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File 16-5-105-3

January 3, 2001

Mr. Harry Davidson
Acting Chief, Restoration Branch
Environmental Management Division
377 ABW/EMR
2050 Wyoming Blvd. SE, Suite 125
Kirtland Air Force Base, New Mexico 87115-5270

RE: Request for Further Information, Phase 1 Stage 1 Abatement Plan (AP), Nitrate Impacted Ground Water, Kirtland Air Force Base, Albuquerque, New Mexico

Dear Mr. Davidson:

The New Mexico Environment Department (NMED) Ground Water Quality Bureau is in receipt of the Phase 1 Stage 1 AP for nitrate-impacted ground water at Kirtland Air Force Base (KAFB) submitted by your consultant, Montgomery Watson, dated August 2000. The purpose of a Stage 1 AP is to adequately define site conditions and provide data necessary to select and design an effective abatement option.

NMED has completed its review of the submittal and requires KAFB to address the following issues to better define site conditions and provide additional data. KAFB's response to these issues should be submitted to NMED within 90 days of receipt of this letter.

1. KAFB should submit to NMED a revised schedule of Phase 1 Stage 1 AP activities. This schedule should provide for completion of the proposed activities described in section 12 of the Phase 1 Stage 1 AP by May 31, 2002.

2. KAFB should submit to NMED a limited soil investigation plan for the Albuquerque sanitary sewer line break. This plan should address impacts to the vadose zone within the temporary diversion and retention ponds used to contain the domestic wastewater. The plan should describe, at a minimum, the location, depth, and frequency of soil samples to be collected, the constituents to be

analyzed from samples collected, soil sample collection methods, and a description of lithology collection methods to be used.

3. KAFB should submit to NMED an investigation plan to determine the extent of suspected sanitary sewer line leakage and the degree of impact to ground water from these leaks, if any.

4. KAFB should submit to NMED a plan for the Golf Course Pond that determines whether the current pump and land application remediation system is sized appropriately to contain and capture that nitrate plume.

5. KAFB should submit to NMED a plan for the Golf Course Pond that defines total nitrogen loading at the golf course. This plan should show that the nitrogen loading at the golf course is not contributing to the nitrate-contaminated ground water.

6. KAFB should submit to NMED a plan for identifying other potential sources of nitrate-impacted ground water throughout the base as proposed in the introduction of the Phase 1 Stage 1 AP. This plan should include a sampling from at least the following wells from the following areas: North of sewage lagoons (KAFB-14), golf course pond area (RG-1598-S-4), technical area 2 (TA1-W-01, TA2-NW1-325, TA2-NW-1-595, TA2-W-01, TA2-SW1-320, KAFB-0308, KAFB-0309, TJA-3, TJA-4, WYO-1, WYO-2), LF-20 area (KAFB-2003, KAFB-2001, KAFB-9, RW-06-01), north technical area 5 (LWDS-MW2, LWDS-MW1, TA5-MW4, TA5-MW5, TA5-MW3, TA5-MW1, KAFB-10, NWTA-3), central technical area 5 (MWL-BW1, MWL-MW1, MWL-MW3), south technical area 5 (one regional and one perched well from CWL wells), the McCormick Ranch area (KAFB-1003), and water supply wells KAFB-11 and 15. This plan should include sampling locations, a schedule for sampling, and descriptions of screened intervals from each sampling location. Analytical parameters and testing methods should be in accordance with table 8-4 of the submitted Phase 1 Stage 1 AP.

7. KAFB should include in table 8-4 of the submitted Phase 1 Stage 1 AP bicarbonate and total dissolved solids as analytical parameters.

8. KAFB's long term ground water monitoring plan, as described in section 10 of the submitted Phase 1 Stage 1 AP, should be modified to exclude turbidity and nitrite, and to include total kjeldahl nitrogen, ammonia, and total dissolved solids. This plan should also include a description of sample filtration prior to sample analysis. KAFB's semi-annual long term ground water monitoring results should be submitted to NMED no later than April 31 and October 31 of each year beginning in October 2001. These reports shall include ground water analytical results, water level measurements, a water level potentiometric map, and description of activities performed during that quarter.

NMED appreciates KAFB's continued cooperation towards the development and implementation of this AP. If you have any questions, please feel free to call me at (505) 841-9466.

Sincerely,

for

Bart Faris
Assessment and Abatement Section
Ground Water Quality Bureau

cc: Tom Skibitski, Acting Program Manager, NMED Dist. 1
Mark Holmes, Environmental Management Division, KAFB
Chris DeWitt, Environmental Management Division, KAFB
Jeffrey Johnston, Montgomery Watson, 6100 Indian School Road, NE, Suite 100, Albuquerque, NM 87110-4137

AR Doc # 1984

CH2M HILL Field Project Instructions for Well Installation Associated with Stage 1 Abatement Plan for Nitrate-Impacted Groundwater – CAU ST-105

PREPARED FOR: Mark Holmes/KAFB 377th ABW Environmental Restoration Group

PREPARED BY: CH2M HILL

DATE: April 18, 2001

Site Investigation Project Instructions

These Project Instructions summarize the drilling and sampling activities to be preformed by CH2M HILL as part of the Stage 1 Abatement Plan for Nitrate-Impacted Groundwater. The Instructions are based upon the August 2000 *Stage 1 Abatement Plan for Nitrate-Impacted Groundwater at WP-26, Sewage Lagoons and Golf Course Pond (WP-26) and City of Albuquerque Sanitary Sewer Line Break* that was prepared for Kirtland AFB by Montgomery-Watson. Any changes to the project from the Stage 1 Abatement Plan are documented in these Project Instructions.

As specified in the Stage 1 Abatement Plan, the proposed wells will be located to:

- identify areas of nitrate-impacted groundwater near the sewage lagoons and sanitary sewer line break;
- help determine sources (such as sewage, fertilizer, and explosives) of nitrate in groundwater; and
- monitor the potential for denitrification in the subsurface.

Monitoring wells (both regional and perched) will be installed at four locations to assess the distribution of nitrate-impacted groundwater in areas of sparse well coverage. Subsurface soil samples will be collected during drilling in suspected source areas to evaluate nitrate-impacted subsurface soils. Groundwater samples will be collected and analyzed for a variety of parameters to assess nitrate concentrations, nitrate sources, and other pertinent parameters.

1. Monitoring Well Drilling and Installation

To obtain groundwater samples and analytical results in areas surrounding the sewage lagoons, and sanitary sewer line break, four regional aquifer and three perched aquifer monitoring wells will be installed. These monitoring wells will be installed in areas where monitoring well coverage is inadequate. Installation of the perched aquifer monitoring wells is contingent upon identifying perched groundwater in the borehole during drilling. The proposed monitoring well installation locations for the Phase 1 investigation are shown on Figure 1. The location, rationale, and drilling depths for each proposed monitoring well are provided in Table 1. The

wells will be installed in the order that they appear in Table 1 (i.e. KAFB-0514 will be the first well and KAFB-0509 will be the last). Monitoring well locations were chosen to fill identified data gaps and to provide a broader area of monitoring well coverage for the potential source areas of interest. Historical data were used to determine target zones for perched groundwater and to determine sampling depth intervals for tracking the potential infiltration of contaminants into the vadose zone soil.

Table 1. Proposed Phase 1 Drilling Locations and Depths for the Sewage Lagoons, and Sanitary Sewer Line Break

Well Identification	Drilling Sequence Rational	Well Location	Rationale	Estimated Depth (feet)
KAFB-0514*	Difficult access: is currently coordinated with Base Security thereby reducing standby time	Regional aquifer, within sanitary sewer line break retention pond	Will be used to identify nitrogen species in the vadose zone and determine if raw sewage held in the retention ponds contributed to nitrate-impacted groundwater at KAFB-7	530
KAFB-0513		Perched aquifer, near sanitary sewer line break	Will be used to determine if the City of Albuquerque sewer line contributed to nitrate-impacted groundwater at KAFB-7	280
KAFB-0512*		Regional aquifer, near sanitary sewer line break	Will be used to identify nitrogen species in the vadose zone and determine if the City of Albuquerque sewer line contributed to nitrate-impacted groundwater at KAFB-7	530
KAFB-0510	Easy access no soil sampling	Regional aquifer, downgradient of sewage lagoons, between sewage lagoons and KAFB-16	Will be used to identify extent of regional aquifer nitrate-impacted groundwater and potential impact to KAFB-16	530
KAFB-0511		Perched aquifer, downgradient of sewage lagoons, between sewage lagoons and KAFB-16	Will be used to identify extent of perched aquifer nitrate-impacted groundwater and potential impact to KAFB-16	280
KAFB-0508*	Easy access	Regional aquifer, near KAFB-7	Will be used to determine if regional aquifer nitrate-impacted groundwater is contributing to KAFB-7	530
KAFB-0509		Perched aquifer, near KAFB-7	Will be used to determine if perched aquifer nitrate-impacted groundwater is contributing to KAFB-7	280
* - Boreholes where soil samples will be collected				

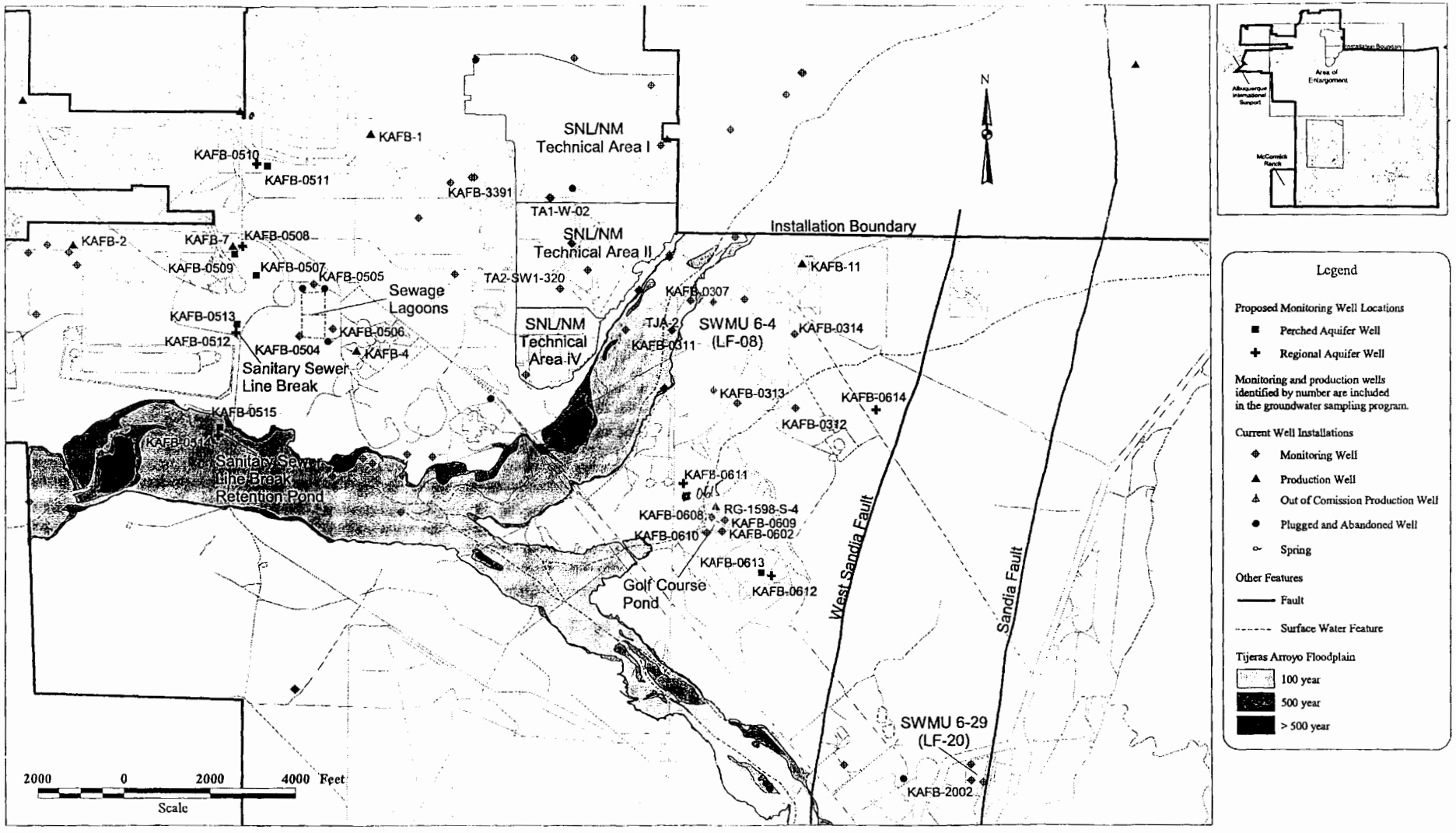

Figure 1. Proposed Phase 1 Monitoring Well Installation Locations and Groundwater Sampling Locations

1.1. Drilling Method and Sequence

The soil borings for monitoring well installation will be drilled using an air-rotary casing-hammer (ARCH) drill rig. Pressurized airflow will be used to remove drill cuttings. The borehole will be drilled by advancing a 9-5/8-inch drive casing and an under-reaming down-hole hammer drill bit (STRATEX). The drive casing will prevent: 1) the bore hole from caving in, 2) the bore hole from belling out, and 3) fluids in any existing perched water-bearing zones from migrating down the bore hole The STRATEX bit will reduce sidewall friction from the 500-ft drill casing and permit the advancement of the drive casing to the desired depth. Using air as the drilling fluid allows the identification of significant perched water bearing zones. This proposed drilling method represents a change to what was specified in the Stage 1 Abatement Plan. The original Plan called for dual-wall drilling with a telescoping drive-casing.

In areas where both regional aquifer and perched aquifer monitoring wells will be installed in close proximity, the regional aquifer monitoring well will be drilled and installed first to help determine the target depth and screened interval for the perched aquifer monitoring well. Careful observations of the drilling conditions and drill cuttings will be made, particularly at intervals where perched groundwater is projected. At intervals where the presence of perched groundwater is suggested, the drive casing may be raised for an interval of time to allow water to enter the boring. The duration allowed for water to enter the well will be determined in the field.

1.2. Subsurface Soil Sampling

All boreholes will be lithologically logged by drill cuttings and/or soil samples. Soil samples will be collected by split spoon from boreholes KAFB-0508, KAFB-0512, and KAFB-0514 to assess the presence of nitrogen species in the vadose zone near production well KAFB-7, the sanitary sewer line break, and within the ponding area of the sanitary sewer line break.

Samples collected from these boreholes will be submitted for chemical analyses as outlined in Table 2. Soil samples will not be collected for analysis from the remaining boreholes. Drilling and sampling will be completed in accordance with Standard Operating Procedures (SOPs) A1.6 and A1.7 of the BWP Field Sampling Plan (FSP) (USAF, 1996).

Table 2. Proposed Frequency and Analysis for Phase 1 Environmental Subsurface Soil Samples

Sample Depth (ft bgs)	Nitrate/ Nitrite	Ammonium	Total Kjeldahl Nitrogen	Total Organic Carbon
KAFB-0508 (regional aquifer) 2, 5, 10, 25, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 525	15	15	15	15
KAFB-0512 (regional aquifer) 2, 5, 10, 25, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 525	15	15	15	15
KAFB-0514 (regional aquifer) 2, 5, 10, 25, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 525	15	15	15	15
Total Environmental Samples	**45**	**45**	**45**	**45**
Notes: ft bgs =feet below ground surface				

1.3. Geophysical Logging

Geophysical logging, including neutron, natural gamma, resistivity, and conductivity, will be performed in both regional and perched aquifer wells to further assess the presence of lithologic intervals that may cause perched groundwater.

1.4. Monitoring Well Construction

Monitoring wells (both perched and regional aquifers) will be completed at the surface in accordance with Kirtland AFB specifications as presented in SOP A1.8 of the Base-Wide Plan (BWP) Field Sampling Plan (FSP); however, the monitoring wells will not be cased off in the manner described in this SOP. A brief outline of the monitoring well construction is provided in the following paragraphs.

As specified in the Stage 1 Abatement Plan, the wells will be constructed using 4-inch-diameter schedule 80 polyvinyl chloride and have 1-ft silt traps, 25 ft of slotted screen, and approximately 2 to 3 ft of stickup at the surface. Centralizers will be used to stabilize the well casing within the borehole at intervals to be determined in the field. Well completions will be as follows:

- The sand filter pack type will be determined based on field observations and will extend from the bottom of the silt trap to about 2 ½ to 5 ft above the top of the screen. The filter pack sand will be placed through a tremie pipe. If necessary, a small amount of distilled water may be used to flush the sand down the tremie pipe during placement of the filter pack. An approximately 2½ -ft thick transition of fine sand will be placed above the filter pack to prevent intrusion of the bentonite seal.

- A bentonite seal, at least 5 ft thick, will be installed above the filter pack through a tremie pipe. The seal will be hydrated with clean potable water in 6-inch lifts. Setup time for the bentonite will be at the discretion of the field geologist, however, the field geologist will make sure that the seal is sounded before backfilling with the bentonite slurry.

- The annular space above the hydrated bentonite seal will be backfilled with bentonite slurry instead of bentonite-cement grout as specified in the SOP. Bentonite slurries are effective in sealing off groundwater units above the screened and sand packed intervals of a well and are less likely to damage the well casing than grout. The bentonite slurry will be installed through a tremie pipe. The bentonite slurry will extend from the bentonite seal to approximately 50 ft bgs. The bentonite slurry will be installed in approximately 20-ft lifts.

- The remaining 50 ft of annular space will be filled with bentonite-cement grout consisting of 94 pounds of Portland cement, 3 percent by weight sodium bentonite powder, and 7 gallons of contaminant-free water. The bentonite-cement grout will be placed using a grout pump and tremie pipe to within 5 ft of the land surface. The grout will be allowed to set for at least 24 hours before well development begins.

Each monitoring well will be developed in accordance with Kirtland AFB and NMED specifications. The drilling contractor will develop the monitoring wells by using a suitable surge block, bailer, and/or submersible pump under the direction of the field hydrogeologist. The well will be developed until the field parameters (pH, electrical conductivity) for groundwater have stabilized and the water is clear and substantially free from sediments. At that point, monitoring well development will be considered complete.

The field hydrogeologist will certify that a 10-ft-long section of pipe, ½ inch less in diameter than the inner diameter of the well riser pipe, is able to pass freely from the top to the bottom of each new monitoring well (SOP A1.8). The well must also be capable of producing water that is substantially free from suspended sediments. If these criteria are not met, the monitoring well may be rejected.

Following completion and development of the wells, a well installation report will be prepared and submitted to the New Mexico Office of the State Engineer, Kirtland AFB EM, and NMED.

2. Groundwater Sampling

Groundwater samples will be collected in September 2001 from the monitoring wells listed in Table 3 and shown on Figure 1. The sampled wells were selected to provide more comprehensive data for the areas of interest around the sewage lagoons, and sanitary sewer line break. Monitoring wells completed in both the regional and perched aquifers were selected. Groundwater samples will be analyzed for a variety of field and laboratory parameters (Table 4). The selected analytes will provide data on general groundwater parameters, nitrate concentrations, and the potential for *in situ* denitrification and will potentially identify sources of nitrate.

Groundwater sampling will follow the procedures outline in SOP A1.2 of the BWP FSP (USAF, 1996). Field parameters, including dissolved oxygen (DO), temperature, pH, conductivity, and oxidation-reduction potential, will be measured using appropriate probes in flow-through cells. At the request of NMED (per conversation with Montgomery-Watson) nitrate samples will be filtered and preserved with sulfuric acid. Additional non-filtered unpreserved samples will be collected and analyzed for nitrate/nitrite to provide nitrogen-speciation data. Once the analytical data have been received from the laboratory, the data will be compiled and provided to Montgomery-Watson along with the applicable boring logs. Montgomery-Watson will then use the data as part of their on-going efforts to determine the extent of contamination and any potential remedies for the nitrate-impacted groundwater at Kirtland.

Table 3. Production and Monitoring Wells for Phase 1 Groundwater Sampling

Well Identification	Location	Well Type	Aquifer	Screen Interval (ft above msl)
KAFB-0504	Sewage Lagoons	Monitoring	Regional	4884.2 to 4864.2
KAFB-0505	Sewage Lagoons	Monitoring	Regional	4865.14 to 4840.14
KAFB-0506	Sewage Lagoons	Monitoring	Perched	5160.8 to 5140.8
KAFB-0507	Sewage Lagoons	Monitoring	Perched	TBD
KAFB-0508	Sewage Lagoons	Monitoring	Regional	TBD
KAFB-0509	Sewage Lagoons	Monitoring	Perched	TBD
KAFB-0510	Sewage Lagoons	Monitoring	Regional	TBD
KAFB-0511	Sewage Lagoons	Monitoring	Perched	TBD
KAFB-0512	Sanitary Sewer Line Break	Monitoring	Regional	TBD
KAFB-0513	Sanitary Sewer Line Break	Monitoring	Perched	TBD
KAFB-0514	Sanitary Sewer Line Break	Monitoring	Regional	TBD
KAFB-0515	Sanitary Sewer Line Break	Monitoring	Perched	TBD
KAFB-0602	Golf Course Pond	Production	Perched	4925.8 to 4905.8
KAFB-0608	Golf Course Pond	Monitoring	Perched	5051.5 to 5031.5
KAFB-0609	Golf Course Pond	Production	Perched	5047.2 to 5027.2
KAFB-0610	Golf Course Pond	Production	Perched	5023.8 to 5003.8
KAFB-0611	Golf Course Pond	Monitoring	Regional	TBD
KAFB-0612	Golf Course Pond	Monitoring	Regional	TBD
KAFB-0613	Golf Course Pond	Monitoring	Perched	TBD
KAFB-0614	LF-08 (KAFB-0312)	Monitoring	Regional	TBD
TA1-W-02	Sandia North	Monitoring	Regional	4874.0 to 4854.0
TA2-SW1-320	Sandia North	Monitoring	Perched	5107.8 to 5087.8
KAFB-0307	LF-08	Monitoring	Regional	4956.9 to 4911.9
KAFB-0311	LF-08	Monitoring	Regional	4917.6 to 4892.6
KAFB-0312	LF-08	Monitoring	Regional (semi-confined)	4926.5 to 4901.5
KAFB-0313	LF-08	Monitoring	Perched	5068.3 to 5048.3
KAFB-0314	LF-08	Monitoring	Perched	5025.1 to 5005.1
TJA-2	LF-08	Monitoring	Perched	5074.8 to 5054.8
KAFB-2002	LF-20	Monitoring	Regional	5319.3 to 5299.3
KAFB-3391	Contractor's Yard	Monitoring	Perched	5133.9 to 5113.9
KAFB-1	North of Sewage Lagoons	Production	Regional	4413.8 to 4184.8
KAFB-2	Northwest of Sewage Lagoons	Production	Regional	4830.4 to 4324.4
KAFB-4	Southeast of Sewage Lagoons	Production	Regional	4863.5 to 4357.5
KAFB-7	Northwest of Sewage Lagoons	Production	Regional	4899.7 to 4501.5
KAFB-11	North of Golf Course Pond	Production	Regional	4756.4 to 4099.4
KAFB-16	North of Sewage Lagoons	Production	Regional	4650 to 3960

Notes :
TBD = to be determined
ft = foot/feet
msl = mean sea

Table 4. Analytical Parameters and Testing Methods for Phase 1 Groundwater Samples

Analysis	Method	Testing Location	Data Use
Groundwater Elevation	Groundwater probe	Field	Groundwater flow direction
PH	pH probe	Field, flow-through cell	General groundwater parameter
Specific Conductivity	Conductivity meter	Field, flow-through cell	General groundwater parameter
Temperature	Digital thermometer	Field, flow-through cell	General groundwater parameter
Turbidity	Turbidity meter	Field, flow-through cell	General groundwater parameter
Dissolved Oxygen (DO)	DO probe	Field, flow-through cell	Assess aerobic or anaerobic conditions for denitrification
Oxidation-Reduction Potential	EH meter	Field, flow-through cell	Assess conditions for denitrification
Preserved Nitrate (NO_3) (filtered)	EPA Method 300	Laboratory	Assess nitrate-impacted groundwater
Nitrate (NO_3) and Nitrite (NO_2)	EPA Method 300	Laboratory	Assess nitrite-impacted groundwater

Method References:

EPA, 1993. *EPA 100-400 Series—Methods for the Determination of Inorganic Substances in Environmental Samples.* EPA/600R-93-100. U.S. Environmental Protection Agency, Office of Research and Development, Environmental Monitoring Systems Laboratory, Cincinnati, Ohio. August 1993.

EPA, 1996. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Third Edition, September 1986; Final Update I, July 1992; Final Update IIA, August 1993; Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996. U.S. Environmental Protection Agency, Office of Solid Waste. December 1996.

3. Investigation-Derived Waste

Handling and disposition of investigation-derived waste will follow SOP requirements included in the BWP (USAF, 1996).

Soil cutting produced during drilling of the monitoring wells will be staged onsite and covered to prevent dispersal by wind or precipitation. Composite samples of the drill cuttings will be analyzed for full suite TCLP constituents, including VOCs, SVOCs, eight RCRA metals, and selected pesticides and herbicides to determine disposal requirements.

Wastewater produced from equipment decontamination, well development, and groundwater sampling will be staged onsite in 55-gallon drums. A composite water sample from each drum will be analyzed for nitrate, VOCs, SVOCs, and eight RCRA metals to determine disposal requirements.

4. Schedule

Figure 2 presents the proposed schedule for the monitoring well installation and sampling project.

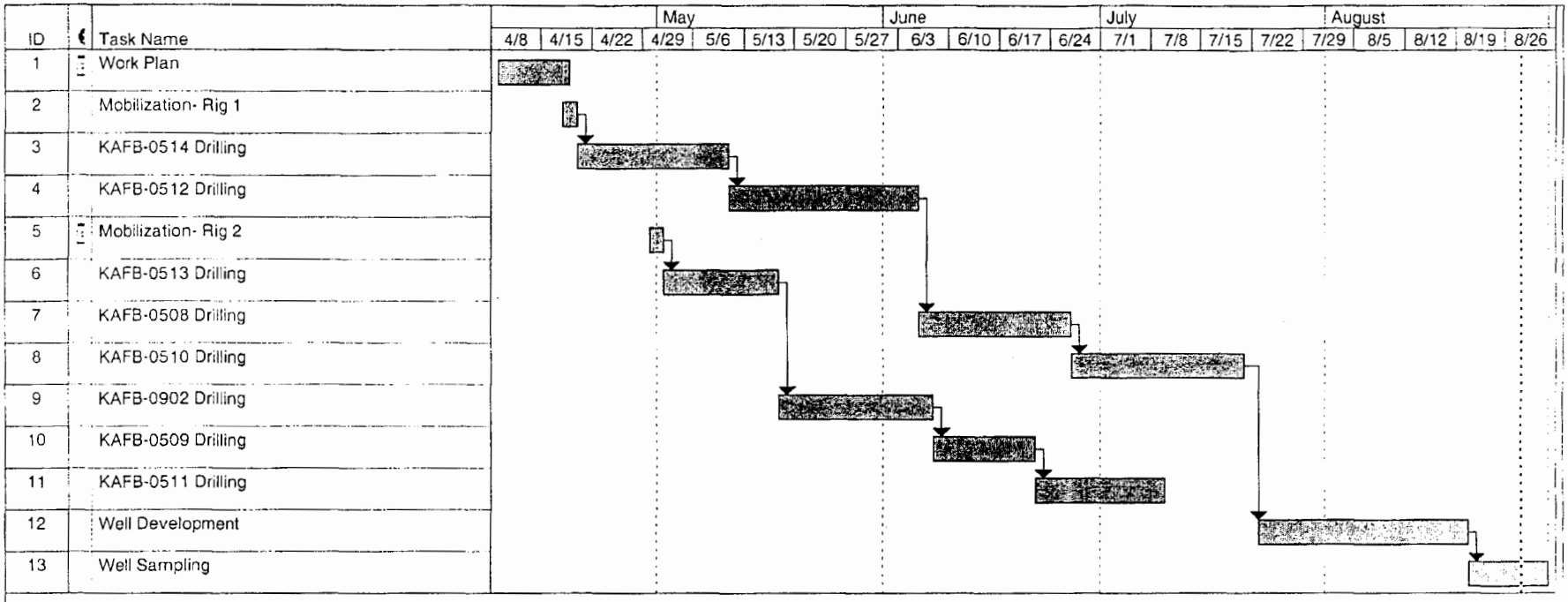

Figure 2
Project Schedule

Task
Split
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Split
Rolled Up Milestone
Rolled Up Progress
External Tasks
Project Summary