

**TINKER AFB RCRA PERMIT**

**ATTACHMENT 5 - NOTICE OF INTENT FOR CORRECTIVE ACTION**

Author: Tinker AFB

Last update: Dec. 15, 2017

- 1.0 Introduction
- 2.0 Facility Background
  - 2.1 Description and Physical Location
  - 2.2 Description of Facility
  - 2.3 Hydrogeology
- 3.0 Corrective Action Strategy (CAS) Program
  - 3.1 Strategic Plan for Using the CAS
  - 3.2 Performance Standards
  - 3.3 Corrective Action Objectives Based on the Performance Standards
- 4.0 Proposed Communication Strategy

- Figure 1: Tinker AFB Vicinity Map
- Figure 2: Tinker AFB National Priority List (CERCLA) Site
- Figure 3: Building #3001 National Priority List Site Conceptual Model
- Figure 4: AF Contaminated Groundwater Unit Sites, Groundwater Management Units and Subunits Map
- Figure 5: Location of Ongoing Solid Waste Management Units and Areas of Concern
- Table 3.1: Ongoing Solid Waste Management Units
- Table 3.2: Ongoing Areas of Concern



# Tinker AFB Notice of Intent

---

## **Corrective Action Strategy**

Prepared by:

AFCEC/CZOW

Tinker AFB, Installation Support Section

Environmental Restoration Program

7701 Arnold St. (Building 1 – Suite 221)

Tinker AFB, OK 73145-9100

*12/15/2017*

---

**TABLE OF CONTENTS**

**1.0 INTRODUCTION..... 2**  
**2.0 FACILITY BACKGROUND..... 3**  
    **2.1 DESCRIPTION AND PHYSICAL LOCATION**  
    **2.2 DESCRIPTION OF FACILITY**  
    **2.3 HYDROGEOLOGY**  
**3.0 CORRECTIVE ACTION STRATEGY (CAS) PROGRAM... 11**  
    **3.1 STRATEGIC PLAN FOR USING THE CAS**  
    **3.2 PERFORMANCE STANDARDS**  
    **3.3 CORRECTIVE ACTION OBJECTIVES BASED ON THE PERFORMANCE STANDARDS**  
**4.0 PROPOSED COMMUNICATION STRATEGY... 18**

**List of Figures**

Figure 1: Tinker AFB Vicinity Map... 3  
Figure 2: Tinker AFB National Priority List (CERCLA) site... 6  
Figure 3: Building 3001 National Priority List Site Conceptual Section... 8  
Figure 4: AF Contaminated Groundwater Unit Sites, Groundwater Management Units and Subunits Location Map. .... 12  
Figure 5: Location of Ongoing Solid Waste Management Units and Areas of Concern..... 13

**List of Tables**

Table 3.1 Ongoing Solid Waste Management Units... 14  
Table 3.2 Ongoing Areas of Concern..... 15

**References Note**

Information provided within this document is primarily obtained and edited for consolidation from the following documents (those documents reference additional documents).

- USEPA Region 6, February 2015. *Corrective Action Strategy (CAS)*.
- AFCEC/CZOW, December 2017. *Tinker AFB RCRA Permit Renewal Application Section 10*.
- AFCEC/CZOW (Cory S. Bowen), December 2017. *Conceptual Site Model for Tinker AFB, Ok.*
- Versar, August 2012, *Basewide Work Plan (Parts 1 & 2)*; that serve as the Unified Federal Policy – Quality Assurance Project Plan and Health and Safety Plan

## 1.0 INTRODUCTION

The Tinker Air Force Base (Tinker AFB) remediation strategy, as executed under the Air Force Environmental Restoration Program (ERP) is consistent with the corrective action requirements set out in the U.S. EPA *Region 6 Corrective Action Strategy (CAS)* dated February 2015. This serves as notice to the State of Oklahoma Department of Environmental Quality of Tinker Air Force Base's intent to continue to conduct corrective action using the CAS.

Corrective Action at Tinker AFB will be performed in accordance with the 2015 United States Environmental Protection Agency (USEPA) Region 6 Corrective Action Strategy (CAS) guideline (February 2015), that has been approved and adopted by the ODEQ Land Protection Division. The proposed CAS for Tinker AFB will be a holistic approach to all of the solid waste management units (SWMUs), areas of concern (AOCs), and other recognized release areas. The CAS will be conducted in accordance with § 264.90 and 264.101, ensuring that the requirements of a corrective action program are implemented and maintained. The emphasis will be on streamlining the process of corrective action to achieve results that satisfy all of the stakeholders.

The CAS is a risk management, performance based, alternate corrective action approach using the development of corrective action objectives (CAOs). The performance standards and achievement of CAOs are based on current and reasonably anticipated land and groundwater uses associated with Tinker AFB. A Corrective Action Strategy Work Plan, a Risk Management Plan, as well as a Notice of Intent have been completed for the Base.

A major component of the CAS for Tinker AFB will be the groundwater monitoring program. The program will work hand-in hand with the Tinker *Final Basewide Work Plan (August 2012)*, which follows the format and guidance set out in the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP). The UFP-QAPP guidelines were prepared by an Intergovernmental Data Quality Task Force including representatives from the U.S. Environmental Protection Agency, the Department of Defense (DoD), and the Department of Energy to provide instructions for preparing Quality Assurance Project Plans (QAPPs). The Basewide Work Plan, provided previously to and concurred on by the ODEQ, describes the data quality objectives (DQOs), sampling and analysis procedures, and reporting protocols for the monitoring program. Under the proposed CAS, the point of compliance for Tinker AFB is the property boundary of the base. The groundwater protection standard will be achieved at the point of compliance in order to protect human health and the environment in accordance with §264.101.

## 2.0 FACILITY BACKGROUND

### 2.1 DESCRIPTION AND PHYSICAL LOCATION

The Tinker Air Force Base legal property description is (¼, ¼, ¼, Section, Township, Range) NE1/4, SW1/4, SW1/4, Section 22, Township 11N, Range 2WIM.

Tinker AFB is located in central Oklahoma, approximately five miles southeast of downtown Oklahoma City. The Base is bounded on the west by Sooner Road, on the east by Douglas Boulevard, on the north by Interstate 40, and on the south by Southeast 74th Street (Figure 1). The surrounding area is a mixture of commercial and residential properties. Communities located in the immediate vicinity of the Base include Midwest City to the north, Del City to the west, and Oklahoma City to the south and east.

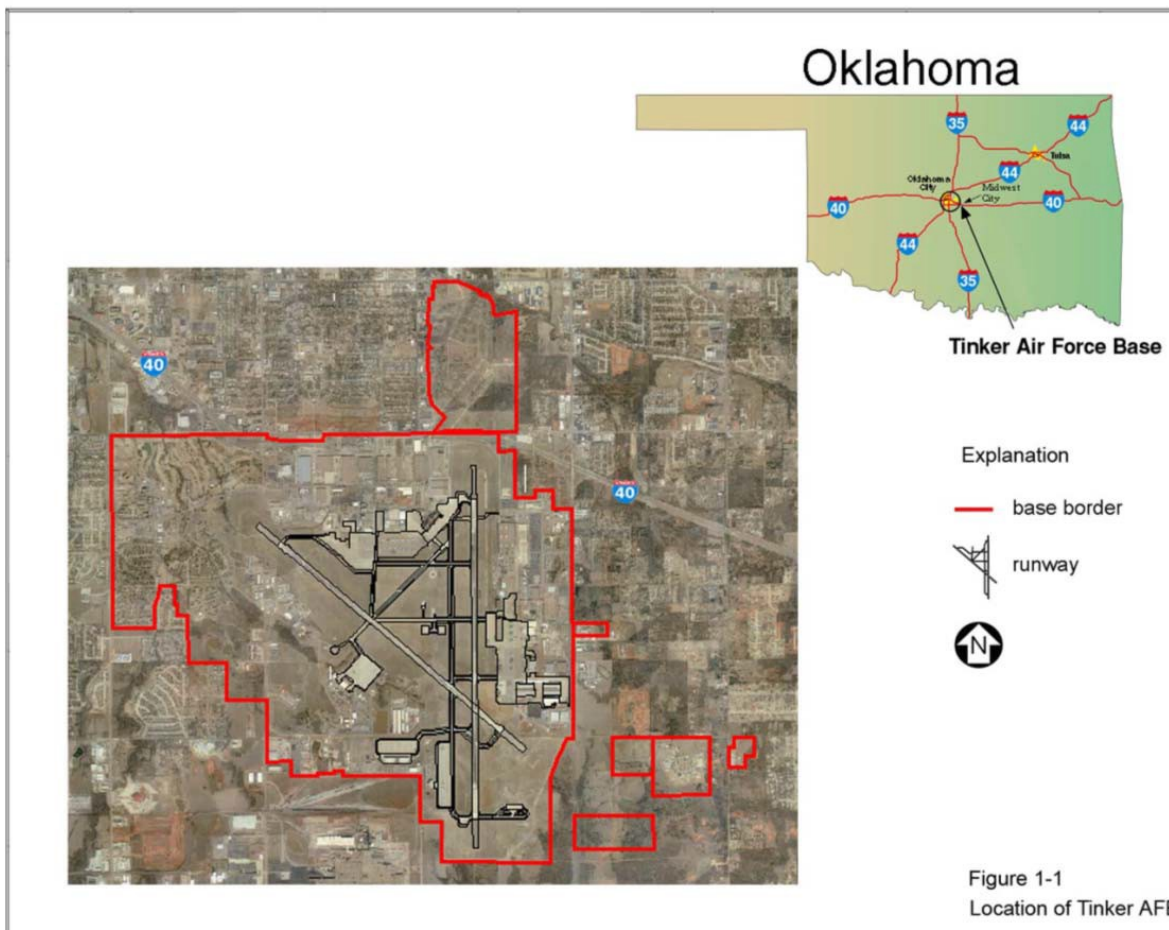


Figure 1 Vicinity Map

Tinker AFB is situated on a relatively flat expanse of grassland. Prior to the development of the Base, the area was characterized by large tracts of private agricultural land. The Base currently occupies approximately 4,277 acres of semi-improved and unimproved grounds that are used for the airfield, golf course, housing area, offices, shops, and other uses characteristic of military installations. Property surrounding the Base includes residential, industrial and non-industrial businesses, and agricultural areas. Potential receptor populations include those related to residences with private water wells, industrial facilities and other businesses with private wells where potable water might be available, and potentially wells used for agricultural purposes such that crops may become contaminated. All of these wells tap into a portion of the Garber-Wellington Aquifer. Lake Stanley Draper, a local surface water supply reservoir with a small portion of its drainage basin in the southeast part of Tinker AFB, is also used for recreational purposes. Local streams, such as Soldier Creek and Crutch Creek, which either transect the Base or have tributaries that extend onto the Base, may be used for recreation and fishing downstream.

## **2.2 DESCRIPTION OF FACILITY**

Tinker AFB's mission is dedicated to providing worldwide technical logistics support to Air Force aerospace weapon systems, equipment, and commodity items, and encompasses a myriad of responsibilities. The logistics center manages or maintains the B-1B, B-2, B-52, E-3, and the C/KC-135 series aircraft. It performs annual depot-level maintenance on more than 120 aircraft and overhauls and maintains more than 1,100 engines from 11 major commands, as well as the Army, Navy, and numerous foreign countries. The center also manages various missile systems. Tinker AFB also accommodates a large family of associate organizations representing several major commands. Two large Air Combat Command support units add to the complex mission of the Base. Tinker AFB is the home operating base for the 552nd Air Control Wing flying the E-3 Sentry, and the Air Force Reserve's 507th Air Refueling Wing. Tinker AFB is also home of the Navy's E-6A Strategic Communications Wing One.

Tinker AFB has been and remains a major industrial complex for overhauling, modifying, and repairing military aircraft, aircraft engines, and accessory items. Base operations began in 1942 and certain activities employing hazardous materials resulted in the generation of hazardous wastes. These wastes have included spent organic solvents, waste oils, waste paint strippers and sludge, electroplating wastewater and sludge, alkaline cleaners, acids, jet fuels, and radium paints. Wastes that currently are generated are managed at two permitted hazardous waste storage facilities. However, prior to enactment of the Resource Conservation and Recovery Act of 1976 (RCRA), industrial wastes were discharged into unlined landfills and waste pits, streams, sewers, and ponds. Past releases from these areas and from underground storage tanks (USTs) have occurred, resulting in soil, groundwater, and surface water contamination.



## **2.2.1 History of Solid Waste Management Units, Areas of Concerns and Other Release Areas**

As a permit condition pursuant to the Resource Conservation and Recovery Act of 1976 (RCRA) and the reauthorization of RCRA in the Hazardous and Solid Waste Amendments of 1984 (HSWA), the USEPA was given the authority to require facilities to take corrective action for any releases of hazardous waste or constituents from any SWMU at a treatment, storage, or disposal (TSD) facility. Tinker AFB entered into a Federal Facilities Agreement (FFA) with USEPA Region 6, and the Oklahoma State Department of Health (OSDH) on December 9, 1988. The FFA defines the geographic boundary on Tinker AFB that lies between the National Priority List (NPL) site administered under CERCLA and the non-NPL sites (administered under RCRA). Any sites that are not identified as part of the FFA are considered non-NPL and subject to RCRA authority. The State of Oklahoma provides lead oversight for the non-NPL sites on the Installation. On July 1, 1991, OSDH (now ODEQ) and USEPA Region 6 issued the RCRA Hazardous Waste Management Permit (No. OK1571724391), which formally authorized Tinker AFB to operate as a hazardous waste storage facility. RCRA was administered at Tinker AFB by the OSDH and USEPA until USEPA Region 6 granted ODEQ administrative authority in 1994. ODEQ is the lead oversight agency for the RCRA Hazardous Waste Management Permit and Corrective Action.

The 1991 RCRA Permit and its successor renewals (August 2002 and the application for 2012) require Tinker AFB to investigate the identified non-NPL listed SWMU and Areas of Concern (AOCs) any newly recognized SWMUs & AOCs newly-discovered releases, and to take further corrective action where appropriate.

A RCRA Facility Assessment (RFA) was performed in 1989 which identified 80 SWMUs (two with multiple subunits/process units). An additional SWMU was added to the 1991 RCRA Permit application, after the RFA was conducted, and has reached no further action (NFA) status. In total, 81 SWMUs have been identified through the RCRA permitting process through August 2002. Of these, 73 SWMUs have achieved NFA status.

The 1989 RFA also identified 19 AOCs. No additional AOCs were added through August 2002. Of the original 19 AOCs, 15 have reached NFA status. The 2012 RCRA Permit renewal application identified an additional thirteen (13) Areas of Concern sites.

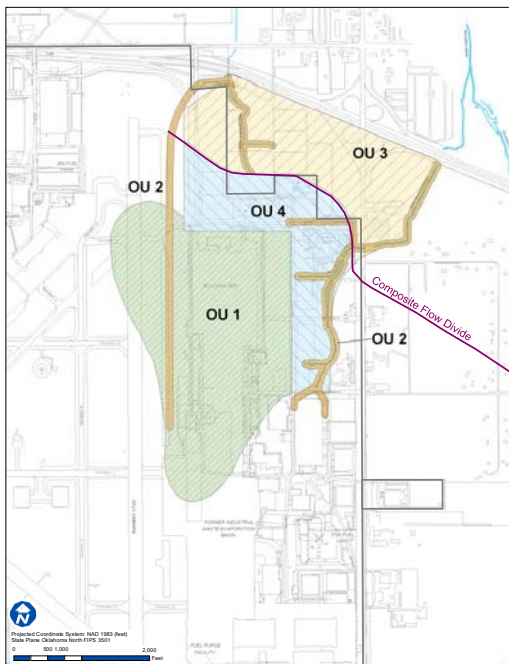
## **2.2.2 Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)**

### **2.2.2.1 National Priorities List (NPL) site**

A portion of Tinker AFB is on the National Priorities List (NPL) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The NPL is administered by USEPA Region 6 under CERCLA of 1980. Congress amended CERCLA in 1986 through the Superfund Amendments and Reauthorization Act (SARA). SARA waived sovereign immunity for federal facilities. At Tinker AFB, USEPA's CERCLA Hazard Ranking System (HRS) ranking criteria mandated placement of Soldier Creek/Building 3001 (B3001) on the NPL in July 1987. The 1988

FFA designated the Air Force as the lead agency for cleanup of the national priority list (NPL) site at Tinker AFB. However, the USEPA is the lead oversight agency for the cleanup of federal facilities under CERCLA/SARA and has the final authority to select the remedial action at federal facilities placed on the NPL if the USEPA and relevant federal agency cannot concur in the selection. The NPL site is a distinct unit defined in December 1988 and cannot be expanded or appended. Any contaminated sites outside of the NPL are deemed non-NPL sites, and as such, are subject to RCRA authority, with ODEQ as the current lead oversight agency.

The Soldier Creek/B3001 NPL is located at the Northeast 'quadrant' of the installation (Figure 2). The site consists of four operable units identified as: Operable Unit (OU) 1 – The Building 3001 OU; OU 2 – The Soldier Creek Sediment and Surface Water OU; OU 3 – The Soldier Creek Groundwater OU; and OU 4 – The Industrial Wastewater Treatment Plant Groundwater OU. In 1990 a Record of Decision was signed by EPA Region 6 and the AF to contain, capture and treat the groundwater contaminated by the chlorinated solvents via a pump and treatment (P&T) system. The system operated from 2002 to 2004 at which time the P&T system was declared asymptotic. The Operable Unit 1 groundwater was allowed to rebound and an updated Remedial Investigation and Feasibility Study was conducted. In 2014 A Record of Decision Amendment (RODA) was signed by EPA Region 6 and the AF to conduct an interim action to focus cleanup activities in the upper saturated zone via In-situ treatment. The RODA also identified that environmental work on OU 4 will be combined with OU 1, since the contaminated groundwater at OU 4 is migrating to OU 1 and is in the same saturated zone. Under the RODA the OU 4 and lower saturated zone of OU 1, which is the same groundwater unit, is being monitored for natural attenuation as an interim remedial action. Operable Units 2 and 3 have reached NFA status with the USEPA.



### **National Priorities List Site Operable Units (OUs)**

**OU 1** → Building 3001  
- 1990 ROD for groundwater  
- 2014 RODA IRA for hot spots

**OU 2** → Soldier Creek Sediment and Surface Water Operable Unit.  
(Certificate of Completion on January 2006)

**OU 3** → Soldier Creek Groundwater Operable Unit  
(January 2008 NFA ROD)

**OU 4** → Industrial Wastewater Treatment Plant Groundwater Operable Unit  
- Combined with OU1  
- 2014 RODA IRA for MNA

**Figure 2 Tinker National Priority Site**



### **2.2.2.2 Military Munitions Response Program**

The Military Munitions Response Program (MMRP) was created in 2002 in response to the NCP. Congress delegated management of this program to the Department of Defense (DOD) under the Defense Environmental Restoration Program (DERP). The purpose of the MMRP is to address unexploded ordnance (UXO), discarded military munitions (DMM) and munitions constituents (MC) located on current and former defense sites. Eligible sites include those where releases of UXO, DMM, or MC are known or suspected to exist and the release occurred prior to September 30, 2002. Five MMRP physical sites have been identified at Tinker AFB: OD051 – Ordnance disposal Area, TS090 – Skeet Range #1, FR092 – Firing-in Buttress #2, TS093 – Skeet Range #2, SR094 – 38<sup>th</sup> EIG Small Arms Range. The NCP designated the Department of Defense as the lead agency with EPA oversight. Although not directly applicable to this permit renewal request, MMRP sites are mentioned for reference purposes. These sites have been investigated under CERCLA/NCP; in October 2012. To date the Department of Defense Explosives Safety Board granted a No Further Action ESS for all but the FR092 – Firing-in Buttress #2 site, which is programmed to be remediated at a future date.

## **2.3 HYDROGEOLOGY**

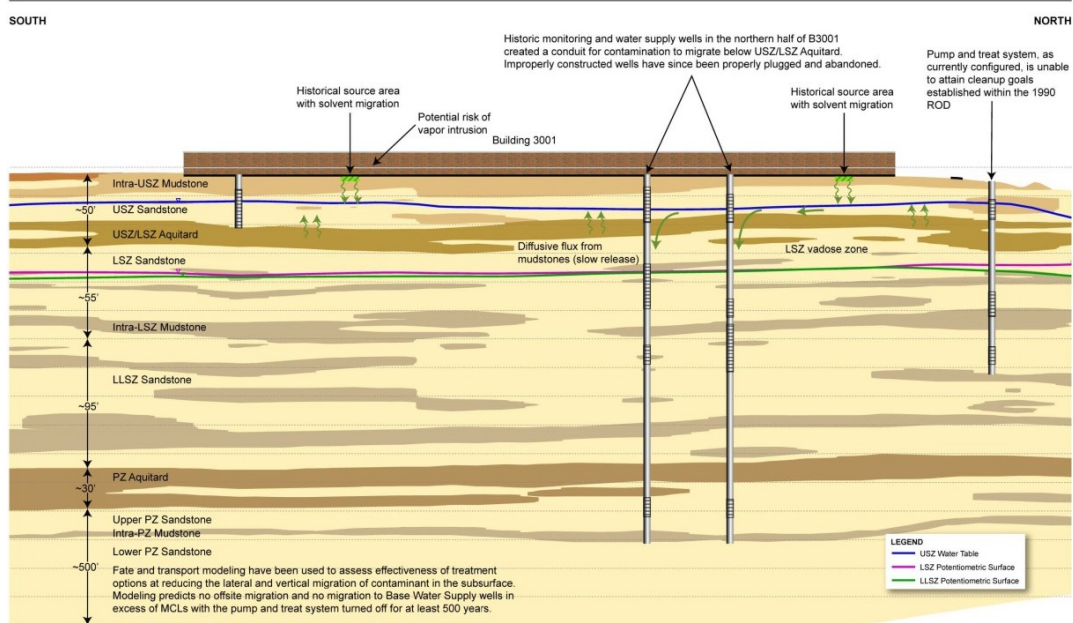
### **2.3.1 Regional Hydrogeology**

Ground water hydrology of the Tinker Air Force Base - Oklahoma City area has been reported by various authors, including Jacobsen and Reed (1949), Wood and Burton (1968), Bingham and Moore (1975), Bedinger and Sniegocki (1976) and Wickersham (1979). Additional information has been obtained from interviews with officials of the Oklahoma Water Resources Board, the District Office, U.S. Geological Survey Water Resources Division, and the Association of Central Oklahoma Governments (ACOG).

The most important source of potable groundwater in the Oklahoma City metropolitan area is the Central Oklahoma Aquifer (COA) System. Two of the primary water-bearing units of this system include the Garber Sandstone and the Wellington Formation. Together, they are commonly referred to as the Garber-Wellington Aquifer and are considered to form a single aquifer because the units were deposited under similar conditions and because many of the best producing wells are completed in this zone. Tinker AFB obtains much of its water from this source while local municipalities (Oklahoma City, Del City, Midwest City) have switched primarily to surface water sources. The Base water supply wells (WSWs) are screened or perforated at depths of 200 to 750 ft below ground surface (BGS). Regional groundwater flow in the Central Oklahoma Aquifer is generally west to east.

### 2.3.2 Local Hydrogeology

Tinker AFB currently manages potentiometric surface maps of the Hennessey Water Bearing Zone (HWBZ), the Upper Saturated Zone (USZ), the Lower Saturated Zone (LSZ), and the Lower-Lower Saturated Zone (LLSZ) that have been generated using over 1,200 existing monitoring wells and piezometers. The aquifer zones are colloquial to the Base and were designated to aid in groundwater investigations at Tinker. These maps are revised each time that a Base-wide Sampling and Water Level Measurements event is completed; maps can be compared over the years to help understand annual (and in some cases seasonal) variations in water levels in the different saturated zones. A Producing Zone (PZ) potentiometric map is not included since available well coverage in that zone is limited. Tinker AFB is located in a recharge area for the Garber-Wellington Aquifer. The following text discusses each of these zones, including the PZ. For visual reference, Figure 3 is an example conceptual cross-section for Building 3001. See the included (in pocket) Figure 10-8 Hydrogeological Cross Section IT-Extension B-B' and Figure 10-9 Hydrological Cross Section IT-RFI C-C' for two actual digital cross sections.



NOT TO SCALE  
 Note: Cross-section interpreted from SAIC, 2009  
ES10181102107MDC: Figure 3-1\_Tinker\_AFB\_SiteModel\_SMP-FE3001\_CSM\_x2 at 9/1/12 at

**FIGURE 3-1**  
 Building 3001 Conceptual Site Model Diagram  
 Tinker Air Force Base, Oklahoma

**Figure 3 Building 3001 NPL Site Conceptual Section**

The Hennessey Group at Tinker AFB does not have a recognized aquifer but some saturation, identified as the Hennessey Water Bearing Zone (HWBZ) does exist. The HWBZ is absent in the northeastern portion of the Base where the Hennessey strata are thin. Three aquifer zones (in descending order) have been identified for the Garber Sandstone and Wellington Formation (Garber-Wellington Aquifer) under Tinker AFB; these zones are part of the regional Garber-Wellington Aquifer. The zones include the Upper Saturated Zone (USZ), the Lower Saturated Zone (LSZ), and the Producing Zone (PZ). The LSZ has been subdivided into an upper and lower (Lower-Lower Saturated Zone) to address a significant downward component of groundwater flow in the LSZ, which is noted within the aquifer under Tinker AFB. The magnitude of this vertical flow component varies across the Base and is much less under the western one-third of Tinker AFB where the overlying Hennessey Group is thicker. The HWBZ is present in the southwestern portion of Tinker AFB where the Hennessey Group thickens and becomes locally saturated with groundwater. The hydraulic conductivity is low; hydraulic conductivity (slug) test data indicate it is generally less than 0.5 ft/day. The HWBZ is not considered a significant source of drinking water. The unit receives recharge from precipitation where it is exposed at the surface, at localized areas where sandstone outcrops at the surface and in locations of desiccation cracks with higher conductivity.

The USZ is the uppermost saturated zone of the Garber-Wellington Aquifer and is delineated from the LSZ by a basal aquitard. The USZ is approximately 50 ft thick, measured from the base of the overlying Hennessey Group to the base of the underlying aquitard, except where portions have been removed by erosion along down-cutting streams such as Crutch Creek. The USZ is primarily recharged by infiltration of precipitation. The saturated portion typically ranges from less than 1 ft to 20 ft thick, and truncates along a line extending from near the Base boundary and the westward toward Douglas Boulevard to just west of West Soldier Creek in the northeast part of the Base, looping through the former Kimsey Addition located north of Building 3001, and turning northwestward around the north end of Runway 17/35. Truncation of the saturated zone is primarily due to westward geologic dip and stream erosion. Desiccation cracks are also present in the USZ where it is exposed at the surface. Vertical contaminant transport from surface spills may impact deeper portions of the USZ more quickly due to the presence of desiccation cracks. Open desiccation cracks would provide relatively little resistance to water and contaminant infiltration, and movement through the desiccation cracks in the unsaturated USZ could be rapid. Groundwater flow in the USZ under Tinker AFB is generally to the west or southwest due to geologic dip, although locally variations occur due to interaction with local streams, such as Crutch Creek, as well as other factors.

Numerous mudstone layers, which act as local aquitards, exist within the Garber-Wellington Aquifer saturated units. Most do not extend over great distances. However, two mudstone

layers occur on a semi-regional basis under Tinker AFB; these are more laterally continuous and actually function as semi-regional aquitards. The uppermost aquitard occurs between the USZ and LSZ and is referred to as the USZ/LSZ aquitard. The second aquitard occurs between the LSZ and PZ and is referred to as the PZ aquitard. These aquitards, however, do not consist of a single continuous mudstone unit. Instead, they are zones composed of interbedded mudstones and fine sandstones and siltstones with a higher proportion of clay relative to sand. They are recognized by significant groundwater pressure head differences (up to 70 ft of head difference across the PZ aquitard for example) at a well cluster location where wells are screened above and below the layers.

The USZ/LSZ aquitard is composed of overlapping discontinuous mudstone lenses with interbedded thin sand lenses. The aquitard interval varies in thickness from less than 10 ft to greater than 25 ft. A vadose zone exists under the eastern third of Tinker AFB between the base of the USZ/LSZ aquitard and the saturated portion of the LSZ. This vadose zone is roughly 10 to 20 ft thick in the northeastern portion of the Base, but thins to the west and is no longer present west of the north-south runway (Runway 17/35) where the LSZ potentiometric surface intersects the aquitard. Head differences of up to 6 ft occur between the USZ and LSZ at the western Base boundary and up to 40 ft on the east side of the Base. The USZ/LSZ aquitard outcrops between 15 and 20 ft above the creek along the west bank of Soldier Creek just south of the IWTP. Based on the distribution of chemical contaminants, the USZ/LSZ aquitard is believed locally to allow some hydraulic communication between the USZ and the LSZ through natural and man-made discontinuities.

The next deeper zone in the Garber-Wellington Aquifer is the LSZ. This saturated interval is approximately 150 ft thick. However, as previously noted, this zone is sub-divided into the LSZ and the LLSZ for modeling and discussion purposes based on the recognition of a vertical component of the flow gradient. Generally, the LSZ consists of the upper third of the section, while the LLSZ is considered, when included, as the lower two-thirds. The LSZ directly underlies the USZ/LSZ aquitard and exists under all of Tinker AFB. Hydraulic conductivity test data show the hydraulic conductivity of the LSZ ranges from 0.25 to 8.7 ft/day. Flow is generally to the west and southwest under the Base but, as with the USZ, local variations exist under the west portion of Tinker AFB due to structural features related to the Oklahoma City Anticline. Just east and north of Tinker AFB, changes in recharge and interaction with Soldier Creek create variable flow directions. Recharge to the LSZ occurs primarily by precipitation where units outcrop just east of the Base and locally by the downward movement of groundwater through the USZ/LSZ aquitard where the USZ overlies it and discontinuities in the aquitard occur.

Groundwater in the LLSZ generally flows in the same direction as groundwater in the LSZ at any given location on Tinker AFB. Recharge to the LLSZ is by downward leakage from the LSZ and by lateral inflow of groundwater from the area east of the Base. A pumping test was conducted at well cluster 1-91PW in the northeastern corner of the Base in November 1994 as part of the IWTP/Soldier Creek Groundwater OUs RI. The hydraulic conductivity values calculated from the pumping test ranged from 0.78 to 15.6 ft/day. The results from the pumping test indicate that the LLSZ is interconnected with the LSZ.

The PZ aquitard occurs at the base of the LSZ (LLSZ) and hydraulically separates the LSZ from the underlying PZ. The isolation of the PZ from the LLSZ is demonstrated by head differences of up to 70 ft across the unit. This aquitard appears to be similar to the USZ/LSZ aquitard, being formed by a series of overlapping mudstones with interbedded more permeable sandstone/siltstone lenses. Well log data suggest that the PZ aquitard is present beneath the entire Base. The aquitard appears to be at least 30 ft thick; however, studies suggest that this aquitard may be up to 80 ft. thick locally.

The PZ lies below the PZ aquitard and extends downward approximately another 500 to 600 ft. At around 700 to 800 ft BGS, the PZ grades progressively into saline water, which forms the lower limit of potable water. A physical boundary between the PZ and underlying units (i.e., the Chase, Council Grove, and Admire Formations) occurs somewhat deeper. The natural flow direction in the PZ is difficult to identify due to the influence of water supply wells (WSW) and limited data coverage but is most likely to the west.

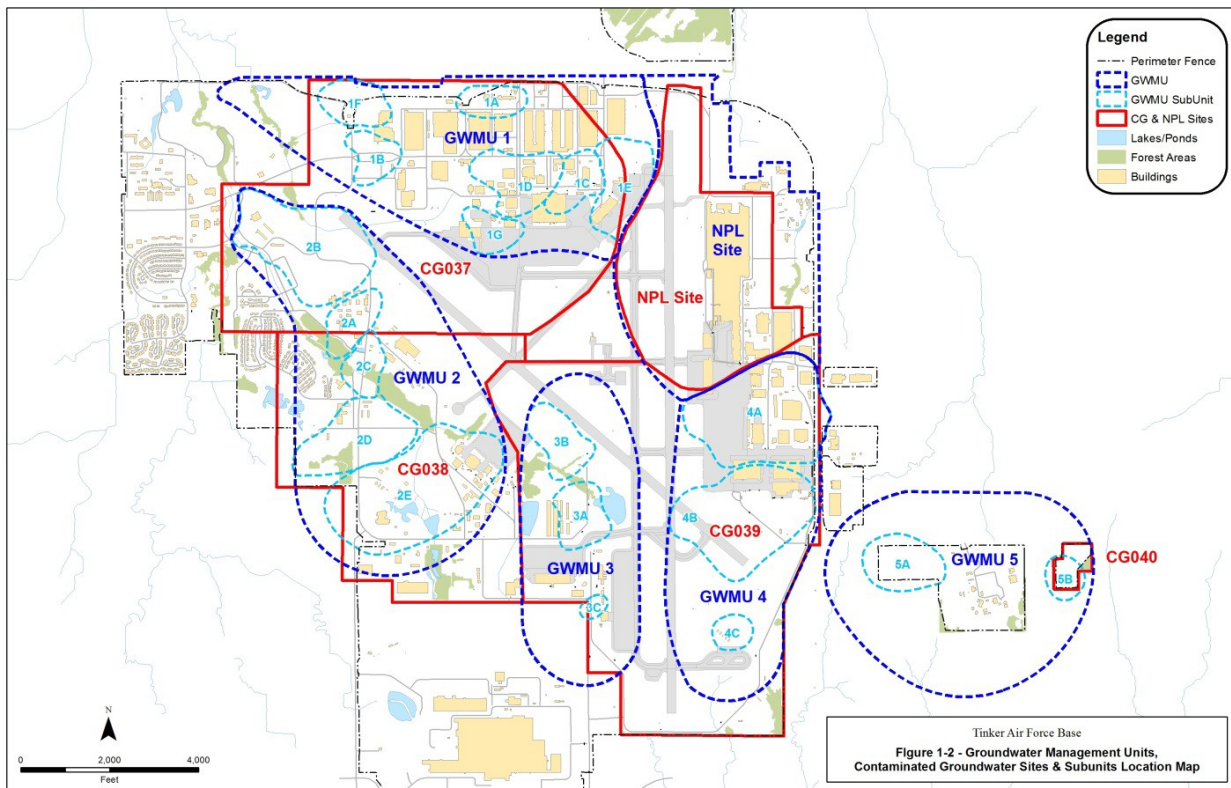
### **2.3.3 Extent of Groundwater Contamination**

All known and documented groundwater contamination is within the installation boundary and is limited to the upper 200 feet, from the USZ down to the LSZ-LLSZ aquifer that is above the PZ aquitard. The PZ saturated zone is not contaminated within the 'footprint' of Tinker AFB property.

## **3.0 CORRECTIVE ACTION STRATEGY (CAS) PROGRAM**

The corrective action strategy at Tinker Air Force Base, consists of a risk management, performance based, alternate corrective action approach using the development of corrective action objectives. Corrective action has been occurring at Tinker AFB since the early 1990s under the previous RCRA permits and many RCRA sites already have corrective measure in place. Both base-wide and site specific sampling is performed on a periodic basis in order to determine the effectiveness of contaminant reduction and containment efforts. Information relating to solid waste management units required in 40 CFR 270.14 (d) are available in numerous site specific investigative reports and base-wide groundwater sampling report.

Tinker AFB has installed and operated groundwater pump and treat systems (P&T) that treat volatile organic compounds at AF designated sites CG038 and CG040 (see Figure 5 below) as well as a number of vapor extraction pumping (VEP) systems (See Tables 3-1 and 3-2) at other sites. Most of these treatment systems have been shutdown to allow for groundwater rebound prior to initiation of a update RFI. Treated water from the VEP and CG040 systems are discharged to the Tinker AFB Industrial Wastewater Treatment Plant for secondary treatment before going to the Oklahoma City Wastewater Treatment System; treated water from CG038 is discharged directly to the Oklahoma City system. Note that Contaminants of Concerns for the sites listed in Tables 3.1 and 3.2 are PCE, TCE, 1,2-DCE, VC, 1,2-DCA (as primary risk drivers). Figure 4 provides a visual reference of the locations of the ongoing SWMU and AOC sites.



**Figure 4 : AF Contaminated Groundwater Units Sites, Basewide Groundwater Management Units and Subunits Location Map**



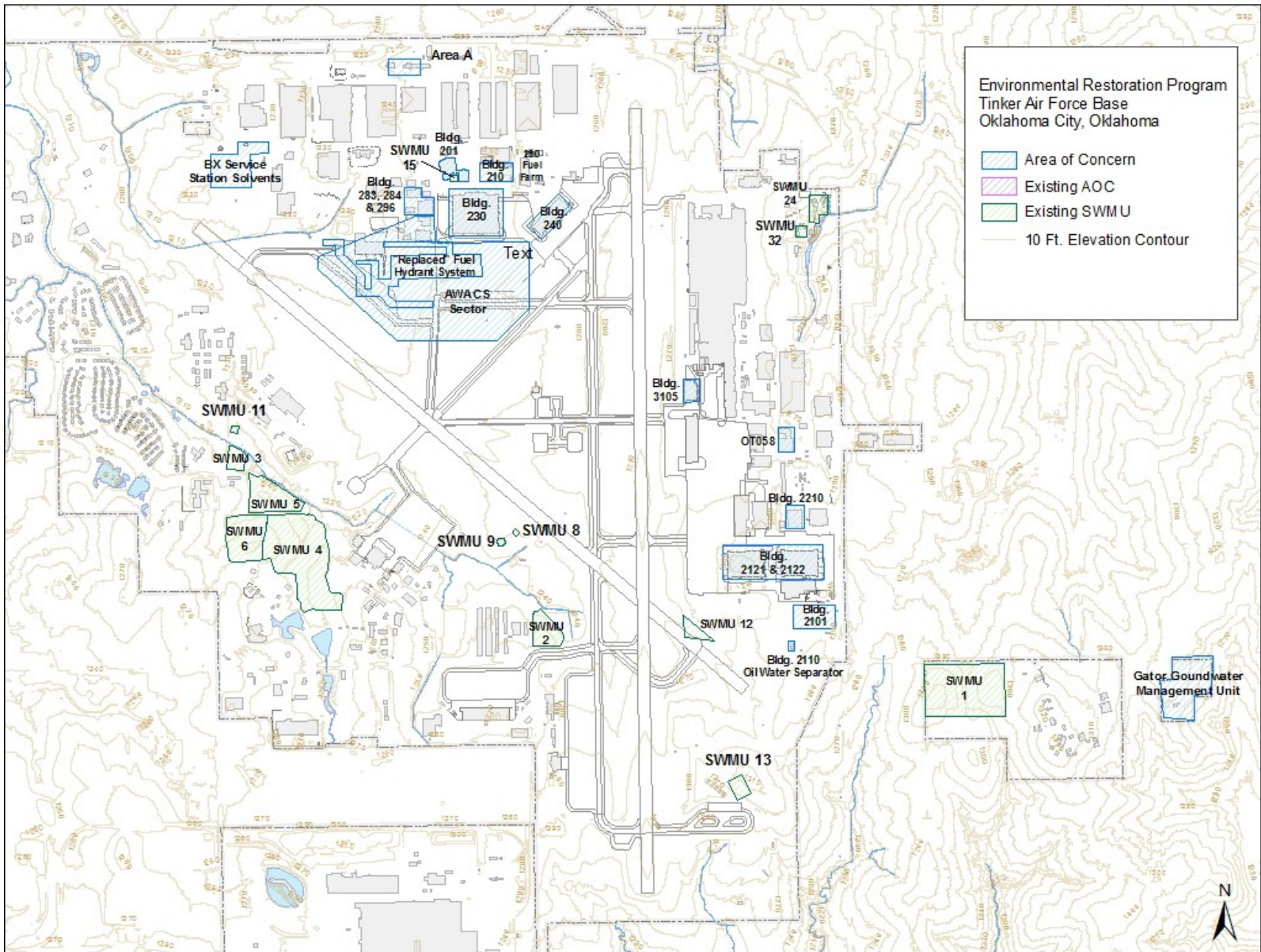


Figure 5 : Location of Existing SWMUs and Other Release Areas at Tinker AFB

Table 3.1 lists the seven (7) ongoing the Solid Waste Management Units (SWMUs) that will be managed under the CAS.

**Table 3-1: Ongoing Solid Waste Management Units**

Current SWMU No.	RFA SWMU No.	Current AOC No.	RFA AOC No.	AFSite No.	Original Site Name	Activity History	Current Status
1	1			LF016	Landfill 6	Listed as a SWMU in the 1991 and 2002 RCRA Permits. Final Phase I RFI report completed September 1994. Final Phase II RFI report completed June 1997. RCRA landfill cap upgrades were completed in 2001. Long term monitoring and care of the RCRA cap was approved as the remedy for this site in a letter from ODEQ dated 6/1/2001.	Long Term Monitoring and Care of the RCRA cap.
2	2			LF015	Landfill 5	Listed as a SWMU in the 1991 and 2002 RCRA Permits. Final Phase I RFI report completed September 1994. Final Phase II RFI completed September 1995. RCRA landfill cap installed in 1998. Long term monitoring and care of the RCRA cap as the remedy for this site was documented in a letter from ODEQ dated 10/4/2001.	Long Term Monitoring and Care of the RCRA cap.
3	3			LF011	Landfill 1	Listed as a SWMU in the 1991 and 2002 RCRA Permits. RCRA landfill cap installed in 1991. Final Phase I RFI report completed September 1994. Final Phase II RFI completed April 1999. Long term monitoring and care of the RCRA cap as the remedy for this site was documented in a letter from ODEQ dated 7/25/2001.	Long Term Monitoring and Care of the RCRA cap.
4	4			LF012	Landfill 2	Listed as a SWMU in the 1991 and 2002 RCRA Permits. Final Phase I RFI report completed September 1994. RCRA landfill cap installed in 1998. Final Phase II RFI completed April 1999. Long term monitoring and care of the RCRA cap as the remedy for this site was documented in a letter from ODEQ dated 7/25/2001.	Long Term Monitoring and Care of the RCRA cap.
5	5			LF013	Landfill 3	Listed as a SWMU in the 1991 and 2002 RCRA Permits. RCRA landfill cap installed in December 1991. Final Phase I RFI report completed September 1994. Final Phase II RFI completed April 1999. Long term monitoring and care of the RCRA cap as the remedy for this site was documented in a letter from ODEQ dated 7/11/2001.	Long Term Monitoring and Care of the RCRA cap.
6	6			LF014	Landfill 4	Listed as a SWMU in the 1991 and 2002 RCRA Permits. RCRA landfill cap installed in December 1991. Final Phase I RFI report completed September 1994. RCRA landfill cap installed in 1998. Final Phase II RFI completed April 1999. Long term monitoring and care of the RCRA cap as the remedy for this site was documented in a letter from ODEQ dated 10/29/2001.	Long Term Monitoring and Care of the RCRA cap.
24	24			OT034	IWTP - Industrial Wastewater Treatment Plant Soils	Identified as a RCRA SWMU in the 1991 and 2002 RCRA Permits. Phase I RFI report completed April 1994. Phase II RFI report completed July 1996. CMS report completed June 2003. The Air Force submitted a decision document to ODEQ (April 23, 2004) proposing the selected remedy be vapor extraction from the soils. The ODEQ concurred with the Air Force in a letter dated May 5, 2004. The VEP system was turned off June 4, 2012. In 2016 a non-time critical removal was performed to remove soil hot spots discovered to be slightly above industrial levels. A RCRA Corrective Action Construction Completion Report for soils was completed and was approved by the DEQ on 1/25/2019.	Corrective Action complete - soil removal

Table 3-2 lists the fourteen (14) Areas of Concern sites that will be managed under the CAS.

**Table 3-2: Ongoing Areas Of Concern Sites**

AF Site Number	Current AOC No.	RFA AOC No.	Site Name	Activity History	Current Status
ST007	1	1	Fuel Farm (290 POL Facility)	AOC 1 was identified in the 6/15/89 USEPA Region 6 RFA, but was not listed as an AOC in the 1991 RCRA Permit. As required by the 1991 RCRA Permit, a summary of previous studies was documented in the December 1992 Description Of Current Conditions for Tinker AFB. This AOC was not listed in the 2002 RCRA Permit. However, a RFI report was completed in 1995, and an additional Draft Site Investigation Report was completed in December 1996. Two vacuum enhanced pumping (VEP) systems were installed at the site between 1998 and 2000 as interim corrective measures. Collectively, the two systems extract groundwater and soil vapor from 34 recovery wells around Building 214, the former Building 210, near Tank 349, and near Building 117. The two systems were shut down in April 2012.	ICM – completed in 2012. New RFI underway
ST008	20		Building 201 Vapor Intrusion	A potential vapor intrusion condition was identified at Building 201 during a base-wide vapor intrusion survey (inventory) in 2010.	RFA completed for soil vapors
CG040	21		Gator Groundwater Management Unit	CG040 encompasses chlorinated solvent impacted groundwater underneath an adjunct facility approximately one mile east of the eastern boundary of Tinker AFB near the intersection of SE 59th St. and Post Road. The facility is non-industrial; only one building used for administrative purposes was found at the site. No unique source has been identified for this contamination. A groundwater extraction and treatment system began operation as an interim action in October 1999. The RFI report was completed in December 2003 and the CMS report was completed in July 2006. A Statement of Basis was completed as a decision document between Tinker AFB and the ODEQ, and was signed by ODEQ on July 31, 2006. In 2013, an insitu-bioremediation treatment system consisting of injection wells and two bioreactors was installed to further treat the higher concentrations of CVOCs within the plumes. The extraction system was temporarily shut down December of 2016. Ultimate goal is to achieve UU/UE site close out.	Corrective Action - GW extraction system and bioreactor with in-situ remediation
CG041	22		AWACS Sector	CG041 encompasses impacted groundwater beneath the tarmac and taxiways south of Building 230. This site was introduced to ODEQ at the October 2009 RAB meeting. The RFI report was completed in August, 2014 with a recommendation to conduct a Corrective Measures Study.	RFI completed under Area A Sites. CMS recommended
OT058	23		Jet Engine Test Cells (Bldg. 3703)	A site investigation report was completed in July 2002; Interim Corrective action using soil gas vapor and groundwater extraction was initiated in 2002 with the report issued in May 2003. A CMS was completed in May 2005. The May 2002 VEP system was turned off on May 4, 2012. An additional RCRA Facility Investigation (RFI) is being conducted at this building to further evaluate the nature and extent of the contamination as well as to determine other possible sources at this location.	RFI underway

AF Site Number	Current AOC No.	RFA AOC No.	Site Name	Activity History	Current Status
OT062	24		Building 230	A RFI report was completed in March 2004. A VEP system was installed as an interim corrective measure to mitigate the potential risk posed by subsurface contaminants along the north and west sides of Building 230. A Phase I CMS was completed in April 2007 and a draft Phase II CMS was completed in May 2011. The 2005 VEP system was shut down in 2011. A new RCRA Facility Investigation (RFI) is being conducted to further characterize nature and extent.	RFI underway
OT064	25		Building 210	A Draft Final RFA was completed in July 2008. A potential vapor intrusion condition was identified. A more recent site investigation (2013) to further delineate the nature and extent of contamination has confirmed that a solvent plume exists within the northern portion of the site and further study is planned to be conducted in the near future.	RFI underway
OT065	26		Building 283, Building 284, Building 296	A potential vapor intrusion condition was identified at Buildings 283, 284, and 296 during a base-wide vapor intrusion survey (inventory) in 2010. . In addition, several fuel USTs existed in the area that may have acted as sources of fuel contamination. However, the tanks were investigated and closed under OCC jurisdiction.	RFI completed under Area A sites; CMS recommended
OT066	27		Building 2110 Oil Water Separator	Same Location as the Fuel Truck Maintenance Area AOC (see Table 10-1). A fuel leak from the oil water separator was noticed in 2004. A RFI report has been completed and was approved by ODEQ in October, 2016. The OWS, and any associated contaminated soil is planned to be removed with the demolition of Building 2110 in the near future. Ultimate goal is to achieve UU/UE site close out.	Corrective Action - Non-time critical OWS removal
OT067	28		Building 2101	This building is the former motor pool which has been demolished and will not be replaced. Due to the nature of the motor pool operations, solvent and fuel leaks are suspected. The RFI report was completed in June 2015. The CMA work plan completed involving a non-time critical soil removal action was approved March 2017. Ultimate goal is to achieve UU/UE site close out.	Corrective Action – non-time critical soil removal action
OT068	29		Replaced" Fuel Hydrant System	In 1992, fuel releases from the hydrant system were detected when fuel would seep to the surface between the joints in the concrete of the tarmac. The RFI report was completed in August, 2014 with a recommendation to conduct a Corrective Measures Study.	RFI completed under Area A Sites. CMS recommended
OT069	30		Building 2121 and Building 2122	A RFA/RFI report was completed in March 2001 followed by a supplemental SI/RFI report in September 2001 and a CMS Report in October 2001 at Building 2122. Soil contamination was identified, but report concluded that it was not impacting the groundwater. Similar process activities occurred at Building 2121 in the past, though no investigations had been performed at Building 2121. Results for sub slab soil gas sampling beneath Building 2121 and 2122 were reported in a Vapor Intrusion Assessment that was completed in August 2011. Recent data from a current RFI to further characterize and delineate indoor air, soil, and groundwater contamination, which is underway, suggests however that soil contamination extends deeper than previously thought and has probably impacted shallow groundwater at the site.	RFI underway



AF Site Number	Current AOC No.	RFA AOC No.	Site Name	Activity History	Current Status
ST033	31		Area A Service (Fuel) Station	Soil and groundwater investigations conducted in 1990 and 1992 showed the presence of motor vehicle gas contamination. A product recovery system was installed in 1992 to pump fuel from the groundwater. By 1996, the extent of soil contamination was delineated, the USTs were removed and the product recovery system expanded. VEP remediation began June 1997, and fuel product recovery was completed by 1999. The OCC approved site closure on December 18, 2000; however, this is limited to only petroleum hydrocarbons in soil and groundwater. A TCE plume (along with other chlorinated compounds) has been identified in the groundwater beneath the site. The VEP system was shut down in November, 2012 and replaced with an Emulsified vegetable oil mixture injection – In Situ.	Corrective Action – In Situ Remediation for CVOCs.
VI080	32		Building 3105	Suspected releases of solvents from drain lines beneath Building 3105 were reported at this site in August 2009. A RFI to further characterize contamination and to evaluate whether continuing sources exist at the building, is currently underway.	RFI completed Jan 2019, GW under NPL Site

### **3.1 STRATEGIC PLAN FOR USING THE CAS**

The Air Force implemented the Installation Restoration Program at Tinker AFB in July 1981. Since that time, the Air Force has maintained the lead role in environmental cleanup at Tinker AFB and has been committed to identification, investigation, and remediation of sites under the IRP and other environmental restoration programs (ERP) in compliance with applicable environmental law and regulations.

The Proposed strategy for using CAS includes:

- Holding the Scoping Meeting;
- Using the current UFP-QAPP (data objective and data types);
- Continue Interim Corrective Action Measure where appropriate;
- Develop Risk-Base Priority Screening Procedure;
- Define Site-Specific Risk criteria;
- Define Risk-Based Corrective Action Goals;
- Implement Risk-Based Corrective Action; and
- Obtain No Further Action status or Site Closure as appropriate.

### **3.2 PERFORMANCE STANDARDS**

Current groundwater corrective action objectives for Tinker AFB are outlined below.

- a. To ensure that in the future contaminants do not migrate off-site at levels above their respective drinking water MCL.
- b. To monitor and provide sampling analytical data that reports the concentrations of COCs in groundwater collected from performance wells, at each groundwater management unit or other named RCRA site.
- c. To mitigate potential indoor air exposure in buildings located over existing groundwater plumes for which there is the potential for vapor intrusion and contamination of indoor air from volatile contaminants.
- d. To remove or treat source material in groundwater to the extent practicable to reduce potential for future migration beyond the installation perimeter and enhance the attainment of performance metrics. The goal includes removal or treatment of surface/subsurface sources in soils to the extent practicable since soil sources could subsequently migrate to groundwater.
- e. To maintain existing on-site institutional and land use controls that protect workers from contact with contaminated groundwater and soils. Restricted access to the base by the general public, required digging permit approval for any excavation below six inches, and appropriate fencing are examples of existing institutional controls.



Current remediation activities and planned remedial actions are designed to meet the objectives listed above. Continuing efforts to remediate groundwater contamination satisfy the groundwater protection intent of regulations stated in 40 CFR 264.90 and 40 CFR 264.101. Tinker AFB will continue both the present groundwater monitoring program and the present groundwater remediation program and will submit to the ODEQ all status reports detailing progress and changes in the program.

### **3.3 CORRECTIVE ACTION OBJECTIVES BASED ON THE PERFORMANCE STANDARDS**

The Corrective Action Objective will be to remediate media exceeding site-specific risk based criteria based previously described performance standards, for each site.

- Achieve No Further Action status at Industrial Risk Level Standards for those sites achieving Long Term (site) Management and compliance at the installation boundary.
- Achieve Site Closeout status at Residential Risk Level Standards for those sites being closed, below MCLs (groundwater) throughout the contamination plume.

### **4.0 PROPOSED COMMUNICATION STRATEGY**

The communication strategy is to work in conjunction with ODEQ to develop plans to mitigate and remediate each site identified within the CAS. Open communication throughout the process will be maintained by work plans, reporting, RCRA phase reports (e.g. RFI, CMS, etc.) and regularly scheduled meetings with ODEQ.