2011 AND 2012
MONITORING WELL INSTALLATION
AND ABANDONMENT REPORT
Version 1

FORT WINGATE DEPOT ACTIVITY
(EPA ID NM 6213820974)

MCKINLEY COUNTY, NEW MEXICO

December 2012

Prepared by:

U.S. Army Corps of Engineers
Albuquerque District

Prepared for:

Base Realignment and Closure Division

Customer Order Number W45XMA10395627

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

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1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
12-31-2012	Final, Version 1	06-01-2011 to 3-31-2012

4. TITLE AND SUBTITLE

2011 and 2012 Monitoring Well Installation and Abandonment Report - Version 1

5a. CONTRACT NUMBER

NA

5b. GRANT NUMBER

NA

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Environmental Engineering Section
U.S. Army Corps of Engineers
Albuquerque District

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

U.S. Army Corps of Engineers
4101 Jefferson Plaza NE
Albuquerque, NM 87109-3435

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The Corps of Engineers (USACE), on behalf of the Base, Realignment, and Closure (BRAC) office, installed several monitoring wells during the fall and winter of 2011/2012 within the boundaries of the Fort Wingate Depot Activity (FWDA). Monitoring wells were installed to delineate contaminant plumes and to assist in defining background concentrations for metals in groundwater. This report discuss locations, depths, and chemical data associated with these new wells. Additionally, several older monitoring wells that no longer contain sufficient quantity of groundwater for sampling or measuring were abandoned in accordance with applicable state regulation. Abandonments are also discussed in the report.

15. SUBJECT TERMS

Groundwater Periodic Monitoring Report
Fort Wingate Depot Activity

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Mark Patterson
C	C	C	SAR		19b. TELEPHONE NUMBER *(Include area code)* 330/358-7312

Final Submittal Letter Place Holder

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BIA = Bureau of Indian Affairs
BIA-NR = Bureau of Indian Affairs – Navajo Regional Office
BIA-Zuni = Bureau of Indian Affairs – Zuni Agency
BRACD = U.S. Army Base Realignment and Closure Division
FWDA = Fort Wingate Depot Activity
FWDA-AR = Fort Wingate Depot Activity - Administrative Record
FWDA-BEC = Fort Wingate Depot Activity Base Realignment and Closure – Environmental Coordinator
NMED-HWB = New Mexico Environment Department – Hazardous Waste Bureau
NN = Navajo Nation
POZ = Pueblo of Zuni
USACE SPA = U.S. Army Corps of Engineers – Albuquerque District
USACE SWF = U.S. Army Corps of Engineers – Fort Worth District
USAEC = U.S. Army Environmental Command
USEPA = U.S. Environmental Protection Agency
USGS = U.S. Geological Survey

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List of Acronyms

BRAC	Base Realignment and Closure
CA	U.S. EPA Regional Screening Levels – for carcinogens
DL	Laboratory Detection Limit
DTW	Depth to Water
EPA	U.S. Environmental Protection Agency
FT	Foot/Feet
FWDA	Fort Wingate Depot Activity
HMX	Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine
HWB	Hazardous Waste Bureau
ID	Identification
MCL	Maximum Contaminant Level
Mg/L	Milligrams per Liter
NC	U.S. EPA Regional Screening Levels – for non-carcinogens
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
MP	Measuring Point (usually the top of casing)
NA	Not Applicable
NRL	No Regulatory Limit
NTUA	Navajo Tribal Utility Authority
OSE	New Mexico Office of the State Engineer
PMR	Periodic Monitoring Report
QAL	Quaternary Alluvium
RCRA	Resource Conservation and Recovery Act
RDX	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine
RL	Analytical Method Reporting Limit
RSL	Regional Screening Level
TD	Total Depth
TB	Sample Container Trip Blank (typically shipped with VOC samples)
TRPP	Triassic Petrified Forest Formation, Painted Desert Member
SVOC	Semi-Volatile Organic Compound
µg/L	Micrograms per Liter
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
VOC	Volatile Organic Compound
WQCC	New Mexico Water Quality Control Commission

1.0 Introduction

The Corps of Engineers (USACE), on behalf of the Base, Realignment, and Closure (BRAC) office, installed several monitoring wells during the fall and spring of 2011/2012 within the boundaries of the Fort Wingate Depot Activity (FWDA). Refer to Figure 1 for the location of FWDA. These monitoring wells were installed to delineate contaminant plumes and to assist in defining background concentrations for metals in groundwater. The following sections discuss locations, depths, and chemical data associated with these new wells. Additionally, several older monitoring wells that no longer contain sufficient quantities of groundwater for sampling or measuring were abandoned in accordance with applicable state regulations. Abandonments are also discussed in the following sections.

2.0 2011 Monitoring Well Installation

Monitoring wells were drilled from June 2011 through September 2011. Ten monitoring wells were installed in the Northern Area of the installation in accordance with the approved FWDA Monitoring Well Installation and Abandonment Plan, dated April 2011 (USGS 2011). Eleven monitoring wells were planned during this mobilization. The location for TMW42 was drilled but dry conditions were encountered. A second borehole near the original location was drilled. It too was dry. In both boreholes, a core barrel was advanced to the top of bedrock to ensure that the alluvium was dry at these locations. Figure 2 shows the locations of both attempts at installing a well at the TMW42 location. These are shown on the map as TMW42 and TMW42A. Also shown in Figure 2 are TMW39S and TNW41; both are alluvial monitoring wells.

Of the ten monitoring wells installed, five were installed into the bedrock (the targeted sandstone). Bedrock monitoring wells, TMW38, TMW39D, TMW40D, TMW48, and TMW49 are shown in Figure 3. The other five monitoring wells, MW23, MW24, TMW39S, TMW40S, and TMW41, were drilled and screened in the alluvium. One borehole location (TMW40) was drilled and nested with two monitoring wells, TMW40S and TMW40D. TMW40S is an alluvial well and TMW40D is a bedrock well. All other wells installed are single borehole monitoring wells. TMW39S and TMW39D are monitoring wells drilled in separate boreholes, but in close proximity to each other.

Monitoring wells MW23 and MW24 were installed as sentinel wells in accordance with the Monitoring Well Installation and Abandonment Plan. The locations for these two monitoring wells, shown in Figure 4, were selected to monitor potential off-site migration of alluvial groundwater contamination and because of their close proximity to the Navajo Tribal Utility Authority (NTUA) water supply well on the north side of Interstate 40.

Table 1 on the following page contains well/borehole depths, coordinates, formations screened, screen length and interval, and initial water levels for monitoring wells installed in the fall of 2011. Additionally, Appendix A contains civil surveys, Appendix B contains well logs, completion diagrams, and well development records, and Appendix C contains New Mexico Office of the State Engineer (OSE) permitting documentation for new monitoring wells.

Table 1: 2011 Monitoring Well Drilling and Construction Data

Well ID	Casing Diameter	Northing	Easting	Ground Elevation	MP Elevation	Hydro Unit	Initial DTW	Screen Top	Screen Bottom	Screen Length	Boring/ Well TD
MW23	2.5	1648792.02	2493767.75	6652.46	6654.50	Qal	43	6588.96	6518.96	70	134.00
MW24	2.5	1648746.52	2494518.24	6655.09	6657.08	Qal	17.6	6638.09	6588.09	50	66.50
TMW38	2.5	1641400.80	2498219.52	6704.41	6706.79	TRPP	58.3	6585.41	6545.41	40	159.50
TMW39S	2.5	1640745.21	2499279.83	6706.53	6708.61	Qal	31.7	6674.03	6654.03	20	53.00
TMW39D	2.5	1640745.21	2499279.83	6706.53	6708.61	TRPP	26.9	6636.53	6606.53	30	67.00
TMW40S	2.5	1641487.06	2498603.50	6703.81	6706.40	Qal	34.4	6653.81	6643.81	10	60.50
TMW40D	2.5	1641487.06	2498603.50	6703.81	6706.15	TRPP	28.7	6568.81	6548.81	20	155.50
TMW41	2.5	1641113.86	2499058.48	6703.48	6705.21	Qal	56.6	6647.48	6637.48	10	66.00
TMW42	NA	NA	NA	NA	NA	Qal	dry	NA	NA	NA	53
TMW42A	NA	NA	NA	NA	NA	Qal	dry	NA	NA	NA	56
TMW48	2.5	1640515.53	2499131.31	6707.82	6709.84	TRPP	32.4	6636.82	6616.82	20	91.50
TMW49	2.5	1639979.77	2498578.38	6712.20	6714.71	TRPP	40.2	6672.20	6652.20	20	60.00

Note: Casing in inches; all remaining measurements are in U.S. feet; screen elevations are calculated from ground elevation
Coordinate System: New Mexico State Plane, West – North American Datum (NAD) 83
Elevation Datum: North American Vertical Datum (NAVD) 88
MP Elevation: Elevation of the Measuring Point of the of the casing
Ground Elevation: Brass Cap elevation cemented into the well pad; or 1-inch rebar on corner of well pad
Hydro Unit: Hydrogeologic unit containing groundwater
NA: Not Applicable because borehole was not constructed into a monitoring well
TD: Total Depth of the casing/screen, or in the case of a borehole with no well installed, TD is Total Depth of the borehole
DTW: Depth to Water, in feet from the MP Elevation
Qal: Quaternary Alluvium
TRPP: Triassic Petrified Forest Formation, Painted Desert Member (in a Sandstone Unit)

3.0 2011 Well Abandonment

Nine old 4-inch diameter monitoring wells, FW07, FW08, FW10, FW11, FW12, FW13, FW27, FW28, and FW29, and one 2-inch diameter monitoring well (TMW05), were abandoned during August of 2011 by the USGS. Well Plugging Plan of Operation documents were submitted to the OSE for approval prior to plugging. When plugging and abandonments activities were completed, the USGS submitted OSE Plugging Records for each well location as required by NMAC 19.27.4. OSE well abandonment documentation is located in Appendix D. One dry monitoring well remains in the Northern Area and requires abandonment, FW26. Monitoring well FW26 shall be abandoned during the next phase of drilling activities. Appropriate NMED and OSE plans shall be submitted prior to its abandonment. Refer to the Well Installation and Abandonment Plan, dated April 2011 (USGS 2011) for the locations of abandoned monitoring wells.

4.0 2012 Monitoring Well Installation

In February of 2012, the USGS installed an additional eight monitoring wells. Nine monitoring wells were planned, but one borehole was dry. This dry borehole was planned as one of the background monitoring wells (BGMW04) and located west, in Parcel 8, near igloo blocks A and B. Of the eight monitoring wells that were installed, three are background monitoring wells and are located in Parcels 12 and 14 (see Figure 5). All the monitoring wells installed during this mobilization were drilled and screened in the alluvial groundwater system.

Table 2 on the following page contains well/borehole depths, coordinates, formation screened, screen length and interval, and initial water levels. Appendix A contains civil surveys, Appendix B contains

well logs, completion diagrams, and well development records, and Appendix C contains OSE permitting documentation.

Table 2: 2012 Monitoring Well Drilling and Construction Data

Well ID	Casing Diameter	Northing	Easting	Ground Elevation	MP Elevation	Hydro Unit	Initial DTW	Screen Top	Screen Bottom	Screen Length	Boring/ Well TD
BGMW01	2.5	1645977.85	2501983.61	6690.28	6692.68	Qal	15.5	6676.78	6656.78	20	33.00
BGMW02	2.5	1646314.67	2501276.54	6689.20	6691.99	Qal	20.4	6675.70	6655.70	20	34.00
BGMW03	2.5	1647012.12	2499392.83	6677.79	6680.57	Qal	21.2	6669.29	6649.29	20	29.00
BGMW04	NA	NA	NA	NA	NA	Qal	dry	NA	NA	NA	84.00
TMW43	2.5	1642171.46	2498570.92	6695.63	6698.63	Qal	50.2	6637.63	6617.63	20	78.50
TMW44	2.5	1642323.41	2499212.51	6694.81	6697.31	Qal	50.5	6651.31	6631.31	20	64.00
TMW45	2.5	1643187.53	2499597.72	6686.50	6689.00	Qal	44	6648.00	6628.00	20	59.00
TMW46	2.5	1644326.04	2497404.70	6678.69	6680.98	Qal	42	6640.19	6620.19	20	59.00
TMW47	2.5	1641475.95	2499610.93	6699.32	6701.88	Qal	50.9	6616.82	6596.82	20	103.00

Casing in inches; all remaining measurements are in U.S. feet; screen elevations are calculated from ground elevation
Coordinate System: New Mexico State Plane, West – North American Datum (NAD) 83
Elevation Datum: North American Vertical Datum (NAVD) 88
MP Elevation: Elevation of the Measuring Point of the casing
Ground Elevation: Brass Cap elevation cemented into the well pad; or 1-inch rebar on corner of well pad
Hydro Unit: Hydrogeologic unit containing groundwater
NA: Not Applicable because borehole was not constructed into a monitoring well
TD: Total Depth of the casing/screen, or in the case of a borehole with no well installed, TD is Total Depth of the borehole
DTW: Depth to Water, in feet from the MP Elevation
Qal: Quaternary Alluvium

5.0 Initial Sampling Chemical Results

With the exception of the two sentinel wells, MW23 and MW24, groundwater samples were collected during the subsequent scheduled sampling/monitoring event. Samples from MW23 and MW24 were collected by the USGS after their installation and development. As of the completion of this report, monitoring wells that were installed during the fall of 2011 have been sampled three times, in October 2011, in April 2012, and once again in October 2012. Monitoring wells installed during the spring of 2012 have been sampled twice, in April 2012 and October 2012. The April 2011 through October 2011 Groundwater Periodic Monitoring Report (PMR), dated May 2012, contains chemical analytical records for monitoring wells installed during the 2011 season (USACE 2012). The table below summarizes the first results of chemicals detected from new monitoring wells installed in 2011, as reported in the April 2011 through October 2011 Groundwater PMR . Only metals exceeding permit cleanup standards are presented. Appendix E contains laboratory reports for results shown in Table 3.

Table 3: October 201l Groundwater Sample Results

Well ID	Analyte/ Analytical Method	RL	DL	Result	Units	Final Flag	Value Used	Standard Used	Standard Exceeded
TMW39D	Nitrate/300.0	0.30	0.048	9.4	mg/L	J	10	MCL	No
	Nitrite/300.0	0.30	0.054	0.62	mg/L	J	1	MCL	No
TMW39S	Nitrate/300.0	0.30	0.048	9.8	mg/L	J	10	MCL	No
TMW40D	Nitrate/300.0	0.30	0.048	2.8	mg/L		10	MCL	No
	Nitrite/300.0	0.30	0.054	0.38	mg/L		1	MCL	No
TMW40S	**Nitrate/300.0**	**0.30**	**0.048**	**28**	mg/L		**10**	**MCL**	**Yes**
	Nitrite/300.0	**0.30**	**0.054**	**6.9**	mg/L		**1**	**MCL**	**Yes**

Well ID	Analyte/ Analytical Method	RL	DL	Result	Units	Final Flag	Value Used	Standard Used	Standard Exceeded
TMW41	Nitrate/300.0	0.30	0.048	5.7	mg/L	J	10	MCL	No
TMW48	**Nitrate/300.0**	**0.30**	**0.048**	**20**	mg/L	**J**	**10**	**MCL**	**Yes**
	Nitrite/300.0	0.30	0.054	0.20	mg/L	J	1	MCL	No
TMW49	Nitrate/300.0	0.30	0.048	8.4	mg/L		10	MCL	No
TMW41	Trinitrotoluene, 2,4,6- /8330	0.10	0.091	0.11	ug/L		2.2	CA	No
TMW39D	**Perchlorate/6850**	**100**	**50**	**810**	**ug/L**		**6**	**Permit**	**Yes**
TMW39S		**50**	**25**	**640**	**ug/L**		**6**	**Permit**	**Yes**
TMW40D		**50**	**25**	**320**	**ug/L**		**6**	**Permit**	**Yes**
TMW40S		**20**	**10**	**140**	**ug/L**		**6**	**Permit**	**Yes**
TMW41		**2**	**1**	**1.5**	**ug/L**	**J**	**6**	**Permit**	**No**
TMW48		**200**	**100**	**1600**	**ug/L**		**6**	**Permit**	**Yes**
TMW49		**200**	**100**	**2100**	**ug/L**		**6**	**Permit**	**Yes**
TMW39S	Dichloroethylene, 1,2-cis- /8260	1.0	0.17	5.1	ug/L		70	MCL	No
	Toluene/8260	1.0	0.20	0.57	ug/L	J	750	WQCC	No
	Vinyl chloride/8260	1.0	0.24	3.8	ug/L		1	WQCC	Yes
TMW38	Bis(2-ethylhexyl)phthalate /8270	5.0	0.27	1.3	ug/L	J	6	MCL	No
	Cresol, o-/8270	5.0	0.18	0.52	ug/L	J	720	NC	No
TMW39S	**Bis(2-ethylhexyl)phthalate/8270**	**5.0**	**0.27**	**6.5**	**ug/L**		**6**	**MCL**	**Yes**
	Caprolactam/8270	5.0	5.0	46	ug/L		7700	NC	No
	Phenol/8270	5.0	0.14	0.21	ug/L	J	5	WQCC	No
TMW41	Bis(2-ethylhexyl)phthalate /8270	5.0	0.27	0.65	ug/L	J	6	MCL	No
TMW48	Bis(2-ethylhexyl)phthalate /8270	5.0	0.27	0.32	ug/L	J	6	MCL	No
TMW49	Bis(2-ethylhexyl)phthalate /8270	5.0	0.27	3.0	ug/L	J	6	MCL	No
	Cresol, o-/8270	5.0	0.18	0.69	ug/L	J	720	NC	No
	Diethyl Phthalate/8270	5.0	0.16	0.76	ug/L	J	11000	NC	No
TMW38	**Iron/ 6020 Total**	**0.040**	**0.019**	**3.6**	**mg/L**		**1**	**WQCC**	**Yes**
	Manganese/6020 Total	**0.0020**	**0.00011**	**0.21**	**mg/L**		**0.2**	**WQCC**	**Yes**
TMW39S	**Manganese/6020 Total**	**0.0020**	**0.00011**	**0.33**	**mg/L**		**0.2**	**WQCC**	**Yes**

mg/L: milligrams per Liter
RL: Reporting Limit
DL: Detection Limit
Final Flag: Final qualifier
MCL: U.S. EPA Maximum Contaminant Level
Standard Value: Regulatory Limit
Bolded Values: Standard exceeded
Nitrate and Nitrite: Reported as total nitrogen
ug/L: micrograms per Liter
J: Estimated, but detected value
Permit – Clean Up Criteria Established by the Permit
NC: U.S. EPA Regional Screening Levels - non-carcinogens
CA: U.S. EPA Regional Screening Levels - carcinogens
WQCC: New Mexico Water Quality Control Standard
Value Used: The Regulatory Limit value compared to results

The following tables are results for the two sentinel wells (MW23 and MW24). The USGS collected these samples after well development. Laboratory reports for results shown in Tables 4 and 5 are presented in Appendix F**.**

Table 4: 2011 USGS Chemical Results for MW23

Analytical Method 6010B Dissolved Metals								
Well ID	**Analyte**	**RL**	**DL**	**Result (mg/L)**	**Final Flag**	**Value Used**	**Standard Used**	**Standard Exceeded**
MW23	Aluminum	0.1	0.018	0.25		1.6	NC	No
MW23	Barium	0.01	0.00058	0.17		1	WQCC	No
MW23	Chromium	0.01	0.00066	0.00069		0.05	WQCC	No
MW23	Cobalt	0.01	0.0012	0.0044		0.047	NC	No
MW23	Iron	0.1	0.022	0.27		1	WQCC	No
MW23	Manganese	0.01	0.00025	0.12		0.2	WQCC	No
MW23	Molybdenum	0.02	0.0031	0.017		0.078	NC	No
MW23	Nickel	0.04	0.0013	0.0023		NRL	NRL	NRL
MW23	Vanadium	0.00001	0.0011	0.0049		NRL	NRL	NRL
MW23	Zinc	0.00002	0.0045	0.013		10	WQCC	No
MW23	Aluminum	0.3	0.018	9.9		1.6	NC	NA
MW23	Barium	0.01	0.00058	0.3		1	WQCC	NA
Analytical Method 6010B - Total Metals								
Well ID	**Analyte**	**RL**	**DL**	**Result (mg/L)**	**Final Flag**	**Value Used**	**Standard Used**	**Standard Exceeded**
MW23	Cobalt	0.015	0.0012	0.0029		0.047	NC	NA
MW23	Copper	0.015	0.0014	0.0055		1	WQCC	NA
MW23	Iron	0.1	0.022	4.7		1	WQCC	NA
MW23	Lead	0.015	0.0026	0.0048		0.015	WQCC	NA
MW23	Manganese	0.01	0.00025	0.2		0.2	WQCC	NA
MW23	Molybdenum	0.03	0.0031	0.016		0.078	NC	NA
MW23	Vanadium	0.015	0.0011	0.016		NRL	NRL	NA
MW23	Zinc	0.15	0.0045	0.024		10	WQCC	NA
Analytical Method 8260 - Volatile Organic Compounds								
Well ID	**Analyte**	**RL**	**DL**	**Result (ug/L)**	**Final Flag**	**Value Used**	**Standard Used**	**Standard Exceeded**
MW23	Acetone	10	1.9	6.4		12000	NC	No
MW23	4-Isopropyltoluene	1	0.17	0.6		NRL	NRL	NRL
MW23	Toluene	1	0.17	0.3		750	WQCC	No
MW23	Methylene Chloride	5	0.32	0.39		5	MCL	No
MW23 -TB	Acetone	10	1.9	2.5		NA	NA	NA
MW23 -TB	Methylene Chloride	5	0.32	0.89		NA	NA	NA
Analytical Method 8015B - Diesel Range Organics								
Well ID	**Analyte**	**RL**	**DL**	**Result (mg/L)**	**Final Flag**	**Value Used**	**Standard Used**	**Standard Exceeded**
MW23	Diesel Range Organics	0.24	0.031	0.066		NRL	NRL	NRL

mg/L: milligrams per Liter
RL: Reporting Limit
DL: Detection Limit
TB: Trip Blank
Final Flag: Final qualifier
Bolded Values: Standard exceeded
No Regulatory Limit
ug/L: micrograms per Liter
NA: Not Applicable
MCL: U.S. EPA Maximum Contaminant Level
WQCC: New Mexico Water Quality Control Standard
Standard Value: Regulatory Limit
NC: U.S. EPA Regional Screening Levels - non-carcinogens
Value Used: The Regulatory Limit value compared to results

Table 5: 2011 USGS Chemical Results for MW24

Analytical Method 6010B Dissolved Metals								
Well ID	**Analyte**	**RL**	**DL**	**Result (mg/L)**	**Final Flag**	**Value Used**	**Standard Used**	**Standard Exceeded**
MW24	Aluminum	0.1	0.018	0.03		1.6	NC	No
MW24	Barium	0.01	0.00058	0.27		1	WQCC	No
MW24	**Iron**	**0.1**	**0.022**	**1.7**		**1**	**WQCC**	**Yes**
MW24	**Manganese**	**0.01**	**0.00025**	**0.52**		**0.2**	**WQCC**	**Yes**
MW24	Molybdenum	0.02	0.0031	0.0032		0.078	NC	No
Analytical Method 6010B Total Metal								
Well ID	**Analyte**	**RL**	**DL**	**Result (mg/L)**	**Final Flag**	**Value Used**	**Standard Used**	**Standard Exceeded**
MW24	Aluminum	0.3	0.018	0.031		1.6	NC	No
MW24	Barium	0.01	0.00058	0.26		1	WQCC	No
MW24	**Iron**	**0.1**	**0.022**	**1.6**		**1**	**WQCC**	**Yes**
MW24	**Manganese**	**0.01**	**0.00025**	**0.49**		**0.2**	**WQCC**	**Yes**
MW24	Molybdenum	0.03	0.0031	0.0032		0.078	NC	no
Analytical Method 8260								
Well ID	**Analyte**	**RL**	**DL**	**Result (ug/L)**	**Final Flag**	**Value Used**	**Standard Used**	**Standard Exceeded**
MW24	Methylene Chloride	5	0.32	0.42		5	MCL	No
MW24-TB	Acetone	10	1.9	2.6		NA	NA	NA
MW24-TB	Methylene Chloride	5	0.32	1		NA	NA	NA

mg/L: milligrams per Liter
RL: Reporting Limit
DL: Detection Limit
Standard Value: Regulatory Limit
Final Flag: Final qualifier
Bolded Values: Standard exceeded
Value Used: The Regulatory Limit value compared to results
ug/L: micrograms per Liter
NA: Not Applicable
MCL: U.S. EPA Maximum Contaminant Level
NC: U.S. EPA Regional Screening Levels - non-carcinogens
WQCC: New Mexico Water Quality Control Standard
TB: Trip Blank

The following tables show the first chemical results of monitoring wells installed during 2012. These samples were collected during the April 2012 groundwater monitoring/sampling event. As of the completion of this report, the April 2012 PMR was still in draft and not yet submitted to the New Mexico Environmental Department (NMED) – Hazardous Waste Bureau (HWB). Results shown below will also be published in the April 2012 Groundwater PMR that is currently scheduled for publication by the end of January 2013. Appendix G contains laboratory reports for results shown in Table 6 and 7. Laboratory reports for waste characterization are presented in Appendix H for all monitoring wells drilled in 2011 and in 2012.

Table 6: April 2012 Groundwater Sample Results

Well ID	Analyte/Analytical Method	RL	DL	Results (mg/L)	Final Flag	Value Used	Standard Used	Standard Exceeded
TMW43	Nitrate/300.0	0.30	0.048	10		10	MCL	No
	Nitrite/300.0	0.30	0.054	0.19	J	1	MCL	No
TMW44	**Nitrate**/300.0	**0.30**	**0.048**	**46**		**10**	**MCL**	**Yes**
TMW45	Nitrate/300.0	0.30	0.048	5.5		10	MCL	No

Well ID	Analyte/Analytical Method	RL	DL	Results (mg/L)	Final Flag	Value Used	Standard Used	Standard Exceeded
TMW46	**Nitrate**/300.0	**0.30**	**0.048**	**97**		**10**	**MCL**	**Yes**
TMW47	**Nitrate**/300.0	**0.30**	**0.048**	**18**		**10**	**MCL**	**Yes**
TMW43	**RDX/8330**	**0.50**	**0.028**	**2.5**		**0.61**	**CA**	**Yes**
TMW43	HMX/8330	0.50	0.026	0.12	J	780	NC	No
TMW44	**Trinitrobenzene, 1,3,5-/8330**	**0.20**	**0.019**	**0.26**	**J**	**460**	**NC**	**No**
BGMW02	Perchlorate/6850	0.200	0.100	0.510		6	Permit	No
BGMW03	Perchlorate/6850	0.200	0.100	0.579		6	Permit	No
TMW45	Perchlorate/6850	0.200	0.100	0.368		6	Permit	No
TMW46	Perchlorate/6850	0.200	0.100	0.712		6	Permit	No
BGMW02	Butyl Benzyl Phthlate/8270	5.1	0.25	0.88	J	14	CA	No
BGMW03	Bis(2-chloroisopropyl) ether/8270	5.0	0.24	0.25	J	0.31	CA	No
	Bis(2-ethylhexyl) phthalate/8270	5.0	0.27	0.91	J	6	MCL	No
TMW43	Bis(2-ethylhexyl) phthalate/8270	5.0	0.27	0.53	J	6	MCL	No
TMW44	Bis(2-ethylhexyl) phthalate/8270	5.1	0.27	3.2	J	6	MCL	No
TMW45	Bis(2-ethylhexyl) phthalate/8270	5.0	0.27	1.5	J	6	MCL	No

mg/L: milligrams per Liter
RL: Reporting Limit
DL: Detection Limit
Lab Flag: Qualifier assigned by lab
V Flag: Qualifier assigned by validation
Final Flag: Final qualifier
Standard Value: Regulatory Limit
Bolded Values: Standard exceeded
RDX: hexahydro-1,3,5-trinitro-1,3,5-triazine
HMX: octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
ug/L: micrograms per Liter
J: Estimated, but detected value
NA: Not Applicable
MCL: U.S. EPA Maximum Contaminant Level
NC: U.S. EPA Regional Screening Levels - non-carcinogens
CA: U.S. EPA Regional Screening Levels - carcinogens
WQCC: New Mexico Water Quality Control Standard
Value Used: The Regulatory Limit value compared to results
Nitrate and Nitrite: Reported as total nitrogen

Table 7: April 2012 Total and Dissolved Metal above Cleanup Criteria

Well ID	Analyte/Analytical Method	Dis/ Tot	RL	DL	Result (mg/L)	Final Flag	Value Used	Standard Used	Standard Exceeded
BGMW02	**Arsenic/6020**	**Dis**	**0.0015**	**0.00061**	**0.011**		**0.01**	**MCL**	**Yes**
	Selenium/6020	**Tot**	**0.0050**	**0.0015**	**0.095**		**0.05**	**MCL**	**Yes**
	Selenium/6020	**Dis**	**0.0050**	**0.0015**	**0.11**		**0.05**	**MCL**	**Yes**
TMW44	**Manganese/6020**	**Tot**	**0.0050**	**0.00027**	**0.54**		**0.2**	**WQCC**	**Yes**
TMW45	**Iron/6020**	**Tot**	**0.10**	**0.048**	**1.3**		**1**	**WQCC**	**Yes**
	Thallium/6020	**Dis**	**0.0050**	**0.00016**	**0.0038**	**J**	**0.002**	**MCL**	**Yes**
TMW46	**Arsenic/6020**	**Tot**	**0.0015**	**0.00061**	**0.011**		**0.01**	**MCL**	**Yes**
	Selenium/6020	**Tot**	**0.0050**	**0.0015**	**0.11**		**0.05**	**MCL**	**Yes**
	Selenium/6020	**Dis**	**0.0050**	**0.0015**	**0.11**		**0.05**	**MCL**	**Yes**

RL: Reporting Limit
DL: Detection Limit
Final Flag: Final qualifier
Bolded Values: Standard exceeded
Standard Value: Regulatory Limit
Dis: Dissolved Metals
mg/L: milligrams per Liter
J: Estimated, but detected value
MCL: U.S. EPA Maximum Contaminant Level
WQCC: New Mexico Water Quality Control Standard
Value Used: The Regulatory Limit value compared to results
Tot: Total Metals

6.0 Summary and Conclusions

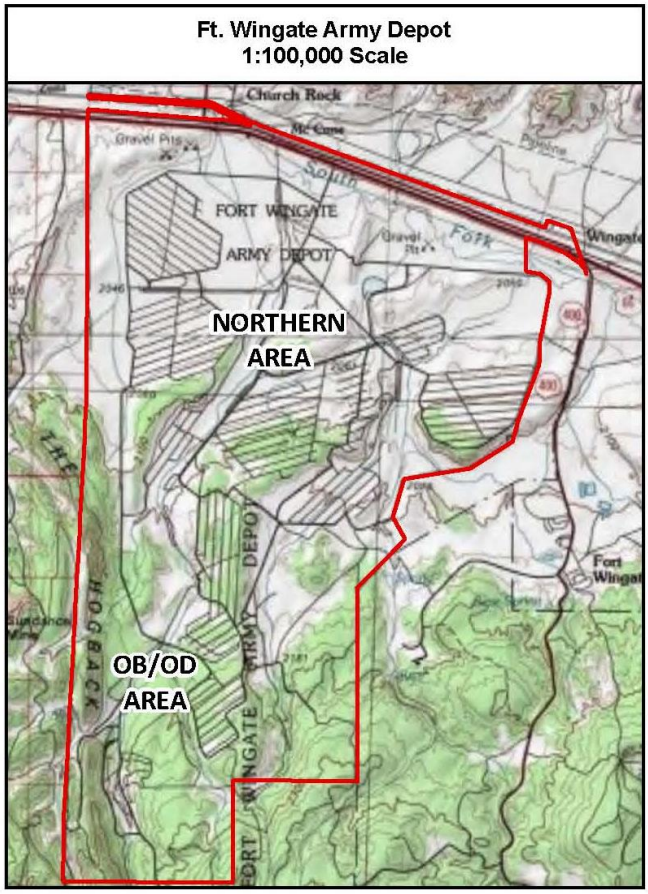
During the fall of 2011 and spring of 2012, 18 new monitoring wells were installed in the Northern Area of the FWDA facility. Two hydrogeologic units were targeted, the alluvium and the Painted Desert Member of the Petrified Forest Formation (NMT 2003). Five monitoring wells were screened in a sandstone unit within the Painted Desert Member primarily to characterize perchlorate in groundwater. The remaining 13 monitoring wells were installed in the alluvial groundwater system. Alluvial monitoring wells were installed for three purposes: 1) to monitoring constituent migration in the alluvial groundwater, 2) to further delineate nitrate and hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) constituents in the alluvial groundwater, and 3) to establish background concentrations for metals such as arsenic, iron, and manganese. New iso-concentration maps developed using the additional chemical data collected from the new 2011 monitoring wells were presented in the April 2011 through October 2011 Groundwater PMR (USACE 2012). Additionally, the forthcoming April 2012 Groundwater PMR will contain detailed iso-concentration maps that change due to additional chemical data collected from monitoring wells installed in 2012. In general, however, only the RDX plume was fully delineated during the 2011/2012 monitoring well installation effort. Perchlorate and nitrate still require additional work to fully define the extents of these plumes. On the following page, figure show the locations of newly installed monitoring wells. Please refer to the April 2011 through October 2011 Groundwater PMR and the forthcoming April 2012 Groundwater PMR for the interpretation of new groundwater chemical data. At the time of finalizing this report, the interpretation of the new 2012 iso-concentration maps were under review and not ready for publication.

7.0 References

U.S. Geological Survey (USGS). 2011. Monitoring Well Installation and Abandonment Plan, Fort Wingate Depot Activity, McKinley County, New Mexico, April 2011.

U.S. Army Corps of Engineer (USACE). 2012. Final Groundwater Periodic Monitoring Report for April Through October 2011, Fort Wingate Depot Activity, McKinley County, New Mexico, May 2012.

New Mexico Institute of Mining and Technology (NMT). 2003. Geology of Fort Wingate Quadrangle, McKinley County, New Mexico, Orin J. Anderson, Charles H. Maxwell, and Spencer G. Lucas, New Mexico Institute of Mining and Technology, Socorro, New Mexico, September 2003.



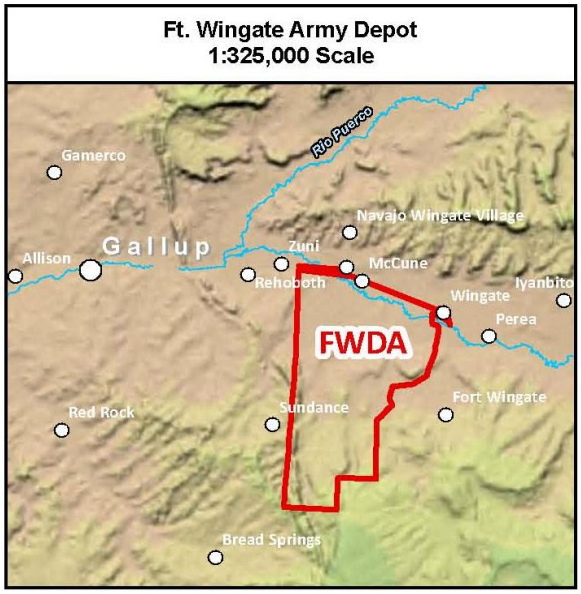


Figure 1: Fort Wingate Depot Activity Location
Installation Boundary in Red

Map Date: March 2012

Data sources: drainages, railroad, roads: Tele Atlas GDT-Dynamap, 2008; populated places: USGS, ESRI, 2005; orthophotography: USGS, 2005; Ft. Wingate Environmental Restoration detail: USACE.

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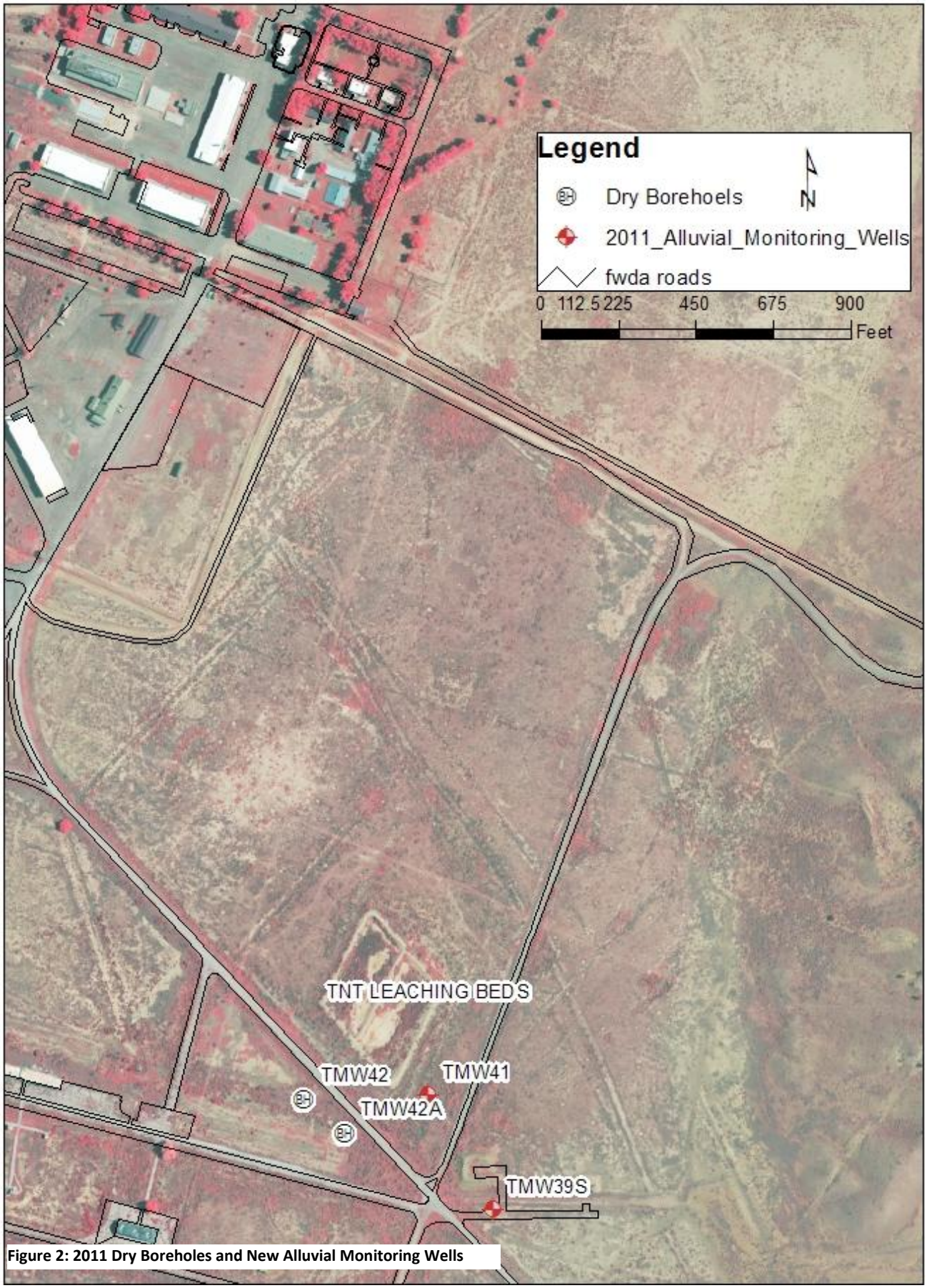

Figure 2: 2011 Dry Boreholes and New Alluvial Monitoring Wells

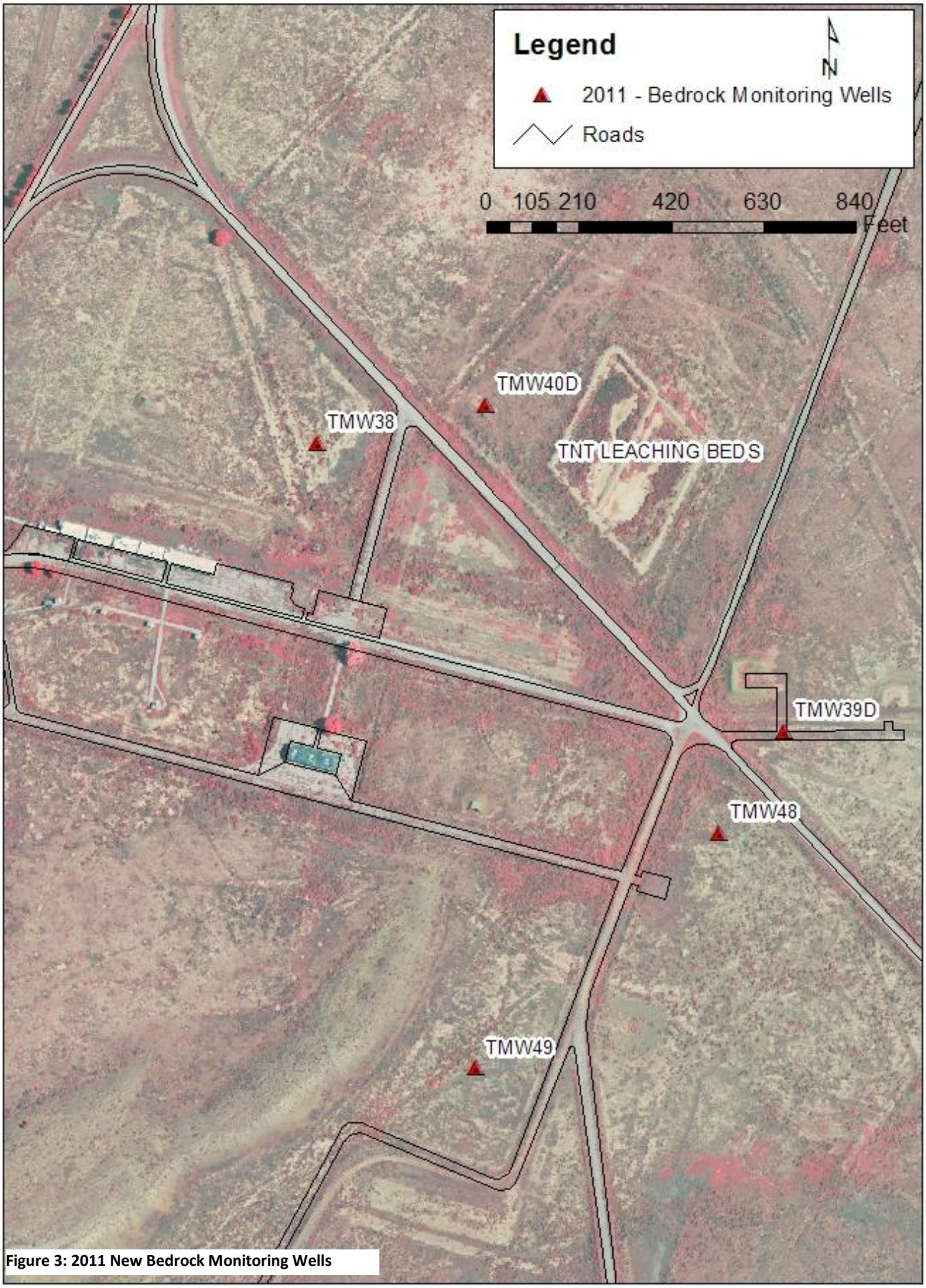

Figure 3: 2011 New Bedrock Monitoring Wells

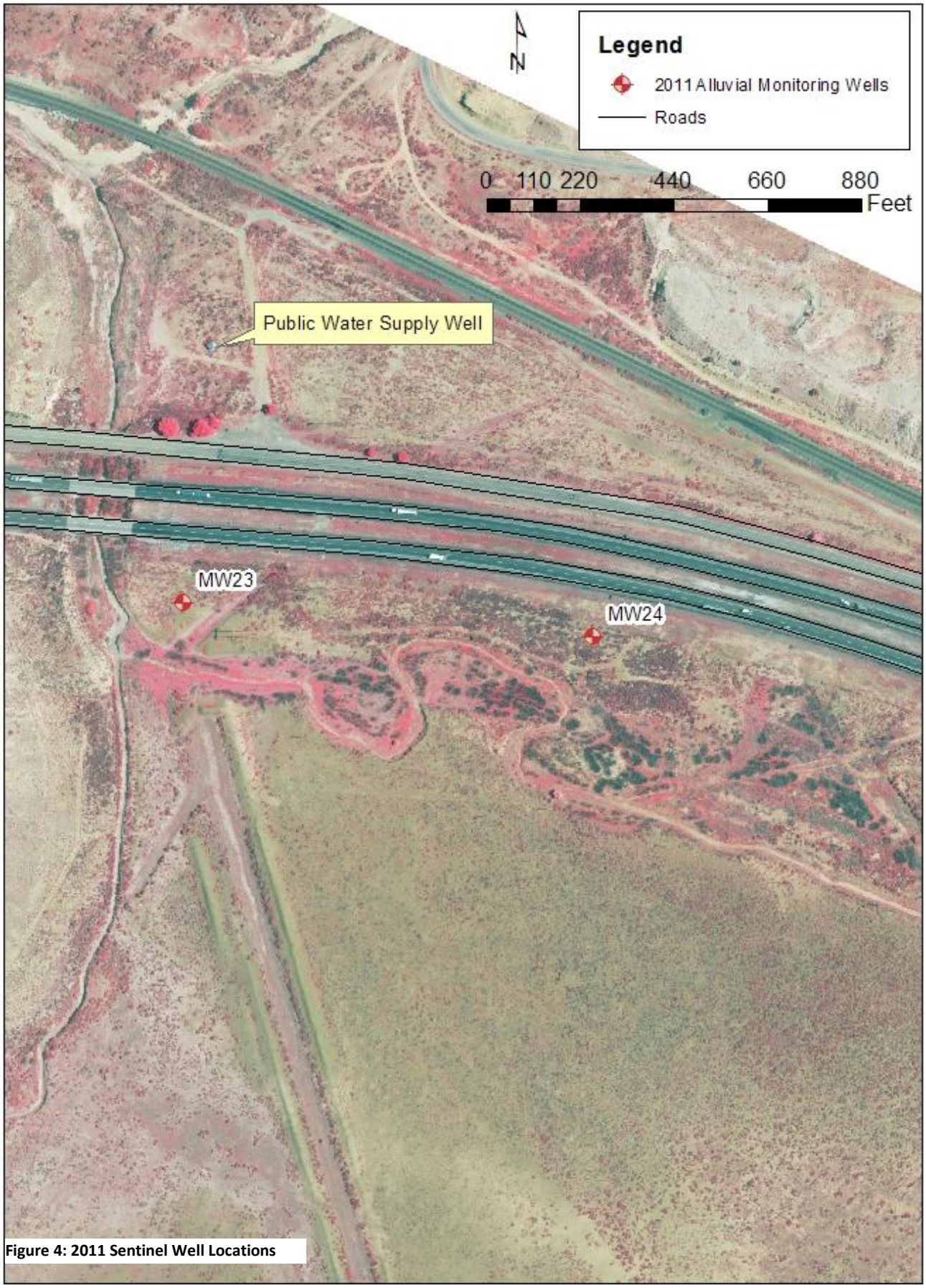

Figure 4: 2011 Sentinel Well Locations

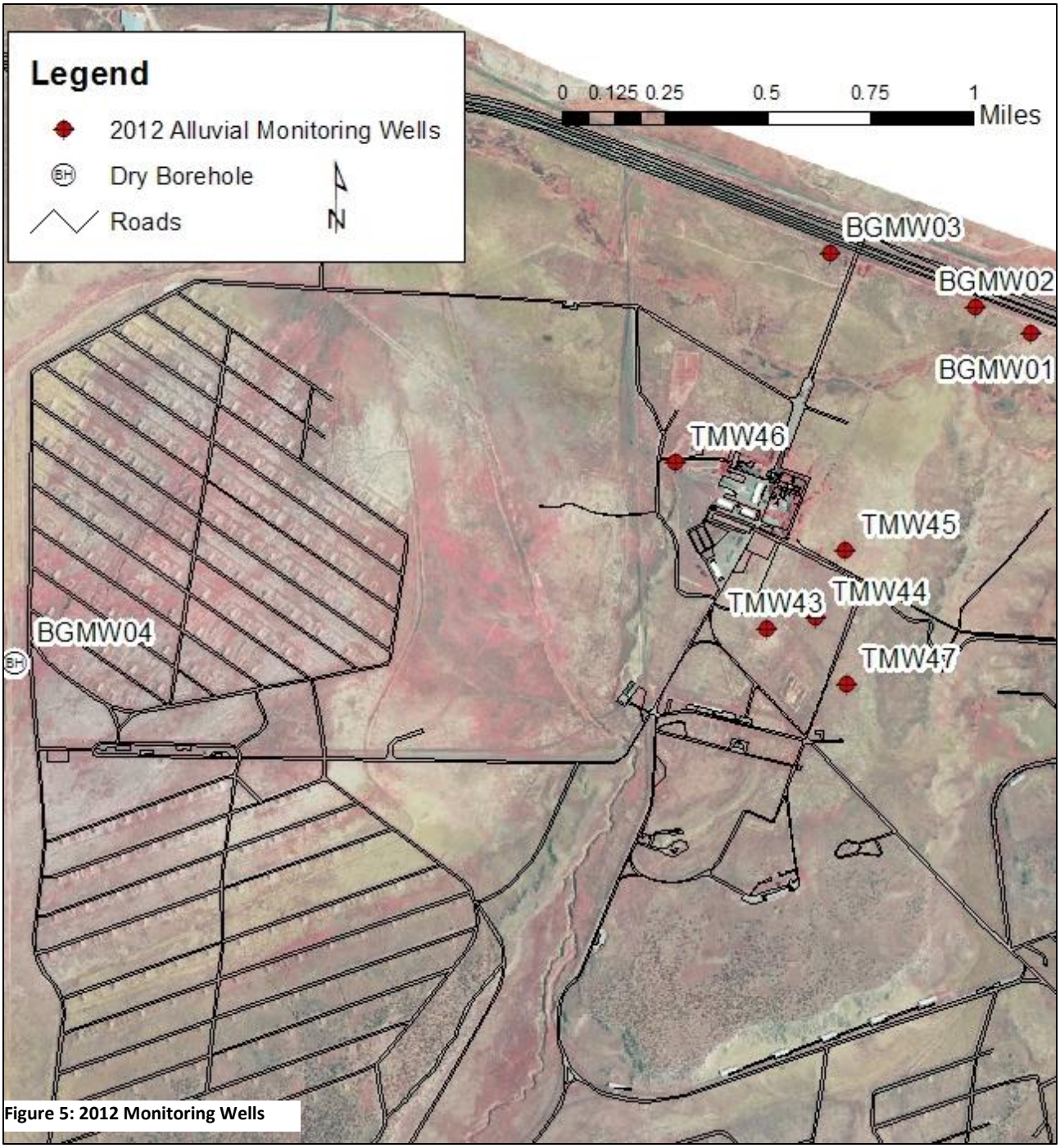

Figure 5: 2012 Monitoring Wells

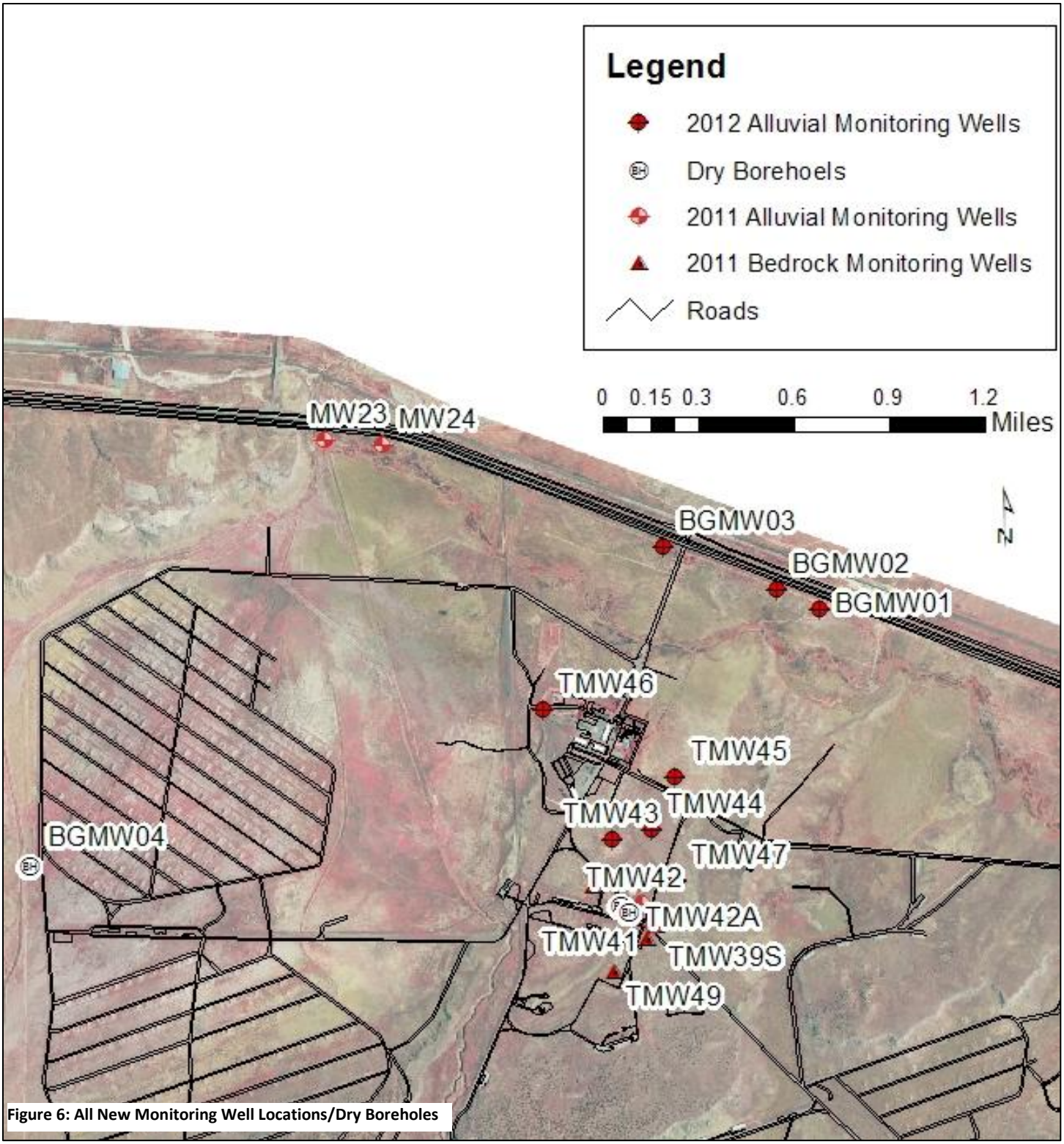

Figure 6: All New Monitoring Well Locations/Dry Boreholes