DEPARTMENT OF THE NAVY
NAVAL ORDNANCE SAFETY AND SECURITY ACTIVITY
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INDIAN HEAD, MD 20640-5151

8020
Ser N45G/102
24 Jan 20

From: Commanding Officer, Naval Ordnance Safety and Security Activity
To: Commander, Joint Region Marianas

Subj: TRANSMITTAL OF FINAL DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD APPROVAL OF HYBRID EXPLOSIVES SAFETY SUBMISSION AMENDMENT 7 FOR GUAM CONSTRUCTION SUPPORT, COMMANDER, JOINT REGION MARIANAS, GUAM

Ref: (a) NOSSA ltr 8020 Ser N45G/080 of 17 Jan 20 [WebESS ID# 547/ESS19-24]
(b) DDESB memo DDESB-PE of 30 Jul 15 [GG-052]
(c) DDESB memo DDESB-PE of 24 Aug 18 [GG-052MOD]
(d) NAVSEA OP 5, Volume 1, Seventh Revision, Change 14
(e) NOSSAINST 8020.15D
(f) ASN (EI&E) ltr of 24 Jan 2019 [Subj: Secretarial Acceptance of Risk Associated with Previously Disturbed Soil on the Territory of Guam and Commonwealth of Northern Marianas Islands]

Encl: (1) DDESB memo DDESB-PE of 24 Jan 20
(2) Revised Guam Construction Support ESS Amendment 7 [Amended per DDESB Comments of 21 Jan 20]

1. Final Department of Defense Explosives Safety Board (DDESB) approval, enclosure (1), is provided for Amendment 7 Explosives Safety Submission (ESS) for construction support on the island of Guam. The subject ESS was endorsed to the DDESB for review and approval with reference (a). The Amendment 6 and 6A ESSs were approved by references (b) and (c).

2. The following identifies the changes made from the previous ESS amendment:

a. The tables identifying the munitions with the greatest fragmentation distance (MGFD) and maps depicting the explosives safety quantity-distance arcs are now located in appendix 14B.

b. Only one primary and one contingency MGFD are identified for each area.

c. Some areas have been broken out into several smaller areas, but those areas retain the original MGFDs identified in the previous amendment. Additional maps have been incorporated but the required separation distances remain the same. All of the required separation distances for each area are consolidated in table 6-2.1 in appendix 14B.

d. The amendment allows for annexes to be prepared for individual areas within the larger areas using site-specific risk analyses to change the MGFD, target of interest, or likelihood of finding munitions and explosives of concern and/or material potentially presenting an explosive hazard. Annexes will be submitted to NOSSA for review. Those annexes meeting explosives safety criteria will be submitted to the DDESB for review and approval. Those annexes that do not meet explosives safety criteria will be forwarded to Chief of Naval Operations, N41, for adjudication.

e. Requirements for remote operations and Advanced Geophysical Classification have been added for potential use during operations.

3. Naval Ordnance Safety and Security Activity (NOSSA) authorizes you to conduct work within unbarricaded (K18) intraline (IL) separation distance from existing potential explosion sites (PESs), as necessary. However, coordinate work schedules with the responsible Explosives Safety Officer to ensure the proposed project and operations at any PES at less than IL distance do not occur simultaneously.

4. All of the stipulations and requirements established by the initial ESS and subsequent amendments, as identified in references (b), (c), and the approvals of previous amendments, remain in effect and unchanged.

5. After submittal of this project to the DDESB, changes were required to be made to the ESS. Enclosure (2) contains a complete version of the revised ESS Amendment 7. All changes made were to table 6-2.1 and the maps in appendix 14B. A footnote has been added to the pages in appendix 14B identifying that they were amended per DDESB comments.

6. Paragraph a of enclosure (1) identifies that the Assistant Secretary of the Navy (Energy, Installation and Environment) (ASN(EI&E)) has accepted the risk for previously disturbed soils as documented in reference (f). As such, ASN(EI&E) assumes all risks associated with the procedures detailed in section 1.3.5, Special Condition of Previously Disturbed Soils, of the ESS. Therefore, it is imperative that those areas that are to be designated as previously disturbed are well documented, including supporting rationale and all records maintained by the command.

7. You must maintain a copy of the current ESS, enclosure (2); reference (a); references (c) and (d), including all other previous DDESB approvals; enclosure (1); and this letter on-site and available to inspectors upon request.

8. If any changes occur, which could increase explosives hazards, an amendment to this ESS must be submitted through NOSSA, to the DDESB, for review and approval, following the requirements of references (d) and (e).

Subj: TRANSMITTAL OF FINAL DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD APPROVAL OF HYBRID EXPLOSIVES SAFETY SUBMISSION AMENDMENT 7 FOR GUAM CONSTRUCTION SUPPORT, COMMANDER, JOINT REGION MARIANAS, GUAM

9. The NOSSA points of contact for this matter are Mr. Shawn Jorgensen, who can be reached at commercial (301) 744-5636, DSN 354-5636 or via email at shawn.a.jorgensen@navy.mil, and Mr. Pat Altman, who can be reached at commercial (301) 744-5630, DSN 354-5630 or email daniel.altman@navy.mil.

DALE W. SISSON, JR.
Executive Director

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DDESB-PE

JAN 24 2020

MEMORANDUM FOR COMMANDING OFFICER, NAVAL ORDNANCE SAFETY AND SECURITY ACTIVITY (ATTENTION: CODE N45)

SUBJECT: DDESB Approval of Amendment 7, Hybrid Explosives Safety Submission for Munitions Response Sites, Guam Construction Support, Joint Region Marianas, Guam

References: (a) NOSSA ltr 8020 Ser N45G/080 of 17 January 2020, Subject: Request for Review and Approval of Hybrid Explosives Safety Submission Amendment 7 for Guam Construction Support, Commander, Joint Region Marianas, Guam

(b) Email from Mr. Shawn Jorgensen (NOSSA) to Ms. Kristene Bigej (DDESB) dated 23 January 2020, Subject: RE: Guam Amend 7

(c) Defense Explosives Safety Regulation 6055.09, Edition 1, 13 January 2019

(d) ASN (EI&E) ltr of 24 Jan 2019, Subject: Secretarial Acceptance of Risk Associated with Previously Disturbed Soil on the Territory of Guam and Commonwealth of Northern Marianas Islands

(e) DDESB Technical Paper 16 (TP-16), Current Revision, "Methodologies for Calculating Primary Fragment Characteristics" 19 December 2016

(f) DDESB Technical Paper 15 (TP-15), Current Revision, "Approved Protective Construction"

The Department of Defense Explosives Safety Board (DDESB) Staff has reviewed the subject Amendment 7 to the explosives safety submission (ESS) forwarded by reference (a), as modified by reference (b), against the requirements of reference (c). Based on the information provided, approval is granted for removal and destruction of material potentially presenting an explosive hazard (MPPEH) and munitions and explosives of concern (MEC) at Joint Region Marianas, Guam. This approval is based on the following:

a. The Assistant Secretary of the Navy (Energy, Installation and Environment) has accepted the risk for previously disturbed soils as documented in reference (d). The Navy assumes all risks associated with the procedures detailed in Section 1.3.5, Special Condition of Previously Disturbed Soils, of reference (a). As such, this DDESB approval excludes the procedures detailed in Section 1.3.5.

b. This amendment identifies the primary and only one contingency munition with the greatest fragmentation distance (MGFD) for each area; incorporates the 3 May 2018 Fragmentation Data Review Forms of reference (e); adds mechanized high input unintentional detonation operations; restricts performance of intentional detonation operations to military Explosive Ordnance Disposal personnel; restructures some of the previously identified areas into smaller areas for a total of 26 areas; and specifies that future revisions to the areas will be prepared as Annexes meeting the requirements of reference (c).

c. The efforts addressed in this Hybrid ESS involve manual unintentional detonation operations (to include mechanized unintentional detonation operations employing anomaly avoidance), mechanized low input unintentional detonation operations, and mechanized high input unintentional detonation operations supporting munitions response actions within 26 areas: Andersen Air Force Base (AAFB) Area 1, AAFB Area 2, AAFB Area 3, AAFB Area 4, AAFB Area 5, AAFB Area 6, AAFB Area 7, AAFB Area 8, Andersen South, Apra Heights, Barrigada, Dan Dan, Finegayan, Finegayan Breakout (J-001B), Naval Base, Naval Base Breakout (J-006), Naval Hospital East, Naval Hospital West, Nimitz Hill, Ordnance Annex, Orote Point, Polaris Point, Santa Rosa, Sasa Valley, Tenjo Vista, and Tipalao.

d. The attached Table lists the primary and contingency MGFD for each area; the team separation distance (TSD); the minimum separation distance (MSD) for unintentional detonations for nonessential personnel; and the MSD for intentional single in-grid detonations for all personnel.

e. Collection points are authorized provided the Navy ensures usage of reference (f), paragraph C6.2.7.5.

f. Operators of mechanized equipment will be shielded from hazardous fragments based on an unintentional detonation from low input mechanized operations or an intentional detonation from high input mechanized operations involving the MEC identified in reference (a). The use of barricades/shields is authorized as an engineering control to prevent fragment penetration provided the Navy ensures usage per reference (e). Additionally, operators will be provided blast overpressure protection based on K24 of the MGFD.

g. The use of hearing protection is authorized as an engineering control for unintentional detonation operations to provide equivalent K24 blast overpressure protection for essential personnel based on K18 of the MGFD. The Navy shall ensure the use of double hearing protection which provides $\geq$ 9 decibel (dB) attenuation.

h. Intentional detonations, per reference (a), will be performed by military Explosive Ordnance Disposal personnel in-grid, at DDESB approved facilities, or as determined in accordance with EOD emergency procedures.

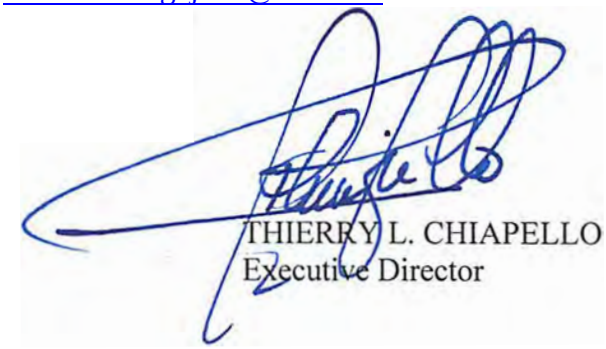
i. If a munition with an unknown fill or chemical warfare material is encountered, all work will cease pending Navy assessment of the need to submit a Chemical Safety Submission.

j. Prior to initiation and through completion of on-site explosives operations, all nonessential personnel will be evacuated and prevented from entering any area/facility encumbered by the MSD required for the operation being conducted, or explosives operations will be suspended if nonessential personnel enter the MSD.

k. MPPEH will be inspected and classified as material documented as safe prior to release to the public.

All other stipulations and requirements established via the original ESS and subsequent amendments remain in effect.

The point of contact for this action is Ms. Kristene Bigej, (571) 372-6705, DSN 372-6705, E-mail address: kristene.a.bigej.civ@mail.mil.



THIERRY L. CHIAPELLO
Executive Director

Attachment
As stated

TABLE (page 1 of 2)

Area	MGFD	K18 (ft)	K24 (ft)	TSD[1] (ft)	TSD[2] (ft)	MSD[3] (ft) unintentional detonation	MSD[4] (ft) intentional detonation
AAFB Area 1	Primary: 600-pound M32 (TNT filled) Bomb	125	167	278	662	662	3,110
	Contingency: 1,000-pound AN-M65A1 (TNT filled) Bomb	159[5]	212[5]	353[5]	810	810	3,828
AAFB Area 2, AAFB Area 3, Finegayan, J-001B, Naval Base, J-006, Ordnance Annex, Orote Point, & Polaris Point	Primary: 500-pound M64A1 (Amatol filled) Bomb	123[6]	164[6]	273[6]	638[6]	638[6]	2,849
	Contingency: 1,000-pound AN-M65A1 (TNT filled) Bomb	159[5]	212[5]	353[5]	810	810	3,828
AAFB Area 4	Primary: 5-inch Mk 41 Projectile	33	44	74	359	359	2,377
	Contingency: 1,000-pound AN-M65A1 (TNT filled) Bomb	159[5]	212[5]	353[5]	810	810	3,828
AAFB Area 5, AAFB Area 6, AAFB Area 7, AAFB Area 8, & Barrigada	Primary: 155mm M107 (Composition B filled) Projectile	47	63	105	450	450	2,630
	Contingency: 1,000-pound AN-M65A1 (TNT filled) Bomb	159[5]	212[5]	353[5]	810	810	3,828
Andersen South	Primary: 8-inch Mk 25 Projectile	47	63	105	445	445	3,434
	Contingency: 600-pound M32 (TNT filled) Bomb	125	167	278	662	662	3,434[7]

[1] For essential personnel for manual and mechanized operations with anomaly avoidance based on K40 of MGFD
[2] For essential personnel for low and high input mechanized operations based on the HFD of the MGFD
[3] For nonessential personnel for manual and low input mechanized operations based on the HFD of the MGFD
[4] For nonessential personnel for high input mechanized operations use MSD for intentional single in-grid detonations
[5] Based on the 1,000-pound AN-M65A1 (Composition B filled) Bomb
[6] Based on the 500-pound M64A1 (Composition B filled) Bomb
[7] Based on the 8-inch Mk 25 Projectile

Attachment

TABLE (page 2 of 2)

Area	MGFD	K18 (ft)	K24 (ft)	TSD[1] (ft)	TSD[2] (ft)	MSD[3] (ft) unintentional detonation	MSD[4] (ft) intentional detonation
Apra Heights, Dan Dan, Nimitz Hill, Santa Rosa, Sasa Valley, & Tenjo Vista	Primary: 14-inch Mk 22 Projectile	80	107	178	559	559	5,214
	Contingency: 1,000-pound AN-M65A1 (TNT filled) Bomb	159[5]	212[5]	353[5]	810	810	5,214[8]
Naval Hospital East & Tipalao	Primary: 5-inch/38 Caliber Mk 35 Projectile	33	45	74	343	343	2,131
	Contingency: 1,000-pound AN-M65A1 (TNT filled) Bomb	159[5]	212[5]	353[5]	810	810	3,828
Naval Hospital West	Primary: 81mm Japanese Type 97 HE Mortar	19	25	42	207	207	1,481
	Contingency: 1,000-pound AN-M65A1 (TNT filled) Bomb	159[5]	212[5]	353[5]	810	810	3,828
All Areas – Limited Clearance Ahead of Construction – Phase 2[9]	60mm M49A2 Mortar	13	17	28	152	152	1,322

[1] For essential personnel for manual and mechanized operations with anomaly avoidance based on K40 of MGFD
[2] For essential personnel for low and high input mechanized operations based on the HFD of the MGFD
[3] For nonessential personnel for manual and low input mechanized operations based on the HFD of the MGFD
[4] For nonessential personnel for high input mechanized operations use MSD for intentional single in-grid detonations
[5] Based on the 1,000-pound AN-M65A1 (Composition B filled) Bomb
[8] Based on the 14-inch Mk 22 Projectile
[9] Applicable only after removal of larger MEC/MPPEH items from the construction footprint as detailed in Section 6.1.5 of reference (a).

MUNITIONS RESPONSE EXPLOSIVES SAFETY SUBMISSION

GUAM CONSTRUCTION SUPPORT

AMENDMENT 7

January 2020 (FINAL)

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TABLES

FIGURES

ACRONYMS AND ABBREVIATIONS

AAR	After Action Report
AGC	Advanced Geophysical Classification
AGC QAPP	AGC Quality Assurance Project Plan
AFB	Air Force Base
AP	Armor piercing
APP	Accident Prevention Plan
BSI	Blind Seed Item
BUD	Berkley UXO Discriminator
C/D	Class / Division
CES	Civil Engineering Squadron
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGJ	Consulate General of Japan
cm	centimeter
CNIC	Commander Navy Installations Command
CNMI	Commonwealth of Northern Marianas Islands
COA	Corrective Action
CPR	Cardio-Pulmonary Resuscitation
CRM	Cultural Resources Manager
DAGCAP	DoD Advanced Geophysical Classification Accreditation Program
DDESB	Department of Defense Explosives Safety Board
DGM	Digital Geophysical Mapping
DGPS	Differential Global Positioning System
DoD	Department of Defense
DPAA	Defense Prisoner of War and Missing in Action Accounting Agency
DR	Determination Request
ECP	Entry Control Point
EOD	Explosive Ordnance Disposal
EODMUFIVE	EOD Mobile Unit Five
EM	Electromagnet Induction, Engineer Manual
ESO	Explosives Safety Officer
ESQD	Explosive Safety Quantity-Distance
ESS	Explosives Safety Submission
ESS DR	ESS Determination Request
EZ	Exclusion Zone
ft	foot / feet
GIS	Geographical Information System
GPS	Global Positioning System
GSV	Geophysical System Verification
HAZWOPER	Hazardous Waste Operations and Emergency Response
HC	HC Mixture, a White Screening Smoke
HE	High Explosive(s)
HFD	Hazardous Fragment Distance
Hz	hertz
IBD	Inhabited Building Distance

IL	Intraline
INST	Instruction
ISO	Industry Standard Object
IVS	Instrument Verification Strip
JA	Japanese
JRM	Joint Region Marianas
lb	pound(s)
LSF	Line / Station / Fiducial
MCE	Maximum Credible Event
MDEH	Material Documented as Explosive Hazard
MDAS	Material Documented as Safe
MEC	Munitions and Explosives of Concern
MEC WP	MEC Work Plan
MFD	Maximum Fragment Distance
MFD-H	MFD-Horizontal
MGFD	Munition with the Greatest Fragmentation Distance
MILCON	Military Construction
mm	millimeter
MMR	Military Munitions Rule
MPIT	MEC Process Improvement Team
MPPEH	Material Potentially Presenting an Explosive Hazard
MPV	Man Portable Vector
MRESS	Munitions Response ESS
MRS	Munitions Response Site
NAVSEA	Navy Sea Systems Command
NAVFAC	Naval Facilities Engineering Command
NFM	NAVFAC Marianas
NFP	NAVFAC Pacific
NCIS	Naval Criminal Investigative Service
NEW	Net Explosive Weight
NBG	Naval Base Guam
NOSSA	Naval Ordnance Safety and Security Activity
NTOI	Non MEC-like Targets of Interest
NTR	Navy Technical Representative
OP 5	Ordnance Pamphlet 5
ORM	Operational Risk Management
OSHA	Occupational Safety and Health Administration
PLS	Professional Land Surveyor
PDA	Personal Digital Assistant
PES	Potential Explosion Site
PM	Project Manager
PRTC	Pacific Regional Training Center
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCP	Quality Control Plan
RCA	Root Cause Analysis
RCRA	Resource Conservation and Recovery Act

RESO	Regional Explosives Safety Officer
ROC	Regional Operations Center
RTS	Robotic Total Station
SHPO	State Historic Preservation Officer
SUXOS	Senior UXO Supervisor
TL	Team Leader
TM	Technical Manual
TNT	Trinitrotoluene
TOI	Target of Interest
TP	Technical Paper
US	United States
UXO	Unexploded Ordnance
UXOQAS	UXO Quality Assurance Specialist
UXOQCS	UXO Quality Control Specialist
UXOSO	UXO Safety Officer
UXOTII/I	UXO Technician II/I
UXOTIII	UXO Technician III
WP	White Phosphorus
WWII	World War II

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1.0 OVERVIEW OF THE MUNITIONS RESPONSE EXPLOSIVES SAFETY SUBMISSION (MRESS)

This Munitions Response Explosives Safety Submission (MRESS) supports planned construction, repair, and maintenance projects on Department of the Navy (DON) property on Guam, and on non-DON property when the Navy or its contractor conducts the work.

This MRESS is the 7th Amendment to the "Guam Construction Support" ESS, first submitted and approved in 2010. This document establishes a disciplined process for the Commander, Joint Region Marianas (CJRM) to implement explosive safety principles and accept prudent risk in accordance with established DoD and DON explosive safety criteria while accomplishing their assigned missions.

This MRESS was prepared in accordance with Naval Sea Systems Command (NAVSEA) Ordnance Pamphlet 5 (OP 5), Volume 1, Seventh Revision, Naval Ordnance Safety Security Activity (NOSSA) Instruction 8020.15D, and Secretary of the Navy (SECNAV) Instruction (SECNAVINST) 5100.1K.

1.1 BACKGROUND

Munitions and Explosives of Concern (MEC) are known or suspected to be present at various sites on Guam as a result of World War II battles and subsequent military activities. MEC is a safety hazard and may constitute an imminent and substantial endangerment to personnel and the local population.

This amendment departs from previous versions, which were based on knowledge obtained from historical records with risk assignments extended to the limits of military-controlled property parcels rather than planned construction site limits. This was a conservative approach, appropriately used out of an abundance of caution at the time; this amendment takes a different approach.

This MRESS introduces a defined, recordable, and repeatable risk determination process for CJRM to conduct site-specific risk assessments, determine the anticipated presence and nature of MEC, implement appropriate mitigation, and report and record the results and lessons from intrusive soil activities at locations known or suspected of containing MEC.

This amendment is intended to reinforce reliable, safe practices operating in an environment where explosive risk exists with variable levels of uncertainty. Further, this amendment highlights the team, comprised of CJRM, NOSSA, the Chief of Naval Operations (OPNAV) N41, and Office of the Assistant Secretary of the Navy (Energy, Installations, and Environment) [OASN (EI&E)], who must work together as partners to ensure construction operations occur in a safe, prudent, and cost-efficient manner, protective of property and worker safety.

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1.2 PROGRAM MANAGER

The Regional Explosives Safety Officer (RESO) is Larry Reisher.

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The Naval Facilities Engineering Command (NAVFAC) Marianas MEC Program Manager is Pete Jimenez:

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E-mail: pedro.jimenez@fe.navy.mil

1.3 RISK MANAGEMENT DECISION LENS

The purpose of this section is to enable informed risk decisions at the appropriate level of leadership, and specifically to provide CJRM with a process-driven, risk-based decision procedure for conducting intrusive soil operations on Guam. This MRESS departs from prior safety submissions that used island-wide likelihood determinations. This document transitions explosive safety risk assessment to a project specific determination. The Department of the Navy, after consulting with the DoD Explosives Safety Board (DDESB), considers this a valid approach to document work effort and memorialize the historical explosive profile on Guam.

1.3.1 SITE IDENTIFIERS AND DESCRIPTIONS

Whereas most munitions response actions are executed on munitions response sites (MRSs), the proposed munitions response actions described in this MRESS will take place on DoD/military installation properties, and other non-DON properties when conducted by or for the Navy, on the island of Guam. These areas include but are not limited to: Andersen Air Force Base (AFB), Pacific Regional Training Center (PRTC), Andersen South, Apra Heights, Apra Wharves, Barrigada, DanDan, Finegayan (future Camp Blas), Naval Base, Naval Hospital East, Naval Hospital West, Nimitz Hill, Ordnance Annex, Orote Point, Polaris Point, Santa Rosa, Sasa Valley, Tenjo Vista, and Tipalao. Each of the Areas is identified in Figure 1-1 and Table 1-1 (Appendix B).

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1.3.2 LIKELIHOOD DEFINITIONS

Based on the collection of data obtained from historical records, military Explosive Ordnance Disposal (EOD) incident reports, and recent MEC clearance results, each of the MRESS Areas were previously assigned a probability of encountering MEC or MPPEH. This historical information is depicted for each of the 25 respective Guam MRESS Areas in Figures 1-2a through 1-2d (Appendix B).

This MRESS will be departing from this scheme on a likely or unlikely determination as defined below.

A "high-likelihood" determination may be assigned to those areas for which a search of available historical records and/or on-site investigation data indicates it is probable to encounter MEC or MPPEH. This assessment must include factors such as: military or munitions-related activities that occurred at the site, previous MEC discovery, clearance actions, and whether the site is undisturbed from its natural state. Construction activities on a site determined to be a high-likelihood of encountering MEC or MPPEH requires a MEC clearance of the three-dimensional limits of the construction footprint as described in Section 6 of this MRESS.

Note: Throughout the remainder of this document, a high-likelihood determination of encountering MEC/MPPEH will be referred to as "likely".

A "low-likelihood" determination is assigned to those areas for which a search of available historical records and/or on-site investigation data indicates it is improbable to encounter MEC or MPPEH. This assessment must include factors such as: military or munitions-related activities that occurred at the site, previous MEC discovery, clearance actions, and whether the site has been previously disturbed. Construction activities on a site determined to be a low-likelihood of encountering MEC or MPPEH requires On-Call Construction Support as defined by NAVSEA OP 5.

Note: Throughout the remainder of this document, a low-likelihood determination of encountering MEC/MPPEH will be referred to as "unlikely".

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1.3.3 SITE SPECIFIC RISK ANALYSIS UTILIZING AN ANNEX CONSTRUCT

An Annex structure is hereafter adopted for each project or activity that CJRM decides is, based upon a site-specific risk assessment: "likely" of encountering MEC, or "unlikely" of encountering MEC in an area previously determined "likely" per the historical figures and tables documented in Appendix 14B. Each Annex will follow an approved NOSSA, OPNAV N41, ASN (EI&E) template per Appendix D and shall:

1. Demonstrate relevant risk using Conceptual Site Model (CSM) considerations of the site specific conditions to determine: likelihood, Target of Interest (TOI), Munitions with the Greatest Fragmentation Distance (MGFD), and Exclusion Zones (EZ) for the specific project.

2. Identify information relevant to the site-specific risk assessment and CJRM determinations. Annexes at a minimum shall include the following figures and tables (Figures and Tables not applicable to an "unlikely" decision shall be annotated "NA"):

    a. Figure – Likelihood of Encountering MEC/MPPEH (similar to Fig. 1-2 series)
    b. Table – Type of Munitions Potentially Used During War Activities (per Table 1-2)
    c. Table – Previous MEC/MPPEH Encountered (similar to Table 3-1 series). If no MEC/MPPEH was previously encountered, indicate any previous soil disturbance or excavation, including timeframe, in the project area.
    d. Figure – Figure showing the locations where previous MEC/MPPEH were encountered at the project site and surrounding area using the JRM MEC GIS database.
    e. Table – Primary and Contingency Munition with the Greatest Fragmentation Distance (similar to Table 3-2 series)
    f. Table – Exclusion Zones (similar to Table 6-1 series)
    g. Table – Controlling Exclusion Zones (similar to Table 6-2 series)
    h. Table – Potential Explosion Sites Encumbering the Munitions Response Areas similar to Table 6-3 series)
    i. Table – Supporting Explosives Safety Data (similar to Appendix C)
    j. Figure – Explosive Safety Quantity-Distance Arcs

3. Generate a unique identifier for each project site submission, starting with "A01", "A02", and so on. For example, the first Annex submitted will be named: "Guam MRESS Amendment 7 Annex A01, [insert project name]".

Annexes prepared under this paragraph shall be submitted to NOSSA at least 60 days prior to commencement of work. Annexes shall reflect endorsements by the Public Works Officer, Regional Explosives Safety Officer, and MEC Program Manager. NOSSA will review and document as official correspondence. If NOSSA concurs with a CJRM submission, the project will be endorsed to DDESB for approval and copies of the correspondence will be provided to OPNAV N41 and Assistant Secretary of the Navy (Energy, Installations and Environment) (ASN (EI&E)), Attention Deputy Assistant Secretary of the Navy (Safety) (DASN(Safety)) within 10 working days. If NOSSA objects to a CJRM decision, the documentation must be forwarded to OPNAV N41 within 10 working days for review, adjudication and risk decision; a copy of this correspondence will be provided to ASN (EI&E), Attention: DASN (Safety). Upon OPNAV N41 approval, each Annex shall be submitted to DDESB, with a copy provided to NOSSA within 10 working days.

Upon completion of soil disturbing activities associated with a project performed under a DDESB approved Annex to this MRESS, CJRM shall submit an After Action Report (AAR) to close out the Annex.

1.3.4 SPECIAL CONDITION OF ONGOING PROJECTS (GRANDFATHER CLAUSE)

Projects that began prior to the approval of Amendment 7 may continue to utilize historical risk determinations and associated historical tables and figures in this document, or CJRM may decide to adopt the annex structure established in this Amendment for any ongoing or newly awarded project.

1.3.5 SPECIAL CONDITION OF PREVIOUSLY DISTURBED SOILS

Previously disturbed soils where no MEC or MPPEH was found may be considered unlikely of containing MEC and MPPEH. Previous disturbance shall be based on knowledge of previous work as established by CJRM procedures to visually inspect the site and review drawings. This special condition applies to the three-dimensional limits of previous soil disturbance.

If MEC or MPPEH is discovered after commencement of intrusive soil activities in previously disturbed soils, CJRM shall conduct the following actions:

1. Stop work and perform an EOD response.

2. Consult with the JRM MEC Process Improvement Team (MPIT) to assess the circumstances of the discovery, determine whether site safety conditions differ from those initially considered, assess the extent of the impacted area, and determine if risk levels should increase.

3. In order to minimize safety risk to the greatest extent possible, CJRM's risk assessment conducted after discovery of MEC or MPPEH in previously disturbed soil shall be conducted in a manner consistent with the following guidelines:

    a. **Discovered MEC is determined to have originated from the site, but missed during previous activities.** CJRM shall independently assess whether the discovery represents a change from the initial determination and decide whether risk levels should change before proceeding with soil disturbing activities. If no change in risk level was made and additional MEC is discovered, a similar assessment shall be conducted and documented.

    b. **Discovered MEC is determined to be a reseeded item from imported soil.** CJRM shall independently assess the extent of imported fill and decide whether risk levels should change before proceeding with soil disturbing activities. If no change in risk level was made and additional MEC is discovered, a similar assessment shall be conducted and documented.

    c. **MEC is discovered in an area incorrectly believed to be previously disturbed.** CJRM shall independently assess the three-dimensional extent of undisturbed soil at the project or activity site and decide whether risk levels or risk-associated boundaries should change before proceeding with soil disturbing activities. A

similar assessment shall be conducted for any subsequent MEC or MPPEH discovery in the same area.

4. The following responses shall be conducted depending on the new limits of risk established by the CJRM decision:

    a. In the three-dimensional area where CJRM has determined risk should increase, an approved response per the MRESS shall be performed in this area before a new likelihood characterization is made. Based on historical data and discovered MEC, CJRM may determine the necessary Maximum Greatest Fragmentation Distance (MGFD) and Target of Interest (TOI) for the area. CJRM shall decide when the increase of likelihood warrants an Annex submission.

    b. In the area CJRM determines the risk remains unlikely, intrusive work may recommence in accordance with the original work plan.

5. Decisions exercised under this paragraph shall be documented per Section 6.1.8.1 and submitted to NOSSA within 24 hours. Documentation shall include MEC PM and RESO recommendations – if the CJRM decision differs from these recommendations, a justification will be included. NOSSA will review and document as official correspondence. If NOSSA concurs with a CJRM submission, a copy of the correspondence will be provided to DDESB, OPNAV N41 and ASN (EI&E), Attention: DASN (Safety) within 10 working days. If NOSSA objects to a CJRM decision, the documentation must be forwarded to OPNAV N41 within 10 working days for review, adjudication and risk decision; a copy of this correspondence will be provided to ASN (EI&E), Attention: DASN (Safety), with a copy provided to NOSSA and DDESB within 10 working days.

1.4 REGIONAL MAPS AND HISTORICAL FIGURES AND TABLES

Figures and Tables in this MRESS are derived from historical records, military EOD incident reports, MEC clearance results, and knowledge of previous soil disturbance. This information has been consolidated to Appendix B as a historical record.

This information shall be used as a point of departure for further investigation by consulting the database of record when conducting a site specific risk assessment established in chapter 1.3.

Information drawn from historical figures and tables included herein will be addressed in the future individual annexes.

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1.5 SCOPE OF MUNITIONS RESPONSE

The overall scope of the proposed actions is to detect and remove MEC or MPPEH from the three-dimensional limits of DoD projects/sites on Guam. No other response actions will be taking place concurrent with the proposed munitions response. Given the variable nature of the planned construction and maintenance activities, this MRESS covers the below-listed Response Techniques, which have been developed to provide flexibility while still ensuring appropriate explosives safety criteria are met:

1. UXO Escort
2. Anomaly Avoidance
3. Construction Support
4. Limited Clearance ahead of Construction
5. Full Clearance ahead of Construction

Descriptions of these Response Actions are provided in Section 6.0.

1.6 HISTORY OF MUNITIONS USE

Guam has been part of the United States since 1898, and retained a small 500-man U.S. Military Garrison until 1941, when the Japanese attacked Naval Forces on Guam at the same time as the Japanese attack on Pearl Harbor, HI. In the days that followed, Japan invaded Guam with over 5,000 troops. With the attack on Pearl Harbor, the United States declared war on Japan and officially entered World War II (WWII). The U.S. military returned to Guam in July 1944 to liberate the island from Japan. Prior to the initial amphibious landing of U.S. troops on the island of Guam, an intense pre-invasion bombardment was conducted by U.S. Naval forces that would continue without letup for days with round-the-clock naval gunfire. The U.S. Navy bombarded Japanese defensive positions and strategic areas on Guam prior to landing troops on 21 July 1944. The objective of intense naval bombardment was to reduce the Japanese capability to conduct defensive ground operations. Landings were conducted on the west coast of Guam at Asan and Agat beaches. Figure 1-3 (Appendix B) depicts Guam's WWII battlefields and Figure 1-4 (Appendix B) shows the Japanese infantry and tank positions in July 1944.

1.6.1 HISTORICAL STUDY

The *Historical Ordnance Assessment, P-50 Territory of Guam, NAVFACPAC,* summarizes the various WWII-related battles that took place during the liberation of Guam. The assessment addresses the types of munitions used during the battles and the likelihood of encountering MEC or MPPEH during current and future construction projects within the Areas. The table at Appendix B presents the munitions confirmed or suspected of being used within each Area, as summarized by the historical assessment.

1.7 EXTENT OF MEC OR MPPEH CONTAMINATION

Although no studies of the extent of MEC or MPPEH have been conducted specifically for the designated construction, pertinent information has been gathered and reviewed to assess the likelihood of encountering MEC or MPPEH within each MRESS Area.

1.7.1 INCIDENT REPORTS

U.S. Navy EOD incident reports from 1991-2018 and U.S. Air Force EOD incident reports from 1992-2018 are summarized in the MEC or MPPEH Encountered tables in Section 3.1.

1.7.2 GEOSPATIAL RECORD

CJRM has developed a geospatial layer in the regional planning database that will be used as the basis for all Conceptual Site Models, project planning, and reporting. This database consists of all information obtained from historical records, military EOD incident reports, MEC clearance results, and knowledge of previous soil disturbance. CJRM will maintain currency of this database as Response Actions are completed within individual project sites. CJRM shall have a plan to maintain the MEC database.

1.7.3 AFTER ACTION REPORTS (AAR)

After Action Reports will be submitted for each project or annex providing essential data elements and follow the process in accordance with NOSSAINST 8020.15 (series) within 90 days from project completion to NOSSA as a matter of record. NOSSA will review, document as official correspondence, and determine whether clarification or further documentation is required. Within 10 business days, NOSSA will either accept and forward to DDESB for acknowledgement, or respond to CJRM requesting clarification or further documentation. In both cases, a copy of the correspondence will be provided to DDESB and ASN (EI&E), Attention: DASN (Safety).

This document acknowledges the fact not all information is available to satisfy AAR requirements per NAVSEA OP5 for projects conducted prior to October 2018. Information is available in accordance with DDESB requirements per Defense Explosives Safety Regulation (DESR) 6055.09 V7.E4.7. CJRM will submit AARs for the 25 projects between 2010 and October 2018, and annotate any incomplete information. NOSSA will review, document as official correspondence, and forward to DDESB for the record. A copy of this correspondence will be provided to ASN (EI&E), Attention: DASN (Safety).

1.8 JUSTIFICATION FOR NO FURTHER ACTION DECISION

This section is not applicable.

Justifications for no further action decision will be provided on an individual basis for each AAR by project Annex.

2.0 PROJECT DATES

This ESS is in support of all ongoing, planned, and future DoD construction, service maintenance and repair projects on Guam not covered by a military munitions response program related ESS.

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3.0 TYPES OF MEC AND MPPEH

3.1 TYPES AND QUANTITIES OF MEC AND MPPEH

Table 3-1 (Appendix B) identifies the types and quantities of MEC and MPPEH known or suspected to have been recovered within or around each of the identified ESS Areas as of May 2018. It should be noted that not all of the listed MEC and MPPEH was recovered within the boundaries of each Area. Due to the lack of specific location information contained within the available EOD incident reports, many of the items listed recovery locations near or adjacent to the ESS Area.

3.2 MUNITION WITH THE GREATEST FRAGMENTATION DISTANCE (MGFD)

Given the development of the JRM MEC Global Information System (GIS) Database and the uncertainties regarding the accuracy of the reported locations of previously recovered MEC and MPPEH, a spatial reassessment was performed to validate the locations of MEC and MPPEH that were actually discovered with the boundaries of each of the respective ESS Areas. Based on this spatial assessment, selection of the primary MGFD, and one or more contingency MGFDs were reassigned. The MGFDs establish the explosives safety distances to be employed during intrusive operations.

Each ESS Area's primary MGFD has been assessed based on the actual munition type located inside boundaries of the ESS Areas listed in the historical Table 3-1 (Appendix B) and having the maximum fragment distance-horizontal (MFD-H) and hazardous fragment distance (HFD) greater than the other munitions listed. Contingency MGFDs are munitions items having MFD-H's greater than the primary MGFD that may have been found adjacent to, in the general area of, or in an area near the designated ESS Areas, and have the potential to be found in the respective ESS Areas. As noted in paragraph 1.3.2, this MRESS departs from the previous assignment of probability of encountering MEC or MPPEH, and instead utilizes an Annex structure (see para 1.3.3) for each project or activity that requires a site-specific risk assessment. Therefore, Table 3-1 (Appendix B) is provided for historical purposes only.

The correct explosive safety distances are being assigned for each of the ESS Area's selected MGFDs, a review of historical ordnance publications/technical data was conducted for munitions types and their explosive fillers utilized during WWII (Part 6, Chapter 17, Section 5 of NAVSEA OP 1164, dated 28 May 1947; with Change-1 of January 1969). Based on this review, it was noted the primary high explosive filler (main charge) for U.S. military munitions (ie., general-purpose bombs and artillery) prior to 1949 was the explosive filler trinitrotoluene (TNT). Based on this documented information for military munitions explosive fillers during the WWII period of 1944 when the Liberation Battle of Guam took place, munitions items with a primary explosive filler (main charge) of TNT is the most probable military munition to be found on Guam as a result of WWII battle. However, due to the known and documented fact that the external painted color coding for WWII military munitions was the only true identification feature for determining the munitions probable primary explosive filler, and the fact that this external painted color coding is no longer visible on unearthed/recovered WWII military munitions from this time period, a positive identification of the primary explosive filler cannot be made. Therefore, explosive type, quantities, and safety distances have to be taken in account to include all the military munitions items that may have been utilized during this period of WWII.

Each area's historical primary and contingency MGFDs are identified in Tables 3-2 (Appendix B).

If while executing a munitions response the UXO contractor identifies a MEC item which has a greater maximum fragment distance-horizontal (MFD-H), hazardous fragment distance (HFD), or K328 distance than the approved MGFD, then the Senior UXO Supervisor (SUXOS) will halt all operations, notify the UXO contractor Project Manager, who will notify the Navy Project Manager. Intrusive work may recommence after putting in place either increased protection required by the item found or the contingency MGFD. CJRM shall notify NOSSA upon the decision to change the MGFD within 72 hours and the change will be documented in the AAR.

If while executing a munitions response, the UXO contractor identifies a MEC item with a greater MFD-H, HFD, or K328 distance than the largest approved contingency MGFD, then the SUXOS will halt all operations, notify the UXO contractor Project Manager, who will notify the Navy Project Manager. The UXO contractor must provide the new procedures/distances they recommend to implement, and identify any safeguards associated with the newly selected MGFD. CJRM shall consult with the MPIT to assess the circumstances of the discovery, determine the necessary MGFD and whether appropriate safeguards are in place, and decide whether to recommence intrusive activities. CJRM shall notify NOSSA upon the decision to change the MGFD within 72 hours, and submit within 2 weeks an Annex amendment that identifies the new MGFD and incorporates the revised procedures/distances. The change in the MGFD will be documented in the AAR.

3.3. MAXIMUM CREDIBLE EVENT

This section is not applicable.

3.4 EXPLOSIVELY CONTAMINATED BUILDINGS

This section is not applicable.

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4.0 MEC AND MPPEH MIGRATION

MEC and MPPEH migration may occur naturally through erosion, such as during heavy rainfall or typhoons or through anthropogenic means (e.g., borrow soils from other sites). In areas adjacent to the ocean, movement may be possible due to wave action and the lack of substrate to hold MEC and MPPEH items in place.

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5.0 DETECTION AND POSITIONING TECHNOLOGIES

The selection of detection and positioning technologies is driven by the response action requirements, including depth of clearance (e.g., construction depth), and maximum detection depth for the types of MEC expected.

5.1 DETECTION EQUIPMENT, METHOD, AND STANDARDS

5.1.1 SENSOR EQUIPMENT

5.1.1.1 Analog Sensors

Analog sensors include magnetic gradiometers (e.g., Schonstedt GA-52Cx) and Electromagnetic Induction (e.g., Minelab or White's). Magnetic gradiometers are the easiest to use; however, they detect ferrous metals only, and are more sensitive to geologic interference (e.g., magnetic “hot rock”). Electromagnetic induction sensors detect all metals and can adapt to varying geologic conditions.

The advantage of analog sensors is their ability to perform the response action in a single mobilization, and to function in rougher terrain and heavier vegetation conditions. A limitation of all analog sensors is that their signals are interpreted by the operator in real time and are not recorded for subsequent processing and analysis. This limitation typically imposes additional quality control (QC) measures to ensure proper site coverage and reliable detection (e.g., the use of blind see items (BSIs)). The selected analog sensor, its justification, and QC procedures will be detailed in the QC Plan of the MEC Work Plan (WP) developed by the MEC Contractor. Section 5.3.1.1 and Section 7.0 provide minimum QC procedures for the use of analog detectors.

5.1.1.2 Digital Geophysical Mapping (DGM) Sensors

DGM sensors include total field magnetometers (Mag), and electromagnetic (EM) induction technologies. Typical industry standard systems include the Geometrics G-858 total field magnetic gradiometer and the Geonics EM61-MK2. Mag systems can typically detect larger, deeper objects, but detect only ferrous metals and are more susceptible to geological interference (e.g., “hot rock”). EM systems function better on smaller, shallower objects of all metal types. Coupled with a positioning system, DGM systems record their data for subsequent processing and analysis to produce color image maps and selected anomaly dig lists, along with in-line and across-line site coverage documentation. DGM systems can be configured in man-portable single sensor configurations or multisensory towed arrays. They are limited by steep and rough terrain, heavy vegetation, and areas saturated with metal. The selected DGM sensor, its justification, configuration, and QC procedures will be detailed in the QC Plan of the MEC WP developed by the MEC Contractor. Section 5.3.1.2 and Section 7.0 provide minimum QC procedures for the use of DGM sensors.

5.1.1.3 Advanced Geophysical Classification (AGC) Sensors

AGC sensors use improved EM systems with multiple 3-axis receivers and multiple transmit coils, coupled with finer and longer decay recording. Typical AGC sensors include Geometrics MetalMapper and MetalMapper 2x2, the Man Portable Vector (MPV), and more developmental systems such as the University of Berkley UXO Discriminator (BUD and handheld BUD). This extra data allows for improved modeling and analysis to discriminate MEC-like Targets of Interest (TOIs) from non MEC-like Targets of

Interest (NTOIs), as well as the ability to compare the results to a published library of MEC, producing a ranked dig list that better defines the expected MEC source, location, and depth. AGC technology has successfully demonstrated a significant reduction in the number of objects that require intrusive investigation. This cost savings may be offset by AGC accreditation requirements, higher sensor costs, more stringent QC measures and documentation, and multiple mobilizations (e.g., four mobilizations) for dynamic survey, cued surveys, training digs to update the MEC library, and final intrusive investigations. AGC systems are limited by steep and rough terrain, heavy vegetation, and areas saturated with metal. The selected AGC sensor, its justification, and QC procedures will be detailed in an AGC Quality Assurance Project Plan (QAPP) (AGC QAPP) developed by the MEC Contractor. Section 5.3.1.2 and Section 7.0 provide minimum QC procedures for the use of AGC sensors.

5.1.2 DETECTION METHODS

5.1.2.1 Analog Detection Methods

Analog detection requires limited vegetation removal. Physical grids are established (e.g., 100 x 100 ft), and search lanes (e.g., 4 ft) are identified with lines or other suitable marking. Once a grid (or lot of grids) is established, it is seeded with coverage and blind seeds, in accordance with the QC Plan of the MEC WP. The teams then sweep each lane, intrusively investigate each detected anomaly, and record the results for each grid in accordance with the approved MEC WP.

Once the item is exposed for inspection, the UXO Technicians will determine whether the item is MEC, MPPEH, or other debris. If the item is MEC/MPPEH, a positive identification will be documented and confirmed by the UXOTIII. The SUXOS will coordinate disposition of the item IAW Section 6.4. All other debris will be collected and segregated to prevent comingling. Following the removal of the anomaly, the area will be checked to ensure no additional anomalies remain.

Missed coverage or blind seeds require the team to re-sweep that grid or lot of grids. The seeding process will be repeated for each additional lift within the same footprint as the required construct depth progresses.

5.1.2.2 DGM Detection Methods

DGM systems require more vegetation removal to allow sensor access and improve positioning system performance. Following the vegetation removal, a surface clearance is typically performed to improve the DGM detection of subsurface objects. The site is also seeded with blind seed items, in accordance with the QC Plan of the MEC WP. DGM data is collected along overlapping survey lines until the project site is 100 percent mapped. DGM and positioning data are processed and analyzed to produce a color image map and selected DGM anomalies or intrusive investigation. QC for DGM detection includes documented site coverage maps, sample separation maps, and blind seed detection location and response metrics compared to the performance metrics specified in the QC Plan of the MEC WP.

5.1.2.3 AGC Detection Methods

AGC systems will be used to perform a dynamic survey to better identify anomalies for the AGC cued (static) survey. AGC sensors require even more vegetation removal, due to the sensors' lower ground clearance. The AGC site is seeded with both QC blind seeds and QA blind seeds, as specified in the

approved AGC QAPP. Following the dynamic data collection, processing, and analysis, an additional mobilization is required to collect the AGC cued (static) data over each selected anomaly. The cued data is then processed and analyzed to produce a ranked dig list identifying high –confidence TOIs, and high-confidence NTOIs. Any cued anomaly that could not be reliably analyzed is included on the must dig list. Typically, clusters of cued objects have similar response values, but do not match the MEC library. To help decide if these clustered objects are TOIs or NTOIs, a selection is intrusively investigated during a third mobilization, and the MEC library is updated accordingly. As a part of the planning process, and prior to any fieldwork, the project team will verify that the library used is the most current and includes all signatures for all munitions known or suspected to be present at the site. A final ranked dig list is then produced and the final intrusive investigation is completed.

5.1.3 DETECTION STANDARDS

Detection standards for Analog, DGM, or AGC sensors will be specified in the MEC Contractor's QC Plan of the MEC WP or AGC QAPP. The same detection technology will be required to acquire and reacquire anomalies. Detection standards are met with analog sensors when each coverage and blind seed item is recovered in a lot. For DGM and AGC sensors, the detection standards are considered met when all site coverage metrics are met, and all QC and QA blind seeds are included on the dig list, with location accuracy and response values within the metrics specified in the QC Plan of the MEC WP or AGC QAPP.

5.2 POSITIONING SYSTEMS, METHODS, AND STANDARDS

The selection of the positioning system depends on the MEC response site vegetation conditions. Sites with vegetation that block the view of the sky may require traditional line/station/fiducial (LSF) positioning. Sites with a clear view of the sky will utilize Differential Global Positioning Systems (DGPSs). Sites that maintain a tree canopy, but are largely open underneath the canopy, may use Robotic Total Station (RTS) positioning systems. All positioning systems will operate on a coordinate system established by a licensed Professional Land Surveyor (PLS).

5.2.1 POSITIONING SYSTEMS

5.2.1.1 LSF Methods

The LSF positioning method is the traditional one for positioning DGM data. It requires that a physical grid be constructed, with a known origin (e.g., 0,0) and end point (e.g., 0, 100 or 100, 100), known line numbers and lengths at the line spacing specified in the QAPP, and known fiducial intervals along each line (e.g., every 25 ft). Tape measures are used to establish the grid corners, survey lines, and fiducial marks. A grid layout QC metric is included in the QC Plan of the MEC WP (e.g., any grid length or diagonal is within 30 cm). Sensor data are collected along each line, with a mark or fiducial added to the data at each start point, marked fiducial, and end point. The line is incremented and the procedure is repeated until all lines in that grid have been collected. Sensor data positioning is accomplished by assigning the start, fiducial, and end points of each line, and linearly interpolating the sensor readings between each marked fiducial. If the geodetic locations of two or more grid points are known, the LSF positioned data can be warped in real-world coordinates. Selected DGM anomaly locations are typically reported in local grid coordinates.

5.2.1.2 Digital Global Positioning System (DGPS) Methods

DGPSs use available, multinational GPS satellites to determine the receiver's location. The use of a base station and a differential radio link between the base and rover DGPS receivers allows for rover location accuracies within several centimeters (cm). The rover DGPS receiver is mounted over the DGM/AGC sensor, or at a fixed offset. These positioning systems require a consistent clear view of the sky, with position outputs ranging from 1 Hertz (Hz) to 20 Hz. For DGM applications, DGPS data is output at 1 Hz and AGC system data is output at 5 Hz, with the data recorded in the same file as the sensor data. The selected DGPS, configurations, and back check accuracy requirement will be detailed in the QC Plan of the MEC WP or AGC QAPP.

5.2.1.3 RTS Methods

RTS positioning systems use a laser base station (e.g., gun) to measure the distance to a roving prism with sub-centimeter accuracy. A radio connects the base station and the roving prism, providing location data at the rover. The rover prism is mounted over the DGM/AGC sensor, or at a fixed offset. Line of sight between the base and rover is required, often necessitating that an operator be stationed at the base station to help recover lock after passing an obstruction (e.g., tree trunk). For DGM applications, RTS data is output at 1Hz and AGC system data at 5Hz, with the data recorded in the same file as the sensor data. The selected RTS, configuration, and back-check accuracy requirement will be detailed in the QC Plan of the MEC WP or AGC QAPP.

5.2.2 Positioning Standards

Site survey control is required to be established or confirmed by a PLS, tied to a recognized network. Normally, two survey control points are established, one for a base station and the other for a back-check point. Back-check position accuracy metrics will be detailed in the QC Plan of the MEC WP or AGC QAPP.

5.3 EQUIPMENT CHECKOUT

5.3.1 DETECTION EQUIPMENT CHECKS

5.3.1.1 Analog Sensors

An Instrument Verification Strip (IVS) is required to document the site-specific maximum reliable depth of analog detection. The IVS is seeded with inert MEC or suitable Industry Standard Objects (ISOs). As a starting seed item depth, IVS seed items should be buried at 11 times their outer diameter, measured from ground surface to object center. Based on past Naval Research Laboratory demonstrations, it has been noted that site noise at some sites in Guam is considerable. Therefore, at no time will 11x diameter be exceeded for detection depths. The seed item depth(s) are adjusted upwards until the reliable maximum detection depth is established. The finalized IVS is documented and used daily to check the selected analog sensor and its operator. The daily IVS check results are recorded by the UXOQCS. Details of the IVS, its documentation, and consequences of failure are addressed in the QC Plan of the MEC WP.

5.3.1.2 DGM and AGC Sensors

As part of the Geophysical System Verification (GSV) process, a DGM/AGC related IVS is required to document that the selected DGM/AGC sensor, and its positioning system, are performing as expected and within the measurement performance criteria detailed in the QC Plan of the MEC WP or AGC QAPP. The IVS is seeded with inert MEC, or equivalent ISOs. Since the DGm/AGC depth of detection for most MEC is known, the IVS seed items are buried at 3 to 7 times the seed item's outer diameter. The initial IVS results are documented in an IVS report, finalizing the DGM/AGC performance metrics, including the initial anomaly selection criteria. The IVS is surveyed at the beginning and end of each survey day, with the IVS check results tracked and reviewed by the Contractor's Geophysicist. Details of the IVS, its documentation, and consequences of failure will be detailed in the QC Plan of the MEC WP or AGC QAPP.

Daily morning and afternoon DGM Static and AGC Function Checks are performed to document the basic sensor performance. After sensor warmup and nulling, a standard object is placed at a known, repeatable position relative to the sensor, and data is recorded for a set time (e.g., 1 minute). The results of the DGM static check or AGC function check are tracked, reviewed, and delivered to the project team. Details of the DGM Static and AGC Function checks, their documentation, and consequences of failure are provided in the QC Plan of the MEC WP or AGC QAPP.

As part of the GSV process, BSIs are placed in the project work area. For analog systems, coverage BSIs are also used. The BSI type(s), density or rate, and burial depth(s), along with coverage seed density, are detailed in the QC Plan of the MEC WP or AGC QAPP firewalled seeding plan. At a minimum, one BSI per team, per day, will be used. For analog systems, all BSIs and coverage seeds must be recovered. For DGM/AGC systems, all BSIs must be on the dig list, with location accuracy and response values within the metrics specified in the QC Plan of the MEC WP or AGC QAPP. Details of the BSI program, its documentation, and consequences of failure are provided in the QC Plan of the ME CWP or AGC QAPP.

5.3.1.3 IVS Guidelines

The IVS will be seeded by the MEC Contractor. Each seed item will be labeled with a unique identifier, photographed (open hole), and located in relation to the IVS survey ends that will also be located. The following idealized IVS ISO seed items will be buried ten feet apart in a horizontal orientation at the depths indicated:

- 1 each 20mm surrogate 5/8"-11x2" fully threaded bolt buried at 6 inches
- 1 each medium ISO (2-inch x 8-inch pipe nipple) buried at 13 inches and
- 1 each large ISO (4-inch x 12-inch pipe nipple) buried at 20 inches.

Due to large encompassing acreage covered by the various areas, specific IVS design may need to be tailored to meet individual clearance areas and project requirements. For DGM surveying, the contractor WP will provide a description of any changes in the IVS design.

5.3.2 POSITIONING SYSTEM CHECKS

Analog grid layout is checked by measuring the grids' side or diagonal to confirm they are within 30 cm. Details of the analog grid layout check, its documentation, and consequences of failure will be detailed in the QC Plan of the MEC WP.

Site Survey Control is checked monthly for long-term projects. Daily back-check results are recorded and documented to confirm compliance with positioning accuracy metrics specified in the QC Plan of the MEC WP or AGC QAPP. Details of the site survey control and back checks, their documentation, and consequences of failure will be detailed in the QC Plan of the MEC WP or AGC QAPP.

The twice daily DGM/AGC IVS checks provide additional positioning system checks, documenting that IVS seed item location accuracy metrics are being met, as do the detected BSI location accuracy checks.

5.4 DATA COLLECTION AND STORAGE

Data collection includes the daily IVS check results, the intrusive results, and the recovery of BSIs and coverage seeds for each grid or lot of grids. The preferred method of storage is on a rugged Personal Digital Assistant (PDA), using pull-down menus, as well as digital photos of recovered objects (e.g., MEC and MPPEH items are photographed specifically, while grid debris is photographed collectively by grid or lot of grids). As a back-up to PDA systems, a logbook will also be kept. Data and photos, if collected separately from a PDA, are downloaded and imported in to the project database for review and reporting.

DGM/AGC survey data are collected on system-specific data loggers and then downloaded and transferred to the data processor. Processed data, along with the processed results, are stored on computers and file sharing sites. DGM/AGC intrusive results are recorded on ruggedized PDAs or tablets, along with recovered object photos, using drop-down menus. PDA data will be downloaded and imported into the project database for review and reporting. Response Action-related data will be entered into the JRM MEC GIS Database.

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6.0 RESPONSE ACTIONS

Given the variable nature of the planned construction and maintenance activities, this ESS covers the below-listed response techniques, which have been developed to provide flexibility while still ensuring appropriate explosives safety criteria are met.

1. UXO Escort
2. Anomaly Avoidance
3. Construction Support
4. Full Clearance Ahead of Construction
5. Limited Clearance Ahead of Construction

6.1 RESPONSE TECHNIQUES

Response actions covered under this ESS will be selected, as appropriate, based on the type of site activities being performed and the respective likelihood determination (likely or unlikely) of the work site. The following sections detail the techniques related to performance of the respective Response Actions.

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6.1.1 UXO ESCORT

1. **Conditions of Use.** The response technique *UXO Escort* is required for site activities in areas designated **likely** to encounter MEC/MPPEH and when there are:

    a. **NO** planned ground disturbance (intrusive) activities, and

    b. **NO** expectation of intentional physical contact with MEC/MPPEH (regardless of configuration)

2. **Purpose.** This technique requires all non-UXO personnel that have not met minimum training requirements to be escorted by UXO-qualified personnel to prevent contact with any potential surface MEC/MPPEH.

3. **UXO-Qualified personnel.** Qualifications and quantity of UXO-qualified personnel for this technique must meet the requirements in paragraph 8.2 of this document.

4. **Procedure**

    a. A MEC safety briefing and awareness training must be provided by the assigned UXO-qualified personnel for all site personnel.

    b. Any surface MEC/MPPEH discovered will be avoided.

    c. If MEC/MPPEH is discovered, the UXO-qualified escort will record the following: identification of type without touching or moving it, location recorded with a handheld GPS, description of how it was discovered, and photographs. The item will then be reported to the NFM MEC PM, as well as the JRM Regional Operations Center (ROC) for the cognizant military EOD unit action per Section 6.4.

5. **Special Conditions**

    a. An escort is not required for site access of non-UXO qualified personnel who received the required annual 3R's (Recognize, Retreat, and Report) UXO Awareness training and obtained written approval from the JRM ESO. Individuals who have an active contract or official purpose must submit a request detailing the planned site activities, total number and names of personnel who will be on site, a detailed map/figure depicting the site areas requiring access, and proof of training.

    b. An escort is not required for access to "routinely maintained areas," (e.g., firebreaks, unimproved roads, routinely maintained hiking trails, mowed and maintained fields).

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6.1.2 ANOMALY AVOIDANCE

1. **Conditions of Use.** The response technique *Anomaly Avoidance* is required for site activities in areas designated **likely** to encounter MEC/MPPEH and when there are:

    a. **PLANNED** ground disturbance (intrusive) activities, and

    b. **NO** expectation of intentional physical contact with MEC/MPPEH (regardless of configuration)

2. **Purpose.** This technique requires support to ensure the avoidance of:

    a. Surface MEC/MPPEH, regardless of configuration, during any activities that require entry to the area, and

    b. Subsurface anomalies during all ground-disturbing operations (note: intrusive anomaly investigation is not authorized during anomaly avoidance operations)

3. **UXO-Qualified personnel.** The qualifications and quantity of UXO-qualified personnel for this technique must meet the requirements in paragraph 8.2 of this document.

4. **Procedure.** A MEC safety briefing and awareness training for all site personnel will be provided by the assigned UXO-qualified personnel.

    a. During anomaly avoidance, a UXO-qualified individual will utilize a handheld analog metal detector to assist with detecting and avoiding surface MEC/MPPEH and subsurface anomalies. During anomaly avoidance intrusive activities, the UXO Technician will first inspect the ground surface of the operational area to ensure the surface area is free of any MEC/MPPEH before site operations can proceed. This surface inspection will include areas of ingress and egress to the work site. At the location or area where intrusive activities will occur, the UXO Technician will utilize the handheld analog metal detector to check the location for subsurface anomalies prior to the commencement of any intrusive work (excavations, drilling, or trenching).

    b. If a subsurface anomaly is detected at the location of the intended intrusive or ground-disturbing activity, this area will be avoided for intrusive work in favor of an alternate location adjacent to or nearby the original location (but far enough away to ensure no contact is made with the previously detected anomaly).

    c. Intrusive work will not commence until the UXO-qualified person has indicated that it is safe to do so. After confirming the work area is clear of surface MEC/MPPEH and subsurface anomalies, the intended intrusive or ground-disturbing activities may commence. The initial intrusive activity (excavations, drilling, or trenching) will be limited to a maximum depth or intervals established by taking into account the approved TOI and performing a site-specific prove-out of the selected handheld analog detector (per Section 5.3.1.1).

d. As intrusive activities progress, the location or area will be checked by the UXO-qualified personnel at the same intervals used in paragraph 4c until the maximum depth of excavation, drilling, or trenching is reached, or bedrock is encountered (as determined per JTREG MARIANAS NOTICE 8020, *Clarification on Determination of Bedrock While Conducting ESS Operations in JRM AOR*), whichever occurs first.

e. During the analog detector-aided subsurface anomaly surveys, all metallic equipment will be moved far enough away from the detection location or area so as not to interfere with or mask any metallic subsurface anomalies.

f. Discovered surface MEC/MPPEH must be avoided and the following recorded: identification of type without touching or moving it, location recorded with a handheld GPS, description of how it was discovered, and photographs. The item will then be reported to the NFM MEC PM, as well as the JRM Regional Operations Center (ROC) for the cognizant military EOD unit action per Section 6.4.

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6.1.3 CONSTRUCTION SUPPORT

1. **Conditions of Use.** "On-call" construction support is required for site activities in areas designated as **unlikely** to encounter MEC/MPPEH, and when there **IS** planned ground disturbance (intrusive activities).

2. **Purpose.** UXO-qualified personnel or military EOD personnel are called to the site on an as-needed basis if suspected MEC/MPPEH is discovered during ground disturbance activities.

3. **UXO-Qualified personnel.** When a UXO-qualified contractor is called to respond to suspected MEC/MPPEH, the qualifications and quantity of UXO qualified personnel must meet the requirements in paragraph 8.2 of this document. Supplemental on-call construction support can be provided by military EOD, as required.

4. **Procedure.** A MEC safety briefing and awareness training for all site personnel will be provided by the contractor conducting the work.

    a. If suspected MEC/MPPEH is discovered at any time during site activities (including ground disturbance activities), the contractor performing the work will immediately stop, relocate all personnel to a safe location away from the suspected MEC/MPPEH, and contact the NFM MEC PM and the JRM ROC for the cognizant military EOD unit action per Section 6.4.

    b. Discovered surface MEC/MPPEH must be avoided and the following recorded: identification of type without touching or moving it, location recorded with a handheld GPS (including depth if found in the subsurface), description of how it was discovered, and photographs.

    c. As a conservative measure, CJRM may direct UXO-qualified personnel to be physically on-site and available to continually monitor intrusive construction activities being conducted at the site.

    d. The discovery of MEC/MPPEH in an area designated unlikely requires immediate reassessment per section 1.3 of this document.

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6.1.4 FULL CLEARANCE AHEAD OF CONSTRUCTION

1. **Conditions of Use**. Full Clearance Ahead of Construction is the preferred technique for site activities in areas designated **likely** to encounter MEC/MPPEH, and when there are:

    a. **PLANNED** ground disturbance (intrusive) activities, and

    b. **EXPECTED** intentional physical contact with MEC/MPPEH (regardless of configuration)

2. **Purpose.** Full Clearance Ahead of Construction is the preferred method and consists of completely removing surface and subsurface MEC/MPPEH within the planned construction footprint ahead of conducting any construction activities in areas designated as a likely area of encountering MEC and/or MPPEH. Full Clearance Ahead of Construction requires the removal **of all MEC/MPPEH equivalent to the approved TOI and larger, down to construction depth or bedrock**.

3. **UXO-Qualified personnel.** The qualifications and quantity of UXO-qualified personnel for this technique must meet the requirements in paragraph 8.2 of this document.

4. **Procedure**. There are several ways to achieve full clearance ahead of construction. The following provides two alternatives for achieving Full Clearance Ahead of Construction: Alternative 1 and Alternative 2 (Phases 1 and 2). Note that both phases of Alternative 2 must be completed in order to achieve Full Clearance Ahead of Construction. In addition, Alternative 2 can be varied depending on the desired excavation depth of each layer and limitations of equipment to detect anomalies of different diameters, as specified in Alternative 2 (Phase 1).

    a. For both alternatives, the following applies:

        (1) **Vegetation Removal.** Vegetation will be removed employing surface anomaly (MEC/MPPEH) avoidance support provided by UXO-qualified personnel within the project construction footprint boundaries, to a height not less than 6 inches above the ground surface using machetes, man-portable brush cutters, and chain saws or mechanical equipment. Vegetation removal will be limited to cutting of brush, vines, small trees, and tree limbs that would directly impede the movement of the selected detection equipment and MEC/MPPEH removal operations. Cut vegetation will be moved from the area so as not to impede the surface removal operations. Refer to Table 7-1 for QC requirements associated with performing vegetation removal operations.

        (2) **Surface Removal**. Following vegetation removal, UXO teams will conduct a surface removal. Each team consists of one UXO Technician III (UXOTIII) Team Leader and up to six UXO Technicians II/I (UXOTII/I). The limits of construction (i.e., limit of disturbance) will be subdivided into work grids. In areas of high and medium archaeological interest (as determined through coordination with the Installation Cultural Resource Manager), archaeological monitors will accompany each UXO

Team for the duration of the fieldwork to ensure protection of archaeological features. Archaeological monitors will be escorted by UXO Technicians at all times while in the construction footprint. Using 4-foot wide individual search lanes the UXO teams will systematically traverse each work grid with analog detectors to detect, locate and mark all MEC/MPPEH items encountered, and recover any non-MEC related scrap. The UXOTIII organizes the team and directs the movement of the team back and forth across the grid in a manner that ensures 100% coverage of each grid. As the team moves forward, the UXOTII/Is use the analog detector to assist them in locating metallic items that may be camouflaged by the soil or hidden in vegetation. Whenever the team encounters material suspected to be MEC/MPPEH, the UXOTII inspects the item. If the item is determined to be non-MEC related scrap the UXOTIII directs the UXOTII to recover the material, and it is removed from the grid and stockpiled with other non-MEC related scrap. If the item is determined to be MEC/MPPEH, item disposition will be IAW Section 6.4. **During surface removal operations all MEC/MPPEH will be removed.**

b. ALTERNATIVE 1 – Scan, Remove all anomalies down to the depth limited by detection technology for the approved TOI, and excavate in lifts equivalent to this depth. The following steps apply to this alternative and must be conducted by a UXO contractor, unless otherwise identified:

(1) Utilizing UXO-qualified personnel, conduct a scan over the entire area to be excavated to identify all buried anomalies. Note: appropriate digital (traditional DGM or Advanced Sensors-preferred) and analog equipment that can be used for scanning are identified in Section 5 of this document.

(2) Evacuate all non-essential personnel from within the approved HFD of the MGFD for the area as identified in Section 3 or the approved Annex as appropriate. Note that this distance is measured from the location of the anomaly being investigated at the time. Therefore, this exclusion zone (EZ) will move depending on the location of the intrusive activity.

(3) Subsurface anomalies selected during the processes described in Section 5.1 will then be reacquired and intrusively investigated by manually excavating each anomaly identified during the scan in Step 1 down to the depth limited by detection technology for the approved TOI.

(4) Take down the EZ and mechanically excavate a layer of soil equivalent in depth to Step 3 as a non-explosive operation. Note that this excavated soil is considered free of MEC and MPPEH and may be transported and used anywhere, including off-base, as long as it is not co-mingled with soil that potentially contains MEC/MPPEH, and meets Quality Control/Quality Assurance requirements of Section 7 of this ESS. This step may be conducted by a general contractor with on-site support from the UXO contractor.

(5) Repeat Steps (1) through (4) until depth of construction has been obtained or bedrock is reached, as defined in COMJTREG MARIANAS NOTICE 8020.3, *Clarification on Determination of Bedrock While Conducting ESS Operation in JRM AOR*.

c. ALTERNATIVE 2 (PHASE 1) – Scan, Remove All Anomalies Down to 18 inches, Excavate 18-inch Lifts

(1) Utilizing UXO-qualified personnel, conduct a scan over the entire area to be excavated to identify all anomalies. NOTE: Appropriate digital (traditional DGM or Advanced Sensors-preferred) and analog equipment that can be used for scanning are identified in Section 5 of this document.

(2) Evacuate all non-essential personnel from within the HFD of the MGFD for the area as identified in Section 3. Note that this distance is measured from the location of the anomaly being investigated at the time. Therefore, this exclusion zone (EZ) will move depending on the location of the intrusive activity.

(3) Manually excavate each anomaly identified during the scan in Step 1 down to 18-inches.

(4) Prepare to mechanically excavate soil in 18-inch lifts:

a. Evacuate all non-essential personnel within the HFD of the 60 mm mortar (152 feet),

b. Armor the excavation equipment with shielding (thickness identified on the Fragmentation Data Review Form for the 60 mm mortar in the unintentional detonation column and is dependent on the type of material used) to protect the operator from an unintentional detonation.

c. Ensure the edge of the excavator bucket (or lip of the front end loader bucket, if used), gets no closer to the operator than the K24 distance of 17 feet, or the K18 distance of 13 feet, if the operator is wearing double hearing protection that provides $\geq$ 9 dB attenuation. This separation distance, along with the shielding requirement identified in Step 4b, applies to all other essential personnel that may be observing the excavation, such as UXO technicians watching for potential MEC/MPPEH and archeologists looking for archeological significant finds.

(5) Mechanically excavate an 18-inch layer of soil. Note that this soil may contain MEC/MPPEH smaller than the 60 mm mortar. Therefore, the soil cannot be placed in locations where the public can access it and the requirements for transporting the soil off-base will be dependent on site-specific information from where the soil came and weight of evidence as to what the soil may contain. However, when handling the soil, such as moving it, the separation distances and shielding requirements for the 60 mm mortar identified in Steps (4)a, (4)b, and (4)c apply. Note: Although it is not preferred, this soil can be used as fill at another construction site that is not accessible to the public, but the requirements of alternative steps (3)a through (5)a in Section 6.1.5.4(7) LIMITED CLEARANCE AHEAD OF CONSTRUCTION must be followed, utilizing on-site UXO contractor support.

(6) Repeat Steps (1) through (5) until depth of construction has been obtained or bedrock is reached, as defined in COMJTREG MARIANAS NOTICE 8020.3, *Clarification on Determination of Bedrock While Conducting ESS Operation in JRM AOR*.

(7) This alternative can be varied depending on the desired excavation depth of each layer and limitations of equipment to detect anomalies of different diameters. For example, if the depth of the construction project is 36 inches, then:

a. To remove all anomalies greater than or equal to the 60 mm munition requires 2 scans, one at the surface and the other at a depth of 18 inches, and 2 lifts of 18 inches each. Note that 60 mm mortars can reliably be detected to a depth of 18 inches on Guam, due to site-specific soil conditions, including composition and interference/noise.

b. To remove all anomalies greater than or equal to the 40 mm munition requires 3 scans, one at the surface and the other two at depths of 12 and 24 inches, and 3 lifts of 12 inches each. Note that 40 mm projectiles can reliably be detected to a depth of 12 inches on Guam.

c. During implementation of either (7)a or (7)b above, EZs and shielding for personnel must be based upon the primary MGFD for the area (or the contingency MGFD for the area, if one was found), as identified in Section 3 of this document.

d. ALTERNATIVE 2 (PHASE 2) – Remove MEC/MPPEH down to the 20mm projectile from the excavated soil

(1) Follow the separation distances and shielding requirements identified in Steps (4)a, (4)b, and (4)c of **Alternative 2 (Phase 1)** for the following step.

(2) Conduct either one of the following:

a. Spread soil on the ground in 6-inch layers, scan all soil, and remove all anomalies equal in size to the 20 mm projectile and larger.

b. Place the soil in a mechanical screener, using a 0.75-inch screen, or series of screen sizes, if necessary, to remove all anomalies equal in size to the 20 mm projectile and larger.

c. NOTE: Regardless of the method used, all metallic objects equal in size to or greater than a 20 mm projectile must be removed from the soil. As indicated in Section 7, any metallic object 20 mm or larger in size will constitute a QC/QA failure of the grid and require re-work by the UXO contractor.

e. Next step after completing Alternative 1 or Alternative 2 (Phases 1 and 2). The following applies after completing Alternative 1 or after completing Alternative 2, Phases 1 and 2, and can be conducted by the construction contractor without on-site construction support from the UXO contractor:

(1) Place the soil that was excavated back into the hole from which it was excavated.

(2) Identify the three-dimensional footprint of the soil from which MEC/MPPEH has been removed down to the 20mm projectile TOI in the GIS and begin construction, staying within that three-dimensional footprint.

(3) Future construction within that footprint will not require on-site UXO contractor support and can be considered unlikely of finding MEC/MPPEH once the After Action Report (AAR) for the project has been submitted to and accepted by the DDESB.

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6.1.5 LIMITED CLEARANCE AHEAD OF CONSTRUCTION

1. **Conditions of Use**. Limited Clearance Ahead of Construction is an alternate technique for site activities in areas designated **likely** to encounter MEC/MPPEH, and when there are:

    a. **PLANNED** ground disturbance (intrusive) activities, and

    b. **EXPECTED** intentional physical contact with MEC/MPPEH (regardless of configuration)

2. **Purpose.** Limited Clearance Ahead of Construction consists of removing larger MEC/MPPEH items from the construction footprint, allowing the contractor to conduct work with armored equipment and using required separation distances to ensure the protection of essential and non-essential personnel. Limited clearance ahead of construction can speed up the construction process, but leaves MEC/MPPEH smaller than the 60 mm mortar in place, requiring the use of EZs and shielding during all future projects within the soil, as this soil is NOT considered unlikely of finding MEC/MPPEH.

3. **UXO-Qualified personnel.** The qualifications and quantity of UXO-qualified personnel for this technique must meet the requirements in paragraph 8.2 of this document. On-site construction support provided by UXO technicians is required as this is an explosive operation.

4. **Procedure**

    (1) Conduct vegetation removal and surface removal as described in the FULL CLEARANCE AHEAD OF CONSTRUCTION section of this ESS.

    (2) Conduct Alternative 2 (Phase 1) – Scan, Remove All Anomalies Down to 18 inches, Excavate 18-inch Lifts, as described in the FULL CLEARANCE AHEAD OF CONSTRUCTION section of this ESS down to construction depth or bedrock.

    (3) All soils excavated using the "lift" process (18"/12") must be managed by identifying the soils location in the GIS and handled appropriately, as discussed in Step 5 below, during any subsequent use.

    (4) Once the soil has been excavated to construction depth or bedrock, the construction contractor may begin work without on-site support from the UXO contractor, provided no excavation occurs outside of the construction footprint, i.e., the contractor may have to bring in clean soil that has all MEC/MPPEH removed that is greater than or equal to the 20 mm projectile TOI.

    WARNING: SOILS EXCAVATED USING THE "LIFT" PROCESS MUST NOT BE COMMINGLED WITH THOSE SOILS THAT HAVE BEEN SCREENED/CLEARED TO THE 20 mm TOI OR SOILS THAT MAY CONTAIN MEC/MPPEH GREATER THAN OR EQUAL TO THE 60 MM MORTAR. When commingled, all of the soil must be identified as containing the largest munition item that was in any of the separate soils prior to commingling.

(5) When handling those soils excavated using lifts greater than 6 inches, i.e., Limited Clearance Ahead of Construction, the separation distances and shielding requirements for the 60 mm mortar identified in Steps 4a, 4b, and 4c of **Alternative 2 (Phase 1)** must be followed.

(6) When time permits, conduct **Alternative 2 (Phase 2)**, as described in the FULL CLEARANCE AHEAD OF CONSTRUCTION section of this ESS.

NOTE: After Step (6) above has been completed, the excavated soil is considered free of MEC and MPPEH and may be transported and used anywhere, including off-base, as long as it is not co-mingled with soil that potentially contains MEC/MPPEH, i.e., it can be used as clean fill (Step (4) above) in the next construction project that incorporates limited clearance ahead of construction.

(7) In place of Steps (3), (4), (5), and (6) of this section, the following may be conducted with on-site UXO contractor support:

(3a) The contractor may return the soil to project site, but must adhere to the separation distances and shielding requirements identified for the 60 mm mortar in Steps (4)a, (4)b, and (4)c of **Alternative 2 (Phase 1)**.

(4a) Begin construction while continuing to adhere to the separation distance and shielding requirements for the 60 mm mortar identified in Step 3a.

(5a) Identify the three-dimensional footprint of the soil from which MEC/MPPEH greater than and equal to the 60 mm mortar has been removed in the GIS. The MGFD for the soil within that footprint can be reduced to the 60 mm mortar upon submission of the AAR to the DDESB. As such, the separation distances and shielding requirements for the 60 mm mortar identified in Steps (4)a, (4)b, and (4)c of **Alternative 2 (Phase 1)** must be followed for future construction projects within that footprint, instead of having to use the greater separation distances and manual excavation required for the larger MGFD for areas where no MEC/MPPEH has been removed.

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6.1.6 REMOTE OPERATIONS

1. In areas where accessibility by personnel may be an issue or where the required separation distances for essential personnel cannot be met, remote operations may be conducted.

2. If the remote operation being conducted is low-input (i.e., the equipment is not likely to deform MEC/MPPEH that is encountered), then the separation distances and shielding requirements must be as follows, based on the approved MGFD for the area:

    a. Non-essential personnel must be located outside of the HFD of the MGFD.

    b. Essential personnel must be located at distance of at least K24 of the MGFD or K18 of the MGFD, if double hearing protection is worn that provides $\geq$9 dB attenuation, and behind shields or barricades that are designed to defeat hazardous fragments. The thickness of the shield or barricade, which is based on the material from which it is made, can be found on the fragmentation data review form for the MGFD of the area, as identified in Section 3, in the "Minimum Thickness to Prevent Perforation" block, "Unintentional" column.

3. If the remote operation being conducted is high-input (i.e., likely to deform MEC/MPPEH that is encountered), then the required separation distance for non-essential personnel is the approved MFD of the MGFD for the area. Essential personnel must follow the requirements of Step 2.b. above with the exception of the required shielding/barricade thickness, which is to be based on the "intentional" detonation column in the fragmentation data review form.

    NOTE: If non-essential personnel enter into the required EZs, then operations must stop until those personnel are relocated outside of the required EZs, as discussed in Section 6.2.4 of the ESS.

6.1.7 NIGHT WORK

Night work may be performed as required. Illumination must be provided to meet current Occupational Safety and Health Administration (OSHA) requirements (10 foot-candles, minimum) with safety protocols established in the MEC Contractor's approved project plans.

6.1.8 PROCESS FOR CHANGING AN ESS AREA'S LIKELIHOOD DESIGNATION

6.1.8.1 PROCESS TO INCREASE LIKELIHOOD OF ENCOUNTERING MEC/MPPEH (UNLIKELY TO LIKELY)

1. In the event that a MEC/MPPEH item is found within an unlikely area, or new information is received which should result in the unlikely area being re-categorized as a likely area, intrusive activities in the area will be stopped and the JRM MEC Process Improvement Team (MPIT) will be notified.

2. CJRM shall consult with the MPIT to assess the circumstances of the discovery, determine whether site safety conditions differ from those initially considered, assess the extent of the impacted area, and determine if risk levels should increase.

3. The decision shall be documented in the "Summary of actions taken…" section of the MRS Identification and Notification (ID&N) Report from NOSSAINST 8020.15 (series), and forwarded to NOSSA (N4) within 72 hours, copying OPNAV N41 and ASN (EI&E), Attention: DASN (Safety).

4. NOSSA will review and document as official correspondence. If NOSSA concurs with a CJRM submission, a copy of the correspondence will be provided to OPNAV N41 and ASN (EI&E), Attention: DASN (Safety) within 10 working days. If NOSSA objects to a CJRM decision, the documentation must be forwarded to OPNAV N41 within 10 working days for review, adjudication and risk decision; a copy of this correspondence will be provided to ASN (EI&E), Attention: DASN (Safety), with a copy provided to NOSSA within 10 working days.

6.1.8.2 PROCESS TO DECREASE LIKELIHOOD OF ENCOUNTERING MEC/MPPEH (LIKELY TO UNLIKELY), OR MGFD, OR TOI

1. Completed Clearance Actions

    a. Following the completion of a full clearance activity in a likely area, an AAR will be submitted in accordance with paragraph 1.7.3 of this document to the NFM ESS PM, who will review and submit to the JRM RESO, who will submit to NOSSA via WebESS, copying OPNAV N41 and ASN (EI&E), Attention: DASN (Safety). After Action Reports will provide essential data elements and follow the process in accordance with NOSSAINST 8020.15 (series).

    b. NOSSA will review and document as official correspondence. If NOSSA concurs with a CJRM submission, then the AAR will be forwarded to DDESB for the record, copying CJRM, OPNAV N41 and ASN (EI&E), Attention: DASN (Safety) within 10 working days. If NOSSA requires clarification or further documentation, a copy of the correspondence will be provided to DDESB and ASN (EI&E), Attention: DASN (Safety). If NOSSA objects to a CJRM decision, the documentation must be forwarded to OPNAV N41 within 10 working days, copying JRM and ASN (EI&E), Attention: DASN (Safety).

    c. OPNAV N41 will review, adjudicate and make a risk decision on the new classification, and forward to DDESB for the record within 10 working days, copying NOSSA and ASN (EI&E), Attention: DASN (Safety).

2. Ongoing Clearance Actions

    a. Likelihood characterizations can be reduced during the course of a clearance project if sufficient data has been collected to develop a conceptual site model (CSM).

    b. CJRM shall consult with the MPIT and decide whether the CSM supports risk levels should decrease.

c. The decision shall be documented by an Annex Amendment (or new Annex for "grandfathered" projects per Section 1.3.4) following the requirements of Section 1.3.3.

3. Decision Record via the JRM MEC GIS Database.

   a. Once accepted by the appropriate approval authority, the decision documented in the format of an AAR or Annex will be uploaded in the JRM MEC GIS Database, and the reported limits of clearance will be characterized as unlikely for encountering MEC/MPPEH.

   b. Additional requirements may be placed on the site based on the level of clearance performed. For example, if clearance to 1-foot was conducted for a specific construction feature, then the unlikely characterization shall be annotated to a depth of 1-ft. These areas will be identified as partially cleared areas on the map using a separate and distinctive color identifier to differentiate from a fully cleared area.

   c. The JRM MEC GIS Database will be the source data for all site re-categorization and will be updated in "real time" as site characterizations occur. The maps contained in this ESS may not contain the most current site characterizations and as a result must be cross-checked with the JRM MEC GIS Database. CJRM shall have a plan to maintain the MEC database if the GIS position is vacant.

6.2 EXCLUSION ZONES (EZS) FOR MUNITIONS ENCOUNTERED AT PROJECT SITES

6.2.1 EXCLUSION ZONES

1. Exclusion Zones (EZs) will be established at project sites while conducting intrusive operations in all areas likely to encounter MEC or MPPEH. An EZ is a controlled area where only essential personnel are allowed while manual or mechanized intrusive or mechanized operations are taking place. Essential personnel are personnel whose duties require them to remain within the EZ to ensure that munitions clearance operations are conducted in a safe and efficient manner. At a minimum, signs and temporary barricades will be posted along the perimeter of the EZ to prevent unauthorized access. The UXOSO will determine if additional resources are required to control the EZs.
2.
3. Historical Exclusion Zones for the various Areas are identified in Table 6-1 (Appendix B). Each Area's Historical EZ table is based on the MGFDs that were identified in Table 3-2 (Appendix B). Table 6-1 (Appendix B) also identifies Historical EZs for operations following Limited Clearance ahead of Construction for all Areas in accordance with the response techniques detailed in relative Sections.

4. Below are definitions of each of the applicable Minimum Separation Distances for essential and non-essential personnel during manual and mechanized low- and high-input operations based on unintentional detonations:

a. Hazardous Fragmentation Distance (HFD) is the distance at which the density of hazardous fragments become one per 600 square feet. This is the calculated distance at which a fragment impacts at 58 foot pounds, or more, of energy. This is the distance at which non-essential personnel must be located from manual or low-input mechanized operations (unintentional detonations for fragmenting munitions). HFD is also the required team separation distance when conducting mechanized, low- input operations.

b. Maximum Fragmentation Distance – Horizontal (MFD-H) is the calculated maximum distance to which any fragment from the cylindrical portion of an ammunition and explosives case is expected to be thrown by the design mode detonation of a single ammunition and explosives item. Note that these distances do not consider rogue fragments that are produced by nose plugs, base plates, boat tails or lugs, which can travel significantly greater distances than MFD-H. This is the distance at which non-essential personnel must be located from high-input mechanized operations and all personnel must be located from intentional detonations.

c. K-Factors (K40, K24, K18) – The factors in the formulas D=KW (English units) or D=KQ (metric units) which are used in quantity-distance determinations for overpressure thresholds. The K40 is used as the minimum UXO team separation distance from manual operations, the K24 distance is used as the minimum separation distance for essential personnel operating mechanical equipment, and the K18 is used if essential personnel operating or observing mechanical equipment wear double hearing protection that provides ≥9-decibel attenuation. Personnel working at K24 or K18 distance from mechanized operations must be located behind shields or barricades designed to defeat hazardous fragments.

6.2.2 OPERATIONS TO BE CONDUCTED

Tables 6-2.1 and 6-2.2 (Appendix B) identify Historical Controlling EZs for Guam ESS Areas. As specified in the table 3-2 (Appendix B), the Guam ESS Areas have a Primary MGFD, and a Contingency-1 MGFD (Except for *All areas utilizing the method: Limited Clearance ahead of Construction (Phase 2)).* Table 6-2 and Figure 6-1 series (Appendix B) presents the historical controlling and Explosive Safety Quantity-Distance (ESQD) distances which reflect the greater distance for the specified blast overpressure (K) distance, and fragmentation (HFD) distance of Primary and Contingency-1 MGFD for the respective ESS Areas.

All overpressure and fragment distances for each of the ESS Areas MGFDs, Primary and Contingency-1, was obtained from Table 6-1 (Appendix B) in this ESS or from the Fragmentation Data Review Forms contained within Appendix C of this ESS.

Table 6-2 (Appendix B) identifies historical controlling EZs for operations following Limited & Full Clearance ahead of Construction for all Areas in accordance with the response techniques detailed in Section 6.1.4 and 6.1.5.

6.2.3 POTENTIAL EXPLOSION SITES ENCUMBERING THE MUNITIONS RESPONSE AREAS

The following tables identify the Potential Explosion Sites (PESs) located within each Area listed that may encumber the construction activities therein. Since specific construction footprints have yet to be

identified, distances from listed PESs to specific construction footprints are unknown. The MEC Contractor will coordinate with the applicable Navy/Air Force Explosives Safety Officer (ESO) to determine which PESs, if any, encumber the specific construction footprint location, once identified. The ESO will determine if controlling EZs (Table 6-2 series in Appendix B) related to intrusive operations that are being performed as a response action affect a PES listed in the Table 6-3 series (Appendix B). If an encumbrance is established, explosives operations within the PES will be halted while intrusive operations are being performed in the response action site.

6.2.4 EXCLUSION ZONE CONTROL

EZ control will be implemented by using entry control points (ECPs) to block access to the EZ during intrusive operations. ECPs along roads and sidewalks will be sufficiently barricaded (e.g., road barriers, security/construction fencing) to block unauthorized access to the site during MEC operations. Signs will be posted at each ECP with the point of contact information for the MEC Contractor's Senior UXO Supervisor (SUXOS) and UXOSO. Building evacuations and roadway closures will be implemented, as necessary, in coordination with appropriate JRM authorities. If a roadway or waterway located within the EZ cannot be blocked, spotters will be used to alert the UXOSO and SUXOS to cease MEC operations when non-essential personnel enter into the EZ. Operations will not be allowed to resume until non-essential personnel leave the EZ. All personnel working within the EZ will stop work in the event that an unauthorized individual encroaches into the EZ.

6.2.5 EXCLUSION ZONE ACCESS PROTOCOL

1. Access to EZs is limited to personnel essential to the operation being conducted. However, under specific conditions and on a case-by-case basis, authorized visitors may be granted access to the EZ when operations are being conducted. In addition to general munitions response site access requirements, formal written procedures addressing EZ access, including authorized visitor access, must be developed in support of response actions involving MEC and/or MPPEH and must address the following requirements:

    a. Access to an EZ while munitions response operations are occurring is limited to essential personnel and authorized visitors.

    b. The UXOSO is responsible for conducting an operational risk management (ORM) assessment in accordance with OPNAVINST 3500.39C prior to initiating response actions involving MEC. In addition, the UXOSO must determine the maximum number of persons (essential personnel and authorized visitors) that can be in the EZ at one time. The ratio of qualified UXO Technicians who escort visitors will be determined by the UXOSO based on this site-specific operational risk analysis.

    c. Based on the risk posed by the munitions response operation underway, the UXOSO may determine that access to the EZ is unsafe for visitors. However, every effort should be made to accommodate the authorized visitor's needs.

    d. With concurrence of the responsible Project Manager (PM), the UXOSO will grant EZ access to authorized visitors. Access to the site will be based upon the operational risk analysis of the scheduled MEC operations and availability of escorts, as well as a demonstrated visitor need and subsequent completion of visitor safety briefings.

e. Persons requiring access to the EZ must demonstrate a legitimate need for access and obtain authorization from the responsible PM and UXOSO. At a minimum, the request for authorization will include names of the individuals requesting access, the identification of emergency contacts for these individuals, purpose of visit; task(s) to be performed; and rationale to support EZ access. Persons requesting access must submit their request to the responsible PM and UXOSO prior to the proposed date of the site visit. This advance notice will allow time for the UXOSO to support the visit request by assigning a qualified escort, conducting an operational risk analysis on the operations planned for the date of the site visit, and preparing a site-specific safety briefing for visitors for the planned operations.

f. Prior to entry, all authorized visitors must receive a site-specific safety briefing describing the specific hazards and safety procedures to be followed within the EZ for operations underway that work day. Each authorized visitor must acknowledge receipt of this briefing in writing.

g. Authorized visitors to the EZ must be escorted at all times by a qualified UXO Technician assigned to the project.

h. Other requirements, such as OSHA, may also apply.

2. Any authorized visitor who violates established safety procedures will be immediately escorted out of the EZ for the visitor's own protection and to protect essential personnel in the EZ.

6.3 MEC/MPPEH HAZARD CLASSIFICATION, MOVEMENT, TRANSPORTATION, AND STORAGE

6.3.1 HAZARD CLASSIFICATION

All recovered MEC and MPPEH will be managed as Hazard C/D 1.1 per NAVSEA OP 5.

6.3.2 MOVEMENT

Prior to on-site movement, MEC/MPPEH must be evaluated and determined to be safe to move by the SUXOS and UXOSO. They must determine that the risk associated with movement is acceptable and that the movement is necessary for the efficiency of the activities being conducted or for the protection of people, property, or critical assets. In such cases, the responsible SUXOS and UXOSO must agree with the risk determination and document this decision in writing prior to movement of the MEC/MPPEH items that are being treated as MEC. Recovered MEC/MPPEH that is determined safe to move will be relocated to a collection point within the ESS Area and managed as detailed in Sections 6.4.1 and 6.4.2.

6.3.3 TRANSPORTATION

Recovered MEC or MPPEH items deemed safe to move in accordance with Section 6.3.2 may be either relocated by the MEC Contractor to an on-site collection point or transported by military EOD for off-site as a Level 1 emergency response.

6.3.4 STORAGE

Storage of MEC/MPPEH by MEC Contractors is not authorized under this ESS; however, the MEC Contractor can establish collection points for recovered MEC/MPPEH items that are determined to be safe to move are temporarily held in the open, pending custody transfer to EOD. The total Net Explosive Weight (NEW) of the MEC/MPPEH held at a collection point shall be limited so that the K40 arc does not exceed the HFD distance of the largest MGFD present at the collection point. The K40 EZ, as well as arms, ammunition, and explosives security controls for collection points, must be maintained if the recovered MEC/MPPEH items are to remain at the collection point when there are no intrusive operations taking place. Multiple collection points must be separated by at least K11 based on the total NEW of the MEC/MPPEH items in each collection point. MEC/MPPEH contained in a collection point must be moved at the end of the shift or end of the workday. If it cannot be moved, then it must be guarded until such time that it has been removed from the collection point.

6.4 MEC/MPPEH DISPOSITION PROCESSES

6.4.1 MEC DISPOSITION PROCESS

A systematic approach will be used for collecting, inspecting, and segregating MEC/MPPEH and non-MPPEH items recovered from the site. The approach is designed so that materials undergo a continual inspection/evaluation process from the time the items are recovered until they are removed from the site. Segregation procedures will begin when the item is discovered by the UXO Technician. The UXO Technician will make a preliminary determination as to the item's classification into one of the categories and the UXOTIII will confirm the item to be MEC, MPPEH, or non-MPPEH debris. The location of MEC items will be recorded, to include the depth found.

MEC/MPPEH items recovered by the MEC Contractor will be transferred to the cognizant military EOD unit for destruction as a Level 1 emergency per Section 3.9 of DoD 4715.26 (DoD Military Munitions Rule). MEC/MPPEH items that are determined by the MEC Contractor's SUXOS and UXOSO to be unacceptable to move/transport per Sections 6.3.2/ 6.3.3, will be further evaluated by EOD, who will likely perform render safe procedures.

The MEC contractor will contact the JRM Regional Operations Center (ROC) at 671-349-4004 to request EOD support for recovered MEC/MPPEH requiring an EOD emergency response.

6.4.2 MPPEH DISPOSITION PROCESS

During MEC field operations, the MEC Contractor will recover and inspect MPPEH. MPPEH must be managed to prevent transfer or release prior to being fully documented as having an explosive status of safe, as specified in OP 5. MPPEH will be assumed to present an explosive hazard until it is visually inspected and/or processed and certified as material documented as safe (MDAS) in accordance with Department of Defense (DoD) Instruction 4140.62 and NAVSEA OP 5. The first signatory must be a UXO Technician III or higher, and have performed or witnessed the initial 100 percent inspection. The second signatory must be a UXO Technician III or higher who has performed or witnessed the independent 100 percent re-inspection. Each signatory must ensure the chain of custody was maintained before signing the documentation. All MPPEH classified as having an explosive hazard will be managed as MEC and transferred to EOD for off-site destruction.

MDAS processing and storage areas must be secure and designated as restricted areas. Positive control measures will be in place to prevent comingling of documented MDAS with material that has been identified as MPPEH. Lockable containers, clearly marked as to their contents, will be used to maintain positive control of MDAS. The UXOQCS will conduct random sampling of all MDAS to ensure no MPPEH items were comingled with MDAS per Section 7 and the QC Plan in the MEC Contractor's Work Plan.

MDAS will be documented using a Disposal Turn-in Document, DD Form 1348-1 series. The SUXOS and the UXOQCS will sign the DD Form 1348-1 with their names and positions legibly printed, along with the company's name, address, and telephone number. Each container will be sealed to prevent tampering, and will have a unique seal identification number to maintain tracking during shipment to a certified recycler. The MEC Contractor will track all documentation from cradle to grave and will include all documentation in the AAR. The DD Form 1348-1 will include the following statement:

> *"The material listed on this form has been inspected or processed by DDESB-approved means, as required by DoD policy, and to the best of my knowledge and belief does not pose an explosive hazard."*

The MDAS will be released in sealed containers to either the Defense Logistics Agency or a local recycler, along with the Disposal Turn-in Document DD Form 1348-1 series that serves as both the explosives safety status documentation and the chain-of-custody documentation. The contractor will request the recycler to provide a certification of destruction for all MDAS, which will be included in the AAR.

6.5 EXPLOSIVELY CONTAMINATED SOIL. This section is not applicable.

6.6 CONTAMINATED BUILDINGS. This section is not applicable.

6.7 OPERATIONAL RISK MANAGEMENT

As required by OPNAVINST 3500.39, all operations undertaken by this MRESS document must incorporate ORM principles into all phases of planning, operations, and training. Since munitions response actions involve inherent risks, the MEC Program Manager and UXOSO will evaluate those risks using facts, prudence, experience, judgment, and situational awareness. Table 6-4 outlines the Operational Risk Matrix for all Construction Areas.

Table 6-4: Hazard Analysis Matrix for All Construction Areas

Process Step	Hazard	Triggering Event	Initial Risk Index	Hazard Mitigation	Residual Risk Index
1	Manual MEC removal operations	MEC reacts to impact or movement during soil removal	C/II/3	Initial excavation beside anomaly excavation with hand tools	D/IV/5
2	Mechanized excavation of soil	MEC reacts to impact or movement during soil removal	C/II/3	Subsurface clearance is conducted in areas which are likely for encountering MEC before mechanized soil removal is performed. UXO personnel will provide MEC construction support in areas which are unlikely for encountering MEC. Frontal shielding (fragmentation protection) and K18 distance (blast overpressure distance) protection with hearing protection for essential personnel that provides ≥ 9-decibel attenuation.	C/IV/4
3	Mechanized screening of excavated soil	MEC reacts to impact or movement during soil removal	C/II/3	Personnel operating the screening plant will be stationed at the K24 distance behind shielding with remote kill switch to stop the plant.	C/IV/4
4	MPPEH Management	MPPEH reacts to impact or friction during inspection process/ transportatio n/storage	C/II/3	Sufficient cushioning and over-pack are utilized when packaging and containerizing MPPEH. Items are immobilized by appropriate blocking and bracing specifications prior to transportation. MPPEH follows prescribed compatibility requirements. EZs are established for non-essential personnel.	D/IV/5

6.8 CONTINGENCIES

In the event the soil conditions prevent effective mechanical screening of excavated soils, the soil will be broadcast to a depth not to exceed the maximum established detection depth (from the IVS) and swept by UXO Technicians using handheld analog detectors to identify and remove any remaining MEC/MPPEH, and munitions debris from the soil.

While the probability of encountering Chemical Warfare Material (CWM) or Chemical Agent Identification Sets (CAIS) is low, in the event a CWM or CAIS kit is identified, all work shall cease, and EOD and appropriate first responders will be notified. NOSSA must be notified within 2 business days. If items are indeed confirmed as CWM or CAIS, then a probability assessment must be conducted and provided to NOSSA for concurrence and Army review.

7.0 QUALITY CONTROL / QUALITY ASSURANCE (QC/QA)

7.1 QC IMPLEMENTATION

The UXO Quality Control Specialist (UXOQCS) will meet the minimum qualification standards identified by DDESB TP-18 for the UXOQCS. The UXOQCS will implement the MEC Contractor's approved QC Plan, which is based upon the Performance Work Statement requirements, and the project objectives agreed upon by the MPIT. The UXOQCS will conduct and document audits of each MEC-related task using the three-phase QC surveillance process in accordance with the UFP QAPP. These MEC-related tasks include:

- Surface MEC removal
- Subsurface MEC removal
- Removal of MEC/MPPEH from the excavated soils
- MEC disposition process
- MPPEH disposition process

The pass/fail criteria for each of these tasks are presented in Tale 7-1 below. Additionally, the procedures for managing deficiencies, and identifying and implementing corrective actions, are provided.

The UXOQCS will verify that each UXO Technician conducts a daily operational check of their handheld analog detectors at the IVS prior to using the magnetometers during a MEC task. The UXOQCS will also ensure all IVS seeds (ISOs) and QC and any QA BSIs are reported and removed prior to project completion and documented in an After Action Report.

Table 7-1: QC Methods and Pass/Fail Criteria

Operations/Definable Feature of Work (DFOW)	Inspection	Audit	Pass/Fail Criteria
Site Preparation: Establish site boundaries; erect soil erosion controls, barricades, and ECPs	Conforms to MEC WP, SOPs, QCP, QAPP, etc.	Locations of site boundaries, erosion control efforts, barricades, and ECPs	In accordance with MEC WP criteria and the ESS.
Instrument validation, grid placement, and equipment acceptance	Conforms to MEC WP, SOPS, QCP, QAPP, etc.	Checkout and operation of geophysical instruments (including documentation)	100% detection and selection of MEC, MPPEH, and other metal items with any one dimension 20mm or larger. Rework of area and repeat QC process.
Boundary Survey (e.g., GPS)	Conforms to MEC WP, SOPS, QCP, QAPP, etc.	Professional license verification, equipment checkout against known control monument for vertical and horizontal accuracy	Site boundaries achieve specified tolerance for traverse closure.

Operations/Definable Feature of Work (DFOW)	Inspection	Audit	Pass/Fail Criteria
Vegetation reduction	Conforms to MEC WP, SOPS, QCP, QAPP, etc.	Anomaly avoidance provided by UXO Technicians. Personal protective equipment worn in accordance with the Health and Safety Plan	Brush cut no closer than 6 inches above surface.
Surface removal	Conforms to MEC WP, SOPS, QCP, QAPP, etc.	Al work performed in accordance with ESS, Annex, and MEC WP	Pass = 0 MEC/MPPEH or metal items with any one dimension **equal to the approved TOI** or larger. Fail = 1 MEC or MPPEH, or metal item with any one dimension **equal to the approved TOI or larger**; Rework of area and repeat QC process.
Mechanical soil screening	Conforms to MEC WP, SOPS, QCP, QAPP, etc.	In accordance with Activity Hazard Analysis Controls and MEC WP	Pass = no metal larger than the smallest screen detected in 25% of mechanical screening output (or 10% after four passed lots). Fail = metal larger than the smallest screen detected in 25% mechanical screening output (or 10% after four passed lots). As a result, the lot fails and must be rescreened, and subsequent lots screened at 25% until four lots pass.
Manual MEC and or MPPEH removal	Conforms to MEC WP, SOPS, QCP, QAPP, etc.	In accordance with Activity Hazard Analysis Controls and MEC WP	Pass = 100% recovery of blind seeds, no MEC/MPPEH **equal to approved TOI or larger** detected during QC/QA inspections (if using AGC). All QC/QA seeds included on dig list. All validation seeds correctly classified. Fail = MEC/MPPEH **equal to approved TOI or larger** detected during QDC/QA inspections. As a result, the lot fails and must be re-screened by the UXO team and subsequent lots QC-inspected at 25% frequency until four lots pass. Failure response must include a…

Operations/Definable Feature of Work (DFOW)	Inspection	Audit	Pass/Fail Criteria
			...Root Cause Analysis (RCA) to determine corrective action (COA).
MPPEH processing	Conforms to MEC WP, SOPS, QCP, QAPP, etc.	MPPEH/Material documented as an Explosive Hazard (MDEH) holding area and processing is in accordance with ME CWP. MDAS and MDEH are properly documented and a chain of custody maintained. 100% verification of demilitarization methods to achieve a determination of releasable to a recycler.	100% of all MDAS has been properly assessed and documented as safe. Re-inspect and document any discrepant material. Visual inspection of all surface areas; demilitarization in accordance with DoDI 4140.62

7.1.1 SURFACE CLEARANCE

The UXOQCS will utilize ISOs or surrogates as BSIs to evaluate the effectiveness of the surface clearance. Each ISO will be of the size and material specified in the MEC WP or AGC QAPP and individually numbered for tracking purposes. A seeding density will also be specified in the MEC WP or AGC QAPP. The BSI will be placed beneath duff (leaves, grass, or other naturally occurring debris) at the rate prescribed by the MEC WP or AGC QAPP, but no less than one per team per day. The UXOQCS will record the location of each BSI and track whether or not each BSI is recovered by the UXO teams. Failure to recover a SI will result in the failure of the clearance grid and will require that the grid be re-worked. The UXOQCS will also perform an inspection of a minimum of 15 percent (randomly selected) of each clearance grid for the presence of any MEC or MPPEH, the discovery of which will constitute a failure of the clearance grid and require rework. The quality deficiency will be corrected, and a QC re-inspection will take place before submitting to the Navy for verification and acceptance.

7.1.2 SUBSURFACE CLEARANCE

The UXOQCS will utilize ISOs or surrogates as BSIs to evaluate the effectiveness of the subsurface clearance. Each ISO will be of the size and material specified in the MEC WP or AGC QAPP and individually numbered for tracking purposes. A seeding density will also be specified in the MEC WP or AGC QAPP, but no less than 1 per team per day. The BSIs will be buried in order to build accepted confidence when using AGC systems. A greater number of BSIs may be required and will be defined in the MEC WP or AGC QAPP.

The UXOQCS will ensure the BSIs are buried in anomalous-free areas and will record the location and the burial depth of each BSI. The UXOQCS will track each BSI to ensure it is recovered by the UXO teams. Failure to recover a BSI will result in the failure of the clearance grid and will require that the grid be reworked. The UXOQCS will inspect a minimum of 15 percent (randomly selected) of each excavation for the presence of any MEC, MPPEH, or ferrous metal object equivalent to or greater than **the approved TOI** in any diameter or width, the discovery of which will constitute a failure of the individual grid and require re-work.

7.1.3 EXCAVATED SOIL

All excavated soil will be cleared by UXO Technicians of MEC and MPPEH or ferrous metal objects equivalent to or greater than the **approved TOI**, consistent with the reasonable anticipated future use of the soil in accordance with the Regional Soils Management Plan. Once the UXO teams have cleared the excavated soil using on of the two methods described in Section 6, the UXOQCS will also perform an inspection of a minimum of 25 percent of mechanical screening output (or 10 percent after four passed lots) of the excavated soil for the presence of any MEC or MPPEH. Any MEC or MPPEH found in the soil by the UXOQCS that is inconsistent with the reasonable anticipated future soil reuse will constitute a failure and will require rework. After the screened piles have been QC/QA inspected the piles will be consolidated and labeled or otherwise demarcated as passed QC/QA (e.g. with signage, tape, etc.).

Upon completion of the QA inspection process, the UXOQCS will sign off on a statement for each QC Lot indicating the following:

> *QC Lot _____ has been processed in accordance with the procedures outlined in this ESS, which were developed to ensure the removal of all MEC and MPPEH equal to or larger than the approved TOI. This material is thereby, within a reasonable degree of certainty, documented to be free of MEC and MPPEH equal to or larger than the approved TOI and, contingent upon the independent QA inspection, is approved for use per the soils management plan.*
>
> _____ _____ _____
> *QC Inspector Name* *QC Inspector Signature* *Date*

7.1.4 MEC DISPOSITION PROCESS

The UXOQCS will verify that all MEC is properly documented, from recovery to final disposition, in accordance with the approved MEC WP and is included in the project database. Proper documentation includes, but is not limited to, a record of the following for each item of MEC:

- Horizontal location and depth
- Identification of type and filler
- Photograph
- Determination of being acceptable to move and safe to transport
- Transfer to EOD for off-site disposition

7.1.5 MPPEH DISPOSITION PROCESS

The UXOQCS will verify the MPPEH disposition process is in strict conformance with the procedures outlined in NAVSEA OP 5. The UXOQCS will verify the following:

- Areas where MPPEH is processed must be designated as restricted areas and have a DDESB explosives safety site approval per NAVSEA OP 5.
- Lockable containers, clearly marked as to their contents, will be used to maintain positive control.
- Items will be classified as MDAS through visual inspection only when every surface is visible and capable of being inspected. Visual inspection is applicable only to pieces of metal that have no cavities, holes, blind spaces, rivets, cracks, or other obscured features.

The UXOQCS will conduct random sampling of all MDAS to ensure no item with an explosive hazard is comingled with MDAS. Should the UXOQCS find MPPEH with an explosive status other than "safe" comingled with MDAS, all of the MDAS in that container or group will undergo a 100 percent re-inspection by a fully qualified UXO Technician III or higher, and an independent 100 percent re-inspection by a second fully qualified UXO Technician III or higher. If the MDAS certification paperwork is missing or non-compliant, the MDAS covered by the documents would revert back to MPPEH until it can be re-certified and a new chain of custody can be established.

7.1.6 DEFICIENCY MANAGEMENT

The UXOQCS will document all work failures, deficiencies, and non-conformance with approved plans; conduct a root-cause analysis; recommend corrective actions to the SUXOS; and track the corrective actions through completion, using reports and logs. These QC documents will be included in the project database and incorporated in an AAR.

7.2 QA IMPLEMENTATION

The QA program will be based upon the approved QC Plan in the MEC WP or AGC QAPP and administered by the NFM MEC Program Manager or qualified Third-Party QA Contractor. Individuals assigned as the UXO Quality Assurance Specialist (UXOQAS) for the NFM or Third-Party QA Inspector will meet the minimum qualification standards identified by DDESB TP-18 for the UXOQCS.

QA will be conducted to evaluate all facets of MEC clearance QC activities. The UXOQAS will provide QA oversight of the MEC Contractor's activities conducted at the site. The UXOQAS has the authority to act independently of the MEC Contractor in all QA matters. The UXOQAS may request the Contracting Officer to direct a stop work order if operations are found to be out of compliance with contract requirements and/or specifications. Duties include oversight of the following:

- Contractor QC personnel and evaluation/audit procedures
- Quality compliance with contract plans and specifications as defined in the MEC QWP
- QA of project plans
- QA of project data
- Corrective actions until they are resolved; and Contractor performance of assigned tasks UXOQCS blind seeding program

For the conduct of QA, once the material has gone through the QC process discussed in Section 7.1 and is ready to be relocated to the stockpile point, the front end loader, or similar machine, will relocate and stage an adequate sampling of the material to a cleared area, where it will remain until the Third Party QA conducts the QA process of the material, after which it will be collected and relocated to the designated stockpile point.

Ten percent of all material that has passed the QC process will pass through a QA inspection. Upon completion, the QA inspector will sign off on a statement indicating the following:

> *A minimum of 10% QA inspection was performed on QC Lot_____to confirm that the procedures outlined in this ESS were adequate to remove all MEC and MPPEH equal or greater than the approved TOI and that the QC process confirmed the adequacy of the procedure. QA of this QC LOT is intended to be representative of QC Lots _____. QC Lot _____ has successfully passed the QA inspection. Therefore, the material in QC Lots _____ is (are), within a reasonable degree of certainty, documented to be free of MEC and MPPEH equal and larger than the approved TOI in diameter in the smallest dimension.*

_____	_____	_____
QC Inspector Name	*QC Inspector Signature*	*Date*

Note: The UXOQAS has the authority to install blind seeds as part of the UXO QA program. If using AGC sensors, UXOQAS personnel must be qualified and must also emplace validation seeds as a part of the QA process.

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8.0 TECHNICAL SUPPORT

8.1 EXPLOSIVE ORDNANCE DISPOSAL

Level 1 emergency support for off-site transport and disposal of MEC and MPPEH or on-site destruction of MEC and MPPEH will be provided by EOD Mobile Unit Five (EODMUFIVE) Detachment Marianas or 36th Civil Engineering Squadron (CES) EOD Flight. The MEC Contractor shall contact the JRM ROC at 671-349-4004 to request Level 1 emergency support from EOD.

8.2 MEC CONTRACTOR

The MEC Contractor's UXO personnel will meet the requirements set forth in DDESB TP-18, Minimum Qualifications for Personnel Conducting MEC-Related Activities, dated 1 September 2016, or latest version.

Below are the minimum UXO personnel requirements for respective activities covered under this ESS:

- UXO Escort
  - One UXO Technician II (or higher) per three escorted personnel
  - Additional UXO Technicians I (or higher) as required; one per every three escorted personnel
- Anomaly Avoidance
  - One UXO Technician II (or higher, per activity being conducted at the project site
  - Additional UXO Technician I (or higher) as required; one per each activity being concurrently conducted at the project site
- Construction Support (when a contractor is the responding entity to the MEC discovery site)
  - One SUXOS (for no more than 6 UXO Teams)
  - One UXOSO (can be dual hatted with the UXOQCS position if <15 personnel on site)
  - One UXOQCS (can be dual hatted with the UXOSO position if <15 personnel on site)
  - One UXO Technician III (or higher)
  - Additional UXO Technician IIs (or higher) as required; one per each concurrent ground disturbance activity as long as line of sight is maintained. When line of sight is not possible, an additional Tech III and Tech II must be added for each activity.
- Surface and Subsurface MEC and MPPEH Clearance Activities (Limited and Full Clearances Ahead of Construction) per individual project:
  - One SUXOS (for no more than 6 UXO Teams)
  - One UXOSO (can be dual hatted with the UXOQCS position if <15 personnel on site)
  - One UXOQCS (can be dual hatted with the UXOSO position if <15 personnel on site)
  - One UXO Technician III Team Lead (one per 5-person UXO Team)

The SUXOS and UXOQCS must have received company and project specific QC training and work under the supervision of a certified quality professional. The SUXOS and UXOSO must have completed a 10-hour OSHA Construction Safety and Health Training and earned a Department of Labor construction Safety Course Completion Card.

All contractor geophysicists and geophysical instrument technicians will be appropriately trained. The project geophysicist will have a degree in geophysics, geology, geological engineering, or a closely

related field, and will have a minimum of 5 years of experience directly related to the geophysical mapping, detection, and classification of buried military munitions. This individual is the project geophysicist-of-record and has overall responsibility for design, implementation, and management of all geophysical investigations required for the work effort related to military munitions, but may not necessarily be on-site full time. Geophysical instrument technicians will have training commensurate with their duties.

MEC Contractors or subcontractors performing AGC operations must be certified in accordance with the DoD Advanced Geophysical Classification Accreditation Program (DAGCAP) and meet all applicable DoD policy requirements.

Field personnel on this project have completed the training requirements found in Table 8-1, as required for their specific responsibilities. Additional site-specific training in accordance with OSHA 29 Code of Federal Regulations (CFR) 1910.120 for Hazardous Waste Operations and Emergency Response (HAZWOPER), as well as Engineer Manual (EM) 385-1-1 (U.S. Army Corps of Engineers Safety and Health Requirements Manual), will be provided to all personnel upon their initial mobilization. Additionally, all field personnel will participate in a Medical Surveillance Program, with the latest exam occurring within 12 months of field operations. JRM and NAVFAC Marianas will ensure all government personnel are in compliance with training requirements.

Table 8-1: Personnel Training

Training Course	Personnel Attending
40-Hour HAZWOPER Training	All personnel who have not previously received this training or who do not qualify for certification through documented experience or training equivalent to that in paragraphs €(1) through €(4) of 29 CFR 1910.120
8-Hour Supervisor Course	All MEC Contractor management and supervisory personnel. This includes the SUXOS, UXOSO, XOQCS and UXO TIII's
8-Hour HAZWOPER Refresher Course	All site personnel, except those who have completed their initial 40-Hour HAZWOPER training within the past year.
First Aid and Cardiopulmonary Resuscitation (CPR) Training	At least two site personnel will have current First Aid and CPR training
10-Hour OSHA Construction Safety Course	SUXOS and UXOSO

8.3 PHYSICAL SECURITY

Areas covered under this ESS **and approved Annexes** are under DoD control; however, access to the site varies.

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9.0 ENVIRONMENTAL, ECOLOGICAL, CULTURAL, AND/OR OTHER CONSIDERATIONS

9.1 REGULATORY STATUTE

This MRESS describes a munitions response that is an explosives safety requirement to support construction and maintenance projects. It is not being executed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). As a non-CERCLA cleanup, all actions will be executed in accordance with the Resource Conservation and Recovery Act (RCRA) as provided in DoD-M 4715.26, DoD Military Munitions Rule (MR) Implementation Procedures. Specifically, EODMUFIVE Detachment Marianas or the 36th CES EOD Flight will respond to any MEC / MPPEH discovered at the construction site or other JRM projects as an emergency response and manage in accordance with section 3.9 of the DoD-M.

9.2 HISTORIC AND ARCHAEOLOGICAL SITES

Cultural resources encountered during MEC clearance operations will, to the extent practicable, be treated in accordance with existing Federal historic preservation consultation and mitigation agreements, including Section 106 of the National Historic Preservation Act of 1966. The MEC Contractors should be aware of cultural resource conservation requirements and consult with the NFM MEC PM and Regional Cultural Resources Manager (CRM) as required. JRM has developed standard operating procedures for conducted MEC-related excavations at known archaeologic sites in Guam (JRM Instruction 8000). The CRM and/or an Archaeological Monitor will provide the MEC Contractor's field team with cultural resource awareness training.

If MEC is encountered near a cultural or archeological site and is determined to be unacceptable to move, the MEC contractor, EOD, and CRM will determine the appropriate course of action to safely dispose of the MEC and preserve the site in accordance with JRM Instruction 8000.

Upon discovery of a potential significant cultural resource, the MEC clearance activity within the area will be stopped until a qualified archaeologist has assessed the resource. The archaeologist and MEC Contractor will ensure that reasonable measures are taken to protect and stabilize the discovery. The archaeologist will then contact the cognizant CRM. Based upon consultations between the responding archaeologist and the cognizant CRM, a significance assessment of the discovery will be made.

If human remains are discovered during the performance of MEC response actions, all activities will immediately cease in the vicinity. The Archaeological Monitor and MEC Contractor will ensure that reasonable measures are taken to protect and stabilize the discovery and the Archaeological Monitor will contact the project Contracting Officer's Representative, who will then contact the cognizant CRM. The CRM will inspect the site and concur or not whether the discoveries are human remains and whether they fall under the jurisdiction of the Guam State Historical Preservation Office (SHPO). If the CRM does not concur that the discovery represents human remains, MEC activities can immediately continue. If the CRM determines that the discovery represents human remains or a human burial, then the CRM will attempt to determine the ethnicity and the age of the remains. The CRM, in consultation with the NFM MEC PM, will determine the feasibility of project alternatives that will avoid disturbance of the remains, or whether disinterment is necessary. If disinterment is required by the project, then the CRM will conduct a preliminary identification to determine the context of the discovery.

9.3 NON-EXPLOSIVE SOIL

This section is not applicable.

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10.0 RESIDUAL RISK MANAGEMENT

10.1 LAND USE CONTROLS

DoD property is being developed to address mission requirements and will remain under DoD control for the foreseeable future. The reasonably anticipated future land use includes military industrial, military administrative, quality of life, community support, military housing, and military training.

10.2 LONG-TERM MANAGEMENT

Access restrictions, signs, fences and gates, public education, and excavation restrictions are Institutional Controls that will be used to protect the public from exposure to MEC.

10.3 AFTER ACTION REPORTS (SEE ALSO PARAGRAPH 1.7.3)

After Action Reports will be submitted for each project or annex providing essential data elements and follow the process in accordance with NOSSAINST 8020.15 (series) within 90 days from project completion to NOSSA as a matter of record. NOSSA will review, document as official correspondence, and forward to DDESB for acknowledgement within 10 business days. A copy of this correspondence will be provided to ASN (EI&E), Attention: DASN (Safety).

This document accepts the fact not all information is available to satisfy AAR requirements per NAVSEA OP5 for projects conducted prior to October 2018. Information is available in accordance with DDESB requirements per Defense Explosives Safety Regulation (DESR) 6055.09 V7.E4.7. CJRM will submit AARs for all Military Construction projects completed prior to October 2018 and annotate any incomplete information. NOSSA will review, document as official correspondence, and forward to DDESB for the record. A copy of this correspondence will be provided to ASN (EI&E), Attention: DASN (Safety).

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11.0 SAFETY EDUCATION PROGRAM

The Navy maintains a MEC awareness program through the DoD Environment, Safety and Occupational Health Network and Information Exchange (DENIX) website (http:/www.denix.osd.mil/uxo/). This program is intended to familiarize contractors and local residents with the basic characteristics of MEC items on Guam, and the procedures that should be followed if a suspected MEC item is encountered.

MEC awareness training will be provided to all project personnel by a qualified UXO Technician.

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12.0 STAKEHOLDER INVOLVEMENT

JRM is the primary stakeholder for all DoD activities on Guam. The J3 is responsible for enforcing explosive safety requirements for DoD operations. NFM supports construction, maintenance, and repair activities, many of which include ground-disturbing activities. Tenant Commands and Sister Services coordinate activities through their respective chains of command through JRM for explosive safety compliance and through their respective chains of command through JRM for explosive safety compliance and through NFM for infrastructure support activities.

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13.0 REFERENCES

Department of Defense Explosives Safety Board (DDESB), 2016, TP-18 Minimum Qualifications for Personnel Conducting Munitions and Explosives of Concern-Related Activities.

Department of Defense Explosives Safety Board (DDESB), May 2010, TP-15M Approved Protective Construction.

Department of Defense Instruction 4140.62, August 2015, Change 1 dated 03 October 2017, Material Potentially Presenting an Explosive Hazard.

Department of the Navy, March 2018, OPNAVINST 3500.39D, Operational Risk Management.

Joint Region Marianas, May 2017, JRM Instruction 8000 – Standard Operating Procedures (SOP) for Excavation Requiring Munitions and Explosives of Concern Clearance.

Joint Region Marianas, January 2018, Joint Region Marianas Notice 8020 – Clarification of the Determination of Bedrock (Solid Rock Formation) While Conduction Explosive Safety Submission Operations in Joint Region Marianas Area of Responsibility.

Naval Facilities Engineering Command Pacific, 2010, Final Historical Ordnance Assessment, Guam and CNMI Area, P-50, Territory of Guam and Tinian, CNMI.

National Historic Preservation Act, 1966, 16 U.S.C. 470.

Naval Ordnance Safety and Security Activity, 2013, NOSSAINST 8020.15D, Explosives Safety Review, Oversight, and Verification of Munitions Responses.

Naval Sea Systems Command, June 2017, NAVSEA OP 5, Volume 1, Seventh Revision, Change 14, Ammunition and Explosive Safety Ashore.

Naval Sea Systems Command, May 1947, NAVSEA OP 1664, Part 6, U.S. Explosive Ordnance.

U.S. Air Force EOD incident reports, 1992-2018.

U.S. Army Corps of Engineers, November 2014, EM 385-1-1 Safety and Health Requirements.

U.S. Navy EOD incident reports, 1991-2018.

14.0 APPENDICES

Appendix A – Signature Page

Appendix B – Historical Figures and Tables

Appendix C – Supporting Explosives Safety Data

Appendix D – Annex Template

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APPENDIX A – SIGNATURE PAGES

DEPARTMENT OF THE NAVY
JOINT REGION MARIANAS
PSC 455 BOX 211
FPO AP 96540-1000

8020
Ser J00/0531
15 Oct 19

From: Commander, Joint Region Marianas
To: Assistant Secretary of the Navy (Energy, Installations and Environment)

Subj: MUNITIONS RESPONSE EXPLOSIVE SAFETY SUBMISSION (MRESS)

Ref: (a) OPNAVINST 8020.14A
(b) NAVSEA OP-5

1. As munitions and explosives of concern (MEC) are known or suspected to be present on the island of Guam due to World War II battles and subsequent military activity, this Munitions Response Explosive Safety Submission (MRESS) is intended to establish procedures and processes that will enable safe execution of construction, repair, and maintenance projects on Department of Defense-owned property. MEC is a safety hazard and may constitute a substantial danger to military personnel, contracted construction workers, and the local population. While this MRESS is intended for policy development purposes, I believe it represents an important evolution of the Joint Region's Munitions and Explosives of Concern (MEC) Program. I endorse the adoption of this MRESS to supersede all prior Explosive Safety Submissions for Guam.

2. I would like to extend my thanks to you, your staff, and all of the various federal employees who worked so hard to bring the MRESS to this point. It is my intent to use the new authorities granted to the Commander, Joint Region Marianas in this MRESS to make well informed risk-based decisions that improve project-specific responses to the threat posed by MEC while keeping safety paramount.

3. Should you have any questions regarding the MRESS, my point of contact for this matter is Lieutenant Colonel Ross McAfee, who can be reached at (671) 349-2636 or Ross.McAfee@fe.navy.mil.

J. V. MENONI

Copy to:
CNO WASHINGTON DC N41
NAVORDSAFSECACT INDIAN HEAD MD
CNIC WASHINGTON DC N3

APPENDIX B – HISTORICAL FIGURES AND TABLES

Figure 1-1: Guam MRESS Areas

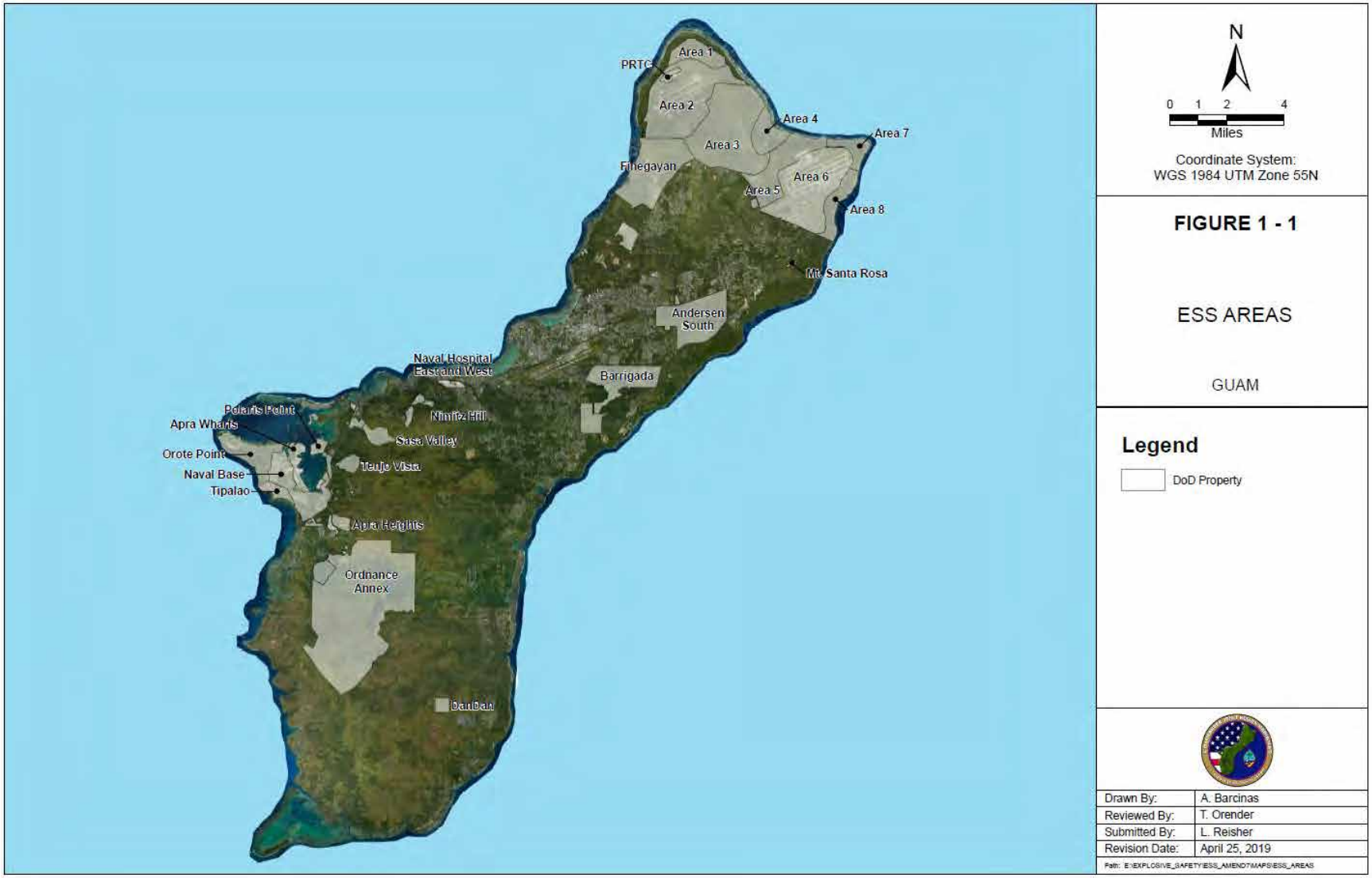


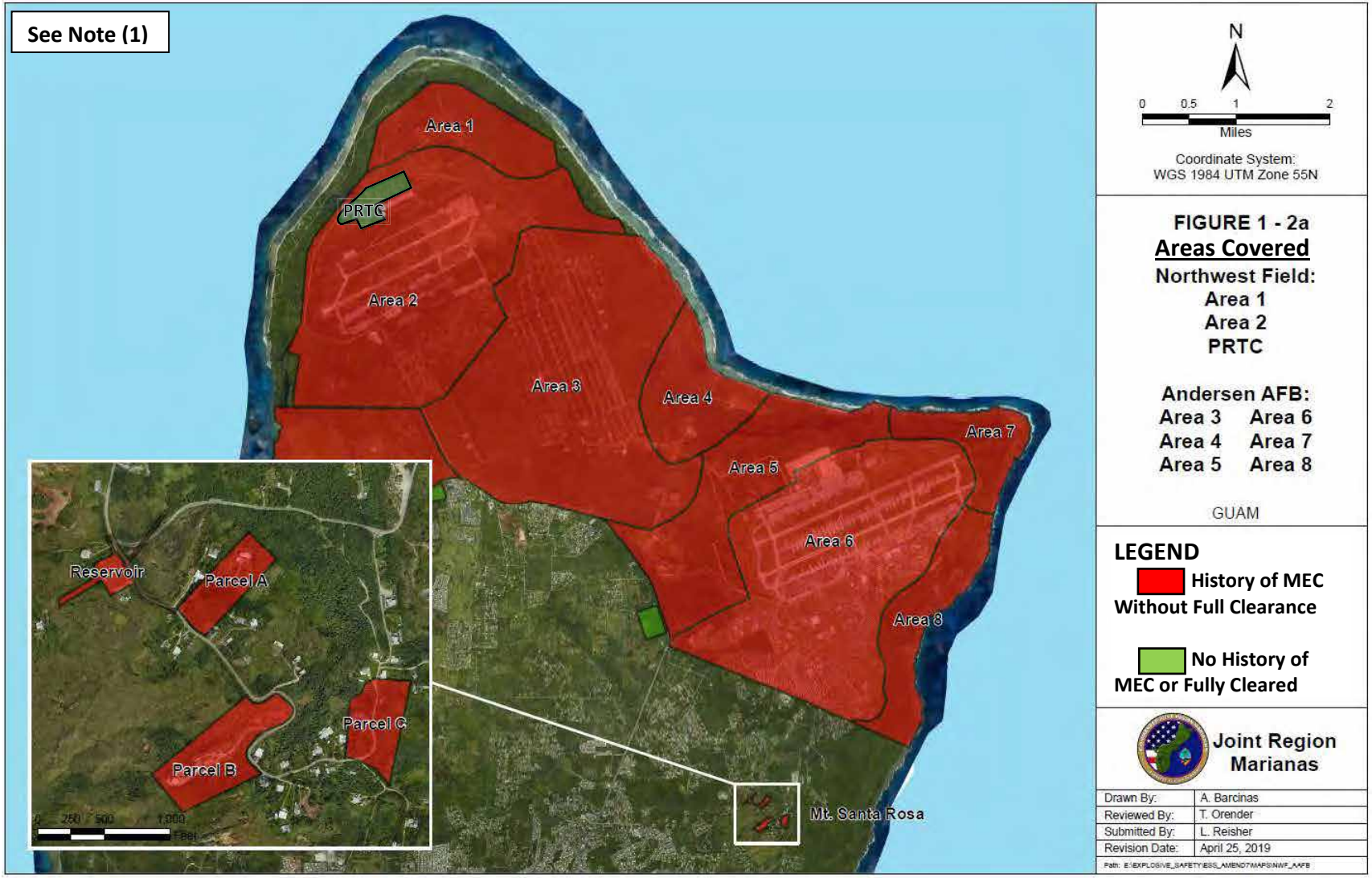
Table 1-1: Munitions Response Areas

Area Identifier	**Current Land Use** *(Note: All areas are historical WWII Battlefields[1])*	**Size (Acres)**
1. AAFB Area 1	Undeveloped	751
2. AAFB Area 2 (includes PRTC)	Industrial / Training	3,610
3. AAFB Area 3	Industrial / Munitions Storage	3,908
4. AAFB Area 4	Industrial	776
5. AAFB Area 5	Industrial	1,678
6. AAFB Area 6	Residential, Industrial, Commercial	3,427
7. AAFB Area 7	Undeveloped	504
8. AAFB Area 8	Undeveloped	773
9. Andersen South	Residential, Industrial	1,960
10. Apra Heights	Residential, Industrial	242
11. Barrigada	Industrial, Residential, Commercial	1,849
12. DanDan	Industrial, Commercial	159
13. Finegayan (includes J-006)	Residential, Industrial, Commercial	3,195
14. Naval Base (includes J-001B)	Industrial, Residential, Commercial	1,393
15. Naval Hospital East	Naval Hospital, Residential, School, Commercial	48
16. Naval Hospital West	Naval Hospital, Residential, School, Commercial	73
17. Nimitz Hill	Residential, Industrial, Commercial	209
18. Ordnance Annex	Residential, Industrial, Commercial	8,663
19. Orote Point	Industrial, Commercial	1,057
20. Polaris Point	Industrial, Commercial	253
21. Santa Rosa	Industrial, Residential, Commercial	23
22. Sasa Valley	Industrial, Residential, Commercial	427
23. Tenjo Vista	Residential, Industrial	230
24. Tipalao	Residential, Industrial, Commercial	280

Table 1-1 Reference:

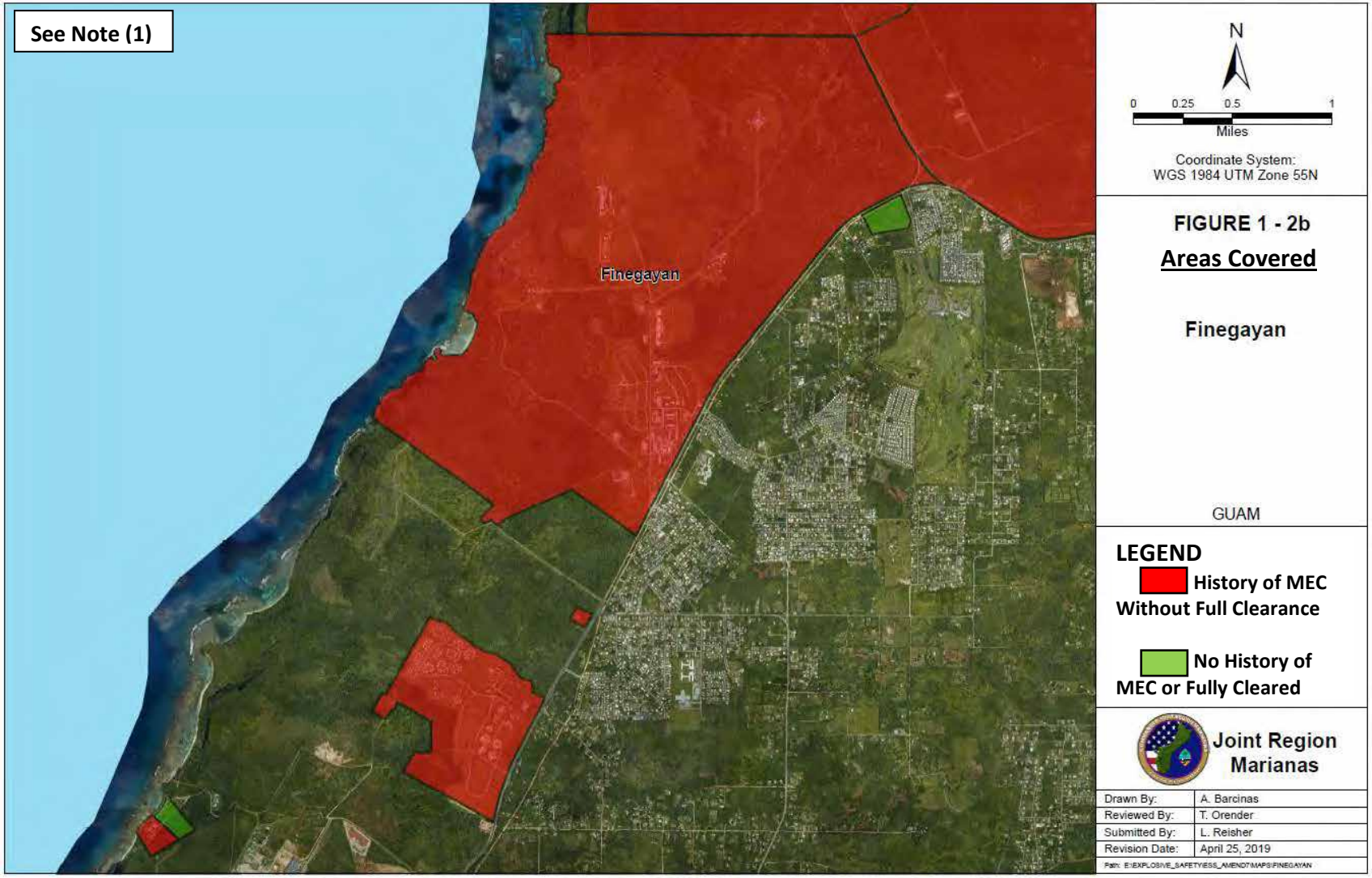
(1) *Historical Ordnance Assessment, P-50 Territory of Guam*, NAVFACPAC, January 2010

Figure 1-2a: Historical Presence of MEC and MPPEH[(1)] - Andersen AFB and NWF Areas



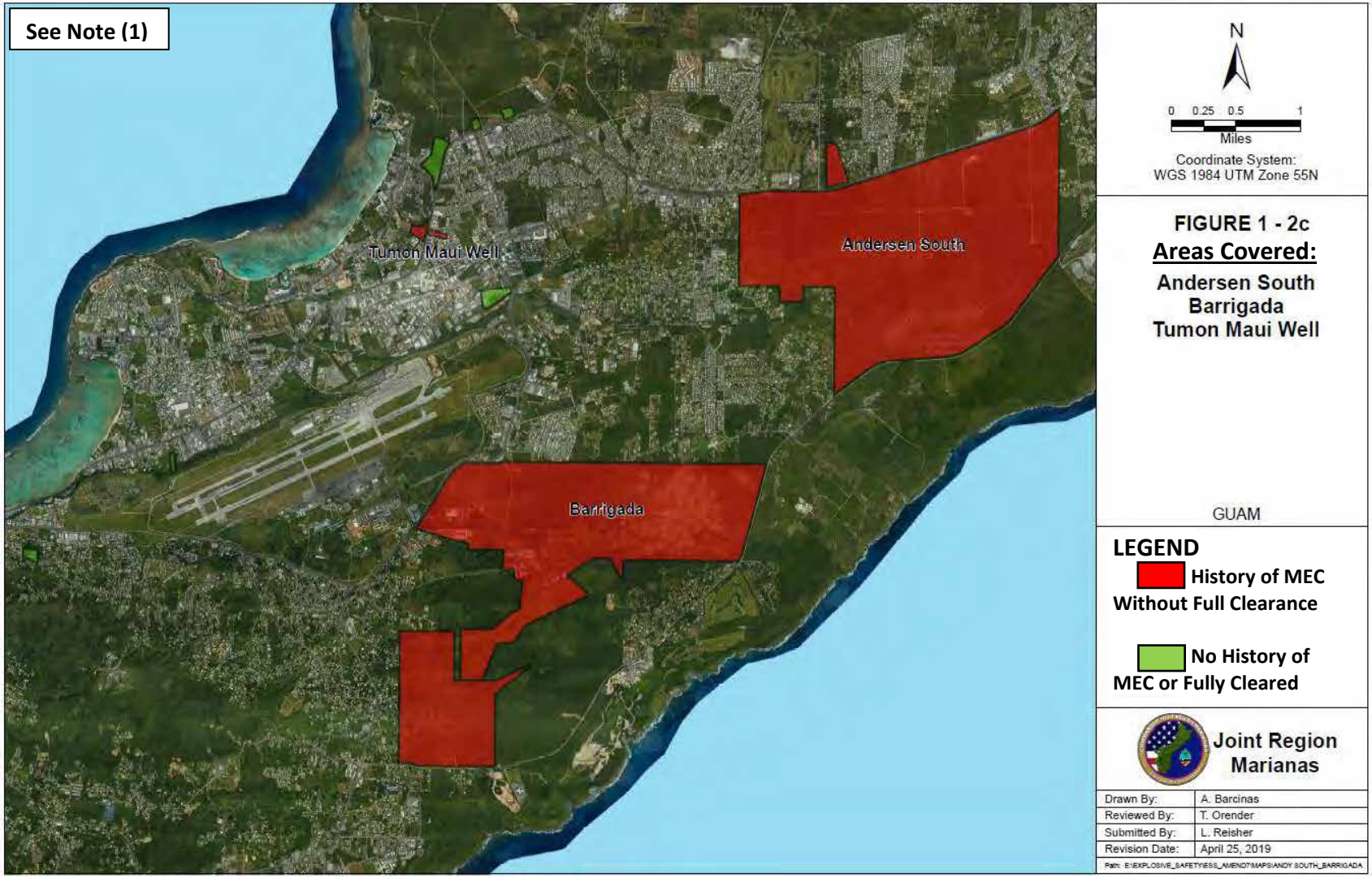
Note (1): Information depicted in this figure is historical data per paragraph 1.4 of this document. See approved Annex for identification of MEC data and likelihood decisions for a specific project site.

Figure1-2b: Historical Presence of MEC and MPPEH[(1)] – Finegayan



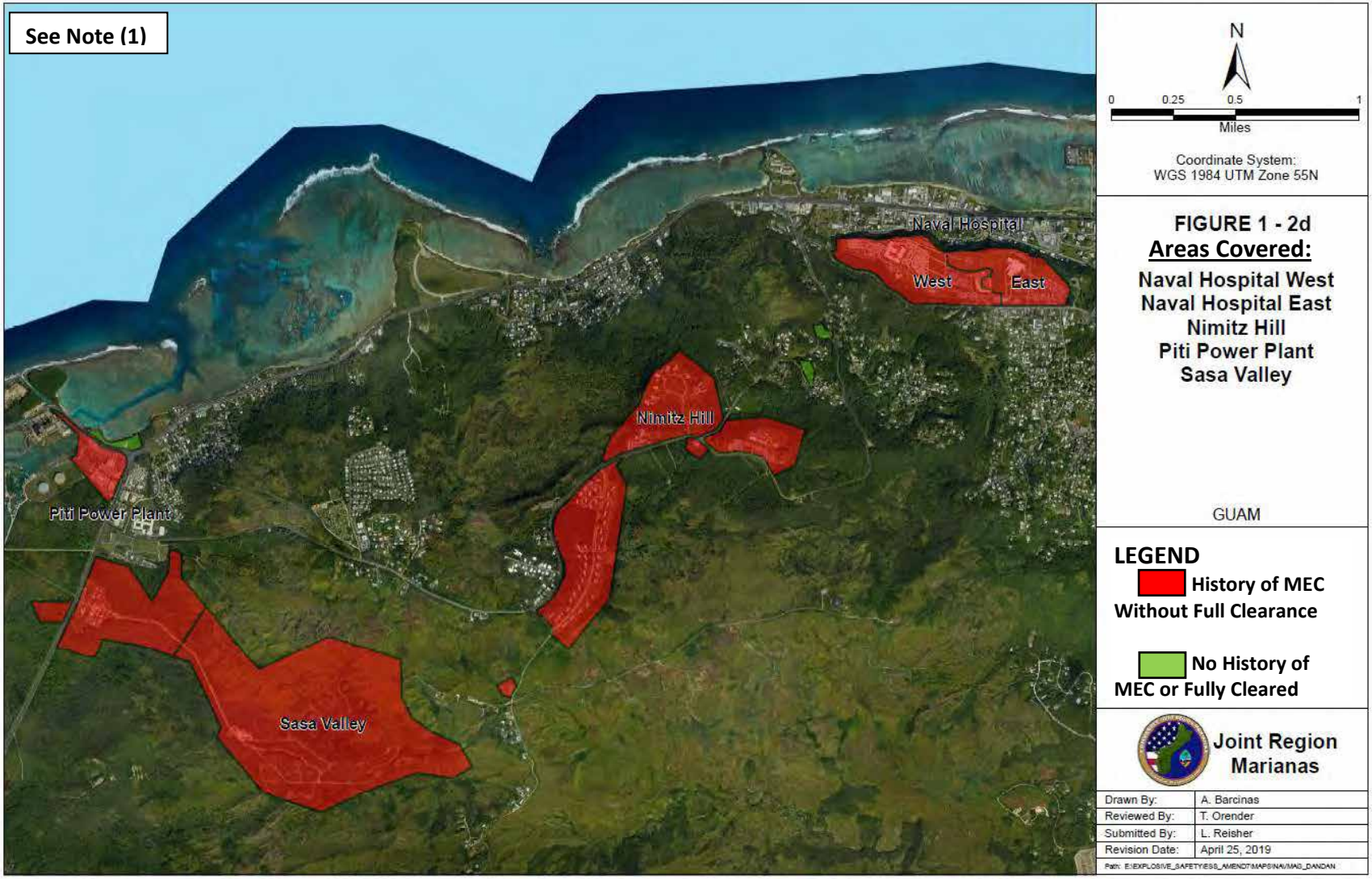
Note (1): Information depicted in this figure is historical data per paragraph 1.4 of this document. See approved Annex for identification of MEC data and likelihood decisions for a specific project site.

Figure 1-2c: Historical Presence of MEC and MPPEH[(1)] - Andersen South, Barrigada, and Tumon Maui Well



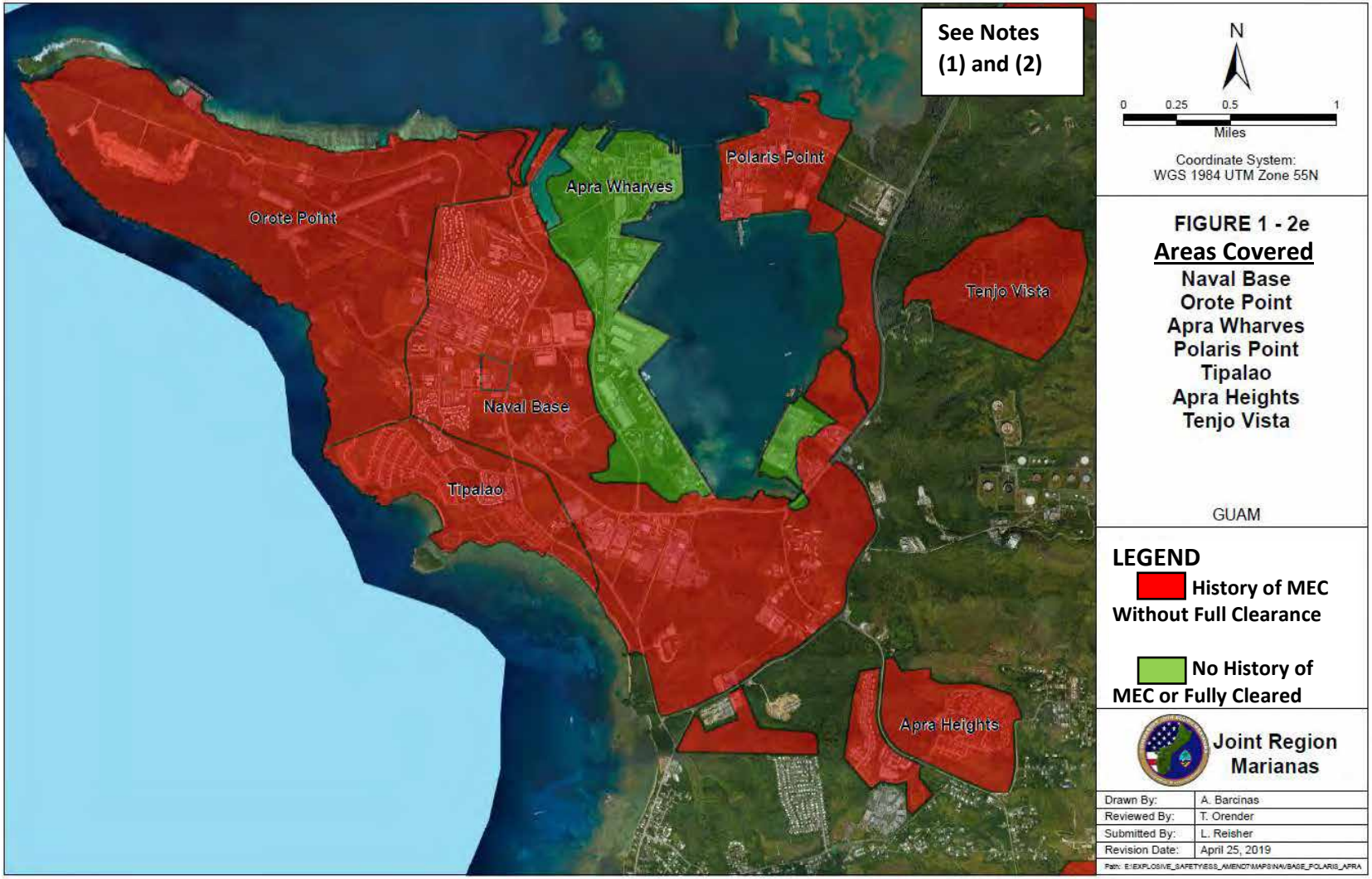
Note (1): Information depicted in this figure is historical data per paragraph 1.4 of this document. See approved Annex for identification of MEC data and likelihood decisions for a specific project site.

Figure 1-2d: Historical Presence of MEC and MPPEH(1) - Naval Hospital West and East, Nimitz Hill, Piti, and Sasa Valley



Note (1): Information depicted in this figure is historical data per paragraph 1.4 of this document. See approved Annex for identification of MEC data and likelihood decisions for a specific project site.

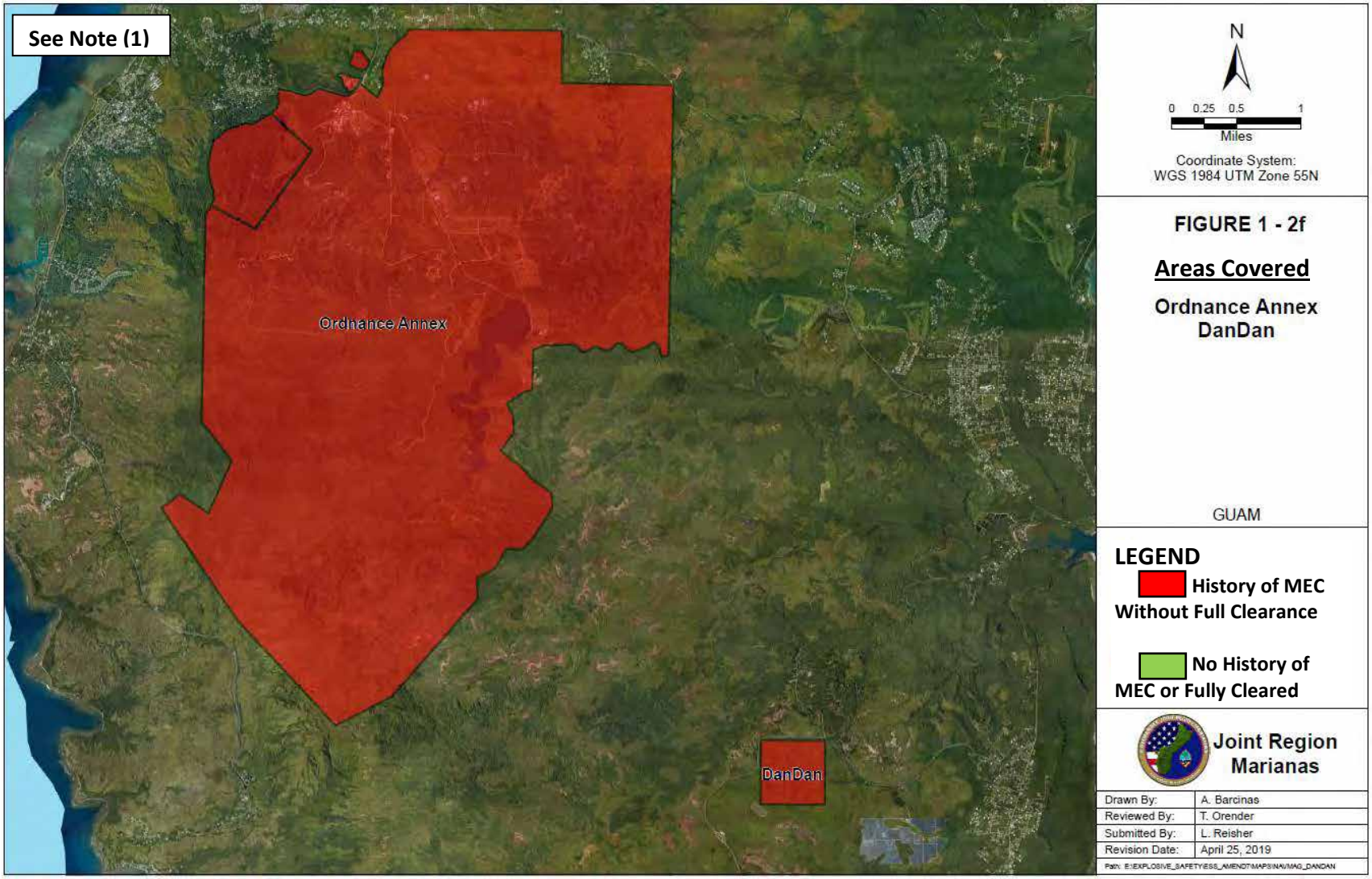
Figure 1-2e: Historical Presence of MEC and MPPEH[(1)] - Naval Base, Orote Point, Apra Wharves, Polaris Point, Tipalao, Apra Heights, and Tenjo Vista



Note (1): Information depicted in this figure is historical data per paragraph 1.4 of this document. See approved Annex for identification of MEC data and likelihood decisions for a specific project site.

(2): This Figure does not cover MEC discovered in the water. In-water disturbance shall require a separate "In-Water MRESS".

Figure 1-2f: Historical Presence of MEC and MPPEH(1) - Ordnance Annex and DanDan



Note (1): Information depicted in this figure is historical data per paragraph 1.4 of this document. See approved Annex for identification of MEC data and likelihood decisions for a specific project site.

Figure 1-3: Battlefields of Guam

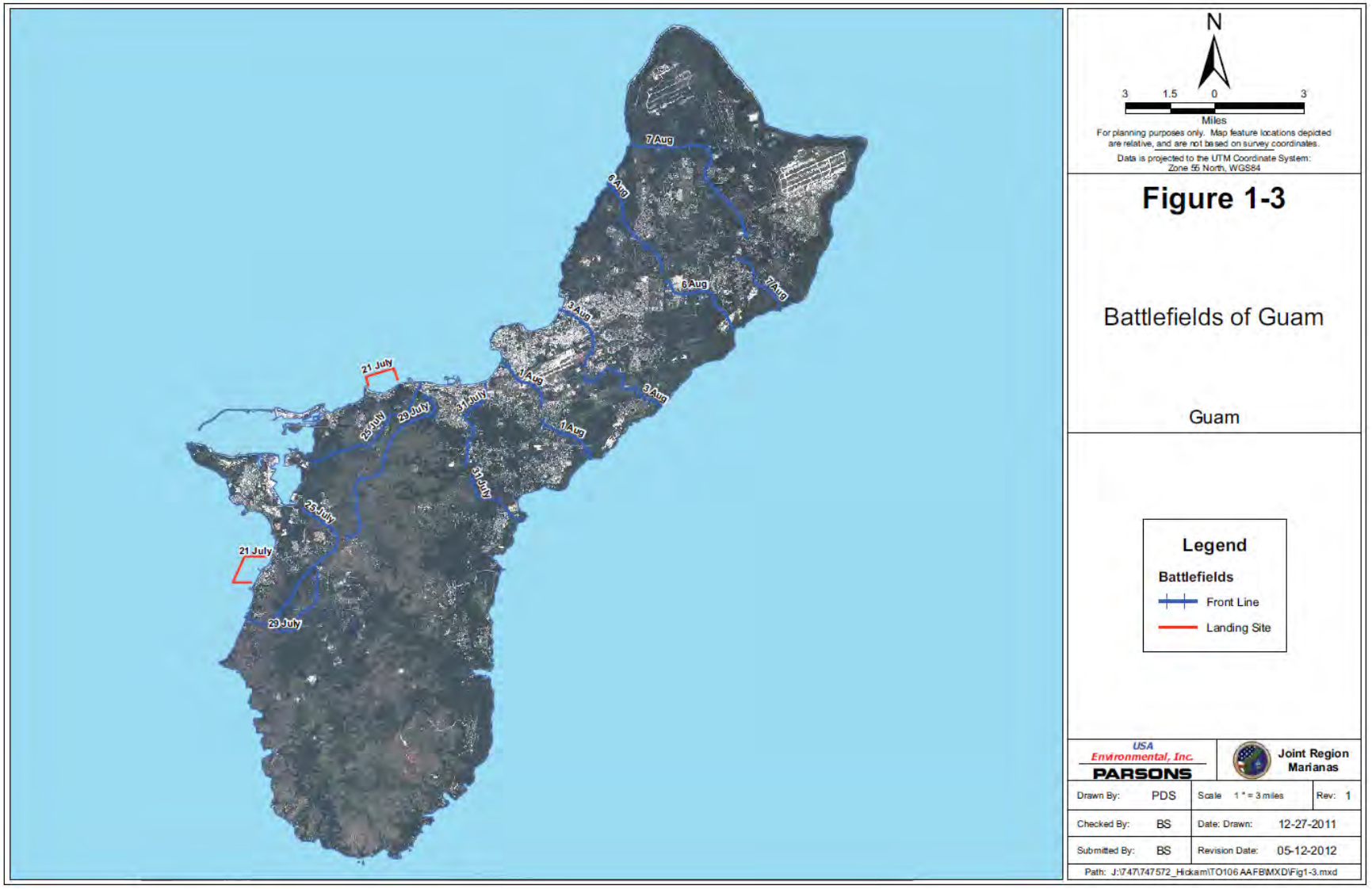


Figure 1-4: Japanese Infantry and Tank Positions – July 1944

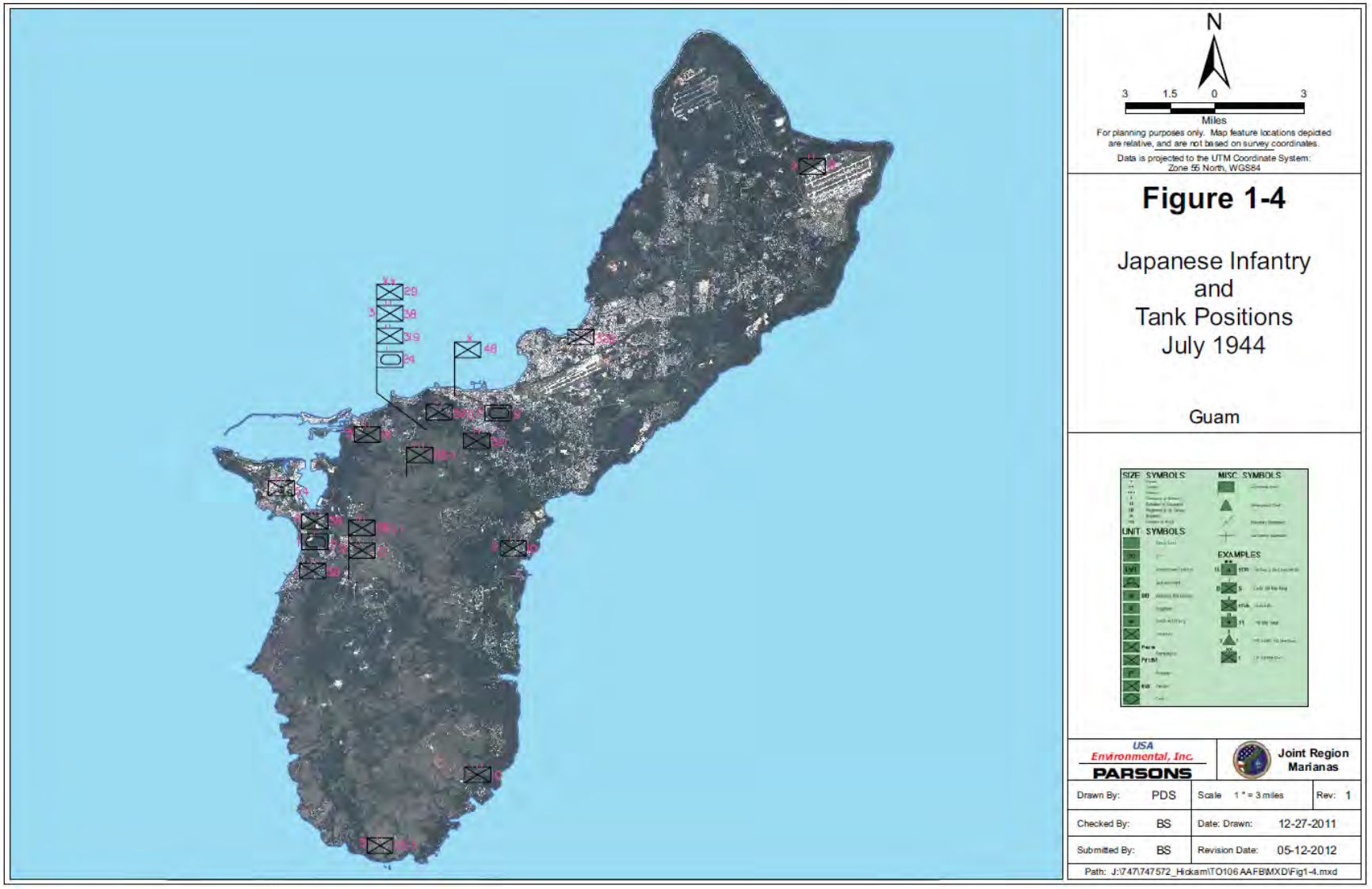


Table 1-2: Types of Munitions Potentially Used During War Activities by Area

Area	Origin Country	Small Arms	Land Mines	Hand Grenades	Projected Grenades	Anti-Tank Rockets	Mortars	Land Artillery	Naval Artillery	Aircraft Bombs	Aircraft Rockets
1. Andersen AFB Area 1	US	X		X	P	X	P	X	X	X	P
	Japan	X		X			P				
2. Andersen AFB Area 2	US	X		X	P	X	P	X	X	X	P
	Japan	X		X	P		P	X			
3. Andersen AFB Area 3	US	X		X	P	X	X	X	X	X	P
	Japan	X		X	P		X	X			
4. Andersen AFB Area 4	US	X		X	P	P	X	X	X	X	P
	Japan	X		X	P	P	X	X			
5. Andersen AFB Area 5	US	X		X	P	X	X	X	X	P	P
	Japan	X		X	P		P	X			
6. Andersen AFB Area 6	US	X		X	P	X	P	X	X	X	P
	Japan	X		X	P		P	X			
7. Andersen AFB Area 7	US	X		X				X	X	P	P
	Japan	X	X	X				X			
8. Andersen AFB Area 8	US	X		X						P	P
	Japan	X		X							
9. Andersen South	US	X		X	X	X	X			P	P
	Japan	X		X		X					
10. Apra Heights	US	X									
	Japan	X					X				
11. Barrigada	US	X		X		X	X	X		P	P
	Japan	X		X							
12. DanDan	US	P	P	X	P	P	X	X	X	P	P
	Japan	P	P	X	X	P	X	X			
13. Finegayan (includes J-001B)	US	X		X	X	P	X	X	X	X	P
	Japan	X	P	X	X		X				
14. Naval Base[a] (includes J-006)	US	X		X			X	X	X	X	
	Japan	X		P			X	X			
15. Naval Hospital East	US	P		X	P	P	X	X	X	P	P
	Japan	P		X	P	P	X	X			

Area	Origin Country	Small Arms	Land Mines	Hand Grenades	Projected Grenades	Anti-Tank Rockets	Mortars	Land Artillery	Naval Artillery	Aircraft Bombs	Aircraft Rockets
16. Naval Hospital West	US	P		P	P	P	P	P	P	P	P
	Japan	P		P	P	P	X	P			
17. Nimitz Hill	US	P		X							
	Japan	P		P				X			
18. Ordnance Annex	US	X		X	X	X	X	X	X	X	P
	Japan	X	X	X	X	P		X			
19. Orote Point	US	X		X	X	P	X	X	X	X	P
	Japan	X	P	X	X	P	X	X			
20. Polaris Point	US	P		P				X			
	Japan	P		X				X			
21. Santa Rosa	US			X							
	Japan										
22. Sasa Valley	US							X			
	Japan										
23. Tenjo Vista	US							X			
	Japan										
24. Tipalao	US	X		X	P	P	P	P	X	P	P
	Japan	X	P	X	P		P	X			

Notes: X = Confirmed

P = Possible, not confirmed

(a) Apra Wharves were not present during WWII as they are currently configured.

Table 3-1: Previous MEC and MPPEH Encountered

Description	Quantity
1. Andersen AFB Area 1	
Bomb, 600 lb, Mk 32	1
Bomb, 500 lb, AN-M64	2
Bomb, 100 lb, GP MK1	3
Projectile, M1 105mm HE	1
Rocket, 4.5 in, Barrage, MK 3	2
Hand Grenade, MK II	3
Bomb, Incendiary, AN-M52	18
2. Andersen AFB Area 2	
Bomb, 500 lb, AN-M64	8
Bomb, 100 lb, AN-Mk 47A1	1
Projectile, 6 in, HC, Mk34	1
Projectile 5 in	2
Projectile, M1 105mm HE	1
Projectile, 75mm, HE	1
Japanese (JA) Projectile, 75 mm, Type 97	1
Hand Grenade, MK II	7
JA Hand Grenade, High Explosive (HE), Type 97	3
Bomb, Incendiary, AN-M50A2	2
3. Andersen AFB Area 3	
Bomb, 500 lb, AN-M64	1
Bomb, 100 lb, AN-M30A1	1
Bomb, 4 lb, Incendiary, AN-M50	2

Projectile, 6 in, HC, Mk34	1
Projectile, 5 in.	25
Projectile, 155 mm, HE, M107	1
Mortar, 81 mm, WP, M57	1
JA Mortar, 58 mm, HE Type 89	10
Hand Grenade, MKII	10
Hand Grenade, Smoke	4
JA Hand Grenade, HE, Type 97	2
JA Hand Grenade, Type 99	2
Bomb, Incendiary, AN-M50	30
Bomb, Incendiary, AN-M69X	12
Submunition, M32	1
Submunition, M38	3
Submunition, M40	1
4. Andersen AFB Area 4	
Bomb, 4 lb, Incendiary, AN-M50	6
Projectile, 5 in, Illumination	1
Projectile, 5 in	3
Projectile, 105 mm, M1	2
Projectile, 75 mm, Mk I	1
Mortar, 60mm, M49A2	1
Mortar 81 mm, type unknown	1
JA Mortar, 58 mm, HE Type 89	1
JA Mortar, 81 mm HE, Type 100	1
Hand Grenade, MKII	4
JA Hand Grenade, Type 99	1

Submunition, M38	4
JA Mine, Boat, Type JG Series	1
5. Andersen AFB Area 5	
Projectile, 5 in, Mk47	1
Projectile, 155 mm, HE, M107	5
Projectile, 155 mm, White Phosphorus, M110	4
Projectile, 75 mm, AT, M66	1
JA Projectile, 75 mm, Type 94	1
Rocket, 2.36 in, M6A3	1
Mortar 81 mm, type unknown	1
Hand Grenade, MKII	3
JA Hand Grenade, HE, Type 91	1
JA Hand Grenade, HE, Type 97	3
JA Hand Grenade, Type 99	1
Bomb, Incendiary, AN-M Series	60
Projectile, 20mm, HE	3
6. Andersen AFB Area 6	
Bomb, 100 lb, GP MK1	1
Projectile, 6 in, HC, Mk34	1
Projectile, 5 in, HE,	6
Projectile, 155 mm, HE, M107	3
Projectile, 105 mm, M1	2
Mortar, 60mm, M49A2	1
Mortar 81 mm, type unknown	1
Hand Grenade, MKII	16
JA Hand Grenade, HE, Type 97	3

Bomb, Incendiary, AN-M Series	708
Projectile, 20mm, HE	3
7. Andersen AFB Area 7	
Illumination, AN-M43A1	1
Projectile, 25 mm	1
8. Andersen AFB Area 8	
JA Projectile, 105 mm, Type 91	1
9. Andersen South	
Projectile, 8", Mk 25, Mod 1	1
Projectile, 5 in, Mk 35	8
Rocket, 2.36 in, M6A3	1
Hand Grenade, M67	1
JA Hand Grenade, Type 97	1
Projectile, 3 in, AP, Mk 29	1
Hand Grenade, MK II	2
10. Apra Heights[a]	
JA Mortar, 81mm HE	4
11. Barrigada	
Bomb, 100 lb, AN-M30A1	1
Projectile, 155 mm, M107	1
Projectile, 5 in, Mk 35	8
JA Mortar, 81 mm, Type 97	3
Projectile, 4 in Mk16	5
JA Projectile, 7 cm, Type 97	1
Mortar, 60mm, M49A2	1
JA Hand Grenade, Type 97	2

Projectile, 3 in AP, Mk 29	2
Hand Grenade, MK II	8
JA Projectile, Anti-Aircraft, 25 mm	1
12. DanDan[a]	
Projectile, 37mm HE MK II	1
Hand Grenade, MK II	1
13. Finegayan (includes J-001B)	
Bomb, 500 lb, HE, AN-M64	1
Bomb, 100 lb, HE	3
Projectile, 5 in, Mk 35	39
Mortar, 81 mm, M362A1	12
Projectile, 75mm	7
JA Projectile, 7 cm, Type 97	1
Mortar, 60mm, M49A2	10
JA Hand Grenade, Type 97	2
JA Rifle Grenade, Type 91	1
Projectile, 3 in AP, Mk 29	2
Hand Grenade, MK II	102
Projectile, 20mm HE	11
14. Naval Base[a] (includes J-006)	
Bomb, 1000 lb, AN-M65A1 *(Note: Only one 1,000 lb bomb has been found on Guam)*	1
Bomb, 500 lb, M64A1	1
Bomb, 250 lb, M57	1
Projectile, 14 in, Mk22	1
Bomb, 100 lb, AN-M30A1	2

Bomb, Land, Type 97, No. 6	1
Rocket, 7.2 in	12
Projectile, 155 mm, M107	2
Projectile, 6 in HC, Mk34	96
Projectile, 5 in, Mk 35	27
Rocket, Barrage, 4.5 in, Mk3	5
JA Projectile, 10 cm	1
Projectile, 105 mm, M1	1
JA Mortar, 90 mm, Type 94	1
Mortar, 81mm, M362A1	2
JA Projectile, 75 mm, Type 98	4
Projectile, 75 mm, Mk I	1
JA Mortar, 81 mm, Type 100	2
JA Projectile, 7 cm, Type 90	175
Mortar, 60mm, M49A2	1
JA Hand Grenade, Type 97	7
JA Rifle Grenade, Type 91	3
Projectile, 40 mm, MK II	40
Projectile, 3 in AP, Mk 29	17
Grenade, MK II	5
Projectile, 30 mm, HEI	2
Projectile, 25 mm, M792	17
Projectile, 37 mm, MK II	166
JA Projectile, 25 mm	28
JA Torpedo, Type 97	2
JA Mortar, 58 mm	5
JA Projectile, 40 mm AP, Type 1	1

JA Projectile, 37 mm, Type 97	8
JA Projectile, 20mm, Type 97	4
15. Naval Hospital East	
Bomb, Depth, 350 lb, AN-Mk 54	1
Projectile, 5 in, Mk 35	4
JA Mortar, 81 mm, Type 97	5
Projectile, White Phosphorus,155 mm, M110	1
Mortar, White Phosphorus, 81 mm, M375	1
JA Mortar, 58 mm, Type 89	1
JA Hand Grenade, Type 97	1
Hand Grenade, MK II	2
16. Naval Hospital West	
JA Mortar, 81mm, Type 97	3
17. Nimitz Hill[a]	
Projectile, 75mm, HE	1
Grenade, MK II	5
18. Ordnance Annex	
Bomb, 500 lb, AN-M64	8
Projectile 5 in	9
Hand Grenade, MK II	2
JA Hand Grenade, High Explosive (HE), Type 97	3
19. Orote Point[a]	
Bomb, 500 lb, AN-M64	2
Projectile, 155 mm, M107	1
Projectile, 6 in HC, Mk34	1
Projectile, 5 in, Mk 35	14

Projectile, 105 mm, M1	2
Mortar, 81 mm, M362A1	2
JA Projectile, 7 cm, Type 92	9
JA Projectile, 7 cm, Type 97	1
Mortar, 60mm, M49A2	2
JA Hand Grenade, Type 97	1
JA Rifle Grenade, Type 91	1
Projectile, 3 in AP, Mk 29	5
Hand Grenade, MK II	21
JA Mortar, 58 mm, Type 89	1
20. Polaris Point[a]	
Projectile, 75mm, HE	2
Grenade, MK II	1
21. Santa Rosa[a]	
Grenade, MK II	1
22. Sasa Valley[a]	
Projectile, 14 in, Mk22	1
Projectile, 20mm HE	2
23. Tenjo Vista[a]	
Grenade, MK II	1
24. Tipalao	
JA Projectile, 202 mm/Short, HE Ordinary MK 1	1
Projectile, 5 in, Mk 35	1
JA Projectile, Anti-Aircraft, 25 mm	1
Hand Grenade, MK II	4

Table 3-1 Notes:

a. "Apra Harbor" (per previous Amendment) is subdivided to the following (9) distinct areas: Apra Heights; Dan Dan; Naval Base; Nimitz Hill; Orote Point; Polaris Point; Santa Rosa; Sasa Valley; and Tenjo Vista.

Table 3-2: Historical Primary and Contingency MGFD

MGFD Type	Munition Item[a]	HFD (ft)[b]	MFD-H (ft)[b]
1. Andersen Air Force Base (AAFB) Area 1			
Primary	600-lb M32 Bomb (TNT filled)	662	3,110
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
2. AAFB Area 2			
Primary	500-lb M64A1 Bomb (Composition B filled)	638	2,486
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
3. AAFB Area 3			
Primary	500-lb M64A1 Bomb (Composition B filled)	638	2,486
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
4. AAFB Area 4			
Primary	5-in Mk 41 Projectile	359	2,377
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
5. AAFB Area 5			
Primary	155-mm M107 Projectile (Composition B filled)	450	2,630
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
6. AAFB Area 6			
Primary	155-mm M107 Projectile (Composition B filled)	450	2,630
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
7. AAFB Area 7			
Primary	155-mm M107 Projectile (Composition B filled)	450	2,630
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
8. AAFB Area 8			
Primary	155-mm M107 Projectile (Composition B filled)	450	2,630
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355

MGFD Type	Munition Item[a]	HFD (ft)[b]	MFD-H (ft)[b]
9. Andersen South			
Primary	8-in Mk 25 Projectile	445	3,434
Contingency-1	600-lb M32 Bomb (TNT filled)	662	3,110
10. Apra Heights[c]			
Primary	14-In Projectile, Mk 22	559	5,214
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
11. Barrigada			
Primary	155-mm M107 Projectile (Composition B filled)	450	2,630
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
12. Dan Dan[c]			
Primary	14-In Projectile, Mk 22	559	5,214
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
13. Finegayan			
Primary	500-lb M64A1 Bomb (Composition B filled)	638	2,486
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
14. J-001B (Finegayan Breakout)[d]			
Primary	500-lb M64A1 Bomb (Composition B filled)	638	2,486
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
15. Naval Base[c]			
Primary	500-lb M64A1 Bomb (Composition B filled)	638	2,486
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
J-006 (Naval Base Breakout) [d]			
Primary	500-lb M64A1 Bomb (Composition B filled)	638	2,486
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355

MGFD Type	Munition Item[a]	HFD (ft)[b]	MFD-H (ft)[b]
17. Naval Hospital East			
Primary	5-in/38 Mk 35 Projectile	343	2,131
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
18. Naval Hospital West			
Primary	81-mm Japanese Type 97 HE Mortar	207	1,481
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
19. Nimitz Hill[c]			
Primary	14-In Projectile, Mk 22	559	5,214
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
20. Ordnance Annex			
Primary	500-lb M64A1 Bomb (Composition B filled)	638	2,486
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
21. Orote Point[c]			
Primary	500-lb M64A1 Bomb (Composition B filled)	638	2,486
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
22. Polaris Point[c]			
Primary	500-lb M64A1 Bomb (Composition B filled)	638	2,486
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
23. Santa Rosa[c]			
Primary	14-In Projectile, Mk 22	559	5,214
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
24. Sasa Valley[c]			
Primary	14-In Projectile, Mk 22	559	5,214
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355

MGFD Type	Munition Item[a]	HFD (ft)[b]	MFD-H (ft)[b]
25. Tenjo Vista[c]			
Primary	14-In Projectile, Mk 22	559	5,214
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355
26. Tipalao			
Primary	5-in/38 Mk 35 Projectile	343	2,131
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,355

Table 3-2 Notes:

a. Based on WWII records research, military EOD incident reports from 1978-2018, and available MEC clearance data reports

b. From Fragmentation Data Review Form (DDESB, 5/03/2018)

c. "Apra Harbor" (per previous Amendment) is subdivided to the following (9) distinct areas: Apra Heights; Dan Dan; Naval Base; Nimitz Hill; Orote Point; Polaris Point; Santa Rosa; Sasa Valley; and Tenjo Vista.

d. Two large construction projects are subdivided: J-001B, and J-006.

Table 6-1: Historical Exclusion Zones

MGFDs		EZs (ft)					
Description	NEW (lbs) [a,b]	Fragmentation Effects		Blast Overpressure Effects			
		HFD	MFD-H	K328 [b]	K40 [b]	K24 [b]	K18 [b]
1. Andersen Air Force Base (AAFB) Area 1							
600-lb M32 Bomb (TNT filled)	336	662	3,110	2,280	278	167	125
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
2. AAFB Area 2							
500-lb M64A1 Bomb (Composition B filled)	317.84	638	2,486	2,238	273	164	123
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
3. AAFB Area 3							
500-lb M64A1 Bomb (Composition B filled)	317.84	638	2,486	2,238	273	164	123
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
4. AAFB Area 4							
5-in Mk 41 Projectile	6.273	359	2,377	605	74	44	33
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
5. AAFB Area 5							
155-mm M107 Projectile (Composition B filled)	17.92	450	2,630	858	105	63	47
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159

MGFDs		EZs (ft)					
Description	NEW (lbs) [a,b]	Fragmentation Effects		Blast Overpressure Effects			
		HFD	MFD-H	K328[b]	K40 [b]	K24 [b]	K18 [b]
6. AAFB Area 6							
155-mm M107 Projectile (Composition B filled)	17.92	450	2,630	858	105	63	47
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
7. AAFB Area 7							
155-mm M107 Projectile (Composition B filled)	17.92	450	2,630	858	105	63	47
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
8. AAFB Area 8							
155-mm M107 Projectile (Composition B filled)	17.92	450	2,630	858	105	63	47
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
9. Andersen South							
8-in Mk 25 Projectile[3]	18.13	445	3,434	862	105	63	47
600-lb M32 Bomb (TNT filled)	336	662	3,110	2,280	278	167	125
10. Apra Heights[c]							
14-In Projectile, Mk 22	88.579	559	5,214	1,462	178	107	80
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159

MGFDs		EZs (ft)					
Description	NEW (lbs) [a,b]	Fragmentation Effects		Blast Overpressure Effects			
		HFD	MFD-H	K328[b]	K40 [b]	K24 [b]	K18 [b]
11. Barrigada							
155-mm M107 Projectile (Composition B filled)	17.92	450	2,630	858	105	63	47
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
12. Dan Dan[c]							
14-In Projectile, Mk 22	88.579	559	5,214	1,462	178	107	80
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
13. Finegayan							
500-lb M64A1 Bomb (Composition B filled)	317.89	638	2,486	2,238	273	164	123
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
14. J-001B (Finegayan Breakout)[d]							
500-lb M64A1 Bomb (Composition B filled)	317.89	638	2,486	2,238	273	164	123
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
15. Naval Base[c]							
500-lb M64A1 Bomb (Composition B filled)	317.89	638	2,486	2,238	273	164	123
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159

MGFDs		EZs (ft)					
Description	NEW (lbs) [a,b]	Fragmentation Effects		Blast Overpressure Effects			
		HFD	MFD-H	K328[b]	K40 [b]	K24 [b]	K18 [b]
16. J-006 (Naval Base Breakout)[d]							
500-lb M64A1 Bomb (Composition B filled)	317.89	638	2,486	2,238	273	164	123
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
17. Naval Hospital East							
5-in/38 Mk 35 Projectile	6.418	343	2,131	610	74	45	33
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
18. Naval Hospital West							
81-mm Japanese Type 97 HE Mortar	1.190	207	1,481	348	42	25	19
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
19. Nimitz Hill[c]							
14-In Projectile, Mk 22	88.579	559	5,214	1,462	178	107	80
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
20. Ordnance Annex							
500-lb M64A1 Bomb (Composition B filled)	317.89	638	2,486	2,238	273	164	123
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159

MGFDs		EZs (ft)					
Description	NEW (lbs) [a,b]	Fragmentation Effects		Blast Overpressure Effects			
		HFD	MFD-H	K328[b]	K40 [b]	K24 [b]	K18 [b]
21. Orote Point[c]							
500-lb M64A1 Bomb (Composition B filled)	317.89	638	2,486	2,238	273	164	123
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
22. Polaris Point[c]							
500-lb M64A1 Bomb (Composition B filled)	317.89	638	2,486	2,238	273	164	123
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
23. Santa Rosa[c]							
14-In Projectile, Mk 22	88.579	559	5,214	1,462	178	107	80
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
24. Sasa Valley[c]							
14-In Projectile, Mk 22	88.579	559	5,214	1,462	178	107	80
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
25. Tenjo Vista[c]							
14-In Projectile, Mk 22	88.579	559	5,214	1,462	178	107	80
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159

MGFDs		EZs (ft)					
Description	NEW (lbs) [a,b]	Fragmentation Effects		Blast Overpressure Effects			
		HFD	MFD-H	K328[b]	K40 [b]	K24 [b]	K18 [b]
26. Tipalao							
5-in/38 Mk 35 Projectile	6.418	343	2,131	610	74	45	33
1000-lb AN-M65A1 Bomb (Composition B filled)	690.2	810	3,355	2,899	353	212	159
27. All Areas, Limited Clearance Ahead of Construction – Phase 2							
60mm M49A2 Mortar	0.340	152	1,322	229	28	17	13

Table 6-1 Notes:

a. TNT equivalent weight

b. From Fragmentation Data Review Form (DDESB, 5/03/2018)

c. "Apra Harbor" (per previous Amendment) has been subdivided to the following (9) distinct areas: Apra Heights; Dan Dan; Naval Base; Nimitz Hill; Orote Point; Polaris Point; Santa Rosa; Sasa Valley; and Tenjo Vista.

d. Two large construction projects are subdivided: J-001B, and J-006.

Table 6-2.1: Historical Controlling EZs (ESQD in feet[f])

Operation:	Manual Operations[a]				Mechanized (low input) Operations[b]				Remote (high input) Operations	
Sited as:	Unintentional Detonation								Intentional Detonation	
Exposed Sites:	UXO Teams		Public and Non-essential Personnel		Essential Personnel		Public and Non-essential Personnel		All Personnel	
Basis of MGFD[c]:	K40 of Primary	K40 of Cont-1	HFD of Primary	HFD of Cont-1	K24 of Primary	K24 of Cont-1	HFD of Primary	HFD of Cont-1	MFD-H of Primary	MFD-H of Cont-1
1. AAFB-Area 1	278	353	662	810	167	212	662	810	3,100	3,828[1]
2. AAFB-Area 2	273	353	638	810	164	212	638	810	2,849[2]	3,828[1]
3. AAFB-Area 3	273	353	638	810	164	212	638	810	2,849[2]	3,828[1]
4. AAFB-Area 4	74	353	359	810	44	212	359	810	2,377	3,828[1]
5. AAFB-Area 5	105	353	450	810	63	212	450	810	2,630	3,828[1]
6. AAFB-Area 6	105	353	450	810	63	212	450	810	2,630	3,828[1]
7. AAFB-Area 7	105	353	450	810	63	212	450	810	2,630	3,828[1]
8. AAFB-Area 8	105	353	450	810	63	212	450	810	2,630	3,828[1]
9. Andersen South	105	278	445	662	63	167	445	662	3,434	3,434[3]
10. Apra Heights[g]	178	353	559	810	107	212	559	810	5,214	5,214[3]
11. Barrigada	105	353	450	810	63	212	450	810	2,630	3,828[1]
12. DanDan[g]	178	353	559	810	107	212	559	810	5,214	5,214[3]
13. Finegayan	273	353	638	810	164	212	638	810	2,849[2]	3,828[1]
14. J-001B (Finegayan)[h]	273	353	638	810	164	212	638	810	2,849[2]	3,828[1]
15. Naval Base[g]	273	353	638	810	164	212	638	810	2,849[2]	3,828[1]
16. J-006 (Naval Base)[h]	273	353	638	810	164	212	638	810	2,849[2]	3,828[1]
17. Naval Hospital East	74	353	343	810	45	212	343	810	2,131	3,828[1]
18. Naval Hospital West	42	353	207	810	25	212	207	810	1,481	3,828[1]
19. Nimitz Hill[g]	178	353	559	810	107	212	559	810	5,214	5,214[3]
20. Ordnance Annex	273	353	638	810	164	212	638	810	2,849[2]	3,828[1]
21. Orote Point[g]	273	353	638	810	164	212	638	810	2,849[2]	3,828[1]
22. Polaris Point[g]	273	353	638	810	164	212	638	810	2,849[2]	3,828[1]
23. Santa Rosa[g]	178	353	559	810	107	212	559	810	5,214	5,214[3]
24. Sasa Valley[g]	178	353	559	810	107	212	559	810	5,214	5,214[3]
25. Tenjo Vista[g]	178	353	559	810	107	212	559	810	5,214	5,214[3]
26. Tipalao	74	353	343	810	45	212	343	810	2,131	3,828[1]

Table 6-2.1 Notes:

a. Manual operations involve excavating anomalies with hand tools
b. Mechanized operations involve excavating anomalies with an excavator and mechanically screening the soil. Conducting mechanized operations may require a long reach excavator or remotely operated equipment.
c. MGFDs (Primary & Contingency-1) are shown in Table 3-2.1 through 3-2.25
d. K18 distance may be used if essential personnel wear double hearing protection that provides ≥ 9-decibel attenuation.
e. Requires DDESB-approved shields/barricades designed to defeat hazardous fragments.
f. From Fragmentation Data Review Form (DDESB, 5/03/2018)
g. "Apra Harbor" (per previous Amendment) has been subdivided to the following (9) distinct areas: Apra Heights; Dan Dan; Naval Base; Nimitz Hill; Orote Point; Polaris Point; Santa Rosa; Sasa Valley; and Tenjo Vista.
h. Two large construction projects are subdivided: J-001B, and J-006.

Table 6-2.1 Notes Amended per DDESB Comments of 21 Jan 2020:

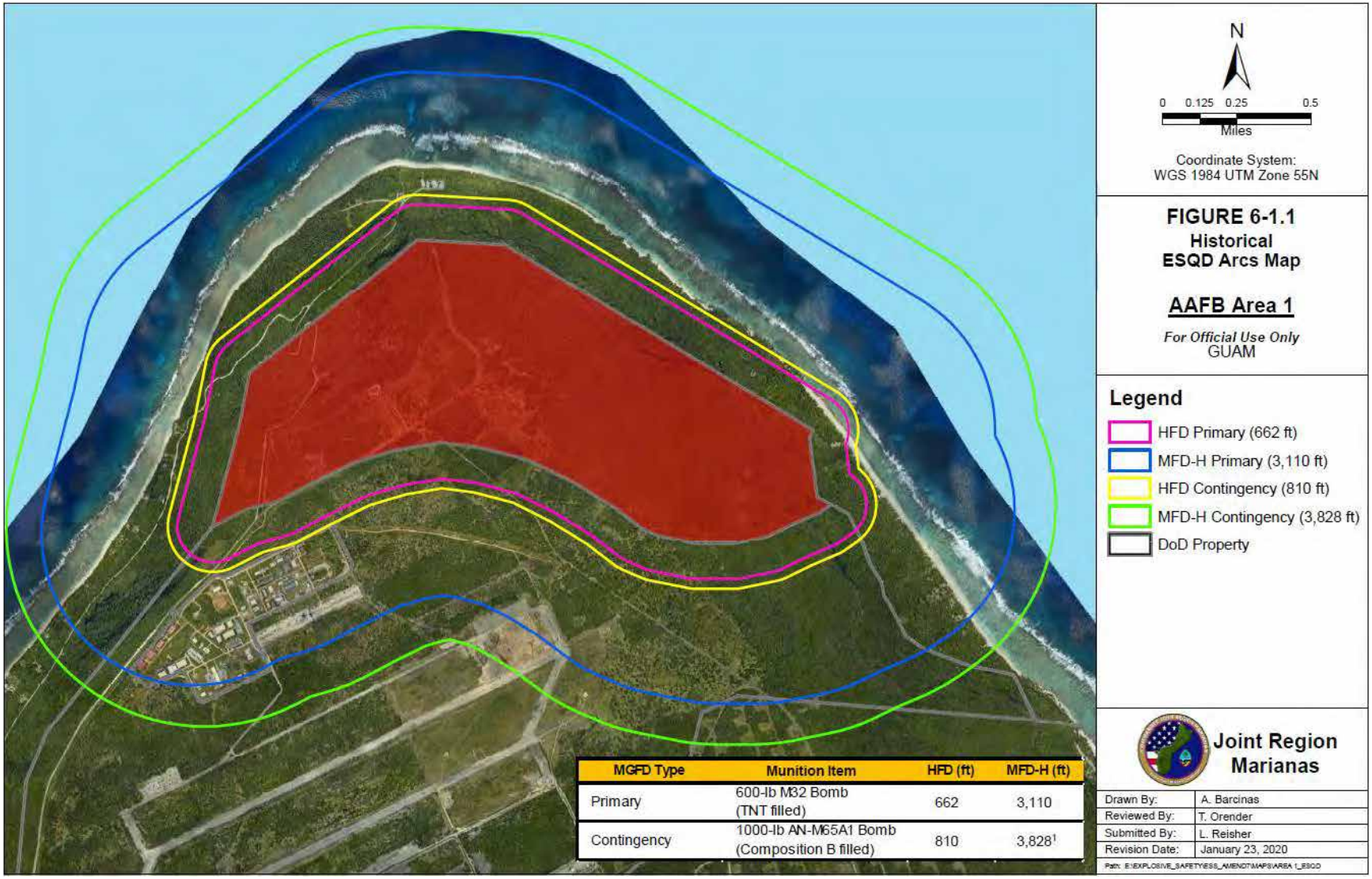
1. Based on the 1,00 pound AN-M65A1 Bomb (TNT filled)
2. Based on the 500 pound AN-M64A1 Bomb (Amatol filled)
3. MFD is based on the primary MFD-H

Table 6-2.2: Historical Controlling EZs (ESQD in feet[g]) – All Areas, Limited Clearance ahead of Construction (Phase 2)

Operation[a]:	Following Limited Clearance Ahead of Construction – Manual Operations[b]		Following Limited Clearance Ahead of Construction - Mechanized (low input) Operations[c]	
Sited as:	Unintentional Detonation			
Exposed Sites:	UXO Teams	Public and Non-essential Personnel	Essential Personnel	Public and Non-essential Personnel
Basis[d]:	K40 of MGFD Primary	HFD of MGFD Primary	K24 of MGFD Primary[e,f]	HFD of MGFD Primary
ESQD (ft)[g]	28	152	17	152

Table 6-2.2 Notes:

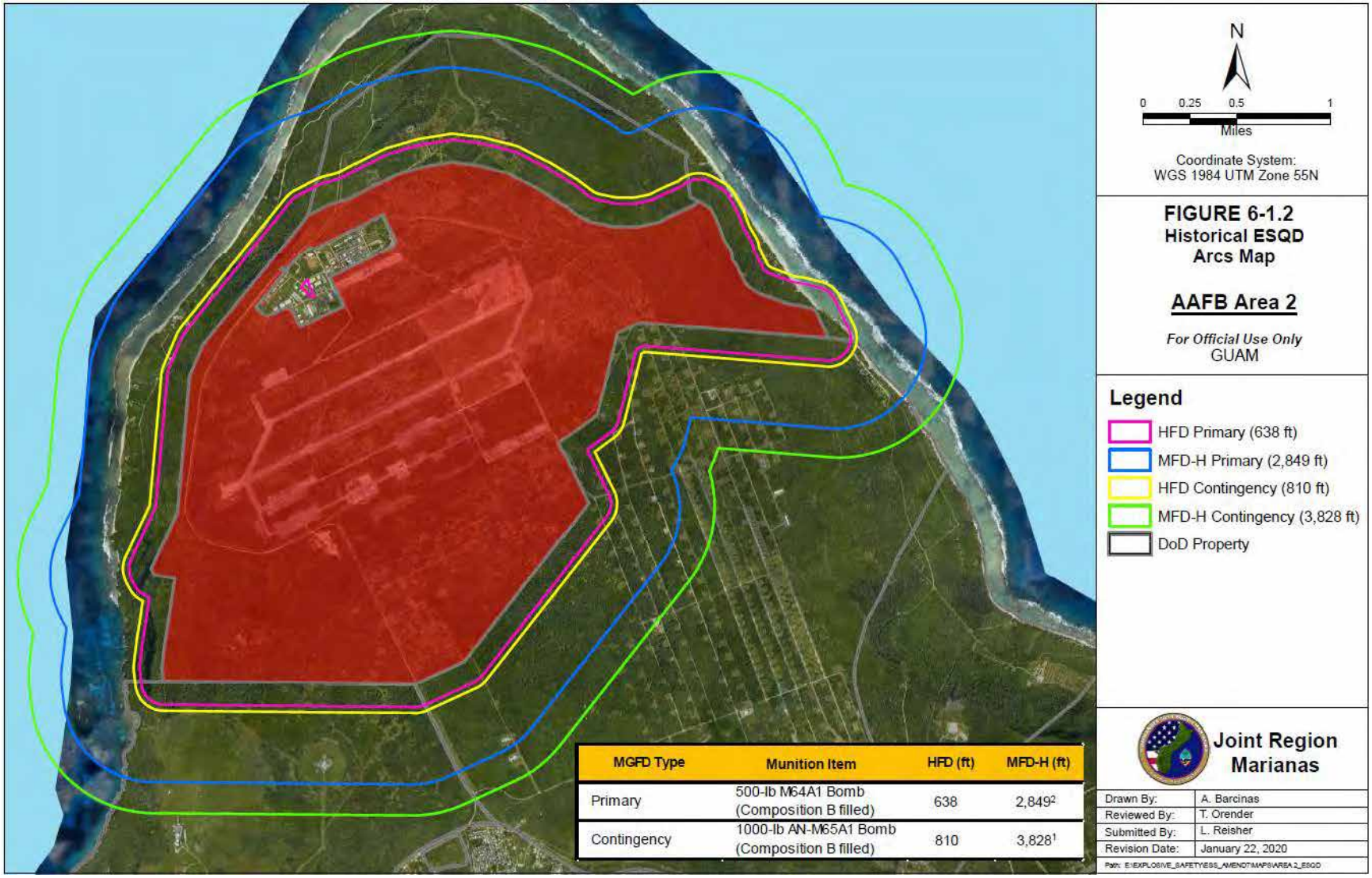
a. As described per Section 6.1.4
b. Manual operations involve excavating anomalies with hand tools
c. Mechanized operations involve excavating anomalies with an excavator and mechanically screening the soil. Conducting mechanized operations may require a long reach excavator or remotely operated equipment.
d. Primary MGFD following Limited Clearance ahead of Construction will be the 60mm M49A2 Mortar.
e. K18 distance may be used if essential personnel wear double hearing protection that provides ≥ 9-decibel attenuation.
f. Requires DDESB-approved shields/barricades designed to defeat hazardous fragments.
g. From Fragmentation Data Review Form (DDESB, 5/03/2018)



MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	600-lb M32 Bomb (TNT filled)	662	3,110
Contingency	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,828[1]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.

Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.

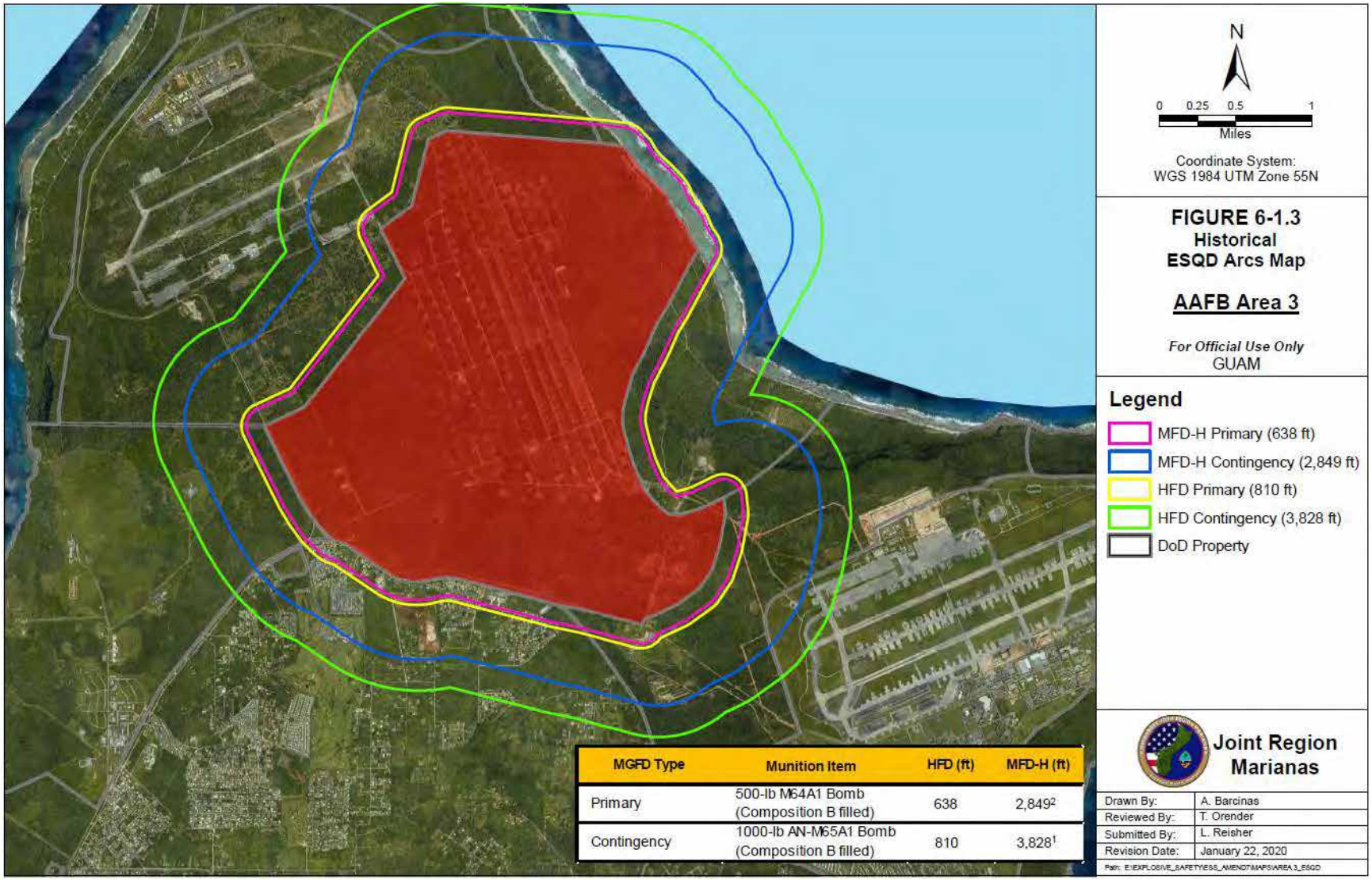


MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	500-lb M64A1 Bomb (Composition B filled)	638	2,849[2]
Contingency	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,828[1]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.

Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.

Note 2: Based on the 500 pound AN-M64A1 Bomb (Amatol filled), as amended per DDESB comment.

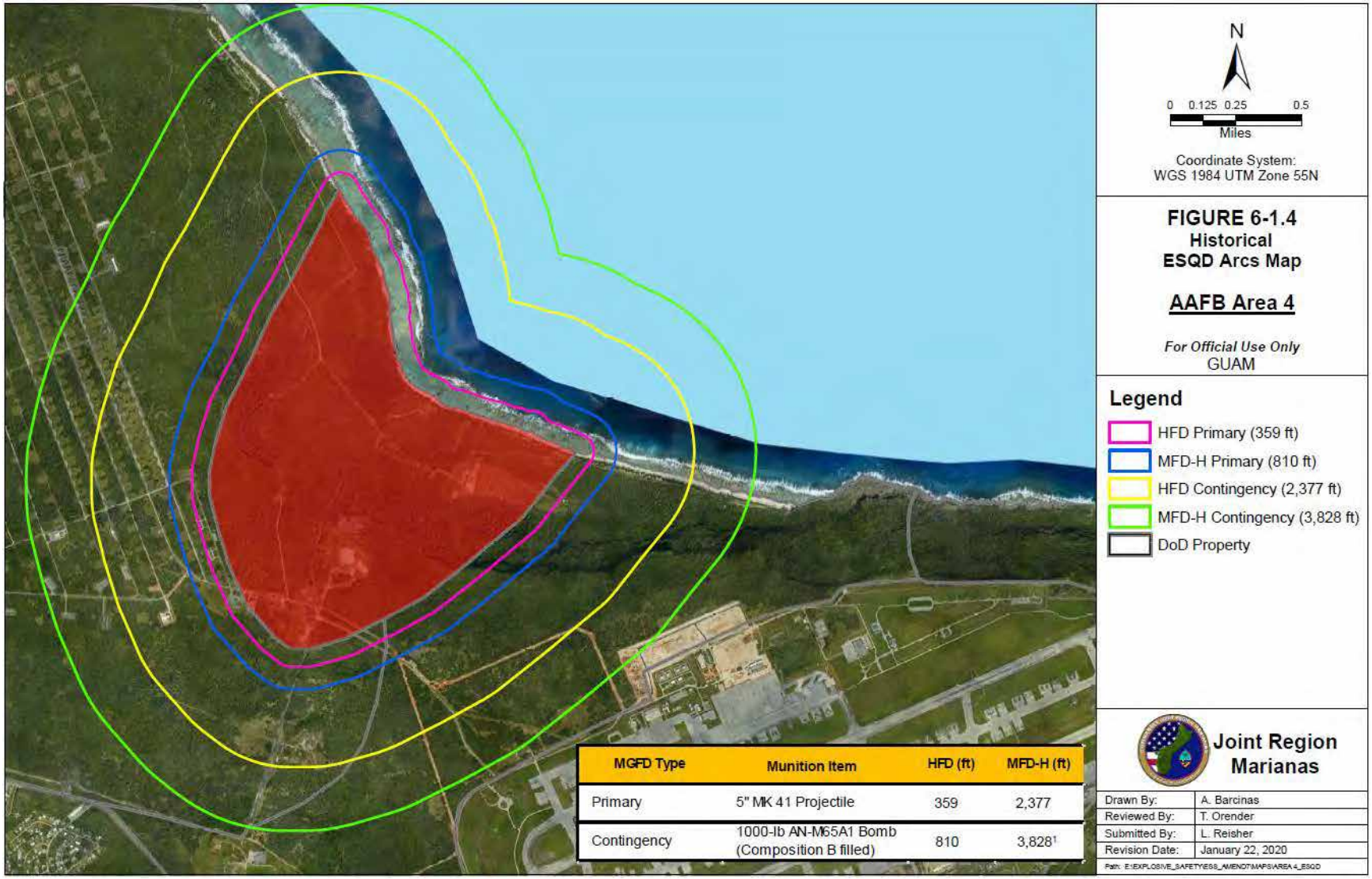


MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	500-lb M64A1 Bomb (Composition B filled)	638	2,849[2]
Contingency	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,828[1]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.

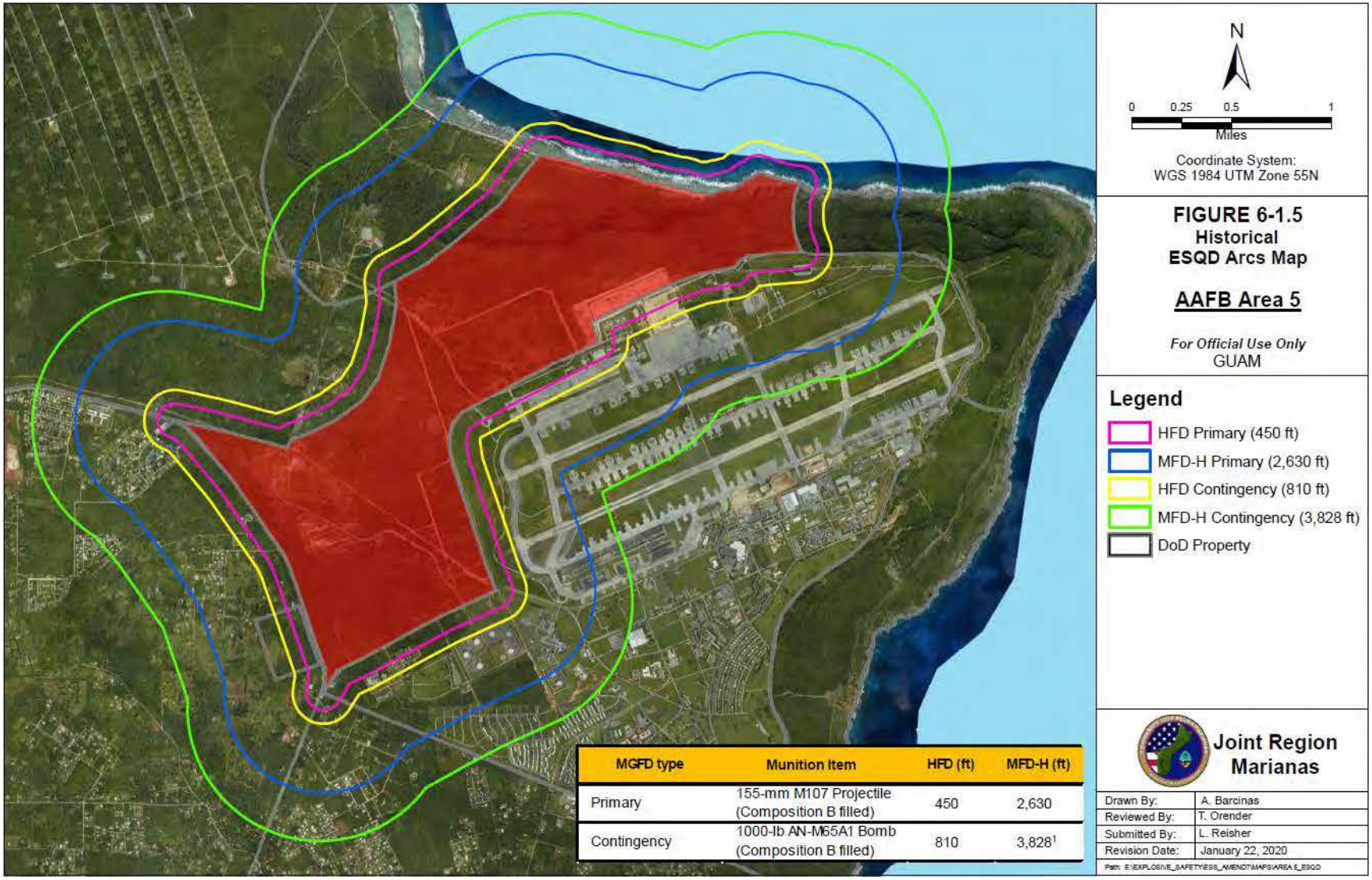
Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.

Note 2: Based on the 500 pound AN-M64A1 Bomb (Amatol filled), as amended per DDESB comment.



MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	5" MK 41 Projectile	359	2,377
Contingency	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,828[1]

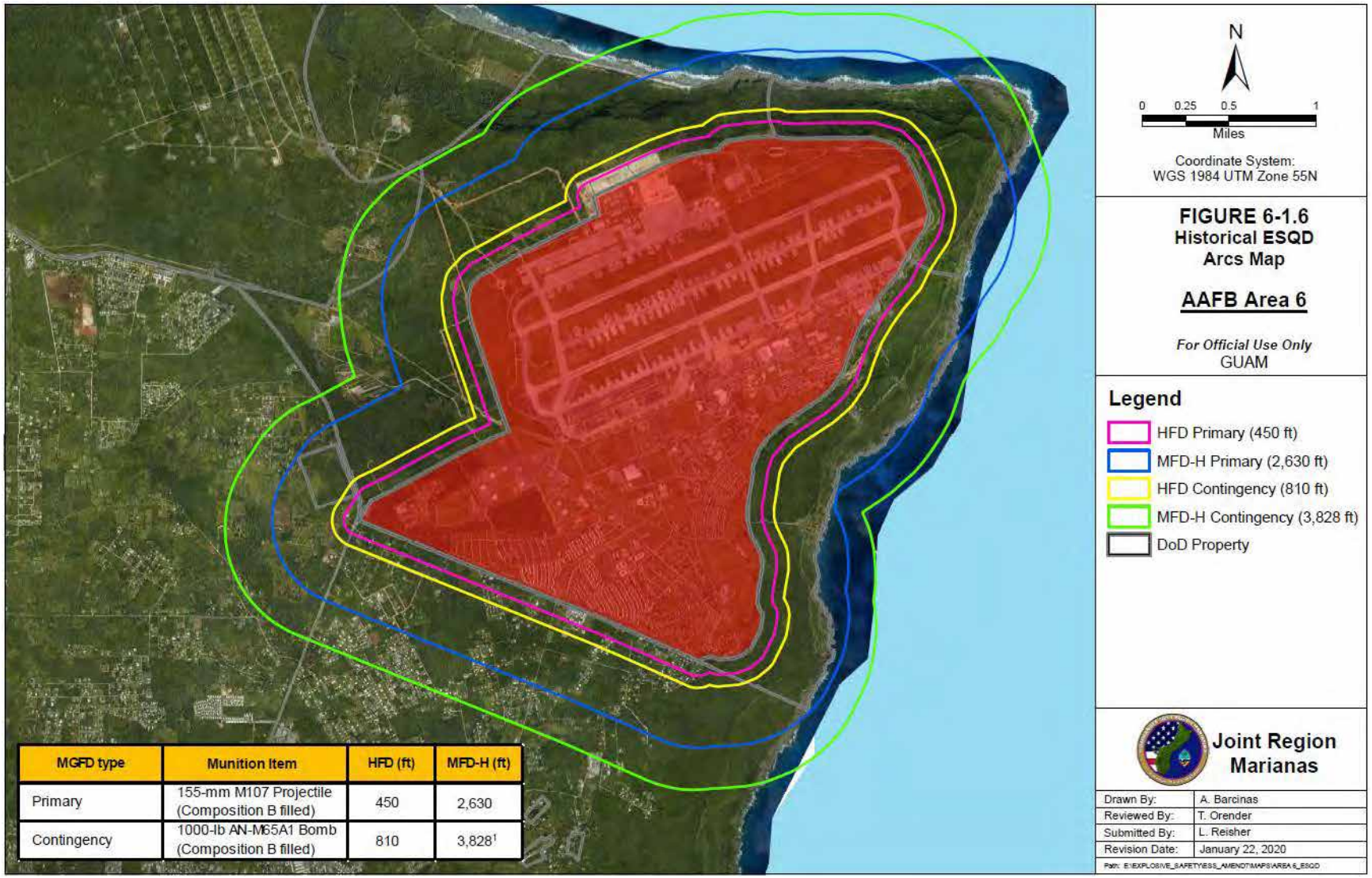
General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.
Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.



MGFD type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	155-mm M107 Projectile (Composition B filled)	450	2,630
Contingency	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,828[1]

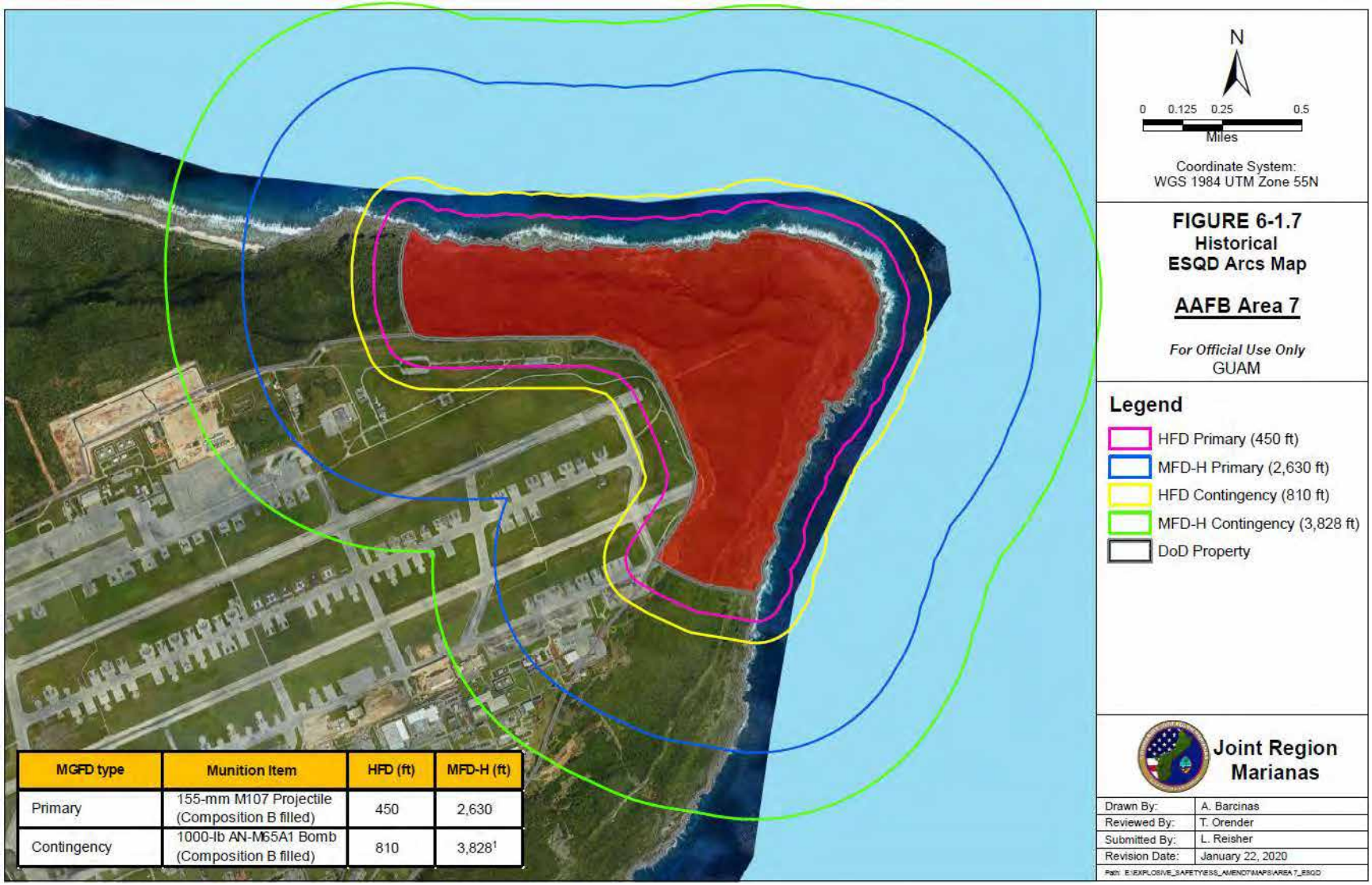
General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.

Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.



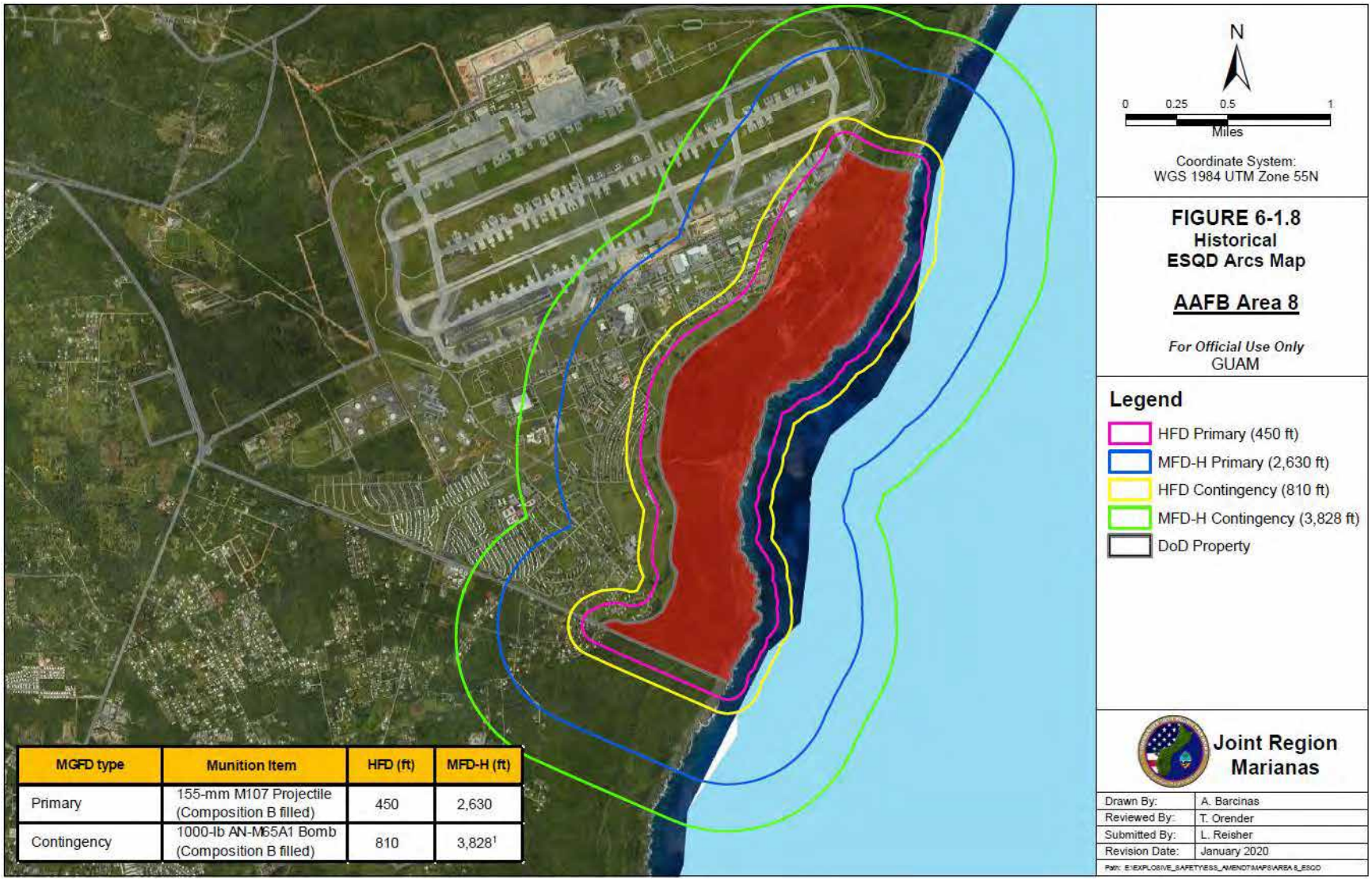
MGFD type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	155-mm M107 Projectile (Composition B filled)	450	2,630
Contingency	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,828[1]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.
Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.



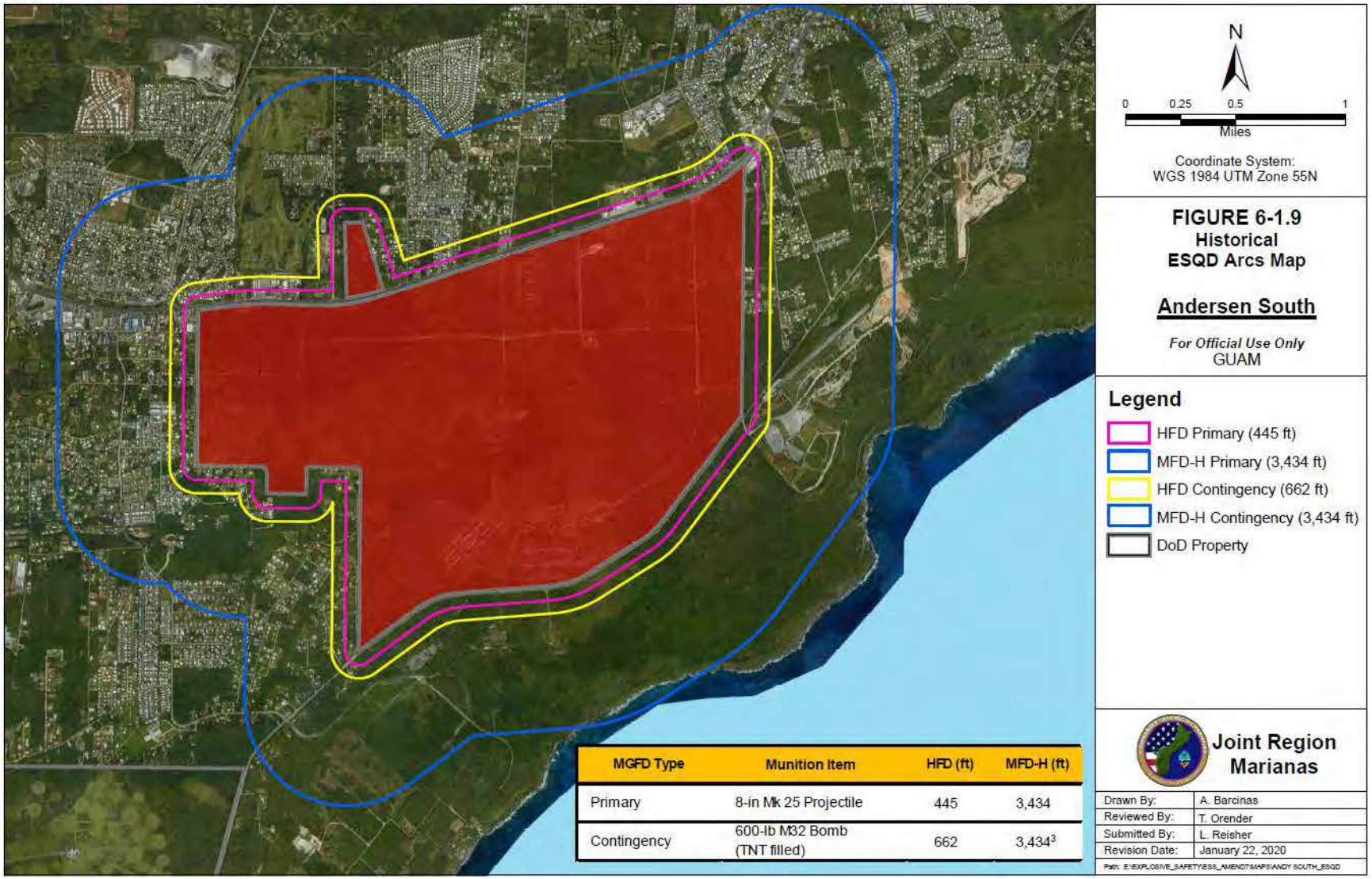
MGFD type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	155-mm M107 Projectile (Composition B filled)	450	2,630
Contingency	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,828[1]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.
Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.



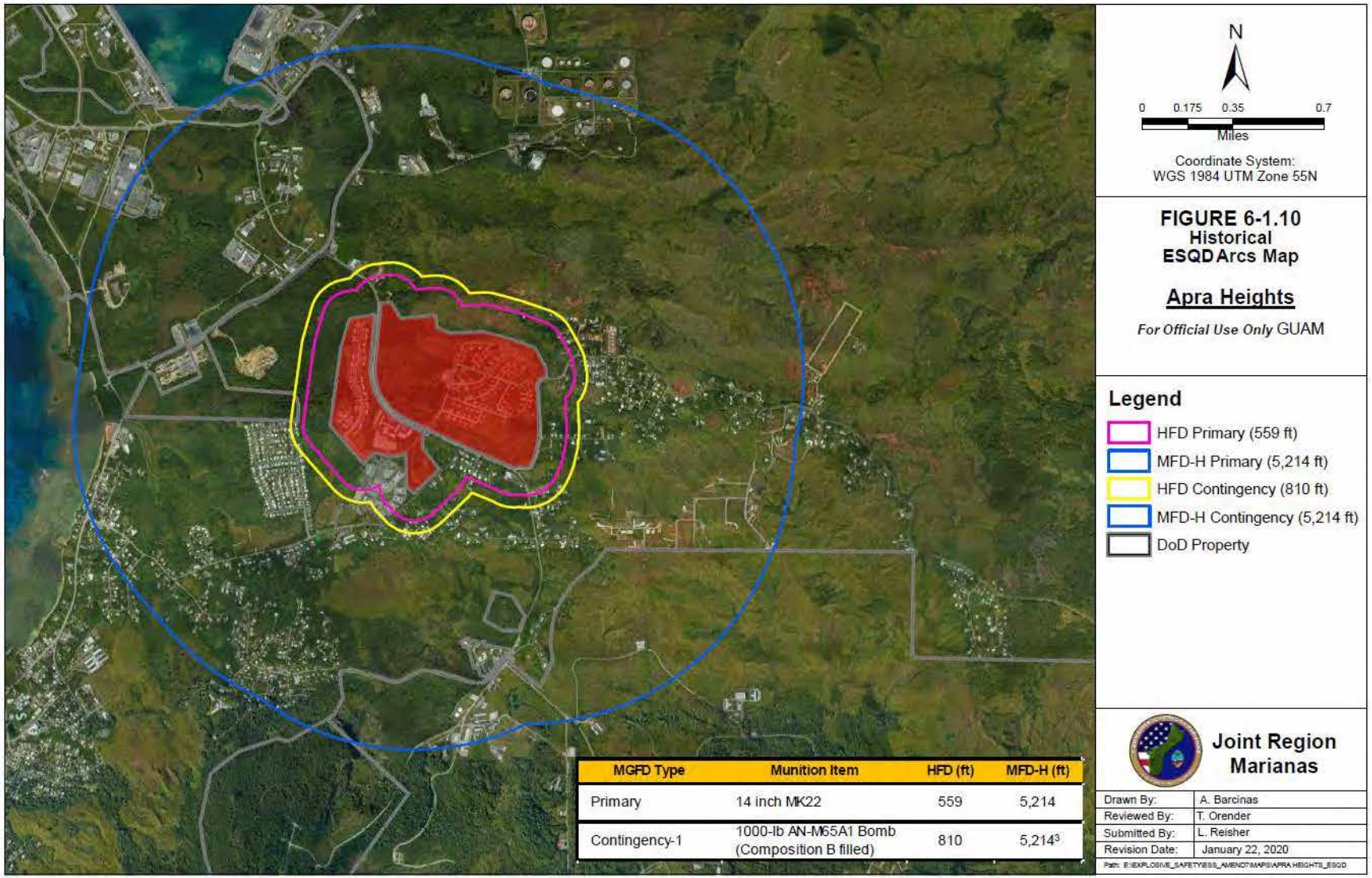
MGFD type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	155-mm M107 Projectile (Composition B filled)	450	2,630
Contingency	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,828[1]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.
Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.



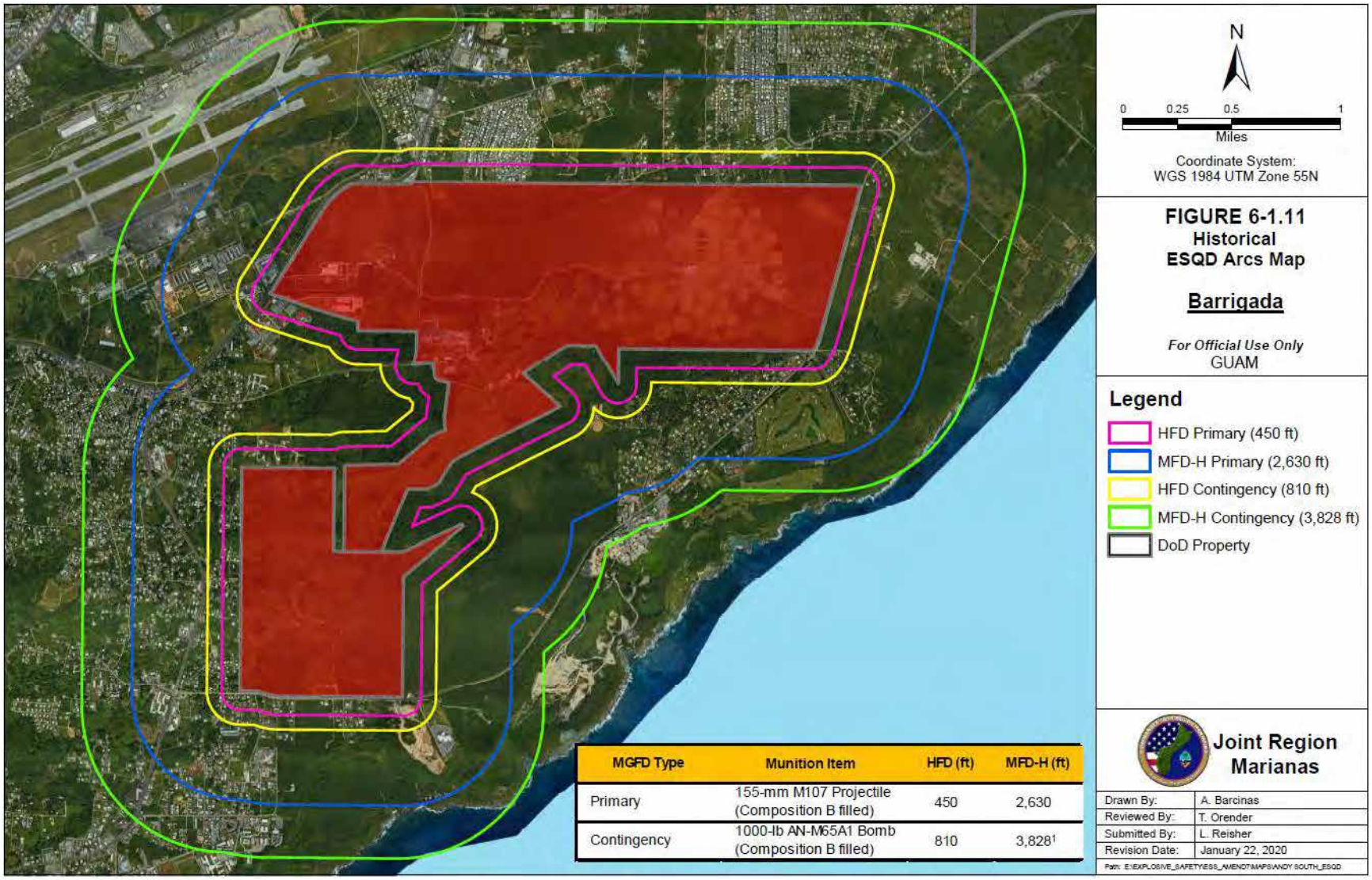
MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	8-in Mk 25 Projectile	445	3,434
Contingency	600-lb M32 Bomb (TNT filled)	662	3,434[3]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.
Note 3: MFD Based on the primary MFD-H, as amended per DDESB comment.



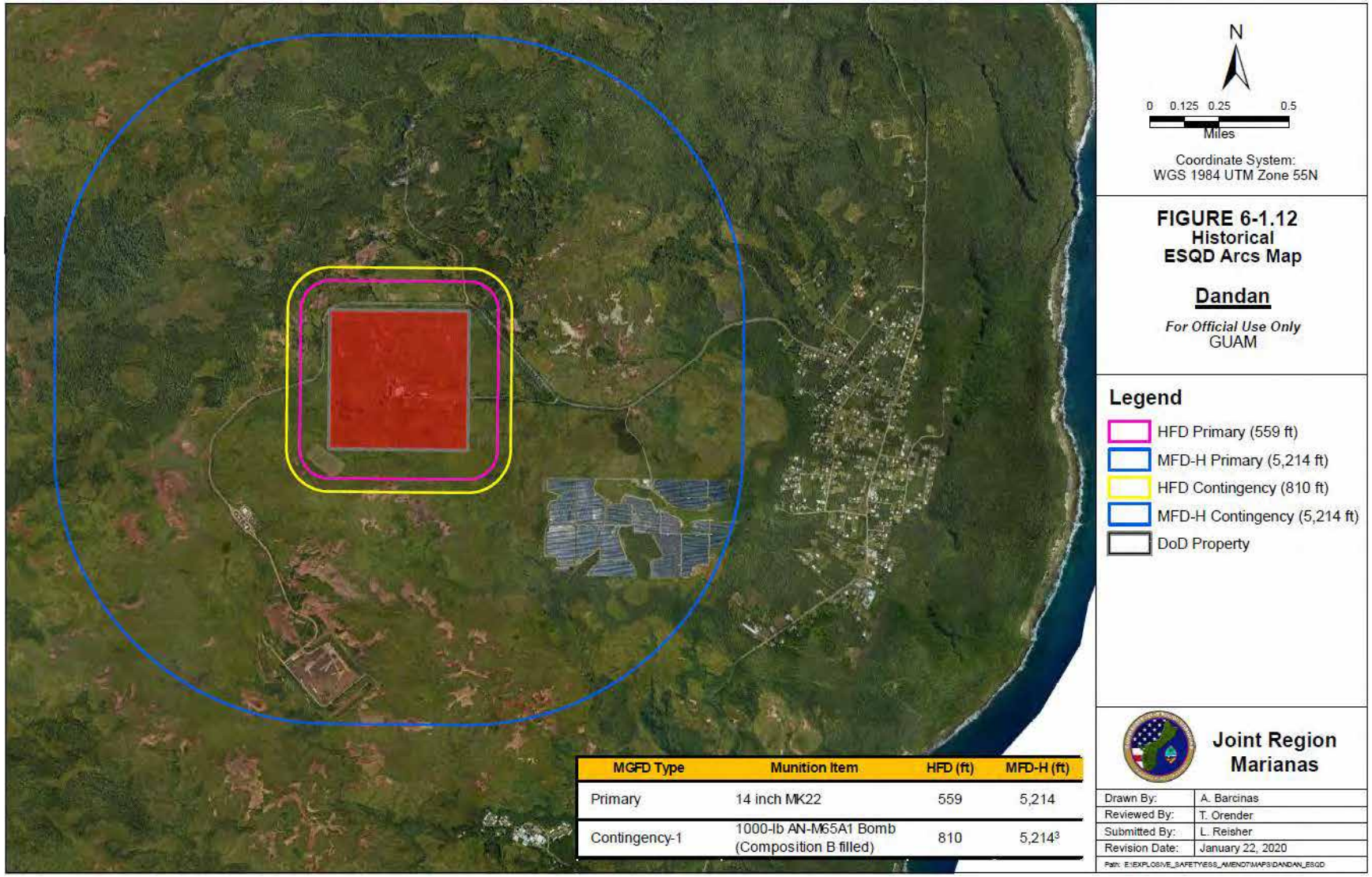
MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	14 inch MK22	559	5,214
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	5,214[3]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.
Note 3: MFD Based on the primary MFD-H, as amended per DDESB comment.



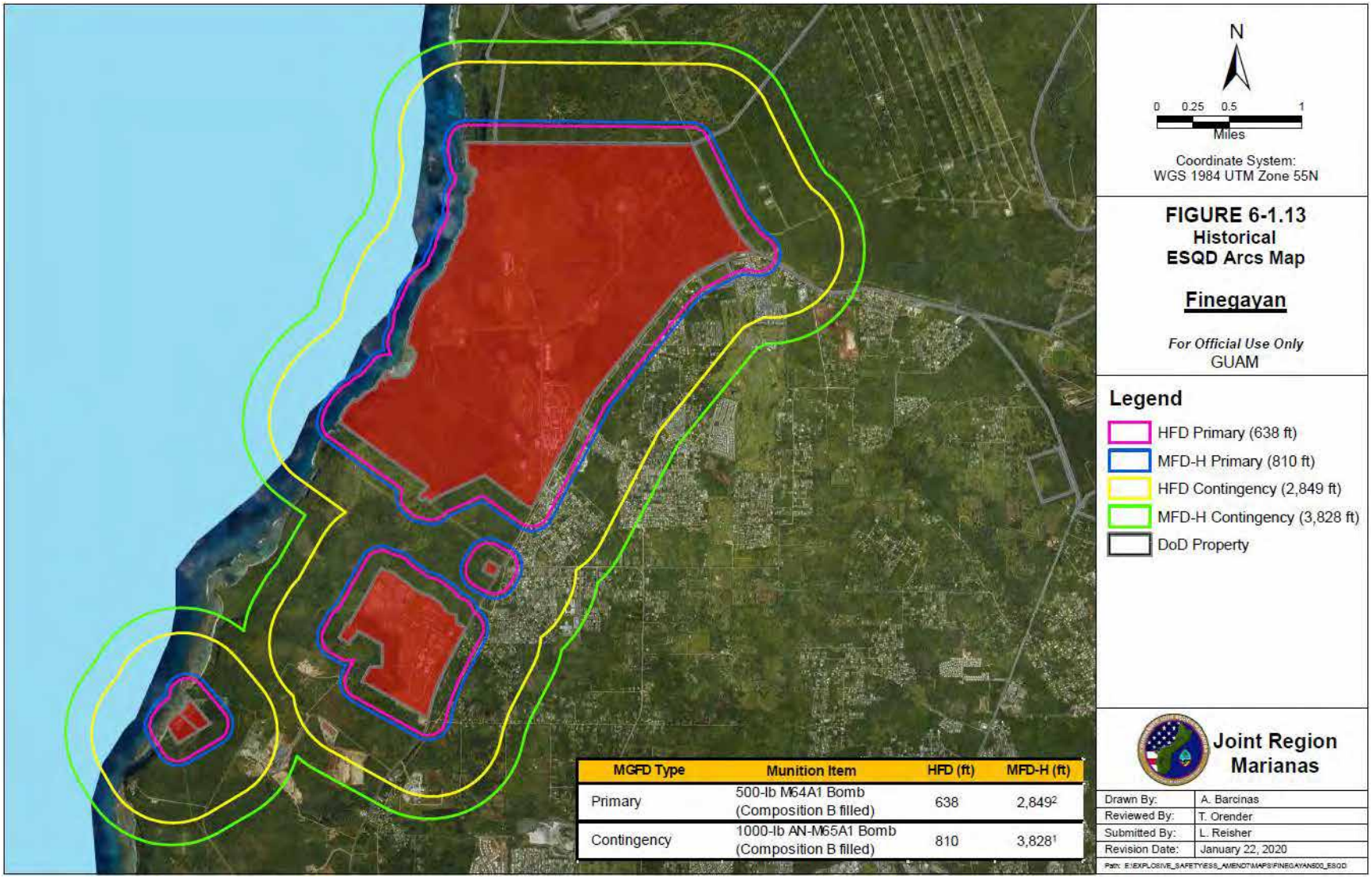
MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	155-mm M107 Projectile (Composition B filled)	450	2,630
Contingency	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,828[1]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.
Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.



MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	14 inch MK22	559	5,214
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	5,214[3]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.
Note 3: MFD Based on the primary MFD-H, as amended per DDESB comment.

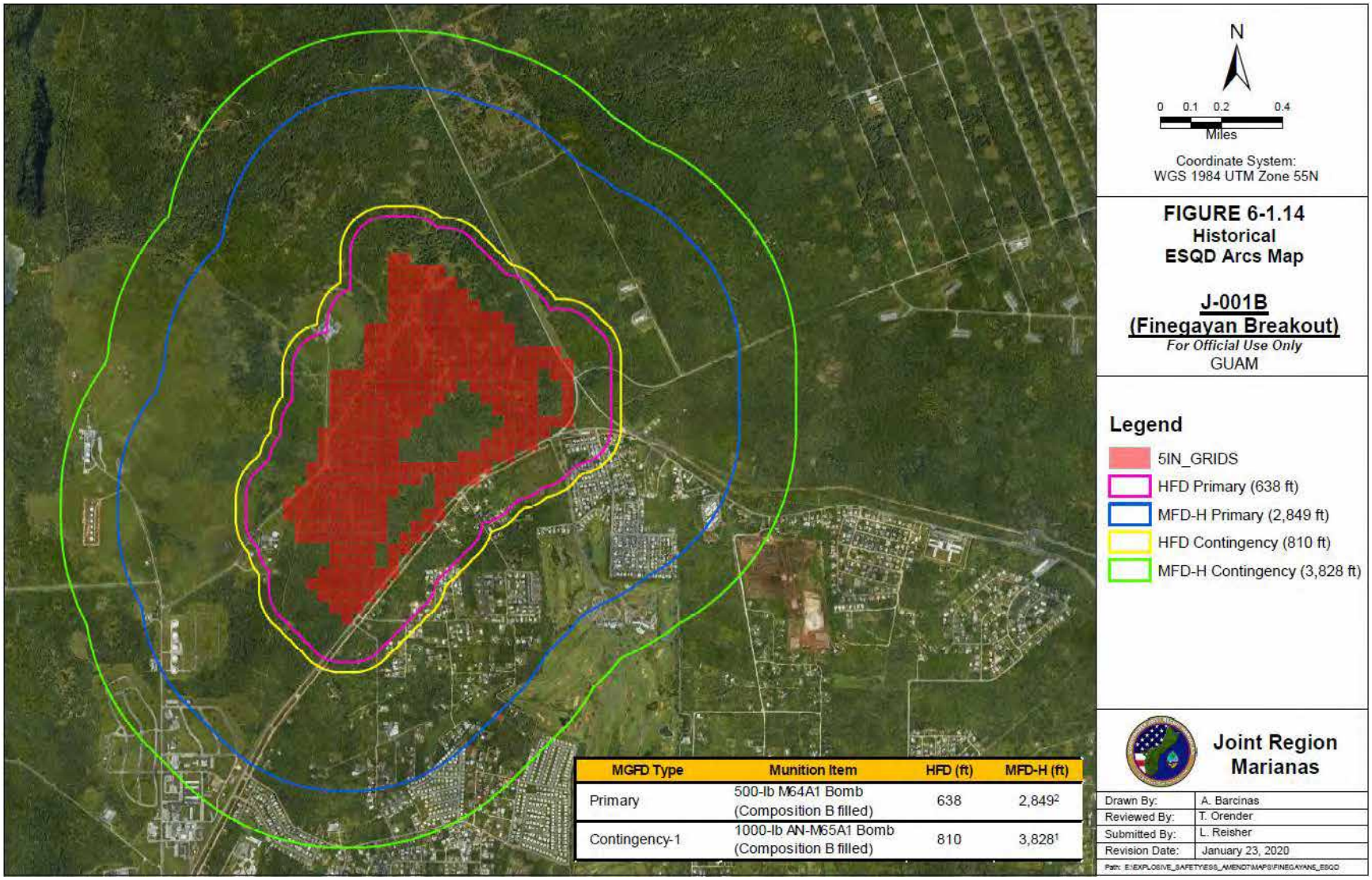


MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	500-lb M64A1 Bomb (Composition B filled)	638	2,849[2]
Contingency	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,828[1]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.

Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.

Note 2: Based on the 500 pound AN-M64A1 Bomb (Amatol filled), as amended per DDESB comment.

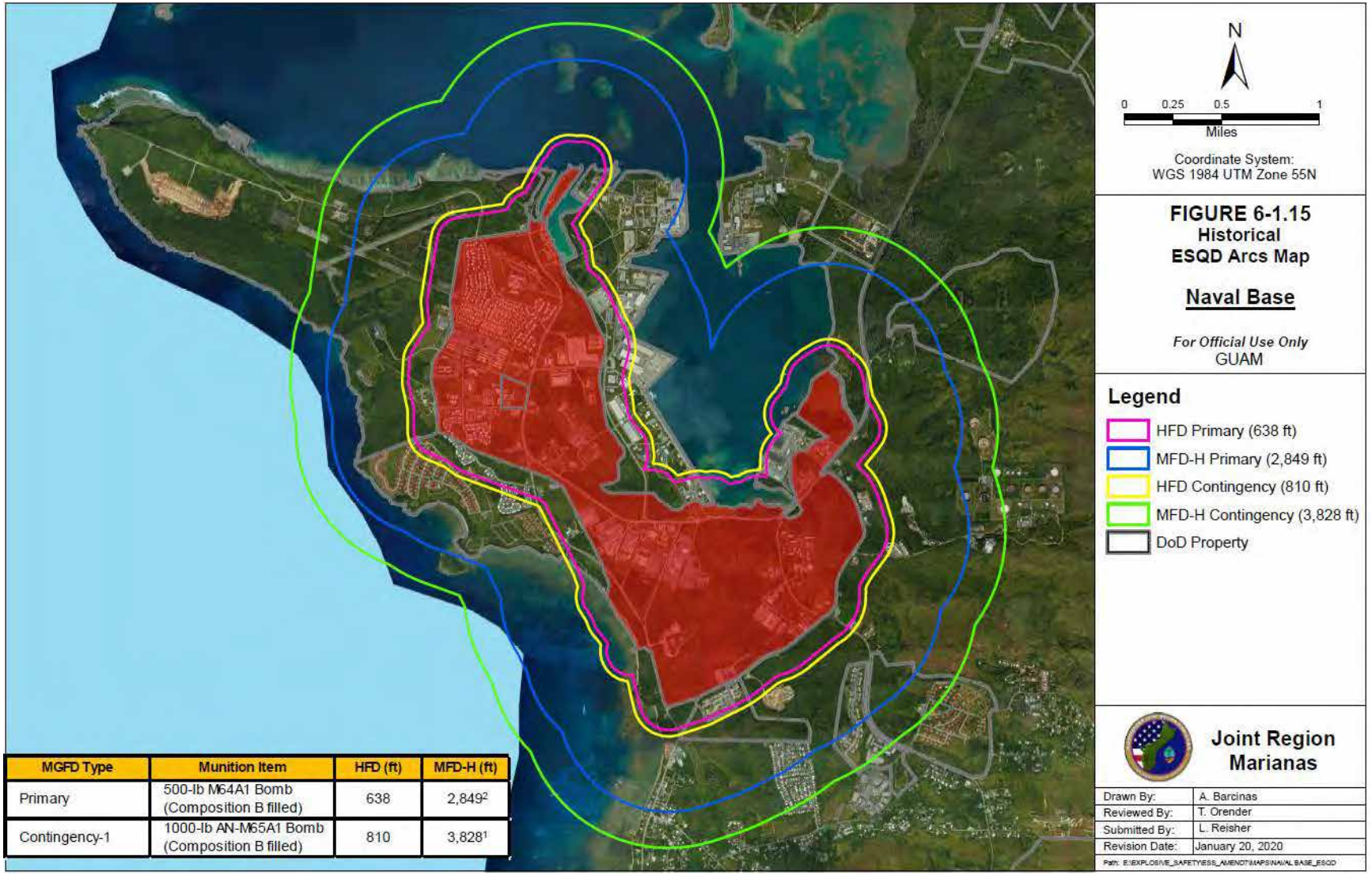


MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	500-lb M64A1 Bomb (Composition B filled)	638	2,849[2]
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,828[1]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.

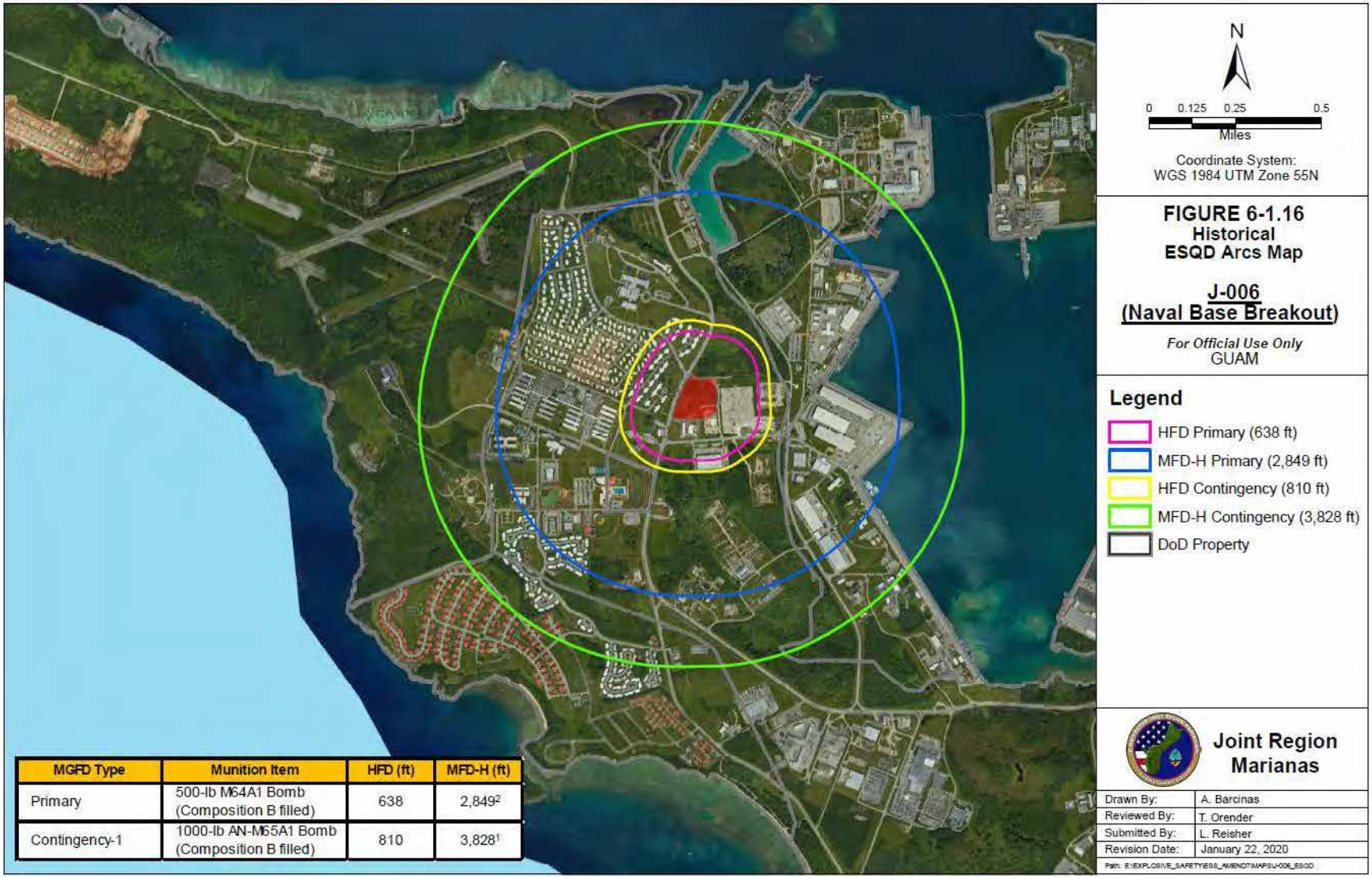
Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.

Note 2: Based on the 500 pound AN-M64A1 Bomb (Amatol filled), as amended per DDESB comment.



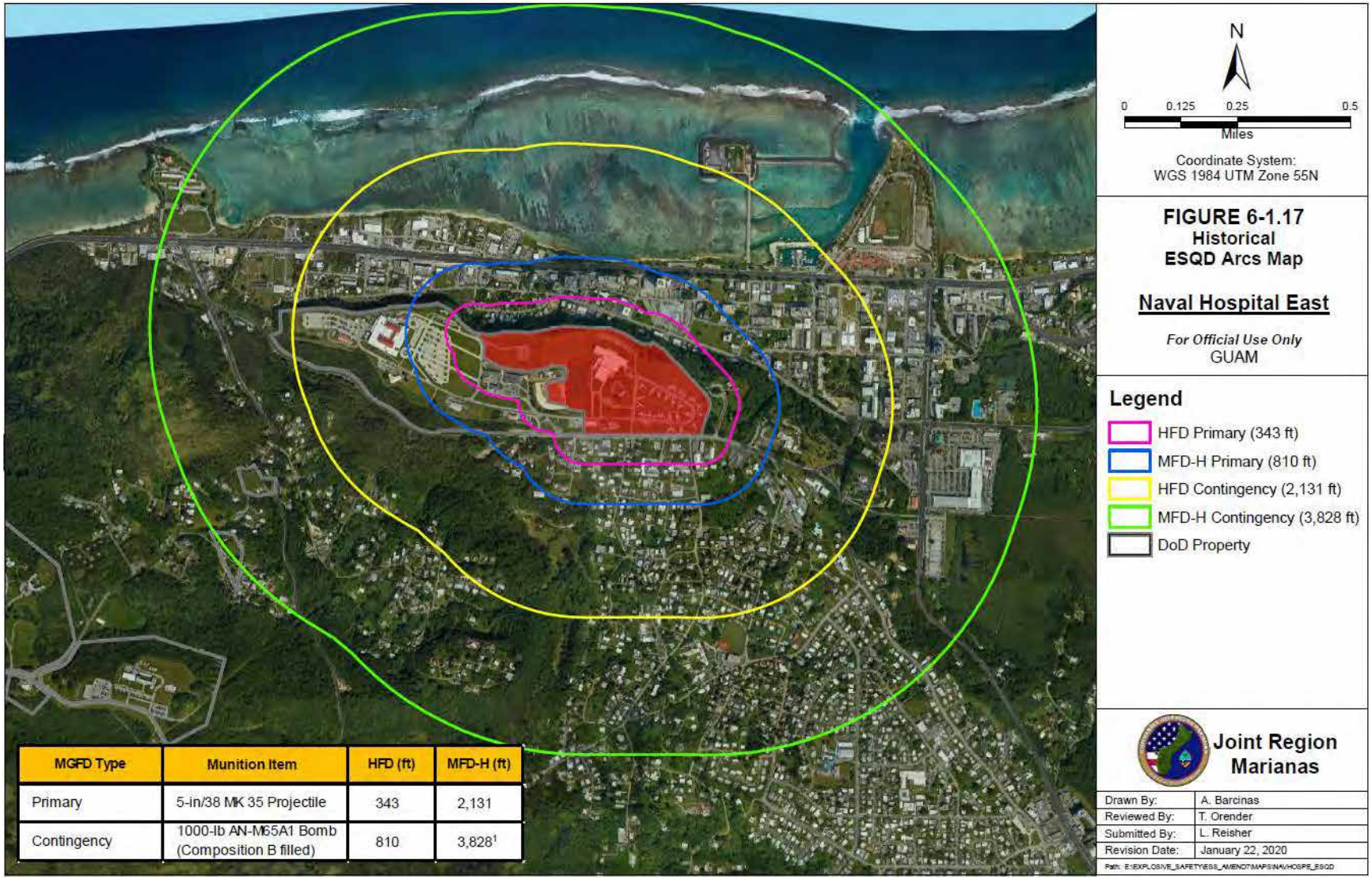
MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	500-lb M64A1 Bomb (Composition B filled)	638	2,849[2]
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,828[1]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.
Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.
Note 2: Based on the 500 pound AN-M64A1 Bomb (Amatol filled), as amended per DDESB comment.



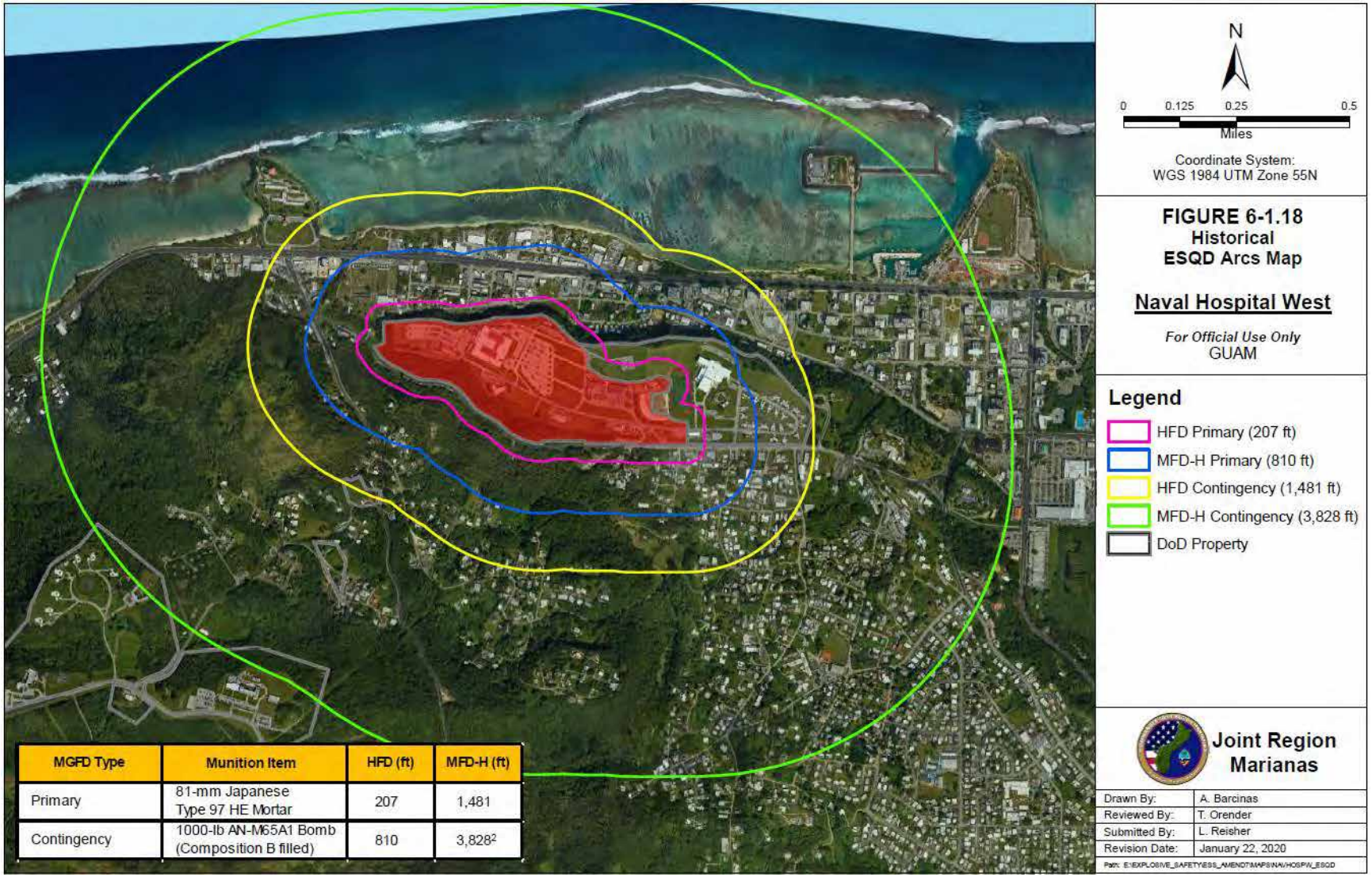
MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	500-lb M64A1 Bomb (Composition B filled)	638	2,849[2]
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,828[1]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.
Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.
Note 2: Based on the 500 pound AN-M64A1 Bomb (Amatol filled), as amended per DDESB comment.



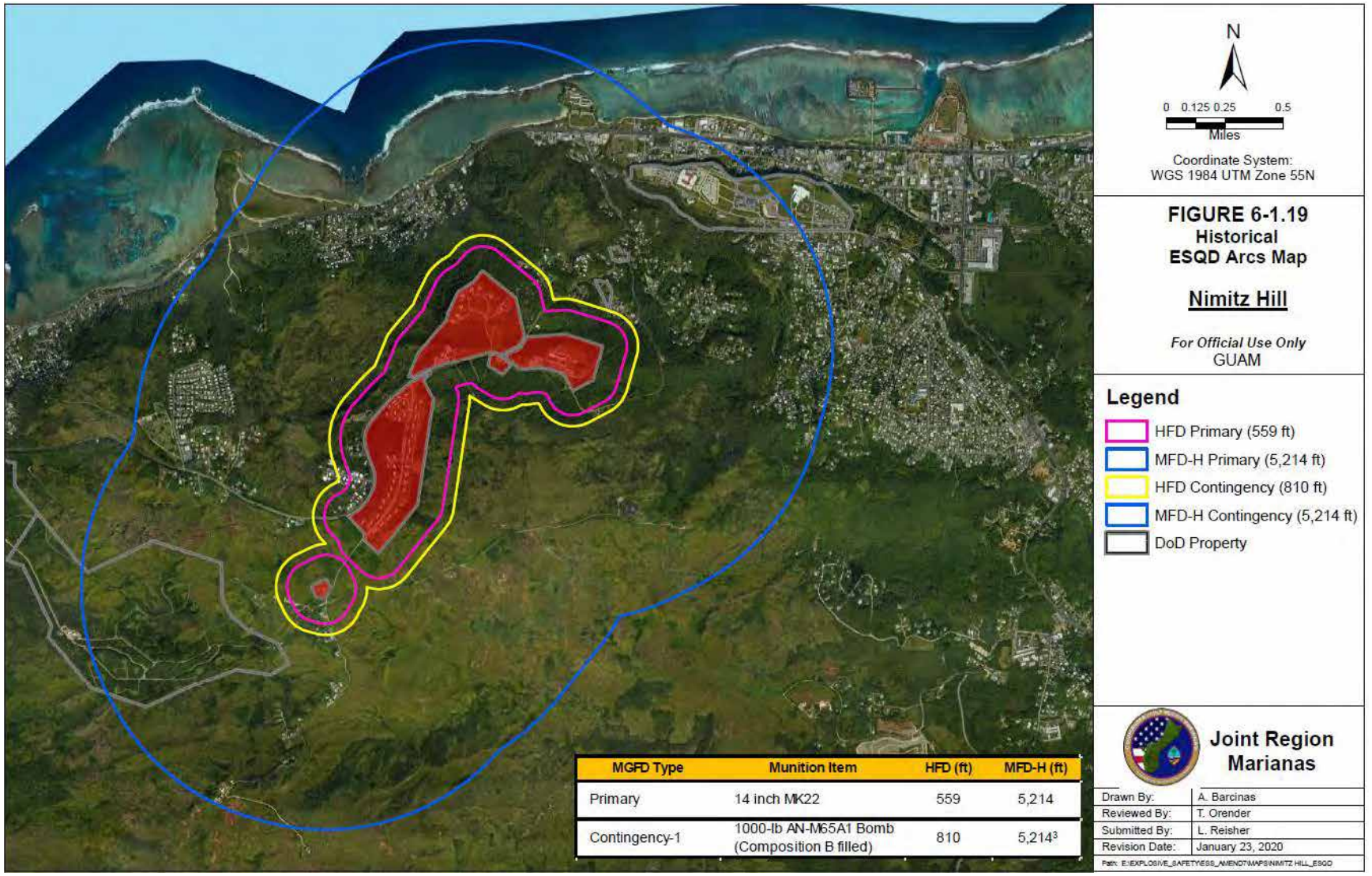
MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	5-in/38 MK 35 Projectile	343	2,131
Contingency	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,828[1]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.
Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.



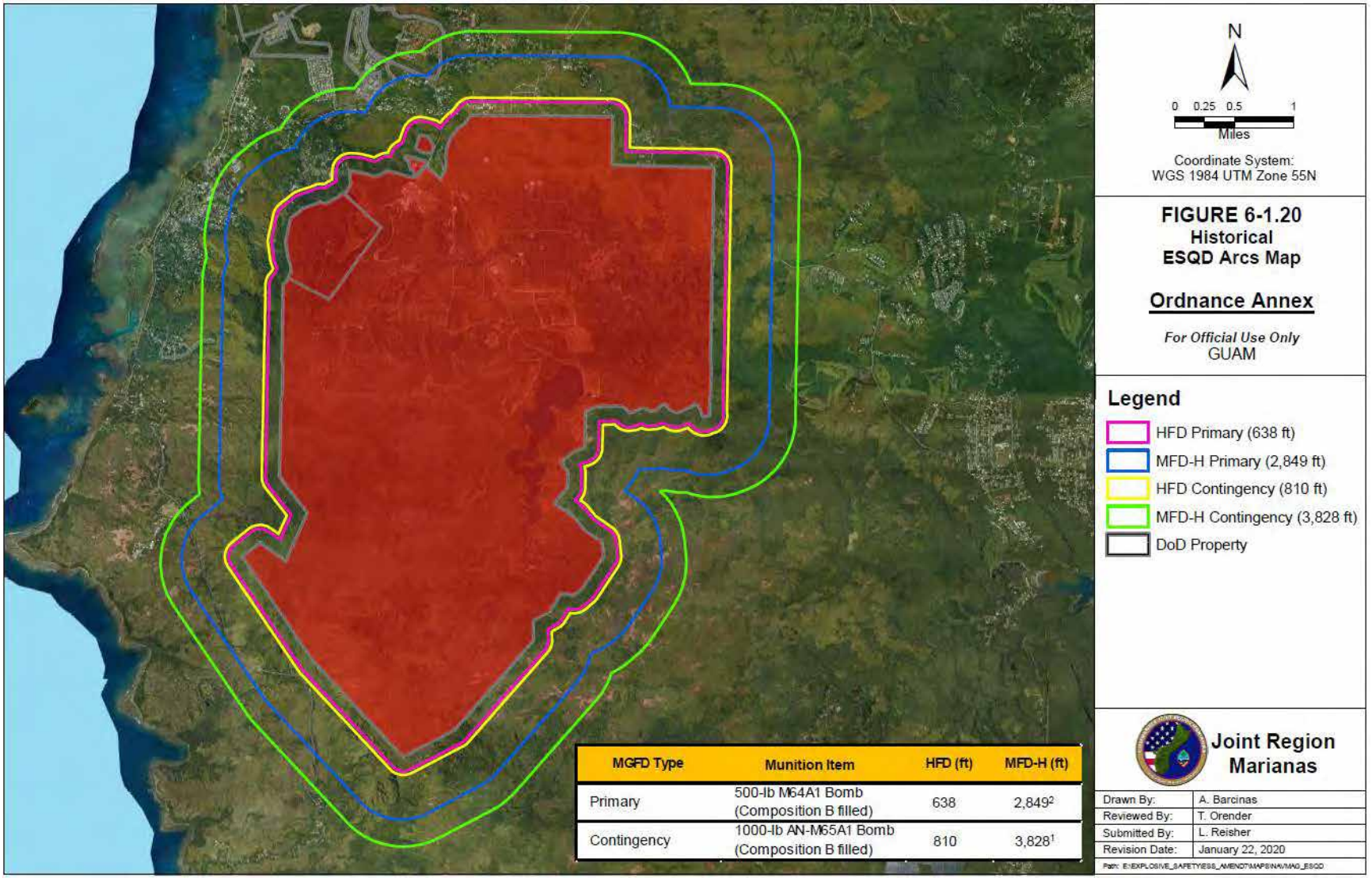
MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	81-mm Japanese Type 97 HE Mortar	207	1,481
Contingency	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,828[2]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.
Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.



MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	14 inch MK22	559	5,214
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	5,214[3]

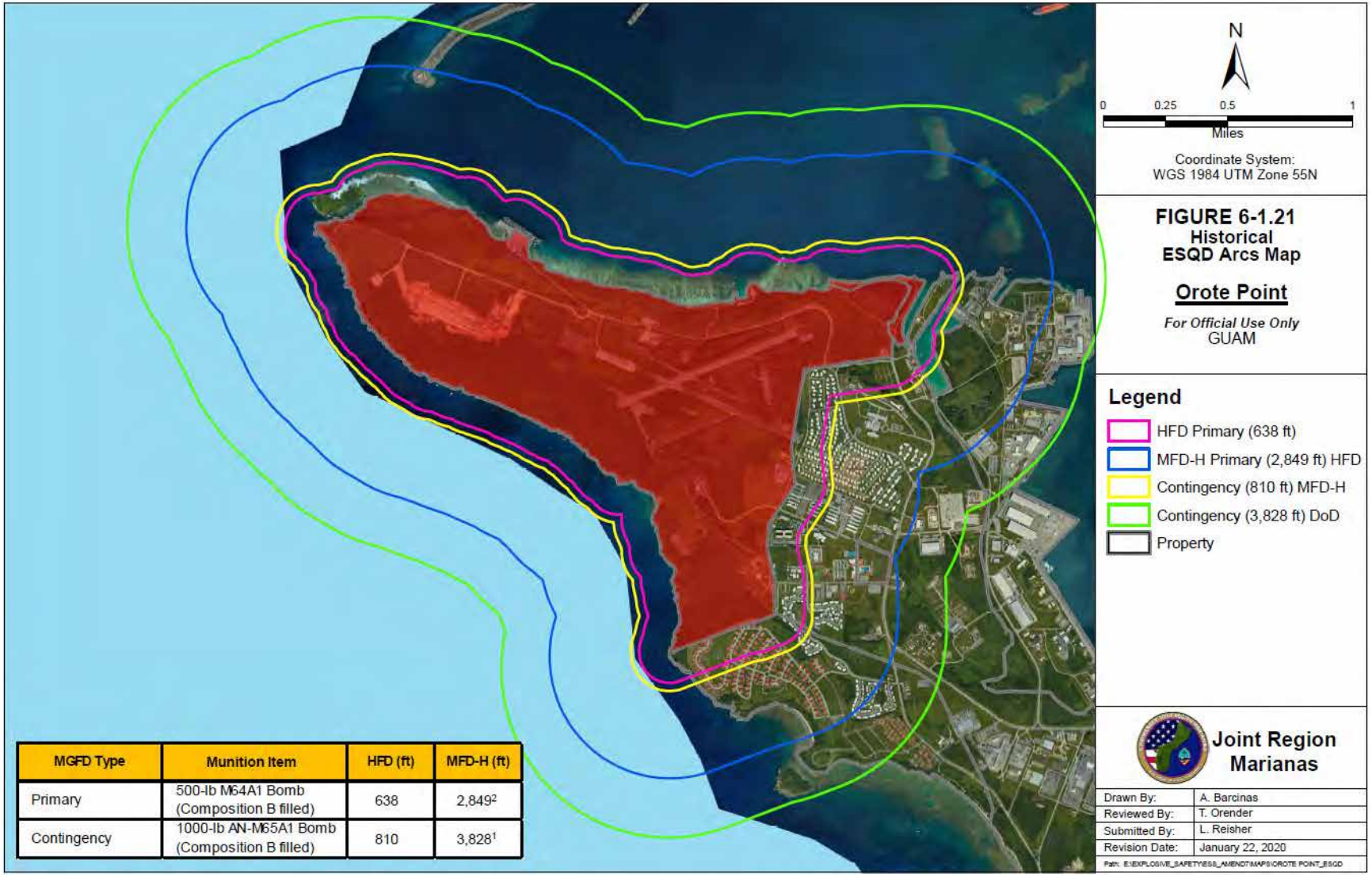
General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.
Note 3: MFD Based on the primary MFD-H, as amended per DDESB comment.



General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.

Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.

Note 2: Based on the 500 pound AN-M64A1 Bomb (Amatol filled), as amended per DDESB comment.

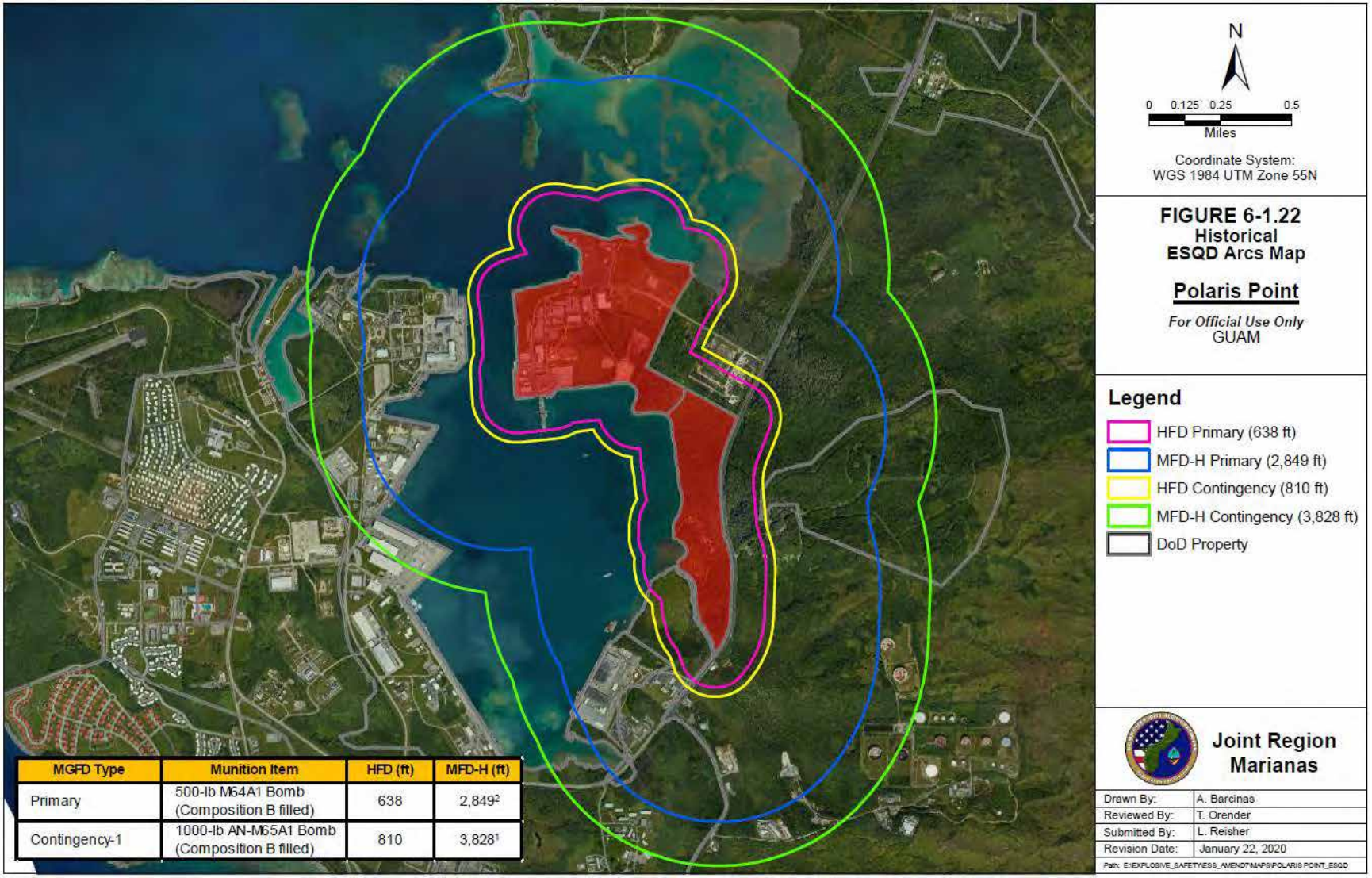


MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	500-lb M64A1 Bomb (Composition B filled)	638	2,849[2]
Contingency	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,828[1]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.

Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.

Note 2: Based on the 500 pound AN-M64A1 Bomb (Amatol filled), as amended per DDESB comment.

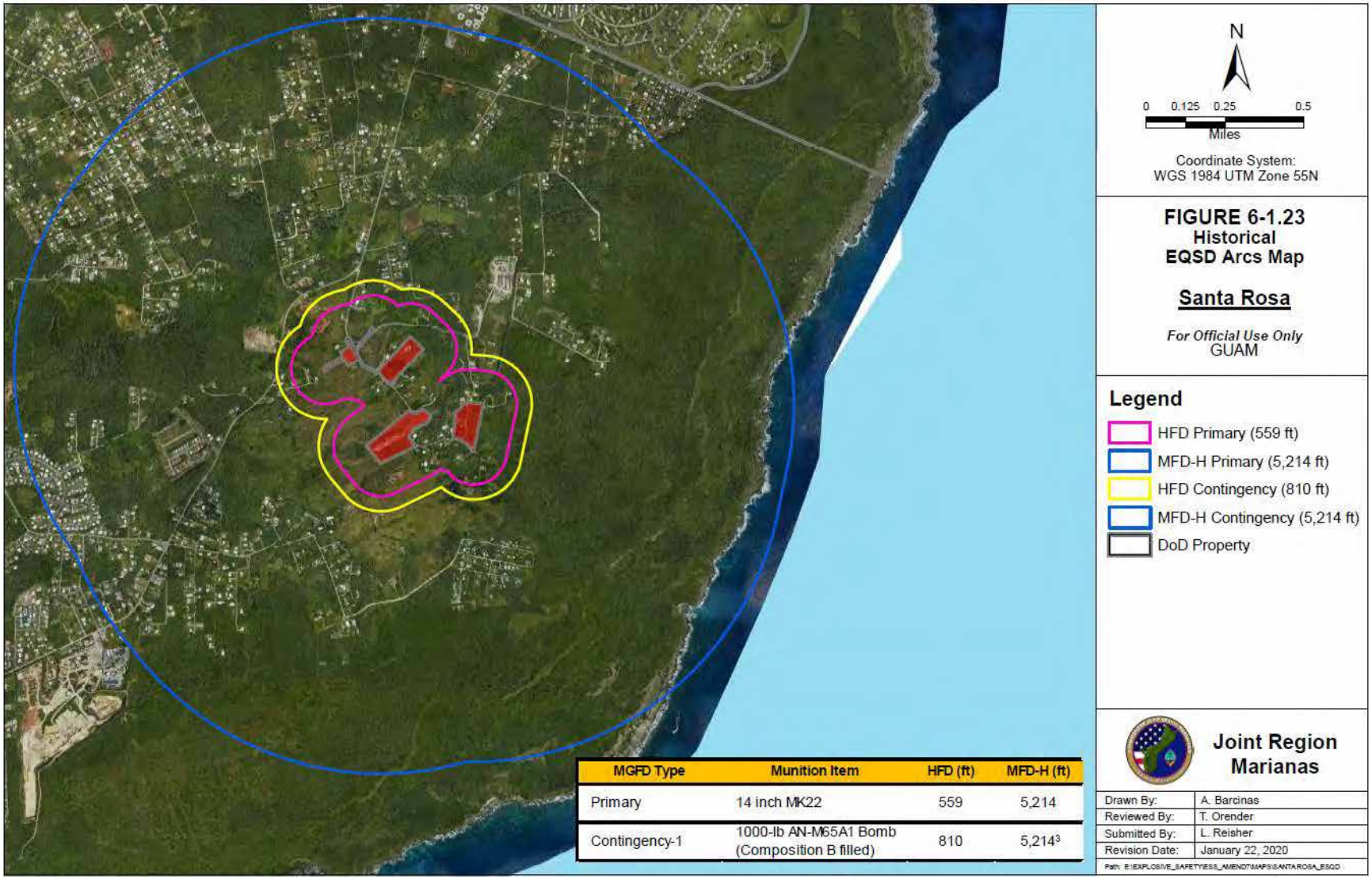


MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	500-lb M64A1 Bomb (Composition B filled)	638	2,849[2]
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,828[1]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.

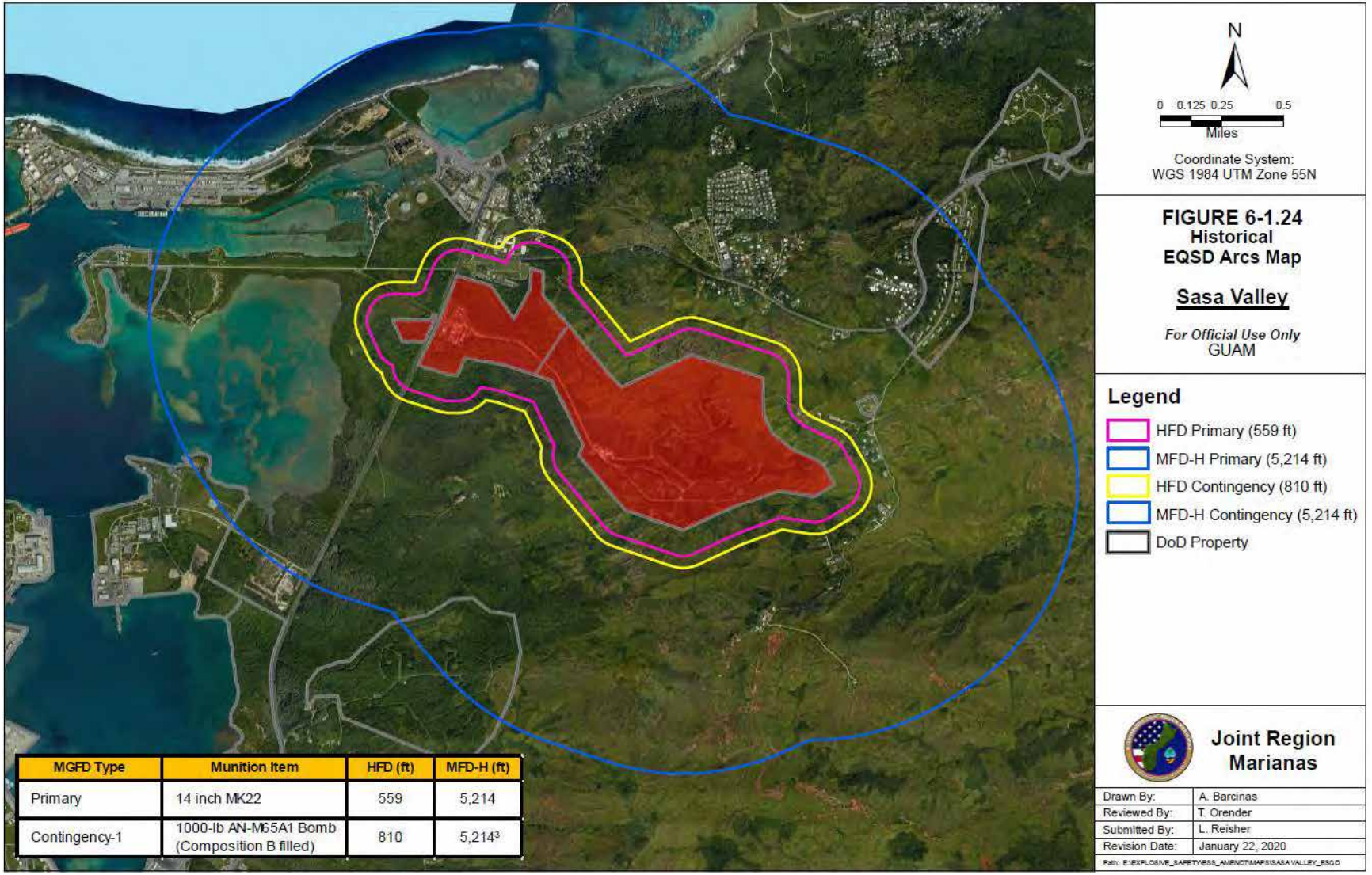
Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.

Note 2: Based on the 500 pound AN-M64A1 Bomb (Amatol filled), as amended per DDESB comment.



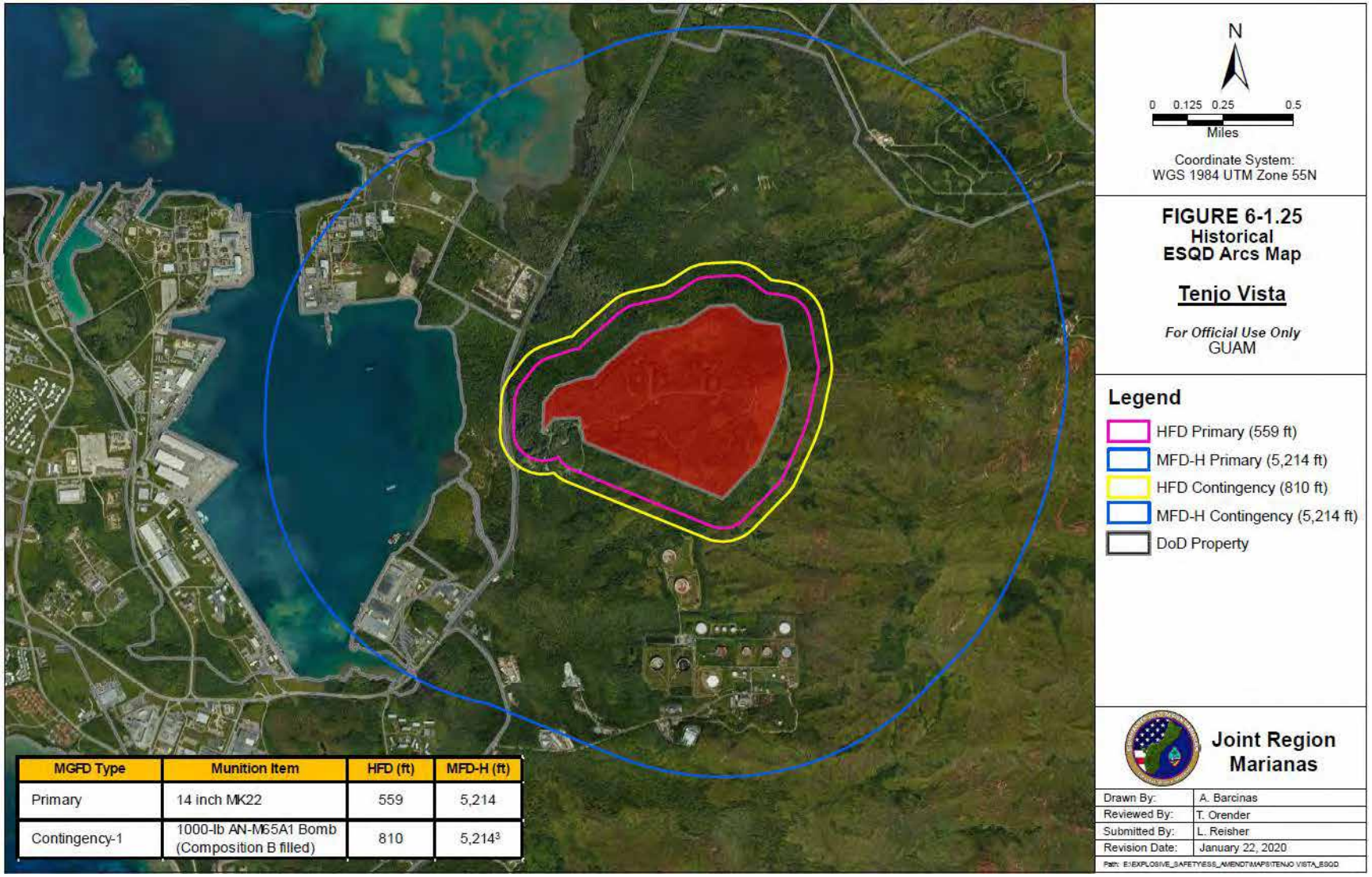
MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	14 inch MK22	559	5,214
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	5,214[3]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.
Note 3: MFD Based on the primary MFD-H, as amended per DDESB comment.



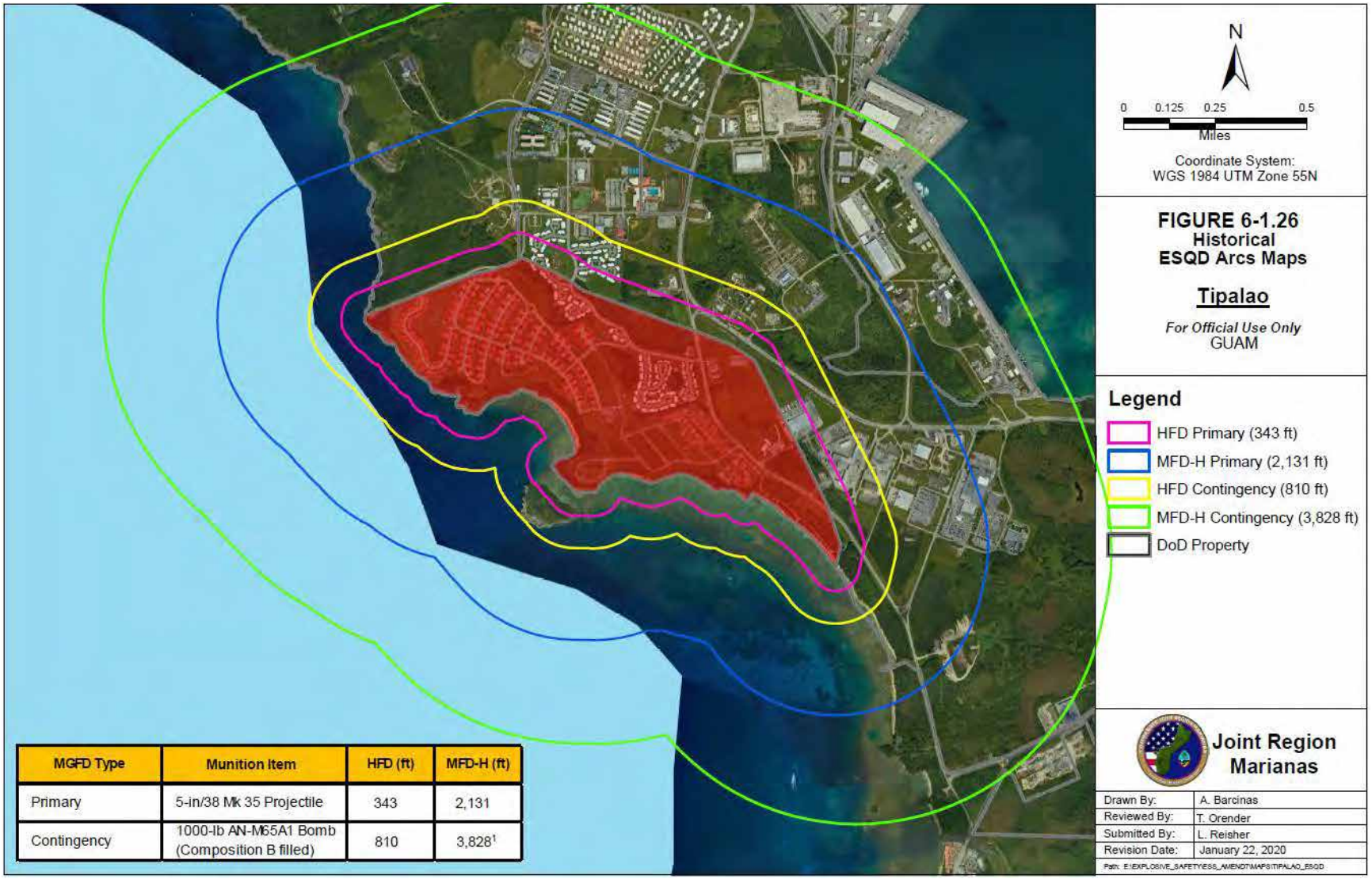
MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	14 inch MK22	559	5,214
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	5,214[3]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.
Note 3: MFD Based on the primary MFD-H, as amended per DDESB comment.



MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	14 inch MK22	559	5,214
Contingency-1	1000-lb AN-M65A1 Bomb (Composition B filled)	810	5,214[3]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.
Note 3: MFD Based on the primary MFD-H, as amended per DDESB comment.



MGFD Type	Munition Item	HFD (ft)	MFD-H (ft)
Primary	5-in/38 Mk 35 Projectile	343	2,131
Contingency	1000-lb AN-M65A1 Bomb (Composition B filled)	810	3,828[1]

General Note: Information is historical data per para 1.4. See approved Annex for ESQD Arcs for a specific project site.

Note 1: Based on the 1,000 pound AN-M65A1 Bomb (TNT filled), as amended per DDESB comment.

Table 6-3.1: PESs Encumbering – Andersen AFB

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
8400	ECM	AAFB Areas 2, 3, & 4	1,149	260,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8401	ECM	AAFB Areas 2, 3, & 4	1,245	330,895	500K >450	500 K	(13) 500K <450	500K	MEQ
8402	ECM	AAFB Areas 2, 3, & 4	1,253	337,638	500K >450	500 K	(13) 500K <450	500K	MEQ
8403	ECM	AAFB Areas 2, 3, & 4	1,272	352,894	500K >450	500 K	(13) 500K <450	500K	MEQ
8404	ECM	AAFB Areas 2, 3, & 4	1,288	366,549	500K >450	500 K	(13) 500K <450	500K	MEQ
8405	ECM	AAFB Areas 2, 3, & 4	1,325	398,688	500K >450	500 K	(13) 500K <450	500K	MEQ
8406	ECM	AAFB Areas 2, 3, & 4	1,372	442,451	500K >450	500 K	(13) 500K <450	500K	MEQ
8407	ECM	AAFB Areas 2, 3, & 4	1,427	498,049	500K >450	500 K	(13) 500K <450	500K	MEQ
8408	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8409	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8410	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8411	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8412	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8413	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8414	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8415	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
8416	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8418	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8419	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8420	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8421	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8422	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8423	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8424	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8425	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8426	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8427	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8428	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8429	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8463	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8464	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8465	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8466	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
8467	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8468	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8469	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8470	ECM	AAFB Areas 2, 3, & 4	1,401	472,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8471	ECM	AAFB Areas 2, 3, & 4	1,332	405,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8472	ECM	AAFB Areas 2, 3, & 4	1,269	350,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8473	ECM	AAFB Areas 2, 3, & 4	1,214	307,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8474	ECM	AAFB Areas 2, 3, & 4	1,171	275,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8475	ECM	AAFB Areas 2, 3, & 4	1,134	250,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8476	ECM	AAFB Areas 2, 3, & 4	1,122	242,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8477	ECM	AAFB Areas 2, 3, & 4	1,114	237,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8478	ECM	AAFB Areas 2, 3, & 4	1,111	235,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8479	ECM	AAFB Areas 2, 3, & 4	1,117	239,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8500	ECM	AAFB Areas 2, 3, & 4	720	64,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8501	ECM	AAFB Areas 2, 3, & 4	880	117,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8502	ECM	AAFB Areas 2, 3, & 4	1,063	206,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8503	ECM	AAFB Areas 2, 3, & 4	1,166	272,000	500K >450	500 K	(13) 500K <450	500K	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
8504	ECM	AAFB Areas 2, 3, & 4	1,161	268,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8505	ECM	AAFB Areas 2, 3, & 4	1,152	262,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8506	ECM	AAFB Areas 2, 3, & 4	1,146	258,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8507	ECM	AAFB Areas 2, 3, & 4	1,140	254,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8508	ECM	AAFB Areas 2, 3, & 4	1,131	248,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8509	ECM	AAFB Areas 2, 3, & 4	1,125	244,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8510	ECM	AAFB Areas 2, 3, & 4	1,122	242,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8511	ECM	AAFB Areas 2, 3, & 4	1,115	238,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8512	ECM	AAFB Areas 2, 3, & 4	1,109	234,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8513	ECM	AAFB Areas 2, 3, & 4	1,103	230,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8514	ECM	AAFB Areas 2, 3, & 4	1,100	228,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8515	ECM	AAFB Areas 2, 3, & 4	1,095	225,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8516	ECM	AAFB Areas 2, 3, & 4	1,088	221,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8600	ECM	AAFB Areas 2, 3, & 4	547	28,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8601	ECM	AAFB Areas 2, 3, & 4	791	85,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8602	ECM	AAFB Areas 2, 3, & 4	1,038	192,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8603	ECM	AAFB Areas 2/3, & 4	1,155	264,000	500K >450	500 K	(13) 500K <450	500K	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
8604	ECM	AAFB Areas 2, 3, & 4	1,152	262,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8605	ECM	AAFB Areas 2, 3, & 4	1,150	260,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8606	ECM	AAFB Areas 2, 3, & 4	1,143	256,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8607	ECM	AAFB Areas 2, 3, & 4	1,137	252,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8608	ECM	AAFB Areas 2, 3, & 4	1,134	250,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8609	ECM	AAFB Areas 2, 3, & 4	1,131	248,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8610	ECM	AAFB Areas 2, 3, & 4	1,125	244,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8611	ECM	AAFB Areas 2, 3, & 4	1,122	242,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8612	ECM	AAFB Areas 2, 3, & 4	1,115	238,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8613	ECM	AAFB Areas 2, 3, & 4	1,112	236,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8614	ECM	AAFB Areas 2, 3, & 4	1,106	232,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8615	ECM	AAFB Areas 2, 3, & 4	1,096	226,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8616	ECM	AAFB Areas 2, 3, & 4	1,095	225,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8617	ECM	AAFB Areas 2, 3, & 4	1,185	285,323	500K >450	500 K	(13) 500K <450	500K	MEQ
8618	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8619	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8620	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
8621	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8622	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8623	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8624	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8625	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8626	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8627	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8628	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8629	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8630	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8631	ECM	AAFB Areas 2, 3, & 4	1,429	500,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8700	ECM	AAFB Areas 2, 3, & 4	709	61,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8701	ECM	AAFB Areas 2, 3, & 4	846	104,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8702	ECM	AAFB Areas 2, 3, & 4	1,013	178,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8703	ECM	AAFB Areas 2, 3, & 4	1,103	230,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8704	ECM	AAFB Areas 2, 3, & 4	1,103	230,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8705	ECM	AAFB Areas 2, 3, & 4	1,103	230,000	500K >450	500 K	(13) 500K <450	500K	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
8706	ECM	AAFB Areas 2, 3, & 4	1,106	232,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8707	ECM	AAFB Areas 2, 3, & 4	1,106	232,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8708	ECM	AAFB Areas 2, 3, & 4	1,106	232,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8709	ECM	AAFB Areas 2, 3, & 4	1,109	234,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8710	ECM	AAFB Areas 2, 3, & 4	1,109	234,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8711	ECM	AAFB Areas 2, 3, & 4	1,109	234,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8712	ECM	AAFB Areas 2, 3, & 4	1,112	236,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8713	ECM	AAFB Areas 2, 3, & 4	1,112	236,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8714	ECM	AAFB Areas 2, 3, & 4	1,109	234,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8715	ECM	AAFB Areas 2, 3, & 4	1,109	234,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8716	ECM	AAFB Areas 2, 3, & 4	1,115	238,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8717	ECM	AAFB Areas 2, 3, & 4	1,112	236,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8718	ECM	AAFB Areas 2, 3, & 4	1,115	238,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8719	ECM	AAFB Areas 2, 3, & 4	1,115	238,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8720	ECM	AAFB Areas 2, 3, & 4	1,115	238,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8721	ECM	AAFB Areas 2, 3, & 4	1,115	238,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8722	ECM	AAFB Areas 2, 3, & 4	1,115	238,000	500K >450	500 K	(13) 500K <450	500K	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
8723	ECM	AAFB Areas 2, 3, & 4	1,115	238,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8724	ECM	AAFB Areas 2, 3, & 4	1,115	238,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8725	ECM	AAFB Areas 2, 3, & 4	1,115	238,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8726	ECM	AAFB Areas 2, 3, & 4	1,115	238,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8727	ECM	AAFB Areas 2, 3, & 4	1,115	238,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8728	ECM	AAFB Areas 2, 3, & 4	1,115	238,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8729	ECM	AAFB Areas 2, 3, & 4	1,115	238,000	500K >450	500 K	(13) 500K <450	500K	MEQ
8730	ECM	AAFB Areas 2, 3, & 4	1,109	234,000	500K >450	500 K	(13) 500K <450	500K	MEQ
7A-1	AGM	AAFB Areas 2, 3, & 4	923	135,000	500K >450	500K	(13) 500K <450	500K	MEQ
10C 3	AGM	AAFB Areas 2, 3, & 4	1,134	250,000	500K >450	500 K	(13) 500K <450	500K	MEQ
10C 5	AGM	AAFB Areas 2, 3, & 4	1,134	250,000	500K >450	500 K	(13) 500K <450	300K	MEQ
10C 6	AGM	AAFB Areas 2, 3, & 4	-	-	-	-	-	-	MEQ
10C 7	AGM	AAFB Areas 2, 3, & 4	1,134	250,000	500K >450	500K	(13) 500K <450	400K	MEQ
11C 8	AGM	AAFB Areas 2, 3, & 4	-	-	-	-	-	-	MEQ
11D 2	AGM	AAFB Areas 2, 3, & 4	835	100,000	500K >450	500K	(13) 500K <450	400K	MEQ
4 E1	EOL	AAFB Areas 2, 3, & 4	1,099	227,350	500K >450	500K	(13) 500K <450	500K	MEQ
8200	AGM	AAFB Areas 2, 3, & 4	1,143	256,000	500K >450	500K	(13) 500K <450	500K	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
8202	AGM	AAFB Areas 2, 3, & 4	1,143	256,000	500K >450	500K	(13) 500K <450	500K	MEQ
8204	AGM	AAFB Areas 2, 3, & 4	1,235	323,000	500K >450	500K	(13) 500K <450	500K	MEQ
9010	EOL	AAFB Areas 2, 3, & 4	388	10,000	25K >450	50K	(13) 500K <450	50K	MEQ
9012	AGM	AAFB Areas 2, 3, & 4	388	10,000	10K >450	10K	(13) 10K <450	10K	MEQ
9014	AGM	AAFB Areas 2, 3, & 4	388	10,000	10K >450	10K	(13) 10K <450	10K	MEQ
9016	EOL	AAFB Areas 2, 3, & 4	257	2,900	1K <99	50K	(07) 50K <116	195K	MEQ
9028	AGM	AAFB Areas 2, 3, & 4	1,147	259,000	500K >450	500 K	(13) 500K <450	500K	MEQ
9030	AGM	AAFB Areas 2, 3, & 4	1,163	270,000	500K >450	500 K	(13) 500K <450	500K	MEQ
9032	AGM	AAFB Areas 2, 3, & 4	1,022	183,300	500K >450	500 K	(13) 500K <450	500K	MEQ
9200	EOL	AAFB Areas 2, 3, & 4	742	70,000	50K >450	50K	(13) 50K <450	50K	MEQ
9018 (TMMF)	EOL	AAFB Areas 2, 3, & 4	663	50,000	500K >450	500 K	(13) 500K <450	200K	MEQ
9100 Area	EOL	AAFB Areas 2, 3, 4, & 5	705	60,000	90K >450	100 K	100K	100K	MEQ
51109	EOL	AAFB Areas 5, 6, & 7	489	20,000	25K >450	50K	50K	50K	MEQ
51150B	EOL	AAFB Areas 5, 6, & 7	480	19,000	20K >450	20K	(13) 20K <450	50K	MEQ
51243	ECF	AAFB Areas 5, 6, & 7	489	20,000	25K >450	500K	(13) 500K <450	500K	MEQ
51246	ECF	AAFB Areas 5, 6, & 7	571	32,000	44K >450	500K	(13) 500K <450	500K	MEQ
51247	ECF	AAFB Areas 5, 6, & 7	571	32,000	86K >450	500K	(13) 500K <450	500K	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
51249	ECF	AAFB Areas 5, 6, & 7	429	13,500	150K >450	500K	(13) 500K <450	500K	MEQ
51250	ECM	AAFB Areas 5, 6, & 7	-	-	13.6K <344	500K	(11) 500K <344	500K	MEQ
51253	ECM	AAFB Areas 5, 6, & 7	640	45,000	500K>450	500 K	(13) 500K <450	500K	MEQ
51254	ECM	AAFB Areas 5, 6, & 7	605	38,000	500K >450	500 K	(13) 500K <450	500K	MEQ
51255	ECM	AAFB Areas 5, 6, & 7	633	43,400	500K >450	500 K	(13) 500K <450	500K	MEQ
51256	ECM	AAFB Areas 5, 6, & 7	643	45,600	500K >450	500 K	(13) 50K <45	500K	MEQ
51257	ECM	AAFB Areas 5, 6, & 7	559	30,000	500K >450	500 K	(13) 500K <450	500K	MEQ
51258	ECM	AAFB Areas 5, 6, & 7	646	46,300	500K >450	500 K	(13) 500K <450	500K	MEQ
51259	ECM	AAFB Areas 5, 6, & 7	821	95,000	500K >450	500 K	(13) 500K <450	500K	MEQ
51260	ECM	AAFB Areas 5, 6, & 7	776	80,000	500K >450	500 K	(13) 50K <45	500K	MEQ
51261	ECM	AAFB Areas 5, 6, & 7	724	65,000	500K >450	500 K	(13) 500K <450	500K	MEQ
51262	ECM	AAFB Areas 5, 6, & 7	663	50,000	500K >450	500 K	(13) 500K <450	500K	MEQ
51263	FMHA	AAFB Areas 5, 6, & 7	1,114	237,000	250K >100	250K	(13) 250K <450	250K	MEQ
51264	ECM	AAFB Areas 5, 6, & 7	643	45,600	500K >450	500 K	(13) 50K <45	500K	MEQ
51266	ECM	AAFB Areas 5, 6, & 7	-	-	83.3K >321	500K	(13) 500K <321	500K	MEQ
EOD Frag Range	IDS	AAFB Areas 4, 5, & 7	-	600	-	-	-	-	-
Silver Flag Range	IDS	AAFB Area 2	-	166	-	-	-	-	-

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
Red Horse Quarry	IDS	AAFB Area 2	-	30	-	-	-	-	-
C04	CAP	AAFB Area 6	552	28,800	50,000 >450	50,000	(13) 50,000 ≤ 450	50,000	MEQ
C05	CAP	AAFB Area 6	264	3,150	900 ≤ 99	50,000	(06) 50,000 ≤ 105	50,000	MEQ
C07	CAP	AAFB Area 6	277	3,650	0	9,000	(03) 50,000 ≤ 45	30,400	MEQ
C09	CAP	AAFB Area 6	577	33,000	2650 ≤170	50,000	(08) 50,000 ≤ 170	50,000	MEQ
C10	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C11	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C12	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C13	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C14	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C15	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C16	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C17	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C18	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C19	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C20	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
C21	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C22	CAP	AAFB Area 6	370	8,700	10,000 >450	10,000	(12) 10,000 ≤ 450	10,000	MEQ
C23	CAP	AAFB Area 6	370	8,700	10,000 >450	10,000	(12) 50,000 ≤ 450	10,000	MEQ
C24	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C25	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C26	CAP	AAFB Area 6	370	8,700	10,000 >450	10,000	(12) 50,000 ≤ 450	10,000	MEQ
C27	CAP	AAFB Area 6	370	8,700	10,000 >450	10,000	(12) 50,000 ≤ 450	10,000	MEQ
C28	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C29	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C30	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C31	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C32	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C34	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C35	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C36	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C37	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
C38	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C39	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C40	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C41	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C43	CAP	AAFB Area 6	360	8,000	5,000 >450	5,000	(12) 5,000 ≤ 450	5,000	MEQ
C44	CAP	AAFB Area 6	360	8,000	5,000 >450	5,000	(12) 5,000 ≤ 450	5,000	MEQ
C45	CAP	AAFB Area 6	577	33,000	50,00 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C46	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C47	CAP	AAFB Area 6	360	8,000	5,000 >450	5,000	(12) 5,000 ≤ 450	5,000	MEQ
C48	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C49	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C50	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C51	CAP	AAFB Area 6	360	8,000	5,000 >450	5,000	(12) 5,000 ≤ 450	5,000	MEQ
C52	CAP	AAFB Area 6	360	8,000	5,000 >450	5,000	(12) 5,000 ≤ 450	5,000	MEQ
C53	CAP	AAFB Area 6	360	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C46	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
C47	CAP	AAFB Area 6	360	8,000	5,000 >450	5,000	(12) 5,000 ≤ 450	5,000	MEQ
C48	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C49	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C50	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C51	CAP	AAFB Area 6	360	8,000	5,000 >450	5,000	(12) 5,000 ≤ 450	5,000	MEQ
C52	CAP	AAFB Area 6	360	8,000	5,000 >450	5,000	(12) 5,000 ≤ 450	5,000	MEQ
C53	CAP	AAFB Area 6	360	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C54	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C55-1	CAP	AAFB Area 6	-	-	10K >450	10K	(12) 10K ≤ 450	10K	MEQ
C55-2	CAP	AAFB Area 6	289	4,150	10K >450	10K	(13) 10K ≤ 450	6,100	MEQ
C56	CAP	AAFB Area 6	577	33,000	50,000 >450	50,000	(12) 50,000 ≤ 450	50,000	MEQ
C57	CAP	AAFB Area 6	289	4,150	10K >450	10K	(13) 10K ≤ 450	6,180	MEQ
C58-1	CAP	AAFB Area 6	-	-	10K >450	10K	(12) 10K ≤ 450	10K	MEQ
C58-2	CAP	AAFB Area 6	289	4,150	10K >450	10K	(13) 10K ≤ 450	5,900	MEQ
C59	CAP	AAFB Area 6	289	4,150	10K >450	10K	(13) 10K ≤450	10K	MEQ
C60	CAP	AAFB Area 6	289	4,150	10K >450	10K	(13) 10K ≤450	5,900	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
C62-1	CAP	AAFB Area 6	289	4,150	10K >450	10K	(13) 10K ≤450	10K	MEQ
C62-2	CAP	AAFB Area 6	289	4,150	10K >450	10K	(13) 10K ≤450	6,100	MEQ
C64	CAP	AAFB Area 6	289	4,150	10K >450	10K	(13) 10K ≤450	6,100	MEQ
C66-1	CAP	AAFB Area 6	289	4,150	10K >450	10K	(13) 10K ≤450	10K	MEQ
C66-2	CAP	AAFB Area 6	289	4,150	10K >450	10K	(13) 10K ≤450	5,900	MEQ
C68	CAP	AAFB Area 6	289	4,150	10K >450	10K	(12) 10K ≤450	5,900	MEQ
C70-1	CAP	AAFB Area 6	289	4,150	10K ≤420	10K	(12) 10K ≤420	10K	MEQ
FS1	CAP	AAFB Area 6	91	130	160 ≤ 75	300	(05) 300 ≤ 40	1,000	MEQ
FS2	CAP	AAFB Area 6	91	130	160 ≤ 75	300	(05) 300 ≤ 40	1,000	MEQ
FS3	CAP	AAFB Area 6	91	130	160 ≤ 75	300	(05) 300 ≤ 40	1,000	MEQ
FS4	CAP	AAFB Area 6	91	130	160 ≤ 75	300	(05) 300 ≤ 40	1,000	MEQ
FS5	CAP	AAFB Area 6	91	130	160 ≤ 80	300	(05) 300 ≤ 40	1,000	MEQ
FS6	CAP	AAFB Area 6	91	130	160 ≤ 80	300	(05) 300 ≤ 40	1,000	MEQ
FS7	CAP	AAFB Area 6	91	130	160 ≤ 80	300	(05) 300 ≤ 40	1,000	MEQ
FS8	CAP	AAFB Area 6	91	130	160 ≤ 80	300	(05) 300 ≤ 40	1,000	MEQ
FS9	CAP	AAFB Area 6	91	130	160 ≤ 80	300	(05) 300 ≤ 40	1,000	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
FS10	CAP	AAFB Area 6	91	130	160 ≤ 80	300	(05) 300 ≤ 40	1,000	MEQ
FS11	CAP	AAFB Area 6	91	130	160 ≤ 80	300	(05) 300 ≤ 40	1,000	MEQ
FS12	CAP	AAFB Area 6	91	130	160 ≤ 80	300	(05) 300 ≤ 40	1,000	MEQ
S28	CAP	AAFB Area 6	206	1,500	490 ≤ 80	2,300	(05) 10,000 ≤ 80	10,000	MEQ
S32	CAP	AAFB Area 6	206	1,500	500 ≤ 80	2,300	(05) 10,000 ≤ 80	10,000	MEQ
S36	CAP	AAFB Area 6	206	1,500	500 ≤ 80	2,300	(05) 10,000 ≤ 80	10,000	MEQ
S40	CAP	AAFB Area 6	206	1,490	480 ≤ 80	2,300	(05) 10,000 ≤ 80	10,000	MEQ
S48	CAP	AAFB Area 6	105	200	1000 ≤ 110	2,200	(07) 10,000 ≤ 110	10,000	MEQ
S83	ECA	AAFB Areas, 6, & 8	-	-	-	-	-	3K	MEQ
S85	ECA	AAFB Areas, 6, & 8	-	-	-	-	-	3K	MEQ
S87	ECA	AAFB Areas, 6, & 8	113	250	180 <50	3K	(3) 3K <50	8K	MEQ
S91	ECA	AAFB Areas, 6, & 8	143	500	180 <65	3K	(4) 3K <65	8K	MEQ
S95	ECA	AAFB Areas, 6, 7, & 8	489	20,000	10.4K <300	200K	(10) 200K <300	200K	MEQ
S96	ECA	AAFB Areas, 6, 7, & 8	280	30,000	28K >450	100K	(12) 100K <450	100K	MEQ
S97	ECA	AAFB Areas, 6, 7, & 8	559	30,000	28K >450	200K	(12) 200K <450	200K	MEQ
S98	ECA	AAFB Areas, 6, 7, & 8	559	30,000	28K >450	100K	(12) 100K <450	100K	MEQ
HS-1	CAP	AAFB Area 6	84	100	256 <59	8,016	(04) 8,106 <59	6,180	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
HS-2	CAP	AAFB Area 6	87	111	266 <59	8,016	(04) 8,106 <59	6,180	MEQ
HS-3	CAP	AAFB Area 6	91	129	256 <59	8,016	(04) 8,106 <59	6,180	MEQ
HS-4	CAP	AAFB Area 6	96	152	276 <59	8,016	(04) 8,106 <59	6,180	MEQ
HS-5	CAP	AAFB Area 6	102	183	259 <59	8,016	(04) 8,106 <59	6,180	MEQ
HS-6	CAP	AAFB Area 6	109	221	276 <59	8,016	(04) 8,106 <59	5,713	MEQ
HS-7	CAP	AAFB Area 6	116	271	259 <59	8,016	(04) 8,106 <59	5,713	MEQ
HS-8	CAP	AAFB Area 6	119	290	266 <59	8,016	(04) 8,106 <59	5,944	MEQ
HS-9	CAP	AAFB Area 6	115	264	269 <59	8,016	(04) 8,106 <59	6,180	MEQ
HS-10	CAP	AAFB Area 6	113	250	155 <46	6,036	(03) 8,106 <46	6,180	MEQ

Table 6-3.1 Notes:

a. All PES are located within the ESS Areas, distances to specific construction footprints are unknown.
b. IL/K18 = Unbarricaded intraline (IL) distance, derived from NAVSEA OP 5, Table 7-10. Quantities not found in Table 7-10 were calculated using the formula $D\text{-}18W^{1/3}$.
c. AGM= Above Ground Magazine
d. CAP= Combat Aircraft Parking
e. ECF= Earth Covered Flow-through
f. EOL= Explosive Operating Location
g. FMHA= Flight line Munitions Holding Area
h. IDS= Intentional Detonation Site
i. MCE = maximum credible event
j. MEQ= Mission Essential Quantities

Table 6-3.2: PESs Encumbering – Orote Point

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
Kilo Wharf	Ammun-ition Terminal	Orote Point	2,596	3M	3M	3M	3M	3M	MEQ
Orote Point Pad	Orote Pt Pad	Orote Point	956	150K	-	-	-	-	MEQ
Helipad 1	Hard Stand	Orote Point	308	5K	-	-	-	-	MEQ
Helipad 2	Hard Stand	Orote Point	308	5K	-	-	-	-	MEQ
Helipad 3	Hard Stand	Orote Point	308	5K	-	-	-	-	MEQ
Alpha Wharf	General Berth	Orote Point	705	60K	-	-	-	-	MEQ
425-1	ECM	Orote Point	888	120K	500K, MCE>450	500K	(13) 500K, ≤450	382,000	MEQ
425-2	ECM	Orote Point	857	108K	500K, MCE>450	500K	(13) 500K, ≤450	500K	MEQ
425-3	ECM	Orote Point	849	105K	500K, MCE>450	500K	(13) 500K, ≤450	500K	MEQ
425-4	ECM	Orote Point	862	110K	500K, MCE>450	500K	(13) 500K, ≤450	500K	MEQ
425-5	ECM	Orote Point	905	127K	500K, MCE>450	500K	(13) 500K, ≤450	409K	MEQ
425-6	ECM	Orote Point	932	139K	500K, MCE>450	500K	(13) 500K, ≤450	319K	MEQ
425-7	ECM	Orote Point	907	128K	500K, MCE>450	500K	(13) 500K, ≤450	298K	MEQ
425-8	ECM	Orote Point	914	131K	500K, MCE>450	500K	(13) 500K, ≤450	303K	MEQ
425-9	ECM	Orote Point	941	143K	500K, MCE>450	500K	(13) 500K, ≤450	343K	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
425-10	ECM	Orote Point	943	144K	500K, MCE>450	500K	(13) 500K, ≤450	338K	MEQ
425-11	ECM	Orote Point	919	133K	500K, MCE>450	500K	(13) 500K, ≤450	309K	MEQ
425-12	ECM	Orote Point	978	87K	500K, MCE>450	500K	(13) 500K, ≤450	310K	MEQ
425-13	ECM	Orote Point	923	135K	500K, MCE>450	500K	(13) 500K, ≤450	342K	MEQ
425-14	ECM	Orote Point	950	147K	500K, MCE>450	500K	(13) 500K, ≤450	340K	MEQ
425-15	ECM	Orote Point	827	97K	500K, MCE>450	500K	(13) 500K, ≤450	235K	MEQ
425-16	ECM	Orote Point	870	113K	500K, MCE>450	500K	(13) 500K, ≤450	489K	MEQ
425-17	ECM	Orote Point	873	114K	500K, MCE>450	500K	(13) 500K, ≤450	500K	MEQ
425-18	ECM	Orote Point	873	114K	500K, MCE>450	500K	(13) 500K, ≤450	500K	MEQ
425-19	ECM	Orote Point	852	106K	500K, MCE>450	500K	(13) 500K, ≤450	500K	MEQ
425-20	ECM	Orote Point	818	94K	500K, MCE>450	500K	(13) 500K, ≤450	500K	MEQ
425-21	ECM	Orote Point	813	92K	500K, MCE>450	500K	(13) 500K, ≤450	500K	MEQ
425-22	ECM	Orote Point	813	92K	500K, MCE>450	500K	(13) 500K, ≤450	500K	MEQ
425-23	ECM	Orote Point	827	97K	500K, MCE>450	500K	(13) 500K, ≤450	500K	MEQ
425-24	ECM	Orote Point	827	97K	500K, MCE>450	500K	(13) 500K, ≤450	500K	MEQ
425-25	ECM	Orote Point	816	93K	500K, MCE>450	500K	(13) 500K, ≤450	500K	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
425-26	ECM	Orote Point	816	93K	500K, MCE>450	500K	(13) 500K, ≤450	500K	MEQ
425-27	ECM	Orote Point	827	97K	500K, MCE>450	500K	(13) 500K, ≤450	500K	MEQ
425-28	ECM	Orote Point	376	9113	500K, MCE>450	500K	(13) 500K, ≤450	500K	MEQ

Table 6-3.2 Notes:

a. All PES are located within the ESS Area, distances to specific construction footprints are unknown.
b. IL/K18 = Unbarricaded IL distance, derived from NAVSEA OP 5, Table 7-10. Quantities not found in Table 7-10 were calculated using the formula $D=18W^{1/3}$.
c. ECM = Earth Covered Magazine
d. MEQ= Mission Essential Quantities

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Table 6-3.3: PESs Encumbering – Polaris Point

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
Kilo Wharf	Ammun-ition Terminal	Orote Point	2,596	3M	3M	3M	3M	3M	MEQ
Bravo Wharf North	Ammun-ition Terminal	Polaris Point	245	2,500	800	30K	(06)800	30K	MEQ
Bravo Wharf South	Ammun-ition Terminal	Polaris Point	245	2,500	800	30K	(06)800	30K	MEQ

Table 6-3.3 Notes:

- **a.** All PES are located within the ESS Area, distances to specific construction footprints are unknown.
- **b.** IL/K18 = Unbarricaded IL distance, derived from NAVSEA OP 5, Table 7-10. Quantities not found in Table 7-10 were calculated using the formula $D=18W^{1/3}$.
- **c.** MEQ= Mission Essential Quantities

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Table 6-3.4: PESs Encumbering – Ordnance Annex

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
1012NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13) 500K, ≤450	500K	MEQ
1013NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13) 500K, ≤450	500K	MEQ
1017NM	ECM	Ordnance Annex, Maanot	837	100,500	500K, MCE >450	500K	(13) 500K, ≤450	500K	MEQ
418NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13) 500K, ≤450	500K	MEQ
419NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13) 500K, ≤450	500K	MEQ
420NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13) 500K, ≤450	500K	MEQ
421NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13) 500K, ≤450	500K	MEQ
422NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13) 500K, ≤450	500K	MEQ
423NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13) 500K, ≤450	500K	MEQ
424NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13) 500K, ≤450	500K	MEQ
425NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13) 500K, ≤450	500K	MEQ
426NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13) 500K, ≤450	500K	MEQ
427NM	ECM	Ordnance Annex, Maanot	1,134	250K	500K, MCE >450	500K	(13) 500K, ≤450	500K	MEQ
428NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13) 500K, ≤450	500K	MEQ
429NM	ECM	Ordnance Annex, Maanot	1,134	250K	500K, MCE >450	500K	(13) 500K, ≤450	500K	MEQ
430NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13) 500K, ≤450	500K	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
431NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
432NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
433NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
434NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
435NM	ECM	Ordnance Annex, Maanot	1,227	316,700	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
436NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
437NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
438NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
439NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
440NM	ECM	Ordnance Annex, Maanot	1,392	462,500	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
441NM	ECM	Ordnance Annex, Maanot	825	96,200	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
442NM	ECM	Ordnance Annex, Maanot	1,214	307K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
443NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
444NM	ECM	Ordnance Annex, Maanot	627	42,200	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
445NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
446NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
447NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
448NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
449NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
450NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
451NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
452NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
453NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE >450	500K	(13)500K, ≤450	500K	MEQ
454NM	ECM	Ordnance Annex, Maanot	444	15K	15K, MCE >450	15K	(13)500K, ≤450	15K	MEQ
455NM	ECM	Ordnance Annex, Maanot	444	15K	15K, MCE >450	15K	(13)500K, ≤450	15K	MEQ
456NM	ECM	Ordnance Annex, Maanot	444	15K	15K, MCE >450	15K	(13)500K, ≤450	15K	MEQ
457NM	ECM	Ordnance Annex, Maanot	444	15K	15K, MCE >450	15K	(13)500K, ≤450	15K	MEQ
458NM	ECM	Ordnance Annex, Maanot	444	15K	15K, MCE >450	15K	(13)500K, ≤450	15K	MEQ
459NM	ECM	Ordnance Annex, Maanot	444	15K	15K, MCE >450	15K	(13)500K, ≤450	15K	MEQ
629NM	OSA	Ordnance Annex, Maanot	576	32,700	378,600, MCE >450	500K	(13)500K, ≤450	436,183	MEQ
630NM	OSA	Ordnance Annex, Maanot	589	35K	500K, MCE >450	500K	(13)500K, ≤450	461,026	MEQ
631NM	OSA	Ordnance Annex, Maanot	550	28,500	500K, MCE >450	500K	(13)500K, ≤450	388,510	MEQ
632NM	OSA	Ordnance Annex, Maanot	453	15,900	500K, MCE 99	500K	(13)500K, ≤450	236,310	MEQ
633NM	OSA	Ordnance Annex, Maanot	429	13,500	500K, MCE 99	500K	(13)500K, ≤450	203,635	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
634NM	OSA	Ordnance Annex, Maanot	206	13,500	500K, MCE 99	500K	(13)500K, ≤450	203,635	MEQ
635NM	OSA	Ordnance Annex, Maanot	385	9,800	200,400, MCE 99	500K	(13)500K, ≤450	152,870	MEQ
636NM	OSA	Ordnance Annex, Maanot	385	9,800	240,200, MCE 99	500K	(13)500K, ≤450	152,870	MEQ
638NM	OSA	Ordnance Annex, Maanot	502	21,700	240,200, MCE>450	500K	(13)500K, ≤450	309,020	MEQ
639NM	OSA	Ordnance Annex, Maanot	502	21,700	500K, MCE>450	500K	(13)500K, ≤450	309,020	MEQ
746NM	ECM	Ordnance Annex, Maanot	0	0	0	0	0	0	MEQ
747NM	ECM	Ordnance Annex, Maanot	942	143,400	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
748NM	ECM	Ordnance Annex, Maanot	712	61,900	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
749NM	ECM	Ordnance Annex, Maanot	748	71,700	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
750NM	ECM	Ordnance Annex, Maanot	561	30,200	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
751NM	ECM	Ordnance Annex, Maanot	1,155	264,200	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
752NM	ECM	Ordnance Annex, Maanot	1,104	230,700	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
753NM	ECM	Ordnance Annex, Maanot	534	26,100	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
754NM	ECM	Ordnance Annex, Maanot	552	28,800	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
755NM	ECM	Ordnance Annex, Maanot	627	42,200	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
756NM	ECM	Ordnance Annex, Maanot	223	18,900	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
757NM	ECM	Ordnance Annex, Maanot	1,203	298,500	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
758NM	ECM	Ordnance Annex, Maanot	1,138	252,500	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
759NM	ECM	Ordnance Annex, Maanot	1,248	333,300	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
760NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
761NM	ECM	Ordnance Annex, Maanot	533	260,100	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
762NM	ECM	Ordnance Annex, Maanot	556	294,100	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
763NM	ECM	Ordnance Annex, Maanot	595	360,400	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
764NM	ECM	Ordnance Annex, Maanot	1,140	254,000	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
765NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
780NM	ECM	Ordnance Annex, Maanot	909	128,800	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
781NM	ECM	Ordnance Annex, Maanot	1,269	350K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
782NM	ECM	Ordnance Annex, Maanot	1,134	250K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
783NM	ECM	Ordnance Annex, Maanot	1,269	350K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
784NM	ECM	Ordnance Annex, Maanot	1,269	350K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
785NM	ECM	Ordnance Annex, Maanot	1,269	350K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
786NM	ECM	Ordnance Annex, Maanot	927	136,600	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
800NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
801NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
802NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
803NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
804NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
805NM	ECM	Ordnance Annex, Maanot	1,386	456,500	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
806NM	ECM	Ordnance Annex, Maanot	702	59,300	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
807NM	ECM	Ordnance Annex, Maanot	993	167,900	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
808NM	ECM	Ordnance Annex, Maanot	825	96,200	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
809NM	ECM	Ordnance Annex, Maanot	1,134	250K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
810NM	ECM	Ordnance Annex, Maanot	936	140,600	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
811NM	ECM	Ordnance Annex, Maanot	918	132,600	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
812NM	ECM	Ordnance Annex, Maanot	627	42,200	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
813NM	ECM	Ordnance Annex, Maanot	879	116,400	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
814NM	ECM	Ordnance Annex, Maanot	945	144,700	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
815NM	ECM	Ordnance Annex, Maanot	621	41,000	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
816NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
817NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
818NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
819NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
820NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
821NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
822NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
823NM	ECM	Ordnance Annex, Maanot	801	88,100	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
824NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
825NM	ECM	Ordnance Annex, Maanot	1,134	250K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
826NM	ECM	Ordnance Annex, Maanot	627	421,900	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
827NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
828NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
829NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
830NM	ECM	Ordnance Annex, Maanot	569	316,700	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
831NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
832NM	ECM	Ordnance Annex, Maanot	1,008	175,600	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
833NM	ECM	Ordnance Annex, Maanot	1,355	426,500	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
834NM	ECM	Ordnance Annex, Maanot	930	137,900	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
842NM	ECM	Ordnance Annex, Maanot	1,056	201,900	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
843NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
844NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
845NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
846NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
847NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
848NM	ECM	Ordnance Annex, Maanot	1,305	381,100	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
849NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
850NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
851NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
871NM	ECM	Ordnance Annex, Maanot	388	10K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
872NM	ECM	Ordnance Annex, Maanot	388	10K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
873NM	ECM	Ordnance Annex, Maanot	388	10K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
874NM	ECM	Ordnance Annex, Maanot	388	10K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
875NM	ECM	Ordnance Annex, Maanot	388	10K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
876NM	ECM	Ordnance Annex, Maanot	388	10K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
904NM	ECM	Ordnance Annex, Maanot	948	146,000	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
905NM	ECM	Ordnance Annex, Maanot	1,219	310,500	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
852NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
853NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
854NM	ECM	Ordnance Annex, Maanot	651	47,300	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
855NM	ECM	Ordnance Annex, Maanot	489	200,200	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
856NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
857NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
858NM	ECM	Ordnance Annex, Maanot	1,429	500K	500K, MCE>450	500K	(13)500K, ≤450	500K	MEQ
EOD Disposal Area[(3)]	Emerg-ency Deton-ation Site	Ordnance Annex, Maanot	-	3K	-	-	-	-	-

Table 6-3.4 Notes:

a. All PES are located within the ESS Area, distances to specific construction footprints are unknown.

b. IL/K18 = Unbarricaded IL distance, derived from NAVSEA OP 5, Table 7-10. Quantities not found in Table 7-10 were calculated using the formula $D=18W^{1/3}$.

c. MEQ= Mission Essential Quantities

APPENDIX C – SUPPORTING EXPLOSIVES SAFETY DATA

Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Surface-Launched HE Rounds
Munition:	20 mm M56A3/M56A4
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Projectile
Munition Case Classification:	Robust

DODIC:	A890
Date Record Created:	11/9/2006
Record Created By:	MMC
Last Date Record Updated:	5/3/2018
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	H-764 (RDX)
Explosive Weight (lb):	0.0264
Diameter (in):	0.7874
Cylindrical Case Weight (lb):	0.10516
Maximum Fragment Weight (Intentional) (lb):	0.0034
Design Fragment Weight (95%) (Unintentional) (lb):	0.0017
Critical Fragment Velocity (fps):	3064

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	1.3
TNT Equivalent Weight - Impulse (lbs):	0.034
Kinetic Energy 10^6 (lb-ft²/s²):	0.0307

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	12
Expected Max. Throw Distance (ft):	25
Minimum Separation Distance (ft):	25

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	24
Expected Max. Throw Distance (ft):	10
Minimum Separation Distance (ft):	12.5

Water Mitigation

Minimum Separation Distance (ft):	200/200
Water Containment System:	5 gal carboys/ inflatable pool

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	65
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	535
MFD-V [Maximum Fragment Distance, Vertical] (ft):	427

Overpressure Distances

TNT Equivalent (Pressure):	1.46
TNT Equivalent Weight - Pressure (lbs):	0.039
3.5 psi, K18 Distance (ft):	6
2.3 psi; K24 Distance (ft):	8
1.2 psi, K40 Distance (ft):	14
0.0655 psi, K328 Distance (ft):	111

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	1.86	1.00
Mild Steel:	0.36	0.20
Hard Steel:	0.30	0.16
Aluminum:	0.80	0.45
LEXAN:	3.04	2.11
Plexi-glass:	1.77	1.10
Bullet Resist Glass:	1.33	0.80

Item Notes

Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Grenades & Mines
Munition:	Mk II Grenade
Case Material:	Cast Iron, Grey, CL35
Fragmentation Method:	Pre-formed Fragmenting
Secondary Database Category:	Hand Grenade
Munition Case Classification:	Robust

DODIC:	G890
Date Record Created:	9/21/2004
Record Created By:	MMC
Last Date Record Updated:	5/3/2018
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	TNT
Explosive Weight (lb):	0.125
Diameter (in):	2.2600
Cylindrical Case Weight (lb):	0.24047
Maximum Fragment Weight (Intentional) (lb):	0.0129
Design Fragment Weight (95%) (Unintentional) (lb):	0.0043
Critical Fragment Velocity (fps):	578

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	1
TNT Equivalent Weight - Impulse (lbs):	0.125
Kinetic Energy 10^6 (lb-ft²/s²):	0.0021

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	12
Expected Max. Throw Distance (ft):	25
Minimum Separation Distance (ft):	25

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	24
Expected Max. Throw Distance (ft):	10
Minimum Separation Distance (ft):	12.5

Water Mitigation

Minimum Separation Distance (ft):	200/200
Water Containment System:	5 gal carboys/ inflatable pool

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	62
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	521
MFD-V [Maximum Fragment Distance, Vertical] (ft):	397

Overpressure Distances

TNT Equivalent (Pressure):	1
TNT Equivalent Weight - Pressure (lbs):	0.125
3.5 psi, K18 Distance (ft):	9
2.3 psi; K24 Distance (ft):	12
1.2 psi, K40 Distance (ft):	20
0.0655 psi, K328 Distance (ft):	164

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	1.15	0.79
Mild Steel:	0.07	0.05
Hard Steel:	0.06	0.04
Aluminum:	0.16	0.10
LEXAN:	1.61	1.23
Plexi-glass:	0.73	0.51
Bullet Resist Glass:	0.55	0.37

Item Notes

Fragment sizes, number of fragments and HFD came from test information. These numbers were used to calculate MFD-H using TP 16 Eq 4-34 & iterating using TRAJ to calculate the intial velocity. With this information, standard TP 16 methods were used to ca

Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Surface-Launched HE Rounds
Munition:	37 mm Japanese Type 94 HE
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Projectile
Munition Case Classification:	Robust

DODIC:	
Date Record Created:	2/1/2011
Record Created By:	SDH
Last Date Record Updated:	5/3/2018
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Picric Acid/TNT
Explosive Weight (lb):	0.176
Diameter (in):	1.2700
Cylindrical Case Weight (lb):	0.60700
Maximum Fragment Weight (Intentional) (lb):	0.0233
Design Fragment Weight (95%) (Unintentional) (lb):	0.0068
Critical Fragment Velocity (fps):	3170

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	0.93/1.0
TNT Equivalent Weight - Impulse (lbs):	0.170
Kinetic Energy 10^6 (lb-ft²/s²):	0.1170

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	12
Expected Max. Throw Distance (ft):	25
Minimum Separation Distance (ft):	25

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	24
Expected Max. Throw Distance (ft):	10
Minimum Separation Distance (ft):	12.5

Water Mitigation

Minimum Separation Distance (ft):	200/200
Water Containment System:	5 gal carboys/ inflatable pool

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	111
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	957
MFD-V [Maximum Fragment Distance, Vertical] (ft):	737

Overpressure Distances

TNT Equivalent (Pressure):	0.93/1.0
TNT Equivalent Weight - Pressure (lbs):	0.170
3.5 psi, K18 Distance (ft):	10
2.3 psi; K24 Distance (ft):	13
1.2 psi, K40 Distance (ft):	22
0.0655 psi, K328 Distance (ft):	182

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	2.79	1.75
Mild Steel:	0.53	0.34
Hard Steel:	0.43	0.28
Aluminum:	1.10	0.73
LEXAN:	4.08	3.04
Plexi-glass:	2.63	1.78
Bullet Resist Glass:	2.11	1.36

Item Notes

This item contains almost double the amount of explosives as the US 37 mm. This is based on the best information available.

Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Surface-Launched HE Rounds
Munition:	60 mm M49A2
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Mortar
Munition Case Classification:	Robust

DODIC:	B632
Date Record Created:	9/21/2004
Record Created By:	MMC
Last Date Record Updated:	5/3/2018
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	TNT
Explosive Weight (lb):	0.34
Diameter (in):	2.3622
Cylindrical Case Weight (lb):	1.45420
Maximum Fragment Weight (Intentional) (lb):	0.0570
Design Fragment Weight (95%) (Unintentional) (lb):	0.0159
Critical Fragment Velocity (fps):	3982

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	1
TNT Equivalent Weight - Impulse (lbs):	0.340
Kinetic Energy 10^6 (lb-ft²/s²):	0.4518

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	20
Expected Max. Throw Distance (ft):	125
Minimum Separation Distance (ft):	125

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	48
Expected Max. Throw Distance (ft):	10
Minimum Separation Distance (ft):	12.5

Water Mitigation

Minimum Separation Distance (ft):	264/200
Water Containment System:	5 gal carboys/ inflatable pool

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	152
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	1322
MFD-V [Maximum Fragment Distance, Vertical] (ft):	1025

Overpressure Distances

TNT Equivalent (Pressure):	1
TNT Equivalent Weight - Pressure (lbs):	0.340
3.5 psi, K18 Distance (ft):	13
2.3 psi; K24 Distance (ft):	17
1.2 psi, K40 Distance (ft):	28
0.0655 psi, K328 Distance (ft):	229

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	4.96	2.99
Mild Steel:	0.97	0.58
Hard Steel:	0.79	0.48
Aluminum:	1.97	1.23
LEXAN:	5.75	4.21
Plexi-glass:	4.14	2.74
Bullet Resist Glass:	3.47	2.19

Item Notes

Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Surface-Launched HE Rounds
Munition:	81 mm Japanese Type 97 HE Mortar
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Mortar
Munition Case Classification:	Robust

DODIC:	
Date Record Created:	2/1/2011
Record Created By:	SDH
Last Date Record Updated:	5/3/2018
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	TNT
Explosive Weight (lb):	1.1902
Diameter (in):	2.8700
Cylindrical Case Weight (lb):	3.94900
Maximum Fragment Weight (Intentional) (lb):	0.0722
Design Fragment Weight (95%) (Unintentional) (lb):	0.0204
Critical Fragment Velocity (fps):	4691

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	1
TNT Equivalent Weight - Impulse (lbs):	1.190
Kinetic Energy 10^6 (lb-ft²/s²):	0.7944

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	24
Expected Max. Throw Distance (ft):	125
Minimum Separation Distance (ft):	125

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	48
Expected Max. Throw Distance (ft):	10
Minimum Separation Distance (ft):	12.5

Water Mitigation

Minimum Separation Distance (ft):	200
Water Containment System:	1100 gal tank

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	207
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	1481
MFD-V [Maximum Fragment Distance, Vertical] (ft):	1163

Overpressure Distances

TNT Equivalent (Pressure):	1
TNT Equivalent Weight - Pressure (lbs):	1.190
3.5 psi, K18 Distance (ft):	19
2.3 psi; K24 Distance (ft):	25
1.2 psi, K40 Distance (ft):	42
0.0655 psi, K328 Distance (ft):	348

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	6.59	3.62
Mild Steel:	1.27	0.71
Hard Steel:	1.04	0.58
Aluminum:	2.58	1.48
LEXAN:	6.67	4.70
Plexi-glass:	5.04	3.16
Bullet Resist Glass:	4.28	2.56

Item Notes

Distribution Statement D. Distribution authorized to the Department of Defense and U.S. DoD contractors only for Administrative-Operational Use (3 May 2018). Other requests shall be referred to the Department of Defense Explosives Safety Board, 4800 Mark Center Drive, Suite 16E12, Alexandria, VA 22350.

Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Surface-Launched HE Rounds
Munition:	75 mm HE Mk I
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Projectile
Munition Case Classification:	Robust

DODIC:	
Date Record Created:	9/21/2004
Record Created By:	MMC
Last Date Record Updated:	5/3/2018
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	TNT
Explosive Weight (lb):	1.64
Diameter (in):	2.9528
Cylindrical Case Weight (lb):	9.52026
Maximum Fragment Weight (Intentional) (lb):	0.2135
Design Fragment Weight (95%) (Unintentional) (lb):	0.0392
Critical Fragment Velocity (fps):	3468

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	1
TNT Equivalent Weight - Impulse (lbs):	1.640
Kinetic Energy 10^6 (lb-ft²/s²):	1.2842

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	24
Expected Max. Throw Distance (ft):	125
Minimum Separation Distance (ft):	125

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	200
Water Containment System:	1100 gal tank

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	239
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	1873
MFD-V [Maximum Fragment Distance, Vertical] (ft):	1425

Overpressure Distances

TNT Equivalent (Pressure):	1
TNT Equivalent Weight - Pressure (lbs):	1.640
3.5 psi, K18 Distance (ft):	21
2.3 psi; K24 Distance (ft):	28
1.2 psi, K40 Distance (ft):	47
0.0655 psi, K328 Distance (ft):	387

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	7.22	3.71
Mild Steel:	1.40	0.72
Hard Steel:	1.15	0.59
Aluminum:	2.77	1.47
LEXAN:	7.36	4.86
Plexi-glass:	5.75	3.32
Bullet Resist Glass:	5.02	2.73

Item Notes

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Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Surface-Launched HE Rounds
Munition:	5 in Mk 41
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Projectile
Munition Case Classification:	Robust

DODIC:	D320
Date Record Created:	9/21/2004
Record Created By:	MMC
Last Date Record Updated:	9/14/2011
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Explosive D
Explosive Weight (lb):	7.38
Diameter (in):	5.0000
Cylindrical Case Weight (lb):	51.30473
Maximum Fragment Weight (Intentional) (lb):	0.6726
Design Fragment Weight (95%) (Unintentional) (lb):	0.1367
Critical Fragment Velocity (fps):	2538

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	0.81
TNT Equivalent Weight - Impulse (lbs):	5.978
Kinetic Energy 10^6 (lb-ft²/s²):	2.4521

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	36
Expected Max. Throw Distance (ft):	220
Minimum Separation Distance (ft):	220

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	275
Water Containment System:	1100 gal tank

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	359
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	2377
MFD-V [Maximum Fragment Distance, Vertical] (ft):	1748

Overpressure Distances

TNT Equivalent (Pressure):	0.85
TNT Equivalent Weight - Pressure (lbs):	6.273
3.5 psi, K18 Distance (ft):	33
2.3 psi; K24 Distance (ft):	44
1.2 psi, K40 Distance (ft):	74
0.0655 psi, K328 Distance (ft):	605

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	9.17	4.80
Mild Steel:	1.77	0.92
Hard Steel:	1.45	0.75
Aluminum:	3.43	1.86
LEXAN:	8.58	5.73
Plexi-glass:	7.05	4.13
Bullet Resist Glass:	6.32	3.49

Item Notes

Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Surface-Launched HE Rounds
Munition:	5 in 38 Caliber Mk 35
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Projectile
Munition Case Classification:	Robust

DODIC:	
Date Record Created:	1/11/2008
Record Created By:	MMC
Last Date Record Updated:	9/14/2011
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Explosive D
Explosive Weight (lb):	7.55
Diameter (in):	5.0000
Cylindrical Case Weight (lb):	29.81237
Maximum Fragment Weight (Intentional) (lb):	0.3380
Design Fragment Weight (95%) (Unintentional) (lb):	0.0667
Critical Fragment Velocity (fps):	3409

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	0.81
TNT Equivalent Weight - Impulse (lbs):	6.116
Kinetic Energy 10^6 (lb-ft²/s²):	1.9634

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	36
Expected Max. Throw Distance (ft):	220
Minimum Separation Distance (ft):	220

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	275
Water Containment System:	1100 gal tank

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	343
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	2131
MFD-V [Maximum Fragment Distance, Vertical] (ft):	1613

Overpressure Distances

TNT Equivalent (Pressure):	0.85
TNT Equivalent Weight - Pressure (lbs):	6.418
3.5 psi, K18 Distance (ft):	33
2.3 psi; K24 Distance (ft):	45
1.2 psi, K40 Distance (ft):	74
0.0655 psi, K328 Distance (ft):	610

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	8.80	4.49
Mild Steel:	1.71	0.87
Hard Steel:	1.40	0.71
Aluminum:	3.37	1.79
LEXAN:	8.19	5.49
Plexi-glass:	6.62	3.89
Bullet Resist Glass:	5.85	3.26

Item Notes

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Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Surface-Launched HE Rounds
Munition:	6 in/47 Cal HC Mk 34
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Projectile
Munition Case Classification:	Robust

DODIC:	D407
Date Record Created:	9/21/2004
Record Created By:	MMC
Last Date Record Updated:	9/14/2011
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Explosive D
Explosive Weight (lb):	13.22
Diameter (in):	6.0000
Cylindrical Case Weight (lb):	53.83737
Maximum Fragment Weight (Intentional) (lb):	0.5586
Design Fragment Weight (95%) (Unintentional) (lb):	0.1059
Critical Fragment Velocity (fps):	3322

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	0.81
TNT Equivalent Weight - Impulse (lbs):	10.708
Kinetic Energy 10^6 (lb-ft²/s²):	3.0817

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	36
Expected Max. Throw Distance (ft):	220
Minimum Separation Distance (ft):	220

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	275
Water Containment System:	1100 gal tank

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	394
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	2446
MFD-V [Maximum Fragment Distance, Vertical] (ft):	1841

Overpressure Distances

TNT Equivalent (Pressure):	0.85
TNT Equivalent Weight - Pressure (lbs):	11.237
3.5 psi, K18 Distance (ft):	40
2.3 psi; K24 Distance (ft):	54
1.2 psi, K40 Distance (ft):	90
0.0655 psi, K328 Distance (ft):	735

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	10.47	5.25
Mild Steel:	2.03	1.01
Hard Steel:	1.67	0.83
Aluminum:	3.96	2.06
LEXAN:	9.11	6.05
Plexi-glass:	7.63	4.44
Bullet Resist Glass:	6.87	3.78

Item Notes

Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Surface-Launched HE Rounds
Munition:	155 mm M107 (Composition B filled)
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Projectile
Munition Case Classification:	Robust

DODIC:	D571
Date Record Created:	9/21/2004
Record Created By:	MMC
Last Date Record Updated:	
Individual Last Updated Record:	
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Composition B
Explosive Weight (lb):	15.448
Diameter (in):	6.1024
Cylindrical Case Weight (lb):	73.50184
Maximum Fragment Weight (Intentional) (lb):	0.6641
Design Fragment Weight (95%) (Unintentional) (lb):	0.1372
Critical Fragment Velocity (fps):	3584

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	1.14
TNT Equivalent Weight - Impulse (lbs):	17.611
Kinetic Energy 10^6 (lb-ft²/s²):	5.4935

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	36
Expected Max. Throw Distance (ft):	220
Minimum Separation Distance (ft):	220

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	275
Water Containment System:	1100 gal tank

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	450
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	2630
MFD-V [Maximum Fragment Distance, Vertical] (ft):	2022

Overpressure Distances

TNT Equivalent (Pressure):	1.16
TNT Equivalent Weight - Pressure (lbs):	17.920
3.5 psi, K18 Distance (ft):	47
2.3 psi; K24 Distance (ft):	63
1.2 psi, K40 Distance (ft):	105
0.0655 psi, K328 Distance (ft):	858

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	14.45	6.68
Mild Steel:	2.74	1.29
Hard Steel:	2.25	1.06
Aluminum:	5.30	2.61
LEXAN:	10.69	6.73
Plexi-glass:	9.43	5.10
Bullet Resist Glass:	8.58	4.39

Item Notes

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Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Surface-Launched HE Rounds
Munition:	8 in Mk 25
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Projectile
Munition Case Classification:	Robust

DODIC:	
Date Record Created:	3/7/2011
Record Created By:	SDH
Last Date Record Updated:	3/31/2011
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Explosive D
Explosive Weight (lb):	21.34
Diameter (in):	7.9500
Cylindrical Case Weight (lb):	181.54700
Maximum Fragment Weight (Intentional) (lb):	2.6299
Design Fragment Weight (95%) (Unintentional) (lb):	0.4711
Critical Fragment Velocity (fps):	2392

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	0.81
TNT Equivalent Weight - Impulse (lbs):	17.285
Kinetic Energy 10^6 (lb-ft²/s²):	7.5259

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	Not Permitted
Water Containment System:	Not Permitted

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	445
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	3434
MFD-V [Maximum Fragment Distance, Vertical] (ft):	2476

Overpressure Distances

TNT Equivalent (Pressure):	0.85
TNT Equivalent Weight - Pressure (lbs):	18.139
3.5 psi, K18 Distance (ft):	47
2.3 psi; K24 Distance (ft):	63
1.2 psi, K40 Distance (ft):	105
0.0655 psi, K328 Distance (ft):	862

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	13.58	7.03
Mild Steel:	2.51	1.27
Hard Steel:	2.06	1.04
Aluminum:	4.68	2.47
LEXAN:	11.06	7.27
Plexi-glass:	9.90	5.67
Bullet Resist Glass:	9.35	5.04

Item Notes

Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Air-Launched HE Rounds
Munition:	100 lb GP Mk 1 Bomb
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Bomb
Munition Case Classification:	Non-Robust

DODIC:	
Date Record Created:	9/21/2004
Record Created By:	MMC
Last Date Record Updated:	3/31/2011
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	TNT
Explosive Weight (lb):	65
Diameter (in):	7.9000
Cylindrical Case Weight (lb):	29.85245
Maximum Fragment Weight (Intentional) (lb):	0.1165
Design Fragment Weight (95%) (Unintentional) (lb):	0.0120
Critical Fragment Velocity (fps):	8519

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	1
TNT Equivalent Weight - Impulse (lbs):	65.000
Kinetic Energy 10^6 (lb-ft²/s²):	4.2274

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	Not Permitted
Water Containment System:	Not Permitted

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	441
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	1923
MFD-V [Maximum Fragment Distance, Vertical] (ft):	1540

Overpressure Distances

TNT Equivalent (Pressure):	1
TNT Equivalent Weight - Pressure (lbs):	65.000
3.5 psi, K18 Distance (ft):	72
2.3 psi; K24 Distance (ft):	96
1.2 psi, K40 Distance (ft):	161
0.0655 psi, K328 Distance (ft):	1319

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	18.58	7.17
Mild Steel:	2.97	1.21
Hard Steel:	2.44	0.99
Aluminum:	5.96	2.56
LEXAN:	10.42	5.99
Plexi-glass:	9.07	4.35
Bullet Resist Glass:	8.00	3.53

Item Notes

Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Surface-Launched HE Rounds
Munition:	14 in Mk 22
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Projectile
Munition Case Classification:	Extremely Heavy Cased

DODIC:	
Date Record Created:	12/3/2010
Record Created By:	SDH
Last Date Record Updated:	3/31/2011
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Explosive D
Explosive Weight (lb):	104.21
Diameter (in):	13.9700
Cylindrical Case Weight (lb):	1007.41053
Maximum Fragment Weight (Intentional) (lb):	11.6706
Design Fragment Weight (95%) (Unintentional) (lb):	1.8294
Critical Fragment Velocity (fps):	2418

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	0.81
TNT Equivalent Weight - Impulse (lbs):	84.410
Kinetic Energy 10^6 (lb-ft²/s²):	32.7617

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	Not Permitted
Water Containment System:	Not Permitted

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	559
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	5214
MFD-V [Maximum Fragment Distance, Vertical] (ft):	3704

Overpressure Distances

TNT Equivalent (Pressure):	0.85
TNT Equivalent Weight - Pressure (lbs):	88.579
3.5 psi, K18 Distance (ft):	80
2.3 psi; K24 Distance (ft):	107
1.2 psi, K40 Distance (ft):	178
0.0655 psi, K328 Distance (ft):	1462

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	24.40	11.92
Mild Steel:	4.59	2.20
Hard Steel:	3.77	1.81
Aluminum:	8.24	4.13
LEXAN:	16.01	10.19
Plexi-glass:	16.16	8.87
Bullet Resist Glass:	16.12	8.28

Item Notes

Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Surface-Launched HE Rounds
Munition:	16 in Mk 14 Projectile
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Projectile
Munition Case Classification:	Extremely Heavy Cased

DODIC:	
Date Record Created:	9/21/2004
Record Created By:	MMC
Last Date Record Updated:	9/14/2011
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Explosive D
Explosive Weight (lb):	153.57
Diameter (in):	16.0000
Cylindrical Case Weight (lb):	1576.05305
Maximum Fragment Weight (Intentional) (lb):	15.1260
Design Fragment Weight (95%) (Unintentional) (lb):	2.4110
Critical Fragment Velocity (fps):	2394

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	604
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	5578
MFD-V [Maximum Fragment Distance, Vertical] (ft):	3947

Overpressure Distances

TNT Equivalent (Pressure):	0.85
TNT Equivalent Weight - Pressure (lbs):	130.535
3.5 psi, K18 Distance (ft):	91
2.3 psi; K24 Distance (ft):	122
1.2 psi, K40 Distance (ft):	203
0.0655 psi, K328 Distance (ft):	1664

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	0.81
TNT Equivalent Weight - Impulse (lbs):	124.392
Kinetic Energy 10^6 (lb-ft^2/s^2):	43.3567

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	Not Permitted
Water Containment System:	Not Permitted

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	26.75	13.15
Mild Steel:	5.03	2.43
Hard Steel:	4.13	1.99
Aluminum:	8.97	4.53
LEXAN:	16.96	10.84
Plexi-glass:	17.46	9.63
Bullet Resist Glass:	17.57	9.07

Item Notes

Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Air-Launched HE Rounds
Munition:	500 lb M64A1 Bomb (Amatol filled)
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Bomb
Munition Case Classification:	Non-Robust

DODIC:	
Date Record Created:	10/19/2012
Record Created By:	SDH
Last Date Record Updated:	
Individual Last Updated Record:	
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Amatol
Explosive Weight (lb):	262
Diameter (in):	14.2000
Cylindrical Case Weight (lb):	114.40615
Maximum Fragment Weight (Intentional) (lb):	0.5120
Design Fragment Weight (95%) (Unintentional) (lb):	0.0550
Critical Fragment Velocity (fps):	6671

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	0.87
TNT Equivalent Weight - Impulse (lbs):	227.940
Kinetic Energy 10^6 (lb-ft^2/s^2):	11.3908

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	Not Permitted
Water Containment System:	Not Permitted

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	581
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	2849
MFD-V [Maximum Fragment Distance, Vertical] (ft):	2241

Overpressure Distances

TNT Equivalent (Pressure):	0.97
TNT Equivalent Weight - Pressure (lbs):	254.140
3.5 psi, K18 Distance (ft):	114
2.3 psi; K24 Distance (ft):	152
1.2 psi, K40 Distance (ft):	253
0.0655 psi, K328 Distance (ft):	2078

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	23.82	9.41
Mild Steel:	4.08	1.68
Hard Steel:	3.34	1.38
Aluminum:	7.89	3.44
LEXAN:	13.06	7.58
Plexi-glass:	12.27	5.96
Bullet Resist Glass:	11.31	5.07

Item Notes

Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Air-Launched HE Rounds
Munition:	500 lb M64A1 Bomb (TNT filled)
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Bomb
Munition Case Classification:	Non-Robust

DODIC:	
Date Record Created:	10/5/2009
Record Created By:	SDH
Last Date Record Updated:	12/23/2009
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	TNT
Explosive Weight (lb):	267
Diameter (in):	14.2000
Cylindrical Case Weight (lb):	114.40615
Maximum Fragment Weight (Intentional) (lb):	0.4276
Design Fragment Weight (95%) (Unintentional) (lb):	0.0437
Critical Fragment Velocity (fps):	8612

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	1
TNT Equivalent Weight - Impulse (lbs):	267.000
Kinetic Energy 10^6 (lb-ft²/s²):	15.8545

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	Not Permitted
Water Containment System:	Not Permitted

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	616
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	2845
MFD-V [Maximum Fragment Distance, Vertical] (ft):	2264

Overpressure Distances

TNT Equivalent (Pressure):	1
TNT Equivalent Weight - Pressure (lbs):	267.000
3.5 psi, K18 Distance (ft):	116
2.3 psi; K24 Distance (ft):	155
1.2 psi, K40 Distance (ft):	258
0.0655 psi, K328 Distance (ft):	2112

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	32.71	12.51
Mild Steel:	5.03	2.04
Hard Steel:	4.13	1.67
Aluminum:	9.78	4.19
LEXAN:	14.39	8.25
Plexi-glass:	13.93	6.66
Bullet Resist Glass:	12.88	5.67

Item Notes

Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Air-Launched HE Rounds
Munition:	500 lb M64A1 Bomb (Composition B filled)
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Bomb
Munition Case Classification:	Non-Robust

DODIC:	
Date Record Created:	10/5/2009
Record Created By:	SDH
Last Date Record Updated:	12/23/2009
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Composition B
Explosive Weight (lb):	274
Diameter (in):	14.2000
Cylindrical Case Weight (lb):	114.40615
Maximum Fragment Weight (Intentional) (lb):	0.2491
Design Fragment Weight (95%) (Unintentional) (lb):	0.0221
Critical Fragment Velocity (fps):	9907

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	1.14
TNT Equivalent Weight - Impulse (lbs):	312.360
Kinetic Energy 10^6 (lb-ft²/s²):	12.2227

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	Not Permitted
Water Containment System:	Not Permitted

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	638
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	2486
MFD-V [Maximum Fragment Distance, Vertical] (ft):	1995

Overpressure Distances

TNT Equivalent (Pressure):	1.16
TNT Equivalent Weight - Pressure (lbs):	317.840
3.5 psi, K18 Distance (ft):	123
2.3 psi; K24 Distance (ft):	164
1.2 psi, K40 Distance (ft):	273
0.0655 psi, K328 Distance (ft):	2238

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	32.57	11.69
Mild Steel:	4.74	1.82
Hard Steel:	3.89	1.49
Aluminum:	9.34	3.79
LEXAN:	13.62	7.55
Plexi-glass:	12.95	5.91
Bullet Resist Glass:	11.79	4.93

Item Notes

Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Air-Launched HE Rounds
Munition:	600 lb M32 Bomb (TNT filled)
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Bomb
Munition Case Classification:	Non-Robust

DODIC:	
Date Record Created:	3/7/2011
Record Created By:	SDH
Last Date Record Updated:	
Individual Last Updated Record:	
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	TNT
Explosive Weight (lb):	336
Diameter (in):	15.2000
Cylindrical Case Weight (lb):	159.75400
Maximum Fragment Weight (Intentional) (lb):	0.5830
Design Fragment Weight (95%) (Unintentional) (lb):	0.0592
Critical Fragment Velocity (fps):	8442

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	1
TNT Equivalent Weight - Impulse (lbs):	336.000
Kinetic Energy 10^6 (lb-ft²/s²):	20.7761

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	Not Permitted
Water Containment System:	Not Permitted

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	662
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	3110
MFD-V [Maximum Fragment Distance, Vertical] (ft):	2468

Overpressure Distances

TNT Equivalent (Pressure):	1
TNT Equivalent Weight - Pressure (lbs):	336.000
3.5 psi, K18 Distance (ft):	125
2.3 psi; K24 Distance (ft):	167
1.2 psi, K40 Distance (ft):	278
0.0655 psi, K328 Distance (ft):	2280

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	36.13	13.78
Mild Steel:	5.57	2.25
Hard Steel:	4.57	1.84
Aluminum:	10.74	4.59
LEXAN:	15.35	8.78
Plexi-glass:	15.18	7.24
Bullet Resist Glass:	14.18	6.22

Item Notes

Distribution Statement D. Distribution authorized to the Department of Defense and U.S. DoD contractors only for Administrative-Operational Use (3 May 2018). Other requests shall be referred to the Department of Defense Explosives Safety Board, 4800 Mark Center Drive, Suite 16E12, Alexandria, VA 22350.

Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Air-Launched HE Rounds
Munition:	1000 lb AN-M65A1 Bomb (TNT filled)
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Bomb
Munition Case Classification:	Robust

DODIC:	
Date Record Created:	10/5/2009
Record Created By:	SDH
Last Date Record Updated:	9/14/2011
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	TNT
Explosive Weight (lb):	558
Diameter (in):	18.8000
Cylindrical Case Weight (lb):	314.38573
Maximum Fragment Weight (Intentional) (lb):	1.2046
Design Fragment Weight (95%) (Unintentional) (lb):	0.1239
Critical Fragment Velocity (fps):	8144

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	1
TNT Equivalent Weight - Impulse (lbs):	558.000
Kinetic Energy 10^6 (lb-ft²/s²):	39.9470

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	Not Permitted
Water Containment System:	Not Permitted

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	748
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	3828
MFD-V [Maximum Fragment Distance, Vertical] (ft):	3023

Overpressure Distances

TNT Equivalent (Pressure):	1
TNT Equivalent Weight - Pressure (lbs):	558.000
3.5 psi, K18 Distance (ft):	148
2.3 psi; K24 Distance (ft):	198
1.2 psi, K40 Distance (ft):	329
0.0655 psi, K328 Distance (ft):	2700

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	46.38	17.79
Mild Steel:	7.13	2.90
Hard Steel:	5.85	2.38
Aluminum:	13.52	5.80
LEXAN:	17.97	10.31
Plexi-glass:	18.71	8.96
Bullet Resist Glass:	17.92	7.90

Item Notes

Fragmentation Data Review Form

Database Revision Date 5/3/2018

Category:	Air-Launched HE Rounds
Munition:	1000 lb AN-M65A1 Bomb (Composition B filled)
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Bomb
Munition Case Classification:	Robust

DODIC:	
Date Record Created:	10/5/2009
Record Created By:	SDH
Last Date Record Updated:	9/14/2011
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Composition B
Explosive Weight (lb):	595
Diameter (in):	18.8000
Cylindrical Case Weight (lb):	314.38573
Maximum Fragment Weight (Intentional) (lb):	0.7020
Design Fragment Weight (95%) (Unintentional) (lb):	0.0627
Critical Fragment Velocity (fps):	9385

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	1.14
TNT Equivalent Weight - Impulse (lbs):	678.300
Kinetic Energy 10^6 (lb-ft²/s²):	30.9134

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	Not Permitted
Water Containment System:	Not Permitted

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	810
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	3355
MFD-V [Maximum Fragment Distance, Vertical] (ft):	2673

Overpressure Distances

TNT Equivalent (Pressure):	1.16
TNT Equivalent Weight - Pressure (lbs):	690.200
3.5 psi, K18 Distance (ft):	159
2.3 psi; K24 Distance (ft):	212
1.2 psi, K40 Distance (ft):	353
0.0655 psi, K328 Distance (ft):	2899

"NOTE: Values shown within this section only address overpressure hazards and do not account for applicable distance values for fragments and debris as required per DoD 6055.09-M."

Minimum Thickness to Prevent Perforation (in)

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	46.31	16.66
Mild Steel:	6.73	2.59
Hard Steel:	5.52	2.12
Aluminum:	12.93	5.27
LEXAN:	17.03	9.45
Plexi-glass:	17.41	7.97
Bullet Resist Glass:	16.43	6.89

Item Notes

BASED ON TP-16 350-pound Depth AN-MK 53 Mod I
REVISION 4 292.5 pounds NEW

PRIMARY FRAGMENT RANGE GENERIC EQUATIONS CALCULATOR VERSION 2.0

SELECT UNITS

ENGLISH

CHOOSE KNOWN INFORMATION (i.e. Diameter or NEW)

ENGLISH UNITS

ENTER NEW (lbs) 292.50

Calculated Diameter Based On NEW Entered (in)	Robust 12.45	EHC 15.87	Non-Robust 13.02

	Robust (ft)	EHC (ft)	Non-Robust (ft)
Maximum Fragment Distance - Horizontal (MFD-H)			
Based On NEW Entered (lbs)	4,539.4	5,818.4	3,092.8
Based On Diameter Derived From NEW Entered (in)	4,308.2	5,483.7	2,751.8
Maximum Calculated Distance	*4,539.4*	*5,818.4*	*3,092.8*
Hazardous Fragment Distance (HFD)			
Based On NEW Entered (lbs)	791.2	750.1	796.9
Based On Diameter Derived From NEW Entered (in)	806.6	683.3	845.3
Maximum Calculated Distance	*806.6*	*750.1*	*845.3*
Maximum Fragment Distance - Vertical (MFD-V)			
Based on Maximum Calculated MFD-H (ft)			
Maximum Calculated Distance (ft)	*3,345.9*	*4,251.5*	*2,310.4*

SI UNITS

NEW (kg) 132.68

Calculated Diameter Based On NEW Entered (in)	Robust 316.20	EHC 403.22	Non-Robust 330.81

	Robust (m)	EHC (m)	Non-Robust (m)
Maximum Fragment Distance - Horizontal (MFD-H)			
Based On NEW Entered (kg)	1,383.6	1,773.5	942.7
Based On Diameter Derived From NEW Entered (mm)	1,313.2	1,671.4	838.7
Maximum Calculated Distance	*1,383.6*	*1,773.5*	*942.7*
Hazardous Fragment Distance (HFD)			
Based On NEW Entered (kg)	241.2	228.6	242.9
Based On Diameter Derived From NEW Entered (mm)	245.9	208.3	257.6
Maximum Calculated Distance	*245.9*	*228.6*	*257.6*
Maximum Fragment Distance - Horizontal (MFD-H)			
Based on Maximum Calculated MFD-H (m)			
Maximum Calculated Distance (ft)	*1,019.8*	*1,295.9*	*704.2*

BASED ON TP-16
REVISION 4

350-pound Depth AN-Mk 53 Mod I
13.8-inch Diameter

PRIMARY FRAGMENT RANGE GENERIC EQUATIONS CALCULATOR VERSION 2.0

SELECT UNITS

ENGLISH

CHOOSE KNOWN INFORMATION (i.e. Diameter or NEW)

ENGLISH UNITS

ENTER DIAMETER (in) 13.80

Calculated NEW Based On Diameter Entered (lbs)	Robust 431.44	EHC 63.96	Non-Robust 383.50

	Robust (ft)	EHC (ft)	Non-Robust (ft)
Maximum Fragment Distance - Horizontal (MFD-H)			
Based On Diameter Entered (in)	4,604.0	4,845.3	2,830.7
Based On NEW Derived From Diameter Entered (lbs)	4,729.7	5,032.8	3,235.2
Maximum Calculated Distance	*4,729.7*	*5,032.8*	*3,235.2*
Hazardous Fragment Distance (HFD)			
Based On Diameter Entered (in)	862.0	619.5	879.4
Based On NEW Derived From Diameter Entered (lbs)	848.4	611.7	833.1
Maximum Calculated Distance	*862.0*	*619.5*	*879.4*
Maximum Fragment Distance - Vertical (MFD-V)			
Based on Maximum Calculated MFD-H (ft)			
Maximum Calculated Distance (ft)	*3,481.1*	*3,696.2*	*2,413.0*

SI UNITS

DIAMETER (mm) 350.52

Calculated NEW Based On Diameter Entered (lbs)	Robust 195.70	EHC 29.01	Non-Robust 173.95

	Robust (m)	EHC (m)	Non-Robust (m)
Maximum Fragment Distance - Horizontal (MFD-H)			
Based On Diameter Entered (mm)	1,403.3	1,476.8	862.8
Based On NEW Derived From Diameter Entered (kg)	1,441.6	1,534.0	986.1
Maximum Calculated Distance	*1,441.6*	*1,534.0*	*986.1*
Hazardous Fragment Distance (HFD)			
Based On Diameter Entered (mm)	262.7	188.8	268.0
Based On NEW Derived From Diameter Entered (kg)	258.6	186.5	253.9
Maximum Calculated Distance	*262.7*	*188.8*	*268.0*
Maximum Fragment Distance - Horizontal (MFD-H)			
Based on Maximum Calculated MFD-H (m)			
Maximum Calculated Distance (ft)	*1,061.0*	*1,126.6*	*735.5*

Fuzing

· ATIIWARTSHIP-Because of numerous instances in water crash landings where depth bombs fuzed with Athwartship Fuzes AN-Mk 221 or AN-)Ik 234 exploded. these two fuzes have bun suspended from use. As n eonsequ,nce. the Depth Bombs Mk 17 Type. ru'I-Mk 41 and AN-Mk 4-1 may be used only if a nose impact fuze is installed.

:-IOSE--Nose le,ehanical lmpAct Fuze AN-Mk 219 will not arm if dropped from below 2.500 feel when used on a bomb with the flat-nose attachment or a flat nose. It re.quires an auxiliar)' booster and the Adapter Ring I!k 219. It gives instantaneous action. Nose Mechanical Impact Fuzes Mk 221 and Mk 239 with delay of 0.01second will not arm on a flat nose if dropped !t-om below 2.500 feel. Nose Mechanical lmJ.):tct Fuzes AN-'1103 and AN-Ail03A 1 (Instantaneous only) have been designed with special vanes for Rat-nose bombs.

Body construcllon

AN-Mk 17 Mod 2 and AN-Mk 44—These depth bombs are made with rou nd noses welded to a cyl indl'ical steel t u be. The•·e is a st rength- ening disc m·ound the nose and a steel strip along the suspension lugs to reinforce the body. The h·ansverse fuze pocket is 11.9 inches abaf t the nose. To pt·event ricochet and improve un- derwater trajectory, a flat-nose attachment is made for these bombs, the altMhment being in the shape of a bucket which fits down over the nose and is filled with plaster of paris, in- creasing the weight of the bomb by 44 pounds. The bomb case is extremely thin.

AN-)Ik 41 and AN-Mk -17 These bombs nrc constructed with a flat nose, there being a slight tapet· from the walls to the nose. The body is in three pieces. The sides are tubular " th a transverse fu'£e pocket tube welded in place IS inches abaft the nose.

Sus nsion:Sus nsion of these bombs is by the usual dual or single lugs. the lugs being welded to the bomb. The single lug is actually somewhat different than is usually found. being in the form of a bracket rather than a lug. Trurutions on a band are fo•· displacement gear in dive bombing.

Tail construction: Instead of employing the box-type, tail, these bombs use n drum tail. As see,n from the after end, it is circular and has four fins extending at right angles to eath other. The fins are spot-welded to a cone which fits over the after end of the bomb. The fins are also spot-welded to the drum shroud. The tail is bolted onto the base of the bomb.

I\larkings: TNT-loaded bombs have weight and Mark number stencilled in yellow: Torpex-loaded bombs have these items stencilled in blue.

Remarks: The 325-pound Depth Bomb Mk 17 is TNT-loaded but has a light tail assembly: the Mk 17 Mod 1 is the same. except that a stttrdier tail assembly is used. The AN-Mk 17 Mod 2 is similar to the Mod 1. but has n lal·ger filling hole.

The IIfk 17 is obsolete: the Ml 17 Mod 1, AN-Mk 17 Mod 2, AN-Mk 44, AN-Mk 47, and AN-Mk 41 are obsolescent.

325-. 350-pound Depth AN-Mk 53 Mod 1 (TNTl, AN-Mk 54 Mod 1 (HBX), Mk 53 (TNT, and Mk 54 (Torpex)

Over-all length, inches.....52.5
Body length, inches.....33.25
Body diameter, inches.....13.8
Wall thickness, inch.....0.06
Tail length, inches.....24.6
Tail width, inches.....13.9

AN-bIk S3

	Modi Mk S3	1k $4	AN-}Ik $4 loct I
Filling	.TNT	Torpex	HBX
Wt.of filling	225:1;:	250#	250#
Total weight	SSO::	354#	354#
Chg wt. ratio	68 <	70.6%	70

Fuzing

NosE-AN-bI103, AN- 1103A1 (must have modified arming "'anes for use with flat-nose bomb). AN- !k 219 (with an adapter ting) may be used in the nose if the AN-AIIOS with the modified vancs is not available.The AN-Mk

pg400.jpg

219 retjUii'C5 2.!:(1() reel ur nir lmvel to arm.

TAit.-AN-Mk 2:)() Mods •1, 5, !md 6 or Ik 2:31 (hy<irOlltatie).

Body ton5t ruction: The eylindrie1 ll welded sheet-steel body has 11 flnl nose. A bnse closing plntc is 5CCUrl! I to the renr or the bomb by rour bolts. A b.18!! closing t>lnte is secured to the re:w or the bomb by four bolt....

Suspension: These bombs nrc suspended horizont<ttly by two lulfs seven inches on each side or the center or j!rM·ity. or by n sin!l'le lulf al the ccnlo.w nr gr1wity and 180 o·cmoved fo·om the oth<o·lugs. "l'he••e is no ex\te111nl band. the boml>s being strenl(lhenccl lntemally by a band which is lltted into the bomb nt the center or gravil)'. Trunnions for dive bombing may be thre<·\ded to the cnse >Hid intcl'lll\l sh-engthening band.

Tail construction: Wchleel to the lail cone are fouo.Vllnes which are t••engthencd b.v interio>. box-l.l'fl< Rtruts. and nn cxtcl'ior wide •·ing strut. The tail cone is secured t<> the hnsc closing pinto Ul' fom· bolts.

Ma••kings: Oli ve cl'a b over nil. "Mk 5il-32fi lb. do]lth bomll", "Mk M-3:.0 ll> depth bomb" stencilled on the l'CS!l<lctive bomb bodies in yellow if the fillint is TNT, or in blue if the filling is Torpex.

lttmnrks: These two bombs (identical exCCJll for filling) have been desi)(ned lo replace depth bombs usinlf nthwm'Uhip fu>.es, since dilticulties have been encountered at times in the past with the Athwarl hir> f"uzes AN-Mk 224 and AX- Ik 231. The Depth Bombs Mk 3 and Mk 51 will use the Tail llydro.•talic Fuze AN-Mk 2.'10 and a nose fuze, having no athwartship pocket.

The Depth Bombs A:-1- lk r,s Mod I and AN-Ik ..t lod I differ from the Depth Bombs Ml< i:3 and Mk >-espectively in thnt the suspension luKJ! no c welded on, Instead or being or the screw t)'l>e. In Addition, the \l'llls of the explosive cuvity of the two bombs nrc coated with nn nsphaltic composition known as llol Melt. The AN-Ik 5Mod 1 is loaded with **Ilt X rather than Torpe:<.**

Only the modifications or the De11th Born!.>• Ik i;3 and Ik 54 hal'e been standardized as AN bombs.

1,000-pound Aircraft Mine AN-Mk 26 Mod I (Ground, Influence-Fired)

Over-all length. inches	
With parachute pack	68.::
Without parael>utc pack	6 .!;
Diameter, inches	
Case	18.62::
Tail section	1 .7::
Pamchute pack	18.50
filling TNT	'l'ol"j>eX
\Veight of filling	**;)2=>#**
Tobll weight ,	1.000: 1,1160#
Chal·ge/weight ralio -16.5	**19.6'**
Negl1tive buoyanc.v 400#	460#

Fuzing

FOR USE AS A MINE— Alhwartship.-(Minc Mechanisms: forward well. clock sl:\ll.cr und clock delay; after well, extender unci booste>·.)

FOR USE AS A BOMB-Nose: AN-'tl(l!l, AN-m03A1, Ml3f>A1, Mi36, Ml36A1, m3!l. MI39A1, AN-M139A1, MHO. ML<lOA1. AN-Ml40A 1, i\'1149, M1, Ml61, Ml65, AN-Mk 210 (wit h adapter l'ingand one additional Auxilim·y Booster tk 1).

Construction: The 1,000-pound Aircraft line AN-Mk 26 Mod I consists or a cylindrical steel case welded with hemispherical nose and tapered tail section. The tail is closed l>y a con**cave eover secured with cap screws. A ring for** m< unting the p:>.rachute assembly is welded around the after end or the case. The Tail Pamchute Pack Mk 1, cont. ining Parnchute Mk 2. is fitted to the tail when the mine is inst<tlled in plane. This parachute stows the fall of the mine through the air lo lessen the shock or water impact. and is released *fiom* the case on striking water by nn impact rele:>.se mechanism. Sus1 lension is hori>.ontal, two standard lugs beint welded onto the body 14 inches 8J)llrt and placed 90° from the side pockets.

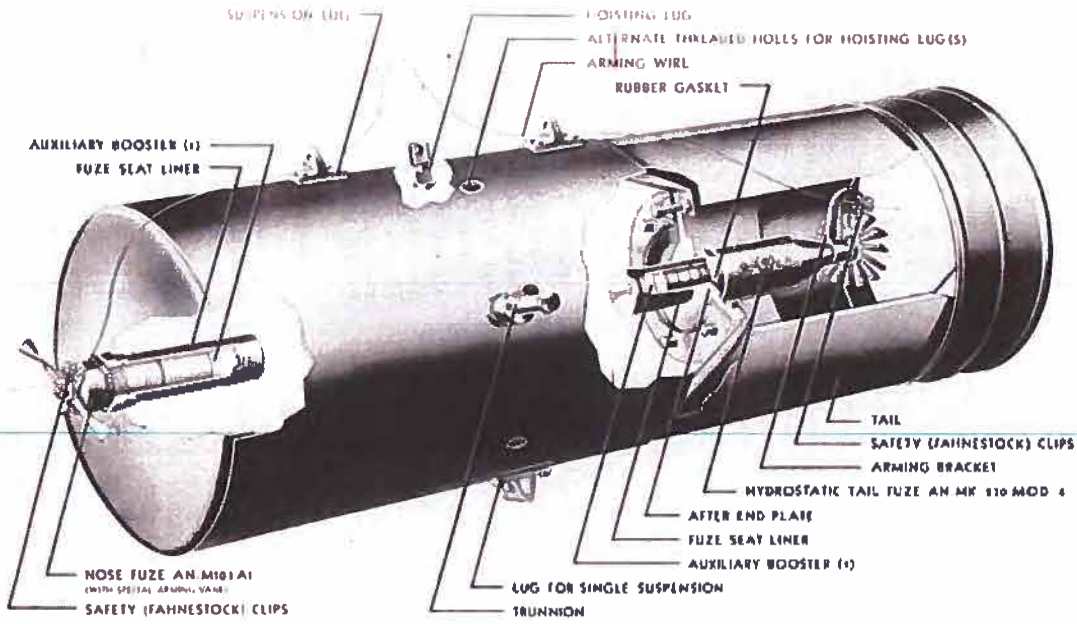

Figure 291. 325-pound Depth Bombs AN-Mk 53 and AN-Mk 54

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APPENDIX D – ANNEX TEMPLATE (per paragraph 1.3.3)

ANNEX A-[01]
[PROJECT NAME]
[DATE]

Note: This template represents the minimum required information for an Annex per paragraph 1.3.3. Changes to this template are expected, and shall be approved by NOSSA, OPNAV N411, and DASN (Safety). Future Amendments to this MRESS shall incorporate the most recently approved template.

1 SITE SPECIFIC RISK ASSESSMENT

1.1 Project description, to include all relevant information to the intended three-dimensional limits of soil disturbance

1.2 Project site knowledge, to include:

1.2.1 Acts of war

1.2.2 Previous construction

1.2.3 Previous soil disturbance

1.2.4 MEC/MPPEH discoveries

1.2.5 MEC/MPPEH clearance activities

1.2.6 Other information relevant to risk analysis

2 CJRM RISK DECISION:

2.1 Likelihood

2.2 TOI

2.3 Primary & contingency MGFD

2.4 Controlling EZ,

2.5 ESQD

3 SUPPORTING FIGURES AND TABLES

Figure 1: Site Area

Note: Utilize additional figures as required to present a complete description as “Figure 1.[X]”.

Table 1: Munition Response Areas

Area Identifier	**Current Land Use** *(Note: All areas are historical WWII Battlefields[1])*	**Size (Acres)**

Table 1 Reference:

(1) *Historical Ordnance Assessment, P-50 Territory of Guam*, NAVFACPAC, January 2010

Figure 2: Presence of MEC and MPPEH

Note: Utilize additional figures as required to present a complete description as “Figure 2.[X]”.

Table 2: Types of Munitions Potentially Used During War Activities by Area

Area	Origin Country	Small Arms	Land Mines	Hand Grenades	Projected Grenades	Anti-Tank Rockets	Mortars	Land Artillery	Naval Artillery	Aircraft Bombs	Aircraft Rockets
Area:	US										
	Japan										
Area:	US										
	Japan										

Notes: X = Confirmed
P = Possible, not confirmed

Table 3: Previous MEC and MPPEH Encountered (see format of Table 3-1 of Appendix B)

Description	Quantity
Area:	
Area:	

Table 4: Primary and Contingency MGFD (see format of Table 3-2 of Appendix B)

MGFD Type	Munition Item[a]	HFD (ft)[b]	MFD-H (ft)[b]
Area:			
Primary			
Contingency-1			
Area:			
Primary			
Contingency-1			

Notes:

a. Based on WWII records research, military EOD incident reports from 1978-2018, and available MEC clearance data reports

b. From Fragmentation Data Review Form (DDESB, 5/03/2018)

Table 5: Exclusion Zones (see format of Table 6-1 of Appendix B)

MGFDs		EZs (ft)					
Description	NEW (lbs) [a,b]	Fragmentation Effects		Blast Overpressure Effects			
		HFD	MFD-H	K328[b]	K40 [b]	K24 [b]	K18 [b]
Area:							
Area:							

Notes:

a. TNT equivalent weight

b. From Fragmentation Data Review Form (DDESB, 5/03/2018)

Table 6: Controlling EZs (ESQD in feet[f]) (see format of Table 6-2.1 of Appendix B)

Operation:	**Manual Operations[a]**				**Mechanized (low input) Operations[b]**				**Remote (high input) Operations**			
Sited as:	**Unintentional Detonation**								**Intentional Detonation**			
Exposed Sites:	**UXO Teams**		**Public and Non-essential Personnel**		**Essential Personnel**		**Public and Non-essential Personnel**		**UXO Teams**		**Non-essential Personnel**	
Basis of MGFD[c]:	**K40 of Primary**	**K40 of Cont-1**	**HFD of Primary**	**HFD of Cont-1**	**K24 of Primary [d,e]**	**K24 of Cont-1 [d,e]**	**HFD of Primary**	**HFD of Cont-1**	**K24 of Primary [d,e]**	**K24 of Cont-1 [d,e]**	**HFD-H of Primary**	**HFD-H of Cont-1**
Area:												
Area												

Notes:

a. Manual operations involve excavating anomalies with hand tools
b. Mechanized operations involve excavating anomalies with an excavator and mechanically screening the soil. Conducting mechanized operations may require a long reach excavator or remotely operated equipment.
c. MGFDs (Primary & Contingency-1) are shown in Table 4 of this Appendix
d. K18 distance may be used if essential personnel wear double hearing protection that provides ≥ 9-decibel attenuation.
e. Requires DDESB-approved shields/barricades designed to defeat hazardous fragments.
f. From Fragmentation Data Review Form (DDESB, 5/03/2018)

Table 7: Controlling EZs (ESQD in feet[g]) – All Areas, Limited Clearance ahead of Construction (Phase 2)

Operation[a]:	Following Limited Clearance Ahead of Construction – Manual Operations[b]		Following Limited Clearance Ahead of Construction - Mechanized (low input) Operations[c]	
Sited as:	Unintentional Detonation			
Exposed Sites:	UXO Teams	Public and Non-essential Personnel	Essential Personnel	Public and Non-essential Personnel
Basis[d]:	K40 of MGFD Primary	HFD of MGFD Primary	K24 of MGFD Primary[e,f]	HFD of MGFD Primary
ESQD (ft)[g]				

Notes:

a. As described per Section 6.1.4
b. Manual operations involve excavating anomalies with hand tools
c. Mechanized operations involve excavating anomalies with an excavator and mechanically screening the soil. Conducting mechanized operations may require a long reach excavator or remotely operated equipment.
d. Primary MGFD following Limited Clearance ahead of Construction will be the 60mm M49A2 Mortar.
e. K18 distance may be used if essential personnel wear double hearing protection that provides ≥ 9-decibel attenuation.
f. Requires DDESB-approved shields/barricades designed to defeat hazardous fragments.
g. From Fragmentation Data Review Form (DDESB, 5/03/2018)

Figure 3: EQSD Arc Maps

Note: Utilize additional figures as required to present a complete description as “Figure 3.[X]”.

Table 8: PESs Encumbering

PES Bldg/ Area	PES Type/ Ops	Areas Encumbered by PES	IL/K18[b] From PES (ft)	PES explosive limits by class/division (C/D) (lb)					
				1.1	1.2.1 (MCE)	1.2.2	1.2.3 (MCE)	1.3	1.4
Area:									
Area:									

Notes:

a. All PES are located within the ESS Areas, distances to specific construction footprints are unknown.
b. IL/K18 = Unbarricaded intraline (IL) distance, derived from NAVSEA OP 5, Table 7-10. Quantities not found in Table 7-10 were calculated using the formula $D\text{-}18W^{1/3}$.
c. AGM= Above Ground Magazine
d. CAP= Combat Aircraft Parking
e. ECF= Earth Covered Flow-through
f. EOL= Explosive Operating Location
g. FMHA= Flight line Munitions Holding Area
h. IDS= Intentional Detonation Site
i. MCE = maximum credible event
j. MEQ= Mission Essential Quantities

15.0 ANNEXES

This section designated to record approved Annexes as outlined in paragraph 1.3.3 of this document.

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