

WEST MARTELLO TOWERS HISTORIC AMMUNITION BUNKERS



DAMAGE ASSESSMENT REPORT

January 2019

Prepared for:
MONROE COUNTY BOARD OF COUNTY COMMISSIONERS
1100 SIMONTON STREET
KEY WEST, FLORIDA

By: *Bender & Associates* ARCHITECTS *p.a.*
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1. SECRETARY OF INTERIOR'S STANDARDS FOR HISTORIC PRESERVATION PROJECTS:

General Standards for Historic Preservation Projects

The following general standards apply to all treatments undertaken on historic properties listed in the National Register.

1. Every reasonable effort shall be made to provide a compatible use for a property that requires minimal alteration of the building structure, or site and its environment, or to use a property for its originally intended purpose.
2. The distinguishing original qualities or character of a building, structure, or site and its environment shall not be destroyed. The removal or alteration of any historic material or distinctive architectural features should be avoided when possible.
3. All buildings, structures, and sites shall be recognized as products of their own time. Alterations which have no historical basis and which seek to create an earlier appearance shall be discouraged.
4. Changes which have taken place in the course of time are evidence of the history and development of a building, structure, or site and its environment. These changes may have acquired significance in their own right, and this significance shall be recognized and respected.
5. Distinctive architectural features or examples of skilled craftsmanship which characterize a building, structure, or site shall be treated with sensitivity.
6. Deteriorated architectural features shall be repaired rather than replaced wherever possible. In the event replacement is necessary, the new material should match the material being replaced in composition, design, color, texture, and other visual qualities. Repair or replacement of missing architectural features should be based on accurate duplications of features, substantiated by historic, physical, or pictorial evidence rather than on conjectural designs or the availability of different architectural elements from other buildings or structures.
7. The surface cleaning of structures shall be undertaken with the gentlest means possible. Sandblasting and other cleaning methods that will damage the historic building materials shall not be undertaken.
8. Every reasonable effort shall be made to protect and preserve archeological resources affected by, or adjacent to, any acquisition, stabilization, preservation, rehabilitation, restoration, or reconstruction project.

Specific Standards for Historic Preservation Projects

The following specific standards for each treatment are to be used in conjunction with the eight general standards and, in each case, begin with number 9. For example, in evaluating acquisition projects, include the eight general standards plus the four specific standards listed under Standards for Acquisition. The specific standards differ from those published for use in Historic Preservation Fund grant-in-aid projects (36 CFR Part 68) in that they discuss more fully the treatment of archeological properties.

STANDARDS FOR REHABILITATION

9. Contemporary design for alterations and additions to existing properties shall not be discouraged when such alterations and additions do not destroy significant historic, architectural, or cultural material and such design is compatible with the size, scale, color, material, and character of the property, neighborhood, or environment.
10. Whenever possible, new additions or alterations to structures shall be done in such a manner that if such additions or alterations were to be removed in the future, the essential form and integrity of the structure would be unimpaired.

STANDARDS FOR RESTORATION

11. Every reasonable effort shall be made to use a property for its originally intended purpose or to provide a compatible use that will require minimum alteration to the property and its environment.
12. Reinforcement required for structural stability or the installation of protective or code required mechanical systems shall be concealed wherever possible so as not to intrude or detract from the property's aesthetic and historical qualities, except where concealment would result in the alteration or destruction of historically significant materials or spaces.
13. Restoration work such as the demolition of non-contributing additions that will result in ground or structural disturbance shall be preceded by sufficient archeological investigation to determine whether significant subsurface or structural features or artifacts will be affected. Recovery, curation and documentation of archaeological features and specimens shall be undertaken in accordance with appropriate professional methods and techniques.

EXISTING ARCHITECTURAL CONDITIONS EVALUATION CRITERIA / DEFINITIONS

<u>Adaptive Use:</u>	Changing an existing, often historic, building to accommodate a new function; may include extensive restoration and/ or renovation and removal of some existing building elements.*
<u>Altered:</u>	A building element which has been changed during the course of its history from its original built configuration. The change itself may be old enough to warrant being defined as historic.
<u>Conservation:</u>	The skilled repair and maintenance of cultural artifacts, including buildings and historic and artistic materials, with the aim of extending their longevity and aesthetic qualities.*
<u>Dated:</u>	A building element, usually mechanical, electrical or plumbing, which is technologically outdated and /or inefficient, based on current construction standards.
<u>Deteriorated:</u>	A building element which has decayed from its original built condition. This condition can be cosmetic, as in a plaster wall, or more significant, such as structural deterioration.
<u>Original:</u>	Building element which can be dated back to original construction of the building.
<u>Preservation:</u>	The act or process of applying measures to sustain the existing form, integrity, and material of a building or structure, and the existing form or vegetative cover of a site.*
<u>Reconstruction:</u>	The process of duplicating the original materials, form and appearance of a vanished building or structure at a particular historical moment based on historical research.
<u>Rehabilitation:</u>	The act or process of returning a property to a state of utility through repair or alteration which makes possible an efficient or contemporary use while preserving those portions or features of the property which are significant to its historical, architectural, or cultural values.*

<u>Restoration:</u>	The process or product of returning, as nearly as possible an existing site, building, structure, or object to its condition at a particular time in its history, using the same construction materials and methods as the original where possible; typically the period of greatest historical significance or aesthetic integrity is chosen; may include removing later additions, making hidden repairs, and replacing missing period work; often based on a historic structures report.*
<u>Serviceable:</u>	A building element which is capable of serving the function for which it was constructed. For example, a door or window.
<u>Significant:</u>	An element which contributes to the historic nature of a building. A significant element does not necessarily have to be original to construction.
<u>Sound:</u>	An element which is still structurally sound, and capable of serving the purpose for which it was built. The term usually is applied to a structural element of a building, for instance a floor or roof structure.
<u>Stabilization:</u>	The process of temporarily protecting a historic building until restoration or rehabilitation efforts can begin; typically includes making the building weathertight, structurally stable, and secure against intruders on a one-time basis.
<u>Weathered:</u>	A building element which is decayed due to exposure to outside elements without routine maintenance. The element can usually be repaired by providing said maintenance.

* These definitions are reprinted from:

Dictionary of Building Preservation, William Ward Bucher III, John Wiley & Sons, Inc, 1996.

2. HISTORY AND SIGNIFICANCE

Note: This short history is taken from the National Register of Historic Places Master Site File on the West Martello Tower, dated March, 1976. The file was prepared by William N. Thurston, Chief Preservation Planner, Department of State, Tallahassee, FL.

The West Martello Tower Ruins are situated on the Monroe County Beach between Reynolds and White Streets on the south side of the island of Key West. They consist of the remnants of a Civil War period masonry fortification designed as an outlying support for Fort Zachary Taylor. The ruins are presently occupied by the Key West Garden Club, which has created a permanent horticultural exhibit on the grounds and makes use of the interior spaces for a variety of club activities.

The original fortification included these basic structural elements: a central tower; a casemated counterscarp on the north, or landward side; and a double tier of casemate batteries on the south, or seaward side. Apparently, the latter were never completed, only one tier of casemates having been built, and no armament was installed, as the fortification was obsolete long before construction was halted in November, 1866.

This original construction was later modified. In 1904, two concrete emplacements for light coast artillery guns were constructed on the original seaward casements, which were filled and covered with earth. Portions of the central tower were demolished. In addition to these alterations, extensive destruction and deterioration of the exposed brickwork of the counterscarp has occurred. Entrance to the ruin is through a breach in the outer wall of the counterscarp. Several of the small, vaulted casemates of the counterscarp are in regular use as display and exhibit areas.

Passing through those spaces the visitor emerges into an inner "courtyard", originally part of the dry moat that surrounded the central tower. This courtyard and the sodded area covering the casemates of the south side contain a wide variety of trees, shrubs, and flowering plants, both native and exotic, some growing naturally and some cultivated, in striking contrast to the brick and concrete remnants of military construction. The late period concrete gun emplacements overlook the ruins and also offer a vantage point from which to view the shoreline and the sea approaches to Key West. The grounds are attractive and well maintained by the Key West Garden Club. The structural ruins are in a continuing state of slow deterioration. However, the Monroe County Government has included stabilization of the ruins in its planning program.

The West Martello Tower is one of two such defensive works constructed on the south shore of the island of Key West during the Civil War period to supplement the main fortification, Fort Zachary Taylor. These structures represent the ultimate development of design and construction concepts in this type of defensive works in the era of masonry seacoast fortification. The East Martello Tower (already listed in the National Register) has survived in essentially the form of its original construction. The West Martello Tower, however, was subsequently modified, and continued to form a part of the harbor defense installations at Key West until the end of World War II. Thus, the West Martello Tower is significant for both its unique reflection of the evolution of coastal fortifications, and its connection with events important in the history of Key West and the nation.

The construction of outlying tower fortification on the island of Key West was first suggested in the 1840's by Captain George Dutton, of the Army Corps of Engineers (Williams, p. 5). Dutton was at that time in charge of the construction of Fort Taylor, which, with Fort Jefferson in the Dry Tortugas, was intended to be a major link in the nation's coastal defense system. Dutton recommended the construction of five outlying towers, each mounting two guns, to prevent the landing of hostile forces on the beaches east of the fort, which would threaten the security of Fort Taylor itself.

Tower fortifications had proven effective for limited defense purposes, most notably in 1794 at the Bay of Martello in Corsica, when two British warships were repulsed by such an installation mounting a single gun (Lewis, p. 42). Several similar fortifications of various design, but commonly referred to as Martello towers, were built in the United States prior to the War of 1812. But subsequent coast defense planning emphasized more elaborate structures, and Dutton's recommendation was ignored.

Construction and armament of Fort Taylor were essentially complete by early 1860. As the Civil War approached, timely action by the local military commanders secured the fort and prevented the emergence of a Confederate civil administration in Key West (Camp, pp. 31-43). But the vulnerability of the island to amphibious assault was once more recognized. In August, 1861, plans were forwarded by the War Department to Captain Edward B. Hunt, in command at Fort Taylor, for the construction of two tower fortifications on the south shore beaches (Williams, p. 10).

The towers were built approximately one and one-half and three and one-half miles from Fort Taylor. The original plans, prepared by Brigadier General Joseph G. Totten, were an elaboration and refinement of the Martello tower concept. The traditional Martello tower consisted of a simple tower mounting one or two guns, without protecting glacis, ditch, or other outwork. Totten's plan called for a masonry tower fifty-six feet square and thirty-six feet high, containing magazines, kitchen, mess room, barracks, and officers' quarters, and topped by barbette emplacements for four heavy coast defense guns. The tower was surrounded by a dry moat twenty feet wide. On the seaward side of the moat, opposite the south corner of the tower, an earth cover face twelve feet high would provide protection from naval gunfire. On the landward side, an elaborate galleried counterscarp was constructed, with four casemated gun emplacements at each end, facing the east and west corners of the tower, from which 24-pounder howitzers could sweep the tower faces and moat in the event of assault by infantry. The entire counterscarp, including the casemates, was to be covered with earth to form a glacis. The counterscarp gallery and casemates were only accessible from inside the base of the tower through a covered way. The only access to the interior of the tower was at the second floor level, by way of a drawbridge from the top of the counterscarp glacis (Williams, pp. 10-12).

A subsequent revision of the plans substantially changed the nature of the two fortifications. In order to provide greater resistance to naval attack, casemated batteries were designed to replace the earthen glacis on the seaward side. These batteries, mounting twenty-eight guns in two tiers, would be returned at each flank to join the reverse casemates of the counterscarp. A wet ditch eight feet wide and six feet deep in front of the casemates was to extend around the flanks to join the counterscarp glacis at each end (Williams, p. 13).

Construction continued throughout the Civil War years, hampered and frequently interrupted by yellow fever epidemics, storms, and the diversion of materials and labor to more pressing

military needs. Although the masonry work was substantially complete by the end of the war, the outer works were never finished and no armament had been installed. The wartime development of rifled artillery had rendered masonry fortifications obsolete, and by November, 1866, construction on the Martello towers had been indefinitely suspended (Williams, p. 17). As in many other areas, the obsolete masonry fortifications at Key West were subsequently modified to provide foundations for the complex coastal defense installations of the Spanish-American War and later periods.

In February 1904, construction began on two reinforced concrete 3-inch coastal gun batteries at the West Martello. The guns were named Battery Inman, after Captain Shadrach Inman, a revolutionary war soldier killed in action on 18 August 1780. Made by the Watervliet Arsenal, the 3" model M1903 pedestal mount guns had an effective range of 10,988 yards. Construction was completed in December 1904 and the new mount was transferred to the Coast Artillery on 26 April 1906. The battery was deactivated in 1945, and the mounts for the guns still remain today. From 1914 to 1944, the tower was used as a radio station, and 90mm anti-aircraft artillery mounts (still in existence) were located on the beach adjacent to the Fort. These artillery mounts were called Battery AMTB-6 (AMTB standing for Anti-Torpedo Motor Boat). The property remained a part of the military reservation through World War II, after which it and the East Martello Tower were declared surplus and subsequently sold to Monroe County in 1947.

In 1949, the West Martello was claimed to be an eyesore from the shoreline, and pressure was put on the County to level the structure and construct a new beach area.

The current Garden Club is named for Joe Allen, a congressman and avid gardener, who lobbied heavily to stop the demolition of the West Martello. Through the efforts of Mr. Allen, a lend-lease agreement was signed in 1955 by the County and the Key West Garden Club to operate the structure.

West Martello Tower was declared a National Historic Site on June 24, 1976 by the State of Florida and is now listed in the National Register of Historic Places. In September 1984, the West Martello Tower was renamed ***West Martello Tower, Joe Allen Garden Center***. This was in honor of former State Representative Allen who made it possible for the Key West Garden Club to call West Martello its home.

Sources:

Camp, Vaughn, Jr. "Captain Brannan's Dilemma: Key West 1861." Tequesta, (1960) 31-43.

Lewis, Emanuel Raymond. Seacoast Fortifications of the United States: An Introductory History. Washington D.C.: Smithsonian Institution Press, 1970.

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Williams, Ames W. "Stronghold of the Straits." Periodical Journal of the Council on Abandoned Military Posts, VI (Winter 1974-75), 2 20.

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3. STRUCTURAL CONDITION ASSESSMENT



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Structural Condition Assessment West Martello Batteries and Ammunition Bunkers Key West, Florida

Prepared For

Bender & Associates P.A.
410 Angela Street
Key West, Florida 33040-7402

Prepared By

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AES Project No. 317-412
January 8, 2019



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January 8, 2019

Mr. David James Salay, RA, LEED AP
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410 Angela Street
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Re: Structural Condition Assessment
West Martello Batteries and Ammunition Bunkers
Key West, Florida

AES Project: #317-412

Dear David:

Atlantic Engineering Services of Jacksonville (AES) has completed its structural condition assessment of the West Martello Batteries and Ammunition Bunkers located at 1100 Atlantic Boulevard in Key West, Florida. Our assessment consisted of a visual review of the structure on December 3, 2017, along with carbonation and chloride testing. Concrete chloride testing was performed by AMEC Foster Wheeler Environmental & Infrastructure, Inc. and carbonation testing was performed by AES. Present at the site were Mr. David James Salay, RA, LEED AP; and Mr. Mark J. Keister, P.E.

BACKGROUND

The West Martello Batteries and Ammunition Bunkers are two (2) emplacements for light coastal artillery guns constructed on the original seaward casemates of the West Martello Tower ruins in 1904 (see Photographs 1 and 2). There are two (2) artillery gun emplacements with three (3) ammunition bunkers covered in earth. The artillery gun emplacements face the south on the east and west with the ammunition bunkers lined up in between. To the north of the bunkers, a meeting room has been added and the bunkers are currently being used as storage. The batteries are elevated concrete artillery gun emplacements with concrete walls 2'-0" to 3'-0" thick on the south-east and west sides, with concrete stairs and terraces leading down to the earth covered bunkers below. The bunkers consist of concrete roofs in excess of 4'-0" thick. The concrete walls between the bunkers are 2'-0" thick and the perimeter concrete walls are 3'-9" thick or thicker.

OBSERVATIONS

Our structural condition assessment consisted of a visual review of the structure. Concrete carbonation testing was determined at three (3) locations and concrete chloride testing was also determined at three (3) locations. The testing locations were in the ammunition bunker ceilings and the results for the concrete carbonation testing and the chloride testing are shown in Appendix A.

Fresh concrete has a PH of approximately 12 to 13, which creates a layer of passivity on embedded reinforcing that protects the reinforcing from corrosion. With exposure to atmospheric carbon dioxide, concrete PH slowly decreases over time as carbon dioxide penetrates the concrete. When the concrete PH reduces to a value of about 9 to 10, the passivating layer protecting the reinforcing is destroyed and the reinforcing can corrode due to exposure to oxygen and water. The PH at all three (3) locations is 8.5 or lower at the face of reinforcing, and the concrete is no longer protecting the reinforcing from corrosion near the surface of the concrete.



Chlorides in concrete greatly accelerate corrosion and the lower the concrete PH, the greater the impact of chloride induced corrosion. Chloride content in concrete exposed to moisture should be less than .15% of Cl to weight of cement and the chloride corrosion threshold is 1.2 pounds of chloride per cubic yard of concrete, which works out to .0317% Cl for concrete weighing 140 pounds /cubic yard. Of the three (3) samples tested for chlorides, three (3) exceeded the chloride corrosion threshold with one (1) being very high in chloride content.

The gun emplacement walls are in good condition with random vertical and horizontal hairline cracks and one (1) location of rust stains indicating exposed corroding reinforcing (See Photographs 3, 4 and 5). Each artillery gun emplacement wall has two (2) expansion joints through the wall that are open, and the sealant has deteriorated away (see Photograph 6).

The ammunition bunker walls are also in good condition with random vertical hairline cracks and isolated larger cracks. Over the doors, there are large areas of wall that are spalling (see Photograph 7). The bottoms of the ammunition bunker slabs are in poor condition with the east and west slab bottoms delaminated, and exposed corroding reinforcing (see Photograph 8). At the middle ammunition bunker, the slab bottom is partially delaminated with exposed corroding reinforcing. The remainder is separated from the main slab above and could fall at any time.

EVALUATION AND RECOMMENDATIONS

The West Martello artillery gun emplacements are in good condition, but they do require repair. The expansion joints need to be cleaned of debris and filled with sealant and the exposed corroding reinforcing drilled out and patched with a corrosion inhibiting repair mortar. The hairline cracks should be injected with epoxy to weatherproof them.

The ammunition bunker walls are also in good condition, but they do require repair. The hairline cracks should be injected with epoxy and the larger cracks filled with a flowable corrosion inhibiting repair mortar. The wall areas that are spalling should have the loose concrete removed and replaced with a corrosion inhibiting repair concrete. The bottoms of the ammunition bunker slabs are in poor condition, but due to their significant thickness, are stable. To repair them, all loose concrete needs to be removed and the existing reinforcing cleaned of corrosion and supplemental reinforcing added with the new steel mat connected to the upper main slab, and new concrete placed at the bottom of the slabs. The bottom of the slabs should be board-formed to match the walls and existing slab bottoms, and the concrete should contain a corrosion inhibitor and should be self-consolidating to aid in placement. The middle ammunition bunker should have the delaminated slab bottom concrete that is still in place removed, or the bunker should not be used for storage until the slab is repaired.

CONCLUSIONS

In general, the West Martello artillery gun emplacements and ammunition bunkers are in good condition with the ammunition bunker slab bottoms in poor condition. The middle bunker should have the delaminated slab bottom concrete still in place removed or the bunker locked and not used for storage until the slab bottom is repaired. Repair will be in the form of epoxy injection of cracks, spall repair and bottom of slab replacement.



Mr. David James Salay, RA, LEED AP
January 8, 2019
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AES Project: #317-412

It has been a pleasure serving you as a consulting structural engineer. Please contact our office if there are any questions regarding this correspondence, or if you need any additional information.

Very truly yours,
ATLANTIC ENGINEERING SERVICES OF JACKSONVILLE
FLORIDA CERTIFICATE OF AUTHORIZATION #791

A handwritten signature in blue ink, appearing to read "Mark J. Keister", is written over the typed name and title.

Mark J. Keister, P.E.
Principal

MJK/drg





Photograph 1



Photograph 2



Photograph 3



Photograph 4



Photograph 5



Photograph 6



Photograph 7



Photograph 8



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APPENDIX A

DEPTH OF CARBONATION AND CHLORIDE TESTING



DEPTH OF CARBONATION

<u>TEST LOCATION</u>	<u>PH AT DEPTH</u>
West Ammunition Slab Bottom	8.0
Middle Ammunition Slab Bottom	8.5
East Ammunition Slab Bottom	8.0

REPORT OF ACID SOLUBLE CHLORIDE TESTING

PROJECT: West Martello Amunition Bunkers
Key West, FL

PROJECT NO.: 6738-17-5525.02

CLIENT: AES

DATE TESTED: December 21, 2018

As requested, Wood Environment & Infrastructure Solutions, Inc. has completed testing of concrete fragments received from Atlantic Engineering Services on December 12, 2018 . The samples were crushed and tested in general accordance with Florida Test Method FM5-516. Results are outlined below.

Choride Content

Sample ID	% Cl	ppm
A	14.9374	149373.4
B	27.0238	270238.2
C	10.3784	103783.4

Respectfully Submitted

 11/4/19
Corey T. Chascin, E.I.



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APPENDIX B

DEFINITION OF TERMS ASSOCIATED WITH THE DURABILITY OF CONCRETE



DEFINITION OF TERMS ASSOCIATED WITH THE DURABILITY OF CONCRETE

(From ACI 201.1R-08)

1 CRACKING

Crack- A complete or incomplete separation, of either concrete or masonry, into two or more parts produced by breaking or fracturing.

- 1.1 *Checking*- Development of shallow cracks at closely spaced but irregular intervals on the surface of plaster, cement paste, mortar, or concrete (See also *cracks* and *crazing*).
- 1.2 *Craze cracks*- Fine random cracks or fissures in a surface of plaster, cement paste, mortar or concrete. *Crazing*- The development of craze cracks; the pattern of craze cracks existing in a surface (See also *checking* and *cracks*).
- 1.3 *D-cracks*- A series of cracks in concrete near and roughly parallel to joints and edges.
- 1.4 *Diagonal crack*- In a flexural member, an inclined crack, caused by shear stress, usually at approximately 45 degrees to the axis; or a crack in a slab, not parallel to either the lateral or longitudinal directions.
- 1.5 *Hairline cracks*- Cracks in an exposed-to-view concrete surface having widths so small as to be barely perceptible.
- 1.6 *Longitudinal cracks*- A crack that develops parallel to the length of the member.
- 1.7 *Map cracking*- 1) Intersecting cracks that extend below the surface of hardened concrete; caused by shrinkage of the drying surface concrete that is restrained by concrete at greater depths where either little or no shrinkage occurs; vary in width from fine and barely visible to open and well defined; or 2) the chief symptom of a chemical reaction between alkalis in cement and mineral constituents in aggregate within hardened concrete; due to differential rate of volume change in different members of the concrete; cracking is usually random and on a fairly large scale and, in severe instances, the cracks may reach a width of 12.7 mm (0.50 in.) (See also *checking* and *crazing*; also known as *pattern cracking*).
- 1.8 *Pattern cracking*- Cracking on concrete surfaces in the form of a repeated sequence; resulting from a decrease in volume of the material near the surface, or an increase in volume of the material below the surface, or both (see *map cracking*).
- 1.9 *Plastic shrinkage cracking*- Cracking that occurs in the surface of fresh concrete soon after it is placed and while it is still plastic.
- 1.10 *Random cracks*- Uncontrolled cracks that develop at various directions away from the control joints.
- 1.11 *Shrinkage cracking*- Cracking of a structure or member due to failure in tension caused by external or internal restraints as reduction in moisture content develops, carbonation occurs, or both.
- 1.12 *Temperature cracking*- Cracking due to tensile failure, caused by temperature drop in members subjected to external restraints or by a temperature differential in members subjected to internal restraints.
- 1.13 *Transverse cracks*- Cracks that occur across the longer dimension of the member.



2 DISTRESS

Deterioration- 1) Physical manifestation of failure of a material (for example, cracking, delamination, flaking, pitting, scaling, spalling, and staining) caused by environmental or internal autogenous influences on rock and hardened concrete as well as other materials; or 2) Decomposition of material during either testing or exposure to service (See also *disintegration*).

- 2.1 *Chalking*- Formation of a loose powder resulting from the disintegration of the surface of concrete or an applied coating, such as cementitious coating.
- 2.2 *Curling*- The distortion of concrete member from its original shape such as the warping of a slab due to differences in temperature or moisture content in the zones adjacent to its opposite faces (See also *warping*).
- 2.3 *Deflection*- Movement of a point on a structure or structural element, usually measured as a linear displacement or as succession displacements transverse to a reference line or axis.
- 2.4 *Deformation*- A change in dimension or shape.
- 2.5 *Delamination*- A separation along a plane parallel to a surface, as in the case of a concrete slab, a horizontal splitting, cracking, or separation within a slab in a plane roughly parallel to, and generally near, the upper surface; found most frequently in bridge decks and caused by the corrosion of reinforcing steel or freezing or thawing; similar to spalling, scaling, or peeling except that delamination affects large areas and can often only be detected by non-destructive tests, such as tapping or chain dragging.
- 2.6 *Disintegration*- Reduction into small fragments and subsequently into particles (See also *deterioration*).
- 2.7 *Distortion*- See *Deformation*.
- 2.8 *Drummy area*- area where there is a hollow sound beneath a layer of concrete due to a delamination, poor consolidation, or void (See also *delamination*).
- 2.9 *Dusting*- The development of a powdered material at the surface of hardened concrete (See also *chalking*).
- 2.10 *Efflorescence*- A deposit of salts, usually white, formed on a surface, the substance having emerged in solution from within either concrete or masonry and subsequently been precipitated by a reaction, such as carbonation or evaporation.
- 2.11 *Exfoliation*- Disintegration occurring by peeling off in successive layers; swelling up, and opening into leaves or plates like a partly opened book.
- 2.12 *Exudation*- A liquid or viscous gel-like material discharged through a pore, crack, or opening in the surface of concrete.
- 2.13 *Joint deficiencies*- Expansion, contraction, and construction joints not functioning in intended service conditions.
 - 2.13.1 *Joint spall*- A spall adjacent to a joint.
 - 2.13.2 *Joint sealant failure*- Joints opened due to a cracked and/or debonded sealant.
 - 2.13.3 *Joint leakage*- Liquid migrating through the joint.
 - 2.13.4 *Joint fault*- Differential displacement of a portion of a structure along a joint.
- 2.14 *Leakage*- Contained material is migrating through the concrete member.
 - 2.14.1 *Leakage, liquid*- Liquid is migrating through the concrete.
 - 2.14.2 *Leakage, gas*- Gas is migrating through the concrete.



- 2.15** *Mortar flaking*- A form of scaling over course aggregate.
- 2.16** *Peeling*- A process in which thin flakes of mortar are broken away from a concrete surface, such as by deterioration or by adherence of surface mortar to forms as forms are removed.
- 2.17** *Pitting*- Development of relatively small cavities in a surface; in concrete, localized disintegration, such as a popout; localized corrosion evident as minute cavities on the surface.
- 2.18** *Popout*- The breaking away of small portions of a concrete surface due to localized internal pressure that leaves a shallow, typical conical, depression with a broken course aggregate at the bottom.
 - 2.18.1** *Popouts, small*- Popouts leaving depressions up to 10 mm (0.4 in.) in diameter, or the equivalent.
 - 2.18.2** *Popouts, medium*- Popouts leaving depressions between 10 and 50 mm (0.4 and 2 in.) in diameter.
 - 2.18.3** *Popouts, large*- Popouts leaving depressions greater than 50 mm (2 in.) in diameter.
- 2.19** *Scaling*- Local flaking or peeling away of the near-surface portion of hardened concrete or mortar (See also *peeling* and *spalls*).
 - 2.19.1** *Scaling, light*- Loss of surface mortar without exposure of coarse aggregate.
 - 2.19.2** *Scaling, medium*- Loss of surface mortar 5 to 10 mm (0.2 to 0.4 in.) in depth and exposure of coarse aggregate.
 - 2.19.3** *Scaling, severe*- Loss of surface mortar 5 to 10 mm (0.2 to 0.4 in.) in depth with some loss of mortar surrounding aggregate particles 10 to 20 mm (0.4 to 0.8 in.) in depth.
 - 2.19.4** *Scaling, very severe*- Loss of coarse aggregate particles as well as surface mortar, generally to a depth greater than 20 mm (0.8 in.).
- 2.20** *Spall*- A fragment, usually in the shape of a flake, detached from a concrete member by a blow, by the action of weather, by pressure, by fire, or by expansion within the larger mass.
 - 2.20.1** *Small spall*- A roughly circular depression not greater than 20 mm (0.8 in.) in depth and 150 mm (6 in.) in any dimension.
 - 2.20.2** *Large spall*- May be roughly circular or oval or, in some cases, elongated, and is more than 20 mm (0.8 in.) in depth and 150 mm (6 in.) in greatest dimension.
- 2.21** *Warping*- Out-of-plane deformation of the corners, edges, and surface of a pavement, slab, or wall panel from its original shape (See also *curling*).



3 TEXTURAL FEATURES AND PHENOMENA RELATIVE TO THEIR DEVELOPMENT.

- 3.1 *Air void*- A space in cement paste, mortar, or concrete filled with air; an entrapped air void is characteristically 1 mm (0.04 in.) or greater in size and irregular in shape; entrained air void is typically between 10 μ m and 1 mm (0.04 mil and 0.04 in.) in diameter and spherical or nearly so.
- 3.2 *Blistering*- the irregular raising of a thin layer at the surface of placed mortar or concrete during or soon after the completion of the finishing operation; also, bulging of the finish plaster coat as it separates and draws away from the base coat.
- 3.3 *Bugholes*- Small regular or irregular cavities, usually not exceeding 15 mm (0.6 in.) in diameter, resulting from entrapment of air bubbles at the surface of formed concrete during placement and consolidation (Also known as surface air voids).
- 3.4 *Cold joint*- A joint or discontinuity resulting from a delay in placement of sufficient duration to preclude intermingling and bonding of the material in two successive lifts of concrete, mortar, or the like.
- 3.5 *Cold-joint lines*- Visible lines on the surfaces of formed concrete indicating the presence of a cold joint where one layer of concrete had hardened before subsequent concrete was placed.
- 3.6 *Discoloration*- Departure of color from that which is normal or desired (See also *staining*).
- 3.7 *Honeycomb*- Voids left in concrete due to failure of the mortar to effectively fill the spaces among coarse aggregate particles.
- 3.8 *Incrustation*- A crust or coating, generally hard, formed on the surface of concrete or masonry construction or on aggregate particles.
- 3.9 *Laitance*- A layer of weak material known as residue derived from cementitious material and aggregate fines either: 1) carried by bleeding to the surface or to the internal cavities of freshly placed concrete; or 2) separated from the concrete and deposited on the concrete surface or internal cavities during placement of concrete underwater.
- 3.10 *Sand pocket*- A zone in concrete or mortar containing fine aggregate with little or no cement material.
- 3.11 *Sand streak*- A streak of exposed fine aggregate in the surface of formed concrete, caused by bleeding.
- 3.12 *Segregation*- The differential concentration of the components of mixed concrete, aggregate, or the like, resulting in nonuniform proportions in the mass.
- 3.13 *Staining*- Discoloration by foreign matter.
- 3.14 *Stalactite*- A downward-pointing deposit formed as an accretion of mineral matter produced by evaporation of dripping liquid from the surface of concrete, commonly shaped like an icicle (See also *stalagmite*).
- 3.15 *Stalagmite*- An upward-pointing deposit formed as an accretion of mineral matter produced by evaporation of dripping liquid, projecting from the surface of rock or of concrete, commonly roughly conical in shape (See also *stalactite*).
- 3.16 *Stratification*- The separation of overwet or overvibrated concrete into horizontal layers with increasingly lighter material toward the top; water, laitance, mortar, and coarse aggregate tend to occupy successively lower positions in that order; a layered structure in concrete resulting from placing of successive batches that differ in appearance; occurrence in aggregate stockpiles of layers of differing grading or composition; a layered structure in a rock foundation.



**ATLANTIC
ENGINEERING**
SERVICES

APPENDIX C

EXISTING STRUCTURAL CONDITIONS EVALUATION CRITERIA



**EXISTING STRUCTURAL CONDITIONS
EVALUATION CRITERIA**

EXCELLENT

Meets or exceeds current structural code requirements.

Capable of safely carrying proposed occupancies.
No significant vibrations, cracking or deflections.
No structural reinforcement or repairs required.
Very minor, if any, maintenance required.

GOOD

Meets current structural code requirements.

Capable of safely carrying proposed occupancies.
Deflections, cracking, vibrations may be observable.
No structural reinforcement required.
Minor structural repairs required.
Some significant maintenance repairs required.

FAIR

Majority of structure meets structural code requirements.

Portions of structure are not capable of carrying proposed occupancies.
Deflections, cracking, vibrations, structural distress is observable.
Structural reinforcement required in limited portions of the structure.
Structural repairs required generally.
Many significant maintenance repairs required.

POOR

Majority of structure does not meet structural code requirements.

Much of the building is not capable of carrying proposed occupancies.
Deflections, cracking, vibrations, structural distress commonly observable throughout the structure.
Major reinforcement or reconstruction of the structure is required.
Major maintenance repairs are required.

EXTREMELY POOR

Collapse of structure is imminent.

Structure exhibits significant deflections, cracking, vibrations, structural distress.
Structure requires extensive reinforcement or reconstruction of impractical scope.

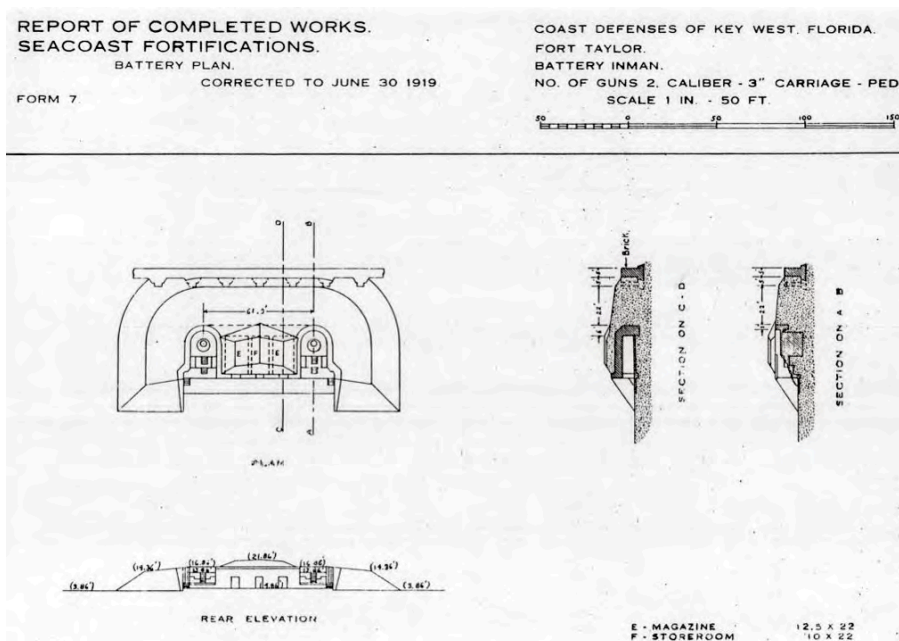
NOTE: Some parts of each definition may not apply.

4. ARCHITECTURAL ASSESSMENT

In general, the highest priority for any preservation project is structural stabilization, making the building watertight and reversing the damage caused by water intrusion. Inattention to these problems will cause additional damage to the resource and increase costs in the long term.

The West Martello Ammunition Bunkers are part of the reinforced concrete coastal gun Battery Inman, completed in late 1904. The entire battery was constructed within the walls of the Civil War-era West Martello fort, which was completed in 1866. The West Martello was never officially completed, as the brick fortification became obsolete due to the advent of rifled artillery in the late 1860s.

The guns of Battery Inman consisted of two 3" model M1903 pedestal mount guns mounted in two identical batteries facing the Florida Straits to the south, giving a field of fire of over 180 degrees. The artillery batteries were constructed atop three concrete bunkers which originally held ammunition and stores. The walls and ceilings of the bunkers consist of reinforced concrete around 48" thick. The bunker was backfilled and buried under sloped earth to provide additional protection from incoming fire.



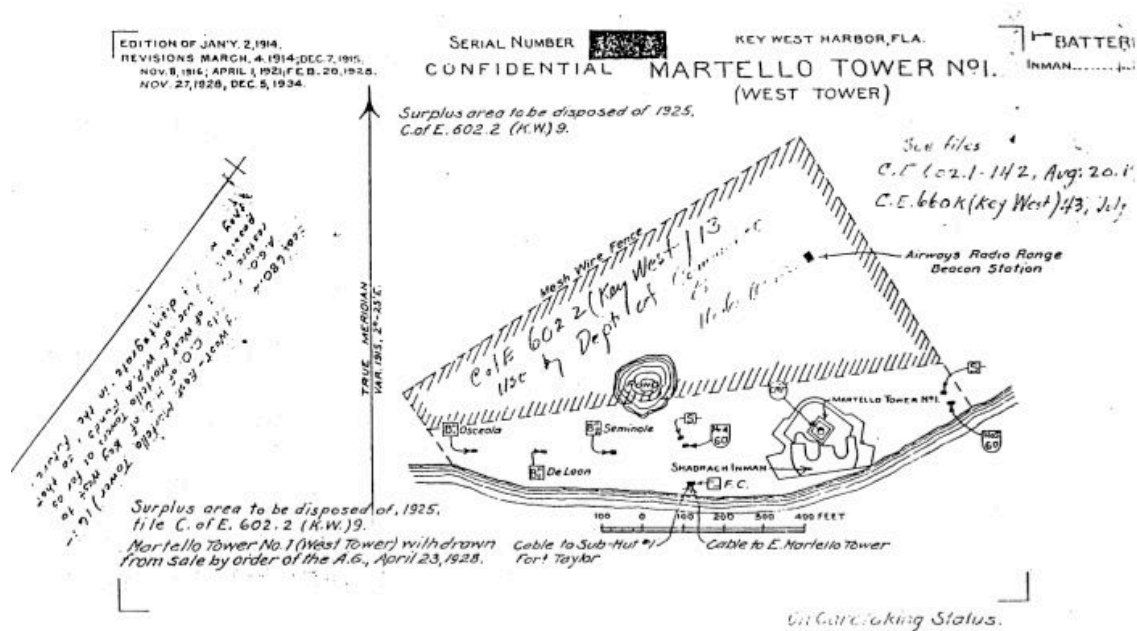
Above is a 1919 drawing of the entire fortification. There are two section cuts in the drawing which show the relationship of gun mounts, ammunition bunkers, stairs, and backfilled earthen berms. With the exception of the guns themselves, all of these items still remain.

WEST MARTELLO AMMO BUNKERS



Above is an aerial photo of Battery Inman, taken 11 November 1939. The twin gun mounts can be clearly seen facing outward. The ruins of the Civil War-era West Martello surround the guns, including the citadel and outer walls. The west side of the outer fort walls has been removed. The brick from these walls was used as rubble fill for Fort Taylor. The bricks were also salvaged and used all over the city of Key West. Many bricks were used to pave the first paved roads in the City. Note that the Fort sits right on the water; the existing beach and park was installed in the 1950's.

WEST MARTELLÔ AMMO BUNKERS



The above military drawing shows the multiple fortifications along the south side of Key West in 1934. Battery Inman can be seen at right.



The date of this photo is unknown, but probably 1940s. The photo shows the twin batteries of Battery Inman as they stood within the West Martello. The twin sets of stairs, which still exist, can be seen leading to the gun mounts, which have no guns. The doors to the ammunition bunkers can be seen at the ground level. The roof of the ammunition bunkers are covered with fill. The tower at center is the remains of the central stair of the original Citadel, constructed in 1866. The brick walls in the foreground are the remains of the West Martello.

WEST MARTELLO AMMO BUNKERS



This date of this photo is unknown but probably circa 1930s. The photo was taken standing atop Battery Inman, and looking north at the ruins of Fort Taylor. Note the height of the former walls, which are much lower today.



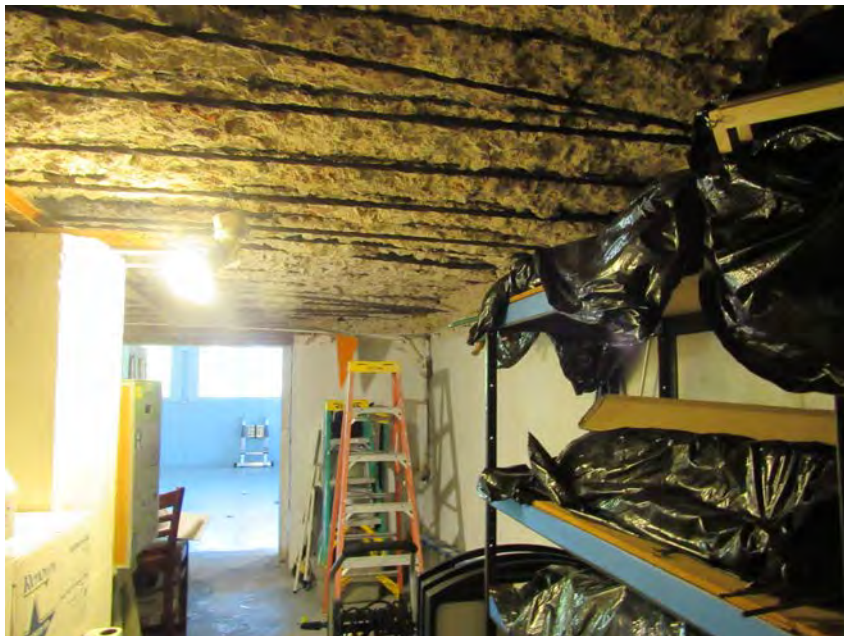
This photo shows the West Martello during World War II. The guns of Battery Inman are carefully camouflaged and barely visible, unless you know where to look. Note the large observation tower atop the original Citadel, and the multiple tar paper barracks buildings surrounding the fort. The fort lies directly on the beach.

WEST MARTELLO AMMO BUNKERS

THE AMMUNITION BUNKERS TODAY



The ammunition bunkers today are surrounded by a contemporary meeting room building which was constructed in the 1970s. The large wood doors of the bunkers are still intact and in good condition.



A view of the bunker interior. The finishes of the three ammunition bunkers consist of painted concrete walls, floors and ceilings. The ceilings of the bunkers have delaminated, and around 6" of the 4 foot thick ceiling has fallen. The cause of this delamination is the original reinforcement

bars, which have rusted and expanded, popping off the lower layer of concrete. The original ceilings of the bunkers were board formed concrete. There are also many smaller cracks in the concrete, caused by spalling concrete. The concrete ceilings and walls should be repaired, which is the goal of this project. The Secretary of Interior's Standards dictate that the repair should match the original finishes, board formed concrete.

The structural assessment of this report explains the proposed concrete repair method in detail.



Each of the bunkers contains a ventilation shaft at the rear. This 12" wide shaft is composed of hollow clay pipe, and originally provided fresh air from the top. The pipes are blocked by small concrete plugs now, and terminate around 8" below the existing earth surface of the top of the bunker. The pipes are historic, and should be retained. It is possible that the pipes can be used to assist in the pouring of new concrete ceilings, to admit concrete and to expel air during the pour.



General view of empty ammunition bunker. Each bunker has a single concrete column at center. The original 1904 rebar can be seen running through the ceiling. This bar has rusted and expanded, causing the delamination of the lower 6" of the concrete ceiling, which is several feet thick. The bar and the small metal beams should be removed before new concrete is poured. New reinforcement will then be installed, followed by a new pour of board-formed concrete. The concrete can be poured from the top, utilizing the original ventilation pipes and new holes. All of the miscellaneous electric conduit should also be removed.



This detail photo of the ceiling shows the original rebar partially embedded in the concrete. The original bar was square and was twisted. Note the chips of brick in the concrete. All of this rebar should be removed and new bar should be installed, which should be doweled and epoxied to the original concrete.



General view of the top of the bunkers. During this assessment, holes were dug to locate the original vent pipes, which are around 8" below the surface and capped with a thin layer of concrete. These pipes can be excavated and used in the new concrete pour.



This photo shows the original gun mount at the west side. The gun mount walls and stairs are in fairly good condition, and are used as a garden area housing native and exotic plants. Contemporary stair railings and guardrails have been installed, as well as a trellis. Many of the walls have minor cracks which should be repaired in this scope of work.

WEST MARTELLO AMMO BUNKERS



This photo shows the original gun mount at the east side, which is identical to the west, and used for the same purpose. These walls also have minor cracks which should be repaired in this scope.



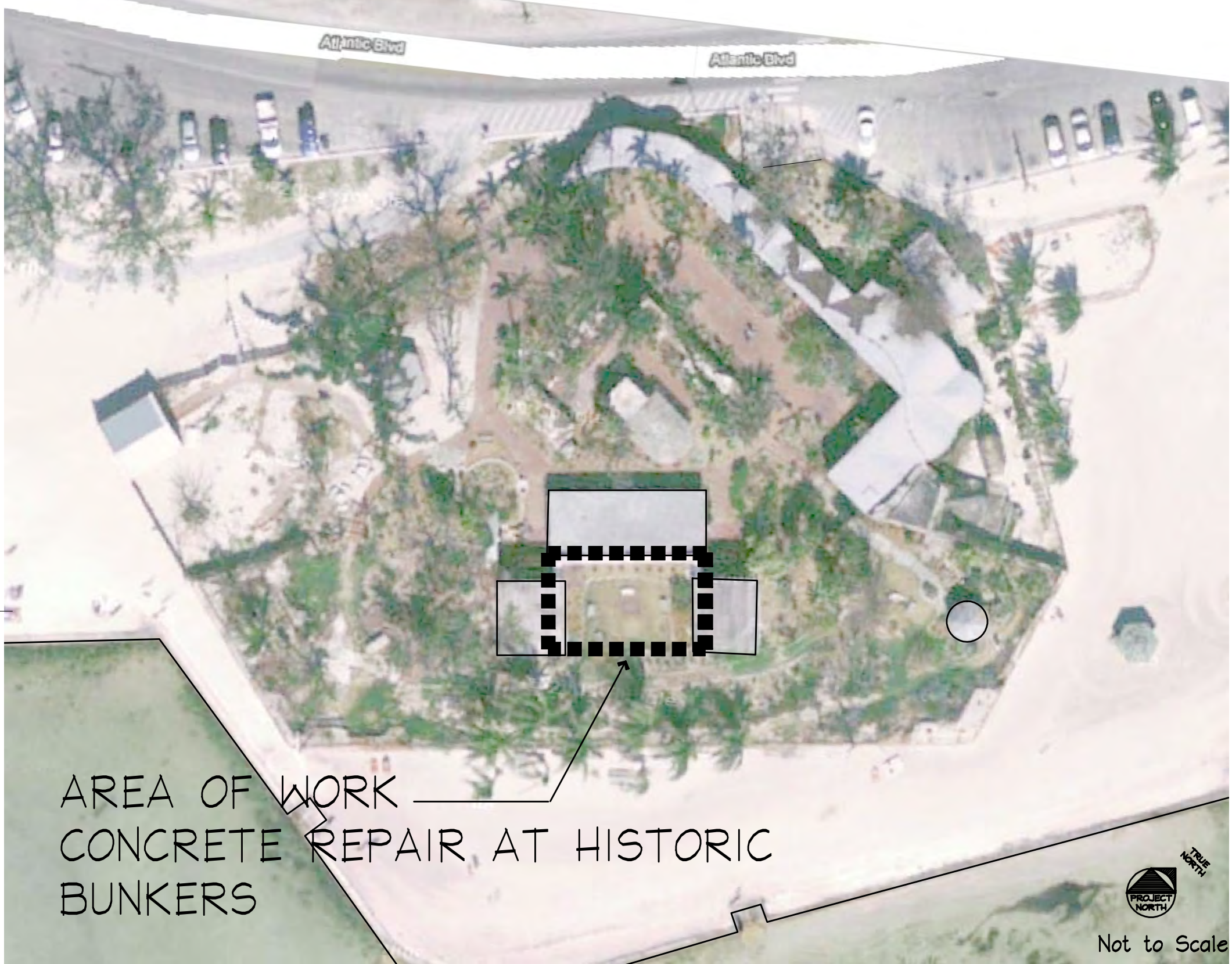
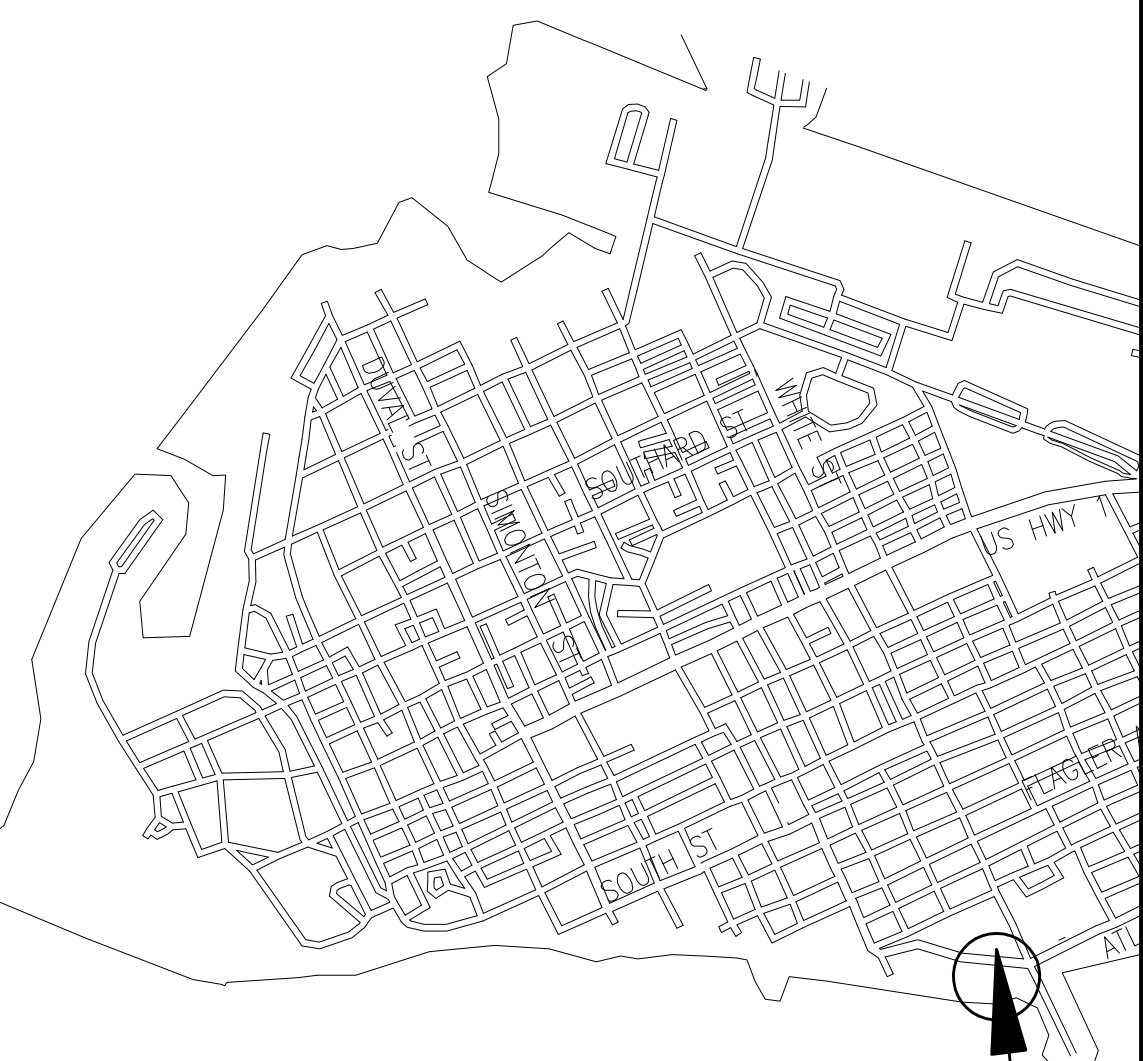
This photo shows the minor cracks in the wall of the gun battery, which should be repaired in this scope of work. Note the 1904-era board formed concrete.

5. EXISTING DRAWINGS

WEST MARTELLO TOWERS

AMMUNITION BUNKERS HURRICANE DAMAGE REPAIR

MONROE COUNTY BOARD OF COUNTY COMMISSIONERS
1100 ATLANTIC BLVD. KEY WEST FLORIDA

AERIAL PHOTO  AREA OF WORK CONCRETE REPAIR AT HISTORIC BUNKERS Not to Scale	SITE MAP - KEY WEST  SITE LOCATION 1100 ATLANTIC BLVD. KEY WEST	PROJECT DIRECTORY PROJECT: WEST MARTELLO HISTORIC MASONRY RESTORATION ARCHITECT'S PROJECT No.: 1505T OWNER: MONROE COUNTY BOARD OF COUNTY COMMISSIONERS Address: 1100 SIMONTON ST. KEY WEST, FL 33040 Tel: 305-292-4468 Fax: 305-296-4321 Representative: RAY SANDERS ARCHITECT: BENDER & ASSOCIATES ARCHITECTS, P.A. Address: 410 Angela Street, Key West, FL 33040 Tel: (305) 296-1347 Fax: (305) 296-2727 E-mail: dsalay@benderarchitects.com Project Manager: Bert L. Bender (Principal-in-Charge) Project Architect: David Salay LIST OF ALTERNATES: 1. None.	GENERAL NOTES 1. All work shall comply with the Florida Building Code, latest edition, and all applicable laws, codes and ordinances of the City, County, and the State of Florida. In the City of Key West, applicable Codes forming the basis of this design and compliance requirements for the Contractor include: FLORIDA BUILDING CODE - Building 6th Edition - 2017 FLORIDA BUILDING CODE - Existing 6th Edition - 2017 FLORIDA BUILDING CODE - Residential 6th Edition - 2017 FLORIDA BUILDING CODE - Plumbing 6th Edition - 2017 FLORIDA BUILDING CODE - Fuel Gas 6th Edition - 2017 FLORIDA BUILDING CODE - Mechanical 6th Edition - 2017 NATIONAL ELECTRICAL CODE 2014 EDITION NFPA 70 LIFE SAFETY CODE w/ Florida Modifications 2006 EDITION FLORIDA FIRE PREVENTION CODE 2007 EDITION NFPA 1 2006 EDITION This project is designed in accordance with A.S.C.E. 7-10 to resist wind loads of 180 mph (3 second gusts). 2. Prior to submitting a bid, verify all existing conditions and dimensions on the jobsite, and also after award, but prior to the start of construction. 3. Contours and/or existing grades shown are approximate. Verify with field conditions. Final grading shall provide gradual slopes and grades. Slope all grades away from the building. Planting areas shall be graded with soil suitable for planting. Rock and debris will not be allowed. 4. Where discrepancies between drawings, specifications, and code requirements occur, adhere to the most stringent requirement. 5. Dimensions shall take precedence over scale. 6. All new utilities shall be underground. 7. Drawings and specifications are complementary. Refer to all sheets of drawings and applicable sections of the specifications for interfaces of work with related trades. 8. After completion of construction remove all debris and construction equipment. Restore site to original condition. 9. Notify owner of any possible artifacts uncovered during site grading and throughout the course of construction. 10. Furnish a receptacle on site to contain construction debris and maintain the site in an orderly manner to ensure public safety and prevent blowing debris. 11. Comply with all requirements for selective demolition as specified, shown on the Demolition Plan, or called for in the selective Demolition Notes. 61G1-16.003 Use of Seal. The personal seal, signature and date of the architect or interior designer shall appear on all architectural or interior design documents to be filed for public record and shall be construed to obligate his partners or his corporation. A corporate seal alone is insufficient. Documents shall be signed personally and sealed by the responsible architect or interior designer. Final official record documents (not tracings, etc.) shall be so signed. The signing and sealing of the specification index sheets shall be considered adequate. All drawing sheets and pages shall be so signed and sealed. An architect or interior designer shall not affix, or permit to be affixed, his seal or name to any plan, specifications, drawings, or other related document which was not prepared by him or under his responsible supervising control as provided in Rule Chapter 61G1-23, F.A.C. An architect or interior designer shall not use his seal or do any other act as an architect or interior designer unless holding at the time a certificate of registration and all required renewals thereof. Specific Authority 481.2055, 481.221 FS. Law Implemented 481.221, 481.225(1)(e), (g), (j), 481.225(1)(q), (h), (i) FS. History-New 12-23-79, Formerly 21B-16.03, Amended 7-27-83, Formerly 21B-16.003, Amended 11-21-94, 4-18-00.																																																																																																																																																	
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ID	INSIDE DIAMETER																																																																																																																																																			
MAX	MAXIMUM																																																																																																																																																			

REVISIONS

WEST MARTELLO TOWERS
AMMUNITION BUNKER HURRICANE DAMAGE REPAIR
1100 ATLANTIC BLVD.
KEY WEST FLORIDA
MONROE COUNTY BOARD OF COUNTY COMMISSIONERS

410 Angela Street
Key West, Florida 33040
Telephone (305) 296-1347
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Florida License AAC002022

Bender & Associates
ARCHITECTS
p.a.

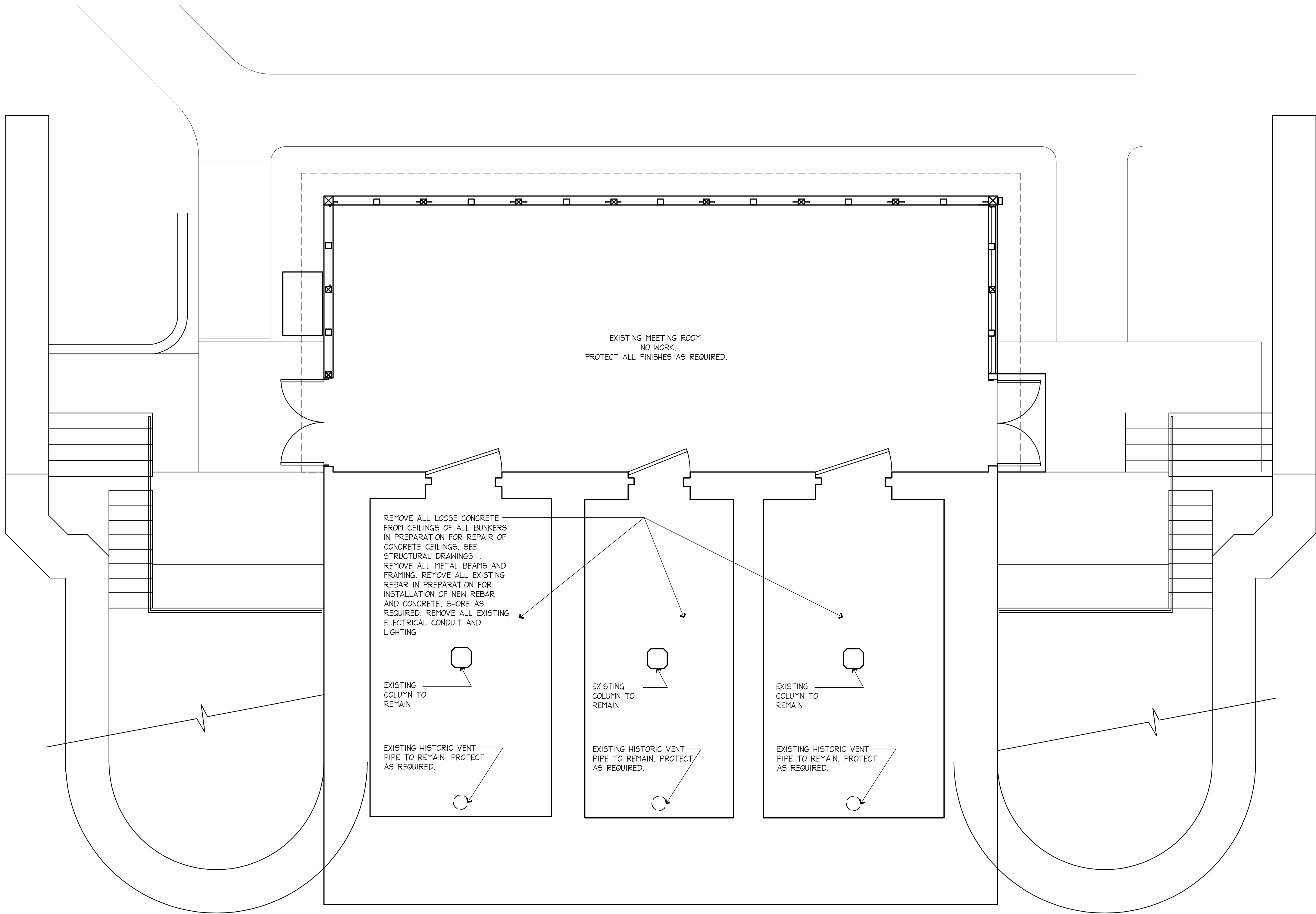
Project No.: 1505T
SITE MAP
PROJECT DIRECTORY
GENERAL NOTES
ABBREVIATIONS
SHEET INDEX
SYMBOL LEGEND

Date: 11/30/18

A0

1 OF 9

PRELIMINARY - NOT FOR CONSTRUCTION



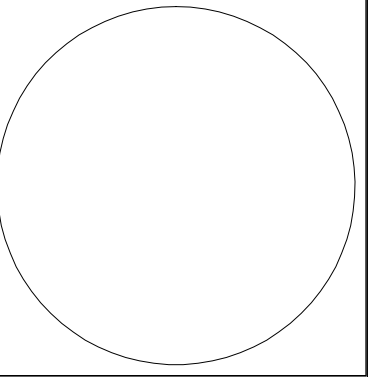
- DEMOLITION NOTES**
1. Prior to submitting a bid, verify all existing conditions and dimensions on the jobsite, and also after award, but prior to the start of construction.
 2. All demolished material shall become the property of the contractor, unless specifically noted otherwise, and shall be properly removed from the site. Comply with all applicable laws, codes and regulations of governmental agencies having jurisdiction over the project.
 3. All costs of demolition including permit fees, disposal fees, etc. are the responsibility of the Contractor.
 4. It is the Contractor's responsibility to be aware of and to conform with all applicable demolition and disposal codes, safety requirements, and environmental protection regulations of any governmental body having jurisdiction over the work.
 5. Provide safety barricades as required to protect the safety of the general public and workers connected with the project.
 6. Provide bracing and shoring as required to protect the safety of the general public and workers connected with the project.
 7. Demolished material classified as clean fill may be distributed on site when specifically approved by the Architect in advance.

PRELIMINARY - NOT FOR CONSTRUCTION

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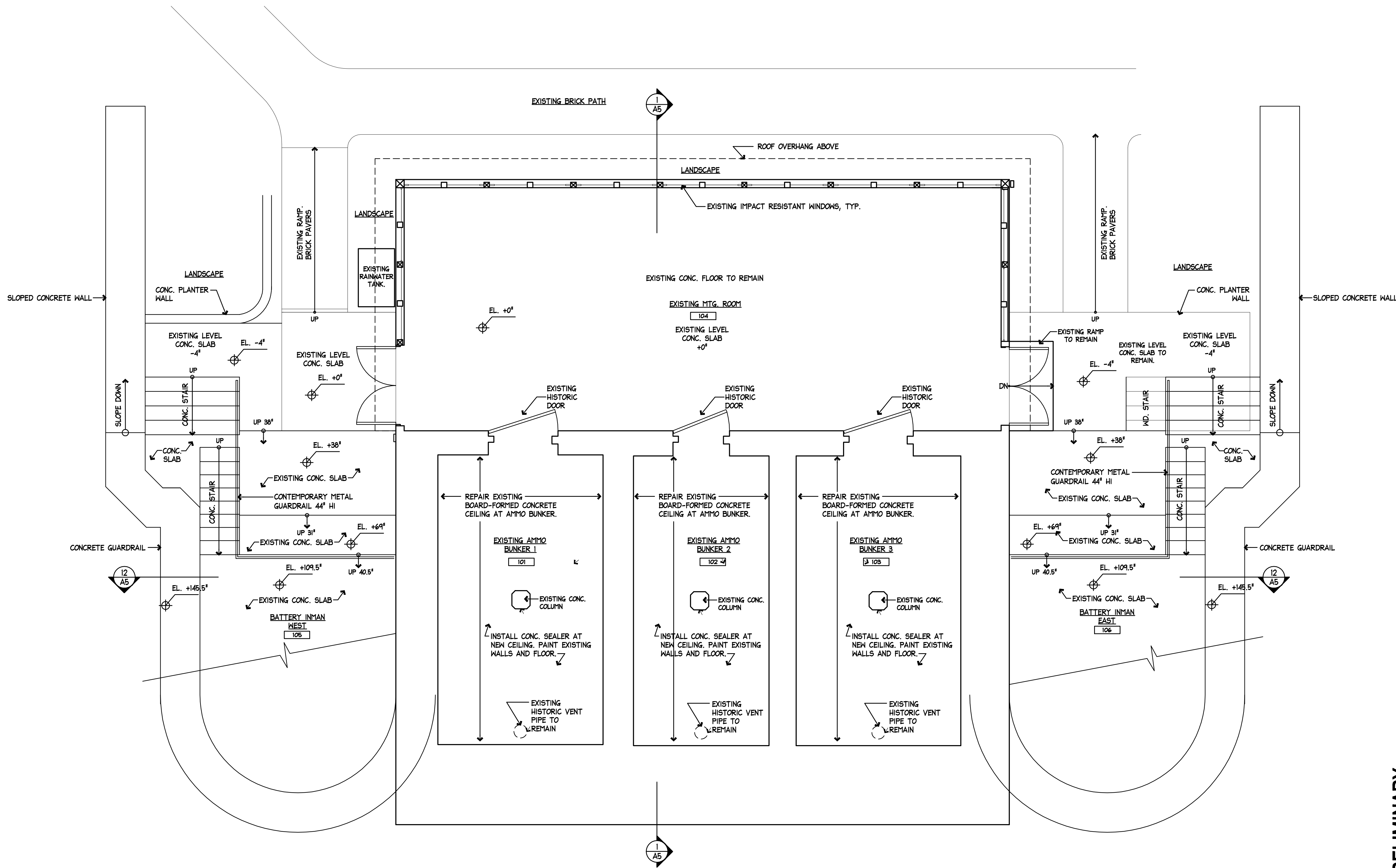


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Project No: 1505T
FLOOR PLAN
LOWER LEVEL
Date: 11/30/18

D1
4 OF 9



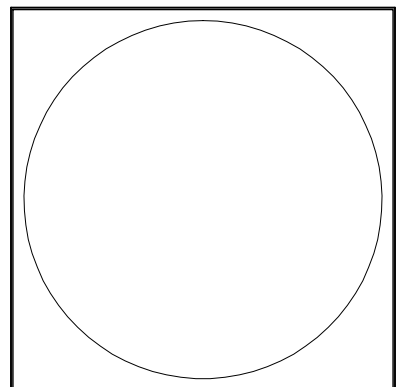
1 LOWER LEVEL FLOOR PLAN
A3 SCALE: 1/4"=1'-0"

PRELIMINARY -
NOT FOR CONSTRUCTION

REVISIONS:

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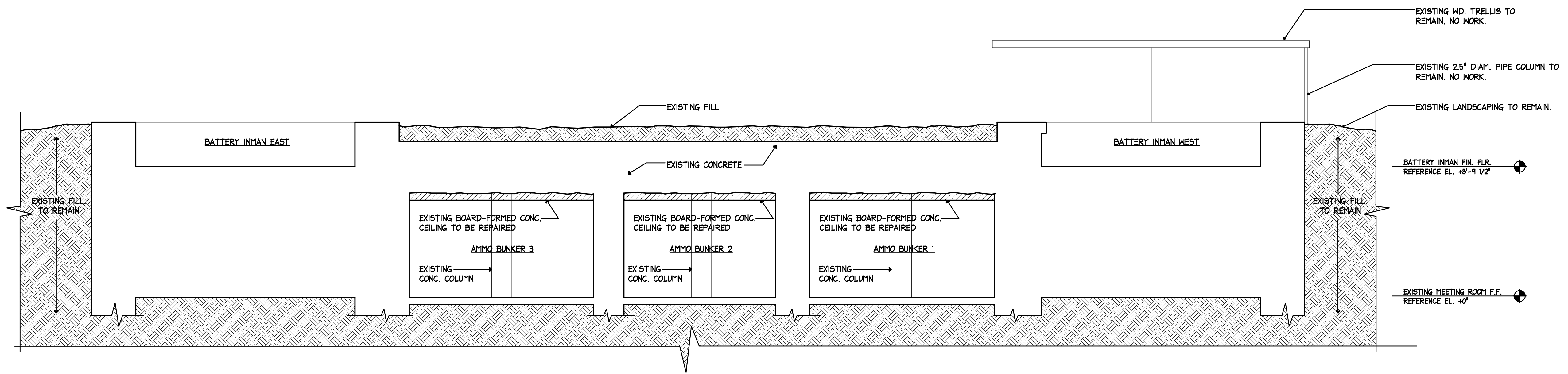
Project N° :	1505T
FLOOR PLAN LOWER LEVEL	
Date:	11/30/18

A3
4 OF 9

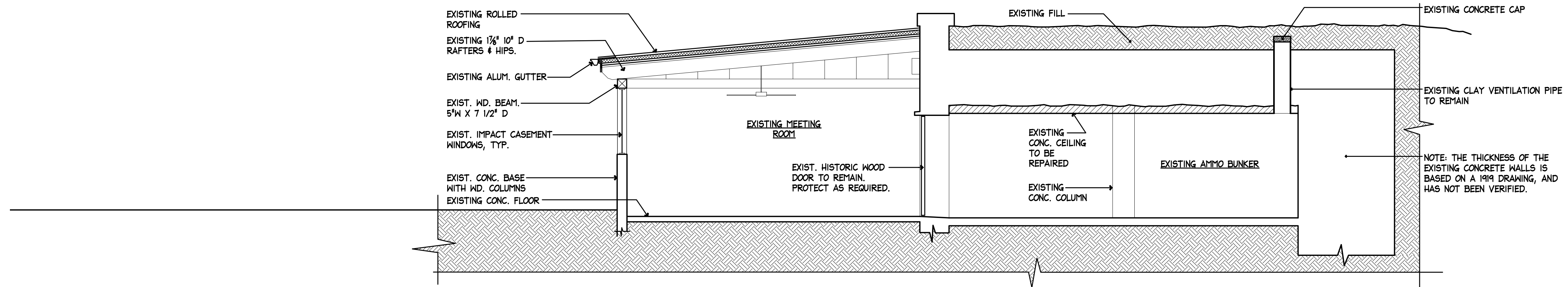


DF 9





12 BUILDING SECTION LOOKING SOUTH
A5 SCALE: 1/4"=1'-0"



1 BUILDING SECTION LOOKING EAST
A5 SCALE: 1/2"=1'-0"

PRELIMINARY -
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REVISIONS:

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Project No: 1505T
SECTIONS
Date: 11/30/18

A5

4 OF 9

12
A6
EXISTING PHOTO - TYPICAL ROOF
SCALE: N.T.S.

11
A6
EXISTING PHOTO TOP OF PARAPET / LIGHTNING ROD
SCALE: N.T.S.

10
A6
EXISTING PHOTO CHILLER PLATFORM
SCALE: N.T.S.

9
A6
EXISTING PHOTO SIMONTON ST PORCH ROOF
SCALE: N.T.S.

8
A6
EXISTING PHOTO - INTERIOR CORNER OF AMMO BUNKER
SCALE: N.T.S.

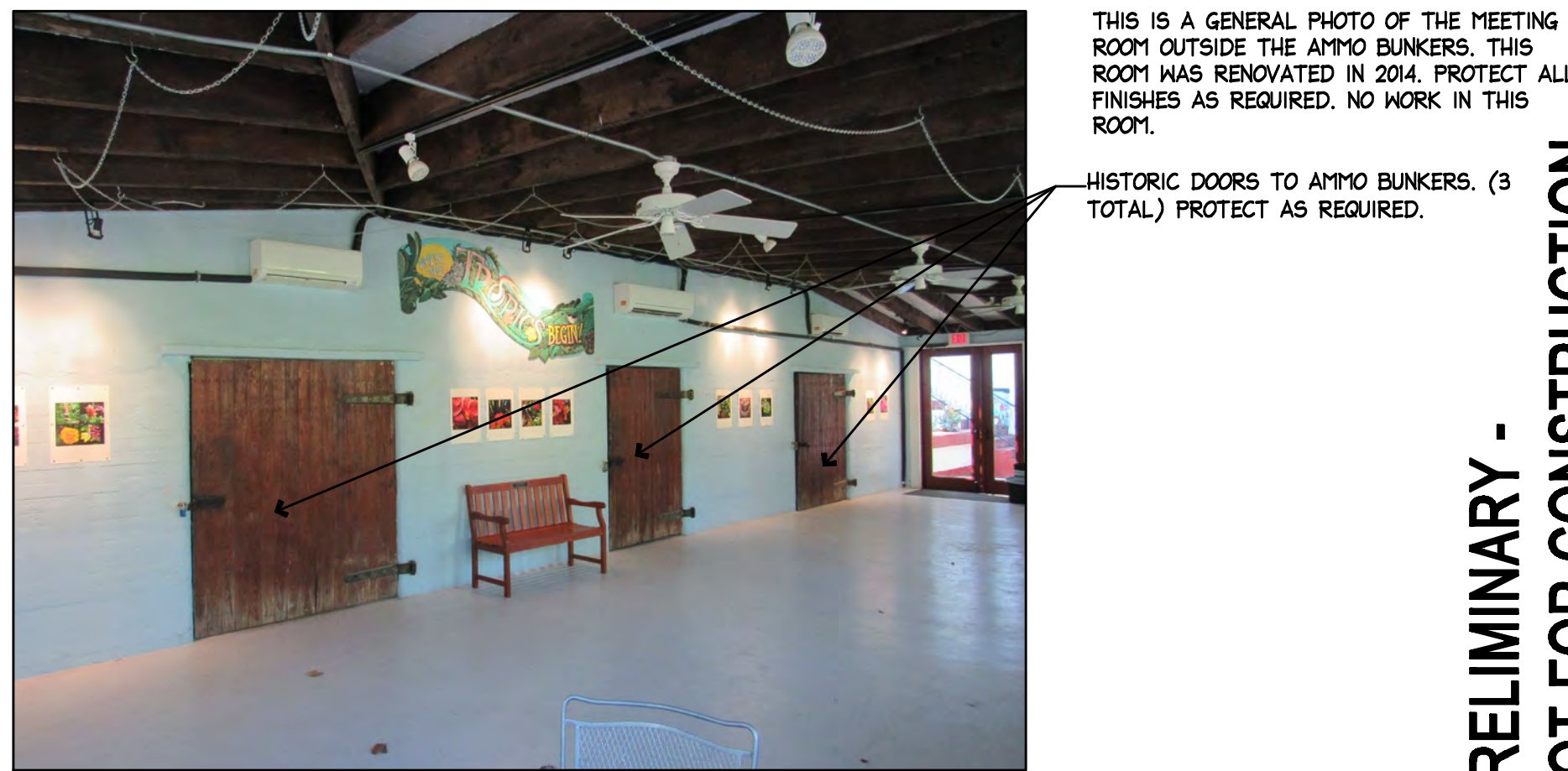
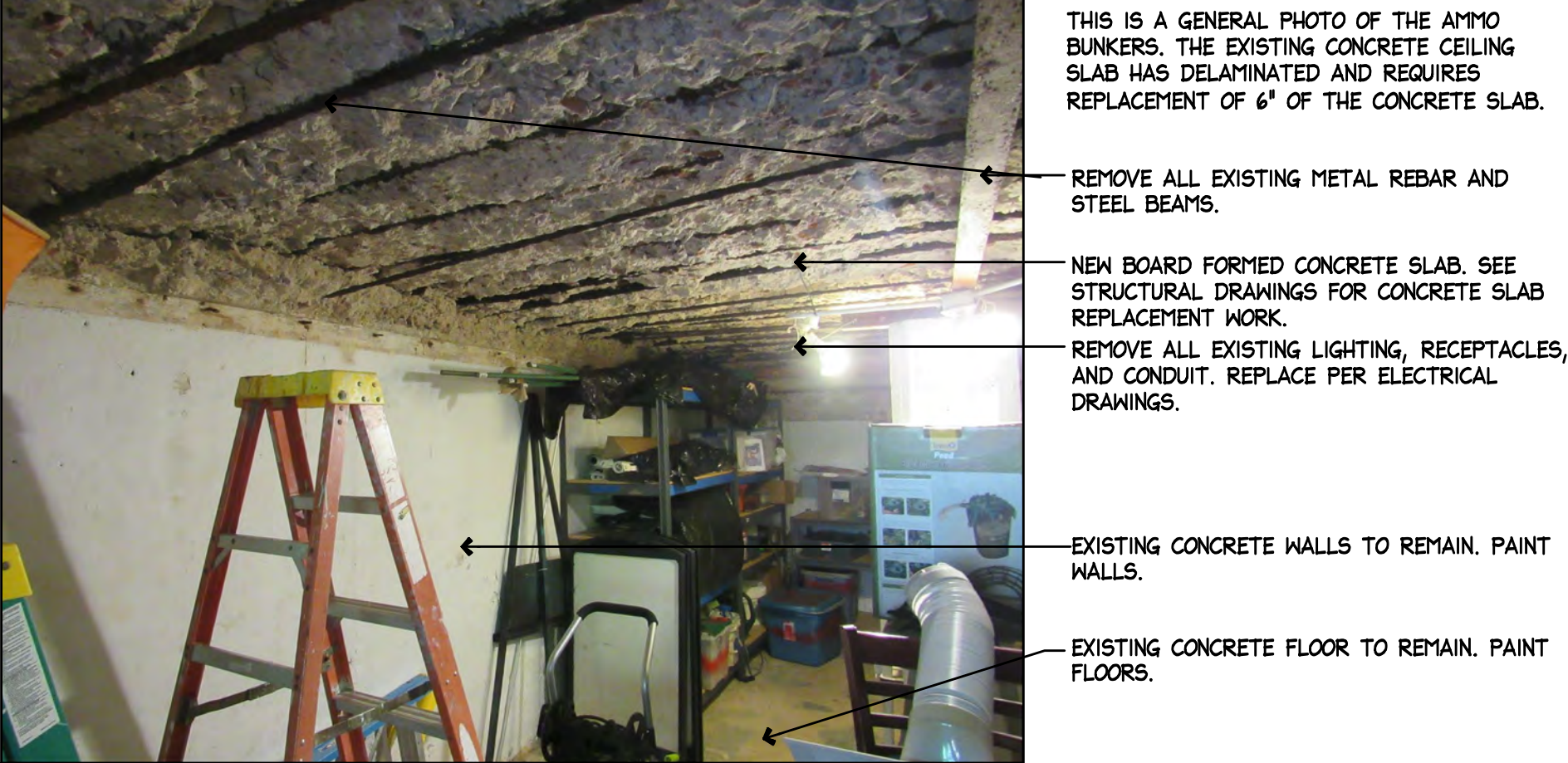
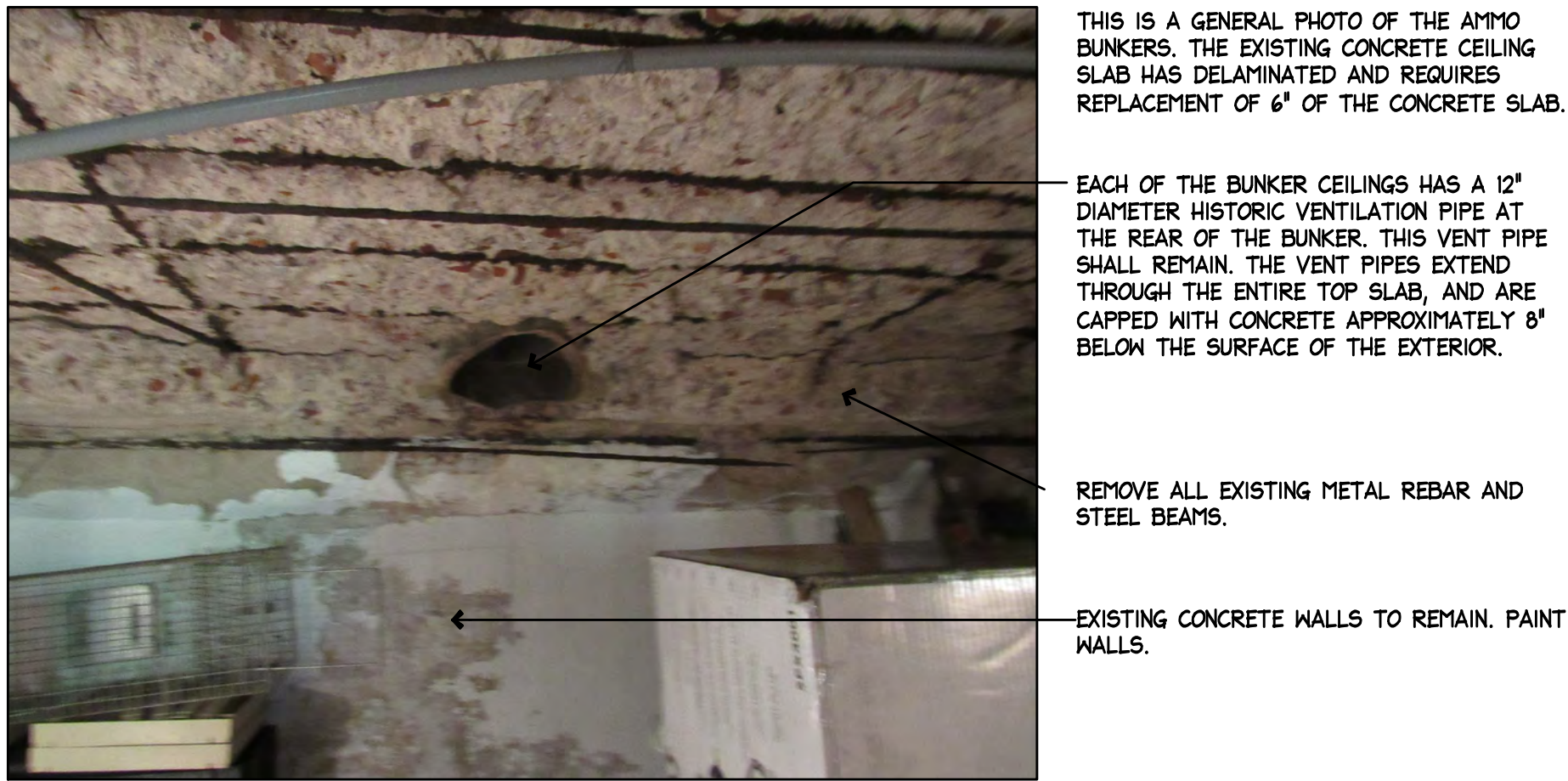
7
A6
EXISTING PHOTO - BATTERY INMAN WEST
SCALE: N.T.S.



6
A6
EXISTING PHOTO - BATTERY INMAN EAST
SCALE: N.T.S.

5
A6
GENERAL VIEW - TOP OF BUNKERS
SCALE: N.T.S.

4
A6
EXISTING PHOTO - AMMO BUNKER INTERIOR CEILING
SCALE: N.T.S.



3
A6
EXISTING PHOTO - REAR OF TYPICAL BUNKER
SCALE: N.T.S.

2
A6
EXISTING PHOTO - TYPICAL AMMO BUNKER INTERIOR
SCALE: N.T.S.

1
A6
EXISTING PHOTO - MEETING ROOM
SCALE: N.T.S.

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Project № : 1505T
PHOTOGRAPHIC
DETAILS
Date: 11/30/18

A6

ELECTRICAL FIXTURE SCHEDULE					
MARK	MANUFACTURER / CATALOG NO.	DESCRIPTION	MOUNTING	LAMPS	REMARKS
A	SUNLITE VTA-100 VAPOR TIGHT WALL MOUNTED LIGHT. WALL MOUNT. CLEAR GLASS	INTERIOR LIGHT	WALL MOUNT TIGHT TO CEILING	LED	UL WET LIST. SURFACE MOUNT CONDUIT. RUN CONDUIT NEATLY AND IN A WORKMANLIKE MANNER, AS IT WILL ALL BE EXPOSED.

- ELECTRICAL NOTES
1.

All electrical work shall be performed in accordance with the National Electrical Code, Florida Building Code and/or any local codes and ordinances.
2.

The Electrical Contractor shall refer to the Architectural plans for exact location of all equipment. Contractor shall not scale plans.
3.

It is not the intent of these plans to show every and all details of construction. The Electrical Contractor shall furnish and install all items as to provide a complete electrical installation with all equipment in proper working order.
4.

The Electrical Contractor shall be responsible for the full coordination of his work with that of the General Contractor.
5.

It shall be understood that all work performed shall be done so by a licensed Electrical Contractor and in a first class workmanlike manner.
6.

All electrical work and material shall be guaranteed for a period of one year of date of issue of Certificate of Occupancy.
7.

All power and control wiring shall be done by the Electrical Contractor.
8.

All panels shall have typewritten directories indicating all circuits.
9.

Lighting fixtures including lamps shall be provided and installed by the Electrical Contractor.
10.

All wires and cables shall be copper except as indicated. Wires shall be #12 minimum size (control wiring shall be #14A/ANG). Wire sizes #10 and smaller shall be THW solid. Wire sized #8 and larger shall be THW stranded.
11.

Contractor shall provide temporary power for all trades.
12.

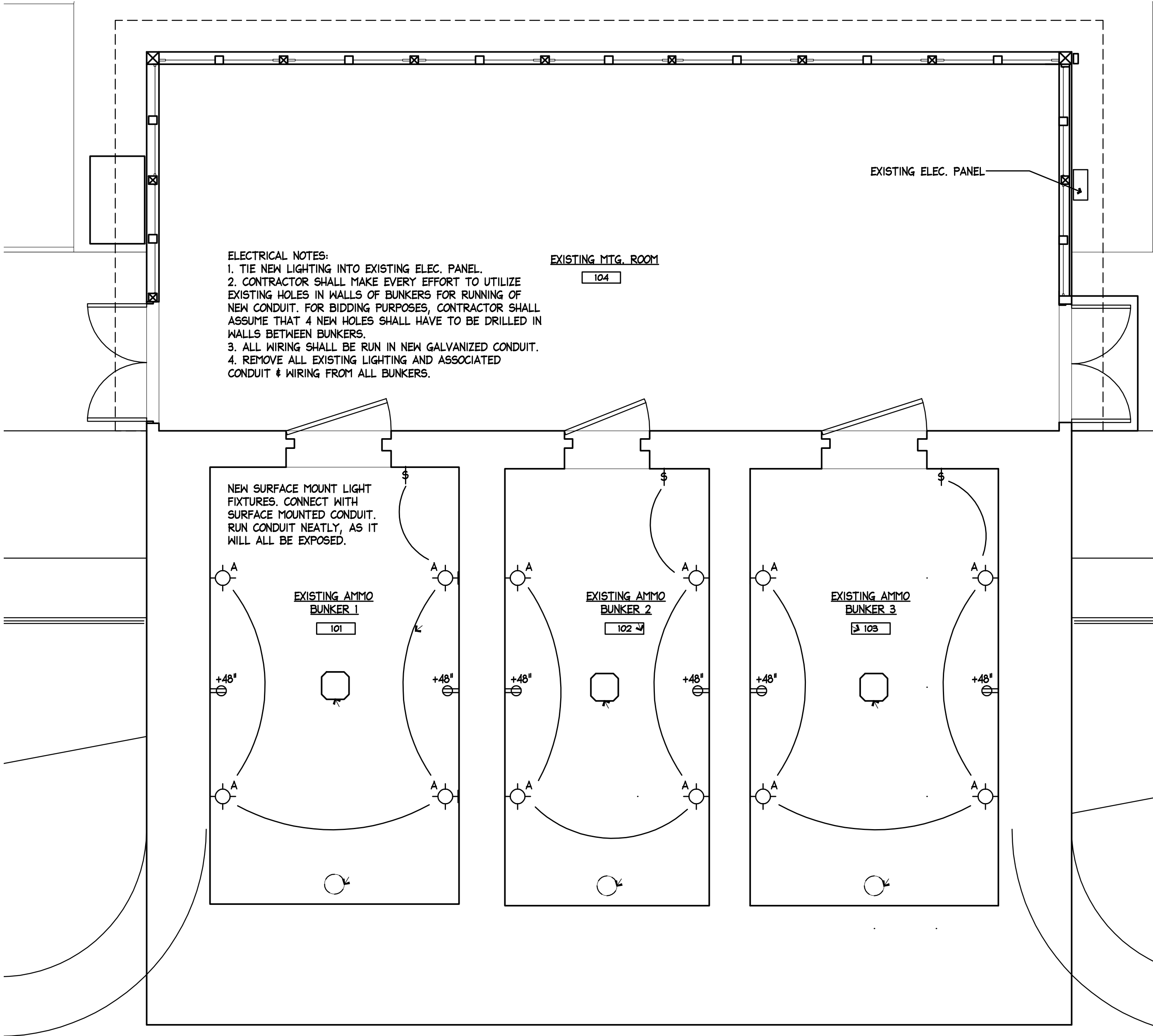
Contractor shall install lighting fixtures provided by others.
13.

All copper water pipe shall be electrical bonded and grounded.
14.

Balance loads in accordance with good construction practices.
15.

The Electrical Contractor shall be responsible for verifying adequate circuitry and breaker sizes which are required by this Contract.
16.

The Contractor shall furnish and install approved hard-wired smoke detectors in accordance with the requirements of the building department having jurisdiction over this project.



1 REFLECTED CEILING / ELECTRICAL PLAN
EI SCALE: 1/4"=1'-0"

PRELIMINARY - NOT FOR CONSTRUCTION

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Project N° : 1505T
REFLECTED CEILING PLAN
Date: 11/30/18

E1
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