

Explosives Site Plan
Amendment 2

Military Munitions Response Program Remedial Investigation/Feasibility Study

Camp Forsyth Landfill Area 2 Munitions Response Site Fort Riley, Kansas

> March 2012 March 2014 March 2015

Prepared By

Bay West LLC

for

U.S. Army Corps of Engineers Omaha Military Munitions Design Center Amendment 2 to the Department of Defense Explosives Safety Board (DDESB) approved "Military Munitions Response Program Remedial Investigation/Feasibility Study, Camp Forsyth Landfill Area 2 Munitions Response Site, Fort Riley, Kansas," dated March 2012, is submitted to include:

- Amend the start date;
- Additional acreage for Breakneck Creek;
- And remote removal procedures for munitions that may get stuck in mechanized MEC equipment;
- Establishment of the M49 series 60 mm mortar as the MGFD for Breakneck Creek; and
- Adjustment of the permitted NEW of the magazine to allow its continued use.

Table of Contents (No Change)

1.0	Site (No Change)	.1
2.0	Anticipated Start Date (Amended)	.1
3.0	Purpose (No Change)	.1
4.0	Site Background and Current Conditions (Amended)	.1
5.0	Executing Agencies (No Change)	.1
6.0	Scope of Investigation Actions (Amended)	2
7.0	Safety Criteria (Amended)	2
8.0	Methods of Disposal (Amended)	3

Appendices (Amended)

Appendix A: Maps (Amended)

Appendix B: Fragmentation Data Review Form (Amended)

1.0 Site (No Change)

a. Name

Camp Forsyth Landfill Area 2 Munitions Response Site (CFLFA 2 MRS), Fort Riley (FTRI)

b. State

Kansas

2.0 Anticipated Start Date (Amended)

April 2015

3.0 Purpose (No Change)

The objective of the Remedial Investigation and Feasibility Study (RI/FS) at the CFLFA 2 MRS is to determine the source of Unexploded Ordnance (UXO) that was found in the Republican River and to determine the need for further munitions response actions.

Subsequent removal responses may be dictated, as determined by action memoranda or other decision documents. Based on the results of this RI/FS and subsequent decision document, an Explosives Safety Submission (ESS) will be submitted in accordance with Department of Defense (DoD) 6055.09-M.

This Explosives Site Plan (ESP) will serve as a zero base approach to ensure current submission standards for munitions response actions are met at CFLFA 2 MRS. The Explosives Safety Submission (ESS) "*Camp Forsyth Landfill Area 2 Munitions Response Site, Fort Riley, Kansas*" approved by Department of Defense Explosives Safety Board (DDESB) on 07 August 2008, as No Change will be considered closed out. The information generated from prior submissions will be used to establish the Munition with the Greatest Fragmentation Distance (MGFD). An RI/FS report will be submitted for the above referenced investigation. No After Action Report will be submitted.

4.0 Site Background and Current Conditions (Amended)

FTRI was established in 1853 and has had a variety of training areas for light artillery, cavalry, and infantry. An area known as the Camp Forsyth Landfill exists on the east bank of the Republican River (Map 1). The Republican River flooded for approximately 30 days in 1993, causing erosion of the river bank. In 1994, approximately two hundred 3.5-inch (in) and 2.36-in rockets and M1 mines were discovered on a sandbar approximately 700 feet (ft) downstream of the landfill. There are reports that these munitions migrated from the landfill due to erosion; however, other evidence suggests a military maneuver area formerly existed in the vicinity of CFLFA 2 MRS.

A remedial investigation (RI) was performed in the summer of 2014 under ESP Amendment 1. The RI included analog surveys in a portion of Breakneck Creek downstream of Tank Trail Purple (Map 2). One 60 mm M49A2 mortar was recovered at the upstream end of the MRS, adjacent to the Breakneck Creek outfall Tank Trail Purple. No further investigation of Breakneck Creek was authorized because the MRS boundary had been reached; therefore no adjustment was necessary to the ESQD arcs. The Army determined that additional investigation is required upstream to ascertain the extent of MEC. This area was not covered by the ESP necessitating the ESP amendment.

The additional area required for investigation on Breakneck Creek (Map 3) is 3.5 acres. A buffer zone has been added to the MRS to allow for step-out grids. The additional investigative area with buffer comprises 16 acres approximately 300 feet wide centered on Breakneck Creek by 1,760 feet long, beginning at the downstream side of the Breakneck Creek outfall at Tank Trail Purple.

5.0 Executing Agencies (No Change)

Fort Riley;

United States Army Environmental Center; and

United States Army Corps of Engineers (USACE) Omaha Military Munitions Design Center.

6.0 Scope of Investigation Actions (Amended)

a. Scope (Amended)

Table 6-1 describes the scope of the investigation. Map 2 depicts the CFLFA 2 MRS - Republican River Investigative Area and Map 3 depicts the CFLFA 2 MRS - Breakneck Creek Investigative Area.

Munitions Response Site	Type of Investigation	Investigation Method	Acreage
CFLFA 2 MRS (Republican River Investigative Area)	(Republican River RI/FS anomalies.		92.22
CFLFA 2 MRS (Breakneck Creek Investigative Area)	RI/FS	Surface sweep. Digital Geophysical Mapping (DGM) to identify anomalies. Excavation of 100% of DGM-selected anomalies. Mag and dig in DGM inaccessible areas.	16

Table 6-1: Scope of Investigation (Amended)

Only UXO personnel qualified in accordance with (IAW) DDESB Technical Paper (TP) 18 will perform UXO operations.

The investigation will be by manual and mechanized methods.

The UXO Team will use earth moving machinery (EMM) to assist in manual excavation of anomalies. A UXO Technician will guide excavation and excavation with EMM will stop at least 12-in from anomalies and continue with hand tools.

The UXO Team will use EMM to remove material from the river bed, spread the material or process it through a mechanical screen plant, and inspect it for the presence of munitions. There will be intentional contact with munitions and explosives of concern (MEC). Personnel operating mechanized equipment will be shielded and maintain the K24 separation distance (K18 if using hearing protection of 9 decibels or better) as described in the Fragmentation Data Sheet in Appendix B. During excavation, the K18 distance is achieved by using an excavator with an effective digging range of >23 feet in **the Republican River Investigative Area and >14 feet in the Breakneck Creek Investigative Area**. This is a low input mechanized MEC operation IAW DoD6055.09-M V7.E4.5.8.3.5.1 because there is no intent to deform the munitions. The mechanical screen plant will be equipped with a remote kill switch located at or outside the K24/K18. If a munition becomes stuck in the mechanical screen plant, the screen plant will be shut down and the munition will be removed. If the munition is determined to have an unacceptable risk of movement, it will be removed remotely using the unintentional detonation distances presented in Table 7-1 or using mechanized equipment observing shielding and overpressure distance requirements.

7.0 Safety Criteria (Amended)

The MGFD in the Republican River Investigative Area is the M28A2, 3.5-inch Anti-Tank Rocket (M28A2) Map 2).

The MGFD in the Breakneck Creek Investigative Area is the M49 series 60 mm mortar because an M49A3 was recovered immediately downstream of the Breakneck Creek outfall at Tank Trail Purple during the 2014 RI (Map 3). The M49A5 has been ruled out because it was fielded after military training ceased at the MRS.

If MEC with a greater fragmentation distance is encountered, the Minimum Separation Distances (MSD) will be adjusted in accordance with DDESB TP 16, operations will continue, and an amendment to this ESP will be submitted for approval (a copy of this document will be available on-site). Explosives Safety Quantity Distance (ESQD) arcs will be adjusted accordingly.

- a. See Appendix B for Fragmentation Data Sheets.
- b. See Table 7-1 for MSD.
- c. Any occupied buildings or public roadways in the MSD areas during MEC related operations will be evacuated and/or roadways blocked to prevent non-essential personnel from entering during the conduct of MEC operations.
- d. The Installation mandated no more than 100 feet MSD for intentional detonations. The UXO Team will use engineering controls (single or multiple items) IAW the DDESB Buried Explosion Module (BEM), Version 6.3.2 or later and DDESB Technical Paper (TP) 16. These documents will be available on site.

			Unintentio	nal Detonation		Intentional Detonation
Investigative Area	MGFD	Hazardous Fragment Distance	Team Separation Distance (K40)**	<u>K24</u> Overpressure Distance	<u>K18</u> Overpressure Distance	Maximum Fragment Distance Horizontal
Republican						
River	M28A2	<u>157</u>	<u>52</u>	<u>31</u>	<u>23</u>	<u>772</u>
Breakneck	M49A2	152	28	17	13	<u>1,322</u>
Creek	M49A3/A4	<u>162</u>	<u>31</u>	<u>19</u>	<u>14</u>	1,156
	•		•	2014. Underscore		
** Team Sepai	ration Distance	e during mechan	ized operations w	vill be the Hazardo	us Fragment Distai	nce.

Table 7-1: Minimum Separation Distances (feet)*(Amended))

8.0 Methods of Disposal (Amended)

a. Disposal (No change)

The UXO Team will dispose of MEC by detonation or open burning within the MRS. All explosives operations will follow the procedures outlined in Technical Manual (TM) 60A 1-1-31 and Engineering Manual (EM) 385-1-97, *Explosives Safety and Health Requirements Manual*. Demolition operations will be performed daily or items properly guarded until operations can be conducted.

The UXO Team will normally detonate munitions encountered in place. The exception is when technically qualified personnel who are performing the functions of the Senior Unexploded Ordnance Supervisor (SUXOS) and Unexploded Ordnance Safety Officer (UXOSO) determine the risk associated with movement is acceptable, and movement is necessary for the protection of people, property, or critical assets, or the efficiency of the activities being conducted. In such cases, the SUXOS and UXOSO responsible for the MEC activities may evaluate the munition and authorize its movement within the MRS.

Collection Points (No change)

Collection points are those areas used to temporarily accumulate MEC pending destruction at the end of the day using consolidated shots. MEC items at collection points must be laid out as shown IAW US Army Engineering and Support Center, Huntsville (USAESCH) publication "*Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites, August 1998 with Terminology update March 2000.*" A copy of this report will be available at the site. The maximum net explosive weight (NEW) at a collection point will be limited such that the K40 overpressure distance for the total NEW does not exceed the HFD for the area. MEC will not be left unattended in collection points.

Consolidated Shots (No change)

The UXO Team will consolidate multiple MEC for disposal IAW USAESCH publication "Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites, August 1998 with Terminology Update March 2000." A copy of this report will be available At the site. The maximum NEW during a consolidated

shot must be limited such that the K328 overpressure distance for the total NEW (including donor charges) does not exceed the MSD for the intentional detonation.

<u> Open Burning (No change)</u>

The maximum NEW during a burn must be limited so that the K328 overpressure distance does not exceed the MSD for intentional detonations.

b. Explosives (Amended)

The UXO Team will store project explosives in a Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) Type 2 magazine with attached detonator box (Map 4). The maximum Net Explosive Weight stored in the magazine is being reduced to preclude closing Tank Trail Purple to traffic. Approach roads to the magazine will be signed to preclude parking within the inhabited building distance. Table 8-1 presents the magazine data. If intentional detonations in the Breakneck Creek Investigative Area encumber the magazine, engineering controls will be used to protect the magazine.

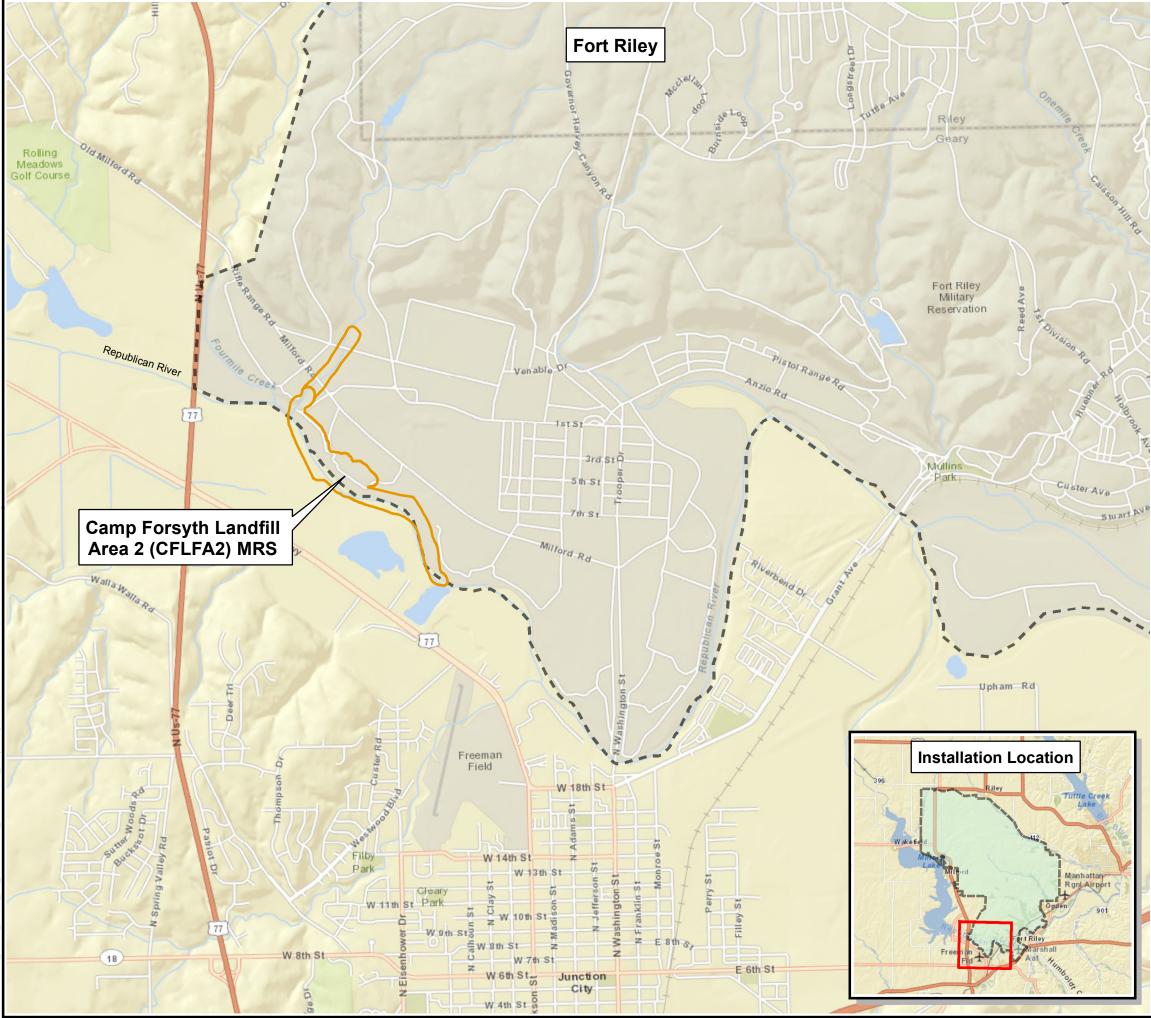
	Table 8-1: Magazine Data	
Maximum Net Explosive Weight	Inhabited Building Distance**	Public Traffic Route Distance*
(HD1.1)*		
31 lbs.	200 ft.	120 ft.
*HD 1.4 may be stored to capacity		
**Department of Defense (DoD) 6055.	.09-M V3.E3.T2.	

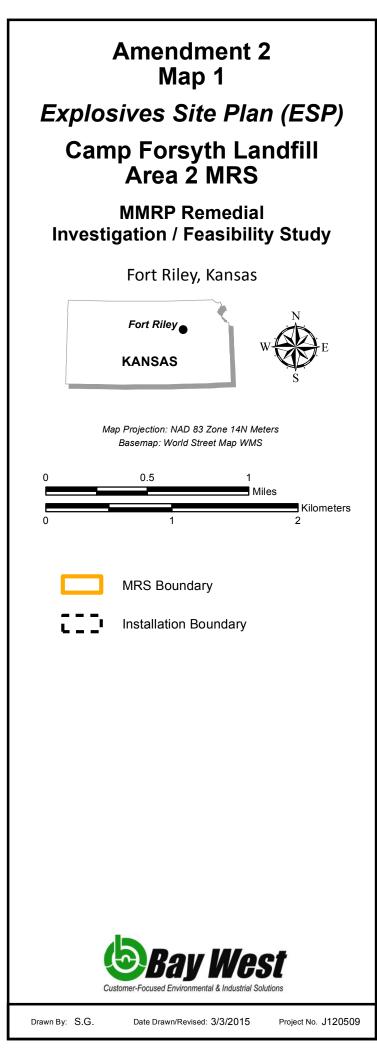
c. MPPEH (No change)

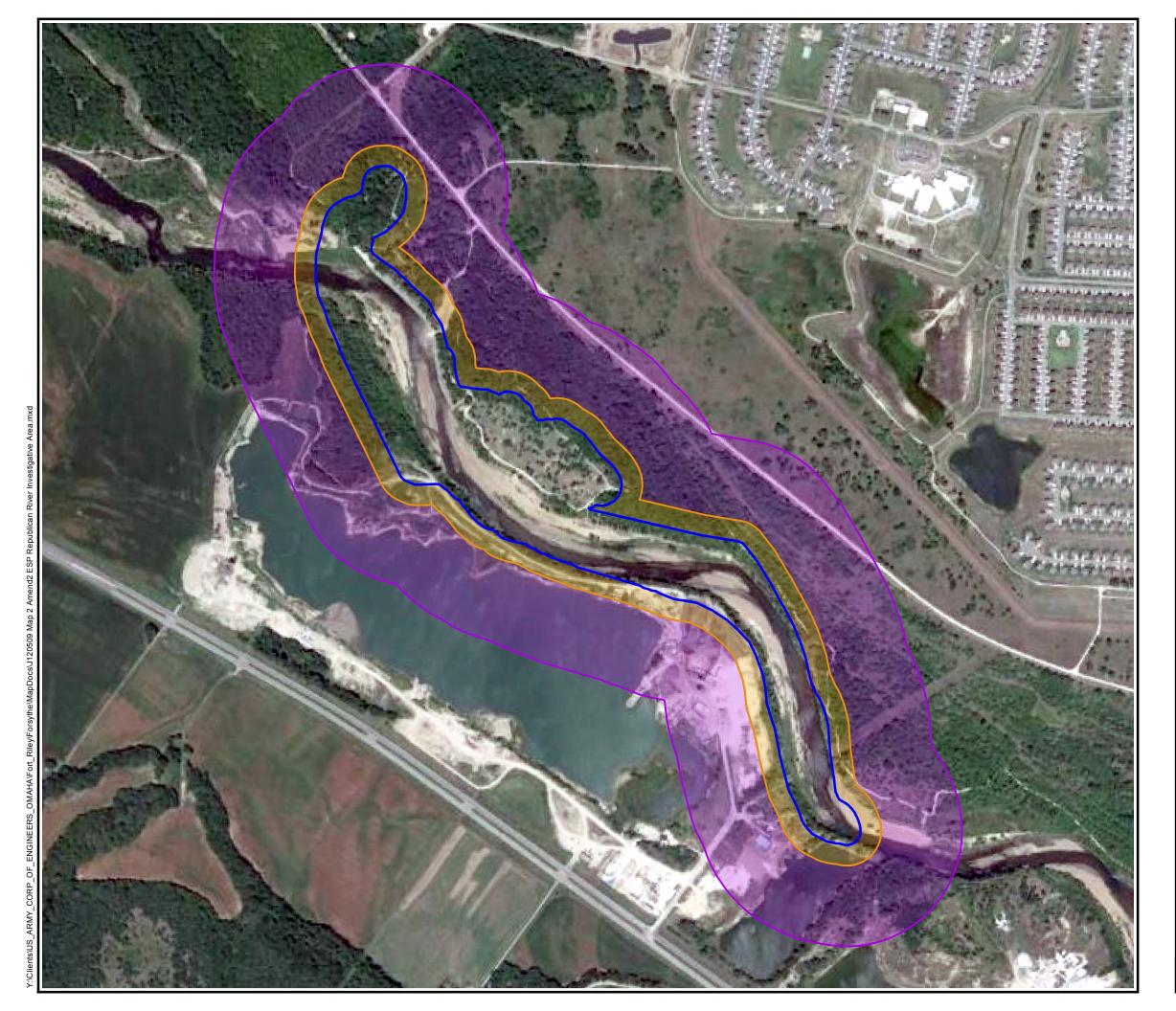
All Material Potentially Possessing an Explosive Hazard (MPPEH) procedures will be IAW DoD Instruction 4140.62 and EM 1110-1-4009. MPPEH will be assessed and its explosives safety status determined and documented prior to transfer within the DoD or release from DoD control. Prior to release to the public, MPPEH will be documented by authorized and technically qualified personnel as Material Documented as Safe (MDAS) after a 100% inspection and an independent 100% reinspection to determine that it is safe from an explosives safety perspective.

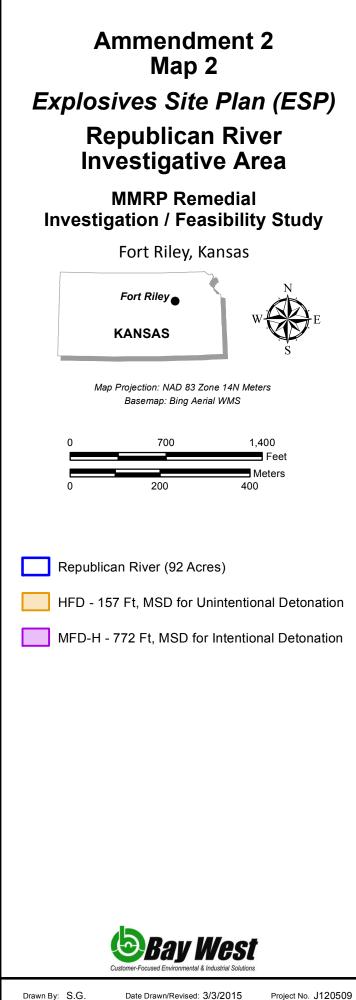
Appendix A

Maps (Amended)

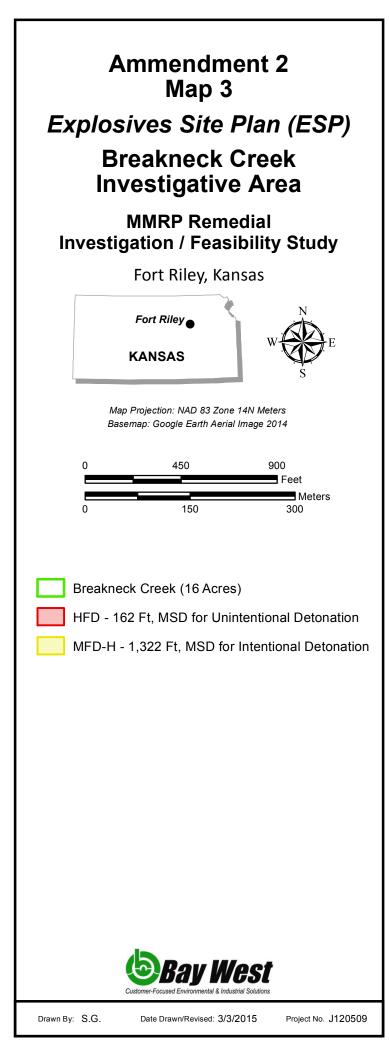


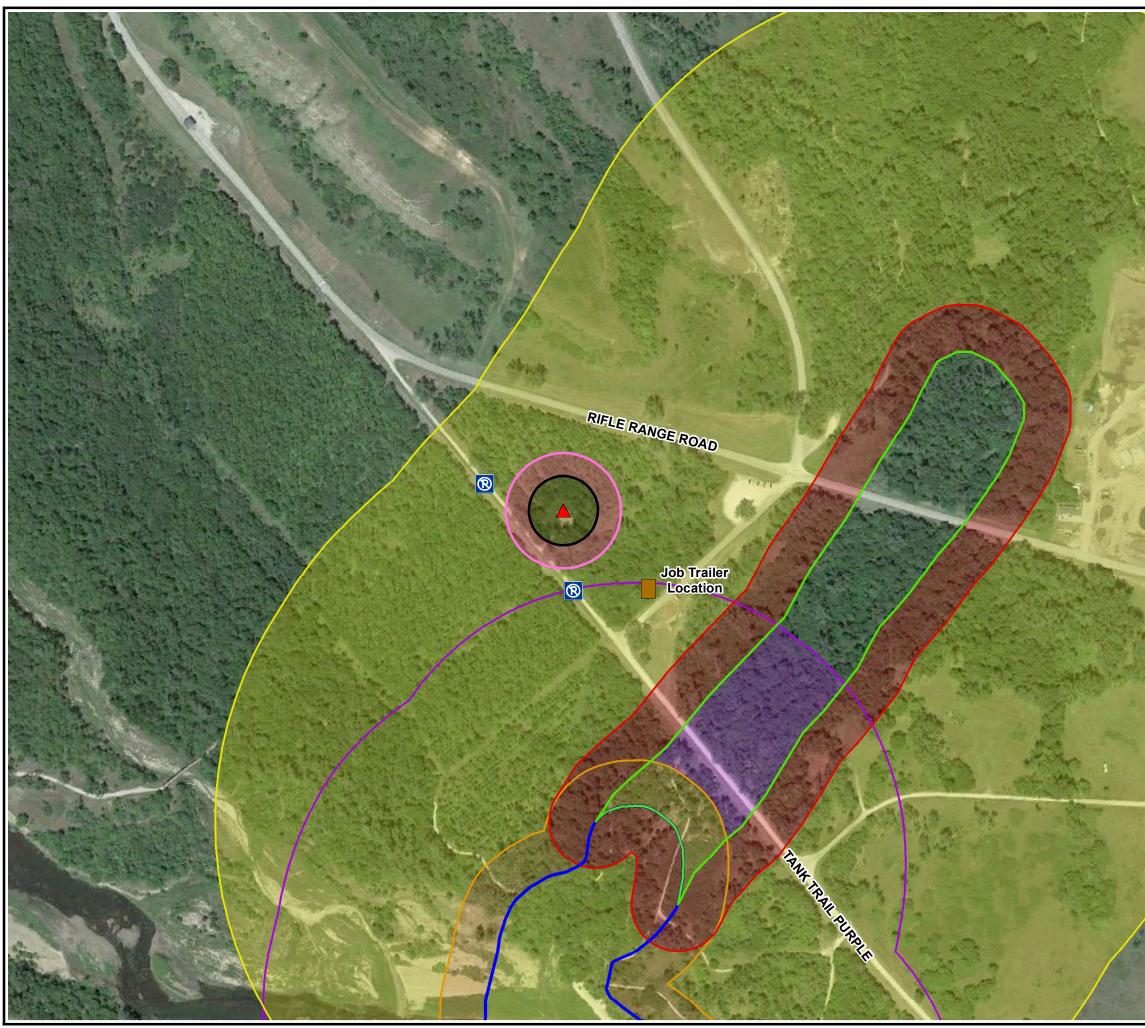


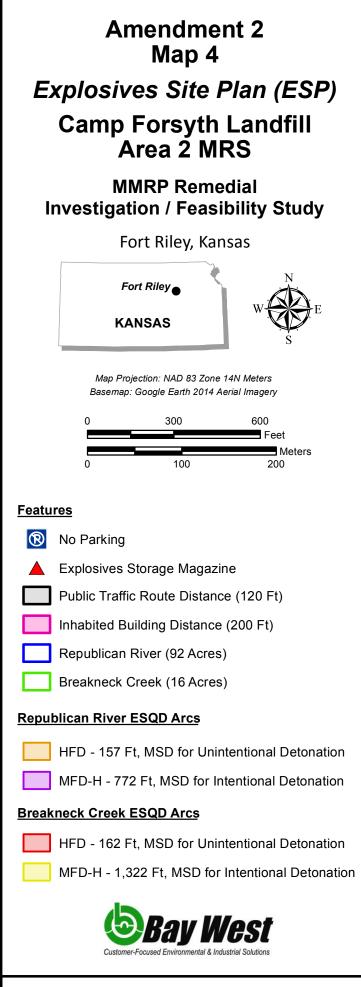












Appendix B

Fragmentation Data Review Forms (Amended)

Fragmentation Data Review Form

Database Revision Date 8/21/2014

Category:	Surface-Launch	ed HE Rounds	DODIC:	
Aunition:	3.5 in M28A2 R	ocket	Date Record Created:	Γ
	<u> </u>		Record Created By:	Ē
case Material:	Steel, Mild		Last Date Record Updat	ed:
ragmentation Method:	Naturally Fragm	entina	Individual Last Updated	Record:
econdary Database Category:	Rocket		Date Record Retired:	Γ
unition Case Classification:	Robust		Theoretical Calcul	atad Eraam
	Information a		HFD [Hazardous Fragment Dista	ance: distance
5	tion Characteri		than 1 hazardous fragment per	600 square fe
Explosive Type:	Co	omposition B	MFD-H [Maximum Fragment Dis	stance, Horizo
Explosive Weight (Ib):		1.88	MFD-V [Maximum Fragment Dis	tance, Vertica
Diameter (in):		3.5000		
Cylindrical Case Weight (lb):		1.00688		essure Dista
Maximum Fragment Weight		0.0054	TNT Equivalent (Pressure):	
(Intentional) (lb): Design Fragment Weight (95%)		0.0007	TNT Equivalent Weight - Pressu	
(Unintentional) (Ib):			Unbarricaded Intraline Distance	
Critical Fragment Velocity (fps):		9261	Public Traffic Route Distance (2	
Sandhag and W	tor Mitigation	Ontions	Inhabited Building Distance (1.2	
Sandbag and Wa	ater mitigation		Intentional MSD (0.0655 psi), K	328 Distance:
TNT Equivalent (Impulse):		1.14	Note: Per V5.E3.2.2.1 of DoD 6 distance may be no smaller that	
TNT Equivalent Weight - Impul	se (lbs):	2.143		1200 11.
Kinetic Energy 10 ⁶ (lb-ft ² /s ²):		0.2307	Minimum Thick	ness to Prev
Sing	le Sandbag Mitiga	ation		Intention
Required Wall & Roof Thickness	s (in)	20	4000 psi Concrete (Prevent Spall):	5.80
Expected Max. Throw Distance	(ft):	125	Mild Steel:	0.96
Minimum Separation Distance (ft):	125	Hard Steel:	0.79
		tion	Aluminum:	2.08
Required Wall & Roof Thickness	<u>e Sandbag Mitiga</u> s (in)	Not Permitted	LEXAN:	5.15
			Plexi-glass:	3.56
Expected Max. Throw Distance		Not Permitted	Bullet Resist Glass:	2.82
Minimum Separation Distance (ft):	Not Permitted		Item Notes
	later Mitigation			ntem Notes
Minimum Separation Distance (f	· _	264/200		
Water Containment System:	5 g	al carboys/ inflatable pool		
Note: Use Sandbag and Water M applicable documents and guida grams is utilized, the above miti- applicable. Subject matter expe- specific mitigation options.	nce. If a donor of gation options are	charge larger than 32 e no longer		

DODIC:	H600
Date Record Created:	9/21/2004
Record Created By:	MC
Last Date Record Updated:	9/14/2011
Individual Last Updated Record:	SDH
Date Record Retired:	

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Theoretical Calculated Fragment Distances	5
HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	157
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	772
MFD-V [Maximum Fragment Distance, Vertical] (ft):	628
Querpressure Distances	
Overpressure Distances	
TNT Equivalent (Pressure):	1.16
	1.16
TNT Equivalent (Pressure):	
TNT Equivalent (Pressure): TNT Equivalent Weight - Pressure (lbs):	2.181

Note: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K328 distance may be no smaller than 200 ft.

Minimum Thick	ness to Prevent I	Perfor	ation
	Intentional		Unintentional
4000 psi Concrete (Prevent Spall):	5.80		2.43
Mild Steel:	0.96		0.42
Hard Steel:	0.79		0.35
Aluminum:	2.08		0.96
LEXAN:	5.15		3.10
Plexi-glass:	3.56		1.81
Bullet Resist Glass:	2.82		1.33

Item Notes

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Fragmentation Data Review Form

		Database Revis	sion Date 8/21/2014	
Category:	Surface-Lau	nched HE Rounds	DODIC:	Γ
Munition:	60 mm M49	A2	Date Record Created	: [
Case Material:	Steel, Mild		Record Created By: Last Date Record Up	dated:
	Net wells Fr		Individual Last Upda	
Fragmentation Method: Secondary Database Category:	Naturally Fra Mortar	agmenting	Date Record Retired:	i j
Aunition Case Classification:	Robust		Theoretical Ca	culated Fragme
Munition	Informatio	n and	HFD [Hazardous Fragment D	-
	tion Charac		than 1 hazardous fragment	
Explosive Type:		TNT	MFD-H [Maximum Fragment	Distance, Horizor
Explosive Weight (lb):	í E	0.34	MFD-V [Maximum Fragment	Distance, Vertica
Diameter (in):	Г	2.3622		
Cylindrical Case Weight (lb):	Г	1.45420		rpressure Dista
Maximum Fragment Weight	Γ	0.0570	TNT Equivalent (Pressure):	(11-2)
(Intentional) (lb): Design Fragment Weight (95%)	0.0159	TNT Equivalent Weight - Pre Unbarricaded Intraline Dista	
(Unintentional) (lb):		0000	Public Traffic Route Distance	
Critical Fragment Velocity (fps)	:	3982	Inhabited Building Distance	
Sandbag and Wa	ater Mitigati	ion Options	Intentional MSD (0.0655 psi)	
TNT Equivalent (Impulse):		1	Note: Per V5.E3.2.2.1 of Dol	
TNT Equivalent Weight - Impul	se (lbs):	0.340	distance may be no smaller	than 200 ft.
Kinetic Energy 10 ⁶ (lb-ft ² /s ²):		0.4518	Minimum Th	ickness to Prev
Sing	le Sandbag M	<u>litigation</u>		Intentiona
Required Wall & Roof Thickness	s (in)	20	4000 psi Concrete (Prevent Spall):	4.96
Expected Max. Throw Distance	(ft):	125	Mild Steel:	0.97
Minimum Separation Distance ((ft):	125	Hard Steel:	0.79
Doubl	le Sandbag M	itigation	Aluminum:	1.97
Required Wall & Roof Thickness	Ŭ	48	LEXAN:	5.75
Expected Max. Throw Distance	(ft):	10	Plexi-glass: Bullet Resist Glass:	4.14
Minimum Separation Distance ((ft):	12.5		5.77
W	Vater Mitigatio	on -		Item Notes
Minimum Separation Distance (f	-	264/200		
Water Containment System:		5 gal carboys/ inflatable pool		
Note: Use Sandbag and Water M applicable documents and guida grams is utilized, the above miti applicable. Subject matter expe specific mitigation options.	ance. If a dor gation option:	hor charge larger than 32 s are no longer		

Distribution authorized to the Department of Defense and U.S. DoD contractors only for Administrative-Operational Use (17 October 2002). Other requests shall be referred to the Chairman, Department of Defense Explosives Safety Board, Room 856C, Hoffman Building I, 2461 Eisenhower Avenue, Alexandria, VA 22331-0600.

d Created:	9/21/2004
ated By:	MC
ecord Updated:	9/14/2011
ast Updated Record:	SDH
d Retired:	

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2.74 2.19

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Theoretical Calculated Fragment Distanc	es
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	
Overpressure Distances	1
·	1
TNT Equivalent (Pressure):	1 0.340 13

lance 28 tance:

minimum sited K328

ent Perforation **Unintentional** al 2.99 0.58 0.48 1.23 4.21

Fragmentation Data Review Form

DODIC:

Database Revision Date 8/21/2014

ategory:	Surface-L	aunched HE Rounds
lunition:	60 mm N	149A3/M49A4
ase Material:	Iron, Pea	rlitic Malleable
ragmentation Method:	Naturally	Fragmenting
econdary Database Category:	Mortar	
unition Case Classification:	Robust	
	n Informa ation Char	tion and acteristics
Explosive Type:		Composition B
Explosive Weight (lb):		0.42
Diameter (in):		2.3622
Cylindrical Case Weight (lb):		1.35179
Maximum Fragment Weight (Intentional) (Ib):		0.0354
Design Fragment Weight (95% (Unintentional) (lb):))	0.0081
Critical Fragment Velocity (fps)	:	4788
TNT Equivalent Weight - Impu Kinetic Energy 10 ⁶ (Ib-ft²/s²):	lse (lbs):	0.479
Sing	gle Sandba	g Mitigation
Required Wall & Roof Thicknes	s (in)	12
Expected Max. Throw Distance	(ft):	25
Minimum Separation Distance	(ft):	25
Doub	le Sandbag	Mitigation
Required Wall & Roof Thicknes	s (in)	24
Expected Max. Throw Distance	(ft):	10
Minimum Separation Distance	(ft):	12.5
V	Vater Mitiga	ation
Minimum Separation Distance (ft):	200/200
Water Containment System:		5 gal carboys/ inflatable pool
Note: Use Sandbag and Water I applicable documents and guida grams is utilized, the above mit	ance. If a o	donor charge larger than 32

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

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Theoretical Calculated Fragment Distances				
HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	162			
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	1156			
MFD-V [Maximum Fragment Distance, Vertical] (ft):	910			
Overpressure Distances				
TNT Equivalent (Pressure):	1.16			
TNT Equivalent Weight - Pressure (lbs):	0.487			
INT Equivalent Weight - Pressure (lbs): Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	0.487			

ntentional MSD (0.0655 psi), K328 Distance:	
lote: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K3.	28
listance may be no smaller than 200 ft.	

Minimum Thickness to Prevent Perforation					
	Intentional		Unintentional		
4000 psi Concrete (Prevent Spall):	5.24		2.89		
Mild Steel:	1.02		0.57		
Hard Steel:	0.84		0.47		
Aluminum:	2.12		1.22		
LEXAN:	5.92		4.13		
Plexi-glass:	4.24		2.63		
Bullet Resist Glass:	3.51		2.06		

Item Notes

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