Repair Stormwater Outfall 008

Type B-1 CDDM Submittal Book

Project No. TQKD132008
January 31, 2014

Prepared by:

TETRA TECH
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M&H Project No.:
3142100-130429.01

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January 31, 2014

Mr. Jonathan Corrigan
142 FW / CE
Oregon Air National Guard
Portland ANGB
Portland, Oregon

Subject: Type B-1 CCDM Submittal
Repair Stormwater Outfall 008
Project No.: TQKD132008

Dear Jonathan,

Mead & Hunt, Inc. is pleased to present the Type B-1 CCDM Submittal for the Portland Air National Guard Base Repair Stormwater Outfall 008.

If there is anything else you require, please contact us.

Sincerely,

MEAD & HUNT, Inc.

Kari Nichols, PE
Project Manager

cc: Chad Helmle, Tetra Tech
Pete Newell, USPFO
Harry Danberg, Portland Air National Guard, Portland, OR
Ed Shorey, Project Manager, NGB/A7OT, Salem, OR
Mark Schumaker, CETSC, Minot, ND

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ATTACHMENT 10

Portland Air National Guard
Portland, OR
Project No.: TQKD132008
Repair Stormwater Outfall 008

TYPE B-1 – CDDM SUBMITTAL CHECKLIST

_X_ EDITED DRAFT TECHNICAL SPECIFICATIONS

_X_ DETAILED CONSTRUCTION COST ESTIMATE

_X_ ALL DRAWINGS IN 65% DETAIL

_n/a_ UPDATED ANG SUSTAINABLE DESIGN AND ENERGY CONSERVATION SCORE SHEET AND NARRATIVE

_X_ UPDATED BASIS OF DESIGN, PARTS I AND II

_n/a_ TWO PERSPECTIVE SKETCHES FOR EXTERIOR OF FACILITY (IF AUTHORIZED BY NGB/A7O PROJECT MANAGER)

_n/a_ PERMIT APPLICATIONS FOR BCE SIGNATURE

_X_ COPY OF TYPE A-2 REVIEW COMMENTS AND DISPOSITIONS

I. DESIGN INTENT (Basis of Design Part I)

A. Project Number & Title

Project No.: TQKD132008

Project Title: Repair Stormwater Outfall 008

B. Scope

Portland Air National Guard (PANG) Base, located on the Portland International Airport in Portland, OR is permitted under NPDES Permit 107654 for stormwater discharges. Monitoring records show that discharges from Outfall 008 has exceeded permit levels for zinc, phosphorous, and TSS. A study was conducted in 2012 to evaluate alternatives for lowering pollutant levels at Outfall 008 (TEC, 2012). The preferred alternative selected would redirect the flow from Outfall 008 to Outfall 010 which would include lining the Outfall 008 drainage pipe, routing flow to a new infiltration/detention device, and connecting the overflow to the Outfall 010 drainage network.

The concept design evaluated various types of treatment approaches and flow redirecting solutions. Field investigations were conducted including infiltration tests at the proposed location of the infiltration/detention device, site topographic survey, and televising of the Outfall 008 pipe. Field investigations are included with the Type A submittals. The preferred alternative is to install a pump station, divert the Outfall 008 runoff to an infiltration basin and connect overflow to the existing storm drain within Outfall 010.

The Maximum Construction Costs and Scope Parameters are described in the enclosed Form DD1391.

II. DESIGN NARRATIVES (Basis of Design Part II)

A. SITE IMPROVEMENTS

(1) Treatment Approaches

(a) NPDES Permit Compliance

In order to comply with The NPDES Industrial Stormwater Discharge Permit renewal for facilities that exceed benchmark(s) based on the 4th year benchmark criteria of the permit, the applicant must comply with the following permit requirements (pg. 7 of NPDES permit : 1200-COLS):

> *"Item 4.b. The Owner or operators must include additional treatment measures in the SWPCP, which may include a combination of source control and treatment measures, with the goal of achieving the benchmark(s) in Schedule a.9 of this permit in future discharges. Include in the SWPCP the rationale for the selection of the measures and the projected reduction of pollutant concentrations(s). …..*
>
> *…c. The owner or operator may request a waiver from including the additional treatment measures in the SWPCP if:…*
> *…ii. Owner or operator implements or has implemented volume reduction measures, such as low impact development practices, that have or will result in reductions of the mass load of pollutants in the discharge below the mass equivalent of the benchmarks in Schedule A.9 of the permit. The Updated SWPCP must include data and analysis to support this determination, including the description of measure(s), date(s) implements or expected to be implemented and the mass load analysis".*

Computation of the mass load equivalent of the benchmarks as documented by the Washington Department of Ecology Standard Operating Procedures for Calculating Pollutant Loads for Stormwater Discharges (9WA-DOE, 2009) requires extensive datasets including daily flow and water quality information. The limited collection of grab samples available for use in computation of mass pollutant loads at Outfall 008 (generally only a few samples each year) result in considerable uncertainty in the computation of annual or total mass load for the site.

(b) Modeling Introduction

To reduce the uncertainty in computation of mass load and volume reduction components of the permit requirements listed above, a continuous simulation model was developed. Model inputs were obtained from a variety of sources including; previous studies, available geospatial datasets, geotechnical reports, and publically available data sources. Model inputs were further refined by observations made during a site visit to the study area conducted on May 15, 2013 and responses to questions submitted to facility staff received May 20 through May 29, 2013.

(c) Model Development

i. Overview of SWMM

SWMM is a dynamic precipitation-runoff simulation model designed for discrete event or continuous representation of hydraulics, hydrology, and water quality. It is optimized and designed for storm event flow management in urban area drainage systems. First developed in 1971, SWMM has undergone numerous updates and enhancements. SWMM is currently maintained by USEPA and generically referred to as SWMM 5 (distinguishing it from SWMM 4 which is still in use, though not updated). The most recent public version as of this writing is 5.0.022 (released April 2011).

Modeling was performed using PCSWMM, a commercial product developed by Computational Hydraulics International (http://www.chiwater.com/). PCSWMM implements the public-domain SWMM 5 computational engine, but provides an advanced user interface and tool set for building models and analyzing simulation results. In this document, the SWMM model in general is referred to as *SWMM 5*.

Precipitation and other meteorological input time series are used to drive the hydrologic and water quality response in the simulation. SWMM 5 represents land areas as a series of *subcatchments*, with properties that define retention and runoff of precipitation, infiltration, and (optionally) percolation to a shallow aquifer and discharge from the aquifer. Subcatchments are connected to the drainage network, which may include natural watercourses, open channels, culverts and storm drainage pipes, storage and treatment units, outlets, diversions, and many other elements of an urban drainage system. *Nodes* and *links* are used in SWMM 5 to define the connectivity and control within the drainage network. Water quality from surface runoff is modeled using buildup and washoff functions, defined by land use type. Buildup describes the process by which a pollutant accumulates on land surfaces during dry periods, while washoff describes the rate at which pollutant mass is depleted from land surfaces during storm events.

ii. Development of the Baseline SWMM 5 Model

The Baseline model represents current conditions within the study area, and was used to perform the water quality calibration for the pollutants of concern. The schematic for the Baseline model is shown in **Figure 1**. SWMM 5 is fully capable of modeling a highly articulated drainage network, including all surface and subsurface stormwater infrastructure; however, a more simplified representation was utilized due to the nature of the study questions and the inherent uncertainty of long-term simulation modeling. Two subcatchments (named S008 and S010) were used to represent surface runoff to Outfall 008 and Outfall 010. The baseline model was configured with a detailed representation of stormwater infrastructure beginning with the ditch all the way to Outfall 010, and model scenarios for the diversion of subcatchment S008 to Outfall 010 also used detailed representations of treatment facilities and other infrastructure. Modeling results of Outfall 010 and the diversion of S008 to the S010 system are not reported in this summary as they do not impact the selection of sizing of the selected alternative.

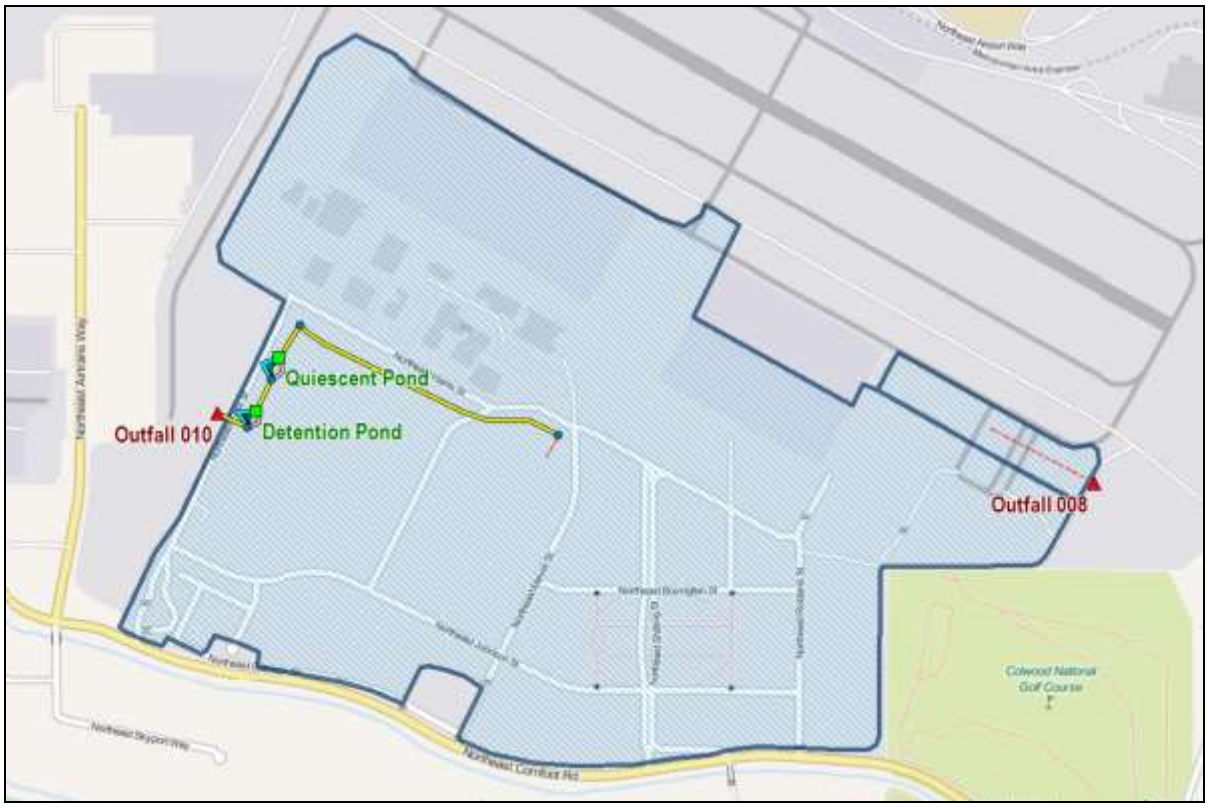

Figure 1: SWMM 5 Schematic for Baseline Model

Monitoring data for the pollutants of concern was available from September 1998 through February 2013 at both outfalls, so the model period of simulation was set to begin January 1997 and run continuously through February 2013. The simulation began prior to September 1998 in order to allow for a “spin-up” period; spin-up is commonly performed in watershed modeling to allow internal model variables (e.g., soil moisture, pollutant concentrations in ponds) to stabilize prior to performing comparisons of model predictions to monitoring data.

Simulation of hydrology and pollutant processes in SWMM 5 is largely driven by meteorological data, including rainfall and evapotranspiration (ET). The ability of a model to predict hydrologic response and pollutant generation, fate, and transport is strongly influenced by the accuracy and appropriate representation of meteorological data. High quality daily and hourly precipitation data were available from National Weather Service monitoring at Portland International Airport adjacent to the PANG Base. Daily precipitation provides a more accurate measure of total volume, while hourly precipitation provides the timing and intensity needed for stormwater modeling. As a result, the daily volume was disaggregated to hourly values, weighted by the hourly data. Daily ET was obtained from the U.S. Bureau of Reclamation AgriMet weather station network (http://www.usbr.gov/pn/agrimet/index.html), which calculates reference ET using measured air temperature, humidity, solar radiation, and wind. Values were averaged from two stations located about 20 miles from the PANG Base, one in Forest Grove, OR and one in Aurora, OR. A constant monthly coefficient of 0.8 was used within the model to translate ET from the reference crop alfalfa to managed lawn, based on guidance provided by AgriMet. Snowfall, snow packs, and snow melt were not simulated because the level of effort for

proper calibration would not have resulted in any appreciable gain in the model's predictive power to answer the study questions.

Key model parameters for hydrology and hydraulics were configured as follows:

- Subcatchments
    - Subcatchment area was calculated using Geospatial datasets supplemented by delineation information provided in previous studies. The subcatchment drainage area for S010 was about 229 acres, and S008 was 6.23 acres.
    - Impervious area was digitized from aerial photos for S008, with an estimated value of 35 percent. For S010, a value of 43 percent was used based on information contained within the 2012 Stormwater Pollution Control Plan developed as a component of the 2012 NPDES industrial stormwater discharge permit.
    - Default manning's N values from EPA SWMM 5 User's Manual (Rossman, 2010) for overland flow. Impervious depression storage for S008 was set at 0.05 inches. For S010, it was set slightly higher to 0.07 inches due to the presence of many flat roofs.
    - The *Percent Routed* parameter (a measure of impervious disconnection) was set to a low value of 15 percent for S010 based on an assumption that the majority of PANG Base impervious surfaces are routed directly to storm drainage systems. *Percent Routed* for S008 was set at 70 percent; while technically all impervious surface in this subcatchment is routed to grass before entering a culvert, some concentrated flow is discharged very near culvert entrances.
    - The Green-Ampt option was selected for surface infiltration. Parameters were set using guidance from Rossman (2010) and James et al. (2005); Hydrologic Soil Group (HSG) D was assumed based on local soil survey data (Green, 1983), and a soil texture of loam was assumed based on the geotechnical survey. The Infiltration Conductivity value was set to 0.03 in/hr reflecting poorly infiltrating HSG D soils; much of the site is composed of unconsolidated fill and soils are compacted from intensive development. It is important to note that recommended watershed modeling infiltration rates are much lower than those typically published for saturated hydraulic conductivity.
    - Aquifer-groundwater modeling was not enabled due to the complexity of the parameterization, which typically requires continuously monitored streamflow for a meaningful calibration. Soil wetting and drying followed default SWMM 5 behavior.
- Stormwater infrastructure
    - Infrastructure configuration was obtained from GIS layers and as-built drawings. Key parameters included invert elevations, pipe material and sizes, outlet structure configurations, and storage pond dimensions.
    - The length and cross-sectional dimension of the ditch was entered to account for ponding storage. Stage-area contours were specified for both the quiescent pond and the detention pond.

  - For the outlets, only the items limiting flow were included – the outflow pipes and the weirs. A flap gate was specified for the outflow pipe from the detention pond to Outfall 010.

- Water quality
  - Pollutant build-up parameters for TP, TSS, and total Zn were developed using the method of Butcher (2003) as applied to SWMM 5 (Tetra Tech, 2012), which translates Event Mean Concentrations (EMCs) to buildup parameters. EMCs were estimated from land use/pollutant data provided from monitoring in a watershed near Seattle, WA (Herrera, 2007). During calibration, the assumed pollutant EMCs were increased, though the EMCs remained within a reasonable range of the Seattle monitoring data. Final model annual loading rates also compared well to loading rates reported by Herrera.
  - The two washoff parameters (a coefficient and a power) became the primary parameters for calibrating water quality to monitoring data from Outfall 008, discussed below. Samples collected from Outfall 008 during storm events provided the best measure of land surface pollutant runoff, since travel time from the subcatchment to the outfall is very short and not complicated by treatment facilities. Land surface buildup and washoff parameters in S010 were assumed to be identical to those developed for S008.
  - Monitoring data from Outfall 010 is confounded by many factors, most importantly treatment that occurs in the two detention ponds. SWMM 5 pollutant treatment functions were developed to simulate the process of settling and decay occurring in the ponds over time. The functions included terms for a typical concentration (analogous to the median) and settling velocity/decay. The concentration terms were set equal to the median values from Outfall 010 monitoring data, and the settling velocity/decay terms were used to refine the calibration.

- Model Assumptions and Limitations
  - The outlets of the quiescent pond and detention ponds above Outfall 010 are actively managed during the winter seasons as part of a NPDES wastewater discharge permit for BOD associated with de-icing operations at the facility. It was not possible to reflect the active management system within the two ponds.
  - The detention pond downstream of S010, owned by the Port of Portland, results in a variable backwater effect on the outlet of the detention pond upstream of S010. No data was available to describe the variability of this water level and it was not possible to project such variability in the model. A static downstream condition at this location was assumed to result in about 3 feet of permanently ponded water in the detention pond and about 2.5 feet in the quiescent pond. As such, the water level in both ponds varied only as a function of stormwater inflow, with flow transferred via the outlet culverts.
  - There is an active oil/water separator system and suspended fabric mats system incorporated into the upper detention (quiescent) pond at S010. In addition aeration bubblers are installed in both the upper (quiescent) and lower detention ponds at S010. These systems are intended to enhance the pollutant removal performance of the ponds

as it pertains to oil & grease and BOD. The function of these systems was not directly incorporated into the SWMM 5 model although their impact as it pertains to modeled constituents may be indirectly evaluated as part of the model calibration.

- The model does not incorporate the impact of the proposed relining of the aging corrugated metal pipe (CMP) upstream of Outfall 008.

iii. Calibration of Water Quality Performance

The goal of the water quality calibration was for simulated concentrations to match the overall distribution of observed monitoring data, especially with respect to the percentages of concentration exceedances. Given the stochastic nature of pollutant loading and transport mechanisms (as well as limited knowledge about the exact sources of the pollutants at the PANG Base), it is not reasonable to produce point-in-time predictions that match observed values. Rather, replicating the pattern of concentrations provides evidence that the model is *behaving* like the system.

To that end, plots were developed showing the percentiles of observed concentrations for each of the three pollutants at each of the two outfalls. Percentiles were calculated in increments of 5 from 0 to 100 percent. Multiple water quality simulation runs were performed, and calibration parameters were adjusted incrementally until a good fit was achieved between the observed and simulated concentration percentile distributions. Model results were processed as follows:

- Model output was generated on an hourly basis for the entire simulation period.
- Daily average simulated concentrations were calculated and used for the comparison to observed values. Methods differed for each outfall.
    - For Outfall 008, the average daily concentration was calculated using a flow-weighting approach. The highest hourly concentrations during a storm event were usually associated with the highest flows, so flow-weighting greatly reduced bias from over-emphasizing low concentrations during low flows.
    - PANG Base staff advised that samples at Outfall 010 were often collected when stored runoff was discharged some period of time after a storm event. Since the active management of the ponds could not be simulated, outflow in the model occurs only during storm events and many samples were collected when the model did not simulate outflow from the detention pond. To address this limitation, the daily average concentration within the detention pond was used to represent daily conditions.
- Observed values were “matched” with daily average simulated concentrations occurring on the same date as the monitoring event (referred to as “paired” simulated values). The simulated percentile distributions were calculated from the paired simulated concentrations, rather than the full distribution of discharge events. This approach allowed for evaluating calibration model performance strictly on days with monitoring data. Larger storms tended to be monitored, so the simulated percentile distribution was built from storms of the same magnitude.

Calibration was performed first for Outfall 008. Plots of concentration versus percentile for observed and paired simulated values are shown for TP, TSS, and total zinc respectively in **Figure 2**, **Figure 3**, and **Figure 4**. The highest percentiles were omitted in some plots to allow display of the distributions

in the region where exceedances occur, shown as a dashed red line. Focus was placed on matching the percentage of observed exceedances, which is expressed in the plots as the lines crossing each other at the threshold. The land surface buildup and washoff parameters used for subcatchment S008 were transferred to subcatchment S010. A second calibration was performed for monitoring data at Outfall 010 but is not included in this report since these results and calibration do not affect the design or sizing of the proposed improvements. The performance of the water quality calibration can be assessed as excellent, based on the goals of replicating the distribution of storm event concentrations compared to observed monitoring data. The SWMM 5 model is therefore appropriate to use for assessing the equivalent mass load of pollutants from the Outfall 008 watershed.

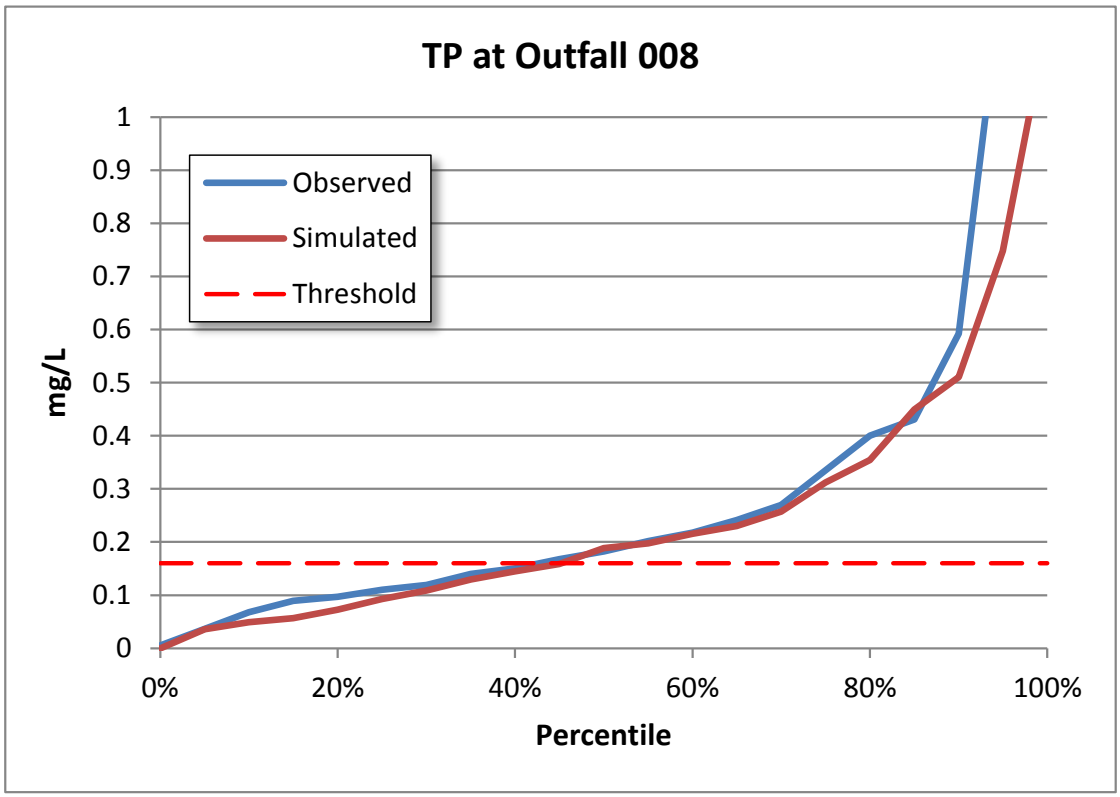

Figure 2: Percentile Distribution of Observed and Paired Simulated TP at Outfall 008

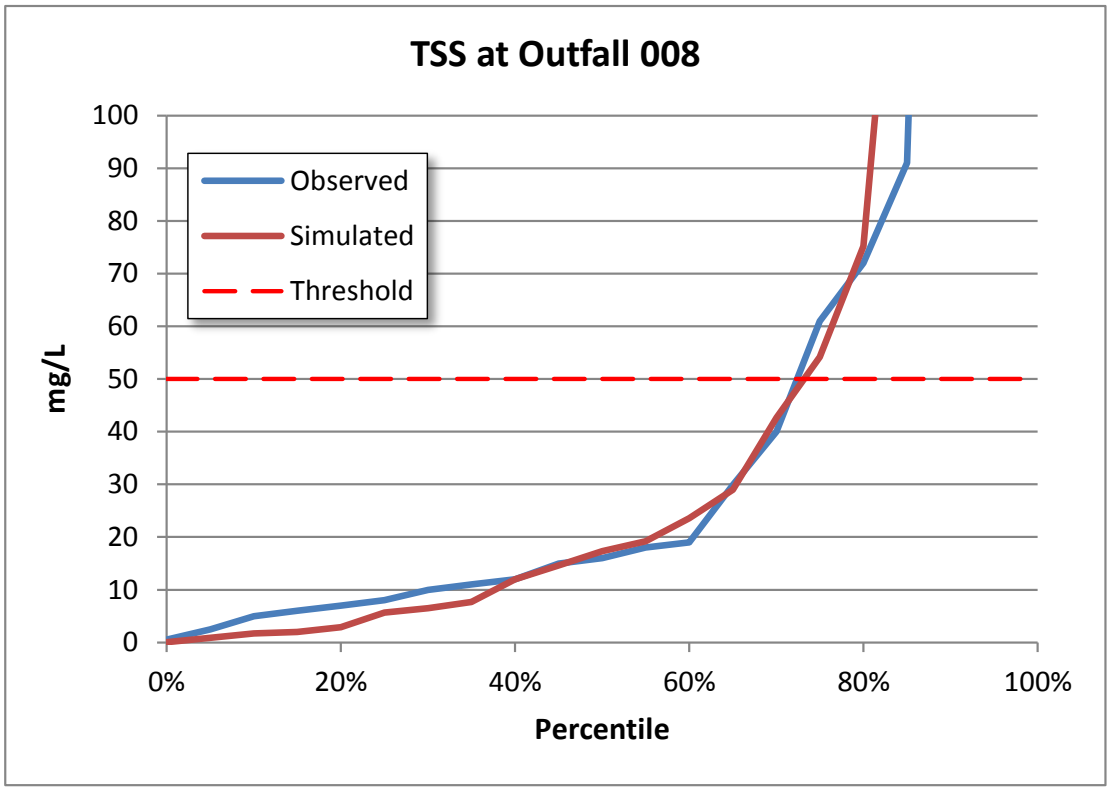

Figure 3: Percentile Distribution of Observed and Paired Simulated TSS at Outfall 008

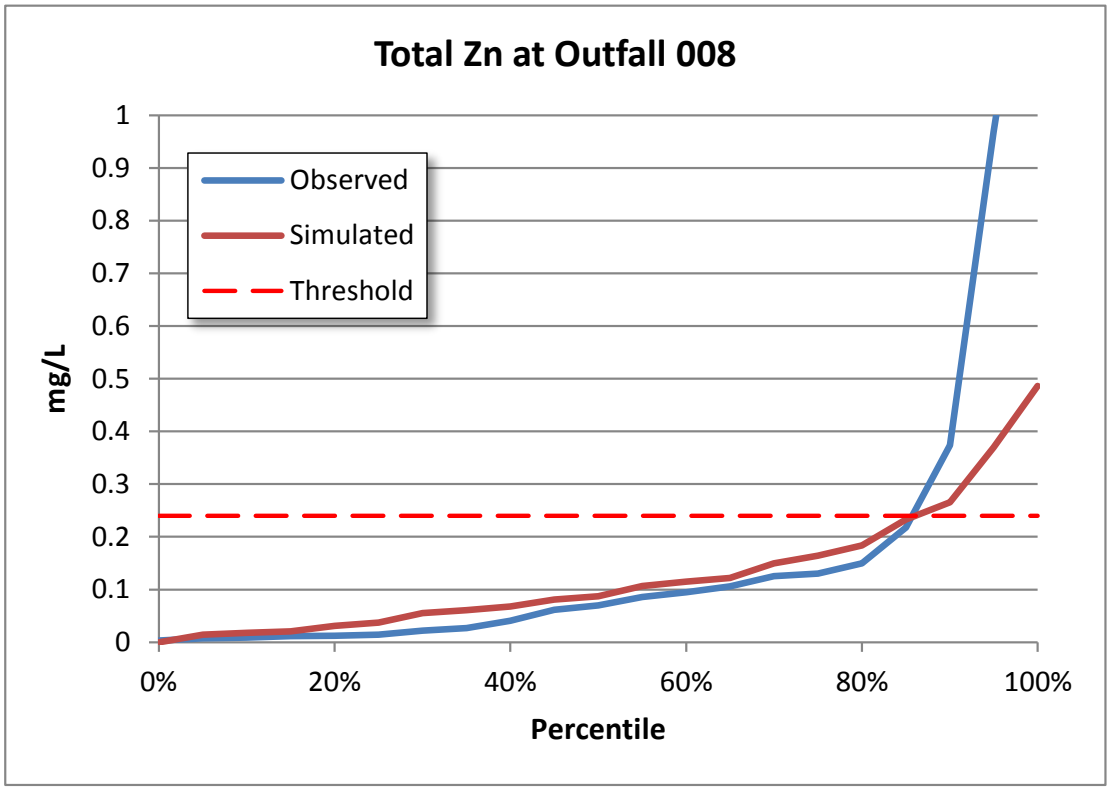

Figure 4: Percentile Distribution of Observed and Paired Simulated Total Zinc at Outfall 008

(d) Selected Alternative

i. Alternatives Analysis

A variety of different treatment options with varying design configurations were presented in the Type A-1 Concept Development Submittal including a number of treatment configurations and geometries. The basic geometric and structural assumptions used to model the treatment option scenarios were based on the Portland Stormwater Management Manual, 2008. The initial site layout for the treatment scenarios was based on the site survey collected by KPFF Consultants on May 22, 2013, and the proposed design in the Outfall 008 feasibility study prepared by TEC, Inc.

The in-situ infiltration rate used for each treatment scenario were based on the geotechnical study that reported falling head infiltration rates of 0 and 0.6 inches per hour at four and five foot depths BGS in the proposed treatment area. A safety factor of 2, in accordance with City of Portland design standards for infiltration basins, was applied to the average observed rate of 0.3 inches per hour resulting in a conductivity of 0.15 inches per hour used in the model simulations. Additional information on these scenarios was provided in the Type A-1 Concept Development Submittal.

ii. Selected Alternative- Infiltration Basin

The selected scenario will consist of the diversion of runoff from Outfall 008 to an infiltration basin constructed in a grassed field southwest of the Building 210 – Alert Hangar. Infiltration basins are flat-bottomed, shallow depressions used to detain stormwater and allow pollutants to settle or filter out while water infiltrates into the ground or slowly drains through a low-flow orifice. The alternative selected during the Type A-1 Concept Development Meeting consists of an infiltration basin partially filled with rip rap to avoid surface ponding of water which may serve as an attractant to waterfowl and other wildlife deleterious to adjacent aviation activities. The dimensions of the infiltration basin are a bottom footprint of 60 feet X 60 feet with a depth approximately 5 feet below existing ground surface. The bottom of the basin is designed with a flat slope to maximize the area of infiltration. The normal detention depth is 3 feet, with a 4” drawdown orifice located 1 foot above the bottom of the basin. The drawdown orifice will be located outlet structure topped with a slot weir at an elevation approximately 4 feet above the bottom of the basin. The rock-lined side slopes of the infiltration basin will be 1.5:1.

Table 1 Infiltration basin configuration

Scenario	Bottom Width (feet)	Bottom Length (feet)	Detention Depth (feet)	Retention Depth (feet)
Infiltration Basin	60	60	3	1

(e) Underground Injection Control (UIC) considerations

The selected alternative described above utilizes the infiltration capacity of the in-situ soil below the infiltration basin to reduce the total runoff volume. Systems which dispose of stormwater in this manner may be considered UIC systems subject to certain federal and state regulations. As such, a determination request was submitted to the Oregon Department of Environmental Quality. Clarification was obtained from the DEQ that the infiltration basin proposed will not be classified as UIC The letter is included as **Appendix B.**

(f) Results

i. Pollutant Reduction

The equivalent mass load at Outfall 008 for each of the three benchmark constituents of concern were computed using the results of the SWMM simulation. The analysis was completed using methods described by Washington Dept. of Ecology for the period of interest (January 1, 1998-February 28, 2013). The mass equivalent load was determined by applying the benchmark threshold to the total runoff volume. The existing conditions mass load was determined by sum of the product of the hourly pollutant concentration and hourly runoff volume from the calibrated existing conditions SWMM model. Results of the equivalent mass load and existing conditions mass load are detailed in Table 2.

Table 2 Mass load analysis

Scenario	Total Suspended Solids	Total Phosphorus	Zinc
Benchmark threshold (mg/L)	50	0.16	0.24
Annual mass equivalent 1998-2013 (kg/yr)	299	0.96	1.44
Ex. conditions annual mass load 1998-2013 (kg/yr)	504	1.67	0.83
% volume reduction required	41%	43%	NA

The mass load equivalence analysis summarized in Table 2 above reveals that a 43 % reduction in total runoff volume from the S008 discharge is required to comply with permit requirements discussed in Section II.A.1.a above.

ii. Runoff Quantity Reduction

Model outputs for existing conditions and the selected alternative were evaluated for total discharge volume throughout the model period (Jan 1, 1998- February 28, 2013) Total discharge was computed as the total runoff volume (cu ft) from S008. For the selected alternative the discharge volume was computed at the outlet of the proposed infiltration basin and complies with the volume reduction requirements necessary to achieve an equivalent mass load to benchmark pollutant levels. Comparison of these two runoff volume computations is detailed in Table 3.

Table 3 Modeled impact of new development proposed with Area S008

Model Scenario	Total Discharge Volume 1998-2012, cu. Ft.
Existing Conditions	3,204,462
Selected Alternative	1,677,800
Reduction in Discharge Volume	47.6%

(2) Piping Infrastructure

(a) Pipe Lining

The Outfall 008 storm pipe is a 24-inch corrugated metal pipe. The pipe has visible surface corrosion which contributes to metal concentrations in the runoff. A cured-in-place pipe (CIPP) lining will be installed the full length of the pipe to prevent leaching of metals into the runoff. The lining will provide a tight barrier which does not significantly reduce the diameter of the pipe, provides a smoother interior surface, and increased structural integrity.

(b) Flow Redirection

iii. Runoff Modeling

Outfall 008 is approximately 6.23 acres. There is a planned development within S008 which will result in an increase of impervious area. For proper pump station sizing, this additional impervious area was included for a total of 3.0 acres of impervious area and 3.23 acres of pervious area within the basin.

NRCS Soil Survey classifies site soils as Pilchuck-Urban land complex, 0 to 3 percent slopes, which are classified as a Hydrologic Soil Group (HSG) A. However, the site has been filled as part of development and is likely a less permeable HSG. For determination of peak runoff rates and volumes, a HSG C is assumed for pervious areas. Pervious areas are grass in good condition.

Santa Barbara Unit Hydrograph runoff modeling was used to determine peak runoff rates and volumes for the 10-year and 100-year 24-hour Type IA rainfall distribution for the flow redirection.

Table 4 24-hour Rainfall Depths

Recurrence Interval (years)	Total Precipitation Depth (inches)
10	3.45
100	4.5

Table 5 Runoff Peak Rates and Volumes

Recurrence Interval (years)	Peak Runoff Rate (cfs)	Runoff Volume (cf)
10	2.70	49,614
100	3.90	70,044

iv. Pump Station and Forcemain

The nearest Outfall 010 drainage piping is at a higher elevation than Outfall 008 drainage piping. In redirecting the flow from Outfall 008 to Outfall 010, a pump station will need to lift the stormwater runoff to a higher elevation and the existing gravity discharge from Outfall 008 will be abandoned.

A manhole will be installed on the existing 24" pipe prior to discharge to the Port drainage system and a gravity pipe will route the Outfall 008 drainage to the pump station. The pump station will be located to the south, outside the taxiway clearance area. The pipe downstream will be removed and manhole connection plugged.

Disconnecting the gravity discharge at Outfall 008 will create an enclosed depression within Outfall 008. Typically, drainage infrastructure is designed to convey the 10-year design storm. With an enclosed depression, the pump will be designed to convey the 100-year design storm such that there will be no detrimental impacts to existing infrastructure and airfield safety.

To accommodate the multiple storm events and to provide redundancy, two 10-hp, 800-gpm submersible pumps are provided. There is limited storage capacity within the basin as ponding water is not desirable. The available storage is limited to the wet well structure and the existing piping network. Surface ponding would only be allowed for short durations due to wildlife attractant concerns and a large underground storage tank would be cost-prohibitive.

The wet well structure and pump on-off elevations have been optimized for storage and pump operations. The pumps on-off elevations are designed to minimize pump starts and meet minimum run-time requirements. For the 10-year, 24-hour storm event, only one pump will be needed and will cycle on and off for an average of 1.6 starts per hour and a maximum of 5 starts per hour. For the 100-year 24-hour storm event, one pump will cycle on and off for an average of 1.7 starts per hour, a maximum of less than 5 starts per hour, and the second pump running only during the peak. The second pump on elevation is set to activate before surface ponding results from backwater conditions.. The pumps will be controlled to alternate run times.

The wet well structure is a round 8-foot diameter precast concrete manhole. A trash rack will be provided to prevent trash from entering the pumps. The pumps will discharge to 8" pipes with check-valves inside the structure. The pipes will extend outside the structure, valves installed on each pipe with valve extensions to ground elevation, then connect to a 10" HDPE forcemain extending to the infiltration basin.

Electrical service will be provided from the existing transformer (T245) near Building 210. New taps off the existing 4 hole blade secondary bushings will provide a new secondary circuit for pump station power. This circuit will serve: one new class 200 utility grade kWH meter, one new 100A disconnect

switch, and one new control panel all installed adjacent to the pump station. The existing transformer is a 120/208V, 300kVA unit which was designed to meet the service demands of Building 210. Conversion of the building's service to generator power reduced the power demands from this transformer. The transformer has adequate capacity for the additional loads of the new service connection for the pump station. No backup power will be provided. In the event of power outage, an emergency flashing light mounted to the control panel will turn on. No other form of emergency notification is proposed.

In the event of loss of power to the pump station, a temporary pump would need to be provided. If there is rain event during that outage, and prior to implementation of the temporary backup, water will backup to the ground surface and overflow to the east, across the perimeter road and into the abandoned Outfall 008 drainage ditch until power is restored to the pump station. No ponding of airfield pavements is expected.

It is assumed that pump station preventative maintenance measures will be performed during the dry season and no accommodations for supplemental bypass pumping are included.

(c) Reconnection to Main Line

An overflow pipe from the infiltration basin outlet structure will extend to the nearest Outfall 010 piping at a new manhole.

B. CONSTRUCTION ENVIRONMENTAL COMPLIANCE

Although it is not expected that the project will disturb greater than 1ac, the Contract will require the Contractor to obtaina NDPES 1200-C Permit from the DEQ. Contract specifications will require erosion control, grading, and restoration will be performed per state and local erosion control regulations. Dewatering of excavations will be required for construction and must comply with erosion control regulations.

There are no known areas of soil contamination within the project site. Excavated material will be hauled off-site by the Contractor and it is expected that no special disposal will be required.

C. APPLICABLE CODES & STANDARDS

Uniform Facility Criteria (UFC)

UFC 3-230-01: Surface Drainage Design – Change 1, September 29, 2006.

UFC 3-550-01: Exterior Electrical Power Distribution - Change 1, July 1, 2012

UFC 3-560-01: Electrical Safety, O&M - Change 4, May 1, 2012

Air National Guard Engineering Technical Letters (ANG-ETL)

ANG-ETL 01-1-1, Air National Guard Design Policy - March, 2004

V. SPECIFICATIONS

Type B-1 CDDM Specifications included under a separate cover.

VI. PROJECT SCHEDULE

- TYPE A-1 CONCEPT DEVELOPMENT MEETING: 6/19/13
- TYPE A-2 NTP AND PANG REVIEW COMMENTS TO MEAD & HUNT: 7/11/13
- TYPE A-2 SUBMITTAL TO PANG: 7/31/13
- TYPE B-1 NTP AND PANG REVIEW COMMENTS TO MEAD & HUNT: 12/23/13
- TYPE B-1 SUBMITTAL TO PANG: 1/31/14
- TYPE B-2 NTP AND PANG REVIEW COMMENTS TO MEAD & HUNT: 2/14/14
- TYPE B-2 SUBMITTAL TO PANG: 3/17/14
- TYPE B-3 NTP AND PANG REVIEW COMMENTS TO MEAD & HUNT: 4/1/14
- TYPE B-3 SUBMITTAL TO PANG: 4/16/14
- BID OPENING: 7/2/14
- CONSTRUCTION: 8/4/14-10/31/14

VII. CITATIONS

Butcher, J.B. 2003. Buildup, washoff, and event mean concentrations. Journal of the American Water Resources Association, 39(6): 1521-1528.

Green, L.G. 1983. Soil Survey of Multnomah County, Oregon. United States Department of Agriculture, Soil Conservation Service, and Forest Service, in cooperation with Oregon Agricultural Experiment Station.

Herrera. 2007. Water Quality Statistical and Pollutant Loadings Analysis, Green-Duwamish Watershed Water Quality Assessment. Prepared for King County Dept. of Natural Resources and Parks by Herrera Environmental Consultants, Inc., Seattle, WA.

James, W., W.C. Huber, R.E. Dickinson, R.E. Pitt, R.C. James, L.A. Roesner, and J.A. Aldrich. 2005. Water Systems Models: User's Guide to SWMM, 10th edition. Computational Hydraulics International. Guelph, Ontario. 802 pages.

Rossman, L.A. 2010. Stormwater Management Model User's Manual Version 5.0. EPA/600/R-05/040. U.S. Environmental Protection Agency, Water Supply and Water Resources Division, National Risk Management Research Laboratory. Cincinnati, OH.

TEC, Inc. 2012. Oregon Air National Guard Outfall 008 Stormwater Treatment Study. Prepared for Oregon Air National Guard.

Tetra Tech. 2012. Third Fork Creek Watershed Modeling Report. Prepared for City of Durham Stormwater Services.

Appendix A – Type A-2 Concept Review Comments/Responses

PROJECT DESCRIPTION:	PHASE:	DATE:
Outfall 008	A-2	12 August 2013
LOCATION:	**PROJECT NUMBER:**	**FISCAL YEAR:**
PORTLAND ANG BASE, PORTLAND, OREGON	TQKD132008	2013
NAME OF REVIEWER:	**REVIEWING AGENCY:**	**TELEPHONE:**
Harry Danberg	142 CES	503-335-4470

COMMENT NUMBER	COMMENT	A-E RESPONSE
Inlet Settling Basin	Past design discussions (as noted in the Type-A-1 Meeting minutes) stressed the importance of pretreatment measures to settle out solids prior to infiltration to prevent infiltration failures. Please include the details of these measures in the Section 2, part A (1) (d) ii discussion.	Inlet structure contains baffle and sump for pre-treatment.
1200C Permit	Considering that the area of disturbance includes all staging area for materials, excavated dirt piles, working area of all heavy equipment, the length of pipe that need to be installed to connect Outfall 008 to Outfall 010, and the areas that require excavating, please verify the impacted area and provide a detailed determination if a 1200-C permit is necessary.	Permit requirements included.

NAME OF REVIEWER:	REVIEWING AGENCY:	TELEPHONE:
Aviva Johnston	142 Env	503-335-4470

COMMENT NUMBER	COMMENT	A-E RESPONSE
1	Somewhere in all this verbiage and in verbiage to come, I would like to see specific reference to the permit requirement that prompted the LID infiltration project for outfall 008. Page 7 . Item 4. C of the permit specifies the requirements to renew the permit (1200-COLS permit that expired August 31, 2011) for facilities that exceeded benchmark(s) base on the 4th year Benchmark Evaluation pursuant to Schedule A. The owner operator must either: 1) Include additional treatment measures in the SWPCP, which may be a combination of source control and treatment measures, with the goal of achieving the benchmark(s) in Schedule A.9 of the permit in future discharges. These treatment measures must include the rationale for their selection and the projected reduction of pollutant concentration(s). A licensed professional engineer (PE) or certified engineering geologist (CEG) must	Addressed.

	design and stamp the portion of the SWPCP that addresses the treatment measures. 2) Or if the owner /operator does not wish to comply with the above option, they may implement volume reduction measures such as a low impact development practice, that have or will result in reduction of mass load pollutants in the discharge. The permit application's must include the data and analysis to support this determination, including the description of the measure(s), date(s), implementation to be expected and a mass load analysis. At the first A-1 meeting , the project driver came to light after laborious discussion. The driver needs to be upfront and foremost.	
2	Your report III.B.2 says FILL INFILTRATION PONDING ZONE WITH WATER. Did you mean to say ROCK instead of WATER (to prevent ponding)?	Addressed.

NAME OF REVIEWER:	**REVIEWING AGENCY:**	**TELEPHONE:**
Not provided.	Port of Portland	Not provided.

COMMENT NUMBER	**COMMENT**	**A-E RESPONSE**
1	Section 9.4.1 of the lease states the following "Underground Injection Controls. Construction or use of any kind of an underground injection control ("UIC") system, including dry wells, storm water injection wells, or subsurface fluid distribution systems such as french drains, sumps and drainfields, is prohibited without prior written approval of Port, which approval will not be unreasonably withheld. All approved UICs must be permitted and registered in accordance with applicable environmental law.	Received determination from DEQ that facility is not classified as a UIC.
2	Page 14 of the design document states the following "(e) Underground Injection Criteria (UIC) considerations - The selected alternative described above utilizes the infiltration capacity of the in-situ soil below the infiltration basin to reduce the total runoff volume. Systems which dispose of stormwater in this manner may be considered underground Injection Control (UIC) systems subject to certain federal and state regulations. The treatment alternative selected meets the criteria for a UIC classified as "Permit-by-Rule" (OAR 340-044-0018(3))."	Received determination from DEQ that facility is not classified as a UIC.
3	Over the past 10 years the Port has made an effort to decommission all UIC systems on our properties. The UIC system that is being proposed will have to be formally approved by the Port for inclusion as part of the project. More information regarding the proposed UIC system and possible alternatives will need to be submitted for the Port's consideration. If a reasonable alternative is identified than approval of a UIC system will not be granted.	Received determination from DEQ that facility is not classified as a UIC.

4	An additional item that needs to be addressed in regards to the possible UIC/infiltration basin is as follows The UIC/infiltration basin that is being recommended for flow diverted from Outfall 008 prior to discharge into the drainage line flowing to existing Outfall 010. The geotech report indicates an infiltration rate of 0-0.6 in/hr at a depth of 4-5 feet. Even with the additional safety factor, this does not provide adequate drainage per the City's Stormwater management manual for an infiltration basin. Confirm capacity and retention time for UIC/ infiltration basin, as the potential result could be standing water (they have recommended rock/rip rap to minimize the impact, which is good, but still does not address the standing water issue), for an unspecified length of time.	Received determination from DEQ that facility is not classified as a UIC. The basin outlet structure includes a 4" drawdown orifice located one foot above the bottom of the basin.
5	The Guard will need to be responsible to maintain the all stormwater feature so that they do not support any emergent vegetation. Any basin design needs to conform with FAA guidance found in AC 150/5200-33, Hazardous Wildlife Attractants on or Near Airports, Section 2- 3, Water Management Facilities and ORS 836.623, Local Compatibility and Safety Requirements (http://www.oregonlaws.org/ors/836.623).	The outlet structure has been designed to provide for basin drawdown such that no standing water will be present within 24-hours after a storm event.
6	Provide a detail for abandonment of the pipe downstream of the proposed pump station. Will this be plugged/grouted at the downstream (Port) manhole?	The pipe will be removed and the pipe opening plugged at the manhole with concrete.
7	Confirm size and capacity of the outlet pipe connecting from the UIC/infiltration basin to the outfall 010 line.	The outlet structure will have a 10" round discharge pipe @0.75% slope.
8	Additional review recommended prior to final approval, as level of detail provided is enough only to allow conceptual level review at this time.	PANG to coordinate reviews with Port.
9	Please provide information relating to what happens if there is a power failure that affects the collection sump and force main? Could this impact PDX operations?	In the event of loss of power to the pump station, a temporary pump would need to be provided. If there is rain event during that outage, and prior to implementation of the temporary backup, water will backup to the ground surface and overflow to the east, across the perimeter road and into the abandoned Outfall 008 drainage ditch until power is restored to the pump station. No ponding of airfield pavements is expected.

10	During construction soil removed as part of this project needs to be properly managed. If contamination is encountered during this work, the Port needs to be notified	Contract documents contain provisions for Government notification the event of Contractor encountering potentially contaminated soils.
11	The Guard will be responsible for sampling the solids in the line they are disconnecting from our (basin 7) system. The Port further requires the Guard to provide documentation of the inspection and clean-out of the line they are abandoning	PANG to provide inspection reports upon removal of pipe and plugging of manhole.

Appendix B – DEQ UIC Determination Letter

Oregon

John A. Kitzhaber, MD, Governor

Department of Environmental Quality
Headquarters
811 SW Sixth Avenue
Portland, OR 97204-1390
(503) 229-5696
FAX (503) 229-6124
TTY 711

December 11, 2013

Jonathan M. Corrigan, Lt, ORANG
Deputy Base Civil Engineer
142d Civil Engineer Squadron
6801 NE Cornfoot Road
Portland, OR 97218-2797

RE: UIC Determination Request / 142nd Civil Engineering Squadron
6801 NE Cornfoot Road Portland, OR 97218

Dear Lieutenant Corrigan,

At the request of Kari Nichols of Mead & Hunt, Inc., this letter has been prepared clarifying why the detention basin at 6801 NE Cornfoot Road, Portland, Oregon has not been determined to be an underground injection control (UIC) system by the Oregon Department of Environmental Quality (DEQ). To clarify our responses, I have included Kari's questions and the DEQ's responses:

Q: I am looking for clarification on OARS 340-044 and a determination if this facility would be classified as a UIC as currently designed.

A: It appears from the design that stormwater enters the basin at the surface through a weir structure—not through a subsurface pipe or distribution system. Assuming the detention basin is constructed as designed it will be wider than it is deep (60 feet wide, 4 feet deep). In accordance with OAR 340-044-0005 (51), the infiltration basin would not be classified as a UIC system.

Q: If the design is not considered a UIC, would you please provide direction on what features or characteristics should be avoided as we move into final design to prevent a UIC classification.

A: In order to continue to ensure the design is not considered a UIC system, do not design a detention basin or trench that is deeper than it is wide. Do not include perforated pipes, drain tiles or other similar mechanisms that distribute fluids below the ground surface in your design. A design feature that could be *included* and further prevent a UIC classification would be the planting of vegetation in the basin.

Q: Lastly, please provide guidance on specific requirements for separation with groundwater (average and seasonal high) we need to consider moving into final design to avoid a UIC classification.

A: Since the detention basin does not appear to be a UIC system, separation requirements from the infiltration basin to seasonal high groundwater do not apply from a UIC standpoint. However, generally speaking, various DEQ programs recommend or require roughly 4 to 10 feet of vertical separation (vadose zone) to the groundwater table, but this is not a strict UIC rule requirement. Some vertical separation must be maintained to avoid defining the structure as waters of the state [ORS 468B.005(10)].

Please feel free to let us know if you have any further questions at this time.

Sincerely,

Derek Sandoz
UIC Program Coordinator
sandoz.derek@deq.state.or.us

cc: Kari Nichols, Mead & Hunt, Inc.
Ron Doughten, DEQ NWR

Project Manual
For
Portland Air National Guard
Repair Stormwater Outfall 008
Project No. TQKD 132008

Mead & Hunt, Inc.
3142100-130429.01

Prepared for:

Portland Air National Guard Base
Portland, Oregon

Prepared by:

Type B-1 CDDM Submittal

January 31, 2014

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SECTION 01 11 00

SUMMARY OF WORK
08/11

PART 1 GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

1.1.1 Project Description

The work includes but is not limited to: a prepackaged stormwater lift station with control panel, forcemain piping, detention/infiltration basin, gravity storm sewer, and cured-in-place pipe lining. and incidental related work.

1.1.2 Location

The work shall be located at the Portland Air National Guard Base in Portland, Oregon, approximately as indicated. The exact location will be shown by the Contracting Officer.

1.2 OCCUPANCY OF PREMISES

Adjacent building(s) and Site will be occupied during performance of work under this Contract.

Before work is started, the Contractor shall arrange with the Contracting Officer a sequence of procedure, means of access, space for storage of materials and equipment, and use of approaches, corridors, and stairways.

1.3 EXISTING WORK

In addition to "FAR 52.236-9, Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements":

a. Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.

b. Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work shall be in a condition equal to or better than that which existed before new work started.

1.4 ON-SITE PERMITS

Notify the Contracting Officer at least 72 hours prior to starting excavation work. The Contractor must obtain from the Contracting Officer a completed AF 103 Form. The Contractor must retain this form until completion of work. Contractor is responsible for marking and verifying all utilities not marked.

1.5 LOCATION OF UNDERGROUND UTILITIES

The Contractor shall scan the construction site with electromagnetic or sonic equipment, and mark the surface of the ground or paved surface where existing underground utilities are discovered. Verify the elevations of

existing piping, utilities,and any type of underground or encased obstruction not indicated to be specified or removed but indicated or discovered during scanning in locations to be traversed by piping, ducts, and other work to be conducted or installed. Verify elevations before installing new work closer than nearest manhole or other structure at which an adjustment in grade can be made.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 14 00

WORK RESTRICTIONS
11/11

PART 1 GENERAL

1.1 SPECIAL SCHEDULING REQUIREMENTS

a. The adjacent Building 210 will remain in operation during the entire construction period. The Contractor must conduct his operations so as to cause the least possible interference with normal operations of the adjacent Buidings.

b. Permission to interrupt any roads, taxiways and/or utility service must be requested in writing a minimum of 21 calendar days prior to the desired date of interruption.

1.2 CONTRACTOR ACCESS AND USE OF PREMISES

1.2.1 Installation Regulations

Ensure that Contractor personnel employed on the Installation become familiar with and obey regulations including safety, fire, traffic and security regulations. Keep within the limits of the work and avenues of ingress and egress. Wear hard hats in designated areas. Do not enter any restricted areas unless required to do so and until cleared for such entry. Mark Contractor equipment for identification.

1.2.1.1 Subcontractors and Personnel Contacts

Provide a list of contact personnel of the Contractor and subcontractors including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

1.2.1.2 Identification Badges and Installation Access

Application for and use of badges will be as directed.

1.2.1.3 Personnel Entry Approval

Failure to obtain entry approval will not affect the contract price or time of completion.

1.2.1.4 No Smoking Policy

Smoking is prohibited within and outside of all buildings except in designated smoking areas in accordance with installation regulations. This applies to existing buildings, buildings under construction and buildings under renovation. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines. The Contracting Officer will identify designated smoking areas.

1.2.2 Working Hours

Regular working hours are between the hours of 7:00a.m. and 4:00p.m., Monday through Friday, excluding Government holidays.

1.2.3 Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. The Contractor shall provide justification for this work outside of regular working hours. If approved by the Contracting Officer, the contractor may be required to compensate the government for all additional personnel or services it must perform to accommodate such work, unless such work is requried for utility cutovers. Make application 15 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress

1.2.4 Occupied Building[s]

The Contractor shall be working around existing buildings which are occupied. Do not enter the buildings without prior approval of the Contracting Officer.

The existing buildings and their contents must be kept secure at all times. Provide temporary closures as required to maintain security as directed by the Contracting Officer.

1.2.5 Utility Cutovers and Interruptions

a. Coordinate utility cutovers and interruptions with the Contracting Officer. This may require work after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required in the paragraph "Work Outside Regular Hours."

b. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.

c. Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, and fire alarm, are considered utility cutovers pursuant to the paragraph entitled "Work Outside Regular Hours."

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS
11/11

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Progress and completion pictures; G

1.2 PROGRESS AND COMPLETION PICTURES

Photographically document site conditions prior to start of construction operations. Provide monthly, and within one month of the completion of work, digital photographs, showing the sequence and progress of work. Take a minimum of 20 digital photographs each week throughout the entire project from a minimum of ten views. Submit a view location sketch indicating points of view. Submit with the monthly invoice on a CD-R, cumulative of all photos to date. Indicate photographs demonstrating environmental procedures. Photographs for each month shall be in a separate monthly directory and each file shall be named to indicate its location on the view location sketch. The view location sketch shall also be provided on the CD as digital file. All file names shall include a date designator]. Cross reference submittals in the appropriate daily report. Photographs shall be provided for unrestricted use by the Government.

1.3 MINIMUM INSURANCE REQUIREMENTS

Procure and maintain during the entire period of performance under this contract the following minimum insurance coverage:

a. Comprehensive general liability: $500,000 per occurrence

b. Automobile liability: $200,000 per person, $500,000 per occurrence for bodily injury, $20,000 per occurrence for property damage

c. Workmen's compensation as required by Federal and State workers' compensation and occupational disease laws.

d. Employer's liability coverage of $100,000, except in States where workers compensation may not be written by private carriers,

e. Others as required by Solicitation.

1.4 SUPERVISION

Have at least one qualified supervisor capable of reading, writing, and conversing fluently in the English language on the job site during working

hours. In addition, if a Quality Control (QC) representative is required on the contract, then that individual shall also have fluent English communication skills.

1.5 PRECONSTRUCTION CONFERENCE

After award of the contract but prior to commencement of any work at the site, meet with the Contracting Officer to discuss and develop a mutual understanding relative to the administration of the safety program, preparation of the schedule of prices or earned value report, shop drawings, and other submittals, scheduling programming, prosecution of the work, and clear expectations of the "Interim DD Form 1354" Submittal. Major subcontractors who will engage in the work shall also attend.

1.6 AVAILABILITY OF CADD DRAWING FILES

After award and upon request, the electronic "Computer-Aided Drafting and Design (CADD)" drawing files will only be made available to the Contractor for use in preparation of construction data related to the referenced contract subject to the following terms and conditions.

Data contained on these electronic files shall not be used for any purpose other than as a convenience in the preparation of construction data for the referenced project. Any other use or reuse shall be at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor shall make no claim and waives to the fullest extent permitted by law, any claim or cause of action of any nature against the Government, its agents or sub consultants that may arise out of or in connection with the use of these electronic files. The Contractor shall, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic CADD drawing files are not construction documents. Differences may exist between the CADD files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic CADD files, nor does it make representation to the compatibility of these files with the Contractors hardware or software. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished CADD files, the signed and sealed construction documents shall govern. The Contractor is responsible for determining if any conflict exists. Use of these CADD files does not relieve the Contractor of duty to fully comply with the contract documents, including and without limitation, the need to check, confirm and coordinate the work of all contractors for the project.

If the Contractor uses, duplicates and/or modifies these electronic CADD files for use in producing construction drawings and data related to this contract, all previous indicia of ownership (seals, logos, signatures, initials and dates) shall be removed.

1.7 ELECTRONIC MAIL (E-MAIL) ADDRESS

The Contractor shall establish and maintain electronic mail (e-mail) capability along with the capability to open various electronic attachments in Microsoft, Adobe Acrobat, and other similar formats. Within 10 days after contract award, the Contractor shall provide the

Contracting Officer a single (only one) e-mail address for electronic communications from the Contracting Officer related to this contract including, but not limited to contract documents, invoice information, request for proposals, and other correspondence. The Contracting Officer may also use email to notify the Contractor of base access conditions when emergency conditions warrant, such as hurricanes, terrorist threats, etc. Multiple email address will not allowed.

It is the Contractor's responsibility to make timely distribution of all Contracting Officer initiated e-mail with its own organization including field office(s). The Contractor shall promptly notify the Contracting Officer, in writing, of any changes to this email address.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 32 01.00 10

PROJECT SCHEDULE
08/08

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Project Schedule; G

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Prepare for approval a Project Schedule, as specified herein, pursuant to the Contract Clause, SCHEDULE FOR CONSTRUCTION CONTRACTS. Show in the schedule the sequence in which the Contractor proposes to perform the work and dates on which the Contractor contemplates starting and completing all schedule activities. The scheduling of the entire project is required. Contractor management personnel shall actively participate in its development. Subcontractors and suppliers working on the project shall also contribute in developing and maintaining an accurate Project Schedule. Provide a schedule that is a forward planning as well as a project monitoring tool.

3.1.1 Approved Project Schedule

Use the approved Project Schedule to measure the progress of the work and to aid in evaluating time extensions. Make the schedule cost loaded and activity coded. The schedule will provide the basis for all progress payments. If the Contractor fails to submit any schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments until the Contractor submits the required schedule.

3.1.2 Schedule Status Reports

Provide a Schedule Status Report on at least a monthly basis. If, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, take steps necessary to improve its progress including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules as the

Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

3.1.3 Default Terms

Failure of the Contractor to comply with the requirements of the Contracting Officer shall be grounds for a determination, by the Contracting Officer, that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of the contract.

3.2 BASIS FOR PAYMENT AND COST LOADING

Use the schedule as the basis for determining contract earnings during each update period and therefore the amount of each progress payment. Lack of an approved schedule update, or qualified scheduling personnel, will result in the inability of the Contracting Officer to evaluate contract earned value for the purposes of payment. Failure of the Contractor to provide all required information will result in the disapproval of the preliminary, initial and subsequent schedule updates. In the event schedule revisions are directed by the Contracting Officer and those revisions have not been included in subsequent revisions or updates, the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until such revisions to the Project Schedule have been made. Activity cost loading shall be reasonable, as determined by the Contracting Officer. The aggregate value of all activities coded to a contract CLIN shall equal the value of the CLIN on the Schedule.

3.3 PROJECT SCHEDULE DETAILED REQUIREMENTS

The computer software system utilized to produce and update the Project Schedule shall be capable of meeting all requirements of this specification.

3.3.1 Critical Path Method

Use the Critical Path Method (CPM) of network calculation to generate the Project Schedule.

3.3.2 Level of Detail Required

Develop the Project Schedule to an appropriate level of detail. Failure to develop the Project Schedule to an appropriate level of detail, as determined by the Contracting Officer, will result in its disapproval. The Contracting Officer will consider, but is not limited to, the following characteristics and requirements to determine appropriate level of detail:

3.3.2.1 Activity Durations

Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Less than 2 percent of all non-procurement activities shall have Original Durations (OD) greater than 20 work days or 30 calendar days. Procurement activities are defined herein.

3.3.2.2 Procurement Activities

The schedule must include activities associated with the submittal, approval, procurement, fabrication and delivery of long lead materials, equipment, fabricated assemblies and supplies. Long lead procurement activities are those with an anticipated procurement sequence of over 90 calendar days. A typical procurement sequence includes the string of activities: submit, approve, procure, fabricate, and deliver.

3.4 REQUESTS FOR TIME EXTENSIONS

In the event the Contractor believes it is entitled to an extension of the contract performance period, completion date, or any interim milestone date, furnish the following for a determination by the Contracting Officer: justification, project schedule data, and supporting evidence as the Contracting Officer may deem necessary. Submission of proof of excusable delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is a condition precedent to any approvals by the Government. In response to each Request For Proposal issued by the Government, submit a schedule impact analysis demonstrating whether or not the change contemplated by the Government impacts the critical path.

3.4.1 Justification of Delay

The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved with this request. The Contracting Officer's determination as to the number of allowable days of contract extension shall be based upon the project schedule updates in effect for the time period in question, and other factual information. Actual delays that are found to be caused by the Contractor's own actions, which result in a calculated schedule delay, will not be a cause for an extension to the performance period, completion date, or any interim milestone date.

3.5 PROGRESS MEETINGS

a. Meet bi-weekly with the Government (or as otherwise mutually agreed to) for the purpose of jointly reviewing the actual progress of the project as compared to the as planned progress and to review planned activities for the upcoming two weeks. The then current and approved schedule update shall be used for the purposes of this meeting and for the production and review of reports. The Contractor's Project Manager and the Authorized Representative of the Contracting Officer shall attend. The progress meeting will address the status of RFI's, RFP's and Submittals.

c. The Government and the Contractor shall jointly review the reports. If it appears that activities on the longest path(s) which are currently driving the calculated completion date (driving activities), are not progressing satisfactorily and therefore could jeopardize timely project completion, corrective action must be taken immediately. Corrective action includes but is not limited to: increasing the number of work crews; increasing the number of work shifts; increasing the number of hours worked per shift; and determining if Government responsibility coded activities require Government corrective action.

-- End of Section --

SECTION 01 32 16.00 20

CONSTRUCTION PROGRESS DOCUMENTATION
11/09

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction schedule; G

1.2 ACCEPTANCE

Prior to the start of work, prepare and submit to the Contracting Officer for acceptance a construction schedule in the form of a in accordance with the terms in Contract Clause "FAR 52.236-15, Schedules for Construction Contracts," except as modified in this contract. Acceptance of an error free Baseline Schedule and updates is a condition precedent to processing the Contractor's pay request.

1.3 UPDATED SCHEDULES

Update the Construction schedule at monthly intervals or when the schedule has been revised. The updated schedule shall be kept current, reflecting actual activity progress and plan for completing the remaining work. Submit copies of purchase orders and confirmation of delivery dates as directed.

1.4 3-WEEK LOOK AHEAD SCHEDULE

The Contractor shall prepare and issue a 3-Week Look Ahead schedule to provide a more detailed day-to-day plan of upcoming work identified on the Construction Schedule. The work plans shall be keyed to activity numbers when a NAS is required and updated each week to show the planned work for the current and following two-week period. Additionally, include upcoming outages, closures, preparatory meetings, and initial meetings. Identify critical path activities on the Three-Week Look Ahead Schedule. The detail work plans are to be bar chart type schedules, maintained separately from the Construction Schedule on an electronic spreadsheet program and printed on 8 ½ by 11 sheets as directed by the Contracting Officer. Activities shall not exceed 5 working days in duration and have sufficient level of detail to assign crews, tools and equipment required to complete the work. Three hard copies and one electronic file of the 3-Week Look Ahead Schedule shall be delivered to the Contracting Officer no later than 8 a.m. each Monday and reviewed during the weekly CQC Coordination Meeting.

1.5 CORRESPONDENCE AND TEST REPORTS:

All correspondence (e.g., letters, Requests for Information (RFIs), e-mails, meeting minute items, Production and QC Daily Reports, material

delivery tickets, photographs, etc.) shall reference Schedule activities that are being addressed. All test reports (e.g., concrete, soil compaction, weld, pressure, etc.) shall reference schedule activities that are being addressed.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 33 00

SUBMITTAL PROCEDURES
05/11

PART 1 GENERAL

1.1 SUMMARY

The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections.

Units of weights and measures used on all submittals are to be the same as those used in the contract drawings.

Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

Contractor to check and approve all items prior to submittal and stamp, sign, and date indicating action taken. Proposed deviations from the contract requirements are to be clearly identified. Include within submittals items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals.

Submittals requiring Government approval are to be scheduled and made prior to the acquisition of the material or equipment covered thereby. Pick up and dispose of samples not incorporated into the work in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

1.2 DEFINITIONS

1.2.1 Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections. Submittals are identified by Submittal Description (SD) numbers and titles as follows:

SD-01 Preconstruction Submittals

Submittals which are required prior to the start of construction or the next major phase of the construction on a multi-phase contract. They include:

Certificates of insurance

Surety bonds

List of proposed Subcontractors

List of proposed products

Construction progress schedule

Submittal register

Schedule of prices

Health and safety plan

Work plan

Quality Control(QC) plan

Environmental protection plan

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or

system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project.)

Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports.

Daily logs and checklists.

Final acceptance test and operational test procedure.

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or Subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and (MSDS)concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and must state the test results; and indicate whether the material, product, or system has passed or failed the test.

SD-10 Operation and Maintenance Data

Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel, including manufacturer's help and product line documentation necessary to maintain and install equipment. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

This data is intended to be incorporated in an operations and

maintenance manual or control system.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

Special requirements necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

Interim "DD Form 1354" with cost breakout for all assets 30 days prior to facility turnover.

1.2.2 Approving Authority

Office or designated person authorized to approve submittal.

1.2.3 Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with this section.

SD-01 Preconstruction Submittals

Submittal Register; G

1.4 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.4.1 Government Approved G

Government approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled, "Specifications and Drawings for Construction," they are considered to be "shop drawings."

1.4.2 Information Only

Submittals not requiring Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.5 FORWARDING SUBMITTALS REQUIRING GOVERNMENT APPROVAL

1.5.1 Submittals Required from the Contractor

As soon as practicable after award of contract, and before procurement of fabrication, forward to the CO submittals required in the technical sections of this specification, including shop drawings, product data and samples.

1.5.1.1 O&M Data

Submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

In the event the Contractor fails to deliver O&M Data within the time limits specified, the Contracting Officer may withhold from progress payments 50 percent of the price of the item with which such O&M Data are applicable.

1.6 PREPARATION

1.6.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels, to office of approving authority. Transmit submittals with transmittal form prescribed by Contracting Officer and standard for project. On the transmittal form identify Contractor, indicate date of submittal, and include information prescribed by transmittal form and required in paragraph entitled, "Identifying Submittals," of this section. Process transmittal forms to record actions regarding sample installations or panels, if included in project.

Use AF Form 3000 for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor. Properly complete this form by filling out all the heading blank spaces and identifying each item submitted. Exercise special care to ensure proper listing of the specification paragraph and sheet number of the contract drawings pertinent to the data submitted for each item.

1.6.2 Identifying Submittals

When submittals are provided by a Subcontractor, the Prime Contractor is to prepare, review and stamp with Contractor's approval all specified submittals prior to submitting for Government approval.

Identify submittals, except sample installations and sample panels, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

a. Project title and location.

b. Construction contract number.

c. Date of the drawings and revisions.

d. Name, address, and telephone number of subcontractor, supplier, manufacturer and any other subcontractor associated with the submittal.

e. Section number of the specification section by which submittal is required.

f. Submittal description (SD) number of each component of submittal.

g. When a resubmission, add alphabetic suffix on submittal description, for example, submittal 18 would become 18A, to indicate resubmission.

h. Product identification and location in project.

1.6.3 Format for SD-02 Shop Drawings

Shop drawings are not to be less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless other form is required. Drawings are to be suitable for reproduction and be of a quality to produce clear, distinct lines and letters with dark lines on a white background.

Present 8 1/2 by 11 inches sized shop drawings as part of the bound volume for submittals required by section. Present larger drawings in sets.

Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph entitled, "Identifying Submittals," of this section.

Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location adjacent to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

Reserve a blank space on the right hand side of each sheet for the Government disposition stamp.

Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

Include the nameplate data, size and capacity on drawings. Also include applicable federal, military, industry and technical society publication references.

1.6.4 Format of SD-03 Product Data and SD-08 Manufacturer's Instructions

Present product data submittals for each section as a complete, bound volume. Include table of contents, listing page and catalog item numbers for product data.

Indicate, by prominent notation, each product which is being submitted; indicate specification section number and paragraph number to which it pertains.

Supplement product data with material prepared for project to satisfy submittal requirements for which product data does not exist. Identify this material as developed specifically for project, with information and format as required for submission of SD-07 Certificates.

Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry and technical society publication references. Should manufacturer's data require supplemental information for clarification, submit as specified for SD-07 Certificates.

Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal and marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will not be accepted for expedition of construction effort.

Submit manufacturer's instructions prior to installation.

1.6.5 Format of SD-04 Samples

Furnish samples in sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately same size as specified:

a. Sample of Equipment or Device: Full size.

b. Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.

c. Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.

d. Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.

e. Sample of Non-Solid Materials: Pint. Examples of non-solid materials are sand and paint.

f. Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.

g. Sample Panel: 4 by 4 feet.

h. Sample Installation: 100 square feet.

Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at time of use.

Recording of Sample Installation: Note and preserve the notation of area constituting sample installation but remove notation at final clean up of project.

When color, texture or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.6.6 Format of SD-05 Design Data and SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11 inches paper. Provide a bound volume for submittals containing numerous pages.

1.6.7 Format of SD-06 Test Reports and SD-09 Manufacturer's Field Reports

Provide reports on 8 1/2 by 11 inches paper in a complete bound volume.

Indicate by prominent notation, each report in the submittal. Indicate specification number and paragraph number to which it pertains.

1.6.8 Format of SD-10 Operation and Maintenance Data (O&M)

Comply with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA for O&M Data format.

1.6.9 Format of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

When submittal includes a document which is to be used in project or become part of project record, other than as a submittal, do not apply Contractor's approval stamp to document, but to a separate sheet accompanying document.

1.7 QUANTITY OF SUBMITTALS

1.7.1 Number of Copies of SD-02 Shop Drawings

Submit shop drawings in digital format with the exception of larger scale drawings that would be more appropriately reviewed with hard copies. When hard copies are submitted, provide six copies of submittals of shop drawings requiring review and approval.

1.7.2 Number of Copies of SD-03 Product Data and SD-08 Manufacturer's Instructions

Submit in compliance with quantity requirements specified for shop drawings.

1.7.3 Number of Samples SD-04 Samples

a. Submit two samples, or two sets of samples showing range of variation, of each required item. One approved sample or set of samples will be retained by approving authority and one will be returned to Contractor.

b. Submit one sample panel or provide one sample installation where directed. Include components listed in technical section or as directed.

c. Submit one sample installation, where directed.

d. Submit one sample of non-solid materials.

1.7.4 Number of Copies SD-05 Design Data and SD-07 Certificates

Submit in compliance with quantity requirements specified for shop drawings.

1.7.5 Number of Copies SD-06 Test Reports and SD-09 Manufacturer's Field Reports

Submit in compliance with quantity and quality requirements specified for shop drawings other than field test results that will be submitted with QC reports.

1.7.6 Number of Copies of SD-10 Operation and Maintenance Data

Submit three hard copies of O&M Data and a digital version to the Contracting Officer for review and approval.

1.7.7 Number of Copies of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

Unless otherwise specified, submit digital sets of administrative submittals.

1.8 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

1.9 VARIATIONS

Variations from contract requirements require both Designer of Record (DOR) and Government approval pursuant to contract Clause FAR 52.236-21 and will be considered where advantageous to Government.

1.9.1 Considering Variations

Discussion with Contracting Officer prior to submission, after consulting with the DOR, will help ensure functional and quality requirements are met and minimize rejections and re-submittals. When contemplating a variation which results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

Specifically point out variations from contract requirements in transmittal letters. Failure to point out deviations may result in the Government requiring rejection and removal of such work at no additional cost to the Government.

1.9.2 Proposing Variations

When proposing variation, deliver written request to the Contracting Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Government, including the DOR's written analysis and approval. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

1.9.3 Warranting That Variations Are Compatible

When delivering a variation for approval, Contractor warrants that it has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.9.4 Review Schedule Is Modified

In addition to normal submittal review period, a period of 10 working days will be allowed for consideration by the Government of submittals with variations.

1.10 SUBMITTAL REGISTER

Prepare and maintain submittal register, as the work progresses. Do not change data which is output in columns (c), (d), (e), and (f) as delivered by Government; retain data which is output in columns (a), (g), (h), and (i) as approved. A submittal register showing items of equipment and materials for which submittals are required by the specifications is provided as an attachment. This list may not be all inclusive and additional submittals may be required. The Government will provide the initial submittal register in electronic format with the following fields completed, to the extent that will be required by the Government during subsequent usage.

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD No. and type, e.g. SD-02 Shop Drawings) required in each specification section.

Column (e): Lists one principal paragraph in specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting project requirements.

Thereafter, the Contractor is to track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are received and returned by the Government.

1.10.1 Use of Submittal Register

Submit submittal register. Submit with QC plan and project schedule. Verify that all submittals required for project are listed and add missing submittals. Coordinate and complete the following fields on the register submitted with the QC plan and the project schedule:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for approving authority to receive submittals.

Column (h) Contractor Approval Date: Date Contractor needs approval of submittal.

Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.

1.10.2 Contractor Use of Submittal Register

Update the following fields with each submittal throughout contract.

Column (b) Transmittal Number: Contractor assigned list of consecutive numbers.

Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to QC.

Column (l) List date of submittal transmission.

Column (q) List date approval received.

1.10.3 Approving Authority Use of Submittal Register

Update the following fields.

Column (b) Transmittal Number: Contractor assigned list of consecutive numbers.

Column (l) List date of submittal receipt.

Column (m) through (p) List Date related to review actions.

Column (q) List date returned to Contractor.

1.10.4 GOVERNMENT REVIEW ACTION CODES

"A" - "Approved as submitted"; "Completed"

"B" - "Approved, except as noted"; "Completed"

"C" - "Approved, resubmission required"; "Resubmit"

"D" - "Returned by correspondence"; "Completed"

"E" - "Disapproved (See attached)"; "Resubmit"

"F" - "Receipt acknowledged"; "Completed"

"G" - "Other (Specify)"; "Resubmit"

"X" - "Receipt acknowledged, does not comply"; "Resubmit"

1.10.5 Copies Delivered to the Government

Deliver submittal register updated by Contractor to Government with each invoice request.

1.11 SCHEDULING

Schedule and submit concurrently submittals covering component items forming a system or items that are interrelated. Include certifications to be submitted with the pertinent drawings at the same time. No delay damages or time extensions will be allowed for time lost in late submittals.

a. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential resubmittal of requirements.

b. Submittals called for by the contract documents will be listed on the register. If a submittal is called for but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Contracting Officer does not relieve the Contractor of supplying submittals required by the contract documents but which have been omitted from the register or marked "N/A."

c. Re-submit register and annotate monthly by the Contractor with actual submission and approval dates. When all items on the register have been fully approved, no further re-submittal is required.

d. Carefully control procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

1.11.1 Constraints

Conform to provisions of this section, unless explicitly stated otherwise for submittals listed or specified in this contract.

Submit complete submittals for each definable feature of work. Submit at the same time components of definable feature interrelated as a system.

When acceptability of a submittal is dependent on conditions, items, or materials included in separate subsequent submittals, submittal will be returned without review.

Approval of a separate material, product, or component does not imply approval of assembly in which item functions.

1.12 GOVERNMENT APPROVING AUTHORITY

When approving authority is Contracting Officer, the Government will:

a. Note date on which submittal was received.

b. Review submittals for approval within scheduling period specified and only for conformance with project design concepts and compliance with contract documents.

c. Identify returned submittals with one of the actions defined in paragraph entitled, "Review Notations," of this section and with markings appropriate for action indicated.

Upon completion of review of hard copy submittals requiring Government approval. Four (4) copies of the approved submittal will be retained by the Contracting Officer and two (2) copies of the submittal will be returned to the Contractor.

1.13 DISAPPROVED OR REJECTED SUBMITTALS

Contractor shall make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications; notice as required under the clause entitled, "Changes," is to be given to the Contracting Officer. Contractor is responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the Government requiring rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, the Contractor shall make such revisions and submission of the submittals in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.14 APPROVED/ACCEPTED SUBMITTALS

The Contracting Officer's approval or acceptance of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing and other information are satisfactory.

Approval or acceptance will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work.

After submittals have been approved or accepted by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.15 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

1.16 APPROVED SAMPLES

Approval of a sample is only for the characteristics or use named in such approval and is not be construed to change or modify any contract requirements. Before submitting samples, the Contractor to assure that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those which may be damaged in testing, will be returned to the Contractor, at his expense, upon completion of the contract. Samples not approved will also be returned to the Contractor at its expense, if so requested.

Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make of that material. Government reserves the right to disapprove any material or equipment which previously has proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. Contractor to replace such materials or equipment to meet contract requirements.

Approval of the Contractor's samples by the Contracting Officer does not relieve the Contractor of his responsibilities under the contract.

1.17 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements is to be similar to the following:

CONTRACTOR
(Firm Name)
_____ Approved
_____ Approved with corrections as noted on submittal data and/or attached sheets(s)
SIGNATURE: _____
TITLE: _____
DATE: _____

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 35 13

SPECIAL PROJECT PROCEDURES
11/11

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 150/5300-13	(2012; Rev A; Errata 2013) Airport Design
FAA AC 70/7460-1	(2007; Rev K) Obstruction Marking and Lighting

1.2 DEFINITIONS

1.2.1 Landing Areas

"Landing Areas" means:

a. The primary surfaces, comprising the surface of the runway, runway shoulders, and lateral safety zones. The length of each primary surface is the same as the runway length. The width of each primary surface is 1000 feet (500 feet on each side of the runway centerline).

b. The "clear zone" beyond the ends of each runway is the extension of the primary surface for a distance of 1000 feet beyond each end of each runway.

c. All taxiways, plus the lateral clearance zones along each side for the length of the taxiways. (The Military Taxiway adjacent to the project site has a 200 feet clearance area measured from the centerline of the taxiway.

d. All aircraft parking aprons, plus the area 125 feet in width extending beyond each edge all around the aprons.

1.2.2 Safety Precaution Areas

“Safety Precaution Areas” means those portions of approach-departure clearance zones and transitional zones where placement of objects incident to contract performance might result in vertical projections at or above the approach-departure clearance, or the transitional surface.

a. The “approach-departure clearance surface” is an extension of the primary surface and the clear zone at each end of each runway, for a distance of 50,000 feet, first along an inclined (glide angle) and then along a horizontal plane, both flaring symmetrically about the runway centerline extended.

(1) The inclined plane (glide angle) begins in the clear zone 200 feet past the end of the runway (and primary surface) at the same

elevation as the end of the runway. It continues upward at a slope of 50:1 (1 foot vertically for each 50 feet horizontally) to an elevation of 500 feet above the established airfield elevation. At that point the plane becomes horizontal, continuing at that same uniform elevation to a point 50,000 feet longitudinally from the beginning of the inclined plane (glide angle) and ending there.

(2) The width of the surface at the beginning of the inclined plane (glide angle) is the same as the width of the clear zone. It then flares uniformly, reaching the maximum width of 16,000 feetat the end.

b. The “approach-departure clearance zone” is the ground area under the approach-departure clearance surface.

c. The “transitional surface” is a sideways extension of all primary surfaces, clear zones, and approach-departure clearance surfaces along inclined planes.

(1) The inclined plane in each case begins at the edge of the surface.

(2) The slope of the incline plane is 7:1 (1 foot vertically for each 7 feet horizontally). It continues to the point of intersection with the:

(a) Inner horizontal surface (which is the horizontal plane 150 feet above the established airfield elevation); or

(b) Outer horizontal surface (which is the horizontal plane 500 feet above the established airfield elevation), whichever is applicable.

d. The “transitional zone” is the ground area under the transitional surface. (It adjoins the primary surface, clear zone, and approach-departure clearance zone.)

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Heavy Equipment and Vehicle List

Construction Operations Plan

Safety Plan

Schedule of Work

PART 2 PRODUCTS

2.1 AIRFIELD OBSTRUCTION LIGHTS

Airfield obstruction lights must conform to FAA AC 70/7460-1 and have red or white lenses.

PART 3 EXECUTION

3.1 HAZARDS TO AIRFIELD HELIPORT OPERATION

In addition to "DFARS 252.236-7005, Airfield Safety Precautions," the following paragraphs apply.

3.1.1 Work in Proximity to Landing Areas

Place nothing upon the landing area or applicable portions of safety precaution areas without authority of the Contracting Officer.

Use of landing areas for purposes other than aircraft operation,is prohibited without permission of the Contracting Officer, and the landing area is closed by order of the Contracting Officer and marked as indicated herein.

Accomplish all construction work 75 feet to each side of the taxiways with extreme care regarding the operation of aircraft. Cooperate closely, and coordinate with the Contracting Officer. Park equipment in an area designated by the Contracting Officer. Parking of equipment, vehicles, or any type of storage overnight or for any extended period of time in the proximity of the landing areas is strictly prohibited. Leave no material in areas where extreme care is to be taken regarding the operation of aircraft.

During periods of active performance of work on the airfield by the Contractor, govern all operations of mobile equipment per the safety provisions.

3.1.2 Schedule of Work/Aircraft Operating Schedules

Schedule work to conform to aircraft operating schedules. The Government will exert every effort to schedule aircraft operations so as to permit the maximum amount of time for the Contractor's activities; however, in the event of emergency, intense operational demands, adverse wind conditions, and other such unforeseen difficulties, the Contractor must cease operations at the specified locations in the aircraft operational area for the safety of the Contractor and military personnel and Government property. Submit a schedule of the work to the Contracting Officer describing the work to be accomplished; the location of the work, noting distances from the ends of landing areas and buildings and other structures as necessary; and dates and hours during which the work is to be accomplished. Keep the approved schedule of work current, and notify the Contracting Officer of any changes prior to beginning each day's work.

Prior to commencement of work, submit the following to the Contracting Officer:

Construction Operations Plan
Safety Plan
Heavy Equipment and Vehicle List

Where flying is controlled, additional permission must be obtained from the control tower operator to enter a landing area unless such area is marked as hazardous to aircraft.

3.1.3 Daytime Markings

During daylight, mark stationary and mobile equipment with international orange and white checkered flags, mark the material, and work with yellow flags.

Vehicles operating in the landing area, must be identified by means of a flag on a staff attached to and flying above the vehicle. Flag size must be not less than 3 feet square and consist of a checkered pattern of international orange and white squares not less than 1 foot on each side. Flags varying in any dimension by not more than 10 percent of the specified dimensions are considered to comply with the stated requirements.

3.1.4 Nighttime Markings

During nighttime, which begins 2 hours before sundown and ends 2 hours after sunrise, mark stationary and mobile equipment and material, and work with battery-operated, low-intensity, red flasher lights]. Where the Contracting Officer determines that the red flasher lights may confuse pilots approaching for landings, the Contracting Officer may direct that the [red lanterns][red flasher lights] be left off or that the color of the lights be changed.

Light construction and installation must comply with FAA AC 70/7460-1. Lights must be operational during periods of reduced visibility, darkness, and as directed by the Contracting Officer.

No separate payments will be made for lighting and protection necessitated by the safety provisions.

3.1.5 Excavation

Open only those trenches for which material is on hand and ready for placing therein. As soon as possible after the material has been placed and work approved, backfill and compact the trenches as specified.

Maintain landing areas at all times free from hazards, holes, material piles, or projecting shoulders that might damage tires or landing gear. Paved surfaces must be kept clean at all times and free from small stones or other objects which could cause damage to propellers, craft, and personnel.

3.1.6 Contractor Safety Precautions

The Contractor is advised that aircraft operations will produce extremely high noise levels and will induce vibrations in pavements, structures, and equipment in the vicinity, and may result in high velocity flying debris in the area. The Contractor is responsible for providing all necessary protective eye and ear gear and other safety devices for his personnel, for insuring protection of his equipment, and for scheduling the work to eliminate hazards to his personnel and equipment and to prevent damage to work performed by him.

Boundary areas for hazardous work locations and restrictions are defined

in FAA AC 150/5300-13. Construction activity within the limits of the boundary areas without approval of the Contracting Officer is prohibited.

Provide a minimum of 2 aviation red or high intensity white obstruction lights on temporary structures (including cranes) over 100 feet above ground level.

3.1.7 Base Civil Engineering (BCE) Work Clearance Request

Obtain an approved BCE Work Clearance Request, AF Form 103, prior to the start of excavation, digging work, or work that disrupts aircraft or vehicular traffic flow, base utility services, fire and intrusion alarm system, or routine activities of the Activity.

3.1.8 Radio Contact

Provide necessary battery powered portable radios, including one radio for the tower. During work within the landing area, have an operator (who speaks fluent English) available for radio contact with the tower at all times. Radio frequency must be approved by the tower.

-- End of Section --

SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS
08/10

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization (e.g. ASTM B564 Standard Specification for Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the standards producing organization should be ordered from the source by title rather than by number.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)
38800 Country Club Drive
Farmington Hills, MI 48331
Ph: 248-848-3700
Fax: 248-848-3701
E-mail: bkstore@concrete.org
Internet: http://www.concrete.org

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
444 North Capital Street, NW, Suite 249
Washington, DC 20001
Ph: 202-624-5800
Fax: 202-624-5806
E-Mail: info@aashto.org
Internet: http://www.aashto.org

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)
1303 W. Walnut Hill Lane, Suite 305
Irving, TX 75038-3008
Ph: 972-506-7216
Fax: 972-506-7682
E-mail: info@concrete-pipe.org
Internet: http://www.concrete-pipe.org

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)
1800 East Oakton Street
Des Plaines, IL 60018-2187
Ph: 847-699-2929

Fax: 847-768-3434
E-mail: customerservice@asse.org
Internet: http://www.asse.org

AMERICAN WATER WORKS ASSOCIATION (AWWA)
6666 West Quincy Avenue
Denver, CO 80235
Ph: 800-926-7337
Fax: 303-347-0804
E-mail: smorrison@awwa.org
Internet: http://www.awwa.org

AMERICAN WELDING SOCIETY (AWS)
550 N.W. LeJeune Road
Miami, FL 33126
Ph: 800-443-9353 - 305-443-9353
Fax: 305-443-7559
E-mail: info@aws.org or customerservice@awspubs.com
Internet: http://www.aws.org

ASME INTERNATIONAL (ASME)
Three Park Avenue, M/S 10E
New York, NY 10016-5990
Ph: 800-854-7179 or 800-843-2763
Fax: 212-591-7674
E-mail: infocentral@asme.org
Internet: http://www.asme.org

ASPHALT INSTITUTE (AI)
Research Park Drive
P.O. Box 14052
Lexington, KY 40512-4052
Ph: 859-288-4960
Fax: 859-288-4999
E-mail: info@asphaltinstitute.org
Internet: http://www.asphaltinstitute.org

ASTM INTERNATIONAL (ASTM)
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959
Ph: 610-832-9585
Fax: 610-832-9555
E-mail: service@astm.org
Internet: http://www.astm.org

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)
933 North Plum Grove Road
Schaumburg, IL 60173-4758
Ph: 847-517-1200 or 800-328-6306
Fax: 847-517-1206
Internet: http://www.crsi.org/

CSA STANDARDS (CSA)
8501 East Pleasant Valley Road
Cleveland, OH 44131-5575
Ph: 216-524-4990 or 877-235-9791
Fax: 216-520-8979
E-mail: cathy.rake@csa-america.org
Internet: http://www.csa-america.org

DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)
245 Riverchase Parkway East, Suite O
Birmingham, AL 35244
Ph: 205-402-8700
Fax: 205-402-8730
E-mail: info@dipra.org
Internet: http://www.dipra.org

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
445 Hoes Lane or 2001 L Street, NW. Suite 700
Piscataway, NJ 08855-1331 or Washington, DC 20036-4910 USA
Ph: 732-981-0060 or 800-701-4333
Fax: 732-562-6380
E-mail: onlinesupport@ieee.org or ieeeusa@ieee.org
Internet: http://www.ieee.org

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)
3, rue de Varembe, P.O. Box 131
CH-1211 Geneva 20, Switzerland
Ph: 41-22-919-0211
Fax: 41-22-919-0300
E-mail: custserv@iec.ch
Internet: http://www.iec.ch

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)
127 Park Street, NE
Vienna, VA 22180
Ph: 703-281-6613
Fax: 703-281-6671
E-mail: info@mss-hq.com
Internet: http://www.mss-hq.com

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
1300 North 17th Street, Suite 1752
Rosslyn, VA 22209
Ph: 703-841-3200
Fax: 703-841-5900
Internet: http://www.nema.org/

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
1 Batterymarch Park
Quincy, MA 02169-7471
Ph: 617-770-3000 or 800-344-3555
Fax: 617-770-0700
E-mail: webmaster@nfpa.org
Internet: http://www.nfpa.org

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)
100 Bureau Drive
Stop 1070
Gaithersburg, MD 20899-1070
Ph: 301-975-NIST (6478
E-mail: inquiries@nist.gov
Internet: http://www.nist.gov

NATIONAL PRECAST CONCRETE ASSOCIATION (NPCA)
10333 N. Meridian Street, Suite 272
Indianapolis, Indiana 46290
Ph: 317-571-9500 or 800 366 7731
Fax: 317-571-0041
E-mail: npca@precast.org
Internet: www.precast.org

NATIONAL READY MIXED CONCRETE ASSOCIATION (NRMCA)
900 Spring Street
Silver Spring, MD 20910
Ph: 240-485-1165
E-mail: jjenkins@nrmca.org (jacques jenkins)
Internet: http://www.nrmca.org

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS)
Publication Distribution Unit
1900 Royal Oaks Dr.
Sacramento, CA 95815-3800
Ph: 916-263-0822 or 916-263-0865
Fax: 916-263-0469
E-mail: publications@dot.ca.gov
Internet: www.//caltrans-opac.ca.gov/publicathtm

UNDERWRITERS LABORATORIES (UL)
2600 N.W. Lake Road
Camas, WA 98607-8542
Ph: 877-854-3577
Fax: 360-817-6278
E-mail: CEC.us@us.ul.com
Internet: http://www.ul.com/
UL Directories available through IHS at http://www.ihs.com

U.S. AIR FORCE (USAF)
Air Force Publishing Distribution Center
E-mail: afdpo-ppl@pentagon.af.mil
Internet: http://www.e-publishing.af.mil/

U.S. ARMY (DA)
U.S. Army Publishing Directorate
Ph: 314-592-0910
Fax: 314-592-0923
Internet: http://www.apd.army.mil

U.S. ARMY CORPS OF ENGINEERS (USACE)
Order CRD-C DOCUMENTS from:
U.S. Army Engineer Waterways Experiment Station
ATTN: Technical Report Distribution Section, Services Branch, TIC
3909 Halls Ferry Road
Vicksburg, MS 39180-6199
E-mail: MTC-INFO@erdc.usace.army.mil
Internet:
http://gsl.erdc.usace.army.mil/SL/MTC/handbook/handbook.htm
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Hyattsville, MD 20781-1102

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Fax: 301-394-0084
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Internet: http://www.usace.army.mil/publications
or
http://www.hnc.usace.army.mil/Missions/Engineering/TECHINFO.aspx

U.S. DEPARTMENT OF AGRICULTURE (USDA)
Order AMS Publications from:
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Seed Regulatory and Testing Branch
801 Summit Crossing Place, Suite C
Gastonia, NC 28054-2193
Ph: 704-810-8871
Fax: 704-852-4189
E-mail: seed.ams@usda.gov
Internet: http://www.ams.usda.gov/lsg/seed.htm
Order Other Publications from:
U.S. Department of Agriculture, Rural Utilities Service
14th and Independence Avenue, SW, Room 4028-S
Washington, DC 20250
Ph: 202-720-2791
Fax: 202-720-2166
Internet: http://www.usda.gov/rus

U.S. DEPARTMENT OF DEFENSE (DOD)
Order DOD Documents from:
Room 3A750-The Pentagon
1400 Defense Pentagon
Washington, DC 20301-1400
Ph: 703-571-3343
FAX: 215-697-1462
E-mail: pia@hq.afis.asd.mil
Internet: http://www.dod.gov
Obtain Military Specifications, Standards and Related Publications from:
Acquisition Streamlining and Standardization Information System (ASSIST)
Department of Defense Single Stock Point (DODSSP)
Document Automation and Production Service (DAPS)
Building 4/D
700 Robbins Avenue
Philadelphia, PA 19111-5094
Ph: 215-697-6396 - for account/password issues
Internet: http://assist.daps.dla.mil/online/start/; account registration required
Obtain Unified Facilities Criteria (UFC) from:
Whole Building Design Guide (WBDG)
National Institute of Building Sciences (NIBS)
1090 Vermont Avenue NW, Suite 700
Washington, CD 20005
Ph: 202-289-7800
Fax: 202-289-1092
Internet: http://www.wbdg.org/references/docs_refs.php

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, DC 20004

Ph: 202-272-0167
for Fax and E-mail see below
Internet: http://www.epa.gov
--- Some EPA documents are available only from:
National Technical Information Service (NTIS)
5301 Shawnee Road
Alexandria, VA 22312
Ph: 703-605-6050 or 1-688-584-8332
Fax: 703-605-6900
E-mail: info@ntis.gov
Internet: http://www.ntis.gov

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U.S. Government Printing Office (GPO)
732 North Capitol Street, NW
Washington, DC 20401
Ph: 202-512-1800
Fax: 202-512-2104
E-mail: contactcenter@gpo.gov
Internet: http://www.gpoaccess.gov
Order free documents from:
Federal Aviation Administration
Department of Transportation
800 Independence Avenue, SW
Washington, DC 20591
Ph: 1-866-835-5322
Internet: http://www.faa.gov

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8601 Adelphi Road
College Park, MD 20740-6001
Ph: 866-272-6272
Fax: 301-837-0483
E-mail: contactcenter@gpo.gov
Internet: http://www.archives.gov
Order documents from:
Superintendent of Documents
U.S.Government Printing Office (GPO)
732 North Capitol Street, NW
Washington, DC 20401
Ph: 202-512-1800
Fax: 202-512-2104
E-mail: contactcenter@gpo.gov
Internet: http://www.gpoaccess.gov

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

-- End of Section --

SECTION 01 45 00.10 20

QUALITY CONTROL FOR MINOR CONSTRUCTION
02/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2008; Errata 1-2010; Changes 1-3 2010; Changes 4-6 2011; Change 7 2012) Safety and Health Requirements Manual

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

QC Plan; G

Submit a QC plan within 15 calendar days after receipt of Notice of Award.

1.3 INFORMATION FOR THE CONTRACTING OFFICER (KO)

Prior to commencing work on construction, the Contractor can obtain a single copy set of the current report forms from the KO. The report forms will consist of the Contractor Production Report, Contractor Production Report (Continuation Sheet), Contractor Quality Control (CQC) Report, CQC Report (Continuation Sheet), Preparatory Phase Checklist, Initial Phase Checklist, Rework Items List, and Testing Plan and Log.

Deliver the following to the KO:

a. CQC Report: Original and one copy, by 10:00 AM the next working week after each week that work is performed;

b. Contractor Production Report: Original and one copy by 10:00 AM the next working week after each week that work is performed;

c. Preparatory Phase Checklist: Original attached to the original CQC Report and one copy attached to each copy;

d. Initial Phase Checklist: Original attached to the original CQC Report and one copy attached to each copy;

e. Field Test Reports: One copy, within two working days after

the test is performed, attached to the CQC Report;

f. QC Meeting Minutes: One copy, within two working days after the meeting; and

g. QC Certifications: As required by the paragraph entitled "QC Certifications."

1.4 QC PROGRAM REQUIREMENTS

All testing and inspections, inclduding special inspections, required by the specifications, codes, regulations and authorities having jurisdiction are the contractor's responsibility, unless specifically assigned to the government. Establish and maintain a QC program as described in this section. The QC program consists of a QC Manager, a QC plan, a Coordination and Mutual Understanding Meeting, QC meetings, three phases of control, submittal review and approval, testing, and QC certifications and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations which comply with the requirements of this contract. The QC program shall cover on-site and off-site work and shall be keyed to the work sequence. No work or testing may be performed unless the QC Manager is on the work site.

1.4.1 Preliminary Work Authorized Prior to Acceptance

The only work that is authorized to proceed prior to the acceptance of the QC plan is mobilization of storage and office trailers, temporary utilities, and surveying.

1.4.2 Acceptance

Acceptance of the QC plan is required prior to the start of construction. The KO reserves the right to require changes in the QC plan and operations as necessary, including removal of personnel, to ensure the specified quality of work. The KO reserves the right to interview any member of the QC organization at any time in order to verify the submitted qualifications.

1.4.3 Notification of Changes

Notify the KO, in writing, of any proposed change, including changes in the QC organization personnel, a minimum of seven calendar days prior to a proposed change. Proposed changes shall be subject to the acceptance by the KO.

1.5 QC ORGANIZATION

1.5.1 QC Manager

1.5.1.1 Duties

Provide a QC Manager at the work site to implement and manage the QC program. In addition to implementing and managing the QC program, the QC Manager may perform the duties of project superintendent. The QC Manager is required to attend the Coordination and Mutual Understanding Meeting, conduct the QC meetings, perform the three phases of control, perform submittal review and approval, ensure testing is performed and provide QC certifications and documentation required in this contract. The QC Manager is responsible for managing and coordinating the three phases of

control and documentation performed by others.

1.5.1.2 Qualifications

An individual with a minimum of 5 years combined experience as a superintendent, inspector, QC Manager, project manager, or construction manager on similar size and type construction contracts which included the major trades that are part of this contract. The individual must be familiar with the requirements of the EM 385-1-1 and have experience in the areas of hazard identification and safety compliance.

1.5.1.3 Construction Quality Management Training

In addition to the above experience and education requirements, the QC Manager shall have completed the course Construction Quality Management for Contractors and will have a current certificate.

1.5.2 Alternate QC Manager Duties and Qualifications

Designate an alternate for the QC Manager to serve in the event of the designated QC Manager's absence. The period of absence may not exceed two weeks at one time, and not more than 30 workdays during a calendar year. The qualification requirements for the Alternate QC Manager shall be the same as for the QC Manager.

1.6 QC PLAN

1.6.1 Requirements

Provide, for acceptance by the KO, a QC plan submitted in a three-ring binder that covers both on-site and off-site work and includes the following with a table of contents listing the major sections identified with tabs.

I. QC ORGANIZATION: A chart showing the QC organizational structure and its relationship to the production side of the organization.

II. NAMES AND QUALIFICATIONS: In resume format, for each person in the QC organization. Include the CQM for Contractors course certification required by the paragraph entitled "Construction Quality Management Training".

III. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONAL: Of each person in the QC organization.

IV. OUTSIDE ORGANIZATIONS: A listing of outside organizations such as architectural and consulting engineering firms that will be employed by the Contractor and a description of the services these firms will provide.

V. APPOINTMENT LETTERS: Letters signed by an officer of the firm appointing the QC Manager and Alternate QC Manager and stating that they are responsible for managing and implementing the QC program as described in this contract. Include in this letter the QC Manager's authority to direct the removal and replacement of non-conforming work.

VI. SUBMITTAL PROCEDURES AND INITIAL SUBMITTAL REGISTER: Procedures for reviewing, approving and managing submittals. Provide the

name(s) of the person(s) in the QC organization authorized to review and certify submittals prior to approval.

VII. TESTING LABORATORY INFORMATION: Testing laboratory information required by the paragraphs "Accredited Laboratories" or "Testing Laboratory Requirements", as applicable.

VIII. TESTING PLAN AND LOG: A Testing Plan and Log that includes the tests required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test.

IX. PROCEDURES TO COMPLETE REWORK ITEMS: Procedures to identify, record, track and complete rework items.

X. DOCUMENTATION PROCEDURES: Use Government formats.

XI. LIST OF DEFINABLE FEATURES: A Definable Feature of Work (DFOW) is a task, which is separate and distinct from other tasks, has the same control requirements and work crews. The list shall be cross-referenced to the Contractor's Construction Schedule and the specification sections. For projects requiring a Progress Chart, the list of definable features of work shall include but not be limited to all items of work on the schedule. For projects requiring a Network Analysis Schedule, the list of definable features of work shall include but not be limited to all critical path activities.

XII. PROCEDURES FOR PERFORMING THREE PHASES OF CONTROL: For each DFOW provide Preparatory and Initial Phase Checklists. Each list shall include a breakdown of quality checks that will be used when performing the quality control functions, inspections, and tests required by the contract documents. The preparatory and initial phases shall be conducted with a view towards obtaining quality construction by planning ahead and identifying potential problems.

XIII. PERSONNEL MATRIX: Not Applicable.

XIV. PROCEDURES FOR COMPLETION INSPECTION: See the paragraph entitled "COMPLETION INSPECTIONS".

XV. TRAINING PROCEDURES AND TRAINING LOG: Not Applicable.

1.7 COORDINATION AND MUTUAL UNDERSTANDING MEETING

During the Pre-Construction conference and prior to the start of construction, discuss the QC program required by this contract. The purpose of this meeting is to develop a mutual understanding of the QC details, including documentation, administration for on-site and off-site work, and the coordination of the Contractor's management, production and the QC personnel. At the meeting, the Contractor will be required to explain how three phases of control will be implemented for each DFOW. Contractor's personnel required to attend shall include the QC Manager, project manager, and superintendent. Minutes of the meeting will be prepared by the QC Manager and signed by both the Contractor and the KO. The Contractor shall provide a copy of the signed minutes to all attendees. Repeat the coordination and mutual understanding meeting when a new QC Manager is appointed.

1.8 QC MEETINGS

After the start of construction, the QC Manager shall conduct QC meetings once every two weeks at the work site with the superintendent and the foreman responsible for the ongoing and upcoming work. The QC Manager shall prepare the minutes of the meeting and provide a copy to the KO within two working days after the meeting. As a minimum, the following shall be accomplished at each meeting:

a. Review the minutes of the previous meeting;

b. Review the schedule and the status of work and rework;

c. Review the status of submittals;

d. Review the work to be accomplished in the next two weeks and documentation required;

e. Resolve QC and production problems (RFIs, etc.);

f. Address items that may require revising the QC plan; and

g. Review Accident Prevention Plan (APP).

1.9 THREE PHASES OF CONTROL

The three phases of control shall adequately cover both on-site and off-site work and shall include the following for each DFOW.

1.9.1 Preparatory Phase

Notify the KO at least two work days in advance of each preparatory phase. Conduct the preparatory phase with the superintendent and the foreman responsible for the definable feature of work. Document the results of the preparatory phase actions in the daily CQC Report and in the QC checklist. Perform the following prior to beginning work on each definable feature of work:

a. Review each paragraph of the applicable specification sections;

b. Review the contract drawings;

c. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required;

d. Review the testing plan and ensure that provisions have been made to provide the required QC testing;

e. Examine the work area to ensure that the required preliminary work has been completed;

f. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data;

g. Review the APP and appropriate Activity Hazard Analysis (AHA) to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted; and

h. Discuss specific controls used and the construction methods and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each DFOW.

1.9.2 Initial Phase

Notify the KO at least two work days in advance of each initial phase. When construction crews are ready to start work on a DFOW, conduct the Initial Phase with the foreman responsible for that DFOW. Observe the initial segment of the work to ensure that it complies with contract requirements. Document the results of the Initial Phase in the daily CQC Report and in the QC checklist. Perform the following for each DFOW:

a. Establish the quality of workmanship required;

b. Resolve conflicts;

c. Ensure that testing is performed by the approved laboratory; and

d. Check work procedures for compliance with the APP and the appropriate AHA to ensure that applicable safety requirements are met.

1.9.3 Follow-Up Phase

Perform the following for on-going work daily, or more frequently as necessary, until the completion of each DFOW and document in the daily CQC Report and in the QC checklist:

a. Ensure the work is in compliance with contract requirements;

b. Maintain the quality of workmanship required;

c. Ensure that testing is performed by the approved laboratory;

d. Ensure that rework items are being corrected; and

e. Assure manufacturers representatives have performed necessary inspections, if required.

1.9.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same DFOW if the quality of on-going work is unacceptable, if there are changes in the applicable QC organization, if there are changes in the on-site production supervision or work crew, if work on a DFOW is resumed after substantial period of inactivity, or if other problems develop.

1.9.5 Notification of Three Phases of Control for Off-Site Work

Notify the KO at least two weeks prior to the start of the preparatory and initial phases.

1.10 SUBMITTAL REVIEW AND APPROVAL

Procedures for submission, review, and approval of submittals are described in the submittal section of the specification.

1.11 TESTING

Except as stated otherwise in the specification sections, perform sampling and testing required under this contract.

1.11.1 Accreditation Requirements

Construction materials testing laboratories 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, D 3740, 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."

1.11.2 Laboratory Accreditation Authorities

Laboratory Accreditation Authorities include the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute of Standards and Technology, the American Association of State Highway and Transportation Officials (AASHTO), International Accreditation Services, Inc. (IAS), U. S. Army Corps of Engineers Materials Testing Center (MTC), the American Association for Laboratory Accreditation (A2LA), the Washington Association of Building Officials (WABO) (Approval authority for WABO is limited to projects within Washington State), and the Washington Area Council of Engineering Laboratories (WACEL) (Approval authority by WACEL is limited to projects within the NAVFAC WASH and Public Works Center Washington geographical area).

1.11.3 Capability Check

The KO retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this contract.

1.11.4 Test Results

Cite applicable Contract requirements, tests or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. If the item fails to conform, notify the KO immediately. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results shall be signed by a testing laboratory representative authorized to sign certified test reports. Furnish the signed reports, certifications, and other documentation to the KO.

1.12 QC CERTIFICATIONS

1.12.1 Contractor Quality Control Report Certification

Each CQC Report shall contain the following statement: "On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge except as noted in this report."

1.12.2 Invoice Certification

Furnish a certificate to the KO with each payment request, signed by the QC Manager, attesting that as-built drawings are current and attesting that the work for which payment is requested, including stored material, is in compliance with contract requirements.

1.12.3 Completion Certification

Upon completion of work under this contract, the QC Manager shall furnish a certificate to the KO attesting that "the work has been completed, inspected, tested and is in compliance with the contract."

1.13 COMPLETION INSPECTIONS

1.13.1 Punch-Out Inspection

Near the completion of all work or any increment thereof established by a completion time stated in the Contract clause "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the QC Manager shall conduct an inspection of the work and develop a punch list of items which do not conform to the approved drawings and specifications. Include in the punch list any remaining items of the "Rework Items List", which were not corrected prior to the Punch-Out inspection. The punch list shall include the estimated date by which the deficiencies will be corrected. A copy of the punch list shall be provided to the KO. The QC Manager or staff shall make follow-on inspections to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government "Pre-Final Inspection".

1.13.2 Pre-Final Inspection

The Government and QC manager will perform this inspection to verify that the facility is complete and ready to be occupied. A Government pre-final punch list may be developed as a result of this inspection. The QC Manager shall ensure that all items on this list are corrected prior to notifying the Government that a "Final" inspection with the customer can be scheduled. Any items noted on the "Pre-Final" inspection shall be corrected in a timely manner and shall be accomplished before the contract completion date for the work or any particular increment thereof if the project is divided into increments by separate completion dates.

1.13.3 Final Acceptance Inspection

The QC Manager, the superintendent, or other Contractor management personnel and the KO will be in attendance at this inspection. Additional Government personnel may be in attendance. The final acceptance inspection will be formally scheduled by the KO based upon results of the "Pre-Final Inspection". Notice shall be given to the KO at least 14 days prior to the final inspection. The notice shall state that all specific items previously identified to the Contractor as being unacceptable will be complete by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the KO to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause "Inspection of Construction".

1.14 DOCUMENTATION

Maintain current and complete records of on-site and off-site QC program operations and activities. The forms identified under the paragraph "INFORMATION FOR THE CONTRACTING OFFICER (KO)" shall be used. Reports are required for each day work is performed. Account for each calendar day throughout the life of the contract. Every space on the forms must be filled in. Use N/A if nothing can be reported in one of the spaces. The superintendent and the QC Manager must prepare and sign the Contractor Production and CQC Reports, respectively. The reporting of work shall be identified by terminology consistent with the construction schedule. In the "remarks" section in this report which will contain pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered and a record of visitors to the work site. For each remark given, identify the Schedule Activity No. that is associated with the remark.

1.14.1 Quality Control Validation

Establish and maintain the following in a series of three ring binders. Binders shall be divided and tabbed as shown below. These binders shall be readily available to the Government's Quality Assurance Team during all business hours.

a. All completed Preparatory and Initial Phase Checklists, arranged by specification section.

b. All milestone inspections, arranged by Activity/Event Number.

c. A current up-to-date copy of the Testing and Plan Log with supporting field test reports, arranged by specification section.

d. Copies of all contract modifications, arranged in numerical order. Also include documentation that modified work was accomplished.

e. A current up-to-date copy of the Rework Items List.

f. Maintain up-to-date copies of all punch lists issued by the QC Staff on the Contractor and Sub-Contractors and all punch lists issued by the Government.

1.14.2 As-Built Drawings

The QC Manager is required to review the as-built drawings, required by Section 01 78 00 CLOSEOUT SUBMITTALS, are kept current on a daily basis and marked to show deviations, which have been made from the Contract drawings. Ensure each deviation has been identified with the appropriate modifying documentation, e.g. PC number, modification number, RFI number, etc. The QC Manager shall initial each deviation or revision. Upon completion of work, the QC Manager shall submit a certificate attesting to the accuracy of the as-built drawings prior to submission to the KO.

1.15 NOTIFICATION ON NON-COMPLIANCE

The KO will notify the Contractor of any detected non-compliance with the foregoing requirements. The Contractor shall take immediate corrective

action. If the contractor fails or refuses to correct the non-compliant work, the KO will issue a non compliance notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the KO may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall make no part of the time lost due to such stop orders the subject of claim for extension of time, for excess costs, or damages.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS
08/09

PART 1 GENERAL

1.1 SUMMARY

Requirements of this Section apply to, and are a component of, each section of the specifications.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241	(2013) Standard for Safeguarding Construction,Alteration, and Demolition Operations
NFPA 70	(2011; Errata 2 2012) National Electrical Code

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1	(2007; Rev K) Obstruction Marking and Lighting

PART 2 PRODUCTS

2.1 TEMPORARY TRAFFIC CONTROL

2.1.1 Barricades

Erect and maintain temporary barricades to limit public access to hazardous areas. Whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic barricades will be required. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

2.1.2 Fencing

a. Provide fencing along the construction site at all open excavations and tunnels to control access by unauthorized people. Fencing must be installed to be able to restrain a force of at least 250 pounds against it.

2.1.3 Temporary Wiring

Provide temporary wiring in accordance with NFPA 241 and NFPA 70. Include frequent inspection of all equipment and apparatus.

PART 3 EXECUTION

3.1 EMPLOYEE PARKING

Contractor employees will park privately owned vehicles in an area designated by the Contracting Officer. This area will be within reasonable walking distance of the construction site. Contractor employee parking must not interfere with existing and established parking requirements of the government installation.

3.2 AVAILABILITY AND USE OF UTILITY SERVICES

3.2.1 Temporary Utilities

Provide temporary utilities required for construction. Materials may be new or used, must be adequate for the required usage, not create unsafe conditions, and not violate applicable codes and standards.

3.2.2 Payment for Utility Services

Unless otherwise provided in the contract, the amount of each utility service consumed will be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. Carefully conserve any utilities furnished without charge.

3.2.3 Sanitation

Provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer and periodically empty wastes into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Obtain approval from the system owner prior to discharge into any municipal, district, or commercial sanitary sewer system. Any penalties and / or fines associated with improper discharge will be the responsibility of the Contractor. Coordinate with the Contracting Officer and follow station regulations and procedures when discharging into the station sanitary sewer system. Maintain these conveniences at all times without nuisance. Include provisions for pest control and elimination of odors. Government toilet facilities will not be available to Contractor's personnel.

3.2.4 Telephone

Make arrangements and pay all costs for telephone facilities desired.

3.2.5 Obstruction Lighting of Cranes

Provide a minimum of 2 aviation red or high intensity white obstruction lights on temporary structures (including cranes) over 100 feet above ground level. Light construction and installation must comply with FAA AC 70/7460-1. Lights must be operational during periods of reduced visibility, darkness, and as directed by the Contracting Officer.

3.2.6 Fire Protection

Provide temporary fire protection equipment for the protection of personnel and property during construction. Remove debris and flammable

materials to minimize potential hazards.

3.3 TRAFFIC PROVISIONS

3.3.1 Maintenance of Traffic

Conduct work so as to minimize obstruction of traffic. Obtain approval from the Contracting Officer prior to starting any activity that will obstruct traffic

3.4 CONTRACTOR'S TEMPORARY FACILITIES

3.4.1 Safety

Protect the integrity of any installed safety systems or personnel safety devices. If entrance into systems serving safety devices is required, the Contractor must obtain prior approval from the Contracting Officer. If it is temporarily necessary to remove or disable personnel safety devices in order to accomplish contract requirements, provide alternative means of protection prior to removing or disabling any permanently installed safety devices or equipment and obtain approval from the Contracting Officer.

3.4.2 Administrative Field Offices

Provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

3.4.3 Appearance of Trailers

Trailers utilized by the Contractor for administrative or material storage purposes must present a clean and neat exterior appearance and be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on installation property.

3.4.4 Security Provisions

Provide adequate outside security lighting at the Contractor's temporary facilities. The Contractor will be responsible for the security of its own equipment; in addition, the Contractor will notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

3.4.5 Weather Protection of Temporary Facilities and Stored Materials

Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

3.4.5.1 Building and Site Storm Protection

When a warning of gale force winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Government property. Precautions must include, but are not limited to, closing openings; removing loose materials, tools and equipment from exposed locations; and

removing or securing scaffolding and other temporary work. Close openings in the work when storms of lesser intensity pose a threat to the work or any nearby Government property.

3.5 PLANT COMMUNICATION

Whenever the Contractor has the individual elements of its plant so located that operation by normal voice between these elements is not satisfactory, the Contractor must install a satisfactory means of communication, such as telephone or other suitable devices and made available for use by Government personnel.

3.6 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, furnish and erect temporary project safety fencing at the work site. Unless noted otherwise, the safety fencing must be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 42 inches high, supported and tightly secured to steel posts located on maximum 10 foot centers, constructed at the approved location. Maintain the safety fencing during the life of the contract and, upon completion and acceptance of the work, will become the property of the Contractor and be removed from the work site.

3.7 CLEANUP

Remove construction debris, waste materials, packaging material and the like from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways must be cleaned away. Store within the fenced area described above or at the supplemental storage area any materials resulting from demolition activities which are salvageable. Neatly stacked stored materials not in trailers, whether new or salvaged.

3.8 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletinboard, signs, barricades, haulroads, and any other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence that will become the property of the Contractor. Restore to the original or better condition, areas used by the Contractor for the storage of equipment or material, or other use. Gravel used to traverse grassed areas must be removed and the area restored to its original condition, including top soil and seeding as necessary.

-- End of Section --

SECTION 01 57 20.00 10

ENVIRONMENTAL PROTECTION
04/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. AIR FORCE (USAF)

AFI 32-1053	(2009) Integrated Pest Management Program

U.S. ARMY (DA)

DA AR 200-1	(2007) Environmental Protection and Enhancement

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2008; Errata 1-2010; Changes 1-3 2010; Changes 4-6 2011; Change 7 2012) Safety and Health Requirements Manual
WETLANDS DELINEATION MANUAL	(1987) Corps of Engineers Wetlands Delineation Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

33 CFR 328	Definitions of Waters of the United States
40 CFR 260	Hazardous Waste Management System: General
40 CFR 279	Standards for the Management of Used Oil
40 CFR 302	Designation, Reportable Quantities, and Notification
40 CFR 355	Emergency Planning and Notification
40 CFR 68	Chemical Accident Prevention Provisions

STATE OF OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

1200-C	National Pollution Discharge Elimination System (NPDES). Storm Water Discharge Permits for Construction Activities. www.deq.state.or.us./wq/stormwater/construction.htm
1200-COLS	National Pollution Discharge Elimination System (NPDES). Storm Water Discharge Permits for Industrial Activities and ANG

1.2 DEFINITIONS

1.2.1 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally and/or historically.

1.2.2 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2.3 Contractor Generated Hazardous Waste

Contractor generated hazardous waste means materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e. methyl ethyl ketone, toluene etc.), waste thinners,excess paints, excess solvents, waste solvents, and excess pesticides, and contaminated pesticide equipment rinse water.

1.2.4 Installation Pest Management Coordinator

Installation Pest Management Coordinator (IPMC) is the individual officially designated by the Installation Commander to oversee the Installation Pest Management Program and the Installation Pest Management Plan.

1.2.5 Project Pesticide Coordinator

The Project Pesticide Coordinator (PPC) is an individual that resides at a Civil Works Project office and that is responsible for oversight of pesticide application on Project grounds.

1.2.6 Land Application for Discharge Water

The term "Land Application" for discharge water implies that the Contractor must discharge water at a rate which allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the "waters of the United States" must occur. Land Application must be in compliance with all applicable Federal, State, and local laws and regulations.

1.2.7 Pesticide

Pesticide is defined as any substance or mixture of substances intended

for preventing, destroying, repelling, or mitigating any pest, or intended for use as a plant regulator, defoliant or desiccant.

1.2.8 Pests

The term "pests" means arthropods, birds, rodents, nematodes, fungi, bacteria, viruses, algae, snails, marine borers, snakes, weeds and other organisms (except for human or animal disease-causing organisms) that adversely affect readiness, military operations, or the well-being of personnel and animals; attack or damage real property, supplies, equipment, or vegetation; or are otherwise undesirable.

1.2.9 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 "waters of the United States" and would require a permit to discharge water from the governing agency.

1.2.10 Waters of the United States

All waters which are under the jurisdiction of the Clean Water Act, as defined in 33 CFR 328.

1.2.11 Wetlands

Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, and bogs. Official determination of whether or not an area is classified as a wetland must be done in accordance with WETLANDS DELINEATION MANUAL.

1.3 GENERAL REQUIREMENTS

Minimize environmental pollution and damage that may occur as the result of construction operations. The environmental resources within the project boundaries and those affected outside the limits of permanent work must be protected during the entire duration of this contract. Comply with all applicable environmental Federal, State, and local laws and regulationsincluding the 1200-COLS, ANG SWPCP Plan and the ANG SPCC Plan. Any delays resulting from failure to comply with environmental laws and regulations will be the Contractor's responsibility.

1.4 SUBCONTRACTORS

Ensure compliance with this section by subcontractors.

1.5 PAYMENT

No separate payment will be made for work covered under this section. Payment of fees associated with environmental permits, application, and/or notices obtained by the Contractor, and payment of all fines/fees for violation or non-compliance with Federal, State, Regional and local laws and regulations are the Contractor's responsibility. All costs associated with this section must be included in the contract price.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Environmental Protection Plan; G
Signed EMS Policy; G

1.7 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

Environmental Management System (EMS): The Contractor shall obtain the Base EMS policy letter from this website, http://www.142fw.ang.af.mil/resources/ and require all contractor personnel associated with this project to read it. The Contractor shall submit a record to the Contracting Officer stating that all personnel associated with the Contract (general and subcontactors) have read the EMS policy.

1.8 ENVIRONMENTAL PROTECTION PLAN

Prior to commencing construction activities or delivery of materials to the site, submit an Environmental Protection Plan for review and approval by the Contracting Officer. The purpose of the Environmental Protection Plan is to present a comprehensive overview of known or potential environmental issues which the Contractor must address during construction. Issues of concern must be defined within the Environmental Protection Plan as outlined in this section. Address each topic at a level of detail commensurate with the environmental issue and required construction task(s). Topics or issues which are not identified in this section, but are considered necessary, must be identified and discussed after those items formally identified in this section. Prior to submittal of the Environmental Protection Plan, meet with the Contracting Officer for the purpose of discussing the implementation of the initial Environmental Protection Plan; possible subsequent additions and revisions to the plan including any reporting requirements; and methods for administration of the Contractor's Environmental Plans. The Environmental Protection Plan must be current and maintained onsite by the Contractor.

1.8.1 Compliance

No requirement in this Section will relieve the Contractor of any applicable Federal, State, and local environmental protection laws and regulations. During Construction, the Contractor will be responsible for identifying, implementing, and submitting for approval any additional requirements to be included in the Environmental Protection Plan.

1.8.2 Contents

Include in the environmental protection plan, but not limit it 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, if applicable.

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. An erosion and sediment control plan which identifies the type and location of the erosion and sediment controls to be provided. The plan must include monitoring and reporting requirements to assure that the control measures are in compliance with the erosion and sediment control plan, Federal, State, and local laws and regulations. A Storm Water Pollution Control Plan (SWPCP) may supplement this plan.

f. Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on the site.

g. Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plan shall include measures to minimize the amount of mud transported onto paved public roads by vehicles or runoff.

h. 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 including methods for protection of features to be preserved within authorized work areas.

i. Drawing showing the location of borrow areas.

j. Include in the Spill Control plan the procedures, instructions, and reports to be used in the event of an unforeseen spill of a substance regulated by 40 CFR 68, 40 CFR 302, 40 CFR 355, and/or regulated under State or Local laws and regulations. The Spill Control Plan supplements the requirements of EM 385-1-1 . Include in this plan, as a minimum:

(1) The name of the individual who will report any spills or hazardous substance releases and who will follow up with complete documentation. This individual will immediately notify the Contracting Officer and Base Command Post at 503-335-4911, in addition to the legally required Federal, State, and local reporting channels (including the National Response Center 1-800-424-8802) if a reportable quantity is released to the environment. Include in the plan a list of the required reporting channels and telephone numbers.

(2) The name and qualifications of the individual who will be responsible for implementing and supervising the containment and cleanup.

(3) Training requirements for Contractor's personnel and methods of accomplishing the training.

(4) A list of materials and equipment to be immediately available at the job site, tailored to cleanup work of the potential hazard(s) identified.

(5) The names and locations of suppliers of containment materials and locations of additional fuel oil recovery, cleanup, restoration, and material-placement equipment available in case of an unforeseen spill emergency.

(6) The methods and procedures to be used for expeditious contaminant cleanup.

k. A non-hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris and schedules for disposal.

(1) Identify any subcontractors responsible for the transportation and disposal of solid waste. Submit licenses or permits for solid waste disposal sites that are not a commercial operating facility.

(2) Evidence of the disposal facility's acceptance of the solid waste must be attached to this plan during the construction. Attach a copy of each of the Non-hazardous Solid Waste Diversion Reports to the disposal plan. Submit the report for the previous quarter on the first working day after the first quarter that non-hazardous solid waste has been disposed and/or diverted (e.g. the first working day of January, April, July, and October).

(3) Indicate in the report the total amount of waste generated and total amount of waste diverted in cubic yards or tons along with the percent that was diverted.

(4) A recycling and solid waste minimization plan with a list of measures to reduce consumption of energy and natural resources. Detail in the plan the Contractor's actions to comply with and to participate in Federal, State, Regional, and local government sponsored recycling programs to reduce the volume of solid waste at the source.

l. An air pollution control plan detailing provisions to assure that dust, debris, materials, trash, etc., do not become air borne and travel off the project site.

m. A contaminant prevention plan that: identifies potentially hazardous substances to be used on the job site; identifies the intended actions to prevent introduction of such materials into the air, water, or ground; and details provisions for compliance with Federal, State, and local laws and regulations for storage and handling of these materials. In accordance with EM 385-1-1, a copy of the Material Safety Data Sheets (MSDS) and the maximum quantity of each hazardous material to be onsite at any given time must be included in the contaminant prevention plan. Update the plan as new hazardous materials are brought onsite or removed from the site. The Contractor shall register all hazardous materials brought on base with the base HAZMART by submitting to the base HAZMART to their satisfaction 5-days prior to the hazardous material arriving on base. The necessary forms will be provided upon request. Store all hazardous materials in accordance with Article 80 of the Oregon Uniform Fire Code. Insure all

hazardous materials stored outdoors are placed in secondary containment in accordance with 40 Code of Federal Regulations 112, http://www.access.gpo.gov/nara/cfr/waisidx_02/40cfr112_02.html

n. A waste water management plan that identifies the methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines. If a settling/retention pond is required, the plan must include the design of the pond including drawings, removal plan, and testing requirements for possible pollutants. If land application will be the method of disposal for the waste water, the plan must include a sketch showing the location for land application along with a description of the pretreatment methods to be implemented. If surface discharge will be the method of disposal, include a copy of the permit and associated documents as an attachment prior to discharging the waste water. If disposal is to a sanitary sewer, the plan must include documentation that the Waste Water Treatment Plant Operator has approved the flow rate, volume, and type of discharge.

o. A historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on the project site: and/or identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in the area are discovered during construction. Include in the plan methods to assure the protection of known or discovered resources, identifying lines of communication between Contractor personnel and the Contracting Officer.

p. Include and update a pesticide treatment plan, as information becomes available. Include in the plan: sequence of treatment, dates, times, locations, pesticide trade name, EPA registration numbers, authorized uses, chemical composition, formulation, original and applied concentration, application rates of active ingredient (i.e. pounds of active ingredient applied), equipment used for application and calibration of equipment. Federal, State, Regional and Local pest management record keeping and reporting requirements as well as any additional Installation Project Office specific requirements are the Contractor's responsibility in conformance with [DA AR 200-1 Chapter 5--Pest Management, Section 5-4 "Program requirements"] [AFI 32-1053 Sections 3.4.13 and 3.4.14] for data required to be reported to the Installation.

1.8.3 Appendix

Attach to the Environmental Protection Plan, as an appendix, copies of all environmental permits, permit application packages, approvals to construct, notifications, certifications, reports, and termination documents including, but not limited to, the 1200-C.

1.9 PROTECTION FEATURES

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite construction activities, the Contractor and the Contracting Officer will make a joint condition survey. Immediately

following the survey, the Contractor will prepare a brief report including a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. This survey report will be signed by both the the Contractor and the Contracting Officer upon mutual agreement as to its accuracy and completeness. The Contractor must protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference which their preservation may cause to the work under the contract.

1.10 ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS

Any deviations from the drawings,plans and specifications, requested by the Contractor and which may have an environmental impact, will be subject to approval by the Contracting Officer and may require an extended review, processing, and approval time. The Contracting Officer reserves the right to disapprove alternate methods, even if they are more cost effective, if the Contracting Officer determines that the proposed alternate method will have an adverse environmental impact.

1.11 NOTIFICATION

A. The Contracting Officer will notify the Contractor in writing of any observed noncompliance with Federal, State or local environmental laws or regulations, permits, and other elements of the Contractor's Environmental Protection plan. After receipt of such notice, the Contractor will inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions will be granted or equitable adjustments allowed for any such suspensions. This is in addition to any other actions the Contracting Officer may take under the contract, or in accordance with the Federal Acquisition Regulation or Federal Law.

B. Spill Notification: The Contractor shall notify the Base Command Post at 503-335-4911 upon spilling any quantity of hazardous materials or waste. Spill Containment Control and Coutermeasures shall be provided by the Contractor in accordance with 20 CFR 112.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 ENVIRONMENTAL PERMITS AND COMMITMENTS

Obtaining and complying with all environmental permits and commitments required by Federal, State, Regional, and local environmental laws and regulations is the Contractor's responsibility. Contractor shall obtain a 1200-C if required for the project including permit application preparation and payment of permit fees.

3.2 LAND RESOURCES

Confine all activities to areas defined by the drawings and specifications. Identify any land resources to be preserved within the work area prior to the beginning of any construction. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without approval, except in areas indicated on the drawings or specified to be cleared. Ropes, cables, or guys will not be fastened to or attached to any trees for anchorage unless specifically authorized. Provide effective protection for land and vegetation resources at all times, as defined in the following subparagraphs. Remove stone, soil, or other materials displaced into uncleared areas.

3.2.1 Work Area Limits

Mark the areas that need not be disturbed under this contract prior to commencing construction activities. Mark or fence isolated areas within the general work area which are not to be disturbed. Protect monuments and markers before construction operations commence. Where construction operations are to be conducted during darkness, any markers must be visible in the dark. The Contractor's personnel must be knowledgeable of the purpose for marking and/or protecting particular objects.

3.2.2 Landscape

Trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved must be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques. Restore landscape features damaged or destroyed during construction operations outside the limits of the approved work area.

3.2.3 Erosion and Sediment Controls

Providing erosion and sediment control measures in accordance with Federal, State, and local laws and regulations is the Contractor's responsibility. Select and maintain the erosion and sediment controls such that water quality standards are not violated as a result of construction activities. The area of bare soil exposed at any one time by construction operations should be kept to a minimum. Construct or install temporary and permanent erosion and sediment control best management practices (BMPs) as indicated on the drawings and as specified in Section 01 57 23 TEMPORARY STORM WATER POLLUTION CONTROL. BMPs may include, but not be limited to, vegetation cover, stream bank stabilization, slope stabilization, silt fences, construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels, and sedimentation basins. Remove any temporary measures after the area has been stabilized.

3.2.4 Contractor Facilities and Work Areas

Place field offices, staging areas, stockpile storage, and temporary buildings in areas designated on the drawings or as directed by the Contracting Officer. Temporary movement or relocation of Contractor facilities will be made only when approved. Erosion and sediment controls must be provided for onsite borrow and spoil areas to prevent sediment from entering nearby waters. Temporary excavation and embankments for plant and/or work areas must be controlled to protect adjacent areas.

3.3 WATER RESOURCES

Monitor all water areas affected by construction activities to prevent pollution of surface and ground waters. Do not apply toxic or hazardous chemicals to soil or vegetation unless otherwise indicated. For construction activities immediately adjacent to impaired surface waters, the Contractor must be capable of quantifying sediment or pollutant loading to that surface water when required by State or Federally issued Clean Water Act permits.

3.3.1 Groundwater

The Contractor shall submit an engineering proposal to the Base Commander for apprvoal showing hydraulic claculations from a registered professional hydrologist for proposed dewatering influence on existing groundwater contaminant plumes indicated at this website under "Feasibility Study": http://www.142fw.ang.af.mil/resources/

3.4 AIR RESOURCES

Equipment operation, activities, or processes will be in accordance with all Federal and State air emission and performance laws and standards.

3.4.1 Particulates

Dust particles; aerosols and gaseous by-products from construction activities; and processing and preparation of materials, such as from asphaltic batch plants; must be controlled at all times, including weekends, holidays and hours when work is not in progress. Maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would cause the Federal, State, and local air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. Provide sufficient, competent equipment available to accomplish these tasks. Perform particulate control as the work proceeds and whenever a particulate nuisance or hazard occurs. Comply with all State and local visibility regulations.

3.4.2 Odors

Odors from construction activities must be controlled at all times. The odors must be in compliance with State regulations and/or local ordinances and may not constitute a health hazard.

3.4.3 Sound Intrusions

Keep construction activities under surveillance and control to minimize environment damage by noise. Comply with the provisions of the State of Oregon rules.

3.4.4 Burning

Burning is prohibited on the Government premises.

3.5 CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL

Disposal of wastes will be as directed below, unless otherwise specified in other sections and/or shown on the drawings.

3.5.1 Solid Wastes

Place solid wastes (excluding clearing debris) in containers which are emptied on a regular schedule. Handling, storage, and disposal must be conducted to prevent contamination. Employ segregation measures so that no hazardous or toxic waste will become co-mingled with solid waste. Transport solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill will be the minimum acceptable offsite solid waste disposal option. Verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate.

3.5.2 Chemicals and Chemical Wastes

Dispense chemicals ensuring no spillage to the ground or water. Perform and document periodic inspections of dispensing areas to identify leakage and initiate corrective action. This documentation will be periodically reviewed by the Government. Collect chemical waste in corrosion resistant, compatible containers. Collection drums must be monitored and removed to a staging or storage area when contents are within 6 inches of the top. Wastes will be classified, managed, stored, and disposed of in accordance with Federal, State, and local laws and regulations.

3.5.3 Contractor Generated Hazardous Wastes/Excess Hazardous Materials

A. Hazardous Waste: All hazardous waste generated from the use of hazardous materials becomes the property of the Government to dispose of. The Contractor shall make the Base Environmental Office (142 FW/EM, phone 503-335-4462) aware of all hazardous waste accumulation and disposal requirements through the AF Form 3952 process (see para. B). The Contractor will be required to accumulate hazardous waste on site in an approved container and location and request disposal from the Environmental Office with 2-weeks notice.

B. Building Demolition Waste: In the event that the Contractor could not offer hazardous building components to be re-used upon removal, the Contractor shall collect, containerize, and dispose of these components in a manner approved by the Base Commander or Base Environmental Officer. The Contractor shall submit their collection, containerization, and disposal plan to the Base Commander or Base Environmental Officer for approval. Hazardous building components considered shall include (as a minimum):

a. Refrigerant reclaimed from air conditioning equipment (required to be removed by a licensed operator of EPA registered recovery equipment)

b. Florescent light tubes

c. Lighting ballasts (except those with factory markings "NON-PCB")

d. Transformers

e. Mercury switches (including thermostats)

f. Lead-based paint

g. Asbestos

h. Oil water separators and contained sludge/liquids

i. Storage tanks (underground or above ground)

3.5.4 Fuel and Lubricants

Storage, fueling and lubrication of equipment and motor vehicles must be conducted in a manner that affords the maximum protection against spill and evaporation. Manage and store fuel, lubricants and oil in accordance with all Federal, State, Regional, and local laws and regulations. Used lubricants and used oil to be discarded must be stored in marked corrosion-resistant containers and recycled or disposed in accordance with 40 CFR 279, State, and local laws and regulations. Storage of fuel on the project site will be in accordance with all Federal, State, and local laws and regulations.

3.5.5 Waste Water

Disposal of waste water will be as specified below.

a. Waste water from construction activities, such as onsite material processing, concrete curing, foundation and concrete clean-up, water used in concrete trucks, forms, etc. will not be allowed to enter water ways or to be discharged prior to being treated to remove pollutants. Dispose of the construction related waste water off-Government property in accordance with all Federal, State, Regional and Local laws and regulations.

b. Water generated from the flushing of lines after disinfection or disinfection in conjunction with hydrostatic testing will be land applied in accordance with all Federal, State, and local laws and regulations for land application.

c. The Contractor may submit washing operations for approval by the Base Commander for discharge to sanitary sewer. Approval may require the Contractor provide pretreatment or other means deemed necessary by the Base Commander and permitting authority.

3.6 RECYCLING AND WASTE MINIMIZATION

Participate in State and local government sponsored recycling programs. The Contractor is further encouraged to minimize solid waste generation throughout the duration of the project.

3.7 NON-HAZARDOUS SOLID WASTE DIVERSION REPORT

Maintain an inventory of non-hazardous solid waste diversion and disposal of construction and demolition debris. Submit a report to Base Commander through the Contracting Officer on the first working day after each fiscal year quarter, starting the first quarter that non-hazardous solid waste has been generated. Include the following in the report:

a. Construction and Demolition (C&D) Debris Disposed = in cubic yards

or tons, as appropriate.

b. Construction and Demolition (C&D) Debris Recycled = in cubic yards or tons, as appropriate.

c. Total C&D Debris Generated = in cubic yards or tons, as appropriate.

d. Waste Sent to Waste-To-Energy Incineration Plant (This amount should not be included in the recycled amount) = in cubic yards or tons, as appropriate.

3.8 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

If during excavation or other construction activities any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found, all activities that may damage or alter such resources will be temporarily suspended. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, immediately notify the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. Cease all activities that may result in impact to or the destruction of these resources. Secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources.

3.9 BIOLOGICAL RESOURCES

Minimize interference with, disturbance to, and damage to fish, wildlife, and plants including their habitat. The protection of threatened and endangered animal and plant species, including their habitat, is the Contractor's responsibility in accordance with Federal, State, Regional, and local laws and regulations.

3.10 INTEGRATED PEST MANAGEMENT

In order to minimize impacts to existing fauna and flora, the Contractor through the Contracting Officer, must coordinate with the Installation Pest Management Coordinator (IPMC) Project Pesticide Coordinator (PPC)at the earliest possible time prior to pesticide application. Discuss integrated pest management strategies with the [IPMC][PPC] and receive concurrence from the [IPMC][PPC] through the COR prior to the application of any pesticide associated with these specifications. Installation Project Office Pest Management personnel will be given the opportunity to be present at all meetings concerning treatment measures for pest or disease control and during application of the pesticide.

3.10.1 Pesticide Delivery and Storage

Deliver pesticides to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses. Store pesticides according to manufacturer's instructions and under lock and key when unattended.

3.10.2 Qualifications

For the application of pesticides, use the services of a subcontractor whose principal business is pest control. The subcontractor must be licensed and certified in the state where the work is to be performed.

3.10.3 Pesticide Handling Requirements

Formulate, treat with, and dispose of pesticides and associated containers in accordance with label directions and use the clothing and personal protective equipment specified on the labeling for use during all phases of the application. Furnish Material Safety Data Sheets (MSDS) for all pesticide products.

3.10.4 Application

Apply pesticides using a State Certified Pesticide Applicator in accordance with EPA label restrictions and recommendation. The Certified Applicator must wear clothing and personal protective equipment as specified on the pesticide label. The Contracting Officer will designate locations for water used in formulating. Do not allow the equipment to overflow. All equipment must be inspected for leaks, clogging, wear, or damage and repaired prior to application of pesticide.

3.11 PREVIOUSLY USED EQUIPMENT

Clean all previously used construction equipment prior to bringing it onto the project site. Ensure that the equipment is free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. Consult with the USDA jurisdictional office for additional cleaning requirements.

3.12 MAINTENANCE OF POLLUTION FACILITIES

Maintain permanent and temporary pollution control facilities and devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

3.13 MILITARY MUNITIONS

In the event military munitions, as defined in 40 CFR 260, are discovered or uncovered, the Contractor will immediately stop work in that area and immediately inform the Contracting Officer.

3.14 TRAINING OF CONTRACTOR PERSONNEL

The Contractor's personnel must be trained in all phases of environmental protection and pollution control. Conduct environmental protection/pollution control meetings for all personnel prior to commencing construction activities. Additional meetings must be conducted for new personnel and when site conditions change. Include in the training and meeting agenda: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, wetlands, and endangered species and their habitat that are known to be in the area.

3.15 CONTAMINATED MEDIA MANAGEMENT

The Contractor shall provide appropriate training and air monitoring to excavate at sites with contaminated soils or groundwater. Appropriate training and air monitoring shall be as determined by the Contractor to meet OSHA requirements for contaminants and their extents represented in the "Feasibility Study" at this website: http://www.142fw.ang.af.mil/resources/. Before conducting any work, the Contractor shall determine if excavation will take place at any of the sites in this "Feasibility Study" and provide the appropriate training and air monitoring for contractor personnel. In the event that excavated materials in areas identified as contaminated cannot be backfilled to the same location, the Contractor shall provide disposal at a location approved by the Base Commander and the Contracting Officer.

3.16 POST CONSTRUCTION CLEANUP

The Contractor will clean up all areas used for construction in accordance with Contract Clause: "Cleaning Up". Unless otherwise instructed in writing by the Contracting Officer, obliterate all signs of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. The disturbed area must be graded, filled and the entire area seeded unless otherwise indicated.

-- End of Section --

SECTION 01 57 23

TEMPORARY STORM WATER POLLUTION CONTROL
04/08

PART 1 GENERAL

1.1 SUMMARY

The work consists of implementing the storm water pollution prevention measures to prevent sediment from entering streams or water bodies as specified in this Section in conformance with the requirements of Section 01 57 20.00 10 ENVIRONMENTAL PROTECTION, and the requirements of the National Pollutant Discharge Elimination System (NPDES).

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D4439	(2011) Geosynthetics
ASTM D4491	(1999a; R 2009) Water Permeability of Geotextiles by Permittivity
ASTM D4533	(2011) Trapezoid Tearing Strength of Geotextiles
ASTM D4632	(2008) Grab Breaking Load and Elongation of Geotextiles
ASTM D4751	(2012) Determining Apparent Opening Size of a Geotextile
ASTM D4873	(2002; R 2009) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

STATE OF OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

1200-C	RNational Pollution Discharge Elimination System (NPDES). Storm Water Discharge Permits for Construction Activities. www.deq.state.or.us./wq/stormwater/construction.htm

1.3 EROSION AND SEDIMENT CONTROLS

The controls and measures required of the Contractor are described below.

1.3.1 Erosion, Sediment and Stormwater Control

a. Install, inspect, and maintain best management practices (BMPs) as required by the 1200-C. BMPs may include: temporary seeding, mulching,geotextiles, sod stabilization, vegatative buffer

strips,erosion control mats and preservation of vegetation as identified in the erosion and sediment control plan.

b. Prepare and submit Storm Water Inspection Reports in accordance with the 1200-C to the Contracting Officer once every 7 calendar days and within 24 hours of a storm event that produces 0.5 inch or more of rain.

c. Once construction is complete and the site has been stabilized with a final, sustainable cover, submit the Notice of Termination to Oregon Department of Environmental Quality within 30 days after all land disturbing activities end.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Material Submittals
Erosion and Sediment Control Materials

SD-06 Test Reports

Storm Water Inspection Reports for General Permit

1.5 DELIVERY, STORAGE, AND HANDLING

Identify, store and handle filter fabric in accordance with ASTM D4873.

PART 2 PRODUCTS

2.1 COMPONENTS FOR SILT FENCES

2.1.1 Filter Fabric

Provide geotextile that complies with the requirements of ASTM D4439, and consists of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of ester, propylene, or amide, and contains stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and heat exposure. Provide synthetic filter fabric that contains ultraviolet ray inhibitors and stabilizers to assure a minimum of six months of expected usable construction life at a temperature range of 0 to 120 degrees F. The filter fabric shall meet the following requirements:

FILTER FABRIC FOR SILT SCREEN FENCE		
PHYSICAL PROPERTY	TEST PROCEDURE	STRENGTH REQUIREMENT

FILTER FABRIC FOR SILT SCREEN FENCE		
Grab Tensile Elongation (percent)	ASTM D4632	100 lbs. min. 30 percent max.
Trapezoid Tear	ASTM D4533	55 lbs. min.
Permittivity	ASTM D4491	0.2 sec-1
AOS (U.S. Std Sieve)	ASTM D4751	20-100

2.1.2 Silt Fence Stakes and Posts

Use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction, shall have a minimum cross section of 2 by 2 inches when oak is used and 4 by 4 inches when pine is used, and have a minimum length of 5 feet. Steel posts (standard "U" or "T" section) utilized for silt fence construction, shall have a minimum weight of 1.33 pounds/linear foot and a minimum length of 5 feet.

2.1.3 Mill Certificate or Affidavit

Provide a mill certificate or affidavit attesting that the fabric and factory seams meet chemical, physical, and manufacturing requirements specified above. Specify in the mill certificate or affidavit the actual Minimum Average Roll Values and identify the fabric supplied by roll identification numbers. Submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the filter fabric.

2.2 COMPONENTS FOR STRAW BALES

The straw in the bales shall be stalks from oats, wheat, rye, barley, rice, or from grasses such as byhalia, bermuda, etc., furnished in air dry condition. Provide bales with a standard cross section of 14 by 18 inches. Wire-bound or string-tie all bales. Use either wooden stakes or steel posts to secure the straw bales to the ground. Wooden stakes utilized for this purpose, shall have a minimum dimensions of 2 by 2 inches in cross section and have a minimum length of 3 feet. Steel posts (standard "U" or "T" section) utilized for securing straw bales, shall have a minimum weight of 1.33 pounds/linear foot and a minimum length of 3 feet.

PART 3 EXECUTION

3.1 INSTALLATION OF SILT FENCES

Extend silt fences a minimum of 16 inches above the ground surface without exceeding 34 inches above the ground surface. Provide filter fabric from a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, splice together filter fabric at a support post, with a minimum 6 inch overlap, and securely sealed. Excavate trench approximately 4 inches wide and 4 inches deep on the upslope side of the location of the silt fence. The 4 by 4 inch trench shall be backfilled and the soil compacted over the filter fabric. Remove silt fences upon approval by the Contracting Officer.

3.2 INSTALLATION OF STRAW BALES

Place the straw bales in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another. Install straw bales so that bindings are oriented around the sides rather than along the tops and bottoms of the bales in order to prevent deterioration of the bindings. Entrench and backfill the barrier. Excavate a trench the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. After the bales are staked and chinked (gaps filled by wedging with straw), backfill the excavated soil against the barrier. Conform the backfill soil with the ground level on the downhill side and build up to 4 inches against the uphill side of the barrier. Scatter loose straw over the area immediately uphill from a straw bale barrier to increase barrier efficiency. Securely anchor each bale by at least two stakes driven through the bale. Drive the first stake or steel post in each bale toward the previously laid bale to force the bales together. Drive stakes or steel pickets a minimum 18 inches deep into the ground to securely anchor the bales.

3.3 FIELD QUALITY CONTROL

Maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures. Use the following procedures to maintain the protective measures.

3.3.1 Silt Fence Maintenance

Inspect the silt fences in accordance with paragraph, titled "Inspections," of this section. Any required repairs shall be made promptly. Pay close attention to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, replace the fabric promptly. Remove sediment deposits when deposits reach one-third of the height of the barrier. Remove a silt fence when it is no longer required. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall [receive erosion control] [be seeded in accordance with Section 32 05 33 LANDSCAPE ESTABLISHMENT, except that the coverage requirements in paragraph, titled "Establishment" of this section do not apply].

3.3.2 Straw Bale Maintenance

Inspect straw bale barriers in accordance with paragraph, titled "Inspections". Pay close attention to the repair of damaged bales, end runs and undercutting beneath bales. Accomplish necessary repairs to barriers or replacement of bales in a promptly manner. Remove sediment deposits when deposits reach one-half of the height of the barrier. At the each end of each row turn bales uphill when used to retain sediment. Remove a straw bale barrier when it is no longer required. The immediate area occupied by the bales and any sediment deposits shall be shaped to an acceptable grade. Seed the areas disturbed by this shaping in accordance with Section 32 92 19 SEEDING.

3.3.3 Diversion Dike Maintenance

Inspect diversion dikes in accordance with paragraph, titled "Inspections," of this section. Pay close attention to the repair of damaged diversion dikes and accomplish necessary repairs promptly. When diversion dikes are no longer required, shape to an acceptable grade. Seed the areas disturbed by this shaping in accordance with Section 32 92 19 SEEDING.

-- End of Section --

SECTION 01 74 19

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT
01/07

PART 1 GENERAL

1.1 GOVERNMENT POLICY

Government policy is to apply sound environmental principles in the design, construction and use of facilities. As part of the implementation of that policy: (1) practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction and demolition waste from landfills and incinerators and to facilitate their recycling or reuse. A minimum of 75 percent by weight of total project solid waste shall be diverted from the landfill.

1.2 MANAGEMENT

Develop and implement a waste management program. Take a pro-active, responsible role in the management of construction and demolition waste and require all subcontractors, vendors, and suppliers to participate in the effort. Construction and demolition waste includes products of demolition or removal, excess or unusable construction materials, packaging materials for construction products, and other materials generated during the construction process but not incorporated into the work. In the management of waste consideration shall be given to the availability of viable markets, the condition of the material, the ability to provide the material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates. The Contractor is responsible for implementation of any special programs involving rebates or similar incentives related to recycling of waste. Revenues or other savings obtained for salvage, or recycling accrue to the Contractor. Appropriately permit firms and facilities used for recycling, reuse, and disposal for the intended use to the extent required by federal, state, and local regulations. Also, provide on-site instruction of appropriate separation, handling, recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Waste Management Plan; G;

SD-11 Closeout Submittals

Records;

1.4 MEETINGS

Conduct Construction Waste Management meetings. After award of the Contract and prior to commencement of work, schedule and conduct a meeting with the Contracting Officer to discuss the proposed Waste Management Plan and to develop a mutual understanding relative to the details of waste management. The requirements for this meeting may be fulfilled during the coordination and mutual understanding meeting outlined in Section 01 45 00.00 10 QUALITY CONTROL. At a minimum, environmental and waste management goals and issues shall be discussed at the following additional meetings:

b. Preconstruction meeting.

c. Regular site meetings.

1.5 WASTE MANAGEMENT PLAN

A waste management plan shall be submitted within 15 days after contract award and not less than 10 days before the preconstruction meeting. The plan shall demonstrate how the project waste diversion goal shall be met and shall include the following:

a. Name of individuals on the Contractor's staff responsible for waste prevention and management.

b. Actions that will be taken to reduce solid waste generation, including coordination with subcontractors to ensure awareness and participation.

c. Description of the regular meetings to be held to address waste management.

d. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas on site and equipment to be used for processing, sorting, and temporary storage of wastes.

e. Characterization, including estimated types and quantities, of the waste to be generated.

f. Name of landfill and/or incinerator to be used and the estimated costs for use, assuming that there would be no salvage or recycling on the project.

g. Identification of local and regional reuse programs, including non-profit organizations such as schools, local housing agencies, and organizations that accept used materials such as materials exchange networks and Habitat for Humanity. Include the name, location, and phone number for each reuse facility to be used, and provide a copy of the permit or license for each facility.

h. List of specific waste materials that will be salvaged for resale, salvaged and reused on the current project, salvaged and stored for reuse on a future project, or recycled. Recycling facilities that will be used shall be identified by name, location, and phone number, including a copy of the permit or license for each facility.

i. Identification of materials that cannot be recycled/reused with an

explanation or justification, to be approved by the Contracting Officer.

j. Description of the means by which any waste materials identified in item (h) above will be protected from contamination.

k. Description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site).

Revise and resubmit Plan as required by the Contracting Officer. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations or meeting project cumulative waste diversion requirement. Distribute copies of the Waste Management Plan to each subcontractor, the Quality Control Manager, and the Contracting Officer.

1.6 RECORDS

Records shall be maintained 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. The records shall be made available to the Contracting Officer during construction, and a copy of the records shall be delivered to the Contracting Officer upon completion of the construction.

1.7 COLLECTION

Separate, store, protect, and handle at the site identified recyclable and salvageable waste products in a manner that maximizes recyclability and salvagability of identified materials. Provide the necessary containers, bins and storage areas to facilitate effective waste management and clearly and appropriately identify them. Provide materials for barriers and enclosures around recyclable material storage areas which are nonhazardous and recyclable or reusable. Locate out of the way of construction traffic. Provide adequate space for pick-up and delivery and convenience to subcontractors. Recycling and waste bin areas are to be kept neat and clean, and recyclable materials shall be handled to prevent contamination of materials from incompatible products and materials. Clean contaminated materials prior to placing in collection containers. Use cleaning materials that are nonhazardous and biodegradable. Handle hazardous waste and hazardous materials in accordance with applicable regulations. Separate materials by one of the following methods:

1.7.1 Source Separated Method.

Waste products and materials that are recyclable shall be separated from trash and sorted as described below into appropriately marked separate containers and then transported to the respective recycling facility for further processing. Deliver materials in accordance with recycling or reuse facility requirements (e.g., free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process). Separate materials into the following category types as appropriate to the project waste and to the available recycling and reuse programs in the project area:

a. Land clearing debris.

b. Asphalt.

c. Concrete and masonry.

d. Metal (e.g. banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized, stainless steel, aluminum, copper, zinc, lead brass, bronze).

(1) Ferrous.

(2) Non-ferrous.

e. Wood (nails and staples allowed).

f. Debris.

g. Glass (colored glass allowed).

h. Paper.

(1) Bond.

(2) Newsprint.

(3) Cardboard and paper packaging materials.

i. Plastic.

(1) Type 1: Polyethylene Terephthalate (PET, PETE).

(2) Type 2: High Density Polyethylene (HDPE).

(3) Type 3: Vinyl (Polyvinyl Chloride or PVC).

(4) Type 4: Low Density Polyethylene (LDPE).

(5) Type 5: Polypropylene (PP).

(6) Type 6: Polystyrene (PS).

(7) Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

k. Non-hazardous paint and paint cans.

n. Insulation.

o. Beverage containers.

1.7.2 Co-Mingled Method.

Waste products and recyclable materials shall be placed into a single container and then transported to a recycling facility where the recyclable materials are sorted and processed.

1.7.3 Other Methods.

Other methods proposed by the Contractor may be used when approved by the Contracting Officer.

1.8 DISPOSAL

Control accumulation of waste materials and trash. Recycle or dispose of collected materials off-site at intervals approved by the Contracting Officer and in compliance with waste management procedures. Except as otherwise specified in other sections of the specifications, disposal shall be in accordance with the following:

1.8.1 Reuse.

First consideration shall be given to salvage for reuse since little or no re-processing is necessary for this method, and less pollution is created when items are reused in their original form. Sale or donation of waste suitable for reuse shall be considered.

1.8.2 Recycle.

Waste materials not suitable for reuse, but having value as being recyclable, shall be made available for recycling. All fluorescent lamps, HID lamps, and mercury-containing thermostats removed from the site shall be recycled. Arrange for timely pickups from the site or deliveries to recycling facilities in order to prevent contamination of recyclable materials.

1.8.3 Waste.

Materials with no practical use or economic benefit shall be disposed at a landfill or incinerator.

1.8.4 Return

Set aside and protect misdelivered and substandard products and materials and return to supplier for credit.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 78 00

CLOSEOUT SUBMITTALS
08/11

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Warranty Management Plan
Warranty Tags
Spare Parts Data

SD-08 Manufacturer's Instructions

Preventative Maintenance and Inspection Schedules

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

SD-11 Closeout Submittals

Record Drawings
Interim Form DD1354; G
Checklist for Form DD1354; G

1.3 PROJECT RECORD DOCUMENTS

1.3.1 Record Drawings

Drawings showing final as-built conditions of the project. This paragraph covers record drawings complete, as a requirement of the contract. The terms "drawings," "contract drawings," "drawing files," "working record drawings" and "final record drawings" refer to contract drawings which are revised to be used for final record drawings showing as-built conditions. The manually prepared drawings must consist of 1 set of completed final red-linedas-built record drawings, 2 sets of prints/copeis of the final red-lined record drawings, and the approved marked working as-built prints.

1.3.1.1 Working Record and Final Record Drawings

Revise 1 sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. Keep this working as-built marked drawings current on a weekly basis and aavailable on the jobsite at all times. Changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction must be accurately and neatly recorded as they occur by means of details and notes. Prepare final record (as-built) drawings after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project). The working as-built marked prints and final record (as-built) drawings will be jointly reviewed for accuracy and completeness by the Contracting Officer and the Contractor prior to submission of each monthly pay estimate. If the Contractor fails to maintain the working and final record drawings as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of maintaining the record drawings. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of updated drawings. Show on the working and final record drawings , but not limited to, the following information:

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.

b. The location and dimensions of any changes within the building structure.

c. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.

d. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

f. Changes or modifications which result from the final inspection.

g. Where contract drawings or specifications present options, show only the option selected for construction on the final as-built prints.

h. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, furnish a contour map of the final borrow pit/spoil area elevations.

i. Systems designed or enhanced by the Contractor, such as HVAC controls,

fire alarm, fire sprinkler, and irrigation systems.

j. Modifications (include within change order price the cost to change working and final record drawings to reflect modifications) and compliance with the following procedures.

(1) Follow directions in the modification for posting descriptive changes.

(2) Place a Modification Delta at the location of each deletion.

(3) For new details or sections which are added to a drawing, place a Modification Delta by the detail or section title.

(4) For minor changes, place a Modification Delta by the area changed on the drawing (each location).

(5) For major changes to a drawing, place a Modification Delta by the title of the affected plan, section, or detail at each location.

(6) For changes to schedules or drawings, place a Modification Delta either by the schedule heading or by the change in the schedule.

(7) The Modification Delta size shall be 1/2 inch diameter unless the area where the circle is to be placed is crowded. Smaller size circle shall be used for crowded areas.

1.3.1.2 Drawing Preparation

Modify the record drawings as may be necessary to correctly show the features of the project as it has been constructed by bringing the contract set into agreement with approved working as-built prints, and adding such additional drawings as may be necessary. These working as-built marked prints must be neat, legible and accurate. These drawings are part of the permanent records of this project and must be returned to the Contracting Officer after approval by the Government. Any drawings damaged or lost by the Contractor must be satisfactorily replaced by the Contractor at no expense to the Government.

1.3.1.3 Manually Prepared Drawings

Employ only personnel proficient in the preparation of manually prepared drawings to prepare the final record drawings. Additions and corrections to the drawings must be neat, clean and legible, shall be done to the same level of detail.The Contracting Officer will review record drawings for accuracy and conformance to the above specified drafting standards. Corrections, changes, additions, and deletions required must meet these standards.

a. When final revisions have been completed, Letter or stamp each drawing with the words "RECORD DRAWINGS / AS-BUILT CONDITIONS" followed by the name of the Contractor in letters at least 3/16 inch high. Mark original contract drawings either "Record" drawings denoting no revisions on the sheet or "Revised Record" denoting one or more revisions Date all original contract drawings in the revision block.

b. Within 10 days after Government approval of all of the working record drawings for a phase of work, prepare the final record drawings for that phase of work and submit two sets of prints of these drawings for

Government review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 7 days revise the drawings accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 10 days of substantial completion of all phases of work, submit the final record drawing package for the entire project. Submit two prints of these drawings and the return of the approved marked record prints, complete in all details. Paper prints and reproducible drawings will become the property of the Government upon final approval. Failure to submit final record drawings and marked prints, as required herein, will be cause for withholding any payment due the Contractor under this contract. Approval and acceptance of final record drawings must be accomplished before final payment is made to the Contractor.

1.3.1.4 Payment

No separate payment will be made for record drawings required under this contract, and all costs accrued in connection with such drawings are considered a subsidiary obligation of the Contractor.

1.3.2 Construction Contract Specifications

Furnish final record (as-built) construction contract specifications, including modifications thereto, 10 days after substantial completion of the facility.

1.3.3 Real Property Equipment

Furnish a list of installed equipment furnished under this contract. Include all information usually listed on manufacturer's name plate. In the "EQUIPMENT-IN-PLACE LIST" include, as applicable, the following for each piece of equipment installed: description of item, location (by room number), model number, serial number, capacity, name and address of manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty. Furnish a draft list at subtantial completion. Furnish the final list prior to final completion.

1.4 SPARE PARTS DATA

Submit electronically the Spare Parts Data list.

a. Indicate manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair. List those items that may be standard to the normal maintenance of the system.

1.5 PREVENTATIVE MAINTENANCE

Submit Preventative Maintenance and Inspection schedules with instructions that state when systems should be retested.

a. Define the anticipated length of each test, test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a signoff blank for the Contractor and Contracting Officer for each test feature; e.g., gpm, rpm, psi. Include a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration,

adjustments, cleaning, or special system notes. Delineate procedures for preventative maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

b. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

1.6 WARRANTY MANAGEMENT

1.6.1 Warranty Management Plan

Develop a warranty management plan which contains information relevant to the clause Warranty of Construction. Prior to substantial completion, electronically submit the warranty management plan. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan must be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below must include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase must be submitted to the Contracting Officer for approval prior to each monthly pay estimate. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period will begin on the date of project acceptance and continue for the full product warranty period. A joint 4 month and 9 month warranty inspection will be conducted, measured from time of acceptance, by the Contractor, Contracting Officer and the Customer Representative. Include within the warranty management plan , but not limited to, the following:

a. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subContractors, manufacturers or suppliers involved.

b. Furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.

c. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.

d. A list for each warranted equipment, item, feature of construction or system indicating:

(1) Name of item.
(2) Model and serial numbers.
(3) Location where installed.
(4) Name and phone numbers of manufacturers or suppliers.
(5) Names, addresses and telephone numbers of sources of spare parts.
(6) Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty

of construction. Items which have extended warranties must be indicated with separate warranty expiration dates.

(7) Cross-reference to warranty certificates as applicable.

(8) Starting point and duration of warranty period.

(9) Summary of maintenance procedures required to continue the warranty in force.

(10) Cross-reference to specific pertinent Operation and Maintenance manuals.

(11) Organization, names and phone numbers of persons to call for warranty service.

(12) Typical response time and repair time expected for various warranted equipment.

e. The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.

f. Procedure and status of tagging of all equipment covered by extended warranties.

g. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

1.6.2 Performance Bond

The Contractor's Performance Bond must remain effective throughout the construction period.

a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

c. Following oral or written notification of required construction warranty repair work, respond in a timely manner. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor.

1.6.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty will be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point

of contact will be located within the local service area of the warranted construction, be continuously available, and be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

1.6.4 Warranty Tags

At the time of installation, tag each warranted item with a durable, oil and water resistant tag approved by the Contracting Officer. Attach each tag with a copper wire and spray with a silicone waterproof coating. Also, submit two record copies of the warranty tags showing the layout and design. The date of acceptance and the QC signature must remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

Type of product/material	
Model number	
Serial number	
Contract number	
Warranty period from/to	
Inspector's signature	
Construction Contractor	
Address	
Telephone number	
Warranty contact	
Address	
Telephone number	
Warranty response time priority code	
WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.	

1.7 OPERATION AND MAINTENANCE MANUALS

Submit 3 copies of the project operation and maintenance manuals 30 calendar days prior to testing the system involved. Update and resubmit data for final approval no later than 30 calendar days prior to contract completion.

1.7.1 Configuration

Operation and Maintenance Manuals must be consistent with the

manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Bind information in manual format and grouped by technical sections. Test data must be legible and of good quality. Light-sensitive reproduction techniques are acceptable provided finished pages are clear, legible, and not subject to fading. Pages for vendor data and manuals must have 0.3937-inch holes and be bound in 3-ring, loose-leaf binders. Organize data by separate index and tabbed sheets, in a loose-leaf binder. Binder must lie flat with printed sheets that are easy to read. Caution and warning indications must be clearly labeled.

1.7.2 Training and Instruction

Submit classroom and field instructions in the operation and maintenance of systems equipment where required by the technical provisions. These services must be directed by the Contractor, using the manufacturer's factory-trained personnel or qualified representatives. Contracting Officer will be given 7 calendar days written notice of scheduled instructional services. Instructional materials belonging to the manufacturer or vendor, such as lists, static exhibits, and visual aids, must be made available to the Contracting Officer.

1.8 CLEANUP

Use only nonhazardous cleaning materials, including natural cleaning materials, in the final cleanup. Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Replace filters of operating equipment. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA
07/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E1971	(2005; R 2011) Stewardship for the Cleaning of Commercial and Institutional Buildings

1.2 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data specifically applicable to this contract and a complete and concise depiction of the provided equipment, product, or system, stressing and enhancing the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation. The subcontractors must compile and prepare data and deliver to the Contractor prior to the training of Government personnel. The Contractor must compile and prepare aggregate O&M data including clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01 33 00 SUBMITTAL PROCEDURES.

1.2.1 Package Quality

Documents must be fully legible. Poor quality copies and material with hole punches obliterating the text or drawings will not be accepted.

1.2.2 Package Content

Data package content shall be as shown in the paragraph titled "Schedule of Operation and Maintenance Data Packages." Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission, except as follows. Commissioned items without a specified data package requirement in the individual technical sections must use Data Package 3. Commissioned items with a Data Package 1 or 2 requirement must use instead Data Package 3.

1.2.3 Changes to Submittals

Manufacturer-originated changes or revisions to submitted data must be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M Data. Submit changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data within 30 calendar days of the notification of this change

requirement.

1.3 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.3.1 Operating Instructions

Include specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

1.3.1.1 Safety Precautions

List personnel hazards and equipment or product safety precautions for all operating conditions.

1.3.1.2 Operator Prestart

Include procedures required to install, set up, and prepare each system for use.

1.3.1.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

1.3.1.4 Normal Operations

Provide narrative description of Normal Operating Procedures. Include Control Diagrams with data to explain operation and control of systems and specific equipment.

1.3.1.5 Emergency Operations

Include Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of all utility systems including required valve positions, valve locations and zones or portions of systems controlled.

1.3.1.6 Operator Service Requirements

Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gage readings.

1.3.1.7 Environmental Conditions

Include a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

1.3.2 Preventive Maintenance

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.3.2.1 Lubrication Data

Include preventative maintenance lubrication data, in addition to instructions for lubrication provided under paragraph titled "Operator Service Requirements":

a. A table showing recommended lubricants for specific temperature ranges and applications.

b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.

c. A Lubrication Schedule showing service interval frequency.

1.3.2.2 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

1.3.2.3 Cleaning Recommendations

Provide environmentally preferable cleaning recommendations in accordance with ASTM E1971.

1.3.3 Corrective Maintenance (Repair)

Include manufacturer's recommended procedures and instructions for correcting problems and making repairs. For the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.3.3.1 Troubleshooting Guides and Diagnostic Techniques

Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

1.3.3.2 Wiring Diagrams and Control Diagrams

Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

1.3.3.3 Maintenance and Repair Procedures

Include instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

1.3.3.4 Removal and Replacement Instructions

Include step-by-step procedures and a list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

1.3.3.5 Spare Parts and Supply Lists

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

1.3.4 Corrective Maintenance Work-Hours

Include manufacturer's projection of corrective maintenance work-hours including requirements by type of craft. Corrective maintenance that requires completion or participation of the equipment manufacturer shall be identified and tabulated separately.

1.3.5 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.3.5.1 Product Submittal Data

Provide a copy of all SD-03 Product Data submittals required in the applicable technical sections.

1.3.5.2 Manufacturer's Instructions

Provide a copy of all SD-08 Manufacturer's Instructions submittals required in the applicable technical sections.

1.3.5.3 O&M Submittal Data

Provide a copy of all SD-10 Operation and Maintenance Data submittals required in the applicable technical sections.

1.3.5.4 Parts Identification

Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of

equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog

1.3.5.5 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

1.3.5.6 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

1.3.5.7 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.3.5.8 Testing and Performance Data

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms.

1.3.5.9 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.4 TYPES OF INFORMATION REQUIRED IN CONTROLS O&M DATA PACKAGES

Include Data Package 5 and the following for control systems:

a. Narrative description on how to perform and apply all functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.

b. Full as-built sequence of operations.

c. Copies of all checkout tests and calibrations performed by the Contractor (not Cx tests).

1.5 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O&M data packages specified in individual technical sections. The required information for each O&M data package is as follows:

1.5.1 Data Package 1

a. Safety precautions

b. Cleaning recommendations

c. Maintenance and repair procedures

d. Warranty information

e. Contractor information

f. Spare parts and supply list

1.5.2 Data Package 2

a. Safety precautions

b. Normal operations

c. Environmental conditions

d. Lubrication data

e. Preventive maintenance plan and schedule

f. Cleaning recommendations

g. Maintenance and repair procedures

h. Removal and replacement instructions

i. Spare parts and supply list

j. Parts identification

k. Warranty information

l. Contractor information

1.5.3 Data Package 3

a. Safety precautions

b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Environmental conditions

g. Lubrication data

h. Preventive maintenance plan and schedule

i. Cleaning recommendations

j. Troubleshooting guides and diagnostic techniques

k. Wiring diagrams and control diagrams

l. Maintenance and repair procedures

m. Removal and replacement instructions

n. Spare parts and supply list

o. Product submittal data

p. O&M submittal data

q. Parts identification

r. Warranty information

s. Testing equipment and special tool information

t. Testing and performance data

u. Contractor information

1.5.4 Data Package 4

a. Safety precautions

b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Operator service requirements

g. Environmental conditions

h. Lubrication data

i. Preventive maintenance plan and schedule

j. Cleaning recommendations

k. Troubleshooting guides and diagnostic techniques

l. Wiring diagrams and control diagrams

m. Maintenance and repair procedures

n. Removal and replacement instructions

o. Spare parts and supply list

p. Corrective maintenance man-hours

q. Product submittal data

r. O&M submittal data

s. Parts identification

t. Warranty information

u. Personnel training requirements

v. Testing equipment and special tool information

w. Testing and performance data

x. Contractor information

1.5.5 Data Package 5

a. Safety precautions

b. Operator prestart

c. Start-up, shutdown, and post-shutdown procedures

d. Normal operations

e. Environmental conditions

f. Preventive maintenance plan and schedule

g. Troubleshooting guides and diagnostic techniques

h. Wiring and control diagrams

i. Maintenance and repair procedures

j. Removal and replacement instructions

k. Spare parts and supply list

l. Product submittal data

m. Manufacturer's instructions

n. O&M submittal data

o. Parts identification

p. Testing equipment and special tool information

q. Warranty information

r. Testing and performance data

s. Contractor information

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 02 41 00

DEMOLITION
05/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.6	(2006) Safety Requirements for Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2008; Errata 1-2010; Changes 1-3 2010; Changes 4-6 2011; Change 7 2012) Safety and Health Requirements Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61	National Emission Standards for Hazardous Air Pollutants

1.2 PROJECT DESCRIPTION

1.2.1 General Requirements

Do not begin demolition or deconstruction until authorization is received from the Contracting Officer. The work of this section is to be performed in a manner that maximizes the value derived from the salvage and recycling of materials. Remove rubbish and debris from the project site; do not allow accumulations inside or outside the building[s]. The work includes demolition and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.3 ITEMS TO REMAIN IN PLACE

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract. Do not overload pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition,

deconstruction, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

1.3.1 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of project components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove dust, dirt, and debris from work areas daily.

1.3.2 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations. Prior to start of work, utilities serving each area of alteration or removal will be shut off by the Government and disconnected and sealed by the Contractor.

1.3.3 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished or deconstructed, unless directed otherwise by the Contracting Officer. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract.

1.4 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-07 Certificates

Notification[; G][; G, [_____]]

SD-11 Closeout Submittals

Receipts

1.6 QUALITY ASSURANCE

Submit timely notification of demolition projects to Federal, State,

regional, and local authorities in accordance with 40 CFR 61, Subpart M. Notify the State's environmental protection agency and the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61, Subpart M. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSE/SAFE A10.6. Comply with the Environmental Protection Agency requirements specified. Use of explosives will be permitted.

1.6.1 Dust Control

Prevent the spread of dust on airfield pavements and avoid the creation of a nuisance [or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to aircraft.

1.7 PROTECTION

1.7.1 Traffic Control Signs

a. Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Anchor barricades in a manner to prevent displacement by wind, jet or prop blast. Notify the Contracting Officer prior to beginning such work.

Provide a minimum of 2 aviation red or high intensity white obstruction lights on temporary structures (including cranes) over 100 feet above ground level. Light construction and installation shall comply with FAA AC 70/7460-1. Lights shall be operational during periods of reduced visibility, darkness, and as directed by the Contracting Officer. Maintain the temporary services during the period of construction and remove only after permanent services have been installed and tested and are in operation.

1.7.2 Protection of Personnel

Before, during and after the demolition work continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.8 FOREIGN OBJECT DAMAGE (FOD)

Aircraft and aircraft engines are subject to FOD from debris and waste material lying on airfield pavements. Remove all such materials that may appear on operational aircraft pavements due to the Contractor's operations. If necessary, the Contracting Officer may require the Contractor to install a temporary barricade at the Contractor's expense to control the spread of FOD potential debris. The barricade shall include a fence covered with a fabric designed to stop the spread of debris. Anchor the fence and fabric to prevent displacement by winds or jet/prop blasts. Remove barricade when no longer required.

1.9 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair or replace items to be relocated which are damaged by the Contractor with new undamaged items as approved by the Contracting Officer.

1.10 EXISTING CONDITIONS

Before beginning any demolition or deconstruction work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 4 inch will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to before starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document. Submit survey results.

PART 2 PRODUCTS

2.1 FILL MATERIAL

a. Comply with excavating, backfilling, and compacting procedures for soils used as backfill material to fill basements, voids, depressions or excavations resulting from demolition or deconstruction of structures.

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

Inspect and evaluate existing structures onsite for reuse. Existing construction scheduled to be removed for reuse shall be disassembled. Dismantled and removed materials are to be separated, set aside, and prepared as specified, and stored or delivered to a collection point for reuse, remanufacture, recycling, or other disposal, as specified. Materials shall be designated for reuse onsite whenever possible.

3.1.1 Utilities and Related Equipment

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition or deconstruction work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

3.1.2 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces, using on-site materials when available. Where new work is to be applied to existing surfaces, perform removals and patching in a

manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. Patching shall be as specified and indicated, and shall include:

a. Concrete and Masonry: Completely fill holes and depressions, left as a result of removals in existing masonry walls to remain, with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.

3.2 CLEANUP

Remove debris and rubbish from basement and similar excavations. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.3 DISPOSAL OF REMOVED MATERIALS

3.3.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified . Storage of removed materials on the project site is prohibited.

3.3.2 Burning on Government Property

Burning of materials removed from demolished and deconstructed structures will not be permitted on Government property.

3.3.3 Removal from Government Property

Transport waste materials removed from demolished and deconstructed structures, except waste soil, from Government property for legal disposal. Dispose of waste soil as directed.

-- End of Section --

SECTION 03 20 00.00 10

CONCRETE REINFORCING
08/10

PART 1 GENERAL

1.1 UNIT PRICES

1.1.1 Deformed Steel Bars

1.1.1.1 Payment

Payment will be made for costs associated with furnishing and placing deformed steel bars for concrete reinforcement. Payment for steel in laps will be made as indicated or required. No payment will be made for additional steel in laps wherein the additional steel lap was made for the convenience of the Contractor.

1.1.1.2 Measurement

Deformed Steel Bars for Concrete Reinforcement will be measured for payment based upon the quantity of pounds in place. The measured lengths will be converted to weights for the size of bars listed by the use of the nominal weights per linear foot specified in ASTM A615/A615M.

1.1.1.3 Unit of Measure

Unit of measure: per pound.

1.1.2 Fabricated Deformed Steel Bar Mats

1.1.2.1 Payment

Payment will be made for costs associated with furnishing and placing fabricated deformed steel bar mats for concrete reinforcement. Payment for steel in laps will be made as indicated or required. No payment will be made for additional steel in laps wherein the additional steel lap was made for the convenience of the Contractor.

1.1.2.2 Measurement

Fabricated Deformed Steel Bar Mats for Concrete Reinforcement will be measured for payment based upon the quantity of pounds in place. The weights shall be determined by weighing or by manufacturer's or catalog weights when weighing is not practicable.

1.1.2.3 Unit of Measure

Unit of measure: per pound.

1.1.3 Butt-Splices in Deformed Steel Bars

1.1.3.1 Payment

Payment will be made for costs associated with making butt-splices in deformed steel bars for concrete reinforcement. No separate payment will

be made for test splices, tension testing, or radiographic examination of butt-splices since these costs are included in the contract unit price for Butt-Splices in Deformed Steel Bars for Concrete Reinforcement.

1.1.3.2 Measurement

Butt-Splices in Deformed Steel Bars for Concrete Reinforcement will be measured for payment based upon each butt-splice in place.

1.1.3.3 Unit of Measure

Unit of measure: each.

1.1.4 Steel Welded Wire Fabric

1.1.4.1 Payment

Payment will be made for costs associated with furnishing and placing steel welded wire fabric for concrete reinforcement. Payment for steel in laps will be made as indicated or required. No payment will be made for additional steel in laps wherein the additional steel lap was made for the convenience of the Contractor.

1.1.4.2 Measurement

Steel Welded Wire Fabric for Concrete Reinforcement will be measured for payment based upon the quantity of pounds in place. The weights shall be determined by weighing or by manufacturer's or catalog weights when weighing is not practicable.

1.1.4.3 Unit of Measure

Unit of measure: per pound.

1.1.5 Resplicing Bars

1.1.5.1 Payment

Payment will be made for costs associated with resplicing bars selected for supplemental examinations and tests for those splices found to be acceptable. No payment will be made for costs associated with resplicing bars selected for supplemental examinations and tests for those splices found to be defective. No payment will be made for costs associated with the supplemental examinations and tests performed by the Government.

1.1.5.2 Measurement

Resplicing Bars, selected for examinations and tests and found to be acceptable, will be measured for payment based upon 150 percent of the applicable contract unit price for pay item Butt-Splices in Deformed Steel Bars for Concrete Reinforcement. Resplicing Bars, selected for examinations and tests and found to be defective, will not be measured for payment.

1.1.5.3 Unit of Measure

Unit of measure: each.

1.1.6 Accessories

No payment will be made for costs associated with furnishing and placing accessories incidental to and included in the payment for other items of work.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 318	(2011; Errata 1 2011; Errata 2 2012; Errata 3-4 2013) Building Code Requirements for Structural Concrete and Commentary
ACI SP-66	(2004) ACI Detailing Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4/D1.4M	(2011) Structural Welding Code - Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

ASTM A1035/A1035M	(2013a) Standard Specification for Deformed and Plain, Low-carbon, Chromium, Steel Bars for Concrete Reinforcement
ASTM A184/A184M	(2006; E2011) Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A185/A185M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A370	(2012a) Standard Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A496/A496M	(2007) Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
ASTM A497/A497M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A615/A615M	(2012) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

ASTM A675/A675M	(2003; R 2009) Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
ASTM A706/A706M	(2009b) Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A767/A767M	(2009) Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
ASTM A775/A775M	(2007b) Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A82/A82M	(2007) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A884/A884M	(2012) Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
ASTM A934/A934M	(2013) Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM C1116/C1116M	(2010a) Standard Specification for Fiber-Reinforced Concrete
ASTM E94	(2004; R 2010) Radiographic Examination

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 10MSP	(2009; 28th Ed) Manual of Standard Practice

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-310-04	(2012) Seismic Design for Buildings

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Reinforcement[; G][; G, [_____]]

SD-03 Product Data

Welding
Butt-Splices[; G][; G, [_____]]
Material[; G][; G, [_____]]

[SD-04 Samples

Epoxy-Coated Bars
]

SD-06 Test Reports

Material[; G][; G, [_____]]
Tests, Inspections, and Verifications[; G][; G, [_____]]

SD-07 Certificates

Reinforcing Steel
Qualification of Steel Bar Butt-Splicers

1.4 QUALITY ASSURANCE

1.4.1 Welding Qualifications

Welders shall be qualified in accordance with AWS D1.4/D1.4M. Qualification test shall be performed at the worksite and notify the Contracting Officer 24 hours prior to conducting tests. Special welding procedures and welders qualified by others may be accepted as permitted by AWS D1.4/D1.4M. Submit a list of qualified welders names.

1.4.2 Qualification of Steel Bar Butt-Splicers

Qualification of steel bar butt-splicers shall be certified to have satisfactorily completed a course of instruction in the proposed method of butt-splicing or have satisfactorily performed such work within the preceding year. Submit certificates on the Qualifications of Steel Bar Butt-Splicers prior to commencing butt-splicing.

1.4.3 Qualification of Butt-Splicing Procedure

As a condition of approval of the butt-splicing procedure, make three test butt-splices of steel bars of each size to be spliced using the proposed butt-splicing method, in the presence of the Contracting Officer. These test butt-splices and unspliced bars of the same size shall be tension tested to destruction with stress-strain curves plotted for each test. Test results shall show that the butt-splices meet the specified strength and deformation requirements in order for the splicing procedure to be approved.

1.5 DELIVERY, STORAGE, AND HANDLING

Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.1 DOWELS

Dowels shall conform to ASTM A675/A675M, Grade 80[or ASTM A1035/A1035M]. Steel pipe conforming to ASTM A53/A53M, Schedule 80, may be used as dowels provided the ends are closed with metal or plastic inserts or with mortar.

2.2 FABRICATED BAR MATS

Fabricated bar mats shall conform to ASTM A184/A184M.

2.3 REINFORCING STEEL

Reinforcing steel shall be deformed bars conforming to ASTM A615/A615M, ASTM A706/A706M, or ASTM A1035/A1035M grades and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to ASTM A82/A82M. In highly corrosive environments or when directed by the Contracting Officer, reinforcing steel shall conform to ASTM A767/A767M, ASTM A775/A775M, ASTM A1035/A1035M or ASTM A934/A934M as appropriate.[If Grade 40 bars are unavailable the Contractor may substitute Grade 50 or Grade 60 bars of the same size and spacing as indicated for Grade 40 bars when authorized.]

Submit certified copies of mill reports attesting that the reinforcing steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation of reinforcing steel.

[2.3.1 Zinc-Coated (Galvanized) Bars

Zinc-coated (galvanized) bars shall comply with the requirements of ASTM A767/A767M, Class [_____] coating, galvanized after fabrication.

][2.3.2 Epoxy-Coated Bars

Epoxy-coated steel bars shall comply with the requirements of [ASTM A775/A775M][ASTM A934/A934M], including written certifications for coating material and coated bars, sample of coating material, and 1.5 pounds of patching material.

]2.4 WELDED WIRE FABRIC

Welded wire fabric shall conform to [ASTM A185/A185M][ASTM A496/A496M][ASTM A497/A497M]. When directed by the Contracting Officer for special applications, welded wire fabric shall conform to ASTM A884/A884M. For wire with a specified yield strength (fy) exceeding 60,000 psi, fy shall be the stress corresponding to a strain of 0.35 percent.

2.5 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.[Ties for epoxy-coated bars shall be vinyl-coated or epoxy-coated.][Ties for zinc-coated bars shall be zinc-coated.]

2.6 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI 10MSP and shall be steel or precast concrete blocks. Precast concrete blocks shall have wire ties and shall be not less than 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 1/2 inch of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

Bar supports shall comply with the requirements of ACI SP-66. Supports for bars in concrete with formed surfaces exposed to view or to be painted shall be plastic-coated wire, stainless steel or precast concrete supports. Precast concrete supports shall be wedged-shaped, not larger than 3-1/2 by 3-1/2 inches, of thickness equal to that indicated for concrete cover and have an embedded hooked tie-wire for anchorage. Bar supports used in precast concrete with formed surfaces exposed to view shall be the same quality, texture and color as the finish surfaces.

2.7 SYNTHETIC FIBER REINFORCEMENT

Synthetic fiber shall be polypropylene with a denier less than 100 and a nominal fiber length of 2 inches.

2.8 TESTS, INSPECTIONS, AND VERIFICATIONS

Perform material tests, specified and required by applicable standards, by an approved laboratory and certified to demonstrate that the materials are in conformance with the specifications. Tests, inspections, and verifications shall be performed and certified at the Contractor's expense. Submit certified tests reports of reinforcement steel showing that the steel complies with the applicable specifications for each steel shipment and identified with specific lots prior to placement. Submit three copies of the heat analyses for each lot of steel furnished certifying that the steel conforms to the heat analyses.

2.8.1 Reinforcement Steel Tests

Mechanical testing of steel shall be in accordance with ASTM A370 except as otherwise specified or required by the material specifications. Tension tests shall be performed on full cross-section specimens using a gage length that spans the extremities of specimens with welds or sleeves included. Chemical analyses of steel heats shall show the percentages of carbon, phosphorous, manganese, sulphur and silicon present in the steel.

2.8.2 Radiographic Examination of Welds

Radiographic examination of welds shall be in accordance with ASTM E94 and shall be performed and evaluated by an approved testing agency adequately equipped to perform such services. Radiographs of welds and evaluations of the radiographs submitted for approval shall become the property of the Government.

PART 3 EXECUTION

3.1 REINFORCEMENT

Reinforcement steel and accessories shall be fabricated and placed as specified and shown and approved shop drawings. Fabrication and placement details of steel and accessories not specified or shown shall be in accordance with ACI SP-66 and ACI 318. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill.[Zinc-Coated and epoxy-coated bars shall be mill-bent prior to coating. All steel shall be bent cold unless authorized.] Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms. Submit detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show

support details including types, sizes and spacing.

3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318 at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

3.1.2 Splicing

Splices of reinforcement shall conform to ACI 318 and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical or welded butt connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Welding shall conform to AWS D1.4/D1.4M. Welded butt splices shall be full penetration butt welds. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 6 inches. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

3.1.3 Placing Tolerances

3.1.3.1 Spacing

The spacing between adjacent bars and the distance between layers of bars may not vary from the indicated position by more than one bar diameter nor more than 1 inch.

3.1.3.2 Concrete Cover

The minimum concrete cover of main reinforcement steel bars shall be as shown. The allowable variation for minimum cover shall be as follows:

MINIMUM COVER (inch)	VARIATION (inch)
6	plus 1/2
4	plus 3/8
3	plus 3/8

MINIMUM COVER (inch)	VARIATION (inch)
2	plus 1/4
1-1/2	plus 1/4
1	plus 1/8
3/4	plus 1/8

3.1.4 Splicing

Splices in steel bars shall be made only as required. Bars may be spliced at alternate or additional locations at no additional cost to the Government subject to approval.

3.1.4.1 Lap Splices

Lap splices shall be used only for bars smaller than size 14 and welded wire fabric. Lapped bars may be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than 1/5 the required length of lap or 6 inches.

3.1.4.2 Butt-Splices

Use butt-splices only for splicing size 14 and 18 bars and for splicing #11 bars to larger bars except where otherwise shown or authorized. Make butt-splices by a method which develops splices suitable for tension, compression and stress reversal applications. Welded butt-splices shall be full penetration butt welds. Butt-splices shall develop 90 percent of the specified minimum ultimate tensile strength of the smallest bar of each splice. Bars shall be cleaned of all oil, grease, dirt, rust, scale and other foreign substances and shall be flame dried before splicing. Adequate jigs and clamps or other devices shall be provided to support, align and hold the longitudinal centerline of the bars to be butt-spliced in a straight line. Submit proposed procedure for butt-splicing steel bars prior to making the test butt-splices for qualification of the procedure. Properties and analyses of steel bars and splicing materials shall be included in the submitted procedure. Physical properties of splicing sleeves shall include length, inside and outside diameters, and inside surface details.. Butt-splices shall be as follows:

3.1.4.2.1 Thermit Welded Butt Splices

Bars to be thermit welded shall be restricted to steel shown by heat analysis to have a sulfur content not exceeding 0.05 percent. The ends of bars to be thermit welded shall be cut square and smooth. Flame cutting will be permitted provided grinding is employed to remove the resulting scale and to square and smooth the cut ends to a condition equivalent to a saw cut. No shearing will be permitted. Bars shall be cleaned and flame dried before splicing. The joint shall be properly aligned in the mold with a gap opening in accordance with the manufacturer's recommendations. Charging and firing shall conform to the manufacturer's recommendations. The end of bars and the welded mold shall be preheated before welding to a temperature of not less than 100 degrees F and the mold shall be left in place for at least 15 minutes after ignition. Risers shall be broken or

burned off after removing the mold. Tension splices shall be staggered longitudinally a minimum of 5 feet so that no more than half of the bars are spliced at any one section or as otherwise indicated.

3.1.4.2.2 Mechanical Butt-Splices

Mechanical butt-splices shall be an approved exothermic, threaded coupling, swaged sleeve or other positive connecting type. Bars to be spliced by a mechanical butt-splicing process may be sawed, sheared or flame cut provided the ends of sheared bars are reshaped after shearing and all slag is removed from the ends of flame cut bars by chipping and wire brushing prior to splicing. Surfaces to be enclosed within a splice sleeve or coupling shall be cleaned by wire brushing or other approved method prior to splicing. Splices shall be made using manufacturer's standard jigs, clamps, ignition devices and other required accessories. In addition to the strength requirements specified paragraph BUTT-SPLICES the additional deformation of number 14 and smaller bars due to slippage or other movement within the splice sleeve shall not exceed 0.015 inches (unit strain 0.0015 inches/inch) beyond the elongation of an unspliced bar based upon a 10 inch gage length spanning the extremities of the sleeve at a stress of 30,000 psi. The additional deformation of number 18 bars shall not exceed 0.03 inches (unit strain 0.003 inches/inch) beyond the elongation of an unspliced bar based upon a 10 inch gage length spanning the extremities of the sleeve at a stress of 30,000 psi. The amount of the additional deformation shall be determined from the stress-strain curves of the unspliced and spliced bars tested as required paragraph QUALIFICATION OF BUTT-SPLICING PROCEDURE for qualification of the butt-splicing procedure. Tension splices of number 14 or smaller bar shall be staggered longitudinally a minimum of 5 feet or as otherwise indicated so that no more than half of the bars are spliced at any one section. Tension splices of number 18 bars shall be staggered longitudinally a minimum of 5 feet so that no more than 1/3 of the bars are spliced at any one section.

3.2 WELDED-WIRE FABRIC PLACEMENT

Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Fabric placement at joints shall be as indicated. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 2 inches. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 4 feet. Fabric shall be positioned by the use of supports.

3.3 DOWEL INSTALLATION

Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

3.4 SYNTHETIC FIBER REINFORCED CONCRETE

Fiber reinforcement shall be added to the concrete mix in accordance with the applicable sections of ASTM C1116/C1116M and the recommendations of the manufacturer, and in an amount of [0.1] [_____] percent by volume.

3.5 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with UFC 3-310-04 and Section 01 45 35 SPECIAL INSPECTIONS.

3.6 FIELD TESTS AND INSPECTIONS

3.6.1 Identification of Splices

Establish and maintain an approved method of identification of all field butt-splices which will indicate the splicer and the number assigned each splice made by the splicer.

3.6.2 Examining, Testing, and Correcting

Perform the following during the butt-splicing operations as specified and as directed:

3.6.2.1 Visual Examination

All welded splices shall be visually examined for the presence of cracks, undercuts, inadequate size and other visible defects. Respliced connections resulting from correction of visual defects may be radiographically examined at the option of the Contracting Officer as specified in paragraph SUPPLEMENTAL EXAMINATION. Exothermic mechanical butt-splices shall be visually examined to determine if the filler metal is clearly visible at the tap holes and completely fills the sleeves at both ends except for spaces of not more than 3/8 inch occupied by packing.

3.6.2.2 Tension Tests

Tensions tests to 90 percent of the minimum specified ultimate tensile strength of the spliced bars or to destruction shall be performed on one test specimen made in the field for every 25 splices made. Test specimens shall be made by the splicers engaged in the work, using the approved splicing procedure and the same size bars placed in the same relative position, and under the same conditions as those in the groups represented by the specimens. Stress-strain curves shall be furnished for each butt-splice tested.

3.6.2.3 Radiographic Examination

Not less than one of each 25 welded splices selected at random by the Contracting Officer shall be examined radiographically and evaluated for defects. The greatest dimension of any porosity (gas pocket or similar void) or fusion-type defect (slag inclusion, incomplete fusion or similar generally elongated defect in weld fusion) shall not exceed 1/4 inch. The minimum clearance between edges of porosity or fusion-type defects shall not be less than 1 inch.

3.6.2.4 Correction of Deficiencies

No splice shall be embedded in concrete until satisfactory results of visual examination and the required tests or examinations have been obtained. All splices having visible defects or represented by test specimens which do not satisfy the tests or examinations shall be removed. If any of the tension test specimens fail to meet the strength requirements or deformation limitations two production splices from the

same lot represented by the test specimens which failed shall be cut out and tension tested. If both of the retests pass the strength requirements and deformation limitations all of the splices in the lot will be accepted. If one or both of the retests fail to meet the strength requirements or deformation limitations all of the splices in the lot will be rejected. All costs of removal, testing and resplicing of the additional production splices shall be borne by the Contractor. The bars of rejected splices shall be cut off outside the splice zone of weld metal, filler metal contact, coupling or sleeve. The cut ends shall be finished as specified and the joints shall be respliced and reinspected at no additional cost.

3.6.2.5 Supplemental Examination

The Contracting Officer may require additional or supplemental radiographic examination and/or tension test of any completed splice. For costs of such examinations and tests see paragraph UNIT PRICES.

-- End of Section --

SECTION 03 30 00.00 10

CAST-IN-PLACE CONCRETE
11/10

PART 1 GENERAL

1.1 UNIT PRICES

1.1.1 Measurement

Measurement of concrete for payment will be made on the basis of the actual volume within the pay lines of the structure as indicated on the contract drawings. Measurement for payment of concrete placed against the sides of any excavation without intervening forms will be made only within the pay lines of the structure as shown on the contract drawings. No deductions will be made for rounded or beveled edges, for space occupied by metal work, for conduits, for voids, or for embedded items which are less than 5 cubic feet in volume or 1 square foot in cross section.

1.1.2 Payment

Unless otherwise specified, payment for concrete will be made at the respective unit prices per cubic yard for the various items of the schedule, measured as specified above, which price includes the cost of all labor, materials, and the use of equipment and tools required to complete the concrete work, except for any reinforcement and embedded parts specified to be paid separately. Unit price payment will not be made for concrete placed in structures for which payment is made as a lump sum.

1.2 LUMP SUM CONTRACT

Under this type of contract, concrete items will be paid for by lump sum and will not be measured. The work covered by these items consists of furnishing all concrete materials, reinforcement, miscellaneous embedded materials, and equipment, and performing all labor for the forming, manufacture, transporting, placing, finishing, curing, and protection of concrete in these structures.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 211.1	(1991; R 2009) Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
ACI 211.2	(1998; R 2004) Standard Practice for

	Selecting Proportions for Structural Lightweight Concrete
ACI 213R	(2003) Guide for Structural Lightweight-Aggregate Concrete
ACI 214R	(2011) Evaluation of Strength Test Results of Concrete
ACI 301	(2010; Errata 2011) Specifications for Structural Concrete
ACI 305.1	(2006) Specification for Hot Weather Concreting
ACI 318	(2011; Errata 1 2011; Errata 2 2012; Errata 3-4 2013) Building Code Requirements for Structural Concrete and Commentary

ASTM INTERNATIONAL (ASTM)

ASTM C1017/C1017M	(2007) Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1059/C1059M	(1999; R 2008) Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C1064/C1064M	(2011) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1077	(2013b) Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C1107/C1107M	(2013) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C1116/C1116M	(2010a) Standard Specification for Fiber-Reinforced Concrete
ASTM C1240	(2012) Standard Specification for Silica Fume Used in Cementitious Mixtures
ASTM C1260	(2007) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C131	(2006) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

ASTM C143/C143M	(2012) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2012) Standard Specification for Portland Cement
ASTM C1567	(2013) Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C172/C172M	(2010) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2012) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C192/C192M	(2013) Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231/C231M	(2010) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C31/C31M	(2012) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2013) Standard Specification for Concrete Aggregates
ASTM C330/C330M	(2009) Standard Specification for Lightweight Aggregates for Structural Concrete
ASTM C39/C39M	(2012) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C42/C42M	(2013) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C494/C494M	(2013) Standard Specification for Chemical Admixtures for Concrete
ASTM C496/C496M	(2011) Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
ASTM C552	(2012b) Standard Specification for Cellular Glass Thermal Insulation
ASTM C567/C567M	(2011) Determining Density of Structural

	Lightweight Concrete
ASTM C578	(2012b) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C591	(2012a) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C595/C595M	(2013) Standard Specification for Blended Hydraulic Cements
ASTM C618	(2012a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C685/C685M	(2011) Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C78/C78M	(2012; E 2013) Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C881/C881M	(2010) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C937	(2010) Grout Fluidifier for Preplaced-Aggregate Concrete
ASTM C94/C94M	(2013a) Standard Specification for Ready-Mixed Concrete
ASTM C989/C989M	(2012a) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM D75/D75M	(2009) Standard Practice for Sampling Aggregates
ASTM E1155	(1996; R 2008) Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers
ASTM E96/E96M	(2012) Standard Test Methods for Water Vapor Transmission of Materials

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44	(2013) Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices

NATIONAL READY MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(2000; R 2006) Concrete Plant Standards
NRMCA QC 3	(2011) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete

	Production Facilities
NRMCA TMMB 100	(2001; R 2007) Truck Mixer, Agitator and Front Discharge Concrete Carrier Standards

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 104	(1980) Method of Calculation of the Fineness Modulus of Aggregate
COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
COE CRD-C 521	(1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete
COE CRD-C 94	(1995) Corps of Engineers Specification for Surface Retarders

1.4 SYSTEM DESCRIPTION

Provide concrete composed of portland cement, other cementitious and pozzolanic materials as specified, aggregates, water and admixtures as specified.

1.4.1 Proportioning Studies-Normal Weight Conc

Trial design batches, mixture proportions studies, and testing requirements for various classes and types of concrete specified are the responsibility of the Contractor. Except as specified for flexural strength concrete, mixture proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with ASTM C192/C192M and tested in accordance with ASTM C39/C39M.

a. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications.

b. Make trial mixtures having proportions, consistencies, and air content suitable for the work based on methodology described in ACI 211.1, using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project.

c. The maximum water-cement ratios required in subparagraph Water-Cement Ratio below will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations in ACI 211.1 for the term P, which is used to denote the weight of pozzolan. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent by weight of the total cementitious material, and the maximum shall be 35 percent.

d. Design laboratory trial mixtures for maximum permitted slump and air content. Make separate sets of trial mixture studies for each

combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations.

e. Report the temperature of concrete in each trial batch. For each water-cement ratio, at least three test cylinders for each test age shall be made, cured in accordance with ASTM C192/C192M and tested at 7 and 28 days in accordance with ASTM C39/C39M. From these test results, plot a curve showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition, a curve shall be plotted showing the relationship between 7 day and 28 day strengths. Design each mixture to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.

f. Submit the results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of ingredients that will be used in the manufacture of each strength or class of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. Accompany the statement with test results from an approved independent commercial testing laboratory, showing that mixture design studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture design studies without additional tests to show that the quality of the concrete is satisfactory.

1.4.2 Proportioning Studies-Flexural Strength Conc

Trial design batches, mixture proportioning studies, and testing requirements shall conform to the requirements specified in paragraph Proportioning Studies for Normal Weight Concrete above, except that proportions shall be based on flexural strength as determined by test specimens (beams) fabricated in accordance with ASTM C192/C192M and tested in accordance with ASTM C78/C78M. Modify procedures given in ACI 211.1 as necessary to accommodate flexural strength.

1.4.3 Proportioning Studies-Lightweight Aggregate Structural Conc

Trial design batches, mixture proportioning studies, and testing requirements shall conform to the requirements specified in paragraph Proportioning Studies for Normal Weight Concrete above, except as follows. Trial mixtures having proportions, consistencies and air content suitable for the work shall be made based on methodology described in ACI 211.2, using at least three different cement contents. Proportion trial mixes to produce air dry unit weight, concrete strengths, maximum permitted slump, and air content. Test specimens and testing shall be as specified for normal weight concrete except that [28-day compressive strength] [splitting tensile strength in accordance with ASTM C496/C496M] shall be determined from test cylinders that have been air dried at 50 percent relative humidity for the last 21 days. Determine air dry unit weight in accordance with ASTM C567/C567M, designed to be at least 2.0 pcf

less than the maximum specified air dry unit weight. Plot curves using these results showing the relationship between cement factor and strength and air dry unit weight. Normal weight fine aggregate may be substituted for part or all of the lightweight fine aggregate, provided the concrete meets the strength and unit weight. A correlation shall also be developed showing the ratio between air dry unit weight and fresh concrete unit weight for each mix.

1.4.4 Average Compressive Strength

The mixture proportions selected during mixture design studies shall produce a required average compressive strength (f'cr) exceeding the specified compressive strength (f'c) by the amount indicated below. This required average compressive strength, f'cr, will not be a required acceptance criteria during concrete production. However, whenever the daily average compressive strength at 28 days drops below f'cr during concrete production, or daily average 7-day strength drops below a strength correlated with the 28-day f'cr, adjust the mixture, as approved, to bring the daily average back up to f'cr. During production, the required f'cr shall be adjusted, as appropriate, based on the standard deviation being attained on the job.

1.4.5 Computations from Test Records

Where a concrete production facility has test records, establish a standard deviation in accordance with the applicable provisions of ACI 214R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths (f'c) within 1,000 psi of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. Required average compressive strength f'cr used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

f'cr = f'c + 1.34S where units are in psi

f'cr = f'c + 2.33S - 500 where units are in psi

Where S = standard deviation

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
30 or more	1.00

1.4.6 Computations without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength f'cr shall be determined as follows:

a. If the specified compressive strength f'c is less than 3,000 psi,

f'cr = f'c + 1000 psi

b. If the specified compressive strength f'c is 3,000 to 5,000 psi,

f'cr = f'c + 1,200 psi

c. If the specified compressive strength f'c is over 5,000 psi,

f'cr = f'c + 1,400 psi

1.4.7 Average Flexural Strength Required for Mixtures

The mixture proportions selected during mixture design studies for flexural strength mixtures and the mixture used during concrete production shall be designed and adjusted during concrete production as approved, except that the overdesign for average flexural strength shall simply be 15 percent greater than the specified flexural strength at all times.

1.4.8 Mix Design for Bonded Topping for Heavy Duty Floors

The concrete mix design for bonded topping for heavy duty floors shall contain the greatest practical proportion of coarse aggregate within the specified proportion limits. Design the mix to produce concrete having a 28-day strength of at least 5000 psi. Concrete for the topping shall consist of the following proportions, by weight:

1.00 part portland cement
1.15 to 1.25 parts fine aggregate
1.80 to 2.00 parts coarse aggregate

Maximum w/c shall be 0.33. Do not air-entrain the topping concrete. Mix the concrete to produce a mixture of the driest consistency possible to work with a sawing motion of the strike-off and which can be floated and compacted as specified without producing water or excess cement at the surface. In no case shall slump exceed 1 inch as determined by ASTM C143/C143M.

1.4.9 Tolerances

Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices shall be in accordance with ACI 117. Take level and grade tolerance measurements of slabs as soon as possible after finishing; when forms or shoring are used, the measurements shall be made prior to removal.

1.4.10 Floor Finish

For the purpose of this Section the following terminology correlation between ACI 117 and this Section shall apply:

Floor Profile Quality Classification From ACI 117	This Section
Conventional Bullfloated	Same
Conventional Straightedged	Same
Flat	Float Finish or Trowel Finish
Very Flat	Same. Use only with F-system

Levelness tolerance does not apply where design requires floors to be sloped to drains or sloped for other reasons.

1.4.10.1 Floors by the F-Number System

The flatness and levelness of floors shall be carefully controlled and the tolerances shall be measured by the F-Number system of Paragraph 4.8.5 and 4.8.5.1 of ACI 117. Furnish an approved floor profilograph or other equipment capable of measuring the floor flatness (FF) number and the floor levelness (FL) number in accordance with ASTM E1155. Perform the tolerance measurements within 72 hours after floor slab construction while being observed by the Contracting Officer. The tolerances of surfaces beyond the limits of ASTM E1155 (the areas within 24 inches of embedments and construction joints) will be acceptable to the Contracting Officer. Tolerances of the following areas shall meet the requirements for the listed surfaces as specified in paragraphs 4.8.5 and 4.8.5.1 of ACI 117.

Surface	Areas
Bullfloated	[_____]
Straightedged	[_____]
Float Finish	[_____]
Trowel Finish	[_____]
Very Flat	[_____]

1.4.10.2 Floors by the Straightedge System

The flatness of the floors shall be carefully controlled and the tolerances shall be measured by the straightedge system as specified in paragraph 4.5.7 of ACI 117, using a 10 foot straightedge, within 72 hours after floor slab installation and before shores and/or forms are removed. The listed tolerances shall be met at any and every location at which the straightedge can be placed.

Bullfloated	[_____]
Straightedged	[_____]
Float Finish	[_____]
Trowel Finish	[_____]

1.4.11 Strength Requirements

Specified compressive strength (f'c) shall be as follows:

COMPRESSIVE STRENGTH	STRUCTURE OR PORTION OF STRUCTURE
5000 psi at 28 days	[_____]
4000 psi at 28 days	[_____]
3000 psi at 28 days	[_____]
[_____] psi at [_____] days	[_____]

Concrete slabs on-grade shall have a 28-day flexural strength of [650] [_____] psi. Concrete made with high-early strength cement shall have a 7-day strength equal to the specified 28-day strength for concrete made with Type I or II portland cement. Compressive strength shall be determined in accordance with ASTM C39/C39M. Flexural strength shall be determined in accordance with ASTM C78/C78M.

1.4.11.1 Evaluation of Concrete Compressive Strength

Fabricate compressive strength specimens (6 by 12 inch cylinders), laboratory cure them in accordance with ASTM C31/C31M and test them in accordance with ASTM C39/C39M. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'c and no individual test result falls below the specified strength f'c by more than 500 psi. A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.

1.4.11.2 Investigation of Low-Strength Compressive Test Results

When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 500 psi or if tests of field-cured cylinders indicate deficiencies in protection and curing, take steps to assure that the load-carrying capacity of the structure is not jeopardized. When the strength of concrete in place is considered

potentially deficient, cores shall be obtained and tested in accordance with ASTM C42/C42M. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores will be determined by the Contracting Officer to least impair the strength of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Non-destructive tests (tests other than test cylinders or cores) shall not be used as a basis for acceptance or rejection. Perform the coring and repair the holes; cores will be tested by the Government.

1.4.11.3 Load Tests

If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be directed by the Contracting Officer in accordance with the requirements of ACI 318. Concrete work evaluated by structural analysis or by results of a load test as being understrength shall be corrected in a manner satisfactory to the Contracting Officer. All investigations, testing, load tests, and correction of deficiencies shall be performed by and at the expense of the Contractor and approved by the Contracting Officer, except that if all concrete is found to be in compliance with the drawings and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

1.4.11.4 Evaluation of Concrete Flexural Strength

Fabricate flexural strength specimens (beams) laboratory cure them in accordance with ASTM C31/C31M and test them in accordance with ASTM C78/C78M. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified flexural strength and no individual test result falls below the specified flexural strength by more than 50 psi. A "test" is defined as the average of two companion beams. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the slab is considered potentially deficient.

1.4.12 Water-Cement Ratio

Maximum water-cement ratio (w/c) for normal weight concrete shall be as follows:

WATER-CEMENT RATIO, BY WEIGHT	STRUCTURE OR PORTION OF STRUCTURE
0.40	[_____]
0.45	[_____]
0.50	[_____]
0.55	[_____]

WATER-CEMENT RATIO, BY WEIGHT	STRUCTURE OR PORTION OF STRUCTURE
[_____]	[_____]

These w/c's may cause higher strengths than that required above for compressive or flexural strength. The maximum w/c required will be the equivalent w/c as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations of ACI 211.1 for the term P which is used to denote the weight of pozzolan.

1.4.13 Air Entrainment

Except as otherwise specified for lightweight concrete, all normal weight concrete shall be air entrained to contain between 4 and 7 percent total air, except that when the nominal maximum size coarse aggregate is 3/4 inch or smaller it shall be between 4.5 and 7.5 percent. Concrete with specified strength over 5000 psi may have 1.0 percent less air than specified above. Specified air content shall be attained at point of placement into the forms. Air content for normal weight concrete shall be determined in accordance with ASTM C231/C231M. Lightweight concrete in the [_____] parts of the structure shall be air-entrained with a total air content of 4.5 to 7.5 percent, except that if the nominal maximum size coarse aggregate is 3/8 inch or less, the air content shall be 5.5 to 8.5 percent. Air content for lightweight concrete shall be determined in accordance with ASTM C173/C173M.

1.4.14 Slump

Slump of the concrete, as delivered to the point of placement into the forms, shall be within the following limits. Slump shall be determined in accordance with ASTM C143/C143M.

Structural Element	Slump (inches)	
	Minimum	Maximum
Walls, columns and beams	2	4
Foundation walls, substructure walls, footings, slabs	1	3
Any structural concrete approved for placement by pumping:		
At pump	2	6
At discharge of line	1	4

[When use of a plasticizing admixture conforming to ASTM C1017/C1017M or when a Type F or G high range water reducing admixture conforming to ASTM C494/C494M is permitted to increase the slump of concrete, concrete shall have a slump of 2 to 4 inches before the admixture is added and a maximum slump of 8 inches at the point of delivery after the admixture is added.] [For troweled floors, slump of structural lightweight concrete

with normal weight sand placed by pump shall not exceed 5 inches at the point of placement. For other slabs, slump of lightweight concrete shall not exceed 4 inches at point of placement.]

1.4.15 Concrete Temperature

The temperature of the concrete as delivered shall not exceed 90 degrees F. When the ambient temperature during placing is 40 degrees F or less, or is expected to be at any time within 6 hours after placing, the temperature of the concrete as delivered shall be between 55 and 75 degrees F.

1.4.16 Size of Coarse Aggregate

Use the largest feasible nominal maximum size aggregate (NMSA), specified in PART 2 paragraph AGGREGATES, in each placement. However, nominal maximum size of aggregate shall not exceed any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

1.4.17 Lightweight Aggregate Structural Concrete

Lightweight aggregate structural concrete shall conform to the requirements specified for normal weight concrete except as specified herein. [Specified compressive strength shall be at least [_____] at 28 days,] [Specified splitting tensile strength determined in accordance with ASTM C496/C496M shall be at least [_____] at 28 days,] as determined by test specimens that have been air dried at 50 percent relative humidity for the last 21 days. Air-dry unit weight shall not be over [_____] at equilibrium as determined by ASTM C567/C567M. However, fresh unit weight shall be used for acceptance during concreting, using a correlation factor between the two types of unit weight as determined during mixture design studies. Lightweight aggregate structural concrete floor fill shall have a 28-day compressive strength of at least 2500 psi and an air-dry unit weight not exceeding 115 pcf at equilibrium.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Recycled Content Products; (LEED)
Portland Cement
Ready-Mixed Concrete
Vapor Barrier
Latex Bonding Agent
Floor Finish
Floor Hardener
Chemical Admixtures
Epoxy Resin

SD-04 Samples

Surface Retarder

SD-05 Design Data

Mixture Proportions[; G][; G, [_____]]
Lightweight Aggregate Concrete

SD-06 Test Reports

Testing and Inspection for CQC[; G][; G, [_____]]

SD-07 Certificates

Qualifications

1.6 QUALITY ASSURANCE

Submit qualifications for Contractor Quality Control personnel assigned to concrete construction as American Concrete Institute (ACI) Certified Workmen in one of the following grades or show written evidence of having completed similar qualification programs:

Concrete Field Testing Technician	Grade I
Concrete Laboratory Testing Technician	Grade I or II
Concrete Construction Inspector	Level II
Concrete Transportation Construction Inspector or Reinforced Concrete Special Inspector	Jointly certified by American Concrete Institute (ACI), Building Official and Code Administrators International (BOCA), International Code Council (ICC), and Southern Building Code Congress International (SBCCI)
Foreman or Lead Journeyman of the flatwork finishing crew	Similar qualification for ACI Concrete Flatwork Technician/Finisher or equal, with written documentation

1.6.1 Pre-installation Meeting

A pre-installation meeting with the Contracting Officer will be required at least 10 days prior to start of construction on [_____]. The Contractor is responsible for calling the meeting; the Project Superintendent and active installation personnel shall be present.

1.6.2 Special Properties and Products

Concrete may contain admixtures other than air entraining agents, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if specified or approved. Any of these materials to be used on the project shall be used in the mix design studies.

1.6.3 Technical Service for Specialized Concrete

Obtain the services of a factory trained technical representative to oversee proportioning, batching, mixing, placing, consolidating, and finishing of specialized structural concrete, such as [_____]. The technical representative shall be on the job full time until the Contracting Officer is satisfied that field controls indicate concrete of specified quality is furnished and that the Contractor's crews are capable of continued satisfactory work. The technical representative shall be available for consultation with, and advice to, Government forces.

1.6.4 Government Assurance Inspection and Testing

Day-to day inspection and testing shall be the responsibility of the Contractor Quality Control (CQC) staff. However, representatives of the Contracting Officer can and will inspect construction as considered appropriate and will monitor operations of the Contractor's CQC staff. Government inspection or testing will not relieve the Contractor of any CQC responsibilities.

1.6.4.1 Materials

The Government will sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the specifications as considered appropriate. Provide facilities and labor as may be necessary for procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D75/D75M. Other materials will be sampled from storage at the jobsite or from other locations as considered appropriate. Samples may be placed in storage for later testing when appropriate.

1.6.4.2 Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with ASTM C172/C172M and tested in accordance with these specifications, as considered necessary.

1.6.4.3 Hardened Concrete

Tests on hardened concrete will be performed by the Government when such tests are considered necessary.

1.6.4.4 Inspection

Concrete operations may be tested and inspected by the Government as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

1.7 DELIVERY, STORAGE, AND HANDLING

Store cement and other cementitious materials in weathertight buildings, bins, or silos which will exclude moisture and contaminants and keep each material completely separated. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed. Store reinforcing bars and accessories above

the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. Materials shall be capable of being accurately identified after bundles or containers are opened.

PART 2 PRODUCTS

In accordance with Section 01 62 35 RECYCLED/RECOVERED/BIOBASED MATERIALS submit documentation indicating: distance between manufacturing facility and the project site, distance of raw material origin from the project site, percentage of post-industrial and post-consumer recycled content per unit of product and relative dollar value of recycled content products to total dollar value of products included in project. Submittals shall be as specified in the subject Section.

2.1 CEMENTITIOUS MATERIALS

Cementitious Materials shall be portland cement, [portland-pozzolan cement,] [portland blast-furnace slag cement,] or portland cement in combination with [pozzolan] [or ground granulated blast furnace slag] [or silica fume] conforming to appropriate specifications listed below. Restrict usage of cementitious materials in concrete that will have surfaces exposed in the completed structure so there is no change in color, source, or type of cementitious material.

2.1.1 Portland Cement

ASTM C150/C150M, Type I [low alkali] with a maximum 15 percent amount of tricalcium aluminate, or Type II [low alkali] [including false set requirements] or [Type V]. White portland cement shall meet the above requirements except that it may be Type I, Type II or Type III [low alkali]. White Type III shall be used only in specific areas of the structure, when approved in writing.

2.1.2 High-Early-Strength Portland Cement

ASTM C150/C150M, Type III with tricalcium aluminate limited to [5] [8] percent, [low alkali]. Use Type III cement only in isolated instances and only when approved in writing.

2.1.3 Blended Cements

ASTM C595/C595M, Type [IP] [IP (MS)] [IP (MH)] [IS] [IS (MS)] [IS (MH)].

2.1.4 Pozzolan (Fly Ash)

Pozzolan shall conform to ASTM C618, Class C or F, including low alkali [multiple factor,] [drying shrinkage,] [uniformity,] [and [moderate] [severe] sulfate resistance] requirements in Table 3 of ASTM C618. If pozzolan is used, it shall never be less than 15 percent nor more than 35 percent by weight of the total cementitious material. Comply with EPA requirements in accordance with Section 01 62 35 RECYCLED/RECOVERED/BIOBASED MATERIALS.

2.1.5 Ground Granulated Blast-Furnace (GGBF) Slag

ASTM C989/C989M, Grade 120.

2.1.6 Silica Fume

Silica fume shall conform to ASTM C1240. Available alkalis shall conform to the optimal limit given in Table 2 of ASTM C1240. Silica fume may be furnished as a dry, densified material or as a slurry. In accordance with paragraph Technical Service for Specialized Concrete in PART 1, provide at no cost to the Government the services of a manufacturer's technical representative experienced in mixing, proportioning, placement procedures, and curing of concrete containing silica fume.

2.2 AGGREGATES

Fine and coarse aggregates shall ["be tested and evaluated for alkali-aggregate reactivity in accordance with ASTM C1260. The fine and coarse aggregates shall be evaluated separately and in combination, which matches the Contractor's proposed mix design proportioning. All results of the separate and combination testing shall have a measured expansion less than 0.10 (0.08) percent at 16 days after casting. Should the test data indicate an expansion of 0.10 (0.08) percent or greater, the aggregate(s) shall be rejected or additional testing using ASTM C1260 and ASTM C1567 shall be performed. The additional testing using ASTM C1260 and ASTM C1567 shall be performed using the low alkali portland cement in combination with ground granulated blast furnace (GGBF) slag, or Class F fly ash. GGBF slag shall be used in the range of 40 to 50 percent of the total cementitious material by mass. Class F fly ash shall be used in the range of 25 to 40 percent of the total cementitious material by mass."] [conform to the following.]

2.2.1 Fine Aggregate

Fine aggregate shall conform to the quality and gradation requirements of ASTM C33/C33M.

2.2.2 Coarse Aggregate

Coarse aggregate shall conform to ASTM C33/C33M, Class 5S, size designation [_____].

2.2.3 Lightweight Aggregate

Lightweight fine and coarse aggregate shall conform to the quality and gradation requirements of ASTM C330/C330M, size [_____] for coarse aggregate. Prewet and vacuum saturate lightweight aggregate in accordance with the Manufacturer's instructions unless otherwise specified. For pumped concrete, prewet sufficiently to ensure that slump loss through the pump line does not exceed 4 inches.

2.2.4 Materials for Bonded Topping for Heavy Duty Floors

In addition to the requirements specified above, coarse aggregate used for this purpose shall be a well graded, hard, sound diabase, trap rock, emery, granite or other natural or manufactured aggregate having equivalent hardness and wearing qualities and shall have a percentage of loss not to exceed 30 after 500 revolutions when tested in accordance with ASTM C131. Gradation of the aggregates when tested in accordance with

ASTM C136 shall be as follows:

Coarse Aggregate	
Sieve Size	Cumulative Percent Cumulative Percent
3/4 inch	100
1/2 inch	50-100
3/8 inch	25-50
No. 4	0-15
No. 8	0-8

Fine Aggregate	
Sieve Size	Cumulative Percent Cumulative Percent
3/8 inch	100
No. 4	95-100
No. 8	65-80
No. 16	45-65
No. 30	25-45
No. 50	5-15
No. 100	0-5

2.3 CHEMICAL ADMIXTURES

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed. Admixtures shall be furnished in liquid form and of suitable concentration for easy, accurate control of dispensing.

2.3.1 Air-Entraining Admixture

ASTM C260/C260M and shall consistently entrain the air content in the specified ranges under field conditions.

2.3.2 Accelerating Admixture

ASTM C494/C494M, Type C or E, except that calcium chloride or admixtures containing calcium chloride shall not be used.

2.3.3 Water-Reducing or Retarding Admixture

ASTM C494/C494M, Type A, B, or D, except that the 6-month and 1-year compressive and flexural strength tests are waived.

2.3.4 High-Range Water Reducer

ASTM C494/C494M, Type F or G, except that the 6-month and 1-year strength requirements are waived. The admixture shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance

of separate mixture design studies.

2.3.5 Surface Retarder

COE CRD-C 94. Submit sample of surface retarder material with manufacturer's instructions for application in conjunction with air-water cutting.

2.3.6 Expanding Admixture

Aluminum powder type expanding admixture conforming to ASTM C937.

2.3.7 Other Chemical Admixtures

Chemical admixtures for use in producing flowing concrete shall comply with ASTM C1017/C1017M, Type I or II. These admixtures shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

2.4 WATER

Water for mixing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400.

2.5 NONSHRINK GROUT

Nonshrink grout shall conform to ASTM C1107/C1107M, and shall be a commercial formulation suitable for the proposed application.

2.6 NONSLIP SURFACING MATERIAL

Provide nonslip surfacing material consisting of 55 percent, minimum, aluminum oxide or silicon-dioxide abrasive ceramically bonded together to form a homogeneous material sufficiently porous to provide a good bond with portland cement paste; or factory-graded emery aggregate consisting of not less than 45 percent aluminum oxide and 25 percent ferric oxide. The aggregate shall be well graded from particles retained on the No. 30 sieve to particles passing the No. 8 sieve.

2.7 LATEX BONDING AGENT

Latex agents for bonding fresh to hardened concrete shall conform to ASTM C1059/C1059M.

2.8 EPOXY RESIN

Epoxy resins for use in repairs shall conform to ASTM C881/C881M, Type V, Grade 2. Class as appropriate to the existing ambient and surface temperatures. Submit manufacturer's product data, indicating VOC content. Manufacturer's catalog data for the items above, including printed instructions.

2.9 EMBEDDED ITEMS

Embedded items shall be of the size and type indicated or as needed for the application. Dovetail slots shall be galvanized steel. Hangers for suspended ceilings shall be as specified in Section 09 51 00 ACOUSTICAL

CEILINGS. Inserts for shelf angles and bolt hangers shall be of malleable iron or cast or wrought steel.

2.10 FLOOR HARDENER

Floor hardener shall be a colorless aqueous solution containing zinc silicofluoride, magnesium silicofluoride, or sodium silicofluoride. These silicofluorides can be used individually or in combination. Proprietary hardeners may be used if approved in writing by the Contracting Officer.

2.11 PERIMETER INSULATION

Perimeter insulation shall be polystyrene conforming to ASTM C578, Type II; polyurethane conforming to ASTM C591, Type II; or cellular glass conforming to ASTM C552, Type I or IV. Comply with EPA requirements in accordance with Section 01 62 35 RECYCLED/RECOVERED/BIOBASED MATERIALS.

2.12 VAPOR BARRIER

Vapor barrier shall be polyethylene sheeting with a minimum thickness of 6 mils or other equivalent material having a vapor permeance rating not exceeding 0.5 perms as determined in accordance with ASTM E96/E96M.

2.13 JOINT MATERIALS

2.13.1 Joint Fillers, Sealers, and Waterstops

Materials for expansion joint fillers and waterstops shall be in accordance with Section 03 15 00.00 10 CONCRETE ACCESSORIES. Materials for and sealing of joints shall conform to the requirements of Section [07 92 00 JOINT SEALANTS] [32 01 19 FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS] [32 13 73 COMPRESSION JOINT SEALS FOR CONCRETE PAVEMENTS].

2.13.2 Contraction Joints in Slabs

Materials for contraction joint inserts shall be in accordance with Section 03 15 00.00 10 CONCRETE ACCESSORIES.

PART 3 EXECUTION

3.1 PREPARATION FOR PLACING

Before commencing concrete placement, perform the following: Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Forms shall be in place, cleaned, coated, and adequately supported, in accordance with Section 03 11 13.00 10 STRUCTURAL CONCRETE FORMWORK. Reinforcing steel shall be in place, cleaned, tied, and adequately supported, in accordance with Section 03 20 00.00 10 CONCRETE REINFORCEMENT. Transporting and conveying equipment shall be in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete shall be at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material shall be at the placing site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

3.1.1 Foundations

3.1.1.1 Concrete on Earth Foundations

Earth (subgrade, base, or subbase courses) surfaces upon which concrete is to be placed shall be clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation shall be well drained and shall be satisfactorily graded and uniformly compacted.

3.1.1.2 Preparation of Rock

Rock surfaces upon which concrete is to be placed shall be free from oil, standing or running water, ice, mud, drummy rock, coating, debris, and loose, semidetached or unsound fragments. Joints in rock shall be cleaned to a satisfactory depth, as determined by the Contracting Officer, and to firm rock on the sides. Immediately before the concrete is placed, rock surfaces shall be cleaned thoroughly by the use of air-water jets or sandblasting as specified below for Previously Placed Concrete. Keep rock surfaces continuously moist for at least 24 hours immediately prior to placing concrete thereon. All horizontal and approximately horizontal surfaces shall be covered, immediately before the concrete is placed, with a layer of mortar proportioned similar to that in the concrete mixture. Place concrete before the mortar stiffens.

3.1.1.3 Excavated Surfaces in Lieu of Forms

Concrete for [footings] [and] [walls] may be placed directly against the soil provided the earth or rock has been carefully trimmed, is uniform and stable, and meets the compaction requirements of Section 31 00 00 EARTHWORK. Place the concrete without becoming contaminated by loose material, and outlined within the specified tolerances.

3.1.2 Previously Placed Concrete

Concrete surfaces to which additional concrete is to be bonded shall be prepared for receiving the next horizontal lift by cleaning the construction joint surface with either air-water cutting, sandblasting, high-pressure water jet, or other approved method. Prepare concrete at the side of vertical construction joints as approved by the Contracting Officer. Air-water cutting shall not be used on formed surfaces or surfaces congested with reinforcing steel. Regardless of the method used, the resulting surfaces shall be free from all laitance and inferior concrete so that clean surfaces of well bonded coarse aggregate are exposed and make up at least 10-percent of the surface area, distributed uniformly throughout the surface. The edges of the coarse aggregate shall not be undercut. Keep the surface of horizontal construction joints continuously wet for the first 12 hours during the 24-hour period prior to placing fresh concrete. The surface shall be washed completely clean as the last operation prior to placing the next lift. For heavy duty floors and two-course floors, a thin coat of neat cement grout of about the consistency of thick cream shall be thoroughly scrubbed into the existing surface immediately ahead of the topping placing. The grout shall be a 1:1 mixture of portland cement and sand passing the No. 8 sieve. The topping concrete shall be deposited before the grout coat has had time to stiffen.

3.1.2.1 Air-Water Cutting

Air-water cutting of a fresh concrete surface shall be performed at the proper time and only on horizontal construction joints. The air pressure used in the jet shall be 100 psi, plus or minus 10 psi, and the water pressure shall be just sufficient to bring the water into effective influence of the air pressure. When approved by the Contracting Officer, a surface retarder complying with the requirements of COE CRD-C 94 may be applied to the surface of the lift in order to prolong the period of time during which air-water cutting is effective. After cutting, the surface shall be washed and rinsed as long as there is any trace of cloudiness of the wash water. Where necessary to remove accumulated laitance, coatings, stains, debris, and other foreign material, high-pressure waterjet or sandblasting shall be used as the last operation before placing the next lift.

3.1.2.2 High-Pressure Water Jet

Use a stream of water under a pressure of not less than 3,000 psi for cutting and cleaning. Its use shall be delayed until the concrete is sufficiently hard so that only the surface skin or mortar is removed and there is no undercutting of coarse-aggregate particles. If the waterjet is incapable of a satisfactory cleaning, the surface shall be cleaned by sandblasting.

3.1.2.3 Wet Sandblasting

Use wet sandblasting after the concrete has reached sufficient strength to prevent undercutting of the coarse aggregate particles. After wet sandblasting, the surface of the concrete shall then be washed thoroughly to remove all loose materials.

3.1.2.4 Waste Disposal

The method used in disposing of waste water employed in cutting, washing, and rinsing of concrete surfaces shall be such that the waste water does not stain, discolor, or affect exposed surfaces of the structures, or damage the environment of the project area. The method of disposal shall be subject to approval.

3.1.2.5 Preparation of Previously Placed Concrete

Concrete surfaces to which other concrete is to be bonded shall be abraded in an approved manner that will expose sound aggregate uniformly without damaging the concrete. Remove laitance and loose particles. Surfaces shall be thoroughly washed and shall be moist but without free water when concrete is placed.

3.1.3 Vapor Barrier

Provide vapor barrier beneath the interior on-grade concrete floor slabs. Use the greatest widths and lengths practicable to eliminate joints wherever possible. Joints shall be lapped a minimum of 12 inches. Torn, punctured, or damaged vapor barrier material shall be removed and new vapor barrier shall be provided prior to placing concrete. For minor repairs, patches may be made using laps of at least 12 inches. Lapped joints shall be sealed and edges patched with pressure-sensitive adhesive or tape not less than 2 inches wide and compatible with the membrane. Place vapor barrier directly on underlying subgrade, base course, or

capillary water barrier, unless it consists of crushed material or large granular material which could puncture the vapor barrier. In this case, a thin layer of approximately 1/2 inch of fine graded material should be rolled or compacted over the fill before installation of the vapor barrier to reduce the possibility of puncture. Control concrete placement so as to prevent damage to the vapor barrier.

3.1.4 Perimeter Insulation

Install perimeter insulation at locations indicated. Adhesive shall be used where insulation is applied to the interior surface of foundation walls and may be used for exterior application.

3.1.5 Embedded Items

Before placement of concrete, determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Conduit and other embedded items shall be clean and free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete into voids. Welding shall not be performed on embedded metals within 12 inches of the surface of the concrete. Tack welding shall not be performed on or to embedded items.

3.2 CONCRETE PRODUCTION

3.2.1 General Requirements

[Concrete shall either be batched and mixed onsite or shall be furnished from a ready-mixed concrete plant. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C94/C94M, except as otherwise specified. Truck mixers, agitators, and nonagitating transporting units shall comply with NRMCA TMMB 100. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA QC 3. Approved batch tickets shall be furnished for each load of ready-mixed concrete. Site-mixed concrete shall conform to the following subparagraphs.] [Concrete shall be batched and mixed onsite, or close to onsite, and shall conform to the following subparagraphs.]

3.2.2 Batching Plant

Locate the batching plant [onsite in the general area indicated on the drawings] [or] [offsite close to the project]. The batching, mixing and placing system shall have a capacity of at least [_____] cubic yards per hour. The batching plant shall conform to the requirements of NRMCA CPMB 100 and as specified; however, rating plates attached to batch plant equipment are not required.

3.2.3 Batching Equipment

The batching controls shall be semiautomatic or automatic, as defined in NRMCA CPMB 100. Provide a semiautomatic batching system with interlocks such that the discharge device cannot be actuated until the indicated material is within the applicable tolerance. Equip the batching system with accurate recorder or recorders that meet the requirements of NRMCA CPMB 100. Record the weight of water and admixtures if batched by weight. Provide separate bins or compartments for each size group of

aggregate and type of cementitious material, to prevent intermingling at any time. Aggregates shall be weighed either in separate weigh batchers with individual scales or, provided the smallest size is batched first, cumulatively in one weigh batcher on one scale. Aggregate shall not be weighed in the same batcher with cementitious material. If both portland cement and other cementitious material are used, they may be batched cumulatively, provided that the portland cement is batched first, [except that silica fume shall always be batched separately]. Water may be measured by weight or volume. Water shall not be weighed or measured cumulatively with another ingredient. Filling and discharging valves for the water metering or batching system shall be so interlocked that the discharge valve cannot be opened before the filling valve is fully closed. Piping for water and for admixtures shall be free from leaks and shall be properly valved to prevent backflow or siphoning. Furnish admixtures as a liquid of suitable concentration for easy control of dispensing. Provide an adjustable, accurate, mechanical device for measuring and dispensing each admixture. Each admixture dispenser shall be interlocked with the batching and discharging operation of the water so that each admixture is separately batched and individually discharged automatically in a manner to obtain uniform distribution throughout the water as it is added to the batch in the specified mixing period. [When use of truck mixers makes this requirement impractical, the admixture dispensers shall be interlocked with the sand batchers]. Different admixtures shall not be combined prior to introduction in water and shall not be allowed to intermingle until in contact with the cement. Admixture dispensers shall have suitable devices to detect and indicate flow during dispensing or have a means for visual observation. Arrange the plant so as to facilitate the inspection of all operations at all times. Provide suitable facilities for obtaining representative samples of aggregates from each bin or compartment, and for sampling and calibrating the dispensing of cementitious material, water, and admixtures. Filling ports for cementitious materials bins or silos shall be clearly marked with a permanent sign stating the contents.

3.2.4 Scales

The weighing equipment shall conform to the applicable requirements of CPMB Concrete Plant Standard, and of NIST HB 44, except that the accuracy shall be plus or minus 0.2 percent of scale capacity. Provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring devices. Perform the tests at the specified frequency in the presence of a Government inspector. Arrange the weighing equipment so that the plant operator can conveniently observe all dials or indicators.

3.2.5 Batching Tolerances

a. Tolerances with Weighing Equipment

MATERIAL	PERCENT OF REQUIRED WEIGHT
Cementitious materials	0 to plus 2
Aggregate	plus or minus 2
Water	plus or minus 1

MATERIAL	PERCENT OF REQUIRED WEIGHT
Chemical admixture	0 to plus 6

b. Tolerances with Volumetric Equipment - For volumetric batching equipment used for water and admixtures, the following tolerances shall apply to the required volume of material being batched:

MATERIAL	PERCENT OF REQUIRED MATERIAL
Water	plus or minus 1
Chemical admixture	0 to plus 6

3.2.6 Moisture Control

Provide a plant capable of ready adjustment to compensate for the varying moisture content of the aggregates and to change the weights of the materials being batched.

3.2.7 Concrete Mixers

Mixers shall be stationary mixers [or truck mixers] capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. The mixers shall not be charged in excess of the capacity recommended by the manufacturer. Operate the mixers at the drum or mixing blade speed designated by the manufacturer. The mixers shall be maintained in satisfactory operating condition, and the mixer drums shall be kept free of hardened concrete. Should any mixer at any time produce unsatisfactory results, its use shall be promptly discontinued until it is repaired.

3.2.8 Stationary Mixers

Concrete plant mixers shall be drum-type mixers of tilting, nontilting, horizontal-shaft, or vertical-shaft type, or pug mill type provided with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed. The mixing time and uniformity shall conform to all the requirements in ASTM C94/C94M applicable to central-mixed concrete.

3.2.9 Truck Mixers

Truck mixers, the mixing of concrete therein, and concrete uniformity shall conform to the requirements of ASTM C94/C94M. A truck mixer may be used either for complete mixing (transit-mixed) or to finish the partial mixing done in a stationary mixer (shrink-mixed). Each truck shall be equipped with two counters from which it is possible to determine the number of revolutions at mixing speed and the number of revolutions at agitating speed. [Or, if approved in lieu of this, the number of revolutions shall be marked on the batch tickets.] Water shall not be added at the placing site unless specifically approved; and in no case shall it exceed the specified w/c. Any such water shall be injected at the base of the mixer, not at the discharge end.

3.3 CONCRETE PRODUCTION, SMALL PROJECTS

Use batch-type equipment for producing concrete. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C94/C94M, except as otherwise specified. Truck mixers, agitators, and nonagitating transporting units shall comply with NRMCA TMMB 100. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA QC 3. Furnish approved batch tickets for each load of ready-mixed concrete. Produce site-mixed concrete in accordance with ACI 301, with plant conforming to NRMCA CPMB 100. [In lieu of batch-type equipment, concrete may be produced by volumetric batching and continuous mixing, which shall conform to ASTM C685/C685M.]

3.4 LIGHTWEIGHT AGGREGATE CONCRETE

In addition to the requirements specified for normal weight concrete, conform lightweight aggregate concrete to the following. The batching and mixing cycle shall be based on written recommendations from the aggregate supplier furnished by the Contractor, submitted for approval. Unless otherwise directed, charge the mixer with approximately 2/3 of the total mixing water and all of the aggregate. This shall be mixed for at least 1.5 minutes in a stationary mixer or 15 revolutions at mixing speed in a truck mixer. The remaining ingredients shall then be added and mixing continued as specified for normal weight concrete. Lightweight aggregate concrete shall not be vibrated to the extent that large particles of aggregate float to the surface. During finishing, lightweight aggregate concrete shall not be worked to the extent that mortar is driven down and lightweight coarse aggregate appears at the surface. Lightweight aggregate concrete to be pumped shall have a cement content of at least 564 lb/cu. yd.[Perform a field trial run of lightweight aggregate concrete placement and finishing in accordance with ACI 213R.]

3.5 FIBER REINFORCED CONCRETE

Fiber reinforced concrete shall conform to ASTM C1116/C1116M and as follows, using the fibers specified in Section 03 20 00.00 10 CONCRETE REINFORCING. Use a minimum of 1.5 pounds of fibers per cubic yard of concrete. Add fibers at the batch plant. [Toughness indices shall meet requirements for performance level I of ASTM C1116/C1116M.] Provide the services of a qualified technical representative to instruct the concrete supplier in proper batching and mixing of materials.

3.6 TRANSPORTING CONCRETE TO PROJECT SITE

Transport concrete to the placing site in [truck mixers,] [agitators,] [nonagitating transporting equipment conforming to NRMCA TMMB 100] or by approved [pumping equipment] [conveyors]. Nonagitating equipment, other than pumps, shall not be used for transporting lightweight aggregate concrete.

3.7 CONVEYING CONCRETE ONSITE

Convey concrete from mixer or transporting unit to forms as rapidly as possible and within the time interval specified by methods which will prevent segregation or loss of ingredients using following equipment. Conveying equipment shall be cleaned before each placement.

3.7.1 Buckets

The interior hopper slope shall be not less than 58 degrees from the horizontal, the minimum dimension of the clear gate opening shall be at least 5 times the nominal maximum-size aggregate, and the area of the gate opening shall not be less than 2 square feet. The maximum dimension of the gate opening shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be manually, pneumatically, or hydraulically operated except that buckets larger than 2 cubic yards shall not be manually operated. The design of the bucket shall provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position.

3.7.2 Transfer Hoppers

Concrete may be charged into nonagitating hoppers for transfer to other conveying devices. Transfer hoppers shall be capable of receiving concrete directly from delivery vehicles and shall have conical-shaped discharge features. Equip the transfer hopper with a hydraulically operated gate and with a means of external vibration to effect complete discharge. Concrete shall not be held in nonagitating transfer hoppers more than 30 minutes.

3.7.3 Trucks

Truck mixers operating at agitating speed or truck agitators used for transporting plant-mixed concrete shall conform to the requirements of ASTM C94/C94M. Use nonagitating equipment only for transporting plant-mixed concrete over a smooth road and when the hauling time is less than 15 minutes. Bodies of nonagitating equipment shall be smooth, watertight, metal containers specifically designed to transport concrete, shaped with rounded corners to minimize segregation, and equipped with gates that will permit positive control of the discharge of the concrete.

3.7.4 Chutes

When concrete can be placed directly from a truck mixer, agitator, or nonagitating equipment, the chutes normally attached to this equipment by the manufacturer may be used. Use a discharge deflector when required by the Contracting Officer. Separate chutes and other similar equipment will not be permitted for conveying concrete.

3.7.5 Belt Conveyors

Design and operate belt conveyors to assure a uniform flow of concrete from mixer to final place of deposit without segregation of ingredients or loss of mortar and provided with positive means, such as discharge baffle or hopper , for preventing segregation of the concrete at the transfer points and the point of placing. Construct belt conveyors such that the idler spacing does not exceed 36 inches. The belt speed shall be a minimum of 300 feet per minute and a maximum of 750 feet per minute. If concrete is to be placed through installed horizontal or sloping reinforcing bars, the conveyor shall discharge concrete into a pipe or elephant truck that is long enough to extend through the reinforcing bars.

3.7.6 Concrete Pumps

Concrete may be conveyed by positive displacement pump when approved. The pumping equipment shall be piston or squeeze pressure type; pneumatic

placing equipment shall not be used. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least 3 times the nominal maximum-size coarse aggregate in the concrete mixture to be pumped but not less than 4 inches. Aluminum pipe shall not be used.

3.8 PLACING CONCRETE

Discharge mixed concrete within 1.5 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 85 degrees F, reduce the time to 45 minutes. Place concrete within 15 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Provide adequate scaffolding, ramps and walkways so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities prevent proper consolidation, finishing and curing. Provide sufficient placing capacity so that concrete can be kept free of cold joints.

3.8.1 Depositing Concrete

Deposit concrete as close as possible to its final position in the forms, and with no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 12 inches thick, except that all slabs shall be placed in a single lift. Concrete to receive other construction shall be screeded to the proper level. Concrete shall be deposited continuously in one layer or in layers so that fresh concrete is deposited on in-place concrete that is still plastic. Fresh concrete shall not be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. Concrete that has surface dried, partially hardened, or contains foreign material shall not be used. When temporary spreaders are used in the forms, the spreaders shall be removed as their service becomes unnecessary. Concrete shall not be placed in slabs over columns and walls until concrete in columns and walls has been in-place at least two hours or until the concrete begins to lose its plasticity. Place concrete for beams, girders, brackets, column capitals, haunches, and drop panels at the same time as concrete for adjoining slabs.

3.8.2 Consolidation

Immediately after placing, consolidate each layer of concrete by internal vibrators, except for slabs 4 inches thick or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; keep a spare vibrator at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 10,000 vibrations per minute, an amplitude of at least 0.025 inch, and the head diameter shall be appropriate for the structural member and the concrete mixture being placed. Insert vibrators vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1.5 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is

such. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not be used unless specifically approved and unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Excessive vibration of lightweight concrete resulting in segregation or flotation of coarse aggregate shall be prevented. Frequency and amplitude of vibrators shall be determined in accordance with COE CRD-C 521. Do not use grate tampers (jitterbugs).

3.8.3 Cold Weather Requirements

Use special protection measures, approved by the Contracting Officer, if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 40 degrees F. The temperature of the concrete when placed shall be not less than 50 degrees F nor more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, an accelerating admixture conforming to ASTM C494/C494M, Type C or E may be used, provided it contains no calcium chloride. Do not use calcium chloride.

3.8.4 Hot Weather Requirements

When job-site conditions are present or anticipated that accelerate the rate of moisture loss or rate of cement hydration of freshly mixed concrete, including an ambient temperature of 80 degrees F or higher, and an evaporation rate that exceeds 0.2 $lb/ft^2/h$, concrete work shall conform to all requirements of ACI 305.1.

3.8.5 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, as well as interior placements when space heaters produce low humidity, the Contractor shall be alert to the tendency for plastic shrinkage cracks to develop and shall institute measures to prevent this. Take particular care if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Conform with the requirement of ACI 305.1. In addition the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding or wet covering. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

3.8.6 Placing Concrete Underwater

Deposit concrete in water by a tremie or concrete pump. The methods and equipment used shall be subject to approval. Concrete buckets shall not be used for underwater placement of concrete except to deliver concrete to the tremie. The tremie shall be watertight and sufficiently large to permit a free flow of concrete. The concrete shall be deposited so that it enters the mass of the previously placed concrete from within, displacing water with a minimum disturbance to the surface of the

concrete. Keep the discharge end of the pump line or tremie shaft continuously submerged in the concrete. The underwater seal at start of placing shall not produce undue turbulence in the water. Keep the tremie shaft full of concrete to a point well above the water surface. Placement shall proceed without interruption until the concrete has been brought to the required height. The tremie shall not be moved horizontally during a placing operation, and a sufficient number of tremies shall be provided so that the maximum horizontal flow of concrete will be limited to 15 feet. Concrete shall not be deposited in running water or in water with a temperature below 35 degrees F.

3.8.7 Placing Concrete in Congested Areas

Use special care to ensure complete filling of the forms, elimination of all voids, and complete consolidation of the concrete when placing concrete in areas congested with reinforcing bars, embedded items, waterstops and other tight spacing. An appropriate concrete mixture shall be used, and the nominal maximum size of aggregate (NMSA) shall meet the specified criteria when evaluated for the congested area. Vibrators with heads of a size appropriate for the clearances available shall be used, and the consolidation operation shall be closely supervised to ensure complete and thorough consolidation at all points. Where necessary, splices of reinforcing bars shall be alternated to reduce congestion. Where two mats of closely spaced reinforcing are required, the bars in each mat shall be placed in matching alignment to reduce congestion. Reinforcing bars may be temporarily crowded to one side during concrete placement provided they are returned to exact required location before concrete placement and consolidation are completed.

3.8.8 Placing Flowable Concrete

If a plasticizing admixture conforming to ASTM C1017/C1017M is used or if a Type F or G high range water reducing admixture is permitted to increase the slump, the concrete shall meet all requirements of paragraph SYSTEM DESCRIPTION. Use extreme care in conveying and placing the concrete to avoid segregation. No relaxation of requirements to accommodate flowable concrete will be permitted.

3.9 JOINTS

Locate and construct joints as indicated or approved. Joints not indicated on the drawings shall be located and constructed to minimize the impact on the strength of the structure. In general, locate such joints near the middle of the spans of supported slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs, unless otherwise approved. Joints shall be perpendicular to the main reinforcement. All reinforcement shall be continued across joints; except that reinforcement or other fixed metal items shall not be continuous through expansion joints, or through construction or contraction joints in slabs on grade. Reinforcement shall be 2 inches clear from each joint. Except where otherwise indicated, construction joints between interior slabs on grade and vertical surfaces shall consist of 30 pound asphalt-saturated felt, extending for the full depth of the slab. The perimeters of the slabs shall be free of fins, rough edges, spalling, or other unsightly appearance. Reservoir for sealant for construction and contraction joints in slabs shall be formed to the dimensions shown on the

drawings by removing snap-out joint-forming inserts, by sawing sawable inserts, or by sawing to widen the top portion of sawed joints. Joints to be sealed shall be cleaned and sealed as indicated and in accordance with Section 07 92 00 JOINT SEALANTS.

3.9.1 Construction Joints

For concrete other than slabs on grade, locate construction joints so that the unit of operation does not exceed [_____] feet. Concrete shall be placed continuously so that each unit is monolithic in construction. Fresh concrete shall not be placed against adjacent hardened concrete until it is at least 24 hours old. Locate construction joints as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of the Contracting Officer. Unless otherwise indicated and except for slabs on grade, extend reinforcing steel through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the concrete begins to lose its plasticity, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, terminate lifts at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints in walls or columns are required, a strip of 1 inch square-edge lumber, beveled and oiled to facilitate removal, shall be tacked to the inside of the forms at the construction joint. Place concrete to a point 1 inch above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph Previously Placed Concrete above.

3.9.2 Contraction Joints in Slabs on Grade

Contraction joints shall be located and detailed as shown on the drawings. Produce contraction joints by forming a weakened plane in the concrete slab using materials and procedures specified in Section 03 15 00.00 10 CONCRETE ACCESSORIES.

3.9.3 Expansion Joints

Installation of expansion joints and sealing of these joints shall conform to the requirements of Section 03 15 00.00 10 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS and Section 07 92 00 JOINT SEALANTS.

3.9.4 Waterstops

Install waterstops in conformance with the locations and details shown on the drawings using materials and procedures specified in Section 03 15 00.00 10 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

3.9.5 Dowels and Tie Bars

Install dowels and tie bars at the locations shown on the drawings and to the details shown, using materials and procedures specified in Section 03 20 00.00 10 CONCRETE REINFORCEMENT and herein. Conventional smooth "paving" dowels shall be installed in slabs using approved methods to hold the dowel in place during concreting within a maximum alignment tolerance

of 1/8 inch in 12 inches. "Structural" type deformed bar dowels, or tie bars, shall be installed to meet the specified tolerances. Care shall be taken during placing adjacent to and around dowels and tie bars to ensure there is no displacement of the dowel or tie bar and that the concrete completely embeds the dowel or tie bar and is thoroughly consolidated.

3.10 SPECIALTY FLOORS

3.10.1 Heavy Duty Floors

[Areas as indicated on the drawings] [The following areas [_____]] shall have heavy duty floors constructed as follows:

3.10.1.1 General

Construct heavy duty floor by placing a heavy duty bonded topping on a base slab which has had a rough slab finish left 2 inches below final grade. Concrete in the base slab shall be thoroughly hardened but not more than 30 hours old. The temperature of the fresh concrete topping shall not vary more than 10 degrees F plus or minus from the temperature of the base slab. The ambient temperature of the space adjacent to the concrete placement and of the base slab shall be between 50 and 90 degrees F.

3.10.1.2 Preparation of Base Slab

Keep the base slab continuously damp until topping is placed. The surface of the base slab shall be thoroughly cleaned with an air-water jet immediately before placing the topping. A thin coat of neat cement grout of about the consistency of thick cream shall be thoroughly scrubbed into the existing surface immediately ahead of the overlay placing. At the time the neat cement grout is placed, the existing concrete surface shall be damp but shall have no free water present. Deposit the overlay concrete before the grout coat has had time to stiffen.

3.10.2 Two-Course Floor Construction

[Areas as indicated on the drawings] [The following areas [_____]] shall have floors constructed with two-course construction by placing a bonded topping on the thoroughly hardened concrete base slab which has been left with a rough slab finish 2 inches below final grade as shown on the drawings. Apply topping at an approved time late in the contract period. The floor topping mixture shall have a specified compressive strength of 5000 psi at 28 days, a 2 inch maximum slump, 1/2 inch maximum size coarse aggregate, and shall be proportioned to obtain required finishability. The surface of the base slab shall be thoroughly cleaned by sandblasting or high-pressure waterjet immediately before placing topping. The temperature of the fresh concrete topping shall not vary more than 10 degrees F plus or minus from the temperature of the base slab. The ambient temperature of the space adjacent to the concrete placement and of the base slab shall be between 50 and 90 degrees F. The base slab shall be kept continuously wet for the first 12 hours during the 24 hour period immediately prior to placing the finished floor. After all free water has evaporated or has been removed from the surface, a grout shall be scrubbed in. The grout shall be a 1:1 mixture of portland cement and sand passing the No. 8 sieve mixed to a creamlike consistency. Scrub the grout into the surface just ahead of the concrete topping placing operation. While the grout is still damp, the top course shall be spread and screeded and darbied or bull floated.

3.11 FLOOR HARDENER

[Areas as indicated on the drawings] [The following areas [_____]] shall be treated with floor hardener applied after the concrete has been cured and then air dried for [14] [28] days. Apply three coats, each the day after the preceding coat was applied. For the first application, one pound of the silicofluoride shall be dissolved in one gallon of water. For subsequent applications, the solution shall be two pounds of silicofluoride to each gallon of water. Floor should be mopped with clear water shortly after the preceding application has dried to remove encrusted salts. Apply proprietary hardeners in accordance with the manufacturer's instructions. During application, area should be well ventilated. Take precautions when applying silicofluorides due to the toxicity of the salts. Any compound that contacts glass or aluminum should be immediately removed with clear water.

3.12 EXTERIOR SLAB AND RELATED ITEMS

3.12.1 Pavements

Construct pavements where shown on the drawings. After forms are set and underlying material prepared as specified, place the concrete uniformly throughout the area and thoroughly vibrated. As soon as placed and vibrated, the concrete shall be struck off and screeded to the crown and cross section and to such elevation above grade that when consolidated and finished, the surface of the pavement will be at the required elevation. The entire surface shall be tamped with the strike off, or consolidated with a vibrating screed, and this operation continued until the required compaction and reduction of internal and surface voids are accomplished. Take care to prevent bringing excess paste to the surface. Curing shall be as specified.

3.12.2 Sidewalks

Concrete shall be 4 inches minimum thickness. Provide contraction joints at 5 feet spaces unless otherwise indicated. Contraction joints shall be cut 1 inch deep with a jointing tool after the surface has been finished. Provide transverse expansion joints 1/2 inch thick at changes in direction and where sidewalk abuts curbs, steps, rigid pavement, or other similar structures. A transverse slope of 1/4 inch per foot shall be provided, unless otherwise indicated. Variations in cross section shall be limited to 1/4 inch in 5 feet.

3.12.3 Curbs and Gutters

Concrete shall be formed, placed, and finished by hand using a properly shaped "mule" or constructed using a slipform machine specially designed for this work. Contraction joints shall be cut 3 inches deep with a jointing tool after the surface has been finished. Expansion joints (1/2 inch wide) shall be provided at 100 feet maximum spacing unless otherwise indicated.

3.12.4 Pits and Trenches

Construct pits and trenches as indicated on the drawings. Bottoms and walls shall be placed monolithically or waterstops and keys, shall be provided as approved.

3.13 SETTING BASE PLATES AND BEARING PLATES

After being properly positioned, column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates shall be set to the proper line and elevation with damp-pack bedding mortar, except where nonshrink grout is indicated. The thickness of the mortar or grout shall be approximately 1/24 the width of the plate, but not less than 3/4 inch. Concrete and metal surfaces in contact with grout shall be clean and free of oil and grease, and concrete surfaces in contact with grout shall be damp and free of laitance when grout is placed. Use nonshrink grout for [_____].

3.13.1 Damp-Pack Bedding Mortar

Damp-pack bedding mortar shall consist of 1 part cement and 2-1/2 parts fine aggregate having water content such that a mass of mortar tightly squeezed in the hand will retain its shape but will crumble when disturbed. The space between the top of the concrete and bottom of the bearing plate or base shall be packed with the bedding mortar by tamping or ramming with a bar or rod until it is completely filled.

3.13.2 Nonshrink Grout

Nonshrink grout shall be a ready-mixed material requiring only the addition of water. Water content shall be the minimum that will provide a flowable mixture and completely fill the space to be grouted without segregation, bleeding, or reduction of strength.

3.13.2.1 Mixing and Placing of Nonshrink Grout

Mixing and placing shall be in conformance with the material manufacturer's instructions and as specified therein. Ingredients shall be thoroughly dry-mixed before adding water. After adding water, mix the batch for 3 minutes. Batches shall be of size to allow continuous placement of freshly mixed grout. Discard grout not used within 30 minutes after mixing. The space between the top of the concrete or machinery-bearing surface and the plate shall be filled solid with the grout. Forms shall be of wood or other equally suitable material for completely retaining the grout on all sides and on top and shall be removed after the grout has set. The placed grout shall be carefully worked by rodding or other means to eliminate voids; however, overworking and breakdown of the initial set shall be avoided. Grout shall not be retempered or subjected to vibration from any source. Where clearances are unusually small, placement shall be under pressure with a grout pump. Temperature of the grout, and of surfaces receiving the grout, shall be maintained at 65 to 85 degrees F until after setting.

3.13.2.2 Treatment of Exposed Surfaces

For metal-oxidizing nonshrink grout, exposed surfaces shall be cut back 1 inch and immediately covered with a parge coat of mortar consisting of 1 part portland cement and 2-1/2 parts fine aggregate by weight, with sufficient water to make a plastic mixture. The parge coat shall have a smooth finish. For other mortars or grouts, exposed surfaces shall have a smooth-dense finish and be left untreated. Curing shall comply with Section 03 39 00.00 10 CONCRETE CURING.

3.14 TESTING AND INSPECTION FOR CQC

Perform the inspection and tests described below and, based upon the results of these inspections and tests, take the action required. Submit certified copies of laboratory test reports, including mill tests and all other test data, for portland cement, blended cement, pozzolan, ground granulated blast furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this project.

a. When, in the opinion of the Contracting Officer, the concreting operation is out of control, cease concrete placement and correct the operation.

b. The laboratory performing the tests shall be onsite and shall conform with ASTM C1077. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site.

c. The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations and at least once per [_____] thereafter for conformance with ASTM C1077.

3.14.1 Grading and Corrective Action

3.14.1.1 Fine Aggregate

At least once during each shift when the concrete plant is operating, there shall be one sieve analysis and fineness modulus determination in accordance with ASTM C136 and COE CRD-C 104 for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits. When the amount passing on any sieve is outside the specification limits, the fine aggregate shall be immediately resampled and retested. If there is another failure on any sieve, the fact shall be immediately reported to the Contracting Officer, concreting shall be stopped, and immediate steps taken to correct the grading.

3.14.1.2 Coarse Aggregate

At least once during each shift in which the concrete plant is operating, there shall be a sieve analysis in accordance with ASTM C136 for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production control. However, the Contractor shall be responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations shall show the results of the current test as well as the average results of the five most recent tests including the current test. The Contractor may adopt limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Contracting Officer. Where two consecutive averages of 5 tests are outside specification limits, the operation shall be considered out of control and reported to the Contracting Officer. Concreting shall be stopped and immediate steps shall be taken to correct the grading.

3.14.2 Quality of Aggregates

Thirty days prior to the start of concrete placement, perform all tests for aggregate quality required by ASTM C33/C33M. In addition, after the start of concrete placement, perform tests for aggregate quality at least every three months, and when the source of aggregate or aggregate quality changes. Samples tested after the start of concrete placement shall be taken immediately prior to entering the concrete mixer.

3.14.3 Scales, Batching and Recording

Check the accuracy of the scales by test weights prior to start of concrete operations and at least once every three months. Such tests shall also be made as directed whenever there are variations in properties of the fresh concrete that could result from batching errors. Once a week the accuracy of each batching and recording device shall be checked during a weighing operation by noting and recording the required weight, recorded weight, and the actual weight batched. At the same time, test and ensure that the devices for dispensing admixtures are operating properly and accurately. When either the weighing accuracy or batching accuracy does not comply with specification requirements, the plant shall not be operated until necessary adjustments or repairs have been made. Discrepancies in recording accuracies shall be corrected immediately.

3.14.4 Batch-Plant Control

Continuously control the measurement of concrete materials, including cementitious materials, each size of aggregate, water, and admixtures. Adjust the aggregate weights and amount of added water as necessary to compensate for free moisture in the aggregates. The amount of air-entraining agent shall be adjusted to control air content within specified limits. Prepare a report indicating type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water weights per cubic yard amount of water as free moisture in each size of aggregate, and the batch aggregate and water weights per cubic yard for each class of concrete batched during each day's plant operation.

3.14.5 Concrete Mixture

3.14.5.1 Air Content Testing

Perform air content tests when test specimens are fabricated. In addition, at least two tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of concrete production. Perform additional tests when excessive variation in workability is reported by the placing foreman or Government inspector. Tests shall be made in accordance with ASTM C231/C231M for normal weight concrete and ASTM C173/C173M for lightweight concrete. Plot test results on control charts which shall at all times be readily available to the Government and submitted weekly. Keep copies of the current control charts in the field by testing crews and results plotted as tests are made. When a single test result reaches either the upper or lower action limit, perform a second test immediately. The results of the two tests shall be averaged and this average used as the air content of the batch to plot on both the air content and the control chart for range, and for determining need for any remedial action. The result of each test, or average as noted in the

previous sentence, shall be plotted on a separate control chart for each mixture on which an "average line" is set at the midpoint of the specified air content range from paragraph Air Entrainment in PART 1. Set an upper warning limit and a lower warning limit line 1.0 percentage point above and below the average line, respectively. An upper action limit and a lower action limit line shall be set 1.5 percentage points above and below the average line, respectively. The range between each two consecutive tests shall be plotted on a secondary control chart for range where an upper warning limit is set at 2.0 percentage points and an upper action limit is set at 3.0 percentage points. Samples for air content may be taken at the mixer, however, the Contractor is responsible for delivering the concrete to the placement site at the stipulated air content. If the Contractor's materials or transportation methods cause air content loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the air content at the mixer controlled as directed.

3.14.5.2 Air Content Corrective Action

Whenever points on the control chart for percent air reach either warning limit, an adjustment shall immediately be made in the amount of air-entraining admixture batched. As soon as practical after each adjustment, another test shall be made to verify the result of the adjustment. Whenever a point on the secondary control chart for range reaches the warning limit, the admixture dispenser shall be recalibrated to ensure that it is operating accurately and with good reproducibility. Whenever a point on either control chart reaches an action limit line, the air content shall be considered out of control and the concreting operation shall immediately be halted until the air content is under control. Additional air content tests shall be made when concreting is restarted.

3.14.5.3 Slump Testing

In addition to slump tests which are made when test specimens are fabricated, at least four slump tests shall be made on randomly selected batches in accordance with ASTM C143/C143M for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Plot test results on control charts which shall at all times be readily available to the Government and submitted weekly. Keep copies of the current control charts in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond either the upper or lower action limit, immediately perform a second test. The results of the two tests shall be averaged and this average used as the slump of the batch to plot on both the control charts for slump and the chart for range, and for determining need for any remedial action. Set limits on separate control charts for slump for each type of mixture. The upper warning limit shall be set at 1/2 inch below the maximum allowable slump specified in paragraph Slump in PART 1 for each type of concrete and an upper action limit line and lower action limit line shall be set at the maximum and minimum allowable slumps, respectively, as specified in the same paragraph. The range between each consecutive slump test for each type of mixture shall be plotted on a single control chart for range on which an upper action limit is set at 2 inches. Take samples for slump at the mixer. However, the Contractor is responsible for delivering the concrete to the placement site at the stipulated slump. If the Contractor's materials or transportation methods

cause slump loss between the mixer and the placement, take correlation samples at the placement site as required by the Contracting Officer, and the slump at the mixer controlled as directed.

3.14.5.4 Slump Corrective Action

Whenever points on the control charts for slump reach the upper warning limit, make an adjustment immediately in the batch weights of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum w/c ratio specified, based on aggregates which are in a saturated surface dry condition. When a single slump reaches the upper or lower action limit, no further concrete shall be delivered to the placing site until proper adjustments have been made. Immediately after each adjustment, another test shall be made to verify the correctness of the adjustment. Whenever two consecutive individual slump tests, made during a period when there was no adjustment of batch weights, produce a point on the control chart for range at or above the upper action limit, halt the concreting operation immediately, and take appropriate steps to bring the slump under control. Additional slump tests shall be made as directed.

3.14.5.5 Temperature

Measure the temperature of the concrete when compressive strength specimens are fabricated in accordance with ASTM C1064/C1064M. Report the temperature along with the compressive strength data.

3.14.5.6 Strength Specimens

Perform at least one set of test specimens, for compressive or flexural strength as appropriate, on each different concrete mixture placed during the day for each 500 cubic yards or portion thereof of that concrete mixture placed each day. Perform additional sets of test specimens, as directed by the Contracting Officer, when the mixture proportions are changed or when low strengths have been detected. Develop a truly random (not haphazard) sampling plan for approval by the Contracting Officer prior to the start of construction. The plan shall ensure that sampling is done in a completely random and unbiased manner. A set of test specimens for concrete with a 28-day specified strength in accordance with paragraph Strength Requirements in PART 1 shall consist of four specimens, two to be tested at 7 days and two at 28 days. [A set of test specimens for concrete with a 90-day strength in accordance with the same paragraph shall consist of six specimens, two tested at 7 days, two at 28 days, and two at 90 days.] Test specimens shall be molded and cured in accordance with ASTM C31/C31M and tested in accordance with ASTM C39/C39M for test cylinders and ASTM C78/C78M for test beams. Results of all strength tests shall be reported immediately to the Contracting Officer. Quality control charts shall be kept for individual strength "tests", ("test" as defined in paragraph Strength Requirements in PART 1) moving average of last 3 "tests" for strength, and moving average for range for the last 3 "tests" for each mixture. The charts shall be similar to those found in ACI 214R.

3.14.6 Inspection Before Placing

Inspect foundations, construction joints, forms, and embedded items in sufficient time prior to each concrete placement in order to certify to the Contracting Officer that they are ready to receive concrete. Report the results of each inspection in writing.

3.14.7 Placing

The placing foreman shall supervise placing operations, shall determine that the correct quality of concrete or grout is placed in each location as specified and as directed by the Contracting Officer, and shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume placed, and method of placement. The placing foreman shall not permit batching and placing to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Placing shall not be continued if any pile of concrete is inadequately consolidated. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

3.14.8 Vibrators

Determine the frequency and amplitude of each vibrator in accordance with COE CRD-C 521 prior to initial use and at least once a month when concrete is being placed. Perform additional tests as directed when a vibrator does not appear to be adequately consolidating the concrete. The frequency shall be determined while the vibrator is operating in concrete with the tachometer being held against the upper end of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. Determine the amplitude with the head vibrating in air. Take two measurements, one near the tip and another near the upper end of the vibrator head, and these results averaged. Report the make, model, type, and size of the vibrator and frequency and amplitude results in writing. Any vibrator not meeting the requirements of paragraph Consolidation above, shall be immediately removed from service and repaired or replaced.

3.14.9 Cold-Weather Protection

At least once each shift and once per day on non-work days, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

3.14.10 Mixer Uniformity

3.14.10.1 Stationary Mixers

Prior to the start of concrete placing and once every 6 months when concrete is being placed, or once for every 75,000 cubic yards of concrete placed, whichever results in the shortest time interval, uniformity of concrete mixing shall be determined in accordance with ASTM C94/C94M.

3.14.10.2 Truck Mixers

Prior to the start of concrete placing and at least once every 6 months when concrete is being placed, uniformity of concrete mixing shall be determined in accordance with ASTM C94/C94M. Select the truck mixers randomly for testing. When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of the blades may be regarded as satisfactory.

3.14.10.3 Mixer Uniformity Corrective Action

When a mixer fails to meet mixer uniformity requirements, either the mixing time shall be increased, batching sequence changed, batch size

reduced, or adjustments shall be made to the mixer until compliance is achieved.

3.14.11 Reports

Report all results of tests or inspections conducted, informally as they are completed and in writing daily. Prepare a weekly report for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all contractor quality control records.

-- End of Section --

SECTION 03 40 00.00 10

PLANT-PRECAST CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION
08/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 211.1	(1991; R 2009) Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
ACI 211.2	(1998; R 2004) Standard Practice for Selecting Proportions for Structural Lightweight Concrete
ACI 305R	(2010) Guide to Hot Weather Concreting
ACI 306.1	(1990; R 2002) Standard Specification for Cold Weather Concreting
ACI 318	(2011; Errata 1 2011; Errata 2 2012; Errata 3-4 2013) Building Code Requirements for Structural Concrete and Commentary

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)

ACPA 01-102	(2000) Concrete Pipe Handbook
ACPA 01-110	(1984) Design Manual for Sulfide and Corrosion Prediction and Control
ACPA QPC	(2005; Ver 3.0) QCast Plant Certification Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2010; Errata 2011) Structural Welding Code - Steel
AWS D1.4/D1.4M	(2011) Structural Welding Code - Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A185/A185M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A36/A36M	(2012) Standard Specification for Carbon Structural Steel
ASTM A496/A496M	(2007) Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
ASTM A497/A497M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
ASTM A615/A615M	(2012) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A706/A706M	(2009b) Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A767/A767M	(2009) Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
ASTM A775/A775M	(2007b) Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A82/A82M	(2007) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A884/A884M	(2012) Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
ASTM C1064/C1064M	(2011) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1107/C1107M	(2013) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C1116/C1116M	(2010a) Standard Specification for Fiber-Reinforced Concrete
ASTM C1240	(2012) Standard Specification for Silica Fume Used in Cementitious Mixtures
ASTM C1244	(2011) Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill
ASTM C138/C138M	(2013) Standard Test Method for Density ("Unit Weight"), Yield, and Air Content (Gravimetric) of Concrete
ASTM C143/C143M	(2012) Standard Test Method for Slump of Hydraulic-Cement Concrete

ASTM C1478	(2008; R 2013) Standard Specification for Storm Drain Resilient Connectors Between Reinforced Concrete Storm Sewer Structures, Pipes and Laterals
ASTM C150/C150M	(2012) Standard Specification for Portland Cement
ASTM C171	(2007) Standard Specification for Sheet Materials for Curing Concrete
ASTM C173/C173M	(2012) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C192/C192M	(2013) Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231/C231M	(2010) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C31/C31M	(2012) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2013) Standard Specification for Concrete Aggregates
ASTM C330/C330M	(2009) Standard Specification for Lightweight Aggregates for Structural Concrete
ASTM C39/C39M	(2012) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C443	(2011) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C494/C494M	(2013) Standard Specification for Chemical Admixtures for Concrete
ASTM C595/C595M	(2013) Standard Specification for Blended Hydraulic Cements
ASTM C618	(2012a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

ASTM C877	(2008) External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections
ASTM C891	(2011) Installation of Underground Precast Concrete Utility Structures
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM C923	(2008; R 2013) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C989/C989M	(2012a) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C990	(2009) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants

CSA STANDARDS (CSA)

CSA A23.4	(2009; Update 2010) Precast Concrete - Materials and Construction

NATIONAL PRECAST CONCRETE ASSOCIATION (NPCA)

NPCA QC Manual	(2012) Quality Control Manual for Precast and Prestressed Concrete Plants

1.2 SYSTEM DESCRIPTION

Furnish precast concrete units designed and fabricated by an experienced and acceptable precast concrete manufacturer who has been, for at least 3 years, regularly and continuously engaged in the manufacture of precast concrete work similar to that indicated on the drawings. Coordinate precast work with the work of other trades.

1.2.1 Standard Precast Units

Design standard precast concrete units to withstand indicated design load conditions in accordance with applicable industry design standards [ACI 318, ASTM, ACPA 01-102, Chapter 7-Design for Sulfide Control]. Design shall also consider stresses induced during handling, shipping and installation as to avoid product cracking or other handling damage. Indicate design loads for precast concrete units on the shop drawings. Submit drawings for standard precast concrete units furnished by the precast concrete producer for approval by the Contracting Officer. These drawings shall demonstrate that the applicable industry design standards have been met. Include installation and construction information on shop drawings. Include details of steel reinforcement size and placement as well as supporting design calculations, if appropriate. Produce precast concrete units in accordance with the approved drawings. Submit cut sheets, for standard precast concrete units, showing conformance to project drawings and requirements, and to applicable industry design standards listed in this specification.

1.2.2 Custom-Made Precast Units

Submit design calculations for custom-made precast units, prepared and sealed by a registered professional engineer, for approval prior to fabrication. Include in the calculations the analysis of units for lifting stresses and the sizing of lifting devices. Submit drawings furnished by the precast concrete producer for approval by the Contracting Officer. Show on these drawings complete design, installation, and construction information in such detail as to enable the Contracting Officer to determine the adequacy of the proposed units for the intended purpose. Include details of steel reinforcement size and placement as well as supporting design calculations, if appropriate. Produce precast concrete units in accordance with the approved drawings.

1.2.3 Proprietary Precast Units

Products manufactured under franchise arrangements shall conform to all the requirements specified by the franchiser. Items not included in the franchise specification, but included in this specification, shall conform to the requirements in this specification. Submit standard plans or informative literature, for proprietary precast concrete units. Make available supporting calculations and design details upon request. Provide sufficient information as to demonstrate that such products will perform the intended task.

1.2.4 Joints and Sealants

Provide joints and sealants between adjacent units of the type and configuration indicated on shop drawings meeting specified design and performance requirements.

1.2.5 Concrete Mix Design

1.2.5.1 Concrete Mix Proportions

Base selection of proportions for concrete on the methodology presented in ACI 211.1 for normal weight concrete and ACI 211.2 for lightweight concrete. Develop the concrete proportions using the same type and brand of cement, the same type and brand of pozzolan, the same type and gradation of aggregates, and the same type and brand of admixture that will be used in the manufacture of precast concrete units for the project. Do not use calcium chloride in precast concrete containing reinforcing steel or other embedded metal items. At a minimum of thirty days prior to precast concrete unit manufacturing, the precast concrete producer will submit a mix design and proportions for each strength and type of concrete that will be used. Furnish a complete list of materials, including quantity, type, brand and applicable data sheets for all mix design constituents as well as applicable reference specifications. The use of self-consolidating concrete is permitted, provided that mix design proportions and constituents meet the requirements of this specification.

1.2.5.2 Concrete Strength

Provide precast concrete units with a 28-day compressive strength (f'c) of 3000 psi.

1.2.5.3 Water-to-Cement Ratio

Furnish concrete, that will be exposed to freezing and thawing, containing

entrained air and with water-cement ratios of 0.45 or less. Furnish concrete which will not be exposed to freezing, but which is required to be watertight, with a water-cement ratio of 0.48 or less if the concrete is exposed to fresh water, or 0.45 or less if exposed to brackish water or sea water. Furnish reinforced concrete exposed to deicer salts, brackish water or seawater with a water-cement ratio of 0.40 or less for corrosion protection.

1.2.5.4 Air Content

The air content of concrete that will be exposed to freezing conditions shall be within the limits given below.

	AIR CONTENT PERCENT	
NOMINAL MAXIMUM AGGREGATE SIZE	SEVERE EXPOSURE	MODERATE EXPOSURE
3/8 inch	6.0 to 9.0	4.5 to 7.5
1/2 inch	5.5 to 8.5	4.0 to 7.0
3/4 inch	4.5 to 7.5	3.5 to 6.5
1.0 inch	4.5 to 7.5	3.0 to 6.0
1.5 inch	4.5 to 7.0	3.0 to 6.0
Note: For specified compressive strengths greater than 5000 psi, air content may be reduced 1 percent		

1.2.5.5 Corrosion Control for Sewer Systems

Follow design recommendations outlined in Chapter 7 of ACPA 01-102 or the ACPA 01-110 when hydrogen sulfide is indicated as a potential problem.

1.3 SUBMITTALS

All submittals are the responsibility of the precast concrete producer. Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Quality Control Procedures

SD-02 Shop Drawings

Standard Precast Units; G
Custom-Made Precast Units; G

SD-03 Product Data

Standard Precast Units
Proprietary Precast Units
Embedded Items
Accessories

SD-05 Design Data

Design Calculations; G
Concrete Mix Proportions; G

SD-06 Test Reports

Test Reports; G

SD-07 Certificates

Quality Control Procedures

1.4 QUALITY ASSURANCE

Demonstrate adherence to the standards set forth in NPCA QC Manual and/or ACPA QPC. Meet requirements written in the subparagraphs below.

1.4.1 NPCA and ACPA Plant Certification

The precast concrete producer shall be certified by the National Precast Concrete Association's and/or the American Concrete Pipe Association's Plant Certification Program prior to and during production of the products for this project.

1.4.2 Qualifications, Quality Control and Inspection

1.4.2.1 Qualifications

Select a precast concrete producer that has been in the business of producing precast concrete units similar to those specified for a minimum of 3 years. The precast concrete producer shall maintain a permanent quality control department or retain an independent testing agency on a continuing basis.

1.4.2.2 Quality Control Procedures

Submit quality control procedures established by the precast manufacturer in accordance with NPCA QC Manual and/or ACPA QPC. Show that the following QC tests are performed as required and in accordance with the ASTM standards indicated.

a. Slump: Perform a slump test for each 150 cu yd of concrete produced, or once a day, whichever comes first. Perform slump tests in accordance with ASTM C143/C143M.

b. Temperature: Measure the temperature of fresh concrete when slump or air content tests are made and when compressive test specimens are made in accordance with ASTM C1064/C1064M.

c. Compressive Strength: Make at least four compressive strength specimens for each 150 cubic yards of concrete of each mix in accordance with the following Standards: ASTM C31/C31M, ASTM C192/C192M, ASTM C39/C39M.

d. Air Content: Perform tests for air content on air-entrained, wet-cast concrete for each 150 cu yd of concrete, but not less often than once each day when air-entrained concrete is used. Determine the air

content in accordance with either ASTM C231/C231M or ASTM C173/C173M for normal weight aggregates and ASTM C173/C173M for lightweight aggregates.

e. Unit Weight: Perform tests for unit weight a minimum of once per week to verify the yield of batch mixes. Perform unit weight tests for each 100 cu yd of lightweight concrete in accordance with ASTM C138/C138M.

1.4.2.3 Inspection

The Contracting Officer may place an inspector in the plant when the units covered by this specification are being manufactured. The burden of payment for plant inspection will be clearly detailed in the specification. The precast concrete producer shall give notice 14 days prior to the time the units will be available for plant inspection. Neither the exercise nor waiver of inspection at the plant will affect the Government's right to enforce contractual provisions after units are transported or erected.

1.4.2.4 Test Reports

Submit the following as specified in paragraph SUBMITTALS:

1.4.2.4.1 Material Certifications and/or Laboratory Test Reports

Include mill tests and all other test data, for portland cement, blended cement, pozzolans, ground granulated blast furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this project.

1.4.2.4.2 Mix Test

reports showing that the mix has been successfully tested to produce concrete with the properties specified and will be suitable for the job conditions. Such tests may include compressive strength, flexural strength, plastic or hardened air content, freeze thaw durability, abrasion and absorption. Clearly detail in the specifications special tests for precast concrete or cast-in items.

1.4.2.4.3 Self-Consolidating Concrete

icient documentation, when the use of self-consolidating concrete (SCC) is proposed, showing a minimum of 30-days production track records demonstrating that SCC is appropriate for casting of the product.

1.4.2.4.4 In-Plant QA/QC Inspection Reports

Upon the request of the Contracting Officer.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

Deliver precast units to the site in accordance with the delivery schedule to avoid excessive build-up of units in storage at the site. Upon delivery to the jobsite, all precast concrete units will be inspected by the Contracting Officer for quality and final acceptance.

1.5.2 Storage

Store units off the ground or in a manner that will minimize potential damage.

1.5.3 Handling

Handle, transport, and store products in a manner to minimize damage. Lifting devices or holes shall be consistent with industry standards. Perform lifting with methods or devices intended for this purpose as indicated on shop drawings.

PART 2 PRODUCTS

2.1 MATERIALS

Except as otherwise specified in the following paragraphs, conform material to Section 03 30 00.00 10 CAST-IN-PLACE CONCRETE and Section 03 20 00.00 10 CONCRETE REINFORCING.

2.1.1 Cement

Furnish cement conforming to ASTM C150/C150M, Type I, II, III or V. Furnish blended cements that conform to ASTM C595/C595M.

2.1.2 Silica Fume

Provide silica fume conforming to ASTM C1240. Provide available alkalies conforming to the optimal limit given in Table 2 of ASTM C1240. Silica fume may be furnished as a dry, densified material or as a slurry. When necessary, coordinate the services of a technical representative experienced in mixing, proportioning, placement procedures, and curing of concrete containing silica fume.

2.1.3 Fly Ash and Pozzolans

Fly ash is used as a supplementary cementitious material (SCM) conforming to ASTM C618, Class C or F with 4 percent maximum loss on ignition and 35 percent maximum cement replacement by weight.

2.1.4 Ground Granulated Blast-Furnace Slag

Ground granulated blast furnace slag is used as a supplementary cementitious material conforming to ASTM C989/C989M, Grade 120 with between 25 to 50 percent maximum cement replacement by weight.

2.1.5 Water

Furnish water potable or free of deleterious substances in amounts harmful to concrete or embedded metals.

2.1.6 Aggregates

2.1.6.1 Selection

Furnish aggregates conforming to ASTM C33/C33M. Provide aggregates not containing any substance, which may be deleteriously reactive with the alkalies in the cement.

2.1.6.2 Aggregates for Lightweight Concrete

ASTM C330/C330M

2.1.7 Admixtures

2.1.7.1 Air-Entraining

ASTM C260/C260M

2.1.7.2 Accelerating, Retarding, Water Reducing [Moderate to High]

ASTM C494/C494M

2.1.7.3 Pigments

Non-fading and lime-resistant

2.1.8 Reinforcement

2.1.8.1 Reinforcing Bars

a. Deformed Billet-steel: ASTM A615/A615M
b. Deformed Low-alloy steel: ASTM A706/A706M

2.1.8.2 Reinforcing Wire

a. Plain Wire: ASTM A82/A82M
b. Deformed Wire: ASTM A496/A496M

2.1.8.3 Welded Wire Fabric

a. Plain Wire: ASTM A185/A185M
b. Deformed Wire: ASTM A497/A497M

2.1.8.4 Epoxy Coated Reinforcement

a. Reinforcing Bars: ASTM A775/A775M
b. Wires and Fabric: ASTM A884/A884M

2.1.8.5 Galvanized Reinforcement

Provide galvanized reinforcement conforming to ASTM A767/A767M.

2.1.9 Synthetic Fiber Reinforcement

Synthetic fiber shall be polypropylene with a denier less than 100 and a nominal fiber length of 2 inch.

2.1.10 Inserts and Embedded Metal

All items embedded in concrete shall be of the type required for the intended task, and meet the following standards.

a. Structural Steel Plates, Angles, etc.: ASTM A36/A36M
b. Hot-dipped Galvanized: ASTM A153/A153M
c. Proprietary Items: In accordance with manufacturers published literature

2.1.11 Accessories

Submit proper installation instructions and relevant product data for items including, but not limited to, sealants, gaskets, connectors, steps, cable racks and other items installed before or after delivery.

a. Rubber Gaskets for Circular Concrete Sewer Pipe and Culvert Pipe: ASTM C443.

b. External Sealing Bands for Noncircular Sewer, Storm Drain and Culvert Pipe: ASTM C877.

c. Preformed Flexible Joint Sealants for Concrete Pipe, Manholes, and Manufactured Box Sections: ASTM C990.

d. Elastomeric Joint Sealants: ASTM C920

2.1.12 Pipe Entry Connectors

Pipe entry connectors shall conform to ASTM C923 or ASTM C1478.

2.1.13 Grout

Nonshrink Grout shall conform to ASTM C1107/C1107M. Cementitious grout shall be a mixture of portland cement, sand, and water. Proportion one part cement to approximately 2.5 parts sand, with the amount of water based on placement method. [Provide air entrainment for grout exposed to the weather.]

PART 3 EXECUTION

3.1 FABRICATION AND PLACEMENT

Perform fabrication in accordance with NPCA QC Manual and/or ACPA QPC unless specified otherwise.

3.1.1 Forms

Use forms, for manufacturing precast concrete products, of the type and design consistent with industry standards and practices. They should be capable of consistently providing uniform products and dimensions. Construct forms so that the forces and vibrations to which the forms will be subjected can cause no product damage. Clean forms of concrete build-up after each use. Apply form release agents according to the manufacturers recommendations and do not allow to build up on the form casting surfaces.

3.1.2 Reinforcement

Follow applicable ASTM Standard or ACI 318 for placement and splicing. Fabricate cages of reinforcement either by tying the bars, wires or welded wire fabric into rigid assemblies or by welding, where permissible, in accordance with AWS D1.4/D1.4M. Position reinforcing as specified by the design and so that the concrete cover conforms to requirements. The tolerance on concrete cover shall be one-third of that specified but not more than 1/2 inch. Provide concrete cover not less than 1/2 inch. Take positive means to assure that the reinforcement does not move significantly during the casting operations.

3.1.3 Embedded Items

Position embedded items at locations specified in the design documents. Perform welding in accordance with AWS D1.1/D1.1M when necessary. Hold rigidly in place inserts, plates, weldments, lifting devices and other items to be imbedded in precast concrete products so that they do not move significantly during casting operations. Submit product data sheets and proper installation instruction for anchors, lifting inserts and other devices. Clearly indicate the products dimensions and safe working load.

3.1.4 Synthetic Fiber Reinforced Concrete

Add fiber reinforcement to the concrete mix in accordance with the applicable sections of ASTM C1116/C1116M and the recommendations of the manufacturer.

3.2 CONCRETE

3.2.1 Concrete Mixing

Mixing operations shall produce batch-to-batch uniformity of strength, consistency, and appearance.

3.2.2 Concrete Placing

Deposit concrete into forms as near to its final location as practical. Keep the free fall of the concrete to a minimum. Consolidate concrete in such a manner that segregation of the concrete is minimized and honeycombed areas are kept to a minimum. Use vibrators to consolidate concrete with frequencies and amplitudes sufficient to produce well consolidated concrete.

3.2.2.1 Cold Weather Concreting

Perform cold weather concreting in accordance with ACI 306.1.

a. Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather.

b. Free from frost all concrete materials and all reinforcement, forms, fillers, and ground with which concrete is to come in contact.

c. Do not use frozen materials or materials containing ice.

d. In cold weather the temperature of concrete at the time of placing shall not be below 45 degrees F. Discard concrete that freezes before its compressive strength reaches 500 psi.

3.2.2.2 Hot Weather Concreting

Recommendations for hot weather concreting are given in detail in ACI 305R. During hot weather, give proper attention to constituents, production methods, handling, placing, protection, and curing to prevent excessive concrete temperatures or water evaporation that could impair required strength or serviceability of the member or structure. The temperature of concrete at the time of placing shall not exceed 90 degrees F.

3.2.3 Concrete Curing

Commence curing immediately following the initial set and completion of surface finishing.

3.2.3.1 Curing by Moisture Retention

Prevent moisture evaporation from exposed surfaces until adequate strength for stripping is reached by one of the following methods:

a. Cover with polyethylene sheets a minimum of 6 mils thick in accordance with ASTM C171.

b. Cover with burlap or other absorptive material and keep continually moist.

c. Use of a membrane-curing compound applied at a rate not to exceed 200 square ft/gallon, or in accordance with manufacturers' recommendations according to ASTM C309.

3.2.3.2 Curing with Heat and Moisture

Do not subject concrete to steam or hot air until after the concrete has attained its initial set. Apply steam, if used, within a suitable enclosure, which permits free circulation of the steam in accordance with CSA A23.4. If hot air is used for curing, take precautions to prevent moisture loss from the concrete. The temperature of the concrete shall not be permitted to exceed 150 degrees F. These requirements do not apply to products cured with steam under pressure in an autoclave.

3.2.4 Surface Finish

Finish unformed surfaces of wet-cast precast concrete products as specified. If no finishing procedure is specified, finish such surfaces using a strike-off to level the concrete with the top of the form.

3.2.4.1 Formed Non-Architectural Surfaces

Cast surfaces against approved forms following industry practices in cleaning forms, designing concrete mixes, placing and curing concrete. Normal color variations, form joint marks, small surface holes caused by air bubbles, and minor chips and spalls will be accepted but no major imperfections, honeycombs or other major defects will be permitted.

3.2.4.2 Unformed Surfaces

Finish unformed surfaces with a vibrating screed, or by hand with a float. Normal color variations, minor indentations, minor chips and spalls will be accepted but no major imperfections, honeycombs, or other major defects shall be permitted.

3.2.4.3 Special Finishes

Troweled, broom or other finishes shall be according to the requirements of project documents and performed in accordance with industry standards or supplier specifications. Submit finishes for approval when required by the project documents. The sample finishes shall be approved prior to the start of production.

3.2.5 Stripping Products from Forms

Do not remove products from the forms until the concrete reaches the compressive strength for stripping required by the design. If no such requirement exists, products may be removed from the forms after the final set of concrete provided that stripping damage is minimal.

3.2.6 Patching and Repair

No repair is required to formed surfaces that are relatively free of air voids and honeycombed areas, unless the surfaces are required by the design to be finished.

3.2.6.1 Repairing Minor Defects

Defects that will not impair the functional use or expected life of a precast concrete product may be repaired by any method that does not impair the product.

3.2.6.2 Repairing Honeycombed Areas

When honeycombed areas are to be repaired, remove all loose material and cut back the areas into essentially horizontal or vertical planes to a depth at which coarse aggregate particles break under chipping rather than being dislodged. Use proprietary repair materials in accordance with the manufacturer's instructions. If a proprietary repair material is not used, saturate the area with water. Immediately prior to repair, the area should be damp, but free of excess water. Apply a cement-sand grout or an approved bonding agent to the chipped surfaces, followed immediately by consolidating an appropriate repair material into the cavity.

3.2.6.3 Repairing Major Defects

Evaluate, by qualified personnel, defects in precast concrete products which impair the functional use or the expected life of products to determine if repairs are feasible and, if so, to establish the repair procedure.

3.2.7 Shipping Products

Do not ship products until they are at least 5 days old, unless it can be shown that the concrete strength has reached at least 75 percent of the specified 28-day strength, or that damage will not result, impairing the performance of the product.

3.3 INSTALLATION

3.3.1 Site Access

It is the Contractor's responsibility to provide adequate access to the site to facilitate hauling, storage and proper handling of the precast concrete products.

3.3.2 General Requirements

a. Install precast concrete products to the lines and grades shown in the contract documents or otherwise specified.

b. Lift products by suitable lifting devices at points provided by the

precast concrete producer.

c. Install products in accordance with the precast concrete producer's instructions. In the absence of such instructions, install underground utility structures in accordance with ASTM C891. Install pipe and manhole sections in accordance with the procedures outlined by the American Concrete Pipe Association.

d. Field modifications to the product will relieve the precast producer of liability even if such modifications result in the failure of the product.

3.3.3 Water Tightness

Where water tightness is a necessary performance characteristic of the precast concrete product's end use, watertight joints, connectors and inserts should be used to ensure the integrity of the entire system.

3.4 FIELD QUALITY CONTROL

3.4.1 Site Tests

When water tightness testing is required for an underground product, use one of the following methods:

3.4.2 Vacuum Testing

Prior to backfill vacuum test system according to ASTM C1244.

3.4.3 Water Testing

Perform water testing according to the contract documents and precast concrete producer's recommendations.

-- End of Section --

SECTION 26 05 00.00 40

COMMON WORK RESULTS FOR ELECTRICAL
11/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI Z535.1	(2006; R 2011) American National Standard for Safety--Color Code
ANSI/NEMA OS 1	(2008; Amd 2010) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
NEMA FB 1	(2012) Standard for Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable
NEMA KS 1	(2001; R 2006) Enclosed and Miscellaneous Distribution Equipment Switches (600 V Maximum)
NEMA RN 1	(2005) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	(2003) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	(2004) Standard for Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit and Tubing

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; Errata 2 2012) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 489	(2013) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 6	(2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel

1.2 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Stds Dictionary.

b. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Submit Material, Equipment, and Fixture Lists for the following:

Conduits, Raceway sand Fittings

Wire and Cable

Splices and Connectors

Switches

Circuit Breakers

SD-03 Product Data

Submit manufacturer's catalog data for the following items:

Conduits, Raceway sand Fittings

Wire and Cable

Splices and Connectors

Circuit Breakers

Certification

SD-06 Test Reports

Continuity Test

SD-08 Manufacturer's Instructions

Submit Manufacturer's Instructions.

1.4 GENERAL REQUIREMENTS

Submit material, equipment, and fixture lists for the following items showing manufacturer's style or catalog numbers, specification and drawing

reference numbers, warranty information, and fabrication site.

Submit manufacturer's instructions including special provisions required to install equipment components and system packages. Special notices shall detail impedances, hazards and safety precautions.

Submit certification required to install equipment components and system packages.

1.5 POSTED OPERATING INSTRUCTIONS

Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.

c. Safety precautions.

d. The procedure in the event of equipment failure.

e. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and be secured to prevent easy removal or peeling.

1.6 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.7 FIELD FABRICATED NAMEPLATES

ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

PART 2 PRODUCTS

2.1 MATERIALS

Materials and equipment to be provided shall be the standard cataloged

products of manufacturers regularly engaged in the manufacture of the products.

2.1.1 Rigid Steel Conduit

Rigid steel conduit shall comply with UL 6 and be galvanized by the hot-dip process. Rigid steel conduit shall be polyvinylchloride (PVC) coated in accordance with NEMA RN 1, where underground and in corrosive areas, or must be painted with bitumastic.

Fittings for rigid steel conduit shall be threaded.

Gaskets shall be solid. Conduit fittings with blank covers shall have gaskets, except in clean, dry areas or at the lowest point of a conduit run where drainage is required.

Covers shall have captive screws and be accessible after the work has been completed.

2.1.2 Rigid Nonmetallic Conduit

Rigid nonmetallic conduit shall comply with NEMA TC 2 and NEMA TC 3 with wall thickness not less than Schedule 40.

2.2 WIRE AND CABLE

Conductors installed in conduit shall be copper 600-volt type THHN. All conductors AWG No. 8 and larger, shall be stranded. All conductors smaller than AWG No. 8 shall be solid.

2.3 SPLICES AND CONNECTORS

Make all splices in AWG No. 8 and smaller with approved insulated electrical type.

Make all splices in AWG No. 6 and larger with indentor crimp-type connectors and compression tools. Joints shall be wrapped with an insulating tape that has an insulation and temperature rating equivalent to that of the conductor.

2.4 SWITCHES

2.4.1 Safety Switches

Safety switches shall comply with NEMA KS 1, and be the heavy-duty type with enclosure, voltage, current rating, number of poles, and fusing as indicated. Switch construction shall be such that, when the switch handle in the "ON" position, the cover or door cannot be opened. Cover release device shall be coinproof and be so constructed that an external tool shall be used to open the cover. Make provisions to lock the handle in the "OFF" position, but the switch shall not be capable of being locked in the "ON" position.

Provide switches of the quick-make, quick-break type. Approve terminal lugs for use with copper conductors.

Safety color coding for identification of safety switches shall conform to ANSI Z535.1.

Toggle switches shall be commercial grade toggle type, devices rated 20 amperes at 277 volts, 60 hertz alternating current (ac) only, or as noted in drawings.

All toggle switches shall be products of the same manufacturer.

2.5 PULL BOXES

Outlet boxes for use with conduit systems shall be in accordance with NEMA FB 1 and ANSI/NEMA OS 1 and be not less than 1-1/2 inches deep. Furnish all pull and junction boxes with screw-fastened covers.

2.6 CIRCUIT BREAKERS

Circuit-breaker interrupting rating shall be not less than those indicated and in no event less than 10,000 amperes root-mean-square (rms) symmetrical at 208 volts, respectively. Multipole circuit breakers shall be the common-trip type with a single handle. Molded case circuit breakers shall be bolt-on type conforming to UL 489.

PART 3 EXECUTION

3.1 CONDUITS, RACEWAYS AND FITTINGS

Conduit runs between outlet and outlet, between fitting and fitting, or between outlet and fitting shall not contain more than the equivalent of three 90-degree bends, including those bends located immediately at the outlet or fitting.

Do not install crushed or deformed conduit. Avoid trapped conduit runs where possible. Take care to prevent the lodgment of foreign material in the conduit, boxes, fittings, and equipment during the course of construction. Clear any clogged conduit of obstructions or be replaced.

3.1.1 Rigid Steel Conduit

Make field-made bends and offsets with approved hickey or conduit bending machine. Conduit elbows larger than 2-1/2 inches shall be long radius.

3.1.2 Rigid Nonmetallic Conduit

Rigid PVC conduit shall be direct buried.

A green insulated copper grounding conductor shall be in conduit with conductors and be solidly connected to ground at each end. Grounding wires shall be sized in accordance with NFPA 70.

3.2 WIRING

Feeder and branch circuit conductors shall be color coded as follows:

CONDUCTOR	COLOR AC(208/120)
Phase A	Black
Phase B	Red
Phase C	Blue

CONDUCTOR	COLOR AC(208/120)
Neutral	White
Equipment Grounds	Green

Conductors up to and including AWG No. 2 shall be manufactured with colored insulating materials. Conductors larger than AWG No. 2 shall have ends identified with color plastic tape in outlet, pull, or junction boxes.

Splice in accordance with the NFPA 70. Provide conductor identification within each enclosure where a tap, splice, or termination is made and at the equipment terminal of each conductor. Terminal and conductor identification shall match as indicated.

Where several feeders pass through a common pullbox, the feeders shall be tagged to clearly indicate the electrical characteristics, circuit number, and panel designation.

3.3 SAFETY SWITCHES

Securely fasten switches to the supporting structure or wall, utilizing a minimum of four 1/4 inch bolts. Do not use sheet metal screws and small machine screws for mounting. Do not mount switches in an inaccessible location or where the passageway to the switch may become obstructed. Mounting height shall be 5 feet above floor level, when possible.

3.4 BOXES AND FITTINGS

Furnish and install pullboxes where necessary in the conduit system to facilitate conductor installation. Conduit runs longer than 100 feet or with more than three right-angle bends shall have a pullbox installed at a convenient intermediate location.

3.5 IDENTIFICATION PLATES AND WARNINGS

Furnish and install identification plates for all panelboards, pilot lights, disconnect switches, manual starting switches, and magnetic starters. Process control devices and pilot lights shall have identification plates.

Furnish identification plates for all line voltage enclosed circuit breakers, identifying the equipment served, voltage, phase(s) and power source.

3.6 PAINTING

Exposed conduit, supports, fittings, cabinets, pull boxes, and racks shall be thoroughly cleaned and painted.

3.7 FIELD TESTING

Submit Test Reports in accordance with referenced standards in this section.

After completion of the installation and splicing, and prior to energizing the conductors, perform wire and cable continuity and insulation tests as herein specified before the conductors are energized.

Contractor shall provide all necessary test equipment, labor, and personnel to perform the tests, as herein specified.

Perform continuity test to insure correct cable connection (i.e correct phase conductor, grounded conductor, and grounding conductor wiring) end-to end. Any damages to existing or new electrical equipment resulting from contractor mis-wiring will be repaired and re-verified at contractor's expense. All repairs shall be approved by the CO prior to acceptance of the repair.

Conduct phase-rotation tests on all three-phase circuits using a phase-rotation indicating instrument. Perform phase rotation of electrical connections to connected equipment clockwise, facing the source.

Final acceptance will depend upon the successful performance of wire and cable under test. Do not energize any conductor until the final test reports are reviewed and approved by the CO.

-- End of Section --

SECTION 26 05 19.00 10

INSULATED WIRE AND CABLE
11/08

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA WC 70	(2009) Power Cable Rated 2000 V or Less for the Distribution of Electrical Energy--S95-658

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Installation Instructions

SD-06 Test Reports

Tests, Inspections, and Verifications

1.3 DELIVERY, STORAGE, AND HANDLING

Furnish cables on reels or coils. Each cable and the outside of each reel or coil, shall be plainly marked or tagged to indicate the cable length, voltage rating, conductor size, and manufacturer's lot number and reel number. Each coil or reel of cable shall contain only one continuous cable without splices. Cables for exclusively dc applications, as specified in paragraph HIGH VOLTAGE TEST SOURCE, shall be identified as such. Shielded cables rated 2,001 volts and above shall be reeled and marked in accordance with Section I of AEIC CS8 or AEIC CS8, as applicable. Reels shall remain the property of the Government.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Rated Circuit Voltages

All wire and cable shall have minimum rated circuit voltages in accordance with NEMA WC 70.

2.1.2 Conductors

2.1.2.1 Material for Conductors

Conductors shall conform to all the applicable requirements of NEMA WC 70, as applicable, and shall be annealed copper. Copper conductors may be bare, or tin- or lead-alloy-coated, if required by the type of insulation used.

2.1.2.2 Size

Minimum wire size shall be No. 12 AWG for power and lighting circuits; No. 10 AWG for current transformer secondary circuits; No. 14 AWG for potential transformer, relaying, and control circuits; No. 16 AWG for annunciator circuits; and No. 19 AWG for alarm circuits. Minimum wire sizes for rated circuit voltages of 2,001 volts and above shall not be less than those listed for the applicable voltage in NEMA WC 70, as applicable.

2.1.2.3 Stranding

Conductor stranding classes cited herein shall be as defined in NEMA WC 70, as applicable. Lighting conductors No. 10 AWG and smaller shall be solid or have Class B stranding. Any conductors used between stationary and moving devices, such as hinged doors or panels, shall have Class H or K stranding. All other conductors shall have Class B or C stranding, except that conductors shown on the drawings, or in the schedule, as No. 12 AWG may be 19 strands of No. 25 AWG, and conductors shown as No. 10 AWG may be 19 strands of No. 22 AWG.

2.1.2.4 Conductor Shielding

Use conductor shielding conforming to NEMA WC 70, as applicable, on power cables having a rated circuit voltage above 2,000 volts. In addition, conductor shielding for shielded cables shall also comply with Section C of AEIC CS8 or AEIC CS8. Strict precautions shall be taken after application of the conductor shielding to prevent the inclusion of voids or contamination between the conductor shielding and the subsequently applied insulation.

2.1.2.5 Separator Tape

Where conductor shielding, strand filling, or other special conductor treatment is not required, a separator tape between conductor and insulation is permitted.

2.1.3 Insulation

2.1.3.1 Insulation Material

Provide insulation which is a cross-linked thermosetting polyethylene (XLPE) type, meeting the requirements of NEMA WC 70, as applicable, or an ethylene-propylene rubber (EPR) type meeting the requirements of NEMA WC 70. For shielded cables of rated circuit voltages above 2,000 volts, the following provisions shall also apply:

a. XLPE, if used, shall be tree-retardant.

b. Insulation shall be chemically bonded to conductor shielding.

c. The insulation material and its manufacturing, handling, extrusion and vulcanizing processes, shall all be subject to strict procedures to prevent the inclusion of voids, contamination, or other irregularities on or in the insulation. Insulation material shall be inspected for voids and contaminants. Inspection methods, and maximum allowable void and contaminant content shall be in accordance with Section B of AEIC CS8 or AEIC CS8, as applicable.

d. Cables with repaired insulation defects discovered during factory testing, or with splices or insulation joints, are not acceptable unless specifically approved.

2.1.3.2 Insulation Thickness

The insulation thickness for each conductor shall be based on its rated circuit voltage.

a. Power Cables/Single-Conductor Control Cables, 2,000 Volts and Below - The insulation thickness for single-conductor cables rated 2,000 volts and below shall be as required by NEMA WC 70, as applicable. Some thicknesses of NEMA WC 70 will be permitted only for single-conductor cross-linked thermosetting polyethylene insulated cables without a jacket. NEMA WC 70 ethylene-propylene rubber-insulated conductors shall have a jacket.

b.. Multiple-Conductor Control Cables - The insulation thickness of multiple-conductor cables used for control and related purposes shall be as required by NEMA WC 70, as applicable.

2.1.4 Jackets

All cables shall have jackets meeting the requirements of NEMA WC 70, as applicable, and as specified herein. Individual conductors of multiple-conductor cables shall be required to have jackets only if they are necessary for the conductor to meet other specifications herein. Jackets of single-conductor cables and of individual conductors of multiple-conductor cables, except for shielded cables, shall be in direct contact and adhere or be vulcanized to the conductor insulation. Multiple-conductor cables and shielded single-conductor cables shall be provided with a common overall jacket, which shall be tightly and concentrically formed around the core. Repaired jacket defects found and corrected during manufacturing are permitted if the cable, including jacket, afterward fully meets these specifications and the requirements of the applicable standards.

2.1.4.1 Jacket Material

The jacket shall be one of the materials listed below. Polyvinyl chloride compounds will not be permitted.

a. General Use

(1) Heavy-duty black neoprene (NEMA WC 70).

(2) Heavy-duty chlorosulfonated polyethylene (NEMA WC 70).

(3) Heavy-duty cross-linked (thermoset) chlorinated polyethylene (NEMA WC 70).

2.1.4.2 Jacket Thickness

The minimum thickness of the jackets at any point shall be not less than 80 percent of the respective nominal thicknesses specified below.

a. Single-Conductor Cables - Single-conductor cables, if nonshielded, shall have a jacket thickness as specified in NEMA WC 70. If shielded, the jacket thickness shall be in accordance with the requirements of NEMA WC 70.

2.2 CABLE IDENTIFICATION

2.2.1 Color-Coding

Insulation of individual conductors of multiple-conductor cables shall be color-coded in accordance with NEMA WC 70, except that colored braids will not be permitted. Only one color-code method shall be used for each cable construction type. Control cable color-coding shall be as shown on the drawings . Power cable color-coding shall be black for Phase A, red for Phase B, blue for Phase C, white for grounded neutral, and green for an insulated grounding conductor, if included. Other individual conductors shall be color-coded as indicated on the contract drawings but such color-coding may be accomplished by applying colored plastic tapes or sleeving at terminations.

2.2.2 Cabling

Individual conductors of multiple-conductor cables shall be assembled with flame-and moisture-resistant fillers, binders, and a lay conforming to NEMA WC 70, except that flat twin cables will not be permitted. Fillers shall be used in the interstices of multiple-conductor round cables with a common covering where necessary to give the completed cable a substantially circular cross section. Fillers shall be non-hygroscopic material, compatible with the cable insulation, jacket, and other components of the cable. The rubber-filled or other approved type of binding tape shall consist of a material that is compatible with the other components of the cable and shall be lapped at least 10 percent of its width.

2.2.3 Dimensional Tolerance

The outside diameters of single-conductor cables and of multiple-conductor cables shall not vary more than 5 percent and 10 percent, respectively, from the manufacturer's published catalog data.

PART 3 EXECUTION

3.1 INSTALLATION INSTRUCTIONS

Submit cable manufacturing data . The following information shall be provided by the cable manufacturer for each size, conductor quantity, and type of cable furnished:

a. Minimum bending radius, in inches - For multiple-conductor cables, this information shall be provided for both the individual conductors and the multiple-conductor cable.

b. Pulling tension and sidewall pressure limits, in pounds.

c. Instructions for stripping semiconducting insulation shields, if furnished, with minimum effort without damaging the insulation.

d. Upon request, compatibility of cable materials and construction with specific materials and hardware manufactured by others shall be stated. Also, if requested, recommendations shall be provided for various cable operations, including installing, splicing, terminating, etc.

3.2 TESTS, INSPECTIONS, AND VERIFICATIONS

3.2.1 Cable Data

Manufacture of the wire and cable shall not be started until all materials to be used in the fabrication of the finished wire or cable have been approved by the Contracting Officer. Cable data shall be submitted for approval including dimensioned sketches showing cable construction, and sufficient additional data to show that these specifications will be satisfied.

3.2.2 Inspection and Tests

Inspection and tests of wire and cable furnished under these specifications shall be made by and at the plant of the manufacturer, and shall be witnessed by the Contracting Officer or his authorized representative, unless waived in writing. The Government may perform further tests before or after installation. Testing in general shall comply with NEMA WC 70. Specific tests required for particular materials, components, and completed cables shall be as specified in the sections of the above standards applicable to those materials, components, and cable types. Tests shall also be performed in accordance with the additional requirements specified below. Submit certified copies of test reports.

3.2.2.1 Flame Tests

All cable assemblies shall pass IEEE 383 flame tests, paragraph 2.5, using the ribbon gas burner. Single-conductor cables and individual conductors of multiple-conductor cables shall pass the flame test of NEMA WC 70. If such tests, however, have previously been made on identical cables, these tests need not be repeated. Instead, certified reports of the original qualifying tests shall be submitted. In this case the reports furnished under paragraph REPORTS, shall verify that all of each cable's materials, construction, and dimensions are the same as those in the qualifying tests.

3.2.2.2 Independent Tests

The Government may at any time make visual inspections, continuity or resistance checks, insulation resistance readings, power factor tests, or dc high-potential tests at field test values. A cable's failure to pass these tests and inspections, or failure to produce readings consistent with acceptable values for the application, will be grounds for rejection of the cable.

3.2.2.3 Reports

Furnish results of tests made. No wire or cable shall be shipped until authorized. Lot number and reel or coil number of wire and cable tested shall be indicated on the test reports.

-- End of Section --

SECTION 26 05 71.00 40

LOW VOLTAGE OVERCURRENT PROTECTIVE DEVICES
05/11

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C57.13	(2008; INT 2009) Standard Requirements for Instrument Transformers

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C12.1	(2008) Electric Meters Code for Electricity Metering
ANSI C78.23	(1995; R 2003) American National Standard for Incandescent Lamps - Miscellaneous Types
NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA AB 3	(2013) Molded Case Circuit Breakers and Their Application
NEMA ICS 1	(2000; R 2008; E 2010) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2011) Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2014) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 489	(2013) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00

SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Prior to the beginning of construction, submit manufactures equipment and performance data for the following items including use life, system functional flows, safety features, and mechanical automated details..

Fuses

SD-02 Shop Drawings

Submit Connection Diagrams and Fabrication Drawings for the following items in accordance with paragraph entitled, "General Requirements," of this section.

Submit Installation drawings for the following items in accordance with the paragraph entitled, "Installation," of this section.

Control Devices
Protective Devices

SD-03 Product Data

Submit manufacturer's equipment and performance data for the following items including use life, system functional flows, safety features, and mechanical automated details.

Enclosures
Circuit Breakers
Control Devices
Indicating Instruments

SD-08 Manufacturer's Instructions

Submit manufacturer's instructions for the following items, including special provisions required to install equipment components and system packages. Provide detail on resistance impedances, hazards and safety precautions within the special notices.

Control Devices
Protective Devices

SD-10 Operation and Maintenance Data

Submit Operation and Maintenance Manuals for the following equipment:

Circuit Breakers
Indicating Instruments

1.3 GENERAL REQUIREMENTS

PART 2 PRODUCTS

2.1 ENCLOSURES

2.1.1 Equipment Enclosures

Provide enclosures for equipment in accordance with NEMA 250.

Contain equipment installed in wet locations in a NEMA Type 4 watertight, corrosion-resistant sheet-steel enclosure, constructed to prevent entrance of water when tested in accordance with NEMA ICS 6 for Type 4 enclosures.

2.2 CIRCUIT BREAKERS

Provide circuit breakers that conform to UL 489, and NEMA AB 3.

2.2.1 Molded-Case Circuit Breakers

Provide molded case, manually operated, trip-free, circuit breakers, with inverse-time thermal-overload protection and instantaneous magnetic short-circuit protection as required. Completely enclose circuit breakers in a molded case, with the calibrated sensing element factory-sealed to prevent tampering.

Locate thermal-magnetic tripping elements in each pole of the circuit breaker, and provide inverse-time-delay thermal overload protection and instantaneous magnetic short-circuit protection. Provide instantaneous magnetic tripping element, that is adjustable and accessible from the front of the breaker on frame sizes larger than 100 amperes.

Size breaker as required for the continuous current rating of the circuit. Provide breaker class as required.

Provide sufficient interrupting capacity of the panel and lighting branch circuit breakers, to successfully interrupt the maximum short-circuit current imposed on the circuit at the breaker terminals. Provide circuit breaker interrupting capacities with a minimum of 10,000 amperes and that conform to NEMA AB 3.

Provide circuit breakers used for meter circuit disconnects that meet the applicable requirements of NFPA 70 and that are of the motor-circuit protector type.

For circuit breakers used for service disconnection, provide an enclosed circuit-breaker type with external handle for manual operation. Provide sheet metal enclosures with a hinged cover suitable for surface mounting.

2.2.2 Enclosed Molded-Case Circuit Breakers

For enclosed circuit breakers, provide thermal-magnetic molded-case circuit breakers in surface-mounted, nonventilated enclosures conforming to the appropriate articles of NEMA 250 and UL 489.

Provide enclosed circuit breakers in nonhazardous locations as follows:

Contain circuit breakers installed in unprotected outdoor locations, in NEMA Type 3R, weather-resistant sheet steel enclosures that are

splashproof, weatherproof, sleetproof, and moisture resistant.

2.3 FUSES

Provide a complete set of fuses for all switches and switchgear. Rate fuses that have a voltage rating of not less than the circuit voltage.

Make no change in continuous-current rating, interrupting rating, and clearing or melting time of fuses unless written permission has first been secured.

Label fuses showing UL class, interrupting rating, and time-delay characteristics, when applicable. Additionally, clearly list fuse information on equipment drawings.

Provide porcelain fuse holders when field-mounted in a cabinet or box. Do not use fuse holders made of such materials as ebony asbestos, Bakelite, or pressed fiber for field installation.

2.4 INDICATING INSTRUMENTS

2.4.1 Watt-Hour Meters/Wattmeters

For watt-hour meters, wattmeters, and pulse initiation meters, conform to ANSI C12.1.

Provide pulse initiating meters for use with demand meters or pulse recorders, that are suitable for use with mechanical or electrical pulse initiators. Provide mechanical load imposed on the meter by the pulse initiator that is within the limits of the pulse meter. Provide load as constant as practical throughout the entire cycle of operation to ensure accurate meter readings. Provide pulse initiating meter that is capable of measuring the maximum number of pulses at which the pulse device is nominally rated. Consider pulse initiating meter to be operating properly when a kilowatt hour check indicates that the demand meter kilowatthours are within limits of the watthour meter kilowatthours.

Locate pulse initiating meters such that components sensitive to moisture and temperature conditions are minimized. Take precautions to protect sensitive electronic metering circuitry from electromagnetic and electrostatic induction.

Furnish removable meters with draw out test plug and furnish contact devices to operate remote impulse-totalizing graphic demand meters.

Semi-flush mount case with matching cover to the hinged instrument panel.

2.5 FACTORY TESTING

Perform factory tests on control and low voltage protective devices in accordance with the manufacturer's recommendations.

Conduct short-circuit tests in accordance with Section 2 of NEMA ICS 1.

2.6 INDICATING LIGHTS

2.6.1 General-Purpose Type

For indicating lights, provide oiltight instrument devices with threaded

base and collar for flush-mounting, translucent convex lens, candelabra screw-base lampholder, and 120-volt, 6-watt, Type S-6 incandescent lamp in accordance with ANSI C78.23. Provide indicating lights color coded in accordance with NEMA ICS 6.

Provide indicating lights in remote-control stations when pushbuttons and selector switches are out of sight of the controller.

2.7 FINISH

Protect metallic materials against corrosion. Provide equipment with the standard finish by the manufacturer when used for most indoor installations. For harsh indoor environments (any area subjected to chemical and/or abrasive action), and all outdoor installations, refer to Section 09 96 00 HIGH-PERFORMANCE COATINGS.

PART 3 EXECUTION

3.1 INSTALLATION

Install protective devices that are not factory installed in equipment, in accordance with the manufacturer's recommendations and field adjusted and operation tested. Conform to NFPA 70, NEMA ICS 1 and NEMA ICS 2 requirements for installation of control and protective devices.

3.2 FIELD TESTING

Demonstrate to operate as indicated control and protective devices not factory installed in equipment.

Ratio and verify tap settings of instrumentation, potential, and current transformers.

Perform dielectric tests on insulating oil in oil circuit breakers before the breakers are energized. Test oil in accordance with ASTM D877, and provide breakdown voltage that is not less than 25,000 volts. Provide manufacturer certification that the oil contains no PCB's, and affix a label to that effect on each breaker tank and on each oil drum containing the insulating oil.

Field adjust reduced-voltage starting devices to obtain optimum operating conditions. Provide test meters and instrument transformers that conform to ANSI C12.1 and IEEE C57.13.

Do not energize control and protective devices until recorded test data has been approved. Provide final test reports with a cover letter/sheet clearly marked with the System name, Date, and the words "Final Test Reports - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

-- End of Section --

SECTION 26 27 13.10 30

ELECTRIC METERS
10/07

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2012; Errata 2012; INT 1-4 2012; INT 5 2013) National Electrical Safety Code
IEEE C37.90.1	(2012) Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
IEEE C57.13	(2008; INT 2009) Standard Requirements for Instrument Transformers

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 62053-22	(2003; ED 1.0) Electricity Metering Equipment (a.c.) - Particular Requirements - Part 22: Static Meters for Active Energy (Classes 0,2 S and 0,5 S)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C12.18	(2006) Protocol Specification for ANSI Type 2 Optical Port
ANSI C12.20	(2010) Electricity Meters - 0.2 and 0.5 Accuracy Classes

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2014) National Electrical Code

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification and on the drawings shall be as defined in IEEE 100.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

a. Maintenance manual shall provide:
   1. Condensed description of how the equipment operates.
   2. Block diagram indicating major assemblies.
   3. Troubleshooting information
   4. Preventive maintenance.
   5. Spare parts information.

b. Provide operation and maintenance manuals required by submittal item "SD-10 Operation and Maintenance Data."

SD-02 Shop Drawings

SD-03 Product Data

Power meters; G

Submittals shall include manufacturer's information for each component, device, and accessory provided with the meter, protocol module or communications module.

SD-06 Test Reports

Acceptance checks and tests; G

SD-10 Operation and Maintenance Data

Power meters; G

SD-11 Closeout Submittals

System function verification; G

1.4 QUALITY ASSURANCE

1.4.1 Installation Drawings

Drawings shall indicate but not be limited to the following:

a. Elementary diagrams and wiring diagrams with terminals identified of kilowatt meter ..

b. One-line diagram, including meters, switch(es), and fuses.

1.4.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.3 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.4 Material and Equipment Manufacturing Data

Products manufactured more than 2 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.5 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.6 SYSTEM DESCRIPTION

1.6.1 System Requirements

The metering and reading system, consisting of commercial, off-the-shelf meters, protocol modules, communications modules, and communication channels, will be used to record the electricity consumption and other values as described in the sections that follow and as shown on the drawings.

1.6.2 Selection Criteria

Metering components are part of a system that includes the physical meter, data recorder function and communications (modem) method. Every building site identified shall include sufficient metering components to measure the electrical parameters identified and to store and communicate the values as required in the following sections. Contractor shall verify that the metering system installed on any building site is compatible with the facility-wide communication and meter-reading protocol system.

PART 2 PRODUCTS

2.1 POWER METERS

2.1.1 Physical and Common Requirements

a. Metering system components shall be installed according to the Metering shown on the drawings.

b. Power meter shall be socket-mount design.

c. If existing meter base is usable, the meter base determines meter form factor. If a new meter is being installed, use meter and base form factor of 9S.

d. Use Class 200 meters for direct current reading without current transformers.

e. Meter shall be rated for use at temperature from -40 _____ degrees Centigrade to +70 _____ degrees Centigrade.

f. Meter shall have NEMA 3R enclosure for surface mounting.

g. Surge withstand shall conform to IEEE C37.90.1.

h. Meter shall have a standard 4 -year warranty.

i. Meter shall comply with IEC 62053-22 (Part 21: Static Meter for Active Energy, classes 0.2S and 0.5S), certified by a qualified third party test laboratory.

2.1.2 Voltage Requirements

a. Meter shall be capable of connection to the service voltage phases and magnitude being monitored. If the meter is not rated for the service voltage, provide suitable potential transformers to send an acceptable voltage to the meter.

b. Meter shall be capable of connection to the service voltage indicated :

c. Meter shall accept independent voltage inputs from each phase. Meter shall be auto-ranging over the full range of input voltages.

d. Voltage input shall be optically isolated to 2500 volts DC from signal and communications outputs. Components shall meet or exceed IEEE C37.90.1 (Surge Withstand Capability).

e. The Contractor shall be responsible for determining the actual voltage ratio of each potential transformer. Transformer shall conform to IEEE C57.13 and the following requirements.

1. Type: Dry type, of two-winding construction.

2. Weather: Outdoor or Indoor rated for the application.

3. Frequency: Nominal 60Hz, 50Hz for those bases that operate on 50Hz.

4. Accuracy: Plus or minus 0.3% at 60Hz or 0.3% for those systems that operate at 50Hz.

2.1.3 Electrical Measurements

Power meter shall measure and report the following quantities:

a. Kilowatt-hours ("kWh" in Metering Systems Schedule) of consumption. Cumulative.

b. Kilowatts of demand ("kW" in Metering Systems Schedule). Peak average over a selectable demand interval between 5 and 60 minutes (typically 15 minutes).

c. Reactive power ("kVAR" in Metering Systems Schedule). Measured over the same interval as the peak kW reading.

d. Power factor ("PF" in Metering Systems Schedule). Measured over the same interval as the peak kW reading.

e . Time of use consumption ("TOU" in Metering Systems Schedule). Kilowatt-hours recorded separately for each period set by programming into the meter. Time periods shall be capable of being changed without removal from service. The meter shall internally record and store Time of Use data.

1. Four (4) minimum _____ TOU Rates (Registers)

2. Twenty (20) Year Calendar

3. Two (2) minimum _____ seasons per year

f. Interval recording ("IR" in Metering Systems Schedule). Kilowatt-hours shall be recorded for each 15 minute interval and shall accumulate for 30 days. Memory for recording the interval readings shall be internal to the meter and ANSI C12.19 compliant. Meter shall provide time-stamped readings for every measured parameter.

g. Meter readings shall be true RMS.

2.1.4 Meter Accuracy

Power meter shall provide the following accuracies. Accuracies shall be measured as percent of reading at standard meter test points.

a. Power meter shall meet ANSI C12.20 for Class 0.2 and IEC 62053-22 accuracy requirements.

2.1.5 An on the Meter Display, Output and Reading Capabilities

Meter shall include the following output signals.

a. The meter will have a face display plate and shall display every electrical parameter indicated to be recorded. Meters shall not be required to indicate interval data collected in a data logger with a communications output feature. Peak values, instantaneous and cumulative values shall be displayed.

b. Meter shall include optical output port capable of 9600 bps communication with a hand-held reading device. Optical device shall be compatible with ANSI C12.18

2.1.6 Installation Methods

a. Stand-mounted ("STAND" in Metering Systems Schedule)

1. Meter base shall be mounted on a structural steel stand . See detail on the drawings.

b. Common features.

1. PTs (if required for proper voltage range) and CTs shall be physically connected to the service entrance cables inside the service entrance disconnect enclosure.

2.1.7 Disconnecting Switches

a. Disconnecting wiring blocks shall be provided between the current

transformer and the meter. A shorting mechanism shall be built into the wiring block to allow the current transformer wiring to be changed without removing power to the transformer. The wiring blocks shall be located where they are accessible without the necessity of disconnecting power to the transformer. For multi-ratio current transformers, provide a shorting block from each tap to the common lead.

b. Voltage-monitoring circuits shall be equipped with disconnect switches to isolate the meter base or socket from the voltage source.

2.2 SPARE PARTS

2.2.1 Parts List

Provide spare parts as follows:

a. Power meter - two for each type used.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

[3.1.1 Existing Condition Survey

The Contractor shall perform a field survey, including inspection of all existing equipment, resulting clearances, and new equipment locations intended to be incorporated into the system, and furnish an existing conditions report to the Government. The report shall identify those items that are non-workable as defined in the contract documents. The Contractor shall be held responsible for repairs of modifications necessary to make the system perform as required.

]3.1.2 Scheduling of Work and Outages

The Contract Clauses shall govern regarding permission for power outages, scheduling of work, coordination with Government personnel, and special working conditions.

3.2 FIELD APPLIED PAINTING

Where field painting of enclosures is required to correct damage to the manufacturer's factory-applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

3.3 FIELD QUALITY CONTROL

3.3.1 Performance of Acceptance Checks and Tests

3.3.1.1 Meter Assembly

a. Visual and mechanical inspection

1. Compare equipment nameplate data with specification and approved

shop drawings.

2. Inspect physical and mechanical condition.

3. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method.

4. Verify grounding of metering enclosure.

5. Verify the presence of surge arresters.

6. Verify that the CT ratio and the PT ratio are properly included in the meter multiplier or the programming of the meter.

b. Electrical tests

1. Calibrate watthour meters according to manufacturer's published data.

2. Verify that correct multiplier has been placed on face or meter where applicable.

3. Prior to system acceptance, the Contractor will demonstrate and confirm the meter is properly wired and is displaying correct and accurate electrical information.

3.3.2 Follow-Up System Function Verification

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given 5 working days' advance notice of the dates and times of checking and testing.

3.3.3 Training

The Contractor shall conduct a training course for meter configuration, operation, and maintenance of the system as specified. The training shall be oriented for all components and systems installed under this contract. Training manuals shall be delivered for _____ trainees with two additional copies delivered for archiving at the project site. The Contractor shall furnish all audiovisual equipment and all other training materials and supplies. A training day is defined as eight hours of classroom instruction, including two 15-minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility. For guidance in planning the required instruction, the Contractor shall assume that attendees have a high school education or equivalent, and are familiar with utility systems. Approval of the planned training schedule shall be obtained from the Government at least 30 days prior to the training.

a. Training: The course shall be taught at the project site within thirty days after completion of the installation for a period of one _____ day(s). A maximum of 6 personnel will attend the course. The training shall include:

1. Physical layout of each piece of hardware.

2. Meter configuration, troubleshooting and diagnostics procedures.

3. Repair instructions.

4. Preventive maintenance procedures and schedules.

5. Testing and calibration procedures.

-- End of Section --

SECTION 31 23 00.00 20

EXCAVATION AND FILL
02/11

PART 1 GENERAL

1.1 REFERENCES

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.

ASTM INTERNATIONAL (ASTM)

ASTM C136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C33/C33M	(2013) Standard Specification for Concrete Aggregates
ASTM D1140	(2000; R 2006) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	(2012) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2216	(2010) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D2487	(2011) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D4318	(2010) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D6938	(2010) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2008; Errata 1-2010; Changes 1-3 2010; Changes 4-6 2011; Change 7 2012) Safety and Health Requirements Manual

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SW-846.3-3	(1999, Third Edition, Update III-A) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods

1.2 DEFINITIONS

1.2.1 Degree of Compaction

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557], for general soil types, abbreviated as percent laboratory maximum density.

1.2.2 Hard Materials

Weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.2.3 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1 cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Shoring and Sheeting Plan; G

Dewatering work plan; G

Submit 15 days prior to starting work.

SD-06 Test Reports

Fill and backfill test; G

Density tests; G

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

1.4 DELIVERY, STORAGE, AND HANDLING

Perform in a manner to prevent contamination or segregation of materials.

1.5 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Surface elevations are as indicated.

b. Pipes or other artificial obstructions, except those indicated, will not be encountered.

c. Ground water elevations indicated by the boring log were those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.

d. Material character is indicated by the boring logs.

e. Hard materials and rock will not will be encountered.

f. Suitable backfill and bedding material in the quantities required is not available at the project site or on Government property.

g. Blasting will not be permitted. Remove material in an approved manner.

1.6 REQUIREMENTS FOR OFF SITE SOIL

Soils brought in from off site for use as backfill shall be tested for petroleum hydrocarbons, BTEX, PCBs and HW characteristics including toxicity, ignitability, corrosivity, and reactivity. Backfill shall not contain concentrations of these analytes above the appropriate State and/or EPA criteria, and shall pass the tests for HW characteristics. Determine petroleum hydrocarbon concentrations by using appropriate State protocols. Determine BTEX concentrations by using EPA SW-846.3-3 Method 5035/8260B. Perform complete TCLP in accordance with EPA SW-846.3-3 Method 1311. Perform HW characteristic tests for ignitability, corrosivity, and reactivity in accordance with accepted standard methods. Perform PCB testing in accordance with accepted standard methods for sampling and analysis of bulk solid samples. Provide borrow site testing for petroleum hydrocarbons and BTEX from a grab sample of material from the area most likely to be contaminated at the borrow site (as indicated by visual or olfactory evidence), with at least one test from each borrow site. For each borrow site, provide borrow site testing for HW characteristics from a composite sample of material, collected in accordance with standard soil sampling techniques. Do not bring material onsite until tests results have been received and approved by the Contracting Officer.

1.7 QUALITY ASSURANCE

1.7.1 Shoring and Sheeting Plan

Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheeting of excavations. Drawings shall include material sizes and types, arrangement of members, and the sequence and method of installation and removal. Calculations shall include data and references used.

The Contractor is required to hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer shall be responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer shall update the excavation, sheeting and dewatering plans as construction

progresses to reflect changing conditions and shall submit an updated plan if necessary. A written report shall be submitted, at least monthly, informing the Contractor and Contracting Officer of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Geotechnical Engineer shall be available to meet with the Contracting Officer at any time throughout the contract duration.

1.7.2 Dewatering Work Plan

Submit procedures for accomplishing dewatering work.

1.7.3 Utilities

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Excavation made with power-driven equipment is not permitted within of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

2.1.1 Satisfactory Materials

Any materials classified by ASTM D2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, and frozen, deleterious, or objectionable materials. Unless specified otherwise, the maximum particle diameter shall be one-half the lift thickness at the intended location.

2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 6 inches. The Contracting Officer shall be notified of any contaminated materials.

2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM, GP-GM, GW-GM, SW-SM, SP-SM, and SM shall be identified as cohesionless only when the fines are nonplastic. Materials classified as GM and SM will be identified as cohesive only when the fines have a plasticity index greater than zero.

2.1.4 Common Fill

Approved, unclassified soil material with the characteristics required to

compact to the soil density specified for the intended location.

2.1.5 Backfill and Fill Material

ASTM D2487, classification GW, GP, GM, SW, SP, SM, with a maximum ASTM D4318 liquid limit of 35, maximum ASTM D4318 plasticity index of 12, and a maximum of 25 percent by weight passing ASTM D1140, No. 200 sieve.

2.1.6 Topsoil

Provide as specified in Section 32 92 19SEEDING.

2.2 UTILITY BEDDING MATERIAL

Except as specified otherwise in the individual piping section, provide bedding for buried piping as follows:.

Clean, coarsely graded natural gravel, crushed stone or a combination thereof having a classification of GW or GP in accordance with ASTM D2487 for bedding and backfill. Maximum particle size shall not exceed 3/4 inches.

2.3 MATERIAL FOR RIP-RAP

Rock conforming to Oregon Class 50 Riprapfor construction indicated.

2.4 BURIED WARNING AND IDENTIFICATION TAPE

Polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED STORMWATER LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tape Color Codes	
Red:	Electric
Yellow:	Gas, Oil; Dangerous Materials
Orange:	Telephone and Other Communications
Blue:	Potable Water Systems
Green:	Sewer Systems
White:	Steam Systems
Gray:	Compressed Air
Purple:	Stormwater

2.4.1 Detectable Warning Tape for Non-Metallic Piping

Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.5 DETECTION WIRE FOR NON-METALLIC PIPING

Detection wire shall be insulated single strand, solid copper with a minimum of 12 AWG.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Shoring and Sheeting

Provide shoring andtrench boxes as needed. In addition to Section 25 A and B of EM 385-1-1, include provisions in the shoring and sheeting plan that will accomplish the following:

a. Prevent undermining of pavements, foundations and slabs.

b. Prevent slippage or movement in banks or slopes adjacent to the excavation.

3.1.2 Drainage and Dewatering

Provide for the collection and disposal of surface and subsurface water encountered during construction.

3.1.2.1 Drainage

So that construction operations progress successfully, completely drain construction site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish/construct storm drainage features at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, dikes, swales, and other drainage features and equipment as required to maintain dry soils and prevent erosion. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

3.1.2.2 Dewatering

Groundwater flowing toward or into excavations shall be controlled to

prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 2 feet below the working level.

Operate dewatering system continuously until construction work below existing water levels is complete. Submit performance records weekly.

3.1.3 Underground Utilities

Location of the existing utilities indicated is approximate. The Contractor shall physically verify the location and elevation of the existing utilities indicated prior to starting construction.

3.1.4 Machinery and Equipment

Movement of construction machinery and equipment over pipes during construction shall be at the Contractor's risk. Repair, or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged.

3.2 SURFACE PREPARATION

3.2.1 Clearing and Grubbing

Unless indicated otherwise, remove trees, stumps, logs, shrubs, brush and vegetation and other items that would interfere with construction operations within the clearing limits. Remove stumps entirely. Grub out matted roots and roots over 2 inches in diameter to at least 18 inches below existing surface.

3.2.2 Stripping

Strip suitable soil from the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as topsoil shall be wasted. Locate topsoil so that the material can be used readily for the finished grading. Where sufficient existing topsoil conforming to the material requirements is not available on site, provide borrow materials suitable for use as topsoil. Protect topsoil and keep in segregated piles until needed.

3.2.3 Unsuitable Material

Remove vegetation, debris, decayed vegetable matter, sod, mulch, and rubbish underneath paved areas or concrete slabs.

3.3 EXCAVATION

Excavate to contours, elevation, and dimensions indicated. Reuse excavated materials that meet the specified requirements for the material type required at the intended location. Keep excavations free from water. Excavate soil disturbed or weakened by Contractor's operations, soils softened or made unsuitable for subsequent construction due to exposure to

weather. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed. Refill with satisfactory material and compact to 95 percent of ASTM D1557 maximum density. Unless specified otherwise, refill excavations cut below indicated depth with and compact to 95 percent of ASTM D1557 maximum density. Satisfactory material removed below the depths indicated, without specific direction of the Contracting Officer, shall be replaced with satisfactory materials to the indicated excavation grade; except as specified for spread footings. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

3.3.1 Pipe Trenches

Excavate to the dimension indicated. Grade bottom of trenches to provide uniform support for each section of pipe after pipe bedding placement. Tamp if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length. Rock, where encountered, shall be excavated to a depth of at least 6 inches below the bottom of the pipe.

3.3.2 Excavated Materials

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Paragraph "DISPOSITION OF SURPLUS MATERIAL."

3.4 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the Contracting Officer. The surface shall be scarified to a depth of 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to plus or minus 3 percent of optimum moisture. Minimum subgrade density shall be as specified herein.

3.4.1 Proof Rolling

Proof rolling shall be done on an exposed subgrade free of surface water which would promote degradation of an otherwise acceptable subgrade. [After stripping,] proof roll the existing subgrade of the access drive with six passes of a dump truck loaded with 212 cubic feet of soil. Operate the truck in a systematic manner to ensure the number of passes

over all areas, and at speeds between 2 1/2 to 3 1/2 miles per hour. Notify the Contracting Officer a minimum of 3 days prior to proof rolling. Proof rolling shall be performed in the presence of the Contracting Officer. Rutting or pumping of material shall be undercut as directed by the Contracting Officer and replaced with select material.

3.4.2 Infiltration Basin/Trench Subgrade Preparation

Equipment operation within infiltration basin/trenches should be avoided to prevent soil compaction. If machinery must operate in the facility, use light weight, low ground-contact pressure equipment. Prior to placement of rock fill the subgrade should be scarified to a depth of 12 inches. Vehicular traffic and construction equipment shall not drive-on, move onto, or disturb the subgrade once scarification is completed. If it is necessary for mechanical equipment to operate within the infiltration basin in order to place rock fill, subsurface areas in which equipment travels should be re-scarified prior to rock placement. Vehicular travel and equipment should be avoided in any areas in which rock fill has already begun.

3.5 SUBGRADE FILTER FABRIC

Place synthetic fiber filter fabric as indicated directly on prepared subgrade free of [vegetation,] stumps, rocks larger than [2 inches] [_____] diameter and other debris which may puncture or otherwise damage the fabric. Repair damaged fabric by placing an additional layer of fabric to cover the damaged area a minimum of [3 feet][_____] overlap in all directions. Overlap fabric at joints a minimum of 3 feet. Obtain approval of filter fabric installation before placing fill or backfill. Place fill or backfill on fabric in the direction of overlaps and compact as specified herein. Follow manufacturer's recommended installation procedures.

3.6 FILLING AND BACKFILLING

Fill and backfill to contours, elevations, and dimensions indicated. Compact each lift before placing overlaying lift.

3.6.1 Common Fill Placement

Provide for general site. Place in 6 inch lifts. Compact areas not accessible to rollers or compactors with mechanical hand tampers. Aerate material excessively moistened by rain to a satisfactory moisture content. Finish to a smooth surface by blading, rolling with a smooth roller, or both.

3.6.2 Backfill and Fill Material Placement

Provide for paved areas and under concrete slabs. Place in 6 inch lifts. Do not place over wet or frozen areas. Place backfill material adjacent to structures as the structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against the structure.

3.6.3 Backfill and Fill Material Placement Over Pipes and at Walls

Backfilling shall not begin until construction below finish grade has been

approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall be brought to indicated finish grade. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation 2 feet above sewer lines and 1 foot above other utility lines shall be free from stones larger than 1 inch in any dimension. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more than 4 inches in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall.

3.6.4 Trench Backfilling

Backfill as rapidly as construction, testing, and acceptance of work permits. Place and compact backfill under structures and paved areas in 6 inch lifts to top of trench and in 6 inch lifts to one foot over pipe outside structures and paved areas.

3.7 BORROW

Where satisfactory materials are not available in sufficient quantity from required excavations, approved borrow materials shall be obtained as specified herein.

3.8 BURIED WARNING AND IDENTIFICATION TAPE

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.9 BURIED DETECTION WIRE

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over it's entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve box at the pump station end of the pipe.

3.10 COMPACTION

Determine in-place density of existing subgrade; if required density exists, no compaction of existing subgrade will be required.

3.10.1 General Site

Compact underneath areas designated for vegetation and areas outside the 5 foot line of the paved area or structure to 90 percent of ASTM D1557.

3.10.2 Structures, Spread Footings, and Concrete Slabs

Compact top 12 inches of subgrades to 95 percent of ASTM D1557. Compact fill and backfill materialto 95 percent of ASTM D1557.

3.10.3 Adjacent Area

Compact areas within 5 feet of structures to 90 percent of ASTM D1557.

3.10.4 Paved Areas

Compact top 12 inches of subgrades to 95 percent of ASTM D1557. Compact fill and backfill materials to 95 percent of ASTM D1557.

3.11 RIP-RAP CONSTRUCTION

Riprap rock fill should be not be bulk placed but rather placed in lifts not greater than 18 inches. The bottom 1 foot of rock fill in the infiltration basin/trench should be hand placed or mechanically placed in a manner that minimizes the compaction of the subsoil.

3.11.1 Preparation

Trim and dress indicated areas to conform to cross sections, lines and grades shown within a tolerance of 0.1 foot.

3.11.2 Bedding Placement

Spread filter fabric bedding material uniformly on prepared subgrade as indicated. Finish bedding to present even surface free from mounds and windrows.

3.11.3 Stone Placement

Place rock for rip-rap on prepared bedding material to produce a well graded mass with the minimum practicable percentage of voids in conformance with lines and grades indicated. Distribute larger rock fragments, with dimensions extending the full depth of the rip-rap throughout the entire mass and eliminate "pockets" of small rock fragments. Rearrange individual pieces by mechanical equipment or by hand as necessary to obtain the distribution of fragment sizes specified above.

3.12 FINISH OPERATIONS

3.12.1 Grading

Finish grades as indicated within one-tenth of one foot. Grade areas to drain water away from structures. Maintain areas free of trash and debris. For existing grades that will remain but which were disturbed by Contractor's operations, grade as directed.

3.12.2 Topsoil and Seed

Provide as specified in Section 32 92 19 SEEDING.

3.12.3 Protection of Surfaces

Protect newly backfilled, graded, and topsoiled areas from traffic,

erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.

3.13 DISPOSITION OF SURPLUS MATERIAL

Remove from Government property surplus or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber.

3.14 FIELD QUALITY CONTROL

3.14.1 Sampling

Take the number and size of samples required to perform the following tests.

3.14.2 Testing

Perform one of each of the following tests for each material used. Provide additional tests for each source change.

3.14.2.1 Fill and Backfill Material Testing

Test fill and backfill material in accordance with ASTM C136 for conformance to ASTM D2487 gradation limits; ASTM D1140 for material finer than the No. 200 sieve; ASTM D4318 for liquid limit and for plastic limit; ASTM D1557 for moisture density relations, as applicable.

3.14.2.2 Select Material Testing

Test select material in accordance with ASTM C136 for conformance to ASTM D2487 gradation limits; ASTM D1140 for material finer than the No. 200 sieve; ASTM D1557 for moisture density relations, as applicable.

3.14.2.3 Porous Fill Testing

Test porous fill in accordance with ASTM C136 for conformance to gradation specified in ASTM C33/C33M.

3.14.2.4 Density Tests

Test density in accordance with ASTM D1556, or ASTM D6938. When ASTM D6938 density tests are used, verify density test results by performing an ASTM D1556 density test at a location already ASTM D6938 tested as specified herein. Perform an ASTM D1556 density test at the start of the job, and for every 10 ASTM D6938 density tests thereafter. Test each lift at randomly selected locations every 2000 square feet of existing grade in fills for structures and concrete slabs, and every 2500 square feet for other fill areas and every 2000 square feet of subgrade in cut. Include density test results in daily report.

Bedding and backfill in trenches: One test per 50 linear feet in each lift.

3.14.2.5 Moisture Content Tests

In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of materials being placed is required

during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D2216. Include moisture content test results in daily report.

] -- End of Section --

SECTION 32 11 23

AGGREGATE AND/OR GRADED-CRUSHED AGGREGATE BASE COURSE
08/08

PART 1 GENERAL

1.1 REFERENCES

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.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(2010) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
AASHTO T 224	(2010) Standard Method of Test for Correction for Coarse Particles in the Soil Compaction Test

ASTM INTERNATIONAL (ASTM)

ASTM C117	(2013) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C127	(2012) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C128	(2012) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C131	(2006) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C29/C29M	(2009) Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C88	(2013) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D1557	(2012) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2167	(2008) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2487	(2011) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D422	(1963; R 2007) Particle-Size Analysis of Soils
ASTM D4318	(2010) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D5821	(2001; R 2006) Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6938	(2010) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D75/D75M	(2009) Standard Practice for Sampling Aggregates
ASTM E11	(2009; E 2010) Wire Cloth and Sieves for Testing Purposes

1.2 DEFINITIONS

For the purposes of this specification, the following definitions apply.

1.2.1 Aggregate Base Course

Aggregate base course (ABC) is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Graded-Crushed Aggregate Base Course

Graded-crushed aggregate (GCA) base course is well graded, crushed, durable aggregate uniformly moistened and mechanically stabilized by compaction. GCA is similar to ABC, but it has more stringent requirements and it produces a base course with higher strength and stability.

1.2.3 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum laboratory dry density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum dry density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve are expressed as a percentage of the laboratory maximum dry density in

accordance with AASHTO T 180 Method D and corrected with AASHTO T 224.

1.3 SYSTEM DESCRIPTION

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. Submit a list of proposed equipment, including descriptive data. Provide adequate equipment having the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Plant, Equipment, and Tools
Waybills and Delivery Tickets

SD-06 Test Reports

Sampling and Testing
Field Density Tests

1.5 QUALITY ASSURANCE

Sampling and testing are the responsibility of the Contractor and performed by a testing laboratory approved in accordance with Section 01 45 00.00 1001 45 00.00 2001 45 00.00 40 QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. Test the materials to establish compliance with the specified requirements; perform testing at the specified frequency. The Contracting Officer may specify the time and location of the tests. Furnish copies of test results to the Contracting Officer within 24 hours of completion of the tests.

1.5.1 Sampling

Take samples for laboratory testing in conformance with ASTM D75/D75M. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.5.2 Tests

Perform the following tests in conformance with the applicable standards listed.

1.5.2.1 Sieve Analysis

Make sieve analysis in conformance with ASTM C117 and ASTM C136. Sieves shall conform to ASTM E11. [Particle-size analysis of the soils shall also be completed in conformance with ASTM D422].

1.5.2.2 Liquid Limit and Plasticity Index

Determine liquid limit and plasticity index in accordance with ASTM D4318.

1.5.2.3 Moisture-Density Determinations

Determine the laboratory maximum dry density and optimum moisture content in accordance with [ASTM D1557] [AASHTO T 180, Method D and corrected with AASHTO T 224].

1.5.2.4 Field Density Tests

Measure field density in accordance with ASTM D1556, ASTM D2167 or ASTM D6938. [For the method presented in ASTM D1556 use the base plate as shown in the drawing.] [For the method presented in ASTM D6938 check the calibration curves and adjust them, if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D6938 result in a wet unit weight of soil, and ASTM D6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D6938. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration of ASTM D6938, on each different type of material being tested at the beginning of a job and at intervals as directed.]

a. Submit certified copies of test results for approval not less than [30] [_____] days before material is required for the work.

b. Submit calibration curves and related test results prior to using the device or equipment being calibrated.

c. Submit copies of field test results within [24] [_____] hours after the tests are performed.

1.5.2.5 Wear Test

Perform wear tests on [ABC] [and] [GCA] course material in conformance with ASTM C131.

1.5.2.6 Soundness

Perform soundness tests on GCA in accordance with ASTM C88.

1.5.2.7 Weight of Slag

Determine weight per cubic foot of slag in accordance with ASTM C29/C29M on the [ABC] [and] [GCA] course material.

1.5.3 Testing Frequency

1.5.3.1 Initial Tests

Perform one of each of the following tests, on the proposed material prior to commencing construction, to demonstrate that the proposed material meets all specified requirements when furnished. If materials from more than one source are going to be utilized, this testing shall be completed for each source.

a. Sieve Analysis [including the No. 635 sieve].

b. Liquid limit and plasticity index.

c. Moisture-density relationship.

d. Wear.

e. [Soundness].

f. [Weight per cubic foot of Slag].

g. [_____].

1.5.3.2 In Place Tests

Perform each of the following tests on samples taken from the placed and compacted [ABC] [and] [GCA]. Samples shall be taken and tested at the rates indicated. [Perform sampling and testing of recycled concrete aggregate at twice the specified frequency until the material uniformity is established.]

a. Perform density tests on every lift of material placed and at a frequency of one set of tests for every [250 square yards] [_____], or portion thereof, of completed area.

b. Perform sieve analysis [including the No. 635 sieve] on every lift of material placed and at a frequency of one sieve analysis for every [500 square yards] [_____], or portion thereof, of material placed.

c. Perform liquid limit and plasticity index tests at the same frequency as the sieve analysis.

d. Measure the total thickness of the base course at intervals, in such a manner as to ensure one measurement for each [500] [_____] square yards of base course. Measurements shall be made in 3 inch diameter test holes penetrating the base course.

1.5.4 Approval of Material

Select the source of the material [30] days prior to the time the material will be required in the work. Tentative approval of material will be based on initial test results. Final approval of the materials will be based on sieve analysis, liquid limit, and plasticity index tests performed on samples taken from the completed and fully compacted course(s).

1.6 ENVIRONMENTAL REQUIREMENTS

Perform construction when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F, protect all completed areas by approved methods against detrimental effects of freezing. Correct completed areas damaged by freezing, rainfall, or other weather conditions to meet specified requirements.

PART 2 PRODUCTS

2.1 AGGREGATES

Provide [ABC] [and] [GCA] consisting of clean, sound, durable particles of crushed stone, crushed slag, crushed gravel, [crushed recycled concrete,] angular sand, or other approved material. [ABC shall be free of lumps of clay, organic matter, and other objectionable materials or coatings.] [GCA shall be free of silt and clay as defined by ASTM D2487, organic matter, and other objectionable materials or coatings.] The portion retained on the No. 4 sieve is known as coarse aggregate; that portion passing the No. 4 sieve is known as fine aggregate.

2.1.1 Coarse Aggregate

Provide coarse aggregates with angular particles of uniform density. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements and shall be stockpiled separately.

a. Crushed Gravel: Crushed gravel shall be manufactured by crushing gravels, and shall meet all the requirements specified below.

b. Crushed Stone: Provide crushed stone consisting of freshly mined quarry rock, meeting all the requirements specified below.

c. Crushed Recycled Concrete: Provide crushed recycled concrete consisting of previously hardened portland cement concrete or other concrete containing pozzolanic binder material. The recycled material shall be free of all reinforcing steel, bituminous concrete surfacing, and any other foreign material and shall be crushed and processed to meet the required gradations for coarse aggregate. Reject recycled concrete aggregate exceeding this value. Crushed recycled concrete shall meet all other applicable requirements specified below.

d. Crushed Slag: Crushed slag shall be an air-cooled blast-furnace product having an air dry unit weight of not less than 70 pcf as determined by ASTM C29/C29M, and shall meet all the requirements specified below.

2.1.1.1 Aggregate Base Course

ABC coarse aggregate shall not show more than 50 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C131. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregates shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces determined in accordance with ASTM D5821. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be manufactured from gravel particles 50 percent of which, by weight, are retained on the maximum size sieve listed in TABLE 1.

2.1.1.2 Graded-Crushed Aggregate Base Course

GCA coarse aggregate shall not show more than [40] [50] percent loss when

subjected to the Los Angeles abrasion test in accordance with ASTM C131. GCA coarse aggregate shall not exhibit a loss greater than 18 percent weighted average, at five cycles, when tested for soundness in magnesium sulfate, or 12 percent weighted average, at five cycles, when tested in sodium sulfate in accordance with ASTM C88. The amount of flat and elongated particles shall not exceed 20 percent for the fraction retained on the 1/2 inch sieve nor 20 percent for the fraction passing the 1/2 inch sieve. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregate shall contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces determined in accordance with ASTM D5821. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be manufactured from gravel particles 90 percent of which by weight are retained on the maximum size sieve listed in TABLE 1.

2.1.2 Fine Aggregate

Fine aggregates shall be angular particles of uniform density. When the fine aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements.

2.1.2.1 Aggregate Base Course

ABC fine aggregate shall consist of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.

2.1.2.2 Graded-Crushed Aggregate Base Course

Provide GCA fine aggregate consisting of angular particles produced by crushing stone, slag, [recycled concrete,] or gravel that meets the requirements for wear and soundness specified for GCA coarse aggregate. [Fine aggregate shall be produced by crushing only particles larger than No. 4 sieve in size. The fine aggregate shall contain at least 90 percent by weight of particles having two or more freshly fractured faces in the portion passing the No. 4 sieve and retained on the No. 10 sieve, and in the portion passing the No. 10 sieve and retained on the No. 40 sieve.] [Fine aggregate shall be manufactured from gravel particles 95 percent of which by weight are retained on the 1/2 inch sieve.]

2.1.3 Gradation Requirements

Apply the specified gradation requirements to the completed base course. The aggregates shall be continuously well graded within the limits specified in TABLE 1. Sieves shall conform to ASTM E11.

TABLE 1. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3
2 inch	100	----	----

TABLE 1. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3
1-1/2 inch	70-100	100	----
1 inch	45-80	60-100	100
1/2 inch	30-60	30-65	40-70
No. 4	20-50	20-50	20-50
No. 10	15-40	15-40	15-40
No. 40	5-25	5-25	5-25
No. 200	0-8	0-8	0-8

NOTE 1: Particles having diameters less than No. 635 shall not be in excess of 3 percent by weight of the total sample tested.

NOTE 2: The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, they shall be tested in accordance with ASTM C127 and ASTM C128 to determine their specific gravities. If the specific gravities vary by more than 10 percent, the percentages passing the various sieves shall be corrected as directed by the Contracting Officer.

2.2 LIQUID LIMIT AND PLASTICITY INDEX

Apply liquid limit and plasticity index requirements to the completed course and to any component that is blended to meet the required gradation. The portion of any component or of the completed course passing the No. 40 sieve shall be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the [ABC] [or] [GCA] is constructed in more than one layer, clean the previously constructed layer of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Provide adequate drainage during the entire period of construction to prevent water from collecting or standing on the working area. Provide line and grade stakes as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 OPERATION OF AGGREGATE SOURCES

Clearing, stripping, and excavating are the responsibility of the Contractor. Operate the aggregate sources to produce the quantity and quality of materials meeting the specified requirements in the specified time limit. [Upon completion of the work, the aggregate sources on Government property shall be conditioned to drain readily and shall be left in a satisfactory condition.] Aggregate sources on private lands shall be conditioned in agreement with local laws or authorities.

3.3 STOCKPILING MATERIAL

Clear and level storage sites prior to stockpiling of material. Stockpile all materials, including approved material available from excavation and grading, in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.4 PREPARATION OF UNDERLYING COURSE

Prior to constructing the base course(s), the underlying course or subgrade shall be cleaned of all foreign substances. At the time of construction of the base course(s), the underlying course shall contain no frozen material. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. The underlying course shall conform to [Section 31 00 00 EARTHWORK] [Section 32 11 16 SUBBASE COURSES]. Ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses containing sands or gravels, as defined in ASTM D2487, the surface shall be stabilized prior to placement of the base course(s). Stabilization shall be accomplished by mixing [ABC] [or] [GCA] into the underlying course and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements of the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained in a satisfactory condition until the base course is placed.

3.5 INSTALLATION

3.5.1 Mixing the Materials

Mix the coarse and fine aggregates in a stationary plant, or in a traveling plant or bucket loader on an approved paved working area. Make adjustments in mixing procedures or in equipment, as directed, to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory base course meeting all requirements of this specification.

3.5.2 Placing

Place the mixed material on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. When a compacted layer 6 inches or less in thickness is required, place the material in a single layer. When a compacted layer in excess of 6 inches is required, place the material in layers of equal thickness. No layer shall be thicker than 6 inches or thinner than 3 inches when compacted. The layers shall be so placed that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the base course is placed in more than one layer, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Such adjustments in placing procedures or equipment shall be made as may be directed to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable base course.

3.5.3 Grade Control

The finished and completed base course shall conform to the lines, grades, and cross sections shown. Underlying material(s) shall be excavated and prepared at sufficient depth for the required base course thickness so that the finished base course and the subsequent surface course will meet the designated grades.

3.5.4 Edges of Base Course

The base course(s) shall be placed so that the completed section will be a minimum of [2] [_____] feet wider, on all sides, than the next layer that will be placed above it. Additionally, place approved fill material along the outer edges of the base course in sufficient quantities to compact to the thickness of the course being constructed, or to the thickness of each layer in a multiple layer course, allowing in each operation at least a 2 foot width of this material to be rolled and compacted simultaneously with rolling and compacting of each layer of base course. If this base course material is to be placed adjacent to another pavement section, then the layers for both of these sections shall be placed and compacted along this edge at the same time.

3.5.5 Compaction

Compact each layer of the base course, as specified, with approved compaction equipment. Maintain water content during the compaction procedure to within plus or minus [2] [_____] percent of the optimum water content determined from laboratory tests as specified in this Section. Begin rolling at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Continue compaction until each layer has a degree of compaction that is at least [100] [_____] percent of laboratory maximum density through the full depth of the layer. Make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory base course. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

3.5.6 Thickness

Construct the compacted thickness of the base course as indicated. No individual layer shall be thicker than 6 inches nor be thinner than 3 inches in compacted thickness. The total compacted thickness of the base course(s) shall be within 1/2 inch of the thickness indicated. Where the measured thickness is more than 1/2 inch deficient, correct such areas by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 1/4 inch of the thickness indicated. The total thickness of the base course shall be measured at intervals in such a manner as to ensure one measurement for each [500] [_____] square yards of base course.

Measurements shall be made in 3 inch diameter test holes penetrating the base course.

3.5.7 Proof Rolling

Proof rolling of the areas indicated shall be in addition to the compaction specified and shall consist of the application of [_____] coverages with a heavy pneumatic-tired roller having four or more tires, each loaded to a minimum of 30,000 pounds and inflated to a minimum of 125 psi. In areas designated, apply proof rolling to the top of the underlying material on which the base course is laid and to each layer of base course [top of the completed [ABC] [GCA] course]. Maintain water content of the underlying material at optimum or at the percentage directed from start of compaction to completion of proof rolling of that layer. Water content of each layer of the base course shall be maintained at the optimum percentage directed from start of compaction to completion of proof rolling. Any base course materials or any underlying materials that produce unsatisfactory results by proof rolling shall be removed and replaced with satisfactory materials, recompacted and proof rolled to meet these specifications.

3.5.8 Finishing

The surface of the top layer of base course shall be finished after [final compaction] [and] [proof rolling] by cutting any overbuild to grade and rolling with a steel-wheeled roller. Thin layers of material shall not be added to the top layer of base course to meet grade. If the elevation of the top layer of base course is 1/2 inch or more below grade, then the top layer should be scarified to a depth of at least 3 inches and new material shall be blended in [and compacted] [, compacted and proof rolled] to bring to grade. Adjustments to rolling and finishing procedures shall be made as directed to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, the unsatisfactory portion shall be scarified, reworked and recompacted or it shall be replaced as directed.

3.5.9 Smoothness

The surface of the top layer shall show no deviations in excess of 3/8 inch when tested with a 12 foot straightedge. Take measurements in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at [50] [_____] foot intervals. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.6 TRAFFIC

[Do not allow traffic on the completed base course]. [Completed portions of the base course may be opened to limited traffic, provided there is no marring or distorting of the surface by the traffic. Heavy equipment shall not be permitted except when necessary to construction, and then the area shall be protected against marring or damage to the completed work.]

3.7 MAINTENANCE

Maintain the base course in a satisfactory condition until the full pavement section is completed and accepted. Maintenance shall include

immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact. Any base course that is not paved over prior to the onset of winter, shall be retested to verify that it still complies with the requirements of this specification. Any area of base course that is damaged shall be reworked or replaced as necessary to comply with this specification.

3.8 DISPOSAL OF UNSATISFACTORY MATERIALS

Any unsuitable materials that must be removed shall be disposed of [outside the limits of Government-controlled land] [as directed] [in waste disposal areas indicated]. No additional payments will be made for materials that must be replaced.

-- End of Section --

SECTION 32 12 16

HOT-MIX ASPHALT (HMA) FOR ROADS
08/09

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 156	(2013) Standard Specification for Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
AASHTO M 320	(2010) Standard Specification for Performance-Graded Asphalt Binder

ASPHALT INSTITUTE (AI)

AI MS-2	(1997 6th Ed) Mix Design Methods
AI MS-22	(2001; 2nd Ed) Construction of Hot-Mix Asphalt Pavements
AI SP-2	(2001; 3rd Ed) Superpave Mix Design

ASTM INTERNATIONAL (ASTM)

ASTM C117	(2013) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C1252	(2006) Standard Test Methods for Uncompacted Void Content of Fine Aggregate (as Influenced by Particle Shape, Surface Texture, and Grading)
ASTM C127	(2012) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C128	(2012) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C131	(2006) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

ASTM C136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C142/C142M	(2010) Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C29/C29M	(2009) Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C566	(2013) Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
ASTM C88	(2013) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D140/D140M	(2009) Standard Practice for Sampling Bituminous Materials
ASTM D1461	(2011) Moisture or Volatile Distillates in Bituminous Paving Mixtures
ASTM D2172/D2172M	(2011) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D2419	(2009) Sand Equivalent Value of Soils and Fine Aggregate
ASTM D242/D242M	(2009) Mineral Filler for Bituminous Paving Mixtures
ASTM D2489/D2489M	(2008) Estimating Degree of Particle Coating of Bituminous-Aggregate Mixtures
ASTM D2950/D2950M	(2011) Density of Bituminous Concrete in Place by Nuclear Methods
ASTM D3381/D3381M	(2013) Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D3665	(2012) Random Sampling of Construction Materials
ASTM D3666	(2011) Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D4125/D4125M	(2010) Asphalt Content of Bituminous Mixtures by the Nuclear Method
ASTM D4791	(2010) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D4867/D4867M	(2009) Effect of Moisture on Asphalt Concrete Paving Mixtures

ASTM D5444	(2008) Mechanical Size Analysis of Extracted Aggregate
ASTM D6307	(2010) Asphalt Content of Hot Mix Asphalt by Ignition Method
ASTM D6925	(2009) Standard Test Method for Preparation and Determination of the Relative Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor
ASTM D6926	(2010) Standard Practice for Preparation of Bituminous Specimens Using Marshall Apparatus
ASTM D6927	(2006) Standard Test Method for Marshall Stability and Flow of Bituminous Mixtures
ASTM D946/D946M	(2009a) Penetration-Graded Asphalt Cement for Use in Pavement Construction

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS)

CTM 526	(2002) Operation of California Profilograph and Evaluation of Profiles

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 171	(1995) Standard Test Method for Determining Percentage of Crushed Particles in Aggregate

1.2 SYSTEM DESCRIPTION

Perform the work consisting of pavement courses composed of mineral aggregate and asphalt material heated and mixed in a central mixing plant and placed on a prepared course. HMA designed and constructed in accordance with this section shall conform to the lines, grades, thicknesses, and typical cross sections shown on the drawings. Construct each course to the depth, section, or elevation required by the drawings and roll, finish, and approve it before the placement of the next course.

1.2.1 Asphalt Mixing Plant

Plants used for the preparation of hot-mix asphalt shall conform to the requirements of AASHTO M 156 with the following changes:

a. Truck Scales. Weigh the asphalt mixture on approved, certified scales at the Contractor's expense. Inspect and seal scales at least annually by an approved calibration laboratory.

b. Testing Facilities. Provide laboratory facilities at the plant for the use of the Government's acceptance testing and the Contractor's quality control testing.

c. Inspection of Plant. Provide the Contracting Officer with access at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant; verifying weights,

proportions, and material properties; checking the temperatures maintained in the preparation of the mixtures and for taking samples. Provide assistance as requested, for the Government to procure any desired samples.

d. Storage Bins. Use of storage bins for temporary storage of hot-mix asphalt will be permitted as follows:

(1) The asphalt mixture may be stored in non-insulated storage bins for a period of time not exceeding 3 hours.

(2) The asphalt mixture may be stored in insulated storage bins for a period of time not exceeding 8 hours. The mix drawn from bins shall meet the same requirements as mix loaded directly into trucks.

1.2.2 Hauling Equipment

Provide trucks for hauling hot-mix asphalt having tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. Petroleum based products shall not be used as a release agent. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers (tarps) shall be securely fastened.

1.2.3 Asphalt Pavers

Provide asphalt pavers which are self-propelled, with an activated screed, heated as necessary, and capable of spreading and finishing courses of hot-mix asphalt which will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

1.2.3.1 Receiving Hopper

Provide paver with a receiving hopper of sufficient capacity to permit a uniform spreading operation and equipped with a distribution system to place the mixture uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

1.2.3.2 Automatic Grade Controls

Equip the paver with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from either a reference line and/or through a system of mechanical sensors or sensor-directed mechanisms or devices which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent. A transverse slope controller shall not be used to control grade. Provide controls capable of working in conjunction with any of the following attachments:

a. Ski-type device of not less than 30 feet in length.

b. Taut stringline set to grade.

c. Short ski or shoe for joint matching.

d. Laser control.

1.2.4 Rollers

Rollers shall be in good condition and shall be operated at slow speeds to avoid displacement of the asphalt mixture. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. Do not use equipment which causes excessive crushing of the aggregate.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Mix Design[; G][; G, [_____]]
Contractor Quality Control[; G][; G, [_____]]
Material Acceptance[; G][; G, [_____]]
Percent Payment[; G][; G, [_____]]

SD-04 Samples

Asphalt Cement Binder
Aggregates

SD-06 Test Reports

Aggregates[; G][; G, [_____]]
QC Monitoring

SD-07 Certificates

Asphalt Cement Binder[; G][; G, [_____]]
Testing Laboratory

1.4 ENVIRONMENTAL REQUIREMENTS

Do not place the hot-mix asphalt upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 3. The temperature requirements may be waived by the Contracting Officer, if requested; however, all other requirements, including compaction, shall be met.

Table 3. Surface Temperature Limitations of Underlying Course

Mat Thickness, inches	Degrees F
3 or greater	40

Table 3. Surface Temperature Limitations of Underlying Course

Mat Thickness, inches	Degrees F
Less than 3	45

PART 2 PRODUCTS

2.1 AGGREGATES

Provide aggregates consisting of crushed stone, crushed gravel, crushed slag, screenings, natural sand and mineral filler, as required. Submit sufficient materials to produce 200 lb of blended mixture for mix design verification. The portion of material retained on the No. 4 sieve is coarse aggregate. The portion of material passing the No. 4 sieve and retained on the No. 200 sieve is fine aggregate. The portion passing the No. 200 sieve is defined as mineral filler. Submit all aggregate test results and samples to the Contracting Officer at least 14 days prior to start of construction.

2.1.1 Coarse Aggregate

Provide coarse aggregate consisting of sound, tough, durable particles, free from films of material that would prevent thorough coating and bonding with the asphalt material and free from organic matter and other deleterious substances. All individual coarse aggregate sources shall meet the following requirements:

a. The percentage of loss shall not be greater than 40 percent after 500 revolutions when tested in accordance with ASTM C131.

b. The percentage of loss shall not be greater than 18 percent after five cycles when tested in accordance with ASTM C88 using magnesium sulfate [or 12 percent when using sodium sulfate].

c. At least 75 percent by weight of coarse aggregate shall have at least two or more fractured faces when tested in accordance with COE CRD-C 171. Fractured faces shall be produced by crushing.

d. The particle shape shall be essentially cubical and the aggregate shall not contain more than 20 percent percent, by weight, of flat and elongated particles (3:1 ratio of maximum to minimum) when tested in accordance with ASTM D4791.

e. Slag shall be air-cooled, blast furnace slag, with a compacted weight of not less than 75 lb/cu ft when tested in accordance with ASTM C29/C29M.

f. Clay lumps and friable particles shall not exceed 0.3 percent, by weight, when tested in accordance with ASTM C142/C142M.

2.1.2 Fine Aggregate

Fine aggregate shall consist of clean, sound, tough, durable particles free from coatings of clay, silt, or any objectionable material and containing no clay balls.

a. All individual fine aggregate sources shall have a sand equivalent value not less than 45 when tested in accordance with ASTM D2419.

b. The fine aggregate portion of the blended aggregate shall have an uncompacted void content not less than 45.0 percent when tested in accordance with ASTM C1252 Method A.

c. The quantity of natural sand (noncrushed material) added to the aggregate blend shall not exceed 25 percent by weight of total aggregate.

d. Clay lumps and friable particles shall not exceed 0.3 percent, by weight, when tested in accordance with ASTM C142/C142M

2.1.3 Mineral Filler

Mineral filler shall be nonplastic material meeting the requirements of ASTM D242/D242M.

2.1.4 Aggregate Gradation

The combined aggregate gradation shall conform to gradations specified in Table 4, when tested in accordance with ASTM C136 and ASTM C117, and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa, but grade uniformly from coarse to fine.

Table 4. Aggregate Gradations

Sieve Size, inch	Gradation 1 Percent Passing by Mass	Gradation 2 Percent Passing by Mass	Gradation 3 Percent Passing by Mass
1	100	---	---
3/4	76-96	100	---
1/2	68-88	76-96	100
3/8	60-82	69-89	76-96
No. 4	45-67	53-73	58-78
No. 8	32-54	38-60	40-60
No. 16	22-44	26-48	28-48
No. 30	15-35	18-38	18-38
No. 50	9-25	11-27	11-27
No. 100	6-18	6-18	6-18
No. 200	3-6	3-6	3-6

2.2 ASPHALT CEMENT BINDER

Submit a 5 gallon sample for mix design verification. Asphalt cement binder shall conform to AASHTO M 320 Performance Grade (PG) [_____]. [As an alternate, ASTM D3381/D3381M Table 4, Viscosity Grade [_____] or ASTM D946/D946M penetration grade [_____] may be used.] Test data indicating grade certification shall be provided by the supplier at the time of delivery of each load to the mix plant. Submit copies of these certifications to the Contracting Officer. The supplier is defined as the last source of any modification to the binder. The Contracting Officer may sample and test the binder at the mix plant at any time before or during mix production. Obtain samples for this verification testing in accordance with ASTM D140/D140M and in the presence of the Contracting Officer. Furnish these samples to the Contracting Officer for the verification testing, which shall be at no cost to the Contractor. Submit samples of the asphalt cement specified for approval not less than 14 days before start of the test section. Submit copies of certified test data,

amount, type and description of any modifiers blended into the asphalt cement binder.

2.3 MIX DESIGN

a. Develop the mix design. The asphalt mix shall be composed of a mixture of well-graded aggregate, mineral filler if required, and asphalt material. The aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF). Submit proposed JMF; do not produce hot-mix asphalt for payment until a JMF has been approved. The hot-mix asphalt shall be designed in accordance with Marshall (MS-02), Superpave (SP-2), or Hveem (MS-02) procedures and the criteria shown in Table 5. Use the hand-held hammer to compact the specimens for Marshall mix design. If the Tensile Strength Ratio (TSR) of the composite mixture, as determined by ASTM D4867/D4867M is less than 75, the aggregates shall be rejected or the asphalt mixture treated with an approved anti-stripping agent. The amount of anti-stripping agent added shall be sufficient to produce a TSR of not less than 75. Provide an antistrip agent, if required, at no additional cost. Sufficient materials to produce 200 pound of blended mixture shall be provided to the Contracting Officer for verification of mix design at least 14 days prior to construction of test section.

b. At the option of the Contractor, a currently used DOT Superpave hot mix may be used in lieu of developing a Marshall hot mix design as described herein. Design the Superpave volumetric mix in accordance with AI SP-2 and ASTM D6925. The nominal maximum aggregate size (NMAS) shall be [1-1/2] [1] [3/4] [1/2] [3/8] inch. Other DOT hot mix design methods (Hveem, etc.) may be suitable, as determined by the Contracting Officer. The number of compaction gyrations, Ndes, shall be based on a design traffic of [_____] equivalent single axle loads (EASLs).

c. Design Superpave mixes with the number of gyrations specified in Table 5, unless the DOT option is chosen.

2.3.1 JMF Requirements

Submit in writing the job mix formula for approval at least 14 days prior to the start of the test section including as a minimum:

a. Percent passing each sieve size.

b. Percent of asphalt cement.

c. Percent of each aggregate and mineral filler to be used.

d. Asphalt viscosity grade, penetration grade, or performance grade.

e. Number of blows of hand-held hammer per side of molded specimen. (NA for Superpave)

f. Number of gyrations of Superpave gyratory compactor, (NA for Marshall mix design)

g. Laboratory mixing temperature.

h. Lab compaction temperature.

i. Temperature-viscosity relationship of the asphalt cement.

j. Plot of the combined gradation on the 0.45 power gradation chart, stating the nominal maximum size.

k. Graphical plots of stability (NA for Superpave), flow (NA for Superpave), air voids, voids in the mineral aggregate, and unit weight versus asphalt content as shown in AI MS-2.

l. Specific gravity and absorption of each aggregate.

m. Percent natural sand.

n. Percent particles with 2 or more fractured faces (in coarse aggregate).

o. Fine aggregate angularity.

p. Percent flat or elongated particles (in coarse aggregate).

q. Tensile Strength Ratio(TSR).

r. Antistrip agent (if required) and amount.

s. List of all modifiers and amount.

t. Correlation of hand-held hammer with mechanical hammer (NA for Superpave).

u. Percentage and properties (asphalt content, binder properties, and aggregate properties) of reclaimed asphalt pavement (RAP) in accordance with paragraph RECYCLED HOT-MIX ASPHALT, if RAP is used.

Table 5. Mix Design Criteria

Test Property	50 Blows or 50 Gyrations	75 Blows or 75 Gyrations
Stability, pounds, minimum (NA for Superpave)	*1000	*1800
Flow, 0.01 inch (NA for Superpave)	8-18	8-16
Air voids, percent	3-5	3-5
Percent Voids in mineral aggregate VMA, (minimum)		
Gradation 1	13.0	13.0
Gradation 2	14.0	14.0
Gradation 3	15.0	15.0
TSR, minimum percent	75	75

* This is a minimum requirement. The average during construction shall be significantly higher than this number to ensure compliance with the specifications.
** Calculate VMA in accordance with AI MS-2, based on ASTM C127 and ASTM C128 bulk specific gravity for the aggregate.

2.3.2 Adjustments to Field JMF

Keep the Laboratory JMF for each mixture in effect until a new formula is approved in writing by the Contracting Officer. Should a change in sources of any materials be made, perform a new laboratory jmf design and a new JMF approved before the new material is used. The Contractor will be allowed to adjust the Laboratory JMF within the limits specified below to optimize mix volumetric properties with the approval of the Contracting Officer. Adjustments to the Laboratory JMF shall be applied to the field (plant) established JMF and limited to those values as shown. Adjustments shall be targeted to produce or nearly produce 4 percent voids total mix (VTM).

TABLE 6. Field (Plant) Established JMF Tolerances

Sieves	Adjustments (plus or minus), percent
1/2 inch	3
No. 4	3
No. 8	3
No. 200	1
Binder Content	0.40

If adjustments are needed that exceed these limits, develop a new mix design. Tolerances given above may permit the aggregate grading to be outside the limits shown in Table 4; while not desirable, this is acceptable, except for the No. 200 sieve, which shall remain within the aggregate grading of Table 4.

2.4 RECYCLED HOT MIX ASPHALT

Recycled HMA shall consist of reclaimed asphalt pavement (RAP), coarse aggregate, fine aggregate, mineral filler, and asphalt cement to produce a consistent gradation and asphalt content and properties. When RAP is fed into the plant, the maximum RAP chunk size shall not exceed 2 inches. Design the recycled HMA mix using procedures contained in AI MS-2 and AI MS-22. The job mix shall meet the requirements of paragraph MIX DESIGN. The amount of RAP shall not exceed 30 percent.

2.4.1 RAP Aggregates and Asphalt Cement

The blend of aggregates used in the recycled mix shall meet the requirements of paragraph AGGREGATES. Establish the percentage of asphalt in the RAP for the mixture design according to ASTM D2172/D2172M or ASTM D6307 using the appropriate dust correction procedure.

2.4.2 RAP Mix

The blend of new asphalt cement and the RAP asphalt binder shall meet [the dynamic shear rheometer at high temperature and bending beam at low temperature] [penetration] [viscosity] requirements in paragraph ASPHALT CEMENT BINDER. The virgin asphalt cement shall not be more than two standard asphalt material grades different than that specified in paragraph ASPHALT CEMENT BINDER.

PART 3 EXECUTION

3.1 PREPARATION OF ASPHALT BINDER MATERIAL

Heat the asphalt cement material avoiding local overheating and providing a continuous supply of the asphalt material to the mixer at a uniform temperature. The temperature of unmodified asphalts shall be no more than 325 degrees F when added to the aggregates. Performance-Graded (PG) asphalts shall be within the temperature range of [_____] degrees F when added to the aggregate.

3.2 PREPARATION OF MINERAL AGGREGATE

Heat and dry the aggregate for the mixture prior to mixing. No damage shall occur to the aggregates due to the maximum temperature and rate of heating used. The temperature of the aggregate and mineral filler shall not exceed 350 degrees F when the asphalt cement is added. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

3.3 PREPARATION OF HOT-MIX ASPHALT MIXTURE

The aggregates and the asphalt cement shall be weighed or metered and introduced into the mixer in the amount specified by the JMF. Mix the combined materials until the aggregate obtains a uniform coating of asphalt binder and is thoroughly distributed throughout the mixture. Wet mixing time shall be the shortest time that will produce a satisfactory mixture, but no less than 25 seconds for batch plants. Establish the wet mixing time for all plants based on the procedure for determining the percentage of coated particles described in ASTM D2489/D2489M, for each individual plant and for each type of aggregate used. The wet mixing time will be set to at least achieve 95 percent of coated particles. The moisture content of all hot-mix asphalt upon discharge from the plant shall not exceed 0.5 percent by total weight of mixture as measured by ASTM D1461.

3.4 PREPARATION OF THE UNDERLYING SURFACE

Immediately before placing the hot mix asphalt, clean the underlying course of dust and debris. Apply a [prime coat] [and/or] [tack coat] in accordance with the contract specifications.

3.5 TEST SECTION

Prior to full production, place a test section for each JMF used. Construct a test section 250 - 500 feet long and two paver passes wide placed for two lanes, with a longitudinal cold joint. The test section shall be of the same thickness as the course which it represents. The underlying grade or pavement structure upon which the test section is to be constructed shall be the same as the remainder of the course represented by the test section. The equipment and personnel used in construction of the test section shall be the same equipment to be used on the remainder of the course represented by the test section. Place the test section as part of the project pavement, as approved by the Contracting Officer.

3.5.1 Sampling and Testing for Test Section

Take one random sample at the plant, triplicate specimens compacted, and tested for stability, flow, and laboratory air voids. Test a portion of the same sample for theoretical maximum density (TMD), aggregate gradation and asphalt content. Take four randomly selected cores from the finished pavement mat, and four from the longitudinal joint, and tested for density. Random sampling shall be in accordance with procedures contained in ASTM D3665. The test results shall be within the tolerances shown in Table 7 for work to continue. If all test results meet the specified requirements, the test section shall remain as part of the project pavement. If test results exceed the tolerances shown, the test section shall be removed and replaced at no cost to the Government and another test section shall be constructed. The test section shall be paid for with the first lot of paving

Table 7. Test Section Requirements for Material and Mixture Properties

Property	Specification Limit
Aggregate Gradation-Percent Passing (Individual Test Result)	
No. 4 and larger	JMF plus or minus 8
No. 8, No. 16, No. 30, and No. 50	JMF plus or minus 6
No. 100 and No. 200	JMF plus or minus 2.0
Asphalt Content, Percent (Individual Test Result)	JMF plus or minus 0.5
Laboratory Air Voids, Percent (Average of 3 specimens)	JMF plus or minus 1.0
VMA, Percent (Average of 3 specimens)	[13] [14] [15] minimum
Stability, pounds (Average of 3 specimens) (NA for superpave)	[1000 minimum for 50 blows] [1800 minimum for 75 blows]
Flow, 0.01 inches (Average of 3 specimens) (NA for superpave)	[8 - 18 for 50 blows] [8 - 16 for 75 blows]
Mat Density, Percent of TMD (Average of 4 Random Cores)	92.0 - 96.0
Joint Density, Percent of TMD (Average of 4 Random Cores)	90.5 - 92.5

3.5.2 Additional Test Sections

If the initial test section should prove to be unacceptable, make the necessary adjustments to the JMF, plant operation, placing procedures, and/or rolling procedures and place a second test section. Additional test sections, as required, shall be constructed and evaluated for conformance to the specifications. Full production shall not begin until an acceptable section has been constructed and accepted.

3.6 TESTING LABORATORY

Submit certification of compliance and Plant Scale Calibration Certification. Use a laboratory to develop the JMF that meets the requirements of ASTM D3666. The Government will inspect the laboratory equipment and test procedures prior to the start of hot mix operations for conformance to ASTM D3666. The laboratory shall maintain the Corps certification for the duration of the project. A statement signed by the manager of the laboratory stating that it meets these requirements or clearly listing all deficiencies shall be submitted to the Contracting Officer prior to the start of construction. The statement shall contain as a minimum:

a. Qualifications of personnel; laboratory manager, supervising technician, and testing technicians.

b. A listing of equipment to be used in developing the job mix.

c. A copy of the laboratory's quality control system.

d. Evidence of participation in the AASHTO Materials Reference Laboratory (AMRL) program.

3.7 TRANSPORTING AND PLACING

3.7.1 Transporting

Transport the hot-mix asphalt from the mixing plant to the site in clean, tight vehicles. Schedule deliveries so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Provide adequate artificial lighting for night placements. Hauling over freshly placed material will not be permitted until the material has been compacted as specified, and allowed to cool to 140 degrees F. To deliver mix to the paver, use a material transfer vehicle operated to produce continuous forward motion of the paver.

3.7.2 Placing

Place and compact the mix at a temperature suitable for obtaining density, surface smoothness, and other specified requirements. Upon arrival, place the mixture to the full width by an asphalt paver; it shall be struck off in a uniform layer of such depth that, when the work is completed, it will have the required thickness and conform to the grade and contour indicated. Regulate the speed of the paver to eliminate pulling and tearing of the asphalt mat. Unless otherwise permitted, placement of the mixture shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. Place the mixture in consecutive adjacent strips having a minimum width of 10 feet. The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 1 foot; however, the joint in the surface course shall be at the centerline of the pavement. Transverse joints in one course shall be offset by at least 10 feet from transverse joints in the previous course. Transverse joints in adjacent lanes shall be offset a minimum of 10 feet. On isolated areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and luted by hand tools.

3.8 COMPACTION OF MIXTURE

After placing, the mixture shall be thoroughly and uniformly compacted by rolling. Compact the surface as soon as possible without causing displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once. Furnish sufficient rollers to handle the output of the plant. Continue rolling until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained. To prevent adhesion of the mixture to the roller, keep the wheels properly moistened but excessive water will not be permitted. In areas not accessible to the roller, the mixture shall be thoroughly compacted with hand tampers. Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or is in any way defective shall be removed full depth, replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. Skin patching will not be allowed.

3.9 JOINTS

The formation of joints shall be performed ensuring a continuous bond between the courses and to obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.

3.9.1 Transverse Joints

Do not pass the roller over the unprotected end of the freshly laid mixture, except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing material at the joint. Remove the cutback material from the project. In both methods, all contact surfaces shall be given a light tack coat of asphalt material before placing any fresh mixture against the joint.

3.9.2 Longitudinal Joints

Longitudinal joints which are irregular, damaged, uncompacted, cold (less than 175 degrees F at the time of placing adjacent lanes), or otherwise defective, shall be cut back a maximum of 3 inches from the top of the course with a cutting wheel to expose a clean, sound vertical surface for the full depth of the course. All cutback material shall be removed from the project. All contact surfaces shall be given a light tack coat of asphalt material prior to placing any fresh mixture against the joint. The Contractor will be allowed to use an alternate method if it can be demonstrated that density, smoothness, and texture can be met.

3.10 CONTRACTOR QUALITY CONTROL

3.10.1 General Quality Control Requirements

Develop and submit an approved Quality Control Plan. Submit aggregate and QC test results. Do not produce hot-mix asphalt for payment until the

quality control plan has been approved addressing all elements which affect the quality of the pavement including, but not limited to:

a. Mix Design

b. Aggregate Grading

c. Quality of Materials

d. Stockpile Management

e. Proportioning

f. Mixing and Transportation

g. Mixture Volumetrics

h. Moisture Content of Mixtures

i. Placing and Finishing

j. Joints

k. Compaction

l. Surface Smoothness

3.10.2 Testing Laboratory

Provide a fully equipped asphalt laboratory located at the plant or job site and meeting the pertinent requirements in ASTM D3666. Laboratory facilities shall be kept clean and all equipment maintained in proper working condition. The Contracting Officer shall be permitted unrestricted access to inspect the Contractor's laboratory facility, to witness quality control activities, and to perform any check testing desired. The Contracting Officer will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to adversely affect test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are corrected.

3.10.3 Quality Control Testing

Perform all quality control tests applicable to these specifications and as set forth in the Quality Control Program. The testing program shall include, but shall not be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, moisture in the asphalt mixture, laboratory air voids, stability (NA for Superpave), flow (NA for Superpave), in-place density, grade and smoothness. Develop a Quality Control Testing Plan as part of the Quality Control Program.

3.10.3.1 Asphalt Content

A minimum of two tests to determine asphalt content will be performed per lot (a lot is defined in paragraph MATERIAL ACCEPTANCE and PERCENT PAYMENT) by one of the following methods: the extraction method in accordance with ASTM D2172/D2172M, Method A or B, the ignition method in

accordance with ASTM D6307, or the nuclear method in accordance with ASTM D4125/D4125M. Calibrate the ignition oven or the nuclear gauge for the specific mix being used. For the extraction method, determine the weight of ash, as described in ASTM D2172/D2172M, as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. The last weight of ash value obtained shall be used in the calculation of the asphalt content for the mixture.

3.10.3.2 Gradation

Determine aggregate gradations a minimum of twice per lot from mechanical analysis of recovered aggregate in accordance with ASTM D5444. When asphalt content is determined by the ignition oven or nuclear method, aggregate gradation shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix plants. For batch plants, test aggregates in accordance with ASTM C136 using actual batch weights to determine the combined aggregate gradation of the mixture.

3.10.3.3 Temperatures

Check temperatures at least four times per lot, at necessary locations, to determine the temperature at the dryer, the asphalt cement in the storage tank, the asphalt mixture at the plant, and the asphalt mixture at the job site.

3.10.3.4 Aggregate Moisture

Determine the moisture content of aggregate used for production a minimum of once per lot in accordance with ASTM C566.

3.10.3.5 Moisture Content of Mixture

Determine the moisture content of the mixture at least once per lot in accordance with ASTM D1461 or an approved alternate procedure.

3.10.3.6 Laboratory Air Voids, Marshall Stability and Flow

Take mixture samples at least four times per lot compacted into specimens, using [50] [75] blows per side with the hand-held Marshall hammer as described in ASTM D6926. When the Superpave gyratory compactor is used, mixes will be compacted to [50] [75] gyrations in accordance with ASTM D6925. Hot-mix provided under the DOT Superpave option shall be compacted in accordance with the DOT requirements. After compaction, determine the laboratory air voids of each specimen. Stability and flow shall be determined for the Marshall-compacted specimens, in accordance with ASTM D6927.

3.10.3.7 In-Place Density

Conduct any necessary testing to ensure the specified density is achieved. A nuclear gauge may be used to monitor pavement density in accordance with ASTM D2950/D2950M.

3.10.3.8 Grade and Smoothness

Conduct the necessary checks to ensure the grade and smoothness requirements are met in accordance with paragraphs MATERIAL ACCEPTANCE and PERCENT PAYMENT.

3.10.3.9 Additional Testing

Any additional testing, which the Contractor deems necessary to control the process, may be performed at the Contractor's option.

3.10.3.10 QC Monitoring

Submit all QC test results to the Contracting Officer on a daily basis as the tests are performed. The Contracting Officer reserves the right to monitor any of the Contractor's quality control testing and to perform duplicate testing as a check to the Contractor's quality control testing.

3.10.4 Sampling

When directed by the Contracting Officer, sample and test any material which appears inconsistent with similar material being produced, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

3.10.5 Control Charts

For process control, establish and maintain linear control charts on both individual samples and the running average of last four samples for the parameters listed in Table 8, as a minimum. These control charts shall be posted as directed by the Contracting Officer and kept current at all times. The control charts shall identify the project number, the test parameter being plotted, the individual sample numbers, the Action and Suspension Limits listed in Table 8 applicable to the test parameter being plotted, and the Contractor's test results. Target values from the JMF shall also be shown on the control charts as indicators of central tendency for the cumulative percent passing, asphalt content, and laboratory air voids parameters. When the test results exceed either applicable Action Limit, take immediate steps to bring the process back in control. When the test results exceed either applicable Suspension Limit, halt production until the problem is solved. Use the control charts as part of the process control system for identifying trends so that potential problems can be corrected before they occur. Make decisions concerning mix modifications based on analysis of the results provided in the control charts. The Quality Control Plan shall indicate the appropriate action to be taken to bring the process into control when certain parameters exceed their Action Limits.

Table 8. Action and Suspension Limits for the Parameters to be Plotted on Individual and Running Average Control Charts

Parameter to be Plotted	Individual Samples		Running Average of Last Four Samples	
	Action Limit	Suspension Limit	Action Limit	Suspension Limit
No. 4 sieve, Cumulative % Passing, deviation from JMF target; plus or minus values	6	8	4	5
No. 30 sieve, Cumulative % Passing, deviation from JMF target; plus or minus values	4	6	3	4
No. 200 sieve, Cumulative % Passing, deviation from JMF target; plus or minus values	1.4	2.0	1.1	1.5
Stability, pounds (minimum) (NA for Superpave)				
75 Blow JMF	1800	1700	1900	1800
50 Blow JMF	1000	900	1100	1000
Flow, 0.01 inches (NA for Superpave)				
75 Blow	8 min. 16 max.	7 min. 17 max.	9 min. 15 max.	8 min. 16 max.
50 Blow	8 min. 18 max.	7 min. 19 max.	9 min. 17 max.	8 min. 18 max.
Asphalt content, % deviation from JMF target; plus or minus value	0.4	0.5	0.2	0.3
Laboratory Air Voids, % deviation from JMF target value	No specific action and suspension limits set since this parameter is used to determine percent payment			
In-place Mat Density, % of TMD	No specific action and suspension limits set since this parameter is used to determine percent payment			
In-place Joint Density, % of TMD	No specific action and suspension limits set since this parameter is used to determine percent payment			

3.11 MATERIAL ACCEPTANCE

Testing for acceptability of work will be performed by an independent laboratory hired by the Contractor. Forward test results and payment calculations daily to the Contracting Officer. Acceptance of the plant produced mix and in-place requirements will be on a lot to lot basis. A standard lot for all requirements will be equal to [_____] [2000 short tons] [8 hours of production]. Where appropriate, adjustment in payment for individual lots of hot-mix asphalt will be made based on in-place density, laboratory air voids, grade and smoothness in accordance with the following paragraphs. Grade and surface smoothness determinations will be

made on the lot as a whole. Exceptions or adjustments to this will be made in situations where the mix within one lot is placed as part of both the intermediate and surface courses, thus grade and smoothness measurements for the entire lot cannot be made. In order to evaluate laboratory air voids and in-place (field) density, each lot will be divided into four equal sublots.

3.11.1 Sublot Sampling

One random mixture sample for determining laboratory air voids, theoretical maximum density, and for any additional testing the Contracting Officer desires, will be taken from a loaded truck delivering mixture to each sublot, or other appropriate location for each sublot. All samples will be selected randomly, using commonly recognized methods of assuring randomness conforming to ASTM D3665 and employing tables of random numbers or computer programs. Laboratory air voids will be determined from three laboratory compacted specimens of each sublot sample in accordance with ASTM D6926. The specimens will be compacted within 2 hours of the time the mixture was loaded into trucks at the asphalt plant. Samples will not be reheated prior to compaction and insulated containers will be used as necessary to maintain the temperature.

3.11.2 Additional Sampling and Testing

The Contracting Officer reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. The cost of any additional testing will be paid for by the Government. Testing in these areas will be in addition to the lot testing, and the requirements for these areas will be the same as those for a lot.

3.11.3 Grade

The final wearing surface of pavement shall conform to the elevations and cross sections shown and shall vary not more than 0.05 foot from the plan grade established and approved at site of work. Finished surfaces at juncture with other pavements shall coincide with finished surfaces of abutting pavements. Deviation from the plan elevation will not be permitted in areas of pavements where closer conformance with planned elevation is required for the proper functioning of drainage and other appurtenant structures involved. The grade will be determined by running lines of levels at intervals of 25 feet, or less, longitudinally and transversely, to determine the elevation of the completed pavement surface. Within 5 working days, after the completion of a particular lot incorporating the final wearing surface, test the final wearing surface of the pavement for conformance with the specified plan grade. Diamond grinding may be used to remove high spots to meet grade requirements. Skin patching for correcting low areas or planing or milling for correcting high areas will not be permitted.

3.11.4 Surface Smoothness

Use one of the following methods to test and evaluate surface smoothness of the pavement. Perform all testing in the presence of the Contracting Officer. Keep detailed notes of the results of the testing and furnish a copy to the Government immediately after each day's testing. [Use the profilograph method for all longitudinal testing, except where the runs would be less than 200 feet in length and the ends where the straightedge will be used.] Where drawings show required deviations from a plane

surface (crowns, drainage inlets, etc.), the surface shall be finished to meet the approval of the Contracting Officer.

3.11.4.1 Smoothness Requirements

a. Straightedge Testing: The finished surfaces of the pavements shall have no abrupt change of 1/4 inch or more, and all pavements shall be within the tolerances of 1/4 inch in both the longitudinal and transverse directions, when tested with an approved 12 feet straightedge.

b. Profilograph Testing: The finished surfaces of the pavements shall have no abrupt change of 1/8 inch or more, and each 0.1 mile segment of each pavement lot shall have a Profile Index not greater than 9 inches/mile when tested with an approved California-type profilograph. If the extent of the pavement in either direction is less than 200 feet, that direction shall be tested by the straightedge method and shall meet requirements specified above.

3.11.4.2 Testing Method

After the final rolling, but not later than 24 hours after placement, test the surface of the pavement in each entire lot in such a manner as to reveal all surface irregularities exceeding the tolerances specified above. Separate testing of individual sublots is not required. If any pavement areas are ground, these areas shall be retested immediately after grinding. Test each lot of the pavement in both a longitudinal and a transverse direction on parallel lines. Set the transverse lines 15 feet or less apart, as directed. The longitudinal lines shall be at the centerline of each paving lane for lanes less than 20 feet wide and at the third points for lanes 20 feet or wider. Also test other areas having obvious deviations. Longitudinal testing lines shall be continuous across all joints.

a. Straightedge Testing. Hold the straightedge in contact with the surface and move it ahead one-half the length of the straightedge for each successive measurement. Determine the amount of surface irregularity by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points.

b. Profilograph Testing. Perform profilograph testing using approved equipment and procedures described in CTM 526. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate "must-grind" bumps and the Profile Index for each 0.1 mile segment of each pavement lot. Grade breaks on parking lots shall be accommodated by breaking the profile segment into shorter sections and repositioning the blanking band on each segment. The "blanking band" shall be 0.2 inches wide and the "bump template" shall span 1 inch with an offset of 0.3 inch. Compute the Profile Index for each pass of the profilograph in each 0.1 mile segment. The Profile Index for each segment shall be the average of the Profile Indices for each pass in each segment. The profilograph shall be operated by a DOT approved operator. Furnish a copy of the reduced tapes to the Government at the end of each day's testing.

-- End of Section --

SECTION 32 92 19

SEEDING
10/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D4972	(2001; R 2007) pH of Soils

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act	(1940; R 1988; R 1998) Federal Seed Act
DOA SSIR 42	(1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

1.2 DEFINITIONS

1.2.1 Stand of Turf

95 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

[Section 31 23 00.00 20 Excavation and Fill], applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wood cellulose fiber mulch

Fertilizer

Include physical characteristics, and recommendations.

SD-06 Test Reports

Topsoil composition tests (reports and recommendations).

SD-07 Certificates

State certification and approval for seed

SD-08 Manufacturer's Instructions

Erosion Control Materials

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 FertilizerDelivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, [fertilizer] [gypsum] [sulphur] [iron] [and] [lime] may be furnished in bulk with certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Seed and Fertilizer Storage

Store in cool, dry locations away from contaminants.

1.5.2.2 Topsoil

Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.3 Handling

Do not drop or dump materials from vehicles.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Seed

Apply seed within twenty four hours after seed bed preparation.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Classification

Provide State-certified seed of the latest season's crop delivered in

original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected.

2.1.2 Planting Dates

Planting Season	Planting Dates
[Season 1]	September and October 15

2.1.3 Seed Purity

Seed Mix shall be a three-way blend of endoohyte enhanced dwarf turf tall fescues meeting the following criteria:

Common Name	Minimum Percent Pure Seed	Minimum Percent Germination and Hard Seed	Maximum Percent Endophyte Enhanced Seed
Seed type 1	98	90	80
Seed type 2	98	90	80
Seed type 3	98	90	80

2.1.4 Seed Mixture by Weight

Planting Season	Variety	Percent (by Weight)
[Season 1]	Seed type 1 Seed type 2 Seed type 3 Inert matter	33 33 33 1

Proportion seed mixtures by weight. Temporary seeding must later be replaced by Season 1 plantings for a permanent stand of grass. The same requirements of turf establishment for Season 1 apply for temporary seeding.

2.2 TOPSOIL

2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph entitled "Composition." When available topsoil shall be existing surface soil stripped and stockpiled on-site in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL].

2.2.2 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with

maximum 3 percent retained on 1/4 inch screen. The pH shall be tested in accordance with ASTM D4972. Topsoil shall be free of sticks, stones, roots, and other debris and objectionable materials.

2.3 FERTILIZER

2.3.1 Granular Fertilizer

2.3.2 Hydroseeding Fertilizer

Controlled release fertilizer, to use with hydroseeding and composed of pills coated with plastic resin to provide a continuous release of nutrients for at least 6 months and containing the following minimum percentages, by weight, of plant food nutrients.

25 percent available nitrogen
5 percent available potassium
3 percent iron]

2.4 MULCH

Mulch shall be free from noxious weeds, mold, and other deleterious materials.

2.4.1 Straw

Stalks from oats, wheat, rye, barley, or rice. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Straw shall contain no fertile seed.

2.4.2 Wood Cellulose Fiber Mulch

Use recovered materials of either paper-based (100 percent) or wood-based (100 percent) hydraulic mulch. Processed to contain no growth or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of materials application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 5.5 to 8.2. Use with hydraulic application of grass seed and fertilizer.

2.5 WATER

Source of water shall be approved by Contracting Officer and of suitable quality for irrigation, containing no elements toxic to plant life.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 EXTENT OF WORK

Provide soil preparation (including soil conditioners as required), fertilizing, seeding, and surface topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.1.1.1 Topsoil

Provide 4 inches of on-site topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer into soil a minimum depth of [4]inches by disking, harrowing, tilling or other method approved by the Contracting Officer. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.1.1.2 [Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site and shall meet applicable state requirements. For bidding purposes only apply at rates for the following:

[Hydroseeding Fertilizer [no more than 200 pounds combined solids shall be added to and mixed with each 100 gallons of water.

]3.2 SEEDING

3.2.1 Seed Application Seasons and Conditions

Immediately before seeding, restore soil to proper grade. Do not seed when ground is muddy or in an unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the above seeding dates or conditions, submit a written request to the Contracting Officer stating the special conditions and proposed variance. Apply seed within twenty four hours after seedbed preparation. Sow seed by approved sowing equipment. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing.

3.2.2 Seed Application Method

Seeding method shall be hydroseeding.

Drill seed uniformly to average depth of [1/2] inch.

3.2.2.1 [Hydroseeding

First, mix water and fiber. Wood cellulose fiber, paper fiber, or recycled paper shall be applied as part of the hydroseeding operation. Fiber shall be added at a maximum of 2,000 pounds, dry weight, per acre. Then add and mix seed and fertilizer to produce a homogeneous slurry. Seed shall be mixed to ensure broadcasting at the rate of 350 pounds acre . When hydraulically sprayed on the ground, material shall form a blotter like cover impregnated uniformly with grass seed. Spread with one application with no second application of mulch.

3.2.3 Mulching

3.2.3.1 Hay or Straw Mulch

Hay or straw mulch shall be spread uniformly at the rate of 2000 pounds per acre. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch shall not be bunched or

clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

]3.2.3.2 Non-Asphaltic Tackifier

Hydrophilic colloid shall be applied at the rate recommended by the manufacturer, using hydraulic equipment suitable for thoroughly mixing with water. A uniform mixture shall be applied over the area.

]3.2.4 Watering

Start watering areas seeded as required by temperature and wind conditions. Apply water at a rate sufficient to insure thorough wetting of soil to a depth of [2]inches without run off. During the germination process, seed is to be kept actively growing and not allowed to dry out.

3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

3.4 RESTORATION

Restore to original condition existing turf areas which have been damaged during turf installation operations at the Contractor's expense. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

-- End of Section --

SECTION 33 31 01

PIPING REHABILITATION, CURED-IN-PLACE
01/14

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

A. These Specifications cover all work necessary to furnish and install, the Cured-in-Place Pipe (CIPP). The Contractor shall provide all materials, labor, equipment, and services necessary for traffic control, bypass pumping and/or diversion of stormwater flows, cleaning and television inspection of sewers to be lined, liner installation, reconnection of service connections, all quality controls, provide samples for performance of required material tests, final television inspection, testing of lined pipe system and warranty work, all as specified herein.

B. The product furnished shall be a complete CIPP system including all materials, applicable equipment and installation procedures.

C. The CIPP shall be continuous and jointless from manhole to manhole or access point to access point and shall be free of all defects that will affect the long term life and operation of the pipe.

D. The CIPP shall fit sufficiently tight within the existing pipe so as to not leak at the manholes, at the service connections or through the wall of the installed pipe. If leakage occurs at the manholes or the service connections the Contractor shall seal these areas to stop all leakage using a material compatible with the CIPP as directed by the Contracting Officer at the price bid therefore in the Proposal. If leakage occurs through the wall of the pipe the liner shall be repaired or removed as recommended by the CIPP manufacturer. Final approval of the liner installation will be based on a leak tight pipe.

E. The CIPP shall be designed for a life of 50 years or greater.

F. The installed CIPP shall have a long term corrosion resistance to the typical chemicals found in stormwater.

G. All existing and confirmed active service connections and any other service laterals to be reinstated as directed by the Contracting Officer shall be re-opened robotically or by hand in the case of man-entry size piping, to their original shape and to 95% of their original capacity. All over-cut service connections will be properly repaired to meet the requirements of these specifications.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fabric tube material; G
Raw resin data; G
Flexible membrane materials; G

SD-06 Test Reports

Test Reports; G

SD-08 Manufacturer's Instructions

Manufacturer's recommendations for installing Products specified, including curing methods; G

SD-09 Manufacturer's Field Reports

Factory test reports; G

1.3 PERFORMANCE WORK STATEMENT (PWS)

A. The Contractor shall submit, to the CO, a Performance Work Statement (PWS) at the pre-construction meeting, which clearly defines the CIPP product delivery in conformance with the requirements of these contract documents. Unless otherwise directed by the Owner, the PWS shall at a minimum contain the following:

B. Clearly indicate that the CIPP will conform to the project requirements as outlined in the Description of Work and as delineated in these specifications.

C. Where the scope of work is specifically delineated in the contract documents, a detailed installation plan describing all preparation work, cleaning operations, pre-CCTV inspections, by-pass pumping, traffic control, installation procedure, method of curing, quality control, testing to be performed, final CCTV inspection, warrantees furnished and all else necessary and appropriate for a complete CIPP liner installation. A detailed installation schedule shall be prepared, submitted and conform to the requirements of this contract.

D. A description of the CIPP materials to be furnished for the project. Materials shall be fully detailed in the submittals and conform to these.

E. A statement of the Contractors experience. The Contractor shall have a minimum of three (3) years of continuous experience installing CIPP liners in pipe of a similar size, length and configuration as contained in this contract. A minimum of 100,000 linear feet of shop wet-out liner installation is required and minimum of 6 onsite wet-out installations are required as applicable to this contract. The lead personnel including the superintendent, the foreman and the lead crew personnel for the CCTV inspection, resin wet-out, the CIPP liner installation, liner curing and the robotic service reconnections must have a minimum of three (3) years of total experience with the CIPP technology proposed for this contract and must have demonstrated competency and experience to perform the work.

F. Engineering design calculations, in accordance with the Appendix of ASTM F-1216, for each length of liner to be installed including the thickness of each proposed CIPP. It will be acceptable for the Contractor to submit a design for the most severe line condition and apply that

design to all of the line sections. These calculations shall be performed and certified by a, qualified, Professional Engineer. All calculations shall include data that conforms to the requirements of these specifications.

G. Proposed manufacturers technology data shall be submitted for all CIPP products and all associated technologies to be furnished.

H. A detailed description of the Contractor's proposed procedures for removal of any existing blockages in the pipeline that may be encountered during the cleaning process.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not store pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written instructions.

PART 2 PRODUCTS

2.1 MATERIALS

A. The CIPP System must meet the chemical resistance requirements of theses contract documents.

B. All materials, shipped to the project site, shall be accompanied by test reports certifying that the material conforms to the ASTM standards listed herein. Materials shall be shipped, stored, and handled in a manner consistent with written recommendations of the CIPP system manufacturer to avoid damage. Damage includes, but is not limited to, gouging, abrasion, flattening, cutting, puncturing, or ultra-violet (UV) degradation. On site storage locations, shall be approved by the COR. All damaged materials shall be promptly removed from the project site at the Contractor's expense and disposed of in accordance with all current applicable agency regulations.

2.2 FABRIC TUBE

A. The fabric tube shall consist of one or more layers of absorbent non-woven felt fabric, felt/fiberglass or fiberglass and meet the requirements of ASTM F 1216, ASTM F 1743, ASTM D 5813 & ASTM F2019. The fabric tube shall be capable of absorbing and carrying resins, constructed to withstand installation pressures and curing temperatures and have sufficient strength to bridge missing pipe segments, and stretch to fit irregular pipe sections. The contractor shall submit certified information from the felt manufacturer on the nominal void volume in the felt fabric that will be filled with resin.

B. The wet-out fabric tube shall have a uniform thickness and excess resin distribution that when compressed at installation pressures will meet or exceed the design thickness after cure.

C. The fabric tube shall be manufactured to a size and length that when installed will tightly fit the internal circumference, meeting applicable

ASTM standards or better, of the original pipe. Allowance shall be made for circumferential stretching during installation. The tube shall be properly sized to the diameter of the existing pipe and the length to be rehabilitated and be able to stretch to fit irregular pipe sections and negotiate bends. The Contractor shall determine the minimum tube length necessary to effectively span the designated run between access ponts. The Contractor shall verify the lengths in the field prior to ordering and prior to impregnation of the tube with resin, to ensure that the tube will have sufficient length to extend the entire length of the run. The Contractor shall also measure the inside diameter of the existing pipelines in the field prior to ordering liner so that the liner can be installed in a tight-fitted condition.

D. The outside and/or inside layer of the fabric tube before inversion/pull-in, as applicable shall be coated with an impermeable, flexible membrane that will contain the resin and facilitate, if applicable, vacuum impregnation and monitoring of the resin saturation during the resin impregnation (wetout) procedure.

E. No material shall be included in the fabric tube that may cause de-lamination in the cured CIPP. No dry or unsaturated layers shall be acceptable upon visual inspection as evident by color contrast between the felt fabric and the activated resin containing a colorant.

F. The wall color of the interior pipe surface of CIPP after installation shall be a light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made. The hue of the color shall be dark enough to distinguish a contrast between the fully resin saturated felt fabric and dry or resin lean areas.

G. Seams in the fabric tube, if applicable, shall meet the requirements of ASTM D5813.

H. The outside of the fabric tube shall be marked every 5 feet with the name of the manufacturer or CIPP system, manufacturing lot and production footage.

I. The minimum length of the fabric tube shall be that deemed necessary by the installer to effectively span the distance from the starting manhole to the terminating manhole or access point, plus that amount required to run-in and run-out for the installation process.

J. The nominal fabric tube wall thickness shall be constructed, as a minimum, to the nearest 0.5 mm, rounded up from the design thickness for that section of installed CIPP. Wall thickness transitions, in 0.5 mm increments or greater as appropriate, may be fabricated into the fabric tube between installation entrance and exit access points. The quantity of resin used in the impregnation shall be sufficient to fill all of the felt voids for the nominal felt thickness.

2.3 RESIN

A. The resin shall be a corrosion resistant polyester or vinyl ester resin and catalyst system that when properly cured within the tube composite meets the requirements of ASTM F1216, ASTM F1743 or F2019, the physical properties herein, and those, which are to be utilized in the design of the CIPP for this project. The resin shall produce CIPP which will comply with or exceed the structural and chemical resistance

requirements of this specification.

2.4 STRUCTURAL REQUIREMENTS

A. The physical properties and characteristics of the finished liner will vary considerably, depending on the types and mixing proportions of the materials used, and the degree of cure executed. It shall be the responsibility of the Contractor to control these variables and to provide a CIPP system which meets or exceeds the minimum properties specified herein: .

Property	Test Method	Cured Composite Per ASTM F1216	Cured Composite Per Design
Flexural Modulus of Elasticity (Short Term)	ASTM D-790	250,000 psi	Contractor Value
Fexural Strength (Short Term)	ASTM D-790	4,500 psi	Contractor Value

B. The CIPP shall be designed as per ASTM standards. The CIPP design shall assume no bonding to the original pipe wall.
C. The design engineer shall set the long term (50 year extrapolated) Creep Retention Factor at 33% of the initial design flexural modulus as determined by ASTM D-790 test method. This value shall be used unless the Contractor submits long term test data (ASTM D2990) to substantiate a higher retention factor.
D. The cured pipe material (CIPP) shall, at a minimum, meet or exceed the structural properties, as listed below.

2.5 MINIMAL PHYSICAL PROPERTIES

A. The required structural CIPP wall thickness shall be based, as a minimum, on the physical properties of the cured composite and per the design of the Professional Engineer (see section 1.4) and in accordance with the Design Equations contained in the appendix of the ASTM standards, and the following design parameters:

Design Safety Factor	2.0
Creep Retention Factor	33%
Ovality	2% or as measured by field inspection
Constrained Soil Modulus	Per AASHTO LRFD Section 12 and AWWA Manual M45
Soil Depth (above the crown)	As specified or indicated on the Plans
Live Load	Highway, railroad or airport as applicable
Soil Load (assumed)	120 lb/cu. Ft.

Design Safety Factor	2.0
Minimum service life	50 years

B. The Contractor shall submit certification of compliance with these specifications, prior to installation of the lining materials. Certified material test results shall be included that confirm that all materials conform to these specifications. Materials not complying with these requirements will be rejected.
C. The design soil modulus may be adjusted based on data determined from detailed project soil testing results as provided by the COR in the contract documents

PART 3 EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

Preparation, cleaning, inspection, drainage by-passing and public notification. The Contractor shall clean the interior of the existing host pipe prior to installation of the CIPP liner. All debris and obstructions, that will affect the installation and the final CIPP product delivery to the Base, shall be removed and disposed of.

B. The CIPP liner shall be constructed of materials and methods, that when installed, shall provide a jointless and continuous structurally sound liner able to withstand all imposed static and dynamic loads on a long-term basis.

C. The Contractor may utilize any of the existing manholes in the project area as installation access points.

D. Cleaning of Pipe Lines -The Contractor shall remove all internal debris from the pipe line that would interfere with the installation and the final product delivery of the CIPP as required in these specifications. Solid debris and deposits shall be removed from the system and disposed of properly by the Contractor. Moving material from manhole section to manhole section shall not be allowed. As applicable the contractor shall either plug or install a flow bypass pumping system to properly clean the pipe lines. Precaution shall be taken, by the Contractor in the use of cleaning equipment to avoid damage to the existing pipe. The repair of any damage, caused by the cleaning equipment, shall be the responsibility of the Contractor. The Contractor will disposal of all debris removed as a direct result of the cleaning operation off site.

E. By-passing Existing Flows -The Contractor shall provide for the flow of existing mainline around the section or sections of pipe designated for CIPP installation. Installation of the liner shall not begin until the Contractor has installed a by-pass system and all pumping facilities have been installed and tested. Once the lining process has begun, existing flows shall be maintained, until the resin/felt tube composite is fully cured, cooled down, full televised and the CIPP ends finished. The Contractor shall coordinate sewer bypass and flow interruptions with the CO at least 2 days in advance. The pump and bypass lines shall be of adequate capacity and size to handle peak flows. The Contractor shall submit a detail of the bypass plan and design to the CO before proceeding

with any CIPP installation. Contractor shall include costs for bypass pumping in the contract price.

F. Contractor shall perform post-cleaning video inspections of the pipelines. The Contractor shall provide the Contracting Officer a copy of the pre-cleaning and post-cleaning video and suitable log, and/or in digital format for review prior to installation of the CIPP and for later reference by the Contracting Officer.

G. Line Obstructions -It shall be the responsibility of the Contractor to clear the line of obstructions that will interfere with the installation and long-term performance of the CIPP. If pre-installation inspection reveals an obstruction, misalignment, broken or collapsed section or sag, or the Contractor shall correct the problem(s) prior to lining.

H. The Contractor shall be responsible for confirming the locations of all branch service connections prior to installing and curing the CIPP.

I. The Contractor shall be allowed use water from an Contracting Officer-approved fire hydrant in the project vicinity.

3.2 INSTALLATION OF LINER

A. The CIPP Liner shall be installed and cured in the host pipe per the manufacturer's specifications as described and submitted in the PWS.

B. CIPP installation shall be in accordance with the applicable ASTM standards with the following modification:

1. The wet-out tube shall be positioned in the pipeline using the method specified by the manufacturer. Care should be exercised not to damage the tube as a result of installation. The tube should be pulled-in or inverted through an existing manhole or approved access point and fully extend to the next designated manhole or termination point.

2. Prior to installation and as recommended by the manufacturer remote temperature gauges or sensors shall be placed inside the host pipe to monitor the temperatures during the cure cycle. Liner and/or host pipe interface temperature shall be monitored and logged during curing of the liner.

3. Curing shall be accomplished by utilizing the appropriate medium in accordance with the manufacturer's recommended cure schedule. The curing source or in and output temperatures shall be monitored and logged during the cure cycles. The manufacturer's recommended cure schedule shall be used for each line segment installed, and the liner wall thickness and the existing ground conditions with regard to temperature, moisture level, and thermal conductivity of soil, per ASTM as applicable, shall be taken into account by the Contractor.

3.3 COOL DOWN

A. The Contractor shall cool the CIPP in accordance with the approved CIPP manufacturer's recommendations as described and outlined in the PWS.

B. Temperatures and curing data shall be monitored and recorded, by the Contractor, throughout the installation process to ensure that each phase of the process is achieved as approved in accordance with the CIPP System manufacturer's recommendations.

3.4 FINISH

A. The installed CIPP shall be continuous over the entire length of a sewer line section and be free from visual defects such as foreign inclusions, dry spots, pinholes, major wrinkles and de-lamination. The lining shall be impervious and free of any leakage from the pipe to the surrounding ground or from the ground to inside the lined pipe.

B. Any defect, which will or could affect the structural integrity or strength of the linings, shall be repaired at the Contractor's expense, in accordance with the procedures submitted under Section1.7 CIPP Repair/Replacement.

C. The beginning and end of the CIPP shall be sealed to the existing host pipe. The sealing material shall be compatible with the pipe end and shall provide a watertight seal.

D. If the wall of the CIPP leaks, it shall be repaired or removed and replaced with a watertight pipe as recommended by the manufacture of the CIPP system.

3.5 MANHOLE CONNECTIONS AND RECONNECTIONS OF EXISTING SERVICES

A. A seal, consisting of a resin mixture or hydrophilic seal compatible with the installed CIPP shall be applied at manhole walls in accordance with the CIPP System manufacturer's recommendations.

B. Existing services shall be internally or externally reconnected unless indicated otherwise in the contract documents.

C. Reconnections of existing services shall be made after the CIPP has been installed, fully cured, and cooled down. Contractor shall verify that all active service connections are reconnected.

D. External reconnections are to be made with a tee fitting in accordance with CIPP System manufacturer's recommendations. Saddle connections shall be seated and sealed to the new CIPP using grout or resin compatible with the CIPP.

E. A CCTV camera and remote cutting tool shall be used for internal reconnections. The machined opening shall be at least 95 percent of the service connection opening and the bottom of both openings must match. The opening shall not be more than 100 percent of the service connection opening. The edges of the opening shall not have pipe fragments or liner fragments, which may obstruct flow or snag debris.

F. In the event that service reconnections result in openings that are greater than 100 percent of the service connection opening, the Contractor shall install a CIPP type repair, sufficiently in size to completely cover the over-cut service connection. No additional compensation will be paid for the repair of over-cut service connections.

G. Pipe material resulting from service tap cutting shall be collected at the next manhole downstream of the pipe rehabilitation operation prior to leaving the site. Pipe material may not be allowed to pass through the system.

3.6 TESTING OF INSTALLED CIPP

A. The physical properties of the installed CIPP shall be verified through field sampling and laboratory testing.

B. The Contractor shall provide testing results to the Contracting Officer from the actual installed CIPP liner. Samples shall be provided, at a minimum from one location per 1,000 linear feet of CIPP installed. The sample shall be cut from a section of cured CIPP that has been inverted or pulled through a like diameter pipe which has been held in place by a suitable heat sink, such as sandbags. All curing, cutting and identification of samples will be witnessed by the Contracting Officer.

C. The laboratory results shall identify the test sample location as referenced to the nearest manhole and station. Final payment for the project shall be withheld pending receipt and approval of the test results. If properties tested do not meet minimum requirements, the CIPP shall be repaired or replaced by the Contractor, at no additional cost to the Contracting Officer.

D. The CIPP system installed shall meet the chemical resistance requirements of ASTM standards. CIPP samples tested shall be of fabric tube and the specific resin proposed for actual construction. It is required that CIPP samples without plastic coating meet these chemical testing requirements.

E. Overall, the hydraulic capacity shall be maintained as large as possible. The installed CIPP shall at a minimum be equal to the full flow capacity of the original pipe before rehabilitation. In those cases where full capacity cannot be achieved after liner installation, the Contractor shall submit a request to waive this requirement, together with the reasons for the waiver request. Calculated capacities may be derived using a commonly accepted roughness coefficient for the existing pipe material taking into consideration its age and condition.

F. The installed CIPP thickness shall be measured for each line section installed. If the CIPP thickness does not meet that specified in the contract and submitted as the approved design by the Contractor then the liner shall be repaired or removed. The liner thickness shall have tolerance of minus 5% plus 10%.

3.7 FINAL ACCEPTANCE

A. All CIPP sample testing and repairs to the installed CIPP as applicable, shall be completed, before final acceptance, meeting the requirements of these specifications and documented in written form.

B. The Contractor shall perform a detailed closed-circuit television inspection in accordance with ASTM standards, in the presence of the Contracting Officer after installation of the CIPP liner and reconnection of the side sewers. A radial view (pan and tilt) TV camera shall be used. The camera shall be panned 360 degrees around the circumference of the pipe and along the wall of the finished pipe at 10 foot intervals. The

finished liner shall be continuous over the entire length of the installation and shall be free of significant visual defects, damage, deflection, holes, leaks and other defects. Unedited digital documentation of the inspection shall be provided to the Contracting Officer within ten (10) working days of the liner installation. The data shall note the inspection date, location of all reconnected side sewers, debris, as well as any other defects in the liner, including, but not limited to, gouges, cracks, bumps, or bulges. If post installation inspection documentation is not submitted within Ten (10) working days of the liner installation, the Contracting Officer may at its discretion suspend any further installation of CIPP until the post-installation documentation is submitted. As a result of this suspension, no additional working days will be added to the contract, nor will any adjustment be made for increase in cost. Immediately prior to conducting the closed circuit television inspection, the Contractor shall thoroughly clean the newly installed liner removing all debris and buildup that may have accumulated.

C. Bypass pumping or plugging from the upstream manhole shall be utilized to minimize water from entering the line during the inspection. In the case of bellies in the line, the pipe shall be cleared of any standing water to provide continuous visibility during the inspection.

D. Where leakage is observed through the wall of the pipe, the contractor shall conduct additional testing including but not limited to air testing and any other testing that will verify the leak-proof integrity of the installed CIPP to the satisfaction of the Contracting Officer.

-- End of Section --

SECTION 33 32 13.13

PACKAGED SEWAGE LIFT STATIONS, WET WELL TYPE
05/09

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 198	(2010) Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	(2008; Errata 2010) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2012) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151/A21.51	(2009) Ductile-Iron Pipe, Centrifugally Cast, for Water

ASME INTERNATIONAL (ASME)

ASME B16.11	(2011) Forged Fittings, Socket-Welding and Threaded
ASME B16.3	(2011) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B31.3	(2012) Process Piping

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2012) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A36/A36M	(2012) Standard Specification for Carbon Structural Steel
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A536	(1984; R 2009) Standard Specification for Ductile Iron Castings
ASTM C443	(2011) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C443M	(2012) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric)
ASTM C478	(2013) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C478M	(2013) Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric)
ASTM C618	(2012a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C989/C989M	(2012a) Standard Specification for Slag Cement for Use in Concrete and Mortars

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Submit Material, Equipment, and Fixtures List in accordance with paragraph entitled, "General Requirements," of this section.

SD-02 Shop Drawings

Submit the following in accordance with paragraph entitled, "Design Requirements," of this section.

Fabrication Drawings; G

Erection/Installation Drawings; G

SD-03 Product Data

Submit manufacturer's catalog data and equipment and performance data for the following items:

Submit Spare Parts Data also for the following in accordance with paragraph entitled, "General Requirements," of this section.

Entrance Covers; G

Sewage Pumps; G

Pump Controls; G

Impellers; G

Bearings; G

Stuffing Boxes; G

Valves; G

Piping; G

Trash Basket; G

Electric Motors; G

SD-05 Design Data

Submit Design Data of Motor/Pumps with Manufacturer part number following:

Speed of Rotation

Bearing Manufacturer

Bearing Style

Bearing Type

Balls/Elements

Pump Impellers

SD-07 Certificates

Submit the following in accordance with paragraph entitled, "General Requirements," of this section.

Listing of Product Installations

Safety Considerations

Recycled Material Content

Submit Certificates for the following items in accordance with the applicable reference standards and description of this section.

Entrance Covers; G

Sewage Pumps; G

Bearings

Pump Controls; G

Impellers

Stuffing Boxes

Valves; G

Piping

Electric Motors; G

SD-08 Manufacturer's Instructions

Submit manufacturer's instructions including special provisions required to install equipment components and system packages for the following items.

Submit operating instructions, including standard operating procedures with startup, shutdown, and emergency operation for Package Lift Station, and the following:

Entrance Covers; G

Sewage Pumps; G

Pump Controls; G

Impellers

Valves; G

Piping

Trash Basket

Electric Motors; G

Submit the following in accordance with paragraph entitled, "General," of this section.

Preventative Maintenance and Inspection

Special Tools

Posted Instructions

SD-10 Operation and Maintenance Data

Submit Operation and Maintenance Manuals for package lift stations including the following in accordance with paragraph entitled, "Operation and Maintenance," of this section.

Equipment Description

Assembly and Installation Procedures

Adjustment and Alignment

Checkout Procedures

Procedures of Operation
Troubleshooting

1.3 DESIGN REQUIREMENTS

Actual range in capacities may vary from that stipulated if the minimum and maximum capacities specified are included.

Provide each station with two pumps with controls capable of operating the pumps either simultaneously or individually, depending on the load conditions.

Furnish and install each lift station as a complete unit with necessary appurtenances factory installed within a pump chamber and a vertical entrance cover, all designed for the following:

Service life - 15 years

Pump capacity 800 gallons per minute (gpm)

Total head - 21.5 feet

Submit Fabrication Drawings after receiving tentative approval of the equipment and the materials list but before installation, Contractor to submit drawings covering necessary or recommended changes to accommodate the equipment offered. Show clearly on the drawings the design of the chamber, with dimensions, types, and thicknesses of materials, and elevation levels with reference to those elevations indicated.

Submit Erection/Installation Drawings for the manhole chamber with the required equipment and accessories that are inclusive. Precast reinforced concrete manhole sections are to conform to ASTM C478M ASTM C478, and AASHTO M 198. Show clearly on the drawings the design of the chamber, with dimensions, types, and thicknesses of materials, and elevation levels with reference to those elevations indicated.

Provide the following motor/pumps design data provided prior to final turnover - RPM of motor; bearings, bearing manufacturer, bearing type, bearing style and number of balls/elements; and number of pump impellers.

1.4 PROTECTION FROM MOVING PARTS

Locate and guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts in accordance with applicable OSHA standards and so that personnel are properly protected from injury.

1.5 NAMEPLATES

Provide the manufacturer's name or trademark on a corrosion-resistant identification plate or cast integrally, on each item of equipment, stamped, or otherwise permanently marked in a conspicuous place. Include on the pump identification plate the pump capacity in gpm, pump head in feet and speed of rotation. Cast on the body of the pump the direction of rotation. Indicate all necessary information to complete identification such as the manufacturer.

1.6 FIELD REPRESENTATIVE

A representative of the lift station manufacturer is to direct the startup of the station and instruct representatives of the Government in startup and operation procedures.

1.7 GENERAL REQUIREMENTS

Submit Material, Equipment, and Fixtures List of all major components including manufacturer's catalog numbers, specification and drawing reference number, warranty information, and fabrication site.

Submit Listing of Product Installations similar to the package lift station the Contractor is installing.

Submit Safety Considerations including information relating to load limits, speed of operation, environmental criteria (temperature and pressure limitations), and personnel hazards and equipment safety precautions for the package lift station.

Submit Spare Parts Data, including a complete list of parts and supplies with current unit prices and source of supply. List parts and supplies that are either normally furnished at no extra cost with the purchase of equipment, or specified to be furnished as a part of the contract, and list additional items recommended by the manufacturer to ensure an efficient operation for a period of one year.

PART 2 PRODUCTS

Verify conformance of materials and equipment for package lift station to the referenced publications or as specified Verify manufacturers regularly engaged in the manufacture of such products.

Submit manufacturer's data indicating percentage of recycled material content in packaged sewage lift stations to verify affirmative procurement compliance.

2.1 CHAMBER

Fabricate Chamber, including base, walls, and cover with 5000 psi precast concrete designed to form an integral unit. Include pipe supports, brackets, and other miscellaneous components of steel conforming to ASTM A36/A36M,ASME B16.3,ASME B16.11 and hot-dipped galvanized in accordance with ASTM A123/A123M.

Fly ash is required as an admixture and is to conform to ASTM C618, Class C or F. Fly ash replacement of cement is not to exceed 20 percent by weight.

Ground granulated blast furnace slag used as an admixture is to conform to ASTM C989/C989M, Grade 120 with between 25 to 50 percent maximum cement replacement by weight. Submit certificate to verify EPA-CPG compliance

Submit Man hole chambers, including base, entrance covers, and similar structural parts.

2.2 ENTRANCE COVERS

1. Access doors shall be fabricated of ¼" thick aluminum plate and frame, constructed using components assembled with spot welded construction.

2. Door to be a single leaf, hinged on the long side, including a dry application frame system imbedded flush into a poured concrete

floor.

3. Provide a slip resistant surface of the top of the door plate, along with zinc plated and chromate sealed hardware including a T'cam lifting system.

4. Special features to include a perimeter seal for odor control and submersible pump guide brackets for 2 submersible pumps, and trach basket guide bracket.

2.3 PUMPS

A. Construction

1. Major parts shall be ASTM Class 30 cast iron coated with an epoxy paint system.

2. Hardware in contact with the pump media shall be at a minimum 300 series stainless steel.

3. Gaskets shall be of the compression square ring type; o-ring seals shall be acceptable only between machined mating surfaces.

4. Shall be a non-clogging design capable of passing a 3-inch diameter sphere.

5. Maximum pump speed is 1,800 revolutions per minute.

6. Shall conform to the requirements of HI M100.

B. Mechanical Seal

1. Tandem enclosed block cartridge seal or independent double mechanical type in a "double imposing" direction.

2. Carbon or silicon carbide for the rotating face and ceramic or silicon carbide for the stationary face, lapped and polished to a tolerance of one light band.

3. Stainless steel hardware and / or cartridge.

4. Elastomers of both inner and outer seals shall be Buna-N rubber or Viton material.

5. Shall be lubricated by oil reservoir.

6. Seals which rely on the pumped media for lubrication are not acceptable.

7. Seal chamber shall have a moisture detection system.

8. Independent tandem seals shall be a standard off the shelf product.

C. Motor

1. Shall be furnished in a water-tight housing.

2. Shall be rated for use in explosion proof for use in wet well pumping applications.

3. The motor shall be secured in place by standard threaded fasteners requiring only simple hand tools for removal; shrink fit motor assemblies shall not be acceptable.

4. The motor housing shall be oil or air filled.

5. Shall be supplied with thermal overload indicator to relay alarm control panel.

6. Oil filled motor housings shall be equipped with a high pressure relief valve for safety considerations.

7. Shall be supplied with minimum 30 foot power and control cables.

8. Motor terminal housing shall be filled with an epoxy seal with a secondary elastomer compression grommet for strain relief.

9. Motor terminal housing shall be filled with an epoxy seal with a secondary elastomer compression grommet for strain relief.

D. Slide Away Coupling

1. Shall automatically connect to discharge piping and allow removal of the pump without personnel entering the wet well.

2. Shall be securely fastened to the floor with stainless steel concrete anchors.

3. Shall utilize dual two inch (2") schedule 40, 304 stainless steel guide rails for each pump and shall extend no less than one foot below the top deck elevation.

4. Shall utilize 304 stainless steel upper brackets.

5. 304 stainless steel intermediate brackets shall be supplied for stations deeper than 15 feet.

6. Mating of moveable bracket to discharge elbow shall be of a linear downward motion.

7. Mating surfaces shall be rated to 100 psi.

8. Mating surfaces shall be of dissimilar materials to prevent corrosion and possible sticking..

9. Moveable fitting shall be constructed of brass to prevent sparking during insertion and removal.

2.4 PUMP CONTROLS

A. Enclosure

1. The described equipment shall be housed in a NEMA 4 enclosure with hinged dead front inner door.

2. The enclosure shall be constructed of 14 gauge 304 stainless steel.

3. The enclosure door shall be provided with a padlocking hasp,

stainless steel hinge and pin.

4. Enclosure shall be securely mounted to a post as shown on details.

5. Interior of enclosure shall be insulated with ¾" insulation and ½" on the outside door.

6. The entire control panel, as manufactured, shall be listed by Underwriters Laboratories, Inc.

B. Lightning Arrestor

1. A lightning arrestor shall be supplied in the control panel and connected to each line of the incoming side of the power input terminals.

2. The arrestor shall protect the control against damage due to lightning strikes on the incoming power line.

C. Phase Failure/Undervoltage Pump Protection

1. A phase-loss/unbalance/reversal and under-voltage protection assembly with adjustable nominal voltage setting shall be provided for each pump.

2. This device shall automatically lockout pump operation if all phases drop below 90% or if one phase drops below 80-83% nominal voltage.

3. This device shall have a nominal ½ second dropout delay and adjustable restoration time delay of up to 1000 seconds.

D. Pump Overtemp

1. Over-temperature protection shall be provided in the control panel to operate in conjunction with the over-temperature switch in each pump motor.

2. The control shall provide pump cutout with auto reset and indicator with manual reset.

3. The device shall be non-volatile and not be affected by power outages.

E. Circuit Breakers and Motor Starters

1. A motor circuit protector shall be supplied for each pump motor.

2. The circuit breaker must have a minimum ampere interrupting capacity of 18,000 symmetrical RMS amps.

3. The circuit breakers shall be operable through the operator's door of the enclosure and shall have a trip rating to allow full voltage starting and continuous operation of the motors.

4. A NEMA rated, full-voltage across-the-line magnetic motor starter with ambient-compensated, quick-trip class 10 overload in each phase to provide over current and running protection shall be provided for each pump motor.

5. The overload trip setting shall be determined by replaceable heater elements.

6. Operator's door mounted overload reset push-buttons shall be provided.

7. A 120 VAC control power transmitter shall be provided for each motor starter control circuit.

Pump	HP
No.1	10 HP
No. 2	10 HP

8. Pump power shall be monitored for ground fault conditions.

9. A control power circuit breaker (10A) shall be provided to provide a disconnect means and short circuit protection for any 120 VAC (or less)devices not powered from motor starter circuits.

F. Pump Control Selector Switches and Run Lights

1. A door mounted, 1-3/16" diameter, "hand-off-auto" 3 position, rotary, oil-tight, heavy-duty type selector switch shall be furnished for each pump.

2. A door mounted, 1" diameter, oil tight pilot light with a "Green" lens shall be provided for each pump to indicate a "pump running" condition.

3. All panel mounted indicators shall be push-to-test pilot lights.

G. Condensation Protective Heater

1. A 100-watt, 120 VAC condensation protective heater and high temperature cutout thermoswitch shall be supplied in the control panel.

2. The heater's surface area for heat dissipation shall be large enough to prevent a skin burn.

H. Pump Running Meters

1. This specification is intended to cover a complete and operational automatic pump control and abnormal level alarm system that responds to the wet well level changes.

2. The pump controller shall receive the wet well level signal from the float switches. Provide pump on/off pump control and alternation with standard ladder logic.

3. The controller shall incorporate the pump control output load relays and a high & low level alarm output load relay with dry contacts wired to terminals rated 10 amps at 240 VAC.

4. The controller shall include level alarm annunciation circuitry with a front accessible alarm silence push-button. Upon power-up, the pump controller shall go through a timing routine which allows the signal to stabilize before any control or alarm outputs are

enabled. After the stabilization period, the control circuits of the Pump controller shall be sequentially enabled on a timed-step arrangement, providing staggered starting of the pumps.

5. The pump controller shall provide automatic pump alternation on successive starts.

6. Provide a minimum of four (4) analog inputs, ten (10) contact/digital inputs and six (6) relay outputs integral to the pump controller module.

7. The controller shall monitor and alarm for each phase of each pump the following:

   a) Voltage
   b) Amperage
   c) kW
   d) kWH
   e) kVA
   f) Power factor
   g) Frequency
   h) CT value

N. Float Switches

1. Each liquid level sensor shall be a 316 stainless steel float switch with a non-mercury snap-action SPDT switch inside having a rating of 4 amp at 250 VAC and flexibly supported by a PVC jacketed cable.

2. The Contractor shall install and wire the float switches as shown on the plan sheets. The float switches shall be mounted to a stainless steel cable/weight kit utilizing all stainless steel float switch mounting hardware for common float switch suspension in the wet well. The cable/weight assembly shall utilize a 25# plastisol coated cast iron weight and be suspended from an eyelet in the top slab of the wet well.

3. Float Switches shall be Anchor Scientific or equal.

O. Float Switch Intrinsic Safety Barrier

1. The high level alarm/pump control module shall connect to the float switch level sensors through a control panel mounted UL Listed intrinsic safety barrier.

2.5 PIPING CONNECTIONS

Provide pump discharge with flanged connections of the proper size for the pump type and capacity. Conform pipe flanges to AWWA C104/A21.4, AWWA C110/A21.10, AWWA C111/A21.11, A21.15, AWWA C151/A21.51,ASTM A53/A53M, ASTM A536 for ductile iron. Piping is to conform to the requirements of ASME B31.3.

2.6 VALVES

Provide horizontal, swing check type check valves. Provide valves that permit a free flow of sewage forward and a positive check against backflow. Provide iron body valves with a removable cover for inspection

and removal of the gate assembly. Provide bronze gate, gate seats, shaft, studs, and nuts.

2.7 PIPING

Terminate discharge lines 5-feet outside the lift station in flanged connections. Terminate inlet pipe 5 feet outside the lift station. External connection joints for pipe using rubber gaskets are to comply with the standards of ASTM C443M ASTM C443.

2.8 ELECTRIC MOTORS

Provide 60-hertz, 3-phase motors.

2.9 TRASH BASKET

Furnish and install an aluminum trash basket system mounted on an aluminum guide rail assembly to remove the basket from at grade elevation. The basket shall be constructed of ¼ inch bars with 2 inch clear opening between bars, solids sides, and 4 solid aluminum wheels with ½ inch diameter stainless steel axles. Guide rail system shall be 3 inch structural aluminum channel with an aluminum basket stop to insure proper basket position.

2.10 PAINT

Treat and paint equipment in accordance with the manufacturer's standard practice for sewage resistance.

PART 3 EXECUTION

3.1 GENERAL

Install lift station as indicated, in accordance with drawings and the manufacturer's instructions.

Submit Preventative Maintenance and Inspection procedure for package lift stations. Include in procedures the frequency of preventative maintenance, inspection, adjustment, lubrication, and cleaning necessary to minimize corrective maintenance and repair.

Submit Special Tools that are required for maintenance and testing of the package lift stations.

Submit a complete package of Posted Instructions, consisting of labels, signs, and templates of operating instructions that are required to be mounted or installed on or near the package lift stations.

3.2 TESTS

Perform Tests, including hydrostatic leak checking of piping and operation of equipment.

3.3 OPERATION AND MAINTENANCE

Submit Operation and Maintenance Manuals for package lift stations, including Equipment Description, Assembly and Installation Procedures, Adjustment and Alignment, Checkout Procedures, Procedures of Operation and Troubleshooting.

-- End of Section --

SECTION 33 34 00

FORCE MAINS AND INVERTED SIPHONS; SEWER
04/08

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2012) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115/A21.15	(2011) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151/A21.51	(2009) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C203	(2008) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C207	(2013) Standard for Steel Pipe Flanges for Waterworks Service-Sizes 100 mm through 3600 mm 4 in. through 144 in.
AWWA C210	(2007) Standard for Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances

ASME INTERNATIONAL (ASME)

ASME B16.1	(2010) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

ASTM INTERNATIONAL (ASTM)

ASTM D2657	(2007) Heat Fusion Joining Polyolefin Pipe and Fittings
ASTM D2774	(2012) Underground Installation of Thermoplastic Pressure Piping
ASTM D3035	(2012; E 2012) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside

Diameter

ASTM D3350 (2012) Polyethylene Plastics Pipe and Fittings Materials

DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)

DIPRA TRD (2006) Thrust Restraint Design for Ductile Iron Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-78 (2011) Cast Iron Plug Valves, Flanged and Threaded Ends

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for quality control and not for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Hydrostatic Tests; G.

1.3 DELIVERY, STORAGE, AND HANDLING

Do not damage pipe, fittings and accessories, and pipe coatings during delivery, handling, and storage.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

Piping for force mains 4 inches in diameter and larger shall be ductile iron, and polythylene (P.E). Piping 4 inches in diameter and larger inside pump stations shall be ductile iron pipe with bolted flange joints. Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Plastic Pipe

2.1.1.1 PE Pipe

ASTM D3350 and ASTM D3035, minimum pressure rating of 100 psi at 73.4 degrees F.

2.1.2 Ductile Iron Pipe

a. Ductile Iron Pipe: AWWA C151/A21.51, working pressure not less than 150 psi, unless otherwise shown or specified.

b. Fittings, Mechanical: AWWA C110/A21.10, rated for 150 psi.

c. Fittings, Push-On: AWWA C110/A21.10 and AWWA C111/A21.11, rated

for 150 psi.

2.2 JOINTS

2.2.1 PE Piping

a. Heat Fusion Joints: ASTM D2657.

b. Flanged Joints: ASME B16.1 or AWWA C207.

c. Mechanical Joints: ASME B16.1.

2.2.2 Ductile Iron Piping

a. Push-on Joints: AWWA C111/A21.11.

b. Mechanical Joints: AWWA C111/A21.11 as modified by AWWA C151/A21.51.

c. Flanged Joints: AWWA C115/A21.15.

2.3 VALVES

2.3.1 Plug Valves

Cast iron valves shall comply with MSS SP-78. Steel plug valves shall comply with API Spec 6D. Values shall be designed for direct bury and shall be provided with value box.

2.4 MISCELLANEOUS MATERIALS

Miscellaneous materials shall comply with the following requirements:

2.4.1 Pipe Coatings and Linings

a. Steel, interior: AWWA C203 or AWWA C210.

b. Steel, exterior, buried: AWWA C203.

c. Steel, exterior, exposed: AWWA C210.

2.4.2 Joint Lubricants

Joint lubricants shall be as recommended by the pipe manufacturer.

2.4.3 Bolts, Nuts and Glands

AWWA C111/A21.11.

2.4.4 Joint Compound

A stiff mixture of graphite and oil or inert filler and oil.

PART 3 EXECUTION

3.1 INSTALLATION

Pipe, pipe fittings, and appurtenances shall be installed at the locations indicated. Excavation, trenching, and backfilling shall be as specified

in Section 31 00 00 EARTHWORK.

3.1.1 Cutting

Pipe shall be cut in a neat manner with mechanical cutters. Wheel cutters shall be used where practicable. Sharp and rough edges shall be ground smooth and loose material removed from the pipe before laying.

3.1.2 Laying

Except where otherwise authorized, pipe shall be laid with bells facing the direction of laying. Before lowering and while suspended, the pipe shall be inspected for defects. Defective material shall be rejected. Pipe shall be laid in compliance with the following:

a. Ductile Iron: AWWA C600.

b. Polyethylene: ASTM D2774.

3.1.3 Jointing

3.1.3.1 Joints for PE Pipe

Heat fusion joints shall comply with the manufacturer's instructions concerning equipment, temperature, melt time, heat coat, and joining time. Flanged and mechanical joints shall be made in compliance with the manufacturer's instructions.

3.1.3.2 Joints for Ductile Iron Pipe

Installation of mechanical and push-on type joints shall comply with AWWA C600 and the manufacturer's instructions. Installation of flanged joints shall comply with manufacturer's instructions.

3.1.4 Installation of Valves

Prior to installation, valves shall be cleaned of all foreign matter and inspected for damage. Valves shall be fully opened and closed to ensure that all parts are properly operating. Valves shall be installed with the stem in the vertical position.

3.1.5 Installation of Valve Boxes

Valve boxes shall be installed over each outside gate valve, unless otherwise indicated. Valve boxes shall be centered over the valve. Fill shall be carefully tamped around each valve box to a distance of 4 feet on all sides or to undisturbed trench face, if less than 4 feet.

3.1.6 Thrust Restraint

Plugs, caps, tees and bends deflecting 11-1/4 degrees or more, either vertically or horizontally, shall be provided with thrust restraint. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be either thrust blocks or, for ductile-iron pipes, restrained joints.

3.1.6.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than: 1 cement,

2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.6.2 Restrained Joints

For ductile iron pipe, restrained joints shall be designed by the Contractor or the pipe manufacturer in accordance with DIPRA TRD.

3.2 HYDROSTATIC TESTS

The pipeline shall be subjected to both a pressure test and a leakage test. The method proposed for disposal of waste water from hydrostatic tests shall be approved by the Contracting Officer. Testing is the responsibility of the Contractor. Perform testing using an approved independent testing laboratory or the Contractor, subject to approval. The test may be witnessed by the Contracting Officer. The Contracting Officer shall be notified at least 7 days in advance of equipment tests. The final test report shall be delivered to the Contracting Officer within 30 days of the test.

3.2.1 Pressure Test

After the pipe has been installed, joints completed, thrust blocks have been in place for at least five days, and the trench has been partially backfilled, leaving the joints exposed for examination, the pipe shall be filled with water to expel all air. The pipeline shall be subjected to a test pressure of 100 psi or 150 percent of the working pressure, whichever is greater, for a period of at least one hour. Each valve shall be opened and closed several times during the test. The exposed pipe, joints, fitting, and valves shall be examined for leaks. Visible leaks shall be stopped or the defective pipe, fitting, joints, or valve shall be replaced.

3.2.2 Leakage Test

The leakage test may be conducted subsequent to or concurrently with the pressure test. The amount of water permitted as leakage for the line shall be placed in a sealed container attached to the supply side of the test pump. No other source of supply will be permitted to be applied to the pump or line under test. The water shall be pumped into the line by the test pump as required to maintain the specified test pressure as described for pressure test for a 2 hour period. Exhaustion of the supply or the inability to maintain the required pressure will be considered test failure. PE pipe can experience diametric expansion and pressure elongation during initial testing. The manufacturer shall be consulted prior to testing for special testing considerations. Allowable leakage shall be determined by the following I-P formula:

$L = NDP/K$ Where:

L = Allowable leakage in gallons per hour.

N = Number of joints in length of pipeline tested.

D = Nominal diameter of the pipe in inches.

P = Square root of the test pressure in psig.

K = 7400 for pipe materials.

At the conclusion of the test, the amount of water remaining in the container shall be measured and the results recorded in the test report.

3.2.3 Retesting

If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted until the results of the tests are within specified allowances, without additional cost to the Government.

-- End of Section --

SECTION 33 40 00

STORM DRAINAGE UTILITIES
02/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A536	(1984; R 2009) Standard Specification for Ductile Iron Castings
ASTM C231/C231M	(2010) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C270	(2012a) Standard Specification for Mortar for Unit Masonry
ASTM C443	(2011) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C478	(2013) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C990	(2009) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM D1557	(2012) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D1751	(2004; R 2008) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2004a; R 2008) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
ASTM D1784	(2011) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

ASTM D2167	(2008) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2321	(2011) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D3034	(2008) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D6938	(2010) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-04 Samples

Pipe for Culverts and Storm Drains

SD-07 Certificates

Frame and Cover for Gratings; G

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 PVC Pipe

2.1.1.1 Type PSM PVC Pipe

ASTM D3034, Type PSM, AWWA C 900, produced from PVC certified by the compounder as meeting the requirements of ASTM D1784, minimum cell class 12454-B.

2.2 MISCELLANEOUS MATERIALS

2.2.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for 03 30 00 CAST-IN-PLACE CONCRETE. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Air content shall be determined in accordance with ASTM C231/C231M. The concrete covering over steel reinforcing shall not be less than 1 inch thick for covers and not less than 1-1/2 inches thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 3 inches between steel and ground. Expansion-joint filler material shall conform to ASTM D1751, or ASTM D1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D1752.

2.2.2 Mortar

Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to ASTM C270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar. Water shall be clean and free of harmful acids, alkalis, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

2.2.3 Precast Reinforced Concrete Manholes

Conform to ASTM C478. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall be smoothed to a uniform surface on both interior and exterior of the structure.

2.2.4 Frame and Cover for Gratings

Submit certification on the ability of frame and cover or gratings to carry aircraft loads. Frame and cover for gratings shall be cast ductile iron, ASTM A536, Grade 65-45-12. Weight, shape, size, and waterway openings for grates shall be as indicated on the plans.

2.2.5 Joints

2.2.5.1 Flexible Watertight, Gasketed Joints

a. Gaskets: Rubber O-ring gaskets shall be 13/16 inch in diameter for pipe diameters of 36 inches or smaller having 1/2 inch deep end corrugation. Rubber O-ring gaskets shall be 1-3/8 inches in diameter for pipe having 1 inch deep end corrugations. O-rings shall meet the requirements of ASTM C990 or ASTM C443.

b. Connecting Bands: Connecting bands shall be of the type, size and sheet thickness of band, and the size of angles, bolts, rods and lugs as indicated or where not indicated as specified in the applicable standards or specifications for the pipe. Exterior rivet heads in the longitudinal seam under the connecting band shall be countersunk or the rivets shall be omitted and the seam welded.

2.2.5.2 PVC Plastic Pipes

Joints shall be elastomeric gasket type in accordance with the specification for the pipe and as recommended by the pipe manufacturer.

2.3 RESILIENT CONNECTORS

Flexible, watertight connectors used for connecting pipe to manholes and inlets shall conform to ASTM C923.

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 31 00 00 EARTHWORK and the requirements specified below.

3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not greater than the outside diameter of the pipe plus 24 inches to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheeting and bracing, where required, shall be placed within the trench width as specified, without any overexcavation. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures will be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

3.1.2 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor while performing shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the Government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Plastic Pipe

Bedding for PVC pipe shall meet the requirements of ASTM D2321. Use Class IB or II material for bedding, haunching, and initial backfill. Use Class I, II, or III material for PP pipe bedding, haunching and initial backfill.

3.3 PLACING PIPE

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to direct sunlight prior to laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed flexible pipe shall not exceed the following limits:

TYPE OF PIPE	MAXIMUM ALLOWABLE DEFLECTION (percent)
Plastic (PVC)	5

3.3.1 PVC Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.4 JOINTING

3.4.1 Flexible Watertight, Gasketed Joints

Installation shall be as recommended by the gasket manufacturer for use of lubricants and cements and other special installation requirements. The gasket shall be placed over one end of a section of pipe for half the width of the gasket. The other half shall be doubled over the end of the same pipe. When the adjoining section of pipe is in place, the doubled-over half of the gasket shall then be rolled over the adjoining section. Any unevenness in overlap shall be corrected so that the gasket covers the end of pipe sections equally. Connecting bands shall be centered over adjoining sections of pipe, and rods or bolts placed in position and nuts tightened. Band Tightening: The band shall be tightened evenly, even tension being kept on the rods or bolts, and the gasket; the gasket shall seat properly in the corrugations.

3.5 DRAINAGE STRUCTURES

3.5.1 Manholes and Inlets

Construction shall be of reinforced concrete or precast reinforced concrete, complete with frames and covers or gratings. Pipe connections to concrete manholes and inlets shall be made with flexible, watertight connectors.

3.6 BACKFILLING

3.6.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, backfill the pipe as specified in SECTION 31 23 00.00 EXCAVATION AND FILL. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation of at least 12 inches above the top of the pipe for flexible pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 6 inches. Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the Contracting Officer, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.6.2 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.6.3 Compaction

3.6.3.1 General Requirements

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.6.3.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which will be determined as specified below.

a. Under airfield pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 95 percent of maximum density for cohesionless

material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.

b. Under unpaved traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.

3.6.4 Determination of Density

Testing is the responsibility of the Contractor and performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D2167 or ASTM D6938. When ASTM D6938 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D6938 results in a wet unit weight of soil and ASTM D6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D6938. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

-- End of Section --

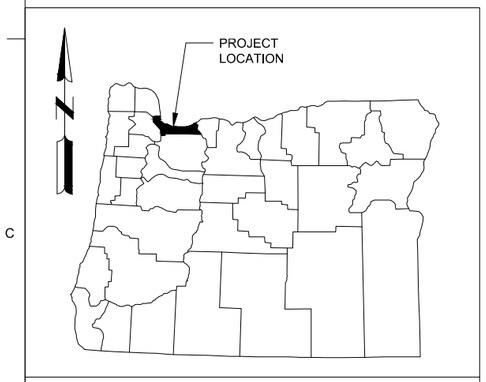
PORTLAND AIR NATIONAL GUARD BASE

REPAIR OUTFALL 008

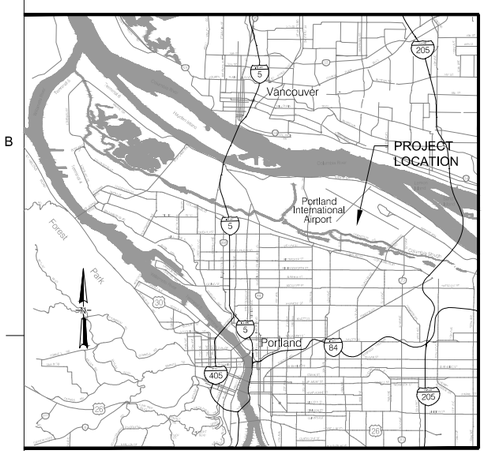
6801 NE CORNFOOT RD, PORTLAND OR 97218

TQKD132008

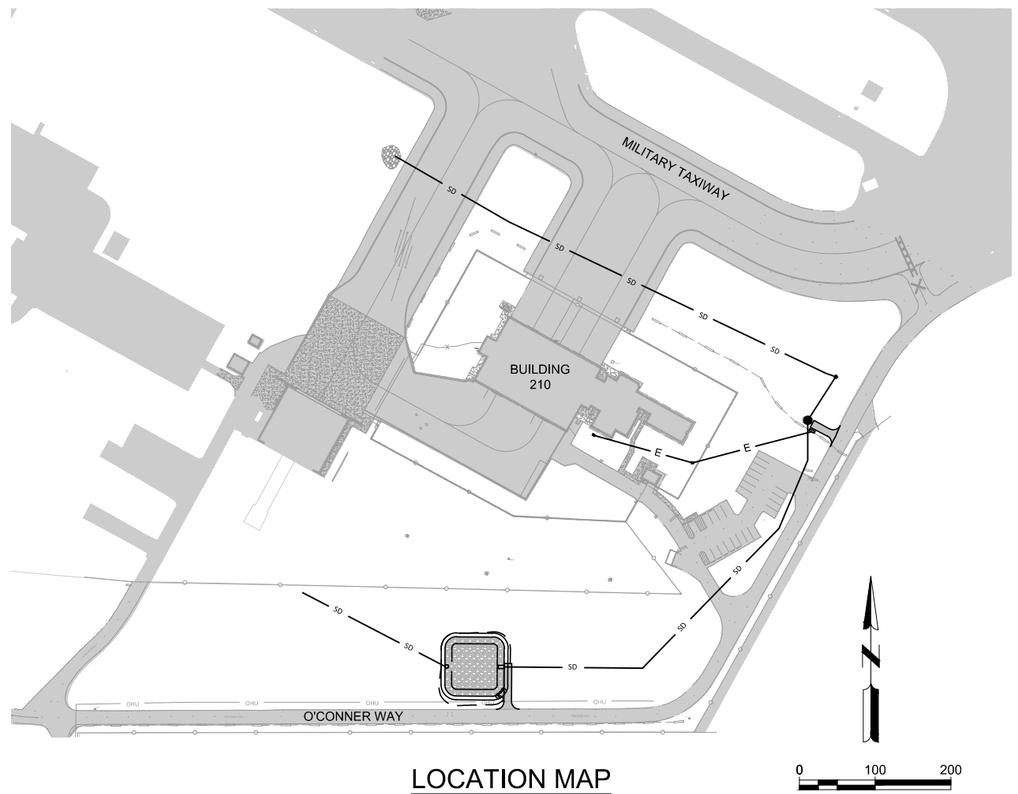
1-30-2014



OREGON MAP



VICINITY MAP
SCALE: N.T.S.



LOCATION MAP
SCALE: 1"=100'

Sheet List Table

Sheet Number	Sheet Title
1	COVER SHEET
2	GENERAL NOTES AND LEGEND SHEET
3	CONSTRUCTION SAFETY AND PHASING PLAN
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5	EROSION CONTROL DETAIL SHEET
6	CIVIL PLAN SHEET
7	CIVIL PLAN SHEET
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9	CIVIL DETAILS SHEET
10	CIVIL DETAILS SHEET
11	ELECTRICAL LAYOUT AND DETAIL SHEET

ATTENTION: Oregon law requires you to follow rules adopted by Oregon Utility Notification Center. Those rules are set forth in OAR 952-001-0010 through OAR 952-001-0090. You may obtain copies of the rules by calling the center. (Note: the telephone number for Oregon Utility Notification Center is 503-232-1987.)

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.
	TYPE B-1 SUBMITTAL	1-31-14					

DESIGNED BY: KDN
DWN BY: APF
CKD BY: JRA
SUBMITTED BY: TU MAH JV
DATE: 1-31-14
SOLICITATION NO.: -
CONTRACT NO.: -
PLOT SCALE: -
PLOT DATE: -
FILE NUMBER: -
SIZE: ANSI D
FILE NAME:

Mead & Hunt
TETRA TECH
Joint Venture

142nd CIVIL ENGINEERING SQUADRON
OREGON AIR NATIONAL GUARD
PORTLAND AIR NATIONAL GUARD BASE
6801 NE CORNFOOT ROAD
PORTLAND, OREGON 97218
REPAIR OUTFALL 008 STORM DRAIN
PROJECT NO.: TQKD 132008
COVER SHEET

SHEET IDENTIFICATION
SHEET 1 OF 11

NOTES:

1. VERTICAL DATUM : NAVD 88
BENCHMARK : 3 INCH BRASS CAP STAMPED "POP NO. 31"
PORT OF PORTLAND CONTROL POINT NO. 31 ELEVATION = 19.20'

2. HORIZONTAL DATUM FOR THIS SURVEY IS PORT OF PORTLAND LOCAL PROJECTION, PER DRAWING NO. 2006-3098, DATED NOVEMBER 2006.

3. THIS MAP DOES NOT REPRESENT A BOUNDARY SURVEY. A TITLE REPORT WAS NOT FURNISHED FOR THE PURPOSE OF THIS SURVEY, EASEMENTS MAY EXIST.

4. UTILITY LOCATIONS SHOWN ARE PER FIELD LOCATED UTILITY PAINT MARKS & REFERENCE MAPS MADE AVAILABLE BY PORTLAND AIR NATIONAL GUARD. ALL UTILITY LOCATIONS SHOULD BE FIELD VERIFIED PRIOR TO CONSTRUCTION.

5. THE CONTRACTOR SHALL NOT BEGIN EXCAVATION UNTIL ALL EXISTING UNDERGROUND FACILITIES WITHIN THE AREA TO BE EXCAVATED HAVE BEEN MARKED IN THE FIELD BY THE CONTRACTOR. THE CONTRACTOR SHALL POTHOLE AND VERIFY THE DEPTH OF ALL UTILITIES WITHIN THE CONSTRUCTION ZONE BEFORE TRENCHING.

6. NO GUARANTEE IS EXPRESSED OR IMPLIED THAT ALL UNDERGROUND OBSTRUCTIONS ARE SHOWN ON THE PLANS. UNDERGROUND OBSTRUCTIONS NOT SHOWN MAY BE ENCOUNTERED. THOSE SHOWN ARE BASED ON THE BEST INFORMATION AVAILABLE AND THE CONTRACTOR IS CAUTIONED THAT THE ENGINEERS, AND THE ORANG ASSUME NO RESPONSIBILITY FOR ANY OBSTRUCTIONS EITHER SHOWN OR NOT SHOWN ON THE PLANS.

7. THE CONTRACTOR SHALL OBTAIN A PERMIT FROM THE APPLICABLE AGENCY PRIOR TO EXCAVATION OF ANY TRENCH OVER FIVE FEET IN DEPTH. A COPY OF THIS PERMIT MUST BE ON FILE IN THE CITY DEPARTMENT OF PUBLIC WORKS OFFICE PRIOR TO THE COMMENCEMENT OF WORK.

PROJECT CONTROL:

STATION	DESCRIPTION	NORTHING	EASTING	ELEVATION
95	5/8" IR W/ RED PLASTIC CAP "KPFF CONTROL"	58559.28	118143.61	20.69'
96	5/8" IR W/ RED PLASTIC CAP "KPFF CONTROL"	58546.98	118928.14	25.25'
97	MAG NAIL W/ WASHER "KPFF CONTROL"	58861.14	119089.88	26.02'
407	5/8" IR W/ RED PLASTIC CAP "KPFF CONTROL"	58757.52	118689.79	34.67'

ABBREVIATIONS

AB	AGGREGATE BASE	G	GAS LINE	RCP	REINFORCED CONCRETE PIPE
AC	ASPHALT CONCRETE	GALV	GALVANIZED	REQ	REQUIRED
ASB	AGGREGATE SUB-BASE	GB	GRADE BREAK	RWA	RUNWAY WORK RESTRICTED AREA
AWG	AMERICAN WIRE GAUGE	GFCI	GROUND FAULT CIRCUIT INTERRUPTER	RWY	RUNWAY
BC	BEGINNING OF CURVE	GS	GROUND SHOT	SD	STORM DRAIN
BLDG	BUILDING	HDPE	HIGH DENSITY POLYETHYLENE	SDMH	STORM DRAIN MANHOLE
BM	BENCHMARK	HORIZ	HORIZONTAL	SG	STRAIGHT GRADE
BVC	BEGIN VERTICAL CURVE	HP	HIGH POINT	SH	SHOULDER
CL	CENTERLINE	IE	INVERT ELEVATION	SS	SANITARY SEWER
CLF	CHAIN LINK FENCE	L	LENGTH	SSMH	SANITARY SEWER MANHOLE
CB	CATCH BASIN	LF	LINEAL FEET	STA	STATION
CMP	CORRUGATED METAL PIPE	MAX	MAXIMUM	STD	STANDARD
CONC	CONCRETE	MH	MANHOLE	T	TELEPHONE LINE
COR	CONTRACTING OFFICE REPRESENTATIVE	MID	MID POINT	TC	TOP OF CURB
DB	DIRECT BURIAL	MIN	MINIMUM	TG	TOP OF GRATE
DI	DROP INLET	MIRL	MEDIUM INTENSITY RUNWAY LIGHTING	T/L	TAXILANE
DIA or Ø	DIAMETER	MITL	MEDIUM INTENSITY TAXIWAY LIGHTING	TOE	TOE OF BANK
(E)	EXISTING	(N)	NEW	TOP	TOP OF BANK
E	ELECTRICAL LINE	OC	ON CENTER	TWY	TAXIWAY
EC	END OF CURVE	ORANG	OREGON AIR NATIONAL GUARD	TYP	TYPICAL
EG	EXISTING GRADE (OR GROUND)	PB	PULLBOX	UD	UNDERDRAIN
EL	ELEVATION	PC	POINT OF CURVATURE	UON	UNLESS OTHERWISE NOTED
EP	EDGE OF PAVEMENT	PCC	PORTLAND CEMENT CONCRETE	USA	UNDERGROUND SERVICE ALERT
EVC	END VERTICAL CURVE	PI	POINT OF INTERSECTION	VERT	VERTICAL
FAA	FEDERAL AVIATION ADMINISTRATION	PORT	PORT OF PORTLAND	VG	VALLEY GUTTER
FBO	FIXED BASE OPERATOR	PT	POINT OF TANGENCY	W	WATER LINE
FF	FINISH FLOOR	PVC	POLY-VINYL CHLORIDE	W/	WITH
FG	FINISH GRADE	PVI	POINT OF VERTICAL INTERSECTION	W/O	WITHOUT
FH	FIRE HYDRANT	R	RADIUS	WV	WATER VALVE
FL	FLOW LINE	R&R	REMOVE & REPLACE	WWM	WELDED WIRE MESH
FR	FLUSHING RISER	RC	RELATIVE COMPACTION		

LEGEND:

	BUILDING OUTLINE WITH DOOR
	CONCRETE SURFACE
	ASPHALT SURFACE
	BUILDING OVERHANG
	EDGE OF ASPHALT
	CYCLONE FENCE W/BARBED WIRE
FO	FIBER OPTIC LINE
E	ELECTRICAL LINE
SD	STORM LINE
W	WATER LINE
G	GAS LINE
T	TELECOMMUNICATION LINE
[T]	TELECOMMUNICATION LINE, PER RECORD
OHU	OVERHEAD UTILITY LINES
	GROUNDING WIRE
	SIGN
B	BOLLARD
RD	ROOF DRAIN
AC	AIR CONDITIONER UNIT
CAM	CAMERA
SDP	SECURITY DETECTION POST
GR	GROUNDING ROD
	ELECTRICAL MANHOLE
JB	ELECTRICAL JUNCTION BOX
ER	ELECTRICAL RISER
ES	ELECTRICAL SWITCH
EVLT	ELECTRICAL VAULT
TRAN	TRANSFORMER
	BLUE RUNWAY LIGHT
	ELEVATED FLOOD LIGHT
	OVERHEAD LIGHT
	POWER POLE
W/UD	WITH UTILITY DROP
G	GAS METER
GV	GAS VALVE
	SANITARY MANHOLE WITH STRUCTURE
	STORM MANHOLE WITH STRUCTURE
	CATCH BASIN
	AREA DRAIN
CO	STORM / SANITARY CLEAN OUT
1 1	SANITARY / STORM STRUCTURE #
	TELECOMMUNICATION MANHOLE
TELVLT	TELECOMMUNICATION VAULT
TR	TELECOMMUNICATION RISER
FOVLT	FIBER OPTIC VAULT
TSL	TRAFFIC SIGNAL LIGHT
WV	WATER VALVE
	FIRE HYDRANT
PIV	POST INDICATOR VALVE
	FIRE DEPARTMENT CONNECT
HB	HOSE BIB
	WATER MANHOLE
MW	MONITORING WELL
	JERSEY BARRIER
TP	TEST PIT
#1	PROJECT CONTROL POINT

MARK	DESCRIPTION	DATE	APPR.
	TYPE B-1 SUBMITTAL	1-31-14	
	TYPE B-1 SUBMITTAL		

DESIGNED BY: KDN | DATE: 1-31-14
DWN BY: APF | CKD BY: JRA | SOLICITATION NO.: -
SUBMITTED BY: TV / MM / JV | CONTRACT NO.: -
PLOT SCALE: | PLOT DATE: | FILE NUMBER: -
SIZE: ANSI D | FILE NAME:

TETRA TECH Mead & Hunt Joint Venture

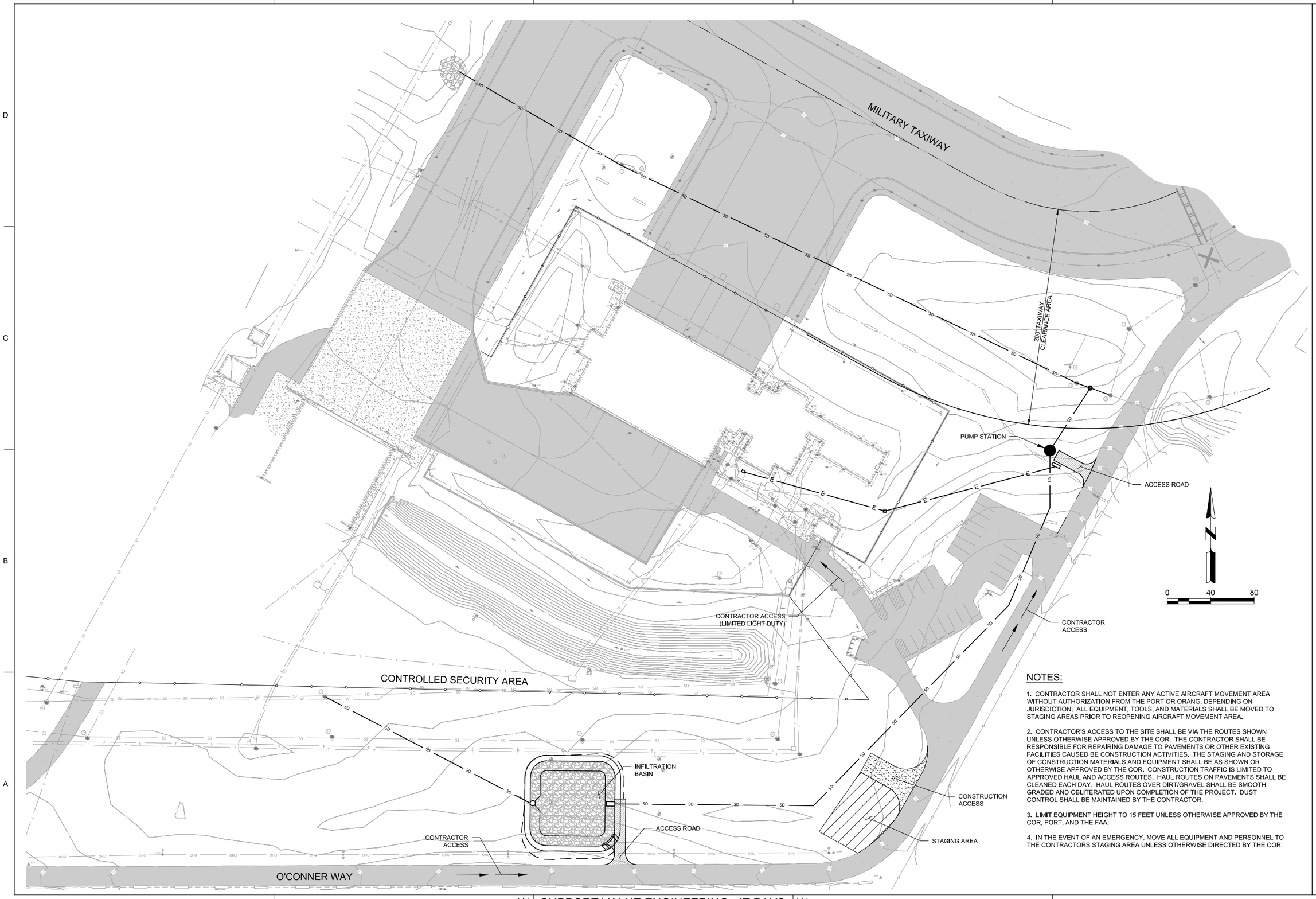
142nd CIVIL ENGINEERING SQUADRON
OREGON AIR NATIONAL GUARD
PORTLAND AIR NATIONAL GUARD BASE
6801 NE CORNFOOT ROAD
PORTLAND, OREGON 97218

REPAIR OUTFALL 008 STORM DRAIN
PROJECT NO.: TOKD 132/08

GENERAL NOTES AND LEGEND SHEET

SHEET IDENTIFICATION

SHEET 2 OF 11



NOTES:

1. CONTRACTOR SHALL NOT ENTER ANY ACTIVE AIRCRAFT MOVEMENT AREA WITHOUT AUTHORIZATION FROM THE PORT OR ORANG, DEPENDING ON JURISDICTION. ALL EQUIPMENT, TOOLS, AND MATERIALS SHALL BE MOVED TO STAGING AREAS PRIOR TO REOPENING AIRCRAFT MOVEMENT AREA.

2. CONTRACTOR'S ACCESS TO THE SITE SHALL BE VIA THE ROUTES SHOWN UNLESS OTHERWISE APPROVED BY THE COR. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING DAMAGE TO PAVEMENTS OR OTHER EXISTING FACILITIES CAUSED BE CONSTRUCTION ACTIVITIES. THE STAGING AND STORAGE OF CONSTRUCTION MATERIALS AND EQUIPMENT SHALL BE AS SHOWN OR OTHERWISE APPROVED BY THE COR. CONSTRUCTION TRAFFIC IS LIMITED TO APPROVED HAUL AND ACCESS ROUTES. HAUL ROUTES ON PAVEMENTS SHALL BE CLEANED EACH DAY. HAUL ROUTES OVER DIRT/GRAVEL SHALL BE SMOOTH GRADED AND OBLITERATED UPON COMPLETION OF THE PROJECT. DUST CONTROL SHALL BE MAINTAINED BY THE CONTRACTOR.

3. LIMIT EQUIPMENT HEIGHT TO 15 FEET UNLESS OTHERWISE APPROVED BY THE COR, PORT, AND THE FAA.

4. IN THE EVENT OF AN EMERGENCY, MOVE ALL EQUIPMENT AND PERSONNEL TO THE CONTRACTORS STAGING AREA UNLESS OTHERWISE DIRECTED BY THE COR.

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.
	TYPE B-1 SUBMITTAL	1-31-14					
	TYPE B-1 SUBMITTAL						

DESIGNED BY: KDN | DATE: 1-31-14
DWN BY: APF | CKD BY: JRA | SOLICITATION NO.: -
SUBMITTED BY: TV-MM-JV | CONTRACT NO.: -
PLOT SCALE: 1 | PLOT DATE: | FILE NUMBER: -
SIZE: ANSI D | FILE NAME:

Mead & Hunt
TETRA TECH
Joint Venture

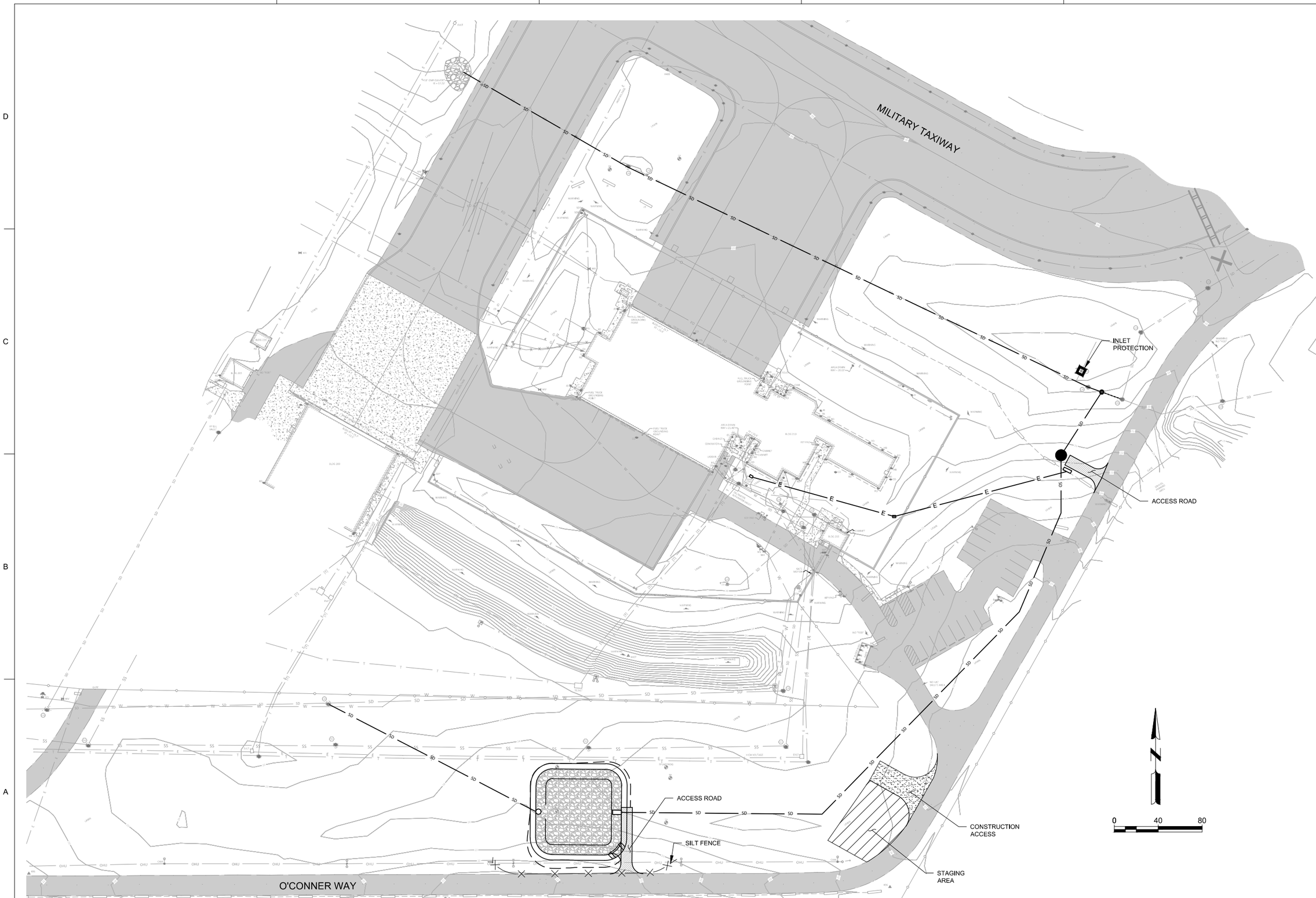
142nd CIVIL ENGINEERING SQUADRON
OREGON AIR NATIONAL GUARD
PORTLAND AIR NATIONAL GUARD BASE
6801 NE CORNFOOT ROAD
PORTLAND, OREGON 97218

REPAIR OUTFALL 008 STORM DRAIN
PROJECT NO.: TOKD 132008

CONSTRUCTION SAFETY AND PHASING PLAN

SHEET IDENTIFICATION

SHEET 3 OF 11



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	TYPE B-1 SUBMITTAL						

DESIGNED BY: KDN
DWN BY: APF
CKD BY: JRA
SUBMITTED BY: T/7 MSgt J.V.
DATE: 1-31-14
SOLICITATION NO.: -
CONTRACT NO.: -
PLOT SCALE: -
PLOT DATE: -
FILE NUMBER: -
SIZE: ANSI D
FILE NAME: -

Mead & Hunt
TETRA TECH
Joint Venture

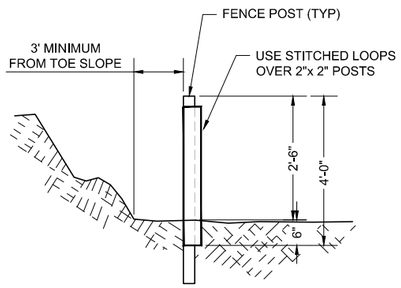
142nd CIVIL ENGINEERING SQUADRON
OREGON AIR NATIONAL GUARD
PORTLAND AIR NATIONAL GUARD BASE
6801 NE CORNFOOT ROAD
PORTLAND, OREGON 97218

REPAIR OUTFALL 008 STORM DRAIN
PROJECT NO.: TOKO 132008

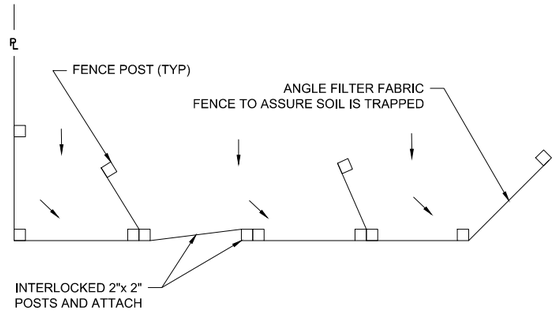
EROSION CONTROL SHEET

SHEET IDENTIFICATION

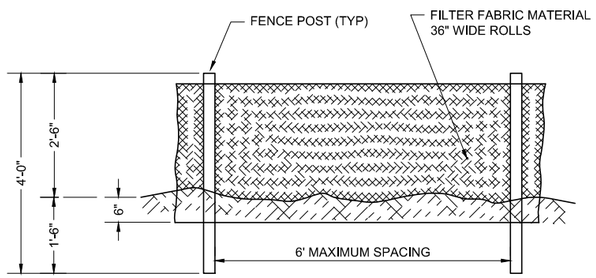
SHEET 4 OF 11



PROFILE



PLAN VIEW



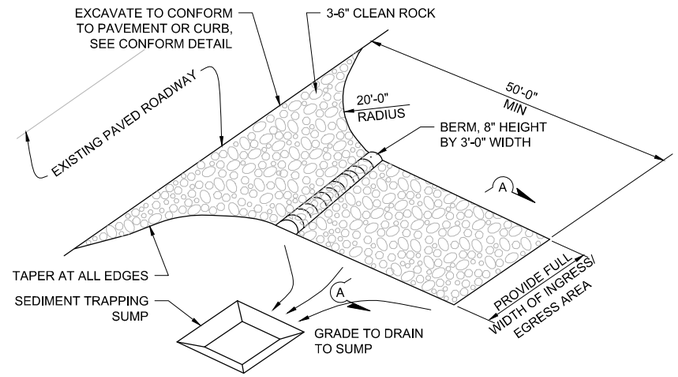
FRONT VIEW

NOTES:

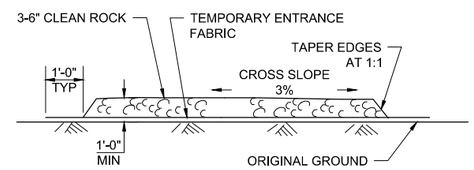
1. BURY BOTTOM OF FILTER FABRIC 6" VERTICALLY BELOW FINISHED GRADE.
2. 2"x 2" FIR, PINE OR STEEL FENCE POSTS.
3. POSTS TO BE INSTALLED ON UPHILL SIDE OF SLOPE.
4. COMPACT BOTH SIDES OF FILTER FABRIC TRENCH.

1 SILT FENCE

NO SCALE



PERSPECTIVE



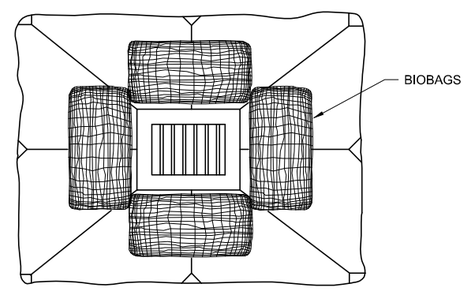
SECTION A-A

NOTES:

1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEAN OUT OF ANY MEASURES USED TO TRAP SEDIMENT.
2. WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY.
3. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.
4. WHERE RUNOFF CONTAINING SEDIMENT LADEN WATER IS LEAVING THE SITE VIA THE CONSTRUCTION ENTRANCE, OTHER MEASURES SHALL BE IMPLEMENTED TO DIVERT RUNOFF THROUGH AN APPROVED FILTERING SYSTEM.

2 CONSTRUCTION ENTRANCE

NO SCALE



AREA DRAIN

NOTES:

1. ADDITIONAL MEASURES MUST BE CONSIDERED DEPENDING ON SOIL TYPES.
2. BIO-FILTER BAGS SHOULD BE STAKED WHERE APPLICABLE USING (2) 1"x2"WOODEN STAKES OR APPROVED EQUAL PER BAG.
3. WHEN USING 30" BIO-BAGS TO PROTECT A CATCH BASIN, 4 BAGS ARE REQUIRED AND THEY SHALL BE OVERLAPPED BY 6".
4. FOR PIPE HEADWALL, PLACE & STAPLE BIOBAGS UPSTREAM ACROSS CHANNEL WIDTH.

3 INLET PROTECTION

NO SCALE

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.
	TYPE B-1 SUBMITTAL	1-31-14					
	TYPE B-1 SUBMITTAL						

DESIGNED BY: KDN
DWN BY: APF
SUBMITTED BY: T1 / M&H JV
DATE: 1-31-14
SOLICITATION NO.: -
CONTRACT NO.: -
PLOT SCALE
PLOT DATE
FILE NUMBER: -
SIZE: ANSI D
FILE NAME:

Mead & Hunt
TETRA TECH
Joint Venture

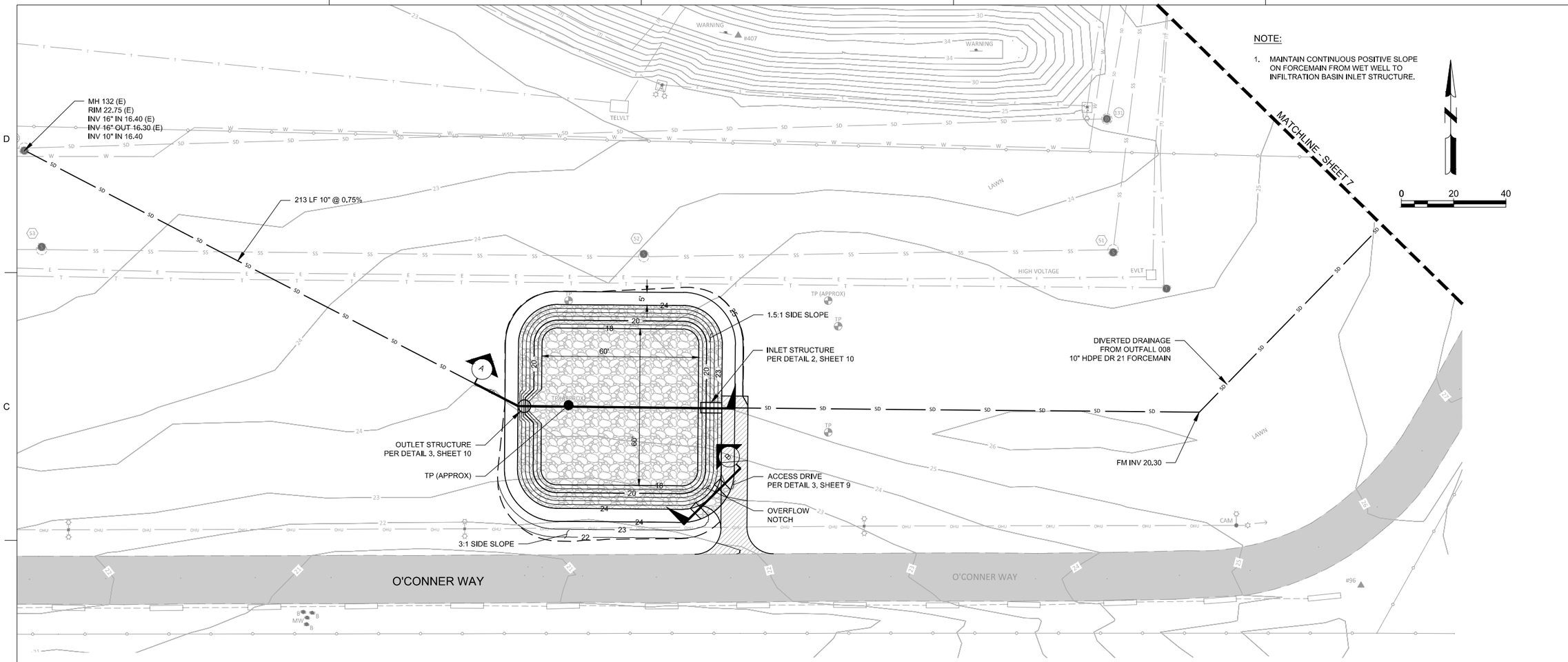
142nd CIVIL ENGINEERING SQUADRON
OREGON AIR NATIONAL GUARD
PORTLAND AIR NATIONAL GUARD BASE
6801 NE CORNFOOT ROAD
PORTLAND, OREGON 97218

REPAIR OUTFALL 008 STORM DRAIN
PROJECT NO.: TOKD 132008

EROSION CONTROL DETAIL SHEET

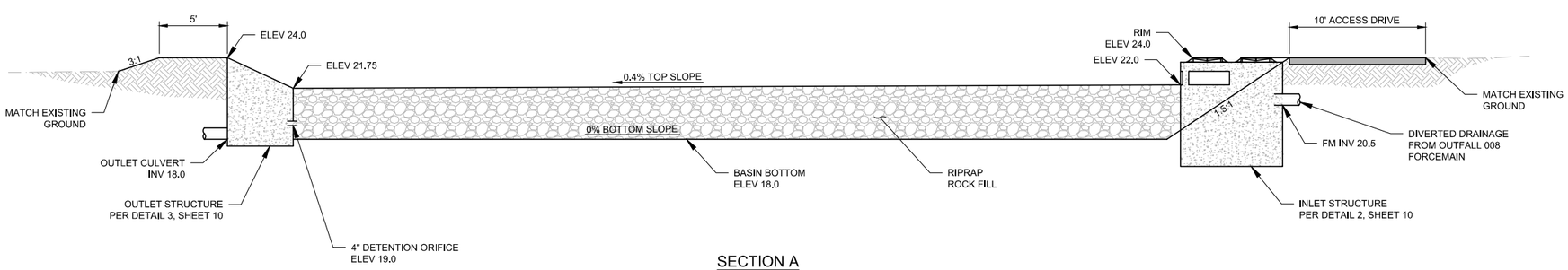
SHEET IDENTIFICATION

SHEET 5 OF 11



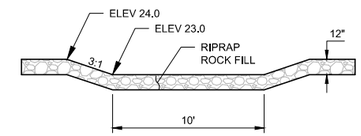
NOTE:

1. MAINTAIN CONTINUOUS POSITIVE SLOPE ON FORCEMAIN FROM WET WELL TO INFILTRATION BASIN INLET STRUCTURE.



SECTION A

SCALE: 1"=5'



OVERFLOW NOTCH

SECTION B

SCALE: 1"=5'

MARK	DESCRIPTION	DATE	APPR.
	TYPE B-1 SUBMITTAL	1-31-14	
	TYPE B-1 SUBMITTAL		

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: KDN
DWN BY: APP
CKD BY: JRA
SUBMITTED BY: TTJV, MJV
DATE: 1-31-14
SOLICITATION NO.: -
CONTRACT NO.: -
PLOT SCALE: -
PLOT DATE: -
FILE NUMBER: -
SIZE: ANSI D
FILE NAME:

Mead & Hunt
TETRA TECH
Joint Venture

142nd CIVIL ENGINEERING SQUADRON
OREGON AIR NATIONAL GUARD
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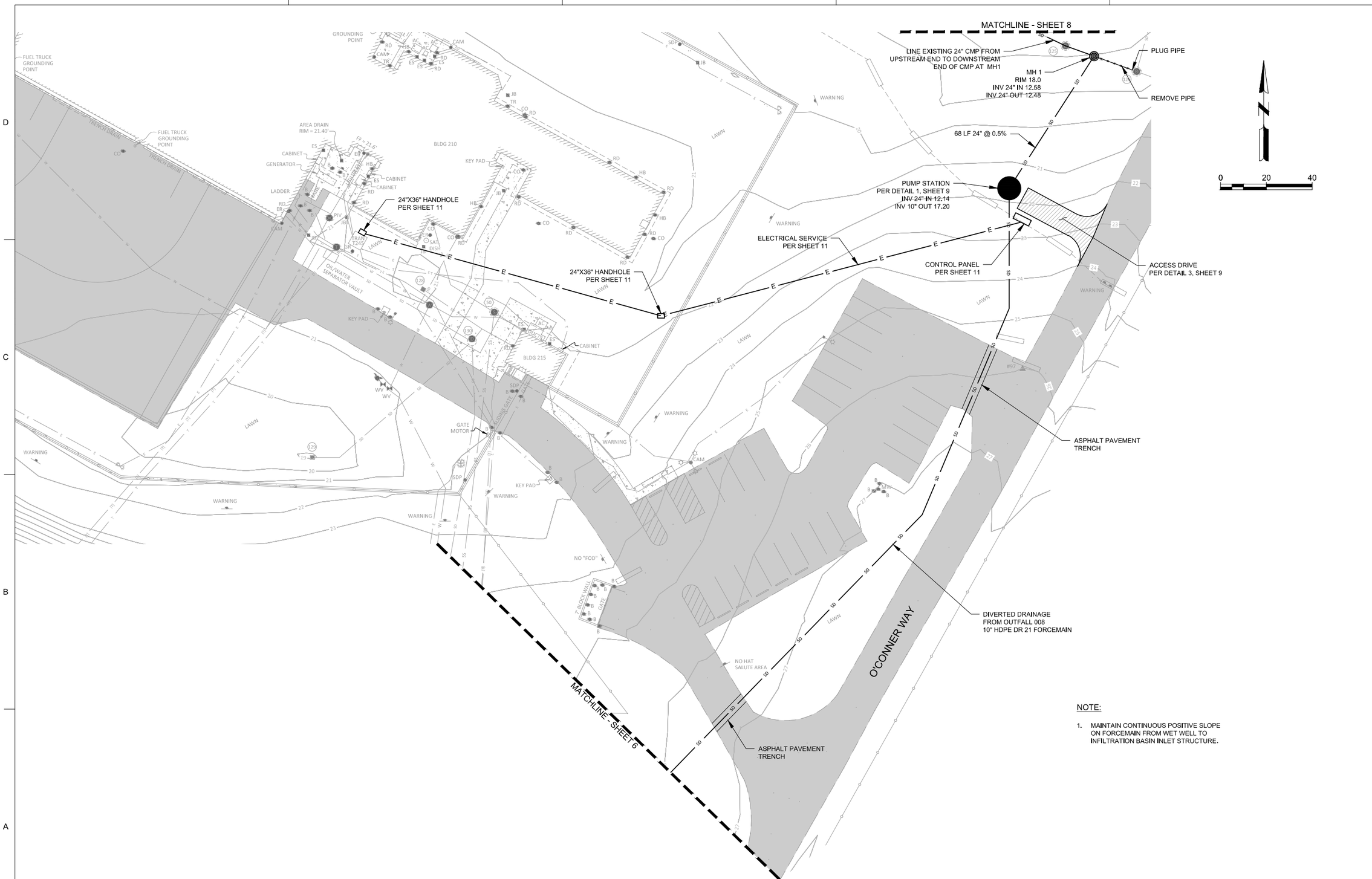
REPAIR OUTFALL 008 STORM DRAIN
PROJECT NO.: TOKD 132008

CIVIL PLAN SHEET

SHEET IDENTIFICATION

SHEET 6 OF 11



NOTE:

1. MAINTAIN CONTINUOUS POSITIVE SLOPE ON FORCEMAIN FROM WET WELL TO INFILTRATION BASIN INLET STRUCTURE.

MARK	DESCRIPTION	DATE	APPR.
	TYPE B-1 SUBMITTAL	1-31-14	

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: KDN
DWN BY: ARP
CKD BY: JRA
SUBMITTED BY: TETRA TECH
DATE: 1-31-14
SOLICITATION NO.: -
CONTRACT NO.: -
PLOT SCALE: -
PLOT DATE: -
FILE NUMBER: -
SIZE: ANSI D
FILE NAME:

Mead & Hunt
TETRA TECH
Joint Venture

142nd CIVIL ENGINEERING SQUADRON
OREGON AIR NATIONAL GUARD
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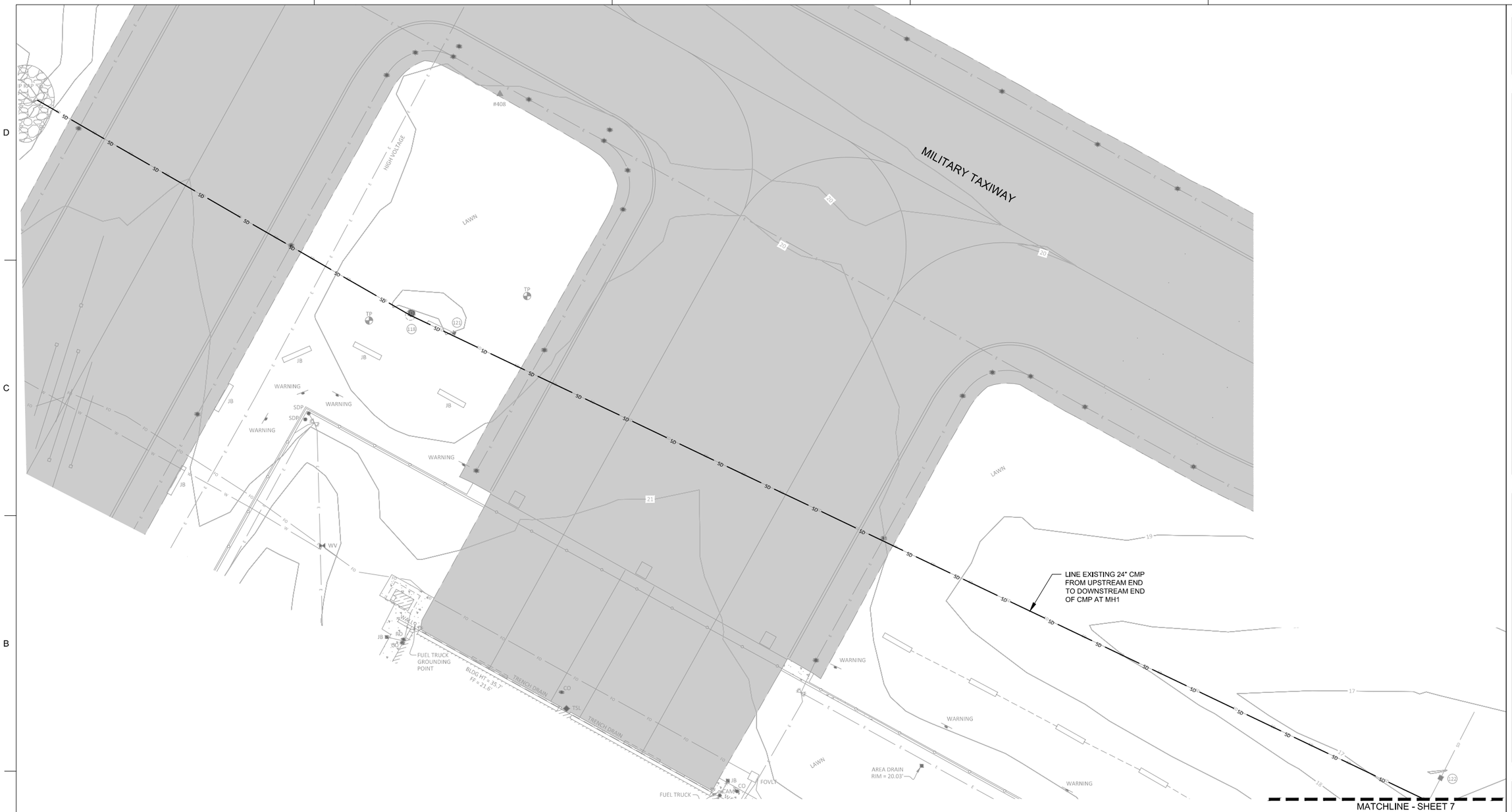
PORTLAND, OREGON 97218

REPAIR OUTFALL 008 STORM DRAIN
PROJECT NO.: TOKD 132008

CIVIL PLAN SHEET

SHEET IDENTIFICATION

SHEET 7 OF 11



MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.
	TYPE B-1 SUBMITTAL	1-31-14					

DESIGNED BY: KDN
DWN BY: AWB
CKD BY: JJRA
SUBMITTED BY: TJ MAHAFFY
DATE: 1-31-14
SOLICITATION NO.: -
CONTRACT NO.: -
FILE NUMBER: -
PLOT SCALE: -
PLOT DATE: -
SIZE: ANSI D
FILE NAME:

Mead & Hunt
TETRA TECH
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142nd CIVIL ENGINEERING SQUADRON
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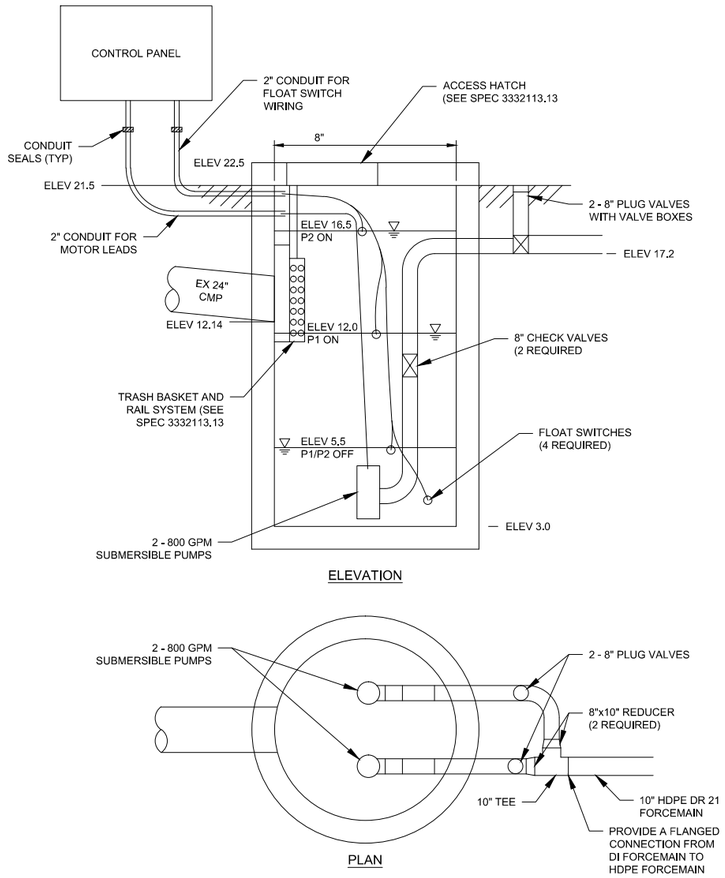
REPAIR OUTFALL 008 STORM DRAIN
PROJECT NO.: TOKD 132008

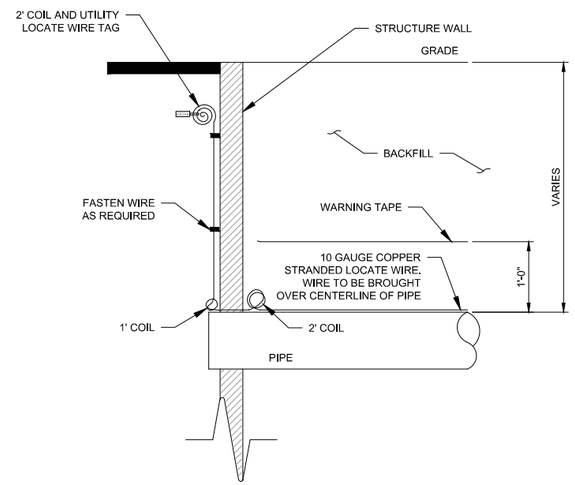
CIVIL PLAN SHEET

SHEET IDENTIFICATION

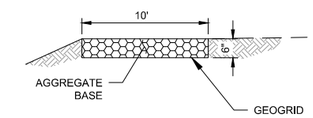
SHEET 8 OF 11



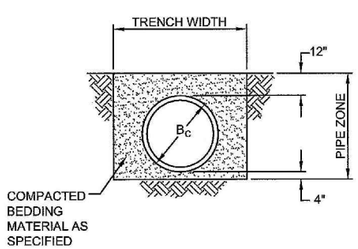
1 PUMP STATION DETAIL
NTS



2 TYPICAL WARNING TAPE
NTS



3 ACCESS ROAD SECTION
NTS



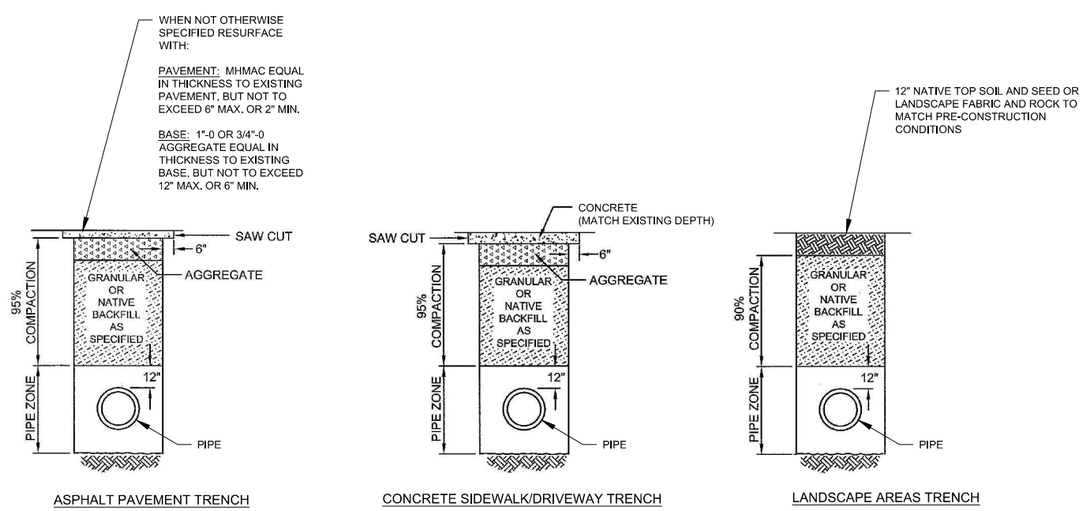
NOTES:

1. TRENCH STABILIZATION:
   WHERE DIRECTED, TRENCH STABILIZATION SHALL BE PLACED PRIOR TO PLACEMENT OF PIPE BEDDING.

LEGEND:

B_c= OUTSIDE DIAMETER

4 PIPE BEDDING
NTS



NOTE:

1. FOR PIPE ZONE BEDDING, BACKFILL AND COMPACTION REQUIREMENTS, SEE DETAIL 4, SHEET 9.

5 PIPE TRENCH
NTS

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.
	TYPE B-1 SUBMITTAL	1-31-14					
	TYPE B-1 SUBMITTAL						

DESIGNED BY: KDN | DWN BY: APF | CKD BY: JRA | SUBMITTED BY: TI: MAI / JV | PLOT SCALE: - | PLOT DATE: - | FILE NUMBER: - | FILE NAME: | SIZE: ANSI D | DATE: 1-31-14 | SOLICITATION NO.: - | CONTRACT NO.: - |

Mead & Hunt
TETRA TECH
Joint Venture

142nd CIVIL ENGINEERING SQUADRON
OREGON AIR NATIONAL GUARD
PORTLAND AIR NATIONAL GUARD BASE
6801 NE CORNFOOT ROAD
PORTLAND, OREGON 97218

REPAIR OUTFALL 008 STORM DRAIN
PROJECT NO.: TOKD 132008

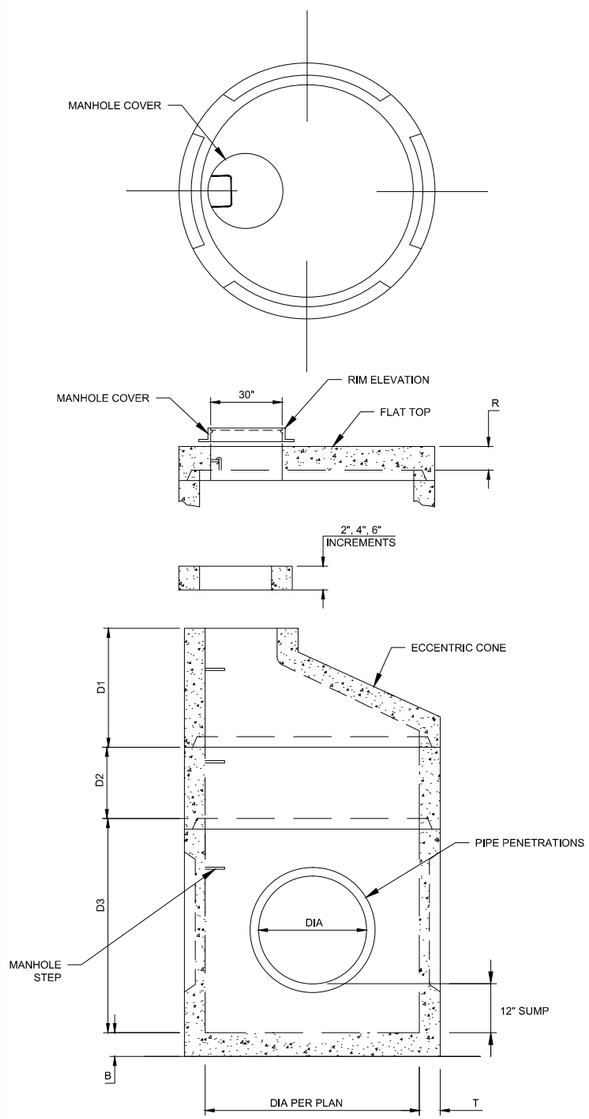
CIVIL DETAILS SHEET

SHEET IDENTIFICATION

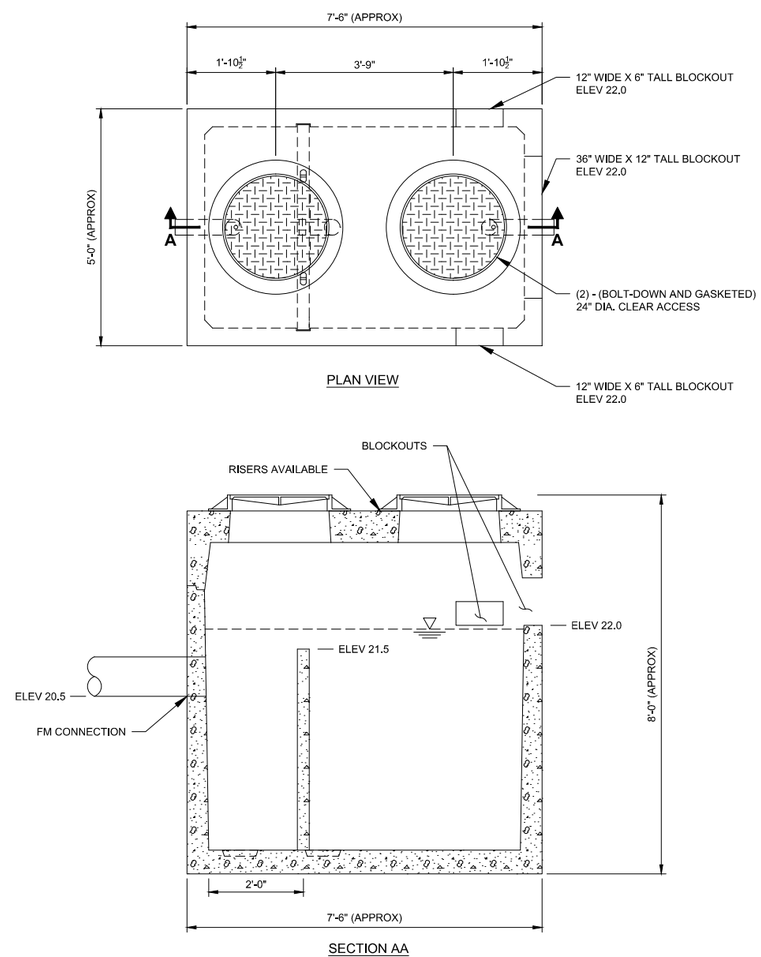
SHEET 9 OF 11

PRECAST STRUCTURE NOTES:

1. CONTRACTOR SHALL SUBMIT PRECAST STRUCTURE SHOP DRAWINGS STAMPED BY A REGISTERED OREGON STRUCTURAL ENGINEER AND SUBMITTED TO THE COR FOR APPROVAL. PRECAST MANHOLE RINGS AND CATCH BASIN STRUCTURES SHALL CONFORM TO ASTM C-478 AND BE DESIGNED TO SUPPORT 30,000 POUND WHEEL LOADS AT 250 POUNDS PER SQUARE INCH TIRE PRESSURE. ALLOWABLE SOIL PRESSURE IS 2,000 PCF.
2. FOR MANHOLES, THICKNESS OF WALLS (T), DEPTH OF ROOF (R), AND BASE SLAB (B), DEPTH OF RISERS (D), AND STEEL REINFORCING SHALL BE SUITABLE TO WITHSTAND 30,000 POUND WHEEL LOADS AT 250 POUNDS PER SQUARE INCH TIRE PRESSURE.
3. PIPE PENETRATIONS SHALL BE CORED OR BLOCKED OUT. CONCRETE STORM PIPE CONNECTIONS SHALL BE SEALED WITH NON-SHRINK GROUT.
4. PROVIDE ROUND RUBBER GASKET MEETING ASTM C-443 BETWEEN MANHOLE SECTION JOINTS.
5. ECCENTRIC CONE PREFERRED. FLAT TOP ACCEPTABLE. FRAMES MAY BE EMBEDDED INTO FLAT TOP IF DEPTH IS NEEDED TO ACCOMMODATE A PRECAST DESIGN.
6. MANHOLE COVER SHALL BE CAST IRON FRAME WITH HEAVY DUTY GRATE. MANHOLE COVER SHALL BE NEENAH FOUNDRY R-2557 (OR APPROVED EQUAL). PROVIDE GRATE OR SOLID LID FOR MANHOLE COVER AS SPECIFIED.
7. FRAMES SHALL BE CAST INTO THE CONCRETE OR BOLTED TO THE CONCRETE STRUCTURE.
8. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS OF THE SELECTED LIDS, FRAMES, AND GRATES FOR COR APPROVAL.
9. PLACE MANHOLES ON 12" OF COMPACTED BEDDING.
10. PRECAST REINFORCEMENT SHALL BE REBAR MEETING ASTM A615 GRADE OR WELDED WIRE MEETING ASTM A497.
11. ALL POURED IN PLACE CONCRETE SHALL HAVE A 28 DAY STRENGTH OF 3000 P.S.I. AND A SLUMP OF 2" TO 4".
12. MAXIMUM VERTICAL DISTANCE BETWEEN MANHOLE STEPS SHALL BE 12".
13. STEPS SHALL CONFORM TO ASTM A615 WITH STEEL REINFORCING BAR ENCAPSULATED WITH INJECTION MOLDED COPOLYMER POLYPROPYLENE WITH SERRATED SURFACES.



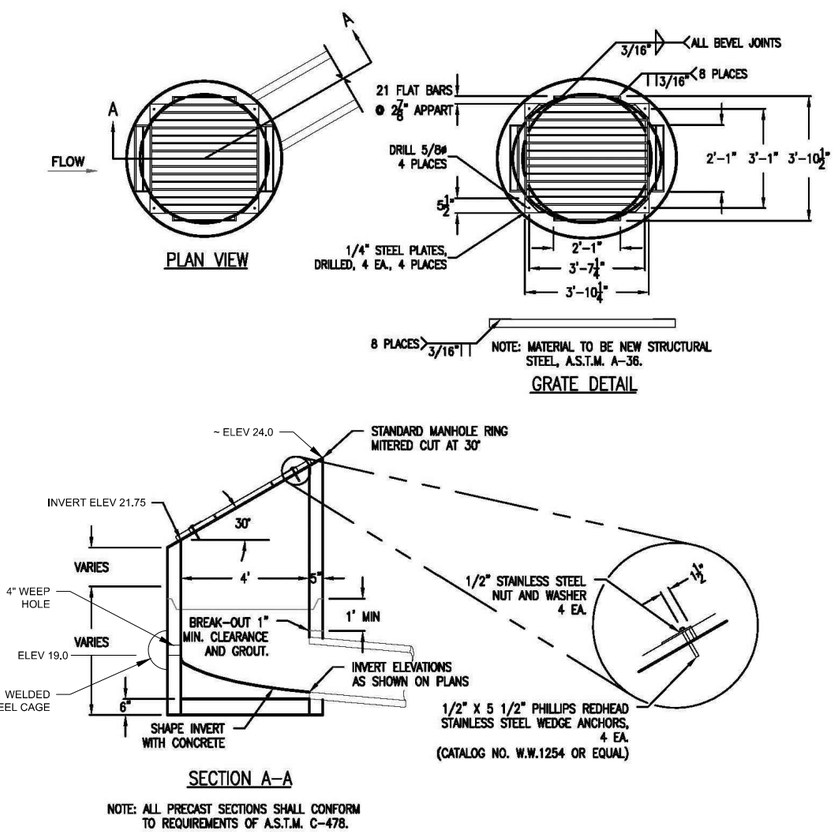
1 PRECAST MANHOLE
NTS



PLAN VIEW

SECTION AA

2 PRECAST INLET STRUCTURE
NTS



3 PRECAST OUTLET STRUCTURE
NTS

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.
	TYPE B-1 SUBMITTAL	1-31-14					
	TYPE B-1 SUBMITTAL						

DESIGNED BY: KCN | DATE: 1-31-14
DWN BY: APF | CKD BY: JRA | SOLICITATION NO.: -
SUBMITTED BY: TI / M&H JV | CONTRACT NO.: -
PLOT SCALE | PLOT DATE: | FILE NUMBER: -
SIZE: ANSI D | FILE NAME:

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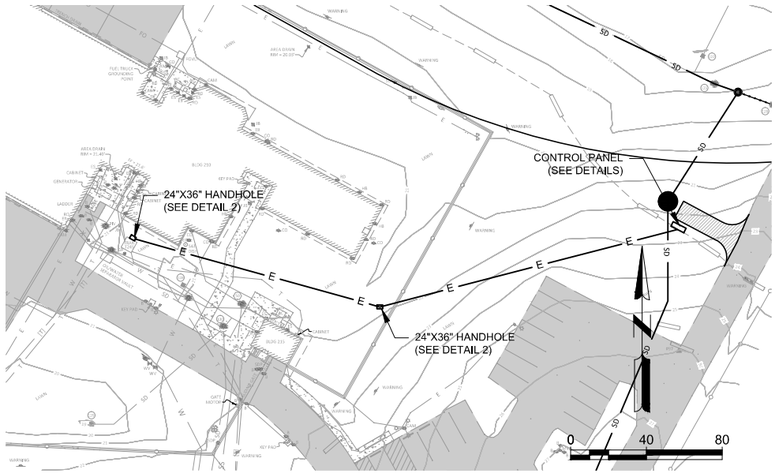
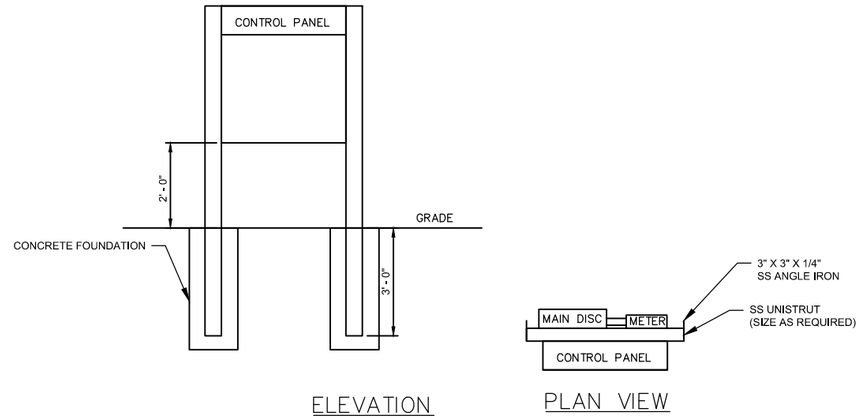
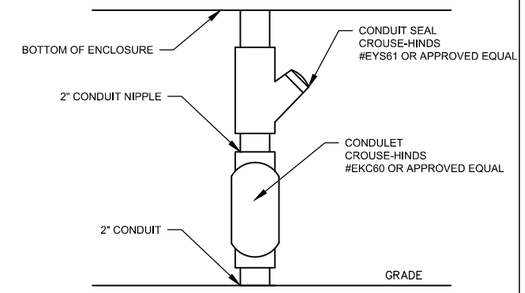
SHEET IDENTIFICATION
SHEET 10 OF 11

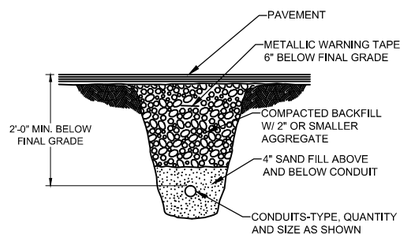




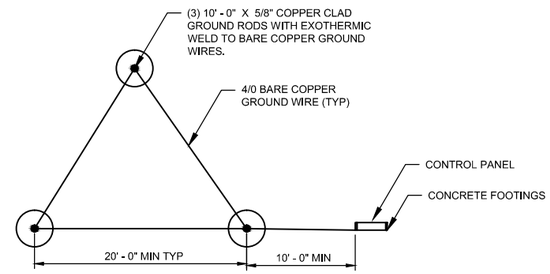
5 SUBMERSIBLE PUMP STATION CONTROL PANEL DETAIL
NO SCALE



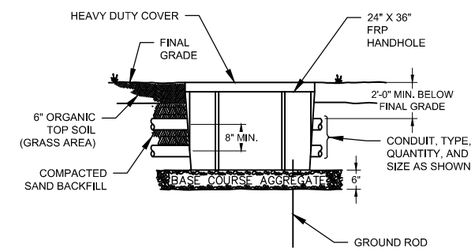
3 WET WELL CONDUIT SEAL DETAIL
NO SCALE



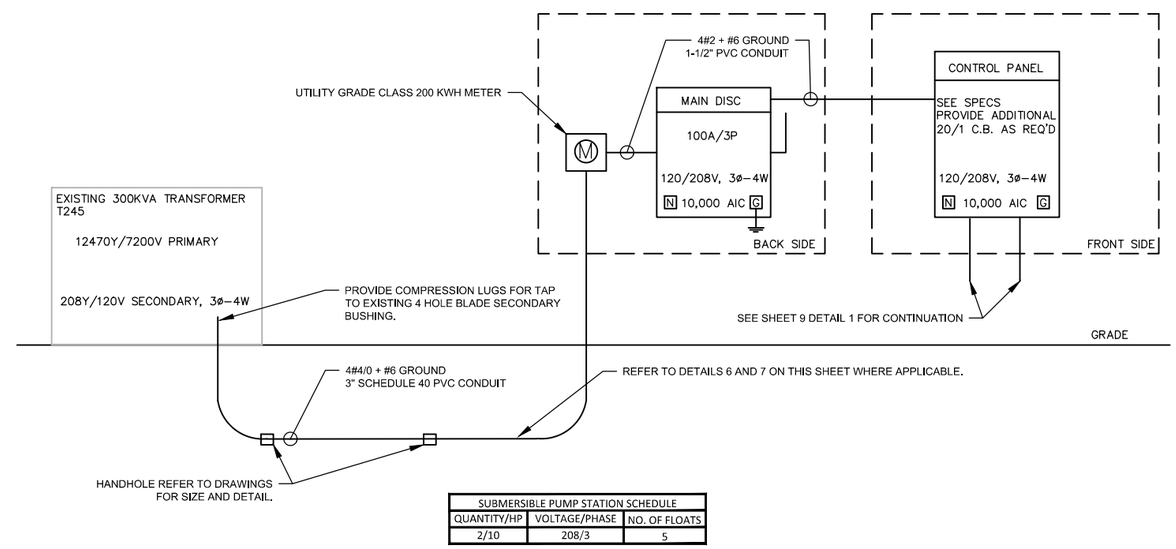
7 UNDERGROUND CONDUIT UNDER PAVEMENT DETAIL (TYP)
NO SCALE



4 ELECTRICAL GROUNDING DETAIL
NO SCALE

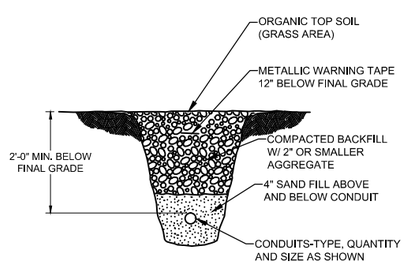


2 ELECTRICAL HANDHOLE DETAIL (TYP)
NO SCALE



SUBMERSIBLE PUMP STATION SCHEDULE		
QUANTITY/HP	VOLTAGE/PHASE	NO. OF FLOATS
2/10	208/3	5

1 POWER RISER DIAGRAM
NO SCALE



6 UNDERGROUND CONDUIT UNDER GRASS DETAIL (TYP)
NO SCALE

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ELECTRICAL LAYOUT AND DETAIL SHEET

SHEET IDENTIFICATION
SHEET 11 OF 11