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FINAL TASK SPECIFIC PLAN FOR THE BUILDING 584 FINAL STATUS SURVEY FORMER  
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TETRA TECH EC INC

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**FINAL  
TASK-SPECIFIC PLAN FOR THE BUILDING 584 FINAL STATUS SURVEY  
FORMER NAVAL AIR STATION BRUNSWICK  
BRUNSWICK, MAINE**

**June 2015**

*Prepared for*



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## ACRONYMS AND ABBREVIATIONS

APP	Accident Prevention Plan
cm <sup>2</sup>	square centimeter
cm/s	centimeters per second
Co-60	Cobalt-60
cpm	counts per minute
Cs-137	Cesium-137
CTO	Contract Task Order
DAC	Derived Air Concentration
DCGL	Derived Concentration Guideline Level
DFW	Definable Features of Work
DoD	Department of Defense
dpm	disintegrations per minute
DQO	Data Quality Objectives
DRMO	Defense Reutilization and Marketing Office
FSS	Final Status Survey
H-3	Tritium
HEPA	high-efficiency particulate arrestance
HRA	Historical Radiological Assessment
LBGR	Lower Boundary of the Gray Region
LLRW	low-level radioactive waste
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
MDCR	Minimum Detectable Count Rate
NASB	Naval Air Station Brunswick
NAVFAC	Naval Facilities Engineering Command
NAVSEA	Naval Sea Systems Command
Ra-226	Radium-226
RASO	Radiological Affairs Support Office
RMA	Radioactive Materials Area
ROCs	radionuclides of concern
RSOR	Radiation Safety Officer Representative
RWP	Radiation Work Permit
SOP	Standard Operating Procedure
Sr-90	Strontium-90
SSHP	Site Safety and Health Plan
SU	Survey Unit
T&D	transportation and disposal
Th-232	Thorium-232
TtEC	Tetra Tech EC, Inc.
TSP	Task-Specific Plan
U-238	Uranium-238

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## **1.0 INTRODUCTION**

Tetra Tech EC, Inc. (TtEC) has prepared this Task-Specific Plan (TSP) for the Final Status Survey (FSS) of Building 584 at the former Naval Air Station Brunswick (NASB), Brunswick, Maine for the United States Department of the Navy, Naval Facilities Engineering Command (NAVFAC), Atlantic under Remedial Action Contract, N62470-13-D-8007, Contract Task Order (CTO) WE09. The survey will be conducted in accordance with the general approach and methodologies provided in the Basewide Radiological Management Plan (TtEC, 2014a) and Standard Operating Procedures (SOPs) provided in Attachment 3 to the Basewide Radiological Management Plan. The surveys will conform to the requirements of the Accident Prevention Plan (APP)/Site Safety and Health Plan (SSHP) (TtEC, 2014b) and the Radiation Protection Plan, Attachment 2 to the Basewide Radiological Management Plan, prepared for the survey program.

No exceptions to the Basewide Radiological Management Plan, SOPs, or APP/SSHP are noted. The survey of this area has been designed as a Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) NUREG-1575 survey (Department of Defense [DoD] et.al, 2000). This methodology will allow the use of survey data to support an FSS.

### **1.1 Site Description and Historical Summary**

Building 584 is a one story metal structure covering 7,200 square feet (180 feet long by 40 feet wide). The building was used as the Defense Reutilization and Marketing Office (DRMO) where the sale or disposal of the Navy's hazardous waste and surplus material was coordinated. The location of Building 584 within NASB is shown on Figure A-1 in Appendix A.

Per review of the Public Works drawings provided in Appendix B, the building, when constructed in 1965 was 3,200 square feet in size (80 feet long by 40 feet wide). The original building had one office with a restroom located at the southwestern end of the building with the furnace directly across from the office along the north wall. Per the revised as-built dated September 10, 1982, an additional 100 feet was added to the eastern portion of the building. As part of the remodel process in 1981/1982, a new partition and doorway were installed down the center of the original building and the furnace was relocated to a new room constructed just east of the partition within the warehouse. The security cage located between the original furnace and the western wall was also removed. The interior walls of the office were replaced with new gypsum wall board, a new access door was installed in the center of the western wall, and new resilient flooring was placed up to the new partition. The restroom located within the office was removed, new restrooms were installed east of the office, and a lunch area established between the restroom and the new partition. A new office and conference room were established along the northern side of the building between the former location of the furnace and the new partition. The remodel of Building 584 is shown on Figure A-2 in Appendix A.

Building 584 is part of the DRMO Area, which consists of this building and the adjacent DRMO Yard. The Yard is south of Building 584 and is currently an approximate 84,000 square foot asphalt paved surface. Building 584 has no current radiological use; however, as the DRMO Area has

been in use since 1965 for storage of equipment to be surplus by the Navy and because commodities that contained radioactive materials may have been turned into DRMO, the DRMO Area is considered a potential for radiological impact (Naval Sea Systems Command [NAVSEA], 2014). Per the Historical Radiological Assessment (HRA), the radionuclides of concern (ROCs) for the DRMO Area are Cobalt-60 (Co-60), Cesium-137 (Cs-137), Radium-226 (Ra-226), Strontium-90 (Sr-90), Thorium-232 (Th-232), Tritium (H-3), and Uranium-238 (U-238) (NAVSEA, 2014). This TSP covers Building 584. A separate TSP has been developed for the DRMO Yard.

In October 2014 an area in the northeast portion of the building was discovered to have Ra-226 contamination on the floor. The area was surveyed and posted as a Radioactive Materials Area (RMA). Figure A-2 of Appendix A shows the location of the radium contamination.

## **2.0 PREPARATION AND SURVEY DESCRIPTION**

Any miscellaneous equipment, trash, and debris present inside Building 584 that will impede performance of the survey activities described herein will be removed and surveyed as materials and equipment in accordance with SOP 003, Release of Materials and Equipment from Radiologically Controlled Areas, before the survey activities begin. Materials identified as having contamination present above the levels specified in Table 2-1 will be packaged for subsequent decontamination or storage and disposal. All waste generated will be controlled as potentially low-level radioactive waste (LLRW) until the FSS is completed and the results are evaluated to determine the release of these materials.

Carpet and vinyl tile were identified in the building during the 2014 field season. The carpet and vinyl tile in the building will be removed to facilitate survey of the original concrete surface. The carpet and tile in the building was laid down using asbestos containing mastic. As a result, the carpet and tile will be removed following the Asbestos Abatement Plan with Activity Hazard Analysis and applicable regulations. Prior to removal of the carpet and tile, a 100% gamma scan survey (health and safety survey) of the carpet and tile will be conducted in accordance with SOP 003. For gamma surveys, the investigation level will be established as the reference area mean plus 3-sigma ( $\sigma$ ), where  $\sigma$  is the standard deviation of the gamma readings in the reference area. If an area of contamination is discovered during the gamma survey the area will be posted as a RMA and the carpet or tile will be removed using radiological controls and stored in a LLRW storage area.

The carpet and tile will be removed by a licensed asbestos abatement contractor, separated and labeled by room, and staged in the building until the FSS has been completed. Segregation by room will allow disposal of a limited amount of waste should survey results indicate one, or a few rooms, exhibit contamination. Carpet and tile will be disposed of based on the FSS survey results of the concrete under the carpet and tile. If any flooring is determined to be LLRW, TtEC will contact the Navy and the Navy's LLRW contractor will provide the necessary containerization and arrange for transportation and disposal (T&D) of the asbestos waste. If the concrete flooring under the tile and carpet is not contaminated, the licensed abatement contractor will arrange T&D of the asbestos waste under TtEC oversight. T&D of the asbestos waste will be conducted by a licensed

transporter and disposed of in accordance with all applicable laws, regulations, and appropriate guidelines.

Any area of elevated activity exceeding the release criteria, as identified by the survey data, will be remediated. This will be accomplished by removing a thin layer of the surface material (concrete flooring). It is important to note that removal of fixed contamination can result in the creation of removable surface contamination. This creates a condition that may generate airborne radioactive material. Removal activities will be controlled in such a manner that potential generation of airborne radioactivity is greatly reduced.

Remediation will be performed in accordance with the requirements of a TtEC Radiation Work Permit (RWP) and SOP 007, Decontamination of Equipment and Tools. Personnel performing the remediation will be required to wear protective coveralls, shoe covers, and gloves. A step-off pad with 55-gallon drums with plastic liners for waste shall be placed at each entry point. To mitigate potential airborne contamination, a water surfactant will be sprayed on the affected areas prior to remediation. Air monitoring will be performed during remediation using a low-volume continuous air monitor in accordance with SOP 009, Air Sampling and Sample Analysis. Air samples will be collected during the entire time that potential airborne causing remediation occurs, and for a minimum of 2 hours, to ensure that the minimum detectable concentration for 10 percent of the derived air concentration (DAC) for Th-232 is met during air sampling. During the course of work, if an airborne concentration exceeds 10 percent of the DAC for one of the ROCs, activities will cease. The affected location will then be posted as an Airborne Radioactivity Area until the source of the airborne concentration is eliminated and levels are confirmed to be below 10 percent of the DAC, or increased controls are established in the applicable RWP.

The progress of remedial actions will be checked periodically by a Radiological Control Technician scanning the area with a Ludlum Model 2360 survey meter with a Ludlum Model 43-68 gas-flow proportional detector and a Ludlum Model 2350 survey meter with a Ludlum Model 44-10 sodium iodide scintillation detector. Large area swipe samples will also be collected throughout the remediation process to ensure removable contamination is contained.

Remediation activities will continue until remedial action status surveys indicate that the residual fixed radioactivity is less than 100 disintegrations per minute dpm/100 square centimeters (cm<sup>2</sup>) alpha and removable radioactivity is less than 20 dpm/100 cm<sup>2</sup> alpha as specified in Table 2-1. When the survey indicates that the remediation is complete, the area will be cleaned with a high-efficiency particulate arrestance (HEPA) vacuum to remove any loose material. Any plastic sheeting used to protect against the spread of contamination to adjacent Survey Units (SU) will be disposed of as LLRW.

### **3.0 FINAL STATUS SURVEY DESCRIPTION**

Prior to initiating the FSS, a scoping survey will be conducted in the building to evaluate the potential for additional contamination. The scoping survey will be conducted in areas based on the evaluation of the RSOR and approved by the Navy prior to survey. The scoping survey will concentrate on areas that have the potential for contamination. A minimum of 25% of the floors

outside the Class 1 and 2 survey units, indicated on Figure A-2, will be surveyed as a Class 3 survey unit based on the professional judgment of the Site RSOR. Specific areas of concern that will be considered by the RSOR include: the sinks, drains and floors in the restrooms and the janitors' closet in the office area; the warehouse around the heavy equipment and storage areas where spills may have occurred; areas of the floor and shelving that show visible signs of spills. If no additional areas of contamination are discovered the scoping survey will be considered a Class 3 FSS of the area of the building not covered by a Class 1 or 2 survey.

The FSS is being performed to assess whether residual activity has been removed to levels below the release criteria defined in Table 2-1. The intent of the Building 584 FSS is to achieve unrestricted release for the building. Based on the results of the scoping survey, the FSS surveys will involve surveying 100 percent of all floor surfaces and up to 2 meters of the wall surfaces in the areas that have elevated activity (Class 1 survey), 50 percent of the floor surfaces around any Class 1 area (Class 2 survey), and 25 percent survey of the remaining floor surfaces within the building (Class 3 survey).

### **3.1 Release Criteria**

The release criterion for building surfaces is 5,000 dpm/100 cm<sup>2</sup> for Co-60, Cs-137, and U-238; 100 dpm/100 cm<sup>2</sup> for Ra-226; and 1,000 dpm/100 cm<sup>2</sup> for Sr-90 and Th-232. The release criteria for H-3 is 5,000 dpm/100 cm<sup>2</sup> total surface activity; however, due to the low energy beta emitted by H-3, detection with surface monitoring is not practical and these samples will be sent off-site for analysis for H-3. The removable contamination release criterion is one-fifth of the total activity criteria. The limits for the specific ROCs to be addressed in Building 584 are provided in Table 2-1.

### **3.2 Reference Area**

Prior to performing the survey activities, material-specific background reference areas will be established for the building survey activities. Non-radiologically impacted building background reference areas with similar physical, chemical, geological, radiological, and biological characteristics as the building materials will be selected. Building 53 will initially be used as the reference area for this survey. If similar material types are not available within Building 53, radiologically non-impacted portions of Buildings 200 and 250 may also be used as reference areas, with the selected areas being reviewed and approved by the Radiological Affairs Support Office (RASO). These buildings appear to have similar building materials as in Building 584. Location of Buildings 53, 200, and 250 are shown on Figure A-1 in Appendix A. Additional reference areas may be chosen by the RSOR, in consultation with the RASO.

### **3.3 Investigation Level**

The investigation level for alpha surveys will be areas identified by two or more alpha counts over the predetermined scan interval followed by two or more alpha counts after pausing over the same area when using a large area detector. Note that in cases where several contiguous areas are identified with two or more alpha counts, single static measurement investigations for each contiguous area may be conducted with RASO concurrence. Additionally, in cases where elevated

alpha counts are identified in many areas as result of elevated background conditions, such as those due to radon progeny, the investigation level may be adjusted with RASO concurrence. However, all areas exceeding two or more alpha counts during the pause will be identified.

When using a handheld detector that has a background count rate of one or fewer counts per minute for alpha surveys, the investigation level will be one or more alpha counts over the predetermined scan interval followed by one or more alpha counts after pausing over the same area. The investigation level for beta surveys will be 4,500 dpm/100 cm<sup>2</sup> beta (at 90 percent of the release criteria). The investigation levels for removable contamination are 20 dpm/100 cm<sup>2</sup> alpha and 200 dpm/100 cm<sup>2</sup> beta. These levels are consistent with the release criteria presented in Table 2-1. For gamma surveys, the investigation level will be established at the SU mean plus 3-sigma ( $\sigma$ ), where  $\sigma$  is the standard deviation of the gamma readings in the reference area.

### 3.4 Survey Units

As a minimum the area containing the elevated readings on the floor and the surrounding area will be surveyed as indicated below. SU 1 is considered to be a Class 1 area that requires 100 percent scan survey of the floor and walls up to approximately 2 meters as recommended in MARSSIM guidance (DoD et al. 2000) Section 8.5.3. SU 2 is considered to be a Class 2 area that requires 50 percent scan survey of the floor and walls up to approximately 2 meters. The remainder of the building will surveyed as a Class 3 SU. Additional Class 1 and Class 2 SUs may added based on the results of the scoping survey. The locations of the proposed SUs within Building 584 are provided on Figure A-2 in Appendix A.

The SU will contain systematic data collection locations. At each systematic sample location, a direct surface measurement and swipe survey samples will be obtained. Swipe surveys will be analyzed in accordance with the SOPs. The number of systematic locations has been determined in Section 3.5 to be a minimum of 16. The number of systematic locations is set at 48 based on RASO guidance. However, additional static locations may be developed based on the results of the scoping survey. Using a random start point, the systematic data collection locations have been laid out in a triangular grid pattern for each SU using the computer process provided by Visual Sample Plan (Matzke et al., 2010). Locations for the systematic data collection are shown on Figure A-3 in Appendix A.

One hundred percent of the swipe samples will be analyzed for removable alpha and beta contamination using a Ludlum 2929 swipe counter or equivalent. Ten percent of the samples will be analyzed for H-3 by liquid scintillation counting.

### 3.5 Establishing the Number of Measurements

Since the contaminants may be present in the background,  $N$  is calculated in the manner specified for the Wilcoxon Rank-Sum test (Equation 5-2 from the Basewide Radiological Management Plan):

**Equation 5-2 from the Basewide Radiological Management Plan (TtEC, 2014a)**

$$N = \left\{ \frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{3(P_r - 0.5)^2} \right\} (1.2)$$

Where:

- $Z_{1-\alpha}$  = Type I decision error level as determined from MARSSIM (1.645)
- $Z_{1-\beta}$  = Type II decision error level as determined from MARSSIM (1.645)
- $P_r$  = random measurement probability, which is based on relative shift discussed in Section 5.5.2.2 from MARSSIM
- 1.2 = factor for over-sampling to account for missing or unusable data

The second term in the equation increases the number of data points by 20 percent. The value of 20 percent was selected to account for a reasonable amount of uncertainty in the parameters used to calculate  $N$  and still allow flexibility to account for some lost or unusable data. While this 20 percent factor assists in meeting all data quality objectives (DQOs) as stated in Table 3-1, it is not required during the data quality assessment to demonstrate compliance with the stated objectives of the statistical tests. The actual number of measurements required for each SU will be calculated for the final report.

$P_r$  in Equation 5-2 from the Basewide Radiological Management Plan is based on the relative shift. The relative shift is equal to  $\Delta/\sigma$ , where  $\Delta$  is equal to [derived concentration guideline level (DCGL) – lower boundary of the gray region (LBGR)], and  $\sigma$  is an estimate of the standard deviation of the measured values in an SU. In cases where the unity rule is used, the DCGL is set at 1.

**3.5.1 LBGR Determination**

The LBGR is the net median concentration of the contaminant in the SU. Since this value is unknown, MARSSIM (DoD et al. 2000) suggests using a value for the LBGR of  $\frac{1}{2}$  DCGL during planning purposes. However, once the median concentration activity in the SU is established (as expressed in a gross alpha and gross beta measurement), this value will be used as a ratio to the lowest DCGL for the decay method to determine the LBGR. Equation 6-7 from the Basewide Radiological Management Plan gives the method used to determine the LBGR:

**Equation 6-7 from the Basewide Radiological Management Plan (TtEC, 2014a)**

$$LBGR = \frac{C_1}{DCGL_1} + \frac{C_2}{DCGL_2} + \frac{C_3}{DCGL_3} + \dots + \frac{C_i}{DCGL_i} \leq 1$$

Where:

- $C_i$  = concentration of radionuclide “i”
- $DCGL_i$  = DCGL of radionuclide “i”

For planning purposes, the LBGR will administratively be set to ½ the DCGL, or at a value of 0.5.

### 3.5.2 Standard Deviation

There is also no estimate of the standard deviation of the contaminant in the survey unit, especially if no contaminant is initially expected. Therefore,  $\sigma$  will be assigned the value of the standard deviation of the adjusted measurement values in the survey unit as shown in Equation 6-8 from the Basewide Radiological Management Plan:

***Equation 6-8 from the Basewide Radiological Management Plan (TtEC, 2014a)***

$$\sigma = \sqrt{\left(\frac{\sigma_{C1}}{DCGL_1}\right)^2 + \left(\frac{\sigma_{C2}}{DCGL_2}\right)^2 + \dots + \left(\frac{\sigma_{Ci}}{DCGL_i}\right)^2}$$

Where:

$\sigma_{Ci}$  = standard deviation from radionuclide “i”  
 $DCGL_i$  = DCGL of radionuclide “i”

For planning purposes, as  $\sigma$  is unknown, per MARSSIM recommendations, it will be estimated as 0.3.

### 3.5.3 Relative Shift

The relative shift is equal to  $\Delta/\sigma$ , where  $\Delta$  is equal to [wide-area DCGL ( $DCGL_w$ ) – LBGR] and  $\sigma$  is an estimate of the standard deviation of the measured values in a survey unit (or for planning purposes from the background area). As stated previously, in cases where the unity rule is used, the DCGL is set to 1. The relative shift can be calculated as shown in Equation 5-1 from the Basewide Radiological Management Plan:

***Equation 5-1 from the Basewide Radiological Management Plan (TtEC, 2014a)***

$$\frac{\Delta}{\sigma} = \frac{DCGL_w - LBGR}{\sigma} = \frac{1 - 0.5}{0.3} = 1.67$$

Using this  $\Delta/\sigma$  value of 1.67, from Table 5.1 of MARSSIM,  $P_r$  was determined to be 0.871014.

### 3.5.4 Unity Rule

As stated in Section 4.3.3 and Appendix I.11 of MARSSIM, the unity rule was used since multiple radionuclides (with different decay methods, with unknown ratios, and with unrelated radionuclide concentrations) were present. As stated in Appendix I.11.1 of MARSSIM, the DCGL is set at 1.0.

Therefore,  $N$  is calculated using Equation 5-2 from the Basewide Radiological Management Plan as follows:

Where:

Type I decision error level (MARSSIM Table 5.2): 1.645

Type II decision error level (MARSSIM Table 5.2): 1.645

Random measurement probability (MARSSIM Table 5.1): 0.871014

$$31.45 = \left\{ \frac{(1.645 + 1.645)^2}{3(0.871014 - 0.5)^2} \right\} (1.2)$$

$N$  for surveys is calculated as a minimum of 31.45 total data collection locations. Rounding this number up to an even number would equate to 16 from each survey unit and 16 from the reference area, for a total of 32. Figure A-3 indicates the approximate systematic measurement locations.

The survey is not initially designated as an FSS, but was designed so that if no radioactive contamination was found above the established release criteria, this survey could be used as an FSS, in accordance with MARSSIM (DoD et al., 2000). To maintain the potential for an FSS, data will be continuously analyzed to determine the relationship between each survey unit and the reference area.

### 3.6 Alpha and Beta Scan Measurements

Scan measurements are performed to identify areas of radioactivity that exceed an action level within the survey unit. Alpha ( $\alpha$ ) scans will be effective for identifying elevated concentrations of Ra-226 and Th-232. Beta ( $\beta$ ) scans will be effective in identifying elevated concentrations of Co-60, Cs-137, Sr-90 and U-238. One hundred percent of accessible surface areas in the Class 1 survey units, fifty percent of accessible surface areas in the Class 2 survey units, and 25 percent of accessible surface areas in the Class 3 survey units will be scanned with the Ludlum Model 43-37, 43-37-1, or 43-68 gas flow proportional detectors or 43-89 scintillation detector coupled to a Ludlum 2360 or 2221 survey meter.

#### 3.6.1 Alpha Scan Measurements

##### 3.6.1.1 *Small Area Detectors (Model 43-68 or equivalent)*

The alpha count rate on various surfaces in Building 584 typically averages less than 2 counts per minute (cpm) with a Model 43-68 detector. When using a 126-cm<sup>2</sup> or smaller detector, scanning for alpha emitters differs in that the expected background response of most alpha detectors is very close to zero. Since the amount of time a contaminated area is under the probe varies, and the background count rate of some alpha instruments is less than 1 cpm, it is not reasonable to determine a fixed minimum detectable concentration (MDC) for scanning. Instead, it is more practical to determine the probability of detecting an area of contamination at a predetermined derived concentration guideline level for given scan rates.

For alpha survey instrumentation with backgrounds ranging from less than 1 to 3 cpm, a single count provides a surveyor sufficient cause to stop and investigate further. Assuming this to be true, the probability of detecting given levels of alpha surface contamination can be calculated by use of Poisson summation statistics.

Given a known scan rate and a surface contamination release limit, the probability of getting a second count from a 300 dpm source is calculated using Equation 7-2 from the Basewide Radiological Management Plan (TtEC, 2014a):

***Equation 7-2 from the Basewide Radiological Management Plan (TtEC, 2014a)***

$$P(n \geq 1) = 1 - e^{-\frac{GE d}{60v}}$$

Where:

- $P(n \geq 1)$  = probability of observing a single count when the desired contamination activity is present = 87.09 percent
- $G$  = contamination activity (dpm) = 300
- $E$  = detector efficiency (4π) = 0.07
- $d$  = width of detector in direction of scan (centimeters) = 11.7
- $v$  = scan speed (centimeters per second [cm/s]) = 2

Once a count is recorded and the desired level of contamination to be detected is present, the surveyor will stop and wait until the probability of getting another count is at least 68 percent. This time interval can be calculated using Equation 7-3 from the Basewide Radiological Management Plan (TtEC, 2014a). However in practice a paused reading will be collected in the same locations for the same observation interval as the scan which in this case would be 5.85 seconds.

***3.6.1.2 Large Area Detectors (Model 43-37, 43-37-1, or equivalent)***

The alpha count rate on various surfaces within Building 584 typically averages less than 10 cpm with a Model 43-37 or 43-37-1 (or equivalent) detector. Therefore, alpha scan speeds will be determined using Equation 7-4 from the Basewide Radiological Management Plan (TtEC, 2014a).

***Equation 7-4 from the Basewide Radiological Management Plan (TtEC, 2014a)***

$$P(n \geq 2) = 1 - \left[ 1 + \frac{(GE + B)t}{60} \right] \left[ e^{-\frac{(GE+B)t}{60}} \right]$$

Where:

- $P(n \geq 2)$  = probability of observing two or more counts during the time interval based on the desired activity level  $t(\%)$
- $t$  = time interval (seconds) = 7.95
- $G$  = contamination activity dpm (dpm) = 300
- $E$  = detector total efficiency ( $4\pi$ ) = 0.07
- $B$  = observed background count rate (cpm) = 5
- $P(n \geq 2)$  = 85.82 percent at a scan speed of 2 cms

The scan surveys will be performed using a Ludlum Model 43-37 (or equivalent) detector. The detector position will be adjusted so that the detector window is approximately one-quarter inch from the building surfaces. Based upon the example calculation provided above, the surveyor will move the detector at a scan speed of 2 cm/s while maintaining audio and visual observation of the instrument response. If the surveyor observes two or more counts during a scan interval (approximately 7.95 seconds), the surveyor will pause the detector movement for 8 seconds to obtain additional data. If no additional counts are noticed during the 7.95-second observation, the surveyor can continue the scan survey. Conversely, if additional counts are noticed during the 7.95-second observation, the surveyor will mark the area for further investigation and subsequent biased measurements using a 126-cm<sup>2</sup> or smaller detector to locate and properly quantify any areas of elevated activity. Note, that the detector efficiency and individual meter background values used in the example calculation above are provided for example purposes. The actual scan speed and observation interval to be used will be determined in the field once meters are available and individual meter backgrounds have been performed. The scan speeds and observation windows will be determined to ensure a minimum probability of detecting 2 counts during the observation period of 68% when activity is present at 300 dpm.

### 3.6.2 Beta Scan Measurements

#### 3.6.2.1 *Large Area Detectors (Model 43-37, 43-37-1, or equivalent)*

The minimum number of net source counts in the scan interval can be arrived at by multiplying the square root of the number of background counts (in the scan interval) by the detectability value associated with the desired performance (as reflected in  $d'$ ) as shown in Equation 7-5 from the Basewide Radiological Management Plan (TtEC, 2014a):

***Equation 7-5 from the Basewide Radiological Management Plan (TtEC, 2014a)***

$$MDCR = d' \sqrt{b_i} \left( \frac{60}{i} \right)$$

Where:

- $d'$  = index of sensitivity ( $\alpha$  and  $\beta$  errors [performance criteria])
- $b_i$  = number of background counts in scan time interval (count)
- $i$  = scan or observation interval (seconds)

For beta scans:

$$\begin{aligned}d' &= 3.28 \\b_i &= 66.25 \text{ counts (based on a background of 500 cpm)} \\i &= 15.90 \text{ cm} / 2 \text{ cm/s} = 7.95 \text{ seconds}\end{aligned}$$

Beta scan Minimum Detectable Count Rate (MDCR) = 201.5 cpm at a scan speed of 2 cm/s.

The scan MDC is determined from the MDCR by applying conversion factors that account for detector and surface characteristics and surveyor efficiency. As discussed below, the MDCR accounts for the background level, performance criteria ( $d'$ ), and observation interval. The observation interval during scanning is the actual time that the detector can respond to the contamination source. This interval depends on the scan speed, detector size in the direction of the scan, and area of elevated activity. The scan MDC for structure surfaces is calculated using Equation 7-6 from the Basewide Radiological Management Plan (TtEC, 2014a):

***Equation 7-6 from the Basewide Radiological Management Plan (TtEC, 2014a)***

$$\text{Scan MDC} = \frac{MDCR}{\sqrt{p} \varepsilon_i \varepsilon_s \frac{W_A}{100 \text{ cm}^2}}$$

Where:

$$\begin{aligned}MDCR &\text{ is discussed above} \\p &= \text{surveyor efficiency factor} \\ \varepsilon_i &= \text{instrument efficiency (count per particle)} \\ \varepsilon_s &= \text{contaminated surface efficiency (particle per disintegration)} \\ W_A &= \text{area of the detector window (cm}^2\text{)}\end{aligned}$$

For beta scans:

$$\begin{aligned}MDCR &= 201.5 \\p &= 0.50 \\ \varepsilon_i &= 0.4084 \\ \varepsilon_s &= 0.25 \\ W_A &= 584\end{aligned}$$

Beta scan MDC = 478dpm/100 cm<sup>2</sup> at a scan speed of 2 cm/s.

Note that alpha and beta readings are collected simultaneously and the alpha scan speeds are the limiting factor when determining the appropriate scan speed. Therefore, the actual scan speeds for beta surveys will be determined based on the methods described in section 3.6.1. The example calculations provided here are based on the example alpha scan speed provided in Section 3.6.1.

### 3.7 Alpha and Beta Static Measurements

Alpha and beta static measurements will be obtained from the locations identified in Appendix A. Additional measurements may be collected if radiation readings exceeding the investigation level are identified while performing the scan surveys. Ludlum Model 43-68 gas-flow proportional detectors or Ludlum Model 43-89 scintillation detectors coupled with Ludlum Model 2221 or 2360 data loggers will be used to perform alpha and beta static measurements. Note that all alpha and beta static measurements exceeding investigation levels should have corresponding notes on the survey sheets annotating the investigative action taken (sample taken, surveyed with different instrument type, etc.).

#### 3.7.1 Alpha Static Measurements

The MDC for alpha measurements is calculated using Equation 7-7 from the Basewide Radiological Management Plan (TtEC, 2014a):

*Equation 7-7 from the Basewide Radiological Management Plan (TtEC, 2014a)*

$$MDC = \frac{3 + 4.65\sqrt{R_B T_B}}{\varepsilon_s \varepsilon_i \frac{W_A}{100} T_B}$$

Where:

- 3 + 4.65 = constant factor provided in MARSSIM
- $R_B$  = background count rate = 1 cpm
- $T_B$  = background count time = 2 minutes
- $\varepsilon_i$  = instrument efficiency = 0.4
- $\varepsilon_s$  = surface efficiency factor = 0.25
- $W_A$  = probe area size = 126 cm<sup>2</sup>

The calculated MDC (based on preliminary measurements) for alpha contamination is 37.99 dpm/100 cm<sup>2</sup>, using a 2-minute static counting time. Counting time may be increased as necessary to provide a sufficient static MDC for any ROC below the release criteria (Table 2-1).

The specified count times are based on the MDC formula, Equation 7-7 from the Basewide Radiological Management Plan (TtEC, 2014a). The count times are useful in determining an instrument's ability to meet the required MDC. However, empirically derived values will provide a more accurate assessment of the MDC for a specified count time as recommended by MARSSIM (DoD et al., 2000). Empirical values will be determined at NASB in conjunction with reference area measurements. With concurrence of the Navy RASO, count times determined based on empirical data will be used for static survey measurements.

### 3.7.2 Beta Static Measurements

For the Ludlum 43-68, the MDC equation becomes:

$$MDC = \frac{3 + 4.65\sqrt{R_B T_B}}{\varepsilon_s \varepsilon_i \frac{W_A}{100} T_B}$$

- 3 + 4.65 = constant factor provided in MARSSIM
- $R_B$  = background count rate = 500 cpm
- $T_B$  = background count time = 2 minutes
- $\varepsilon_i$  = instrument efficiency = 0.4
- $\varepsilon_s$  = surface efficiency factor = 0.25
- $W_A$  = probe area size = 126 cm<sup>2</sup>

The calculated MDC (based on preliminary measurements) for beta contamination is 595.4 dpm/100 cm<sup>2</sup>, using a 2-minute static counting time. Counting time may be increased as necessary to maintain the MDC below the Table 2-1 limits.

The specified count times are based on the MDC formula, Equation 7-7 from the Basewide Radiological Management Plan (TtEC, 2014a). The count times are useful in determining an instrument's ability to meet the required MDC. However, empirically derived values will provide a more accurate assessment of the MDC for a specified count time as recommended by MARSSIM (DoD et al., 2000). Empirical values will be determined at NASB in conjunction with reference area measurements. With concurrence of the RASO, count times determined based on empirical data will be used for static survey measurements.

### 3.8 **Gamma Scans**

Gamma scans will be performed in accordance with SOP 001, Radiation and Contamination Surveys. A single detector will be used to perform gamma scans. Scans will be performed at a rate of approximately 0.5 meters per second (1-second scan observation) with the detector held approximately 10 cm (4 inches) above the ground, and it will be moved back and forth across the travel path while scanning, producing a serpentine scan pattern. Backgrounds used for gamma scan measurement will be commensurate with the materials encountered throughout each SU, and will be used for comparison purposes during static gamma measurements.

#### 3.8.1 Minimum Detectable Count Rate for Gamma Surveys (2-inch by 2-inch NaI Probe)

MDCR is the minimum detectable number of net source counts in the scan interval, for an ideal observer, that can be arrived at by multiplying the square root of the number of background counts (in the scan interval) by the detectability value associated with the desired performance (as reflected in  $d'$ ), as shown in Equation 7-5 from the Basewide Radiological Management Plan (TtEC, 2014a):

**Equation 7-5 from the Basewide Radiological Management Plan (TtEC, 2014a)**

$$MDCR = d' \sqrt{b_i} \left( \frac{60}{i} \right)$$

Where:

- $MDCR$  = minimum detectable count rate
- $d'$  = index of sensitivity ( $\alpha$  and  $\beta$  errors) = 3.28
- $b_i$  = number of background counts in scan time interval = 96.77 cpm
- $i$  = scan or observation interval = 1 seconds

For this calculation, the observed background count rate of 5,806 cpm is used. It should be noted that a typical source will remain under the NaI probe for 1 second during the scan; therefore, the average number of background counts in the observation interval is 96.77 [ $b_i = 5,806 \times (1/60)$ ]. The required rate of true positives is 95 percent, and the rate of false positives is 5 percent. From Table 6.5 of MARSSIM (DoD et al. 2000), the value of  $d'$ , representing this performance goal, is 3.28. Using these inputs, the MDCR for Building 584 is 1936 cpm.

**3.8.2 MDCR and Use of Surveyor Efficiency, Gamma (2-inch by 2-inch NaI Probe)**

The minimum detectable count rate calculated assuming a surveyor efficiency ( $MDCR_{SURVEYOR}$ ) can be calculated assuming a surveyor efficiency ( $P$ ) of 0.5 and the observed background count rate of 5,806 cpm using Equation 7-9 from the Basewide Radiological Management Plan (TtEC, 2014a) as follows:

**Equation 7-9 from the Basewide Radiological Management Plan (TtEC, 2014a)**

$$MDCR_{SURVEYOR} = \frac{MDCR}{\sqrt{P}} = \frac{1,936}{\sqrt{0.5}} = 2,738 \text{cpm}$$

**3.9 Exposure/Dose Rate Measurements**

Before any MARSSIM based surveys are conducted, a general area gamma exposure/dose rate survey will be conducted for safety and radiological posting purposes, as well as to identify any areas with comparatively elevated gamma exposure rates. Ludlum Model 19, or equivalent, scintillation detectors will be used to perform the measurements. The measurements will be conducted with the instrument at one meter from the floor.

**3.10 Media Samples**

Swipe surveys will be collected at each of the specified systematic locations for each SU. Additional samples may also be collected based on scan survey results exceeding the investigation level. All swipe surveys will be screened using a Ludlum 2929 or 3030 scaler rate meter with a Ludlum 43-10-1 detector (or equivalent). Swipe surveys will be performed and documented in accordance with SOP 001, Radiation and Contamination Surveys.

When applicable, general area removable contamination will be assessed using Masslinn® cloths and monitoring the cloths with a Ludlum 43-68 or 43-89 detector coupled to a Ludlum 2360 or

2221 survey meter. The detector will be operated on the alpha plus beta plateau. Areas with a Masslinn<sup>®</sup> cloth indicating any increase in activity will be re-wiped with another Masslinn<sup>®</sup> cloth to determine the specific area that contains the removable contamination.

In addition to swipes to determine the presence of alpha and beta emitting radionuclides, swipes will be taken at the systematic data collection points for the presence of H-3. The swipes will be wetted with distilled water prior to survey. Tritium swipes will be sent to an off-site laboratory for analysis using liquid scintillation methods.

### **3.11 Dose Modeling in Support for Unrestricted Release**

The intent of the Building 584 FSS is to achieve unrestricted release for the building. To accomplish this goal, it is necessary to provide a means for calculating residual dose to the critical group; the residential scenario in RESRAD-BUILD was selected. The modifications to the default scenario presented in RESRAD-BUILD will be to use the net mean concentrations for Co-60, Cs-137, H-3, Ra-226, Sr-90, Th-232, and U-238 above background, use the actual surface area for the SU, and change the removable fraction to 20 percent.

After the residual dose is determined, the Navy will also determine the excess lifetime cancer risk to the critical group. These values will be provided in the final report.

## **4.0 QUALITY CONTROL**

The data quality objectives for the survey are provided in Table 3-1.

Definable features of work (DFWs) establish the measures required to verify both the quality of work performed and compliance with project requirements. The DFW for this task is radiological surveys. Description of this DFW and the associated phases of quality control are presented in Table 4-1.

## **5.0 ENVIRONMENTAL PROTECTION**

The environmental protection-driven requirements have been addressed in the Environmental Protection Plan (TtEC, 2014c). No additional requirements are necessary.

## **6.0 REFERENCES**

DoD (Department of Defense), Department of Energy, Nuclear Regulatory Commission, and U.S. Environmental Protection Agency. 2000. Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG-1575, Revision 1. August.

Matzke et al. 2010. Visual Sample Plan. Upgrade version 6.0 released June 2010. Pacific Northwest National Laboratory. June.

NAVSEA. 2014. Final Historical Radiological Assessment, History of the Use of General Radioactive Materials 1943 to 2011, Naval Air Station Brunswick, Brunswick, Maine. March.

TtEC (Tetra Tech EC, Inc.). 2014a. Basewide Radiological Management Plan, Former Naval Air Station Brunswick, Brunswick, Maine. August.

TtEC. 2014b. Accident Prevention Plan/Site Safety and Health Plan, Former Naval Air Station Brunswick, Brunswick, Maine. August.

TtEC. 2014c. Environmental Protection Plan, Former Naval Air Station Brunswick, Brunswick, Maine. August.

## **TABLES**

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**TABLE 2-1  
 BUILDING 584  
 PRIMARY RADIATION PROPERTIES AND RELEASE CRITERIA  
 FOR RADIONUCLIDES OF CONCERN**

Radionuclide	Primary Radiation Properties		Release Criteria			
	Half-Life	Type	Materials & Equipment		Building Surfaces	
			Total Surface Activity	Removable Activity	Total Surface Activity	Removable Activity
Co-60	5.27 years	Beta	5,000	1,000	5,000	1,000
Cs-137	3.01E01 years	Beta	5,000	1,000	5,000	1,000
H-3	1.23E01 years	Beta	5,000	1,000	5,000	1,000
Ra-226	1.6E03 years	Alpha	100	20	100 <sup>b</sup>	20
Sr-90	2.86E01 years	Beta	1,000	200	1,000	200
Th-232	1.41E10 years	Alpha	1,000	200	1,000	200
U-238	4.47E09 years	Alpha/Beta	5,000	1,000	5,000	1,000

**Notes:**

<sup>a</sup> Units are disintegrations per minute per 100 square centimeters.

<sup>b</sup> The Radium-226 value is based upon Reg Guide 1.86 and the value stated in the table for building surfaces is 100 dpm/100cm<sup>2</sup> when averaged over 1 meter. Reg Guide 1.86 also states a maximum of 300 cpm/100cm<sup>2</sup> for any 100cm<sup>2</sup> area.

**Abbreviations and Acronyms:**

Co-60 – Cobalt-60	Ra-226 – Radium-226
Cs-137 – Cesium-137	Th-232 – Thorium-232
H-3 – Tritium	U-238 – Uranium-238
Sr-90 – Strontium-90	

**TABLE 3-1  
 SUMMARY OF DATA QUALITY OBJECTIVES**

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7
<b>State the Problem</b>	<b>Identify the Goal of the Study</b>	<b>Identify Information Inputs</b>	<b>Define the Boundaries of the Study</b>	<b>Develop the Analytical Approach</b>	<b>Specify Performance or Acceptance Criteria</b>	<b>Develop the Plan for Obtaining Data</b>
Building 584 is listed in the HRA as an area impacted by radiological activities. The radionuclides of concern are Co-60, Cs-137, H-3, Ra-226, Sr-90, Th-232, and U-238. It must be determined if the site-specific release criteria for these radionuclides have been met or if remediation is warranted.	The primary use of the data expected to result from completion of this TSP is to support the FSS of Building 584. Therefore, the decision to be made can be stated as “Do the results of the survey meet the release criteria?”	Radiological surveys required to support the FSS of Building 584 will include: <ul style="list-style-type: none"> <li>• 100, 50 and 25 percent scan survey of the Class 1, 2 and 3 areas respectively</li> <li>• A minimum of 16 systematic static measurements in each area</li> <li>• One swipe survey at each systematic sample location</li> <li>• Static and swipe survey measurements at biased locations</li> </ul>	The lateral and vertical spatial boundaries for this survey effort are confined to the interior of Building 584 as shown on the figures in Appendix A.	If the concentration of radioactivity on building surfaces is less than the release criteria, then no further measurements are required.  If the results of the survey exceed the release criteria, then the building will be further investigated.	Limits on decision errors are set at 5 percent as specified in the Basewide Radiological Management Plan (TtEC, 2014a).	Operation details for the radiological survey process have been developed. The theoretical assumptions are based on guidelines contained in MARSSIM (DoD et al. 2000). Specific assumptions regarding types of radiation measurements, instrument detection capabilities, quantities and locations of data to be collected, and investigation levels are contained in this TSP and the Basewide Radiological Management Plan (TtEC, 2014a).

**Abbreviations and Acronyms:**

Co-60 – Cobalt-60  
 FSS – Final Status Survey  
 H-3 - Tritium  
 HRA – Historical Radiological Assessment  
 MARSSIM – Multi-Agency Radiation Survey and Site Investigation Manual  
 Ra-226 – Radium-226

Sr-90 – Strontium-90  
 SU – survey unit  
 Th-232 – Thorium-232  
 TSP – Task-Specific Plan  
 U-238 – Uranium-238

**TABLE 4-1  
 DEFINABLE FEATURES OF WORK FOR RADIOLOGICAL SURVEYS**

<b>ACTIVITY</b>	<b>PREPARATORY (Prior to initiating survey activity)</b>	<b>DONE</b>	<b>INITIAL (At outset of survey activity)</b>	<b>DONE</b>	<b>FOLLOW-UP (Ongoing during survey activity)</b>	<b>DONE</b>
Radiological surveys and sampling	<ul style="list-style-type: none"> <li>Verify that an approved TSP is in place.</li> <li>Verify that the Remedial Project Manager, Navy Technical Representative, and the Caretaker Site Office are notified about mobilization.</li> <li>Verify that an approved RWP, if required, is available and has been read and signed by assigned personnel.</li> <li>Verify that the Basewide Radiological Management Plan (TtEC, 2014a), APP/SSHP (TtEC, 2014b), and TSP have been reviewed.</li> <li>Verify that personnel assigned are trained and qualified.</li> <li>Verify that personnel have been given an emergency notification procedure.</li> <li>Verify that workers assigned dosimetry have completed NRC Form 4.</li> <li>Verify that relevant SOPs and/or manufacturers' instructions are available and have been reviewed for equipment to be used.</li> <li>Verify that equipment is on site and in working order (initial daily check).</li> </ul>		<ul style="list-style-type: none"> <li>Verify that radiological instruments are as specified in the Basewide Radiological Management Plan (TtEC, 2014a) and TSP.</li> <li>Inspect Training Records.</li> <li>Verify that a qualified RCT and SSHO are present in the active work areas.</li> <li>Verify that reference area measurements have been obtained in accordance with the Basewide Radiological Management Plan (TtEC, 2014a) and this TSP. The same survey methodology and instruments used to collect the background data will be used to perform measurements within SUs.</li> <li>Verify that daily checks were performed on all survey instruments.</li> <li>Verify that instrument calibration and setup are current.</li> <li>Verify that required dosimetry is being worn.</li> <li>Verify that field logbooks, chain-of-custody documents, and proper forms are in use.</li> <li>Verify that samples and measurements are being collected in accordance with the TSP, Basewide Radiological Management Plan (TtEC, 2014a), and applicable SOPs.</li> <li>Verify the sample handling is in accordance with the Basewide Radiological Management Plan (TtEC, 2014a) and applicable SOPs.</li> </ul>		<ul style="list-style-type: none"> <li>Verify that the site is properly posted and secured, if necessary.</li> <li>Conduct ongoing inspections of material and equipment.</li> <li>Verify that a qualified RCT and SSHO are present at active work areas.</li> <li>Verify that daily instrument checks were obtained and documented.</li> <li>Verify the survey results were documented.</li> <li>Verify that personnel have read and signed the revised RWP, if revision is required.</li> <li>Inspect chain-of-custody and survey logs for completeness.</li> <li>Verify the survey activities conform to the TSP.</li> <li>Verify that survey instruments are recalibrated after repairs or modifications.</li> <li>Verify that site activities are being photographed.</li> <li>Verify that survey documentation is reviewed by the RSOR.</li> </ul>	

**Abbreviations and Acronyms:**

APP – Accident Prevention Plan  
 NRC – Nuclear Regulatory Commission  
 RCT – Radiation Control Technician  
 RSOR – Radiation Safety Officer Representative

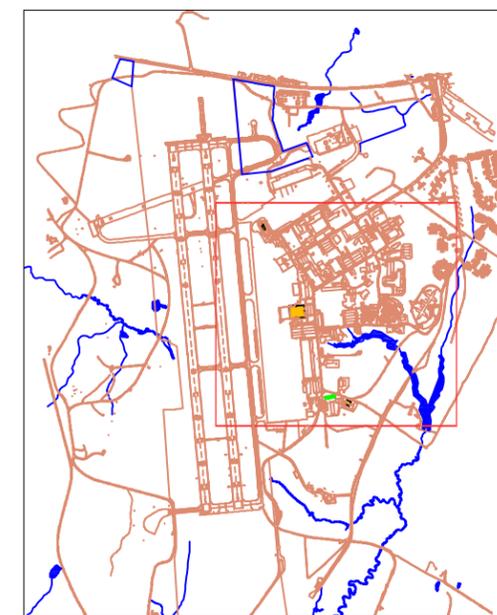
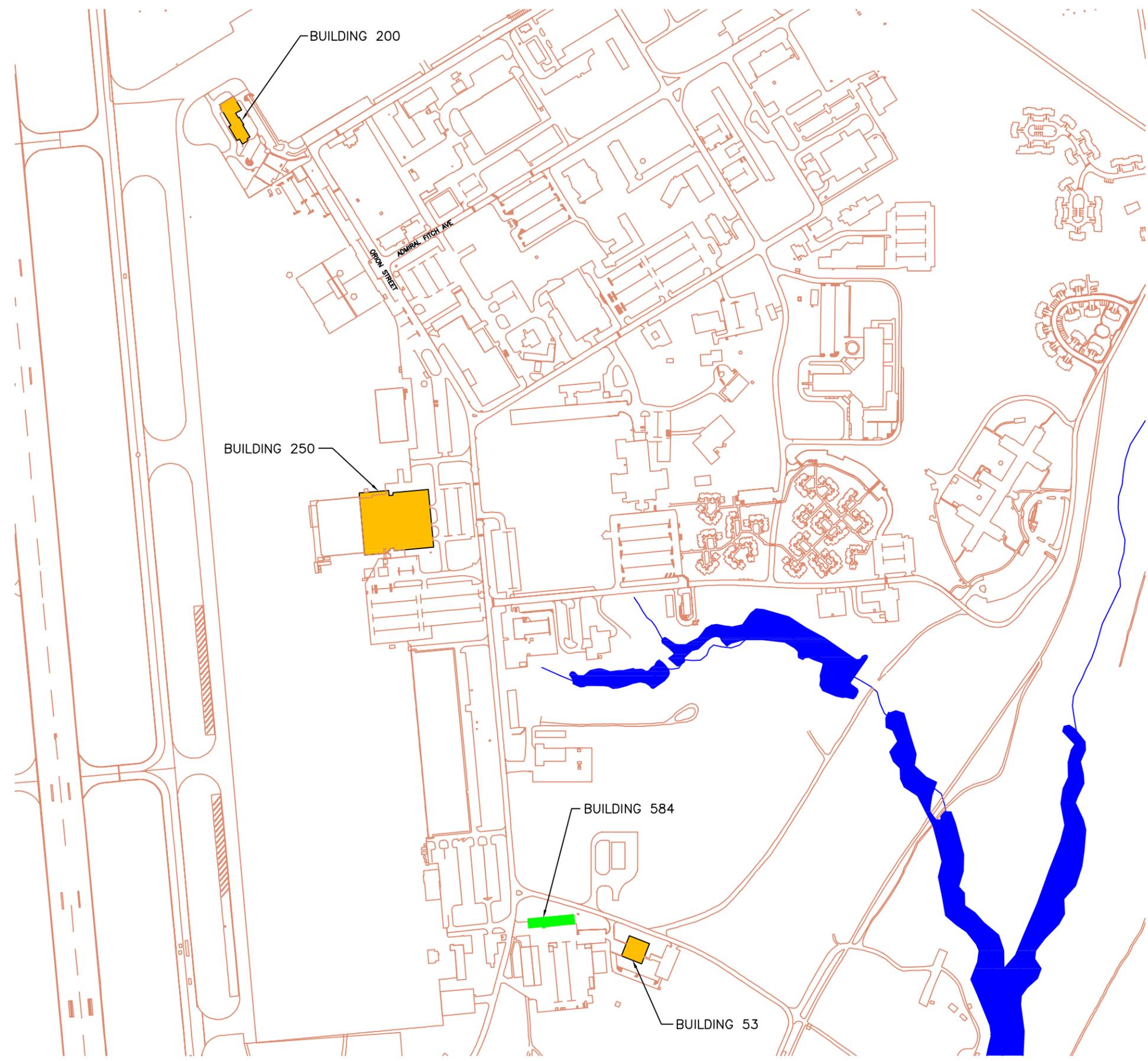
RWP – Radiation Work Permit  
 SOP – Standard Operating Procedure  
 SSHO – Site Safety and Health Officer  
 SSHP – Site Safety and Health Plan  
 SU – Survey Unit

TSP – Task-Specific Plan

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**APPENDIX A**  
**FIGURES FOR BUILDING 584 SURVEYS**

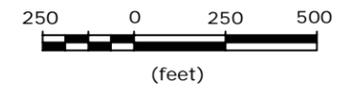
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KEYPLAN

LEGEND

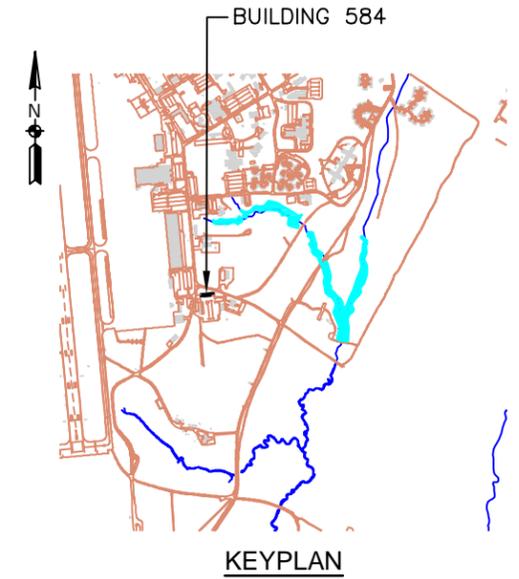
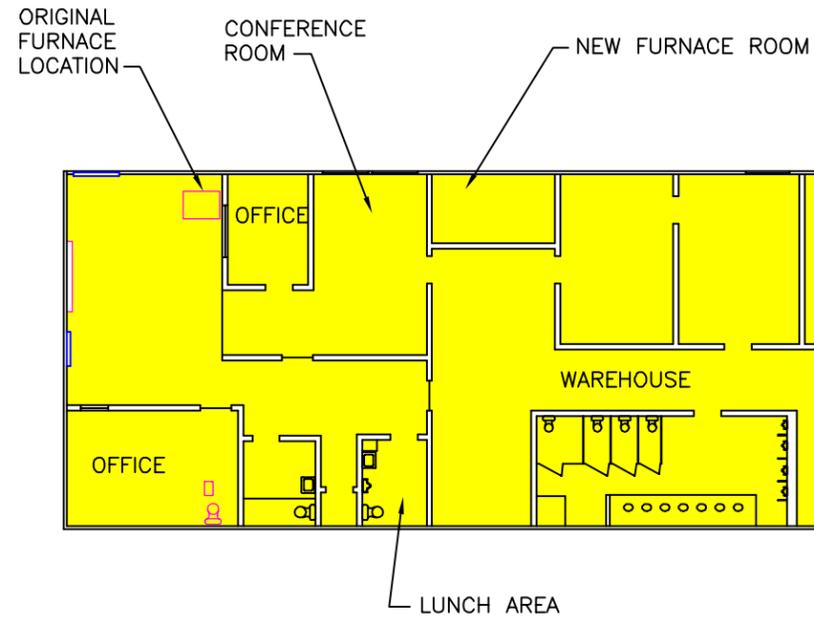
-  BUILDING 584
-  BUILDINGS 53, 200, AND 250
-  WATER



TASK-SPECIFIC PLAN FOR BUILDING 584  
FINAL STATUS SURVEY

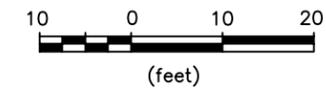
FIGURE A-1  
BUILDING 584 AND BACKGROUND REFERENCE AREAS  
FORMER NAVAL AIR STATION, BRUNSWICK, MAINE

REVISION: — AUTHOR: A.CRABTREE PROJECT NO: FILE: SEE BELOW	 TETRA TECH EC, INC.
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**LEGEND**

- HOTSPOT LOCATION
- REMOVED DURING REMODEL
- - - SURVEY UNIT BOUNDARY
- SU 1** SURVEY UNIT DESIGNATION
- CLASS 1 SURVEY
- CLASS 2 SURVEY
- CLASS 3 SURVEY



TASK-SPECIFIC PLAN FOR BUILDING 584  
FINAL STATUS SURVEY

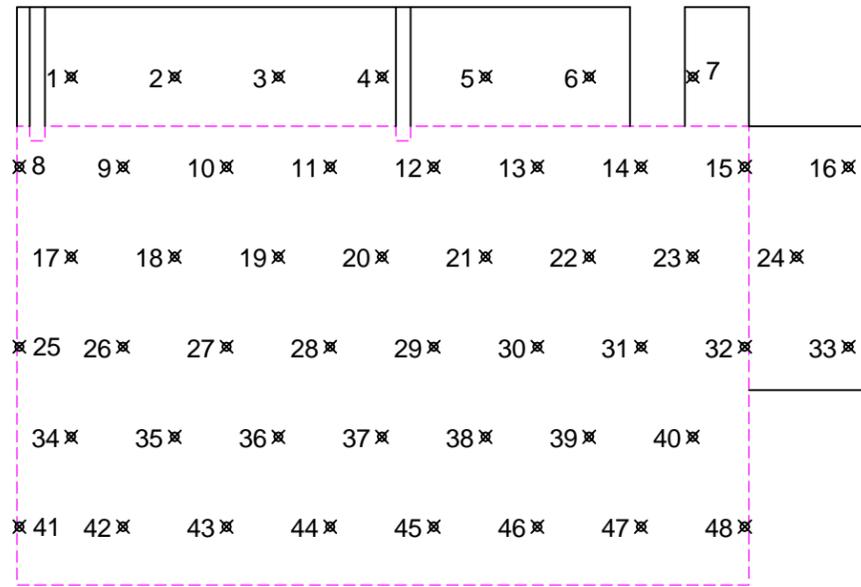
**FIGURE A-2**

BUILDING 584 PLAN VIEW

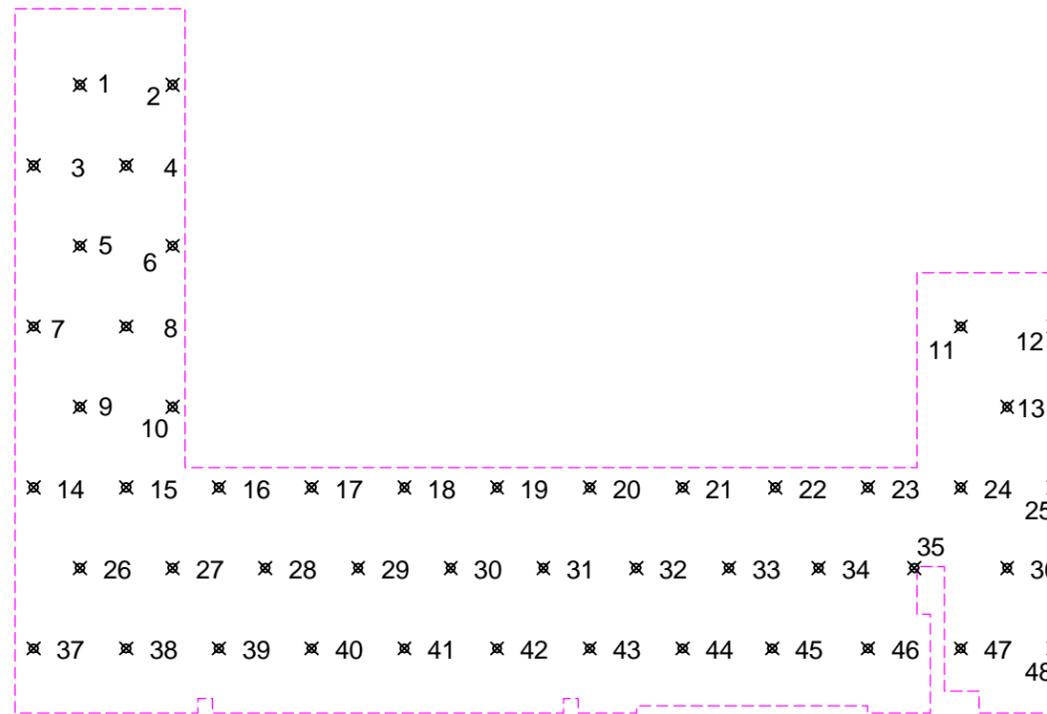
FORMER NAVAL AIR STATION, BRUNSWICK, MAINE

REVISION: —  
AUTHOR: A.CRABTREE  
PROJECT NO:  
FILE: SEE BELOW





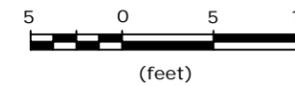
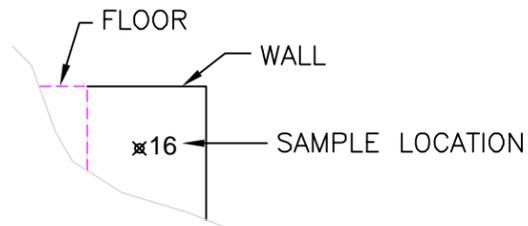
SU 1  
CLASS 1  
92.78 m<sup>2</sup> (998.72 ft<sup>2</sup>)



SU 2  
CLASS 2  
99.22 m<sup>2</sup> (1068.06 ft<sup>2</sup>)

**LEGEND:**

✕ 1 SYSTEMATIC



TASK SPECIFIC PLAN FOR BUILDING 584 REMEDIAL  
ACTION SUPPORT SURVEY AND FINAL STATUS SURVEY

**FIGURE A-3**

BUILDING 584 CLASS 1 AND CLASS 2 SURVEY UNITS  
FORMER NAVAL AIR STATION, BRUNSWICK, MAINE

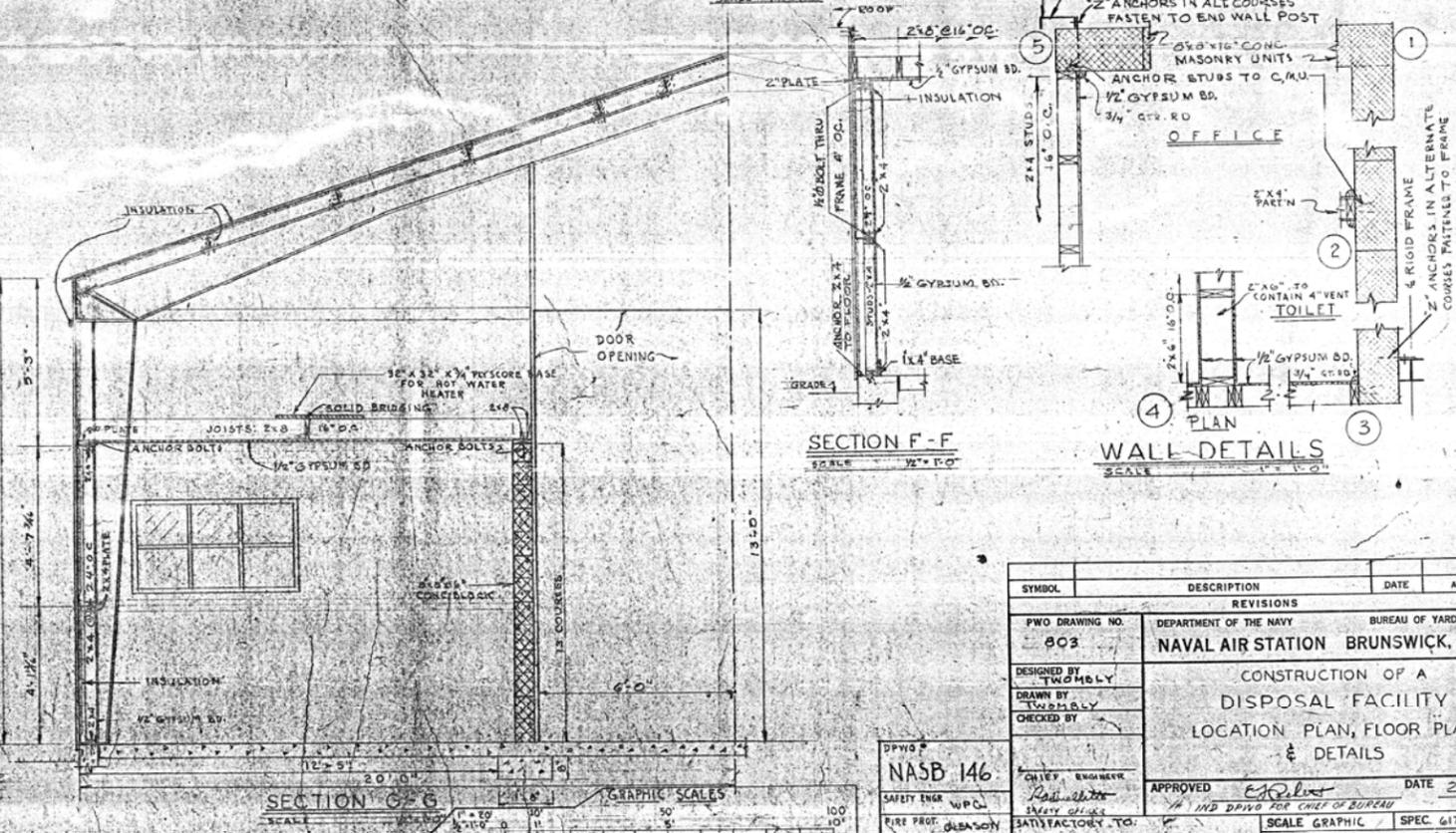
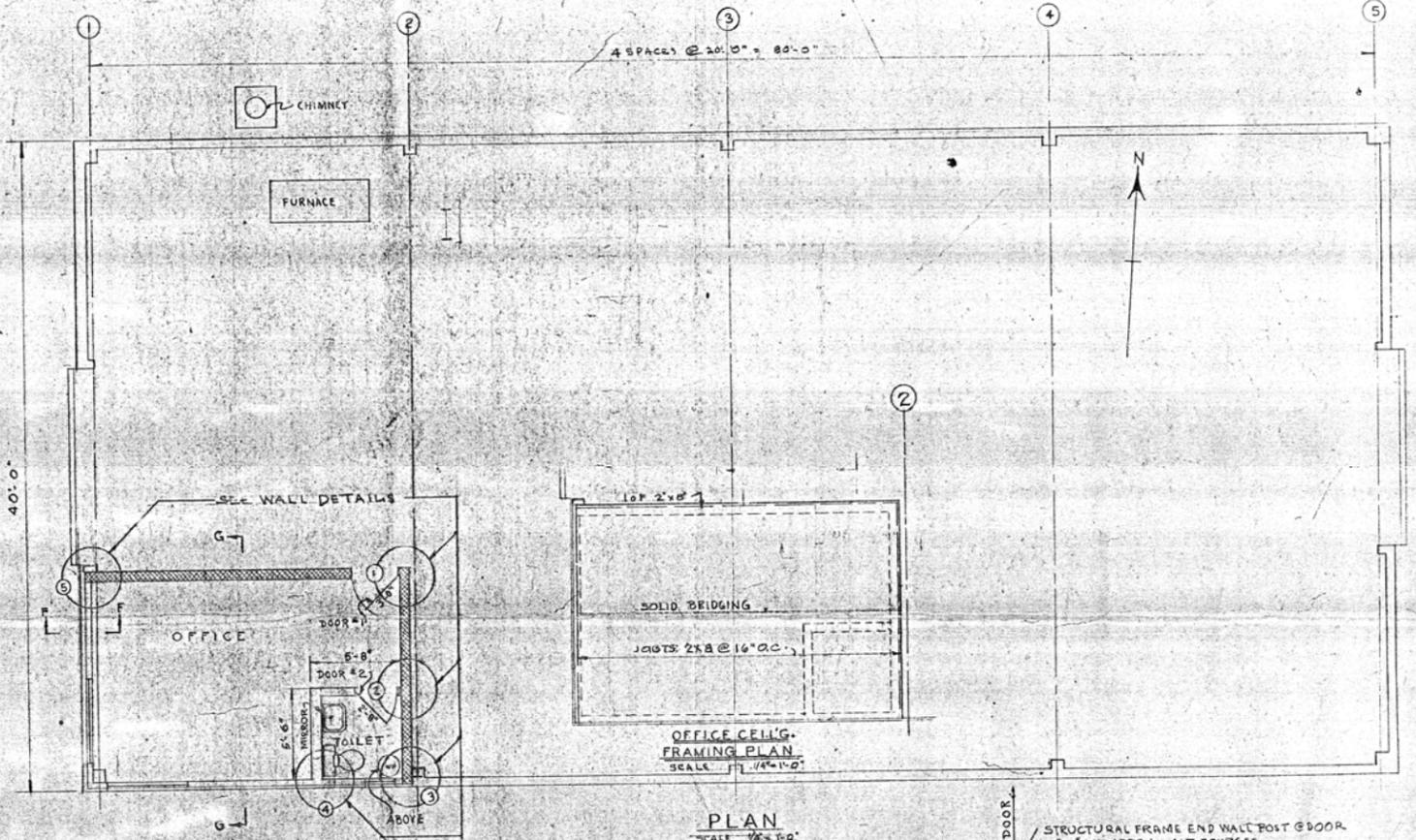
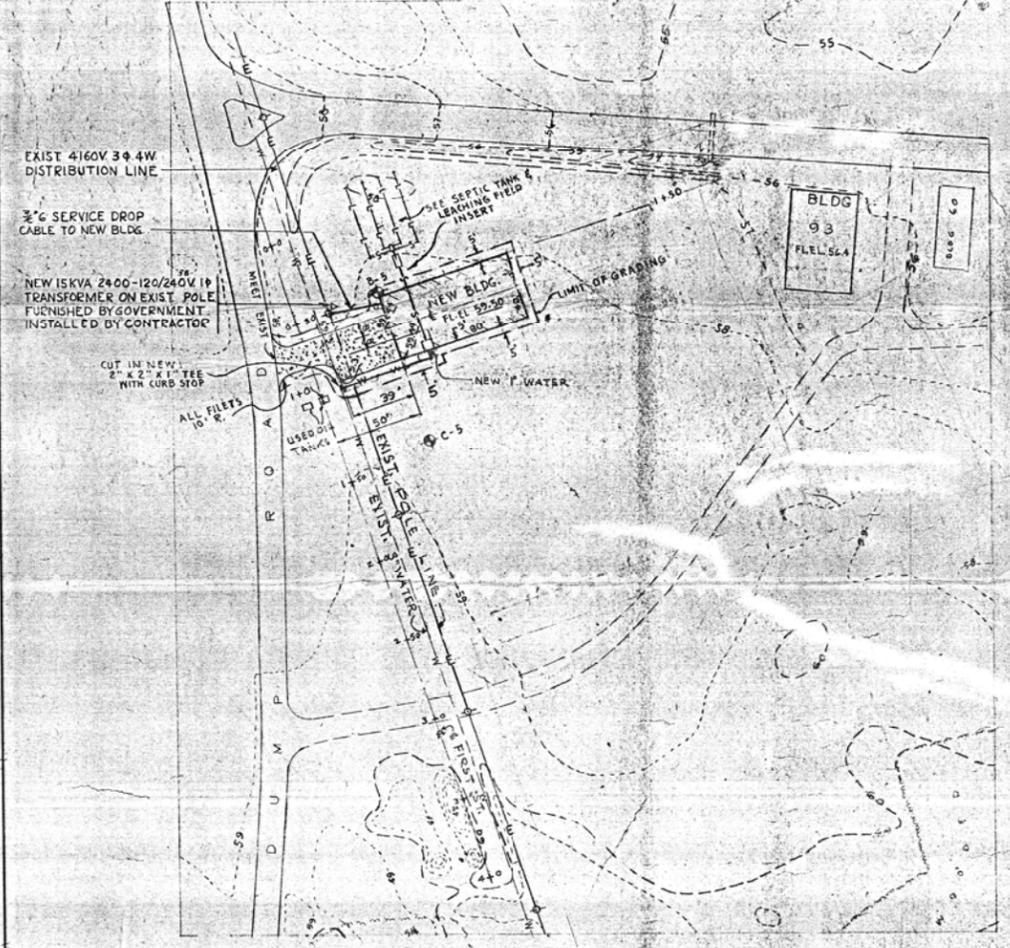
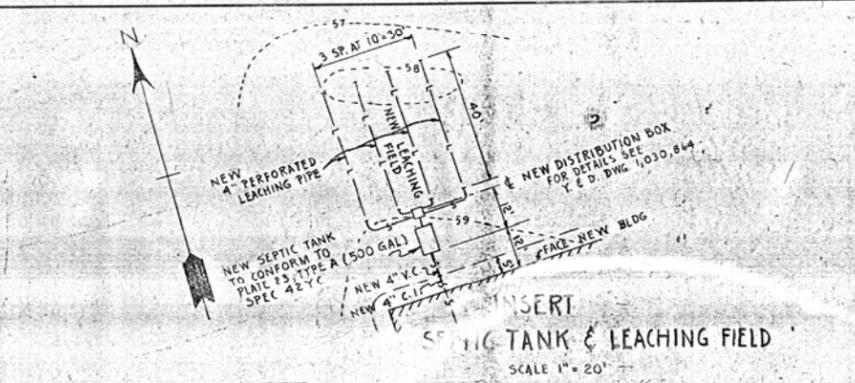
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AUTHOR: A.CRABTREE  
PROJECT NO:  
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**APPENDIX B**  
**PUBLIC WORK DRAWINGS**

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**B-5**  
OCT. 11, 1948

3	ELEV. 59.5
4	5' (0'-6")
5	TOP SOIL
6	MOIST
7	LOOSE
8	19" (1'-0")
9	5-2 (4'-6")
10	BR. FINE SAND
11	# SILT MOIST
12	MED. DENSE

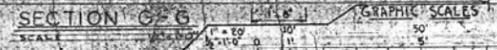
**C-5**  
OCT. 11, 1948

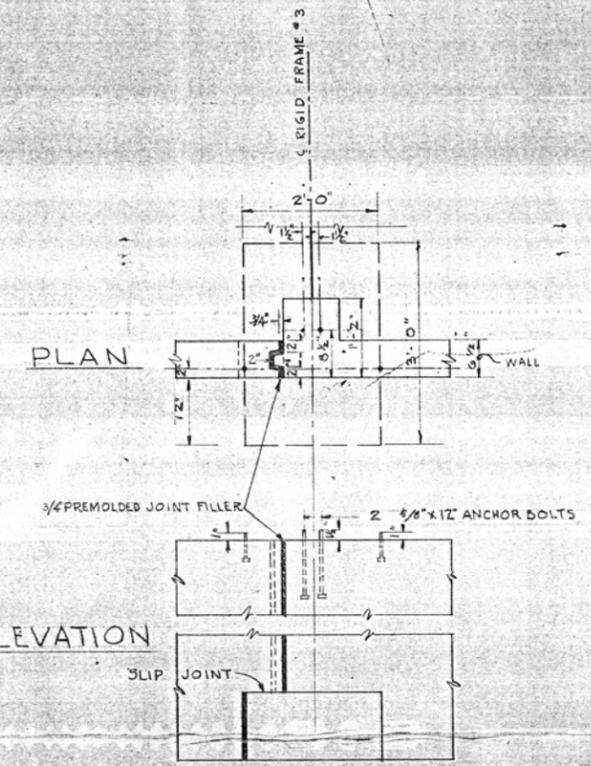
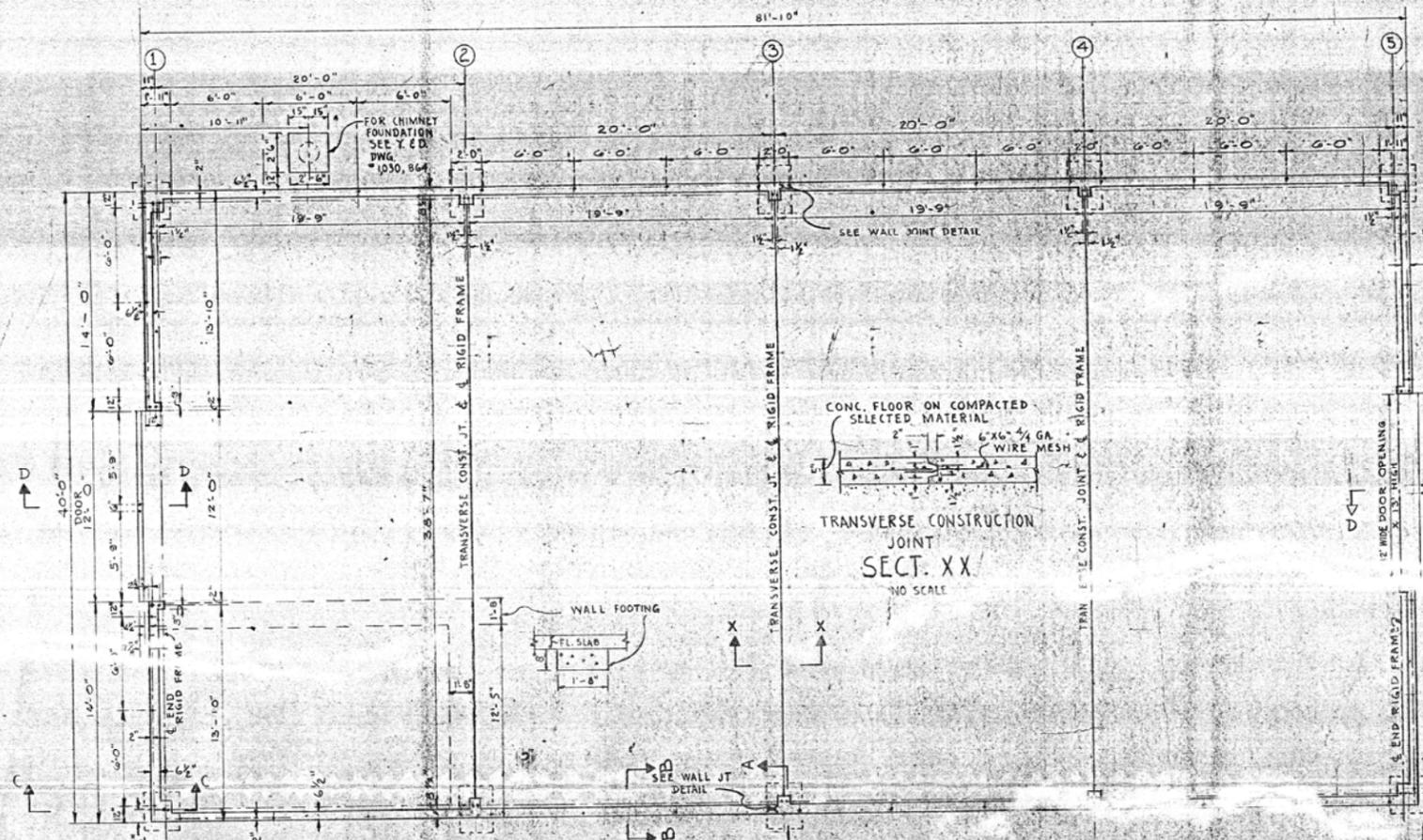
3	ELEV. 59.3
4	3'-1 (0'-11")
5	TOP SOIL
6	MOIST
7	LOOSE
8	INDICATES BLOWS ON CASING
9	4 (1'-0")
10	5-2 (5'-6")
11	BR. FINE SAND
12	MOIST MED. DENSE
13	14
14	15
15	16
16	17
17	18
18	19
19	20

**LEGEND**

- - - - - APPROX. EXISTING CONTOUR LINES
- BORING
- 59.5 NEW ELEVATION
- 2" BIT CONC ON 6" GRAVEL
- " SANITARY SEWER PIPE
- " PERFORATED LEACHING PIPE
- W— EXIST WATER LINE
- E— EXIST 4160V 3Ø 4W DISTRIBUTION LINE

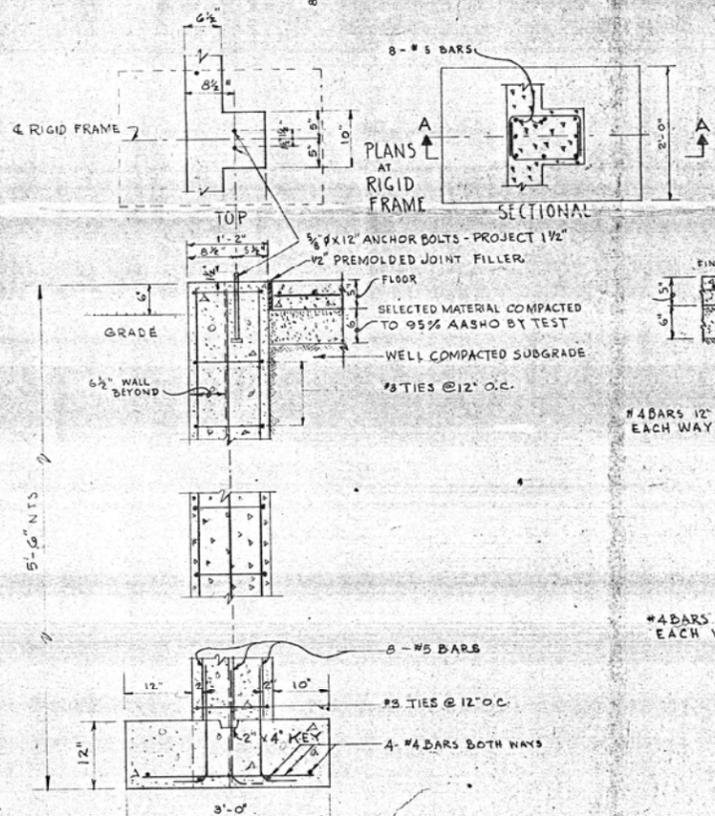
SYMBOL	DESCRIPTION	DATE	APPROVAL
REVISIONS			
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DESIGNED BY TWOMBLY		NAVAL AIR STATION BRUNSWICK, MAINE	
DRAWN BY TWOMBLY		CONSTRUCTION OF A DISPOSAL FACILITY	
CHECKED BY		LOCATION PLAN, FLOOR PLAN, & DETAILS	
APPROVED <i>[Signature]</i>		DATE 2-3-65	
SAFETY ENGR. WPC		SPEC. 61751/64	
FIRE PROT. WILSON		SHEET 1 OF 5	
PROJ. ENGR. SEWSON		NB: 61757	
DIRECTOR SEWSON		Y&D DRAWING NO. 1,030,861	





**WALL JOINT DETAIL**  
SCALE 1" = 1'-0"

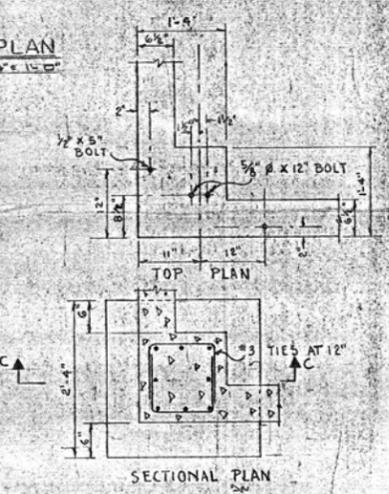
**FOUNDATION PLAN**  
SCALE 1/4" = 1'-0"



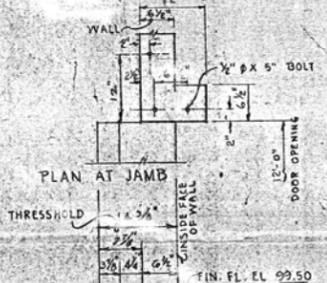
**TYPICAL AT RIGID FRAME SECTION A-A**

**FOUNDATION DETAILS**  
SCALE 1" = 1'-0"

**TYPICAL AT WALL SECTION B-B**



**TYPICAL OF CORNER SECTION C-C**



**TYPICAL AT DOOR SECTION D-D**

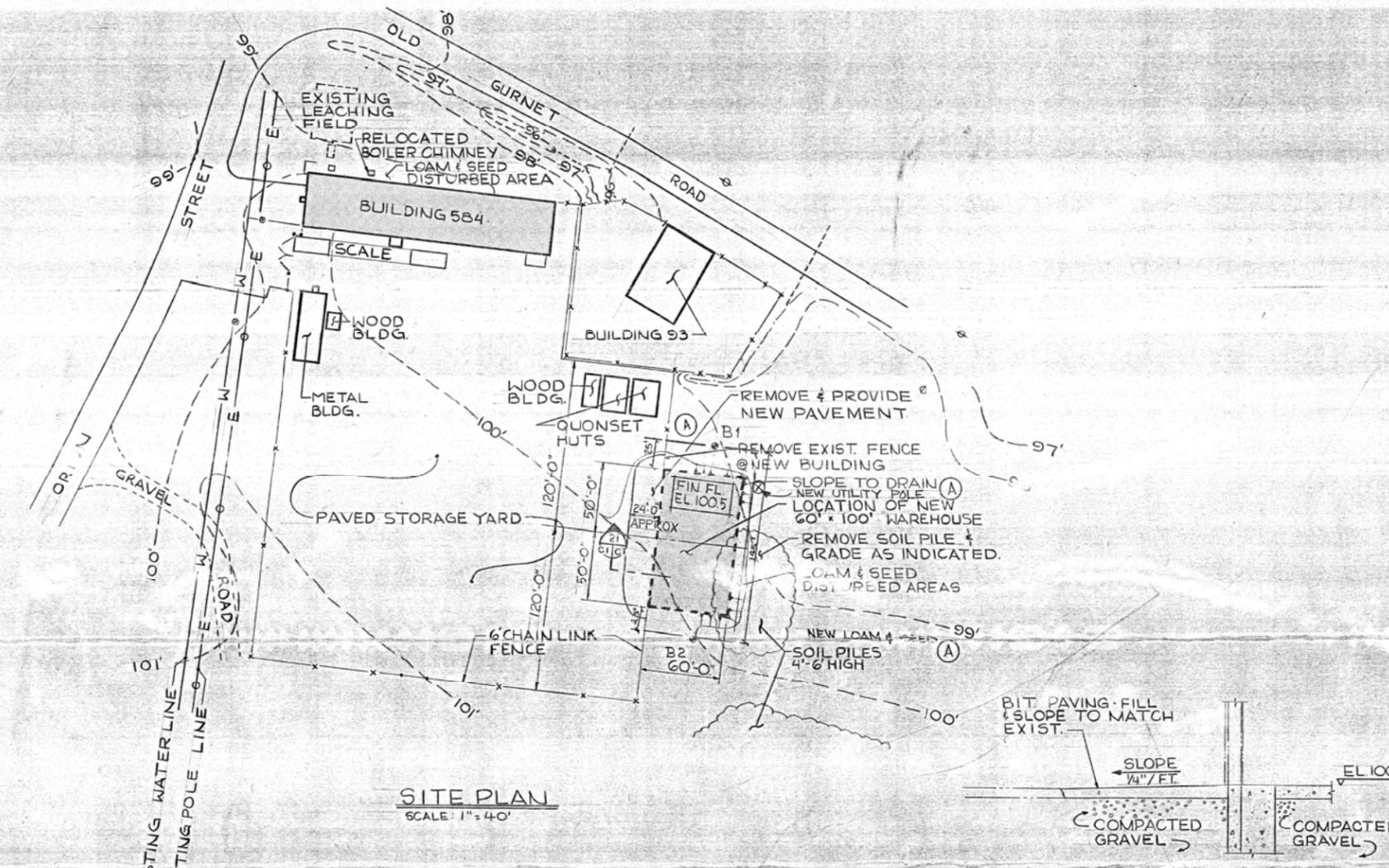
**NOTES:**

1. A GOVERNMENT FURNISHED RIGID FRAME BUTLER BUILDING 40'X100' IS LOCATED ON STATION FOR ASSEMBLY BY THE SUCCESSFUL BIDDER. IT CONSISTS OF 6 RIGID FRAMES WITH PURLINS & GIRTS, FOUR 6'X12' SLIDING DOORS W/ HARDWARE, FOUR WINDOWS, SIDING & ROOFING WITH HARDWARE TO BE ASSEMBLY ON THE 40' X 80' FOUNDATION DIVISION OF ONE 20' BAY.
2. LIVE LOADS:  
ROOF = 30 PSF WIND = 20 PSF  
FLOOR = 200 PSF
3. CONCRETE CLASS D-1  $f'_c = 2500$  PSI  $f_s = 1125$  PSI
4. STEEL REINFE: INTERMEDIATE GRADE, BILLET STEEL-DEFORMED BARS.
5. ALL COL. FOOTINGS TO BEAR ON UNDISTURBED SOIL.
6. TOP OF FOUNDATION SHALL BE SQUARE, LEVEL & TROWELED TO A SMOOTH FINISH.
7. THE RIGID FRAMED BUILDING WILL BE FURNISHED BY THE GOVERNMENT.

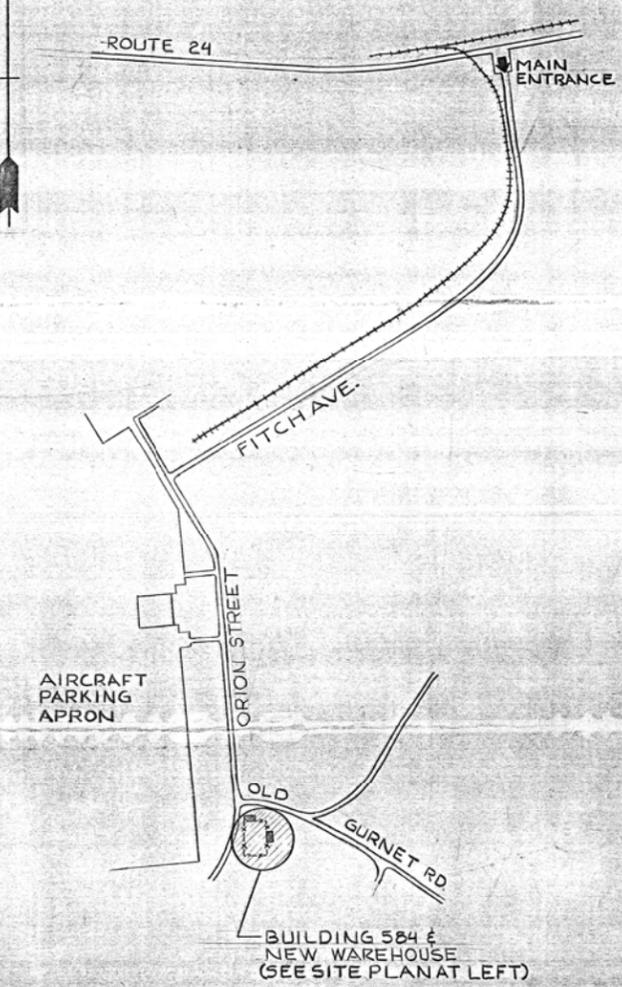
SYMBOL	DESCRIPTION	DATE	APPROVAL
REVISIONS			
PWO DRAWING NO. 804	DEPARTMENT OF THE NAVY BUREAU OF YARDS & DOCKS		
NAVAL AIR STATION BRUNSWICK, MAINE			
DESIGNED BY TWOMBLEY	CONSTRUCTION OF A DISPOSAL FACILITY		
DRAWN BY TWOMBLEY	FOUNDATION PLAN, & DETAILS		
CHECKED BY			
CHIEF ENGINEER	APPROVED	DATE 2-3-65	
SAFETY ENGR. WPG	ND DPWD FOR CHIEF OF BUREAU		
FIRE PROT. CLEARSON	SATISFACTORY TO:	SCALE GRAPHIC SPEC 61757/64	
PROJ. ENGR. BENTON		SHEET 2 OF 5 NB 61757	
DIRECTOR SEIDAN		Y&D DRAWING NO. 1,030,862	



REVISIONS			
LTR	DESCRIPTION	PREP'D BY	DATE
A	REVISED AS BUILT	G.S.	6-11-44
		OS	68



**SITE PLAN**  
SCALE: 1" = 40'

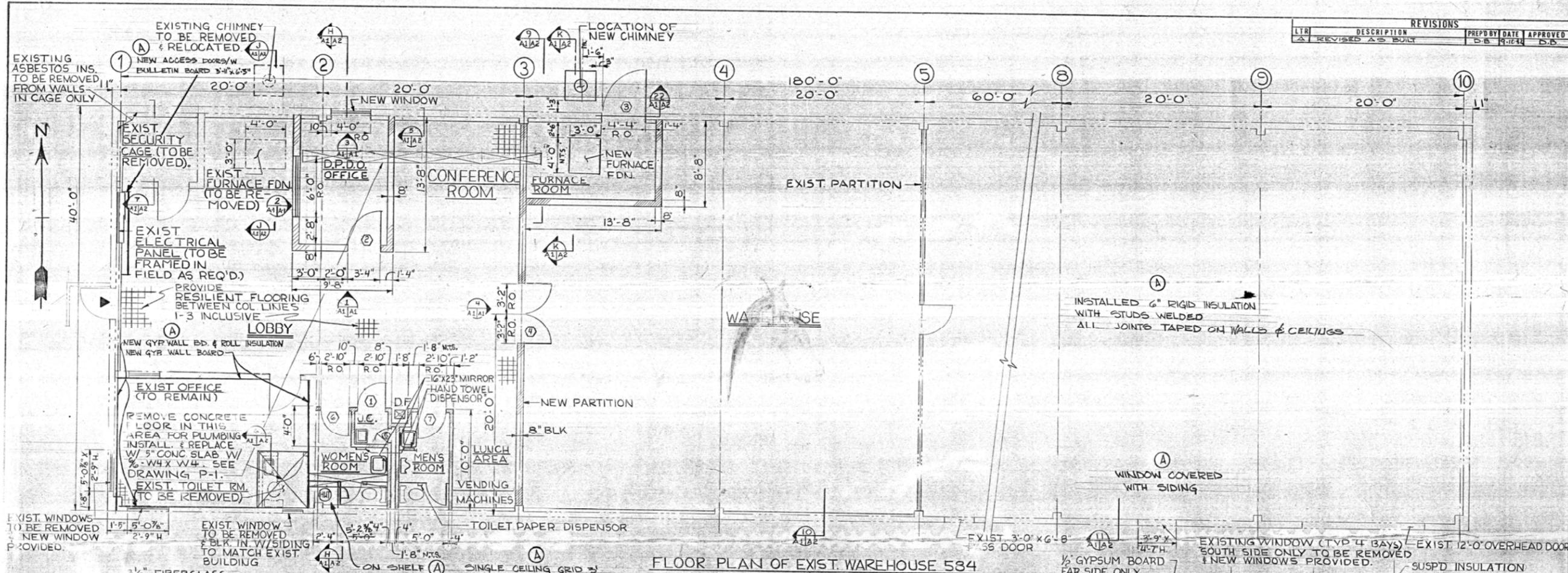


**VICINITY PLAN**  
SCALE: 1" = 600'

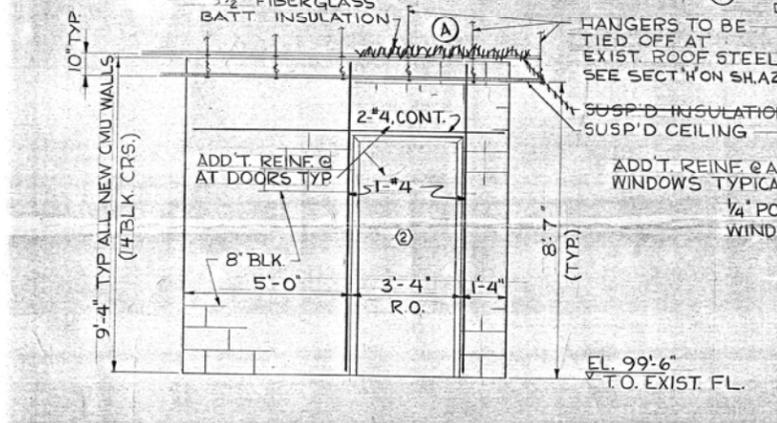
**BORING LOGS**  
SCALE: 1/4" = 1'-0"

B-1	B-2
JUNE 11, 1980 EL. 99'-0"	JUNE 12, 1980 EL. 100'-0"
12 BROWN FINE SAND W/ TRACE GRAVEL	8 BROWN FINE SAND W/TRACE GRAVEL
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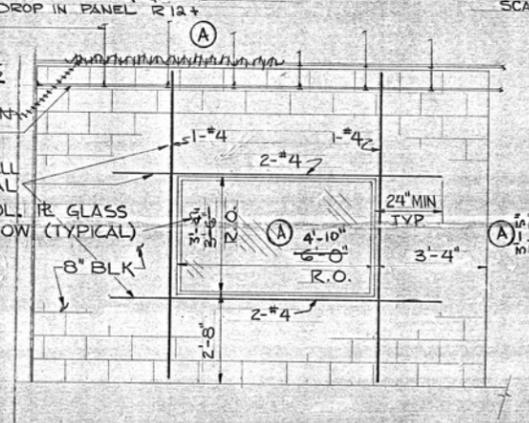
REVISIONS			
LTR	DESCRIPTION	PREP BY	DATE
A1	REVISED AS BUILT	D.S.	9-1-64
		D.S.	



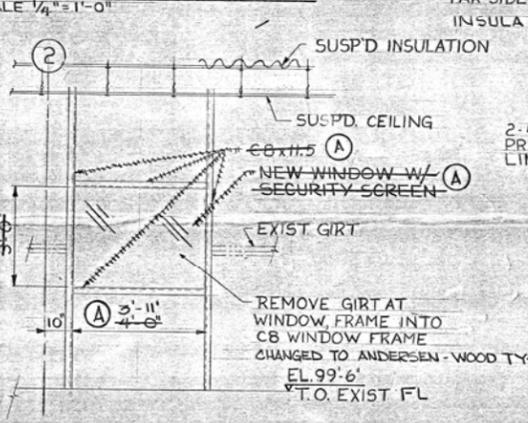
FLOOR PLAN OF EXIST. WAREHOUSE 534  
SCALE 1/4" = 1'-0"



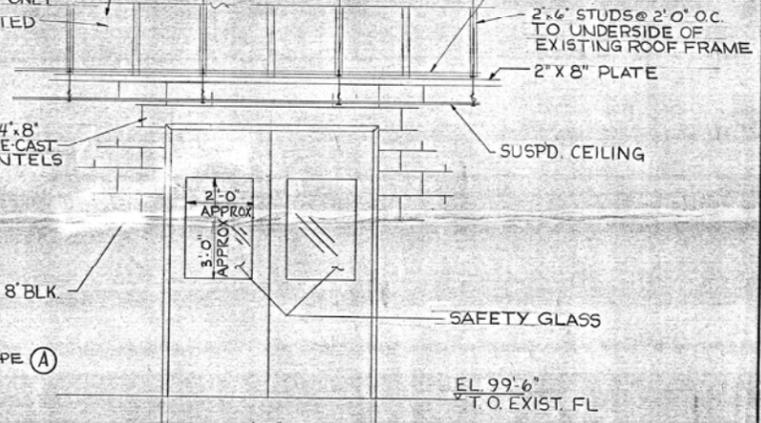
ELEVATION 1  
SCALE 1/2" = 1'-0" A1/A1



ELEVATION 2  
SCALE 1/2" = 1'-0" A1/A1



ELEVATION 3  
SCALE 1/2" = 1'-0" A1/A1



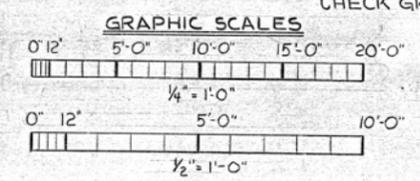
ELEVATION 4  
SCALE 1/2" = 1'-0" A1/A1

DOOR SCHEDULE														
DOOR NO.	LOCATION			FRAME				DOOR				HARDWARE SET NUMBER (SEE SPECS.)	REMARKS	
	OUTSIDE	HAND	INSIDE	WIDTH	HEIGHT	THK	TYPE	WALL CONST	WIDTH	HEIGHT	THK			TYPE
1	LOBBY	L.H.R.	J.C.	2'-10"	6'-10"	1"	METAL	4" BLK	2'-6"	6'-8"	1 3/8"	METAL		
2	LOBBY	R.H.	OFFICE	3'-4"	7'-2"	1"	METAL	8" BLK	3'-0"	7'-0"	1 3/4"			
3	OUTDOOR	L.H.R.	FURN.	4'-4"	7'-2"	1"	CB-II.5	METAL	3'-0"	7'-0"	1 3/4"			
4	LOBBY	L.H.R.H.	WAREH.	6'-4"	7'-2"	1"	METAL	8" BLK	4'-0"	7'-0"	1 3/4"			SEE NOTE 1.
5	J.C.	R.H.R.	PIPE C.	1'-10"	7'-0"	1"		4" BLK	1'-6"	6'-8"	1 3/8"			SEE NOTE 2.
6	LOBBY	L.H.	W. RM.	2'-10"	6'-10"	1"			2'-6"	6'-8"	1 3/8"			
7	LOBBY	R.H.	M. RM.	2'-10"	6'-10"	1"			2'-6"	6'-8"	1 3/8"			
8	OUTDOOR	R.H.R.	NEW WH.	3'-4"	7'-2"	1"	CB-II.5	METAL	3'-0"	7'-0"	1 3/4"	METAL		

DOOR NOTES:  
1. DOOR NO 3 TO HAVE 10" x 14" LOUVER & THR FIRE RATING MIN.  
2. DOOR NO 4 TO HAVE HALF GLASS W/WIRE SAFETY GLASS.

WINDOW NOTES:  
1. ALL EXTERIOR WINDOWS TO BE DOUBLE INSULATED WINDOWS W/ SECURITY SCREEN PROVIDED IN A STEEL FRAME.

GENERAL NOTES:  
1. ALL CMU PARTITIONS TO BE NON STRUC. WALLS AND REINF. VERTICALLY W/ 1" x 4" @ 20" O.C. & HORZ. W/ WIRE JOINT REINF. AT EACH COURSE & ADDT REINF. AT OPNGS.  
2. FOR SPECIAL REQUIREMENTS REGARDING THE HANDLING & REMOVAL OF ASBESTOS REFER TO SECT. 02119 OF SPEC



LEGEND

- 1-A1/A1: SECT. OR ELEVATION NUMBER OR LETTER SHEET SHOWN ON SHEET TAKEN ON.
- : EXISTING WALL
- : NEW WALL
- J.C.: JANITOR'S CLOSET
- D.F.: DRINKING FOUNTAIN

NEILL and GUNTER  
Consulting and Design Engineers  
P. O. Box 1599  
PORTLAND, ME 04104

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND  
NORTH DIVISION  
NAVAL AIR STATION BRUNSWICK, ME.  
D.P.D.O. - COVERED STORAGE FACILITIES  
BUILDING 584 ARCHITECTURAL  
FLOOR PLAN & ELEVATIONS

DATE: 2/1/64  
APPROVED: [Signature]  
OFFICER IN CHARGE: [Signature]  
DATE: 2/1/64

F 80091 2048161  
CONSTR. CONTR. N04162472-80-C-0033  
SCALE: 1/4" = 1'-0" SPEC. 04-80-0033 SHEET 2 OF 11 A1