# APPENDIX A

# SCREENING EVALUATION OF VEGETATION CLEARANCE METHODS

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## TABLE

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# SCREENING EVALUATION OF VEGETATION CLEARANCE METHODS

## A1.0 INTRODUCTION

This Screening Evaluation of Vegetation Clearance Methods (Evaluation) identifies, evaluates and screens applicable vegetation clearance methods suitable for use during Interim Actions being considered under the accompanying *Ordnance and Explosives Interim Action Remedial Investigation/Feasibility Study, For Ranges 43-48, Range 30A, and Site OE-16 [IA sites] at Former Fort Ord, California [IA RI/FS]*. Due to the type of unexploded ordnance (UXO) present at these IA sites, their close proximity to residential areas, and the history of trespassing incidents at these sites, remedial actions are being evaluated for these IA sites. Vegetation clearance must be performed prior to conducting remedial action to improve visual identification of UXO on the ground surface; therefore, the objectives of this Evaluation are to:

1. Identify vegetation clearance methods that can clear vegetation to bare ground or approximately 6 inches above ground surface to allow for proper operation of UXO detection equipment and provide the required ground surface visibility for OE remedial workers, without causing unacceptable impacts to human health or the environment.

2. Evaluate a range of methods and select alternatives for analysis in the accompanying IA RI/FS that are the most effective, implementable and cost effective at clearing vegetation to allow OE remedial workers to then safely locate and remove UXO from the IA sites.

This Evaluation is organized as follows:

**A1.0 Introduction**

Presents the objectives of this Evaluation.

**A2.0 Identification and Description of Vegetation Clearance Methods**

Identifies and describes the vegetation clearance methods that are potentially applicable for each of the IA sites based on a variety of important site-specific parameters.

**A3.0 Screening of Vegetation Clearance Methods and Evaluation of Alternatives**

Evaluates each of the methods based on the Screening criteria, provides the rationale for elimination of methods that do not meet the criteria, and presents the evaluation of the alternatives that were retained for further consideration.

**A4.0 References**

Provides a list of references cited in this Appendix.

# A2.0 IDENTIFICATION AND DESCRIPTION OF VEGETATION CLEARANCE METHODS

A range of vegetation clearance methods identified as potentially applicable for clearing vegetation at the IA sites are evaluated herein: (1) No Action, (2) Manual, Mechanical, and Remotely-Operated Mechanical Clearing, (3) Prescribed Burning, (4) Animal Grazing, and (5) Herbicide Application. This section presents a description of each method, and a discussion of the following parameters:

1. How the Method is Carried Out in the Field
2. Worker Exposure to UXO
3. Accidental Detonation of UXO
4. Duration of the Vegetation Clearance Method
5. Air Emissions
6. Erosion
7. Impacts to Protected and Other Natural Resources
8. Use at Fort Ord or Other Sites and Under What Conditions
9. Availability of Equipment and Personnel
10. Deposition of Vegetation
11. Visibility of Ground Surface
12. Regrowth of Vegetation and Maintenance Requirements
13. Level of Effort in Terms of Personnel.

The general descriptions of vegetation clearance methods presented below are applicable to all three IA sites because the terrain and vegetation are similar at these sites and the methods are potentially applicable to any type of vegetation clearance at Fort Ord. In instances where there is a difference in site-specific conditions between the IA sites when discussing the above parameters, however, site-specific characteristics will be described for each of the IA sites.

## A2.1 No Action

Taking No Action would not clear vegetation from the IA sites prior to OE Remedial Actions and is only considered as a baseline against which to compare other methods as required under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

## A2.2 Manual, Mechanical, and Remotely-Operated Mechanical Vegetation Clearance

These methods are grouped together because they all physically cut the vegetation; however, they differ from one another in terms of the level of safety during implementation, their applicability under site-specific conditions, and impacts to human health and the environment associated with their use. These methods include vegetation clearance by a human operator using hand tools or mechanized equipment, either by direct or remote operation. The purpose of these methods is to cut vegetation that will allow access to the IA sites by OE workers. The distinction between each of these methods is a function of the labor involved in operating the equipment and the degree of potential worker exposure to UXO during clearing activities.

- Manual Clearing is conducted by an operator that is on foot and in the work area being cleared while operating the equipment. Examples would be a worker using pruning shears or a hand held trimmer fitted with a brush blade.

- Mechanical Clearing is conducted by an operator situated on self-propelled equipment in the work area being cleared. An example would be a worker operating a tractor from inside the cab.

- Remotely-Operated Mechanical Clearing is conducted by an operator situated at a remote location away from the work area while operating self-propelled equipment within the work area. An example would be the worker operating heavy equipment such as a Tractor-Accessorized Zeirreisst (TAZ) unit via radio control from a distance of 100 feet away.

The ease of use of each of these vegetation clearance methods is in part a function of slope angle, and the height and density of vegetation. The terrain at the IA sites in some areas slopes slightly to moderately with angles ranging from 0 to less than 20 percent (0 to 10 degrees); therefore, the slope angle is not steep enough to affect the performance of the mechanized equipment. Vegetation clearance performed as part of previous removal actions at Fort Ord were mostly concentrated in the northern portion of the base where manual and mechanized clearance methods were used in designated development areas where surface UXO was not present.

Descriptions of each method, including how they are performed, their applicability at the IA sites, and the degree to which the method affects human health, worker safety, and the environment are presented below. Each of the three cutting methods are described based on the parameters listed above.

### A2.2.1 Manual Clearance

***How the Method is Carried Out in the Field***

This method involves cutting and clearing of vegetation using motorized chainsaws, power chippers, mowers, weed eaters and non-motorized hand tools such as clippers and loppers. Small diameter or short shrubs could be cut and hand-carried to a staging or stockpiling area for chipping or disposal. Large diameter shrubs and trees could be "limbed up" to allow access under the canopy by OE workers. This method is effective at selectively removing vegetation.

***Worker Exposure to UXO***

Manually cutting vegetation would expose workers to UXO that is present in areas being cleared, which if accidentally detonated, could cause serious injury or death. Proper worker awareness, protective equipment and care could reduce worker exposure to injury. The type of UXO present at the IA sites is extremely sensitive and highly dangerous, and could potentially be suspended in the branches of the vegetation being cleared, where it could cause serious injury or death to workers.

***Accidental Detonation of UXO***

In the case of accidental detonation of UXO, manual cutting would expose workers to flying fragments or blast debris depending on the distance to, and the type and size of the UXO. In general, the possibility exists for any vegetation clearance method applied at the IA sites to detonate UXO. Manual cutting has a high likelihood of causing serious injury or death of workers. Mitigation of potential public exposure to flying fragments or blast debris from accidental detonation of UXO during vegetation clearance activities would be addressed in the site health and safety plan for individual areas. In addition, a community safety plan would be provided to present information regarding accidental and intentional detonation of UXO. In general, potential public exposure would be prevented by: (1) conducting a pre-field analysis of the type, size and orientation of the UXO known or expected to be present in a given area and its proximity to the public, (2) calculation of the maximum distance flying fragments or blast debris would travel based on the type and size of UXO, and (3) implementation of mitigation measures if necessary to prevent public exposure.

***Duration of the Vegetation Clearance Method***

Manual vegetation clearance at the IA sites using two 6-person crews operating at 2 acres per day would take approximately 40 weeks (10 months) for the 483 acres at Ranges 43-48; approximately 28 weeks (7 months) for the 388 acres at Range 30A; and approximately 6 weeks (1.5 months) for the 80 acres at Site OE-16.

***Air Emissions***

Air emissions from manual clearing and potential emissions from accidentally detonated UXO are believed to be insignificant with regards to impacts to human health, the environment and worker safety.

***Erosion***

Manual vegetation clearance could be used on slopes where equipment access is not possible or safe to operate. Manual clearance would cause a minimum of surface disturbance in the short term and would remove only plant material that interferes with visibility and access to UXO; however, cutting vegetation could cause erosion in the long term because this method is likely to result in lower diversity and abundance of vegetation.

***Impacts to Protected and Other Natural Resources***

Cutting would have adverse impacts on rare, threatened, endangered, and native plant species present at the IA sites during and after implementation of cutting because it cannot be applied selectively to non-threatened or endangered plants and species (Table 1 of the accompanying IA RI/FS). If cutting were used to clear Central Maritime Chaparral (CMC) vegetation, natural re-vegetation of the area would likely be less diverse and abundant and contain fewer threatened, endangered, and native plant species than present in vegetation communities prior to cutting. Cutting may result in converting existing high quality CMC habitat to a more common and lower quality habitat type. Thus, cutting would not be protective of current environmental conditions in terms of the presence of habitat containing threatened, endangered, and native plant species. These anticipated results are based on preliminary observations made during monitoring of habitat recovery after vegetation clearance at Fort Ord conducted under the HMP monitoring program, which indicated the following:

- Seedlings of HMP shrubs were rarely observed in cut areas after clearance activities. A preliminary evaluation indicated HMP shrub regeneration of only 29 seedlings per acre occurred after cutting as compared to 3,000 seedlings per acre after burning.
- Species diversity was generally lower in cut areas.
- Fewer native herbaceous species were observed in cut areas.

Cutting and placing cut vegetation in windrows and mulch piles on the ground surface appeared to interfere with natural chaparral re-vegetation by occupying habitat and shading the under-story and reducing germination by shrub and herbaceous species.

In addition, because CMC habitat contains protected species at these sites, resource management measures are required by United States Department of the Interior, Fish and Wildlife Service (USFWS). Implementation of cutting in areas greater than 50 acres in size would not be consistent with the Biological and Conference Opinion (*USFWS, 1993; 1997*) issued by USFWS in accordance with the Endangered Species Act.

***Use at Fort Ord or Other Sites and Under What Conditions***

Manual vegetation clearance has been used extensively in development areas and on a limited basis in designated CMC habitat reserve areas at the former Fort Ord under special circumstances where burns cannot be conducted

or terrain is extremely steep. OE contractors typically use a manual brush clearance team consisting of a UXO supervisor and several laborers. Vegetation would be trimmed only to the extent necessary to allow safe access for OE workers.

***Availability of Equipment and Personnel***

Equipment necessary for manual cutting may be available; however, two 6-person crews would have to be available to work full time for approximately 40 weeks (10 months) to clear Ranges 43-48, 28 weeks (7 months) to clear Range 30A, and 6 weeks (1.5 months) of vegetation.

***Deposition of Vegetation***

Vegetation that is cut would typically be hauled to a staging area onsite where it would be chipped or shredded, which would require these areas first be cleared of vegetation and UXO. Recovery of many rare, threatened, or endangered species could be inhibited by a thick layer of woody cuttings, thus inhibiting germination.

***Visibility of Ground Surface***

Safety procedures require the vegetation be cleared to bare ground or approximately 6 inches above ground surface to allow for proper operation of UXO detection equipment and prevent the accidental detonation of UXO on the surface while providing clear enough ground surface visibility for OE workers. This level of clearance could be achieved using manual methods; however, the smaller cuttings generally fall to the ground where they may obscure or cover UXO. The larger cuttings could be gathered and hauled to a staging area for chipping or disposal.

***Regrowth of Vegetation and Maintenance Requirements***

Vegetation cleared by manual methods would not likely require additional cutting if each area has an OE Remedial Action immediately following vegetation clearance; however, standards for long term maintenance of manually cleared vegetation are not known and have not been established.

***Level of Effort in Terms of Personnel***

Manual clearance would require coordination of labor crews accompanied by UXO specialists working with vegetation clearance workers at a rate of 2 acres per day using two 6-person crews over a period of 40 weeks (10 months) for the 483 acres at Ranges 43-48, 28 weeks (7 months) for the 388 acres at Range 30A, and 6 weeks (1.5 months) for the 80 acres at Site OE-16.

### A2.2.2 Mechanical Vegetation Clearance

***How the Method is Carried Out in the Field***

This method consists of using human-operated equipment in 3 basic configurations to cut vegetation: Tractor pulled, track-carriers with booms and skid-steer. These types of equipment have been given product names such as the Brush hog, Hydro-Ax, TAZ, and Brontosaurus and are described below. Equipment operators maneuver the equipment onto the OE sites to clear the vegetation.

***Worker Exposure to UXO***

Mechanically cutting vegetation would expose workers to UXO that is potentially present in areas being cleared, which if accidentally detonated, could cause serious injury or death. Although the machinery being operated could potentially separate the workers from direct contact with UXO and proper worker awareness, protective equipment and care could reduce worker exposure to injury, the type of UXO present at the IA sites is extremely sensitive and in some cases, high explosive antitank (HEAT) armor piercing ammunition which is designed to destroy heavy equipment may be present.

***Accidental Detonation of UXO***

In the case of accidental detonation of UXO, mechanical cutting would directly expose the

equipment operator or other workers to flying fragments or blast debris depending on distance to, and the type and size of the UXO. In general, the possibility exists for any vegetation clearance method applied at the IA sites to detonate UXO. Mechanical cutting has a high likelihood of causing serious injury or death of workers because they would only be separated from direct contact by heavy equipment, and some types of UXO such as high explosive antitank (HEAT) armor piercing ammunition is designed specifically to destroy heavy equipment. Mitigation of potential public exposure to flying fragments or blast debris from accidental detonation of UXO during vegetation clearance activities would be addressed in the site health and safety plan for individual areas. In addition, a community safety plan would be provided to present information regarding accidental and intentional detonation of UXO. In general, potential public exposure would be prevented by: (1) conducting a pre-field analysis of the type, size and orientation of the UXO known or expected to be present in a given area and its proximity to the public,
(2) calculation of the maximum distance flying fragments or blast debris would travel based on the type and size of UXO, and
(3) implementation of mitigation measures if necessary to prevent public exposure.

***Duration of the Vegetation Clearance Method***

Mechanical vegetation clearance at a rate of 2.5 acres per day (two passes at 5 acres per day; one pass to clear to 2 feet and a second pass to clear to bare ground or approximately 6 inches above ground surface) would take approximately 32 weeks (8 months) for the 483 acres at Ranges 43-48, 22 weeks (5.5 months) for the 388 acres at Range 30A, and 5 weeks (1.25 months) for the 80 acres at Site OE-16.

***Air Emissions***

Potential emissions from mechanically operated equipment or accidentally detonated UXO are believed to be insignificant with regards to impacts to human health, the environment and worker safety.

***Erosion***

Mechanical vegetation clearance has the potential to cause surface disturbance and erosion in the short term due to cutting equipment scalping the surface and equipment tires or tracks that could create ruts that lead to erosion. Mechanically cutting vegetation could also cause erosion in the long term because this method is likely to result in lower diversity and abundance of vegetation.

***Impacts to Protected and Other Natural Resources***

Cutting would have adverse impacts on threatened, endangered, and native plant species present at the IA sites during and after implementation of cutting because it cannot be applied selectively to non-threatened or endangered plants and species (Table 1 of the accompanying IA RI/FS). If CMC vegetation is cleared by herbicide application, it likely will not grow back as diverse or as abundant and may result in converting CMC habitat to a more common habitat type. If cutting were used to clear CMC vegetation, natural re-vegetation of the area would likely be less diverse and abundant and contain fewer threatened, endangered, and native plant species than present in vegetation communities prior to cutting. Cutting may result in converting existing high quality CMC habitat to a more common and lower quality habitat type. Thus, cutting would not be protective of current environmental conditions in terms of the presence of habitat containing threatened, endangered, and native plant species. These anticipated results are based on preliminary observations made during monitoring of habitat recovery after vegetation clearance at Fort Ord conducted under the HMP monitoring program, which indicated the following:

- Seedlings of HMP shrubs were rarely observed in cut areas after clearance activities. A preliminary evaluation indicated HMP shrub regeneration of only 29 seedlings per acre occurred after cutting

as compared to 3,000 seedlings per acre after burning.

- Species diversity was generally lower in cut areas.
- Fewer native herbaceous species were observed in cut areas.

Cutting and placing cut vegetation in windrows and mulch piles on the ground surface appeared to interfere with natural chaparral re-vegetation by occupying habitat and shading the under-story and reducing germination by shrub and herbaceous species.

In addition, some mechanical methods cause damage to the soil topography by creating ruts and increasing the threat of erosion and are likely to result in lower diversity and abundance of vegetation. If CMC vegetation is cleared by cutting, it likely will not grow back as diverse or as abundant and may result in converting CMC habitat to a more common habitat type. In addition, because CMC habitat contains protected species at the IA sites, resource management measures are required by USFWS. Implementation of cutting in areas greater than 50 acres in size would not be consistent with the Biological and Conference Opinion (*USFWS, 1993; 1997*) issued by USFWS in accordance with the Endangered Species Act.

***Use at Fort Ord or Other Sites and Under What Conditions***

Mechanical vegetation clearance has been used extensively at the former Fort Ord in development areas and on a limited basis where burning cannot be conducted. Mechanical vegetation clearance was used previously in limited areas behind the firing lines only, to support OE investigation. Two mechanized methods that have been used at Fort Ord include the Brush Hog and TAZ as described below. Vegetation would be trimmed only to the extent necessary to allow safe access for OE workers.

***Availability of Equipment and Personnel***

Equipment necessary for mechanical cutting may be readily available; however, operators would have to be available to work full time for approximately 32 weeks (8 months) to clear vegetation over the 483 acres at Ranges 43-48, 22 weeks (5.5 months) to clear vegetation over the 388 acres at Range 30A, and 5 weeks (1.25 months) to clear vegetation over the 80 acres at Site OE-16.

***Deposition of Vegetation***

Vegetation that is cut would chipped or shredded would fall onto the ground, covering UXO and reducing visibility. Recovery of many rare, threatened, or endangered species could be inhibited by a thick layer of woody cuttings, thus inhibiting germination.

***Visibility of Ground Surface***

Safety procedures require the vegetation be cleared to bare ground or approximately 6 inches above ground surface to allow for proper operation of UXO detection equipment and prevent the accidental detonation of UXO on the surface. This level of clearance may be achievable using mechanical methods; however, the cuttings generally fall to the ground where they could obscure or cover UXO.

***Regrowth of Vegetation and Maintenance Requirements***

Vegetation cleared by mechanical methods would not likely require additional cutting if each area has an OE Remedial Action immediately following vegetation clearance; however, standards for long term maintenance of mechanically cleared vegetation are not known and have not been established. Recovery of vegetation would be inhibited because the ground would be covered preventing germination of threatened or endangered species.

***Level of Effort in Terms of Personnel***

Mechanical clearance would require coordination of labor crews and UXO specialists working with vegetation clearance workers at a rate of 2.5 acres per day per crew over a period of approximately 32 weeks (8 months) to clear vegetation over the 483 acres at Ranges 43-48, 22 weeks (5.5 months) to clear vegetation over the 388 acres at Range 30A, and 5 weeks (1.25 months) to clear vegetation over the 80 acres at Site OE-16.

A description of the types of mechanical equipment available for vegetation clearance is presented below.

### A2.2.2.1 Mechanical Equipment

**Brush Hog**

The term "Brush Hog" is used generically to include a range of proprietary, tractor-pulled, brush-cutting/mulching devices. In general, the device is either side- or rear-mounted and works by cutting and recutting material inside of a casing and gravity distribution of cuttings. The cutting apparatus consist of flails, knives, or a rotary cutter that works by either being driven into or lowered onto the vegetation. The implement could be attached to range of tracked or wheeled tractors. The cut material varies in size, depending on the residence time in the cutter chamber.

This method is effective in removing top growth of vegetation up to a size (stem diameter) that varies by manufacturer and type of equipment. In general, plant material up to 5 inches stem diameter could be effectively reduced to mulch. However, growth greater than 5 feet in height can cause problems with equipment operation.

This method involves introduction of equipment and workers into the area to be cleared and requires workers to be in close proximity to a potentially dangerous machine. Brush hog-type equipment tends to generate dust and noise, limiting visibility and communication between the operator and OE workers and observers. The brush hog could be used on a range of slopes, depending on the specifications of the tractor on which the implement is mounted. It is limited by vegetation height however; and can cause 'scalping' of soil and disturbance of surface UXO.

There are two well known brush hog manufacturers; the Loftness and Brown Tree Cutter are described below.

***Loftness***

Manufacturer of various orchard/brush shredders that come in 6, 7, and 8-foot sizes with a 3-point rear-mount or a hydraulic-driven skid steep-mount. This machinery is both pull behind and push operated.

***Brown Tree Cutter***

The 2000 series folding deck model allows two distinct types of mowing operations while providing maximum safety. With the deck raised, it could back into and cut standing trees up to 8 inches in diameter; with the folding deck down, it could cut and grind materials that the tractor has already driven over with virtually no discharge. The model 2000 series open deck incorporates a newly designed twin coil pressure bar assembly to give added strength, durability, and better operation. It also reduces the amount of discharged debris.

**Tractor-Accessorized Zeirreisst (TAZ)**

The TAZ is a mulching head implement mounted on a track carrier. The head consists of a series of hinged flails on a rotating drum inside of a chamber suspended by a boom. It is operated from the cab of the tracklayer. The TAZ works by making a series of passes over the standing vegetation. The flails cut through the vegetation, leaving a coarse mulch. This method has been used at the former Fort Ord. This method appears to be effective at removing vegetation with stem diameter up to 8 inches to a desired height. Field observations indicate that the TAZ could cut to a height of 8 to 12 inches or could cut to ground level. In some areas,

completely uprooted burls of chamise and shaggy bark manzanita have been observed. The tracklayer could cause ruts to form on loose sandy soil.

Similar to the TAZ are the Slashbuster and the Brontosaurus products, described below.

**Slashbuster**

This rig is an excavator mounted brush cutting attachment. They attach onto larger (20,000 to 100,000 lb.) excavators with long booms and thus are not limited to vegetation height. The Model HD 420B can cut and mulch trees to 14" in diameter and has a 46" cutting swath. There are other models, such as the 480HD, used for a time at Fort Ord that cut larger swaths and have a variety of rotating heads and safety shrouds.

**Brontosaurus**

This rig has been designed by John Brown & Sons to be used in brush cutting, mowing and snow blowing for right of way work. It is similar in size and capability to the Slashbuster.

**Bull Hog/Hydro-Ax**

A third configuration, a skid steer arrangement consists of a cutting tool mounted on the front of the carrier. The carrier typically is a rubber-tired propelled, and articulating piece of heavy equipment. One model, the Bull Hog, is designed by Fecon Resource Recovery Equipment & Systems, and can shred brush, undergrowth, trees, stumps, roots, yard waste, logging scraps, and slash at a rate of 50 to 80 cubic yards per hour. It's designer claims that, "there are no limits to the size or quantity of material that can be processed." The cutting tool has cutter teeth that rotate on a revolving drum. The largest model (BH-250) is capable of cutting trees to 16 inches in diameter and clearing brush to well over 10 feet in height. It has been used extensively in Texas to clear sage and mesquite growth from housing developments and along railroad and pipeline corridors.

### A2.2.3 Remotely-Operated Mechanical Vegetation Clearance

This is a category of approaches to vegetation clearance that adapt standard mechanical equipment (e.g., those methods described above) via remote control. Although several types of remotely-operated vegetation clearance equipment are currently being researched, they are still in the development stages and are not available. The equipment types can be broken into two basic sub-categories: machines that are designed to only clear vegetation, and machines that are designed to clear surface and subsurface OE (primarily practice mines) and are outfitted with attachments to cut vegetation. In addition, there are firms (OAO Robotics, Applied Research Associates, Inc.) that specialize in rigging any type of equipment for remote operation.

While the precise operating characteristics of each machine have not been observed, general statements can be made.

***How the Method is Carried Out in the Field***

This method consists of equipment typically operated remotely via radio controls such as the brush hog, Hydro-Ax, Trackless Land Clearance (TLC) machines, modified Bobcat, Tractor-accessorized Chipping Device (Brontosaurus and TAZ) and Track Hoes. Equipment operators maneuver the equipment into areas to clear the vegetation using hand held radio equipment. In some instances, visual surveillance of the area being cleared is conducted using a remote video camera, which may not have the same degree of accuracy in visually identifying and avoiding UXO.

***Worker Exposure to UXO***

Remotely-operated mechanical cutting of vegetation is intended to isolate workers from direct exposure to UXO that is present in areas being cleared. Although the machinery being operated remotely would separate the workers from direct contact with UXO (from 100 to

3,000 feet depending on type of equipment and manufacturer), the type of UXO present at the IA sites is extremely sensitive and in some cases the fragmentation distance may be greater than the separation distance. In addition, high explosive antitank (HEAT) armor piercing ammunition that is designed to destroy heavy equipment may be present. Although the equipment is designed with sacrificial parts that could be replaced if UXO causes damage that renders the equipment inoperable and some types of remotely-operated equipment have armored undercarriages that may provide some protection against small munitions, certain types of UXO such as the 66mm M72 Light Antitank Weapon (LAW) are designed to penetrate armored undercarriages up to 11 inches thick. Proper worker awareness, protective equipment and care could reduce worker exposure to injury. The type of UXO present at the IA sites is extremely sensitive and highly dangerous, and could potentially be suspended in the branches of the vegetation being cleared, where it could cause serious injury or death to workers.

***Accidental Detonation of UXO***

In the case of accidental detonation of UXO, remotely-operated mechanical cutting would separate workers from potential exposure to flying fragments or blast debris depending on distance to, and the type and size of the UXO. In general, the possibility exists for any vegetation clearance method applied at the IA sites to detonate UXO. Remotely-operated mechanical cutting would minimize this possibility, although some types of UXO such as high explosive antitank (HEAT) armor piercing ammunition is designed specifically to destroy heavy equipment, which has a high likelihood of causing serious injury or death of workers. Mitigation of potential public exposure to flying fragments or blast debris from accidental detonation of UXO during vegetation clearance activities would be addressed in the site health and safety plan for individual areas. In addition, a community safety plan would be provided to present information regarding accidental and intentional detonation of UXO. In general, potential public exposure would be prevented by: (1) conducting a pre-field analysis of the type, size and orientation of the UXO known or expected to be present in a given area and its proximity to the public, (2) calculation of the maximum distance flying fragments or blast debris would travel based on the type and size of UXO, and (3) implementation of mitigation measures if necessary to prevent public exposure.

***Duration of the Vegetation Clearance Method***

Remotely-operated mechanical vegetation clearance at a rate of 2 acres per day would take approximately 40 weeks (10 months) over the 483 acres at Ranges 43-48, 28 weeks (7 months) to clear vegetation over the 388 acres at Range 30A, and 6 weeks (1.5 months) to clear vegetation over the 80 acres at Site OE-16. In addition, although remotely-operated equipment would be expected to be capable of operating in similar terrain as standard mechanical equipment, it would likely be somewhat slower because the operator would be relying on video input from the machine to receive topographic conditions, the size of vegetation, obstacles, and other factors. This information would have to be evaluated, and commands for action then relayed to the machine.

***Air Emissions***

Potential emissions from mechanically operated equipment and accidentally detonated UXO are believed to be insignificant with regards to impacts to human health, the environment and worker safety.

***Erosion***

Remotely-operated mechanical vegetation clearance has the potential to cause surface disturbance and erosion in the short term due to cutting equipment scalping the surface and equipment tires or tracks could create ruts that lead to erosion. Mechanically cutting vegetation could also cause erosion in the long term because this method is likely to result in lower diversity and abundance of vegetation.

***Impacts to Protected and Other Natural Resources***

Cutting would have adverse impacts on threatened, endangered, and native plant species present at the IA sites during and after implementation of cutting because it cannot be applied selectively to non-threatened or endangered plants and species (Table 1 of the accompanying IA RI/FS). If CMC vegetation is cleared by herbicide application, it likely will not grow back as diverse or as abundant and may result in converting CMC habitat to a more common habitat type. If cutting were used to clear CMC vegetation, natural re-vegetation of the area would likely be less diverse and abundant and contain fewer threatened, endangered, and native plant species than present in vegetation communities prior to cutting. Cutting may result in converting existing high quality CMC habitat to a more common and lower quality habitat type. Thus, cutting would not be protective of current environmental conditions in terms of the presence of habitat containing threatened, endangered, and native plant species. These anticipated results are based on preliminary observations made during monitoring of habitat recovery after vegetation clearance at Fort Ord conducted under the HMP monitoring program, which indicated the following:

- Seedlings of HMP shrubs were rarely observed in cut areas after clearance activities. A preliminary evaluation indicated HMP shrub regeneration of only 29 seedlings per acre occurred after cutting as compared to 3,000 seedlings per acre after burning.
- Species diversity was generally lower in cut areas
- Fewer native herbaceous species were observed in cut areas.

Cutting and placing cut vegetation in windrows and mulch piles on the ground surface appeared to interfere with natural chaparral re-vegetation by occupying habitat and shading the under-story and reducing germination by shrub and herbaceous species.

In addition, some mechanical methods cause damage to the soil topography by creating ruts and increasing the threat of erosion and are likely to result in lower diversity and abundance of vegetation. If CMC vegetation is cleared by cutting, it likely will not grow back as diverse or as abundant and may result in converting CMC habitat to a more common habitat type. In addition, because CMC habitat contains protected species at these IA sites, resource management measures are required by USFWS. Implementation of cutting in areas greater than 50 acres in size would not be consistent with the Biological and Conference Opinion (*USFWS, 1993; 1997*) issued by USFWS in accordance with the Endangered Species Act.

***Use at Fort Ord or Other Sites and Under What Conditions***

Remotely-operated mechanical vegetation clearance has not been used at the former Fort Ord and is still in research and development elsewhere. Initial field studies have been performed in grassy areas and their application in the vegetation found in CMC habitat is unknown.

***Availability of Equipment and Personnel***

Because remotely-operated mechanical vegetation clearance has not been used at the former Fort Ord and is still in research and development elsewhere, it would not be available for use at the IA sites under the stringent time constraints associated with a high priority OE Remedial Action.

***Deposition of Vegetation***

Vegetation that is cut, chipped or shredded would fall onto the ground, covering UXO and reducing visibility. Recovery of many rare, threatened, or endangered species could be inhibited by a thick layer of woody cuttings, thus inhibiting germination.

***Visibility of Ground Surface***

Safety procedures require the vegetation be cleared to bare ground or approximately 6 inches above ground surface to allow for proper operation of UXO detection equipment and prevent the accidental detonation of UXO on the surface. This level of clearance may be achievable using remotely-operated mechanical methods; however, the cuttings would generally fall to the ground where they could obscure or cover UXO.

***Regrowth of Vegetation and Maintenance Requirements***

Vegetation cleared by remotely-operated mechanical methods would not likely require additional cutting if each area has an OE Remedial Action immediately following vegetation clearance; however, standards for long term maintenance of mechanically cleared vegetation are not known and have not been established. Recovery of vegetation would be inhibited because the ground would be covered preventing germination of threatened or endangered species.

***Level of Effort in Terms of Personnel***

Remotely-operated mechanical clearance would require coordination of labor crews accompanied by UXO specialists and personnel trained in the use of this developmental type of equipment working with vegetation clearance workers at a rate of 2 acres per day per crew over a period of 40 weeks (10 months) for the 483 acres at Ranges 43-48, 28 weeks (7 months) for the 388 acres at Range 30A, and 6 weeks (1.5 months) for the 80 acres at Site OE-16.

A description of the types of remotely-operated mechanical equipment potentially available for vegetation clearance is presented below.

**Mine Clearing Equipment**

This group includes several machines that have been designed to trigger anti-personnel and/or antitank mines. OAO corporation has developed a Tele-operated Ordnance Disposal System (TODS) unit in collaboration with the US Army in their Humanitarian De-Mining Technology Development Program. It is a reconfigured Bobcat rubber-tired skid steer system that has been retrofitted with armor and GPS guidance control. It can accept vegetation cutting implements as well as backhoe buckets. Another development under this program is the Tempest, a relatively small (4 feet x 12 feet) robotic machine that has been used in Europe and Asia to clear vegetation and trip wires as a pre-cursor to more intensive manual clearance. The Tempest is rated as capable of clearing up to a 200-square-meter area of light vegetation; it can cut through a 10-cm diameter stem (about 4 inches) in three-to-four minutes.

**Remotely-Operated Vegetation Clearance Machines**

Several remotely-operated machines dedicated to vegetation clearance were identified. With retrofitting for remote operation, it may be possible to operate any mechanical vegetation clearance equipment without having personnel in the immediate area.

The All-Purpose Remote Transport System (ARTS) machine was used on the Balboa West Bombing and Gunnery Range (an Air Force installation in Panama) to clear vegetation, primarily thick, 10-foot tall Elephant grass. It allowed EOD personnel to clear UXO in its path. It is essentially a track carrier with a front end Brush Hog attachment that was able to travel at 7 to 8 miles per hour. It was designed by Vertak/ARA and 15 similar units are being built for use at other Air Force installations.

The Mechanically-Assisted Manual De-Mining System (MgM MaM-System) is a vegetation mulcher mounted on a 360-degree, 6-meter boom, on a vehicle hardened against explosives. It appears to operate on a principle similar to the TAZ, but is rubber-tire propelled.

The TAZ is similar in principle to the one described in the previous section. The difference is that because the machine is "sacrificial," most of the components are

recycled or reused. An operator can operate this equipment via radio control from up to 3,500 feet from the work location. This equipment is still under design.

## A2.3 Prescribed Burning

Prescribed burning is the use of fire under a specific set of conditions to burn vegetation. Prescribed burning is used in a large number of plant communities in California to achieve a range of objectives. Most commonly, the objectives for which a prescription is developed are one or more of the following: fuel hazard reduction and control; range improvement; agricultural land clearing; commercial forest stand improvements; slash reduction or removal (tree cutting operations); and habitat maintenance or enhancement. Also considered are two pre-burn site preparation methods that could be used to optimize burn conditions and effectiveness by reducing the moisture content in vegetation before initiating a burn. Preparation methods that could be implemented prior to conducting a prescribed burn include Pre-Crushing (Mechanical Crushing) and Browning (Herbicide Application). Implementation of either of these methods would cause the vegetation to die off or wilt, which would reduce the moisture content and result in a more complete burn. These methods are described below and discussed as a preparatory component of Prescribed Burning in the following sections.

*Prescribed Burning Preparation Methods*

The extent to which woody material would be consumed by prescribed burning is directly related to fuel moisture and ambient conditions at the time of the burn:

- Under relatively cool, moist conditions, it is possible that very little woody material would be consumed
- Under relatively warm, low-humidity, low-fuel moisture conditions, the majority of woody vegetation up to 2 inches in diameter may be consumed.

Although the timing of prescribed burning can be targeted for low-fuel moisture conditions during seasonally dry periods, it is possible to extend the period during which these conditions are present by preparing the vegetation prior to burning to minimize the fuel moisture by one of the following methods:

1. Pre-Crushing (Mechanical Crushing)
2. Browning (Herbicide Application).

In both cases, the leaves and stems of the vegetation would be damaged and within a short period of time would become desiccated, thereby reducing the moisture of the fuel and the amount of smoke generated. In addition, conducting the prescribed burn on low moisture fuel would create a hotter burning fire, which would: (1) increase the height of the smoke convection column and dispersal of the smoke, (2) create a differential in moisture content between the burn area and surrounding areas, making escape into higher moisture areas less likely. For these reasons, herbicide application and pre-crushing will be considered as preparatory components of Prescribed Burning in the following sections.

The following parameters would be associated with conducting prescribed burning for purposes of vegetation clearance.

***How the Method is Carried Out in the Field***

*Prescribed Burning Preparation Methods*

The major elements of each of the preparation methods for purposes of lowering fuel moisture prior to prescribed burning include the following:

- Pre-Crushing (Mechanical Crushing)– Crushing vegetation via mechanical methods within the prescribed burn area as described for the mechanical clearance methods above in Section A2.2.2.
- Browning (Herbicide Application) – Aerial spraying of herbicides (via helicopter) over

the prescribed burn area as described for herbicide application below in Section A2.5.

The major elements of prescribed burning for purposes of vegetation clearance include the following:

- Preparation of a burn prescription/burn plan, outlining the objectives of the burn, the burn area, and the range of environmental conditions (temperature, humidity, wind speed/direction, fuel load, and fuel moisture) under which the burn will be conducted. The burn plan also describes the manpower and equipment resources required to ignite, manage, and contain the fire and establishes the communication procedures for the fire crew and to the public and other affected agencies.

- Site preparation, including establishment and maintenance of primary, secondary, and tertiary containment lines, staging areas, and escape routes.

- Conducting the burn within the window of environmental conditions established in the burn prescription.

- Follow-up operations to ensure the fire is fully contained and does not escape the perimeter of the burn area.

***Worker Exposure to UXO***

Worker exposure to UXO as it relates to Pre-Crushing and Browning preparation methods is described in Section A2.2 (Mechanical Vegetation Clearance Methods) and Section A2.5 (Herbicide Application), respectively. For Pre-Crushing, worker exposure to UXO would be somewhat less likely than for Mechanical Vegetation Clearance because the vegetation would be crushed rather than wholly removed, and would be left in place to dry and create fuel for burning rather than being removed by workers to expose UXO. For Browning, worker exposure would be the same as for Herbicide Application, because both methods would likely be conducted aerially (via helicopter) and would not expose workers to UXO.

Prescribed burning of vegetation would be conducted using aerial methods (e.g., via helicopter), which would isolate workers from direct exposure to UXO that is potentially present in areas being cleared. Although workers clearing vegetation in fuel break areas would potentially be exposed to UXO, their exposure would be limited to a small percentage of the total acreage at the IA sites. Although some ground crews would be present in fuel break areas and air sampling or meteorological stations that have that have been previously cleared of UXO, proper worker awareness, protective equipment and care would reduce worker exposure to injury.

***Accidental Detonation of UXO***

Accidental detonation of UXO as it relates to Pre-Crushing and Browning preparation methods is described in Section A2.2.2 (Mechanical Vegetation Clearance Methods) and Section A2.5 (Herbicide Application), respectively. In the case of accidental detonation of UXO during Pre-Crushing, workers would likely be exposed to flying fragments or blast debris depending on distance to, and the type and size of UXO. Accidental detonation of UXO would likely not expose the Herbicide Application worker to flying fragments or blast debris depending on distance to, and the type and size of UXO.

Prescribed burn workers are not likely to be exposed to flying fragments or blast debris depending on distance to, and the type and size of the UXO. In general, the possibility exists for any vegetation clearance method applied at the IA sites to detonate UXO. The burn would be conducted by personnel located outside the burn area containing UXO, which would minimize exposure. Mitigation of potential public exposure to flying fragments or blast debris from accidental detonation of UXO during vegetation clearance activities would be addressed in the site health and safety plan for individual areas. In addition, a community safety plan would be

provided to present information regarding accidental and intentional detonation of UXO. In general, potential public exposure would be prevented by: (1) conducting a pre-field analysis of the type, size and orientation of the UXO known or expected to be present in a given area and its proximity to the public,
(2) calculation of the maximum distance flying fragments or blast debris would travel based on the type and size of UXO, and
(3) implementation of mitigation measures if necessary to prevent public exposure.

***Duration of the Vegetation Clearance Method***

Durations of the Pre-Crushing and Browning preparation methods are described in Section A2.2.2 (Mechanical Vegetation Clearance Methods) and Section A2.5 (Herbicide Application), respectively. For Pre-Crushing, several months of preparation activities would be added to the duration of vegetation clearance of conducted prior to prescribed burning. For Browning, several days of preparation activities would be added to the duration of vegetation clearance of conducted prior to prescribed burning.

Vegetation clearance using prescribed burning would take approximately 1 week for each of the IA sites, including preparation and relocation (3 days) conducting the burn (2 days), and allowing the smoke to clear and continue air sampling and monitoring (2 days).

***Air Emissions***

Air emissions as they relate to Pre-Crushing and Browning preparation methods would be the same as described in Section A2.2.2 (Mechanical Vegetation Clearance Methods) and Section A2.5 (Herbicide Application), respectively. Air emissions from prescribed burning with pre-crushing may be somewhat less than from burning without pre-crushing, because pre-crushing would produce a drier fuel and hotter fire, which would typically generate fewer emissions. Air emissions from prescribed burning with browning may be somewhat less than from burning without browning, because browning would produce a drier fuel and hotter fire, which would typically generate fewer emissions. However, there is a potential for the herbicide applied to the area to be emitted during burning of the treated vegetation.

During prescribed burning, smoke would be generated for 2 days and residual smoke from burning may remain in the air for several days thereafter. However, prior public notification, smoke management while conducting the burn, and temporary relocation of individuals from areas affected by smoke to unaffected areas would minimize potential impacts of the emissions. Potential emissions from detonated UXO are expected to be insignificant and not of concern in terms of human health, the environment, and worker safety. The Army conducted an assessment of OE-related air emissions that may be associated with conducting a burn. The results are presented in the Technical Memorandum, Air Emissions from Incidental Ordnance Detonation During a Prescribed Burn on Ranges 43-48, Former Fort Ord (*Harding ESE, 2001*) (Air Emissions Technical Memorandum) prepared in cooperation with and under review by the regulatory agencies.

The intense fire associated with prescribed burn conditions may result in the detonation of surface or near-surface OE items. Detonation of OE has the potential to release air pollutants to the atmosphere. These air emissions may potentially include combustion products, volatile or semivolatile organic compounds, unburned or incompletely burned energetic material, and particulate metals and metal compounds from chemical components of the OE items. At issue is whether the type or quantity of air emissions from incidental detonation of OE in Ranges 43-48 from prescribed burning of vegetation (biomass) in the same area, or is significant in absolute magnitude.

A Technical Memorandum, Air Emissions from Incidental Ordnance Detonation During a Prescribed Burn on Ranges 43-48, Former Fort Ord (*Harding ESE, 2001*) (Air Emissions Technical Memorandum) was prepared to

(1) quantify a reasonable upper bound estimate of air emissions from incidental detonation of OE in Ranges 43-48, (2) compare those emissions with those expected from burning of biomass, and (3) compare screening level estimates of pollutant concentrations from OE to health-protective regulatory screening values. Data from this investigation may also be used to guide the development of an appropriate ambient air monitoring program to be implemented during a prescribed burn at Ranges 43-48 if such a prescribed burn is performed. The Air Emissions Technical Memorandum does not address the issue of possible human health effects from biomass burning.

The results of this investigation reveal that reasonable upper bound estimates of air emissions from incidental OE detonation for combustion products and volatile organic compounds are much less than 0.1 percent (i.e., one one-thousandth) of the corresponding emissions from biomass burning in Ranges 43-48. The only exception is for dioxin/furan toxicity equivalent emissions for which the reasonable upper bound OE contribution is about 1 percent (i.e., one one-hundredth) of that from biomass. Reasonable upper bound emissions of all particulate metals except Beryllium from incidental OE detonation are equal to or less than 10 percent (i.e., one-tenth) those from biomass burning. For all pollutants evaluated in this investigation, including Beryllium and those pollutants for which there are no corresponding biomass emissions for comparison, screening model estimates of pollutant concentrations are much less than health-protective regulatory screening values.

The conclusion of this investigation is that air pollutant emissions from incidental OE detonation during a prescribed burn in Ranges 43-48 will be minor compared to emissions contributed directly by biomass burning, and will result in pollutant concentrations well below health-protective regulatory screening levels.

***Erosion***

Erosion as it relates to Pre-Crushing and Browning preparation methods would be the same as described in Section A2.2.2 (Mechanical Vegetation Clearance Methods) and Section A2.5 (Herbicide Application), respectively. Pre-Crushing followed by prescribed burning would likely cause more erosion than prescribed burning alone due to the use of mechanical equipment. Erosion from Browning followed by prescribed burning would be the same as for prescribed burning alone because it would be applied aerially and would not disturb surface soils.

Vegetation clearance using prescribed burning may result in some surface disturbance or erosion on slopes in the short term, since fire reduces most of the vegetation to bare mineral soil. However, revegetation of burned areas is likely to proceed rapidly following the start of the next rain season, thus minimizing further erosion potential. In the long term, burning would have a beneficial impact on the health and growth of the plants and their stability.

***Impacts to Protected and Other Natural Resources***

Burning would have beneficial impacts on threatened, endangered, and native plants present at the IA sites in the long term because chaparral communities in California are adapted to periodic wildfires and the CMC habitat present at the IA sites has evolved to be dependent on fire for its health and functioning (Table 1 of the accompanying IA RI/FS). Vegetation that is cleared by burning not only recovers, but flourishes and provides a diversity and abundance of native plants. Plants and animals at the IA sites have survived, become dependent on, and adapted to a cycle of occasional fire that recycles nutrients and exposes mineral in the soil while stimulating the germination of seeds that accumulate in between fires. This natural succession allows the plant community to recover to pre-burn conditions and enhances the natural diversity of the unique habitat containing threatened and endangered

plants at the IA sites. The central maritime chaparral community that occurs at Fort Ord is similar to other California chaparral associations, having herbaceous and shrub plant species which are considered dependent on fire for reproduction. Reproductive strategies that relate to the occurrence of fire include the release of dormancy by heating (*Wright, 1931*); and the reduction or alteration of chemicals either on the seed coat or in the soil, which inhibit reproduction (*Muller 1966; Christensen and Muller, 1975*). Several of these plant species are either uncommon or endemic to the Monterey Peninsula, and are subject to management provisions of the HMP.

Preliminary observations made during monitoring of habitat recovery after vegetation clearance at Fort Ord (conducted under the HMP monitoring program) support burning as a favorable method for vegetation clearance for the following reasons:

- Seedlings of HMP shrubs were common in burned areas after clearance activities. A preliminary evaluation indicated HMP shrub regeneration occurred in densities over 3,000 seedlings per acre after burning (as compared to only 29 seedlings per acre occurred after cutting).

- Species diversity is generally higher in burned areas.

- A greater diversity of native herbaceous species were observed in burned areas.

In addition, because CMC habitat contains protected species at these sites, resource management measures are required by USFWS as detailed in the Biological and Conference Opinion, memoranda, and other correspondence between USFWS and the Army (*USFWS, 1993 - 2001*; *Army, 1998 - 2000*) and in accordance with the HMP (*USACE, 1997*). The intent of the USFWS is that "the Army would primarily use prescribed fire to clear vegetation in support of OE removal actions in areas designated as habitat reserves . . . to preserve, protect, and enhance populations and habitat of listed species and to protect candidate and sensitive species to the extent needed to preclude the need for future listings. Consequently, methods of vegetation clearance in maritime chaparral that do not involve burning are not consistent with the habitat and species preservation and protection goals of the HMP" (*USFWS, 2001*).

Pre-Crushing followed by prescribed burning would have beneficial impacts on threatened and endangered plants present at the IA sites, similar to that expected from prescribed burning alone as described in Section A2.3 (Prescribed Burning). Browning would have impacts on threatened and endangered plants present at the IA sites during herbicide application and after the subsequent prescribed burning because the herbicide cannot be applied selectively to non-threatened and non-endangered plants (Table 1 of the accompanying IA RI/FS) as discussed in Section A2.5 (Herbicide Application). If CMC vegetation is cleared by herbicide application, it likely will not grow back as diverse or as abundant and may result in converting CMC habitat to a more common habitat type.

***Use at Fort Ord or Other Sites and Under What Conditions***

Use at Fort Ord or other sites and under what conditions as it relates to Pre-Crushing and Browning preparation methods would be the same as described in Section A2.2.2 (Mechanical Vegetation Clearance Methods) and Section A2.5 (Herbicide Application), respectively. Although mechanical vegetation clearance methods have been used at Fort Ord, pre-crushing as a site preparation method for prescribed burning has not been used at Fort Ord. Browning as a site preparation method for prescribed burning has not been used at Fort Ord.

Prescribed burning has been used extensively at former Fort Ord for decades because of military training activities, and has also been used to clear CMC vegetation from OE sites similar to the IA sites to support removal actions at the former Fort Ord since 1994. Prescribed burns are conducted in close coordination with federal,

state and local regulatory agencies. Prescribed burns consist of using fire under optimal climatic conditions to clear vegetation from OE Sites, and is the primary vegetation clearance method for extensive use in designated HMP CMC habitat that exists at the IA sites.

***Availability of Equipment and Personnel***

Availability of equipment and personnel as it relates to Pre-Crushing and Browning preparation methods would be the same as described in Section A2.2.2 (Mechanical Vegetation Clearance Methods) and Section A2.5 (Herbicide Application), respectively.

Prescribed burning has been used extensively at the former Fort Ord and the equipment and personnel necessary to implement burning would be available for use at the IA sites under the stringent time constraints associated with Interim Action.

***Deposition of Vegetation***

Depending on the provisions of the burn prescription and the occurrence of suitable conditions, the burn would clear or consume the majority of top growth on shrubs, consume the leaf litter, and burn a portion of the standing woody stems. The extent to which woody material would be consumed is directly related to fuel moisture and ambient conditions at the time of the burn. Under relatively cool, moist conditions, very little woody material would be consumed. Under low-humidity, low-fuel moisture conditions, woody vegetation up to 2 inches in diameter may burn. Preparation methods could be used to extend the time period under which these conditions exist as described above.

For Pre-Crushing and Browning, the intent is to deposit the vegetation and let it dry to provide fuel for prescribed burning rather than to remove it to provide visibility of the ground surface as is intended with the vegetation clearance methods. Overall, use of these preparation methods followed by prescribed burning would result in consumption of vegetation similar to prescribed burning under low moisture content conditions.

***Visibility of Ground Surface***

Safety procedures require the vegetation be cleared to bare ground or approximately 6 inches above ground surface to allow for proper operation of UXO detection equipment and prevent the accidental detonation of UXO on the surface. This level of clearance would be achievable using burning. Fire clears the vegetation and leaves the range in a condition that typically provides OE workers a clear, unobstructed view of the ground surface.

Pre-Crushing and Browning preparation methods for prescribed burning would result in the same ground surface visibility that would be achieved by prescribed burning alone.

***Regrowth of Vegetation and Maintenance Requirements***

Prescribed burning would consume the majority of the vegetation; however, some additional cutting may be necessary in certain areas to achieve clearance to bare ground or approximately 6 inches above ground surface depending on the fire conditions. Such additional cutting may only occur after a surface clearance of UXO has been conducted. Protocols for the long term maintenance of burned areas have been established in the HMP and include 5 years of monitoring the recovery of the vegetation.

Similar conditions would be expected for Pre-Crushing followed by prescribed burning. Regrowth of vegetation and maintenance requirements as they relate to Browning preparation methods followed by prescribed burning would be as described in Section A2.5 (Herbicide Application).

***Level of Effort in Terms of Personnel***

Pre-Crushing and Browning activities would add to the level of effort in terms of personnel for prescribed burning as described below. For Pre-Crushing, the level of effort would be

somewhat less than for Mechanical Vegetation Clearance (Section A2.2.2) because the vegetation would be left in place to dry rather than being removed to improve visibility of the ground surface. For Browning, the level of effort would be the same as for Herbicide Application (Section A2.5).

Prior to the burn, Army personnel will coordinate relocation efforts and ensure the public is informed of the planned burn through a notice in a local newspaper, public meetings, and other avenues of communication as appropriate. . In addition, over several months time, vegetation and UXO clearance personnel would clear and maintain fuel breaks surrounding the burn area and forming a containment line. The breaks would be pre-treated immediately before conducting the burn with a fire suppressant foam (3 days). An air sampling and monitoring program would be developed and coordinated by several people and air monitoring stations would be set up. In addition, meteorological profiling would be conducted prior to and during the burn. Prescribed burning would be conducted using an operator to pilot the helicopter equipped with a torch to initiate the burn, and several people located at high elevations outside the burn area observing the burn's progress telescopically. A coordination crew of several people would also be involved in planning and monitoring the burn and assessing meteorological conditions and air samples would be collected and analyzed offsite. Fire suppressant crews would stand by during the burn and emergency fire crews from local jurisdictions would be on notice in case the fire traveled in an unplanned manner. After the burn was completed, air monitoring would continue until after the smoke had cleared (approximately 2 days) and the return of relocated residents would be coordinated.

## A2.4 Animal Grazing

This method of vegetation clearance involves introduction of domestic browsing/grazing animals into the areas to be cleared of vegetation. Herbivory for vegetation management is most commonly undertaken with goats, but sheep, horses, and cattle have also been used. If herbivory were to be undertaken as an experimental or applied vegetation clearance method, it is assumed goats would be the most likely animal used. Goats have a broad range of tolerance for food plants and consume leaves and stems of many plant species that other browsers/grazers find unpalatable. Further, goats will clamber onto low branches or raise up on their hind legs to reach browse.

The following parameters would be associated with implementing animal grazing for purposes of vegetation clearance.

***How the Method is Carried Out in the Field***

The major elements of goat grazing include the following:

- Establishment of an electrically fenced perimeter for the area to be browsed.

Introduction of goats to the site involves transportation to the site and ordinarily requires the presence of one or more goatherders and dogs to manage the goats. Portable housing for the goatherders would also be required. For the purposes of this evaluation, a herd of 350 goats was assumed, although the number of goats introduced to a site varies, with literature review indicating the density ranges from 250 to 350 animals per acre in 1.5- to 2-acre fenced areas (*Stromberg, 1997*). The assumed herd sizes coincide with other successful animal grazing studies; areas of larger size would allow the goats to selectively graze and have not been shown to be effective in clearing vegetation. The goats remain in the area until they have consumed all of the palatable vegetation they can reach.

For the purposes of this evaluation, it was assumed the herd of 350 goats would clear 1.5 acres per day (*Stromberg, 1997*). The goats must be fenced in to a relatively small area to maintain constant browsing pressure on the standing vegetation. Otherwise, goats will tend to wander over a large area searching for the most palatable plant materials. Goats also

require attendance by goat herders and usually dogs to keep the animals from escaping and to move them around within the enclosure. Establishment of fencing and attendance by goat herders would require clearing a perimeter area of vegetation and a frequent or constant presence in OE areas. The enclosure is dismantled, a new fenced perimeter is established, and the goats are rotated out of the first enclosure into the next. This process is repeated until the goats have been rotated into all areas to be browsed. Water and supplemental feed would be provided.

If goats are successful in clearing a large portion of leafy vegetation, they will leave a stand of bare branches or broken stems. This may marginally improve visibility and mobility for OE workers but would not result in adequate clearance of vegetation for OE removals and the rate would be very slow. Reviewed studies indicate that up to 350 goats confined to a 1.5-acre area could clear a significant portion of the herbaceous and palatable shrubby vegetation over a two- to three-day period. This rate would translate to a period of four-to-six months to clear a 100-acre site, assuming that the rate of fence installation and other herd maintenance activities would not introduce delays.

***Worker Exposure to UXO***

Personnel involved in implementation of animal grazing would be limited to a crew of herders; however, these workers and the animals would have direct exposure to UXO that is present in areas being cleared, which may cause serious injury or death. Crews installing fences would also have potential direct exposure to UXO. Proper worker awareness, protective equipment and care could reduce worker exposure to injury. The type of UXO present at the IA sites is extremely sensitive and highly dangerous, and could potentially be suspended in the branches of the vegetation being cleared, where it could cause serious injury or death to workers.

***Accidental Detonation of UXO***

In the case of accidental detonation of UXO, goats, shepherds, herd dogs, and water and fence maintenance crews would be exposed to flying fragments or blast debris depending on distance to, and the type and size of the UXO. In general, the possibility exists for any vegetation clearance method applied at the IA sites to detonate UXO. Animal grazing has a high likelihood of causing serious injury or death of workers or animals. Mitigation of potential public exposure to flying fragments or blast debris from accidental detonation of UXO during vegetation clearance activities would be addressed in the site health and safety plan for individual areas. In addition, a community safety plan would be provided to present information regarding accidental and intentional detonation of UXO. In general, potential public exposure would be prevented by: (1) conducting a pre-field analysis of the type, size and orientation of the UXO known or expected to be present in a given area and its proximity to the public, (2) calculation of the maximum distance flying fragments or blast debris would travel based on the type and size of UXO, and (3) implementation of mitigation measures if necessary to prevent public exposure.

***Duration of the Vegetation Clearance Method***

Vegetation clearance using animal grazing (a herd of 350 goats at a rate of 1.5 acres per day) would take approximately 53 weeks (13 months) over the 483 acres at Ranges 43-48, approximately 37 weeks (9 months) over the 388 acres at Range 30A, and approximately 8 weeks (2 months) over the 80 acres at Site OE-16. Additional clearing using other methods would be required subsequent to grazing, which would increase the duration of these methods.

***Air Emissions***

Potential emissions from grazing or accidentally detonated UXO are believed to be insignificant with regards to impacts to human health, the environment and worker safety.

***Erosion***

Vegetation clearance using animal grazing may cause some surface disturbance or erosion in the short term due to the presence of 350 goats grazing and walking over the ground surface. Grazing of vegetation could also cause erosion in the long term because this method is likely to result in lower diversity and abundance of vegetation.

***Impacts to Protected and Other Natural Resources***

Animal grazing would have impacts on threatened and endangered plants present at the IA sites during and after implementation because the goats would not be selective in their foraging and would feed on threatened and endangered species (Table 1 of the accompanying IA RI/FS). If CMC vegetation is cleared by grazing, it likely will not grow back as diverse or as abundant and may result in converting CMC habitat to a more common habitat type. In addition, because CMC habitat contains protected species at these IA sites, resource management measures are required by USFWS as detailed in the Biological and Conference Opinion , memoranda, and other correspondence between USFWS and the Army (*USFWS, 1993- 2001*; *Army, 1998 through 2000*) and in accordance with the HMP (*USACE, 1997*). The intent of the USFWS is that "the Army would primarily use prescribed fire to clear vegetation in support of OE removal actions in areas designated as habitat reserves . . to preserve, protect, and enhance populations and habitat of listed species and to protect candidate and sensitive species to the extent needed to preclude the need for future listings. Consequently, methods of vegetation clearance in maritime chaparral that do not involve burning are not consistent with the habitat and species preservation and protection goals of the HMP" (*USFWS, 2001*).

***Use at Fort Ord or Other Sites and Under What Conditions***

Animal grazing has not been used at Fort Ord to clear vegetation specifically in support of OE Remedial Action. The Pebble Beach Company has successfully used goats to reduce vegetation in Monterey Pine Forests on the Monterey Peninsula to reduce the fuel loads and minimize wildfire hazards (*Stromberg, 1997*); however, these areas did not contain the threatened or endangered species present at the IA sites and grazing was conducted on a small scale compared with the total 951 acres (483 acres at Ranges 43-48, 388 acres at Range 30A, and 80 acres at Site OE-16) requiring vegetation clearance at the three IA sites.

***Availability of Equipment and Personnel***

The use of goats would require installation of temporary, movable electric fences to confine the goats to small parcels until the vegetation is sufficiently reduced. The electric fencing would be relocated each time the goats consumed the vegetation in a given parcel until the vegetation was sufficiently cleared. The approximate herd size would be 350 goats. Goat herders would be required to control herd movements. Additionally, water would need to be trucked into the site daily and portable generators would be required to supply power to the electric fence. Although the fencing and water supply equipment would be available, experienced goat herders and availability of such large herds may be difficult to procure. Fencing and a temporary water supply for the animals would be available, but would be somewhat difficult to install, move and maintain as the herd migrates due to the dense vegetation, rough terrain and presence of UXO.

***Deposition of Vegetation***

Goats would consume the vegetation they can reach and therefore, it would not be deposited on the ground surface. Goats will stand on their hind legs to reach into shrubs and will bend or break small branches to reach leaves, flowers, and fruits and will debark shrubs and trees to

consume the cambium layer, but would not clear the woody material.

***Visibility of Ground Surface***

Safety procedures require the vegetation be cleared to bare ground or approximately 6 inches above ground surface to allow for proper operation of UXO detection equipment and prevent the accidental detonation of UXO on the surface. This level of clearance would not be achievable using animal grazing. The goats tend to consume the most palatable vegetation first, proceeding to the next most palatable until they consume plant material in all strata of the vegetation they can reach. Although they will consume young, relatively tender stems of shrubs and trees, goats do not eat woody material; therefore, the vegetation would need to be cleared further by some other method to achieve an clearance to bare ground or approximately 6 inches above ground surface.

***Regrowth of Vegetation and Maintenance Requirements***

Animal grazing would not clear the majority of the vegetation; therefore, some additional cutting would be necessary to clear vegetation to bare ground or approximately 6 inches above ground surface. Standards for long term maintenance of grazed areas have not been established. High nitrogen release from animal excrement from a herd of 350 goats would act as a fertilizer to exotic and invasive plant species, which could increase their growth and competition with the growth and recovery of threatened or endangered CMC species.

***Level of Effort in Terms of Personnel***

Several goat herders would be required to control herd movements, and maintain an assumed herd size of 350 goats at a rate of clearance of 1.5 acres per day. The level of effort in terms of personnel would require goat herding and fencing crews to work full time for approximately 53 weeks (13 months) over the 483 acres at Ranges 43-48, approximately 37 weeks (9 months) over the 388 acres at Range 30A, and approximately 8 weeks (2 months) over the 80 acres at Site OE-16. Additional clearing using other methods would be required subsequent to grazing, which would increase the duration of these methods. In addition, water would need to be trucked to the herd location daily, portable generators would need to be maintained to supply power to the electric fence, and the mobile would have to be frequently relocated as the herd finishes grazing each area.

## A2.5 Herbicide Application

A number of different chemical formulations of herbicides could be used to kill vegetation at the IA sites. A licensed applicator would need to be consulted to develop the appropriate mixture, application method, and application rate for the treatment areas. Only licensed applicators can apply herbicides on Department of Defense (DoD) property.

Herbicides have the effect of killing the standing vegetation. Products evaluated include:

- Arsenal® (imazapyr)
- Garlon® (triclopyr)
- Finale® (glufosinate-ammonium)
- RoundUp Pro® (glyphosate)
- Krenite® (fosamine-ammonium)
- Tordon® 101 (picloram, 2,4-D)
- Vanquish® (diglycolamine)
- Transline® (clopyralid)
- SpraKil® S-5 (tebuthioron).

All of the products reviewed appeared to have the capability to kill or defoliate standing vegetation. None of the products specifically listed any of the shrub species naturally occurring in CMC at Fort Ord, although plants found in other communities were listed. These products represent a subset of the products

available but are representative of the effects and effectiveness of a range of products. Temporary defoliants were not evaluated. These types of chemicals are primarily used in agriculture on annual plants such as cotton to cause leaf-drop prior to mechanical harvesting. Data on abscission-causing effects on perennial vegetation were not found. If effective, defoliants could cause the temporary (or permanent) loss of leaves from CMC or other types of shrubs. Although this could marginally improve visibility, it would not reduce the volume of standing woody material.

Of the products listed, glyphosate (RoundUp®) is among the most frequently used to control vegetation growth. Glyphosate is non-selective, killing any plants upon which it is applied. Glyphosate is prescribed for terrestrial applications and has a light petroleum distillate as a carrier. For aquatic applications, Rodeo® is used; it contains the same active ingredient with no petroleum carrier. Glyphosate is taken up by plants through the leaves and transported to the roots of plants where it interferes with production of root hairs. Root hairs occur at the very tips of actively growing roots and are the sites where moisture is taken up from the soil. Root hairs persist for only a few days, being constantly replaced at the growing tip. Loss of the ability to take up water from the soil causes the plant to wither. Treated plants may die within a few days or may persist for a few weeks. RoundUp® is considered generally non-toxic to animals. This herbicide binds to soil particles on contact, leaving no residual, active herbicide in the soil. Soil-bound glyphosate is broken down to harmless organic compounds by soil microflora.

The majority of products other than glyphosate have some residual soil activity. Some products kill on contact by chemically burning the leaves; others damage or clog plants' vascular systems, or damage meristematic (growing tips) regions of the plant. Some of the products (imazapyr, tebuthioron) indicate that they will control the re-emergence of plants in treated areas. Use of these products would alter the viability of seeds in the soil following treatment.

A range of herbicides would likely be effective in killing top growth of CMC and other types of vegetation. However, none of these products would break down or clear the standing, dead, woody portions of the plants. Consequently, either mechanical methods or prescribed fire would be required to clear the standing dead material prior to OE removal activities. A second disadvantage is that herbicides would likely kill most or all of the burl-forming shrubs. These shrubs re-sprout quickly after fire or other disturbance and quickly provide ground cover. In general, burl-formers tend to reproduce less frequently from seed that obligate seed-reproducers. Killing all of the standing shrub species would have the effect of setting the community back in terms of the successional process in that all plants would have to return from germinating seedlings. It would likely take many years for the community to return to a species composition that approximates the conditions prior to treatment. The extended period of recovery may render the CMC community vulnerable to invasion by exotic weeds or by coast live oak.

The use of herbicides in CMC would not be effective in reducing vegetation prior to OE removal. The use of herbicides is technically implementable by ground-based or aerial spraying. Administratively, the landscape-level use of herbicides would make this method difficult to implement because it would require extensive coordination with regulatory agencies to address potential air quality effects and to address potential impacts to the structure of CMC and management requirements provided for in the HMP.

The following parameters would be associated with implementing herbicide application for purposes of vegetation clearance.

***How the Method is Carried Out in the Field***

The method of herbicide application would depend on several factors including the size of the area, topography, accessibility, and the type of product used. Aerial application would be most efficient for treating large sites.

Truck-mounted sprayers could be used in areas with adequate roads or trails. "Back pack" sprayers could be used for small areas.

***Worker Exposure to UXO***

Herbicide application would be conducted using aerial methods (e.g., via helicopter), which would isolate workers from direct exposure to UXO that is potentially present in areas being cleared. Although some ground crews would be present at air sampling or meteorological stations that have been previously cleared of UXO, proper worker awareness, protective equipment and care would reduce worker exposure to injury.

***Accidental Detonation of UXO***

In the case of accidental detonation of UXO, herbicide application workers are not likely to be exposed to flying fragments or blast debris depending on distance to, and the type and size of the UXO. In general, the possibility exists for any vegetation clearance method applied at the IA sites to detonate UXO. Herbicide application would be conducted by personnel located in aircraft above the area containing UXO, which would minimize exposure. Mitigation of potential public exposure to flying fragments or blast debris from accidental detonation of UXO during vegetation clearance activities would be addressed in the site health and safety plan for individual areas. In addition, a community safety plan would be provided to present information regarding accidental and intentional detonation of UXO. In general, potential public exposure would be prevented by: (1) conducting a pre-field analysis of the type, size and orientation of the UXO known or expected to be present in a given area and its proximity to the public, (2) calculation of the maximum distance flying fragments or blast debris would travel based on the type and size of UXO, and (3) implementation of mitigation measures if necessary to prevent public exposure.

***Duration of the Vegetation Clearance Method***

Vegetation clearance at each of the IA sites using herbicide application would take approximately 1 week including 3 days preparation and relocation, 2 days to aerially apply the herbicide, and 2 days to allow the herbicides to clear from the air and continue air sampling and monitoring. Additional clearing using other methods would be required subsequent to herbicide application. Herbicides work through a variety of chemical pathways depending on the target plant species and the intended effects. Herbicide effects range from suppression of growth for a short period to essentially sterilized soil that will prevent growth of any plants for up to several years.

***Air Emissions***

Potential emissions from herbicide application that may drift into non-target areas is an issue for any spray method, particularly for aerial application. During herbicide application, airborne herbicides would be generated for several days and may remain in the air for several days thereafter. However, prior public notification, management of airborne herbicides while conducting the application, and temporary relocation of individuals from areas affected by herbicides to unaffected areas would minimize potential impacts of the emissions. In addition, depending on the product used, if fire is subsequently required to clear the vegetation more effectively after herbicide application, workers could be exposed to herbicide residues generated during the fire. Potential emissions from accidentally detonated UXO are believed to be insignificant with regards to impacts to human health, the environment and worker safety.

***Erosion***

Vegetation clearance using herbicide application would not be likely to cause surface disturbance or erosion in the short term because herbicides would be applied aerially. Herbicide application could cause erosion in the long term because this

method is likely to result in lower diversity and abundance of vegetation.

***Impacts to Protected and Other Natural Resources***

Herbicide application would have impacts on threatened and endangered plants present at the IA sites during and after implementation because it cannot be applied selectively to non-threatened or endangered plants and species (Table 1 of the accompanying IA RI/FS). If CMC vegetation is cleared by herbicide application, it likely will not grow back as diverse or as abundant and may result in converting CMC habitat to a more common habitat type. In addition, because CMC habitat contains protected species at these IA sites, resource management measures are required by USFWS as detailed in the Biological and Conference Opinion, memoranda, and other correspondence between USFWS and the Army (*USFWS, 1993 through 2001*; *Army, 1998 through 2000*) and in accordance with the HMP (*USACE, 1997*). The intent of the USFWS is that "the Army would primarily use prescribed fire to clear vegetation in support of OE removal actions in areas designated as habitat reserves . . to preserve, protect, and enhance populations and habitat of listed species and to protect candidate and sensitive species to the extent needed to preclude the need for future listings . . Consequently, methods of vegetation clearance in maritime chaparral that do not involve burning are not consistent with the habitat and species preservation and protection goals of the HMP" (*USFWS, 2001*).

***Use at Fort Ord or Other Sites and Under What Conditions***

Herbicides have not been used for vegetation clearance in preparation for OE Remedial Action at Fort Ord, and specifically has not been used to support OE Remedial Action within CMC habitat areas containing threatened and endangered species found at the IA sites. The Bureau of Land Management (BLM) has used herbicides (RoundUp™) at the former Fort Ord to control Pampas grass and iceplant at several locations. California Department of Parks and Recreation (CDPR) is treating iceplant on the former beach train fire ranges on an ongoing basis.

***Availability of Equipment and Personnel***

Equipment used in herbicide application and during planning, relocation and air sampling activities would be available.

***Deposition of Vegetation***

Although herbicide application may kill the targeted vegetation, it would not be removed, and the dense shrub canopy would persist in a leafless condition. The effect of the herbicide would be to kill the entire plant or at least the above-ground portions. Woody vegetation would not be consumed. Leaves would turn brown and drop from the plant over time in most cases, and would serve to "carpet" the understory of the shrubs, obscuring visual identification of surface UXO.

***Visibility of Ground Surface***

Safety procedures require the vegetation be cleared to bare ground or approximately 6 inches above ground surface to allow for proper operation of UXO detection equipment and prevent the accidental detonation of UXO on the surface. This level of clearance would not be achievable using herbicide application. Removal of leaves may somewhat improve ground visibility; however, the rapid drop of leaves would serve to "carpet" the understory of the shrubs, potentially obscuring UXO.

***Regrowth of Vegetation and Maintenance Requirements***

Vegetation cleared by herbicide application would not consume the majority of the vegetation; therefore, some additional clearance methods would be necessary to achieve clearance to bare ground or approximately 6 inches above ground surface. Standards for long term maintenance of vegetation where herbicides have been applied have not been established.

***Level of Effort in Terms of Personnel***

Application of herbicides over the IA sites could be achieved by personnel operating the aircraft and conducting the spraying working full time for a period of approximately one week. Coordination with the public and regulatory agencies, relocation of residential citizens concerned about exposure to herbicides, and air sampling and monitoring would be conducted by a team of people.

# A3.0 SCREENING OF VEGETATION CLEARANCE METHODS

This section presents the Screening of vegetation clearance methods based on general and site-specific parameters described in Section A2.0. Table A1 presents a summary of the Screening of these methods. Prior to developing and evaluating vegetation clearance alternatives for the IA sites, the methods identified in Section A2.0 were screened for: (1) their ability to achieve the Vegetation Clearance Objective (Section 1.1) of clearing vegetation to bare ground or approximately 6 inches above ground surface, and (2) a preliminary evaluation of its effectiveness, implementability and relative cost. The methods that did not meet the screening criteria were eliminated from further consideration prior to performing the detailed analysis of alternatives in the accompanying IA RI/FS.

## A3.1 Description of Evaluation Criteria

The evaluation criteria categorized in terms of effectiveness, implementability and cost used to screen the vegetation clearance methods and alternatives are described below.

### A3.1.1 Screening of Vegetation Clearance Methods

Safety procedures require vegetation be cleared to bare ground or approximately 6 inches above ground surface so that it is safe for UXO specialists to enter areas requiring OE Remedial Actions to mitigate a threat to public safety by improving visual identification of UXO on the ground surface prior to conducting the OE Remedial Action. Therefore, if the method does not meet this screening criteria, it is not evaluated further in this Evaluation. Historical data from previous vegetation clearance activities at Fort Ord and manufacturer specifications for various types of clearing equipment would be considered and compared to this requirement. In addition, a preliminary evaluation of general and site-specific parameters (Section A2.0) and each method's effectiveness, implementability and relative cost were considered in the screening.

After the screening, the methods that met the screening criteria and were retained for further consideration are further evaluated based on their effectiveness, implementability and cost in Section A3.3. The evaluation criteria are described below.

### A3.1.2 Effectiveness

The effectiveness of each alternative during the implementation and operation phases is assessed. Factors considered included the protection of the community and workers during vegetation clearance operations, the time required to implement the alternative and to achieve the vegetation clearance objectives, and the potential adverse environmental impacts that may result. The reliability and proven history of the alternative would also be evaluated with respect to the vegetation and site-specific conditions found at the sites. Specifically, the effectiveness of the alternative will be further evaluated based on the degree to which it can achieve: (1) Clearance of Vegetation to Bare Ground or Approximately 6 Inches Above Ground Surface, and be (2) Protective of Human Health, (3) Protective of Workers During Implementation, (4) Protective of the Environment, and (5) Compliance with the substantive elements of Applicable or Relevant and Appropriate Requirements (ARARs), as described in the following sections.

#### A3.1.2.1 Protection of Human Health

Factors such as noise, dust, emissions, calculating safety zone distances in case UXO is detonated, and the need for site security during

implementation would be considered and compared to this requirement.

#### A3.1.2.2 Protection of Workers During Implementation

Safety factors such as the potential degree of worker contact with UXO for each of the vegetation clearance methods and the ability to mitigate risks to workers would be considered and compared to this requirement.

#### A3.1.2.3 Protection of the Environment

Factors such as the direct and indirect effects on flora and fauna during implementation would be considered and compared to this requirement.

#### A3.1.2.4 Compliance with ARARs

Factors such as coordinating with regulatory agencies and complying with the substantive elements of permitting processes to the extent practicable associated with implementing each method would be considered. The types of ARARs and To-Be-Considered Requirements that will be evaluated will include action-, location-, and chemical-specific requirements as well as To-Be-Considered requirements.

### A3.1.3 Implementability

The implementability of applying a given alternative is based on its technical and administrative feasibility and availability of services and materials as described below. Technical feasibility considerations include the ability to procure and operate the equipment and monitor the effectiveness of vegetation clearance alternatives that will satisfy the time constraints of conducting a high priority OE Remedial Action. Administrative feasibility includes coordinating with regulatory agencies and complying with the substantive elements of permitting processes to the extent practicable. The availability of contractors with the equipment and knowledge to implement the vegetation clearance alternatives is also assessed.

#### A3.1.3.1 Technical Feasibility

The technical capabilities of each vegetation clearance method and its applicability to site conditions would be considered, such as the equipment's specifications regarding the type and amount of vegetation that could be cut, predicted production rates, and the effects of varying topography and soil conditions. Technical feasibility considerations include the ability to procure and operate the equipment and monitor the effectiveness of vegetation clearance alternatives that will satisfy the time constraints of conducting a high priority OE Remedial Action. Administrative feasibility includes coordinating with regulatory agencies and complying with the substantive elements of permitting processes to the extent practicable. In addition, its prior use under similar conditions, whether it is a proven method, and any anticipated operational difficulties, the frequency and complexity of equipment maintenance, field QA/QC and calibration, and the need for materials and technical staff would be considered. The demonstrated performance and useful life of the equipment or system and its adaptability to variable environmental conditions such as type of vegetation, terrain, and climate and any impacts the alternative may have on future actions and how long it would take to mobilize and implement it in the field would be considered.

#### A3.1.3.2 Administrative Feasibility

The ability to comply with the substantive elements of permitting processes to the extent practicable and secure approvals for each method would be considered. The effort and resources required to coordinate with regulatory agencies and comply with the substantive elements of permitting processes to the extent practicable and the degree to which the alternative is anticipated to be effective in

rendering the IA sites suitable for safe OE Remedial Action would be considered.

#### A3.1.3.3 Availability of Services and Materials

The availability of tools, equipment and labor as well as the ability to maintain equipment during implementation associated with each method would be considered. The availability of contractors with the equipment and knowledge to implement the vegetation clearance alternatives and the ease of acquiring necessary equipment, labor, materials or specialists would be considered. The need for management and/or disposal of cleared vegetation and the ease of maintaining the level of clearance for the duration of the OE Remedial Action would be considered.

### A3.1.4 Cost

Capital and operations and maintenance (O&M) costs associated with implementing each of the methods were estimated based on historical data from previous clearance activities at Fort Ord and contractor and vendor quotes. Costs include contractor's mobilization and demobilization, labor, engineering, equipment purchase or lease and construction/installation, ongoing equipment operation and inspections, utilities, routine maintenance and repairs, etc. There are no O&M costs associated with maintaining cleared areas during OE Remedial Actions assuming OE workers would move immediately into cleared areas. Long term O&M costs for monitoring the recovery of the habitat for a period of 5 years as specified in the HMP are assumed to be the same for each of the methods. These cost estimates do not include the cost to implement corrective measures such as active plantings and additional monitoring and reporting if the HMP success criteria are not met. The costs to repair damages caused to the CMC habitat areas would likely be significant if methods other than prescribed burning (the only vegetation clearance method approved for use in CMC habitat areas at the IA sites) are implemented.

## A3.2 Screening of Vegetation Clearance Methods

Table A1 presents the Screening of each method in achieving the Vegetation Clearance Objective (Section A1.0) of clearing vegetation to bare ground or approximately 6 inches above ground surface. In addition, a preliminary evaluation of each method's effectiveness, implementability and relative cost was considered in the screening.

The following summary of the screening indicates whether the method was retained for further consideration based on the preliminary evaluation and consideration of the site-specific parameters described in Section A2.0.

### A3.2.1 No Action

Taking no action to clear vegetation is not viable for the IA sites because vegetation must be cleared to bare ground or approximately 6 inches above ground surface in order to conduct OE Remedial Action that presents an unacceptable risk to human health.

***No Action is eliminated from further consideration.***

### A3.2.2 Manual, Mechanical and Remotely-Operated Mechanical Vegetation Clearance

Based on previous experience implementing these methods at Fort Ord to clear vegetation prior to UXO sampling or removal actions, manual, mechanical and remotely-operated mechanical vegetation clearance methods (cutting) could be effective under certain circumstances at the IA sites, and are implementable with a medium to high cost compared to other methods depending on the cutting method used. Cutting costs range from medium to high compared to the other methods. Mechanical methods are 23 percent lower than burning, 80 percent higher than grazing, and

57 percent higher than herbicide application. Manual methods are 300 percent higher than burning, 46 percent higher than grazing, and 91 percent higher than herbicide application. Costs for remotely-operated mechanical methods cannot be estimated at this time because units are still in development and are not commercially available; these costs are anticipated to be approximately 30 to 50 percent higher than for mechanical methods.

Capital and O&M costs for cutting are estimated as follows for the IA sites:

***Ranges 43-48***

Costs are estimated at $5,713 per acre for manual methods and $3,350 per acre for mechanical methods. Costs for remotely-operated mechanical methods cannot be estimated at this time because units are still in development and are not commercially available; these costs are anticipated to be approximately 30 to 50 percent higher than for mechanical methods. Long term O&M costs for monitoring the recovery of the habitat for a period of 5 years as specified in the HMP would be approximately $213,000 for each of the methods.

***Range 30A***

Capital costs are estimated at $5,481 per acre for manual methods and $3,178 per acre for mechanical methods. Costs for remotely-operated mechanical methods cannot be estimated at this time because units are still in development and are not commercially available; these costs are anticipated to be approximately 30 to 50 percent higher than for mechanical methods. Long term O&M costs for monitoring the recovery of the habitat for a period of 5 years as specified in the HMP would be approximately $149,000 for manual or mechanical methods.

***Site OE-16***

Capital costs are estimated at $5,516 per acre for manual methods and $3,220 per acre for mechanical methods. Costs for remotely-operated mechanical methods cannot be estimated at this time because units are still in development and are not commercially available; these costs are anticipated to be approximately 30 to 50 percent higher than for mechanical methods. Long term O&M costs for monitoring the recovery of the habitat for a period of 5 years as specified in the HMP would be approximately $30,000 for manual or mechanical methods.

There would be no O&M costs to maintain cleared vegetation during the course of the OE Remedial Action assuming OE workers moved immediately into each area as it was cleared. These cost estimates do not include the cost to implement corrective measures such as active plantings and additional monitoring and reporting if the HMP success criteria are not met. The costs to repair damages caused to the CMC habitat areas would likely be significant if methods other than prescribed burning are used.

Cutting has a production rate of only 2 to 2.5 acres per day depending on the cutting method used; at these rates, it would take 32 to 40 weeks (8 to 10 months) to clear Ranges 43-48, 22 to 28 weeks (5.5 months to 7 months) to clear Range 30A, and 5 to 6 weeks (1.25 to 1.5 months) to clear Site OE-16. These methods would not comply with the HMP and ESA and could only be applied on a limited basis because implementation of cutting in areas greater than 50 acres in size would not be consistent with the Biological and Conference Opinion (*USFWS, 1993; 1997*) issued by USFWS in accordance with the Endangered Species Act. In addition, cutting would not be selective in its impacts on plants and would clear threatened and endangered species, which would not comply with the HMP and ESA. However, because they are valid, standard methods for clearing vegetation (although remotely-operated equipment is still in development) and could be effective in clearing vegetation at the IA sites notwithstanding the limitations described above, they are retained for further consideration as a basis of comparison to other methods.

Remotely-Operated Mechanical Vegetation Clearance methods were eliminated from this analysis because this type of equipment is very specialized, is still in development, is extremely costly, and is not available for commercial use at this time.

***Manual and Mechanical Vegetation Clearance are retained for further consideration; Remotely-Operated Mechanical Vegetation Clearance is eliminated from further consideration.***

### A3.2.3 Prescribed Burning

Preparation methods that could be implemented prior to conducting a prescribed burn include Pre-Crushing (Mechanical Crushing) and Browning (Herbicide Application). Implementation of either of these methods would cause the vegetation to die off or wilt, which would reduce the moisture content and result in a more complete burn. Pre-Crushing uses Mechanical Vegetation Clearance methods and would be effective as described above in Section A2.2.2; however, prescribed burning alone would be effective in clearing vegetation to bare ground or approximately six inches above ground surface, and can be implemented in one week, as compared to Pre-Crushing, which would take many months to implement at significantly higher cost (Table A1). Costs for Pre-Crushing would be approximately $3,151 per acre, which would be in addition to per acre costs for prescribed burning of $3,972, in effect doubling the cost of vegetation removal. Therefore, Pre-Crushing is eliminated from further consideration as a preparation method for prescribed burning. Browning using Herbicide Application could not be implemented because the herbicide could not be applied selectively and would defoliate or kill threatened and endangered species, which would not comply with the HMP and ESA. Therefore, Browning is eliminated from further consideration as a preparation method for prescribed burning.

Based on previous experience implementing prescribed burning at Fort Ord to clear vegetation prior to UXO sampling or removal actions, it would be effective in clearing vegetation to bare ground or approximately 6 inches above ground surface, can be implemented in one week, which would coincide with the intention of clearing vegetation as soon as possible under Interim Action. Burning has medium capital costs compared to other methods (20 percent more than mechanical methods, 70 percent less than manual methods, 83 percent more than grazing, and 33 percent more than herbicide application).

Capital and O&M costs for burning are estimated as follows for the IA sites:

***Ranges 43-48***

Capital costs are $3,972 per acre for burning. Long term O&M costs for monitoring the recovery of the habitat for a period of 5 years as specified in the HMP would be approximately $213,000.

***Range 30A***

Capital costs are $3,906 per acre for burning. Long term O&M costs for monitoring the recovery of the habitat for a period of 5 years as specified in the HMP would be approximately $149,000.

***Site OE-16***

Capital costs are $3,973 per acre for burning. Long term O&M costs for monitoring the recovery of the habitat for a period of 5 years as specified in the HMP would be approximately $30,000.

Capital costs include those associated with planning and conducting the burn, and air monitoring and sampling as well as community relations and costs associated with relocation of community members during the burn. There are no O&M costs associated with maintaining cleared areas during OE Remedial Actions assuming OE workers would move immediately into cleared areas. These cost estimates do not include the cost to implement corrective measures such as active plantings and additional

monitoring and reporting if the HMP success criteria are not met.

***Prescribed Burning is retained for further consideration. Preparation of vegetation to reduce fuel moisture and improve and extend ideal burning conditions using Pre-Crushing (Mechanical Clearance Methods) and Browning (Herbicide Application) is eliminated from further consideration.***

### A3.2.4 Animal Grazing

Based on previous experience implementing animal grazing at other sites to clear grassland vegetation where UXO is not present, it would not be effective in clearing woody vegetation to bare ground or approximately 6 inches above ground surface in UXO areas; therefore an additional method would need to be implemented to clear the vegetation completely. Grazing has low estimated capital (Table A1 costs compared to other methods (83 percent less than burning, 80 percent less than mechanical methods, 95 percent less than manual methods, and 84 percent less than herbicide application). However, an additional clearance method would be required as described above; therefore, actual costs would be more.

Cost estimates are as follows for grazing at the IA sites:

***Ranges 43-48***

Capital costs are estimated at $650 per acre for grazing. Long term O&M costs for monitoring the recovery of the habitat for a period of 5 years as specified in the HMP would be approximately $213,000.

***Range 30A***

Capital costs are estimated at $650 per acre for grazing. Long term O&M costs for monitoring the recovery of the habitat for a period of 5 years as specified in the HMP would be approximately $149,000.

***Site OE-16***

Capital costs are estimated at $650 per acre for grazing. Long term O&M costs for monitoring the recovery of the habitat for a period of 5 years as specified in the HMP would be approximately $30,000.

There are no O&M costs associated with maintaining cleared areas during OE Remedial Actions assuming OE workers would move immediately into cleared areas. These cost estimates do not include the cost to implement corrective measures such as active plantings and additional monitoring and reporting if the HMP success criteria are not met. The costs to repair damages caused to the CMC habitat areas would be significantly higher than if methods other than prescribed burning are used.

Grazing could not be implemented because the goats are not selective in their feeding and would consume threatened and endangered species, which would not comply with the HMP and ESA. In addition, grazing has a production rate of only 1.5 acres per day for a herd of 350 goats (*Stromberg, 1997*); at this rate, it would take approximately 1 year (53 weeks) to clear Ranges 43-48, 37 weeks to clear Range 30A, and 8 weeks to clear Site OE-16. In addition, the goats would not eat all of the vegetation; therefore, this type of clearance would need to be followed by additional vegetation clearance.

***Animal Grazing is eliminated from further consideration.***

### A3.2.5 Herbicide Application

Based on previous experience implementing herbicide application at other sites to clear weeds and other non-CMC type vegetation, it would be not be effective in clearing vegetation to bare ground or approximately 6 inches above ground surface; therefore an additional method would need to be implemented to clear the vegetation completely. In addition, it could not be implemented because it would not be selective in its impacts on plants and would

consume threatened and endangered species, which would not comply with the HMP and ESA. Although herbicide application would only take 1 week to implement, it would require additional vegetation clearance. Herbicide application has medium estimated capital costs (Table A1) compared to other methods (67 percent less than burning, 63 percent less than mechanical methods, 91 percent less than manual methods, and 84 percent more than grazing). However, an additional clearance method would be required as described above; therefore, actual costs would be more.

Capital and O&M costs for herbicide application are estimated as follows for the IA sites:

***Ranges 43-48***

Capital costs are $1,196 per acre for herbicide application. Long term O&M costs for monitoring the recovery of the habitat for a period of 5 years as specified in the HMP would be approximately $213,000.

***Range 30A***

Capital costs are $1,196 per acre for herbicide application. Long term O&M costs for monitoring the recovery of the habitat for a period of 5 years as specified in the HMP would be approximately $149,000.

***Site OE-16***

Capital costs are $1,196 per acre for herbicide application. Long term O&M costs for monitoring the recovery of the habitat for a period of 5 years as specified in the HMP would be approximately $30,000.

There are no O&M costs associated with maintaining cleared areas during OE Remedial Actions assuming OE workers would move immediately into cleared areas. These cost estimates do not include the cost to implement corrective measures such as active plantings and additional monitoring and reporting if the HMP success criteria are not met. The costs to repair damages caused to the CMC habitat areas would be significantly higher if methods other than prescribed burning are used. Herbicide application could not be implemented because the herbicide could not be applied selectively and would defoliate or kill threatened and endangered species, which would not comply with the HMP and ESA.

***Herbicide Application is eliminated from further consideration.***

### A3.2.6 Summary of the Screening of Vegetation Clearance Methods

Based on the screening that (1) evaluated whether each method described in Section A2.0 met the minimum requirement of clearing vegetation to bare ground or approximately 6 inches above ground surface, and (2) a preliminary evaluation of effectiveness, implementability and cost, the following methods met the requirement and were retained for further consideration and analysis in the accompanying IA RI/FS:

- **Manual Vegetation Clearance**
- **Mechanical Vegetation Clearance**
- **Prescribed Burning.**

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# APPENDIX A

# TABLES

# Table A1. Summary of Screening of Vegetation Clearance Methods
## Screening Evaluation of Vegetation Clearance Method
## Interim Action Remedial Investigation/Feasibility Study
## Former Fort Ord, California

| Vegetation Clearance Method | Evaluation Criteria | | |
|---|---|---|---|
| | **Effectiveness** | **Implementability** | **Relative Cost** |
| **No Action** | No Action is considered as a baseline against which to compare other methods but would not be effective for these ranges and would not comply with ARARs since it takes no action to clear vegetation at the Ranges which have been assigned the highest priority for an OE Remedial Action. Vegetation must be cleared prior to conducting OE Remedial Action. Taking no action to clear vegetation and enhance visual identification of UXO on the surface prior to OE Remedial Actions would present unacceptable OE-related risks to workers and the public. | Implementable because no action would be taken to clear the vegetation. However, not implementable from a technical or administrative perspective because the vegetation would not be cleared and surface UXO that may be high explosive and have sensitive fuzing could not be safely removed. | There are no capital or O&M costs associated with No Action. |
| **Manual, Mechanical, and Remotely-Operated Mechanical Vegetation Clearance (Cutting)** | Manual and mechanical methods of clearing vegetation (cutting) would only be effective on a limited basis for areas under 50 acres at these ranges where burning could not be conducted. Cutting vegetation at the Ranges would not comply with the substantive requirements of ARARs such as the HMP and ESA. Although the vegetation could be cut using a variety of manual and mechanical methods and equipment (difficulty would depend on the thickness of the vegetation), OE workers require vegetation be cleared to bare ground or approximately 6 inches above ground surface, which could only be achieved over a period | Cutting could not be implemented at the Ranges regardless of the method used. Because threatened and endangered species exist at Fort Ord, the HMP was developed to comply with the Endangered Species Act (ESA) to mitigate impacts to species and their habitat associated with cleanup and OE Remedial Action. As a result, prescribed burning is the primary vegetation clearance method approved for use in CMC habitat areas found at the Ranges. Therefore, although manual and mechanical methods of cutting have been used extensively in areas designated for future development at Fort Ord and on a limited basis in CMC habitat areas of less than 50 acres where burning could not be conducted, cutting on a widespread basis over the 483, 388, and 80 acre IA sites would not comply with the HMP and ESA.<br><br>Cutting would also be difficult to implement | Capital costs for cutting vegetation would be high for manual methods ($5,481 to $5,713 per acre) compared to prescribed burning ($3, 906 to $3,973 per acre) and mechanical ($3,178 to $3,350 per acre). Costs for remotely-operated mechanical methods cannot be estimated at this time because units are still in development and are not commercially available; these costs are anticipated to be approximately 30 to 50 percent higher than |

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| | of many months for the IA sites. In addition, the cuttings typically fall to the ground where UXO would potentially be present, and would then need to be chipped/removed in order to see UXO on the ground surface and perform the OE Remedial Action. Restoration of habitat in areas exposed to cutting would likely be extensive and in the long term it would be difficult and costly to restore these areas to their pre-existing condition. | because regardless of the method used, it would take many months to clear the IA sites. In addition, vegetation clearance personnel would be required to work in areas where there is a potential for exposure to UXO and serious injury or death. Remotely-operated equipment is still in development and is not available. | for mechanical methods. There would be no O&M costs to maintain cleared vegetation during the course of the OE Remedial Action if OE workers moved immediately into each area as it was cleared. There would be long term O&M costs of $213,000 for Ranges 43-48, $149,000 for Range 30A, and $30,000 for Site OE-16 associated with monitoring the recovery of CMC habitat for a period of 5 years as specified in the HMP. These cost estimates do not include the cost to implement corrective measures such as active plantings and additional monitoring and reporting if the HMP success criteria are not met. The costs to repair damages caused to the CMC habitat areas would be significantly higher if methods other than prescribed burning are used. |
| **Prescribed Burning** | Prescribed burning would be the most effective means of clearing vegetation because fire clears the vegetation and typically provides OE workers with a clear, unobstructed view of the ground surface, which would typically meet the requirement of clearing to bare | Prescribed burning would be implementable because it has been used to clear CMC vegetation from OE sites to support OE removal actions at the former Fort Ord since 1994, complies with the HMP and ESA, and would only take approximately 1 week to implement (3 days preparation & relocation, 2 days to conduct the burn, and 2 days for smoke to clear), which would coincide with | Capital costs associated with implementing a prescribed burn would be high ($3,906 to $3,973 per acre) compared to grazing and herbicides, low compared to manual |

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| | ground or approximately 6 inches above ground surface and would comply with the substantive requirements of ARARs to the extent practicable. In addition, personnel would not need to enter the area containing UXO until the vegetation was cleared. Prescribed burning is the primary vegetation clearance method approved for extensive use in the designated HMP CMC habitat areas that exist at Ranges 43-48. Burning improves the long term health and functioning of the plant community and threatened and endangered species which thrive on occasional fires and provide habitat for animals. The need for restoration of habitat in areas that are burned would be minimal in the long term because these areas thrive on fire and would eventually be restored to their pre-existing condition. | the intention of clearing vegetation as soon as possible to prepare the Ranges for conducting a high priority OE Remedial Action. Prescribed burns must be conducted under optimal climatic conditions and in close coordination with federal, state and local regulatory agencies. Recently, there has been some public concern regarding burn-related issues at Fort Ord such as air quality and fire safety. The Army is conducting ongoing work to mitigate these concerns, and will offer relocation to community members for the duration of the burn. In addition, prescribed burning personnel would not be required to work in areas where there is a potential for direct exposure to UXO and serious injury or death. | methods, and similar to mechanical methods, and would include conducting the burn, community relations, air monitoring and sampling and relocation of community members for the duration of the burn. There would be no O&M costs to maintain cleared vegetation during the course of the OE Remedial Action. There would be long term O&M costs of $213,000 for Ranges 43-48, $149,000 for Range 30A, and $30,000 for Site OE-16 associated with monitoring the recovery of CMC habitat for a period of 5 years as specified in the HMP. These cost estimates do not include the cost to implement corrective measures such as active plantings and additional monitoring and reporting if the HMP success criteria are not met. |
| **Preparation Methods for Prescribed Burning** | ***Pre-Crushing***<br>Pre-Crushing using Mechanical Vegetation Clearance methods would be effective in preparing the vegetation for prescribed burning by damaging or removing leaves and stems that would then be allowed to dry out, providing a low moisture | ***Pre-Crushing***<br>Pre-Crushing using Mechanical Vegetation Clearance methods would be difficult to implement on a wide scale at the Ranges (483 acres) because of the difficult terrain and services and equipment required. Pre-Crushing could be conducted in compliance with the HMP and ESA because it would be followed by burning; however, it would | ***Pre-Crushing***<br>Capital costs for Pre-Crushing would be high ($3,151). There would be no O&M costs associated with preparation of vegetation because it would be followed by |

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| | fuel to optimize subsequent burning.<br><br>***Browning***<br>Browning using Herbicide Application methods would be effective in preparing the vegetation for prescribed burning by damaging leaves and stems that would then be allowed to dry out, providing a low moisture fuel to optimize subsequent burning. | require additional coordination with USFWS.<br><br>***Browning***<br>Browning using Herbicide Application methods could not be implemented because the herbicide could not be applied selectively and would defoliate or kill threatened and endangered species, which would not comply with the HMP and ESA. In addition, herbicide application followed by prescribed burning may release herbicide residues as air emissions during burning. | burning.<br><br>***Browning***<br>Capital costs for Browning would be moderate ($1,196 per acre). There would be no O&M costs associated with preparation of vegetation because it would be followed by burning. |
| **Animal Grazing** | Grazing would not be effective because it is used primarily to thin out vegetation and not clear it completely and would not comply with the HMP and ESA and the substantive requirements of ARARs. A significant portion of the vegetation (e.g., the woody parts that would not be eaten by goats) would remain, and the requirement that vegetation be cleared to bare ground or approximately 6 inches above ground surface would not be met. The need for restoration of habitat in areas exposed to grazing would likely be extensive and in the long term it would be difficult and costly to restore these areas to their pre-existing condition. | Animal grazing could not be implemented because it would not comply with the HMP and ESA and the goat herders and goats would be exposed to the sensitive and extremely hazardous type of UXO present at these ranges. Grazing has not been used at the former Fort Ord to clear vegetation from suspected or known OE Sites, and the use of goats would require management by a herder, and installation of temporary, movable electric fences and a water supply. The rate of grazing and vegetation thinning is 1.5 acres/day for a large herd of 350 goats; therefore, OE workers would only be able to access small portions of the IA sites incrementally. In addition, animals and personnel would be required to work in areas where there is a potential for direct exposure to UXO and serious injury or death. | Capital costs associated with grazing animals would be low ($650 per acre) compared to other methods; however, costs may increase substantially depending on the need to conduct additional vegetation clearance. There would be no O&M costs to maintain cleared vegetation during the course of the OE Remedial Action if OE workers moved immediately into each area as it was cleared. There would be long term O&M costs of $213,000 for Ranges 43-48, $149,000 for Range 30A, and $30,000 for Site OE-16 associated with monitoring the recovery of CMC habitat for a period of 5 years as specified in the HMP. These cost |

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| | | | estimates do not include the cost to implement corrective measures such as active plantings and additional monitoring and reporting if the HMP success criteria are not met. The costs to repair damages caused to the CMC habitat areas would be significantly higher if methods other than prescribed burning are used. |
| **Herbicide Application** | Herbicide application would not be effective because although it would eventually kill the vegetation, it would mainly cause the leaves to fall to the ground, potentially obscuring visual evidence of UXO and would not comply with the HMP and ESA and substantive requirements of ARARs. Since only the leaves would be cleared, the requirement that vegetation be cleared to bare ground or approximately 6 inches above ground surface may not be met unless additional methods of vegetation clearance were subsequently performed. In addition, the type of herbicides that would be effective for the different types of vegetation at the ranges may vary and the time it would take after application for the plants to die would be difficult to determine. The need for restoration of habitat in areas exposed to herbicides would likely be extensive and in the long term | Herbicide application could not be implemented because it would not comply with the HMP and ESA and the public and other species at the Ranges would be exposed to potentially harmful herbicides. Herbicide application has not been used at the former Fort Ord to clear vegetation from suspected or known OE Sites, and would require aerial application because the herbicides could not be safely applied using ground application methods due to the presence of UXO. Widespread application of herbicides over the 483, 388, and 80 acre IA sites would likely cause public concern, and DOD is encouraging a reduction in herbicide use at military installations. The application would need to be conducted in close coordination with federal, state and local regulatory agencies and in accordance with DOD herbicide guidance on its safe use, mixing, handling and application. In addition, although the rate of herbicide application over the entire 483 acres of the Ranges is estimated at 1 day, it would take approximately 1 week to include coordination with public, agencies, relocation and air sampling, etc. Additional vegetation clearance measures may have to be implemented to further clear brush because the herbicide would mainly defoliate | Capital costs associated with applying herbicides would be low ($1,196 per acre) compared to other methods and would include aerial application of herbicides, community relations, air monitoring and sampling and relocation of community members for the duration of the application. Costs may increase substantially depending on the need to conduct additional vegetation clearance. There would be no O&M costs to maintain cleared vegetation during the course of the OE Remedial Action if OE workers moved immediately into each area as it |

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| | it would be difficult and costly to restore these areas to their pre-existing condition. | the plants, leaving plant debris on the ground surface and woody stems in tact. Additional clearing using other methods could take up to 40 weeks, which would not coincide with the intention of clearing vegetation as soon as possible to prepare the Ranges for conducting a high priority OE Remedial Action. Herbicide application personnel would not be required to work in areas where there is a potential for exposure to UXO. | was cleared. There would be long term O&M costs of $213,000 for Ranges 43-48, $149,000 for Range 30A, and $30,000 for Site OE-16 associated with monitoring the recovery of CMC habitat for a period of 5 years as specified in the HMP. These cost estimates do not include the cost to implement corrective measures such as active plantings and additional monitoring and reporting if the HMP success criteria are not met. The costs to repair damages caused to the CMC habitat areas would be significantly higher if methods other than prescribed burning are used. |

Notes:

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| ARARs | Applicable or Relevant and Appropriate Requirements |
| CMC | Central Maritime Chaparral |
| DOD | Department of Defense |
| ESA | Endangered Species Act |
| HMP | Habitat Management Plan |
| OE | Ordnance and Explosives |
| O&M Costs: | Operations & Maintenance Costs |
| UXO | Unexploded Ordnance |