

**DEPARTMENT OF VETERANS AFFAIRS
VHA MASTER SPECIFICATIONS**

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SECTION 00 01 15
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SECTION 00 80 00
GEOTECHNICAL EXPLORATION AND ENGINEERING REVIEW



**GEOTECHNICAL EXPLORATION
AND ENGINEERING REVIEW**

**VA Medical Center Additional Outpatient Space
Fargo, North Dakota**

NTI Project No. 11-11161.100



NORTHERN TECHNOLOGIES, INC.

3522 4th Avenue S., Fargo, ND 58103 701-232-1822 701-232-1864 Fax

August 23, 2011

Image Group Architecture and Interiors
403 Center Avenue
Suite 300
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Attn: Mr. Richard Moorhead, NCARB, AIA

Subject: Geotechnical Exploration and Engineering Review
VA Medical Center Additional Outpatient Space
Fargo, North Dakota
NTI Project No. 11-11161.100

In accordance with your request and subsequent June 10, 2011 authorization, Northern Technologies, Inc. (NTI) conducted a Geotechnical Exploration for the above referenced project. Our services included advancement of exploration borings and preparation of an engineering report with recommendations developed from our geotechnical services. Our work was performed in general accordance with our proposal of July 12, 2010 and verbally authorized Change Order No. 1.

Soil samples obtained at the site will be held for 60 days at which time they will be discarded. Please advise us in writing if you wish to have us retain them for a longer period. You will be assessed an additional fee if soil samples are retained beyond 60 days.

We appreciate the opportunity to have been of service on this project. If there are any questions regarding the soils explored or our review and recommendations, please contact us at your convenience at (701) 232-1822.

Northern Technologies, Inc.

Dan Gibson, P.E.
Project Engineer

Bret R. Anderson, P.E.
Associate

cc: Solien & Larson



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Fargo, North Dakota

NTI Project No. 11-11161.100

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GEOTECHNICAL EXPLORATION AND ENGINEERING REVIEW

VA Medical Center Additional Outpatient Space
Fargo, North Dakota

NTI Project No. 11-11161.100

1.0. EXECUTIVE SUMMARY

We briefly summarize below our geotechnical recommendations for the proposed project. The summary must be read in complete context with our report.

We conclude support for the proposed VA Medical Center Additional Outpatient Space (Addition) will require construction of deep foundations extending into competent glacial till at the approximate depths as recommended within our report. Post meeting of August 22, 2011, direction for project has determined use of a concrete caisson shaft extending to till represents the most economical option due to higher structural loading applied to foundations with use of grade beam construction at basement level.

The need for deep foundations is based on excessive depth of uncontrolled fill and necessary subgrade correction, need for retention of existing foundation, and for control of differential settlements which would have occurred with construction of shallow foundations. We direct you to our August 8, 2011 correspondence outlining basis for selection of deep foundation in support of proposed project.

The following provides a brief summary of recommendations associated with foundation support of project.

- Drilled caissons will need to be advanced to approximate depths of 105 to 110 feet below existing grade with bearing provided within the very stiff competent glacial till soils having estimated cohesion at or in excess of 6,000 pounds per square foot. Table 2 outlines geotechnical parameters for sizing of caissons.
- Our exploration indicates asphalt pavement, topsoil, and fill extends from approximately 7 to 13 feet at project borings. You should anticipate similar but variable depth of asphalt pavement, topsoil, and fill across the project. Presently, we understand you intend to excavate site to approximately 2 feet below bottom of basement level floor slab for installation of caissons. Corrective earthwork for project will be limited to placement of granular fill soils from base of excavation to underside of basement level floor slab. It is understood such corrective action will retain a significant fraction of uncontrolled fill below floor construction. You have noted that this floor is used for general mechanical room and related features at site and can tolerate significant differential movement distress without impairing use of facility. We direct you to further discussion on subgrade correction and support of basement level floor slab.



- Project will include a concrete patio / walk area along exterior of proposed facility. Our recommendation of August 22, 2011 was to retain deep uncontrolled fill below this patio area and design the slab as a structural monolith which can tolerate higher than typical differential settlement. You have indicated this patio area does not abut doorways to facility which would necessitate control of threshold opening / stair rise dimension. Further discussion of this issue is provided within the report.
- *While we did not encounter measurable ground water during or at the completion of drilling operations, select soil samples recovered during our exploration program were moist.* The moisture content of lens soils and the host clays can vary annually and per recent precipitation. Such soils and other regional dependent conditions may produce ground water entry of project excavations. We direct your attention to other report sections and appendices concerning ground water issues and subsurface drainage recommendations.
- You should also anticipate seepage of ground water likely within thin alluvium strata / weaker pre-till soils occurring at interface between Glacial Lake Agassiz and Till deposit. The presence of plastic flow clay deposits and ground water necessitates caisson construction must be temporarily protected with steel casing full depth of the Glacial Lake Agassiz and "pre-till" deposits.
- Through material composition, fat clay soils have a tendency to swell with absorption of moisture. This is especially true for fat clays (CH) or silty fat clays (CH-MH) due to increased montmorillonite mineral content. The attachment presented within the appendices provides a brief description of the swell process of clay, and provides limited recommendation(s) for reducing this risk on your project. Note a major attribute contributing to swell of clays is absorption of moisture under reduced confinement. Continuous drainage of site excavations is necessary to reduce swelling impacts to your project.

2.0. INTRODUCTION

2.1. Site / Project Description

The proposed Addition is to be constructed adjacent to Building No. 38 near the southeast corner of the VA Medical Center at 2101 Elm Street in Fargo, North Dakota. The building is to consist of a near "at-grade" basement level, first and second levels occupied for facility use, and mechanical level on the third floor. The steel, concrete, and masonry structure will be supported by deep caisson construction extending into competent Glacial Till.

2.2. Scope of Services

The purpose of this report is to present a summary of our geotechnical exploration and provide generalized opinions and recommendations regarding the soil conditions and design parameters for founding of the project. Our "scope of services" was limited to the following:



1. Explore the project subsurface by means of four (4) standard penetration borings extending to maximum depth of 116 feet, and conduct laboratory tests on representative samples to characterize the engineering and index properties of the soils.
2. Prepare a report presenting our findings from our field exploration, laboratory testing, and engineering recommendations for foundations, allowable bearing capacity, estimated settlements, floor slab support, excavation, engineered fill, backfill, compaction and potential construction difficulties related to excavation, backfilling and drainage.

3.0 EXPLORATION PROGRAM RESULTS

3.1 Exploration Scope

Site geotechnical drilling occurred on July 17- 28, and August 3- 4, 2011 with individual borings advanced at approximate locations as presented on the diagram within the appendices. NTI located the borings relative to existing site features, and determined the approximate elevation of the borings relative to the finished floor of existing Building (see site plan). The elevation of the finished floor of existing structure is 89.0 feet [architectural datum].

3.2 Surface Conditions

The Addition property is currently occupied by a single level masonry building, surrounding asphalt parking lot, and lawn. We understand the existing VA Hospital complex is located at the confluence of an old oxbow channel of the Red River of the North which was subsequently filled with uncontrolled soils with City of Fargo – City of Moorhead rerouting of the Red River in the early 1920's. The extensive depth of uncontrolled soils encountered at our borings support this historical finding of site.

We assume this lot has not been previously developed other than for current use and understanding with respect to uncontrolled fill placement. It is our premise the lot does not include demolition material. Surface drainage appears to flow overland southeast towards an existing storm water collection system. The elevation change between borings is approximately 2 feet.

3.3 Subsurface Conditions

Please refer to the boring logs within the appendices for a detailed description and depths of stratum at each boring. The boreholes were backfilled with auger cuttings, or abandoned using high solids bentonite or neat cement grout per state statute. Minor settlement of infill soil will occur with Owner responsible for final closure of the boreholes. The general geologic origin of retained soil samples is listed on the boring logs. The upper portion of the soil profile for each boring was sampled using auger flights and is approximate.

The overall subsurface soil profile at the borings consists of approximately 7 to 13 feet of asphalt pavement, topsoil, and uncontrolled fill underlain by rather stiff to soft Glacial Lake



Agassiz (GLA) soils which extend from approximately 92 to 93 ½ feet below existing grade. Very stiff Glacial Till soils underlie the GLA deposits and extend to the termination depth of the borings (maximum 116 feet).

The GLA soils are comprised of fat clay, silty fat clay and clayey silt with varying color, moisture content and unit weight. The glacial till consist of sandy clay and lean clay with trace amounts of gravel.

While not encountered at our borings, we note that other projects in Fargo have encountered gravel, cobbles and boulders within the "pre-till" and glacial till deposit at depth. Furthermore, there is a small risk that erratic cobble or boulder may exist within the GLA soils from ice melt deposition from the ancient lake ice surface. Encountering of such rock with advancement of caisson shaft would require special consideration / methods of removal. Additional comment on the evaluation of recovered soil samples is presented within the report attachments.

3.4 Ground Water Conditions

The drill crew observed the borings for ground water and noted cave-in depth of borings, if any, during and at the completion of drilling activities. These observations and measurements are noted on the boring logs.

While we did not encounter measurable ground water during or at the completion of drilling operations, select soil samples recovered during our exploration program were moist. The moisture content of lens soils and the host clays can vary annually and per recent precipitation. Such soils and other regional dependent conditions may produce ground water entry of project excavations.

Removal of ground water seepage from shafts advanced for caisson construction will be necessary and should be anticipated as part of foundation construction. Use of a debris collection bucket attachment to drill would be required for this recovery of seepage.

We direct your attention to other report sections and appendices concerning ground water issues and subsurface drainage recommendations.

3.5 Laboratory Test Program

Our analysis and recommendations of this report are based upon our interpretation of the standard penetration resistance determined while sampling soils, hand penetrometer test results obtained during classification of retained soils, and experience with similar soils from other sites near the project. The results of such tests are summarized on the boring logs or attached test forms.



4.0 ENGINEERING REVIEW AND RECOMMENDATIONS

The following recommendations are based on our present knowledge of the project. We ask that you or your design team notify us immediately if significant changes are made in building size, location or design as we would need to review our current recommendations and provide modified or different recommendations with respect to such change(s).

Note herein that all elevations referenced within this report are based on architectural datum. Thus elevation 89'-0" as example represents finished floor of existing structure.

4.1 Project Scope

We understand the Addition will utilize concrete foundation walls and grade beam construction to convey structural loading to deep advanced caisson shafts extending to glacial till. We understand column loads on the order of 280 to 300 kips are anticipated with wall loads being no greater than 5 kips per lineal foot (klf). Support of columns and perimeter wall load by grade beam construction will result in nominal caisson loads of approximately 500 kip. We understand project will include minimal change in final grade to maintain drainage from structure. Our assessment of project soils, opinions, and report recommendations are based directly on application of estimated caisson loading to the deep glacial till deposit.

4.2 Site Preparation

Project construction, as proposed, will involve minimal stripping of the site and implementation of corrective grading to create a working base for construction of deep foundations. Table 1 provides a summary of anticipated excavation under alternative to excavate to top of caisson construction. Lesser depth of mass excavation of site would be required under alternative of earth formed grade beam construction.

Table 1: Summary of Unsuitable Soils ^{Note 1}

Boring Number	Existing Ground Elevation (feet, NTI Datum)		Unsuitable Materials Depth of Materials (feet)
SB-1	87.4	6½	Topsoil / Uncontrolled Fill
SB-2	87.6	6 ½	5" Asphalt over Uncontrolled Fill / Topsoil
SB-3	85.4	4 ½	5" Asphalt over Uncontrolled Fill / Topsoil
SB-4	85.8	4 ¾	5" Asphalt over Uncontrolled Fill / Topsoil
Note 1 Above excavation depth does not necessarily remove all unsuitable materials from below grade beam / basement floor construction. <i>Refer to report recommendations associated with excavation at, and within the vicinity of the borings, and along select grid lines of project.</i>			

Special conditions will exist for excavation along Grid Lines 5 to 6, and Q. Excavation from Grid Line 5 – 6 will require retention of soils to counter lateral earth loading of existing building foundation. This area of construction will necessitate contractor retain no less than 5 feet of horizontal fill extending outward from wall at elevation 86 feet. The excavation may then taper downward at a 1H:1V or flatter profile to elevation 81 feet. Isolated incremental excavation to elevation 81 feet will be necessary within this retained soil mass for



construction of grade beams. Such excavation may require use of temporary shoring or similar methods to retain earth. We recommend that any excavations for grade beam construction be staged in alternating sequence prior to start of construction of adjacent grade beam element.

Construction along Grid Line Q must extend to nominal elevation 78 feet to address frost penetration issues along the periphery of project. This deeper excavation must also extend to similar depth along Grid Line 12 until base depth of 81 feet for grade beam is achieved while still providing minimum 5 foot cover against frost action. The deep grade beam construction at periphery of building may necessitate temporary sloping of ground surface or use of trench box to retain earth. Contractor is directed to other report discussion concerning such issue.

We note herein that the deep grade beam along Grid Line Q will abut existing structure. We understand footings at this contact position [Grid Coordinate Q-7.1 extend to base elevation 78 feet, thus no undermining of footings at this location are anticipated. However, we caution that loss of earthen fill against foundation wall of existing structure near this position should be minimized to reduce negative impacts to existing foundation wall of structure.

While proposed work will preclude such issue, you should oversize all earthwork improvements and excavations where new engineered fill placement below foundation elements is required. The minimum excavation oversize should extend per the requirements outlined on the diagram within the report appendices.

You should pump seepage from excavations continuously until the Geotechnical Engineer of Record or their designated representative determines such seepage no longer impacts the bearing soils, engineered fill system, backfill system or soils and concrete placement.

Proposed excavation for deep foundation and grade beam construction will retain existing uncontrolled clay and buried topsoil below project. We have discussed such issue with you on August 22, 2011 whereas you determined such retention was not of issue to project as basement level floor and masonry block partition walls will be designed to accommodate higher settlement limits [total and differential]. While we anticipate construction activities on site will likely disturb uncontrolled fill retained on site, corresponding construction activities will also compact this deposit during installation of deep foundation elements and grade beams. ***You should include provision within the construction documents requiring Contractor to scarify and "re-compact" entire site to greater depth of ruts formed within deposit under traffic, or 18 inch minimum.*** This corrective work should occur immediately prior to placement of engineered fill and casting of basement level floor. Your design must include provision for lesser subgrade support modulus and increased differential settlement as provided within other section of this report.

The Geotechnical Engineer of Record or their designated representative must review project excavations to verify removal of unsuitable material(s) to depth required by specification / documents. It is also necessary that we observe base and retain samples of clay till soil exposed at base of belled section of caisson construction. Such observation / soil sampling is necessary to confirm base provide adequate bearing support of caisson. Such observations should occur prior to / concurrent with testing of concrete materials used in caisson construction.



4.3 Foundations

The following bearing recommendations for design of caisson shafts are based on our understanding of project as well as understanding of glacial till below and in vicinity of project. You should notify us of any changes made to the project size, location, design, or site grades so we can assess how such changes impact our recommendations. It is our premise foundation elements will impose maximum vertical loads as previously noted within report.

In our opinion you should support the proposed Addition by use of drilled concrete caissons extending to very stiff competent glacial till soil occurring from 102 to 105 feet below existing grade [i.e. project datum elevations -15 to -16 feet]. Our opinion is predicated on construction complying with the recommendations and criteria established within this report. You may design Caisson using the Table 2 maximum net allowable soil bearing pressures and related soil parameters.

Table 2: Recommended Design Criteria for Deep Caisson Foundations ¹

Stratum	Datum Elevation	Net Allowable Bearing Capacity	Adhesion (Compression)	Adhesion (Tension)
<i>Uncontrolled Clay Fill & Glacial Lake Agassiz Clays</i>	From 81 to -6 feet	NA	0 [strain compatibility]	NA
<i>Weak "Pre-Till" from 92 to 93 ½ feet to 103 to 105 feet below existing grade</i>	From -6 to -17 feet	NA	0.70 kip/foot ² surface area	0.50 kip/foot ² surface area
<i>Very Stiff Glacial Till at or below 105 feet from existing grade</i>	Deeper than -17 feet	30 kip / foot ²	1.00 kip/ft ² surface area	0.60 kip/foot ² surface area

1. We do not recommend assigning any skin friction to the GLA soils as these soils can easily loose cohesive capacity when clay minerals shift relative to adjacent mineral particles (slickenside effect).

We estimate straight shaft of caisson foundations will extend to approximately 100 feet below existing grade with belled section of caisson continuing to approximately 105 feet below existing grade [respective project elevations -12 and -17 feet].

We caution that Contractor may encounter water bearing stratum throughout soils penetrated by deep foundation construction with higher risk occurring immediately above or within the "pre-till" sandy lean clays encountered at 92 to 96 feet below existing grade. All caisson construction must be temporarily cased into competent glacial till to prevent plastic deformation and caving of the GLA soils into bore opening.

Construction of deep foundations may encounter occasional rocks, cobbles, or boulders due to erratic deposition within the GLA clays or alluvial deposition at and within the "pre-till" and very stiff glacial till deposits. Drilling operations for advancement of caisson shaft must include provision to remove rock, cobbles and boulders from shaft profile. Such removal will likely require but is not limited to use of specialty grapple or other means of removal from bore / belled section.



Contractor must clear caisson bore / belled section of loose soils and ground water seepage. This process typically employs use of a retrieval bucket attachment to drill string.

Placement of concrete for caisson construction must be modified for uniform, high flow viscosity while limiting segregation of coarse aggregate. Concrete mixture design must also provide sufficient excess cementitious materials to incorporate slight to moderate inclusion of seepage which may exist at or near base of construction.

Placement of concrete for caisson must occur within full depth tremie pipe / fixture extending to base. Any water debris at base of shaft must be displaced upward above the free flowing concrete surface for eventual removal at ground surface.

Removal of temporary casing must be controlled whereas Contractor provides no less than 10 feet concrete head above base of steel shell at all time during placement activities. This provision is necessary to maintain positive confinement pressure to weak GLA / alluvium deposits exposed during retrieval of temporary casing.

Construction must extend grade beam construction and any incidental shallow footings to sufficient depth below ground (exposed slab) surface as protection against frost action. For this project, you should extend at-grade footing construction within permanently heated areas (60° Fahrenheit or above) to no less than 5 feet below final grades as protection against frost action. Similarly, you should extend at-grade footings to a minimum of 7 feet below the exterior ground surface in areas lacking permanent heat.

We previously noted clay soils have risk of swell with absorption of moisture. This is especially true when excess runoff, pooled within excavations is absorbed by clay soils. Partially constructed foundations, foundation of reduced confining load, and more importantly, lightly loaded on-grade floor construction may heave due to clay soil swell. You should maintain constant automated subsurface drainage of the construction site to reduce this risk of heaved foundations.

Foundation wall / perimeter grade beams for basement level construction will experience unbalanced lateral loading from retained soils. You may model this lateral loading as an equivalent earth pressure applied to the foundation wall providing site geometric and related conditions complies with the parameters supporting such modeling. We recommend use of the Table 3 "at-rest" equivalent fluid earth pressures for establishing lateral loading of foundations walls within basement or with unbalanced earthen fill.

Table 3: Estimate of Equivalent Fluid Weight of Retained Soils

Type of Retained Soil		"At Rest" Condition (pcf)	"Active" Condition (pcf)
Unit Weight of Equivalent Fluid *	Fat Clay (CH)	95	80
	Sand (SP, SP-SM)	65	45

* The recommendations for equivalent fluid weight are based solely on assumed conditions with respect to sloping ground and/or surcharge loads. Design professional is cautioned that actual loads imparted to the structure will be dependent on soil conditions, site geometric considerations and surcharge loads imparted to the structure.



4.4 Bearing Factor of Safety and Estimate of Settlement

We estimate Glacial Till soils provide a nominal 2 factor of safety against localized end bearing failure when caisson construction complies with report criteria and recommendations, and you design caisson foundations using the Table 2 soil bearing pressure and adhesive skin friction recommendations.

We also estimate that caisson foundations designed with the Table 2 recommendations and loaded per report assumptions may experience long term, total settlement of approximately $\frac{1}{4}$ to $\frac{1}{2}$ inch with the upper estimate more probable. Likewise, caisson foundations may experience differential settlement on the order of 50 to 100 percent of total settlement with greatest movement occurring between adjacent footings of greatest load variation. *Note the above estimate of settlements reflects movement of foundation elements from stress induced to supporting soils. Such settlements do not include movement due to elastic compression of the caisson shaft from applied structural load.*

Furthermore, total and differential movement of caisson shafts could be significantly greater than the above estimates if Contractor does not clear loose debris, accumulated ground water seepage from bore opening or should Contractor not extend caisson shaft to very stiff glacial till soils referenced by this report.

4.5 Basement Level Floors

Our borings indicate poor soils within the project interior. As previously discussed, we anticipate one of two soil correction methods will be used for foundation support of project; deeper excavation to top of caisson pier occurring at assumed elevation 81 feet [Option #1], and lesser excavation to nominal top of grade beam construction occurring at assumed elevation 86 feet [Option #2]. Both options exclude special removal at and near periphery of building. Both options will also retain a portion of uncontrolled fill / buried topsoil present below basement floor.

As basis for consideration, it is our premise subgrade compaction and placement of nominal $\frac{1}{2}$ feet of granular engineered fill would be provided under Option #1. Contrary, subgrade compaction and placement of nominal 1 foot of granular engineered fill would be provided under Option #2. Selection of the appropriate subgrade correction and support of basement level floor should be sole selection of Contractor bidding project providing their construction process complies with respective criteria / limitation imposed by each Option.

Under both Options, corrective preparation of soils exposed at nominal elevation 81 feet must be made to address rutting caused by construction equipment and any variation of insitu density of uncontrolled fill retained below floor. Such scarification and "re-compaction" of floor subgrade should be similar to and comply with the minimum depth criteria as established for construction at or below grade beam construction.

This preparatory work must then be followed by placement of a geotextile separation fabric and reinforcing fabric. This woven material must provide a wide width tensile strength equal to or greater than 110 lbs/in at 5% strain [MARV]. Each individual panel of geotextile must run full length / width of building area. We recommend that adjacent panels of geotextile be sewn with two individual "locking", double stitch pattern whereas the strength of the sewn



seam is equal to or greater than the geotextile. Geotextile placement must also occur whereas no slack material occurs on ground surface. This is necessary to facilitate development tensile strength within the geotextile membrane, thus strengthening the granular layer envelope placed in support of floor slab.

Engineered fill placed in support of basement level floor slab should consist of granular soil having 100 percent material passing the 1 inch sieve opening, no more than 40 percent materials passing the No. 40 U.S. Sieve opening, and no more than 5 percent material passing the No. 200 U.S. Sieve opening. The granular fill should be tempered for correct moisture, placed in 8 inch maximum depth loose lifts and compacted per criteria established within the appendices attachment.

Design of the basement level floor slab may be based on an estimated subgrade reaction modulus (k) of 75 lbs/in³ for Option #1 and 25 lbs/in³ for Option #2. We understand the floor slab will support non-load bearing masonry wall construction for basement. We recommend that you thicken and heavily reinforce the portion of floor supporting walls. This determination and any additional requirements for balance of floor construction including type and level of reinforcement must be established by Structural Engineer of Record.

We understand the basement level floor slab will support miscellaneous facility activities typically associated with maintenance of facility [i.e. work shop(s) and mechanical / electrical equipment]. As such it is our premise the floor will not receive any special treatment other than a light broom finish and will not include placement or covering with impervious or near-impervious materials. Any use others than those noted above would require special review concerning installation of vapor barrier below floor concrete.

You have indicated the basement level floor slab and non-load bearing walls supported by slab can accommodate significant movement without undue impact to use or function of facility. While corrective action will attempt to minimize soft zones, the inclusion of uncontrolled fill below the basement level floor will provide increased risk of settlement and differential movement. We estimate such distress could approach or exceed ½ inch over nominal 10 foot horizontal distance. Any jointing within floor and control joints provided for masonry wall construction must be capable of accommodating such movement. Limiting settlement and differential movement of basement level floor would require use of structural system extending to caisson foundation elements, a costly alternative to above approach.

You should isolate floor slabs from other building components. It is our opinion such isolation should include installation of a ½ inch thick expansion joint between the floor and walls, and/or columns to minimize binding between construction materials. This construction should also include application of a compatible sealant after curing of the floor slab to reduce moisture penetration through the expansion joint. As a minimum, you should install bond breaker to isolate and reduce binding between building components.

We previously noted risk of heave of on-grade floor slab construction if exposed clay soils are allowed to absorb moisture [from runoff or precipitation]. We direct your attention to the appendices attachment on Swell of Clay Soils.



4.6 Exterior Backfill & Subsurface Drainage

Exterior fill placement around the grade beam / periphery foundation wall will impact the performance of structure. Structural Engineers design of grade beam wall system must include lateral loading associated with uneven earthen fill against construction.

We understand isolated fill placement adjacent to new structure periphery will support walkways and patio area. Construction of this work will also be positioned near existing HVAC equipment at site. We caution Contractor that side slope exposed by exterior excavation must be stable and provide permanent support of existing construction. This includes any contributory loading from existing buildings, HVAC equipment, or any other features present at site. Determination of excavation stability may require review by specialty foundation / geotechnical engineer retained by Contractor. We direct you and Contractor to comment concerning stability of excavations and related discussion of competent individual of record per OSHA statute.

While not necessarily required for this project, you should install subsurface drainage at the base of basement grade beam / foundation walls to limit moisture accumulation within granular soils placed below interior floor(s). You should also place separate isolated subsurface drainage system exterior to perimeter grade beams / foundation walls to drain water accumulated within granular fill placed below sidewalks / patio / drives.

As a general guideline, such drainage consists of a geotextile and coarse drainage encased slotted or perforated pipe extending to sump basin(s). We recommend that exterior drainage be separated from interior drainage to reduce risk of cross flow and moisture infiltration below structure interior. You, as project Architect and Structural Engineer of Record should determine actual need for subsurface drainage.

Exterior backfill extending to within 2 feet of final exterior grade for basement grade beam / foundation walls and any exterior retaining walls should consist of a native, coarse alluvium or "pit run" granular soil with a fine content equal to or less than 12 percent passing the No. 200 US Sieve opening. You should then provide and place nominal 18 inch clay cap and 6 inch topsoil section for construction within lawn areas. The final 2 feet of fill placed within areas receiving pavement [i.e. walks, patio and drives] should consist of a North Dakota Department of Transportation Class V granular material herein modified such that the fine content passing the #200 sieve opening is no more than 8%. This reduction in fine content for the granular deposit will promote more rapid drainage of section to underlying granular fill and associated subsurface drainage system.

You should limit placement of exterior backfill until lateral restraint of periphery basement grade beam / foundation wall has been installed to the satisfaction of the Structural Engineer of Record. Final grading of exterior backfill must provide sufficient grade for positive drainage from structure. We presented within other report section recommendations for final grades.

All cohesive and granular fill for exterior to grade beam / foundation walls must be tempered for correction moisture content prior to placement within excavation. You must then place and compact individual lifts of engineered fill to respective criteria outlined within the appendices attachment.



4.7 Surface Drainage

You should maintain positive drainage during and after construction of project and eliminate ponding of water on site soils. We recommend you include provisions within construction documents for positive drainage of site. You should install sumps at critical areas around project to assist in removal of seepage and runoff from site. We present recommendations for sump construction within separate appendices.

You should maintain the moisture content of site clays as close to existing as possible as excessive changes can cause shrinkage or expansion of the soil, and lead to distress of construction.

We understand sidewalks, curbing, pavements, and lawn will direct drainage from structure. You should grade exterior to slope from building(s). We recommend that you provide a 5 percent gradient within 10 feet of building for drainage from lawn, and 2 percent minimum gradient from building for drainage of sidewalks / pavements. All pavements should drain to on-site storm collection, municipal collection system, or roadside ditching.

You should direct roof runoff from building by a system of interior roof and scupper drains, or rain gutters, down spouts and splash pads. It is our opinion interior roof drains plumbed directly to the storm water piping system provide the most favorable method of conveying drainage from the roof as interior drains do not freeze or discharge runoff onto exterior sidewalks and pavements.

4.8 Utilities

Placement of underground utilities typically includes granular bedding for support of piped systems. Placement of granular soils within underground utility construction promotes migration of subsurface moisture towards and below the bearing stratum of footing construction. This, in turn, can lead to moisture uptake by native clays producing heave of construction, loss of shear strength and/or differential settlement of footing and floors.

Therefore, we recommend that you eliminate placement of all granular bedding soils within 10 feet of project excavations creating a zone where cohesive soils or lean concrete (i.e. controlled density fill) is used for all soil replacement within utility trenches. This "zone of control" should significantly reduce moisture migration below project grade beams and basement level floor. All clay bedding fill within this zone should be placed and compacted as recommended for utility trench backfill.

In lieu of placing clay soils within the above referenced "zone of control", alternate means of interception and blockage of drainage along site utilities may be provided to minimize moisture migration into and below structure foundation and floors.

Wetter soils from depth should be placed in the lower portion of utility trench construction while dryer soils from near ground surface should be placed in upper most portion of trench fill. You should temper the utility trench fill for correct moisture content and then place and compact individual lifts of trench fill to criteria established within the report appendices.

There is a high probability that fine and coarse alluvium laminations occur within site soils and may be present along utility trench excavations. Such formations and other regional dependent soil conditions may be water bearing. While it is our opinion small pumps should



handle seepage resulting from utility construction, we caution that interception of a major water bearing stratum may result in significantly greater seepage into utility excavations. Therefore, we recommend that you include provisions within construction document for pumping of seepage from utility excavations.

4.9 Vegetation

Vegetation planting near structures can result in a change in soil moisture content from moisture uptake by the plants or excessive watering of plantings. The resulting change in soil moisture contributes to lateral earth pressure development and frost related heave of local soils. You should eliminate planting of trees or shrubs within 10 feet of the structures as a cautionary measure to reduce the seasonal fluctuation of soil moisture. *As a minimum, we recommend that you establish a plan to control and limit watering of planting within 10 feet of the structures. Such review and control is necessary to minimize the moisture change of the native clays.*

5.0. CONSTRUCTION CONSIDERATIONS

5.1. Excavation Stability

Excavation depth and sidewall inclination should not exceed those specified in local, state or federal regulations. Excavations may need to be widened and sloped, or temporarily braced, to maintain or develop a safe work environment. Also, contractors should comply with local, state, and federal safety regulations including current OSHA excavation and trench safety standards. Temporary shoring must be designed in accordance with applicable regulatory requirements.

5.2. Engineered Fill & Winter Construction

The Geotechnical Engineer of Record or their designated representative should observe and evaluate excavations to verify removal of uncontrolled fills, topsoil and/or unsuitable material(s), and adequacy of bearing support of exposed soils. Such observation should occur prior to construction of foundations or placement of engineered fill supporting excavations.

Engineered fill should be evaluated by above designated representative for moisture content, mechanical analysis and/or Atterberg limits prior to placement. You should temper engineered fill for correct moisture content and then place and compact individual lifts of engineered fill to criteria established within the appendices attachment.

Frozen soil should never be used as engineered fill or backfill nor should you support foundations on frozen soils. Moisture freezing within the soil matrix of fine grained and/or cohesive soils produces ice lenses. Such soils gain moisture from capillary action and, with continued growth, heave with formation of ice lenses within the soil matrix. Foundations constructed on frozen soils settle at or after thaw if ice lenses.



You should protect excavations and foundations from freezing conditions or accumulation of snow, and remove frozen soils, snow, and ice from within excavations, fill section or from below proposed foundations. Replacement soils should consist of similar materials as those removed from the excavation with moisture content, placement and compaction conforming to report criteria.

5.3. Operation of Project Sumps

We previously noted the importance of prompt removal of seepage and runoff from excavations. You should install and continuously operate sumps, temporary subsurface drainage pipe, and/or collection manifold and vacuum wells for removal seepage and runoff from project. We presented within appendices attachment recommendations for sumps.

6.0 CLOSURE

Our conclusions and recommendations are predicated on observation and testing of the earthwork directed by Geotechnical Engineer of Record. Our opinions are based on data assumed representative of the site. However, the area coverage of borings in relation to the entire project is very small. For this and other reasons, we do not warrant conditions below the depth of our borings, or that the strata logged from our borings are necessarily typical of the site. Deviations from our recommendations by plans, written specifications, or field applications shall relieve us of responsibility unless our written concurrence with such deviations has been established.

This report has been prepared for the exclusive use of Image Group Architecture and Interiors for specific application to the proposed VA Medical Center Additional Outpatient Space in Fargo, North Dakota. Northern Technologies, Inc. has endeavored to comply with generally accepted geotechnical engineering practice common to the local area. Northern Technologies, Inc. makes no other warranty, expressed or implied.

Northern Technologies, Inc.

Daniel Gibson

Dan Gibson, P.E.
Project Engineer

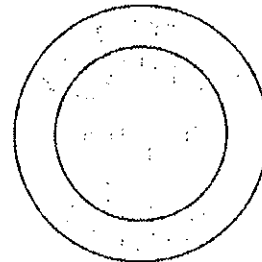
Bret R. Anderson

Bret R. Anderson, P.E.
Associate

DG:ba

Attachments

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Bret R. Anderson

Bret R. Anderson, P.E.

Date: 8-23-2011



APPENDIX A



GEOTECHNICAL EVALUATION OF RECOVERED SOIL SAMPLES

We visually examined recovered soil samples to estimate distribution of grain sizes, plasticity, consistency, moisture condition, color, presence of lenses and seams, and apparent geologic origin. We then classified the soils according to the Unified Soil Classification System (ASTM D2488). A chart describing this classification system and general notes explaining soil sampling procedures are presented within appendices attachments.

The stratification depth lines between soil types on the logs are estimated based on the available data. Insitu, the transition between type(s) may be distinct or gradual in either the horizontal or vertical directions. The soil conditions have been established at our specific boring locations only. Variations in the soil stratigraphy may occur between and around the borings, with the nature and extent of such change not readily evident until exposed by excavation. These variations must be properly assessed when utilizing information presented on the boring logs.

We request that you, your design team or contractors contact NTI immediately if local conditions differ from those assumed by this report, as we would need to review how such changes impact our recommendations. Such contact would also allow us to revise our recommendations as necessary to account for the changed site conditions.

FIELD EXPLORATION PROCEDURES

Soil Sampling – Standard Penetration Boring:

Soil sampling was performed according to the procedures described by ASTM D-1586. Using this procedure, a 2 inch O.D. split barrel sampler is driven into the soil by a 140 pound weight falling 30 inches. After an initial set of six inches, the number of blows required to drive the sampler an additional 12 inches is recorded (known as the penetration resistance (i.e. "N-value") of the soil at the point of sampling. The N-value is an index of the relative density of cohesionless soils and an approximation of the consistency of cohesive soils.

Soil Sampling – Power Auger Boring:

The boring(s) was/were advanced with a 6 inch nominal diameter continuous flight auger. As a result, samples recovered from the boring are disturbed, and our determination of the depth, extend of various stratum and layers, and relative density or consistency of the soils is approximate.

Soil Classification:

Soil samples were visually and manually classified in general conformance with ASTM D-2488 as they were removed from the sampler(s). Representative fractions of soil samples were then sealed within respective containers and returned to the laboratory for further examination and verification of the field classification. In addition, select samples were submitted for laboratory tests. Individual sample information, identification of sampling methods, method of advancement of the samples and other pertinent information concerning the soil samples are presented on boring logs and related report attachments.



GENERAL NOTES

DRILLING & SAMPLING SYMBOLS		LABORATORY TEST SYMBOLS	
SYMBOL	DEFINITION	SYMBOL	DEFINITION
C.S.	Continuous Sampling	W	Moisture content-percent of dry weight
P.D.	2-3/8" Pipe Drill	D	Dry Density-pounds per cubic foot
C.O.	Cleanout Tube	LL, PL	Liquid and plastic limits determined in accordance with ASTM D 423 and D 424
3 HSA	3 1/4" I.D. Hollow Stem Auger	Q _u	Unconfined compressive strength-pounds per square foot in accordance with ASTM D 2166-66
4 FA	4" Diameter Flight Auger	Additional insertions in Q_u Column Pq Penetrometer reading-tons/square foot S Torvane reading-tons/square foot G Specific Gravity -- ASTM D 854-58 SL Shrinkage limit -- ASTM 427-61 pH Hydrogen ion content-meter method O Organic content-combustion method M.A.* Grain size analysis C* One dimensional consolidation Q _c Triaxial Compression * See attached data Sheet and/or graph	
6 FA	6" Diameter Flight Auger		
2 1/2 C	2 1/2" Casing		
4 C	4" Casing		
D.M.	Drilling Mud		
J.W.	Jet Water		
H.A.	Hand Auger		
NXC	Size NX Casing		
BXC	Size BX Casing		
AXC	Size AX casing		
SS	2" O.D. Split Spoon Sample		
2T	2" Thin Wall Tube Sample		
3T	3" Thin Wall Tube Sample		

WATER LEVEL SYMBOL

Water levels shown on the boring logs are the levels measured in the borings at the time and under the conditions indicated. In sand, the indicated levels can be considered reliable ground water levels. In clay soils, it is not possible to determine the ground water level within the normal scope of a test boring investigation, except where lenses or layers of more pervious water bearing soil is present and then a long period of time may be necessary to reach equilibrium. Therefore, the position of the water level symbol for cohesive or mixed soils may not indicate the true level of the ground water table. The available water level information is given at the bottom of the log sheet.

DESCRIPTIVE TERMINOLOGY

DENSITY		CONSISTENCY	
TERM	"N" VALUE	TERM	"N" VALUE
Very Loose	0-4	Soft	0-4
Loose	5-8	Medium	5-8
Medium Dense	9-15	Rather Stiff	9-15
Dense	16-30	Stiff	16-30
Very Dense	Over 30	Very Stiff	Over 30

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch OD split spoon.

RELATIVE PROPORTIONS

TERMS	RANGE
Trace	0-5%
A little	5-15%
Some	15-30%
With	30-50%

PARTICLE SIZES

Boulders	Over 3"
Gravel - Coarse	3/4" - 3"
Medium	#4 - 3/4"
Sand - Coarse	#4 - #10
Medium	#10 - #40
Fine	#40 - #200
Silt and Clay	Determined by plasticity characteristics.

Note: Sieve sizes are U.S. Standard.



CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

ASTM Designation D-2487 and D 2488 (Unified Soil Classification System)

Major Divisions	Group Symbols	Typical Names	Classification Criteria		
Course Grained Soils More than 50% retained on No. 200 sieve *	Gravels 50% or more of coarse fraction retained on No. 4 sieve.	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines.	
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines.	
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures.	
			GC	Clayey gravels, gravel-sand-clay mixtures.	
		Sands More than 50% of coarse fraction passes No. 4 sieve.	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines.
				SP	Poorly-graded sands and gravelly sands, little or no fines.
	Sands with Fines		SM	Silty sands, sand-silt mixtures.	
			SC	Clayey sands, sand-clay mixtures.	
	Fine Grained Soils More than 50% passes No. 200 sieve *	Silty and Clays Liquid Limit of 50% or less	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands.	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	
OL			Organic silts and organic silty clays of low plasticity.		
Silty and Clays Liquid Limit greater than 50%.		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts.		
		CH	Inorganic clays of high plasticity, fat clays.		
		OH	Organic clays of medium to high plasticity.		
Highly Organic Soils		Pt	Peat, muck and other highly organic soils.		
Classification on basis of percentage of fines. Less than 5% passing No. 200 Sieve: GW, GP, SW, SP More than 12% passing No. 200 Sieve: GM, GC, SM, SC From 5% to 12% passing No. 200 Sieve: Borderline Classification requiring use of dual symbols.					
$C_u = D_{60} / D_{10}$ greater than 4. $C_z = (D_{30})^2 / (D_{10} \times D_{60})$ between 1 & 3. Not meeting both criteria for GW materials. Atterberg limits below "A" line, or P.I. less than 4. Atterberg limits plotting in hatched area are <i>borderline</i> classifications requiring use of dual symbols. $C_u = D_{60} / D_{10}$ greater than 6. $C_z = (D_{30})^2 / (D_{10} \times D_{60})$ between 1 & 3. Not meeting both criteria for SW materials. Atterberg limits below "A" line, or P.I. less than 4. Atterberg limits plotting in hatched area are <i>borderline</i> classifications requiring use of dual symbols.					

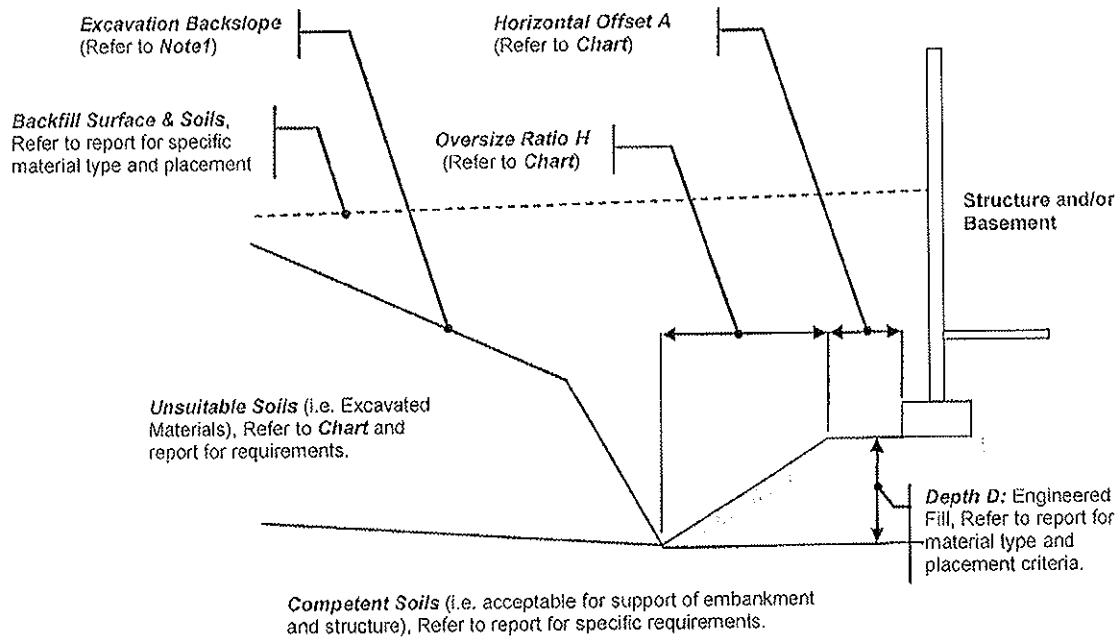
Plasticity Index Chart

The chart plots Plasticity Limit (Y-axis, 0 to 60) against Liquid Limit (X-axis, 0 to 100). Key features include:
- A diagonal line labeled 'A-line'.
- A horizontal line at Plasticity Limit = 7.
- A horizontal line at Plasticity Limit = 4.
- A horizontal line at Plasticity Limit = 2.
- A horizontal line at Plasticity Limit = 0.
- Regions labeled: CL-ML Soils, CH Soils, OL Soils, CL Soils, OL Soils, CH Soils, OH Soils, Pt Soils.
- A hatched area representing borderline classifications.



EXCAVATION OVERSIZE

Excavation oversize facilitates distribution of load induced stress within supporting soils. Unless otherwise superseded by report specific requirements, all construction should conform to the minimum oversize and horizontal offset requirements as presented within the diagram and associated chart.



Definitions

Oversize Ratio H: The ratio of the horizontal distance divided by the engineered fill depth (i.e. # Horizontal / Depth D). Refer to Chart for specific requirements.

Horizontal Offset A: The horizontal distance between the outside edge of footing or critical position and the crest of the engineered fill section. Refer to Chart for specific requirements.

Note 1: Excavation depth and sidewall inclination should not exceed those specified in local, state or federal regulations including those defined by Subpart P of Chapter 27, 29 CFR Part 1926 (of Federal Register). Excavations may need to be widened and sloped, or temporarily braced, to maintain or develop a safe work environment.

Condition	Unsuitable Soil Type	Horizontal Offset A	Oversize Ratio H
Foundation Unit Load equal to or less than 3,000 psf.	SP, SM soils, CL & CH soils with cohesion greater than 1,000 psf	2 feet or width of footing, whichever is greater	Equal to or greater than Depth D
Foundation Unit Load greater than 3,000 psf	SP, SM soils, CL & CH soils with cohesion less than 1,000 psf	5 feet or width of footing, whichever is greater	Equal to or greater than Depth D
Foundation Unit Load equal to or less than 3,000 psf.	Topsoil or Peat	2 feet or width of footing, whichever is greater	Equal to or greater than two (2) time Depth D
Foundation Unit Load greater than 3,000 psf	Topsoil or Peat	5 feet or width of footing, whichever is greater	Equal to or greater than two (2) time Depth D



APPENDIX B



GROUND WATER ISSUES

The following presents additional comment and soil specific issues related to measurement of ground water conditions at your project site.

Note that our ground water measurements, or lack thereof, will vary depending on the time allowed for equilibrium to occur in the borings. Extended observation time was not available during the scope of the field exploration program and, therefore, ground water measurements as noted on the borings logs may or may not accurately reflect actual conditions at your site.

Seasonal and yearly fluctuations of the ground water level, if any, occur. Perched ground water may be present within sand and silt lenses bedded within cohesive soil formations. Groundwater typically exists at depth within cohesive and cohesionless soils.

Documentation of the local ground water surface and any perched ground water conditions at the project site would require installation of temporary piezometers and extended monitoring due to the relatively low permeability exhibited by the site soils. We have not performed such ground water evaluation due to the scope of services authorized for this project.

We anticipate pumps installed within temporary sumps should control subsurface seepage from perched conditions. However, we caution such seepage from such formations and any water entry from excavations below the ground water table may be heavy and will vary based on seasonal and annual precipitation, and ground related impacts in the vicinity of the project.

GEOTEXTILE FABRIC

Unless otherwise amended by our report, we recommend installation of a geotextile separation fabric between the native soils and the engineered fill section below project foundations, floors and/or between a clay subgrade and aggregate base of pavement construction. It is our opinion this geotextile should consist of a non-woven, needle punched, fabric with a minimum grab tensile strength in both directions equal to or greater than 200 lbs minimum average roll value (MARV, ASTM D 4632).

We recommend that the geotextile panels be oriented parallel with proposed aggregate placement activities, and occur in such a manor that the overall number of individual panels are kept to a minimum. As placed, individual panels of geotextile should have a width equal to or greater than 12 feet. We recommend that the Contractor overlap longitudinal and butt seams of adjacent panels a minimum of 18 inches with such joints oriented to follow initial construction traffic (shingles profile with traffic).



PLACEMENT and COMPACTION OF ENGINEERED FILL

Unless otherwise superseded within the body of the Geotechnical Exploration Report, the following criteria shall be utilized for placement of engineered fill on project. This includes, but is not limited to earthen fill placement to improve site grades, fill placed below structural footings, fill placed interior of structure, and fill placed as backfill of foundations.

Engineered fill placed for construction, if necessary should consist of natural, non-organic, competent soils native to the project area. Such soils may include, but are not limited to gravel, sand, or clays with Unified Soil Classification System (ASTM D2488) classifications of GW, SP, SM, CL or CH. Use of silt or clayey silt as project fill will require additional review and approval of project Geotechnical Engineer of Record. Such soils have USCS classifications of ML, MH, ML-CL, MH-CH. Use of topsoil, marl, peat, other organic soils construction debris and/or other unsuitable materials as fill is not allowed. Such soils have USCS classifications of OL, OH, Pt.

Engineered fill, classified as clay, should be tempered such that the moisture content at the time of placement is equal to and no more than 3 percent above the optimum content for as defined by the appropriate proctor test. Likewise, engineered fill classified as gravel or sand should be tempered such that the moisture content at the time of placement is within 3 percent of the optimum content.

All engineered fill for construction should be placed in individual 8 inch maximum depth lifts. Each lift of fill should be compacted by large vibratory equipment until the in-place soil density is equal to or greater than the criteria established within the following tabulation.

Type of Construction	Compaction Criteria (% respective Proctor) ¹	
	Clay	Sand or Gravel
General Embankment Fill	95 to 100	Min. 95
Engineered Fill below Foundations	Min. 95	Min. 95
Engineered Fill below Floor Slabs	95 to 98	Min. 95
Engineered Fill placed against Foundation Walls	95 to 98	95 to 100
Engineered Fill placed as Pavement Subgrade	Min. 95	Min. 95
Engineered Fill placed as Pavement Aggregate Base	NA	Min. 98
Engineered Fill placed within Utility Trench (to within 3 feet of pavement aggregate base or final grade	Min. 95	Min. 95
Engineered Fill placed as Utility Trench Fill (within 3 feet of pavement aggregate base or final grade	Min. 98	Min. 98

Note 1 Unless otherwise required, compaction criteria shall be based on the Standard Proctor Test (ASTM D698).

Density tests should be taken during engineered fill placement to document earthwork has achieved necessary compaction of the material(s). Recommendations for interior fill placement and backfill of foundation walls are presented within other sections of this report.



SWELLING of CLAY SOILS

Swell of clay soil occurs when moderate to highly desiccated, "over consolidated", moderate to highly plastic clay absorbs moisture concurrent within removal of overburden pressure. The fat clay soils comprising the Glacial Lake Agassiz formation are generally known as to have "moderate" to "high risk" of swelling when conditions favorable for heave occur.

Clay minerals are generally elongated bipolar charged particles aligned in plate like structures. Absorption of water by the clay minerals is driven, in part, by the electrical attraction between the bipolar mineral and the electrical charged water molecule. The electrical attraction at the molecular level is a fairly strong bond which forces separation of the clay particle into a stratified system of bonded clay and water. The resulting composite system has greatly increased volume as compared to the original clay minerals.

Major clay minerals include Kaolinite, Halloysite, Illite, Calcium Montmorillonite, Sodium Montmorillonite, and Sodium Hectorite. Mielenz and King (1955) have noted that absorption of water by clays leads to expansion or swelling and that the magnitude of swelling varied widely depending upon the type and quantity of clay mineral present, their exchangeable ions, electrolyte content of the aqueous phase, particle-size distribution, void size and distribution, the internal structure, water content, superimposed load, and possibly other factors. Research geology professor Mr. Ralph Grim [University of Illinois] collaborates free swelling of clay minerals varied widely [referenced Table 5-10].

Table 5-10
Free Swelling Data for Clay Minerals (in per cent)
(After Mielenz and King, 1955)¹

<i>Calcium Montmorillonite:</i>	
Forest, Mississippi	145
Wilson Creek Dam, Colorado	95
Davis Dam, Arizona	45 - 85
Osage, Wyoming (prepared from Na-Mont.)	125
<i>Sodium Montmorillonite</i> - Osage, Wyoming	1,400 - 1,600
Sodium Hectorite - Hector, California	1,600 - 2,000
<i>Illite:</i>	
Pithian, Illinois	115 - 120
Morris, Illinois	60
Tazewell, Virginia	15
<i>Kaolinite:</i>	
Mesa Alta, New Mexico	5
Macon, Georgia	60
Langley, North Carolina	20
	70
Halloysite - Santa Rita, New Mexico	

¹ Ralph E. Grim, Table 5-10, Free Swelling Data for Clay Minerals, "Applied Clay Mineralogy", University of Illinois, Urbana, Illinois, McGraw-Hill Book Company, Inc., 1962, p 248.



As shown in referenced Table 5-10, the effective range of swell in percent varies widely from as little as 5% with Kaolinite to 2,000% with Sodium Hectorite. Of major concern, regional clay soils typically include varying concentration of montmorillonite mineral [commonly defined as smectite]. *Note that defining the percent content and mineral type of clay soils calls for very costly and time intensive laboratory analysis. Such determination cannot be made through visual classification.*

Historically, a majority of clay soils across the Red River Valley (i.e. Sherack Deposition of Glacial Lake Agassiz Formation) have extreme low permeability on the order of 1×10^{-8} or lower cm/sec. However, this low permeability for water flow is moderated by silt and very fine sand lens bedded within the Sherack formation. Such lenses becomes wet to saturated allowing movement of ground water during periods of prolonged wet cycles [nominal 10 to 50 year cycles], allowing limited transport of aqueous minerals through the Sherack clays. This can lead to varied extent of sodium and calcium mineral exchange within the clay soil structure [through presence of gypsum].

Past observation of other projects in south Fargo suggest the most prevalent risk of heave occurs when new, lightly loaded construction occurs over a prior shelter belt [previously forested with mature cotton wood or oaks], or farm fields previously planted in alfalfa or similar deep rooting plants. Clay soils within nominal 10 to 30 feet of ground surface at such locations typically are desiccated to varying degree from moisture uptake by plant cover.

Outside of above anomalies [excluding areas desiccated during seasonal construction exposure and areas immediately adjacent to silt or sand lens], Red River Valley clay soils below nominal depth 12 to 25 feet generally experience extreme slow change in moisture content seasonally, with long term [i.e. decade level event] slight to moderate change in moisture content following cyclical drought or wet cycles common to the northern prairie.

The extreme depth of clay deposit within the Red River Valley precludes construction of conventional frost foundations on other than soil having heave potential. Thus, the major means of reducing risk of heave to construction includes; isolation of lightly loaded floor slabs from more heavily loaded foundation element, allowing unhindered movement between walls / floor and any piped penetrations and, most importantly, providing continuous automated drainage of site during construction and permanent subsurface drainage of foundations and at-grade floors long term. *Lacking access to moisture, heave prone clay soils will have minimal if any volume change.*

PROJECT SUMPS

The collection, control and removal of seepage and runoff from within project excavations is critical in maintaining the bearing capacity of native soils, in-place density of engineered fill and stability of embankments at project excavations.

As constructed, it is our opinion all sumps should consist of a 2 foot by 2 foot or larger plan dimension excavation(s) located adjacent to and directly exterior to the excavation oversize limit for structural engineered fill. Sump excavations should extend a minimum of 2 feet below the base of the excavation for collection of seepage and runoff.



All sumps should be lined with a non-woven, needle-punched, geotextile having a grab tensile strength equal to or greater than 70 pounds per square inch (psi). A standpipe of 12 inches in diameter or larger should be centered within the sump excavation. This pipe should include sufficient openings for entry of seepage. We recommend that the standpipe extend to the ground surface to facilitate pumping during project construction. Infill within the sump area should consist of a 1½ to ¾ inch clear rock placed between the standpipe and walls of the sump excavation.

Pumping of sump(s) should continue until completion of the construction or until the Geotechnical Engineer of Record indicates such pumping is no longer necessary for stability of the project footings and related construction. Sumps should be abandoned per methods required by the Geotechnical Engineer of Record and per Federal, State and local governmental statutes.

Discharge from sumps should be directed away from site and be disposed within storm water systems or other systems which comply with Federal, State and local governmental statute. As constructed and operated, the General Contractor should be responsible for all permits, operation and abandonment of sumps or other temporary dewatering systems.



APPENDIX C



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CLIENT Image Group Architecture and Interiors

PROJECT NAME VA Medical Center - Outpatient Treatment Space

PROJECT NUMBER 11-11161.100

PROJECT LOCATION Fargo, North Dakota

DATE STARTED 7/17/11

COMPLETED 7/17/11

GROUND ELEVATION 87.4 ft HOLE SIZE 6 1/2"

DRILLING CONTRACTOR NTI

GROUND WATER LEVELS:

DRILLING METHOD 3 1/4" H.S.A.

AT TIME OF DRILLING ---

LOGGED BY TS

CHECKED BY DG

AT END OF DRILLING ---

NOTES ---

AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0							Topsoil / Fill, Organic fat clay, black (OH)
	AU 1						
	SS 2		4-4-6 (10)				
5	SS 3		5-6-8 (14)				
	SS 4		2-4-5 (9)	PP = 3.4 tsf MC = 30% DD = 92 pcf			
10	SS 5		2-3-6 (9)	PP = 2.9 tsf MC = 32% DD = 90 pcf			
	SS 6		2-3-4 (7)	PP = 1.7 tsf MC = 29% DD = 94 pcf			
15	SS 7		1-3-5 (8)	PP = 2.3 tsf MC = 31% DD = 90 pcf	CH		
20	SS 8		1-4-5 (9)	PP = 2.7 tsf MC = 28% DD = 96 pcf Qu = 450 psf			
25	SS 9		2-3-5 (8)	PP = 1.8 tsf MC = 31% DD = 91 pcf Qu = 875 psf			
30	SS 10	89	2-3-5 (8)	PP = 3.0 tsf MC = 36% DD = 86 pcf Qu = 500 psf	CH		
35							
40							

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GENERAL 8H/TP/WELL VA LOGS.GPJ GINT US.GDT 2/23/11



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PROJECT NAME VA Medical Center - Outpatient Treatment Space

PROJECT NUMBER 11-11161.100

PROJECT LOCATION Fargo, North Dakota

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
40	X SS 11	111	1-1-1 (2)	PP = 0.5 tsf MC = 73% DD = 69 pcf			Fat Clay, dark gray, soft (CH) (continued)
45							
50	X SS 12	111	0-1-1 (2)	PP = 0.5 tsf MC = 70% DD = 69 pcf			
55							
60	X SS 13	111	0-0-1 (1)	PP = 0.5 tsf MC = 56% DD = 68 pcf			
65					CH		
70	X SS 14	111	0-1-2 (3)	PP = 0.5 tsf MC = 60% DD = 65 pcf			
75							
80	X SS 15	111	1-2-2 (4)	PP = 0.1 tsf MC = 71%			
85							

GENERAL BH / TP / WELL VAL LOGS GP1 GINT US GDT 8/23/11



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PROJECT NAME VA Medical Center - Outpatient Treatment Space

PROJECT NUMBER 11-11161.100

PROJECT LOCATION Fargo, North Dakota

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
90	SS 16	28	2-2-2 (4)	PP = 0.1 tsf MC = 42% DD = 82 pcf	CH		Fat Clay, dark gray, soft (CH) (continued)
93.5							-6.1
95							Sandy Lean Clay, dark gray, very stiff (CL)
100	SS 17	78	8-12-25 (37)	PP = 1.8 tsf MC = 20%	CL		
105	SS 18	78	24-35-50 (85)	PP = 6.0 tsf MC = 17% DD = 112 pcf			105.0
110	SS 19	89	28-94-39 (133)	PP = 6.0 tsf MC = 18% DD = 111 pcf	CL		Lean Clay, trace of gravel, dark gray, very stiff (CL)
115	SS 20	100	32-85-91 (176)	PP = 6.0 tsf MC = 14% DD = 120 pcf			116.0
							Bottom of hole at 116.0 feet.

GENERAL BH / TP / WELL VA LOGS.GPJ GINT US.GDT 8/23/11



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PROJECT NAME VA Medical Center - Outpatient Treatment Space

PROJECT NUMBER 11-11161.100

PROJECT LOCATION Fargo, North Dakota

DATE STARTED 7/17/11 COMPLETED 7/17/11

GROUND ELEVATION 87.6 ft HOLE SIZE 6 1/2"

DRILLING CONTRACTOR NTI

GROUND WATER LEVELS:

DRILLING METHOD 3 1/4" H.S.A.

AT TIME OF DRILLING ---

LOGGED BY TS CHECKED BY DG

AT END OF DRILLING ---

NOTES

AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Pavement, 5 inches of Asphalt over 7 inches of gravel. 86.6
	AU 1					Topsoil / Fill, Organic fat clay, black
	SS 2	67	2-3-5 (8)			
5	SS 3	67	3-4-6 (10)			
	SS 4	67	2-3-6 (9)	PP = 2.2 tsf		
						9.0 78.6
10	SS 5	78	1-3-3 (6)	PP = 2.5 tsf		Fat Clay, Grayish brown, lenses of light gray silt, medium to rather stiff (CH)
	SS 6	89	2-2-4 (6)	PP = 1.6 tsf		
15	SS 7	100	2-3-4 (7)	PP = 3.1 tsf		
20	SS 8	100	1-4-5 (9)	PP = 23.2 tsf		
						22.0 65.6
						Fat Clay, Dark gray, rather stiff (CH)
25	SS 9	100	2-4-5 (9)	PP = 2.6 tsf		
						26.0 61.6
						Bottom of hole at 26.0 feet.

GENERAL BH / TP / WELL VA LOGS.GPJ GINT US.GDT 8/23/11



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PROJECT NAME VA Medical Center - Outpatient Treatment Space

PROJECT NUMBER 11-11161.100

PROJECT LOCATION Fargo, North Dakota

DATE STARTED 7/17/11

COMPLETED 7/17/11

GROUND ELEVATION 85.4 ft HOLE SIZE 6 1/2"

DRILLING CONTRACTOR NTI

GROUND WATER LEVELS:

DRILLING METHOD 3 1/4" H.S.A.

AT TIME OF DRILLING ---

LOGGED BY TS

CHECKED BY DG

AT END OF DRILLING ---

NOTES

AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						
						Pavement, 5 inches of Asphalt over 7 inches of gravel. 84.4
	AU 1					
	SS 2	33	3-5-6 (11)			Topsoli / Fill, Organic fat clay, black
5						
	SS 3	56	3-4-6 (10)			
						7.0 78.4
	SS 4	56	2-3-4 (7)			Fill, Fat clay, dark gray, medium (CH)
10						
	SS 5	78	2-2-3 (5)	PP = 1.4 tsf		10.0 75.4
	SS 6	89	1-2-3 (5)	PP = 1.3 tsf		
15						
	SS 7	89	1-2-3 (5)	PP = 1.5 tsf		
						17.0 68.4
						Fat Clay, Grayish brown, medium to rather stiff (CH)
20						
	SS 8	78	1-3-4 (7)	PP = 2.0 tsf		
25						
	SS 9	67	1-4-5 (9)	PP = 2.2 tsf		26.0 59.4
						Bottom of hole at 26.0 feet.

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PROJECT NAME VA Medical Center - Outpatient Treatment Space

PROJECT NUMBER 11-11161.100

PROJECT LOCATION Fargo, North Dakota

DATE STARTED 7/17/11

COMPLETED 7/17/11

GROUND ELEVATION 85.8 ft HOLE SIZE 6 1/2"

DRILLING CONTRACTOR NTI

GROUND WATER LEVELS:

DRILLING METHOD 3 1/4" H.S.A.

AT TIME OF DRILLING ---

LOGGED BY TS

CHECKED BY DG

AT END OF DRILLING ---

NOTES

AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0								
							1.0 Pavement, 5 inches of Asphalt over 7 inches of gravel.	84.8
							Topsoil / Fill, Organic fat clay, black and dark gray	
	AU 1							
	SS 2	33	2-4-8 (10)					
5								
	SS 3	56	3-3-6 (9)					
							7.5	78.3
	SS 4	78	2-4-6 (10)	PP = 3.5 tsf MC = 28% DD = 95 pcf			Fill, Fat Clay, Brown and gray, rather stiff to soft (CH)	
10					CH			
	SS 5	89	2-2-3 (5)	PP = 1.3 tsf MC = 35% DD = 85 pcf				
							13.0	72.8
	SS 6	78	1-2-3 (5)	PP = 1.2 tsf MC = 38% DD = 82 pcf			Fat Clay, Brown and dark gray, rather stiff to soft (CH)	
15					CH			
	SS 7	100	1-1-3 (4)	PP = 1.3 tsf MC = 40% DD = 81 pcf				
							17.0	68.8
							Fat Clay, Grayish brown, medium to rather stiff (CH)	
20					CH			
	SS 8	100	1-3-4 (7)	PP = 1.5 tsf MC = 36% DD = 86 pcf				
25								
	SS 9	89	1-4-5 (9)	PP = 2.2 tsf MC = 27% DD = 98 pcf				
							25.0	60.8
							Fat Clay, Dark gray with brown mottling, medium (CH)	
30					CH			
	SS 10	100	2-3-5 (8)	PP = 1.7 tsf MC = 30% DD = 93 pcf Qu = 475 psf				
							33.0	52.8
							Fat Clay, Dark gray, soft to medium (CH)	
35								
	SS 11	100	1-1-1 (2)	PP = 0.5 tsf MC = 71% DD = 58 pcf Qu = 300 psf	CH			
40								

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PROJECT NAME VA Medical Center - Outpatient Treatment Space

PROJECT NUMBER 11-11161.100

PROJECT LOCATION Fargo, North Dakota

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
40	X SS 12	100	0-1-1 (2)	PP = 0.4 tsf MC = 69% DD = 59 pcf Qu = 550 psf			Fat Clay, Dark gray, soft to medium (CH) (continued)
45	X SS 13	100	0-0-1 (1)	PP = 0.5 tsf MC = 59% DD = 65 pcf			
50	X SS 14	100	0-0-1 (1)	PP = 0.4 tsf MC = 66%			
55	X SS 15	67	2-2-2 (4)	PP = 0.6 tsf MC = 66% DD = 62 pcf			
60	X SS 16	111	0-1-1 (2)	PP = 0.5 tsf MC = 55% DD = 66 pcf			
65	X SS 17	111	0-1-1 (2)	PP = 0.5 tsf MC = 62% DD = 61 pcf			
70	X SS 18	111	0-1-1 (2)	PP = 0.5 tsf MC = 49% DD = 73 pcf			
75	X SS 19	111	0-1-1 (2)	PP = 0.5 tsf MC = 50% DD = 71 pcf			
80	X SS 20	111	1-1-2 (3)	PP = 0.3 tsf MC = 60% DD = 65 pcf			Fat Clay, Dark gray, soft to medium (CH) (continued)
85	X SS		1-1-1	PP = 0.2 tsf			

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CLIENT Image Group Architecture and Interiors

PROJECT NAME VA Medical Center - Outpatient Treatment Space

PROJECT NUMBER 11-11161.100

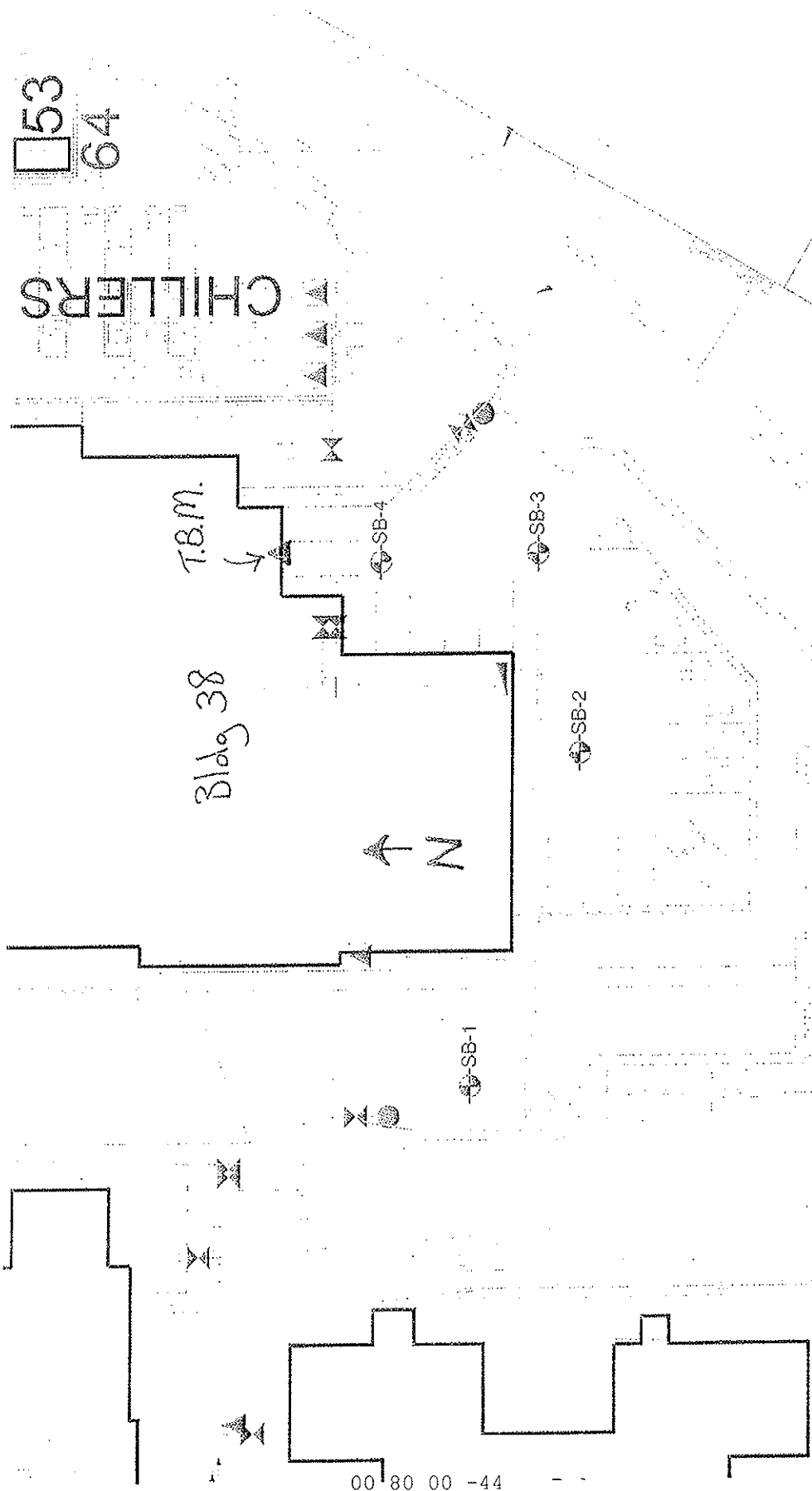
PROJECT LOCATION Fargo, North Dakota

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
90	X 21	111	(2)	MC = 57% DD = 68 pcf	CH		Fat Clay, Dark gray, soft to medium (CH) (continued)
92.0	X SS 22	111	1-2-3 (5)	PP = 0.1 tsf MC = 52% DD = 70 pcf	CH		-6.2
95	X SS 23	87	18-20-23 (43)	PP = 1.5 tsf MC = 18% DD = 114 pcf	CL		Lean Clay, trace of gravel, dark gray, very stiff (CL)
100	X SS 24	78	21-27-34 (61)	PP = 2.9 tsf MC = 21%	CL		102.5
105	X SS 25	100	35-66-128 (194)	PP = 4.7 tsf MC = 21% DD = 101 pcf	CL		Sandy Lean Clay, dark gray, very stiff (CL)
110	X SS 26	100	42-78-135 (213)	PP = 4.4 tsf MC = 19% DD = 103 pcf	CL		111.0
							Bottom of hole at 111.0 feet.

GENERAL BH/TP/WELL VA LOGS.GPJ GINT US.GDT 8/23/11

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CHILLERS



**SECTION 01 00 00
GENERAL REQUIREMENTS**

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**SECTION 01 00 00
GENERAL REQUIREMENTS**

1.1 GENERAL INTENTION

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for Fargo VA Medical Center Building 1 Additional Outpatient Treatment Space Project Number 437-310 as required by drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Medical Center Engineering Officer.
- C. Offices of Image Group, Inc., as Architect-Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or his duly authorized representative.
- D. All employees of general contractor and subcontractors shall comply with VA security management program and obtain I.D. badges from the VA.
- E. Prior to commencing work, general contractor shall provide proof that a OSHA certified "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present.
- F. Training:
 - 1. All employees of general contractor or subcontractors shall have the 10-hour (Non-supervisory Employees) or 30-hour (Supervisory Employees) OSHA certified Construction Safety course and /or other relevant competency training, as determined by VA.
 - 2. Submit training records of all such employees for approval before the start of work.

1.2 STATEMENT OF BID ITEM(S)

- A. ITEM I, BASE BID: Work includes all general construction, alterations, roads, walks, grading, drainage, mechanical and electrical work, utility systems, elevators and necessary removal of existing structures and construction and certain other items.

- B. ITEM II: State the amount for all work in the BASE BID, less deductions under Alternate Bid No. 1.
- C. ITEM III: State the amount for all work in the BASE BID, less deductions under Alternate Bid Nos. 1 and 2.
- D. ITEM IV: State the amount for all work in the BASE BID, less deductions under ALTERNATE BID NOS. 1, 2 and 3.
- E. ITEM V: State the amount for all work in the BASE BID, less deductions under ALTERNATE BID NOS. 1, 2, 3 and 4.
- F. ITEM VI: State the amount for all work in the BASE BID, less deductions under ALTERNATE BID NOS. 1, 2, 3, 4 and 5.
- G. ALTERNATE BIDS:
 - 1. ALTERNATE BID NO. 1: DELETE certain Division 32 EXTERIOR IMPROVEMENTS work and related Division 31 EARTHWORK as indicated on Sheets C1 thru C5. (Retain remaining Division 32 EXTERIOR IMPROVEMENTS work and related Division 31 EARTHWORK as indicated on Sheets C1 through C5 and all Division 33 UTILITIES and Division 31 EARTHWORK related to building foundation and utilities.) Period of performance unchanged.
 - 2. ALTERNATE BID NO. 2: DELETE roofing, roof insulation, roof flashing and related temporary stair and elevator shaft caps at future Second Floor; and DELETE the 3" EIFS resurfacing of backup masonry above the addition roof line. Period of performance unchanged.
 - 3. ALTERNATE BID NO. 3: DELETE Air handler No. M-AHU-77 and related ductwork, piping and electrical work. Period of performance unchanged.
 - 4. ALTERNATE BID NO. 4: DELETE ceiling mounted patient lifts. Retain related structural support and electrical construction.
 - 5. ALTERNATE BID NO. 5: DELETE modular furnishings and seating. Period of performance unchanged.

1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

- A. AFTER AWARD OF CONTRACT, 0 sets of specifications and drawings will be furnished.

- B. Additional sets of drawings may be made by the Contractor, at Contractor's expense, from reproducible sepia prints furnished by Issuing Office. Such sepia prints shall be returned to the Issuing Office immediately after printing is completed.
- C. Contractor shall provide Fargo VA with three (3) sets of Drawings and Specifications.

1.4 FIRE SAFETY

- A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.
 - 1. American Society for Testing and Materials (ASTM):
 - E84-2009.....Surface Burning Characteristics of Building Materials
 - 2. National Fire Protection Association (NFPA):
 - 10-2010.....Standard for Portable Fire Extinguishers
 - 30-2008.....Flammable and Combustible Liquids Code
 - 51B-2009.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work
 - 70-2011.....National Electrical Code
 - 241-2009.....Standard for Safeguarding Construction, Alteration, and Demolition Operations
 - 3. Occupational Safety and Health Administration (OSHA):
 - 29 CFR 1926.....Safety and Health Regulations for Construction
- B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the general contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Documentation shall be provided to the Project Engineer that individuals have undergone contractor's safety briefing.

- C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Temporary Construction Partitions:
 - 1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas and adjoining areas. Construct partitions of 5/8" Type 'X' Fire Rated gypsum board and steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices and locks that use the Fargo VA Best Corporation 7-pin cores.
 - 2. Install fire-rated temporary construction partitions to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.
 - 3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.
- F. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- G. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Project Engineer.
- H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily.
- I. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.

- J. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- K. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems.
- L. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with Project Engineer.
- M. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Project Engineer. Obtain permits from Project Engineer in advance.
- N. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas daily and correct potential fire hazard situations.
- O. Smoking: Smoking is prohibited except in designated smoking rest areas.
- P. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- Q. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.

1.5 OPERATIONS AND STORAGE AREAS

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
- B. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.
- C. Working space and space available for storing materials shall be as determined by the Project Engineer.

- D. Workmen are subject to rules of Medical Center applicable to their conduct.
- E. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by Project Engineer where required by limited working space.
1. Do not store materials and equipment in other than assigned areas.
 2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to Medical Center areas required to remain in operation.
 3. Where access by Medical Center personnel is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.
- F. Utilities Services: Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems (except telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by Project Engineer. All such actions shall be coordinated with the Project Engineer.
- G. Phasing: To insure such executions, Contractor shall furnish the Project Engineer with a schedule of approximate dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the Project Engineer in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such dates to insure accomplishment of this work in successive phases mutually agreeable to Project Engineer and Contractor.
- H. All Buildings will be occupied during performance of work.
1. Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of

construction against dust and debris, so that equipment and affected areas to be used in the Medical Centers operations will not be hindered. Contractor shall permit access to Department of Veterans Affairs personnel and patients through other construction areas which serve as routes of access to such affected areas and equipment. Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Medical Center operations will continue during the construction period.

2. Selected immediate areas of alterations will be temporarily vacated while alterations are performed. Coordinate with Project Engineer. Other areas will not be vacated during construction.

I. Construction Fence: Before construction operations begin, Contractor shall provide a construction fence around the construction area. Provide access as required. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Remove the fence when directed by Project Engineer.

J. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by Project Engineer.

1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of Project Engineer. Electrical work shall be accomplished with all affected circuits or equipment de-energized.
2. Contractor shall submit a request to interrupt any such services to Project Engineer, in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
3. Contractor will be advised of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical

Center may occur at other than Contractor's normal working hours at no additional cost to the Government.

4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the Project Engineer.
5. In case of a contract construction emergency, service will be interrupted on approval of Project Engineer. Such approval will be confirmed in writing as soon as practical.

- K. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.
- L. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles.
 2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the Project Engineer.
- M. Coordinate the work for this contract with other construction operations as directed by Project Engineer. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

1.6 ALTERATIONS

- A. Survey: Before any work is started, the Contractor shall make a thorough survey with the Project Engineer of areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, to the Contracting Officer. This report shall list by rooms and spaces:
1. Existing condition and types of resilient flooring, doors, windows, walls and other surfaces not required to be altered throughout affected areas of buildings.

2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds, shades, etc., required by drawings to be either reused or relocated, or both.
 3. Shall note any discrepancies between drawings and existing conditions at site.
 4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and Project Engineer.
- B. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and Project Engineer together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of resilient flooring, doors, windows, walls and other surfaces as compared with conditions of same as noted in first condition survey report:
1. Re-survey report shall also list any damage caused by Contractor to such flooring and other surfaces, despite protection measures; and, will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workmen in executing work of this contract.
- C. Protection: Provide the following protective measures:
1. Wherever existing roof surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.
 2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.
 3. Protection of interior of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed, floor surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

1.7 INFECTION PREVENTION MEASURES

- A. Implement the requirements of VAMC's Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the

construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.

- B. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group.
 - 1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the Medical Center.
- C. Medical center Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality. In addition:
 - 1. The Project Engineer and VAMC Infection Control personnel shall review pressure differential monitoring documentation to verify that pressure differentials in the construction zone and in the patient-care rooms are appropriate for their settings. The requirement for negative air pressure in the construction zone shall depend on the location and type of activity. Upon notification, the contractor shall implement corrective measures to restore proper pressure differentials as needed.
 - 2. In case of any problem, the Medical Center, along with assistance from the Contractor, shall conduct an environmental assessment to find and eliminate the source.
- D. In general, following preventive measures shall be adopted during construction to keep down dust and prevent mold.
 - 1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by Project Engineer. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction.
 - 2. Do not perform dust producing tasks within occupied areas without the approval of the Project Engineer. For construction in any areas that will remain jointly occupied by the medical Center and Contractor's workers, the Contractor shall:

- a. Provide dust proof construction barriers to completely separate construction from the operational areas of the hospital in order to contain dirt debris and dust. Maintain negative air at all times. A 6-mil thick or greater plastic barrier meeting local fire codes may be used where dust control is the only hazard, and an agreement is reached with the Project Engineer.
- b. HEPA filtration is required where the exhaust dust may reenter the breathing zone. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. Install HEPA (High Efficiency Particulate Accumulator) filter vacuum system rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. Insure continuous negative air pressures occurring within the work area. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Exhaust hoses shall be heavy duty, flexible steel reinforced and exhausted so that dust is not reintroduced to the Medical Center.
- c. Adhesive Walk-off/Carpet Walk-off Mats, minimum 600mm x 900mm (24" x 36"), shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
- d. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as they are created. Transport these outside the construction area in containers with tightly fitting lids.
- e. The contractor shall not haul debris through patient-care areas without prior approval of the Project Engineer and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.

- f. Using a HEPA vacuum, clean inside the barrier and vacuum ceiling tile prior to replacement. Any ceiling access panels opened for investigation beyond sealed areas shall be sealed immediately when unattended.
- g. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.
- h. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

E. Final Cleanup:

- 1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
- 2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
- 3. All new air ducts shall be cleaned prior to final inspection.

1.8 DISPOSAL AND RETENTION

- A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:
- 1. Reserved items which are to remain property of the Government are to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by Project Engineer.
 - 2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.
 - 3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain

the property of the Government shall be removed by the Government in advance of work to avoid interfering with Contractor's operation.

1.9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.
- B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

1.10 RESTORATION

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the Project Engineer. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the Project Engineer before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired,

reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.

- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone).

1.11 LAYOUT OF WORK

- A. The Contractor shall lay out the work and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated.

(FAR 52.236-17)

- B. Establish and plainly mark such lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established are in accordance with lines and elevations shown on contract drawings.

1.12 AS-BUILT DRAWINGS

- A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.
- B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the Project Engineer's review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings to the Project Engineer within 15 calendar days after each completed phase and after the acceptance of the project by the Project Engineer.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

1.13 USE OF ROADWAYS

- A. For hauling, use only established public roads and roads on Medical Center property. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.

1.14 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to compliance with the following provisions:
1. Permission to use each unit or system must be given by Project Engineer. If the equipment is not installed and maintained in accordance with the following provisions, the Project Engineer will withdraw permission for use of the equipment.
 2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.
 3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
 4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
 5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
 6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government.
- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.

- C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

1.15 TEMPORARY USE OF EXISTING ELEVATORS

- A. Outside type hoist shall be used by Contractor for transporting materials and equipment.
- B. Use of existing elevators for limited handling of building materials and Contractor's personnel will be permitted subject to following provisions:
1. Contractor makes all arrangements with the Project Engineer for use of elevators. The Project Engineer will ascertain that elevators are in proper condition.
 2. Contractor covers and provides maximum protection of following elevator components:
 - a. Entrance jambs, heads soffits and threshold plates.
 - b. Entrance columns, canopy, return panels and inside surfaces of car enclosure walls.
 - c. Finish flooring.
 3. Place elevator in condition equal, less normal wear, to that existing at time it was placed in service of Contractor as approved by Contracting Officer.

1.16 TEMPORARY USE OF NEW ELEVATORS

- A. The Contractor and his personnel shall be permitted use of new elevator subject to the following provisions:
1. Contractor shall make arrangements with the Project Engineer for use of elevator. Contractor may obtain elevator for exclusive use.
 2. Prior to the use of elevator, the Contractor shall have the elevator inspected and accepted by an ASME accredited, certified elevator safety inspector. The acceptance report shall be submitted to the Project Engineer.
 3. Submit to the Project Engineer the schedule and procedures for maintaining equipment. Indicate the day or days of the week and total hours required for maintenance. A report shall be submitted to the

Project Engineer monthly indicating the type of maintenance conducted, hours used, and any repairs made to the elevator.

4. The Contractor shall be responsible for enforcing the maintenance procedures.
5. During temporary use of elevator all repairs, equipment replacement and cost of maintenance shall be the responsibility of the Contractor.
6. Personnel for operating elevator shall not be provided by the Department of Veterans Affairs.
7. Contractor shall cover and provide maximum protection of the entire elevator installation.
8. The Contractor shall arrange for the elevator company to perform operation of the elevator so that an ASME accredited, certified elevator safety inspector can evaluate the equipment. The Contractor shall be responsible for any costs of the elevator company.
9. All elevator parts worn or damaged during temporary use shall be removed and replaced with new parts. This shall be determined by an ASME accredited certified elevator safety inspector after temporary use and before acceptance by the Government. Submit report to the Project Engineer for approval.
10. Elevator shall be tested as required by the testing section of the elevator specifications before acceptance by the Department of Veterans Affairs.

1.17 TEMPORARY TOILETS

- A. When approved by Project Engineer, provide suitable dry closets where directed. Keep such places clean and free from flies, and all connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.
- B. Contractor may have for use of Contractor's workmen, such toilet accommodations as may be assigned to Contractor by Medical Center. Contractor shall keep such places clean and be responsible for any damage done thereto by Contractor's workmen. Failure to maintain satisfactory condition in toilets will deprive Contractor of the privilege to use such toilets.

1.18 AVAILABILITY AND USE OF UTILITY SERVICES

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.
- C. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials:
 - 1. Obtain heat by connecting to Medical Center heating distribution system.
 - a. Steam is available at no cost to Contractor.
- D. Electricity (for Construction and Testing): Furnish all temporary electric services.
 - 1. Obtain electricity by connecting to the Medical Center electrical distribution system. Electricity is available at no cost to the Contractor.
- F. Water (for Construction and Testing): Furnish temporary water service.
 - 1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer and obtain approval from the VA Project Engineer prior to making connection. Water is available at no cost to the Contractor.
 - 2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at Project Engineer's discretion) of use of water from Medical Center's system.

G. Steam: Furnish steam system for testing required in various sections of specifications.

1. Obtain steam for testing by connecting to the Medical Center steam distribution system. Steam is available at no cost to the Contractor.
2. Maintain connections, pipe, fittings and fixtures and conserve steam-use so none is wasted. Failure to stop leakage or other waste will be cause for revocation (at Project Engineer's discretion), of use of steam from the Medical Center's system.

1.19 TESTS

- A. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- B. Conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.
- C. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire complex which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one part of entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam, chilled water, refrigerant, hot water, controls and electricity, etc. Another example of a complex which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of fuel, combustion air, controls, steam, feedwater, condensate and other related components.
- D. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonably short period of time during which operating and environmental conditions remain reasonably constant.
- E. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

1.20 CONSTRUCTION MEETING

- A. Construction Meeting will be held weekly to coordinate the activities of the Contractors.
 - 1. Each meeting shall be attended by VA Representative, A/E Representative and Field Representative of each trade.
 - 2. The General Contractor shall be responsible for supervising the meeting and for recording and distributing the minutes of the meeting to each representative.

1.21 INSTRUCTIONS

- A. Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals (two bound hard copies and .pdf files on CD/DVD) for each separate piece of equipment shall be delivered to the Project Engineer coincidental with the delivery of the equipment to the job site. Omit all special characters in electronic file names (i.e.: #, %, &, *, :, <, >, ?, /) Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.
- C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed instructions to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at

the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system, shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the Project Engineer and shall be considered concluded only when the Project Engineer is satisfied in regard to complete and thorough coverage. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the Project Engineer, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

1.22 GOVERNMENT-FURNISHED EQUIPMENT

- A. The Government shall deliver to the Contractor, the Government-furnished equipment as drawn and specified. Equipment furnished by Government includes: Dental Equipment, Maintenance Shop Equipment and Exam Tables. Refer to Drawings for type, quantities and locations.
- B. Equipment furnished by Government to be installed by Contractor will be furnished to Contractor at the Medical Center.
- C. Notify Contracting Officer in writing, 60 days in advance, of date on which Contractor will be prepared to receive equipment furnished by Government. Arrangements will then be made by the Government for delivery of equipment.
 - 1. Immediately upon delivery of equipment, Contractor shall arrange for a joint inspection thereof with Project Engineer. At such time the Contractor shall acknowledge receipt of equipment described, make notations, and furnish the Project Engineer with a written statement as to its condition or shortages.
 - 2. Contractor thereafter is responsible for such equipment until such time as acceptance of contract work is made by the Project Engineer.
- E. Equipment furnished by the Government will be delivered in a partially assembled (knock down) condition in accordance with existing standard commercial practices, complete with all fittings, fastenings, and appliances necessary for connections to respective services installed under contract. All fittings and appliances (i.e., couplings, ells,

tees, nipples, piping, conduits, cables, and the like) necessary to make the connection between the Government furnished equipment item and the utility stub-up shall be furnished and installed by the contractor at no additional cost to the Government.

- F. Completely assemble and install the Government furnished equipment in place ready for proper operation in accordance with specifications and drawings.
- G. Furnish supervision of installation of equipment at construction site by qualified factory trained technicians regularly employed by the equipment manufacturer.

1.23 RELOCATED EQUIPMENT ITEMS

- A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing equipment and items indicated by or shown to be relocated by the Contractor. Equipment to be relocated includes: Dental Equipment and Maintenance Shop Equipment. Refer to Drawings for type, quantities and locations.
- B. Perform relocation of such equipment or items at such times and in such a manner as directed by the Project Engineer.
- C. Suitably cap existing service lines, such as steam, condensate return, water, drain, gas, air, vacuum and/or electrical, whenever such lines are disconnected from equipment to be relocated. Remove abandoned lines in finished areas and cap as specified herein before under paragraph "Abandoned Lines".
- D. Provide all mechanical and electrical service connections, fittings, fastenings and any other materials necessary for assembly and installation of relocated equipment; and leave such equipment in proper operating condition.
- E. Contractor shall employ services of installation engineers approved by VA, who are authorized representatives of the manufacturers of this equipment to supervise the disconnection, dismantling, relocation, assembly, installation and connection of this equipment to assure it is in proper operating condition, any warranties in effect must not be voided.
- F. All service lines such as noted above for relocated equipment shall be in place at point of relocation ready for use before any existing

equipment is disconnected. Make relocated existing equipment ready for operation or use immediately after reinstallation.

1.24 LOCAL FARGO VAM&ROC CONSTRUCTION CONTRACTOR ORIENTATION AND POLICIES

- A. Contracts: The following staff or resource people will be working with you at the Fargo VAM&ROC. Please feel free to contact these individuals with any questions:
1. Contracting Officer: Stuard R. Eidenschink (239-3700, ext. 2786 or 239-3760)
 2. Chief Engineer: Dennis Langevin (239-3700, ext. 93365 or 239-3760)
 3. Project Engineer: Nathan Gjovik (239-3700, ext. 93365 or 239-3760)
 4. Engineering Technician: David Busching (239-3700, ext. 93222 or 239-3760)
- B. Vehicle Traffic Rules: All construction contractors shall park their vehicles in areas assigned by the Contracting Officer or Engineering Service representatives. All persons coming on the premises of the Fargo VAM&ROC must obey the posted traffic and parking rules. Police Service will issue tickets to contractor vehicles parked in areas other than those assigned.
- C. Keys/ID Badges: VA ID badges must be worn while you are on Medical Center premises. Contact Engineering Service to obtain an ID badge and any necessary keys. Contract staff are responsible for the security of keys and ID badges issued to them and may be charged for replacement cost. You must notify Engineering (ext. 3361) personnel in Building 3 immediately to report any loss, theft or suspected reproduction of a Medical Center key or access card.
- D. Smoking: Smoking is prohibited in all Medical Center buildings and grounds. Smoking is permitted only in designated smoking shelters.
- E. Use of Government Telephones and Fax Machines
1. Government telephones are for official Government business use. Contract staff may use telephones, for local calls only, to contact your place of employment or to address unforeseen events such as injury on the job, work schedule changes etc.

2. The Government fax machine located in the Engineering Office, Building 3, may be used for local faxes with the approval of Engineering Office staff.

F. Housekeeping

1. All construction sites shall be kept clean, orderly and in sanitary condition.
2. All rags/cloth and rubbish soaked with flammable and/or combustible material shall be placed in a covered metal receptacle until being disposed.
3. A clear and unobstructed path must be maintained to all portable fire extinguishers, hose cabinets, pull stations, fire exits and electrical panels.
4. Fire doors and smoke barrier doors shall not be blocked in a manner to prevent their protective operation in the event of a fire.
5. The use of wedges, stops, ropes, or other unapproved methods of holding doors open is prohibited.
6. All indoor trash containers over 20 gallons will be constructed of non-combustible materials and be covered or have a self-extinguishing cover.

G. Storage

1. Any commodities that may be hazardous in combination with each other must be stored so they cannot come in contact with each other.
2. Store flammable and combustible liquids and gasses in approved storage containers.
3. A clear space of 18 inches will be maintained below sprinkler heads.
4. Items stored in tiers will be stacked, blocked, interlocked and limited in height to prevent sliding or collapse.
5. Materials will not be stored directly on the floor.
6. Storage areas will be kept free from accumulation of materials that constitute hazards.

7. Stairwells, stairways and corridors shall not be utilized for storage.
8. Storage will not be permitted within 3 feet of an electric panel in all directions.

H. Hazardous Materials

1. Discovery of any suspected asbestos containing material shall result in the contractor stopping work in the area and reporting the discovery immediately to the Engineering Office (ext. 3361) in Building 3 or one of the contact persons indicated above. Engineering Service shall then evaluate the suspect material and if it contains asbestos shall arrange for the removal of the asbestos.
2. Contractors shall maintain and provide upon request MSDS's for products used during construction which shall explain the labeling system and all other required information. Report any discovery of an existing hazardous material to Engineering Service, Building 3 (ext. 3361).

I. Infection Control

1. PURPOSE: To prevent the acquisition of nosocomial infection in patients and healthcare workers during medical center renovation or construction activities.
2. The contractor shall contact Engineering Service (239-3760 or ext. 3361) in Building 3 prior to beginning construction in any areas so that an Infection Control Risk Assessment (ICRA) may be performed and all applicable forms completed. All infection control precautions indicated by the ICRA shall be implemented by the contractor prior to beginning work in the area.
3. General: The goal of Infection Control is to identify and reduce the risks of acquiring and transmitting infections among patients, employees, service workers and visitors to the Medical Center. During construction or renovation projects, hidden infectious disease hazards may be released into the air, carried on dust particles, on workers clothing or be present in damp areas or areas where water has collected. One particular organism of concern is a fungal organism know as Aspergillus. Aspergillus can be found in decaying leaves and compost, plaster and drywall, and settled dust. These organisms like many others encountered in our everyday lives usually do not cause

problems in healthy people, however a hospital is full of sick patients. Aspergillus and other organisms can cause severe illness and even death in some patients. Therefore, it is critical that everyone do their best to help prevent conditions that might lead to the dispersion of this or other infectious organisms by:

- a. Maintaining barrier walls that keep dust and dirt inside the worksite.
 - b. Maintaining a state of negative air pressure within the construction site to prevent dust and dirt from dispersing into the Medical Center from the worksite.
 - c. Removing demolition debris in a manner that minimizes any contamination of the environment outside the worksite by dust and debris.
 - d. Utilizing walk off mats and making sure clothing is free of loose soil and debris when leaving the construction site.
 - e. Assuring that any water or sludge found during demolition of plumbing or in the construction process is collected and disposed of in a controlled manner.
 - f. Keeping demolition chutes sealed when not in use to maintain dust control. Use a water spray to minimize dust generation when using chutes if possible.
 - g. Using only designated entry and exit pathways.
4. Please feel free to contact Infection Control at ext. 3668 if you have questions or concerns.
 5. If you find any needles, syringes, sharp medical objects please do not handle or remove yourself. Contact the Medical Center project coordinator or COTR at 239-3760 or at Medical Center extension 3361 for removal.
 6. Infection control activities are critical in all areas of the Medical Center. Construction activities causing disturbance of existing dust, or generating new dust must be conducted in ways that will minimize dust generation and dispersion.
 7. All construction/maintenance workers and contract workers must follow the infection control procedures as described in this guideline.

8. The following infection control procedures shall be followed at a minimum:

a. BARRIERS - Complete all critical barriers before construction begins.

- 1) Construction or renovation sites not capable of containment within a single room must be separated from patient-care areas and other critical areas by barriers that keep the dirt and dust inside the work site.
- 2) The integrity of the barrier walls must assure a complete seal of the construction area from adjacent areas.
- 3) Temporary barriers and enclosures must be dust proof with airtight seals maintained at the full perimeter of the walls, floors and upper decking, as well as all penetrations. Seal holes, pipes, conduits and punctures appropriately.
- 4) Tightly sealing doors or an overlapping flap of at least 2 feet in width of a durable poly must be used at points of personnel access.
- 5) Elevator shafts or stairways must be isolated outside of the construction field to prevent dispersion of dust from the work site.

b. ENVIRONMENTAL CONTROLS

- 1) Isolate the HVAC system in areas where work is being done to prevent contamination of the duct system.
- 2) Maintain negative air pressure within work site. Utilize HEPA-filtration units if air is being re-circulated.
- 3) Seal holes, pipes, conduits and punctures appropriately.
- 4) Provide a designated area within the work site where all personnel leaving the work site can vacuum off with a HEPA-filtered vacuum to remove all loose dust and debris from clothing.
- 5) Vacuum with a HEPA-filtered vacuum and/or wet mop frequently at entrance and exit points.

- 6) "Sticky" or walk-off mats shall be utilized immediately outside the construction area to remove dust and soil from shoes, cart wheels, etc. as personnel exit the area. The mats must be large enough to cover the entire exit and changed frequently to prevent accumulation of dust.
- 7) Contain construction debris during transport in covered containers.
- 8) Debris must be removed from the construction area on a daily basis in covered carts using specified traffic patterns.
- 9) Control, collection and disposal must be provided for any drain liquid or sludge encountered when demolishing plumbing.

c. CLEANING

- 1) The construction zone and adjacent areas must be maintained by wet mopping the area daily or more frequently as needed to minimize dust generation.
- 2) Final cleaning of the area must be completed prior to acceptance of the completed project area by VA.
- 3) Do not remove barriers from work area until the project is completed and area is thoroughly cleaned. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction.
- 4) Clothing shall be free of loose soil and debris before exiting the construction zone.
- 5) Personnel entering sterile/invasive procedure areas will be provided with a disposable jump suit, head covering and shoe covers to wear while working in the area. They must be removed when exiting the area and new coverings obtained when reentering the areas.
- 6) Tools and equipment must be damp-wiped prior to entry and exit from sterile and invasive procedure areas.
- 7) Tools and equipment soiled with blood or body fluids must be cleaned with a hospital-approved disinfectant prior to removing from the area.

d. ENVIRONMENTAL MONITORING AND COMPLETION

- 1) Infection Control, in cooperation with Engineering and Safety will make periodic visits to the work site to ensure compliance with the infection control guidelines.
- 2) Whenever safe infection control conditions are not met the appropriate contractor will be notified to correct the conditions immediately.
- 3) All work will be stopped on a project if a hazardous infection control deficiency exists that would result in patients being put at significant risk.
- 4) Water supply lines will be flushed before placing newly renovated or constructed areas into service. Industrial Hygiene will assure that water supply lines are safe for use.

J. Construction Safety

1. The Medical Center policy is to provide an environment for patients, visitors and staff that is free from danger. Within the Medical Center, the NFPA Life Safety Code is followed. Interim life safety measures (ILSM's) are applied to all construction projects as necessary and are defined in construction contracts. Minimum ILSM's are:
2. Exits - provide free and unobstructed egress.
3. Free and unobstructed access to emergency department/service for emergency forces.
4. Temporary construction partitions are in accordance with contract requirements.
5. Smoking is permitted in designated areas only.
6. Storage, housekeeping and debris removal policies and procedures that reduce the flammable and combustible fire load are enforced.
7. Hazard surveillance is increased in construction areas.

K. Fire Safety

1. The contractors shall coordinate all construction activities with the VA Engineering Service to determine if fire alarm initiating devices

are located within the construction area. Engineering Service shall disable the appropriate alarm initiating devices. Once work in the area is complete it is the contractor's responsibility to contact Engineering Service to have the fire alarm initiation devices enabled.

2. Fire alarm, detection and suppression systems are not to be impaired unless there is work on the system to be performed. If fire alarm, detection and suppression systems are impaired for more than four hours the contractor shall implement a fire watch, at no additional cost to the Government, in compliance with NFPA requirements and shall obtain VA Engineering Service approval.
3. Additional fire fighting equipment is provided and employees are trained in its use.
4. Hot works permits and fire extinguishers are required when working with open flames, or hot items and for activities that may generate sparks. Contact Engineering Service to obtain a hot work permit.
5. In the event of a fire alarm, "CODE 5" and the location of a fire will be communicated by an overhead announcement. The "all clear" is authorized by the Fargo Fire Department or by the personnel conducting the fire drill and will be communicated by an overhead announcement. If a fire or fire drill is located in or adjacent to the construction area, construction contractor staff shall be responsible for the following:
 - a. Be alert to the Code 5 announcement.
 - b. Participate in fire drills.
 - c. Follow the RACE Plan (Rescue, Alarm, Contain, Extinguish) if fire is discovered by a construction contractor.
 - d. Close all corridor doors within the construction area.
 - e. Evacuate the immediate area.

L. Utilities

1. Engineering (ext. 3361) is responsible for all utilities within the Medical Center. If there are problems or failures of the utilities, call extension 3361 during normal business hours (Monday through Friday, 8:00 a.m. to 4:30 p.m.). After hours and on weekends,

contact the Police Service at ext. 3251 to report problems and failures. A utilities failure and its type/location will be communicated by a "Code 2 - Utility Failure" overhead announcement.

2. All utility service connections shall be reviewed with and approved by Engineering Service just prior to the connection being made with the existing utility. This condition shall apply to both temporary and permanent connections. This final utility system connection check is meant to ensure the following:
 - a. The Medical Center is prepared for the connection.
 - b. The contractor is prepared for the connection work, which shall include but not be limited to, all safety measures have been taken or are in place, backflow preventers are in place, hot work permits have been issued, fire watch is in place, fire alarm initiation devices have been disabled if necessary, etc.

M. Emergencies

1. Disasters ("Code 6"): The Medical Center has initiated a process that provides an "all-hazard" approach to disaster management. Construction contractor staff shall ensure corridors are free of obstructions and a foreman or representative shall report to the Engineering Service office for further instructions.
2. Hostage Situations - Immediately report to Police Service (ext. 3251), any incident in which the safety of any person is threatened by another.
3. Bomb Threats ("Code 7") - React calmly and evacuate. Notify Police Service (ext. 3251) if the threat poses immediate danger to a person or destruction of property. If you discover a suspicious object, do not touch or move the object
4. Severe Weather - In the event of a "Code 8 -Take Cover" overhead announcement, all personnel are expected to take cover in windowless interior corridors that are not on the top floor of the building.
5. "Code Black" - React calmly and evacuate. Avoid area(s) where it has been indicated an armed assailant is in the building or on the ground.

1.25 MAINTENANCE SHOPS TEMPORARY OFFICES

- A. The Contractor shall before demolishing existing Building 38 provide at a location shown on the drawings or where directed by Project Engineer a temporary office, structure for use of the Maintenance Shops Staff during the duration of the construction project.
- B. The temporary offices shall provide not less than 896 gross square feet of floor area in one unit. Installation of the office shall meet all local codes.
- C. Provide office with two, 900 mm (three foot) wide exterior doors, including hardware with locks to match existing Fargo VA 7 pin Best System and OSHA approved platform and stairs leading to grade.
- D. Enclose the entire perimeter of the office from the floor to the ground and finish to match exterior. Provide R7 insulation and seal tight to ground with a painted 19 mm (3/4 inch) exterior grade plywood skirt.
- E. Exterior finishes shall be manufacturer's standards.
- F. Provide floor, wall, and roof with not less than R5 insulation.
- G. Interior finishes shall consist of resilient flooring, plywood paneling or painted wallboard on walls, and acoustical tile ceilings. Interior doors may be either painted or stained.
- H. Interior shall be subdivided with full height partitions to provide one office, one break room, and one large central open office. Provide each space with 900 mm (three foot) wide door with master keyed locks with locks to match existing Fargo VA 7 Pin Best System.
- I. Provide 750 mm (2-1/2 feet) wide by 900 mm (3 feet) high operable windows; two in each room.
- J. Provide sufficient fluorescent lighting in each room to deliver 750 lux (70 foot-candles) of light at desk top height without the aid of daylight. Provide one light switch in each room.
- K. Provide one duplex receptacle in each wall of each room. If a wall is 3.0 m (10 feet) long or more, provide two receptacles for each 3.0 m (10 feet) or portion thereof, of wall.
- L. The Contractor shall provide the following:
 - 1. Electricity.

2. All necessary piping, power circuits network cabling, cat 5e or better cabling for phones and computers, electrical fixtures, lighting, and other items necessary to provide a habitable structure for the purpose intended.
 3. Thermostatically controlled, centralized heating and air conditioning system designed to maintain the temperature between 21 and 27 degrees C (70 and 80 degrees F) with 50 percent relative humidity maintained during the air conditioning season.
- M. The VA will furnish and install all office furniture, desks and equipment. At completion of construction project the VA will remove all office furniture, desks and equipment from the temporary office structure.
- N. At the completion of all work, including the punch list, the temporary office structure shall become the property of the Contractor and Contractor shall remove same, including utility connections, from the Medical Center. The site shall be restored to original condition and finished in accordance with contract requirements.
- O. The Contractor shall furnish floor plans for approval by the Project Engineer prior to furnishing the field office.

- - - E N D - - -

Infection Control Risk Assessment (ICRA)

General Project Information

Project : _____ **Project Leader:** _____

Risk Assessment Completed by: _____ **Date:** _____

Instructions for Use:

1. ___ Determine Type of Construction Project/ Activity (Type A, B or C from chart on back)
2. ___ Determine Risk Group (Low, Medium, High or Highest Risk from chart on back)
3. ___ Determine Class of Precautions (I, II or III using table below)
4. ___ Complete ICRA Form
5. ___ Forward Copies of ICRA to Infection Control and Chief, Engineering Service
6. ___ Project Leader to Communicate Precautions Required to Workers, Implement Precautions and Monitor Compliance

Class of Precautions

Type of Construction Project / Activity (Circle A, B or C)			
Risk Group (Check One)	A	B	C
<input type="checkbox"/> Low Risk Group	I	I	II
<input type="checkbox"/> Medium Risk Group	I	II	III
<input type="checkbox"/> High Risk Group	I	II	III
<input type="checkbox"/> Highest Risk Group	II	III	III

Precautions (Circle Class)

Class I	<ol style="list-style-type: none"> 1) Execute work by methods to minimize raising dust from construction operations 2) Immediately replace any ceiling tile displaced for visual inspection 3) Remove minor demolition materials in manner to avoid dispersion of dust or debris
Class II	<ol style="list-style-type: none"> 1) Provide an active means to prevent airborne dust from dispersing into atmosphere 2) Water-mist work surfaces to control dust while cutting 3) Seal unused doors with tape 4) Block off and seal air vents, isolate HVAC system 5) Place walk off dust mat at exit of work site 6) Clean work surfaces with disinfectant upon completion 7) Contain construction waste during transport in covered containers 8) Wet mop frequently at exit points 9) Clean clothing of all loose soil/dust prior to leaving work area
Class III	<ol style="list-style-type: none"> 1) Remove or isolate HVAC system in area where work is being done to prevent contamination of the duct system 2) Complete all critical barriers before construction begins 3) Maintain negative air pressure within work site utilizing HEPS-equipped air filtration units when air is being re-circulated 4) Contain construction debris during transport in covered containers 5) Seal holes, pipes, conduits and punctures 6) Clean clothing of all loose soil/dust prior to leaving work area. Vacuuming with a HEPA-filtered vacuum to remove all loose dust and debris from clothing is the preferred method to maximize removal and minimize dispersion of dust 7) Wet mop frequently at exit points 8) Leave barriers up in work area for maximum extent possible until the work area has been thoroughly cleaned 9) Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction

Critical Barriers: Critical barriers constructed of plastic or gypsum board should extend from floor to upper decking. All seams should be tightly sealed. Entries made through a plastic barrier should be constructed with 2-foot wide double flap to prevent escape of dust and debris. Door entries must be capable of closing tightly for same purposes.

Send copy of completed document to Infection Control and Chief, Engineering Svc.

STEP ONE:

Using the following table, identify the Type of Construction Project/Activity

TYPE A	Inspection and non-invasive activities. Includes, but is not limited to: <ul style="list-style-type: none"> • Removal of ceiling tiles for visual inspection limited to 1 tile per 50 feet • Painting (but not sanding) • Wall covering, electrical trim work, minor plumbing, and activities which do not generate dust or require cutting of walls or access to ceilings other than for visual inspection
TYPE B	Small scale, short duration activities which create minimal dust. Includes, but is not limited to: <ul style="list-style-type: none"> • Installation of telephone and computer cabling • Access to chase spaces • Cutting of walls or ceiling where dust migration can be controlled
TYPE C	Work that generates a moderate to high level of dust or requires demolition or removal of any fixed building components or assemblies, major remodeling or new construction projects. Includes, but is not limited to: <ul style="list-style-type: none"> • Sanding of walls for painting or wall covering • Removal of floorcoverings, ceiling tiles and casework • New wall construction • Duct work or electrical work above ceilings • Projects that require consecutive work shifts

STEP TWO:

Use the following table to *identify the Risk Group* that will be affected. If more than one risk group will be affected in a specific area, select the higher risk group.

Low Risk	Medium Risk	High Risk	Highest Risk
<ul style="list-style-type: none"> • Office areas • Engineering • Environmental Service areas • Storerooms 	<ul style="list-style-type: none"> • General patient care areas/units (i.e. Ultrasound, Physical Therapy, Radiology, Respiratory Therapy, Urgent Care) • Cafeteria • Kitchens • Blood draw areas • OP Pharmacy 	<ul style="list-style-type: none"> • ICU/CCU • Laboratories • Surgical Pt. Care Unit • Outpatient surgery • Dialysis • Oncology • Pharmacy admixture (Inpatient) 	<ul style="list-style-type: none"> • Surgery • SPD (Processing and Sterile Storage) • Invasive procedure rooms • PACU

SECTION 01 33 23
SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, samples (including laboratory samples to be tested), test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
 - A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
 - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
 - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals (including any laboratory samples to be tested) will not serve as a basis for extending contract time for completion.
- 1-5. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by Project Engineer on behalf of the Contracting Officer.
- 1-6. Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.
- 1-7. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract.

- 1-8. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and Architect-Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- 1-9. Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.
- A. Submit material and finish samples in quadruplicate. Submit other samples in single units unless otherwise specified. Submit seven (7) copies of shop drawings, schedules, manufacturers' literature and data, and certificates, except where a greater number is specified.
- B. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail or Courier and shall contain the list of items, name of Medical Center, VA Project Number, VA Project Title, name of Contractor, VA contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
 2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center, VA Project Number, VA Project Title, name of Contractor, manufacturer, brand, VA contract number and ASTM or Federal Specification Number as applicable and location(s) on project.
 3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
- C. In addition to complying with the applicable requirements specified in preceding Article 1.9, samples which are required to have Laboratory Tests shall be tested, at the expense of Contractor, in a commercial laboratory approved by Contracting Officer.

1. Laboratory shall furnish Contracting Officer with a certificate stating that it is fully equipped and qualified to perform intended work, is fully acquainted with specification requirements and intended use of materials and is an independent establishment in no way connected with organization of Contractor or with manufacturer or supplier of materials to be tested.
 2. Certificates shall also set forth a list of comparable projects upon which laboratory has performed similar functions during past five years.
 3. Samples and laboratory tests shall be sent directly to approved commercial testing laboratory.
 4. Contractor shall forward a copy of transmittal letter to Project Engineer simultaneously with submission to a commercial testing laboratory.
 5. Laboratory test reports shall be sent directly to Project Engineer for appropriate action.
 6. Laboratory reports shall list contract specification test requirements and a comparative list of the laboratory test results. When tests show that the material meets specification requirements, the laboratory shall so certify on test report.
 7. Laboratory test reports shall also include a recommendation for approval or disapproval of tested item.
- D. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.
- E. Approved samples will be kept on file by the Project Engineer at the site until completion of contract.
- F. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.
1. For each drawing required, submit one legible photographic paper or vellum reproducible or electronic .pdf. Omit all special characters in electronic file names (i.e.: #, %, &, *, :, <, >, ?, /).
 2. Reproducible shall be full size.

3. Each drawing shall have marked thereon, proper descriptive title, including Medical Center, location, VA project number, VA Project Title, VA Contract Number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
 4. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
 5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
 6. When work is directly related and involves more than one trade, shop drawings shall be submitted to Architect-Engineer under one cover.
- 1-10. Samples shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to Image Group, Inc, 403 Center Avenue, Suite 300, Moorhead, MN 56560.
- 1-11. At the time of transmittal to the Architect-Engineer, the Contractor shall also send a copy of the complete submittal directly to the Project Engineer. Fargo VA Health Care System, ATTN: Engineering Service (437/138) 2101 Elm Street, Fargo, ND 58102.

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SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained and paid for by Contractor.

1.2 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
- T27-06.....Sieve Analysis of Fine and Coarse Aggregates
- T96-02 (R2006).....Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- T99-01 (R2004).....The Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop
- T104-99 (R2003).....Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
- T180-01 (R2004).....Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
- T191-02(R2006).....Density of Soil In-Place by the Sand-Cone Method
- C. American Concrete Institute (ACI):
- 506.4R-94 (R2004).....Guide for the Evaluation of Shotcrete
- D. American Society for Testing and Materials (ASTM):
- A325-06.....Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- A370-07.....Definitions for Mechanical Testing of Steel Products
- A416/A416M-06.....Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
- A490-06.....Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
- C31/C31M-06.....Making and Curing Concrete Test Specimens in the Field
- C33-03.....Concrete Aggregates

C39/C39M-05.....	Compressive Strength of Cylindrical Concrete Specimens
C109/C109M-05.....	Compressive Strength of Hydraulic Cement Mortars
C138-07.....	Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
C140-07.....	Sampling and Testing Concrete Masonry Units and Related Units
C143/C143M-05.....	Slump of Hydraulic Cement Concrete
C172-07.....	Sampling Freshly Mixed Concrete
C173-07.....	Air Content of freshly Mixed Concrete by the Volumetric Method
C330-05.....	Lightweight Aggregates for Structural Concrete
C567-05.....	Density Structural Lightweight Concrete
C780-07.....	Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C1019-08.....	Sampling and Testing Grout
C1064/C1064M-05.....	Freshly Mixed Portland Cement Concrete
C1077-06.....	Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
C1314-07.....	Compressive Strength of Masonry Prisms
D698-07.....	Laboratory Compaction Characteristics of Soil Using Standard Effort
D1143-07.....	Piles Under Static Axial Compressive Load
D1188-07.....	Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
D1556-07.....	Density and Unit Weight of Soil in Place by the Sand-Cone Method
D1557-07.....	Laboratory Compaction Characteristics of Soil Using Modified Effort
D2166-06.....	Unconfined Compressive Strength of Cohesive Soil
D2167-94(R2001).....	Density and Unit Weight of Soil in Place by the Rubber Balloon Method
D2216-05.....	Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
D2922-05.....	Density of soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D2974-07.....	Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

D3666-(2002).....Minimum Requirements for Agencies Testing and
Inspection Bituminous Paving Materials

D3740-07.....Minimum Requirements for Agencies Engaged in the
Testing and Inspecting Road and Paving Material

E94-04.....Radiographic Testing

E164-03.....Ultrasonic Contact Examination of Weldments

E329-07.....Agencies Engaged in Construction Inspection
and/or Testing

E543-06.....Agencies Performing Non-Destructive Testing

E605-93(R2006).....Thickness and Density of Sprayed Fire-Resistive
Material (SFRM) Applied to Structural Members

E709-(2001).....Guide for Magnetic Particle Examination

E1155-96(R2008).....Determining FF Floor Flatness and FL Floor
Levelness Numbers

E. American Welding Society (AWS):

D1.1-07.....Structural Welding Code-Steel

1.3 REQUIREMENTS:

- A. Accreditation Requirements: Construction materials testing laboratories approved by Fargo VA Medical Center Contracting Officer, retained and paid for by Contractor, must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E 329, C 1077, D 3666, D3740, A 880, E 543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."
- B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by Project Engineer. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of Project Engineer to such failure.
- C. Written Reports: Testing laboratory shall submit test reports to Project Engineer, Contractor, unless other arrangements are agreed to in writing by the Project Engineer. Submit reports of tests that fail to meet construction contract requirements on colored paper.
- D. Verbal Reports: Give verbal notification to Project Engineer immediately of any irregularity.

PART 2 - PRODUCTS (NOT USED)**PART 3 - EXECUTION****3.1 EARTHWORK:**

- A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:
1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the Project Engineer regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to Project Engineer extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
 2. Provide part time observation of fill placement and compaction and field density testing in building areas and provide part time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
 3. Provide supervised Geotechnical Technician to inspect excavation, subsurface preparation, and backfill for structural fill.
- B. Testing Compaction:
1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with ASTM D698 and/or ASTM D1557.
 2. Make field density tests in accordance with the primary testing method following ASTM D2922 wherever possible. Field density tests utilizing ASTM D1556, or ASTM D2167 shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the Project Engineer before the tests are conducted.
 - a. Building Slab Subgrade: At least one test of subgrade for every 185 (2000 square feet) of building slab, but in no case fewer than three tests. In each compacted fill layer, perform one test for every 185 (2000 square feet) of overlaying building slab, but in no case fewer than three tests.

- b. Foundation Wall Backfill: One test per 30 m (100 feet) of each layer of compacted fill but in no case fewer than two tests.
- c. Pavement Subgrade: One test for each 335 (400 square yards), but in no case fewer than two tests.
- d. Curb, Gutter, and Sidewalk: One test for each 90 m (300 feet), but in no case fewer than two tests.
- e. Trenches: One test at maximum 30 m (100 foot) intervals per 1200 mm (4 foot) of vertical lift and at changes in required density, but in no case fewer than two tests.
- f. Footing Subgrade: At least one test for each layer of soil on which footings will be placed. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested subgrade when acceptable to Project Engineer. In each compacted fill layer below wall footings, perform one field density test for every 30 m (100 feet) of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.
- C. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.
- D. Testing Materials: Test suitability of on-site and off-site borrow as directed by Project Engineer.

3.2 FOUNDATION CAISSONS:

- A. Concrete Testing: Test concrete including materials for concrete as required in Article, CONCRETE of this section, except make two test cylinders for each day's placement of concrete.
- B. Maintain a record of concrete used in each caisson. Compare records with calculated volumes.
- C. Inspect percussion hole in bottom of each caisson to determine that material is capable of supporting design load.
- D. Inspect sides and bottom of each caisson for compliance with contract documents.
- E. Submit a certified "Caisson Field Record" for each caisson, recording actual elevation at bottom of shaft; final center line location of top; variation of shaft from plumb; results of all tests performed; actual allowable bearing capacity of bottom; levelness of bottom; seepage of water; still water level (if allowed to flood); variation of shaft (from dimensions shown); location and size of reinforcement, and evidence of seams, voids, or channels below the bottom. Verify the actual bearing capacity of the strata by the use of a calibrated penetrometer or other acceptable method.

F. Caissons Bearing on Hardpan: Take undisturbed samples, suitable for tests required, from caisson bottom. Make auger probe to a depth of 2.5 meters (8 feet) below bottom and visually inspect and classify soil. Verify continuity of strata and thickness.

1. Conduct the following test on each sample, and report results and evaluations to the Project Engineer:
 - a. Unconfined Compression Test (ASTM D2166).
 - b. Moisture Content (ASTM D2216).
 - c. Density.

3.3 ASPHALT CONCRETE PAVING:

A. Aggregate Base Course:

1. Determine maximum density and optimum moisture content for aggregate base material in accordance with ASTM D1557, Method D.
2. Make a minimum of three field density tests on each day's final compaction on each aggregate course in accordance with ASTM D1556.
3. Sample and test aggregate as necessary to insure compliance with specification requirements for gradation, wear, and soundness as specified in the applicable state highway standards and specifications.

B. Asphalt Concrete:

1. Aggregate: Sample and test aggregates in stock pile and hot-bins as necessary to insure compliance with specification requirements for gradation (AASHTO T27), wear (AASHTO T96), and soundness (AASHTO T104).
2. Temperature: Check temperature of each load of asphalt concrete at mixing plant and at site of paving operation.
3. Density: Make a minimum of two field density tests in accordance with ASTM D1188 of asphalt base and surface course for each day's paving operation.

3.4 SITE WORK CONCRETE:

- A. Test site work concrete including materials for concrete as required in Article CONCRETE of this section.

3.5 CONCRETE:

A. Field Inspection and Materials Testing:

1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the

- site at the Contractor's expense. Any rejected concrete that is placed will be subject to removal.
3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 40 (50 cubic yards) or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. Label each cylinder with an identification number. Project Engineer may require additional cylinders to be molded and cured under job conditions.
 4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day's pumping operations to determine change in slump.
 5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 20 (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 (100 cubic yards) at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
 6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
 7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
 8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
 9. Verify that specified mixing has been accomplished.
 10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
 - a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
 - b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.

11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.

B. Laboratory Tests of Field Samples:

1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by Project Engineer. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.
2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.
3. Furnish certified compression test reports (duplicate) to Project Engineer. In test report, indicate the following information:
 - a. Cylinder identification number and date cast.
 - b. Specific location at which test samples were taken.
 - c. Type of concrete, slump, and percent air.
 - d. Compressive strength of concrete in MPa (psi).
 - e. Weight of lightweight structural concrete in kg/ (pounds per cubic feet).
 - f. Weather conditions during placing.
 - g. Temperature of concrete in each test cylinder when test cylinder was molded.
 - h. Maximum and minimum ambient temperature during placing.
 - i. Ambient temperature when concrete sample in test cylinder was taken.
 - j. Date delivered to laboratory and date tested.

3.6 STRUCTURAL STEEL:

- A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with contract documents. Welding shall conform to AWS D1.1 Structural Welding Code.
- B. Fabrication and Erection:
 1. Weld Inspection:
 - a. Inspect welding equipment for capacity, maintenance and working condition.
 - b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.

- c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
 - d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.
 - e. Measure 25 percent of fillet welds.
 - f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:
 - 1) 20 percent of all shear plate fillet welds at random, final pass only.
 - 2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.
 - 3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
 - 4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.
 - 5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.
 - g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.
 - h. Verify that correction of rejected welds are made in accordance with AWS D1.1.
 - i. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.
2. Bolt Inspection:
- a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
 - b. Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
 - c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural

Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.

- d. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.
 - e. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.
 - f. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.
- D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to Project Engineer.

3.7 STEEL DECKING:

- A. Provide field inspection of welds of metal deck to the supporting steel, and testing services to insure steel decking has been installed in accordance with contract documents and manufacturer's requirements.
- B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS D1.1. Refer to the "Plug Weld Qualification Procedure" in Part 3 "Field Quality Control."
- C. Submit inspection reports, certification, and instances of noncompliance to Project Engineer.

3.8 SHEAR CONNECTOR STUDS:

- A. Provide field inspection and testing services required by AWS D.1 to insure shear connector studs have been installed in accordance with contract documents.
- B. Tests: Test 20 percent of headed studs for fastening strength in accordance with AWS D1.1.
- C. Submit inspection reports, certification, and instances of noncompliance to Project Engineer.

3.9 SPRAYED-ON FIREPROOFING:

- A. Provide field inspection and testing services to certify sprayed-on fireproofing has been applied in accordance with contract documents.
- B. Test sprayed-on fireproofing for thickness and density in accordance with ASTM E605.
 - 1. Thickness gauge specified in ASTM E605 may be modified for pole extension so that overhead sprayed material can be reached from floor.
- C. Location of test areas for field tests as follows:
 - 1. Thickness: Select one bay per floor, or one bay for each 930 (10,000 square feet) of floor area, whichever provides for greater

number of tests. Take thickness determinations from each of following locations: Metal deck, beam, and column.

2. Density: Take density determinations from each floor, or one test from each 930 (10,000 square feet) of floor area, whichever provides for greater number of tests, from each of the following areas: Underside of metal deck, beam flanges, and beam web.

D. Submit inspection reports, certification, and instances of noncompliance to Project Engineer.

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SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various contract items of work.
- B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
1. Adversely effect human health or welfare,
 2. Unfavorably alter ecological balances of importance to human life,
 3. Effect other species of importance to humankind, or;
 4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.
- C. Definitions of Pollutants:
1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
 2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
 3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
 4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
 5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.
 6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.

7. Sanitary Wastes:

- a. Sewage: Domestic sanitary sewage and human and animal waste.
- b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2 QUALITY CONTROL

- A. Establish and maintain quality control for the environmental protection of all items set forth herein.
- B. Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.

1.3 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. U.S. National Archives and Records Administration (NARA):
33 CFR 328.....Definitions

1.4 SUBMITTALS

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
 - 1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the Project Engineer to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the Project Engineer and the Contracting Officer for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
 - a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
 - b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
 - c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
 - d. Description of the Contractor's environmental protection personnel training program.
 - e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control,

noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.

- f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.
 - g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.
 - h. Permits, licenses, and the location of the solid waste disposal area.
 - i. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials. Include as part of an Erosion Control Plan approved by the District Office of the U.S. Soil Conservation Service and the Department of Veterans Affairs.
 - j. Environmental Monitoring Plans for the job site including land, water, air, and noise.
 - k. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.
- B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

1.5 PROTECTION OF ENVIRONMENTAL RESOURCES

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs,

vines, grasses, top soil, and land forms without permission from the Project Engineer. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.

1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
 - a. Box and protect from damage existing trees and shrubs to remain on the construction site.
 - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
 - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
 - a. Reuse or conserve the collected topsoil sediment as directed by the Project Engineer. Topsoil use and requirements are specified in Section 31 20 00, EARTH MOVING.
 - b. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.
5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such

- that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features shown on the Environmental Protection Plan. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
6. Manage borrow areas on and off Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.
 7. Manage and control spoil areas on and off Government property to limit spoil to areas shown on the Environmental Protection Plan and prevent erosion of soil or sediment from entering nearby water courses or lakes.
 8. Protect adjacent areas from despoilment by temporary excavations and embankments.
 9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
 10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
 11. Handle discarded materials other than those included in the solid waste category as directed by the Project Engineer.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.

2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.
 3. Monitor water areas affected by construction.
- D. Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife. Prior to beginning construction operations, list species that require specific attention along with measures for their protection.
- E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of insert Name of State and title of State Air Pollution Statute, Rule, or Regulation and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.
1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
 2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
 3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
 4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.
- F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as

directed by the Project Engineer. Maintain noise-produced work at or below the decibel levels and within the time periods specified.

1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00p.m unless otherwise permitted by local ordinance or the Project Engineer. Repetitive impact noise on the property shall not exceed the following dB limitations:

Time Duration of Impact Noise	Sound Level in dB
More than 12 minutes in any hour	70
Less than 30 seconds of any hour	85
Less than three minutes of any hour	80
Less than 12 minutes of any hour	75

2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:
 - a. Maintain maximum permissible construction equipment noise levels at 15 m (50 feet) (dBA):

EARTHMOVING		MATERIALS HANDLING	
FRONT LOADERS	75	CONCRETE MIXERS	75
BACKHOES	75	CONCRETE PUMPS	75
DOZERS	75	CRANES	75
TRACTORS	75	DERRICKS IMPACT	75
SCAPERS	80	PILE DRIVERS	95
GRADERS	75	JACK HAMMERS	75
TRUCKS	75	ROCK DRILLS	80
PAVERS, STATIONARY	80	PNEUMATIC TOOLS	80
PUMPS	75	BLASTING	--
GENERATORS	75	SAWS	75
COMPRESSORS	75	VIBRATORS	75

- b. Use shields or other physical barriers to restrict noise transmission.
 - c. Provide soundproof housings or enclosures for noise-producing machinery.
 - d. Use efficient silencers on equipment air intakes.

- e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
 - f. Line hoppers and storage bins with sound deadening material.
 - g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
3. Measure sound level for noise exposure due to the construction at least once every five successive working days while work is being performed above 55 dB(A) noise level. Measure noise exposure at the property line or 15 m (50 feet) from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at 900 to 1800 mm (three to six feet) in front of any building face. Submit the recorded information to the Project Engineer noting any problems and the alternatives for mitigating actions.
- G. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor shall restore the damaged property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.
- H. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean condition satisfactory to the Project Engineer. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

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SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
 - 1. Waste Management Plan development and implementation.
 - 2. Techniques to minimize waste generation.
 - 3. Sorting and separating of waste materials.
 - 4. Salvage of existing materials and items for reuse or resale.
 - 5. Recycling of materials that cannot be reused or sold.
- D. At a minimum the following waste categories shall be diverted from landfills:
 - 1. Soil.
 - 2. Inerts (eg, concrete, masonry and asphalt).
 - 3. Clean dimensional wood and palette wood.
 - 4. Green waste (biodegradable landscaping materials).
 - 5. Engineered wood products (plywood, particle board and I-joists, etc).
 - 6. Metal products (eg, steel, wire, beverage containers, copper, etc).
 - 7. Cardboard, paper and packaging.
 - 8. Bitumen roofing materials.
 - 9. Plastics (eg, ABS, PVC).
 - 10. Carpet and/or pad.
 - 11. Gypsum board.
 - 12. Insulation.
 - 13. Paint.
 - 14. Fluorescent lamps.

1.2 RELATED WORK

- A. Section 02 41 00, DEMOLITION.
- B. Section 01 00 00, GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
1. Excess or unusable construction materials.
 2. Packaging used for construction products.
 3. Poor planning and/or layout.
 4. Construction error.
 5. Over ordering.
 6. Weather damage.
 7. Contamination.
 8. Mishandling.
 9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to reuse and recycle new materials to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.wbdg.org> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.

- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

1.4 TERMINOLOGY

- A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.
- B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.
- C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.
- D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.
- E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).
- F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.
- G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.
- H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.
- J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.
- K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.

- L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
 - 1. On-site Recycling - Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
 - 2. Off-site Recycling - Materials hauled to a location and used in an altered form in the manufacture of new products.
- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.
- N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.
- O. Return: To give back reusable items or unused products to vendors for credit.
- P. Salvage: To remove waste materials from the site for resale or re-use by a third party.
- Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.
- R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.
- S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Prepare and submit to the Resident Engineer a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
 - 1. Procedures to be used for debris management.
 - 2. Techniques to be used to minimize waste generation.
 - 3. Analysis of the estimated job site waste to be generated:

- a. List of each material and quantity to be salvaged, reused, recycled.
 - b. List of each material and quantity proposed to be taken to a landfill.
- 4. Detailed description of the Means/Methods to be used for material handling.
 - a. On site: Material separation, storage, protection where applicable.
 - b. Off site: Transportation means and destination. Include list of materials.
 - 1) Description of materials to be site-separated and self-hauled to designated facilities.
 - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
 - c. The names and locations of mixed debris reuse and recycling facilities or sites.
 - d. The names and locations of trash disposal landfill facilities or sites.
 - e. Documentation that the facilities or sites are approved to receive the materials.
- C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.
- B. U.S. Green Building Council (USGBC):
LEED Green Building Rating System for New Construction

1.7 RECORDS

- A. Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. List of each material and quantity to be salvaged, recycled, reused.
- B. List of each material and quantity proposed to be taken to a landfill.
- C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

PART 3 - EXECUTION**3.1 COLLECTION**

- A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.
- B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.
- C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

3.2 DISPOSAL

- A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.
- B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

3.3 REPORT

- A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.
- B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.
- C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

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Construction Waste Management Report

Fargo VA Medical Center

Contractor: _____

Month: _____

Roll Off

Date	Amount taken to Landfill (pounds)

Recycling

Date	Material Recycled	Amount (Pounds)	Cost/Credit (\$)

SECTION 01 91 00**GENERAL COMMISSIONING REQUIREMENTS****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS shall form the basis of the construction phase commissioning process and procedures. The Commissioning Agent shall add, modify, and refine the commissioning procedures, as approved by the Department of Veterans Affairs (VA), to suit field conditions and actual manufacturer's equipment, incorporate test data and procedure results, and provide detailed scheduling for all commissioning tasks.
- B. Various sections of the project specifications require equipment startup, testing, and adjusting services. Requirements for startup, testing, and adjusting services specified in the Division 7, Division 23, and Division 26 series sections of these specifications are intended to be provided in coordination with the commissioning services and are not intended to duplicate services. The Contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.
- C. Where individual testing, adjusting, or related services are required in the project specifications and not specifically required by this commissioning requirements specification, the specified services shall be provided and copies of documentation, as required by those specifications shall be submitted to the VA and the Commissioning Agent to be indexed for future reference.
- D. Where training or educational services for VA are required and specified in other sections of the specifications, including but not limited to Division 7, Division 23, and Division 26 series sections of the specification, these services are intended to be provided in addition to the training and educational services specified herein.
- E. Commissioning is a systematic process of verifying that the building systems perform interactively according to the construction documents and the VA's operational needs. The commissioning process shall encompass and coordinate the system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training. Commissioning during the construction, and post-occupancy

phases is intended to achieve the following specific objectives according to the contract documents:

1. Verify that the applicable equipment and systems are installed in accordance with the contract documents and according to the manufacturer's recommendations.
2. Verify and document proper integrated performance of equipment and systems.
3. Verify that Operations & Maintenance documentation is complete.
4. Verify that all components requiring servicing can be accessed, serviced and removed without disturbing nearby components including ducts, piping, cabling or wiring.
5. Verify that the VA's operating personnel are adequately trained to enable them to operate, monitor, adjust, maintain, and repair building systems in an effective and energy-efficient manner.
6. Document the successful achievement of the commissioning objectives listed above.

F. The commissioning process does not take away from or reduce the responsibility of the Contractor to provide a finished and fully functioning product.

1.2 CONTRACTUAL RELATIONSHIPS

A. For this construction project, the Department of Veterans Affairs contracts with a Contractor to provide construction services. The contracts are administered by the VA Contracting Officer and the VA Project Engineer as the designated representative of the Contracting Officer. On this project, the authority to modify the contract in any way is strictly limited to the authority of the Contracting Officer and the VA Project Engineer.

B. In this structure, only two contract parties are recognized and communications on contractual issues are strictly limited to VA VA Project Engineer and the Contractor. It is the practice of the VA to require that communications between other parties to the contracts (Subcontractors and Vendors) be conducted through the VA Project Engineer and Contractor. It is also the practice of the VA that communications between other parties of the project (Commissioning Agent and Architect/Engineer) be conducted through the VA Project Engineer.

C. Whole Building Commissioning is a process that relies upon frequent and direct communications, as well as collaboration between all parties to

the construction process. By its nature, a high level of communication and cooperation between the Commissioning Agent and all other parties (Architects, Engineers, Subcontractors, Vendors, third party testing agencies, etc) is essential to the success of the Commissioning effort.

D. With these fundamental practices in mind, the commissioning process described herein has been developed to recognize that, in the execution of the Commissioning Process, the Commissioning Agent must develop effective methods to communicate with every member of the construction team involved in delivering commissioned systems while simultaneously respecting the exclusive contract authority of the Contracting Officer and VA Project Engineer. Thus, the procedures outlined in this specification must be executed within the following limitations:

1. No communications (verbal or written) from the Commissioning Agent shall be deemed to constitute direction that modifies the terms of any contract between the Department of Veterans Affairs and the Contractor.
2. Commissioning Issues identified by the Commissioning Agent will be delivered to the VA Project Engineer and copied to the designated Commissioning Representatives for the Contractor and subcontractors on the Commissioning Team for information only in order to expedite the communication process. These issues must be understood as the professional opinion of the Commissioning Agent and as suggestions for resolution.
3. In the event that any Commissioning Issues and suggested resolutions are deemed by the VA Project Engineer to require either an official interpretation of the construction documents or require a modification of the contract documents, the Contracting Officer or VA Project Engineer will issue an official directive to this effect.
4. All parties to the Commissioning Process shall be individually responsible for alerting the VA Project Engineer of any issues that they deem to constitute a potential contract change prior to acting on these issues.
5. Authority for resolution or modification of design and construction issues rests solely with the Contracting Officer or VA Project Engineer, with appropriate technical guidance from the Architect/Engineer and/or Commissioning Agent.

1.3 RELATED WORK

- A. Section 01 00 00 GENERAL REQUIREMENTS.
- B. Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.

1.4 SUMMARY

- A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.
- B. The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.
- C. The commissioning activities have been developed to support the United States Green Building Council (USGBC) LEED™ rating program and to support delivery of project performance in accordance with the VA requirements developed for the project.
 - 1. Commissioning activities and documentation for the LEED™ section on "Energy and Atmosphere" and the prerequisite of "Fundamental Building Systems Commissioning."
 - 2. Commissioning activities and documentation for the LEED™ section on "Energy and Atmosphere" requirements for the "Enhanced Building System Commissioning" credit.
 - 3. Activities and documentation for the LEED™ section on "Measurement and Verification" requirements for the Measurement and Verification credit.
- D. The commissioning activities have been developed to support the Green Buildings Initiative Green Globes rating program and to support delivery of project performance in accordance with the VA requirements developed for the project.

1.5 DEFINITIONS

- A. Architect: Includes Architect identified in the Contract for Construction between the Department of Veterans Affairs and Contractor, plus consultant/design professionals responsible for design of fire suppression, plumbing, HVAC, controls for HVAC systems, electrical, communications, electronic safety and security, as well as other related systems.
- B. CxA: Commissioning Agent.
- C. Commissioning Plan: a document that is an overall plan that outlines the commissioning process, commissioning team responsibilities, schedule for commissioning activities, and commissioning documents.

- D. Commissioning Issue: a condition in the installation or function of a component, piece of equipment or system that affects the system operations, maintenance, and/or repair.
- E. Commissioning Observation: a condition in the installation or function of a component, piece of equipment or system that may not be in compliance with the Contract Documents, or may not be in compliance with the manufacturer's installation instruction, or may not be in compliance with generally accepted industry standards.
- F. Systems Functional Performance Test: a test, or tests, of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Systems Functional Performance Testing 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 setpoint). 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 water test and balancing (TAB) is not Systems Functional Performance Testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while System Functional Performance Testing is verifying that the system has already been set up properly and is functioning in accordance with the Construction Documents. The Commissioning Agent develops the Systems Functional Performance Test Procedures in a sequential written form, coordinates, witnesses, and documents the actual testing. Systems Functional Performance Testing is performed by the Contractor. Systems Functional Performance Tests are performed after startups, control systems are complete and operational, TAB functions and Pre-Functional Checklists are complete.
- G. System: A system is defined as the entire set of components, equipment, and subsystems which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one component of an entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam

supply, chilled water supply, refrigerant supply, hot water supply, controls and electrical service, etc. Another example of a system which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of the fuel supply, combustion air, controls, steam, feedwater supply, condensate return and other related components.

- H. Pre-Functional Checklist: a list of items provided by the Commissioning Agent to the Contractor that require inspection and elementary component tests conducted to verify proper installation of equipment. Pre-Functional Checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some Pre-Functional Checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). The term "Pre-Functional" refers to before Systems Functional Performance Testing. Pre-Functional Checklists augment and are combined with the manufacturer's startup checklist and the Contractor's Quality Control checklists.
- I. Seasonal Functional Performance Testing: a test or tests that are deferred until the system will experience conditions closer to their design conditions.
- J. VA: Includes the Contracting Officer, VA Project Engineer, or other authorized representative of the Department of Veterans Affairs.
- K. TAB: Testing, Adjusting, and Balancing.

1.6 SYSTEMS TO BE COMMISSIONED

- A. Commissioning of a system or systems specified for this project is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.
- B. The following systems will be commissioned as part of this project:
 - 1. Facility exterior closure (Division 7 and Division 8)
 - a. Roofs (Asphalt shingles, slate shingles, wood shingles, clay roof tiles, built-up bituminous, modified bituminous, EPDM, PVC, fluid-applied, sprayed polyurethane, flashing & sheet metal, metal roofing, roof specialties, and roof accessories)

- b. Exterior Insulation and Finish Systems (EIFS)
 - c. Curtain Wall Systems (Mullions, glazing, and sealing)
 - d. Exterior Doors (Revolving, glass leaf, emergency exit, and service)
 - e. Exterior Windows (Aluminum, steel, glazing, storm)
 - f. Louvers and Vents
 - g. Sealants (Caulking, mechanical seals, and wind and vapor barriers)
2. HVAC (Division 23)
- a. Air Handling Systems (Fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, filters, dampers, safeties such as smoke detectors or freezestats and damper end switches, controls, gages, and vibration isolation).
 - a. Heating Hot Water Systems (Heat Exchangers, controls, instrumentation and gages, flues, heating water pumps and motors, Variable Speed Drives, mixing valves).
 - b. Condensate Return Systems (Condensate receivers and transfer pumps, controls, pump alternator, alarms and instrumentation, safeties).
 - c. Chilled Water Systems (Chilled water pumps and motors, Variable Speed Drives, controls, instrumentation and safeties, isolation valves, blending valves).
 - d. Exhaust Fans (Fan, motor, Variable Speed Drives, controls and safeties).
 - e. Direct Digital Control System (BACnet or similar Local Area Network (LAN), Operator Work Station hardware and software, building controller hardware and software, terminal unit controller hardware and software, all sequences of operation, system accuracy and response time).
 - f. Laboratory Exhaust Systems (Fume hoods, pressure controls, system alarms, fans, motors, and Variable Speed Drives).
 - g. HVAC Water Treatment Systems (Closed circuits - including shot feeders and final water analysis).
3. Electrical (Division 26)
- h. Standby Generator Systems (Automatic transfer switches, fuel delivery pumps and motors, battery charging and instrumentation, muffler and exhaust system, and vibration isolation).

- i. Generator Paralleling Switchboards (Automatic transfer switches, instrumentation, metering and gages, and controls).
- j. Generator Power Distribution Systems (Fuses and circuit breaker settings, metering, gages, and controls).
- k. Automatic Transfer Switches (Test with associated generator).
- l. Normal Power Distribution Systems (Grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
- m. Life Safety Power Distribution Systems (Automatic transfer on loss of normal power, grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
- n. Critical Power Distribution Systems (Automatic transfer on loss of normal power, grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
- o. Lighting Controls (Control system hardware and software, scene settings, zone settings, occupancy sensor interface, and unoccupied cycle control).
- p. Uninterruptible Power Supply Systems and UPS Power Distribution Systems (i.e. system power displays, and distribution panel circuit breakers).

1.7 COMMISSIONING TEAM

A. Members Appointed by Contractor:

- 1. Contractor: The designated person, company, or entity that plans, schedules and coordinates the commissioning activities for the construction team.
- 2. Contractor's Commissioning Representative(s): Individual(s), each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project Superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the Department of Veterans Affairs (VA) and Commissioning Agent.

B. Members Appointed by VA:

- 1. Commissioning Agent: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. The VA will engage the CxA under a separate contract.

2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.8 VA'S COMMISSIONING RESPONSIBILITIES

- A. Appoint an individual, company or firm to act as the Commissioning Agent.
- B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:
 1. Coordination meetings.
 2. Training in operation and maintenance of systems, subsystems, and equipment.
 3. Testing meetings.
 4. Witness and assist in Systems Functional Performance Testing.
 5. Demonstration of operation of systems, subsystems, and equipment.
- C. Provide the Construction Documents, prepared by Architect and approved by VA, to the Commissioning Agent and for use in managing the commissioning process, developing the commissioning plan, systems manuals, and reviewing the operation and maintenance training plan.

1.9 CONTRACTOR'S COMMISSIONING RESPONSIBILITIES

- A. The Contractor shall assign a Commissioning Manager to manage commissioning activities of the Contractor, and subcontractors.
- B. The Contractor shall ensure that the commissioning responsibilities outlined in these specifications are included in all subcontracts and that subcontractors comply with the requirements of these specifications.
- C. The Contractor shall ensure that each installing subcontractor shall assign representatives with expertise and authority to act on behalf of the subcontractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
 1. Participate in commissioning coordination meetings.
 2. Conduct operation and maintenance training sessions in accordance with approved training plans.
 3. Verify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.

4. Evaluate commissioning issues and commissioning observations identified in the Commissioning Issues Log, field reports, test reports or other commissioning documents. In collaboration with entity responsible for system and equipment installation, recommend corrective action.
5. Review and comment on commissioning documentation.
6. Participate in meetings to coordinate Systems Functional Performance Testing.
7. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to Commissioning Agent for incorporation into the commissioning plan.
8. Provide information to the Commissioning Agent for developing commissioning plan.
9. Participate in training sessions for VA's operation and maintenance personnel.
10. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures to conduct Systems Functional Performance Testing of installed systems.

1.10 COMMISSIONING AGENT'S RESPONSIBILITIES

- A. Organize and lead the commissioning team.
- B. Prepare the commissioning plan. See Paragraph 1.11-A of this specification Section for further information.
- C. Review and comment on selected submittals from the Contractor for general conformance with the Construction Documents. Review and comment on the ability to test and operate the system and/or equipment, including providing gages, controls and other components required to operate, maintain, and test the system. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the Construction Documents.
- D. At the beginning of the construction phase, conduct an initial construction phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; Pre-Functional Checklists, Systems Functional Performance Testing; and project completion.
- E. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss status of the

commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The Commissioning Agent shall prepare and distribute minutes to commissioning team members and attendees within five workdays of the commissioning meeting.

- F. Observe construction and report progress, observations and issues.
Observe systems and equipment installation for adequate accessibility for maintenance and component replacement or repair, and for general conformance with the Construction Documents.
- G. Prepare Project specific Pre-Functional Checklists and Systems Functional Performance Test procedures.
- H. Coordinate Systems Functional Performance Testing schedule with the Contractor.
- I. Witness selected systems startups.
- J. Verify selected Pre-Functional Checklists completed and submitted by the Contractor.
- K. Witness and document Systems Functional Performance Testing.
- L. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.
- M. Review and comment on operation and maintenance (O&M) documentation and systems manual outline for compliance with the Contract Documents.
Operation and maintenance documentation requirements are specified in Paragraph 1.25, Section 01 00 00 GENERAL REQUIREMENTS.
- N. Review operation and maintenance training program developed by the Contractor. Verify training plans provide qualified instructors to conduct operation and maintenance training.
- O. Prepare commissioning Field Observation Reports.
- P. Prepare the Final Commissioning Report.
- Q. Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal Systems Functional Performance Testing. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

R. Assemble the final commissioning documentation, including the Final Commissioning Report and Addendum to the Final Commissioning Report.

1.11 COMMISSIONING DOCUMENTATION

A. Commissioning Plan: A document, prepared by Commissioning Agent, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited, to the following:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
3. Identification of systems and equipment to be commissioned.
4. Schedule of Commissioning Coordination meetings.
5. Identification of items that must be completed before the next operation can proceed.
6. Description of responsibilities of commissioning team members.
7. Description of observations to be made.
8. Description of requirements for operation and maintenance training.
9. Schedule for commissioning activities with dates coordinated with overall construction schedule.
10. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.
11. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
12. Preliminary Systems Functional Performance Test procedures.

B. Systems Functional Performance Test Procedures: The Commissioning Agent will develop Systems Functional Performance Test Procedures for each system to be commissioned, including subsystems, or equipment and interfaces or interlocks with other systems. Systems Functional Performance Test Procedures will include a separate entry, with space for comments, for each item to be tested. Preliminary Systems Functional Performance Test Procedures will be provided to the VA,

Architect/Engineer, and Contractor for review and comment. The Systems Performance Test Procedure will include test procedures for each mode of operation and provide space to indicate whether the mode under test responded as required. Each System Functional Performance Test procedure, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:

1. Name and identification code of tested system.
2. Test number.
3. Time and date of test.
4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
5. Dated signatures of the person performing test and of the witness, if applicable.
6. Individuals present for test.
7. Observations and Issues.
8. Issue number, if any, generated as the result of test.

- C. Pre-Functional Checklists: The Commissioning Agent will prepare *Pre-Functional Checklists*. *Pre-Functional Checklists shall be completed* and signed by the Contractor, verifying that systems, subsystems, equipment, and associated controls are ready for testing. The Commissioning Agent will spot check *Pre-Functional Checklists* to verify accuracy and readiness for testing. Inaccurate or incomplete *Pre-Functional Checklists* shall be returned to the Contractor for correction and resubmission.
- D. Test and Inspection Reports: The Commissioning Agent will record test data, observations, and measurements on Systems Functional Performance Test Procedure. The report will also include recommendation for system acceptance or non-acceptance. Photographs, forms, and other means appropriate for the application shall be included with data. Commissioning Agent Will compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.
- E. Corrective Action Documents: The Commissioning Agent will document corrective action taken for systems and equipment that fail tests. The documentation will include any required modifications to systems and equipment and/or revisions to test procedures, if any. The Commissioning Agent will witness and document any retesting of systems

and/or equipment requiring corrective action and document retest results.

F. Commissioning Issues Log: The Commissioning Agent will prepare and maintain Commissioning Issues Log that describes Commissioning Issues and Commissioning Observations that are identified during the Commissioning process. These observations and issues include, but are not limited to, those that are at variance with the Contract Documents. The Commissioning Issues Log will identify and track issues as they are encountered, the party responsible for resolution, progress toward resolution, and document how the issue was resolved. The Master Commissioning Issues Log will also track the status of unresolved issues.

1. Creating an Commissioning Issues Log Entry:

- a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
- a. Assign a descriptive title for the issue.
- b. Identify date and time of the issue.
- c. Identify test number of test being performed at the time of the observation, if applicable, for cross reference.
- d. Identify system, subsystem, and equipment to which the issue applies.
- e. Identify location of system, subsystem, and equipment.
- f. Include information that may be helpful in diagnosing or evaluating the issue.
- g. Note recommended corrective action.
- h. Identify commissioning team member responsible for corrective action.
- i. Identify expected date of correction.
- j. Identify person that identified the issue.

2. Documenting Issue Resolution:

- a. Log date correction is completed or the issue is resolved.
- b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
- c. Identify changes to the Contract Documents that may require action.
- d. State that correction was completed and system, subsystem, and equipment are ready for retest, if applicable.

e. Identify person(s) who corrected or resolved the issue.

f. Identify person(s) verifying the issue resolution.

G. Final Commissioning Report: The Commissioning Agent will document results of the commissioning process, including unresolved issues, and performance of systems, subsystems, and equipment. The Commissioning Report will indicate whether systems, subsystems, and equipment have been properly installed and are performing according to the Contract Documents. This report will be used by the Department of Veterans Affairs when determining that systems will be accepted. This report will be used to evaluate systems, subsystems, and equipment and will serve as a future reference document during VA occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents and those that do not meet requirements of the Contract Documents. The commissioning report will include, but is not limited to, the following:

1. Lists and explanations of substitutions; compromises; variances with the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. Design Narrative documentation maintained by the Commissioning Agent.
2. Commissioning plan.
3. Pre-Functional Checklists completed by the Contractor, with annotation of the Commissioning Agent review and spot check.
4. Systems Functional Performance Test Procedures, with annotation of test results and test completion.
5. Commissioning Issues Log.
6. Listing of deferred and off season test(s) not performed, including the schedule for their completion.

H. Addendum to Final Commissioning Report: The Commissioning Agent will prepare an Addendum to the Final Commissioning Report near the end of the Warranty Period. The Addendum will indicate whether systems, subsystems, and equipment are complete and continue to perform according to the Contract Documents. The Addendum to the Final Commissioning Report shall include, but is not limited to, the following:

1. Documentation of deferred and off season test(s) results.
2. Completed Systems Functional Performance Test Procedures for off season test(s).

3. Documentation that unresolved system performance issues have been resolved.
4. Updated Commissioning Issues Log, including status of unresolved issues.
5. Identification of potential Warranty Claims to be corrected by the Contractor.

I. Systems Manual: The Commissioning Agent will gather required information and compile the Systems Manual. The Systems Manual will include, but is not limited to, the following:

1. Design Narrative, including system narratives, schematics, single-line diagrams, flow diagrams, equipment schedules, and changes made throughout the Project.
2. Reference to Final Commissioning Plan.
3. Reference to Final Commissioning Report.
4. Approved Operation and Maintenance Data as submitted by the Contractor.

1.12 SUBMITTALS

A. Preliminary Commissioning Plan Submittal: The Commissioning Agent has prepared a Preliminary Commissioning Plan based on the final Construction Documents. The Preliminary Commissioning Plan is included as an Appendix to this specification section. The Preliminary Commissioning Plan is provided for information only. It contains preliminary information about the following commissioning activities:

1. The Commissioning Team: A list of commissioning team members by organization.
2. Systems to be commissioned. A detailed list of systems to be commissioned for the project. This list also provides preliminary information on systems/equipment submittals to be reviewed by the Commissioning Agent; preliminary information on Pre-Functional Checklists that are to be completed; preliminary information on Systems Performance Testing, including information on testing sample size (where authorized by the VA).
3. Commissioning Team Roles and Responsibilities: Preliminary roles and responsibilities for each Commissioning Team member.
4. Commissioning Documents: A preliminary list of commissioning-related documents, include identification of the parties responsible for preparation, review, approval, and action on each document.

5. Commissioning Activities Schedule: Identification of Commissioning Activities, including Systems Functional Testing, the expected duration and predecessors for the activity.
 6. Pre-Functional Checklists: Preliminary Pre-Functional Checklists for equipment, components, subsystems, and systems to be commissioned. These Preliminary Pre-Functional Checklists provide guidance on the level of detailed information the Contractor shall include on the final submission.
 7. Systems Functional Performance Test Procedures: Preliminary step-by-step System Functional Performance Test Procedures to be used during Systems Functional Performance Testing. These Preliminary Systems Functional Performance procedures provide information on the level of testing rigor, and the level of Contractor support required during performance of system's testing.
- B. Final Commissioning Plan Submittal: Based on the Final Construction Documents and the Contractor's project team, the Commissioning Agent will prepare the Final Commissioning Plan as described in this section. The Commissioning Agent will submit three hard copies and three sets of electronic files of Final Commissioning Plan. The Contractor shall review the Commissioning Plan and provide any comments to the VA. The Commissioning Agent will incorporate review comments into the Final Commissioning Plan as directed by the VA.
- C. Systems Functional Performance Test Procedure: The Commissioning Agent will submit preliminary Systems Functional Performance Test Procedures to the Contractor, and the VA for review and comment. The Contractor shall return review comments to the VA and the Commissioning Agent. The VA will also return review comments to the Commissioning Agent. The Commissioning Agent will incorporate review comments into the Final Systems Functional Test Procedures to be used in Systems Functional Performance Testing.
- D. Pre-Functional Checklists: The Commissioning Agent will submit Pre-Functional Checklists to be completed by the Contractor.
- E. Test and Inspection Reports: The Commissioning Agent will submit test and inspection reports to the VA with copies to the Contractor and the Architect/Engineer.
- F. Corrective Action Documents: The Commissioning Agent will submit corrective action documents to the VA Project Engineer with copies to the Contractor and Architect.

G. Preliminary Commissioning Report Submittal: The Commissioning Agent will submit three electronic copies of the preliminary commissioning report. One electronic copy, with review comments, will be returned to the Commissioning Agent for preparation of the final submittal.

H. Final Commissioning Report Submittal: The Commissioning Agent will submit four sets of electronically formatted information of the final commissioning report to the VA. The final submittal will incorporate comments as directed by the VA.

I. Data for Commissioning:

1. The Commissioning Agent will request in writing from the Contractor specific information needed about each piece of commissioned equipment or system to fulfill requirements of the Commissioning Plan.
2. The Commissioning Agent may request further documentation as is necessary for the commissioning process or to support other VA data collection requirements, including Construction Operations Building Information Exchange (COBIE), Building Information Modeling (BIM), etc.

1.13 COMMISSIONING PROCESS

A. The Commissioning Agent will be responsible for the overall management of the commissioning process as well as coordinating scheduling of commissioning tasks with the VA and the Contractor. As directed by the VA, the Contractor shall incorporate Commissioning tasks, including, but not limited to, Systems Functional Performance Testing (including predecessors) with the Master Construction Schedule.

B. Within 15 days of contract award, the Contractor shall designate a specific individual as the Commissioning Manager (CM) to manage and lead the commissioning effort on behalf of the Contractor. The Commissioning Manager shall be the single point of contact and communications for all commissioning related services by the Contractor.

C. Within 30 days of contract award, the Contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CR) to be responsible for commissioning related tasks. The Contractor shall ensure the designated Commissioning Representatives participate in the commissioning process as team members providing commissioning testing services, equipment operation, adjustments, and corrections if necessary. The Contractor shall ensure

that all Commissioning Representatives shall have sufficient authority to direct their respective staff to provide the services required, and to speak on behalf of their organizations in all commissioning related contractual matters.

1.14 QUALITY ASSURANCE

- A. Instructor Qualifications: Factory authorized service representatives shall be experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.
- B. Test Equipment Calibration: The Contractor shall comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

1.15 COORDINATION

- A. Management: The Commissioning Agent will coordinate the commissioning activities with the VA and Contractor. The Commissioning Agent will submit commissioning documents and information to the VA. All commissioning team members shall work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.
- B. Scheduling: The Contractor will work with the Commissioning Agent and the VA to incorporate the commissioning activities into the construction schedule. The Commissioning Agent will provide sufficient information on commissioning activities to allow the Contractor and the VA to schedule commissioning activities. All parties shall address scheduling issues and make necessary notifications in a timely manner in order to expedite the project and the commissioning process. The Contractor shall update the Master Construction as directed by the VA.
- C. Initial Schedule of Commissioning Events: The Commissioning Agent will provide the initial schedule of primary commissioning events in the Commissioning Plan and at the commissioning coordination meetings. The Commissioning Plan will provide a format for this schedule. As construction progresses, more detailed schedules will be developed by the Contractor with information from the Commissioning Agent.
- D. Commissioning Coordinating Meetings: The Commissioning Agent will conduct periodic Commissioning Coordination Meetings of the commissioning team to review status of commissioning activities, to

discuss scheduling conflicts, and to discuss upcoming commissioning process activities.

- E. Meetings: The Commissioning Agent will conduct pretest meetings of the commissioning team to review startup reports, Pre-Functional Checklist results, Systems Functional Performance Testing procedures, testing personnel and instrumentation requirements.
- F. Systems Functional Performance Testing Coordination: The Contractor shall coordinate testing activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting. The Contractor shall coordinate the schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. The Contractor shall provide all standard and specialized testing equipment required to perform Systems Functional Performance Testing. Test equipment required for Systems Functional Performance Testing will be identified in the detailed System Functional Performance Test Procedure prepared by the Commissioning Agent.
- B. Data logging equipment and software required to test equipment shall be provided by the Contractor.
- C. 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 0.5 (1.0) and a resolution of + or - 0.1 (0.2). Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 STARTUP, INITIAL CHECKOUT, AND PRE-FUNCTIONAL CHECKLISTS

- A. The following procedures shall apply to all equipment and systems to be commissioned, according to Part 1, Systems to Be Commissioned.
 - 1. Pre-Functional Checklists are important to ensure that the equipment and systems are hooked up and operational. These ensure that Systems

Functional Performance Testing may proceed without unnecessary delays. Each system to be commissioned shall have a full Pre-Functional Checklist completed by the Contractor prior to Systems Functional Performance Testing. No sampling strategies are used.

- a. The Pre-Functional Checklist will identify the trades responsible for completing the checklist. The Contractor shall ensure the appropriate trades complete the checklists.
 - b. The Commissioning Agent will review completed Pre-Functional Checklists and field-verify the accuracy of the completed checklist using sampling techniques.
2. Startup and Initial Checkout Plan: The Contractor shall develop detailed startup plans for all equipment. The primary role of the Contractor in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures have been completed. Parties responsible for startup shall be identified in the Startup Plan and in the checklist forms.
- a. The Contractor shall develop the full startup plan by combining (or adding to) the checklists with the manufacturer's detailed startup and checkout procedures from the O&M manual data and the field checkout sheets normally used by the Contractor. The plan shall include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.
 - b. The full startup plan shall at a minimum consist of the following items:
 - 1) The Pre-Functional Checklists.
 - 2) The manufacturer's standard written startup procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
 - 3) The manufacturer's normally used field checkout sheets.
 - a) The Commissioning Agent will submit the full startup plan to the VA and Contractor for review. Final approval will be by the VA.
 - b) The Contractor shall review and evaluate the procedures and the format for documenting them, noting any procedures that need to be revised or added.
3. Sensor and Actuator Calibration
- a. All field installed temperature, relative humidity, CO2 and pressure sensors and gages, and all actuators (dampers and

valves) on all equipment shall be calibrated using the methods described in Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 specifications.

- b. All procedures used shall be fully documented on the Pre-Functional Checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.
4. Execution of Equipment Startup
- a. Four weeks prior to equipment startup, the Contractor shall schedule startup and checkout with the VA and Commissioning Agent. The performance of the startup and checkout shall be directed and executed by the Contractor.
 - b. The Commissioning Agent will observe the startup procedures for selected pieces of primary equipment.
 - c. The Contractor shall execute startup and provide the VA and Commissioning Agent with a signed and dated copy of the completed startup checklists, and contractor tests.
 - d. Only individuals that have direct knowledge and witnessed that a line item task on the Startup Checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

3.2 DEFICIENCIES, NONCONFORMANCE, AND APPROVAL IN CHECKLISTS AND STARTUP

- A. The Contractor shall clearly list any outstanding items of the initial startup and Pre-Functional Checklist procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies shall be provided to the VA and the Commissioning Agent within two days of completion.
- B. The Commissioning Agent will review the report and submit comments to the VA. The Commissioning Agent will work with the Contractor to correct and verify deficiencies or uncompleted items. The Commissioning Agent will involve the VA and others as necessary. The Contractor shall correct all areas that are noncompliant or incomplete in the checklists in a timely manner, and shall notify the VA and Commissioning Agent as soon as outstanding items have been corrected. The Contractor shall submit an updated startup report and a Statement of Correction on the original noncompliance report. When satisfactorily completed, the

Commissioning Agent will recommend approval of the checklists and startup of each system to the VA.

- C. The Contractor shall be responsible for resolution of deficiencies as directed the VA.

3.3 PHASED COMMISSIONING

- A. The project may require startup and initial checkout to be executed in phases. This phasing shall be planned and scheduled in a coordination meeting of the VA, Commissioning Agent, and the Contractor. Results will be added to the master construction schedule and the commissioning schedule.

3.4 TRENDING AND ALARMS

- A. Trending is a method of testing as a standalone method or to augment manual testing. The Contractor shall trend any and all points of the system or systems at intervals specified below.
- B. Alarms are a means to notify the system operator that abnormal conditions are present in the system. Alarms shall be structured into three tiers - Critical, Priority, and Maintenance.
1. Critical alarms are intended to be alarms that require the immediate attention of and action by the Operator. These alarms shall be displayed on the Operator Workstation in a popup style window that is graphically linked to the associated unit's graphical display. The popup style window shall be displayed on top of any active window within the screen, including non DDC system software.
 2. Priority level alarms are to be printed to a printer which is connected to the Operator's Work Station located within the engineer's office. Additionally Priority level alarms shall be able to be monitored and viewed through an active alarm application. Priority level alarms are alarms which shall require reaction from the operator or maintenance personnel within a normal work shift, and not immediate action.
 3. Maintenance alarms are intended to be minor issues which would require examination by maintenance personnel within the following shift. These alarms shall be generated in a scheduled report automatically by the DDC system at the start of each shift. The generated maintenance report will be printed to a printer located within the engineer's office.
- C. The Contractor shall provide a wireless internet network in the building for use during controls programming, checkout, and

commissioning. This network will allow project team members to more effectively program, view, manipulate and test control devices while being in the same room as the controlled device.

D. The Contractor shall provide graphical trending through the DDC control system of systems being commissioned. Trending requirements are indicated below and included with the Systems Functional Performance Test Procedures. Trending shall occur before, during and after Systems Functional Performance Testing. The Contractor shall be responsible for producing graphical representations of the trended DDC points that show each system operating properly during steady state conditions as well as during the System Functional Testing. These graphical reports shall be submitted to the VA Project Engineer and Commissioning Agent for review and analysis before, during dynamic operation, and after Systems Functional Performance Testing. The Contractor shall provide, but not limited to, the following trend requirements and trend submissions:

1. Pre-testing, Testing, and Post-testing - Trend reports of trend logs and graphical trend plots are required as defined by the Commissioning Agent. The trend log points, sampling rate, graphical plot configuration, and duration will be dictated by the Commissioning Agent. At any time during the Commissioning Process the Commissioning Agent may recommend changes to aspects of trending as deemed necessary for proper system analysis. The Contractor shall implement any changes as directed by the VA Project Engineer. Any pre-test trend analysis comments generated by the Commissioning Team should be addressed and resolved by the Contractor, as directed by the VA Project Engineer, prior to the execution of Systems Functional Performance Testing.
2. Dynamic plotting - The Contractor shall also provide dynamic plotting during Systems Functional Performance testing at frequent intervals for points determined by the Systems Functional Performance Test Procedure. The graphical plots will be formatted and plotted at durations listed in the Systems Functional Performance Test Procedure.
3. Graphical plotting - The graphical plots shall be provided with a dual y-axis allowing 15 or more trend points (series) plotted simultaneously on the graph with each series in distinct color. The plots will further require title, axis naming, legend etc. all described by the Systems Functional Performance Test Procedure. If

this cannot be sufficiently accomplished directly in the Direct Digital Control System then it is the responsibility of the Contractor to plot these trend logs in Microsoft Excel.

4. The following tables indicate the points to be trended and alarmed by system. The Operational Trend Duration column indicates the trend duration for normal operations. The Testing Trend Duration column indicates the trend duration prior to Systems Functional Performance Testing and again after Systems Functional Performance Testing. The Type column indicates point type: AI = Analog Input, AO = Analog Output, DI = Digital Input, DO = Digital Output, Calc = Calculated Point. In the Trend Interval Column, COV = Change of Value. The Alarm Type indicates the alarm priority; C = Critical, P = Priority, and M = Maintenance. The Alarm Range column indicates when the point is considered in the alarm state. The Alarm Delay column indicates the length of time the point must remain in an alarm state before the alarm is recorded in the DDC. The intent is to allow minor, short-duration events to be corrected by the DDC system prior to recording an alarm.

Dual-Path Air Handling Unit Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
OA Temperature	AI	15 Min	24 hours	3 days	N/A		
RA Temperature	AI	15 Min	24 hours	3 days	N/A		
RA Humidity	AI	15 Min	24 hours	3 days	P	>60% RH	10 min
Mixed Air Temp	AI	None	None	None	N/A		
SA Temp	AI	15 Min	24 hours	3 days	C	±5°F from SP	10 min
Supply Fan Speed	AI	15 Min	24 hours	3 days	N/A		
Return Fan Speed	AI	15 Min	24 hours	3 days	N/A		
RA Pre-Filter Status	AI	None	None	None	N/A		
OA Pre-Filter Status	AI	None	None	None	N/A		

Dual-Path Air Handling Unit Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
After Filter Status	AI	None	None	None	N/A		
OA Supply Temp	AI	15 Min	24 hours	3 days	P	±5°F from SP	10 min
RA Supply Temp	AI	15 Min	24 hours	3 days	N/A		
Duct Pressure	AI	15 Min	24 hours	3 days	C	±25% from SP	6 min
Supply Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Return Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 Min
High Static Status	DI	COV	24 hours	3 days	P	True	1 min
Fire Alarm Status	DI	COV	24 hours	3 days	C	True	5 min
Freeze Stat Level 1	DI	COV	24 hours	3 days	C	True	10 min
Emergency AHU Shutdown	DI	COV	24 hours	3 days	P	True	1 min
High Static Alarm	DI	COV	24 hours	3 days	C	True	10 min
Power Failure	DI	COV	24 hours	3 days	P	True	1 min
Supply Fan Speed	AO	15 Min	24 hours	3 days	N/A		
Return Fan Speed	AO	15 Min	24 hours	3 days	N/A		

Terminal Unit (VAV, CAV, etc.) Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Space Temperature	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min

Terminal Unit (VAV, CAV, etc.) Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Air Flow	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
SA Temperature	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
Local Setpoint	AI	15 Min	12 hours	3 days	M	±10°F from SP	60 min
Unoccupied Override	DI	COV	12 hours	3 days	M	N/A	12 Hours
Damper Position	AO	15 Minutes	12 hours	3 days	N/A		
Heating coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		

Unit Heater Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Space Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
Heating Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
Unit Heater ON/OFF	DO	COV	12 hours	3 days	M	Status <> Command	30 min

Steam and Condensate Pumps Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Steam Flow (LB/HR)	AI	15 Minutes	12 hours	3 days	N/A		

Steam and Condensate Pumps Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Condensate Pump Run Hours	AI	15 Minutes	12 hours	3 days	N/A		
High Water Level Alarm	DI	COV	12 hours	3 days	C	True	5 Min

Hydronic Hot Water Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
System HWS Temperature	AI	15 min	12 hours	3 days	C	±5°F from SP	10 Min
System HWR Temperature	AI	15 min	12 hours	3 days	M	±15°F from SP	300 Min
HX-1 Entering Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
HX-2 Entering Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
System Differential Pressure	AI	15 min	12 hours	3 days	P	±10% from SP	8 Min
HW Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
HW Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
HW Pump 1 VFD Speed	AO	15 Min	12 Hours	3 days	N/A		
HW Pump 2 VFD Speed	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #1 1/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #1 2/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		

Hydronic Hot Water Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Steam Station #2 1/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #2 2/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
HW Pump 1 Start/Stop	DO	COV	12 Hours	3 days	N/A		
HW Pump 2 Start/Stop	DO	COV	12 Hours	3 days	N/A		
HWR #1 Valve	DO	COV	12 Hours	3 days	N/A		
HWR #2 Valve	DO	COV	12 Hours	3 days	N/A		

Chilled Water System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Primary Loop Supply Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Differential Pressure	AI	15 Minutes	12 Hours	3 days	P	±5% from SP	10 Min
Secondary Loop Supply Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Return Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Secondary Loop Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Secondary Loop Pump 1 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		

Chilled Water System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Secondary Loop Pump 2 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Secondary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		

E. The Contractor shall provide the following information prior to Systems Functional Performance Testing. Any documentation that is modified after submission shall be recorded and resubmitted to the VA Project Engineer and Commissioning Agent.

1. Point-to-Point checkout documentation;
2. Sensor field calibration documentation including system name, sensor/point name, measured value, DDC value, and Correction Factor.
3. A sensor calibration table listing the referencing the location of procedures to following in the O&M manuals, and the frequency at which calibration should be performed for all sensors, separated by system, subsystem, and type. The calibration requirements shall be submitted both in the O&M manuals and separately in a standalone document containing all sensors for inclusion in the commissioning documentation. The following table is a sample that can be used as a template for submission.

SYSTEM		
Sensor	Calibration Frequency	O&M Calibration Procedure Reference
Discharge air temperature	Once a year	Volume I Section D.3.aa
Discharge static pressure	Every 6 months	Volume II Section A.1.c

4. Loop tuning documentation and constants for each loop of the building systems. The documentation shall be submitted in outline or table separated by system, control type (e.g. heating valve temperature control); proportional, integral and derivative

constants, interval (and bias if used) for each loop. The following table is a sample that can be used as a template for submission.

AIR HANDLING UNIT AHU-1				
Control Reference	Proportional Constant	Integral Constant	Derivative Constant	Interval
Heating Valve Output	1000	20	10	2 sec.

3.5 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

- A. This paragraph applies to Systems Functional Performance Testing of systems for all referenced specification Divisions.
- B. Objectives and Scope: The objective of Systems Functional Performance Testing is to demonstrate that each system is operating according to the Contract Documents. Systems Functional Performance Testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of noncompliant performance are identified and corrected, thereby improving the operation and functioning of the systems. In general, each system shall be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load, fire alarm and emergency power) where there is a specified system response. The Contractor shall verify each sequence in the sequences of operation. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.
- C. Development of Systems Functional Performance Test Procedures: Before Systems Functional Performance Test procedures are written, the Contractor shall submit 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. Using the testing parameters and requirements found in the Contract Documents and approved submittals and shop drawings, the Commissioning Agent will develop specific Systems Functional Test Procedures to verify and document proper operation of each piece of equipment and system to be commissioned. The Contractor shall assist the Commissioning Agent in developing the Systems Functional Performance Test procedures as requested by the Commissioning Agent i.e. by answering questions about

equipment, operation, sequences, etc. Prior to execution, the Commissioning Agent will provide a copy of the Systems Functional Performance Test procedures to the VA, the Architect/Engineer, and the Contractor, who shall review the tests for feasibility, safety, equipment and warranty protection.

D. Purpose of Test Procedures: The purpose of each specific Systems Functional Performance Test is to verify and document compliance with the stated criteria of acceptance given on the test form. Representative test formats and examples are found in the Commissioning Plan for this project. (The Commissioning Plan is issued as a separate document and is available for review.) The test procedure forms developed by the Commissioning Agent will include, but not be limited to, the following information:

1. System and equipment or component name(s)
2. Equipment location and ID number
3. Unique test ID number, and reference to unique Pre-Functional Checklists and startup documentation, and ID numbers for the piece of equipment.
4. Date
5. Project name
6. Participating parties
7. A copy of the specification section describing the test requirements
8. A copy of the specific sequence of operations or other specified parameters being verified
9. Formulas used in any calculations
10. Required pretest field measurements
11. Instructions for setting up the test.
12. Special cautions, alarm limits, etc.
13. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
14. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
15. A section for comments.
16. Signatures and date block for the Commissioning Agent. A place for the Contractor to initial to signify attendance at the test.

E. Test Methods: Systems Functional Performance Testing shall be achieved by manual testing (i.e. persons manipulate the equipment and observe

performance) and/or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by standalone data loggers. The Contractor and Commissioning Agent shall determine which method is most appropriate for tests that do not have a method specified.

1. Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, although timing the testing to experience actual conditions is encouraged wherever practical.
2. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.
3. Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
4. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the Air Conditioning compressor lockout initiate at an outside air temperature below 12 C (54 F), when the outside air temperature is above 12 C (54 F), temporarily change the lockout setpoint to be 2 C (4 F) above the current outside air temperature.
5. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification shall be completed during systems startup and initial checkout.

- F. Setup: Each function and test shall be performed under conditions that simulate actual conditions as closely as is practically possible. The Contractor shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Contractor shall return all affected building equipment and systems, due to these temporary modifications, to their pretest condition.
- G. Sampling: No sampling is allowed in completing Pre-Functional Checklists. Sampling is allowed for Systems Functional Performance Test Procedures execution. The Commissioning Agent will determine the sampling rate. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the Commissioning Agent may stop the testing and require the Contractor to perform and document a checkout of the remaining units, prior to continuing with Systems Functional Performance Testing of the remaining units.
- H. Cost of Retesting: The cost associated with expanded sample System Functional Performance Tests shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.
- I. and Scheduling: The Contractor shall provide a minimum of 7 days notice to the Commissioning Agent and the VA regarding the completion schedule for the Pre-Functional Checklists and startup of all equipment and systems. The Commissioning Agent will schedule Systems Functional Performance Tests with the Contractor and VA. The Commissioning Agent will witness and document the Systems Functional Performance Testing of systems. The Contractor shall execute the tests in accordance with the Systems Functional Performance Test Procedure.
- J. Testing Prerequisites: In general, Systems Functional Performance Testing will be conducted only after Pre-Functional Checklists have been satisfactorily completed. The control system shall be sufficiently tested and approved by the Commissioning Agent and the VA before it is used to verify performance of other components or systems. The air balancing and water balancing shall be completed before Systems Functional Performance Testing of air-related or water-related equipment or systems are scheduled. Systems Functional Performance

Testing will proceed 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 will be checked.

- K. Problem Solving: The Commissioning Agent will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the Contractor.

3.6 DOCUMENTATION, NONCONFORMANCE AND APPROVAL OF TESTS

- A. Documentation: The Commissioning Agent will witness, and document the results of all Systems Functional Performance Tests using the specific procedural forms developed by the Commissioning Agent for that purpose. Prior to testing, the Commissioning Agent will provide these forms to the VA and the Contractor for review and approval. The Contractor shall include the filled out forms with the O&M manual data.

- B. Nonconformance: The Commissioning Agent will record the results of the Systems Functional Performance Tests on the procedure or test form. All items of nonconformance issues will be noted and reported to the VA on Commissioning Field Reports and/or the Commissioning Master Issues Log.

1. Corrections of minor items of noncompliance identified may be made during the tests. In such cases, the item of noncompliance and resolution shall be documented on the Systems Functional Test Procedure.
2. Every effort shall be made to expedite the systems functional Performance Testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the Commissioning Agent shall not be pressured into overlooking noncompliant work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so by direction from the VA.
3. As the Systems Functional Performance Tests progresses and an item of noncompliance is identified, the Commissioning Agent shall discuss the issue with the Contractor and the VA.
4. When there is no dispute on an item of noncompliance, and the Contractor accepts responsibility to correct it:
 - a. The Commissioning Agent will document the item of noncompliance and the Contractor's response and/or intentions. The Systems Functional Performance Test then continues or proceeds to another test or sequence. After the day's work is complete, the

Commissioning Agent will submit a Commissioning Field Report to the VA. The Commissioning Agent will also note items of noncompliance and the Contractor's response in the Master Commissioning Issues Log. The Contractor shall correct the item of noncompliance and report completion to the VA and the Commissioning Agent.

- b. The need for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test and the test shall be repeated.
5. If there is a dispute about item of noncompliance, regarding whether it is an item of noncompliance, or who is responsible:
- a. The item of noncompliance shall be documented on the test form with the Contractor's response. The item of noncompliance with the Contractor's response shall also be reported on a Commissioning Field Report and on the Master Commissioning Issues Log.
 - b. Resolutions shall be made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive and acceptance authority is with the Department of Veterans Affairs.
 - c. The Commissioning Agent will document the resolution process.
 - d. Once the interpretation and resolution have been decided, the Contractor shall correct the item of noncompliance, report it to the Commissioning Agent. The requirement for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test. Retesting shall be repeated until satisfactory performance is achieved.
- C. Cost of Retesting: The cost to retest a System Functional Performance Test shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.
- D. 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 in compliance with the Contract Documents (mechanically or substantively) due to manufacturing

defect, not allowing it to meet its submitted performance specifications, all identical units may be considered unacceptable by the VA. In such case, the Contractor shall provide the VA with the following:

1. Within one week of notification from the VA, the Contractor shall examine all other identical units making a record of the findings. The findings shall be provided to the VA within two weeks of the original notice.
2. Within two weeks of the original notification, the Contractor shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
3. The VA shall determine whether a replacement of all identical units or a repair is acceptable.
4. Two examples of the proposed solution shall be installed by the Contractor and the VA shall be allowed to test the installations for up to one week, upon which the VA will decide whether to accept the solution.
5. Upon acceptance, the Contractor shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

E. Approval: The Commissioning Agent will note each satisfactorily demonstrated function on the test form. Formal approval of the Systems Functional Performance Test shall be made later after review by the Commissioning Agent and by the VA. The Commissioning Agent will evaluate each test and report to the VA using a standard form. The VA will give final approval on each test using the same form, and provide signed copies to the Commissioning Agent and the Contractor.

3.7 DEFERRED TESTING

A. Unforeseen Deferred Systems Functional Performance Tests: If any Systems Functional Performance Test cannot be completed due to the building structure, required occupancy condition or other conditions, execution of the Systems Functional Performance Testing may be delayed upon approval of the VA. These Systems Functional Performance Tests

shall be conducted in the same manner as the seasonal tests as soon as possible. Services of the Contractor to conduct these unforeseen Deferred Systems Functional Performance Tests shall be negotiated between the VA and the Contractor.

- B. Deferred Seasonal Testing: Deferred Seasonal Systems Functional Performance Tests are those that must be deferred until weather conditions are closer to the systems design parameters. The Commissioning Agent will review systems parameters and recommend which Systems Functional Performance Tests should be deferred until weather conditions more closely match systems parameters. The Contractor shall review and comment on the proposed schedule for Deferred Seasonal Testing. The VA will review and approve the schedule for Deferred Seasonal Testing. Deferred Seasonal Systems Functional Performances Tests shall be witnessed and documented by the Commissioning Agent. Deferred Seasonal Systems Functional Performance Tests shall be executed by the Contractor in accordance with these specifications.

3.8 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

- A. Training Preparation Conference: Before operation and maintenance training, the Commissioning Agent will convene a training preparation conference to include VA's Project Engineer, VA's Operations and Maintenance personnel, and the Contractor. The purpose of this conference will be to discuss and plan for Training and Demonstration of VA Operations and Maintenance personnel.
- B. The Contractor shall provide training and demonstration as required by other Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 sections. The Training and Demonstration shall include, but is not limited to, the following:
1. Review the Contract Documents.
 2. Review installed systems, subsystems, and equipment.
 3. Review instructor qualifications.
 4. Review instructional methods and procedures.
 5. Review training module outlines and contents.
 6. Review course materials (including operation and maintenance manuals).
 7. Review and discuss locations and other facilities required for instruction.

8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

C. Training Module Submittals: The Contractor shall submit the following information to the VA and the Commissioning Agent:

1. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module. At completion of training, submit two complete training manuals for VA's use.
2. Qualification Data: Submit qualifications for facilitator and/or instructor.
3. Attendance Record: For each training module, submit list of participants and length of instruction time.
4. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.
5. Demonstration and Training Videotapes: Submit two copies within seven days of end of each training module.
 - a. Identification: On each copy, provide an applied label with the following information:
 - 1) Name of Project.
 - 2) Name and address of photographer
 - 3) Name of Contractor.
 - 4) Date videotape was recorded.
 - 5) Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
6. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding videotape. Include name of Project and date of videotape on each page.

D. QUALITY ASSURANCE

1. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program

similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

2. Instructor Qualifications: A factory authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
3. Qualifications: A professional photographer who is experienced photographing construction projects.

E. COORDINATION

1. Coordinate instruction schedule with VA's operations. Adjust schedule as required to minimize disrupting VA's operations.
2. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
3. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by the VA.

F. INSTRUCTION PROGRAM

1. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
 - b. Medical equipment, including medical gas equipment and piping.
 - c. Heat generation, including heat exchangers, feedwater equipment, pumps, steam distribution piping, condensate return systems, heating hot water heat exchangers, and heating hot water distribution piping.
 - d. HVAC systems, including air handling equipment, air distribution systems, and terminal equipment and devices.
 - e. switchgear, transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
 - f. Packaged engine generators, including synchronizing switchgear/switchboards, and transfer switches.
 - g. Lighting equipment and controls.

- G. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and

knowledge that participants are expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria:

Include the following:

- a. System, subsystem, and equipment descriptions.
- b. Performance and design criteria if Contractor is delegated design responsibility.
- c. Operating standards.
- d. Regulatory requirements.
- e. Equipment function.
- f. Operating characteristics.
- g. Limiting conditions.
- h. Performance curves.

2. Documentation: Review the following items in detail:

- a. Emergency manuals.
- b. Operations manuals.
- c. Maintenance manuals.
- d. Project Record Documents.
- e. Identification systems.
- f. Warranties and bonds.
- g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

- a. Instructions on meaning of warnings, trouble indications, and error messages.
- b. Instructions on stopping.
- c. Shutdown instructions for each type of emergency.
- d. Operating instructions for conditions outside of normal operating limits.
- e. Sequences for electric or electronic systems.
- f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

- a. Startup procedures.
- b. Equipment or system break-in procedures.
- c. Routine and normal operating instructions.
- d. Regulation and control procedures.
- e. Control sequences.
- f. Safety procedures.

- g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
 6. 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.
- H. Training Execution:
1. Preparation: Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual. Set up instructional equipment at instruction location.
 2. Instruction:

- a. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Department of Veterans Affairs for number of participants, instruction times, and location.
- b. Instructor: Engage qualified instructors to instruct VA's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1) The Commissioning Agent will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2) The VA will furnish an instructor to describe VA's operational philosophy.
 - 3) The VA will furnish the Contractor with names and positions of participants.
- 3. Scheduling: Provide instruction at mutually agreed times. For equipment that requires seasonal operation, provide similar instruction at start of each season. Schedule training with the VA and the Commissioning Agent with at least seven days' advance notice.
- 4. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of **an oral, or a written**, performance-based test.
- 5. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

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