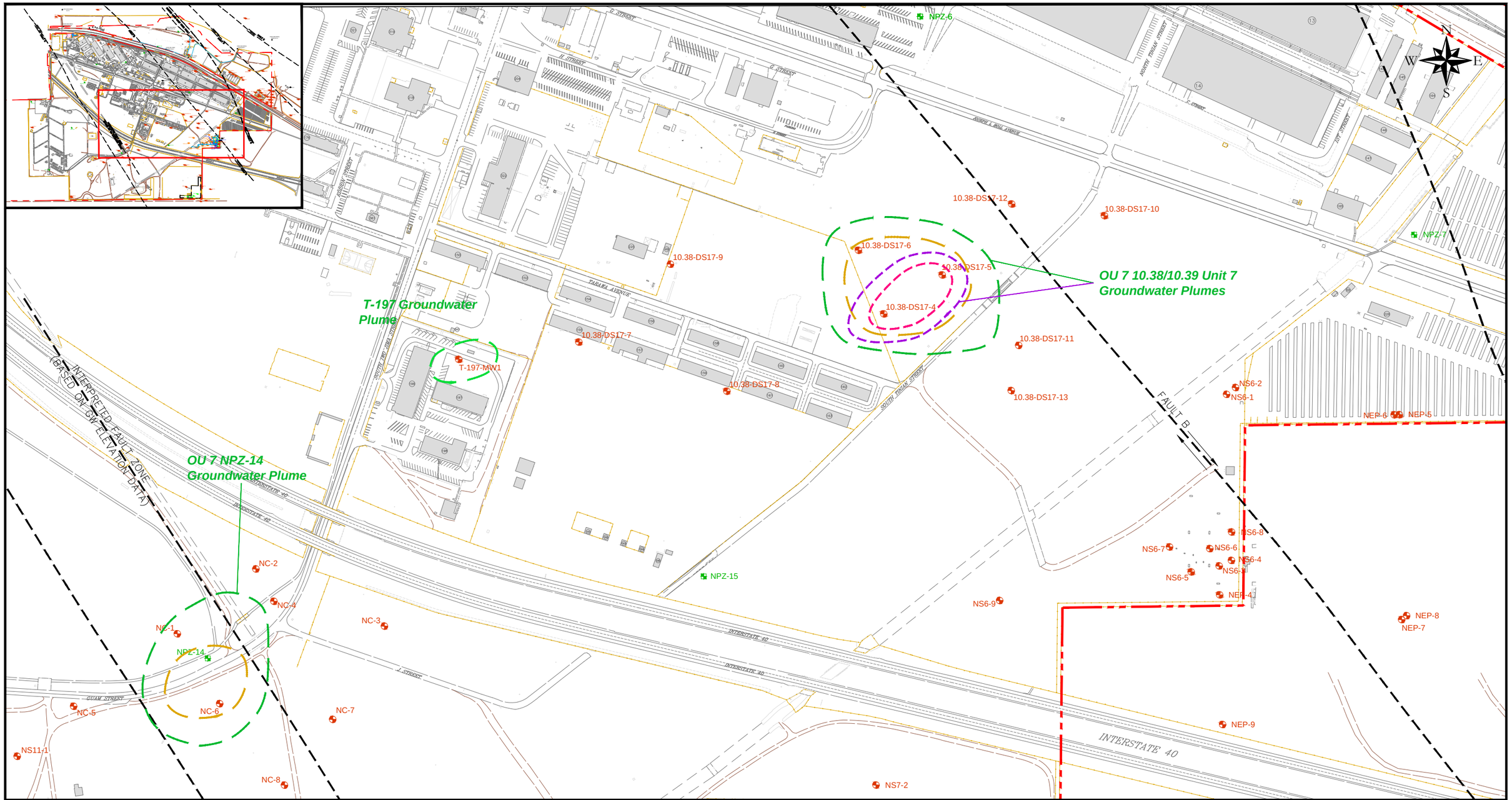


Legend

- Paved Road
- Dirt Road
- Railroad Tracks
- Fence Line
- Base Boundary
- Fault Traces (strike-slip)
- MW-B — Groundwater Monitoring Well
- NPZ-8 — Piezometer
- 5 — Approximate TCE Isoconcentration Contour (ug/L)
- 10 — Approximate TCE Isoconcentration Contour (ug/L)
- 5 — Approximate PCE Isoconcentration Contour (ug/L)
- 10 — Approximate PCE Isoconcentration Contour (ug/L)

Approximate Scale in Feet

0 350 700

Notes

1)

2)

3)

Acronyms

COC = contaminant of concern
TCE = Trichloroethene
PCE = Tetrachloroethene
J = Estimated Value

ft bgs = feet below ground surface
U = Not Detected (value indicates detection limit)
OU = operable unit
CAOC - CERCLA Area of Concern
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act

Figure 6-6
OU 7, NPZ-14 Area and CAOC 10.38/10.39 Unit 7 Groundwater Plumes

Nebo Main Base
Marine Corps Logistics Base
Barstow, California

OTIE
An Oneida Nation Company

Date: May 5, 2017
File: Barstow_A16.dwg
Plotted By: Geoff Brink

N

1548

CAOC 11
Former Fuel Burn Area

SEE INSET 1

CAOC 10

Water
Tank

INSET 1

Soil Hot Spot
to be Removed

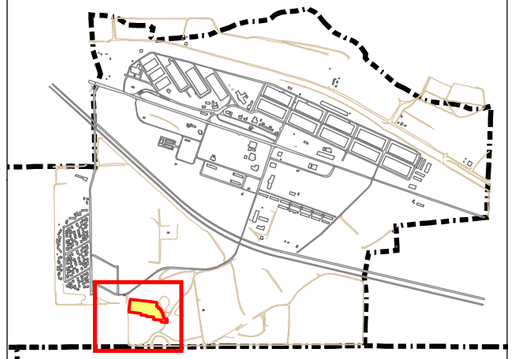
0 30
Feet

NS10-1

NWP-1

150 0 150
Feet

MCLB Barstow - Nebo Main Base



- Monitoring Well
- Aboveground Storage Tank
- 80 mg/kg Estimated Lead Isoconcentration (LeadSpread PRG90 residential RG)
- 320 mg/kg Estimated Lead Isoconcentration (LeadSpread PRG90 industrial RG)
- Geophysical Anomaly (RI, 2005)
- CAOC 10 Site Boundary and Soil LUC Boundary
- CAOC Site Boundary
- Building
- Paved Road
- Dirt Road
- Fence
- MCLB Barstow Boundary

Notes:

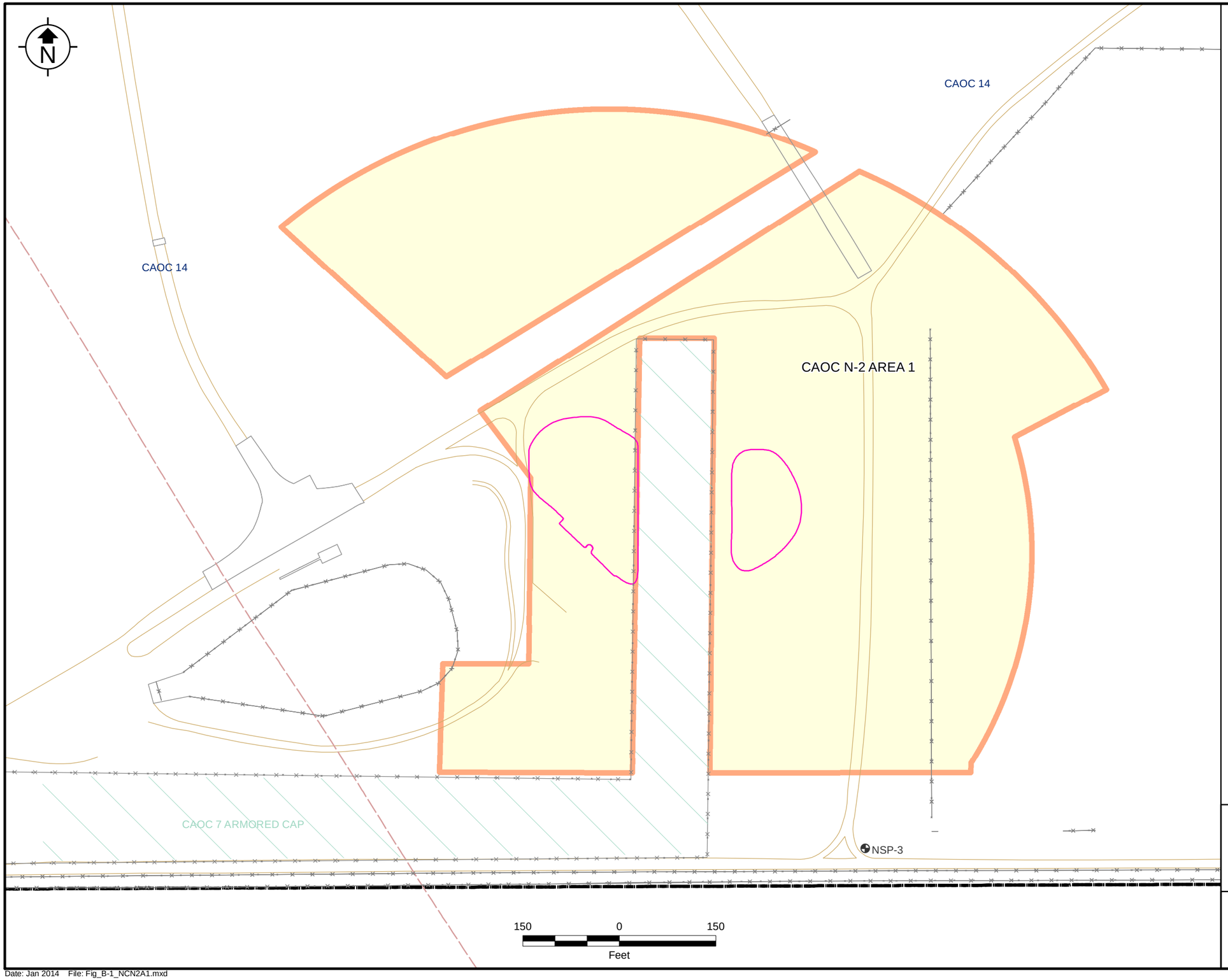
mg/kg - Milligram per Kilogram
CAOC - CERCLA Area of Concern
OU - Operable Unit
PRG - Preliminary Remediation Goal
MCLB - Marine Corps Logistics Base
LUC - Land Use Control

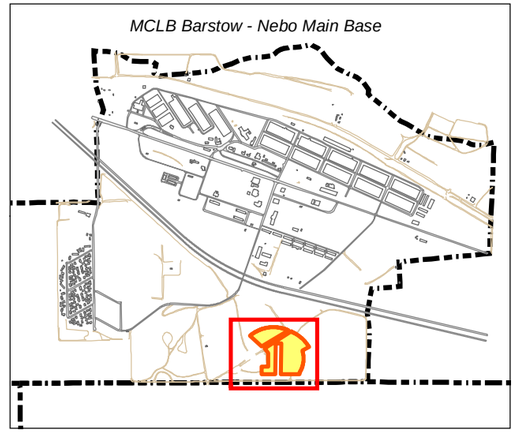
FIGURE 6-7
CAOC 10 METALLIC DEBRIS DISPOSAL AREA

Nebo Main Base
Marine Corps Logistic Base, Barstow, California

OTIE
An Oneida Nation Company

Date: Jan 2014 File: Fig_A-1_NC10.mxd





- Monitoring Well
- Clay Fragment Area
- Landfill Cap
- CAOC N-2 Area 1 Site Boundary and Soil LUC Boundary
- Paved Area
- Dirt Road
- Fence
- Fault Line "A"
- MCLB Barstow Boundary

Notes:

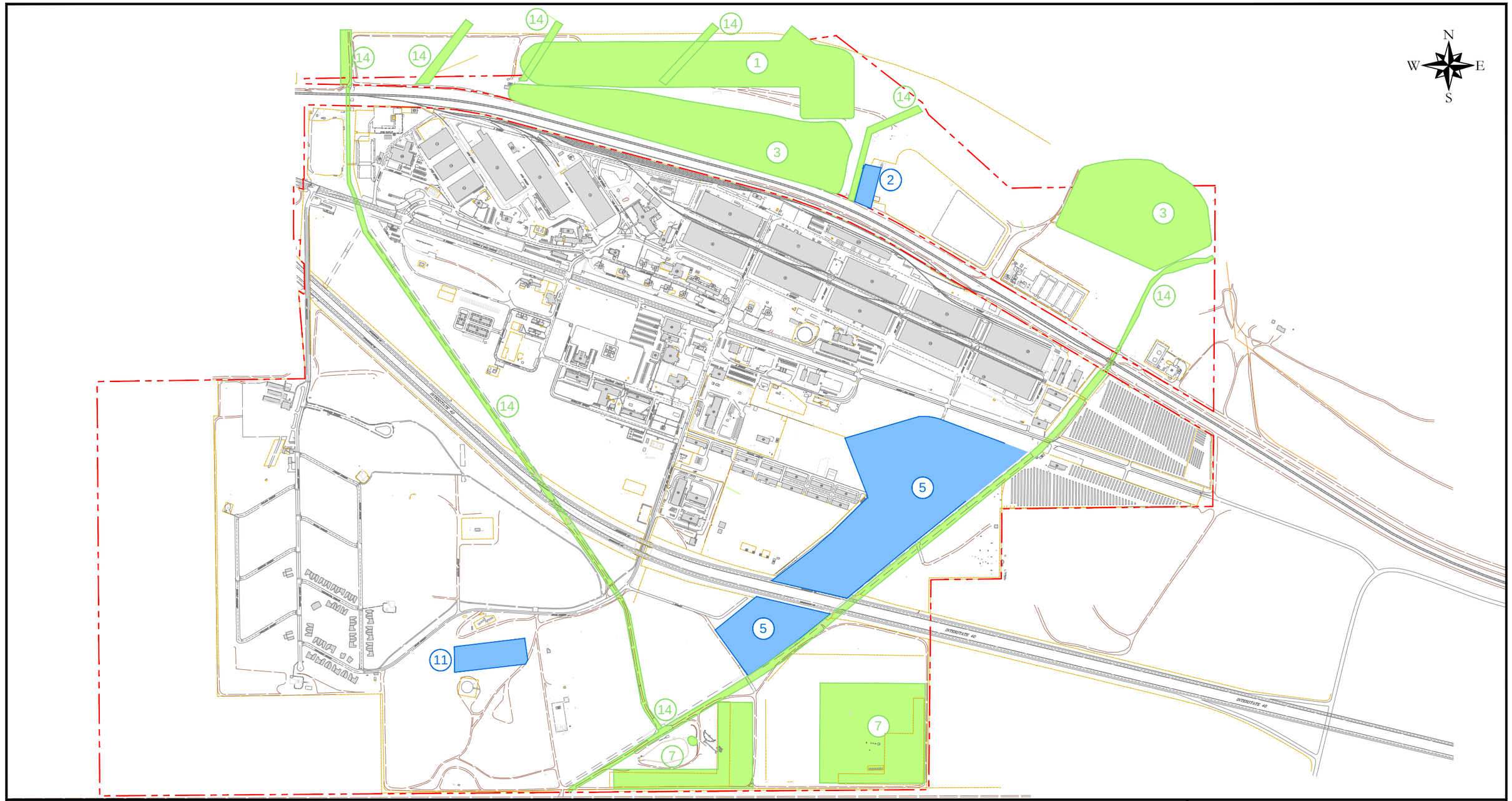
CAOC - CERCLA Area of Concern
OU - Operable Unit
MCLB - Marine Corps Logistics Base
LUC - Land Use Control

FIGURE 6-8
OU 7 CAOC N-2 AREA 1

Nebo Main Base
Marine Corps Logistic Base, Barstow, California

OTIE
An Oneida Nation Company

Date: Jan 2014 File: Fig_B-1_NCN2A1.mxd



Legend

- Paved Road
- Dirt Road
- Railroad Tracks
- Fence Line
- Base Boundary
- Operable Unit 4 (CAOC ##)
- Operable Unit 6 (CAOC ##)

Notes

1) CAOC - CERCLA Area of Concern
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
LUCs = Land Use Controls
OU = Operable Unit

Approximate Scale in Feet

0 900 1800

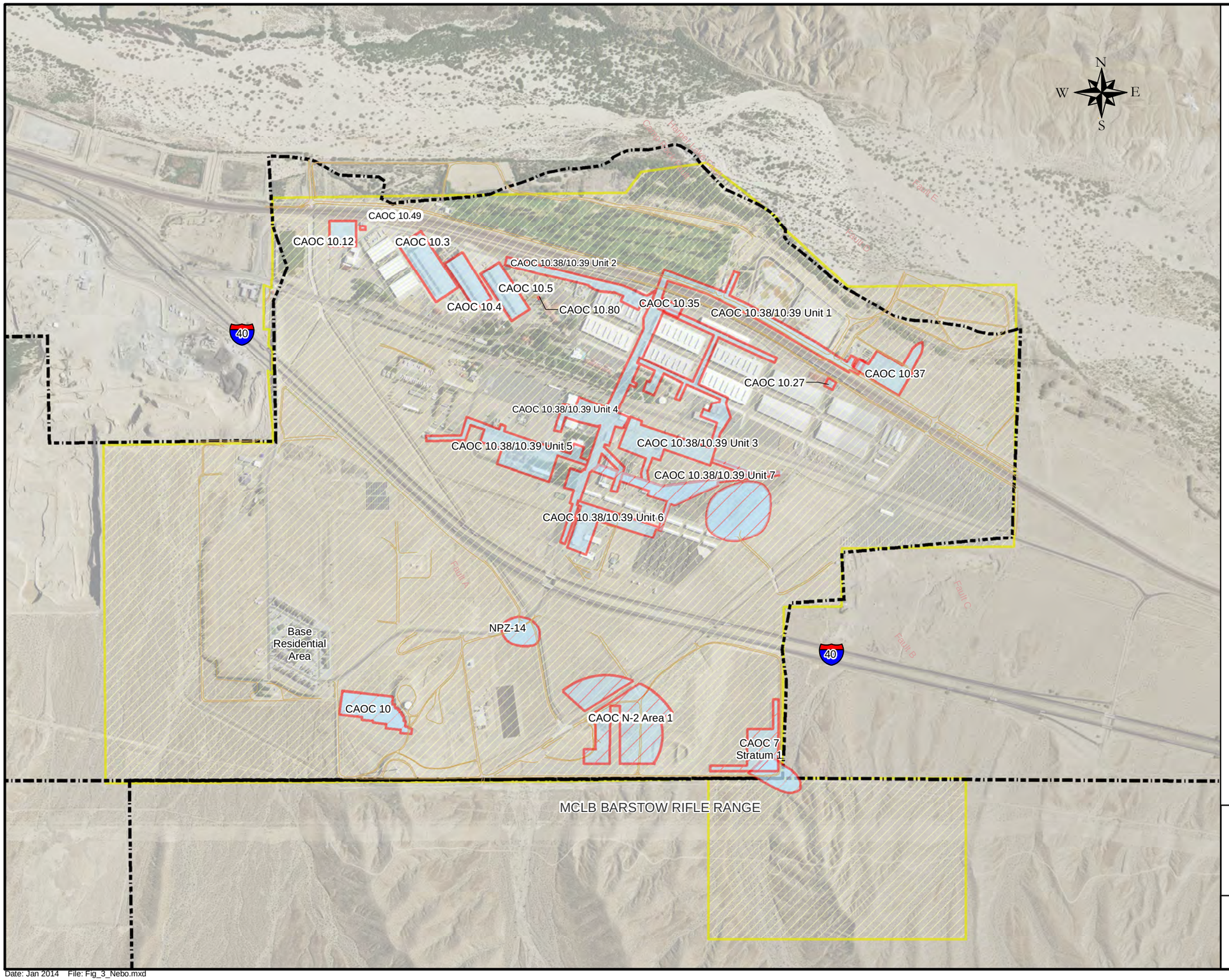
Figure 6-9
CAOCs 1, 2, 3, 5, 7, 11, and 14:
LUCs Only - OUs 4 & 6 Sites

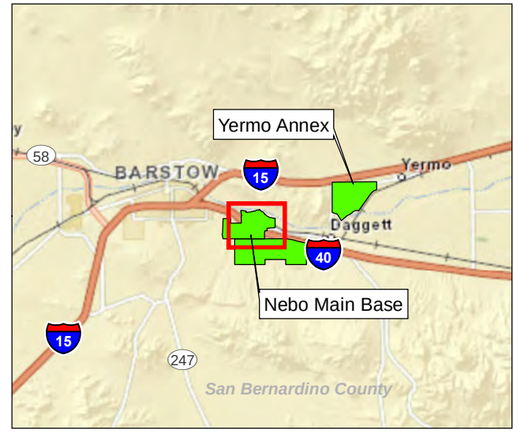
Nebo Main Base
Marine Corps Logistics Base
Barstow, California

OTIE
An Oneida Nation Company

Date: May 5, 2017

File: Barstow_5yrRev - 2017.dwg
Plotted By: Geoff Brink





Actionable Site

OU 7

Land Use Control (LUC) Area for Groundwater Use Controls

Paved Road

Dirt Road

Railroad

MCLB Barstow Boundary

Notes:
CAOC - CERCLA Area of Concern
OU - Operable Unit
MCLB - Marine Corps Logistics Base

850 0 850
Feet

Figure 6-10
LUC Areas for OUs 2 and 7
Groundwater and OU 7 CAOCs
Nebo Main Base
Marine Corps Logistics Base, Barstow, California

OTIE
An Oneida Nation Company

Date: Jan 2014 File: Fig_3_Nebo.mxd

TABLES

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TABLE 2-1
Summary of OUs and CAOCs
Fourth Five-Year Review Report OUs 1 - 7
MCLB Barstow, California

OU	CAOC	Base	Description	Selected Remedy	Total Area (acres)	Areas Requiring LUCs (acres)	Area of Engineering Controls (acres)	5-Yr Review Required?	Inspection Required?
1	37	Yemo	Consists of groundwater contaminated with VOCs, primarily TCE and PCE.	Groundwater extraction and treatment, AS/SVE systems, LUCs, long-term monitoring of groundwater and soil vapor	67.72	Groundwater in contaminated area must be treated before use	Treatment System (GETS) plus wells	Yes	Yes
3	18	Yermo	Stratum 2: Drainage Channel Stratum 3: Sludge Waste Disposal Area	LUCs (Base Environmental Division review of any proposed land use changes)	5.2	Stratum 2 (0.48) (Stratum 3 (3.04)	none	Yes	No
3	20	Yermo	Stratum 1: Radium-painted dial disposal well Stratum 2: Nonradiological waste wells Stratum 3: Areas of discoloration observed in aerial photographs	Stratum 1: concrete cap modification, LTM, infiltration monitoring; groundwater monitoring (assess if groundwater contamination is occurring). Stratum 2: Limited Activities, precipitation infiltration monitoring, drainage control Stratum 3: The no action remedy was selected for CAOC 20, Stratum 3. No remedial action is planned for this stratum	2.6	2.6	Stratum 1 (0.08) Stratum 2 (1.29)	Yes	Yes
3	23	Yermo	Stratum 5: Potential waste burial area Stratum 5A: PCB-hit area Zone 1: Landfill Area	Stratum 1: Concrete cap (LTM), restriction of activities at Zone 1; groundwater monitoring under OU 1 (must comply with groundwater cleanup levels at CAOC boundary) Strata 5, 5a: LUCs (Base Environmental Division review and FFA stakeholder review of any proposed land use changes) Strata 3 and 4: NFA	71.8	Stratum 5 (19.16) Stratum 5(a) (0.26) Statum 1, Zone 1 (10.91)	None	Yes	Yes
3	34	Yemo	Stratum 1: Area covered by the former concrete basins and adjacent soils Stratum 2: Soils within the basins Stratum 3: Concrete basins	LUCs (Base Environmental Division review of any proposed land use changes)	0.58	Stratum 1 (0.58)	none	Yes	Yes
5	15 / 17	Yermo	Former industrial wastewater evaporation ponds	LUCs (Base Environmental Division review of any proposed land use changes); groundwater monitoring under OU 1 (must comply with groundwater cleanup levels at CAOC boundary)	15.98	15.98	NA	Yes	No
5	16	Yermo	Building 573 and surrounding concrete hardstand	LUCs to maintain hardstand cover (prevent exposure to possible subsurface contamination); groundwater contamination addressed under OU 1	47.69	47.69	47.69	Yes	Yes
5	19	Yermo	First Hazardous and Low-Level Radiological Area	NFA	5.8	none	none	No	No
5	21	Yermo	Industrial Waste Disposal Area	LUCs (Base Environmental Division review of any proposed land use changes)	9.96	9.96	none	Yes	No
5	22	Yermo	Domestic Wastewater Disposal Area	NFA	4.1	none	none	No	No
5	24	Yermo	Tracked Vehicle Test Area	NFA	5.5	none	none	No	No
5	25	Yermo	Waste Water Treatment and Sludge Disposal Area - removed from IRP during RI/FS with FFA approval (DON, 2007).	N/A	N/A	N/A	N/A	No	No
5	26	Yermo	Building 533 Waste Disposal Area	LUCs (Base Environmental Division review of any proposed land use changes)	0.95	0.95	none	Yes	No
5	27	Yermo	Fuel Storage Area	NFA	1.6	none	none	No	No
5	28	Yermo	West Lot Dust Control Area	NFA	149.6	none	none	No	No
5	29	Yermo	Sludge Storage Area	NFA	3	none	none	No	No
5	30	Yermo	Locomotive Repair Shop Disposal Area	NFA	0.9	none	none	No	No
5	31	Yermo	North Vehicle Test Track Road	NFA	4.1	none	none	No	No

TABLE 2-1
Summary of OUs and CAOCs
Fourth Five-Year Review Report OUs 1 - 7
MCLB Barstow, California

OU	CAOC	Base	Description	Selected Remedy	Total Area (acres)	Areas Requiring LUCs (acres)	Area of Engineering Controls (acres)	5-Yr Review Required?	Inspection Required?
5	32	Yermo	Preservation and Packaging Storage Area	NFA, except LUCs for Stratum 1 (Base Environmental Division review of any proposed land use changes)	1.2	0.42	sign	Yes	Yes
N/A	33	Rifle Range	removed from IRP during RI/FS stage with FFA stakeholder approval DON (2007).	N/A	N/A	N/A	N/A	No	No
5	35	Yermo	Stratum 1 Zone 1: Closed Class III Landfill Stratum 1 east: east of the landfill area Stratum 2: Area containing areal infrared thermographic survey anomaly (west of landfill)	Stratum 1 Zone 1: LUCs, maintain cap (Written concurrence of the FFA signatories is required before the Navy takes any action at Zone 1); groundwater monitoring under OU 1 (must comply with groundwater cleanup levels at CAOC boundary). Stratum 1 east and Stratum 2: NFA	27.9	27.9	14.77	Yes	Yes
5	36	Yermo	Paint Combat Vehicle Maintenance Shop	NFA	1.1	none	none	No	No
7	9.60	Yermo	Former location of 40,000 gallon UST (T530B)	LUCs (Base Environmental Division review of any proposed land use changes)	0.02	0.02	sign	Yes	Yes
7	9.68	Yermo	UST T-588A: Oil water separator UST T-588B French drain	LUCs (Base Environmental Division review of any proposed land use changes)	0.02	0.02	sign	Yes	Yes
7	Y-7 TA-12	Yermo	Thermal anomaly area	NFA	1	none	none	No	No
2	38	Nebo	Two VOC contaminated plumes (Nebo North and Nebo South plumes)	Nebo North source area treatment with AS/SVE, pump and treat for hydraulic containment if needed (GETS), natural attenuation of remaining groundwater VOCs after source cleaned up; Nebo South AS/SVE system to address on-site contamination and prevent off-site migration; groundwater use LUC to prevent potable use in contaminated areas	North Plume (0.84) South Plumes (0.12), (0.36)	plume areas	fencing and signs to protect remedial equipment; LUC signs at CAOC 6	Yes	Yes
4	2	Nebo	Pesticide Storage area Stratum 1: Two rectangular wash pads Stratum 3: yard	LUCs (Base Environmental Division review of any proposed land use changes)	1.87	Stratum 1 (0.01) Stratum 3 (1.86)	none	Yes	No
4	5	Nebo	Former Chemical Storage Area Stratum 1: Lots 351 and 357 Stratum 2: Lot 352 North	LUCs (Base Environmental Division review of any proposed land use changes)	47.7	Stratum 1 (28.43) Stratum 2 (15.23)	none	Yes	No
4	9	Nebo	Fuel Disposal Area	NFA	0.6	none	none	No	No
4	11	Nebo	Fuel Burn area	LUCs (Base Environmental Division review of any proposed land use changes)	3.49	3.49	none	Yes	No
6	1	Nebo	Stratum 1: Landfill area Stratum 2: Suspected landfill area Stratum 3: Sludge disposal area	LUCs (Base Environmental Division review of any proposed land use changes)	38.09	Stratum 1 (7.76) Stratum 2 (25.88) Stratum 3 (4.45)	none	Yes	No
6	3	Nebo	Stratum 1: Currently used as a golf course. Previously used as a wastewater treatment facility.	LUCs (Base Environmental Division review of any proposed land use changes)	64.9	Stratum 1 (39.31)	none	Yes	No
6	4	Nebo	Old Trap and Skeet Range Areas	NFA	4.3	none	none	No	No
6	6	Nebo	Reported to have operated as a landfill for disposal of hazardous and nonhazardous waste	NFA for soils; groundwater contamination addressed under OU 2	10.1	none (see OU 2, Nebo South)	none (see OU 2, Nebo South)	No	No

TABLE 2-1
Summary of OUs and CAOCs
Fourth Five-Year Review Report OUs 1 - 7
MCLB Barstow, California

OU	CAOC	Base	Description	Selected Remedy	Total Area (acres)	Areas Requiring LUCs (acres)	Area of Engineering Controls (acres)	5-Yr Review Required?	Inspection Required?
6	7	Nebo	Strata 1 and 2: Landfill disposal areas Stratum 3: Drum storage and spillage area Stratum 4: Former playground area	Strata 1 and 2: armored soil cap, precipitation infiltration monitoring, control access by fencing and signage, perform groundwater monitoring under OU 2. Restricted to activities include trenching, excavation or any other activity that could breach the soil cap. Strata 3 and 4: LUCs to prevent potential exposure to PCBs	30.7	Stratum 3 (17.41) Stratum 4 (0.14)	Stratum 1 (4.40) Stratum 2A (1.85) Stratum 2B (1.34)	Yes	Yes
6	8	Nebo	Building 197 Wastewater Disposal Area	NFA	0.6	none	none	No	No
6	12	Nebo	Radiator Cleaning Chemical Disposal Area	NFA	0.3	none	none	No	No
6	13	Nebo	Preservation and Packaging Storage Area	NFA	0.1	none	none	No	No
6	14	Nebo	Consists of three major stormwater drainage channels of the Nebo Main Base surface drainage system.	LUCs (Base Environmental Division review of any proposed land use changes)	24.8	Stratum 1 (13.72) Stratum 2 (0.62) Stratum 3 (0.35) Stratum 4 (0.25)	none	Yes	No
7	7 Stratum 1 (subsurface)	Nebo	Vadose zone and groundwater contamination associated with CAOC 7 Stratum 1 (capped disposal site and drum storage area).	Soil vapor extraction (SVE) of TCE from soils above the groundwater table (vadose zone); install additional monitoring wells off-base and monitor natural attenuation of groundwater contaminants. LUCs to prevent groundwater use at Nebo Main Base and a downgradient area at the Rifle Range.	4.4	Groundwater in contaminated area restricted from use	protect wells, remedial equipment; area TBD	Yes	Yes
7	10.38/10.39 Unit 7	Nebo	Soil and groundwater contamination related to industrial waste water lines and surface water drain discharges	LUCs only for soil (Base Environmental Division review before land use change); Monitored natural attenuation (MNA) of groundwater contaminants; LUCs to prevent groundwater use at Nebo Main Base.	12	Groundwater in contaminated area restricted from use	12 (monitoring well area)	Yes	Yes
7	NPZ-14	Nebo	contaminated groundwater in area of monitoring well NPZ-14	MNA of groundwater contaminants with annual evaluation of protectiveness and effectiveness; LUCs to prevent use of groundwater at Nebo Main Base.	3	Groundwater in contaminated area restricted from use	3 (monitoring well area)	Yes	Yes
7	10	Nebo	Metallic debris/sodium-filled valve burial area	Lead soil hot-spot clean-up, cap maintenance, LUCs to prevent change in land use without DON and FFA involvement.	5	5	5	Yes	Yes
7	N-2 Area 1	Nebo	Former equipment storage area/former skeet and trap range	Remove lead shot and skeet debris; excavate and properly dispose of the PCB-contaminated soil. LUCs for this site will be identified in the Base Master Plan after soil remedial actions are completed.	17	17	17	Yes	Yes
7	10.38/10.39 Units 1-6; Unit 7 soils	Nebo	Domestic (10.38) and industrial (10.39) waste water lines	LUCs only	17	17	none	Yes	Yes
7	10.27	Nebo	Building S-338 used for fire-fighting training activities	LUCs only	0.26	0.26	sign	Yes	Yes
7	10.35	Nebo	Former Domestic Wasteater Treatment Plant	LUCs only	0.78	0.78	sign	Yes	Yes
7	10.37	Nebo	Location of wastewater treatment from industrial operations	LUCs only	4.92	4.92	signs	Yes	Yes
7	10.3	Nebo	Warehouse 2, a concrete storage facility	LUCs only	5.57	5.57	signs	Yes	Yes
7	10.4	Nebo	Warehouse 3, general storage and vehicle repair	LUCs only	3.5	3.5	signs	Yes	Yes
7	10.5	Nebo	Warehouse 4, general warehouse for storage.	LUCs only	3.85	3.85	signs	Yes	Yes
7	10.12	Nebo	Former Preservation and Packaging Shop (Building 50)	LUCs only	2.12	2.12	signs	Yes	Yes
7	10.49	Nebo	Site consists of three formerly used USTs	LUCs only	0.068	0.068	none	Yes	Yes
7	10.8	Nebo	Site consists of a former 450-gallon UST	LUCs only	0.0045	0.0045	none	Yes	Yes

NOTES:

[illegible] amendments.

Engineering controls consist of fencing, signage, caps, or other controls to restrict access.

TABLE 2-1
Summary of OUs and CAOCs
Fourth Five-Year Review Report OUs 1 - 7
MCLB Barstow, California

OU	CAOC	Base	Description	Selected Remedy	Total Area (acres)	Areas Requiring LUCs (acres)	Area of Engineering Controls (acres)	5-Yr Review Required?	Inspection Required?

ACRONYMS:
AS/SVE – air sparging/soil vapor extraction
BMP – Base Master Plan
CAOC – CERCLA Area of Concern
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
FFA – Federal Facility Agreement
FS – Feasibility Study
LUC – land use control
MNA - monitored natural attenuation
N/A – not applicable (site not under a ROD, but listed for completeness)
NFA – no further action
OU – Operable Unit
RI – Remedial Investigation
UST – underground storage tank

TABLE 2-2
Chronology of Significant Events – MCLB Barstow Installation Restoration Program
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

DATE	SIGNIFICANT EVENT
1942	Marine Corps Logistics Base (MCLB) Barstow established at Nebo Main Base.
1946	Yermo Annex acquired.
1980	Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) enacted, Department of the Navy (DON) implements the Installation Restoration Program
Sept. 1983	Initial Assessment Study conducted.
1983	Trichloroethene (TCE) detected in groundwater production wells at the Yermo Annex.
1984 – 1986	Confirmation studies conducted.
1989	Groundwater production wells at Yermo Annex were connected to a granular activated carbon (GAC) system.
Nov. 1989	MCLB Barstow is placed on the CERCLA National Priorities List.
Oct. 1990	MCLB Barstow enters into a Federal Facility Agreement (FFA) with the United States Environmental Protection Agency, California Department of Toxic Substances Control, and the California Regional Water Quality Control Board. The FFA identified 7 Operable Unit (OU) throughout the Base.
Aug. 1991	Preliminary Review/Visual Site Inspection Report completed.
Feb. – Dec. 1992	Phase I Remedial Investigation (RI) conducted for OU 1 and OU 2.
Mar. – Oct. 1992	Phase I RI conducted for OU 3 and OU 4.
1992	TCE detected above the maximum contaminant level (MCL) in a private residence's drinking water well adjacent to Nebo Main Base. A time-critical removal action (TCRA) was conducted to remove the TCE impacted well from service and connect the residence to the Base water supply system.
1993	TCRA was conducted to remove residual sludge at CERCLA Area of Concern (CAOC) 15/17.
June – Sept. 1994	Phase II RI conducted for OU 1 and OU 2.
Aug. – Sept. 1994	TCRA to remove 318 tons of impacted soil from CAOC 2 completed.
1995	TCE detected above MCL downgradient of Yermo Annex eastern boundary. A TCRA was conducted to provide residences with carbon treatment systems.
Oct. 1995	OU 1 and OU 2 RI Report completed.
1996	OU 1 and OU 2 Feasibility Study (FS) Report completed.
1996	OU 1 and OU 2 Proposed Plan (PP) completed.
1996	OU 5 and OU 6 FS Report completed.
Feb. 1996	Phase I Ecological Risk Assessment conducted.
Aug. 1996	RI/ FS for OU 3 and OU 4 completed.

TABLE 2-2
Chronology of Significant Events – MCLB Barstow Installation Restoration Program
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

DATE	SIGNIFICANT EVENT
Aug. 1996	PP for OUs 3 and 4 completed.
1996 - 1998	A non-time-critical removal action for groundwater containment and cleanup was conducted at the Yermo Annex to prevent further migration of contaminants beyond the Base boundary and accelerate groundwater cleanup.
Jun. 1997	OU 3 and OU 4 ROD signed.
Jul. – Aug. 1997	TCRA to remove polychlorinated biphenyl (PCB)-impacted soils at CAOC 21.
1997	OU 5 and OU 6 Proposed Plan completed.
Jan. 1998	OU 5 and OU 6 ROD signed.
Apr. 1998	OU 1 and OU 2 ROD signed for Nebo North and Nebo South groundwater plumes.
1998 - 2000	Remedial actions at OUs 3 and 4 (CAOCs 20, 23, 7)
2001	Final CAOC 26 Technical and Economic Feasibility Report, OU 1. Yermo Annex,
2002	First Five-Year Review conducted for OUs 1 through 6.
2005	OU 7 RI Report finalized
Dec. 2005	Draft Explanation of Significant Differences for Yermo Annex Off-Base Groundwater Extraction Wells (OU 1) submitted, but was not approved by FFA regulators.
Aug. 2006	Nebo South OU 2 PP completed.
Sept.2006	Nebo South OU 2 Final ROD signed.
2007	Second Five-Year Review conducted for OUs 1 through 6.
2010	Base Master Plan amendment for OUs 1 – 6 (CAOCs with land use controls)
2007 - 2011	Nebo North source area Air Sparge /Soil Vapor Extraction (SVE) and treatment system operated until remedial action objectives (RAOs) are met
March 2011	FFA Stakeholders approve Nebo North AS/SVE system TEF and the system is put on maintenance only operations.
Sept. 2009	OU 2 Nebo South Land Use Control (LUC) Remedial Design (RD) plan finalized.
Mar – June 2010	Extraction well (GEW-16) installed to improve hydraulic control of Yermo North plume
Sept. 2010	OU 7 Supplemental RI Report finalized
July 2011	Memorandum post-ROD update describing the change in location of the Nebo North source area and RA treatment system.
June 2012	Final Report: Additional Sampling at CAOC 10.38/10.39 Unit 7 and CAOC N-2 Area 1 in Support of RI at OU 7
Feb – Apr. 2012	Extraction well GEW-17 installed to improve capture of Yermo North plume
2012	Third Five-Year Review conducted for OUs 1 through 6

TABLE 2-2
Chronology of Significant Events – MCLB Barstow Installation Restoration Program
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

DATE	SIGNIFICANT EVENT
Feb. 2013	Technical Memorandum for Additional groundwater monitoring well installation and sampling at NPZ-14 Area, OU 7, Nebo Main Base.
May 2013	OU 7 FS finalized
June – Sept. 2014	Additional groundwater monitoring wells installed at CAOC 10.38/10.39 Unit 7, NPZ-14, and CAOC 7 Stratum 1 (OU 7, Nebo Main Base)
Dec. 2014	OU 7 ROD signed
2015	OU 7 plans completed: Monitored Natural Attenuation (MNA) RD/RA Work Plan; LUC RA Work Plan; LUC signage installed; updated Long Term Management and sampling and analysis plan for MNA monitoring
Mar. 2015	Nebo North groundwater extraction and treatment system (GETS) and CAOC 26 above-ground AS/SVE systems decommissioned
2016	CAOC 7 Stratum 1, pre-design SVE pilot study conducted
2017	Fourth Five-Year Review conducted for OUs 1 through 7

ACRONYMS:

CAOC – CERCLA Area of Concern
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
FFA – Federal Facility Agreement
FS – Feasibility Study
GEW – groundwater extraction well
LUC – land use control
MCL – maximum contaminant level
MCLB – Marine Corps Logistics Base
MNA - Monitored Natural Attenuation
mg/kg – milligrams per kilogram
OU – Operable Unit
PCB – polychlorinated biphenyl
PP - Proposed Plan
RA – Remedial Action
RD - Remedial Design
RI – Remedial Investigation
ROD – Record of Decision
SVE – soil vapor extraction
TCE – trichloroethene
TCRA – time-critical removal action

TABLE 4-1

Site Inspections Findings - Summary For CAOCs with Activities
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

OU	CAOC	Base	Description of Structure/Activity	Activity Period (Start – Completion Dates)	Were activities coordinated with MCLB Barstow Environmental Department?
6	3	Nebo	Golf course clubhouse trailer was constructed on top of soil surface (no subsurface penetrations)	September 2014	yes
5	16	Yermo	Open trench through the hardstand at the northeast corner of CAOC 16 hardstand to repair water line rupture[1]	Excavated April-May 2017; repaired June 2017	yes
5	16	Yermo	2 new slab on-grade buildings (640, 641) were constructed on CAOC 16 hardstand during this Five-year review period	Building 640 (2013-2014) Building 641 (2016-2017)	yes
5	16	Yermo	Inside Building 573, the concrete floor under the former dip tanks was completely removed and replaced. This area is in the far northwest area of Building 573.	March – May 2016	yes
5	16	Yermo	Demolished former cooling towers for engine test stand on CAOC 16 hardstand	2013-2014	yes

See Appendix B for interviews and site inspections documentation

ACRONYMS:

CAOC – Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Area of Concern
LUC - land use control
MCLB – Marine Corps Logistics Base
MDMC – Marine Depot Maintenance Command
Nebo – Nebo Main Base
OU – Operable Unit
Yermo –Yermo Annex

TABLE 4-2

Operation and Maintenance Costs for OUs 1, 3, and 5 – Yermo Annex
Fourth Five-Year Review Reports OUs 1 – 7
MCLB Barstow, California

OU	CAOC	O&M Item	Projected & Prior Costs	Actual Costs (2012 – 2017)[1]	Comments
3	20	Cap maintenance and monitoring	**Original estimate in ROD:** $20,200 per year (for four years) **Last Five-Year Review Actual:** Average $5,000 per year	**Average per year:** $5,000	Monitoring costs funded under OU 1 groundwater monitoring.
3	23	Cap maintenance and monitoring	Original, Not estimated **Last Five - Year Review Actual:** Average $15,400 per year	**Average per year:** $15,400	Monitoring costs funded under OU 1 groundwater monitoring.
5	35	Landfill Cap maintenance and monitoring	**Original estimate in ROD:** Not available for this OU (Assumed portion of total cost estimate of $1,432,215 for capital and O&M) **Last Five-Year Review Actual**: Average $24,500 per year	**Average per year:** $24,500	Monitoring costs funded under OU 1 groundwater monitoring.
1	37	Operation of two AS/SVE systems and one GETS, groundwater monitoring	**Original estimate in ROD:** $1.2 Million per year **Last Five-Year Review Actual**: $696,000 per year	Average per year: $875,000 (O&M, monitoring, and electrical) **Approximate Repair Cost:** $537,000 (total 2012 - 2017) OU 1 CAOC 26 AS/SVE equipment decommissioning: $87,000	

NOTES:

[1]Costs provided by NAVFAC SW or estimated by O&M contractor

ACRONYMS:

AS/SVE – air sparging/soil vapor extraction
CAOC – CERCLA Area of Concern
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
GETS – groundwater extraction and treatment system
MCLB- Marine Corps Logistics Base
NAVFAC SW – Naval Facilities Engineering Command - Southwest
O&M – Operations and Maintenance
OU – Operable Unit
ROD – Record of Decisions

TABLE 4-3

Operation and Maintenance Costs for OUs 2, 6, and 7 - Nebo Main Base
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

OU	CAOC	O&M Item	Projected & Prior Costs	Actual Costs (2012 – 2017)[1]	Comments
6	7	Cap maintenance and monitoring	**Original estimate in ROD:** Not available (were part of total cost estimate of $1,273,080 for capital and O&M) **Last Five-Year Review Actual**: Maintenance: $11,000 per year	**Average per year cost:** $11,000	Monitoring costs covered under OU 2 groundwater monitoring.
2	38	O&M of two AS/SVE systems (Nebo North & Nebo South)	**Original estimate in ROD:** $1.2 million per year **Last Five-Year Review Actual**: $361,000 (O&M, monitoring, and electrical) per year	Average per year cost: $268,000 (O&M, monitoring, and electrical) **Approximate Repair costs :** $115,000 (total 2012 – 2017) Former Nebo North GETS decommissioning: $87,000	The Nebo North AS/SVE system operated for approximately 2 weeks per year twice per year; otherwise only monthly standby O&M was performed. During most of this review period, the Nebo South AS/SVE was operated on a two weeks on and two weeks off cylce, with operations focused on the residual plume area.
7	CAOC 7 Stratum 1	SVE Pilot Study (Pre-design for remedy)	No prior or projected costs (OU 7 ROD signed December 2014)	Approximate total cost: $230,000	90-day pilot study plus 30 additional days

NOTES:

[1] Costs provided by NAVFAC SW or estimated by O&M contractor

ACRONYMS:

AS/SVE – air sparge/soil vapor extraction

CAOC – CERCLA Area of Concern

CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act

GETS – groundwater extraction and treatment system

MCLB- Marine Corps Logistics Base

NAVFAC SW – Naval Facilities Engineering Command - Southwest

O&M – Operations and Maintenance

OU – Operable Unit

ROD – Record of Decision

TABLE 5-1

Yermo Annex – COACs Subject to Five-Year Review
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

OU	CAOC	CAOC Description	Remedy in Place	Review Table
1	37	Yermo groundwater impacted by VOC plumes sourced from CAOCs 16, 15/17, 23, 26, and 35; possible metals contamination from CAOC 16	Groundwater extraction and treatment with reinjection; AS/SVE; long-term groundwater and soil vapor monitoring; protection of drinking water wells with GAC treatment. ICs/LUCs to prevent exposure to contaminated groundwater	Table 5-2
5	16	Building 573 and Underground Wastewater Piping System, surrounding hardstand	ICs/LUCs to preserve hardstand (concrete cover); groundwater and vadose zone contamination addressed under OU 1	Table 5-3
3	20	Second Hazardous and Low Level Radiological Area	Concrete Cap & ICs/LUCs groundwater monitoring	Table 5-4
3	23	Capped Waste Disposal Area (Stratum 2)	Concrete Cap & ICs/LUCs groundwater monitoring under OU 1	Table 5-5
5	35	Stratum 1 Zone 1 – Class III Landfill with cap	Landfill Cap & ICs/LUCs groundwater monitoring under OU 1	Table 5-6
3	18	Sludge Waste Disposal Area	LUCs only	Table 5-7
3	23	Landfill Area (Strata 5, 5a) Waste disposal area, PCB in soils area	LUCs only	Table 5-7
5	15/17	Oil Storage Spillage & Industrial Wastewater Treatment Plant Area	LUCs only	Table 5-7
5	21	Industrial Waste Disposal Area	LUCs only	Table 5-7
5	26	Building 533 Waste Disposal Area	LUCs only	Table 5-7
3	34	PCB Storage Area	LUCs only	Table 5-7
5	32 Stratum 2	Building 203 (Preservation Shop) and perimeter (PCBs in soils area)	LUCs only	Table 5-7
7	9.60	Former USTs T-530A and T-530B	LUCs only	Table 5-7
7	9.68	Former oil/water separator T-588A and French drain T-588B	LUCs only	Table 5-7

ACRONYMS:

AS/SVE – Air Sparging and Soil Vapor Extraction System

CAOC – CERCLA Area of Concern

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act

GETS – Groundwater Extraction and Treatment System

ICs/LUCs – Institutional Controls/Land Use Controls

OU – Operable Unit

PCB – polychlorinated biphenyls

USTs – underground storage tanks

TABLE 5-2
CAOC 37 (OU 1) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 37 (OU 1) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, and Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Change in CAOC conditions since signed Record Of Decision (ROD) and Third Five-Year Review**
Applicable ROD	OUs 1 and 2 ROD (DON 1998a)	None
Site Description (see Figure 5-1)	OU 1 comprises the groundwater and vadose zone contamination at the Yermo Annex; the DON lists CAOC 37 as the sole groundwater CAOC in OU 1. During initial environmental investigations at the Yermo Annex, three commingled dissolved-phase volatile organic compound (VOC) plumes were identified including the CAOC 26 plume, Yermo North plume, and Yermo South plume. The sources for groundwater contamination were identified as: • CAOC 26 - a former chemical packaging area, which was closed with land-use controls under the OUs 5 and 6 ROD (DON 1998b); • CAOCs 16, 15/17, and 35 for the Yermo North plume; these CAOCs have soil remedies under the OUs 5 and 6 ROD (DON 1998b); and • CAOC 23 (capped landfill area) for the Yermo South plume; this CAOC has a remedy under the OUs 3 and 4 ROD (DON 1997). The OU1 contaminants of concern (COCs) included VOCs, primarily trichloroethene (TCE) and tetrachloroethene (PCE), and 1,1-dichloroethene (1,1-DCE). Since VOCs had impacted the drinking water aquifer beneath Yermo Annex and one of two off-Base residential wells, the Department of the Navy (DON) implemented an interim response action including: 1. Installation of groundwater extraction and treatment system (GETS) to capture and treat the identified on-Base VOC plume. Treatment was through granular activated carbon (GAC); 2. Installation of GAC treatment systems connected to two off-Base private residential drinking water wells (Yount and Hodges) in 1995; and 3. Monitoring of the existing GAC treatment on the Base water supply production wells.	The VOC plumes associated with CAOCs 26 and 23 have diminished to below the respective cleanup levels; the Yermo North plume is the remaining plume with concentrations above the groundwater cleanup levels (see Figure 2-2).
Basis of Response Action	**Groundwater Cleanup**: The Regional Water Quality Control Board - Lahontan Region (1995) classified the aquifer underlying the Yermo Annex as a potential drinking water source. The ROD considered both background levels and maximum contaminant levels (MCLs) as cleanup goals to protect human health and the environment. Remediating to background levels versus MCLs would result in only a minimal incremental difference in risk reduction and mass removal while doubling the cleanup costs and duration. Therefore, it was concluded that cleanup to background levels was technically and economically infeasible. Therefore, the DON selected the MCLs as the cleanup goals for the Yermo Annex VOC plume. **Vadose Zone Cleanup**: Vadose zone contamination was determined to exist at five major CAOCs underlying the Yermo Annex: 16, 15/17, 23, 26, and35. Continued releases to groundwater from these CAOCs could reduce the effectiveness of remediation efforts and extend the duration of cleanup;	The Water Quality Control Plan for the Lahontan Region (updated September 2015) classifies the regional aquifer (Lower Mojave River Valley) underlying the Yermo Annex as having the following present and potential beneficial uses: municipal water supply, agriculture supply, industrial service supply, and fresh water replenishment.

TABLE 5-2
CAOC 37 (OU 1) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 37 (OU 1) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, and Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Change in CAOC conditions since signed Record Of Decision (ROD) and Third Five-Year Review**
	therefore the ROD included response actions to reduce subsurface contamination at CAOCs 16, 15/17, and 26. Landfills: Installation of caps (under separate RODs) was considered sufficiently protective of groundwater for CAOCs 23 and 35 (landfill areas), however long-term monitoring is required.	
Remedial Action Objectives (RAOs)	Groundwater cleanup levels for VOCs were established to prevent human exposure to unsafe levels of COCs and are based on secondary and primary MCLs as measured by groundwater monitoring wells. Vadose zone cleanup standards are based on removal of VOCs from soils to levels that will not cause groundwater to exceed the groundwater cleanup standards. The RAOs are defined by CAOCs, as summarized below: • CAOCs 16 and 26 groundwater contamination - the RAO is to achieve and maintain compliance with groundwater cleanup standards throughout the contaminant plumes at these CAOCs; • CAOCs 16 and 26 vadose zone contamination - the RAO for vadose zone cleanup at these CAOCs is to remove contaminant mass in the subsurface soils to the degree necessary to 1) prevent further degradation of the groundwater above groundwater cleanup standards and 2) minimize the aquifer clean up time; and • CAOCs 15/17, 23 and 35 groundwater contamination - the RAO is to attain groundwater cleanup levels at a "point of compliance" at the downgradient edges of these units (the selected remedy does not include vadose zone cleanup at these CAOCs).	Selected RAOs remain the same as specified in the OUs 1 and 2 ROD (Don, 1988a). *See* Appendix C for the technical review of toxicity data, cleanup levels, and RAOS.
Selected Remedy (OUs 1 and 2 ROD, Section 1.4.1)	The selected remedy for OU 1 consists of: • Remedy all the contaminant plume that exceeds the MCL, except directly beneath waste management areas/waste management units (CAOCs 16, 15/17, 23, and 35), by extracting groundwater at three locations: 1) four on-Base wells at the CERCLA area of concern (CAOC) 26 plume downgradient boundary; 2) eight wells at the Base eastern boundary; and 3) four off-Base wells at the MCL boundary; • Treat extracted groundwater aboveground by activated carbon units; • Operate existing AS/SVE systems for groundwater/vadose zone source removal at CAOC 26, and for groundwater VOC mass removal downgradient of CAOCs 16, 15/17, and 35; • Recharge treated groundwater back into the aquifer via two infiltration galleries located at the upgradient edge of the plume; • Monitor the vadose zone at CAOCs 16, 15/17, and 26 for the effectiveness of the AS/SVE systems;	No changes to the selected remedy.

TABLE 5-2
CAOC 37 (OU 1) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 37 (OU 1) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, and Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Change in CAOC conditions since signed Record Of Decision (ROD) and Third Five-Year Review**
	• Monitor groundwater throughout the duration of the remedial action, which is estimated to take approximately 30 years, subject to evaluations of treatment effectiveness at 5-year intervals; • Monitor groundwater at CAOCs 23 and 35 subject to landfill closure requirements; • Sample groundwater quarterly for one year for five dissolved metals (nickel, chromium, antimony, thallium and aluminum) at selected wells in the area of CAOC 16 to ascertain if these metals are naturally occurring or the result of Base activities; and • Implement institutional controls to prevent use of groundwater contaminated by Base operations.	
Remedy Implementation	• The existing groundwater extraction and treatment system (GETS), installed in 1996 as an interim remedial system, was adopted as the final selected remedy in the OUs 1 and 2 ROD. The GETS originally operated with 13 extraction wells; however, over time due to diminishment of the Yermo plume, only three extraction wells are now in operation. Two extraction wells in the Yermo North plume were replaced in 2010 and 2012; • The treated groundwater recharged to the aquifer through an infiltration gallery located upgradient of the plume; • The CAOC 26 AS/SVE system (Figure 5-1) was operated from 1996 - 1998 and was shut-down after meeting RAOs; • The northern AS/SVE system continues to be operated to remove groundwater and vadose zone contaminants downgradient of CAOCs 16, 15/17, and 35. SVE system discharges must substantively comply with the discharge standards and requirements of the local air pollution control district. The vapor GAC treatment system was discontinued with approval of the Federal Facility Agreement (FFA) stakeholders in 2006; • ICs/LUCs were implemented to restrict access to prevent the use of untreated groundwater in the area of the plume above MCLs; • The Yermo Annex on-Base water supply wells are treated through a GAC. Raw water and treated water at two productions wells is monitored monthly for VOCs and the GAC is changed out as needed by the OU 1 remedy O&M contractor; and • Off-base residential wells at two properties have GAC treatment which is monitored and maintained by the OU 1 remedy O&M contractor. The GAC is changed out as needed or at least once every three years.	The GETS remedy has been fully implemented except for the four off-Base wells at the MCL boundary. The CAOC 26 remedial treatment system was decommissioned and all surface equipment removed in 2015. The four related extraction wells were shut down between 2003 and 2005 and are scheduled for full decommissioning during 2017.

TABLE 5-2
CAOC 37 (OU 1) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 37 (OU 1) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, and Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Change in CAOC conditions since signed Record Of Decision (ROD) and Third Five-Year Review**
System O&M	O&M of the remedial systems is the responsibility of the DON, under the Installation restoration (IR) Program. The OUs 1 and 2 ROD specified remedial monitoring to include: • Monitor the effectiveness of the AS/SVE systems treatment at CAOCs 16 and 26, as well as downgradient of CAOCs 16, 15/17, and 35; • Monitor the AS/SVE system effluent vapor concentration on a monthly basis and report quarterly total VOC emissions in comparison with the Mojave Desert Air Quality Management District (MDAQMD) maximum allowable levels (39.6 pounds/day for Total VOCs); • Monitor groundwater throughout the duration of the remedial action operations, which is estimated to take approximately 30 years and subject to evaluations of the treatment effectiveness at 5-year intervals; • Monitor groundwater at CAOCs 23 and 35 subject to landfill closure requirements; • Maintain operation of the GAC treatment systems at two Yermo Annex groundwater production wells, YDW-5 and YDW-6, including preforming monthly groundwater monitoring and spent GAC change-outs, as needed. No GAC treatment was installed at Yermo Annex production well YDW-7, which was brought on-line in May 2008, as this well is located upgradient from the Yermo plume. However, YDW-7 raw water is also sampled monthly for VOCs; and • Maintain operation of the GAC treatment systems on two off-Base private residential drinking water wells (Yount, Hodges) located east of Yermo Annex, including semiannual groundwater monitoring for VOCs and spent GAC change outs, as needed or at least one GAC change out every three years. • Sampling for antimony, thallium and aluminum was eliminated after 2012 as these metals were statistically shown to be below the lower of the respective state or federal MCLs. However, chromium and nickel sampling continued at least annually during this review period.	No changes to system O&M
Institutional Controls / Land Use Controls (ICs/LUCs)	To ensure that human health and the environment remain protected, institutional controls were implemented that include access restrictions to prevent exposure to untreated groundwater. Existing water supply wells located within the area of the plume where detected concentrations exceed the groundwater cleanup levels must have treatment to remove the contaminants. Any proposal for the use of impacted groundwater must ensure compliance with state and federal drinking water standards and be approved by the Base Environmental Division. Written concurrence with signatories of the FFA is required before the DON takes any action at a CAOC that would be inconsistent with the prohibition against use of untreated groundwater at the Yermo Annex as	No changes to the ICs/LUCs

TABLE 5-2
CAOC 37 (OU 1) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 37 (OU 1) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, and Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Change in CAOC conditions since signed Record Of Decision (ROD) and Third Five-Year Review**
	drinking water or for domestic use. An amendment to the Base Master Plan to incorporate the ROD drinking water protection requirements was also required. The Base Master Plan (BMP) was updated in February 2010 to include all ROD-specified amendments reflecting the groundwater access and water supply well design restrictions at the Yermo Annex (Sections 18.1 and 18.6 of the BMP). The DON will provide necessary information to appropriate county agencies identifying off-Base areas impacted by past base activities including groundwater contamination exceeding MCLs. The DON will support county agencies with any technical information needed for the county to implement restrictions on construction and use of wells in the affected areas.	

CAOC 37 – Part 2: Progress Since Last Five-Year Review (2007 - 2012)		
Issues Identified In Last Five Year Review	**Recommendations/Follow-up Actions**	**Action Taken and Outcome**
The primary issue identified in the prior review was the persistence of Yermo North groundwater plume, which remained relatively stable during the prior review period. The presence of VOC mass in the vadose zone at CAOCs 16, 15/17, and 35 was suspected to be a continuing source to the Yermo North plume. Additionally, the plume continued to extend off-Base, indicating lack of hydraulic containment.	Recommendations included: • Review the OU 1 remedy and consider optimization measures and discuss with the FFA stakeholders; • Evaluate the effect of the new extraction wells installed in 2010 and 2012 on plume containment; and • Evaluate the soil vapor concentrations in source areas for the Yermo north plume.	• The DON embarked on an internal review of the OU 1 remedy beginning in 2013; the findings of the internal review and proposed steps for remedy optimization was presented to the FFA stakeholders during meetings in 2014, 2015, and 2016; and • See the detailed OU 1 remedy evaluation in Appendix D – D-1, Technical Assessment Report, and summary in following sections.
Erosion was observed around OU 1 AS/SVE wells located in the area north of CAOC 16 and east of CAOC 35. No demarcation of the OU 1 GETS infiltration gallery area is in place.	Repair erosion around wells; add signage on posts to prevent people driving onto the infiltration galleries area and any other land use.	Well head repairs were completed and LUC signage was added to infiltration gallery area in 2013 (OTIE 2014).
Access to the Hodges residence was not secured during the review period.	Formalize contact with Hodges residence owner to assess current well condition and occupancy status of this property.	The DON has tried repeatedly to contact the Hodges property owner without success.

TABLE 5-2
CAOC 37 (OU 1) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 37 – Part 2: Progress Since Last Five-Year Review (2007 - 2012)		
Issues Identified In Last Five Year Review	**Recommendations/Follow-up Actions**	**Action Taken and Outcome**
The question on if the chromium (total) and/or nickel detected in Yermo Annex groundwater are site-related COCs remained unanswered during the prior review period.	Evaluate groundwater data statistically to determine if chromium and nickel are COCs and require further investigation and/or remedial action.	Three new PVC-screened wells were installed for the metals monitoring. The resulting data set is evaluated in Appendix D – D-3 Technical Assessment Report of this report.

CAOC 37 (OU 1) – Part 3: Summary of Technical Assessment (Based on 2016 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
A. Is the remedy functioning as intended by the decision documents?	
OU 1 Plume Hydraulic Containment and Cleanup	A technical assessment of the OU 1 GETS, provided in Appendix D, D-1, concluded: • The GETS was properly operated, maintained, and optimized to the extent practicable during the review period. O&M costs are reviewed in Appendix D, D-2 O&M Costs Review; • The GETS treated discharge met the substantive requirements of the current RWQCB-Lahontan Region Order No. R6T-2004-0015 (2014) throughout the current review period; • Analysis of the Yermo North VOC plume areas and concentrations found that the TCE, PCE and 1,1-DCE plumes are declining such the remedy is demonstrated to be effective. The cause of the persistent rise in COC concentrations in GEW-8 is uncertain; however the GEW-8 area is within the capture zone of GEW-16. • The continued presence of off-Base COC concentrations (TCE and PCE) in groundwater indicate that the hydraulic containment RAO is not yet being attained despite remedy optimization measures such as increased pumping rates at GEW-16 and GEW-17 implemented during this review period.
CAOC 16 Vadose Zone and Groundwater	The OU 1 remedy of AS/SVE addresses both vadose zone and groundwater contamination at CAOC 16. The following is the conclusions of the technical assessment of the OU 1 AS/SVE system provided in Appendix D, D-1 Technical Assessment Report. • The groundwater RAO for CAOC 16 is not yet attained, although declining PCE and 1,1-DCE concentrations within the on-Base portions of the plume indicate progress is being made on groundwater cleanup; • The AS/SVE system is operated, maintained, and optimized to the extent practicable. Continuous operation of the AS/SVE system beginning in 2014 increased the mass removal rate. The soil vapor sampling data at three CAOC 16 vapor monitoring locations (YCW-16-1 through -3) indicate generally declining TCE and PCE concentrations, with some variability and continued elevated concentrations notably at the southeast corner of Building 573; • The AS/SVE system is somewhat distant (800 feet or more east) from CAOC 16, but the radius of influence of the SVE wells is estimated to extend to 800 – 1000 feet, within the eastern portion of the site; • A lack of data on the residual mass existing beneath CAOC 16 hampers the DON's ability to evaluate and optimize the SVE portion of the remedy; and • The air-sparge wells are spaced 100 -300 feet apart which is many times the standard industry practice for design to effectively treat groundwater. Additionally, declining groundwater levels have further reduced the effectiveness of the AS wells.

TABLE 5-2
CAOC 37 (OU 1) - Yermo Annex – Five Year Review Summary
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CAOC 37 (OU 1) – Part 3: Summary of Technical Assessment (Based on 2016 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
CAOCS 15/17 and 35 groundwater	CAOCs 15/17 and 35 are identified as sources for the OU 1 northern plume. The selected remedy for CAOCs 15/17 and 35 does not include vadose zone cleanup. Groundwater contamination related to these two sites is addressed by the OU 1 pump and treat and the AS/SVE remedies. Groundwater cleanup levels must be met at the CAOC boundary for each site. The following is the conclusions of the technical assessment of the OU 1 GETS provided in Appendix D, D-1. • If CAOC 15/17 and 35 are contributing to OU 1 groundwater contamination, which is not certain, the plume would probably be contained by pumping at GEW-17 and GEW-16, based on groundwater flow modeling; • There are limited monitoring locations to assess the RAO compliance point for CAOC 15/17; • The monitoring locations for CAOC 35 may represent VOC contamination related to upgradient sources (CAOC 15/17 and/or CAOC 16); and • Likely the CAOC 16 SVE wells would be treating the eastern portions of CAOC 15/17 and 35; see Section 4.2 for conclusions regarding the AS portion of the remedy.
CAOC 23 groundwater	The RAO for CAOC 23 groundwater contamination is to attain groundwater cleanup levels at a "point of compliance" at the downgradient edges of this unit. The CAOC 23 concrete cap is maintained and prevents precipitation infiltration that could result in further groundwater contamination. Since the groundwater downgradient of CAOC 23 is currently below the groundwater cleanup levels, the RAO is being met (see Appendix D, D-1 for more details).
CAOC 26 Vadose Zone and Groundwater	The CAOC 26 AS/SVE system was shut-down in 1998 as the RAOs for the system were met for the vadose zone. CAOC 26 groundwater RAOS are also met across nearly all monitoring locations. The RA system was decommissioned in March 2015. See Appendix D, D-1 Technical Assessment Report for additional details.
Metals Monitoring	See **Appendix D, D-3 Technical Assessment Report** for a statistical evaluation of the chromium and nickel data collected at the Yermo Annex. The assessment conclusions are that both metals are not chemicals of concern in groundwater downgradient of CAOC 16 or CAOC 20.
Protection of On-Base Water Supply Wells and Two Off-Base Residential Wells	The RAO to prevent exposure of humans to groundwater COCs is addressed through on-going monitoring and maintenance of GAC treatment at two on-Base groundwater production wells (YDW-5 and YDW-6). O&M of the drinking water system is the responsibility of the MCLB Barstow Public Works Division under the direction of the Base Water Resources Manager. However, monthly monitoring of VOCs and GAC change-out is as part of OU 1 remedial activities. Additionally, two off-Base private residential wells have GAC treatment systems that are monitored and maintained as part of the remedy. • The RAO to prevent exposure to OU 1 contaminated groundwater was met during the five-year review period at both on-Base and off-Base locations; and • Problems with wells (dry or non-operational) and site access (Hodges property) have prevented the DON from fully implementing the remedy at the Yount and Hodges off-Base private residences. The Appendix D, D-1 Technical Assessment Report provides additional details.

TABLE 5-2
CAOC 37 (OU 1) - Yermo Annex – Five Year Review Summary
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MCLB Barstow, California

CAOC 37 (OU 1) – Part 3: Summary of Technical Assessment (Based on 2016 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
LUCs/ICs	The OUs 1 and 2 ROD requires ICs and LUCs to prevent exposure to contaminated groundwater: • Implementation of ICs to prevent on-Base use of untreated groundwater for domestic use: The 2010 Base Master Plan Amendment (Section 18) includes the provision that any activities planned which may affect groundwater within OU 1 need to be reviewed by the Base Environmental Division; and • The DON is to provide monitoring information on off-Base groundwater exceeding the MCLs: The DON provided the 2012, 2013, 2014, and *2015 Final Annual Groundwater Monitoring Reports* (AGMRs) to the San Bernardino County Public Information Officer. The AGMRs identify the off-Base areas impacted by groundwater contamination exceeding MCLs. San Bernardino County did not request information or technical support for restrictions on construction and use of wells in the affected areas during the review period. To the DON's knowledge, no off-Base production wells were installed within the off-Base plume boundaries.
B. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	
Land-use and exposure assumptions remained unchanged during the 2012 – 2017 review period. Cleanup levels for groundwater (MCLs) were unchanged since 2012. Therefore, the RAOs and selected remedies remain protective.	
C. Has new information been found that may impact the protectiveness of the remedy?	
No other information has been found that could call into question the protectiveness of the remedy.	
Summary of Technical Assessments	The RAs at OU 1 (CAOC 37) are performing or have performed as intended; the selected RAOs and remedies are still valid and are generally being met. The DON is in process with a remedy review as discussed further in Part 4.

CAOC 37 – Part 4: Current Issues (Based on 2012 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
Issues identified during the technical assessment and other five-year review activities (e.g., site inspection)	1. The OU 1 pump and treat remedy is not achieving containment of the off-Base contaminant plume. Data gaps in the off-base monitoring well network inhibit evaluation of plume dynamics, concentration distribution, and trends. 2. The long-term persistence of the Yermo North plume suggests the presence of a remaining contaminant mass at CAOCs 16, 15/17 and possibly 35. The existing soil vapor extraction (SVE) system may be located too far from the residual contaminant mass to effectively reduce vadose zone concentrations. The AS system is ineffective due to declining water levels. 3. Off-site exposure to Base groundwater plume is not suspected, however the two off-base residential wells treatment systems are not currently in operation. The Yount private well went dry in May 2016 and the Hodges well appears to be inoperable based on inspections from the public right-of-way. The DON does not have a current access agreement to the Hodges property to perform direct inspection of the well and treatment system despite repeated attempts to contact the property owner who does not live on-site. An occasional resident/trespasser has been observed at the Hodges residence. 4. The CAOC 26 groundwater and vadose zone remedies are completed; no further monitoring is required. 5. CAOC 16 groundwater chromium and nickel data indicate these metals are consistently below maximum contaminant levels and no further monitoring is required.

TABLE 5-2
CAOC 37 (OU 1) - Yermo Annex – Five Year Review Summary
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CAOC 37 – Part 4: Current Issues (Based on 2012 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
Determination of whether issues affect current or future protectiveness	Current protectiveness is not affected by the identified issues because of the operation, maintenance, and repairs of the remedial systems as well as on-going monitoring. However, future protectiveness of the remedy would be better ensured through remedy optimization and addressing the existing data gaps in vadose zone and groundwater contaminant extent.
Discussion of unresolved concerns or items raised by support agencies and the community	*Pending comments from FFA stakeholders and community* Appendix H.
Other Comments, Considerations	None

CAOC 37 – Part 5: Recommendations and Follow-up Actions (implementation by DON under oversight authority of FFA)	
Recommendations / Follow-up Actions	**Schedule for Completion**
1. Perform a data gaps investigation of the Yermo North plume to improve delineation of the northern and off-site extent. 2. Investigate the residual contaminant mass in the vadose zone at CAOCs 16, 15/17, and 35; based on the results evaluate if optimization of the SVE system is required to ensure long-term effectiveness of the remedy. Turn off the AS portion of the system. 3. Maintain contact with Yount residence on status of their private well. Continue to pursue access agreement with off-Base Hodges property owner; the situation is being elevated to the DON legal counsel who will review and pursue options to gain access to the Hodges property to ascertain status of the well and GAC system, and to make necessary repairs (if the well is operable) to meet requirements of the ROD. Additionally, upon securing access to the property, the DON will provide notification to the occupants regarding potentially contaminated groundwater. 4. Document in the Administrative Record that the response action at CAOC 26 for vadose zone and groundwater is completed and no further monitoring is required. 5. Document in the Administrative Record that detected metals in groundwater downgradient from CAOC 16 are consistently below maximum contaminant levels and no further monitoring is required.	1. A new off-base monitoring well is scheduled to be installed during June 2017. Additional potential wells locations both on-Base and off-base are under discussion with the FFA stakeholders. 2. Initial investigations are underway; the Navy will consider results of initial investigations to determine the scope and schedule for further assessments at these CAOCs. Other optimization measures can be implemented upon FFA concurrence with the recommendations. 3. Contact the Yount residence every other month to check on well status. Access the Hodges property and conduct system assessment and resident notifications as soon as legally possible. 4. Following FFA stakeholder concurrence. 5. Following FFA stakeholder concurrence.

TABLE 5-2

CAOC 37 (OU 1) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

ABBREVIATIONS:

AGMR – Annual Groundwater Monitoring Report
AS/SVE – air sparge/soil vapor extraction
bgs – below ground surface
BMP – Base Master Plan
CAOC – CERCLA Area of Concern
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COCs – contaminants of concern
DON – Department of the Navy
EPA – Environmental Protection Agency
FFA – Federal Facilities Agreement
GAC – granular activated carbon
GETS – Groundwater Extraction and Treatment System
GEW – groundwater extraction well
RA – remedial action
RAO – remedial action objectives
ROD – record of decision
ROI – radius of influence
ICs – institutional controls
IR - installation restoration
LUCs – land use controls
LTGWMP – Long Term Groundwater Monitoring Plan
MCL – maximum contaminant level
MCLB – Marine Corps Logistics Base
MDAQMD – Mojave Desert Air Quality Management District
N/A – not applicable
O&M – Operation and Maintenance
OU – Operable Unit
PCE – tetrachloroethene
SAP – Sampling and Analysis Plan
TCE – trichloroethene
VOC – volatile organic compound
YDW – Yermo Drinking Water (well)

REFERENCES:

See Section 9 of the main Report

TABLE 5-3

CAOC 16 (OU 5) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 16 (OU 5) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Change in CAOC conditions since signed ROD and Third Five-Year Review**
Applicable RODs	CAOC 16 OUs 5 () / 6 ROD (soils), OUs 1 and 2 ROD (groundwater)	None
Site Description	CAOC 16 consists of Building 573 and paved perimeter area, located in the northeast portion of Yermo Annex (Figure 5-2). Groundwater beneath the CAOC is impacted by VOCs and is being addressed under OU 1 (*see* Table 5-2 for groundwater remedy evaluation)	Land use remains the same; two additional buildings were constructed on the hardstand
Basis of Response Action	Soils at OU 5 CAOC 16 are impacted by VOCs, particularly TCE, PCE, and 1,1-Dichloroethene (1,1-DCE). A hardstand in the form of a concrete cap ranging in thickness from 10 to 14 inches covers the entire area. The concrete cap limits the potential for worker exposure to VOCs in soil gas (at shallow depths) and minimizes potential for impact to groundwater (from soil/soil gas VOCs) due to infiltration. Groundwater beneath CAOC 16 is contaminated with VOCs and potentially metals; remediation and monitoring of groundwater is addressed under CAOC 37 (OU 1) (*See* Table 5-2).	None (no changes to original identified COCs or the original basis of response).
Remedial Action Objectives	OUs 5 / 6 ROD: • The OU 5 RAOs are to limit the potential for worker exposure to VOCs in soil gas (at shallow depths) and minimize the potential for impact to groundwater (from soil/soil gas VOCs) due to infiltration.	None (no change to selected RAOs).
Remedy Implementation	The concrete hardstand was in place at the signing of OUs 5 / 6 ROD. The groundwater remedy for CAOC 16 is discussed in Table 5-2.	No change
Maintenance	Maintenance of the hardstand is the responsibility of Maintenance Depot Marine Corps (MDMC) in coordination with the MCLB Barstow Public Works Division and Resident Officer in Charge of Construction (ROICC) office.	During the review period, cracks observed during the prior Five-Year Review were repaired.
LUCs	The LUCs documented in the 2010 BMP Amendment include: • the physical and structural integrity of the existing concrete hardstand shall be maintained; • any excavation, damage, or removal of the concrete hardstand will be reported to the MCLB Barstow Environmental Department; and • If a change in land use is proposed that is inconsistent with the selected remedy for CAOC 16 or the land use recorded in the BMP for CAOC 16, the Department of Toxic Substances Control (DTSC), the Water Board, and the U.S. EPA will be notified of such a change, along with an evaluation of what measures will be necessary to protect human health and the environment. FFA concurrence will be obtained before such a change is implemented. The BMP amendment also describes the risk to human health and the environment that exists at CAOC 16; reference the MCLB Barstow OU 5 remedial investigation/feasibility study (RI/ FS), and subsequent ROD; that provide a legal description of the boundaries of CAOC 16. The language in the BMP amendment also includes the title and dates of the related documents and their storage location.	During the review period, seven buildings were constructed on the hardstand and one demolition occurred that involved repairs to the hard stand. Additionally, one 15-foot long trench was excavated to reveal a water line needing repairs.

TABLE 5-3

CAOC 16 (OU 5) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 16 (OU 5) – Part 2: Progress Since Last Five-Year Review (2012)	
Protectiveness statements from last Five-Year Review	The selected remedy for CAOC 16 is protective of human health and the environment; however, to maintain long-term protectiveness of the remedy, promptly repair observed cracks in the concrete hardstand.
Status of recommendations and follow-up actions from last review	The cracked portions of the hardstand observed during the prior five-year review were repaired and the repairs were confirmed during a site walk conducted on March 14-15, 2017.
Results of implemented actions, including whether they achieved intended purpose	Maintenance of the hardstand and LUCs is an on-going requirement.
Status of any other prior issues	No other prior issues were identified.

CAOC 16 (OU 5) – Part 3: Technical Assessment (Based on 2012 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
A. Is the remedy functioning as intended by the decision documents?	
LUC for preservation of the existing hardstand	An initial site inspection on 14 March 2017 identified some areas of the hardstand that required repair to address cracking. Additionally, an approximately 15-foot long trench through the hardstand was observed at the northeast corner of the site; according to MDMC personnel the trench was required to find and repair a ruptured waterline. Based on a follow-up site inspection conducted on 13 June 2017, the trench was in process of being backfilled and repaired along with eroded/cracked areas of the hardstand. Two buildings were constructed in the northeast portion of the hardstand during this review period. The building construction was coordinated with the FEAD and Environmental Division; the hard stand was restored where penetrated. See Table 4-1 for a summary of the site inspection findings, and Appendix B for inspection records and interviews. Based on the available information, the LUC for preservation of the hardstand are functioning as intended by the ROD.
The existing hardstand prevents exposure of workers to shallow depth VOC soil vapors and prevents VOC migration to groundwater by infiltration.	The hardstand and buildings will generally reduce infiltration to the subsurface, and thus reduce the potential for dissolved phase VOC transport. However, the continued presence of vapor phase VOCs at depth within the vadose zone, as measured during the annual monitoring events (2012 through 2016 AGMRs), indicates the potential for exposure of workers to shallow soil vapors and/or VOC transport to the water table. Potential exposure of workers to shallow soil vapors was assessed during the Third Five-Year Review (2012); the assessment indicated vapor exposure risks were within the EPA acceptable risk range of 10^{-4} to 10^{-6} excess lifetime cancer risk. Based on modeling results, the hardstand was determined to be protective for the vapor migration pathway. The FFA stakeholders concurred with the assessment and conclusions (EPA 2013, DTSC 2013). No additional evaluation of the vapor migration pathway was performed during this Fourth Five-Year Review (see Table 5-2 for soil vapor extraction portion of the OU 1 remedy).

TABLE 5-3

CAOC 16 (OU 5) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 16 (OU 5) – Part 3: Technical Assessment (Based on 2012 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
B. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	
There have been no changes that impact the validity of technical assumptions, toxicity data, cleanup levels, and RAOs at CAOC 16, with the exception of a lower toxicity level for TCE due to the risk of fetal abnormalities (EPA, 2012). The primary exposure pathway would be soil vapor intrusion (SVI); prior modeling showed there was a minimal risk of SVI due to the hardstand and the building configuration in conjunction with continued operation of the SVE system (*see* Third Five-Year Review, 2012). Soils at this CAOC were impacted by VOCs with predicted impacts to groundwater. Adequate soil characterization (analytical) data is not available due to the nature of the site (ongoing operations). Groundwater impacts are being addressed under OU 1 (CAOC 37). The RAOs remain unchanged. Appendix C provides additional details on the review of changes in ARARs, toxicity data, and ARARs for CAOC 16.	
C. Has new information been found that may impact the protectiveness of the remedy?	
No other information has been found that would call into question the protectiveness of the remedy.	
Summary of Technical Assessment	The LUCs to preserve the CAOC 16 hardstand concrete cap are functioning as intended by the OUs 5 and 6 ROD. See Table 5-2 for five-year review of CAOC 16 vadose zone and groundwater remedy.

CAOC 16 (OU 5) – Part 4: Issues (Based on 2012 - 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
Issues identified during the technical assessment and other five-year review activities (e.g., site inspection)	None.
Determination of whether issues affect current or future protectiveness	N/A.
Discussion of unresolved concerns or items raised by support agencies and the community	*(pending FFA Stakeholder and community review)*
Other comments, considerations	Related groundwater issues are discussed in Section 7.2 of this document.
CAOC 16 (OU 5) – Part 5: Recommendations and Follow-up Actions (implementation under oversight authority of FFA): None	

TABLE 5-3

CAOC 16 (OU 5) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

ACRONYMNS AND ABBREVIATIONS

1,1-DCE -- 1,1-Dichloroethene

AGMR – Annual Groundwater Monitoring Report

ARAR – Applicable Relevant and Appropriate Requirements

BMP – Base Master Plan

CAOC – CERCLA Area of Concern

CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act

COCs – contaminants of concern

DTSC – Department of Toxic Substances Control

EPA – Environmental Protection Agency

FEAD - Facilities Engineering and Acquisition Division

FFA – Federal Facilities Agreement

LUCs – land use controls

MCLB – Marine Corps Logistics Base

MDMC – Marine Depot Maintenance Command

OU – Operable Unit

PCE – tetrachloroethene

ROD – record of decision

TCE – trichloroethene

VOC – volatile organic compound

REFERENCES:

See Section 9 of the main Report

TABLE 5-4

CAOC 20 (OU 3) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1-7
MCLB Barstow, California

CAOC 20 (OU 3) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Status, and Current Site Conditions		
	Original Site Conditions, Response, Implementation	**Change in COAC conditions since signed ROD and Third Five-Year Review**
Applicable RODs	OUs 3 and 4 ROD (DON 1997)	None
Site Description	CAOC 20, the Second Hazardous and Low-Level Radiological Area, is located on the eastern side of the Yermo Annex (Figures 1-2 and 5-3). Soil contaminants included VOCs, SVOCs, metals, and pesticides. Mathematical modeling (DON 1995) indicated that soil contamination would have limited potential impacts to groundwater. CAOC 20 consists of three strata (Figure 5-3): • Stratum 1 in the northwest corner of CAOC 20 consists of a low-level radiological waste disposal well capped by a concrete pad and surrounded by a chain-link fence. The radiological waste consisted of scrap luminescent dials. The selected remedy for this stratum is a concrete cap with engineering controls and LUCs. • Stratum 2 in the central portion of CAOC 20 consists of 31 uncapped non-radioactive waste disposal wells with a soil cover. These wells are approximately 30 feet deep and 4 feet in diameter. The non-radiological wastes consisted mainly of highly oxidizing bleaching powder. Base records document that cans, drums, pails, and barrels of chlorinated lime, calcium hypochlorite, sodium carbonate, sodium sulfate, potassium hydroxide, waste electrolytic acid, sodium-filled valves, and cans of unknown content were disposed of in these wells (JEG, 1998). The selected remedy for this area was a soil cover and LUCs. • Stratum 3 is located in the northeastern portion of the CAOC between the convergence of the railroad tracks. This stratum included areas of surface discoloration observed in aerial photographs. Determined as NFA by the OU 3 and 4 ROD. Groundwater monitoring to assess upgradient and down-gradient groundwater quality for potential contaminants related to CAOC 20 was also required. The monitoring has been conducted as part of OU 1 long-term monitoring (LTM) program at Yermo Annex.	None (land use remains same; concrete cap and LUC maintained).
Basis of Response	Soils are impacted by VOCs, SVOCs, metals, and pesticides; buried wastes have no direct analyses. The basis of the response was prevention of contaminant migration to groundwater and exposure to contaminants in excess of an ILCR of 1 x 10-6 and a Hazard Index of 1.0. While the calculated human health risk results for the soils in the area to be capped were below the acceptable risk range of 10^{-4} to 10^{-6}, uncertainties existed because of the lack of analysis of the buried waste itself.	No changes to basis of response
Remedial Action Objectives	The RAOs for Strata 1 and 2 of CAOC 20 are to limit the potential for exposure to impacted soil, and disturbance of buried wastes, and to minimize the potential for future releases to groundwater.	No change to RAOs

TABLE 5-4

CAOC 20 (OU 3) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1-7
MCLB Barstow, California

CAOC 20 (OU 3) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Status, and Current Site Conditions		
	Original Site Conditions, Response, Implementation	**Change in COAC conditions since signed ROD and Third Five-Year Review**
Selected Remedy	The following are the relevant portions of the statutory determinations of the selected remedies at CAOC 20: • Modification of the BMP (DON 2010) to add LUCs that limit site activities and maintaining the existing concrete cap. • Replace the existing concrete cap at Stratum 1 to minimize rainwater infiltration. • Install drainage controls that include grading and berms to reduce rainwater infiltration and infiltration monitoring equipment at the Strata 2 soil cover, • Groundwater monitoring for four events and then assess if CAOC 20 is a source of groundwater contamination.	Selected remedy unchanged.
Remedy Implementation	The concrete cap was replaced at Stratum 1 in 2000 as documented in the OUs 3 and 4 Remedial Action Report (RAR) (DON 2000). The neutron access probe for vadose zone precipitation infiltration monitoring at CAOC 20 Stratum 2 was installed later and is documented in the OUs 5 and 6 RAR (DON 2002). Groundwater monitoring is conducted annually under the OU 1 LTM program. The initial groundwater analyte list per the OUs 3 and 4 ROD included the OU 1 COCs including VOCs, metals, geochemical parameters, and radioactive parameters that may indicate a release from Stratum 1 low-level radiological waste disposal (gross alpha, gross beta, Radium 226, and Radium 228). Based on LTM results the analyte list has been reduced over time, with FFA Stakeholder concurrence, to include only the following (radioactive) analytes: gross beta, Radium 226, Radium 228, and tritium (DON 2010). • The OUs 3 and 4 ROD required that the CAOC 20 remedy be evaluated following four monitoring events to assess protectiveness and the need for additional actions. The first such analysis was performed as part of the Second Five-Year Review (DON 2007). That analysis identified gross alpha exceedances in groundwater as a potential trigger to evaluate the effectiveness of the remedy; however, there were questions on the data quality due to well fouling and corrosion. Monitoring continued followed well cleaning and redevelopment; however the corrosion problems continued to affect data quality. Additionally, the existing CAOC 20 monitoring wells has insufficient water column for sampling by 2013 due to regional groundwater level declines (see Appendix F for further details).	A new monitoring well (YS20-3) was installed in April 2014 downgradient of CAOC 20 to replace the previous monitoring wells YS20-1 and YS20-2. The sample data collected during 2014 – 2016 from YS20-3 were reviewed for this five-year review. Prior groundwater sample data was potentially affected by corrosion of the stainless steel well screens at YS20-1 and YS20-2, and YS20-2 was not located in an appropriate downgradient position to evaluate the CAOC. Therefore, only data from YS20-3 along with background radiological data were evaluated for this five-year review.

TABLE 5-4

CAOC 20 (OU 3) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1-7
MCLB Barstow, California

CAOC 20 (OU 3) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Status, and Current Site Conditions		
	Original Site Conditions, Response, Implementation	**Change in COAC conditions since signed ROD and Third Five-Year Review**
O&M and Monitoring	• The concrete cap is maintained in accordance with the CAOCs 7, 20, 23 and 35 O&M Manual (MMEC 2016). Groundwater monitoring was performed annually (*see* Appendix F of this report for a detailed analysis of the groundwater monitoring program at CAOC 20).	No changes to on-going cap/soil cover inspections and maintenance. Wells YS20-1 and YS20-2 were replaced with a new downgradient well YS20-3 in 2014 (OTIE 2015).
Institutional Controls/Land Use Controls (ICs/LUCs)	LUCs in place at CAOC 20 include limiting activities to the use of the surface of the cap, such as equipment storage. Additional measures installed include: drainage control to promote surface water runoff and minimize the infiltration of standing water directly above the areas of buried wastes, and the installation of upgradient and downgradient monitoring wells, were completed in June 1999 (DON 2000). As documented in Section 2.2.8 of the final ROD (DON 1997), the following language establishes the restriction on certain types of land use at CAOC 20: "*To ensure that human health is protected in the future, no excavation of soils (e.g., in the course of construction or maintenance of building or utility facilities) within CAOC 20 Strata 1 and 2 may occur below a 5-foot depth unless prior signed approval from the FFA stakeholders is obtained. The maintenance of railroad tracks adjacent to CAOC 20 is not affected by these limitations.* *If an excavation below the 5-foot level in CAOC 20 Strata 1 and 2 is proposed, the DTSC, RWQCB, and EPA must be provided with written notification of such a proposed action.*"	The Base Master Plan was updated in 2010 to incorporate the ICs/LUCs at CAOC 20. No changes in ICs/LUCs during the review period

CAOC 20 (OU 3) – Part 2: Progress Since Last Five-Year Review (2012)	
Protectiveness statements from last review:	Remedies are currently protective of human health and the environment because of the intact and maintained caps and the LUCs in place. RAOs for CAOC 20 at the time of the remedy selection are still valid. There are no new data that could indicate ineffectiveness of the remedies at this OU.
Status of recommendations and follow-up actions from last review	Well conditions (corrosion) resulted in data quality issues in samples from the CAOC 20 monitoring wells. The two existing wells were abandoned and a replacement PVC-screened monitoring well was installed down-gradient in 2014. Monitoring data collected the new well (YS20-3) during the annual monitoring events conducted from 2014 through 2017 indicated no exceedances of groundwater cleanup levels. Background groundwater data for gross beta, radium, and tritium were also collected from other the Yermo Annex wells to provide a comparison with CAOC 20 groundwater (in place of upgradient monitoring). The new monitoring well provides the required downgradient monitoring well for CAOC 20.

TABLE 5-4

CAOC 20 (OU 3) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1-7
MCLB Barstow, California

CAOC 20 (OU 3) – Part 3: Technical Assessment (Based on 2012 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
A. Is the remedy functioning as intended by the decision documents?	
Cap Maintenance and Performance	A review of the annual operation and maintenance reports for the CAOC 20 cap (Sealaska 2012; MMEC 2015; MMEC 2016) indicated that the cap and fence are maintained. CAOC 20 maintenance activities were as follows: • As part of regular O&M, quarterly inspections of CAOC 20 Stratum 1 were conducted to check for the presence of concrete cracks in the joint sealer. No cracks or repairs were observed during the 2012-2016 inspections. • Soil moisture and rainfall at CAOC 20 Stratum 2 (soil covered area) is monitored quarterly at the installed soil moisture monitoring and rainfall gauge system. Soil moisture and rainfall gauge data are downloaded bimonthly and reported in the annual O&M report for CAOCs 20, 23, 35, and 7. Due to inconsistent data from the rain gauges, monthly precipitation at the base is determined using the total monthly precipitation data recorded at nearby Barstow Dagget County Airport. A visual inspection of the Stratum 1 cap performed in March 2017 found the cap to be in good condition with no visible cracks or defects; the fence surrounding the cap was also found to be in good condition (Appendix B). O&M costs are minimal, primarily associated with removal of debris. The remedy is cost effective and utilizes a permanent solution.
Groundwater Monitoring Results	The OUs 3 and 4 ROD requires that the RA for CAOC 20 be re-evaluated following the fourth year of monitoring for decisions on the effectiveness of the RAO and the potential need for additional actions. If the monitoring indicated a statistically significant release at CAOC 20, an appropriate action is to be proposed after consultation with the FFA regulators. The prior groundwater monitoring data collected from stainless-steel screened wells was compromised by corrosion in the wells and the data have been set aside. Only data from new down-gradient monitoring well YS20-3 (installed 2014) were evaluated for this Review. • Based on the six semiannual monitoring events for VOCs since well installation in 2014, CAOC 20 was not a source of VOCS in groundwater during this review period. However, the nature of the waste disposal into unlined dry wells and the finding of VOC soil contamination at 120 – 124 ft bgs during well installation, indicate there is a potential for groundwater contamination from CAOC 20. • The radiological monitoring data collected from three annual sampling events (2014 – 2016) at the new downgradient well YS20-3 indicate gross beta, total radium, and tritium were below the maximum contaminant levels (MCLs) (Appendix F, Table F-1.2). One additional round of radiological data are needed to complete the evaluation required in the ROD.
ICs/LUCs	The LUC that are in place at CAOC 20 restrict the use of the site. No activities were observed that would have violated the ICs/LUCs.
B. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	
Because the site conditions, surrounding land use, and potential receptors have not changed since the time of the remedy, the exposure assumptions are still valid. Appendix C provides additional details on the review of changes in screening criteria and MCLs for this CAOC.	
C. Has new information been found that may impact the protectiveness of the remedy?	
No other information was identified that would impact the protectiveness of the remedy.	
Summary of Technical Assessments	Based on the technical evaluation and the available groundwater data, the remedy at CAOC 20 appears to be performing effectively to meet the RAOs for this area and to be protective of human health and the environment.

TABLE 5-4

CAOC 20 (OU 3) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1-7
MCLB Barstow, California

CAOC 20 (OU 3) – Part 4: Issues (Based on 2012 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
Issues identified during the technical assessment and other five-year review activities (e.g., site inspection)	Sample quality issues related to stainless steel well corrosion and fouling have prevented timely completion of the four rounds of radiological monitoring since signing of the OUs 3 and 4 ROD. Additionally, the original well intended for downgradient monitoring was actually side gradient to the CAOC. The DON replaced both CAOC 20 monitoring wells with a single down-gradient monitoring well that now provides the necessary representative groundwater data to address the ROD requirements. Since installation of the new monitoring well in 2014, three annual radiological monitoring events have been completed. One additional groundwater sample (scheduled for next Annual Monitoring event in November 2017) is needed to complete radiological monitoring and assessment per the ROD. Based on data evaluations in this five-year review, CAOC 20 is contributing neither metals nor VOCs contamination to groundwater at the site.
Determination of whether issues affect current or future protectiveness	Neither short-term nor long-term protectiveness are affected.
Discussion of unresolved concerns or items raised by support agencies and the community	(*pending comments by FFA stakeholders and community)* (Appendix H).
Other Comments	None

CAOC 20 (OU 3) – Part 5: Recommendations and Follow-up Actions (implementation by DON and the oversight authority of FFA)	
Recommendations / Follow-up Actions	**Schedule for Completion, Comments**
Collect one additional round of radiological data and evaluate per the ROD; cease further monitoring for metals and VOCs.	Publish results of four rounds of radiological parameter sampling, data evaluations, conclusions and recommendations in the next Annual Groundwater Monitoring Report after sampling is completed.

TABLE 5-4

CAOC 20 (OU 3) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1-7
MCLB Barstow, California

ACRONYMS

AGMR – Annual Groundwater Monitoring Report
bgs – below ground surface
BMP – Base Master Plan
CAOC – CERCLA Area of Concern
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COCs – contaminants of concern
DON – Department of the Navy
DTSC – Department of Toxic Substances Control
EPA – Environmental Protection Agency
FFA – Federal Facilities Agreement
ICs – institutional controls
LTM – Long Term Monitoring
LUCs – land use controls
MCLB – Marine Corps Logistics Base
O&M – Operation and Maintenance
OU – Operable Unit
RAO – remedial action objectives
ROD – Record of Decision
SAP – Sampling and Analysis Plan
SVOCs – semi-volatile organic compounds
VOC – volatile organic compound

REFERENCES: *See* Section 9 of the main Report

TABLE 5-5

CAOC 23 (OU 3) - Yermo Annex Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 23 (OU 3) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Status, and Current Site Conditions		
	Original Site Conditions, Response, Implementation	**Change in CAOC conditions since signed ROD and Third Five-Year Review**
Applicable RODs	OUs 3 and 4 ROD (DON 1997) for caps and ICs/LUCs; OUs 1 and 2 ROD (DON, 1998a) for groundwater monitoring.	None
Site Description	OU 3 (CAOC 23), the Landfill Area, is an irregular L-shaped area located in the south/southeast corner of the Yermo Annex between the railroad tracks and the industrial operations' perimeter fence (Figures 1-2 and 5-3). CAOC 23 consists of six strata: • Strata 1: General storage area located in the northeastern portion of CAOC 23; • Stratum 2: Trenches around the southwestern perimeter of CAOC 23; • Stratum 3: A second general storage area in the north-central portion of CAOC 23; • Stratum 4: Waste management area located in the south-central portion of CAOC 23; • Stratum 5: A potential waste burial area; and • Stratum 5a: PCB-hit area in the western portion of CAOC 23. The southern portion of Stratum 1 and all of Stratum 2 (are the only areas that debris/waste was placed in the landfill) were combined to form "CAOC 23, Zone 1" (Figure 5-3). The remaining strata, including the northern portion of Stratum 1, and Strata 3, and 4 were declared NFA, and Stratum 5 and 5a are LUCs-only (Figure 5-5).	None (land use remains the same; concrete cap is maintained).
Basis of Response	Soils in the CAOC 23 (outside the landfill Area) are impacted by low levels of VOCs. Stratum 5a soils were impacted by PCBs. The landfill soils or landfill debris were not sampled, but were considered potentially contaminated based on waste disposal records.	None (no changes to identified COCs or the original basis of response).
	RAOs per the OUs 3 and 4 ROD (Section 1.5): Relevant portions of the statutory determination for CAOC 23, Zone 1 are as follows: • Minimize the potential for disturbance of landfill debris/wastes; • Minimize potential future releases to groundwater; • Attain landfill closure ARARs; and • Provide a final remedy that minimizes impacts to existing Defense Reutilization Materials Office (DRMO) facilities (now Marine Depot Maintenance Command [MDMC]). The installation of the concrete cap at Zone 1 allows each of the CAOC RAOs to be met.	None (no change to RAOs)

TABLE 5-5

CAOC 23 (OU 3) - Yermo Annex Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 23 (OU 3) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Status, and Current Site Conditions		
	Original Site Conditions, Response, Implementation	**Change in CAOC conditions since signed ROD and Third Five-Year Review**
Selected Remedy	**OUs 3 and 4 ROD:** **For Strata 1, 2, and 4:** • In-place abandonment of a water line; • Deep dynamic compaction of soil; • Installation of a concrete cap at Zone 1, which is defined as Stratum 2 and the southern portion of Stratum 1 (see Figure 5-3); and • Groundwater monitoring (under OU 1) and vadose zone precipitation infiltration monitoring. **For Strata 3, 5, and 5a:** • LUCs only (BMP to be modified to include a brief description of the history of CAOC 23 Strata 5 and 5a, statement that low levels of PCBs and pesticides were detected in the soils, and coordination of any proposed actions or changes in site use with the MCLB Barstow Environmental Department).	None (selected remedy unchanged; on-going groundwater monitoring performed annually)
Remedy Implementation	The RA implementation was completed in 2000 and is discussed in detail in the OUs 3 and 4 RAR (DON 2000). In addition, four of the five geophysical anomalies at CAOC 23 (four at Stratum 1 and one at Stratum 4) (Figure 5-3) were excavated and consolidated at the CAOC 35 Landfill prior to installation of a cap at that CAOC. The fifth anomaly could not be found when the area was resurveyed by geophysical methods. It may have been a surface interference that was moved when the DRMO moved from the area. Groundwater monitoring is conducted annually under the OU 1 long-term monitoring (LTM) program. It should be noted that Section 2.3.8 of the OUs 3 and 4 ROD requests for vadose zone monitoring; however, precipitation infiltration monitoring is not requested in Section 2.3.6.3 of the same ROD; therefore no vadose zone precipitation infiltration monitoring is performed beneath the concrete cap nor in other locations at this CAOC.	None (no further RA undertaken)
System O&M	The concrete cap is maintained in accordance with the approved CAOC 23 O&M Manual. CAOC 23 groundwater monitoring is performed annually under the OU 1 long-term monitoring program (see Table 5-2 for OU 1 remedy evaluation).	No significant changes since last review
ICs/LUCs	The 2010 BMP Amendment (Sections 3.1 through 3.6) stated that any actions planned for this area or changes in site use are required to be coordinated and reviewed by the MCLB Barstow Environmental Department. If a change in land use is proposed that is inconsistent with the selected remedy for CAOC 23 or the land use recorded in the BMP for CAOC 23, the FFA will be notified of the proposed change, and concurrence will be obtained before such a change is made.	No changes in land use during the review period

TABLE 5-5

CAOC 23 (OU 3) - Yermo Annex Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 23 – Part 2: Progress Since Last Five –Year Review (2012)	
Protectiveness statements from last Five-Year Review	Remedial measures at CAOC 23 were considered protective of human health and the environment.
Status of recommendations and follow-up actions from last Five – Year Review	No recommendations or follow-up actions were proposed

CAOC 23 – Part 3: Technical Assessment (Based on 2012 – 2016 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
A. Is the remedy functioning as intended by the decision documents?	
Cap Maintenance and Performance	The concrete cap functions as a barrier against contact with the buried debris/waste. The cap also functions to prevent precipitation infiltrating into the buried solid debris/wastes. In addition, the concrete cap has provided a better working surface for the land use for existing equipment storage. Landfill maintenance and monitoring activities at CAOC 23 are performed quarterly and annually, in accordance with the ROD and the maintained in accordance with the CAOCs 7, 20, 23 and 35 O&M Manual (MMEC 2016). Landfill monitoring activities consist of concrete cap and joint sealer inspections, settlement survey, weed eradication, and the inspection of the perimeter fence and perimeter protective gravel cover. In addition, annual groundwater monitoring is performed under OU1 (to determine if there is any impact to groundwater from CAOC 23). The cap is surveyed annually for settling. A review of the annual operation and maintenance reports for the CAOC 23 cap (Sealaska, 2012, MMEC, 2016, MMEC, 2017) indicated that the cap and fence are in good working condition. The landfill cap maintenance activities conducted are: Minor isolated landfill cap cracks were noted in the 2015 cap inspection; however, they appear to be old and were filled in with an epoxy sealer (MMEC, 2015). The O&M costs are minimal; the remedy is cost effective and utilizes a permanent solution.
Groundwater Monitoring Results (under OU 1)	Nine groundwater monitoring wells downgradient of CAOC 23 are sampled annually for VOCs. This monitoring program is adequate for evaluation of remedy effectiveness. Groundwater concentration trends from wells in the vicinity of CAOC 23 were reviewed. TCE and PCE concentration trends for several wells in the vicinity of CAOC 23 shown in Graph D-1.13 of Appendix D, Technical Assessment D-1. Generally COC concentrations downgradient of CAOC 23 remain below the cleanup level, but occasional “spikes” in concentrations are observed after heavy precipitation events.
ICs/LUCs	The LUCs for CAOC 23 are functioning properly. The activities within the area observed during the Site Inspection on 14 March 2017 (equipment storage) do not violate the LUCs.
B. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	
Because the site conditions, surrounding land use, and potential receptors have not changed since the time of the remedy, the exposure assumptions, toxicity data, cleanup levels, and RAOs are still valid.	
C. Has any other information been found that could impact the protectiveness of the remedy?	
No other information was identified that would impact the protectiveness of the remedy.	
Summary of Technical Assessments	Based on the technical evaluation, the selected remedy at CAOC 23 (cap and LUCs) appears to be performing effectively to meet the RAOs and is protective of human health and the environment.

TABLE 5-5

CAOC 23 (OU 3) - Yermo Annex Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 23 – Part 4: Issues (Based on 2012 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
Issues identified during the technical assessment and other five-year review activities (e.g., site inspection)	None
Determination of whether issues affect current or future protectiveness	N/A
Discussion of unresolved concerns or items raised by support agencies and the community	(*pending comments from FFA Stakeholders and community*) (Appendix H).
Other Comments/Considerations	None

CAOC 23 – Part 5: Recommendations and Follow-up Actions (implementation under oversight authority of FFA)
No recommendations or follow-up actions.

ACRONYMS:

ARAR - Applicable or Relevant and Appropriate Requirements
BMP – Base Master Plan
CAOC – CERCLA Area of Concern
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COCs – contaminants of concern
DON – Department of the Navy
EPA – Environmental Protection Agency
FFA – Federal Facilities Agreement
ICs – institutional controls
LUCs – land use controls
LTGWMP – Long Term Groundwater Monitoring Plan
MMEC – Multimedia Environmental Compliance Group
OU – Operable Unit
PCE – tetrachloroethene
RA – remedial action
RAR – remedial action report
RAO – remedial action objectives
ROD – record of decision
SAP – Sampling and Analysis Plan
TCE – trichloroethene
VOC – volatile organic compound

REFERENCES:

See Section 9 of Main Report

Table 5-6

CAOC 35 (OU 5) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 35 (OU 5) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Status, and Current Site Conditions		
	Original Site Conditions, Response, Implementation	**Change in CAOC Conditions since signed ROD and the Third Five-Year Review**
Applicable RODs	OUs 5 and 6 ROD for wastes in place remedy (DON, 1998b), OUs 1 and 2 ROD for groundwater monitoring (DON, 1998a)	None.
Site Description	CAOC 35 (OU 5), the capped and inactive Class III Landfill, is located in the northeastern portion of the Yermo Annex, as shown in Figure 5-4.	None (land use remains the same; landfill cap is maintained).
Basis of Response	The detected VOCs, SVOCs, and pesticides concentrations were low in the surface soil samples collected, while the subsurface soil samples collected indicated the presence of VOCs and SVOCs, including PAHs. TPH and PCB detections were present at high levels in the subsurface soil samples. These contaminants were all believed to be site-related. All metals present were detected at or below background levels. A refined modeling evaluation indicated that groundwater would probably not be affected by the landfill (DON 1996).	None (no changes to identified COCs or the original basis of response).
Remedial Action Objectives	OUs 3 and 5 ROD: The RAO for the OU 5 CAOC 35 Stratum 1 Zone 1 (capped landfill area) remedy is to minimize water infiltration and potential future impact to groundwater, limit potential human exposure to buried waste and impacted soils, and maintain the selected landfill closure ARARs. OUs 1 and 2 ROD: Meet groundwater cleanup levels at the CAOC boundary.	None (no change to RAOs).
Selected Remedy	OUs 5 and 6 ROD: The major components of the selected remedy at CAOC 35 include: • Installation of a 3-foot native soil cover over landfill area with 6-inch rock cover over the native soil cover and a 6-foot fence • Installation of soil moisture monitors • Restriction of land use activities in the area (sign postage and institutional controls)	None (selected remedy unchanged).
Remedy Implementation	The RA construction was completed in January 2001 as documented in the OUs 5 and 6 RA Report (DON 2002). Ongoing quarterly monitoring of the cap is performed and maintenance of cap and fencing completed as necessary. Annual groundwater monitoring for VOCs is conducted under the OU 1 long-term monitoring program.	There were no changes to the RA.
O&M, Monitoring	The soil cap is maintained in accordance with the CAOCs 7, 20, 23 and 35 O&M Manual (MMEC 2016). O&M of the cap involves routine inspections of the surface; weed eradication; and monitoring of soil moisture, rainfall, and settlement. Groundwater monitoring is performed under the OU 1 long-term monitoring program.	There were no changes to O&M of the cap; groundwater monitoring frequency was increased to semi-annual during the review period.
Institutional Controls/Land Use Controls (ICs/LUCs)	If a change in land use is proposed that is inconsistent with the selected remedy for CAOC 35 or the land use recorded in the Base Master Plan (BMP), the DTSC, the Water Board, and the U.S. EPA will be notified of the proposed change, and concurrence will be obtained before such a change is made.	The BMP was amended in 2010 to incorporate the ICs/LUCs at CAOC 35

Table 5-6

CAOC 35 (OU 5) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 35 – Part 2: Progress on Issues and Recommendations in Last Five-Year Review (2012)	
Protectiveness statements from last Five-Review	The selected remedy at CAOC 35 is considered protective of human health and the environment because of the intact and maintained cap and LUCs in place. However, additional measures are required to address the observed increase in groundwater concentrations downgradient of the CAOC.
Status of recommendations and follow-up actions from last Five-Year Review	Groundwater concentrations of the primary groundwater chemicals of concern (COCs) including trichloroethene (TCE) and tetrachloroethene (PCE) remained above cleanup levels at wells YS35-3, YS35-4, and YS35-5 located downgradient of CAOC 35.
Results of implemented remedial actions, including whether the remedial action achieved the intended purpose	The CAOC 35 caps and ICs/LUCs meet the RAO to prevent direct exposure to landfilled wastes at this CAOC. However, as downgradient contamination potentially related to the landfill continues at concentrations above the OU 1 cleanup levels, the cap remedy at the CAOC 35 landfill may not assure long-term protection of groundwater.
Status of any other prior issues	No other prior issues were identified during the prior review.

CAOC 35 (OU 5) – Part 3: Technical Assessment of Remedy (Based on 2016 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
A. Is the remedy functioning as intended by the decision documents?	
Cap Maintenance and Performance (OU 5)	As documented in the "Annual Operation and Maintenance Reports for the CAOCs 7, 20, 23, and 35" (2012 through 2016) inspections of the CAOC 35 cap and surrounding fence were performed quarterly over the five year review period. Erosion impacts were noted along the north fence line (outside the cap area) during heavy rainfall events. Backfilling to the eroded areas was performed WHEN. Monthly rainfall and soil moisture data is collected and reported in the Annual Operation and Maintenance Reports. Soil moisture beneath the cap remained relatively low throughout the review period. The annual settlement monument survey data indicates minimal differential vertical movement has occurred. The observed settlements seem to be associated with long-term settlement of the landfill cover. During this period, yearly settlement rates have ranged from 0.01 to 0.06 foot per year from April 2002 to January 2017 (MMEC 2016). A visual inspection of the cap performed on December 13, 2016 found the cap to be in good shape with no visible cracks or defects; the surrounding fence surrounds the cap was also found to be in good condition (Appendix B). O&M costs are minimal, primarily associated with removal of trash from the fence lines and moisture monitoring. The remedy is cost effective and utilizes a permanent solution.

Table 5-6

CAOC 35 (OU 5) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 35 (OU 5) – Part 3: Technical Assessment of Remedy (Based on 2016 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
Groundwater Monitoring Results (OU 1)	Appendix D, Technical Assessment Report D-1 provides an assessment of the OU 1 groundwater remedy including related to CAOC 35. The Yermo North plume in relation to CAOC 35 is shown in Figure D-1.1. TCE and PCE concentration trends for several CAOC 35 monitoring wells are presented in the Technical Assessment Report D-1 (see Graph D-1.12). A review of the long-term VOC data from monitoring wells both upgradient and downgradient of CAOC 35 revealed: • TCE concentrations detected in monitoring well YS15-2 up-gradient of the CAOC 35 landfill cap sometimes exceed the OU 1 groundwater cleanup level (5 µg/L) indicating an up-gradient source is present; • TCE and PCE concentrations are notably higher than the observed upgradient monitoring wells at three key monitoring wells downgradient from CAOC 35, including YS35-3, YS35-4, and YS35-5. The concentrations vary but are consistently above the OU 1 cleanup limits for TCE, and often for PCE as well; and • 1,2-Dichloroethane (1,2-DCA), is occasionally detected above the cleanup level in monitoring wells downgradient from CAOC 35. • 1,1-Dichloroethene (1,1-DCE) is consistently below the cleanup level. • Upgradient sources include CAOC 16 and CAOC 15/17, however limited groundwater monitoring wells are located in those areas.
Institutional Controls	The LUCs that is in place at CAOC 35 restrict the use of the site. No activities were observed that would have violated the LUCs. No new use of groundwater was reported and/or observed.
B. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	
Because the site conditions, surrounding land use, and potential receptors have not changed since the selection and installation of the remedy, the exposure assumptions are still valid. There have been no change(s) that impact the validity of technical assumptions, toxicity data, cleanup levels, and RAOs at this CAOC. Appendix C provides additional details on the review of changes toxicity data, cleanup levels, and RAOs for this CAOC.	
C. Has new information been found that may impact the protectiveness of the remedy?	
No new information has been found that may impact the protectiveness of the remedy.	
Summary of Technical Assessments	The RAOs developed for CAOC 35 (OU 5) include: minimize precipitation infiltration and potential future impact to groundwater, limit potential human exposure to buried waste and impacted soil, and maintain landfill closure ARARs. The OU 5 RAOs are being met at CAOC 35 Stratum 1 Zone 1 and the remedy is, therefore, protective of human health and the environment. Groundwater monitoring for the CAOC has been conducted under OUs 1 and 2; monitoring data results indicate TCE and PCE downgradient of CAOC 35 exceeded the cleanup levels during the review period (however CAOC 35 is also downgradient of CAOCs 16 and 15/17). Groundwater downgradient of CAOC 35 is being addressed by the OU 1 AS/SVE system and GETS. The uncertainties about what wastes were landfilled at CAOC 35 as well as lack of data from the vadose zone beneath CAOC 35 Stratum 1 Zone 1 prevent assessment of the long-term effectiveness and protectiveness of the remedy for groundwater under the OUs 1 and 2 ROD (DON 1998a).

Table 5-6

CAOC 35 (OU 5) - Yermo Annex – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 35 (OU 5) – Part 4: Issues (Based on 2016 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
Issues identified during the technical assessment and other five-year review activities (e.g., site inspection)	COCs in groundwater exceeding the OU 1 cleanup levels have been detected in monitoring wells downgradient of CAOC 35; some uncertainty exists on if these COCs are related to CAOC 35 landfill wastes or to other upgradient sources.
Determination of whether issues affect current or future protectiveness	Assuming groundwater capture/treatment continues under OU 1, the identified COCs exceeding cleanup levels will not affect the current or future protectiveness of the remedy.
Discussion of unresolved concerns or items raised by support agencies and the community	(pending comments received from FFA stakeholders and community) (Appendix H).
Other comments/considerations: None	

CAOC 35 (OU 5) – Part 5: Recommendations and Follow-up Actions		
Recommendations / Follow-up Actions	**Schedule for Completion**	**Comments**
Consider collecting soil vapor data from beneath CAOC 35 to assess if the landfilled wastes are contributing VOCs to underlying groundwater.	Schedule to be determined	The DON is currently reviewing the OU 1 groundwater remedy for potential optimization measures including improving characterization of vadose zone sources in the CAOCs 16, 15/17, and 35.

ACRONYMS:

µg/L microgram per liter
ARAR – applicable or relevant and appropriate requirement
AS/SVE – air sparge/soil vapor extraction
BMP – Base Master Plan
CAOC – CERCLA Area of Concern
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COCs – contaminants of concern
DON – Department of the Navy
DTSC – Department of Toxic Substances Control
EPA – Environmental Protection Agency
FFA – Federal Facilities Agreement
GETS – Groundwater Extraction and Treatment System
ICs – institutional controls
LUCs – land use controls
MCLB – Marine Corps Logistics Base
MMEC – Multimedia Environmental Compliance Group
O&M – Operation and Maintenance
OU – Operable Unit
PAH – polynuclear aromatic hydrocarbon
PCB – polychlorinated biphenyl
PCE – tetrachloroethene
RA – Remedial Action Report
RAO – remedial action objectives
RAR - Remedial Action Report
ROD – record of decision
SVOC – semivolatile organic compound
TCE – trichloroethene
TPH – total petroleum hydrocarbons
VOC – volatile organic compound

REFERENCES: *See* Section 9 of Main Report

Table 5-7

Review of CAOCs with Land Use Controls Only – Yermo Annex
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC Description (*see* Figures 5-5 for Locations)	Land Use Control Description	2012 – 2017 Status [1,2]
CAOC 9.60 (OU 7)		
CAOC 9.60 is a former waste oil/solvent USTs (T-530A and T-530B) that leaked to the soil. T-530A was investigated but was never found; T-530B was removed along with some impacted soil in 1992. Currently, investigations found some soil and soil vapor contamination at depth; groundwater is about 173 feet deep. Groundwater VOCs results are below MCLs, in the area of CAOC 9.60. There are no completed pathways identified and the selected remedial action is LUCs. CAOC 9.60 is unpaved and sparsely vegetated.	**Total CAOC area:** 0.02 acres **Area requiring LUCs:** 0.02 acres **BMP Modifications (2015):** • A history of the CAOC; • A description of contaminants; and • Requirement for any proposed actions or changes of onsite use(s) will be reviewed by the Environmental Division.	No site changes or actions were undertaken at CAOC 9.60 during this review period.
CAOC 9.68 (OU 7)		
CAOC 9.68 is a former oil/water separator and the associated French drain that received the waste oil. The oil/water separator and French drain were removed. Currently, the area is paved and used for equipment storage. There are no completed exposure pathways identified and the selected remedial action is LUCs.	**Total CAOC area:** 0.02 acres **Area requiring LUCs:** 0.02 acres **BMP Modifications (2015):** • A history of the CAOC; • A description of contaminants; and • Requirement for any proposed actions or changes of onsite use(s) will be reviewed by the Environmental Division.	No site changes or actions were undertaken at CAOC 9.68 during this review period.
CAOC 15/17 (OU 5)		
CAOCs 15/17 are the Oil Storage/Spillage Area and Industrial Wastewater Treatment Plant located in the northern part of Yermo Annex. Activities at CAOC 17 consisted of defueling operations and storage area of an estimated 4,000 drums of waste oil and new lubricating oil. Primary waste operations at CAOC 15 consisted of defueling operations, emptying bilge waters contaminated with fuel, and storing waste oil; several documented releases of contaminated water and waste oil had occurred. CAOC 17 consists of 14 evaporation basins associated with the wastewater treatment plant; overfills and spillages from the basins were documented. CAOC 17 partially overlaps CAOC 15. Shallow soils at these CAOCs were impacted by low levels of metals, TCE, PCBs, TPH (diesel range), and various pesticides. A Time-Critical Removal Action (TCRA) was conducted in 1993 to remove residual impacted sludge. Mathematical modeling indicated that soil contamination would have limited potential impacts to groundwater. However, groundwater cleanup levels must	**Total CAOC area:** 15.98 acres **Area requiring LUCs:** 15.98 acres **BMP Modifications (2010):** • A history of the CAOC; • Description and map of areas requiring LUC; • The low levels of PCBs, hexavalent chromium, and PAHs detected in surface soils will be provided in the MCLB Barstow Master Plan; and • Requirement for any proposed actions or changes of onsite use(s) will be reviewed by the Environmental Division.	No site changes or actions were undertaken at CAOC 15/17 during the review period. The DON is currently reviewing the OU 1 remedy for potential optimization measures including improving characterization of vadose zone at CAOC 15/17.

Table 5-7

Review of CAOCs with Land Use Controls Only – Yermo Annex
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC Description (*see* Figures 5-5 for Locations)	Land Use Control Description	2012 – 2017 Status [1,2]
be met at the CAOC boundary (*see* Table 7-2 for OU 1 groundwater). Because the incremental carcinogenic human health risks at this CAOC exceeded 1 x 10^{-6}, LUCs only was chosen for the two CAOCs, as documented in the OUs 5 and 6 ROD (DON 1998a). A BMP amendment was required for LUC information and future planning purposes.		
CAOC 18 (OU 3)		
CAOC 18 is the former Sludge Waste Disposal Area located in the eastern side of Yermo Annex. Soils at this CAOC are impacted by low levels of VOCs, SVOCs, chlorinated pesticides, PCBs, petroleum hydrocarbons, metals, and PAHs. Mathematical modeling indicated that soil contamination would have no potential impacts to groundwater. LUCs only were chosen for this CAOC, as documented in the OUs 3 and 4 ROD (DON 1997).	**Total CAOC area:** 5.2 acres Area requiring LUCs: Stratum 2 (0.48 acres); Stratum 3 (3.04 acres) **BMP Modifications (2010):** • A history of the CAOC; • A description of the low levels of soil, contaminants; and • Requirement for any proposed actions or changes of onsite use(s) will be reviewed by the Environmental Division.	No site changes or actions were undertaken at CAOC 18 during the review period.
CAOC 21 (OU 5)		
CAOC 21, the Industrial Waste Disposal Area, is located on a flat, open, unpaved area near Gate 5, at the eastern perimeter of the Yermo Annex. This CAOC was originally under OU 3. Sampling indicated that low levels of chlorinated pesticides, VOCs, SVOCs, PCBs, metals, and petroleum hydrocarbons were present. A TCRA was conducted in 1997 to remove PCB impacted soils. Mathematical modeling indicated that soil contamination would have very limited, if any, potential impacts to groundwater. LUCs only were chosen for CAOC 21, as documented in the OUs 3 and 4 ROD (DON 1997).	**Total CAOC area:** 9.96 acres **Area requiring LUCs:** 9.96 acres **BMP Modifications (2010):** • A history of the CAOC; • A description of the low levels of contaminants; and • Requirement for any proposed actions or changes of onsite use(s) will be reviewed by the Environmental Division.	No site changes or actions were undertaken at CAOC 21 during the review period.
CAOC 23 (OU 3) Strata 5 and 5(a)		
CAOC 23, known as the Landfill Area, is an irregular L-shaped area located at the south to southeast corner of the Yermo Annex, between the railroad tracks (that serve the warehouse areas) and the industrial operations' perimeter fence. CAOC 23 was divided into six strata (see Table 7-5 for details). Stratum 5, the potential waste burial area, and Stratum 5a, the PCB-impacted area, are sited in the western portion of CAOC 23 (Figure 7-5). The ROD selected LUCs to prevent exposure to residual contaminants at Strata 5 and 5a (the concrete cap installed at CAOC 23 Zone 1 is separately evaluated in Table 7-5).	**Total CAOC area:** 60 acres **Area requiring BMP Modification:** 60 acres **BMP Modifications (2010):** • A history of the CAOC; • A description of pesticides and PCBs soil contaminants; and • Requirement for any proposed actions or changes of onsite use(s) will be reviewed by the Environmental Division.	No site changes or actions were undertaken at CAOC 23 during the review period.

Table 5-7

Review of CAOCs with Land Use Controls Only – Yermo Annex
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC Description (*see* Figures 5-5 for Locations)	Land Use Control Description	2012 – 2017 Status [1,2]
CAOC 26 (OU 5)		
CAOC 26, the Building 533 Waste Disposal Area, is located in the west-central portion of the Yermo Annex. Sampling results indicated low levels of VOCs, SVOCs, pesticides, and metals above background levels. No PCBs were detected. LUCs only were selected for this CAOC, as documented in the OUs 5 and 6 ROD (DON, 1998b). PCE contamination of the vadose zone and groundwater has been addressed under OU 1 (*see* Table 7-2).	**Total CAOC area:** 0.95 acres **Area requiring BMP Modification:** 0.95 acres **BMP Modifications (2010):** • A history and description of the CAOC; and • Requirement that any actions planned or changes of onsite uses will be reviewed by the Environmental Division.	Surface remedial equipment was removed from CAOC 26 in March 2015.
CAOC 32 Stratum 2 (OU 5)		
CAOC 32, the Preservation and Packaging Area, is located at the north-central portion of the Yermo Annex. The CAOC encompasses Building203 (the Preservation Shop) and the perimeter, a drum storage area, a steam wash rack, a sump and associated piping, and the former location of an excavated underground storage tank. The area west of Building203 was reportedly used to store drums containing hazardous materials (Brown and Caldwell, 1983). Stratum 2 comprises Building 203 and perimeter area. This stratum has had reported releases of waste oil, solvents, ketones, antifreeze, and phosphoric acid. Although not included in the OUs 5 and 6 ROD (DON, 1998b), LUCs for CAOC 32 Stratum 2 were added as recommended in the Third Five-Year Review to address soil concentrations of Aroclor-1242 that exceeded the updated regional screening level (DON 2012).	**Total CAOC area:** 0.42 acres **Area requiring BMP Modification:** 0.42 acres **BMP Modifications (2015):** • A history of the CAOC; • A description of the potential presence of Aroclor 1242; and • A requirement for any proposed actions or changes of onsite use(s) will be reviewed by the Environmental Division.	No site changes or actions were undertaken at CAOC 32 Stratum 2 during the review period.
CAOC 34 Stratum 1 (OU 3)		
CAOC 34, the PCB Storage Area (former Building S-345) is located on the eastern side of the Yermo Annex adjacent to the western side of the MCLB Effluent Disposal Pond (Building 426). Stratum 1 is the area covered by former concrete basins and adjacent soils. Stratum 2 is the soils within the basins and Stratum 3 is the concrete basins themselves. Stratum 1 requires LUCs. The PCB Storage Area consisted of Basin A (western basin) and Basin B (eastern basin), which were demolished and removed as a part of a TCRA completed in 1994. Sampling conducted prior to the TCRA indicated high levels of PAHs, phenol, organochlorine pesticides (OCPs), PCBs, and metals. TPH was detected at low concentrations. The entire CAOC has been covered by concrete evaporation ponds. Mathematical modeling indicated that soil contamination would have very limited, if any, potential impacts to groundwater. An NFA remedy was selected for CAOC 34, as documented by the OUs 3 and 4 ROD (DON 1997).	**Total CAOC area:** 0.58 acres **Area requiring BMP Modification:** 0.58 acres **BMP Modifications (2010):** • A history of the CAOC; • A description of the low levels of the contaminants in soil, specifically the low levels of benzo[a]pyrene detected in the surface soils at Stratum 1; and • Requirement for any proposed actions or changes of onsite use(s) will be reviewed by the Environmental Division.	No site changes or actions were undertaken at CAOC 34 during the review period.

Table 5-7

Review of CAOCs with Land Use Controls Only – Yermo Annex
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

NOTES:

1. The OUs 3 and 4 ROD (DON 1997) and OUs 5 and 6 ROD (DON 1998) selected "No Action" remedies for CAOCs 15, 17, 18, 21, 23 (Strata 5, 5a), 26, and 34 (Stratum 1). The No Action remedy included specific Base Master Plan modifications that require MCLB Barstow Environmental Division review before any land-use changes are made at this site ("NA with BMP modification"). For the purposes of this Five-Year Review report, the "NA with BMP modification" remedy is referred to as "LUCs only" to be consistent with later RODs. The LUCs for the OUs 3 and 5 CAOCs are incorporated into the 2010 BMP Amendment (DON 2010). The LUCs for the OU 7 CAOCs are incorporated into the 2015 BMP Amendment (DON 2015).
2. As recommended in the Third Five Year Review (2012), LUCs were added to CAOC 32 Stratum 2 due to a toxicity level change for an on-site contaminant. The LUC is for Environmental Division review before any land use changes are made, as incorporated into the 2015 BMP Amendment (DON 2015).

ACRONYMS:

BMP – Base Master Plan
CAOC – CERCLA Area of Concern
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
DON – Department of the Navy
IR – Installation Restoration
IRP – Installation Restoration Program
LUC – Land Use Control
MCLB – Marine Corps Logistics Base
OU – Operable Unit
PAH - polynuclear aromatic hydrocarbon
PCB – polychlorinated biphenyl
RA - remedial action
ROD – Record of Decision
SVOC - semivolatile organic compound
TCE – trichloroethene
TCRA - Time-Critical Removal Action
TPH - total petroleum hydrocarbons
VOC - volatile organic compound
UST- underground storage tanks
NFA – No Further Action

REFERENCES:

See Section 9 of Main Report.

TABLE 6-1

Nebo Main Base – CAOCs Subject to Five-Year Review
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

OU	CAOC	CAOC Description	Remedy in Place	Review Summary Table
2	38	Nebo North plume	GETS (hydraulic control), AS/SVE (source area), natural attenuation (down-gradient plume)	Table 6-2
		Nebo South plume	AS/SVE	Table 6-2
6 / 7	7	Strata 1 and 2: Drum Storage and Landfill Area; Stratum 1 groundwater and soil vapor under OU 7	Strata 1 and 2 – landfill caps, LUCs Stratum 1: SVE and Monitored Natural Attenuation (MNA)	Table 6-4
7	10	Sodium valve and metallic waste burial area	Excavation and off-site disposal lead "hot spot"; LUCs	Table 6-5
7	N-2 Area 1	Former equipment storage area; former skeet and trap range	Removal of lead shot, clay target material, and PCB soils. LUCs	Table 8 -5
7	10.38/10.39 Unit 7	Former drainage trenches with industrial wastewater discharges; groundwater	MNA	Table 6-4
7	NPZ-14	Groundwater area in southeast Nebo Main Base	MNA	Table 6-4
4	2	Pesticide Storage and Washout Area	LUCs only[1]	Table 6-8
4	5	Chemical Storage Area (Strata 1 and 2)	LUCs only[1]	Table 6-8
4	11	Fuel Burn Area	LUCs only[1]	Table 6-8
6	1	Landfill North of the Golf Course	LUCs only[1]	Table 6-8
6	3	Wastewater Disposal Area	LUCs only[1]	Table 6-8
6	7	Strata 3 and 4	LUCs only[1]	Table 6-8
6	14	Drainage Channels and Mojave Riverbed Outfalls	LUCs only[1]	Table 6-8
7	10.38/10.39 Units 1 – 7 soils	Domestic and Industrial wastewater conveyance pipelines	LUCs only[2]	Table 6-8
7	10.12	Building 50, Preservation and Packaging Shop	LUCs only[2]	Table 6-8
7	10.27	Building S-338, former firefighting training facility	LUCs only[2]	Table 6-8
7	10.35	Building 34, former domestic wastewater treatment plant	LUCs only[2]	Table 6-8
7	10.37	Industrial wastewater treatment plant (decommissioned)	LUCs only[2]	Table 6-8
7	10.3	Warehouse 2, former vehicle repair facility	LUCs only[2]	Table 6-8
7	10.4	Warehouse 3, general warehouse and steam-cleaning wash rack	LUCs only[2]	Table 6-8
7	10.5	Warehouse 4, general warehouse	LUCs only[2]	Table 6-8
7	10.49	USTs T-27A, T-27B, T-27C	LUCs only[2]	Table 6-8
7	10.80	UST T-354, former blowdown tank	LUCs only[2]	Table 6-8

NOTES:

1. OUs 3 and 4 ROD (DON 1997) or OUs 5 and 6 ROD (DON 1998) selected "No Action" with specific Base Master Plan modifications that require MCLB Barstow Environmental Division review before any land-use changes are made at this site ("NA with BMP modification"). In this Five-Year Review report, the "NA with BMP modification" remedy is referred to as "LUCs only" to avoid confusion. The LUCs for this site are incorporated into the 2010 BMP Amendment (DON 2010).
2. The OU 7 ROD (DON 2014) LUCs for this site are incorporated into the 2015 BMP Amendment (DON 2015).

TABLE 6-1

Nebo Main Base – CAOCs Subject to Five-Year Review
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

ACRONYMS:

AS/SVE – Air Sparging and Soil Vapor Extraction System

BMP - Base Master Plan

CAOC – CERCLA Area of Concern

CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act

GETS – Groundwater Extraction and Treatment System

ICs – Institutional Controls

IRP – Installation Restoration Program

LUCs – land use controls

NFA – no further action

OU – Operable Unit

ROD – Record of Decision

UST – underground storage tank

TABLE 6-2

OU 2 (CAOC 38) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

OU 2 (CAOC 38) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Status, and Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Change in CAOC conditions since signed ROD and Third Five-Year Review**
Applicable RODs	• OUs 1 and 2 ROD (DON, 1998a) Nebo North RA and interim remedy for Nebo South Plume; and • OU 2 ROD (DON, 2006) final remedy for Nebo South plume.	The Nebo North source area location was modified from Warehouse 2 to Building 50 by documenting a Minor Change to the OUs 1 and 2 ROD (DON 2011).
Site Description and Locations	CAOC 38 is the impacted groundwater beneath the Nebo Main Base. It is impacted by dissolved phase VOCs in several locations. The OUs 1 and 2 ROD identified the Nebo North plume associated with source area (former Building 50 - CAOC 10.12) and the Nebo South plume associated with source CAOC 6 (closed with LUCs only under OU 6). The primary VOCs present at the site are trichloroethene (TCE) and tetrachloroethene (PCE). The Nebo North and Nebo South plume locations at Nebo Main Base are shown on Figure 6-1; the plume extents are shown on Figures 6-2 and 6-3, respectively. Additional detail on the Nebo North and Nebo South plumes is provided in Appendix E, Technical Assessment reports E-1 and E-2, respectively.	No changes.
Basis of Response, Interim Response Actions	Prior to approval of the OUs 1 and 2 ROD, groundwater VOC concentrations at Nebo Main Base were determined to pose a threat to human health and the environment. Two interim response actions were taken to address groundwater VOCs, as follows: • A groundwater extraction and treatment system (GETS) was installed at the northern edge of Nebo Main Base to prevent off-site migration of the Nebo North plume, if needed; and • A time-critical removal action (TCRA) was performed in June 1989 in response to the Nebo South VOC plume extending off-site and impacting a private residence's well (Figure 6-3). The private well was taken out of service and the residence connected to the Base potable water system (JEG 1993).	None (no changes to identified COCs or original basis of response). Notes: The Nebo North GETS system was decommissioned in March 2015 per the recommendation in the third five-year review. The Nebo South off-site residence has been vacant since circa 2006; the property is owned by a holding company and was unoccupied during this review period.
Remedial Action Objectives	The OU 2 RAOs per the OUs 1 and 2 ROD for groundwater cleanup are the drinking water standards for specific VOCs (*see* Table 2-1, page 2-39, of the ROD). The RAO for vadose zone cleanup at MCLB Barstow is to remove contaminant mass in the subsurface soils to the degree necessary to: • Prevent further degradation of the groundwater above groundwater cleanup standards; • Minimize the aquifer cleanup time; and • Vadose zone soils cleanup goals are source-specific.	None (Selected RAOs remain the same as specified in the OUs 1 and 2 ROD)
Selected Remedy	**Nebo North Plume – final selected remedy in OUs 1 and 2 ROD:** • Remediation of the groundwater and the vadose zone in the source area by AS/SVE, with natural attenuation of the downgradient contaminant plume after the source area is cleaned	None (Selected RAOs remain the same as specified in the OUs 1 and 2 ROD.)

TABLE 6-2

OU 2 (CAOC 38) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

OU 2 (CAOC 38) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Status, and Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Change in CAOC conditions since signed ROD and Third Five-Year Review**
Selected Remedy (continued)	up and a "*fail-safe*" pump-and-treat system to prevent off-site plume migration. **Nebo South Plume - final selected remedy in OU 2 ROD (DON, 2006):** • Remediation of the groundwater and the vadose zone in the source area by AS/SVE; and • LUCs include access restrictions to prevent the use of untreated groundwater for drinking water in the area of the plume with VOC detections above the MCLs. **ICs/LUCs under the OUs 1 and 2 ROD:** • OUs 1 and 2 ROD required ICs to prevent use of groundwater in contaminated area. Nebo Main Base receives its potable water from an off-site private water purveyor; former production wells are not used except for irrigation at on-Base golf course.	
Remedy Implementation	**Nebo North:** The Nebo North AS/SVE system began operation in October 2007 and operated until March 2011, when operation was shut down with the FFA concurrence (OTIE 2011b). The AS/SVE system is maintained and operated twice per year to address rebound VOCs in the former wash pad area (*see* Part 3 below). **Nebo South:** The interim remedy of AS/SVE was implemented as the final remedy under the OU 2 ROD (DON 2006).	Nebo North: Currently the system is operating approximately 2 weeks every six months to address rebound in soil vapor concentrations. Nebo South: No change to remedy implementation
O&M and Monitoring	**Nebo North:** • Maintenance O&M of the AS/SVE is performed monthly in accordance with the O&M Manual for OUs 1 and 2; and • Groundwater monitoring throughout the estimated 15 year duration of the RA, subject to evaluations of treatment and cost-effectiveness at 5-year intervals.	With AS/SVE system shutdown in 2011, the Nebo North monitoring program was reduced to annual sampling at selected wells.
	Nebo South: O&M is performed on an on-going basis in accordance with the O&M Manual for OUs 1 and 2 which is updated annually. • Soil vapor monitoring continues to measure the RA effectiveness; • Groundwater monitoring is performed semi-annually at off-Base wells located on the adjacent privately-owned property (Figure 6-3); and	AS/SVE system operations were optimized to target residual plume mass; once groundwater concentrations were decreased to MCLs or below, the related AS/SVE wells were shutdown.

TABLE 6-2

OU 2 (CAOC 38) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

OU 2 (CAOC 38) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Status, and Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Change in CAOC conditions since signed ROD and Third Five-Year Review**
	• Groundwater monitoring is performed annually.	
ICs/LUC Implementation	**Nebo North and Nebo South:** The ICs for groundwater use are implemented through the MCLB Barstow Environmental Division, which reviews any proposed change in land use or groundwater use in the identified plume areas. **Nebo South LUC area:** The final LUC boundaries of the Nebo South plume area, including the CAOC 6 soil source area, as determined in the OU 2 ROD (DON, 2006) and LUC Remedial Design document (DON 2009a) were implemented in 2011 through installation of site boundary markers and signs, a survey to establish horizontal coordinates, and updating of the MCLB Barstow GIS database to incorporate the LUC area boundaries. LUC boundaries are shown on Figure 6-3.	No changes to ICs/LUCs

OU 2 (CAOC 38) – Part 2: Progress on Recommendations Made in Last Five-Year Review (2012)	
Protectiveness statements from last review	**Nebo North:** The Nebo North plume has decreased in extent with several wells showing overall decrease in VOC levels. The Nebo North GETS system was decommissioned in March 2015 per the FFA stakeholder concurrence with the recommendation in the third five-year review. The remedy at Nebo North is considered protective of human health and the environment. **Nebo South:** The remedy was considered to be protective of human health and the environment. Aging AS/SVE system components could impact long-term protectiveness by reducing remedial system treatment effectiveness.
Status of recommendations and follow-up actions from last review	**Nebo North:** • 2012 Recommendation: Continue to monitor for soil vapor VOC concentration rebound in the former wash pad area every 6 months. Status: The SVE system was operated for approximately two weeks every six months in the wash pad area. The concentrations of soil vapor VOC concentrations are decreasing. **Nebo South:** • 2012 Recommendation: Identify and completion of remedial equipment repairs and upgrades. Status: During the review period, numerous minor equipment repairs were completed along with one major upgrade – replacement of the malfunctioning old air compressor with a new, more energy-efficient model. The system continues to operate in efforts to meet RAOs in four wells with groundwater TCE concentrations remaining above the MCLs (NS6-4, NS6-5, NS6-V1, and NS-V3). System repairs and upgrades improved the remedial efficiency, resulting in rapid declines in plume area extent and groundwater VOC concentrations.
Status of any other prior issues	No other prior issues were identified.

TABLE 6-2

OU 2 (CAOC 38) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

OU 2 (CAOC 38) – Part 3: Technical Assessment (Based on 2012 – 2016 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
A. Is the remedy functioning as intended by the decision documents?	
Nebo North	• **Source Area Cleanup:** The Nebo North AS/SVE system functioned as intended to reduce vadose zone and groundwater VOC concentrations in the plume source area and the system was shut down in 2011. Relatively low-concentrations of soil vapor VOCs rebounded at the former wash pad area one year after system shutdown. As a protective measure for groundwater, the DON resumed targeted SVE system operation in the wash pad area for approximately two weeks once every 6 months during the review period. Groundwater COC concentrations in the source area have remained below cleanup levels since 2011. See technical assessment of the Nebo North remedy including graphs and supporting data in Appendix E, E-1. • **Natural Attenuation of Residual Groundwater Plume:** The Nebo North groundwater plume has attenuated such that only one monitoring well has one COC (PCE) above the cleanup level; a separate source is suspected in this area (see Appendix E, Figure E-1.3). • **O&M Costs**: Estimated operational costs for Nebo North are provided in Table 4-3; an analysis of O&M costs for OUs 1 and 2 is provided in Appendix D (D-2);
Nebo South	• **Cleanup of Source Area and prevention of off-site migration of impacted groundwater:** The Nebo South AS/SVE system was operated cyclically (two weeks on/off cycling) during most of the review period and is functioning as intended. VOC levels in a majority of the wells that make up the Nebo South plume have decreased below MCLs. The rate of contaminate removal has declined due to the decrease in VOC mass in soil and groundwater. See technical assessment of the Nebo South remedy including graphs and supporting data in Appendix E, E-2. • **Monitoring:** Groundwater monitoring activities are performed semi-annually (at off-base and boundary wells) and annually (at on-base and off-base wells). Soil vapors are only sampled periodically or "as needed" based on very low concentrations produced by the SVE portion of the system. Off-Base groundwater is currently not used; off-Base groundwater monitoring data indicate TCE and PCE concentrations have been below MCLs since 2006 • **O&M:** The Nebo South AS/SVE system is maintained on a regular basis to keep the system functioning as intended. The mass removal rates have "flat-lined," indicating the system is at the limits of effectiveness. The VOC effluent emission rate of 0.0039 pounds per day remained well below the MDAQMD's allowable levels of 39.6 pounds per day. • **O&M Costs:** Operational costs are within range for an AS/SVE system. Estimated operational costs for Nebo South are provided in Table 4-3; an analysis of O&M costs for OUs 1 and 2 is provided in Appendix D (D-2 Report). An estimated 21 pounds of total VOCs have been removed since system startup based on SVE emission sample data; and • **Optimization:** AS/SVE operations are focused on remaining impacted areas, shutting down wells once groundwater concentrations fall below MCLs.
LUC/Institutional Controls:	• The LUCs for the Nebo South area were maintained during the review period; no changes in land use occurred; and • ICs for groundwater use were maintained during the review period. No new groundwater supply wells have been installed (or are planned for installation) on or off Base within the boundaries of the Nebo North or Nebo South plume areas.
B. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	
Land-use and exposure assumptions remain unchanged. The MCLs that were the basis for the selected groundwater cleanup levels have not changed since the RODs were signed. The RAOs remain protective. Appendix C provides a review of the relevant toxicity data changes.	
C. Has new information been found that may impact the protectiveness of the remedy?	
No other information was identified that would impact the protectiveness of the OU 2 remedies.	

TABLE 6-2

OU 2 (CAOC 38) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

OU 2 (CAOC 38) – Part 3: Technical Assessment (Based on 2012 – 2016 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
Summary of Technical Assessments	The RAs at CAOC 38 under the OUs 1 and 2 ROD (Nebo North) and OU 2 ROD (Nebo South) are performing or have performed as intended to reduce groundwater and soil vapor contamination. The remedies are both effective and protective. • At Nebo North, the AS/SVE remedy is completed; natural attenuation of the downgradient groundwater plume has reduced COC concentrations at all monitoring locations except one. • At Nebo South, the AS/SVE system continues to be operated to prevent off-Base migration of the remaining on-Base contaminant plume. Off-base groundwater concentrations have been below the cleanup levels since 2006.

CAOC 38 – Part 4: Issues (Based on 2016 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
Issues identified during the technical assessment and other five-year review activities (e.g., site inspection)	**Nebo North plume:** • Rebounding VOC concentrations in the former wash pad area have declined in response to targeted operation of the SVE system. Based on rebound concentration trends, continued targeted SVE is no longer necessary (See Appendix E, E-1). • The VOC concentrations at monitoring well, T-22A/B-MW1, are thought to be related to former USTs T-22A/B and/or former industrial activities at Warehouse 4 (CAOC 10.5) and/or Building 22. PCE concentrations at this well are increasing, while other COCs are below the cleanup levels. The small groundwater plume in this area does not appear to be migrating or expanding. **Nebo South plume:** • The AS/SVE system has significantly reduced the extent of Nebo South plume. However, two small TCE plumes near the Base boundary are persistent (see Figure E-2.1 in Appendix E, E-2).
Determination of whether issues affect current or future protectiveness	**Nebo North source area:** • Current protectiveness is maintained because the Nebo North source area has been cleaned up and the majority of the plume has attenuated to below cleanup levels. The remaining plume consists of a small area near former UST T22 at the north end of Warehouse 4 (centered on one monitoring well T22A/B-MW-1). This small plume is not migrating or expanding; however, PCE concentrations at T22A/B-MW-1 may affect future protectiveness of the remedy. **Nebo South source area:** • Current or future protectiveness is not affected - the Nebo South AS/SVE system will continue to be operated until the RAOs were met and the FFA concurs with system shutdown.
Discussion of unresolved concerns or items raised by support agencies and the community	(*Pending comments from FFA stakeholders and community*) (Appendix H).
Other Comments, Considerations	None

TABLE 6-2

OU 2 (CAOC 38) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 38 – Part 5: Recommendations and Follow-up Actions		
Recommendations / Follow-up Actions	**Schedule for Completion**	**Comments**
Nebo North: • Discontinue targeted SVE at the former wash pad area. • Perform a limited subsurface investigation to identify the source for the increasing PCE groundwater concentrations downgradient from UST T-22A/B. Prepare a Memorandum to File to add the UST T-22A/B source area to the OUs 1 and 2 ROD with an appropriate response action if necessary based on the additional data.	Nebo North: • Discontinue targeted SVE immediately. • Additional investigation and clarification of ROD within next five years.	The former UST T-22A/B is currently under Regional Water Board oversight under the Leaking Underground Fuel Tank (LUFT) program; the DON has discussed with RWQCB that transfer of this UST to the Installation Restoration Program for management under the Nebo North remedy.
Nebo South: • Conduct a data gaps investigation to identify potential residual vadose zone source upgradient of the residual plume and optimize the AS/SVE remedy as necessary.	Nebo South: • Conduct additional investigation within next five years	No comments

ACRONYMS:

AS/SVE – air sparge/soil vapor extraction
BMP – Base Master Plan
CAOC – CERCLA Area of Concern
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
DON – Department of the Navy
ESD – Explanation of Significant Differences
FFA – Federal Facility Agreement
GAC – granular activated carbon
GETS – groundwater extraction and treatment system
IC – institutional control
LUC – land use control
MCLB – Marine Corps Logistics Base
O&M – Operations and Maintenance
OU – Operable Unit
PCE - tetrachloroethene
RA – Remedial Action
RAOs – remedial action objectives
ROD – Record of Decision
TCE – trichloroethene
VOCs – volatile organic compounds

REFERENCES:

See Section 9 in Main Report

TABLE 6-3

CAOC 7 (OU 6) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 7 (OU 6) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Status, and Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Change in CAOC conditions since signed ROD and Third Five-Year Review**
Applicable RODs	OUs 5 and 6 ROD (DON, 1998b) for caps and ICs/LUCs; OUs 1 and 2 ROD (DON, 1998a) for groundwater monitoring.	OU 7 ROD including subsurface remedy for CAOC 7 Stratum 1 signed in December 2014.
Site Location and Description	CAOC 7 was operated as the principal solid waste landfill for MCLB Barstow from the early 1950s to 1964, and is located in the southeast portion of Nebo Main Base (Figure 1-3). Various chemicals from World War II and the Korean conflict were stored and, when possible, were reportedly burned and disposed of as part of the landfill operation. Drums with unknown contents or that were believed to contain extremely hazardous materials were stored in a bermed area. These materials included caustic soda and various pesticides. Around 1958, a major fire reportedly occurred in the drum storage area, leading to a relatively large spill. The area was covered with approximately 2 feet of soil in 1964. CAOC 7 consists of four strata (Figure 6-4): • Stratum 1: The eastern L-shaped landfill disposal area, with each leg measuring approximately 50 by 750 feet (southeast corner of the Nebo Main Base) • Stratum 2: The western landfill disposal area, consisting of two separate trench areas; each trench area consists of two parallel trenches approximately 15 feet wide and ranging in length from 300 to 800 feet (south/central portion of the Nebo Main Base) • Stratum 3: A drum storage and spillage area measuring approximately 900 by 900 feet (northwest of Stratum 1). Declared NFA per OU 5 and 6 ROD. • Stratum 4: The former playground area next to the amphibious vehicle test pond, also known as the “fish pond.” Declared NFA per OU 5 and 6 ROD. • Under OU 2, monitoring wells were installed in the vicinity of CAOC 7.	No change
Basis of Response, Interim Response Actions	VOCs and SVOCs, organochlorine pesticides (OCPs), metals, and TPH-d were detected at low levels in soil samples. Potential impacts to groundwater were evaluated using mathematical modeling. Modeling indicated that dieldrin detected at Stratum 1 could affect groundwater and dieldrin was added to the Stratum 1 groundwater monitoring program.	Groundwater TCE concentrations rose above the OU 2 cleanup level beginning in November 2004 at NSP-2, a monitoring well located downgradient of the Stratum 1 landfill cap. Subsequently the DON reviewed the remedy and ultimately developed a subsurface remedy for soil vapor and groundwater contamination at Stratum 1 under the OU 7 ROD (signed December 2014)
Remedial Action Objectives	**RAOs per the OUs 5 and 6 ROD:** “The cap will meet the objective of minimizing the potential for disturbing the wastes and the potential for direct exposure. The cap will also minimize the potential for future migration of contaminants to groundwater.”	See Table 6-4 for the OU 7 ROD RAOs for soil vapor and groundwater contamination at Stratum 1.

TABLE 6-3

CAOC 7 (OU 6) - Nebo Main Base – Five Year Review Summary
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CAOC 7 (OU 6) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Status, and Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Change in CAOC conditions since signed ROD and Third Five-Year Review**
Selected Remedy	**OUs 5 and 6 ROD:** • Strata 1 and 2: A single-layer native soil cap with institutional controls (fencing and signs posted along the periphery), and precipitation infiltration and groundwater monitoring. LUCs stipulate that the caps shall not be breached other than for purposes of cap maintenance activities unless prior approval of the FFA signatories (i.e., EPA, Cal/EPA, and the Water Board) is obtained. The Base Environmental Division should be consulted prior to initiating any activities in this area. • Strata 3 and 4: land use controls only. The ROD requires that any actions planned in these strata that changes the site use must be coordinated and reviewed by the Base Environmental Division.	OU 7 ROD selected remedy for CAOC 7 Stratum 1 subsurface: Soil vapor extraction (SVE) to reduce VOCs in the vadose zone to prevent further groundwater contamination; Monitored Natural Attenuation for groundwater VOC contamination.
Remedy Implementation	The remedy selected at CAOC 7 Strata 1 and 2 (monolithic native soil caps with land use controls and groundwater monitoring) under the OUs 5 and 6 ROD (DON, 1998b) has been fully implemented.	
O&M, Monitoring	Landfill maintenance and monitoring activities at CAOC 23 are performed quarterly and annually, in accordance with the ROD and the maintained in accordance with the CAOCs 7, 20, 23 and 35 O&M Manual (MMEC 2016). Groundwater monitoring under the OUs 5 and 6 ROD requirements is performed annually or once every five years in accordance with the latest update to the long-term groundwater monitoring plan (Sampling and Analysis Plan for OUs 1 – 7, OTIE 2014). Groundwater monitoring for the OU 6 RAOs for pesticides and metals was reduced to once per five years.	No change in O&M or monitoring (see also Table 6-4 for OU 7 remedy at CAOC 7 Stratum 1).
ICs/LUC	ICs/LUCs are fully implemented; the BMP was amended in 2010 to incorporate LUCs for CAOC 7.	No change

CAOC 7 (OU 6) – Part 2: Progress on Issues and Recommendations Since Last Review (2012)	
TCE concentrations in Stratum 1 downgradient monitoring well (NSP-2) exceeded the cleanup level over several groundwater monitoring events.	The DON conducted a remedy evaluation of CAOC 7 Stratum 1 in accordance with the OUs 5 and 6 ROD in 2009 (DON 2009). The remedy evaluation concluded that the native soil cover was intact but that groundwater contamination was not prevented and a subsurface evaluation was warranted (Tetra Tech, 2010b). CAOC 7 Stratum 1 was incorporated into the OU 7 ROD with RAOs for groundwater to protect human receptors from ingestion of impacted groundwater from the site and to mitigate further impact to groundwater from vadose zone sources. Multi-screened soil wells were installed through the cap in October 2011 and October 2015; an SVE pilot study was performed in 2015-2016 to support the remedial design for the OU 7 remedy. Groundwater monitoring was increased to semi-annually at Stratum 1 and a new upgradient monitoring well installed in October 2011 (see Table 6-4).

CAOC 7 (OU 6) – Part 3: Technical Assessment (Based on 2012 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
A. Is the remedy functioning as intended by the decision documents?	
Stratum 1 Landfill Cap	The landfill cap at Stratum 1 did not prevent groundwater contamination; therefore the DON incorporated a subsurface remedy for this site into the OU 7 ROD. The landfill cap performed as intended to prevent direct contact with buried wastes based on continued O&M activities performed quarterly in accordance with the ROD and the O&M Manual. O&M activities include: Inspection of the protective gravel cover and perimeter fence, settlement surveys,

TABLE 6-3

CAOC 7 (OU 6) - Nebo Main Base – Five Year Review Summary
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CAOC 7 (OU 6) – Part 3: Technical Assessment (Based on 2012 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
	weed eradication, and soil moisture and rainfall data monitoring. General maintenance activities were as follows: • In 2016, the area around the desert tortoise fencing was regraded, the holes causing erosion were filled, and the soil was raked and redistributed to expose the desert tortoise fence; and • Monument settlement surveys were conducted in June 2011, October 2015, and January 2017. • Soil moisture data is monitored on a regular basis using a soil moisture monitoring system. In addition, rainfall-gauge measures and records rainfall data at regular intervals. The soil moisture and rainfall gauge data are downloaded bimonthly. Measured soil moisture is below 10% and relatively constant at Stratum 1 with little to no variability over time observed at each monitoring point (Sealaska 2012; MMEC 2015, 2016); indicating that the cap is functioning effectively. However, vadose zone and groundwater contamination are present beneath this Stratum.
Stratum 2 Landfill Cap	Landfill cap O&M activities are performed quarterly in accordance with the ROD and the O&M Manual. O&M activities include: Inspection of the protective gravel cover and perimeter fence, settlement surveys, weed eradication, and soil moisture and rainfall data monitoring. General maintenance activities were as follows: • In 2016, the area around the desert tortoise fencing was regraded, the holes causing erosion were filled, and soil was raked and redistributed to expose the desert tortoise fence; and • Monument settlement surveys were conducted in June 2011, October 2015, and January 2017. Based on the functional review of the Stratum 2 landfill cap, significant precipitation infiltration through the cap is not occurring. Similar to Stratum 1, soil moisture and rainfall data are regulatory monitored at Stratum 2. The measured soil moisture content was relatively constant at Stratum 2 with little to no variability over time was observed at each monitoring point (Sealaska 2012; MMEC 2015, 2016), indicating that the cap is functioning effectively. Based on the available groundwater data, the remedy at Stratum 2 is performing as intended; however, only limited groundwater monitoring data and no soil vapor data were available for this review.
Strata 3 & 4 ICs/LUCs	The LUCs for Strata 3 and 4 are functioning as intended by the ROD.
B. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	
Land-use and exposure assumptions remain unchanged; toxicity values for PCE changed but did not result in a change to the MCL; the cleanup levels for groundwater (MCLs) remain relevant and unchanged since 2007; therefore, the RAOs remain protective.	
C. Has new information been found that may impact the protectiveness of the remedy?	
No other information was identified that could impact the protectiveness of the CAOC 7 remedies.	
Summary Of Technical Assessments	The CAOC7 Stratum 1 landfill cap has prevented direct contact with the buried wastes as intended by the ROD. However, the cap has not prevented vertical migration of VOCs, leading to groundwater TCE concentrations above the cleanup level downgradient of the cap. The cap remedy for Stratum 2 is functioning as intended, however there is limited groundwater data and no soil vapor data to fully assess the RAO for prevention of groundwater contamination. The LUCs for Strata 3 and 4 are functioning as intended to prevent changes in site use without MCLB Barstow Environmental Division involvement.

TABLE 6-3

CAOC 7 (OU 6) - Nebo Main Base – Five Year Review Summary
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MCLB Barstow, California

CAOC 7 – Part 4: Issues (Based on 2011 – 2012 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
Issues identified during the technical assessment and other five-year review activities (e.g., site inspection)	No issues identified for capped areas (Strata 1 and 2) or LUCs-only areas (Strata 3 and 4).
Determination of whether issues affect current or future protectiveness	N/A
Discussion of unresolved concerns or items raised by agencies and community	(*Pending comments received from FFA stakeholders and community*) (Appendix H).
Other Comments, Considerations	none

CAOC 7 – Part 5: Recommendations and Follow-up Actions
Recommendations / Follow-up Actions
No recommendations for the CAOC 7 remedy under the OUs 5 and 6 ROD.

ACRONYMS:

IMP – Integrated Maintenance Plan
LUCs – land use controls
LTGWMP – Long Term Groundwater Monitoring Plan
MCL – maximum contaminant level
MCLB – Marine Corps Logistics Base
ICs – institutional controls
AGMR – Annual Groundwater Monitoring Report
AS/SVE – air sparge/soil vapor extraction
bgs – below ground surface
BMP – Base Master Plan
CAOC – CERCLA Area of Concern
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COCs – contaminants of concern
DON – Department of the Navy
EPA – Environmental Protection Agency
FFA – Federal Facilities Agreement
O&M – Operation and Maintenance
OCP - organochlorine pesticide
OU – Operable Unit
PCE – tetrachloroethene
RA – remedial action
RAO – remedial action objectives
RBC – risk-based criteria
ROD – record of decision
SAP – Sampling and Analysis Plan
TCE – trichloroethene
VOC – volatile organic compound

REFERENCES:

See Section 9 of main report

TABLE 6-4

CAOC 7 Stratum 1 (OU 7) – Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 7 Stratum 1 (OU 7 - Soil Vapor and Groundwater) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Changed Conditions Since ROD**
Applicable RODs	OUs 5 and 6 ROD (DON 1998) for surface/wastes-in-place; OU 7 ROD (DON 2014)	None
Site Location and Description	CAOC 7 Stratum 1 is a former burn dump and waste disposal area with a soil cap in the southeastern corner of Nebo Main Base (Figures 6-1, 6-4). A soil cap was constructed over CAOC 7 Stratum 1 in 2000. The soil cap and groundwater monitoring program were established under the OUs 5 and 6 ROD (DON 1998). Beginning in 2001, groundwater samples from CAOC 7 Stratum 1 monitoring well NSP-2 showed TCE at concentrations at or exceeding the MCL, with a maximum concentration of 25 µg/L detected in 2007. The Stratum 1 groundwater contamination extent during 2016 is shown in Appendix G, Figure G-2.	None
Basis of Response	The DON performed a subsurface investigation at CAOC 7 Stratum 1 in 2011. TCE, acetone, and 1,2-diochlorobenzene were detected in a soil/waste sample from beneath the landfill cap. VOCs, primarily TCE and PCE, were detected in soil vapor at concentrations up to 320 and 14 µg/L, respectively. Twenty-one other VOCs were detected in soil vapor at lower concentrations. Groundwater was contaminated with TCE, which exceeded the cleanup level between 2001 and 2010. The risk drivers are TCE in groundwater and TCE and PCE in soil vapor. There are no current receptors or completed exposure pathways for contaminated groundwater or soil vapor at this site. However, VOCs (especially TCE) are present at concentrations in soil and soil vapor that currently pose a contamination threat to groundwater.	None (no changes to identified COCs or original basis of response).
Remedial Action Objectives	The RAOs per the OU 7 ROD are: • Protect human receptors from ingestion of groundwater impacted with TCE and PCE. (Due to the depth of groundwater, ecological receptors were not identified); • Prevent the migration of COCs in groundwater at concentrations greater than the cleanup levels; and • Mitigate further impact to groundwater from TCE and PCE in soil vapor. The cleanup level for both TCE and PCE is 5 µg/L, based on the Federal/State drinking water Maximum Contaminant Levels (MCLs).	No change in RAOs.
Selected Remedy	• Soil Vapor Extraction (SVE) for the vadose zone soil with added Land Use Controls (LUCs) to protect monitoring and remedial equipment, and monitored natural attenuation (MNA) for groundwater with LUCs to prevent potable use of groundwater; • Natural attenuation will reduce groundwater VOC contamination over time to below cleanup levels through natural processes including microbial and geochemical degradation, sorption, dilution, volatilization, and dispersion; • LUCs for CAOC 7 Stratum 1 (capped area under OUs 5 and 6 ROD) are defined in the Base Master Plan (BMP) (DON 2010). The SVE and groundwater LUC for CAOC 7 Stratum 1 will be updated to incorporate specific provisions for protection of the remedial equipment and monitoring wells installed as part of the remedy; • Institutional Controls (ICs) established in the OU1 and OU2 ROD will also be maintained at the OU7 Groundwater sites to prevent potable use of the groundwater until cleanup levels are achieved (see OUs 1 and 2 ROD Section 1.4.2 [DON 1998a]). For the CAOC 7 Stratum 1 site, the groundwater LUC area was extended	None (selected remedies remain the same)

TABLE 6-4

CAOC 7 Stratum 1 (OU 7) – Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 7 Stratum 1 (OU 7 - Soil Vapor and Groundwater) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Changed Conditions Since ROD**
Selected Remedy (continued)	south and east into the MCLB Barstow Rifle Range due to the potential for southeasterly plume migration; • Monitoring: A comprehensive monitoring program will be implemented to verify that the remedy remains protective of human health and the environment. Specific monitoring program requirements are presented in Section 4.4.1 of the OU 7 ROD (DON 2014); monitoring frequency and data evaluation requirements are presented in the Final MNA Remedial Design-Remedial Action Plan (MNA RD/RA WP) (OTIE 2015a). Monitoring will continue until data evaluations demonstrate attainment of the groundwater cleanup levels; • Performance measures for the protectiveness and effectiveness of the MNA remedy are outlined in the OU 7 ROD (DON 2014). Evaluation of the MNA and LUCs protectiveness will be conducted annually; however, the overall remedy performance will first be evaluated during the five year review following the ROD signing. Both protectiveness and effectiveness will be evaluated annually thereafter; • Operation of the SVE system will be used to extract vapors from the vadose zone located below the landfill waste. Two or more SVE wells will be installed in the vadose zone located below the landfill waste. The system will be designed based on an SVE pilot study and other relevant data. The SVE design will be documented in a Remedial Design (RD)/Remedial Action (RA) work plan. Extracted vapors will be treated through granular activated carbon (GAC). The SVE system will be designed and operated, with optimization as needed to meet the groundwater RAOs; • Evaluation of the SVE remedy's effectiveness will be performed annually; and • Evaluation of MNA and LUCs protectiveness will be conducted annually; overall remedy performance will be evaluated once every five years.	
Performance Measures for MNA	Due to some uncertainties and limitations in the data available at the time of feasibility study (FS), the DON incorporated specific performance measures into the OU 7 ROD (see Appendix G of this report for details). The performance measures include a shrinking plume and decreasing trends in contaminant concentrations within the plume as key indicators that natural attenuation processes are working and the selected remedy remains effective and protective.	No change to selected performance measures

TABLE 6-4

CAOC 7 Stratum 1 (OU 7) – Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 7 Stratum 1 (OU 7 - Soil Vapor and Groundwater) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Changed Conditions Since ROD**
SVE and MNA Remedy Implementation	Additional soil vapor and groundwater monitoring wells were installed in 2011 and 2014 to achieve a total of 6 groundwater monitoring wells and four multi-level soil vapor monitoring wells at CAOC 7 Stratum 1 (OTIE 2012b; NOREAS and Trevet 2014b). • MNA groundwater monitored is performed at the CAOC 7 Stratum 1 on a semi-annual basis in accordance with the approved Sampling and Analysis Plan (SAP) (OTIE 2016). Data are reported in the annual groundwater monitoring reports (AGMRs); • The MNA RD/RA WP was finalized with FFA Stakeholder concurrence in August 2015 and provides procedures and methods for conducting the evaluations; • Annual evaluation of the protectiveness of the remedy was included in the 2015 and 2016 AGMRs (OTIE 2016, 2017). Following this Five-Year Review, both protectiveness and effectiveness of the MNA remedy will be included in future AGMRs; and • An SVE pilot study was completed in 2016 (OTIE 2017). The SVE RD/RA work plan is in progress.	Formal evaluation of the protectiveness and effectiveness of the MNA remedy at the Unit 7 was performed as part of this Five-Year Review and is presented in Appendix G.
ICs/ LUCs Implementation	ICs/LUCs implementation measures during this review period include: • The Base Master Plan (BMP) was amended in 2015 (DON 2015b) to provide a description of the history of the groundwater site, concentrations of VOCs present in groundwater; and description of the access restrictions to prevent potable use of the groundwater until cleanup levels are achieved and requiring well head treatment consistent with ICs/LUCs for groundwater established in the OUs 1 and 2 ROD (DON 1998) and OU 2 ROD (DON 2006); • Monitoring wells were surveyed and the DON's GIS database was updated so that well coordinates are available for review and planning; and • Signs were posted near the highest concentration monitoring wells to identify to identify the presence of contaminants. The first annual inspection of the ICs/LUCs implemented at the CAOC 7 Stratum 1 groundwater area was performed in 2016 and documented in the 2016 AGMR.	No changes to ICs/LUCs implementation
SVE O&M Plan	The SVE RD/RA work plan has not been completed for the CAOC 7 Stratum 1 soil vapor remedy. The completed RD/RA work plan will include a long-term operation and maintenance plan, which will be submitted for review and concurrence by the FFA.	N/A
CAOC 7 Stratum 1 – Part 2: Progress Since Last Review		
Not applicable - this is the first Five Year Review of the OU 7 remedy for CAOC 7 Stratum 1.		

TABLE 6-4

CAOC 7 Stratum 1 (OU 7) – Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 7 Stratum 1 – Part 3: Summary of Technical Assessment (Based on 2012 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
A. Is the remedy functioning as intended by the decision documents?	
SVE Technical Assessment	A pre-design SVE pilot study was completed during 2016 (OTIE 2017); the full scale SVE remedial design is in progress.
MNA Technical Assessment	• The TCE concentration trend in well NSP-2 from the time of the maximum observed concentration to the latest sampling date is consistent with natural attenuation occurring to achieve the MCL in a reasonable period of time. The TCE concentration trend in well NS7-6 was not significantly different than zero; however, the monitoring period was too short to draw conclusions; • TCE concentrations remain above the cleanup goal from well NS7-6; however, this well has only been sampled five times, so there is no clear trend has been established; • The TCE plume expanded slightly downgradient toward the east from November 2014 to November 2015, and then retreated through November 2016. This migration was likely due to increased TCE concentrations in NSP-2 from NS7-7 during 2015. However, no additional wells had TCE detections above the cleanup goal; and • The TCE plume remains localized around well NS7-6.
ICs/LUCs Technical Assessment	Current plume boundaries and COC concentrations have not migrated beyond the maintained LUCs, therefore, LUCs remain protective.
B. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	
Land-use and exposure assumptions remained unchanged since the OU 7 ROD signing. Cleanup levels for TCE and PCE were unchanged since the ROD. Therefore, the RAOs and selected remedies remain protective.	
C. Has any other information been found that could impact the protectiveness of the remedy?	
For CAOC 7 Stratum 1, no other information was identified that could call into question the protectiveness of the remedy.	
Summary of Technical Assessments	The MNA remedy cannot be fully evaluated due to limitations of the data set. To remain protective in the long-term, the SVE remedy must be implemented. The selected remedy and RAOs are still valid; no other information was identified that could impact the protectiveness of the remedy.

CAOC 7 Stratum 1 – Part 4: Current Issues (Based on 2012 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
Issues identified during the technical assessment and other five-year review activities (e.g., site inspection)	The TCE plume currently remains localized around well NS7-6 (the only well with TCE above the cleanup level). A data gap exists to the west of NS7-6, due to lack of monitoring wells. The SVE remedy should be implemented to ensure long-term protectiveness of the remedy.
Determination of whether issues affect current or future protectiveness	Current protectiveness is not affected by the identified issues because of the maintenance of ICs/LUCs as well as on-going monitoring. Future protectiveness will be better assured by implementation of the SVE remedy to prevent further degradation of the groundwater.
Discussion of unresolved concerns or items raised by support agencies and the community	*(pending comments by FFA stakeholders and community*) (Appendix H)
Other Comments, Considerations	None

TABLE 6-4

CAOC 7 Stratum 1 (OU 7) – Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC 7 Stratum 1 – Part 5: Recommendations and Follow-up Actions		
Recommendations / Follow-up Actions	**Schedule for Completion**	**Comments**
Implement the SVE portion of the remedy to reduce contaminant mass impacting groundwater at the site	Remedial Design/Remedial Action (RD/RA) Work Plan anticipated to be submitted to FFA stakeholders during 2017; SVE system implementation schedule – TBD	None
Install one or more monitoring wells to address the data gap in plume delineation along western CAOC boundary	Within next two years (during SVE remedy installation)	None

ACRONYMS:

AGMR – Annual Groundwater Monitoring Report
BMP – Base Master Plan
CAOC – CERCLA Area of Concern
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COCs – contaminants of concern
DON – Department of the Navy
FFA – Federal Facilities Agreement
GAC – granular activated carbon
ICs – institutional controls
LUCs – land use controls
MCLB – Marine Corps Logistics Base MCL – maximum contaminant level
N/A – not applicable
OU – Operable Unit
PCE - tetrachloroethene
RA – remedial action
RAO – remedial action objectives
RD – Remedial design
ROD – record of decision
SVE = soil vapor extraction
TCE – trichloroethene
VOCs – volatile organic compounds

REFERENCES:

See Section 9 of main report

Table 6-5

CAOC 10.38/10.39 Unit 7 (OU 7) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1- 7
MCLB Barstow, California

CAOC 10.38/10.39 Unit 7 (OU 7) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, and Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Changed Conditions Since ROD**
Applicable RODs	OU 7 ROD (DON 2014)	None
Site Location and Description	CAOC 10.38/10.39 Unit 7 ("Unit 7") consists of former drainage ditches that received industrial waste water flows from industrial operations in the central portion of Nebo Main Base from the 1940s through the 1970s; the ditches have been filled in and are no longer visible on the ground surface (Figure 6-1). The OU 7 remedial investigation (RI) found groundwater the Unit 7 area to be contaminated with volatile organic compounds (VOCs), including trichloroethene (TCE) and tetrachloroethene (PCE). Possible sources include former underground storage tanks and the former industrial operations located upgradient of the affected area. However, no specific soil source(s) for the groundwater contamination at Unit 7 were identified during the RI. The groundwater contamination extent at Unit 7 as of 2016 is provided in Appendix G, Figure G-1.	None
Basis of Response	The Unit 7 groundwater plume currently has no current known receptors or exposure pathways. A baseline human health risk assessment was conducted for soil and groundwater. The incremental carcinogenic human health risks at this CAOC exceeded 1 x 10^{-6}, therefore a response action was necessary to prevent exposure site contaminants. The depth to groundwater from 63 to 115 feet below ground surface (bgs). The nearest water supply well is located several thousand feet northeast of CAOC 10.38/10.39 Unit 7. The contaminants of concern (COCs) in groundwater are TCE and PCE. The sole risk at this site is potential downgradient migration of the COCs to drinking water wells at concentrations above the Maximum Contaminant Levels (MCL) of 5 µg/L. However, LUCs for the Unit 7 soils were also determined to be necessary to ensure the protection of human health and the environment.	None (no changes to identified COCs or original basis of response).
Remedial Action Objectives	The RAOs per the OU 7 ROD are: • Protect human receptors from ingestion of groundwater impacted with TCE. (Due to the depth of groundwater, ecological receptors were not identified.); • Prevent the migration of COCs in groundwater at concentrations greater than the cleanup levels; and • The selected cleanup level for both TCE and PCE is 5 µg/L (based on the state and federal drinking water MCL).	No change in RAOs.
Selected Remedy	**Monitored natural attenuation (MNA) and Land Use Controls (LUCs) to prevent exposure to soil contaminants and prevent potable use of groundwater:** • Natural attenuation will reduce groundwater VOC contamination over time to below cleanup levels through natural processes including microbial and geochemical degradation, sorption, dilution, volatilization, and dispersion; and • Institutional Controls/Land Use Controls (ICs/LUCs): The selected remedy for the Unit 7 soils is land-use controls only; see Table 6-8 for status of this portion of the remedy. For groundwater, the IC established in the OU1 and OU2 ROD will be extended and maintained to the OU 7 groundwater sites to prevent potable use of the groundwater until cleanup levels are achieved (see OUs 1 and 2 ROD Section 1.4.2 [DON 1998a]). Additionally inspections and maintenance of monitoring and	None (selected remedies remain the same)

Table 6-5

CAOC 10.38/10.39 Unit 7 (OU 7) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1- 7
MCLB Barstow, California

CAOC 10.38/10.39 Unit 7 (OU 7) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, and Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Changed Conditions Since ROD**
Selected Remedy (continued)	remedial wells must be performed and signs installed to indicate the presence of contaminants and instructions to contact the Base Environmental Division prior to digging. **Monitoring:** Additional groundwater monitoring wells will be installed, as necessary, to adequately characterize the vertical and lateral extent of the VOC plume. A comprehensive monitoring program will be implemented to verify that the remedy remains protective of human health and the environment. Specific monitoring program requirements are presented in Section 4.4.1 of the OU 7 ROD (DON 2014); monitoring frequency and data evaluation requirements are presented in the Final MNA Remedial Design-Remedial Action Plan (MNA RD/RA WP) (OTIE 2015a). Monitoring will continue until data evaluations demonstrate attainment of the groundwater cleanup levels.	
Performance Measures for MNA	Performance measures for the protectiveness and effectiveness of the MNA remedy are outlined in the OU 7 ROD (DON 2014). Evaluation of the MNA and LUCs protectiveness will be conducted annually; however, the overall remedy performance will first be evaluated during the five year review following the ROD signing. Both protectiveness and effectiveness will be evaluated annually thereafter. The performance measures include a shrinking plume and decreasing trends in contaminant concentrations within the plume as key indicators that natural attenuation processes are working and the selected remedy remains effective and protective (see Appendix G of this report for details).	No change to selected performance measures
Remedy Implementation	• Well installations were completed in 2008, 2011 and 2014 to achieve a total of 14 monitoring wells for the Unit 7 groundwater plume (OTIE 2010, Sealaska 2012, NOREAS 2014); • MNA groundwater monitored is performed at the Unit 7 site on a semiannual basis in accordance with the approved Sampling and Analysis Plan (SAP) (OTIE 2016), are reported in the annual groundwater monitoring reports (AGMRs); • The MNA RD/RA WP was finalized with FFA Stakeholder concurrence in August 2015 and provides procedures and methods for conducting the evaluation; and • Annual evaluation of the protectiveness of the remedy was included in the 2015 and 2016 AGMRs (OTIE 2016, 2017). Following this Five-Year Review, both protectiveness and effectiveness of the MNA remedy will be included in future AGMRs.	Formal evaluation of the protectiveness and effectiveness of the MNA remedy at the Unit 7 was performed as part of this Five-Year Review and is presented in Appendix G.

Table 6-5

CAOC 10.38/10.39 Unit 7 (OU 7) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1- 7
MCLB Barstow, California

CAOC 10.38/10.39 Unit 7 (OU 7) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, and Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Changed Conditions Since ROD**
ICs/ LUCs Implementation	ICs/LUCs implementation measures during this review period include: • The Base Master Plan (BMP) was amended in 2015 (DON 2015b) to provide a description of the history of the groundwater site, concentrations of VOCs present in groundwater; and description of the access restrictions to prevent potable use of the groundwater until cleanup levels are achieved and requiring well head treatment consistent with ICs/LUCs for groundwater established in the OUs 1 and 2 ROD (DON 1998) and OU 2 ROD (DON 2006); • Monitoring wells were surveyed and the DON's GIS database was updated so that well coordinates are available for review and planning; and • Signs were posted near the highest concentration monitoring wells to identify the presence of contaminants. The first annual inspection of the ICs/LUCs implemented at the Unit 7 groundwater area was performed in 2016 and documented in the 2016 AGMR.	No changes to ICs/LUCs implementation
CAOC 10.38/10.39 Unit 7 – Part 2: Progress Since Last Review		
Not applicable - this is the first five-year review of the selected remedy for CAOC 10.38/10.39 Unit 7		

CAOC 10.38/10.39 Unit 7 – Part 3: Summary of Technical Assessment (Based on 2016 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
A. Is the remedy functioning as intended by the decision documents?	
MNA remedy assessment summary	The eight MNA performance standards were evaluated for the Unit 7 groundwater; the technical assessment report for this evaluation is provided in Appendix G. The conclusions of the evaluation are: • The PCE and TCE plumes have increased in mass and areal extent, migrating slightly downgradient toward well 10.38 D17-5. PCE and TCE plume areas have increased by 20 and 4%, respectively, since 2014. However, there is no observable trend of COC concentrations increasing in monitoring wells outside the PCE-TCE plume boundaries. Although both the PCE and TCE plumes have increased, they remained localized around two (PCE) or three (TCE) wells with the center of mass moving slightly downgradient toward well 10.38-D17-5; • Natural attenuation of neither TCE nor PCE is occurring according to expectations; a remedial time line to meet the RAOs could not be projected on the basis of the available data; • PCE concentrations remain above the cleanup level in two of the 14 monitoring wells; and TCE concentrations remain above the cleanup level in three of the 14 monitoring wells and no exposure pathway exists; • The overall conclusion is that natural attenuation is not occurring, however the downgradient monitoring wells remain below cleanup levels. Plume migration and COC concentrations remain localized and no exposure pathway exists downgradient, or outside the current LUCs; • All other performance standards for the remedy were met; • Based on the evaluation, the remedy is functioning as intended for the protectiveness performance standard; however, the remedy does not appear to be functioning as intended for the effectiveness performance standard; • Monitoring and reporting costs: Since the OU 7 site monitoring and reporting is incorporated into the OUs 1 and 2 monitoring program, the costs are

Table 6-5

CAOC 10.38/10.39 Unit 7 (OU 7) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1- 7
MCLB Barstow, California

CAOC 10.38/10.39 Unit 7 – Part 3: Summary of Technical Assessment (Based on 2016 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
MNA remedy assessment summary (continued)	not separated out. The O&M and monitoring costs are presented in Table 4-3 for Nebo Main Base; • Opportunities for Optimization: The remedy may be optimizable if the source area was known and addressed (if practicable); and • Early indicators of potential remedy problems: See statement on remedy effectiveness above.
ICs/LUCs assessment summary	No land use changes were observed during the review period. Current plume boundaries and COC concentrations have not migrated beyond the maintained LUCs; therefore, the ICs/LUCs remain protective.
B. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	
Land-use and exposure assumptions remained unchanged since signing of the OU 7 ROD. Cleanup levels for groundwater (MCLs) including for TCE and PCE were unchanged since the 2014 ROD. Therefore, the RAOs and selected remedies remain protective.	
C. Has any other information been found that could affect the protectiveness of the remedy?	
For CAOC 10.38/10.39 Unit 7, no other information was identified that could affect the protectiveness of the remedy.	
Summary of Technical Assessments	The selected remedy and RAOs for CAOC 10.38/10.39 Unit 7 are still valid and are performing as intended for protectiveness, but not effectiveness to date. Lack of identification of the source feeding the Unit 7 area plume could affect long-term protectiveness of the remedy.

CAOC 10.38/10.39 Unit 7 – Part 4: Current Issues (Based on 2016 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
Issues identified during the technical assessment and other five-year review activities (e.g., site inspection)	The source of the CAOC 10.38/10.39 Unit 7 groundwater plume remains undefined. Based on the available data, the natural attenuation remedy does not appear to be effective; however, the remedy does remain protective.
Determination of whether issues affect current or future protectiveness	Current protectiveness is not affected by the identified issues because of the maintenance of ICs/LUCs and the on-going monitoring. Long-term effectiveness may be impacted by lack of information on the source(s) of the plume.
Discussion of unresolved concerns or items raised by support agencies and the community	*(Pending comments from FFA Stakeholders and community) Appendix H*
Other Comments, Considerations	Solvent releases from the former UST T-197 (industrial wash rack UST, removed) occurred upgradient of the Unit 7 groundwater plume; however, the UST is not considered a source of the Unit 7 groundwater based on non-detect intervening monitoring wells. However, continued monitoring and assessment of groundwater quality at the UST T-197 site should be considered during evaluation of MNA remedy at Unit 7.

Table 6-5

CAOC 10.38/10.39 Unit 7 (OU 7) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1- 7
MCLB Barstow, California

CAOC 10.38/10.39 Unit 7 – Part 5: Recommendations and Follow-up Actions		
Recommendations / Follow-up Actions	**Schedule for Completion**	**Comments**
Install additional monitoring wells to improve the MNA monitoring network and to support future MNA performance evaluations.	Within next 5 years	Recommend new well(s) between existing wells DS17-9 and NSP-6 to improve the western plume delineation.
Investigate the source area(s) at CAOC 10.38/10.39 Unit 7 to facilitate future remedy evaluations and ensure long-term protectiveness.	Within next 5 years	

ACRONYMS:

AGMR – Annual Groundwater Monitoring Report
BMP – Base Master Plan
CAOC – CERCLA Area of Concern
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COCs – contaminants of concern
DON – Department of the Navy
FFA – Federal Facilities Agreement
ICs – institutional controls
LUCs – land use controls
MCLB – Marine Corps Logistics Base
MCL – maximum contaminant level
N/A – not applicable
OU – Operable Unit
PCE – tetrachloroethene
RA – remedial action
RAO – remedial action objectives
ROD – record of decision
TCE – trichloroethene

REFERENCES:

See Section 9 of main report

TABLE 6-6

NPZ-14 Groundwater Area (OU 7) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

NPZ-14 Groundwater Area (OU 7) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Status, and current site conditions		
	Original Conditions, Investigations, and Responses	**Changed Conditions Since ROD**
Applicable RODs	OU 7 ROD (DON 2014)	None
Site Location and Description	NPZ-14 was initially was a single groundwater monitoring well located in a relatively isolated area of the southern part of the Nebo Main Base (Figure 6-1); this area was formerly used to store military equipment from the 1950s to 1965. Monitoring well NPZ-14 was installed in 1992 and added to the OU 2 groundwater monitoring program in 1998. Trichloroethene (TCE) was detected in groundwater from NPZ-14 at concentrations above the cleanup level since 1999. Six additional wells were installed in 2011 and 2012 to further delineate the impacted area. The TCE plume extent and concentrations as of 2016 are shown on Appendix G, Figure G-1.	None
Basis of Response	The NPZ-14 groundwater area currently has no current known receptors or exposure pathways. No human health risk assessment was conducted for this area. The depth to groundwater is approximately 143 feet. The contaminant of concern is trichloroethene (TCE). The sole risk is potential downgradient migration of the contaminant of concern (TCE) to drinking water wells at concentrations above the Maximum Contaminant Levels (MCL) of 5 µg/L.	None (no changes to identified COCs or original basis of response).
Remedial Action Objectives, Cleanup Level	The RAOs per the OU 7 ROD are: • Protect human receptors from ingestion of groundwater impacted with TCE. (Due to the depth of groundwater, ecological receptors were not identified.); • Prevent the migration of COCs in groundwater at concentrations greater than the cleanup levels; and • The selected cleanup level for TCE is 5 µg/L (based on the state and federal drinking water MCL).	No change in RAOs or cleanup level
Selected Remedy Selected Remedy (continued)	Monitored natural attenuation (MNA) and Land Use Controls (LUCs) to prevent potable use of groundwater. Natural attenuation will reduce groundwater VOC contamination over time to below cleanup levels through natural processes including microbial and geochemical degradation, sorption, dilution, volatilization, and dispersion. • **Institutional Controls/Land Use Controls (ICs/LUCs):** the groundwater IC established in the OU1 and OU2 ROD will be extended and maintained to the OU 7 groundwater sites to prevent potable use of the groundwater until cleanup levels are achieved (see OUs 1 and 2 ROD Section 1.4.2 [DON 1998a]). Additionally inspections and maintenance of monitoring and remedial wells must be performed and signs installed to indicate the presence of contaminants and instructions to contact the Base Environmental Division prior to digging; and • **Monitoring:** A comprehensive monitoring program will be implemented to verify that the remedy remains protective of human health and the environment. Specific monitoring program requirements are presented in Section 4.4.1 of the OU 7 ROD (DON 2014); monitoring frequency and data evaluation requirements are presented in the Final MNA Remedial Design-Remedial Action Plan (MNA RD/RA WP) (OTIE 2015a). Monitoring will continue until data evaluations demonstrate attainment of the groundwater cleanup levels.	None (selected remedies remain the same)

TABLE 6-6

NPZ-14 Groundwater Area (OU 7) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

NPZ-14 Groundwater Area (OU 7) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Status, and current site conditions		
	Original Conditions, Investigations, and Responses	**Changed Conditions Since ROD**
	Performance measures for the protectiveness and effectiveness of the MNA remedy are outlined in the OU 7 ROD (DON 2014). Evaluation of the MNA and LUCs protectiveness will be conducted annually; however, the overall remedy performance will first be evaluated during the five year review following the ROD signing. Both protectiveness and effectiveness will be evaluated annually thereafter.	
Performance Measures for MNA	Due to some uncertainties and limitations in the data available at the time of feasibility study (FS), the DON incorporated specific performance measures into the OU 7 ROD (see Appendix G of this report for details). The performance measures include a shrinking plume and decreasing trends in contaminant concentrations within the plume as key indicators that natural attenuation processes are working and the selected remedy remains effective and protective.	No change to selected performance measures
Remedy Implementation	• Additional well installations were completed in 2011-2012 and 2014 to achieve a total of 8 monitoring wells for the NPZ-14 area (OTIE 2011, 2012b; NOREAS 2014b); • MNA groundwater monitored is performed at the NPZ-14 site on a semi-annual basis in accordance with the approved Sampling and Analysis Plan (SAP) (OTIE 2016). Data are reported in the annual groundwater monitoring reports (AGMRs); • The MNA RD/RA WP was finalized with FFA Stakeholder concurrence in August 2015 and provides procedures and methods for conducting the evaluation; and • Annual evaluation of the protectiveness of the remedy was included in the 2015 and 2016 AGMRs (OTIE 2016 2017). Following this Five-Year Review, both protectiveness and effectiveness of the MNA remedy will be included in future AGMRs.	Formal evaluation of the protectiveness and effectiveness of the MNA remedy at the NPZ-14 Groundwater Area was performed as part of this Five-Year Review and is presented in Appendix G.
ICs/ LUCs Implementation	ICs/LUCs implementation measures during this review period include: • The Base Master Plan (BMP) was amended in 2015 (DON 2015b) to provide a description of the history of the groundwater site, concentrations of VOCs present in groundwater; and description of the access restrictions to prevent potable use of the groundwater until cleanup levels are achieved and requiring well head treatment consistent with ICs/LUCs for groundwater established in the OUs 1 and 2 ROD (DON 1998) and OU 2 ROD (DON 2006); • Monitoring wells were surveyed and the DON's GIS database was updated so that well coordinates are available for review and planning; and • Signs were posted near the highest concentration monitoring wells to identify to identify the presence of contaminants. The first annual inspection of the ICs/LUCs implemented at the NPZ-14 groundwater area was performed in 2016 and documented in the 2016 AGMR.	
NPZ-14 Groundwater Area – Part 2: Progress Since Last Review		
Not applicable - this is the first five-year review of the selected remedy for NPZ-14 Groundwater Area.		

TABLE 6-6

NPZ-14 Groundwater Area (OU 7) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

NPZ-14 Groundwater Area – Part 3: Summary of Technical Assessment (Based on 2012 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
A. Is the remedy functioning as intended by the decision documents?	
MNA remedy technical assessment summary	The eight MNA performance standards were evaluated for the NPZ-14 Groundwater Area; the technical assessment report for this evaluation is provided in Appendix G. The conclusions of the evaluation are: • The TCE plume expanded slightly to the northeast from November 2014 through May 2016, before shrinking back in November 2016. However, with the expansion, no downgradient wells showed TCE detections above the cleanup level. • The TCE plume remains localized around wells NC-1, NC-6, and NPZ-14, with the center of mass moving slightly downgradient toward well NPZ-14. Migration beyond the non-detect downgradient wells is not suspected. • The overall average of the TCE plume concentration has decreased through 2016 and no exposure pathway exists. • Although the TCE concentration in well NPZ-14 is decreasing, the conservative projection is that the cleanup goal will be reached by 2087 (80 years). The TCE concentration was not changing in well NC-6 and increased in well NC 1. • The overall conclusion is that natural attenuation is not occurring at a rate that would attain the cleanup goal within a "reasonable" period of time. A "reasonable" cleanup time frame may be similar to what the DON had assumed for the OU 1 groundwater plumes, which was 30 years (see OUs 1 and 2 ROD). • All other performance standards for the remedy were met. Based on the evaluation, the remedy is functioning as intended for the protectiveness performance standard; however, the remedy does not appear to be functioning as intended for the effectiveness performance standard. Monitoring and reporting costs: Since the OU 7 site monitoring and reporting is incorporated into the OUs 1 and 2 monitoring program, the costs are not separated out. The O&M and monitoring costs are presented in Table 4-3 for Nebo Main Base. Opportunities for Optimization: The remedy may be optimizable if the source area was known and addressed (if practicable). Early indicators of potential remedy problems: See statement on remedy effectiveness above.
ICs/LUCs Remedy	The ICs and LUCs implemented during this review period are functioning as intended.
B. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	
Land-use and exposure assumptions remained unchanged since the ROD signing in 2014. Cleanup levels for groundwater (MCLs) were unchanged since the 2014 ROD. Therefore, the RAOs and selected remedies remain protective.	
C. Has any other information been found that could impact the protectiveness of the remedy?	
For the NPZ-14 Groundwater Area, no other information was identified that impact the protectiveness of the remedy.	
Summary of Technical Assessments	The selected remedy and RAOs for NPZ-14 Groundwater Area are still valid and are performing as intended for protectiveness, but not effectiveness to date. Lack of identification of the source feeding the NPZ-14 area plume could affect long-term protectiveness of the remedy.

TABLE 6-6

NPZ-14 Groundwater Area (OU 7) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

NPZ-14 Groundwater Area – Part 4: Current Issues (Based on 2012 – 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
Issues identified during the technical assessment and other five-year review activities (e.g., site inspection)	The source of the NPZ-14 area plume remains undefined. The estimated time for meeting the groundwater cleanup levels, as currently estimated, may not be reasonable.
Determination of whether issues affect current or future protectiveness	Current protectiveness is not affected by the identified issues because of the maintenance of the ICs/LUCs and on-going monitoring. Long-term protectiveness is less certain with the source area undefined.
Discussion of unresolved concerns or items raised by support agencies and the community	(*Pending comments from FFA Stakeholders and community*)
Other Comments, Considerations	none

NPZ-14 Groundwater Area – Part 5: Recommendations and Follow-up Actions		
Recommendations / Follow-up Actions	**Schedule for Completion**	**Comments**
Investigate the source(s) of the NPZ-14 plume by conducting additional soil vapor and groundwater sampling in the area upgradient of the defined plume.	Within the next five years	

ACRONYMS:

AGMR – Annual Groundwater Monitoring Report
BMP – Base Master Plan
CAOC – CERCLA Area of Concern
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COCs – contaminants of concern
DON – Department of the Navy
FFA – Federal Facilities Agreement
ICs – institutional controls
LUCs – land use controls
MCLB – Marine Corps Logistics Base
MCL – maximum contaminant level
N/A – not applicable
OU – Operable Unit
RA – remedial action
RAO – remedial action objectives
ROD – record of decision
TCE – trichloroethene

REFERENCES:

See Section 9 of main report

TABLE 6-7

CAOC 10 and CAOC N-2 Area 1 (OU 7) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOCs 10 and N-2 Area 1 (OU 7) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Status, and Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Changed Conditions Since ROD (signed December 2014)**
Applicable RODs	OU 7 ROD (DON, 2014)	None
Site Location and Description	CAOC 10 was originally investigated in 1994 as part of OU 6 based on verbal information given from former MCLB Barstow personnel describing the disposal of sodium filled valves and other hazardous material. The investigation failed to find evidence of buried waste; however, in 2000, during the construction of a cap for the CAOC 35 landfill, sodium-filled valves were reportedly discovered while excavating from a borrow area at the current location of CAOC 10 in the southwest corner of the Nebo Main Base. Other solid wastes were discovered during the excavation included metal debris and an unidentified canister. CAOC 10 consists of buried metallic and other wastes under a graded soil cover within the approximately 5-acre area as shown in Figure 6-5. No groundwater samples were collected during the RI or Supplemental RI. GW samples were previously collected (1992 through 1995) from two monitoring wells located near the current location of CAOC as part of the OUs 1 and 2 RI. Detected concentrations of VOCs, SVOCs, and metals did not exceed their respective MCLs. CAOC N-2 Area 1 is an approximate 17-acre area in the southern portion of the Nebo Main Base (Figure 6-6). Military equipment was stored at a portion of CAOC N-2 Area 1 from the early 1950's until 1966. During the equipment storage period, waste oil containing PCBs was spread for dust suppression, contaminating some soil areas in the southern part of the site. During operation of the skeet and trap range, lead shot and fragments of clay targets were deposited on the ground. The clay targets contained PAHs in the tar used in their manufacture (DON 2014).	None
Basis of Response	**CAOC 10** • Soil sampling results indicated five metals (arsenic, iron, selenium, sodium, zinc, and lead) were detected at concentrations above background levels or U.S. EPA RSLs. Soil sampling results identified low levels of VOCs, SVOCs, herbicides, dioxins and dibenzofurans, PCBs, and pesticides that were below RSLs. Results of the human health and ecological risks assessment indicated that contaminants detected in soil and soil gas do not pose a significant risk, with the exception of lead in surface soil in a relatively small surface hot spot area. **CAOC N-2 Area 1** • Soil sampling results indicated PCB and PAH concentrations exceed acceptable exposure levels (transported as airborne fugitive dust). Ecological risk at CAOC N-2 Area 1 is unlikely. However, this CAOC poses potential risk to granivorous birds that ingest grit and that may ingest lead shot pellets or fragments of pellets. Therefore , ecological exposure risk was considered during the remedy selection for CAOC N-2 Area 1	None

TABLE 6-7

CAOC 10 and CAOC N-2 Area 1 (OU 7) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOCs 10 and N-2 Area 1 (OU 7) – Part 1: Review of Site Status, Remedial Action Objectives, Selected Remedies, Implementation, Status, and Current Site Conditions		
	Original Conditions, Investigations, and Responses	**Changed Conditions Since ROD (signed December 2014)**
Remedial Action Objectives	**CAOC 10** • Protect maintenance workers and trespassers from unacceptable risks due to ingestion of and direct contact with soil containing lead. **CAOC N-2 Area 1** • Protects granivorous birds that ingest grit from unacceptable risks due to ingestion of lead shot pellets or fragments on the surface soil; and • Protect maintenance workers and trespassers from unacceptable risks due to ingestion of fugitive dust and direct contact with soil containing lead, PAHs (benzo[a]pyrene and dibenz[a,h]anthracene), and PCBs (specifically Aroclor 1016 and Aroclor 1254.	None
Selected Remedy	**CAOC 10:** • Removal of impacted soil in delineated area identified in the ROD as a soil lead "*hot spot*"; and • Install LUC signage, annual inspections, maintenance of surface drainage and erosion control; amend Base Master Plan with LUCs, and update DON GIS database with surveyed CAOC boundaries. **CAOC N-2 Area 1** • Conduct surface vacuuming of lead and shot clay target material, dispose off-site; • Removal and disposal of PCB impacted soil areas; and • Install LUC signage, annual inspection, amend Base Master Plan with LUCs, and update DON GIS database with surveyed CAOC boundaries.	At both CAOC 10 and N-2 Area 1, LUC signage was installed during 2015. The remedial design for soil cleanup actions at both sites is pending.
Remedy Implementation	• **CAOC 10:** The impacted soil" hot-spot" removal had not yet been implemented. • **CAOC N-2 Area 1:** The DON is considering a ROD amendment for the soil cleanup action at CAOC N-2 Area 1.	None
RA Operations/ O&M / Monitoring	Maintain current LUCs including signage. Once RA is implemented, develop long-term O&M and monitoring plan	None
ICs/LUC	Land use restrictions have been placed on CAOC 10 and CAOC N-2 Area 1. These CAOCs require the Base Environmental Division to review prior to any land use change.	None
CAOCs 10 and N-2 Area 1 – Part 2: Progress Since Last Review		
Not applicable – this is the first Five-Year Review for both CAOCs 10 and N-2 Area 1.		

TABLE 6-7

CAOC 10 and CAOC N-2 Area 1 (OU 7) - Nebo Main Base – Five Year Review Summary
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOCs 10 and N-2 Area 1 – Part 3: Technical Assessment (Based on 2014-2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
A. Is the remedy functioning as intended by the decision documents?	
The LUC portion of remedy is functioning as intended; other parts of the remedy have not yet been implemented at the two CAOCs.	
B. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	
There have been no changes to the exposure assumptions, toxicity data, cleanup levels, and RAOs since the ROD was signed in 2014.	
C. Has any other information been found that could impact the protectiveness of the remedy?	
No	
Summary Of Technical Assessments	Until the remedies are fully implemented at both CAOC 10 and CAOC N-2 Area 1, the exposure issues identified in the OU 7 ROD will not be addressed.

CAOCs 10 and N-2 Area 1 – Part 4: Issues (Based on 2014 - 2017 Data, Site Inspection, Review of Relevant Documents, and Interviews)	
CAOC 10	No issues identified during site inspection or interviews
CAOC N-2 Area 1	No issues identified during site inspection or interviews
Other Comments, Considerations	None

CAOCs 10 and N-2 Area 1 – Part 5: Recommendations and Follow-up Actions		
Recommendations / Follow-up Actions	**Schedule for Completion**	**Comments**
Implement the selected remedies.	Anticipated within next three years	None

ACRONYMS:
BMP – Base Master Plan
CAOC – CERCLA Area of Concern
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COCs – contaminants of concern
DON – Department of the Navy
EPA – Environmental Protection Agency
FFA – Federal Facilities Agreement
ICs – institutional controls
LUCs – land use controls
MCLB – Marine Corps Logistics Base
O&M – Operation and Maintenance
OU – Operable Unit
RA – remedial action
RAO – remedial action objectives
ROD – record of decision
References: See Section 9 of main report

Table 6-8

Review of CAOCs with Land Use Controls Only – Nebo Main Base
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC Description	Land Use Controls[1,2]	2012 – 2017 Status
CAOC 2 (OU 4) (Figure 6-9)		
CAOC 2 is a former Pesticide Storage and Washout Area located on the north side of the Nebo Main Base. Soil samples indicated the presence of DDT and its breakdown products, DDE and DDD, in addition to various other pesticide and herbicide compounds with relatively low potential for vertical migration or subsurface transport of contaminants due to the silty and clayey soils. Dieldrin concentrations were the only ones to exceed the residential soil risk-based criteria (RBCs). Fourteen metals exhibited concentrations that were statistically above background concentrations. All metals except thallium and lead were considered to be naturally occurring. Thallium and lead were considered potential site-related contaminants because they were commercially used in insecticides prior to 1965. A time-critical removal action was conducted at CAOC 2 in 1994, during which 318 tons of soil were excavated and removed for off-site disposal. The selected remedy in the OUs 3 and 4 ROD (DON 1997) was LUCs and groundwater monitoring for dieldrin. Groundwater was monitored for the pesticide dieldrin from 1998 until 2008 when it was discontinued with FFA stakeholder concurrence.	**Total CAOC area/LUC area:** 1.87 acres A LUCs only remedy was selected for CAOC 2 in the OUs 3 and 4 ROD (DON, 1997) due to the low levels of pesticides in surface soils. The LUCs documented in the 2010 BMP Amendment (DON 2010) include a stipulation that any actions or changes in site use will be reviewed by the Environmental Division.	No actions were undertaken at CAOC 2 during this review period.
CAOC 5 (OU 4) (Figure 6-9)		
CAOC 5, the Chemicals Storage Area, is located in the southeastern portion of the Nebo Main Base, south of Joseph Boll Avenue. A variety of low-concentration contaminants in soil were present throughout the site including VOCs, SVOCs, OCPs, phenol, PCBs, TPH, PAHs, and metals. Mathematical modeling indicated that soil contamination would not impact to groundwater. The selected remedy was LUCs only, as documented in the OUs 3 and 4 ROD (DON, 1997).	**Total CAOC area:** 47.7 acres **LUC areas:** Stratum 1 (28.43 acres), Stratum 2 (15.23 acres) A LUCs only remedy was selected for CAOC 5 in the OUs 3 and 4 ROD (DON, 1997) due to the low levels of pesticides in surface soils and the presence of desert mix/dust suppression material. The LUCs documented in the 2010 BMP Amendment (DON 2010) include a stipulation that any actions or changes in site use will be reviewed by the Environmental Division.	CAOC 5 site has been used for equipment storage since 2009, with Environmental Division review and approval.
CAOC 1 (OU 6) (Figure 6-9)		
CAOC 1 is a closed landfill located north of the golf course in the northern portion of the Nebo Main Base. Non-detectable or low concentrations of VOCs, SVOCs, OCPs, PCBs, metals, cyanide, and TPH-d were present in the samples collected at this site. A LUCs only remedy was selected for CAOC 1, as documented by the OUs 5 and 6 ROD (DON, 1998b). Groundwater was monitored for the pesticide dieldrin from 1998 until 2008 when it was discontinued with FFA stakeholder concurrence.	**Total CAOC area/LUC area:** 38.09 acres A LUCs only remedy was selected for CAOC 1 in the OUs 5 and 6 ROD (DON, 1998b) due to the low levels of pesticides and PAHs in surface soils. The LUCs documented in the 2010 BMP Amendment (DON 2010) include a stipulation that any actions or changes in site use will be reviewed by the Environmental Division.	No actions were undertaken at CAOC 1 during of this review period.

Table 6-8

Review of CAOCs with Land Use Controls Only – Nebo Main Base
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC Description	Land Use Controls[1,2]	2012 – 2017 Status
CAOC 3 (OU 6) (Figure 6-9)		
CAOC 3 is a former Wastewater Disposal Area located in the northern portion of the Nebo Main Base, adjacent to the southern boundary of CAOC 1. A LUCs only remedy was selected for CAOC 3, as documented by the OUs 5 and 6 ROD (DON, 1998b). Soil contaminants included VOCs, SVOCs, several pesticides, and extractable petroleum hydrocarbons. All detected metals present were believed to be naturally occurring or present at concentrations of minor concern from a human health perspective. Mathematical modeling performed at CAOC 3 indicated that residual dieldrin in the soil could migrate to the groundwater at concentrations that would contaminate or degrade the aquifer. The selected remedy in the OUs 5 and 6 ROD (DON 1998) was LUCs and groundwater monitoring for dieldrin. Groundwater monitoring for dieldrin was performed from 1998 until 2008, after which it was discontinued with FFA stakeholder concurrence.	**Total CAOC area:** 64.9 acres **LUC area:** Stratum 1 (39.31 acres) A LUCs only remedy was selected for CAOC 3 in the OUs 5 and 6 ROD (DON, 1998b) due to the low levels of pesticides in surface soils. The LUCs documented in the 2010 BMP Amendment (DON 2010) include a stipulation that any actions or changes in site use will be reviewed by the Environmental Division.	No actions were undertaken at CAOC 3 during of this review period.
CAOC 7 Strata 3 and 4 (OU 6) (Figure 6-9)		
CAOC 7, located in the southern portion of Nebo Main Base, was operated as the principal solid waste landfill for the Base from the early 1950s to 1964. Stratum 3 is a drum storage and spillage area identified during the aerial photograph review measuring approximately 900 by 900 feet. Stratum 4 is the former playground area next to the former amphibious vehicle test pond also known as the "fish pond." The playground next to the fish pond was identified as a sampling stratum because of the potential impact to the area from landfill activities. However, the recreation equipment has since been removed, thus minimizing the exposure potential in this area. CAOC 7 Strata 1 and 2 are under landfill covers and are reviewed in in Table 6-3 of this report	**Total CAOC area:** 30.7 acres **LUC area:** Stratum 3 (17.41 acres), Stratum 4 (0.14 acres) A LUCs only remedy was selected for CAOC 7 Strata 3 and 4 in the OUs 5 and 6 ROD (DON, 1998b) due to the low levels of PCBs in soils. The LUCs documented in the 2010 BMP Amendment (DON 2010) include a stipulation that any actions or changes in site use will be reviewed by the Environmental Division.	No actions were undertaken at CAOC 7 Strata 3 and 4 during this review period.
CAOC 11 (OU 6) (Figure 6-9)		
CAOC 11, the Fuel Burn Area, is located in the southwest portion of the Nebo Main Base between I-40 to the north and the Base boundary to the south. Soil sample analysis indicated the presence of SVOCs, pesticides, TPH, and total recoverable petroleum hydrocarbons (TRPH). Mathematical modeling indicated that soil contamination would likely not impact groundwater. A LUCs only remedy was selected for CAOC 11, as documented in the OUs 3 and 4 ROD (DON, 1997).	**Total CAOC area/LUC area:** 3.49 acres A LUCs only remedy was selected for CAOC 7 Strata 3 and 4 in the OUs 5 and 6 ROD (DON, 1998b) due to the low levels of pesticides in soils. The LUCs documented in the 2010 BMP Amendment (DON 2010) include a stipulation that any actions or changes in site use will be reviewed by the MCLB Barstow Environmental Division.	No actions were undertaken at CAOC 11 during of this review period.
CAOC 14 (OU 6) (Figure 6-9)		
CAOC 14 consists of the three major storm water drainage channels comprising the Nebo Main Base surface drainage system and four outfalls that discharge into the Mojave River.	**Total CAOC area:** 24.8 acres **LUCs area:** Stratum 1 – 13.72 acres, Stratum 2 – 0.62 acres, Stratum 3 – 0.35 acres, Stratum 4 – 0.25 acres.	No actions were undertaken at CAOC 14 during of this review period.

Table 6-8

Review of CAOCs with Land Use Controls Only – Nebo Main Base
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MCLB Barstow, California

CAOC Description	Land Use Controls[1,2]	2012 – 2017 Status
During the remedial investigation of CAOC 14, each channel and outfall was inspected and sampled. Samples were analyzed for VOCs, SVOCs, OCPs, PCBs, metals, cyanide, and TPH-d. Soil contamination was not identified at levels of concern for human health risk. The potential for impacts to groundwater from CAOC 14 was evaluated by mathematical modeling, which indicated that groundwater concentration of each of the detected soil contaminants would be below their respective RBCs and maximum contaminant levels (MCLs), except for dieldrin and gamma-chlordane in the northern portion of Nebo. To address this uncertainty, pesticides were monitored under OU 2. Groundwater monitoring and LUCs were selected for CAOC 14, as documented in the OUs 5 and 6 ROD (DON, 1998b). Groundwater monitoring was performed from 1998 until 2008, after which it was discontinued with FFA stakeholder concurrence.	A LUCs only remedy was selected for CAOC 7 Strata 3 and 4 in the OUs 5 and 6 ROD (DON, 1998b) due to the low levels of pesticides in soils. The LUCs documented in the 2010 BMP Amendment (DON 2010) include a stipulation that any actions or changes in site use will be reviewed by the MCLB Barstow Environmental Division.	
CAOC 10.27 (OU 7) (Figure 6-10)		
Building S-338 (CAOC 10.27) was constructed in the early 1940s and used for crane repair until the 1960s. It was modified and used for fire-fighting training activities until 1975. Materials such as wood and scrap metal were sprayed with small amounts of used oil or waste fuel and burned. Wastewater generated from fire-fighting activities was collected by a drainpipe that discharged onto the unpaved railroad right-of-way immediately north of the building. The site is currently partially paved with asphalt and generally unused except for temporary equipment storage and staging. Soil sampling results indicate that arsenic concentrations exceeded residential and industrial RSLs. The elevated arsenic concentrations are considered normal for the region and not CAOC-related.	**Total CAOC area/LUC area:** 0.27 acres A LUCs only remedy was selected for CAOC 10.27 in the OU 7 ROD (DON 2014) due to the presence of low levels of metals, PAHs, dioxins and furans in soils. The LUCs documented in the 2015 BMP Amendment (DON 2015) include: • A stipulation that any actions planned in these areas or changes in site use should be coordinated and reviewed by the MCLB Barstow Environmental Division. • Signage must be placed at site boundaries indicating the presence of contaminants and instructions to contact the MCLB Barstow Environmental Division prior to digging.	LUC signs were installed during 2015. No actions were undertaken at CAOC 10.27 during of this review period.
CAOC 10.35 (OU 7) (Figure 6-10)		
CAOC 10.35 is the Former Domestic Wastewater Treatment Plant located in the northern part of Nebo Main Base and operated form 1942 until approximately 1978. The DWTP initially consisted of a pumping station, one combination clarifier-digester (clarigester), a sludge drying bed, and four effluent disposal ponds. The four effluent ponds were converted into two ponds 1948. In 1952, a second clarigester and three off-site oxidation ponds were added. In 1957, a grit chamber was added to the system. Soil sample results for CAOC 10.35 indicate that RSLs were exceeded only for Aroclor-1260, dieldrin, and arsenic (naturally occurring). The nature and extent	**Total CAOC area/LUC area:** 0.78 acres A LUCs only remedy was selected for CAOC 10.35 in the OU 7 ROD (DON 2014) due to the presence of low levels of pesticides and PCBs in soils. The LUCs documented in the 2015 BMP Amendment (DON 2015) include: • Any actions planned in these areas or changes in site use should be coordinated and reviewed by the MCLB Barstow Environmental Division. • Signage must be placed at site boundaries indicating the presence of contaminants and instructions to contact the MCLB Barstow	LUC signs were installed during 2015. No actions were undertaken at CAOC 10.35 during of this review period.

Table 6-8

Review of CAOCs with Land Use Controls Only – Nebo Main Base
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC Description	Land Use Controls[1,2]	2012 – 2017 Status
of contaminants were defined. VOCs were not detected in the groundwater sample collected from CAOC 10.35. The selected remedy in the OU 7 ROD (DON 2014) was LUCs only.	Environmental Division prior to digging.	
CAOC 10.37 (OU 7) (Figure 6-10)		
CAOC 10.37 is the former industrial wastewater treatment plant (IWTP) in the northern part of Nebo Main Base and constructed in 1975 to treat wastewater from industrial operations such as painting, cleaning, preservation and packaging, steam cleaning, and vehicle maintenance. Plant operations were discontinued in March 1990. CAOC 10.37 includes a wet well, five evaporation ponds, two sludge drying beds, an air flotation unit, a tank for ferrous chloride, a waste oil float tank, and a concrete pad with a drain connected to a wet well. TPH as diesel and TPH as motor oil were detected in shallow soil (0 to 10 feet bgs) at concentrations generally decreasing with depth. PAHs were detected in soil above RSLs at a maximum depth of 5 feet bgs. Acetone, PCE, TCE, and chloroform were detected in soil vapor in the northern area of evaporation basin, and fuel-related VOCs were detected in soil vapor at five locations across the CAOC at depths to 20 feet bgs. Chloroform was also detected in soil vapor samples from several borings north of Evaporation Basin 5 and along the southern boundary of CAOC 10.37.	**Total CAOC area/LUC area:** 4.92 acres A LUCs only remedy was selected for CAOC 10.37 in the OU 7 ROD (DON 2014) due to the presence of low levels of metals, PAHs, and VOC in soil and VOCs in soil vapor. The LUCs documented in the 2015 BMP Amendment (DON 2015) include: • Any actions planned in these areas or changes in site use should be coordinated and reviewed by the MCLB Barstow Environmental Division. • Signage must be placed at site boundaries indicating the presence of contaminants and instructions to contact the MCLB Barstow Environmental Division prior to digging.	LUC signs were installed during 2015. No actions were undertaken at CAOC 10.37 during of this review period.
CAOC 10.38/10.39 Units 1 – 7 (soils) (OU 7) (Figure 6-10)		
CAOCs 10.38/10.39 Units 1 – 6 were industrial and domestic wastewater pipelines. Unit 7 consisted of surface drainage ditches that received industrial waste water. Suspected leaks from subsurface pipelines and infiltration from the surface drainages were investigated during the remedial investigation. Currently, industrial wastewater lines are no longer in use; however, domestic waste waterlines continue to be used. There are no completed pathways identified and the proposed action is LUCs. CAOC 10.38/10/39 Unit 1 – 6 are subsurface conveyance lines, typically under pavement or buildings. The former drainage ditches at Unit 7 have been backfilled with soil and are no longer visible at the surface.	**Total CAOC area/LUCs area**: 17 acres A LUCs only remedy was selected for CAOC 10.38/10.39 Unit 1-7 (soils) in the OU 7 ROD (DON 2014) due to the presence of low levels of metals in soils. The LUCs documented in the 2015 BMP Amendment (DON 2015) include: • Any actions planned in these areas or changes in site use should be coordinated and reviewed by the MCLB Barstow Environmental Division. • Signage must be placed at site boundaries indicating the presence of contaminants and instructions to contact the MCLB Barstow Environmental Division prior to digging.	
CAOC 10.3 (OU 7) (Figure 6-10)		
CAOC 10.3 consists of Warehouse 2, a general warehouse at Nebo Main Base. The warehouse was constructed in 1942, and encompasses an area of approximately 600 by 200 feet or 2.9 acres. Warehouse 2 was generally used	**Total CAOC area/LUC area:** 5.57 acres A LUCs only remedy was selected for CAOC 10.3 in the OU 7 ROD (DON 2014) due to the presence of low levels of VOCs in groundwater beneath	LUC signs were installed during 2015. No actions were undertaken

Table 6-8

Review of CAOCs with Land Use Controls Only – Nebo Main Base
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MCLB Barstow, California

CAOC Description	Land Use Controls[1,2]	2012 – 2017 Status
for vehicle repair from 1942 to 1961. Activities performed on site potentially released hazardous materials to underlying soil through the building sump and floor drain system. During site investigations, VOCs (including PCE and acetone), SVOCs, pesticides, PCB (Aroclor-1260), metals, and a soil pH of 9.9 were detected in soil samples. Metals that exceeded their respective background levels or RSLs included arsenic, lead, mercury, and selenium. Soil vapor samples identified 1,2-DCE; 2-hexanone; MTBE; methylene chloride; PCE; toluene; and TCE. PCE was detected in groundwater beneath CAOC 10.3. However, soil and soil vapor samples did not suggest that operations conducted at the former warehouse are a source of the groundwater contamination. The selected remedy in the OU 7 ROD (DON 2014) was LUCs only. Groundwater beneath CAOC 10.3 is being addressed under the OUs 1 and 2 ROD.	this site. The LUCs documented in the 2015 BMP Amendment (DON 2015) include: • Any actions planned in these areas or changes in site use should be coordinated and reviewed by the MCLB Barstow Environmental Division. • Signage must be placed at site boundaries indicating the presence of contaminants and instructions to contact the MCLB Barstow Environmental Division prior to digging.	at CAOC 10.35 during of this review period.
CAOC 10.4 (OU 7) (Figure 6-10)		
CAOC 10.4 consists of Warehouse 3 located in the northern part of the Nebo Main Base. The warehouse was constructed in 1942, and was reportedly the primary industrial facility at MCLB Barstow Nebo Annex prior to 1961. Afterwards, Warehouse 3 was primarily used for general storage and vehicle repair; recent use has been limited to office space and storage of field equipment. Soil sample results indicated TPH as diesel and oil at very low concentrations. VOCs (including PCE), SVOCs, pesticides, and metals were also detected in soil samples; however, none were above their respective residential RSLs, except arsenic which was considered naturally occurring.	**Total CAOC area/LUC area:** 3.5 acres A LUCs only remedy was selected for CAOC 10.4 in the OU 7 ROD (DON 2014) due to the presence of low levels of VOCs in groundwater and metals in soil. The LUCs documented in the 2015 BMP Amendment (DON 2015) include: • Any actions planned in these areas or changes in site use should be coordinated and reviewed by the MCLB Barstow Environmental Division. • Signage must be placed at site boundaries indicating the presence of contaminants and instructions to contact the MCLB Barstow Environmental Division prior to digging.	LUC signs were installed during 2015. No actions were undertaken at CAOC 10.4 during this review period.
CAOC 10.5 (OU 7) (Figure 6-10)		
CAOC 10.5 consists of Warehouse 4, a general warehouse at Nebo Main Base. The warehouse was constructed in 1942 and used for vehicle repair until 1961. During this time, various hazardous materials may have been used during vehicle repair activities. The warehouse is currently used for recreation and storage of aircraft parts and equipment. Soil sample results indicated TPH as diesel at low concentrations. VOCs were detected at concentrations below their respective U.S. EPA residential RSLs. Soil vapor samples indicated PCE at 1 µg/L, 1.5 µg/L, and 2.6 µg/L (industrial screening level was 2.1 µg/L).	**Total CAOC area/LUC area:** 3.85 acres A LUCs only remedy was selected for CAOC 10.5 in the OU 7 ROD (DON 2014) due to the presence of low levels of metals in soil. The LUCs documented in the 2015 BMP Amendment (DON 2015) include: • Any actions planned in these areas or changes in site use should be coordinated and reviewed by the MCLB Barstow Environmental Division. • Signage must be placed at site boundaries indicating the presence of contaminants and instructions to contact the MCLB Barstow	LUC signs were installed during 2015. No actions were undertaken at CAOC 10.37 during of this review period.

Table 6-8

Review of CAOCs with Land Use Controls Only – Nebo Main Base
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC Description	Land Use Controls[1,2]	2012 – 2017 Status
	Environmental Division prior to digging.	
CAOC 10.12 (OU 7) (Figure 6-10)		
CAOC 10.12 consists of the former Preservation and Packaging Shop (Building 50) at the Nebo Main Base. Building 50 was constructed in 1948 and used for cleaning, minor repair, painting preservation, and packaging operations. The site currently consists of a partial concrete foundation and other paved and unpaved areas. Cleaning operations, preservation dip tanks, and degreaser dip tanks likely used or contained hazardous materials, including liquid cleaners, vapor degreaser, alkaline cleaner, rinsing operation, phosphoric and nitric acid, brass cleaner, and fingerprint removers. Sandblasting and spray painting were conducted at Building 50 and an exterior wash pad was also used. Waste generated at Building 50 was documented during 1990 as containing spent blast media, waste grease, oil, PCE/oil, paint sludge, stream-cleaning wastewater, caustic (sodium hydroxide), heavy metals and solvents. The selected remedy, based on subsurface cleanup being conducted under OU 2, was LUCs only.	**Total CAOC area/LUC area:** 2.12 acres A LUCs only remedy was selected for CAOC 10.12 in the OU 7 ROD (DON 2014) due to the presence of low levels of VOCs in soil, soil vapor, and groundwater. The LUCs documented in the 2015 BMP Amendment (DON 2015) include: • Any actions planned in these areas or changes in site use should be coordinated and reviewed by the MCLB Barstow Environmental Division. • Signage must be placed at site boundaries indicating the presence of contaminants and instructions to contact the MCLB Barstow Environmental Division prior to digging.	The OU 2 Nebo North AS/SVE system remains in place at CAOC 10.12, although subsurface remediation has been largely completed. LUC signs were installed during 2015. No other activities occurred at this CAOC since the ROD signing (2014).
CAOC 10.49 (OU 7) (Figure 6-10)		
CAOC 10.49 consists of formerly used USTs T-27A, T-27B, and T-27C on the south side of Building 27 at Nebo Main Base. Soil sample results indicate TPH as diesel and as motor oil at low concentrations. Detected metals (excluding arsenic) did not exceed their respective residential RSLs. Arsenic concentrations (maximum of 36 mg/kg) exceeded both the residential and industrial RSLs and the Nebo Main Base arsenic 95th percentile background level of 10.43 mg/kg. PCE was detected in groundwater below the U.S. EPA and state of California MCL of 5 µg/L. VOCs detected in soil vapor samples in the area of CAOC 10.49 are subjected to active remediation using AS/SVE under the OU 1 and 2 ROD (DON 2014) Groundwater and soil gas at CAOC 10.49 is addressed under the OU 2 ROD.	**Total CAOC area/LUC area:** 0.068 acres A LUCs only remedy was selected for CAOC 10.49 in the OU 7 ROD (DON 2014) due to the presence of low levels of VOCs and TPH in groundwater, metals and TPH in soil, and VOCs in soil vapor. The LUCs documented in the 2015 BMP Amendment (DON 2015) include: • Any actions planned in these areas or changes in site use should be coordinated and reviewed by the MCLB Barstow Environmental Division. • Signage must be placed at site boundaries indicating the presence of contaminants and instructions to contact the MCLB Barstow Environmental Division prior to digging.	No actions were undertaken at CAOC 10.49 during this review period.
CAOC 10.80 (OU 7) (Figure 6-10)		
CAOC 10.80 consists of former UST T-354, a 450-gallon, fiberglass UST, on the south side of former Building 354 at Nebo Main Base. The UST was removed in 1992 during the RFA. It is suspected that the UST was used as a boiler blowdown tank. MCLB Barstow records indicate that no wastes were managed in UST T-354 and that no releases were recorded during its use.	**Total CAOC area/LUC area:** 0.0045 acres A LUCs only remedy was selected for CAOC 10.80 in the OU 7 ROD (DON 2014) due to the presence of low levels of metals in soil. The LUCs documented in the 2015 BMP Amendment (DON 2015) include: • Any actions planned in these areas or changes in site use should be coordinated and reviewed by the MCLB Barstow Environmental Division.	No actions were undertaken at CAOC 10.80 during of this review period.

Table 6-8

Review of CAOCs with Land Use Controls Only – Nebo Main Base
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

CAOC Description	Land Use Controls[1,2]	2012 – 2017 Status
	• Signage indicating the presence of contaminants and instructions to contact the DON prior to digging will be placed at site boundaries.	

NOTE:

1. The OUs 3 and 4 ROD (DON 1997) and OUs 5 and 6 ROD (DON 1998) selected "No Action" remedies for CAOCs 1, 2, 3, 5, 7, 11, and 14. The No Action remedy included specific Base Master Plan modifications that require MCLB Barstow Environmental Division review before any land-use changes are made at this site ("NA with BMP modification"). For the purposes of this Five-Year Review report, the "NA with BMP modification" remedy is referred to as "LUCs only" to be consistent with later RODs. The LUCs for the OUs 4 and 6 CAOCs are incorporated into the 2010 BMP Amendment (DON 2010).
2. The LUCs for the OU 7 CAOCs are incorporated into the 2015 BMP Amendment (DON 2015).

ACRONYMS:

BMP – Base Master Plan
CAOC – CERCLA Area of Concern
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
DDT - dichlorodiphenyltrichloroethane
DDE - dichlorodiphenyldichloroethene
DDD - dichlorodiphenyldichloroethane
DON – Department of the Navy
FFA – Federal Facility Agreement
IRP – Installation Restoration Program
LUC – Land Use Control
MCL – maximum contaminant level
MCLB – Marine Corps Logistics Base
OU – Operable Unit
PCB – polychlorinated biphenyl
RBC – Risk Based Concentrations
RI – Remedial Investigation
ROD – Record of Decision
SVOCs – semivolatile organic compounds
TCRA – time critical removal action
TPH – total petroleum hydrocarbons
TRPH - total recoverable petroleum hydrocarbons
VOCs – volatile organic compounds

REFERENCES:

See Section 9 of main report

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TABLE 7-1

Summary of Protectiveness Statements, Issues and Recommendations for OUs 1, 3, 5, and 7 at Yermo Annex
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

OU	CAOC	Issues Identified During Five-Year Review	Do the identified issues affect short-term protectiveness?	Do the identified issues affect long-term protectiveness?	Recommendations/Follow-up Actions	Schedule for Completion
OU1 (CAOC 37) Groundwater						
1	37	1. The OU 1 pump and treat remedy is not achieving containment of the off-Base contaminant plume. Data gaps in the off-base monitoring well network inhibit evaluation of plume dynamics, concentration distribution, and trends. 2. The long-term persistence of the Yermo North plume suggests the presence of a remaining contaminant mass at CAOCs 16, 15/17 and possibly 35. The existing soil vapor extraction (SVE) system may be located too far from the residual contaminant mass to effectively reduce vadose zone concentrations. The air-sparge (AS) system has become ineffective due to declining groundwater levels. 3. Off-site exposure to Base groundwater plume is not suspected, however the two off-base residential wells treatment systems are not currently in operation. The Yount private well went dry in May 2016 and the Hodges well appears to be inoperable based on inspections from the public right-of-way. The DON does not have a current access agreement to the Hodges property to perform direct inspection of the well and treatment system despite repeated attempts to contact the property owner who does not live on-site. An occasional resident/trespasser has been observed at the Hodges residence. 4. The CAOC 26 groundwater and vadose zone remedies are completed; no further monitoring is required. 5. OU 1 groundwater chromium and nickel data indicate these metals are consistently below maximum contaminant levels and no further monitoring is required.	Current protectiveness is not affected by the identified issues because of the operation, maintenance, and repairs of the remedial systems as well as on-going monitoring.	Future protectiveness of the remedy would be better ensured through remedy optimization and addressing the existing data gaps in vadose zone and groundwater contaminant extent.	1. Perform a data gaps investigation of the Yermo North plume to improve delineation of the northern and off-site extent. 2. Investigate the residual contaminant mass in the vadose zone at CAOCs 16, 15/17, and 35; based on the results evaluate if optimization of the SVE system is required to ensure long-term effectiveness of the remedy. Turn off the AS portion of the remedy. 3. Maintain contact with Yount residence on status of their private well. Continue to pursue access agreement with off-Base Hodges property owner; the situation is being elevated to the DON legal counsel who will review and pursue options to gain access to the Hodges property to ascertain status of the well and GAC system, and to make necessary repairs (if the well is operable) to meet requirements of the ROD. Additionally, upon securing access to the property, the DON will provide notification to the occupants regarding potentially contaminated groundwater. 4. Document in the Administrative Record that the response action at CAOC 26 for vadose zone and groundwater is completed and no further monitoring is required. 5. Document in the Administrative Record that detected metals in OU 1 groundwater do not require a response action or any further monitoring.	1. A new off-base monitoring well is scheduled to be installed during June 2017. Additional potential wells locations both on-Base and off-base are under discussion with the FFA stakeholders. 2. Initial investigations are underway; the Navy will consider results of initial investigations to determine the scope and schedule for further assessments at these CAOCs. Other optimization measures can be implemented upon FFA concurrence with the recommendations. 3. Contact the Yount residence every other month to check on well status. Access the Hodges property and conduct system assessment and resident notifications as soon as legally possible. 4. Following FFA stakeholder concurrence. 5. Following FFA stakeholder concurrence.
OUs/CAOCs with both ICs/LUCs remedies (under OUs 3or 5) and vadose zone and/or groundwater remedies including monitoring under OU 1						
5	16	No issues identified under OU 5; see OU 1 CAOC 37 for discussion of vadose zone and groundwater issues.	Short-term protectiveness is not affected as the ICs/LUCs are maintained.	Long-term protectiveness is not affected as long as the ICs/LUCs are maintained.	(See recommendations made for the vadose zone and groundwater at CAOCs 16, 15/17, and 35 under OU 1.)	N/A
5	15/17	No issues for the OU 5 remedy (LUCs only). See OU 1 CAOC 37 for discussion of vadose zone and groundwater issues.	Short-term protectiveness is not affected as the ICs/LUCs are maintained.	Long-term protectiveness is not affected as long as the ICs/LUCs are maintained.	(See recommendations made for the vadose zone and groundwater at CAOCs 16, 15/17, and 35 under OU 1.)	N/A
3	20	No issues for the ICs/LUCs portion of remedy. One additional round of groundwater radiological data is needed to complete the ROD-required assessment. VOCs were not detected in six rounds of downgradient groundwater monitoring; metals are consistently below maximum contaminant levels.	Short-term protectiveness is not affected as the ICs/LUCs are maintained.	Long-term protectiveness is assured if cap is maintained and long-term monitoring data substantiate this CAOC is not a source to groundwater	Publish results of four rounds of radiological parameter sampling, data evaluations, conclusions and recommendations in the next Annual Groundwater Monitoring Report after sampling is completed. Discontinue metals and VOC groundwater monitoring.	Sample in 2017, report in 2018
3	23	No cap/LUC issues identified. See OU 1 CAOC 37 for discussion of vadose zone and groundwater issues.	Short-term protectiveness is not affected as the ICs/LUCs are maintained.	Long-term protectiveness is not affected as long as the ICs/LUCs are maintained.	None	N/A
5	26	No issues identified for OU 5 remedy; See OU 1 CAOC 37 for vadose zone/groundwater remedy (completed).	N/A	N/A	None	To be determined
5	35	No issues with landfill cap identified. See OU 1 CAOC 37 for potential vadose zone and groundwater issues.	Short-term protectiveness is not affected cap and ICs/LUCs are maintained.	Long-term protectiveness is not affected as long as the ICs/LUCs are maintained.	(See recommendations made for the vadose zone and groundwater at CAOCs 16, 15/17, and 35 under OU 1.)	N/A

TABLE 7-1

Summary of Protectiveness Statements, Issues and Recommendations for OUs 1, 3, 5, and 7 at Yermo Annex
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

OU	CAOC	Issues Identified During Five-Year Review	Do the identified issues affect short-term protectiveness?	Do the identified issues affect long-term protectiveness?	Recommendations/Follow-up Actions	Schedule for Completion
OUs/CAOCs with LUCs only						
7	9.60	No issues identified.	N/A	N/A	None	N/A
7	9.68	No issues identified.	N/A	N/A	None	N/A
3	18	No issues identified	N/A	N/A	None	N/A
3	21	No issues identified	N/A	N/A	None	N/A
5	32 Stratum 2	No issues identified	N/A	N/A	None	N/A
3	34 Stratum 1	No issues identified	N/A	N/A	None	N/A

ACRONYMS:

AS/SVE – air sparging/soil vapor extraction
CAOC – CERCLA Area of Concern
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COC – contaminate of concern
DON – Department of Navy
LUC s– land use controls
N/A – not applicable (no issues identified)
O&M – Operations and Maintenance
OU – Operable Unit
VOC – volatile organic compound

TABLE 7-2

Summary of Protectiveness Statements, Issues and Recommendations for OUs 2, 4, 6, and 7 at Nebo Main Base
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

OU	CAOC	Issue Identified During Five-Year Review	Do the identified issues affect short-term protectiveness?	Do the identified issues affect long-term protectiveness?	Recommendations/Follow-up Actions	Schedule for Completion
OU 1 (CAOC 38) and OU 7 Groundwater Remedies						
2	38 Nebo North	Nebo North soil vapor VOC concentrations in a small area of the Former Building 50 source zone have been addressed with targeted SVE treatment; the rebounding concentrations are declining and continued targeted SVE is not warranted.	No	No	Discontinue further targeted SVE in the former source area.	Document the evaluation and recommendations in the 2017 Annual Groundwater Monitoring Report.
		The Nebo North plume has attenuated except for a small residual groundwater PCE plume that appears to be related to former underground storage tanks (UST T-22A/B) and/or industrial operations at Warehouse 4 (CAOC 10.5) and/or Building 22. The PCE source area was not identified in the OUs 1 and 2 ROD. Groundwater concentrations of PCE are on an increasing trend at a monitoring well downgradient from UST T-22A/B.	Current protectiveness is not affected by the identified issue because of the maintenance of the groundwater LUCs and on-going monitoring.	The long-term protectiveness of the remedy would be better assured with improved understanding of the source and extent of the T-22A/B area groundwater contamination.	1. Perform a limited subsurface investigation to identify the source for the increasing PCE groundwater concentrations downgradient from UST T-22A/B. 2. Prepare a Memorandum to File to add the source area to the OUs 1 and 2 ROD with an appropriate response action if necessary based on the additional data.	Schedule to be determined
	38 Nebo South	The Nebo South AS/SVE system prevents off-site migration and has reduced the extent of the VOC plume. The persistence of small residual plume areas indicates vadose zone source may be beyond the SVE radius of influence.	Current protectiveness is not affected because of continued operation of the AS/SVE system.	Long-term protectiveness would be better assured by addressing potential source(s) of the small residual plumes at the Base boundary.	Conduct a data gaps investigation to identify potential residual vadose zone source upgradient of the residual plume and optimize the AS/SVE remedy as necessary.	Schedule to be determined
7	7 Stratum 1 (vadose zone, groundwater)	The TCE plume currently remains localized around well NS7-6 (the only well with TCE above the cleanup level). A data gap exists to the west of NS7-6, due to lack of monitoring wells. The SVE remedy should be implemented to ensure long-term protectiveness of the remedy.	Current protectiveness is not affected by the identified issues because of the maintenance of ICs/LUCs as well as on-going monitoring.	Long-term protectiveness will be enhanced once SVE remedy is implemented.	1. Implement the SVE portion of the remedy to reduce contaminant mass impacting groundwater at the site. 2. Install additional monitoring wells to address the data gap in plume delineation along western CAOC boundary	1. Remedial Design/Remedial Action (RD/RA) Work Plan anticipated to be submitted to FFA stakeholders during 2017. 2. Within next two years (or during SVE remedy installation).
7	10.38/10.39 Unit 7 (groundwater)	The source of the CAOC 10.38/10.39 Unit 7 groundwater plume remains undefined. Based on the available data, the natural attenuation remedy does not appear to be effective; however, the remedy does remain protective.	Current protectiveness is not affected by the identified issues because of the maintenance of ICs/LUCs and the on-going monitoring.	Long-term protectiveness will be better assured with improved understanding of the source at this CAOC.	1. Add a groundwater monitoring well between wells 10.38-DS17-9 and NSP-6 to improve the western MNA monitoring network and to support future MNA performance evaluations. 2. Investigate the source area(s) at CAOC 10.38/10.39 Unit 7 to facilitate future remedy evaluations and ensure long-term protectiveness.	1 and 2 within the next five years
7	NPZ-14 Groundwater Area	The source of the NPZ-14 area plume remains undefined. The estimated time for meeting the groundwater cleanup levels, as currently estimated, may not be reasonable.	Current protectiveness is not affected by the identified issues because of the maintenance of the ICs/LUCs and on-going monitoring.	Long-term protectiveness will be better assured with improved understanding of the source at this site.	Investigate the source(s) of the NPZ-14 plume by conducting additional soil vapor and groundwater sampling in the area upgradient of the defined plume.	Within the next five years
OUs 7 CAOCs with Soil and LUCs Remedies						
7	10	None (in the remedial design phase for soil cleanup action)	Current protectiveness is not affected because of the maintenance of ICs/LUCs	Implement the soil remedy to ensure long-term protectiveness	None	N/A
7	N-2 Area 1	None (in the remedial design phase for soil cleanup action)	Current protectiveness is not affected because of the maintenance of ICs/LUCs	Implement the soil remedy to ensure long-term protectiveness	None	N/A
6	7	Stratum 2 (landfill cap), Strata 3 and 4 – no issues identified. Stratum 1 (landfill cap) – no issues; however associated vadose zone and groundwater contamination are being addressed under OU 7.	N/A	N/A	None	N/A
OUs 4, 6, and 7 Sites with LUCs Only						
4	2	None	N/A	N/A	None	N/A

TABLE 7-2

Summary of Protectiveness Statements, Issues and Recommendations for OUs 2, 4, 6, and 7 at Nebo Main Base
Fourth Five-Year Review Report OUs 1 – 7
MCLB Barstow, California

OU	CAOC	Issue Identified During Five-Year Review	Do the identified issues affect short-term protectiveness?	Do the identified issues affect long-term protectiveness?	Recommendations/Follow-up Actions	Schedule for Completion
4	5	None	N/A	N/A	None	N/A
6	1	None	N/A	N/A	None	N/A
6	3	None	N/A	N/A	None	N/A
6	11	None	N/A	N/A	None	N/A
6	14	None	N/A	N/A	None	N/A
7	10.38/10.39 (Units 1 - 7 soils)	None	N/A	N/A	None	N/A
7	10.27	None	N/A	N/A	None	N/A
7	10.35	None	N/A	N/A	None	N/A
7	10.37	None	N/A	N/A	None	N/A
7	10.3	None	N/A	N/A	None	N/A
7	10.4	None	N/A	N/A	None	N/A
7	10.5	None	N/A	N/A	None	N/A
7	10.12	None	N/A	N/A	None	N/A
7	10.49	None	N/A	N/A	None	N/A
7	10.8	None	N/A	N/A	None	N/A

ACRONYMS:

AS/SVE – air sparging/soil vapor extraction
CAOC – CERCLA Area of Concern
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
GETS – groundwater extraction treatment system
MCL – maximum contaminant level
N/A – not applicable
OU – Operable Unit
ROD – Record of Decision
TCE – trichloroethene
VOC – volatile organic compound

APPENDIX A

Fourth Five-Year Review Public Notice
English and Spanish
(English-Only Version Provided for Pre-Draft)

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Public Notice of Fourth Five-Year Review Scheduled for Publication in November 2017

Marine Corps Logistics Base Barstow Announces Fourth Five-Year Review

Marine Corps Logistics Base (MCLB) Barstow announces publication of the Fourth Five-Year Review of its environmental cleanup sites. The public is invited to review the document and to voice any comments or concerns to MCLB Barstow representatives as indicated in the box below.

Background

MCLB Barstow is comprised of the Nebo Main Base and Yermo Annex. For the purposes of defining environmental cleanup goals, the Base has been further divided into what are known as Operable Units (OU). Each OU is generally defined by its location (Nebo Main Base or Yermo Annex) and affected medium (soil or groundwater). There are seven OUs covered in this Five-Year Review.

Cleanup Action

MCLB Barstow, as part of the Department of the Navy (DON), participates in the Installation Restoration Program (IRP), an environmental program developed by the U.S. Department of Defense (DoD) to investigate and clean up contamination at military installations.

In November 1989, the Base was placed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List (NPL) due to the presence of soil and groundwater contamination. While the DON is the lead DoD authority responsible for conducting the cleanup at MCLB Barstow, these efforts are conducted in partnership with the U.S. Environmental Protection Agency (U.S. EPA), California Environmental Protection Agency's Department of Toxic Substances Control (DTSC), and Regional Water Quality Control Board – Lahontan Region under a Federal Facilities Agreement (FFA) that was signed in 1990.

Although waste management practices are now in compliance, previous practices resulted in some soil and groundwater contamination at the Base. The contamination consists primarily of volatile organic compounds (VOCs), such as chemicals found in cleaning solvents, and metals (for example, lead). Five Records of Decision (RODs) have been signed by the FFA signatories to address the identified contamination problems. Several treatment systems are in place to contain and remove these contaminants. Other protective measures such as landfill caps or administrative controls on land use have been implemented. The Five-Year Review was designed as part of the Superfund process to verify that the cleanup activities and other measures remain protective of human health and the environment in the both the short-term and long-term.

Five-Year Review Process and Schedule

The Fourth Five-Year Review provides a progress report on cleanup activities at the MCLB Barstow since 2012. The document summarizes the following:

- MCLB Barstow background and historical use;
- Details the Five-Year Review process;
- Reviews current data and information;
- Assesses on-going technical remedies and other protective measures;
- Presents site inspection and interview findings;
- Identifies issues and potential problems; and
- Provides recommendations and follow-up actions, with a schedule for implementation.

Site inspections and interviews took place during March-May 2017. The Fourth Five-Year Review report was submitted to the FFA regulatory agencies in June 2017 for review and comment. The comments were addressed and incorporated into the document. The review process will end in December 2017 with signature on the final report document.

Community Involvement

Another goal of the Five-Year Review is to invite members of the community to review and discuss cleanup plans and progress reports. The Five-Year Review and other documents related to the MCLB Barstow cleanup actions are available in the Information Repository at the MCLB Barstow Environmental Division (contact information below).

FOR MORE INFORMATION

If you have any questions, comments, and/or concerns about the Five-Year Review or MCLB Barstow environmental cleanup activities, you may contact the following:

Lindsey White, PE, Remedial Project Manager
DON Naval Facilities Engineering Command
Phone: (619) 532-4451
E-mail: lindsey.e.white@navy.mil

INFORMATION REPOSITORY

MCLB Barstow Environmental Division
Building 196, Barstow, CA 92311-5050
Contact: James Debenedetti, ER
IR Program Manager – MCLB Barstow
Phone: (760) 577-6982
Email: james.debenedetti@usmc.mil

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APPENDIX B

Documentation of Interviews and Site Inspections

Interview and Site Inspection Logs
Site Inspection Photos for the CAOCs
with Land Use Controls, Caps, and/or Engineered Covers

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INTERVIEW RECORD
FOURTH FIVE YEAR REVIEW
OU 5 – CAOC 16 YERMO ANNEX (Marine Depot Maintenance Command)
Marine Corps Logistics Base Barstow, CA

Site Name: CAOC 16 (OU 5) Hardstand, Yermo Annex	**EPA ID No.** CA8170024261
Subject: Five-Year Review	**Date:** 06/13/17

Type: ☐ Telephone ☒ Visit ☐ Email (follow-up questions)
Location of Visit: Yermo Annex, Marine Depot Maintenance Command (CAOC 16)

Contact Made By:

Name: Nova Clite	**Title**: Project Manager	**Organization:** OTIE

Individual Contacted:

Name: Keith Jenkins	**Title**: Engineering Technician	**Organization:** Resident Officer in Charge of Construction (ROICC)

Office: (760) 577-6710 **Mobile No:** (760) 535-5429 **E-mail address**: keith.jenkins3@navy.mil	**Mailing address:** NAVFACSW ROICC Barstow Marine Corps Logistics Base, Bldg. 198 Barstow, CA 92311-5050

Summary of Conversation:

Question: Has there been construction on the CAOC 16 hardstand over the past five years that has resulted in a reduction in or lessening of the protective cover?

Response: Buildings 640 and 641 were constructed in the northeast area of the hardstand since October 2012. The protective cover of the hardstand was fully restored around the buildings, which are slab on grade. Subsurface trenching for Base utilities (sewer, water, and power) was performed as part of the construction under proper dig permits and environmental review by the MCLB Barstow Environmental Division. No stained or odorous soils were encountered requiring sampling for possible contamination.

Question: Has there been any sub-floor work requiring opening of the hardstand within Building 573 over the past five years? If so, was the concrete floor restored so that the protectiveness of the cover was maintained?

Response: During March – May 2016 timeframe, the concrete floor under the former dip tanks was completely removed and replaced. This area is in the far northwest area of Building 573. Environmental Division performed monitoring; no stained soils were observed and no soil samples were collected. The dip tanks are now located in the new Dip Tank Building (640).

Question: Has the hardstand surface been maintained over the past five years?

Response: Repairs are done to the hardstand in phases using year-end budget when available; repairs to heavily trafficked areas where there is noticeable damage. Hardstand repairs are currently in progress and will include backfilling and capping the water-line repair trench in the northeast corner of the hardstand.

INTERVIEW RECORD

FOURTH FIVE YEAR REVIEW

OU 5 – CAOC 16 YERMO ANNEX (Marine Depot Maintenance Command)

Marine Corps Logistics Base Barstow, CA

Site Name: CAOC 16 (OU 5) Hardstand, Yermo Annex	**EPA ID No.** CA8170024261
Subject: Five-Year Review inspection	**Date:** 6/13/17

Type: ☐ Telephone ☒ Visit ☐ Email (follow-up questions)

Location of Visit: Yermo Annex, Marine Depot Maintenance Command Building 573 hardstand (CAOC 16)

Contact Made By:

Name: Nova Clite	**Title**: Project Manager	**Organization:** OTIE

Individual Contacted:

Name: Lisa Morris	**Title**: MDMC Environmental Department Supervisor	**Organization:** Marine Depot Maintenance Command (MDMC)

Telephone: **Fax No:** **E-mail address**: lisa.morris@usmc.mil	**Mailing address:**

Summary of Conversation:

Question: Has there been construction on the CAOC 16 hardstand over the past five years that has resulted in penetrations of the protective cover?

Response: Two buildings (640, 641) were constructed in the northeast portion of the hardstand; both buildings are slab-on-grade. Building 640 (Dip Tanks) was constructed in 2013-2014; Building 641 (Dynamo Testing) was just completed (construction 2016-2017). Prior buildings in the area were open-air sun-shaded workstations that were bolted to the hardstand. Other demolition in the area consisted of removal of cooling towers and test stand (outdoors). Concrete work around buildings repaired prior surface and was sloped to facilitate drainage.

Question: There was an open trench through the hardstand observed during the initial site inspection (xx March 2017); what was the nature of that trench and has it been repaired?

Response: The trench was excavated through the hardstand to investigate and repair a broken water line. The trench is being backfilled and repaved this month along with other concrete surfacing work being performed in the Building 573 area.

(760) 577-6790

Land Use Controls Inspection Checklist
CAOC 16 (OU 5)
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Map 20 of the Updated Base Master Plan OUs 1-6 while completing the checklist. The areas requiring Land Use Controls shown on Map 20 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Date: 3/13/17

☐ Annual Inspection
☒ 5-Year Review

Emmanuel Vasquez / Rachel Akili / MCLB Barstow / JOTIE
(name, affiliation, address, and telephone number)

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☒ 601 638 565 640 563 641 640 All new No ☒ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☒ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature:

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 23 Zone 1
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 1 and 7 of the Updated Base Master Plan OUs 1-6 while completing the checklist. The areas requiring Land Use Controls shown on Maps 1 and 7 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Mario Camacho, OTIE (name, affiliation, address, and telephone number)

Date: 3-13-17

☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	Has there been any construction on, excavation of, or breach of the landfill cover (see attached Site figure) since the last inspection?	Yes ☐ No ☒ If no, go to #3. If yes, describe the nature of construction and/or land disturbing activity and go to #2.
2.	If answer to #1 is yes, was prior review and written approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 4. If yes, describe and go to #4 and #5.
4.	Have any of the following items associated with the Site been removed: fencing, signs, monitoring equipment?	Yes ☐ No ☒ If no, go to # 6. If yes, describe.
5.	If answer to #3 or #4 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #4?	Yes ☐ No ☐ Describe.
6.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☐ If no, go to # 8. If yes, provide the number of Work Requests or Service Calls submitted.
7.	If answer to #6 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☐ Attach the approved Work Request(s) and/or Service Call(s).
8.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☐ Describe.
9.	Have there been any significant rain events since the last inspection that has altered the runoff pattern or flow or caused erosional damage to the landfill cover?	Yes ☐ No ☐ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Mario Camacho

Signature: Mario A. Camacho

Title: Staff Env. Engineer

Date: 3-13-17

See photos. CAOC 23 Stratum 1 has solar panels recently installed.

Land Use Controls Inspection Checklist
CAOC 6 (OU 6)
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Figure 2-5 of the OU 1&2 ROD while completing the checklist. The areas requiring Land Use Controls shown on Figure 2-5 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Rachel Ofili, Manny Vasquez, OTIE
(name, affiliation, address, and telephone number)

Date: 3-13-17

☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☒ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature:

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 14, Stratum 1-4 (OU 6)
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 28, 29, 30, and 31 of the Updated Base Master Plan OUs 1- 6 while completing the checklist. The areas requiring Land Use Controls shown on Maps 28, 29, 30, and 31 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Rachel Ofili, Manny Vasquez, OTIE
(name, affiliation, address, and telephone number)

Date: 3-13-17

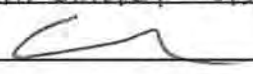
☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☒ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Immanuel Vasquez

Signature: 

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 21 (OU 5)
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Map 22 of the Updated Base Master Plan OUs 1-6 while completing the checklist. The areas requiring Land Use Controls shown on Map 22 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Rachel Ofili, Manny Vasquez, OTIE

Date: 3-13-17

☐ Annual Inspection
☒ 5-Year Review

(name, affiliation, address, and telephone number)

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and written approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ If no, go to # 4. If yes, describe and go to #4 and #5.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Well Removal: Yes ☐ No ☒ If no, go to # 6. If yes, describe.
7.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to # 9. If yes, provide the number of Project Evaluation Review Forms submitted.
8.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request.
9.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature: 

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 15/17 (OU 5)
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Map 21 of the Updated Base Master Plan OUs 1-6 while completing the checklist. The areas requiring Land Use Controls shown on Map 21 subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Rachel Ofili, Manny Vasquez, OTIE
(name, affiliation, address, and telephone number)

Date: 3-13-17

☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☑ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature:

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 1 Stratum 1-3 (OU 6)
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 24, 25, 26 of the Updated Base Master Plan OUs 1-6 while completing the checklist. The areas requiring Land Use Controls shown on Maps 24, 25, 26 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Rachel Ofili, Manny Vasquez, OTIE (name, affiliation, address, and telephone number)

Date: 3-13-17

☐ Annual Inspection
☐ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	Has there been any construction on, excavation of, or breach of the landfill cover (see attached Site figure) since the last inspection?	Yes ☐ No ☒ If no, go to #3. If yes, describe the nature of construction and/or land disturbing activity and go to #2.
2.	If answer to #1 is yes, was prior review and written approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 4. If yes, describe and go to #4 and #5.
4.	Have any of the following items associated with the Site been removed: fencing, signs, monitoring equipment?	Yes ☐ No ☒ If no, go to # 6. If yes, describe.
5.	If answer to #3 or #4 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #4?	Yes ☐ No ☐ Describe.
6.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to # 8. If yes, provide the number of Work Requests or Service Calls submitted.
7.	If answer to #6 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request(s) and/or Service Call(s).
8.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.
9.	Have there been any significant rain events since the last inspection that has altered the runoff pattern or flow or caused erosional damage to the landfill cover?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature: 

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 11
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Map 16 of the Updated Base Master Plan OUs 1-6 while completing the checklist. The areas requiring Land Use Controls shown on Map 16 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Rachel Ofili, Manny Vasquez, OTIE

(name, affiliation, address, and telephone number)

Date: 3-13-17

☐ Annual Inspection
☐ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☒ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature: [signature]

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 5 Strata 1 & 2
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 14, and 15 of the Updated Base Master Plan OUs 1-6 while completing the checklist. The areas requiring Land Use Controls shown on Maps 14 and 15 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Rachel Ofili, Manny Vasquez, OTIE
(name, affiliation, address, and telephone number)

Date: 3-13-17

☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☐ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☐ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Immanuel Vasquez

Signature:

Title: Chemist

Date: 3/13/17

INTERVIEW RECORD
FOURTH FIVE YEAR REVIEW
(Marine Depot Maintenance Command)
Marine Corps Logistics Base Barstow, CA

Site Name: CAOC 3 (OU 6), Nebo Main Base	**EPA ID No.** CA8170024261
Subject: Five-Year Review	**Date:** 3/29/17
Type: ☐ Telephone ☐ Visit ☒ Email (follow-up questions) **Location of Visit:**	

Contact Made By:

Name: Emmanuel Vasquez	**Title**: Environmental Scientist	**Organization:** OTIE

Individual Contacted:

Name: Dianne Langevin	**Title**: Real Property Accountability Officer	**Organization:** Installation and Logistics Department, Public Works Division

Telephone: (760) 577-6882 **Fax No:** (760) 577-6033 **E-mail address**: Dianne.langevin@uscm.mil	**Mailing address:**

Summary of Conversation:

Question: Please confirm the construction performed on the CAOC 3 complies with land use controls for this area.

Response: Building T100 was disassembled and a new prefabricated building, the golf course clubhouse or building #100, was constructed in its place. The current building #100 has the same footprint and is the same size as the previous building.

Land Use Controls Inspection Checklist
CAOC 3 (OU 6)
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 27 of the Updated Base Master Plan OUs 1-6 while completing the checklist. The areas requiring Land Use Controls shown on Maps 27 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Rachel Ofili, Manny Vasquez, OTIE
(name, affiliation, address, and telephone number)

Date: 3-13-17

☐ Annual Inspection
☒ 5-Year Review

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 3. If yes, describe.
2	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☒ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area? New Building #100 installed (prefab building replaced old Building w/ same footprint)	Yes ☒ No ☐ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☒ No ☐ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☒ No ☐ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature: [signature]

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 2 Strata 1 & 3
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 12 and 13 of the Updated Base Master Plan OUs 1-6 while completing the checklist. The areas requiring Land Use Controls shown on Maps 12 and 13 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Rachel Ofili, Manny Vasquez, OTIE
(name, affiliation, address, and telephone number)

Date: 3-13-17

☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☐ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☐ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☐ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature:

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 26 (OU 5)
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 23 of the Updated Base Master Plan OUs 1-6 while completing the checklist. The areas requiring Land Use Controls shown on Maps 23 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Date: 3/13/17 ☐ Annual Inspection ☒ 5-Year Review

Emmanuel Vasquez / Rachel Hill, OTIE
(name, affiliation, address, and telephone number)

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☑ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☑ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☑ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☑ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☑ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☑ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature:

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 35 (OU 5)
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Map 17 of the Updated Base Master Plan OUs 1-6 while completing the checklist. The areas requiring Land Use Controls shown on Map 17 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Mario Camacho, OTIE

(name, affiliation, address, and telephone number)

Date: 3-13-17

☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	Has there been any construction on, excavation of, or breach of the landfill cover (see attached Site figure) since the last inspection?	Yes ☐ No ☒ If no, go to #3. If yes, describe the nature of construction and/or land disturbing activity and go to #2.
2.	If answer to #1 is yes, was prior review and written approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 4. If yes, describe and go to #4 and #5.
4.	Have any of the following items associated with the Site been removed: fencing, signs, monitoring equipment?	Yes ☐ No ☒ If no, go to # 6. If yes, describe.
5.	If answer to #3 or #4 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #4?	Yes ☐ No ☒ Describe.
6.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to # 8. If yes, provide the number of Work Requests or Service Calls submitted.
7.	If answer to #6 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request(s) and/or Service Call(s).
8.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.
9.	Have there been any significant rain events since the last inspection that has altered the runoff pattern or flow or caused erosional damage to the landfill cover?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Mario Camacho

Signature: Mario A. Camacho

Title: Staff Env. Engineer

Date: 3-13-17

3 Pictures taken

Land Use Controls Inspection Checklist
CAOC 18 Strata 2 & 3
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 1, 9, and 10 of the Updated Base Master Plan OUs 1-6 while completing the checklist. The areas requiring Land Use Controls shown on Maps 1, 9, and 10 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Mario Camacho, OTIE
(name, affiliation, address, and telephone number)

Date: 3-13-17

☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☐ N/A, no markers. If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☒ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Mario Camacho

Signature: Mario A. Camacho

Title: Staff Env. Engineer

Date: 3-13-17

3 pictures taken

Land Use Controls Inspection Checklist
CAOC 34
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Map 11 of the Updated Base Master Plan OUs 1-6 while completing the checklist. The areas requiring Land Use Controls shown on Map 11 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Mario Camacho, OTIE
(name, affiliation, address, and telephone number)

Date: 3-13-17

☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ N/A, No Markers If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☐ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☐ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☐ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Mario Camacho

Signature: Mario M. Camacho

Title: Staff Env Engineer

Date: 3-13-17

Land Use Controls Inspection Checklist
CAOC 20 Stratum 1 and Stratum 2
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 1, 5, and 6 of the Updated Base Master Plan OUs 1-6 while completing the checklist. The areas requiring Land Use Controls shown on Maps 1, 5, and 6 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Marco Camacho, OTIE
(name, affiliation, address, and telephone number)

Date: 3-13-17

☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☐ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Marco A. Camacho

Signature: Marco A. Camacho

Title: Staff Env. Engineer

Date: 3-13-17

Land Use Controls Inspection Checklist
CAOC 20 Stratum 2
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 1 and 6 of the Updated Base Master Plan OUs 1-6 while completing the checklist. The areas requiring Land Use Controls shown on Maps 1 and 6 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Emmanuel Vasquez, OTIE
(name, affiliation, address, and telephone number)

Date: 3/13/17

☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	Has there been any construction on, excavation of, or breach of the fine-grained soil cap (see attached Site figure) since the last inspection?	Yes ☐ No ☑ If no, go to #3. If yes, describe the nature of construction and/or land disturbing activity and go to #2.
2.	If answer to #1 is yes, was prior review and written approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☑ Describe.
3.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☑ If no, go to # 4. If yes, describe and go to #4 and #5.
4.	Have any of the following items associated with the Site been removed: fencing, signs, monitoring equipment?	Yes ☐ No ☑ If no, go to # 6. If yes, describe.
5.	If answer to #3 or #4 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #4?	Yes ☐ No ☑ Describe.
6.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☑ If no, go to # 8. If yes, provide the number of Work Requests or Service Calls submitted.
7.	If answer to #6 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☑ Attach the approved Work Request(s) and/or Service Call(s).
8.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☑ Describe.
9.	Have there been any significant rain events since the last inspection that has altered the runoff pattern or flow or caused erosional damage to the landfill cover?	Yes ☐ No ☑ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature:

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 7 Stratum 1
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 39, 40, 47, and 49 of the Base Master Plan OU 7 Amendment while completing the checklist. The areas requiring Land Use Controls shown on Maps 39, 40, 47, and 49 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Emmanuel Vasquez, OTIE
(name, affiliation, address, and telephone number)

Date: 3/13/17

☐ Annual Inspection
☑ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	Has the groundwater from the aquifer within the Site area (see attached figure for the Site) been used for potable water purposes since the last inspection?	Yes ☐ No ☑ If no, go to # 3. If yes, describe the nature and use of extracted groundwater.
2.	If answer to #1 is yes, was prior review and written approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☑ Describe.
3.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☑ If no, go to # 4. If yes, describe and go to #4 and #5.
4.	Have any of the remediation system components including extraction/monitoring wells within the area requiring Land Use Controls (see attached figure for the Site) been removed?	Yes ☐ No ☑ If no, go to # 6. If yes, describe.
5.	If answer to #3 or #4 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #4?	Yes ☐ No ☑ Describe.
6.	Are the following components of each extraction/monitoring well within the Site in good working order: well vaults and well vault locks, well casings, and well labels? Include recommendations for replacement or repair.	Yes ☐ No ☑ Describe.
7.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☑ If no, go to # 9. If yes, provide the number of Project Evaluation Review Forms submitted.
8.	If answer to #7 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☑ Attach the approved Work Request.
9.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☑ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature: [signature]

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC N-2 Area 1
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 39, 40, and 44 of the Base Master Plan OU 7 Amendment while completing the checklist. The areas requiring Land Use Controls shown on Maps 39, 40, and 44 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Emmanuel Vasquez, OTIE

(name, affiliation, address, and telephone number)

Date: 3/13/17

☐ Annual Inspection
☑ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☑ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☒ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☐ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☐ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☐ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☐ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☐ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature:

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 10 Sodium Valve/Metallic Debris Burial Area
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 39, 40, and 43 of the Base Master Plan OU 7 Amendment while completing the checklist. The areas requiring Land Use Controls shown on Maps 39, 40, and 43 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Emmanuel Vasquez, OTIE
(name, affiliation, address, and telephone number)

Date: 3/13/17

☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	Has there been any construction on, excavation of, or breach of the landfill cover (see attached Site figure) since the last inspection?	Yes ☐ No ☒ If no, go to #3. If yes, describe the nature of construction and/or land disturbing activity and go to #2.
2.	If answer to #1 is yes, was prior review and written approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☒ Describe.
3.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 4. If yes, describe and go to #4 and #5.
4.	Have any of the following items associated with the Site been removed: fencing, signs, monitoring equipment?	Yes ☐ No ☒ If no, go to # 6. If yes, describe.
5.	If answer to #3 or #4 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #4?	Yes ☐ No ☒ Describe.
6.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to # 8. If yes, provide the number of Work Requests or Service Calls submitted.
7.	If answer to #6 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request(s) and/or Service Call(s).
8.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.
9.	Have there been any significant rain events since the last inspection that has altered the runoff pattern or flow or caused erosional damage to the landfill cover?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature: [signature]

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
Groundwater Site NPZ-14
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 39, 40, 47, and 48 of the Base Master Plan OU 7 Amendment while completing the checklist. The areas requiring Land Use Controls shown on Maps 39, 40, 47, and 48 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Emmanuel Vasquez, OTIE (name, affiliation, address, and telephone number)

Date: 3/13/17

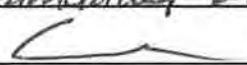
☐ Annual Inspection
☑ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	Has the groundwater from the aquifer within the Site area (see attached figure for the Site) been used for potable water purposes since the last inspection?	Yes ☐ No ☑ If no, go to # 3. If yes, describe the nature and use of extracted groundwater.
2.	If answer to #1 is yes, was prior review and written approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☑ If yes, describe and go to #4 and #5.
4.	Have any of the monitoring wells within the area requiring Land Use Controls (see attached figure for the Site) been removed?	Yes ☐ No ☑ If no, go to #6. If yes, describe.
5.	If answer to #3 or #4 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #4?	Yes ☐ No ☑ Describe.
6.	Are the following components of each monitoring well within the Site in good working order: well vaults and well vault locks, well casings, and well labels? Include recommendations for replacement or repair.	Yes ☐ No ☑ Describe.
7.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☑ If no, go to #9. If yes, provide the number of Project Evaluation Review Forms submitted.
8.	If answer to #7 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☑ Attach the approved Work Request.
9.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☑ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature: 

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 10.38/10.39 Unit 7
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 39, 40, 46, and 47 of the Base Master Plan OU 7 Amendment while completing the checklist. The areas requiring Land Use Controls shown on Maps 39, 40, 46, and 47 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Date: 3/13/17 ☐ Annual Inspection ☒ 5-Year Review

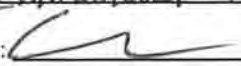
Emmanuel Vasquez, OTIE
(name, affiliation, address, and telephone number)

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	Has the groundwater from the aquifer within the Site area (see attached figure for the Site) been used for potable water purposes since the last inspection?	Yes ☐ No ☒ If no, go to # 3. If yes, describe the nature and use of extracted groundwater.
2.	If answer to #1 is yes, was prior review and written approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☒ Describe.
3.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 4. If yes, describe and go to #4 and #5.
4.	Have any of the monitoring wells within the area requiring Land Use Controls (see attached figure for the Site) been removed?	Well Removal: Yes ☐ No ☒ If no, go to # 6. If yes, describe.
5.	If answer to #3 or #4 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #4?	Yes ☐ No ☒ Describe.
6.	Are the following components of each monitoring well within the Site in good working order: well vaults and well vault locks, well casings, and well labels? Include recommendations for replacement or repair.	Yes ☐ No ☒ Describe.
7.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to # 9. If yes, provide the number of Project Evaluation Review Forms submitted.
8.	If answer to #7 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request.
9.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature: 

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 9.60
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 37, 38, and 41 of the Base Master Plan OU 7 Amendment while completing the checklist. The areas requiring Land Use Controls shown on Maps 37, 38, and 41 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Emmanuel Vasquez, OTIE
(name, affiliation, address, and telephone number)

Date: 3/13/17

☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☒ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☒ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature: 

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 9.68
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 37, 38, and 42 of the Base Master Plan OU 7 Amendment while completing the checklist. The areas requiring Land Use Controls shown on Maps 37, 38, and 42 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Emmanuel Vasquez, OTIE
(name, affiliation, address, and telephone number)

Date: 3/13/17

☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☑ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☒ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☒ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☑ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature: _____

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 10.12
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 39, 40, and 50 of the Base Master Plan OU 7 Amendment while completing the checklist. The areas requiring Land Use Controls shown on Maps 39, 40, and 50 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Emmanuel Vasquez, OTIE
(name, affiliation, address, and telephone number)

Date: 3/13/17

☐ Annual Inspection
☑ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☑ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☑ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☑ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☑ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☑ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☑ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☑ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature: [signature]

Title: CHEMIST

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 10.27
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 39, 40, and 51 of the Base Master Plan OU 7 Amendment while completing the checklist. The areas requiring Land Use Controls shown on Maps 39, 40, and 51 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Emmanuel Vasquez, OTIE
(name, affiliation, address, and telephone number)

Date: 3/13/17

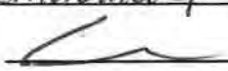
☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☑ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☒ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☒ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature: 

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 10.35
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 39, 40, and 52 of the Base Master Plan OU 7 Amendment while completing the checklist. The areas requiring Land Use Controls shown on Maps 39, 40, and 52 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Emmanuel Vasquez, OTIE
(name, affiliation, address, and telephone number)

Date: 3/13/17

☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☑ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☒ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☒ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☑ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature:

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 10.37
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 39, 40, and 53 of the Base Master Plan OU 7 Amendment while completing the checklist. The areas requiring Land Use Controls shown on Maps 39, 40, and 53 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Emmanuel Vasquez
(name, affiliation, address, and telephone number)

Date: 3/13/17

☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☒ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☒ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature:

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 10.38/10.39 Units 1 – 6
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 39, 40, and 45 of the Base Master Plan OU 7 Amendment while completing the checklist. The areas requiring Land Use Controls shown on Maps 39, 40, and 45 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Emmanuel Vasquez, OTIE
(name, affiliation, address, and telephone number)

Date: 3/13/17

☐ Annual Inspection
☑ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☑ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☑ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☑ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☑ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☑ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☑ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☑ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature: 

Title: Chemist

Date: 3/13/17

Land Use Controls Inspection Checklist
CAOC 10.3
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 39, 40, and 54 of the Base Master Plan OU 7 Amendment while completing the checklist. The areas requiring Land Use Controls shown on Maps 39, 40, and 54 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Emmanuel Vasquez, 0716
(name, affiliation, address, and telephone number)

Date: 3/14/17

☐ Annual Inspection
☑ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☑ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☑ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☑ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☑ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☑ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☑ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☑ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature: _____

Title: RPM Chemist

Date: 3/14/17

Land Use Controls Inspection Checklist
CAOC 10.4
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 39, 40, and 55 of the Base Master Plan OU 7 Amendment while completing the checklist. The areas requiring Land Use Controls shown on Maps 39, 40, and 55 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Emmanuel Vasquez, OTIE

(name, affiliation, address, and telephone number)

Date: 3/14/17

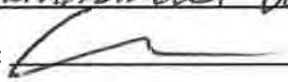
☐ Annual Inspection
☑ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☑ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☑ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☑ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☑ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☑ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☑ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature: 

Title: Chemist

Date: 3/14/17

Land Use Controls Inspection Checklist
CAOC 10.5
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 39, 40, and 56 of the Base Master Plan OU 7 Amendment while completing the checklist. The areas requiring Land Use Controls shown on Maps 39, 40, and 56 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Emmanuel Vasquez, OTIE
(name, affiliation, address, and telephone number)

Date: 3/14/17

☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☒ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☒ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature: [signature]

Title: Chemist

Date: 3/14/17

Land Use Controls Inspection Checklist
CAOC 10.49
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 39, 40, and 57 of the Base Master Plan OU 7 Amendment while completing the checklist. The areas requiring Land Use Controls shown on Maps 39, 40, and 57 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Emmanuel Vasquez
(name, affiliation, address, and telephone number)

Date: 3/14/17

☐ Annual Inspection
☑ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☑ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☑ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☑ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☑ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☑ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☑ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☑ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature:

Title: Geologist

Date: 3/14/17

Land Use Controls Inspection Checklist
CAOC 10.80
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 39, 40, and 58 of the Base Master Plan OU 7 Amendment while completing the checklist. The areas requiring Land Use Controls shown on Maps 39, 40, and 58 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Emmanuel Vasquez, ORE
(name, affiliation, address, and telephone number)

Date: 3/14/17

☐ Annual Inspection
☑ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☐ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☐ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☐ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☐ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature:

Title: Chemist

Date: 3/14/17

Land Use Controls Inspection Checklist
CAOC 32, Stratum 2
Marine Corps Logistics Base Barstow
Barstow, California

General Instructions: Please refer to Maps 37, 38, and 59 of the Base Master Plan OU 7 Amendment while completing the checklist. The areas requiring Land Use Controls shown on Maps 37, 38, and 59 are subject to revision. Also refer to the most current version of the Base Master Plan for updates to areas requiring Land Use Controls.

If required, provide descriptions and comments on separate sheets of paper and attach to this checklist.

Inspected by: Emmanuel Vasquez, OTIE
(name, affiliation, address, and telephone number)

Date: 3/14/17

☐ Annual Inspection
☒ 5-Year Review

Name, affiliation, address, and telephone number of person(s) interviewed during inspection:

1.	In a period between current and last inspection, has the area requiring Land Use Controls (see attached figure for the Site) been used for residential housing, elementary or secondary schools, childcare facilities, or playgrounds?	Yes ☐ No ☒ If no, go to # 3. If yes, describe.
2.	If answer to #1 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #1?	Yes ☐ No ☒ Describe.
3.	Have any of the site security/warning features including permanent site markers associated with the Site area been removed?	Yes ☐ No ☒ If no, go to # 5. If yes, describe.
4.	If answer to #3 is yes, was prior review and approval obtained from the Department of the Navy, Department of Toxic Substances Control, and Regional Water Quality Control Board – Lahontan Region for the activities described in response to #3?	Yes ☐ No ☒ Describe.
5.	In a period between current and last inspection, was a Work Request or Service Call submitted to the Work Input Control Desk of the Public Works Department for any proposed work within the Site area?	Yes ☐ No ☒ If no, go to #7. If yes, provide the number of Project Evaluation Review Forms submitted.
6.	If answer to #5 is yes, was the Work Request or Service Call approved by the MCLB Barstow Environmental Division?	Yes ☐ No ☒ Attach the approved Work Request.
7.	Were any activities undertaken in the Site area for which approval was not obtained through completion of the Work Request or Service Call?	Yes ☐ No ☒ Describe.

I hereby certify that the information provided in this checklist is true and accurate to the best of my knowledge and belief following a reasonable inquiry.

Name: Emmanuel Vasquez

Signature: 

Title: Chemist

Date: 3/14/17

MCLB Barstow
5 Year Review Inspections

Photolog – March 2017

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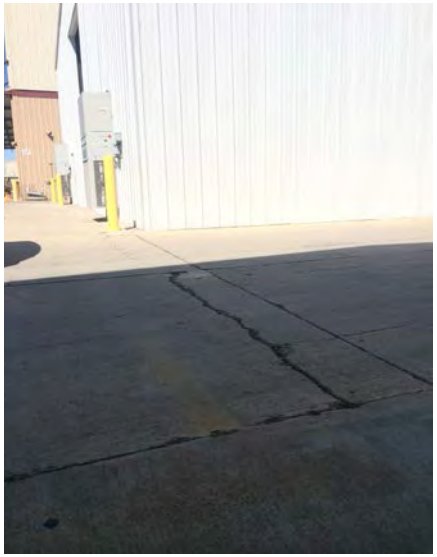
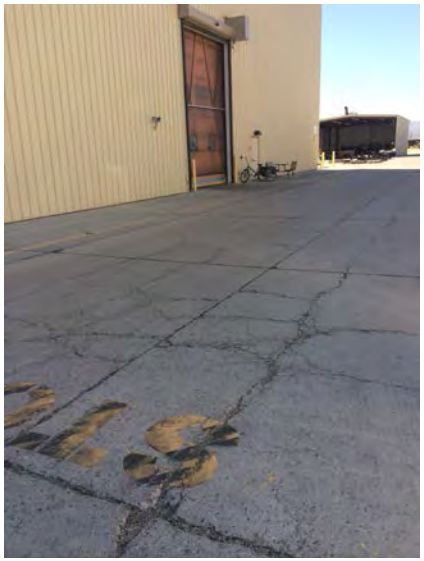
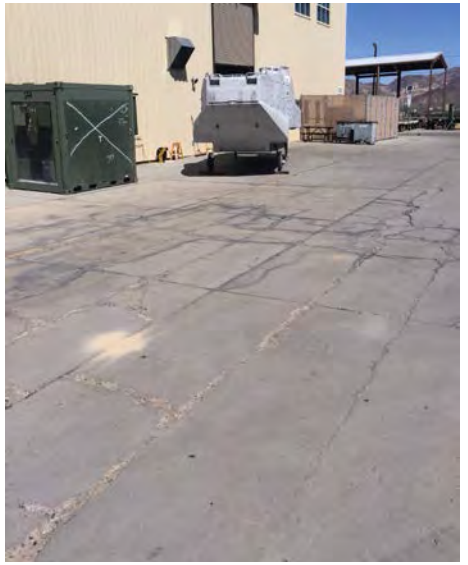
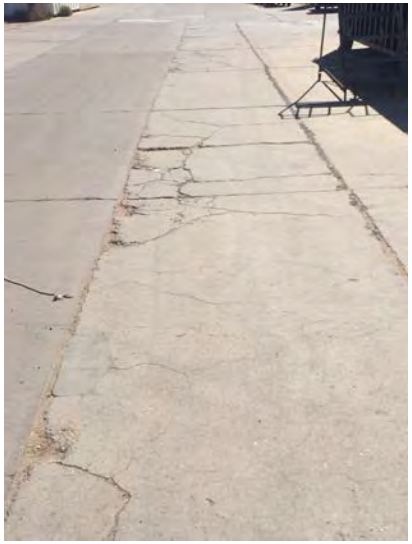
CAOC 16







Inspection completed 3/13/17 by M. Camacho, E. Vasquez



CAOC 16, continued

OU1-Groundwater

Inspection completed 3/13/17 by M. Camacho, E. Vasquez

CAOC 18- Stratum 3

Inspection completed 3/13/17 by M. Camacho, E. Vasquez

CAOC 34- Stratum 1

Inspection completed 3/13/17 by M. Camacho, E. Vasquez

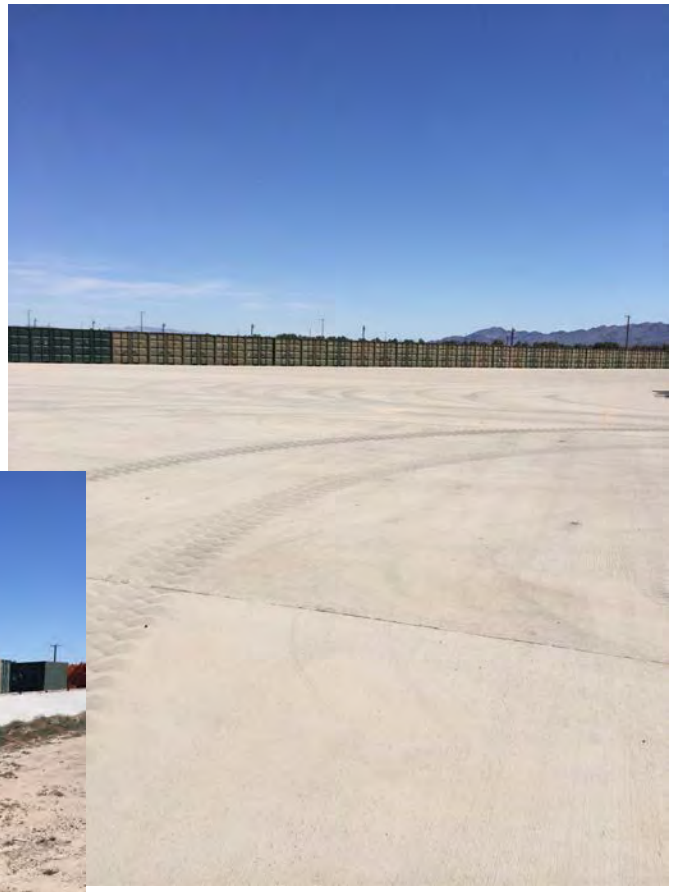
CAOC 20

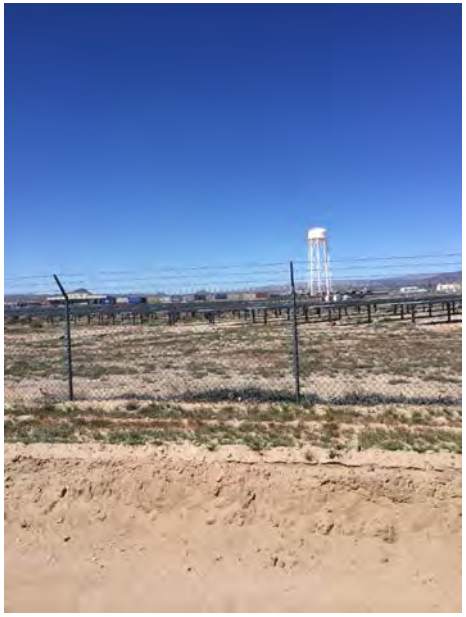
Inspection completed 3/13/17 by M. Camacho, E. Vasquez

CAOC 26

Inspection completed 3/13/17 by M. Camacho, E. Vasquez

CAOC 23



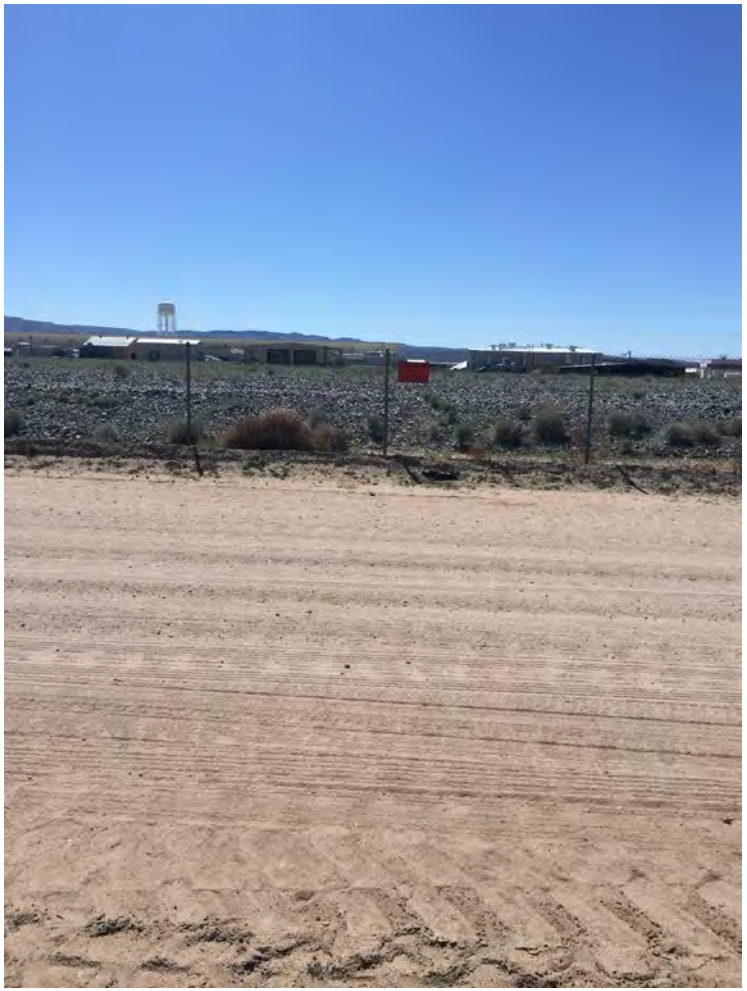


Inspection completed 3/13/17 by M. Camacho, E. Vasquez

CAOC 35

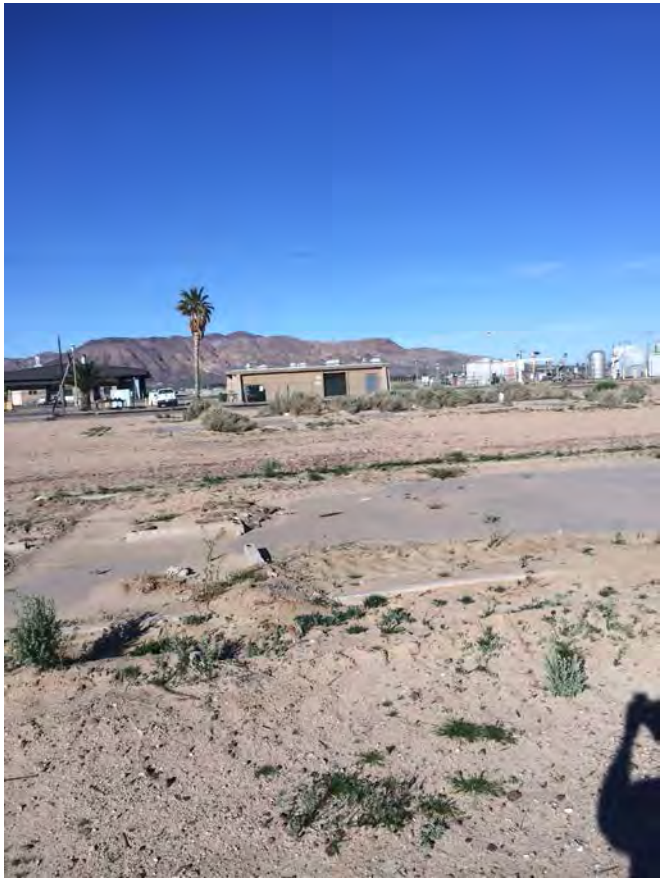
Inspection completed 3/13/17 by M. Camacho, E. Vasquez

CAOC 35, continued



CAOC 15/17

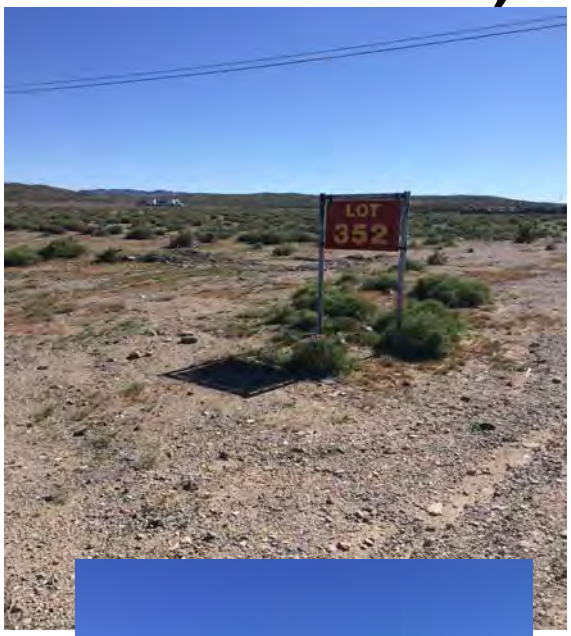
CAOC 21



Inspection completed 3/13/17 by M. Camacho, E. Vasquez

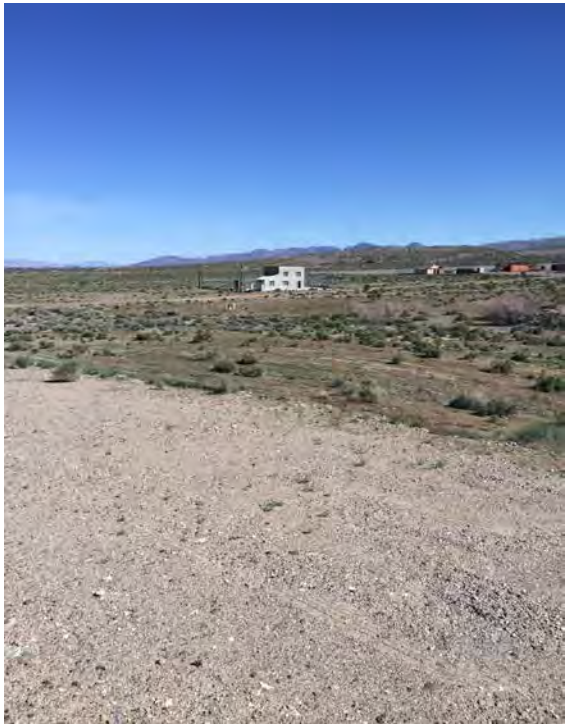
CAOC 21, continued

CAOC 5 – Lot 351, 352, and 357



Inspection completed 3/14/17 by R. Ofili, and E. Vasquez

CAOC 11



Inspection completed 3/14/17 by R. Ofili, and E. Vasquez

CAOC 2

Inspection completed 3/14/17 by R. Ofili, and E. Vasquez

CAOC 1

Inspection completed 3/14/17 by R. Ofili, and E. Vasquez

CAOC 3

Inspection completed 3/14/17 by R. Ofili, and E. Vasquez

CAOC 3, continued

CAOC 14

CAOC 6

Inspection completed 3/14/17 by R. Ofili, and E. Vasquez

CAOC 6, continued

CAOC 10.12 (Former Bldg. 50)

Inspection completed 3/14/17 by R. Ofili, and E. Vasquez

CAOC 10.49 (Former USTs)

Inspection completed 3/14/17 by R. Ofili, and E. Vasquez; Building 27 located north of CAOC 10.49 is scheduled for demolition, with permits in review by MCLB Barstow.