIONS

BID SET

07/02/2021

PROJECT TITLE
LAKEHURST NATIONAL GUARD READINESS CENTER

TO THE:
NATIONAL GUARD READINESS CENTER

PINEHURST ROAD ROUTE 539
LAKEHURST, NJ 08759

FOR THE:
DEPARTMENT OF MILITARY AND VETERANS AFFAIRS
PO BOX 340
TRENTON NJ, 08625

ARNG PROJECT #	DRG NO.	ARH NO.
85478/34012	1948	50-52740

SHEET TITLE
LIGHTING AND ELECTRICAL PLAN

SCALE	DRAWN
AS NOTED	RH
DATE	CHECKED
06/07/2021	DC

SHEET NO.
C-110