New Mexico Environment Department
2018 Strategic Plan (Revised Draft)
For Kirtland Air Force Base
Aviation Fuel Cleanup
March 21, 2018

Sand and gravel deposited by the ancestral Rio Grande is the host material for a major aquifer in the Albuquerque area

2018 Strategic Plan

<u>Goal</u>: Protect Albuquerque's aquifer and drinking water supply wells in the area of the fuel leak

<u>Strategies to Achieve the Goal</u>

In 2018, NMED and the Air Force will continue to:

1. **Implement a robust site monitoring and wellhead protection program**
2. **Monitor the natural attenuation of fuel contamination in soil and groundwater, and identify potential opportunities for enhancement thru interim corrective measures**
3. **Deploy multiple engineered technologies, both simultaneously and sequentially, as interim corrective measures to clean up soil and groundwater**
4. **Meet or exceed all requirements for providing public information and involvement**

Strategy 1 – Implement Robust Site Monitoring and Wellhead Protection

- No detections of EDB in drinking water wells or sentinel wells
- Cone of depression persists in groundwater extraction area
- EDB plume capture analysis will be rigorously updated
- Effects of rising water level on direction of groundwater flow and contaminant migration will be evaluated
- Data gaps caused by water level rise will be filled:
  - Drill new monitoring wells
  - Monitor previously dry soil-vapor wells that now contain groundwater

EDB will not be allowed to adversely impact any drinking water supply wells

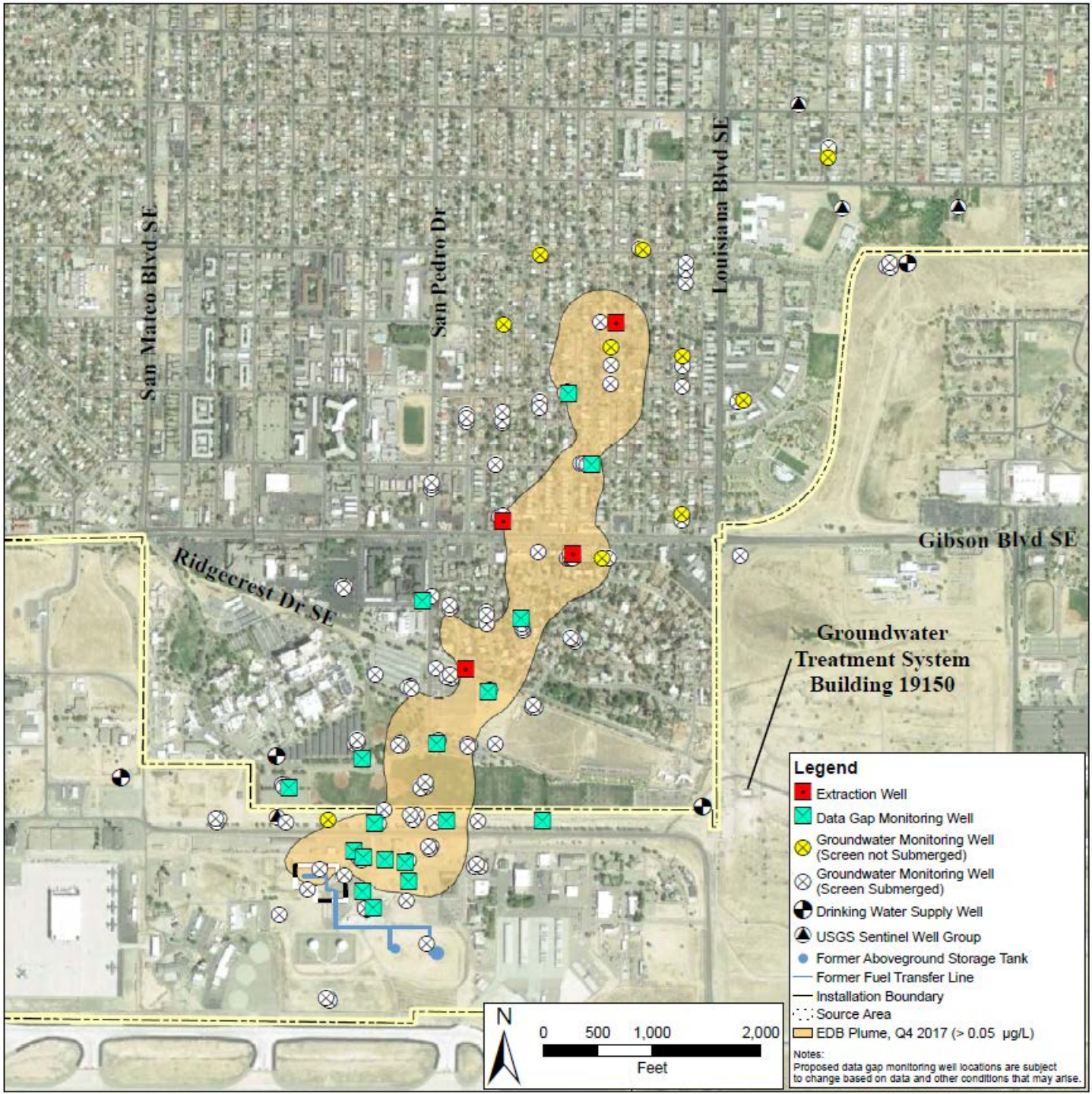
At Least 18 (up to 26) New Wells to Fill Data Gaps

Six monitoring wells will be drilled.

Five, and possibly up to 8, LNAPL coreholes will be completed as monitoring wells.

At least seven, and likely up to 12, previously dry soil-vapor or groundwater wells now have water due to rising water table (using these existing wells will save up to $5.25 million in drilling costs).

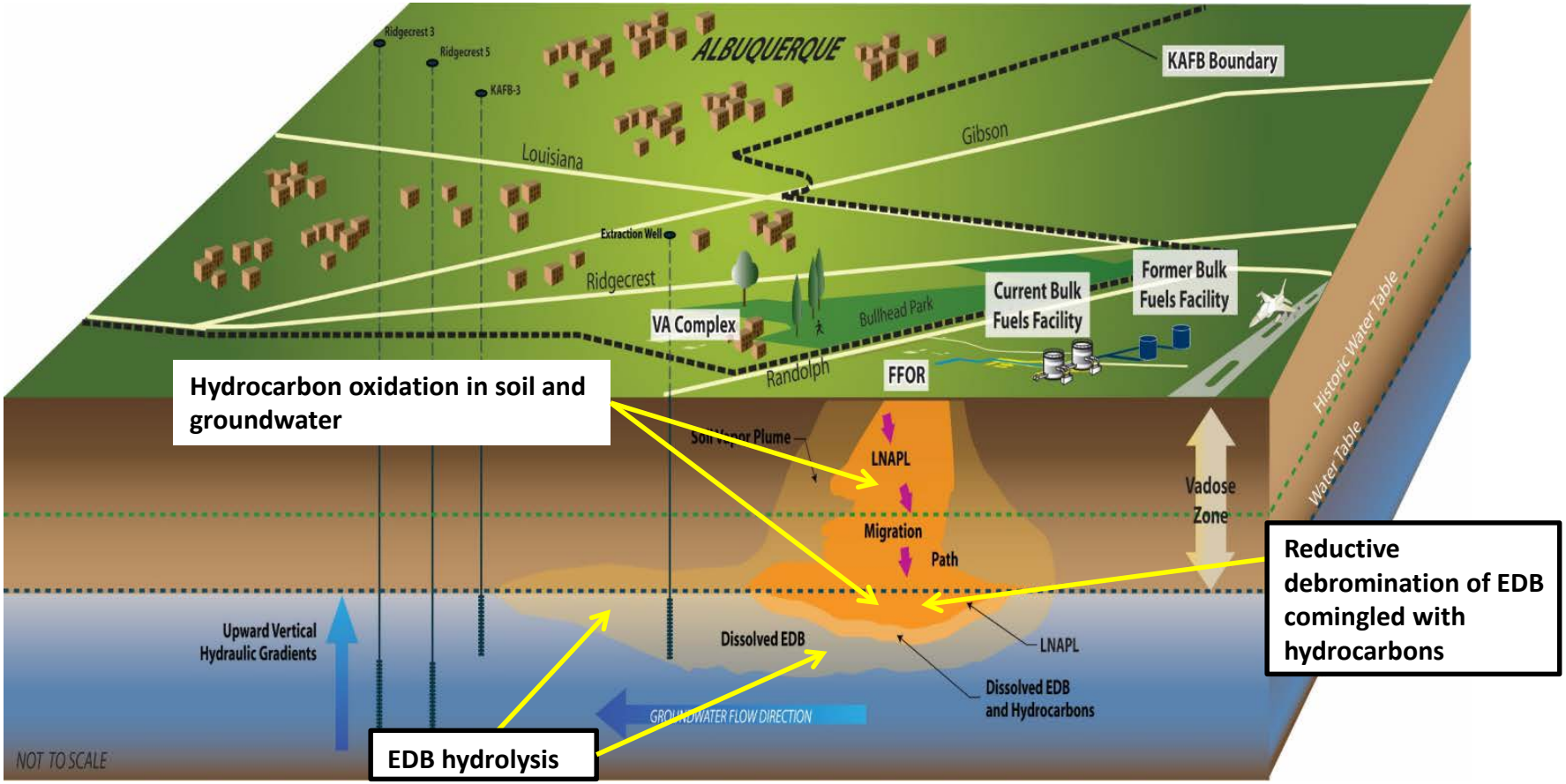
Thanks to the Air Force and Army Corps of Engineers for thinking outside the box to fill data gaps and reduce cost to taxpayers!



Strategy 2 – Monitor Natural Attenuation & Identify Opportunities for Enhancement

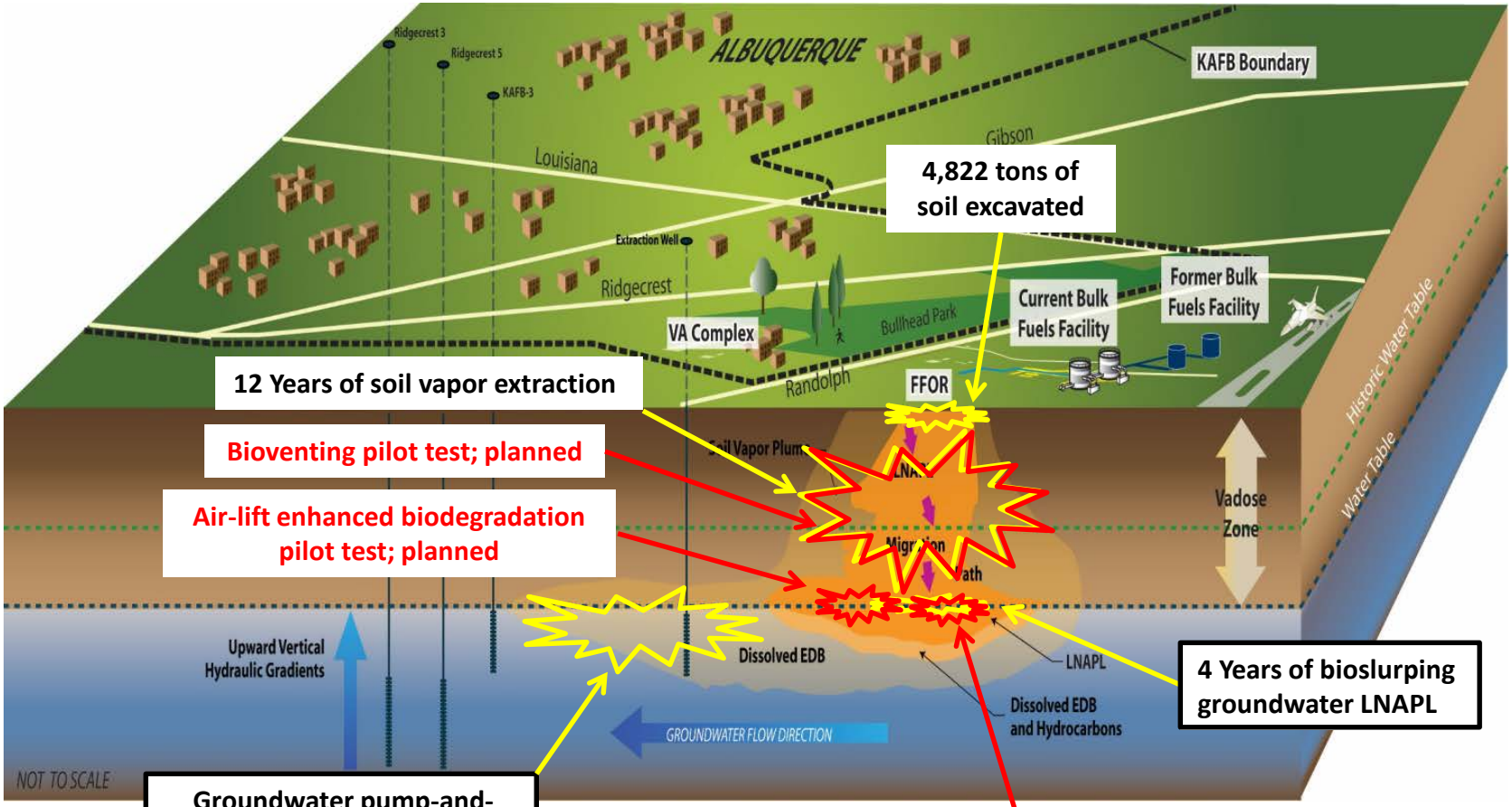
- **Site monitoring has identified ongoing natural degradation processes including hydrocarbon oxidation, EDB hydrolysis, and EDB reductive debromination.**

- **Interim corrective measures include engineered cleanup technologies to enhance natural degradation processes.**



Strategy 3 – Deploy Multiple Engineered Cleanup Technologies, Simultaneously and Sequentially

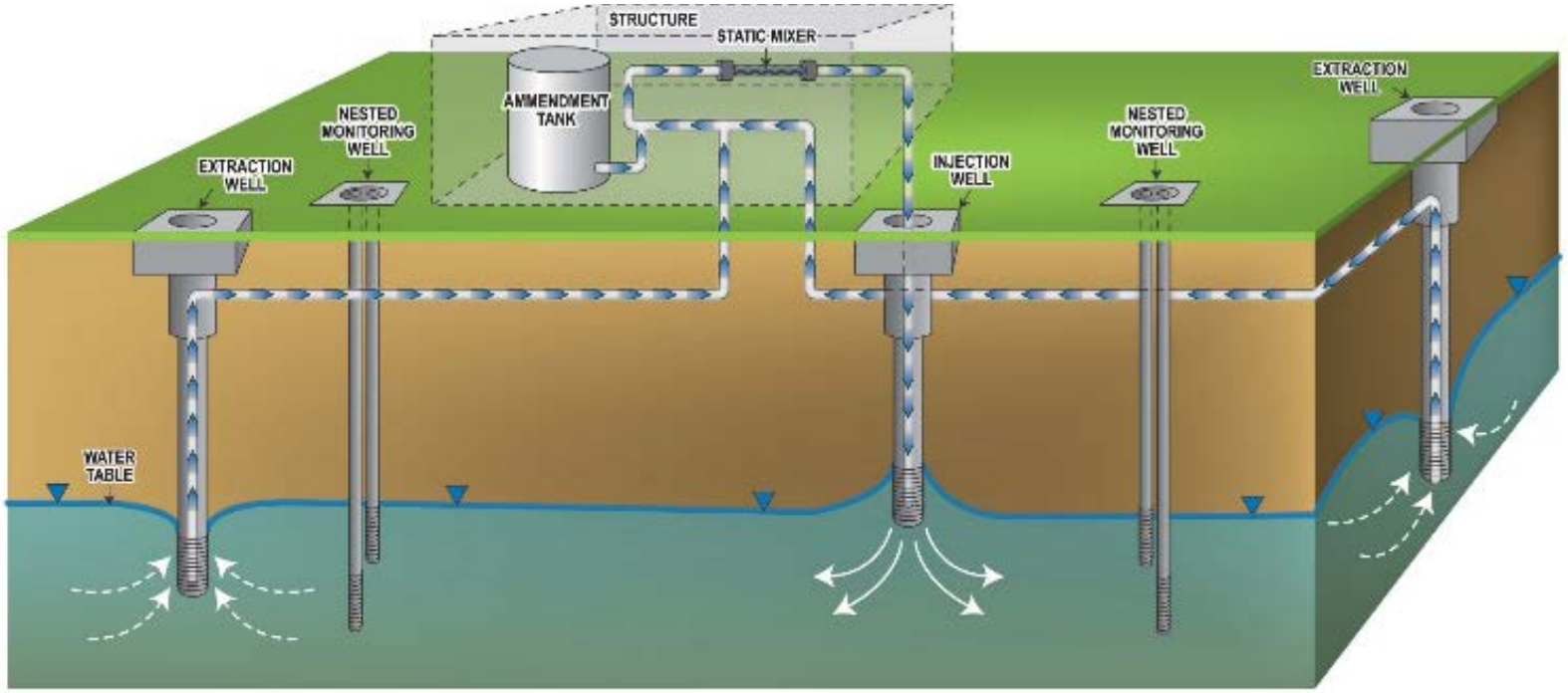
Activities in 2018 will include interim corrective measures for enhanced in-situ anaerobic groundwater biodegradation, soil bioventing, and air-lift enhanced biodegradation.



Anaerobic Biodegradation Pilot Test

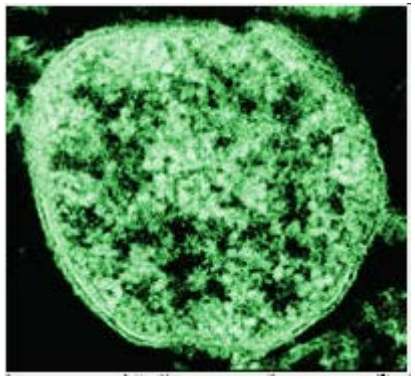
Groundwater Recirculation

- Pump groundwater and add amendments in phases
- Inject amended water to create a recirculation cell
- Supports anaerobic degradation of EDB



Anaerobic Biodegradation Pilot Test

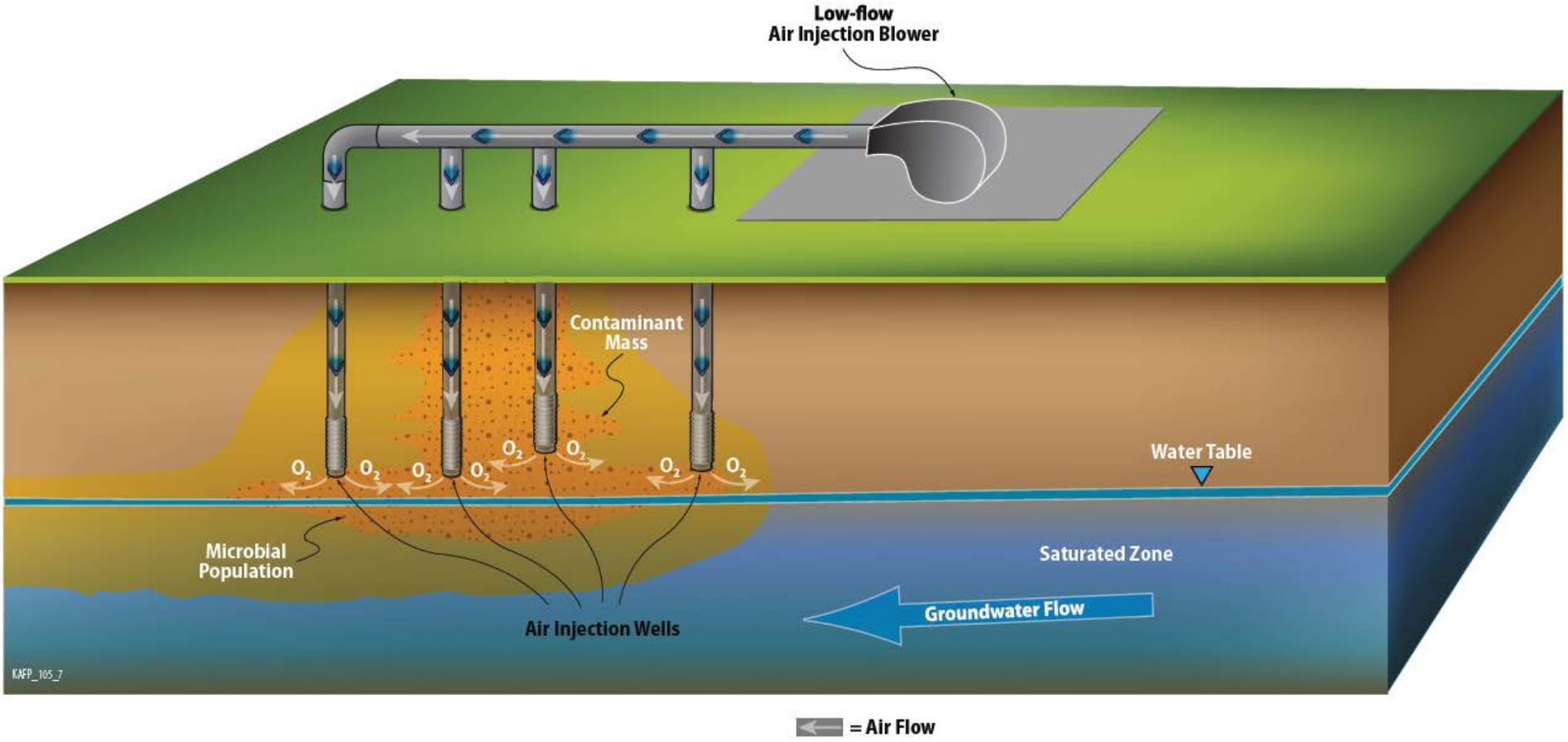
- Phase 1 – Baseline definition, tracer test circulation, passive monitoring (completed)
- Phase 2 – Bio-stimulation by adding nutrients and lactate (commenced December 2017)
- Phase 3 – Bio-augmentation by adding bacteria such as dehalococcoides (scheduled for summer 2018)
- Phase 4 – Long-Term Passive Monitoring



Dehalococcoides – a bacterium known to degrade halogenated pollutants including EDB
(University of Alberta BacMap Genome Atlas, http://wishart.biology.ualberta.ca/BacMap/index.html)

Bioventing

Air will be blown into the soil to deliver oxygen to naturally occurring bacteria and enhance their ability to biodegrade petroleum hydrocarbons



Strategy 4 - Public Outreach Schedule

The Air Force and NMED are conducting public outreach and involvement activities related to investigation and cleanup of the Kirtland Air Force Base aviation fuel contamination in accordance with the public notice and community relations requirements of the WQCC and RCRA Permits. Additionally, NMED will prepare and implement a Public Involvement Plan pursuant to NMED Policy 07-13, https://www.env.nm.gov/wp-content/uploads/2018/02/NMED-Policy-and-Procedure-07-13.pdf.

Date	Description
March 21, 2018	ABWUA Governing Board Meeting, project update
March 22, 2018	Regular Public Meeting with Technical Poster Session
March 24, 2018	Groundwater Treatment System Open House
April 13, 2018	New Mexico Geological Society, Spring Conference, Socorro, NM
June 29, 2018	NMED Public Involvement Plan to be finalized
July 12, 2018	Regular Public Meeting with Technical Poster Session
November 15, 2018	Regular Public Meeting with Technical Poster Session

NMED and the U.S. Air Force welcome invitations from neighborhood associations, civic organizations, environmental groups, and local government agencies.

Site Activity Timeline

1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020

RCRA Facility Investigation

Corrective Measures Evaluation

Soil Investigation

Installation of Groundwater Monitoring Wells

Groundwater Monitoring

Core Sampling and Results

Installation of SVE/SVM/Pneulog Locations

Soil Vapor Monitoring

LNAPL Thickness Monitoring

LNAPL Chemical Characterization

Slug Test of Groundwater Monitoring Wells

Aquifer Test of KAFB-106228

INTERIM CLEANUP MEASURES

Excavation of Contaminated Soil

Operation of SVE Systems

Vadose Zone: Bioventing Pilot Test

LNAPL: Air-Lift Bioremediation Pilot Test

Bioslurping/Skimmer Technology

LNAPL: EDB In-Situ Biodegradation Pilot Test

AS/SVE Pilot Study

EDB/BTEX Treatability Study

Groundwater Treatment System Operation

AS - Air Sparge • BTEX - Benzene, Toluene, Ethylbenzene and Xylenes • EDB - Ethylene Dibromide • LNAPL - Light Non-Aqueous Phase Liquid • RFI - RCRA Facility Investigation Report • SVE - Soil Vapor Extraction • SVM - Soil Vapor Monitoring

A Partnership for Success

A collaborative technical team is solving the complex hydrogeologic and engineering challenges posed by the fuel leak with support from Albuquerque's neighborhood groups

Westside Coalition Neighborhood Assoc.

US Army Corps of Engineers

Siesta Hills Neighborhood Assoc.

ABQ City Council District 6 Coalition of Neighborhood Assocs.

Elder Homestead Neighborhood Assoc.

Christ United Methodist Church

HAWLEY GEOMATTERS

Thomson and Associates