DENISON MINES

Denison Mines (USA) Corp.
1050 17th Street, Suite 950
Denver, CO 80265
USA

Tel : 303 628-7798
Fax : 303 389-4125

www.denisonmines.com

November 16, 2007

VIA FEDERAL EXPRESS

Dane L. Finerfrock, Executive Secretary
Utah Radiation Control Board
Utah Department of Environmental Quality
168 North 1950 West
P.O. Box 144810
Salt Lake City, UT 84114-4810

Dear Mr. Finerfrock:

Re: State of Utah Ground Water Discharge Permit No. UW370004 (the "GWDP") White Mesa Uranium Mill –Revised Addendum to Background Groundwater Quality Report for Existing Wells

Reference is made to the *Revised Background Groundwater Quality Report: Existing Wells for Denison Mines (USA) Corp.'s White Mesa Mill Site, San Juan County*, October 2007 prepared by INTERA Inc. (the "Background Report"), pursuant to Part I.H.3 of the White Mesa Mill's GWDP, and filed with the Executive Secretary under cover of a letter dated October 26, 2007.

Please find enclosed two copies of the *Revised Addendum: Evaluation of Available Pre-Operational and Regional Background Data*, November 2007, prepared by INTERA Inc. (the "Addendum"). The Addendum is intended to supplement the Background Report by focusing exclusively on pre-operational site data and all available regional data to develop the best available set of background data for the site that could not conceivably have been influenced by Mill operations.

After review of the original version of the Background Report (December 2006), the Executive Secretary requested that certain revisions be made, and the revised Background Report was re-submitted to the Executive Secretary on October 29, 2007. The revisions related primarily to the manner of evaluating the available data and the statistical methods that were employed in calculating Ground Water Compliance Limits. In addition, some missing historic data had been located, some additional QA procedures performed and four new quarters of data were added to the database. This resulted in changes to the database and to the resulting statistics and analysis. However, the basic conclusions in the Background Report did not change.

In April, 2007, Denison submitted the first version of the Addendum to the Executive Secretary. That version was based on the database used in the original version of the Background Report. In order to be consistent with the revised Background Report, we have prepared the revised Addendum to incorporate the changes to the database reflected in the revised version of the Background Report. We have also added some recent data for MW-22.

Specifically:

- the revised database includes some changes to the historic data for wells MW-1, MW-2, MW-3, MW-4 and MW-5, resulting from the addition of some missing data and the performance of some additional reviews of the data. For example, some additional data for 1980 was located, resulting in the use of December 1980 data for some constituents rather than the April 1980 data used in the original version of the Addendum;

- In order to be consistent with the analysis in Section 10.0 of the Background Report, we took the average of the four quarters of 2006 and the first two quarters of 2007 as the current data in the revised Addendum for all constituents other than gross alpha. For gross alpha, we used the average of the four quarters of 2002 as the current data, because data after 2002 is reported as gross alpha minus Rn and U, whereas the early data is for total gross alpha. In the original version of the Addendum, the average of the four quarters in 2006 was used as the current data for all constituents;

- we updated the groundwater isopleths map in Figure 3 from 2005 to 2007 data; and

- recent results from sampling MW-22 in 2007 for uranium, sulfate, manganese and selenium were averaged with the limited available data from 1994 for that well (in the case of manganese and selenium, there was no previous data for MW-22).

While the basic conclusions in the Addendum have not changed, the updated database has resulted in some changes to the figures and tables and related analysis.

If you have any questions or require any further information, please contact me at 303-389-

4130 or Steve Landau at 303-389-4132.

Yours truly,

David C. Frydenlund
Vice President Regulatory Affairs and Counsel

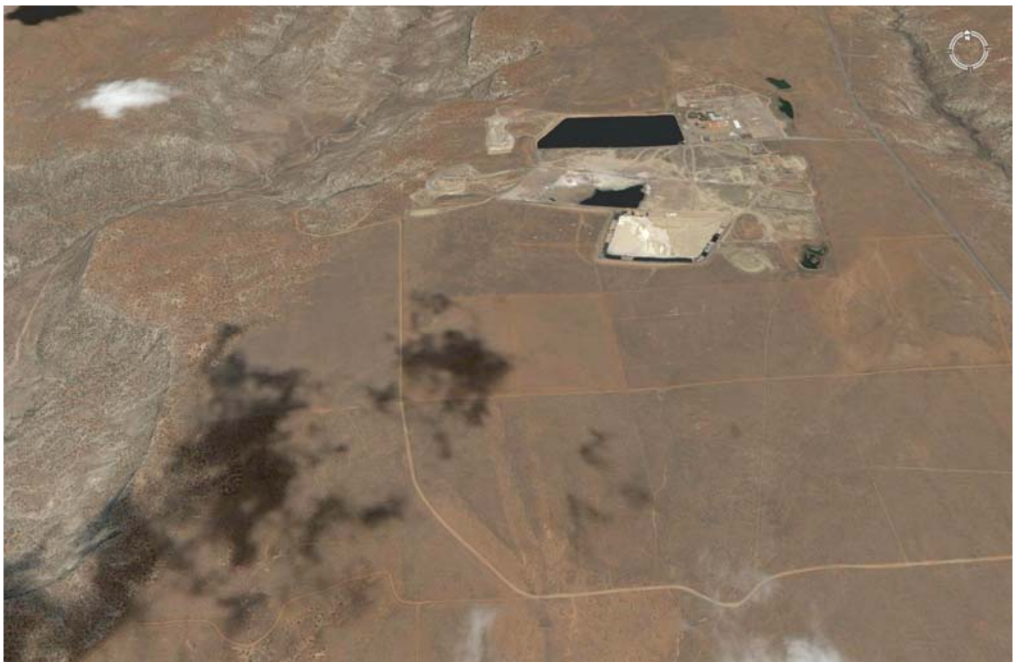
cc: Ron F. Hochstein
Harold R. Roberts
Steven D. Landau
David E. Turk
Daniel W. Erskine, INTERA Inc.

DENISON MINES

Revised Addendum

Evaluation of Available Pre-Operational and Regional Background Data

Background Groundwater Quality Report: Existing Wells For Denison Mines (USA) Corp.'s White Mesa Mill Site, San Juan County, Utah



Prepared for:

Denison Mines (USA) Corp.
Independence Plaza, Suite 950
1050 Seventeenth Street
Denver, CO 80265

Prepared by:

INTERA, Inc
6000 Uptown Boulevard, Suite 100
Albuquerque, New Mexico 87110
November 16, 2007

REVISED ADDENDUM

EVALUATION OF AVAILABLE PRE-OPERATIONAL AND REGIONAL BACKGROUND DATA

Background Groundwater Quality Report: Existing Wells For Denison Mines (USA) Corp.'s White Mesa Uranium Mill Site San Juan County, Utah

Prepared for:

Denison Mines (USA) Corp.
Independence Plaza, Suite 950
1050 Seventeenth Street
Denver, CO 80265

Prepared by:

INTERA
6000 Uptown Boulevard, Suite 100
Albuquerque, New Mexico 87110

November 16, 2007

EXECUTIVE SUMMARY

Denison Mines (USA) Corp. ("Denison") operates the White Mesa uranium mill (the "Mill"), located approximately 6 miles south of Blanding Utah. On January 1, 2007, Denison filed the "*Background Groundwater Quality Report: Existing Wells For Denison Mines (USA) Corp.'s White Mesa Uranium Mill Site, San Juan County, Utah*" (INTERA, 2007a) with the Co-Executive Secretary of the Utah Water Quality Board (the "Executive Secretary"), as required under Part I.H.3 of the Mill's Utah Groundwater Discharge Permit Number UGW370004 (the "GWDP").

After review of such Report, the Executive Secretary requested that certain revisions be made and a revised Background Report was re-submitted to the Executive Secretary on October 29, 2007 (the "Background Report"). The revisions related primarily to the manner of evaluating the available data and the statistical methods that were employed in calculating Ground Water Compliance Limits. In addition, some missing historic data had been located, some additional QA procedures performed and four new quarters of data were added to the database. This resulted in changes to the database and to the resulting statistics and analyses. However, the conclusions in the Background Report did not change.

As required by the GWDP, the Background Report addressed the available historic data for monitoring wells MW-1, MW-2, MW-3, MW-5, MW-11, MW-12, MW-14, MW-15, MW-17, MW-18, MW-19, MW-26 and MW-32, being the compliance wells under the GWDP that were in existence at the date of issuance of the GWDP. All GWDP monitor wells are screened in a zone of perched groundwater in the Burro Canyon Formation which is the uppermost occurrence of groundwater beneath the site. See Figure 1 for the locations of these wells. In the Background Report, a quality assurance evaluation and statistical analyses were performed for the existing data for those wells. Based on those analyses, the Background Report concluded that there have been no impacts to groundwater as a result of Mill activities.

However, the Mill has been in operation since May 1980, and it is therefore important, when determining background groundwater concentrations, to be able to separate true background data, i.e., data that could not possibly have been impacted from Mill operations, from post-operational data that could conceivably have been impacted by Mill operations. The Background Report focused on all available data, which included all pre-operational data and post-operational data that satisfied the QA/QC reviews that were required to be performed under the GWDP. In fact, most of the available historic data for the site post-dates commencement of operations at the site. While compliant with the requirements of the GWDP, the Background Report did not analyze pre-operational background data on its own or available regional data that may be relevant in determining background at the site.

In April, 2007, Denison submitted the first version of this Addendum to the Executive Secretary (INTERA 2007b). That version of this Addendum was based on the database used in the original version of the Background Report. In order to make this Addendum consistent with the revised Background Report, we have prepared this revised Addendum (the "Addendum") to incorporate the changes to the database reflected in the revised version of the Background Report. While the conclusions in this Addendum have not changed, the updated database has resulted in some changes to the figures and tables and related analyses.

The purpose of this Addendum is to assemble all pre-operational site data and all available regional data to develop the best available set of background data for the site that could not conceivably have been influenced by Mill operations. In order to do this, we excerpted the pre-operational data for monitoring wells MW-1, MW-2, MW-3, MW-4 and MW-5 from the data set contained in the Background Report. These wells are the only pre-operational monitoring wells on the site.

We also reviewed all available historic reports and data sets to obtain all available data for the local seeps and springs (Cottonwood Seep and Ruin Spring) and other on-site and off-site regional monitoring wells (MW-20, MW-22, Well #37, Well #38, and Well #39) in the perched zone that are far enough upgradient and downgradient from Mill operations to be considered unimpacted by Mill operations, even though the available data from those sources may have been obtained after commencement of Mill operations. See Figure 1 for the locations of these regional wells, seeps, and springs. Fortunately, while analytical results for a full set of the current GWDP constituents are not available for any of these background sources, results for most of the key indicator parameters (chloride, fluoride, uranium, and sulfate), as well as some of the other constituents that were of concern in the Background Report (selenium, manganese, total dissolved solids (TDS), and gross alpha) are available for most of these wells and sources. Figure 3 is a groundwater contour map for the perched zone which indicates that groundwater flow within the perched zone is from northeast to southwest across the site.

For some of these wells and sources only one or two data points are available for each constituent, and information necessary to perform a proper QA/QC analysis on the data is not available. However, they are the best data available that can be considered to not have been conceivably impacted by Mill operations, and are therefore worthy of analysis. The concentrations of constituents for these background wells and sources are shown on Figures 9 through 17. These figures display relative concentrations at each well or source by setting the area of the symbol (circle) in direct proportion to the magnitude of the concentration.

An analysis of this background data indicates a high variability of all constituents across the site and the region. For some constituents (chloride) the highest observed values are upgradient of the site. For others (sulfate, TDS, selenium and manganese) the highest observed values are far downgradient of the Mill site, or, in the case of fluoride, both at the site and far downgradient of the site. For still others (uranium and gross alpha) the highest concentrations are both upgradient and far downgradient of the site. It is therefore not possible to conclude that higher concentrations of constituents downgradient of the Mill site necessarily imply contamination from site activities. As is evident from this analysis, higher concentrations of a number of constituents occur naturally far downgradient of the Mill site. See Section 8 in the Background Report for a discussion of factors that contribute to natural spatial variability of groundwater in the Burro Canyon Formation.

It is noteworthy that these background results would have resulted in 17 out of compliance situations and 9 exceedances of State groundwater quality standards under the current GWDP compliance limits, purely from natural background.

We then compare these background data to current data for all current monitoring wells on site (MW-1, MW-2, MW-3, MW-5, MW-11, MW-12, MW-14, MW-15, MW-17, MW-18, MW-19, MW-26 and MW-32). For these wells we use the average of the 2006 and first and second quarters of 2007 monitoring results for comparison purposes. MW-4 is not included in the current results, because it is not a monitoring well under the GWDP and there are no current sampling results.

A comparison of the current data to the regional background data is contained in Figures 18 to 27. In those figures the current data for MW-1, MW-2, MW-3 and MW-5 replaces the preoperational data for those wells; the current data for the other newer monitoring wells (MW-11, MW-12, MW-14, MW-15, MW-17, MW-18, MW-19, MW-26 and MW-32) are added to the figures; and the historic data for MW-4, the remaining regional wells and the seeps and springs are the same as in Figures 9 through 17. In this manner, Figures 18 through 27 show the current distribution of concentrations of the various constituents at the site and in the region.

In reviewing these Figures, it should be kept in mind that clusters of plots at the downgradient edges of the tailings cells do not imply higher concentrations at those locations, but rather result from the fact that more wells have been placed at those locations. At those locations, as with all locations, the areas of the circles should be taken into consideration, rather than the mere proximity of circles. These figures show the spatial distribution of the various constituents. Also, while a comparison of Figures 18 to 27 to Figures 9 to 17 merely represents a comparison of snap shots for MW-1, MW-2, MW-3 and MW-5 and not a statistically significant trend analysis, it does give an idea of any temporal changes in concentrations in those wells. A full discussion of linear trends in constituents over time is contained in Sections 6.0 and 7.0 of the Background Report.

From a review of Figures 9 through 17 and 18 through 27 the following conclusions can be made:

- On a comparison of Figures 18 through 27 to Figures 9 through 17, it is evident that changes in the concentrations of constituents in MW-1, MW-2, MW-3 or MW-5 are limited to the minor variability expected in any sampling and analysis program over time;

- With few exceptions (uranium in MW-14, selenium in MW-15 and fluoride in upgradient MW-19), all of the current results fall within the range of background results. However, while these three exceptions set new highs in concentrations for those constituents (one of them upgradient), they do fall within the range of variability established by background. In other words, given this natural variability across the site and region, with the addition of nine new wells to the other background wells and sources, it is not unexpected that three of the 8 constituents in these 9 wells would set new highest levels in the region;

- There are no wells that have a coincidence of unusually high levels of indicator parameters. High levels of uranium are not associated with high levels of chloride, fluoride or sulfate (other than uranium and sulfate in far downgradient well MW-22). High levels of manganese or selenium are not associated with high levels of these indicator parameters (other than manganese and sulfate in far downgradient well MW-22 and manganese and chloride in far upgradient well #38). No wells have unusually high levels of several different parameters. The high concentrations of the various constituents are distributed in a manner across the site and region that does not show any particular pattern or indicate tailings cell leakage.

As a result, we have concluded that the analysis of these background data confirm our conclusions in the Background Report that the groundwater at the Mill site and in the region is highly variable naturally and has not been impacted by Mill operations. Varying concentrations of constituents at the site are consistent with natural background variations in the area.

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1.0 INTRODUCTION

Denison Mines (USA) Corp. ("Denison") operates the White Mesa uranium mill (the "Mill"), located approximately 6 miles south of Blanding Utah. On January 1, 2007, Denison filed the "*Background Groundwater Quality Report: Existing Wells For Denison Mines (USA) Corp.'s White Mesa Uranium Mill Site, San Juan County, Utah*" (INTERA, 2007a) with the Co- Executive Secretary (the "Executive Secretary") of the Utah Water Quality Board, as required under Part I.H.3 of the Mill's Utah Groundwater Discharge Permit No. UGW370004 (the "GWDP").

After review of such Report, the Executive Secretary requested that certain revisions be made and a revised Background Report was re-submitted to the Executive Secretary on October 29, 2007 (the "Background Report"). The revisions related primarily to the manner of evaluating the available data and the statistical methods that were employed in calculating Ground Water Compliance Limits (GWCLs). In addition, some missing historic data had been located, some additional QA procedures performed and four new quarters of data were added to the database. This resulted in changes to the database and to the resulting statistics and analysis. However, the conclusions in the Background Report did not change.

As required by the GWDP, the Background Report addressed the available historic data for monitoring wells MW-1, MW-2, MW-3, MW-5, MW-11, MW-12, MW-14, MW-15, MW-17, MW-18, MW-19, MW-26 and MW-32, being the compliance wells under the GWDP that were in existence at the date of issuance of the GWDP. In the Background Report a quality assurance evaluation and statistical analyses were performed for the existing data for those wells. Based on those analyses, the Background Report concluded that:

- There are a number of exceedances of State Groundwater Quality Standards ("GWQSs") in both upgradient and far-downgradient monitoring wells; therefore exceedances of GWQSs in monitoring wells nearer to the site itself are consistent with natural background;

- There are numerous cases of both increasing and decreasing trends in constituents in upgradient, far downgradient and Mill site wells, which provide evidence that there are natural forces at work that are impacting groundwater quality across the entire site;

- In almost all cases where there are increasing trends in constituents in wells at the site, there are increasing trends in those constituents in upgradient wells. Furthermore, and more importantly, in no case is there any evidence in the wells in question of increasing trends in chloride, which is considered the most mobile and best indicator of potential tailings cell leakage at the site.

As a result, INTERA concluded in the Background Report, that, after extensive analysis of the data, there have been no impacts to groundwater from Mill activities.

However, while the Background Report analyzed all historic data available at the time of the report for all of the 47 constituents listed in Table 2 and Part I.E.C.2)ii. of the GWDP for all of the existing compliance wells listed above, including all pre-operational and operational data, its main focus was on the operational data. This is because the number of monitoring wells and the number of constituents monitored has increased over the years, and the pre-operational data forms only a small part of the data base analyzed in the Background Report.

Since the Mill has been in operation for over 25 years it is important to take care in reviewing historic groundwater monitoring data to ensure that monitoring results to be used to determine background groundwater quality at the site have not been impacted by Mill activities. If all data were generated prior to Mill activities, it would be easy to conclude that the data represent background. Fortunately, a good amount of data was generated and analyses performed prior to Mill activities. These data and analyses were accepted by the United States Nuclear Regulatory Commission (NRC) when the Mill's license was initially granted in May 1980. As these data pre-date operations, it is good evidence of background at the site. In addition, there are some limited data available, both pre- and post-commencement of operations, for regional wells and seeps and springs that are distant enough from the Mill site that they could not have been impacted by Mill operations. These data also provide useful information on natural background concentrations and groundwater variability in the area.

In April, 2007, Denison submitted the first version of this Addendum to the Executive Secretary. That version was based on the database used in the original version of the Background Report. In order to be consistent with the revised Background Report, we have prepared this revised Addendum (the "Addendum") to incorporate the changes to the database reflected in the revised version of the Background Report. The revised database includes some changes to the historic data for wells MW-1, MW-2, MW-3, MW-4 and MW-5, resulting from the addition of some missing data and the performance of some additional reviews of the data. For example, some additional data for 1980 was located, resulting in the use of December 1980 data for some constituents rather than the April 1980 data used in the original version of this Addendum. Further, recent results from sampling MW-22 in July of 2007 for uranium, sulfate, manganese and selenium were averaged with the limited available data from 1994 for that well (in the case of manganese and selenium, there was no previous data for MW-22). In order to be consistent with the analysis in Section 10.0 of the Background Report, we also took the average of the four quarters of 2006 and the first two quarters of 2007 as the current data in this Addendum (other than for gross alpha, where we averaged the four quarters of 2002), whereas the average of the four quarters in 2006 was used in the original version. We used the average 2002 data for gross alpha, because data after 2002 is reported as gross alpha minus Rn and U, whereas the early data is for total gross alpha. We also updated the groundwater isopleth map in Figure 3 with 2007 data. While the conclusions in this Addendum have not changed, the updated database has resulted in some changes to the figures and tables and related analysis.

The purpose of this Addendum is to present a summary and analysis of all available pre-operational data and all available regional data that can be considered not to have been subject to potential impact by Mill operations, either because the data pre-dated commencement of Milling or because the data relate to wells or sources that are upgradient, far-crossgradient or far-downgradient of the Mill facilities and therefore, could not have been impacted by Mill operations. Some of these data (i.e., for MW-1, MW-2, MW-3 and MW-5) are included in the analyses in the Background Report. Other data, such as the data for the regional wells and seeps and springs, are not included in the Background Report. In order to obtain this other data and to analyze all pre-operational data, published literature regarding pre-operational status, construction of the Mill, and hydrogeology of the Mill site was also reviewed. The literature includes letters, reports, and laboratory data that were not the subject of the analysis conducted under the Background Report.

This Addendum is presented as follows: Section 2 is a summary of previous investigations. Section 3 presents a brief history of Mill development. Section 4 is a discussion of the geology and hydrology at the Site. Section 5 is a discussion of the factors considered in determining the pre-operational cut-off date for on site-wells. Section 6 is a discussion of the available pre-operational and regional groundwater data, quality assurance/quality control evaluations that were performed, and other factors applicable to the interpretation of the data. Section 7 is a discussion, analysis and interpretation of the data, and Section 8 is a summary of our conclusions.

2.0 PREVIOUS INVESTIGATIONS

Extensive environmental compliance work was completed under regulation by the NRC prior to the onset of State of Utah authority in 2004. The now defunct Energy Fuels Nuclear, Inc. (EFN) submitted a Source Material License application to the NRC in February of 1978. From 1978 through the present, there have been numerous site investigations which have resulted in environmental reports and assessments, letter reports, well installation logs, and laboratory analytical data. Appendix A lists all of the reports and other literature we have reviewed in preparing this Addendum.

2.1 Summary of Previous Investigations

The following historical reports are briefly summarized here because of their relevance to pre-operational conditions and/or hydrogeological investigations of the Burro Canyon Formation, which hosts the perched aquifer at the site.

- *Environmental Report, White Mesa Uranium Project. Prepared by Dames and Moore, January 30, 1978*

  This report was compiled prior to construction of the Mill and is a detailed study of the region. It is the environmental report that supported the environmental evaluation performed by NRC in connection with the initial licensing of the Mill. It includes information on regional demographics, geology, seismology, hydrology, air quality, and ecology. It also includes the potential environmental effects of Mill operations on the surrounding region.

  This report contains a limited amount of data related to water quality at the Site prior to construction of the Mill. Water was sampled on two occasions from Cottonwood Seep and on one occasion from Ruin Spring, which are in the vicinity of the Mill. These seeps and springs are considered to be hydrologically connected to the shallow aquifer that underlies the Mill, and therefore are relevant to background water quality information at the site. Water was also sampled from an active well on the Mill property, but this well was screened in the much deeper Navajo sandstone, not the Burro Canyon formation. Because the Navajo sandstone aquifer is isolated from the Burro Canyon formation by several hundred feet of low permeability rock, these data do not have any relevance to background water quality of the shallow aquifers in the Burro Canyon formation.

- *Final Environmental Statement Related to Operation of White Mesa Uranium Project. Prepared by NRC, May 1, 1979*

  This is the document that sets out the results of NRC's environmental evaluation performed in connection with the issuance of the initial Mill license. It contains a thorough assessment of the existing environment, proposed Mill operations, and possible impacts to human health, the environment, and socioeconomics of Blanding and San Juan County, from Mill operations. The report does not focus on groundwater issues, because it considered the possibility of groundwater impacts from tailings solutions to be remote and that any potential impacts would be detected by the groundwater sampling required under the Mill's license.

- *Letter Report: Assessment of Groundwater Quality, White Mesa Project, D'Appolonia, 1981*

  This letter report discusses groundwater quality at the site by evaluating the existing local groundwater. Data from both pre-operational and operational wells are presented. This study was triggered by detection of rising water levels in the leak detection system for Cell 2 and shallow subsurface monitor well 7-2 that were ultimately determined to have originated from an adjacent unlined storm water pond (MW-7-2 was subsequently plugged and abandoned during construction of Cell 3). The report concluded that no trends were present which would indicate a failure of the liner system in Cell 2. The changes and trends which were noted were not considered significant enough to indicate a leak from the tailings cell. Statistical analyses indicated that there were no differences in the means between the operational and the pre-operational data at a 99% confidence level. At a 95% confidence level, MW-3 showed slightly higher concentrations of chloride during operations. This increase in chloride was not linked to Cell 2 leakage because MW-3, MW-5, and MW-7-2 did not show increasing trends in sulfate and because water quality in MW 7-2 was consistent with water quality in the unlined stormwater runoff pond.

- *Hydrogeologic Evaluation of White Mesa Uranium Mill. Prepared by: TITAN, July, 1994.*

  This report presents an evaluation of the hydrogeologic setting of the Mill, in support of a submission by the Mill operator to reduce the number of monitoring wells to six downgradient wells (MW-5, MW-11, MW-12, MW-14, MW-15 and MW-17) and four indicator parameters (chloride, uranium, nickel and potassium). The report draws four main conclusions about the impact of Mill activities:

  - The chemistry of perched ground water encountered below the site does not show concentrations or increasing trends in concentration of constituents that would indicate seepage from the existing tailings cells;

- o The useable aquifer (Navajo Sandstone) at the site is separated from the facility by about 1,200 feet of unsaturated, low-permeability rock;
- o The Navajo Sandstone aquifer is under artesian pressure and therefore has an upward pressure gradient that would preclude downward migration of constituents into the aquifer; and
- o The facility had operated for 15 years and had caused no discernible impacts to ground water during this period.

This report includes U.S. Environmental Protection Agency (EPA) HELP (Hydrologic Evaluation of Landfill Performance) models for both dry and wet tailings cells using site and cell specific data to evaluate potential infiltration through the cells. The HELP model determined that no infiltration from a dry cell would take place. It also determined that it would take 50 years for a fully leaking lined cell, and 150 years for a partially leaking lined cell, for contamination to travel through the vadose zone to the perched aquifer at the site. The overall conclusion of this report is that tailings at the Mill are not impacting groundwater at the site.

Based on the results of this analysis by Titan, NRC changed the groundwater monitoring program at the Mill, as requested.

- *Groundwater Information Report. Prepared by International Uranium (USA) Corporation (now Denison), 1999*

  This report contains information on hydraulic conductivity tests done on wells within the Brushy Basin formation. It has information concerning background data, but does not present the data.

- *Utah Division of Radiation Control, 2004, Statement of Basis*

  This document describes the technical and regulatory bases for issuing the GWDP. It contains historical information on activities at the Mill, including information on historical monitoring activities required by previous permits.

- *Summary of Groundwater Background Water Quality and Other Water Quality Studies for the White Mesa Mill. Prepared by International Uranium (USA) Corporation (now Denison), September, 2000.*

  This report is a compilation of excerpts from previous reports on water quality at the Mill. It incorporates information from reports prepared between 1978 and 1997. Although the report as a whole presents no new information, it does provide relevant sections from most of the major reports about hydrogeology at the Mill.

- *Groundwater Information Report, Revision Package. Prepared by International Uranium (USA) Corporation (now Denison), September, 2000*

  This report is also a compilation of previous reports on groundwater at the Mill. It also does not present any new information; rather, it takes excerpts from previous reports. However, it does contain boring logs from most wells that have been installed on Mill property. It also contains hydrographs of water levels in these wells from the time of completion until the time of the report.

- *Ground-Water Hydrology at the White Mesa Tailings Facility. Prepared by Hydro-Engineers, July, 1991.*

  This report was submitted by Umetco Minerals Corp, the then operator of the Mill, to NRC in support of the Mill's 1991 license renewal application. The conclusions in this report draw on the analyses contained in previous reports. However, it does provide data on three regional wells, Well #37, Well #38 and Well #39.

- *Report on Perched Zone Water Movement. Prepared by Hydro Geo Chem, Inc., October 20, 2004*

  This letter report prepared by Hydro Geo Chem presents estimated rates of perched groundwater movement at the Mill. The purpose of this report was to determine which GWDP monitor wells should be sampled semi-annually and which should be sampled on a quarterly basis. Hydraulic conductivities were based on estimates by Hydro Geo Chem, 2002; Hydro Geo Chem, 2004; and

UMETCO, 1994. The calculated rates of perched water movement represent interstitial velocities with an assumed porosity of 0.18. This porosity is an average porosity based on samples collected from the Burro Canyon Formation.

2.2 Interviews

In addition, we interviewed Mr. Harold Roberts, Executive Vice President of Operations for Denison, to better understand the sequence of events and time frames leading up to and subsequent to commencement of initial operations at the Mill. Mr. Roberts has been involved with the Mill beginning in 1978 when he was employed by EFN, the initial operator of the Mill, as Senior Project Engineer/Regulatory Compliance Manager, and Manager of Project Development. His responsibilities included design and construction of the Mill and ongoing support for regulatory and permit compliance activities for company operations. Mr. Roberts has since held various positions related to operations and oversight and project development, and has assumed overall responsibility for the recent re-commencement and operation of Denison's U.S. uranium mines and conventional ore milling operations.

3.0 SITE HISTORY

A timeline of Mill operations from reports and from interviews is included as Figure 2. The key feature here is that the Mill was not licensed until May 1980. As discussed in Section 5 below, we do not consider there to be a realistic potential impact on groundwater from Mill operations for any data obtained in 1980. Accordingly, any data obtained prior to the end of December 1980 is considered to be pre-operational data. A description of the design, construction, and operation of the tailings cells is provided below.

3.1 Tailings Cell Design and Construction

Tailings Cell 2 was completed in May of 1980, Tailings Cell 1 was completed in June of 1981, and Tailings Cell 3 was completed in September of 1982 (Roberts, personal communication, 2007). As a result, all tailings, both liquids and solids, generated prior to June 1981 were deposited into Tailings Cell 2. In September 1981, after completion of

Tailings Cell 1, tailings solutions were placed in both tailings cells 1 and 2, but all solids were placed into Tailings Cell 2. Tailings Cell 3 was not put into use until after September 1982. Tailings Cell 4A was constructed in 1989 and was used for a short period of time to receive tailings solutions until Mill operations ceased in 1991, due to low commodity prices at the time. Cell 4A fell into disrepair after that time. All of the tailings solutions and residual crystals were removed from Cell 4A in 2006, and it is currently in the process of being re-lined for future use. Tailings Cell 2 is full and almost completely covered with interim cover and does not take any more tailings at this time.

Tailings placed in Tailings Cell 2 and currently placed in Tailings Cell 3 typically drain and consolidate to a total moisture content of 20-30 weight percent (DOE, 2004). Tailings solutions are continually decanted off the surface as the tailings are placed and, upon cell closure, internal drainage is removed via an under drain (slimes drain) system consisting of a perforated pipe installed above the liner (D'Appolonia, 9/29/1981). As a result, upon cell closure, all solutions are pumped to Tailings Cell 1 or another active tailings cell for evaporation as tailings solids drain down to field capacity, thereby limiting the amount of available free water and reducing potential for impact to groundwater.

Tailings cells were designed to NRC specifications after more than twenty five years of North American experience in uranium milling. The Mill was among the last uranium mills built before the decline in uranium prices in the 1980's essentially ended uranium mining in the United States. As a result, the Mill was state of the art in 1980 and was built to a higher standard than all other uranium mills that were operating at the time in the United States.

This high standard is evident in the design for the tailings cells. During construction, each of the cells was excavated on a slope toward the dike. Tailings Cells 1, 2 and 3 were lined with a compacted soil layer overlain by a permeable sand layer, overlain, in turn, by a 30 mil PVC liner. The permeable sand layer is more than two times more permeable than the dike material and the underlying compacted soil layer, thereby acting as a sub-drain (D'Appolonia, 5/1/1981).

The sub-drain includes a perforated pipe connected to a riser pipe constructed against the dike to collect any potential leakage. The tailings are generally deposited into the upslope side of the cells in order to concentrate the tailings water at the low end of the cell, nearest to the sub-drain leak detection pipe for early detection of any potential leaks. The riser pipe is monitored daily for potential leakage. In the event of detection of tailings seepage in the sub-drain, a pump can be attached to the riser pipe and the seepage can be pumped back into the tailings cells. Both the sub-drain and the PVC liner installation were inspected by D'Appolonia, EFN, and B.F. Goodrich representatives (D'Appolonia, 1982). When constructed in 1989, Tailings Cell 4A had a 40 ml HDPE liner, underlain by a one foot thick clay secondary liner. There was a leak detection system between these two liners and a slimes drain system on top of the HDPE liner.

4.0 GEOLOGY AND HYDROLOGY OF THE SITE

4.1 General

As described in the Background Report, the lower Cretaceous Burro Canyon Formation is directly overlain by Quaternary deposits at the Mill site. The Quaternary colluvial/alluvial sediments are typically coarse-grained deposits that contain little water. The Burro Canyon Formation is described as interbedded conglomerate and grayish-green shale with light-brown sandstone lenses deposited in a fluvial environment (Aubrey, 1989). The average thickness of the unit is approximately 75 feet (U.S. Department of Energy [DOE], 2004).

The Burro Canyon Formation hosts the uppermost occurrence of groundwater at the site and all compliance monitor wells are screened in this unit. Groundwater in this unit is perched (i.e., isolated from groundwater that occurs in geologic units that underlie the Burro Canyon Formation). Perched water is supported by the relatively impermeable, underlying, fine-grained Brushy Basin Member of the Morrison Formation. The permeability of the Burro Canyon Formation is generally low (TITAN, 1994). Some conglomeratic zones may exist east to northeast of the tailings cells, potentially explaining a relatively continuous zone of higher permeability in these areas. The saturated thickness of the perched groundwater zone ranges from approximately 82 feet in the northeast portion of the site to less than 5 feet in the southwest portion of the site (DOE, 2004).

Groundwater in the perched aquifer generally flows northeast to southwest in the area of the Mill's tailings cells. Figure 3 shows the 2007 groundwater elevations presented in the perched zone. Figure 4 shows those contours as estimated by Dames & Moore in 1978. Groundwater in the regional Entrada/Navajo aquifer, isolated from the perched zone by over 1,000 feet of Morrison Formation, is under artesian pressure (upward flow gradient). This hydrologic barrier isolates deeper groundwater from any potential seepage from overlying geologic units.

4.2 Permeability and Travel Times

The permeability of the Burrow Canyon Formation is relatively low, resulting in slow movement of groundwater in the perched aquifer. Hydraulic conductivities of the various monitor wells at the site have been measured in the past (Hydro Geo Chem, 2002, Hydro Geo Chem, 2004 and UMETCO, 1994) and range from 1.4×10^{-3} cm/s in MW-11 to 8.0×10^{-7} cm/s in MW-1. The wells downgradient of the Mill's tailings cells (MW-3, MW-5, MW-12, MW-15 and MW-20) generally have the lowest hydraulic conductivities. Based on these hydraulic conductivities, we have estimated the average travel times of groundwater in the perched aquifer downgradient of the Mill's tailings cells to be approximately 0.76 feet per year (see Appendix B for assumptions and calculations).

Because of these slow travel times for groundwater in the perched zone, we are confident that a number of downgradient and cross-gradient wells, seeps and springs could not have been impacted by Mill operations to date and represent background to the site.

For example, based on hydraulic conductivities in the various monitoring wells at the site we have calculated that it would take over 3,300 years for a conservative constituent (such as chloride) to travel from the downgradient edge of Tailings Cell 3 to Ruin Spring, which is approximately 10,000 feet downgradient from that cell. This calculation used highly conservative assumptions, and a calculation using more realistic, but still conservative, assumptions resulted in a range of values between 7,620 and 14,000 years. Thus, using highly conservative assumptions, a minimum travel time to the nearest far downgradient well (MW-3, approximately 3,000 feet downgradient of Tailings Cell 3) would be 900 years and a more realistic travel time would be in the range of 2,600 to 4,200 years. Similarly, we have estimated the travel times from Cell 2 to MW-3 to be 1,320 to 5,600 years and from Cell 2 to MW-5 to be approximately 440 years. See Appendix B for details of this analysis.

Due to the distances between the tailings cells and MW-3, MW-20, MW-22, Well #37, Cottonwood Seep and Ruin Spring, we have concluded that there could not have been any impacts from Mill operations to date on those wells, seeps and springs.

5.0 DETERMINATION OF PRE-OPERATIONAL CUT-OFF DATE

We have chosen December 1980 as the cut-off date for pre-operational data. Any data obtained during 1980 or earlier is considered not to have been subject to any potential influences from Mill operations. We have chosen that cut-off date, rather than May 1980, the time of initial licensing and commencement of operations at the Mill for two reasons. First, as discussed in Section 6.2(a), monitoring wells MW-1, MW-2, MW-3, MW-4, and possibly MW-5 were flushed with fresh water during development. This occurred in 1979, and in a number of cases it took until the end of December 1980 for those wells to stabilize. The best indicator of background in those wells is therefore the latest data point in 1980 for each constituent.

Second, there is no realistic scenario where solutions from tailings Cell 2, which was the only tailings cell in use in 1980, could be considered to have impacted MW-1, which is upgradient of the tailings cells, MW-4 and MW-2, which are both cross-gradient to Tailings Cell 2, MW-3 which is some 4,000 feet downgradient of Tailings Cell 2 or MW-5, which is approximately 1,000 feet downgradient of Tailings Cell 2. As discussed in Section 4.2, based on current estimates of permeabilities and travel times, it would take over 1,320 years for any potential contamination to travel from Tailings Cell 2 to MW-3, and over 440 years to travel from Tailings Cell 2 to MW-5. In light of these hydraulic conductivities, it is inconceivable that any potential leakage from the Mill's Tailings Cells could travel vertically through the vadose zone to the perched aquifer and then along the perched aquifer to any of these wells in the 6 months or so of operations in 1980.

6.0 PRE-OPERATIONAL AND REGIONAL BACKGROUND DATA

6.1 Available Data

The pre-operational and regional background data that are the subject of this Addendum are the following:

- On-site monitoring wells. Pre-operational data exist for GWDP compliance wells MW-1, MW-2, MW-3, MW-4 and MW-5. The data for these wells are also included in the Background Report. In this Addendum, we focus only on the pre-operational data for those wells;
- Regional monitoring wells. These are MW-20 and MW-22, which exist and are on the Mill property but are not compliance wells under the GWDP. Well #37, which was on the Mill property but no longer exists, and Well #38 and Well #39, which are upgradient off-site wells; and
- Seeps and springs. Data are available for certain constituents in Cottonwood Seep and Ruin Spring.

In the case of the regional wells and Cottonwood Seep, only a limited amount of sampling was performed. However, even though the data are limited and not adequate for statistical analysis, they do represent the best available data for these regional sources.

6.2 Pre-operational On-Site Monitor Wells

Four pre-operational groundwater monitoring wells were drilled and completed in the perched zone in September 1979. These monitor wells were designated MW-1 through MW-4. Well locations are presented in Figure 1. The first round of groundwater sampling in these wells occurred in October of 1979. The wells were completed with 20 to 40 foot screens to total depths of between 96 and 125 feet. These wells were developed by air lifting and flushing with fresh water (D'Appolonia, 11/16/1979). A falling head permeability test conducted in each well following development indicated that all locations had a low coefficient of permeability requiring considerable time for stabilization prior to sampling (MW-3 was initially dry and required several weeks to recover sufficiently for sampling [D'Appolonia, 11/16/1879]).

The operational groundwater monitoring program for the Tailings Management System Initial Phase involved the installation of one well (MW-5) in the perched groundwater table on the downgradient edge of Tailings Cell 3 (which was in the process of being constructed at the time), five shallow leak detection wells and five intermediate depth leak detection wells in May of 1980. See Figure 1 for the location of MW-5. The shallow and intermediate depth wells were completed in the vadose zone above the perched aquifer. The well development methodology for MW-5 is not described except to say that it was similar to that used for the pre-operational wells. MW-5 was first sampled on May 30, 1980. The shallow and intermediate wells were dry.

The well yield from wells completed in the Burro Canyon formation within the Mill site is generally lower than that obtained from wells in this formation upgradient of the site. For the most part, the documented pumping rates from on-site wells completed in the Burro Canyon formation are less than 0.5 gpm. Even at this low rate, the on-site wells completed in the Burro Canyon formation are typically pumped dry within a few hours (Denison, 1999, Groundwater Information Report).

Low productivity suggests that the Mill is located over a peripheral fringe of perched water; with saturated thickness in the perched zone discontinuous and generally decreasing beneath the site, and with conductivity of the formation being very low. These observations have been verified by studies performed for the U.S. Department of Energy's disposal site at Slick Rock New Mexico, which noted that the Dakota Sandstone, Burro Canyon formation, and upper claystone of the Brushy Basin Member are not considered aquifers due to the low permeability, discontinuous nature, and limited thickness of these units (U.S. DOE, 1993).

6.3 Regional Background Wells

Groundwater quality data have been identified for five regional background wells (Figure 1). Two of these regional wells (MW-20 and MW-22) are monitoring wells that were installed by a previous Mill operator in locations that are far downgradient/cross gradient of the tailings cells. Both of these wells were sampled once in 1994 for a limited number of constituents, and MW-22 was sampled twice (two depths on the same date) in July 2007 for uranium, sulfate, manganese and selenium. Three regional wells existed prior to construction of the Mill, two in upgradient locations (Well #38 and Well #39) and one in a cross gradient location (Well #37). These wells are currently not used (Well #37 no longer exists) but were sampled once in 1991. The results of this sampling are found in the Ground Water Hydrology at the White Mesa Tailings Facility report prepared by Hydro-Engineering in July of 1991.

6.4 Seeps and Springs

If sampled directly at the point groundwater exits geologic materials, samples of seeps and springs reflect the chemical composition of groundwater in the geologic unit that hosts them. Six seeps or springs were identified in canyons adjacent to White Mesa as part of a Denison effort to locate and sample all seeps and springs in the region surrounding the Mill (Figure 1). Only two of these seeps have yielded sufficient water for sampling: Cottonwood Seep and Ruin Spring. Pre-operational sampling data from 1977, are available for Cottonwood Seep (two sampling events) and Ruin Spring (one sampling event) and are reported in the Environmental Report prepared by Dames & Moore January 30, 1978. The average results for the two sampling events for Cottonwood Spring were used for the analysis in this Addendum. Eight quarters of data from Ruin Spring were also collected by Denison in 2003-2004. In this Addendum, the average results for these eight quarters were used for the analysis of Ruin Spring, rather than the one data set collected in 1977.

6.5 Quality Assurance/Quality Control Evaluation

Quality assurance/ quality control (QA/QC) was performed for the data from pre-operational wells MW-1 through MW-5 and for the 2007 data for MW-22 in the same manner as for the Background Report. Because of the range of variables in the pre-operational data and the data collected for the regional wells, we used available information to assist with the QA/QC process. The Ruin Spring data from 2003-2004 included a laboratory QA/QC summary, and QA was performed on those data according to the Background Report. Data from Well #37, Well #38, and Well #39 were presented in a report (Hydro-Engineering, 1991) without any accompanying laboratory reports or laboratory QA/QC summary. The Dames and Moore (1978) Environmental Report presents data from Cottonwood Seep and Ruin Spring in a table within the report, but does not include any laboratory reports or QA/QC summary. In these cases, where information was not available, assumptions were made based on previous knowledge of the sampling protocol and laboratory reporting. For example, if a data set was presented in a report without an accompanying laboratory report with the laboratory QA/QC summary, we assumed that when values were reported with a "<", the value following the "<" was the laboratory detection limit. If the value was reported as a "0" we assumed the value was not detected above the laboratory detection limit. If the value was reported as a "0" and there was no laboratory detection limit presented, we flagged and removed the data point from the database. All data was carefully evaluated and converted to the same units when applicable. Sulfate concentrations were not measured in samples from Wells 37, 38, and 39. Sulfate values for these wells were calculated by ion balance from other data available.

6.6 Analysis of On-Site Pre-Operational Data

Pre-operational data for MW-1, MW-2, MW-3, MW-4, and MW-5 were compiled from early environmental reports and laboratory analytical reports. As discussed in Section 5 above, for the purposes of this study, pre-operational data include analytical data collected through December of 1980. In the discussion that follows, data from subsequent periods were also used to demonstrate the effects of the fresh water flush during development of these wells.

Figures 5 and 6 present sulfate and chloride concentrations, respectively, in samples from these site groundwater monitoring wells during the period from August 1979 to January 1984. The effects of fresh water flushing during development are apparent in monitor wells MW-1 through MW-4. Note for example that sulfate concentrations in samples from MW-1 rise from 220 mg/L, measured during the first sampling event on October 31, 1979, to 635 mg/L measured on May 30, 1980 when sulfate concentrations apparently stabilized. Similar results can be observed in sulfate concentrations and chloride concentrations in samples of groundwater from all the on-site pre-operational wells. These data indicate that it took at least six months for the few gallons of fresh water used in flushing to move out of the radius of influence of the well and for non-impacted groundwater representative of the formation to move in.

The above observations support the conclusion in Section 4.2 above that, as predicted by geologic evidence and well tests that have been conducted over the years, fluids move very slowly in the Burro Canyon Formation (Hydro Geo Chem, 2007). These data do not show any evidence of secondary porosity in the form of fracture flow that might increase groundwater travel times. The initial saturated thickness measured in MW-1 was 12 feet in what was described as coarse wet sandstone (D'Appolonia, February 23, 1980). Assuming a porosity of 0.2, there could be more than 5,000 gallons of groundwater within a radius of ten feet of MW-1. Typically, less than twenty gallons of fresh water are used to develop a well in this fashion and almost certainly less than one hundred gallons were used per well. In spite of these observations, it took more than six months before the fresh water could be displaced and representative formation water could be sampled.

It is evident from the foregoing analysis, that the pre-operational data for the on-site monitoring wells have been impacted by the fresh water flushing used in well development, and are not all representative of background in those wells. The time required to stabilize varied by constituent and well, but for the most part the wells remained impacted by this influence until the end of 1980. As a result, for the analysis that follows, we have taken the latest data point for each constituent in each well in 1980 as the most representative of background.

As discussed in the Background Report, sulfate and chloride, as well as fluoride, are important indicators of potential impact from tailings solutions, because they are present in high concentrations in tailings fluids and are relatively conservative along a groundwater flow path. Chloride has been used as a conservative tracer for a number of years (Davis and others, 1985) and has been shown to travel at the same rate as water (Kaufman and Orlob, 1956). Conservative tracers, such as chloride, do not readily adsorb into soil materials or precipitate unless present in very large concentrations. Evidence of the conservative nature of chloride is that chloride is the dominant anion in ocean water (TITAN, 1994). See section 9.0 of the Background Report for a more detailed discussion of indicator parameters.

Figures 7 and 8 display the results of sulfate and chloride measurements, respectively for the entire sampling history of monitor wells MW-1 through MW-5. With the exception of recent variability in MW-4 related to impact by, and remediation of, chloroform contamination, concentrations of these constituents have remained constant, within the bounds of normal sampling variation, in each of the wells to the present time. These data indicate that there has been no impact to groundwater by tailings solutions, and further supports our decision to use the last data point in 1980 for the constituents in each of MW-1 through MW-5 for purposes of the analysis in this Addendum.

7.0 DISCUSSION

7.1 Pre-Operational and Regional Results

To the extent available, fluoride, chloride, sulfate, uranium, manganese, selenium, TDS, and gross alpha data from regional background wells, seeps and springs, and pre-operational on-site monitor wells have been plotted on Figure 9 to show on-site and regional background data. Figures 9 through 27 display relative concentrations at each well or source by setting the area of the symbol (circle) in direct proportion to the magnitude of the concentration for the entire set of values (pre-operational and average 2006/2007 values).

Note that all data depicted on Figure 9 can be assumed to be un-impacted by any potential tailings seepage. In addition to data from sampling locations that are upgradient or far downgradient of the tailings cells, data from samples of groundwater in tailings cell monitor wells MW-1 through MW-5 were collected before there could be any potential impact from tailings solutions (see Section 5 above). As a result, even though the data shown on Figure 9 are based on one data point for each of the monitoring wells (three data points for uranium, sulfate, manganese and selenium in MW-22), the average of two data points for Cottonwood Seep and the average of 8 data points for Ruin Spring, it represents the best available display of regional background to the site.

Figures 10 through 17 show plots of the same data by individual constituents, thereby allowing for a more direct observation of the individual constituents.

General observations that can be made from Figures 9 through 17 include:

7.1.1 Spatial Variability

Data presented in Figure 9 exhibits a high degree of spatial variability, as summarized in the following Table:

Table 1 Variability of Background Concentrations

Constituent	Minimum (mg/L)	Maximum (mg/L)	Multiple of Range (Max/Min)
Chloride	10 (MW-2)	213 (Well #38)	21.3
Fluoride	0.36 (MW-1, MW-4)	0.75 (Cott. Seep)	2.08
Sulfate	230 (Cott. Seep)	4,974 (MW-22)	21.63
Uranium	0.0005 (MW-5)	0.049 (Well #39)	98
Manganese	0.005 (Ruin Spring)	34.55 (MW-22)	6,910
Selenium	0.0025 (MW-1-5)	0.014 (MW-22)	5.6
TDS	811 (Cott. Seep)	5,105 (MW-22)	6.29
Gross Alpha (pCi/L)	0.28 (pCi/L) (Ruin Spring)	145 (pCi/L) (Well #38)	518 (pCi/L)

7.1.2 Chloride

The highest observed chloride values are from upgradient wells (Well #38 and Well #39). See Figure 10.

7.1.3 Fluoride

The highest observed fluoride values exist in MW-5 and downgradient seeps and springs. See Figure 11.

7.1.4 Uranium

Uranium values show no apparent spatial pattern, although the highest concentrations are in upgradient (Well #39) and far downgradient (MW-22) wells. See Figure 12.

7.1.5 Sulfate and TDS

The highest observed sulfate and TDS values are from far downgradient wells (MW-3 and MW-22). See Figures 13 and 14.

7.1.6 Selenium

The highest observed selenium values are far downgradient in MW-22 and Ruin Spring. All other values are recorded as non-detect. The detection limit for selenium in 1980 was 0.005 mg/l, which is significantly higher than the current detection limit of 0.001 mg/l. Accordingly, pre-operational and regional non-detect values for selenium were recorded as half the detection limit at the time. See Figure 15.

7.1.7 Manganese

The highest observed manganese value is from far downgradient MW-22. Other high values are from upgradient (Well #38 and Well #39) and far downgradient (MW-3) wells. See Figure 16.

7.1.8 Gross Alpha

The highest observed gross alpha values are from upgradient (Well #38 and Well #39) wells and far downgradient in Cottonwood Seep. See Figure 17.

It should be clear from the foregoing, and a review of Figures 9 through 17 that in a number of cases concentrations of constituents occur naturally in higher concentrations upgradient (chloride), others in higher concentrations downgradient (sulfate, TDS, selenium and manganese) and still others in higher concentrations both updradient and far downgradient of the Mill site (uranium, and gross alpha). In the case of fluoride, the highest observed values are observed upgradient of the site, at the site and far downgradient of the site. It is therefore not possible to conclude that higher concentrations of constituents downgradient of the Mill site necessarily implies contamination from site activities. As is evident from this analysis, higher concentrations of a number of constituents occur naturally downgradient of the Mill site.

The observations presented above are consistent with the spatial analysis presented in Section 8 of the Background Report, and Utah Division of Oil, Gas and Mining publications which state that perched groundwater within the Burro Canyon Formation is characterized by low yields and is generally of poor quality (contains moderate to high concentrations of chloride, sulfate, and TDS (Hunt, 1996). These data indicate that pre-operational data from monitor wells MW-1 through MW-5 and the regional wells and seeps and springs fall well within the expected range of regional background.

It is interesting to note that the pure background concentrations set out in Figures 9 through 17 would trigger out-of-compliance status and accelerated monitoring under the current GWDP Groundwater Compliance Levels (GWCLs) and exceedances of current State Groundwater Quality Standards (GWQSs) as follows (note, there are no GWCLs for chloride, sulfate, and TDS in the GWDP, so those constituents are not included in the following table):

Table 2 Pre-Operational and Natural Background Exceedances of GWDP Limits

Sample Point	Groundwater Class*	GWQS	GWCL	Reported Value of Constituents
Uranium (µg/L)				
MW-1	II	30	7.5	**10**
MW-2	II	30	7.5	**18**
MW-3	III	30	15	**23**
MW-4	II	30	7.5	**23**
MW-22	III	30	15	**42**
Well #38	II	30	7.5	**12**
Well #39	II	30	7.5	**49**
Ruin Spring	II	30	7.5	**10**
Manganese (µg/L)				
MW-3	III	800	400	**3,450**
MW-4	II	800	200	**840**
MW-5	II	800	200	**220**
MW-22	III	800	400	**34,550**
Well #38	II	800	200	**7,450**
Well #39	II	800	200	**2,400**
Cott. Seep	II	800	200	**580**
Gross Alpha (pCi/L)				
Well #38	II	15	3.75	**145**
Well #39	II	15	3.75	**61**

*Groundwater class is based on the TDS values used for the analysis in this Addendum

As is evident from Table 2, these pre-operational and background results for the 10 wells and 2 seeps and springs would give rise to out of compliance status under Part I.G.1 and 2 of the GWDP in 17 cases and would be classified as exceedances of the current State GWQSs in 9 cases.

7.2 Comparison of Current Sample Results to Background Results

Figure 18 is similar to Figure 9 except that average 2006/2007 (average of data from all four quarters of 2006 and first two quarters of 2007) concentrations have been substituted for 1980 concentrations at the locations of monitor wells MW-1, MW-2, MW-3, and MW-5 (other than for gross alpha, where we averaged the four quarters of 2002). We used the average 2002 data for gross alpha, because data after 2002 is reported as gross alpha minus Rn and U, whereas the early data is for total gross alpha. Current data for MW-4 are not shown because it is not a monitoring well under the GWDP and current data are not available. Instead, the 1980 data for MW-4 are shown on Figure 18 (and Figures 19 through 27). Concentrations for MW-20, MW-22, Well #37, Well #38, Well #39, Cottonwood Seep and Ruin Spring in Figure 18 (and Figures 19 through 27) are the same as those depicted in Figures 9 through 17.

Figures 19 to 26 show plots of the same data by individual constituent, thereby allowing for a more direct observation of the individual constituents.

These data, together with data depicted in Figures 7 and 8, displaying the results of sulfate and chloride measurements for the entire sampling history of monitor wells MW-1 through MW-5, indicate that current concentrations of these constituents are well within the range of variability in regional background and there have been no groundwater impacts from potential tailings seepage.

General observations that can be made from Figures 18 to 26 include:

7.2.1 Temporal Consistency

On a comparison of Figures 18 through 26 to Figures 9 through 17, it is evident that there have not been many significant changes in the concentrations of constituents in MW-1, MW-2, MW-3, or MW-5 over time, other than would be expected from normal sample variation. While a comparison of Figures 18 to 27 to Figures 9 to 17 merely represents a comparison of snap shots for MW-1, MW-2, MW-3, and MW-5 and not a statistically significant trend analysis, it does serve as an indicator of any temporal changes in concentrations in those wells. A full discussion of linear trends in constituents over time is contained in Sections 6.0 and 7.0 of the Background Report.

7.2.2 Spatial Variability

Data presented in Figure 18 exhibits a similar degree of spatial variability compared to the background data, as summarized in the following Table:

Table 3
Comparison of Pre-Operational and Background Values With Average Current Results

Constituent	Pre-Operational and Background Results			Ave Current & Background Results		
	Minimum (mg/L)	Maximum (mg/L)	Multiple (Max/Min)	Minimum (mg/L)	Maximum (mg/L)	Multiple of Range (Max/Min)
Chloride	10 (MW-2)	213 (Well #38)	21.30	8.0 (MW-2)	213 (Well #38)	26.63
Fluoride	0.36 (MW-1, MW-4)	0.75 (Cott. Seep)	2.08	0.20 (MW-14)	1.18 (MW-19	5.90
Sulfate	230 (Cott. Seep)	4,974 (MW-22)	21.63	230 (Cott. Seep)	4,974 (MW-22)	21.63
Uranium	0.0005 (MW-5)	0.049 (Well #39)	98	0.0005 (MW-1)	0.060 (MW-14)	120
Manganese	0.005 (Ruin Spring)	34.55 (Well #38)	6910	0.005 (Ruin Spring, MW-2)	34.55 (Well #38)	6,910
Selenium	0.0025 (MW-1-5)	0.014 (MW-22)	5.60	0.0025 (MW-1, MW-4, MW-5, MW-11, MW-14, MW-17, MW-18, MW-32)	0.11 (MW-15)	44
TDS	811 (Cott. Seep)	5,105 (MW-22)	6.29	811 (Cott. Seep)	5,105 (MW-22)	6.30
Gross Alpha	0.28 (pCi/L) (MW-4)	145 (pCi/L) (Well #38)	518 (pCi/L)	0.28 (pCi/L) (Ruin Spring)	145 (pCi/L) (Well #38)	518

As evident from Table 3, the current results generally fit within the ranges of concentrations of the background results, with three exceptions. The range for fluoride has increased due to an increase in fluoride concentrations in upgradient well MW-19. The range for uranium has increased due to relatively higher concentrations of uranium in MW-14 and the range for selenium has increased due to relatively higher concentrations of selenium in MW-15. These circumstances are discussed below.

In reviewing Figures 18 through 27, it should be kept in mind that clusters of plots at the downgradient edges of the tailings cells do not imply higher concentrations at those locations, but rather result from the fact that more wells have been placed at those locations. At those locations, as with all locations, the areas of the circles should be taken into consideration, rather than the mere proximity of circles.

7.2.3 Chloride

The highest observed chloride values continue to be from upgradient wells Well #38 and Well #39. 2006/2007 chloride concentrations fall well within the range of background concentrations discussed in Section 7.1 above. There are no spatial patterns in chloride concentrations of concern. See Figure 19.

7.2.4 Fluoride

The highest observed fluoride value is now in upgradient MW-19, followed by MW-5. The remainder of the fluoride concentrations for current wells falls within the range of background concentrations discussed in Section 7.1. The fact that the highest concentration of fluoride is found upgradient in MW-19 and that all other results for fluoride fall within the range established by MW-19 suggests that all current fluoride results are consistent with background for the area. See Figure 20.

7.2.5 Uranium

With the exception of MW-14, all of the current results for uranium fall within the range of background values. The highest concentrations, other than MW-14 are found in upgradient MW-18 (42.8 ug/l) and in Mill site wells MW-15 (49.3 ug/l) and MW-17 (27.1 ug/l). Of these, MW-18 is clearly background, because it is upgradient of the Mill facilities. The concentration in MW-15 of 49.3 ug/l is consistent with the values of 42.8 ug/l, 48.5 ug/l and 41.7 ug/L in upgradient wells MW-18 and Well #39 and far downgradient well MW-22, respectively, and the concentration of 27.1 ug/l in MW-17 is lower than these upgradient wells and consistent with the value in far downgradient well MW-3 (32 ug/l). See Figure 21.

In fact, of the six highest concentrations of uranium (wells MW-3, MW-14, MW-15, MW-17, MW-18, MW-22 and Well #39 that approach or exceed the GWQS of 30 ug/l), three (MW-14, MW-15, MW-17) are close to the tailings cells and the remaining four are either upgradient (MW-18 and Well #39) or far downgradient (MW-3 and MW-22). This is consistent with the general variability of background concentrations of uranium in the region.

MW-14 has the highest concentration (60 ug/l) and, as discussed in Sections 7.0 and 11.0 of the Background Report, has exhibited a rising trend since it was first sampled in 1989. However, the following key points should be noted about MW-14:

- There is no indication of a trend in uranium concentration in the thirty six sampling rounds since 1999.

- Upgradient well MW-18 has exhibited a more pronounced rising trend in uranium concentration during roughly the same time period, which suggests that natural influences are impacting uranium concentrations in certain areas of the site (see Sections 7.0, 11.0 and 12.0 of the Background Report)

- As is evident from Figure 27, which plots the key indicator parameters, chloride, fluoride and sulfate along with uranium, MW-14 is not associated with high concentrations of any of these indicator parameters. In fact, it is associated with a relatively low concentration of chloride, which is considered to be the best indicator parameter for potential tailings cell leakage (see Section 9.0 of the Background Report for a discussion of indicator parameters). Nor is MW-14 associated with a rising trend in any of those indicator parameters (see Section 7.0 of the Background Report).

- While the uranium concentration in MW-14 is higher than the other measured uranium concentrations at the site and in the region, it is not that much higher. The concentration of uranium in MW-14 is approximately 1.23 times that of the next highest uranium concentration (Well #39 and MW-15). However, by way of comparison, the highest chloride value of 213 in Well #38 is approximately 2.5 times higher than the next highest value (Well #39), and the highest manganese value of 34,550 ug/l in MW-22 is approximately 4.64 times higher than the next highest value (Well #38). The range in such values for selenium is even higher than for manganese. The concentration of uranium in MW-14 is therefore consistent with and not unexpected for background at the site and in the region.

While the uranium concentration in MW-14 may initially raise questions that should be addressed, the concentration of uranium in MW-14 is consistent with the variability of constituents in background in the area. As discussed in the Background Report, the historic increasing trend in uranium in MW-14 is due to natural influences and not the result of Mill operations.

7.2.6 Sulfate and TDS

The highest observed sulfate values continue to be from far downgradient wells (MW-3 and MW-22). TDS behaves essentially the same as sulfate. The concentrations for the current wells are well within the range for background at the site. See Figures 22 and 23.

A comparison of Figures 22 and 13 for sulfate and Figures 19 and 10 for chloride indicates that, in general, sulfate values were slightly higher in 2006/2007 than in 1980 and that chloride values are about the same.

An upward trend in sulfate occurred in samples of groundwater from Ruin Spring, as illustrated in Figure 28. In sampling data covering the period between March 2003 through October 2004, sulfate concentrations in samples from Ruin Spring are initially constant at near 500 mg/L but increase nearly twenty five percent to over 600 mg/L in the period from March to October 2004. Chloride data that are also relatively constant during the first year, decline almost fifteen percent during the period from March to October of 2004 (see Figure 29).

While the cause of these trends at Ruin Spring is currently uncertain, it is clear that they are not related to any potential tailings seepage. As explained in the Background Report, concentrations of both sulfate and chloride in tailings solutions are high relative to concentrations in site groundwater. However, sulfate would be retarded relative to chloride during transport in groundwater because high concentrations of sulfate precipitate as a mineral phase that is removed from groundwater along a flow path but no chloride minerals form, as long as enough water is present to flow for any distance.

7.2.7 Manganese

The highest observed manganese values continue to be from far downgradient well MW-22, followed by upgradient Well #38, and then MW-32 (see Section 11.0 of the Background Report for a discussion of specific influences at MW-32 that may be impacting manganese concentrations in that well). Upgradient well Well #39 has the next highest level. The current levels are therefore consistent with background concentrations. See Figure 24.

7.2.8 Selenium

The highest observed selenium value is a concentration of 0.107 mg/l at MW-15, followed by 0.02 mg/l at MW-3. While this is a new high for available data in the region, it is well within the levels of variability for other constituents in the region. See Figure 25. Selenium in MW-15 has also exhibited a rising trend over time, but we have concluded that due to other rising trends in selenium in MW-3 and MW-19, and the fact that chloride, fluoride, and sulfate concentrations are relatively low in MW-15 and have not been rising, this trend in selenium in MW-15 is due to natural causes and not Mill operations (see Section 11.0 of the Background Report).

7.2.9 Gross Alpha

The highest observed gross alpha values continue to be from upgradient wells (Well #38 and Well #39), followed by MW-3. The current levels are therefore consistent with the background concentrations. See Figure 26.

7.2.10 Concentrations in New Wells within Range of Natural Variability for the Site and Region

As is evident from the foregoing discussion, with few exceptions (uranium in MW-14, selenium in MW-15, and fluoride in upgradient MW-19), all of the current results fall within the range of background results. However, while these three exceptions set new highs in concentrations for those constituents, they do fall within the range of variability established by background. In other words, given this natural variability across the site and region, with the addition of nine new wells to the other 12 wells, seeps and springs, it is not unexpected that three of the eight constituents in these nine wells would set the new highest levels in the region;

7.2.11 Absence of Coincidence of Unusually High Levels of Indicator Parameters

The key indicator parameters, chloride, fluoride and sulfate, together with uranium are shown on Figure 27. There are no wells that have a coincidence of unusually high levels of indicator parameters. High levels of uranium are not associated with high levels of chloride, fluoride or sulfate (other than uranium and sulfate in far downgradient MW-22). High levels of manganese or selenium are not associated with high levels of these indicator parameters, other than high levels of manganese and sulfate in far downgradient MW-22 and manganese and chloride in far upgradient Well #38 (compare Figures 24 and 25 to Figure 27). No wells have unusually high levels of a number of different parameters. It is quite evident graphically from a review of Figure 18 that high concentrations of the various constituents are distributed in a manner across the site and region that does not show any particular pattern. There are no "hot spots" with a disproportionately high coincidence of high concentrations of constituents. Almost each well has some relatively high concentrations and some relatively low concentrations of constituents compared to the other wells. This pattern is not consistent with tailings cell leakage, where normally a high coincidence of high concentrations (and rising trends) of indicator parameters would be expected to be at the immediate downgradient edge of a leaking tailings cell.

As a result, this analysis confirms our conclusions in the Background Report that the groundwater at the Mill site and in the region is highly variable, and has not been impacted by Mill operations. Varying concentrations of constituents at the site are consistent with natural background variations in the area.

8.0 CONCLUSIONS

In this Addendum, we have combined the pre-operational data for MW-1, MW-2, MW-3, MW-4 and MW-5 with available data for other on-site and off-site monitoring wells and seeps and springs in the region in order to develop what we consider to be the best set of background data for the Mill site. This background data cannot conceivably be considered to have been impacted by Mill operations. In developing this data base, we reviewed all available reports and sources of data.

An analysis of these background data indicates a high variability of all constituents across the site and the region. For some constituents the highest observed values are upgradient of the Mill site. For others the highest observed values are far downgradient of the site. For still others the highest concentrations are both upgradient and far downgradient of the site. It is therefore not possible to conclude that higher concentrations of constituents downgradient of the Mill site necessarily imply contamination from site activities.

We then compare these background data to current data for all current monitoring wells on site and conclude that:

- Changes in the concentrations of constituents in MW-1, MW-2, MW-3 or MW-5 are generally limited to the minor variability expected in any sampling and analysis program over time;

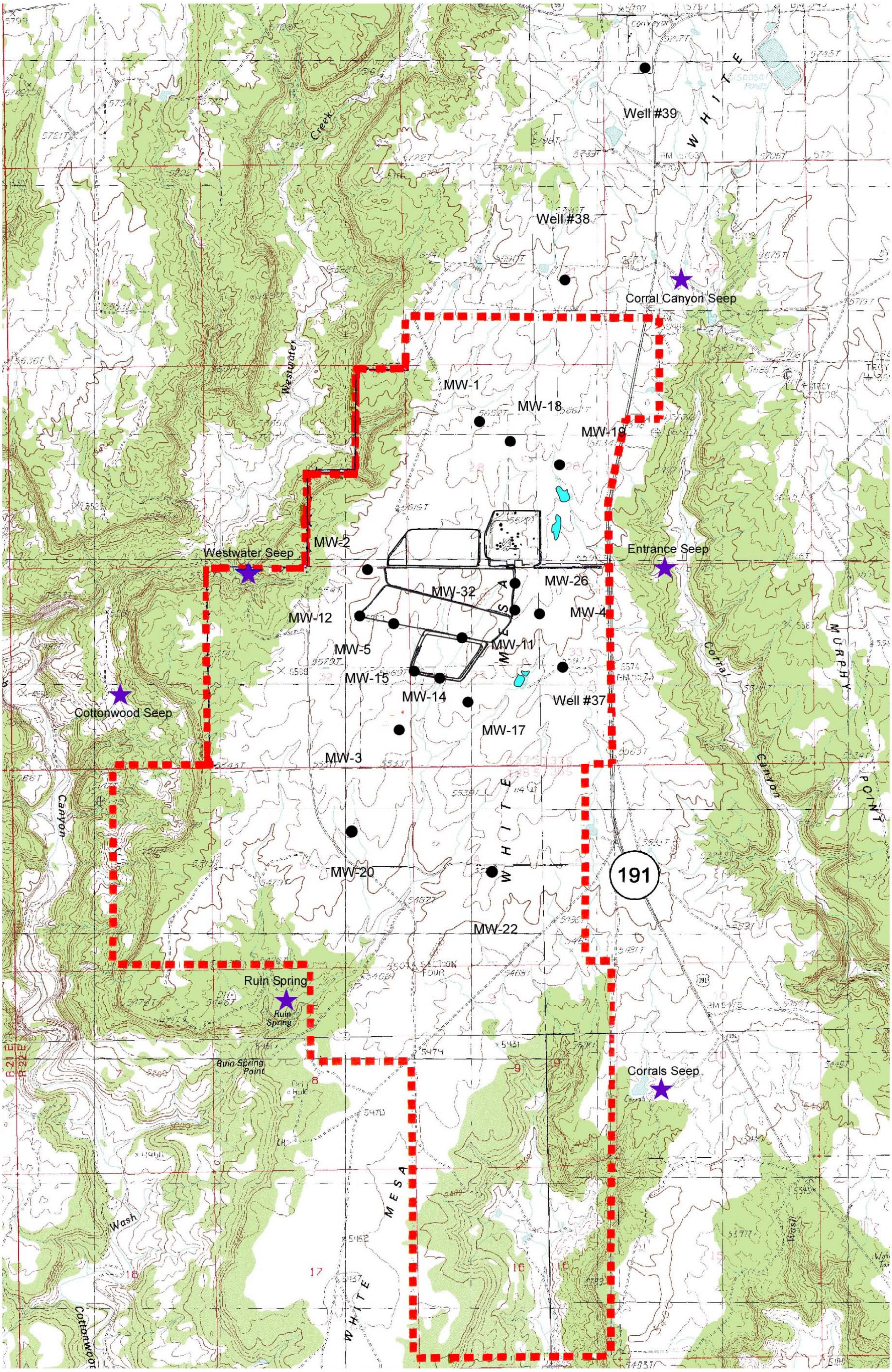
- With few exceptions, all of the current results fall within the range of background results, and in the few cases where current data sets new highs, the new highs in concentrations fall within the range of variability established by background. In other words, given this natural variability across the site and region, with the addition of nine new wells, it is not unexpected that some of the constituents in those wells will set the new highest levels in the region;

- There are no wells that have a coincidence of unusually high levels of indicator parameters. High levels of uranium are not associated with high levels of chloride, fluoride or sulfate (other than uranium and sulfate in one far downgradient well). High levels of manganese or selenium are not associated with high levels of these indicator parameters (other than in the case of one far downgradient well and one far upgradient well). No wells have unusually high levels of a number of different parameters. The high concentrations of the various constituents are distributed in a manner across the site and region that does not show any particular pattern and certainly does not indicate tailings cell leakage.

The analysis in this Addendum confirms our conclusions in the Background Report that groundwater at the Mill site and in the region is highly variable naturally and has not been impacted by Mill operations. Varying concentrations of constituents at the site are consistent with natural background variations in the area.

FIGURES

FIGURES



DUSA Property Boundary

DUSA Wildlife Ponds

Burro Canyon Wells

Springs/Seeps

N

0 1 mile

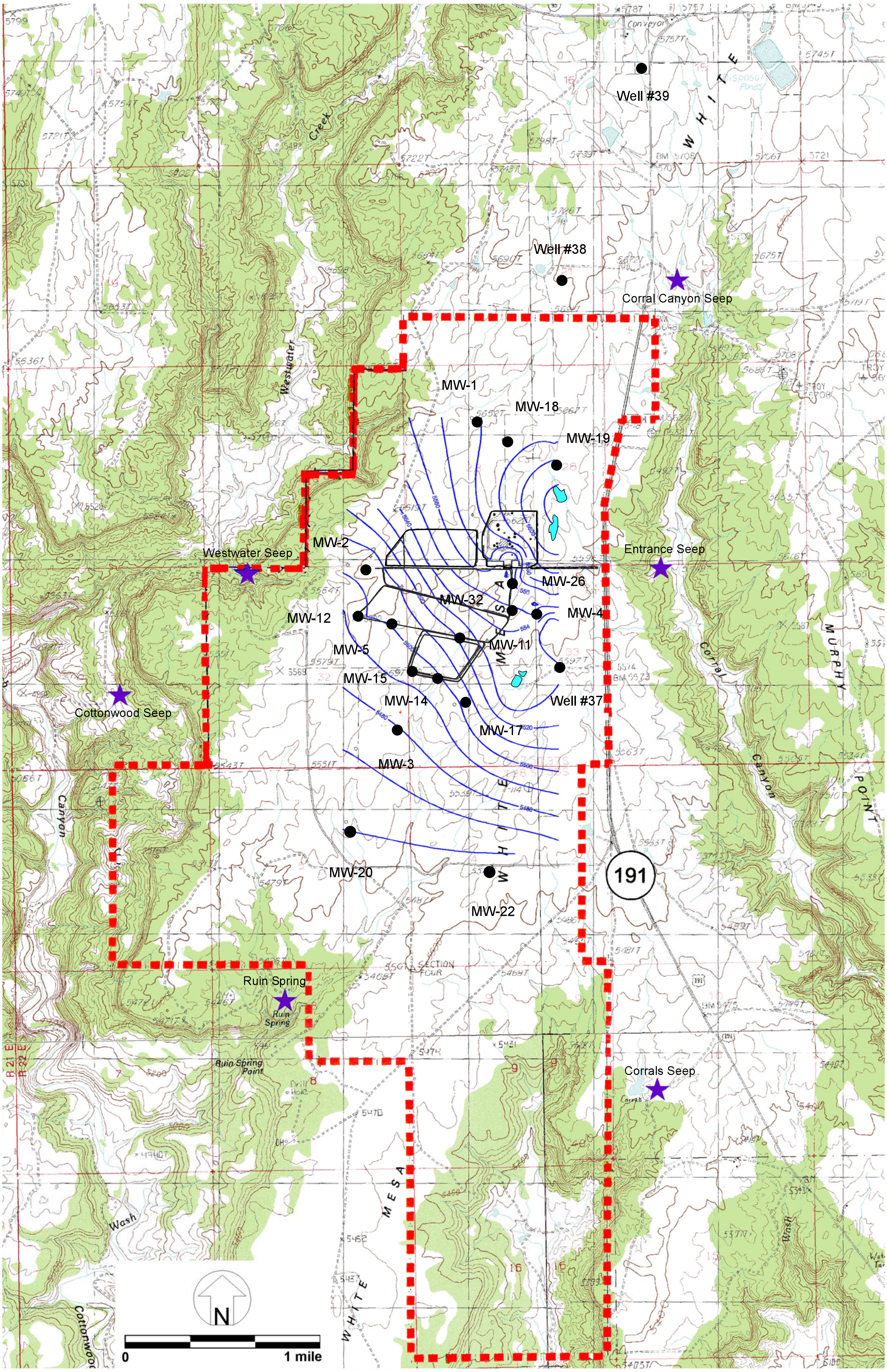
Figure 1
Locations of Wells, Seeps, and Springs in the Vicinity of White Mesa Mill

INTERA

White Mesa Timeline

Date	Activity	Reference
Pre-mill	NW wildlife pond (former rancher's stock watering pond)	Harold Roberts
1979	Wildlife pond E of Mill installed	Harold Roberts
2/8/1978	Source Material License application for WMM was submitted to NRC by Energy Fuels Nuclear (EFN)	DOE, 2004
8/1/1978	Construction on the tailings area began	DOE, 2004
9/1/1979	MW-1 installed	TITAN, 1994
9/1/1979	MW-3 installed	TITAN, 1994
5/1/1980	MW-5 installed	TITAN, 1994
5/4/1980	Cell 2 was completed	DOE, 2004
5/6/1980	The first low grade ore was fed to the Mill	http://www.wma-minelife.com/uranium/mill/ef.htm
5/6/1980	License issued	Harold Roberts
5/8/1980	February 4, 1983 1,511,544 tons of ore were processed	DOE, 2004
June, 1981	Cell 1 was completed	Harold Roberts
7/1/1981	Use of White Mesa tailings cells started	Hydro-Engineers, 1991
9/25/1981	Cells 1 and 2 were operating as of 9-25-81	D'Appolonia, 1981
10/1/1982	MW-12 installed	TITAN, 1994
Summer 1983	Cell 3 was completed	Harold Roberts
1984	Union Carbide Corporation (UCC) Metals Division – which later became UMETCO Minerals Corporation – acquired the mill in majority ownership interest	DOE, 2004
8/31/1984	Original license expires	NRC, Source Material License No. SUA01358, 1979
10/1/1985	December 7, 1987 1,023,393 tons of ore were processed	DOE, 2004
July 1988- November 1990	1,015,032 tons of ore were processed	DOE, 2004
9/1/1989	MW-14 and 15 installed	TITAN, 1994
1989	Cell 4A was completed	Harold Roberts
12/1/1989	Solutions initially discharged to Cell 4	Hydro-Engineers, 1991
9/23/1991	Renewed license expires	NRC, Source Material License No. SUA01358, 1985
12/1/1992	MW-17 installed	Utah Division of Radiation Contrl, 2003
late 1993- early 1994	Wildlife pond SE of Mill installed	Harold Roberts
5/26/1994	FN reassumed complete ownership	DOE, 2004
8/1/1995	January 1996 203,317 tons of ore were processed	DOE, 2004
1990s (mid-to-late)	began processing alternate feed materials	DOE, 2004
5/1/1996	September 1996 3,868 tons of calcium fluoride material was processed	DOE, 2004
5/1/1997	International Uranium (USA) Corporation (IUC) – now known as Denison Mines (USA) Corp. purchased the assets of EFN and is current owner of WMM	DOE, 2004
3/31/2007	Facility license expires	DOE, 2004

Figure 2
Timeline of Mill Operations



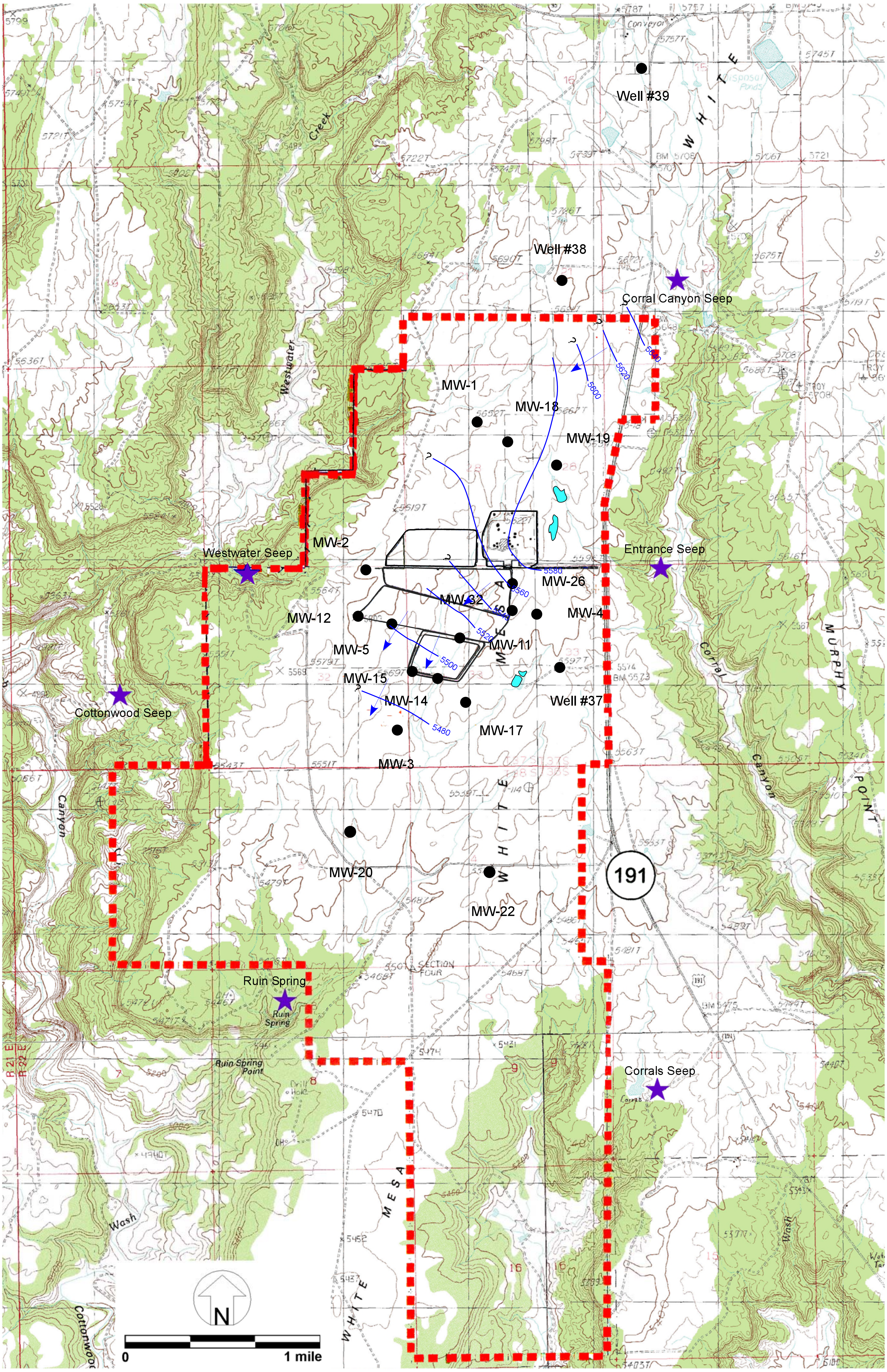
DUSA Property Boundary

DUSA Wildlife Ponds

Burro Canyon Wells

Springs/Seeps

Figure 3
2007 Groundwater Isopleth Map
Modified from the Background Report (INTERA, 2007)



DUSA Property Boundary

DUSA Wildlife Ponds

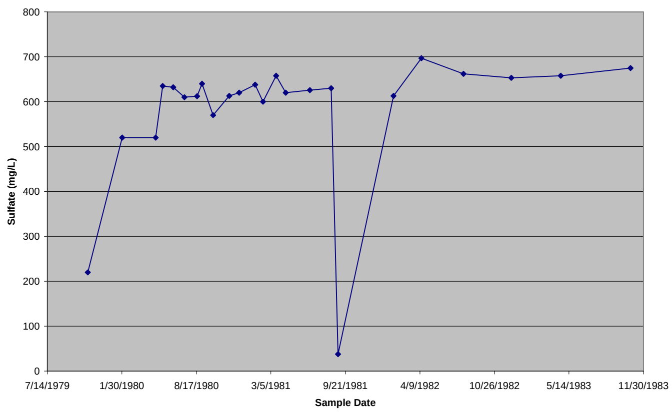
Burro Canyon Wells

Springs/Seeps

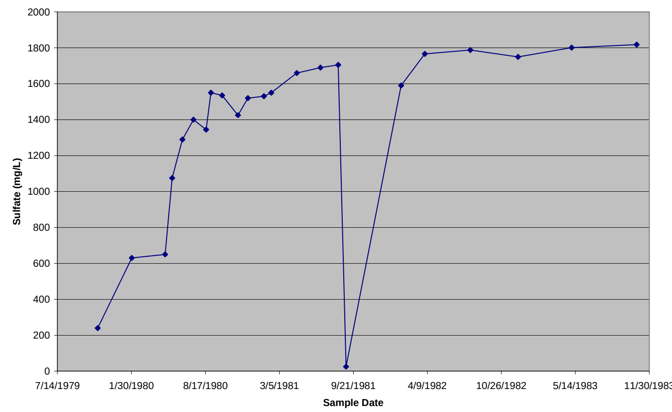
Figure 4
Groundwater Level Map from 1977
Modified from Dames & Moore, 1980

INTERA

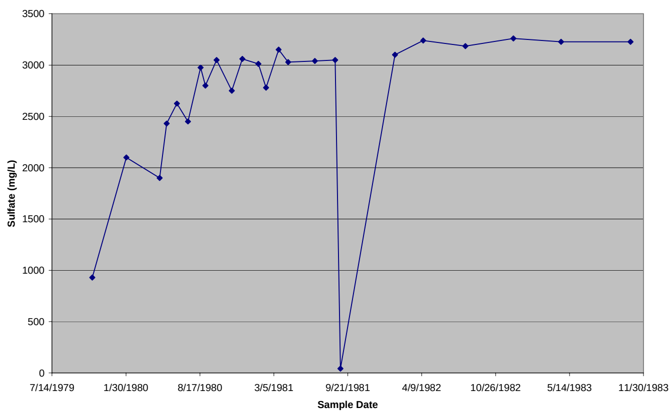
Sulfate in MW-1



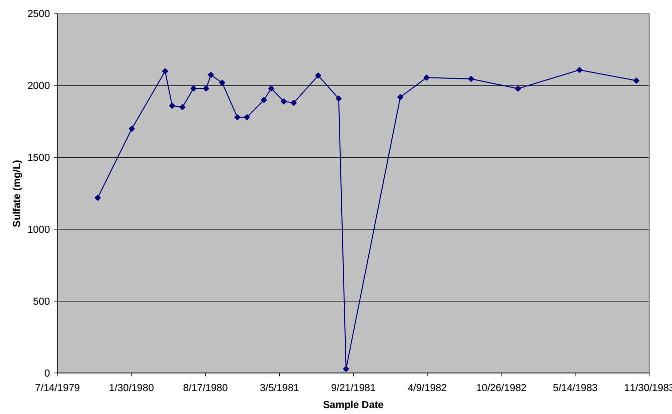
Sulfate in MW-2



Sulfate in MW-3



Sulfate in MW-4



Sulfate in MW-5

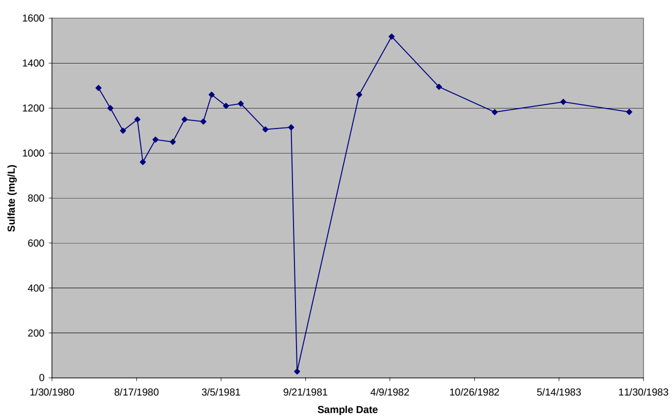
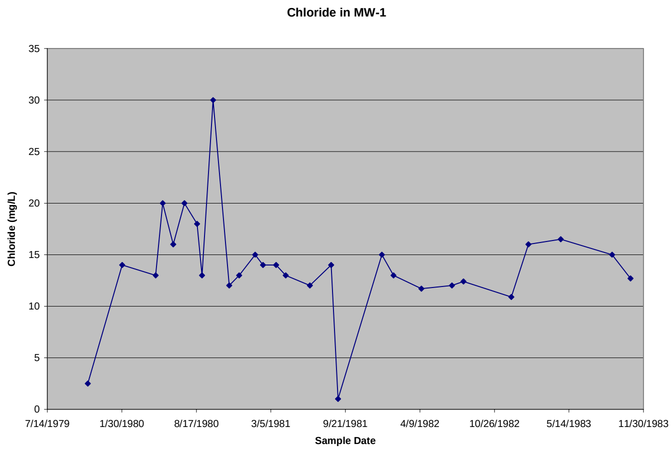
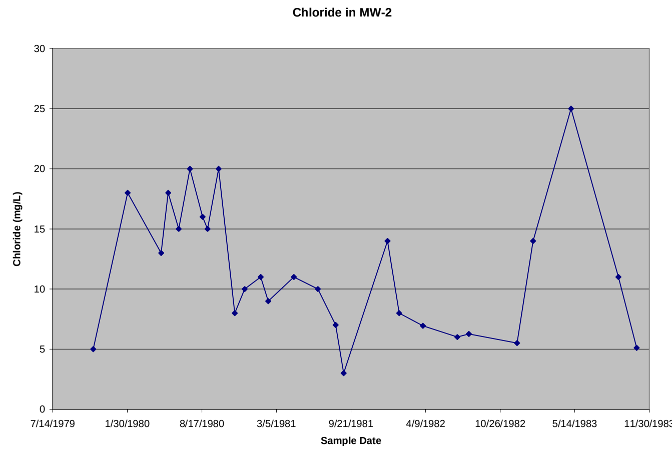
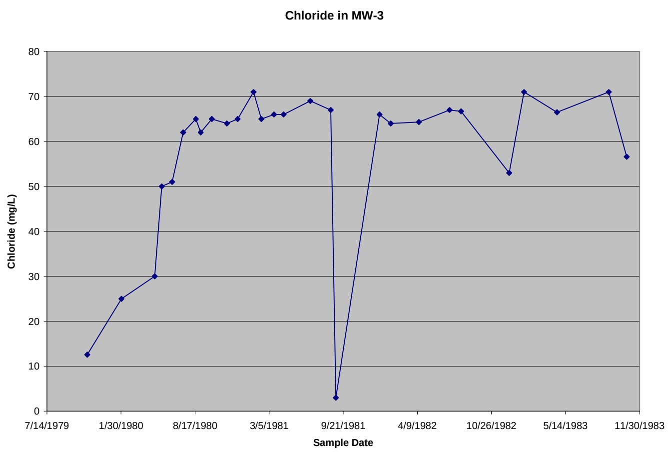
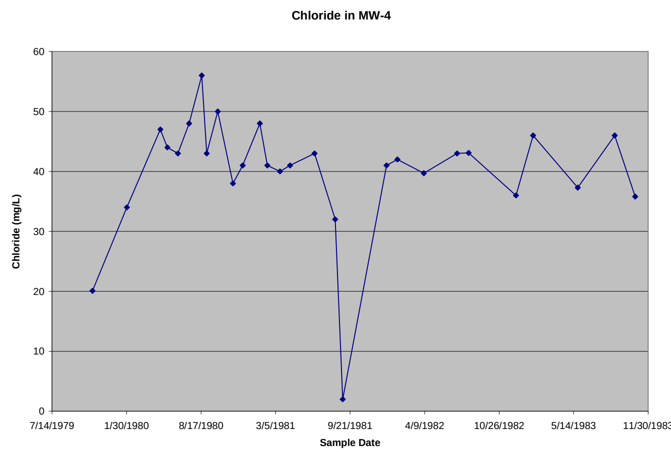


Figure 5
Effects of Fresh Water Development on Sulfate
(Extremes included)









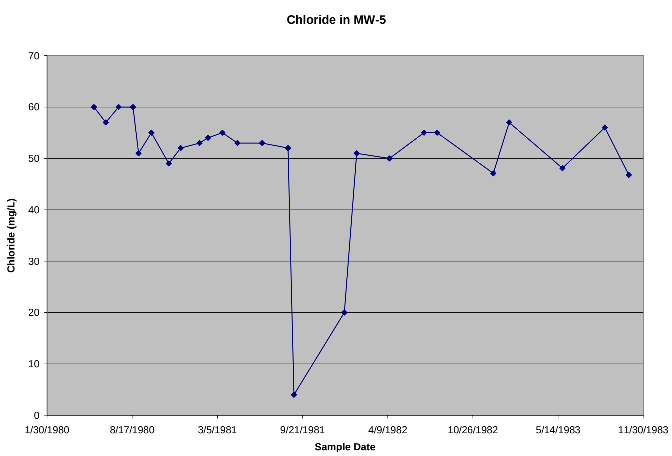
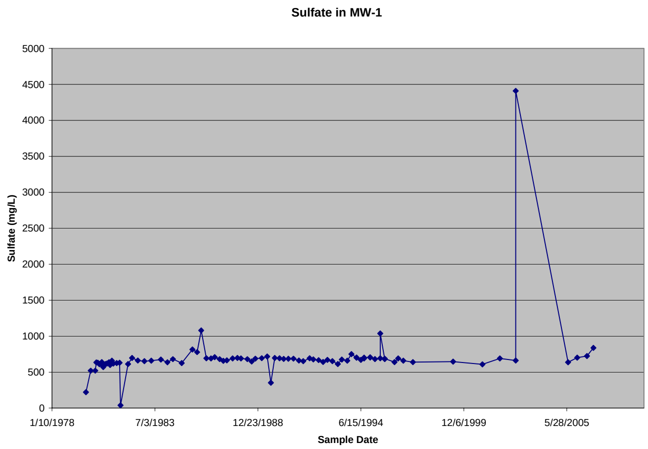
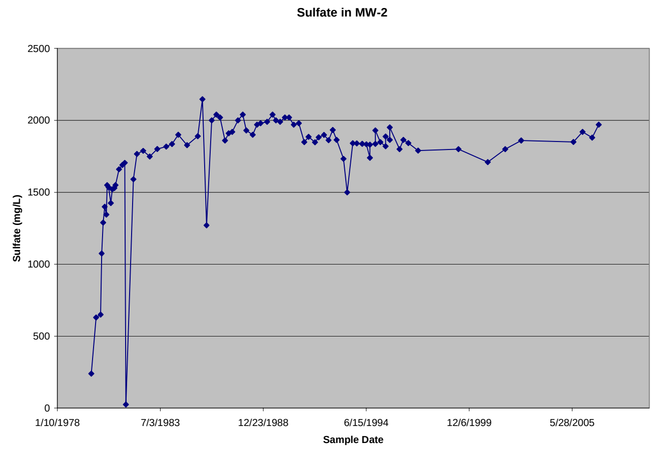
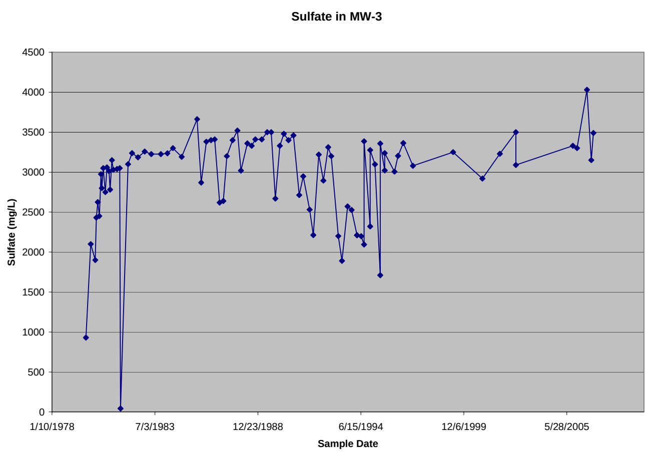
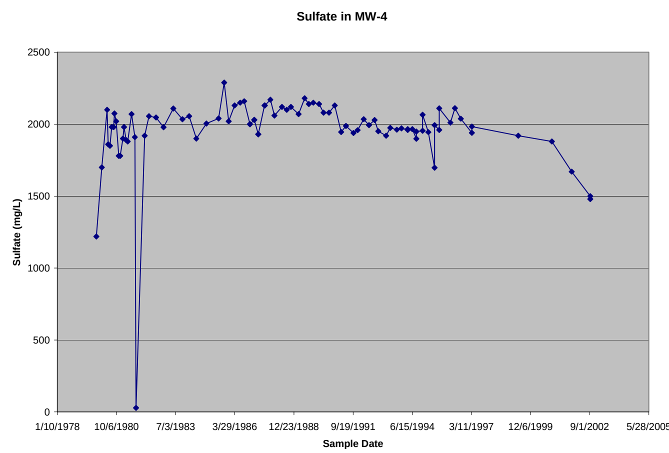


Figure 6
Effects of Fresh Water Development on Chloride
(Extremes included)









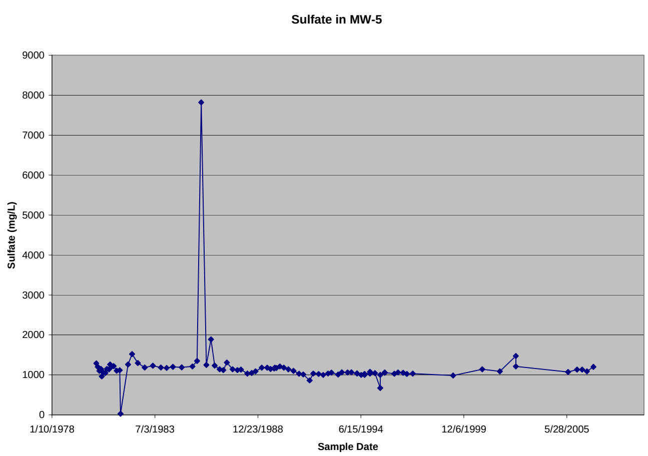
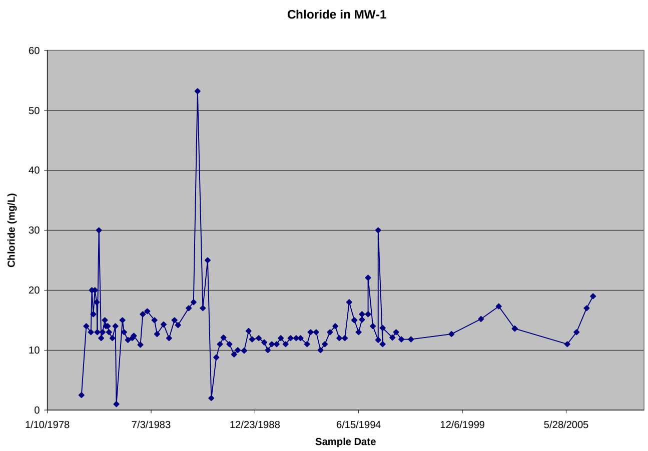
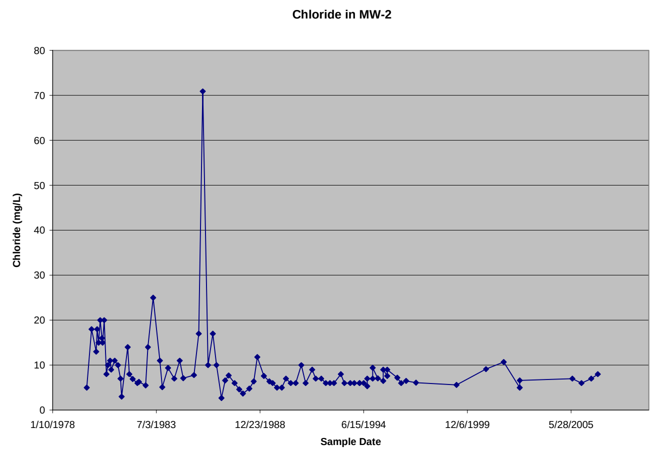
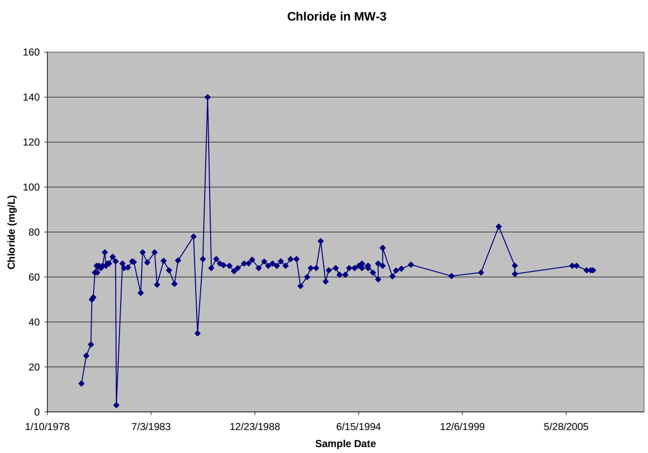
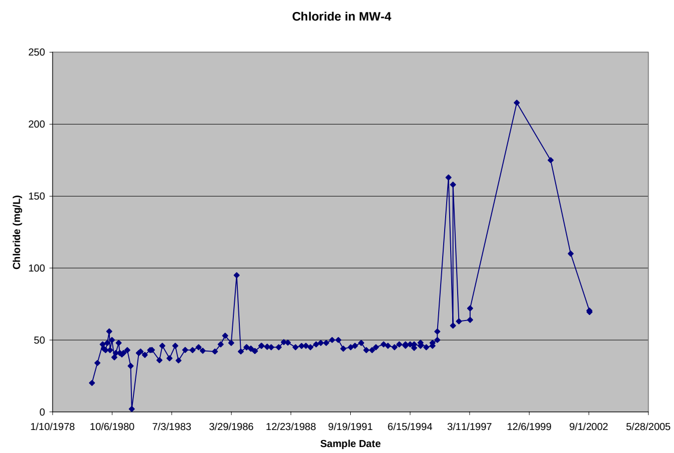


Figure 7
Behavior of Sulfate in Monitoring Wells Over Time
(Extremes included)









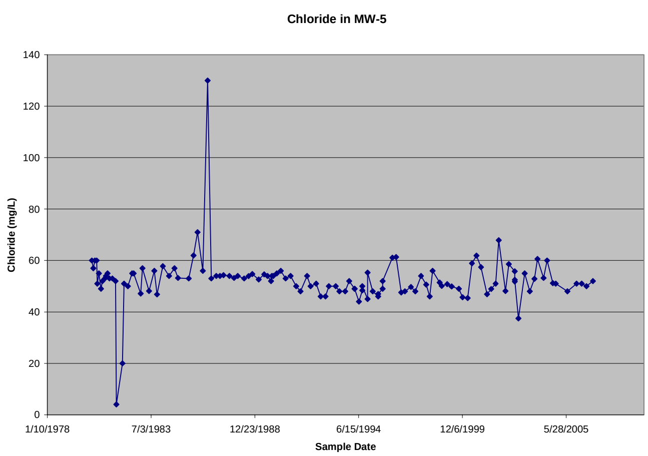
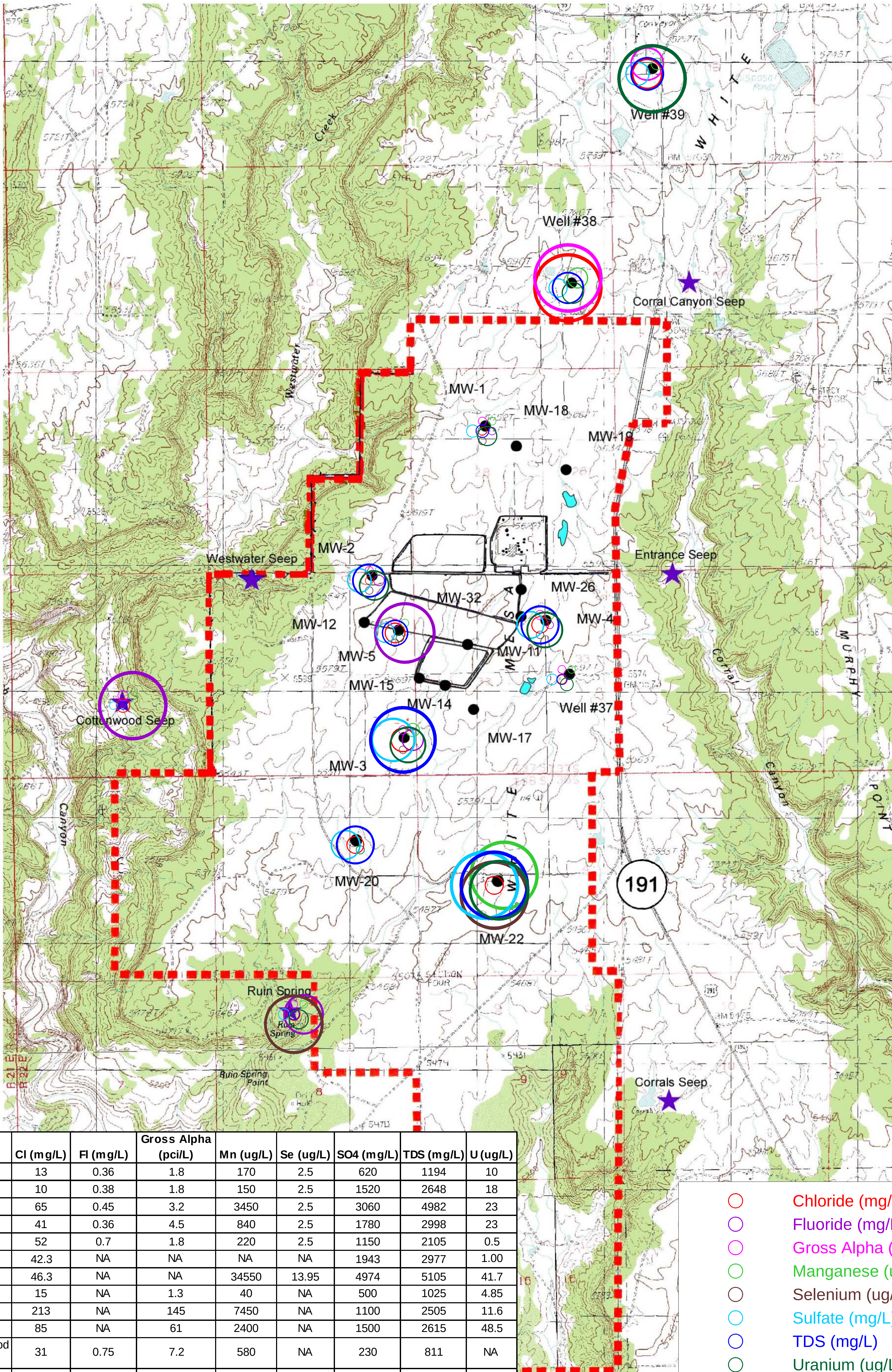


Figure 8
Behavior of Chloride in Monitoring Wells Over Time
(Extremes included)



Sample Point	Cl (mg/L)	Fl (mg/L)	Gross Alpha (pci/L)	Mn (ug/L)	Se (ug/L)	SO4 (mg/L)	TDS (mg/L)	U (ug/L)
MW-1	13	0.36	1.8	170	2.5	620	1194	10
MW-2	10	0.38	1.8	150	2.5	1520	2648	18
MW-3	65	0.45	3.2	3450	2.5	3060	4982	23
MW-4	41	0.36	4.5	840	2.5	1780	2998	23
MW-5	52	0.7	1.8	220	2.5	1150	2105	0.5
MW-20	42.3	NA	NA	NA	NA	1943	2977	1.00
MW-22	46.3	NA	NA	34550	13.95	4974	5105	41.7
Well #37	15	NA	1.3	40	NA	500	1025	4.85
Well #38	213	NA	145	7450	NA	1100	2505	11.6
Well #39	85	NA	61	2400	NA	1500	2615	48.5
Cottonwood Seep	31	0.75	7.2	580	NA	230	811	NA
Ruin Spring	26.7	0.57	0.28	5	12.1	521	1053	10

Chloride (mg/L)
Fluoride (mg/L)
Gross Alpha (pCi/L)
Manganese (ug/L)
Selenium (ug/L)
Sulfate (mg/L)
TDS (mg/L)
Uranium (ug/L)

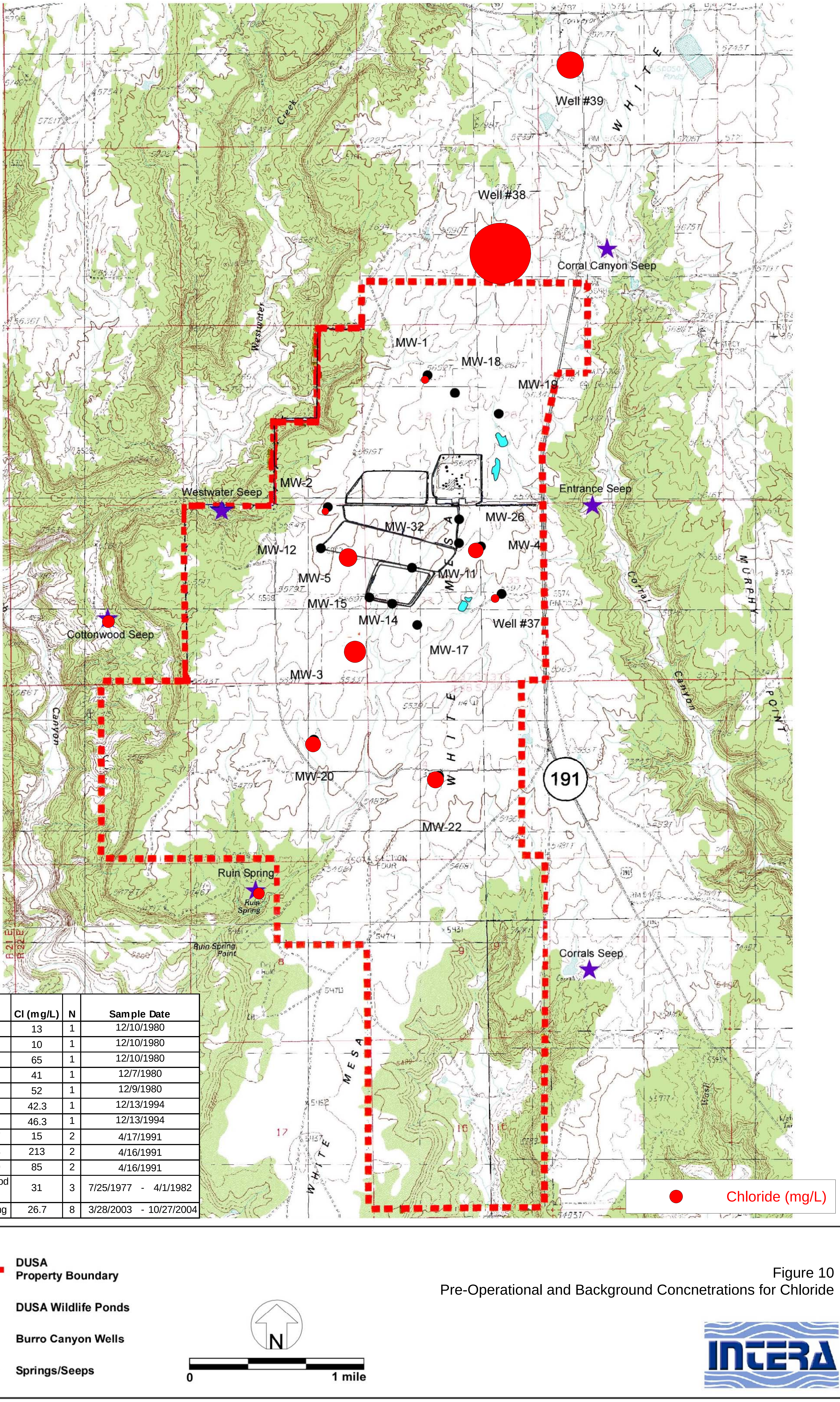
DUSA Property Boundary
DUSA Wildlife Ponds
Burro Canyon Wells
Springs/Seeps

N

0 **1 mile**

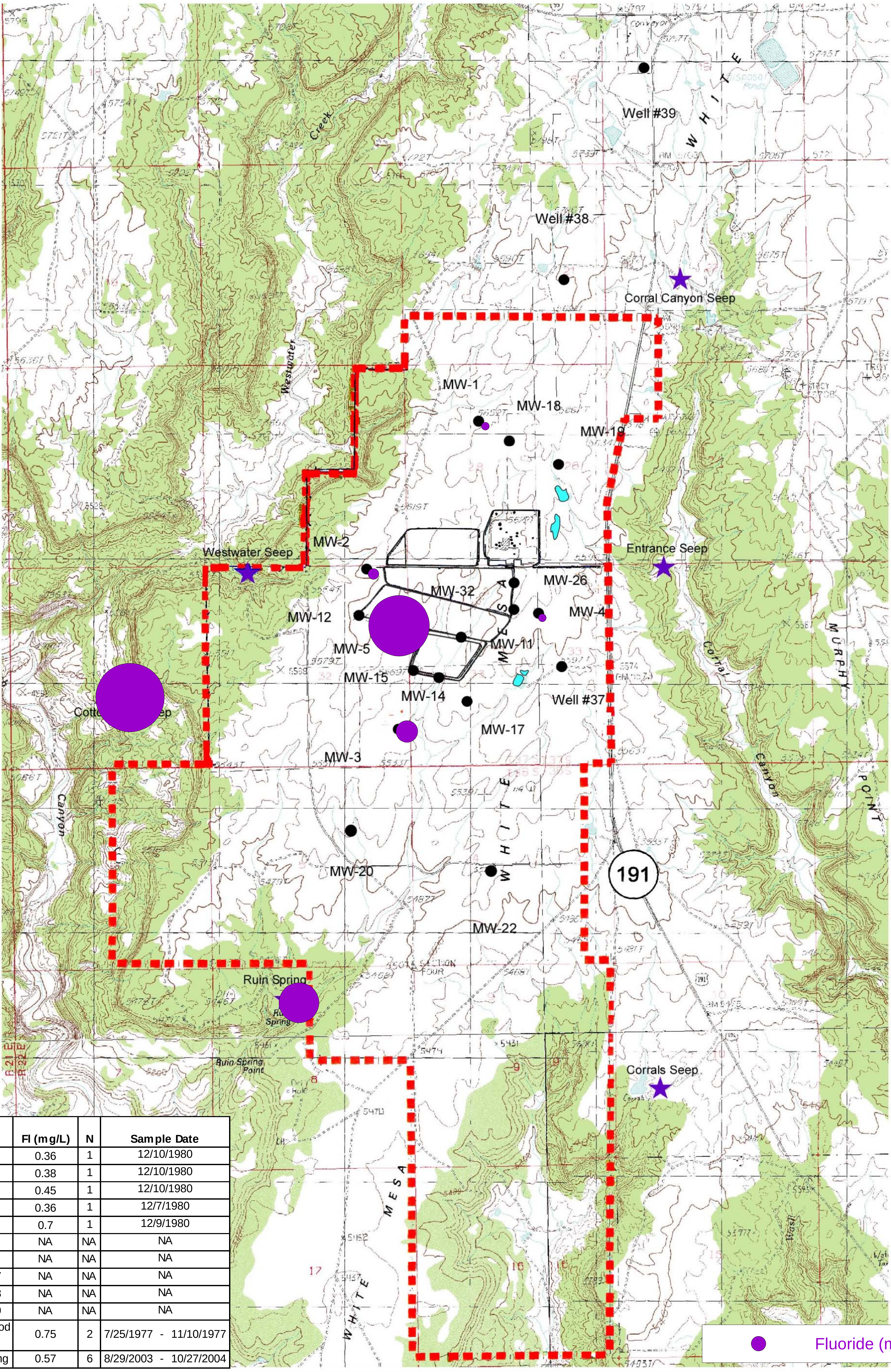
Figure 9
Pre-Operational and Background Concentration Plots
Plots made with averaged data collected from site monitoring wells through 1980 and available regional background data.

INTERA



Sample Point	Cl (mg/L)	N	Sample Date
MW-1	13	1	12/10/1980
MW-2	10	1	12/10/1980
MW-3	65	1	12/10/1980
MW-4	41	1	12/7/1980
MW-5	52	1	12/9/1980
MW-20	42.3	1	12/13/1994
MW-22	46.3	1	12/13/1994
Well #37	15	2	4/17/1991
Well #38	213	2	4/16/1991
Well #39	85	2	4/16/1991
Cottonwood Seep	31	3	7/25/1977 - 4/1/1982
Ruin Spring	26.7	8	3/28/2003 - 10/27/2004

Figure 10
Pre-Operational and Background Concnetrations for Chloride



Sample Point	Fl (mg/L)	N	Sample Date
MW-1	0.36	1	12/10/1980
MW-2	0.38	1	12/10/1980
MW-3	0.45	1	12/10/1980
MW-4	0.36	1	12/7/1980
MW-5	0.7	1	12/9/1980
MW-20	NA	NA	NA
MW-22	NA	NA	NA
Well #37	NA	NA	NA
Well #38	NA	NA	NA
Well #39	NA	NA	NA
Cottonwood Seep	0.75	2	7/25/1977 - 11/10/1977
Ruin Spring	0.57	6	8/29/2003 - 10/27/2004

DUSA Property Boundary

DUSA Wildlife Ponds

Burro Canyon Wells

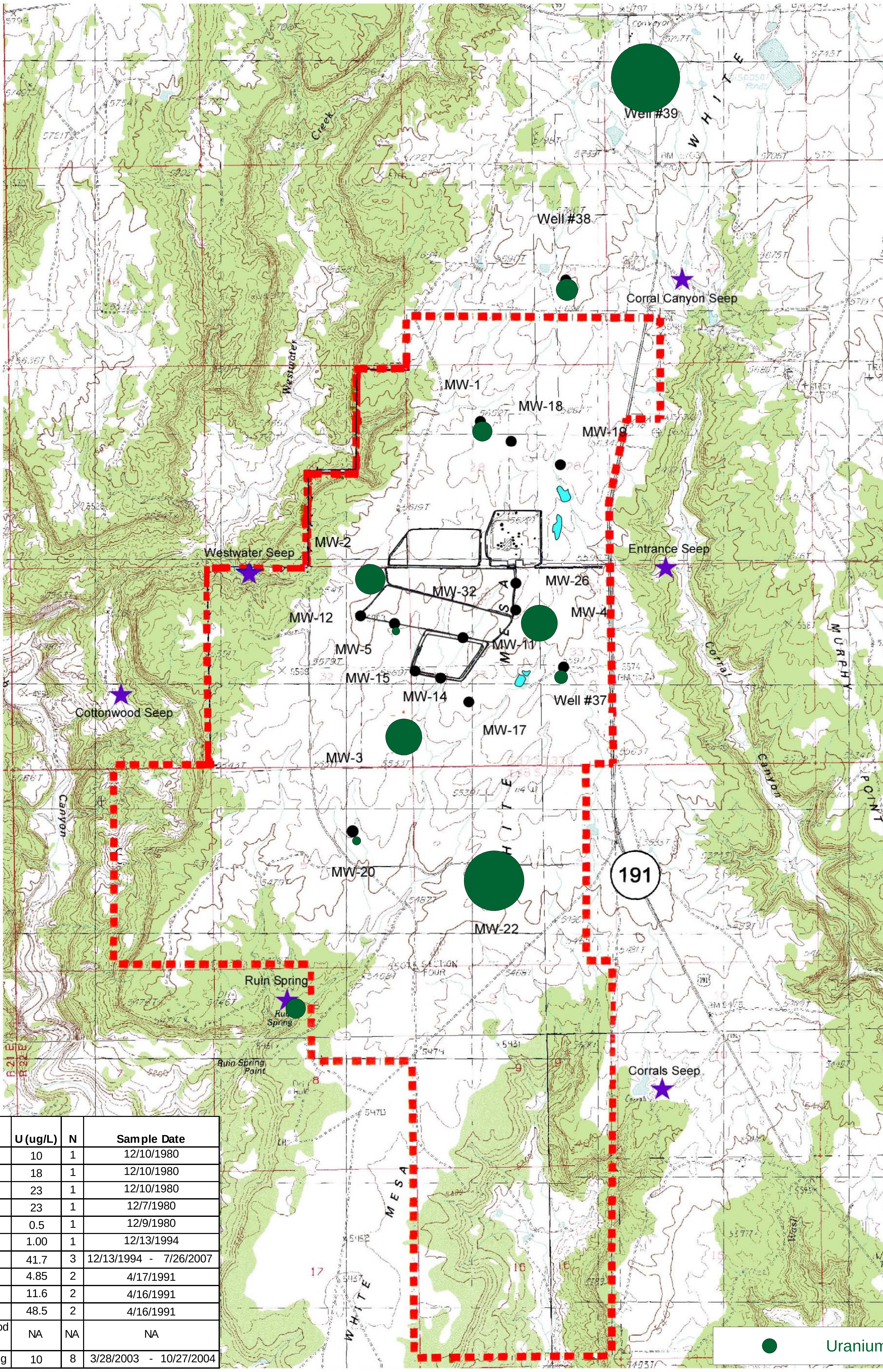
Springs/Seeps

N

0 1 mile

Figure 11
Pre-Operational and Background Concentrations for Fluoride

INTERA



Sample Point	U (ug/L)	N	Sample Date
MW-1	10	1	12/10/1980
MW-2	18	1	12/10/1980
MW-3	23	1	12/10/1980
MW-4	23	1	12/7/1980
MW-5	0.5	1	12/9/1980
MW-20	1.00	1	12/13/1994
MW-22	41.7	3	12/13/1994 - 7/26/2007
Well #37	4.85	2	4/17/1991
Well #38	11.6	2	4/16/1991
Well #39	48.5	2	4/16/1991
Cottonwood Seep	NA	NA	NA
Ruin Spring	10	8	3/28/2003 - 10/27/2004

DUSA Property Boundary

DUSA Wildlife Ponds

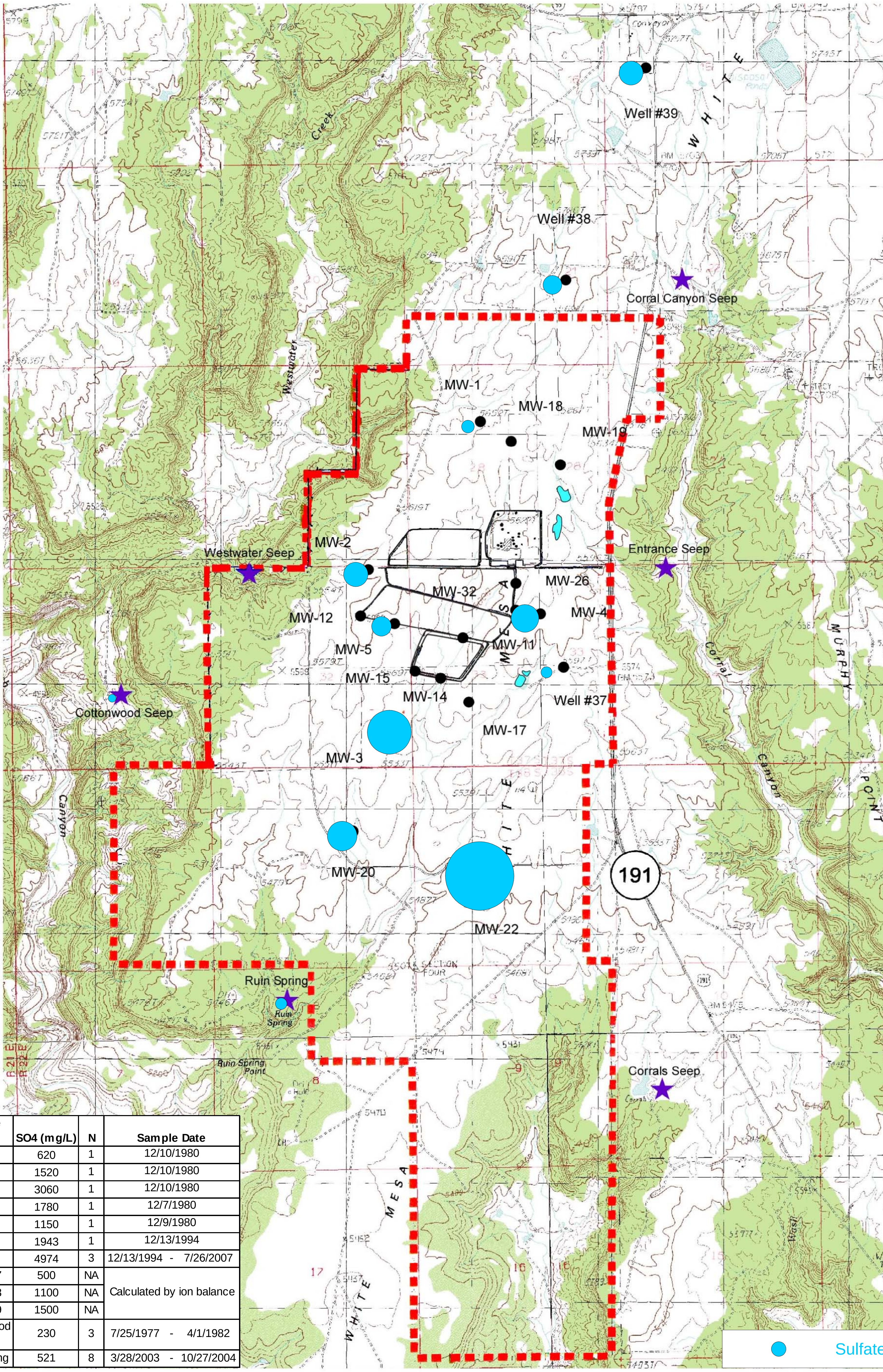
Burro Canyon Wells

Springs/Seeps

N

0 1 mile

Figure 12
Pre-Operational and Background Concentrations for Uranium



Sample Point	SO4 (mg/L)	N	Sample Date
MW-1	620	1	12/10/1980
MW-2	1520	1	12/10/1980
MW-3	3060	1	12/10/1980
MW-4	1780	1	12/7/1980
MW-5	1150	1	12/9/1980
MW-20	1943	1	12/13/1994
MW-22	4974	3	12/13/1994 - 7/26/2007
Well #37	500	NA	Calculated by ion balance
Well #38	1100	NA	
Well #39	1500	NA	
Cottonwood Seep	230	3	7/25/1977 - 4/1/1982
Ruin Spring	521	8	3/28/2003 - 10/27/2004

DUSA Property Boundary

DUSA Wildlife Ponds

Burro Canyon Wells

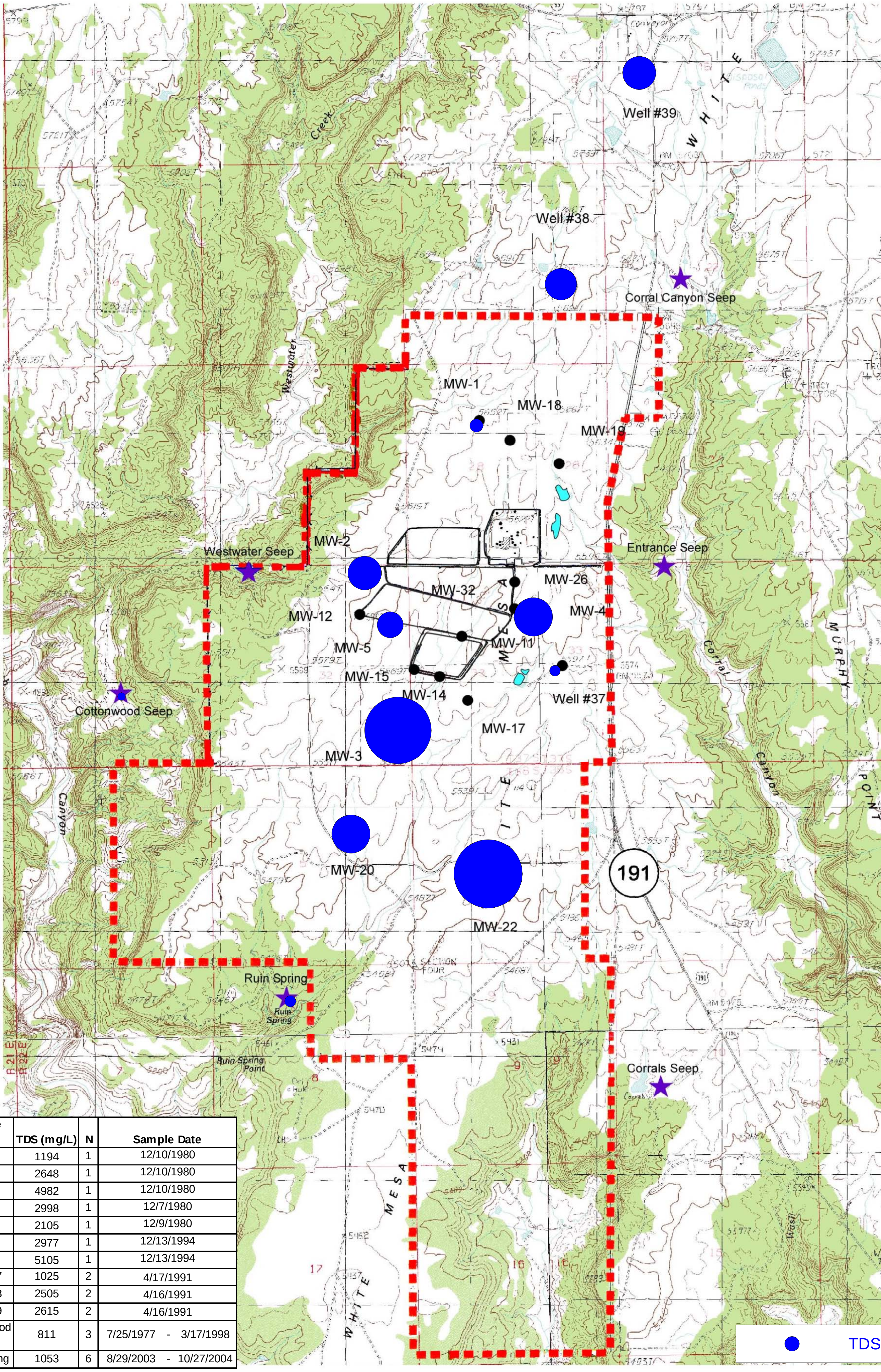
Springs/Seeps

N

0 1 mile

Figure 13
Pre-Operational and Background Concentrations for Sulfate

INTERA



Sample Point	TDS (mg/L)	N	Sample Date
MW-1	1194	1	12/10/1980
MW-2	2648	1	12/10/1980
MW-3	4982	1	12/10/1980
MW-4	2998	1	12/7/1980
MW-5	2105	1	12/9/1980
MW-20	2977	1	12/13/1994
MW-22	5105	1	12/13/1994
Well #37	1025	2	4/17/1991
Well #38	2505	2	4/16/1991
Well #39	2615	2	4/16/1991
Cottonwood Seep	811	3	7/25/1977 - 3/17/1998
Ruin Spring	1053	6	8/29/2003 - 10/27/2004

DUSA Property Boundary

DUSA Wildlife Ponds

Burro Canyon Wells

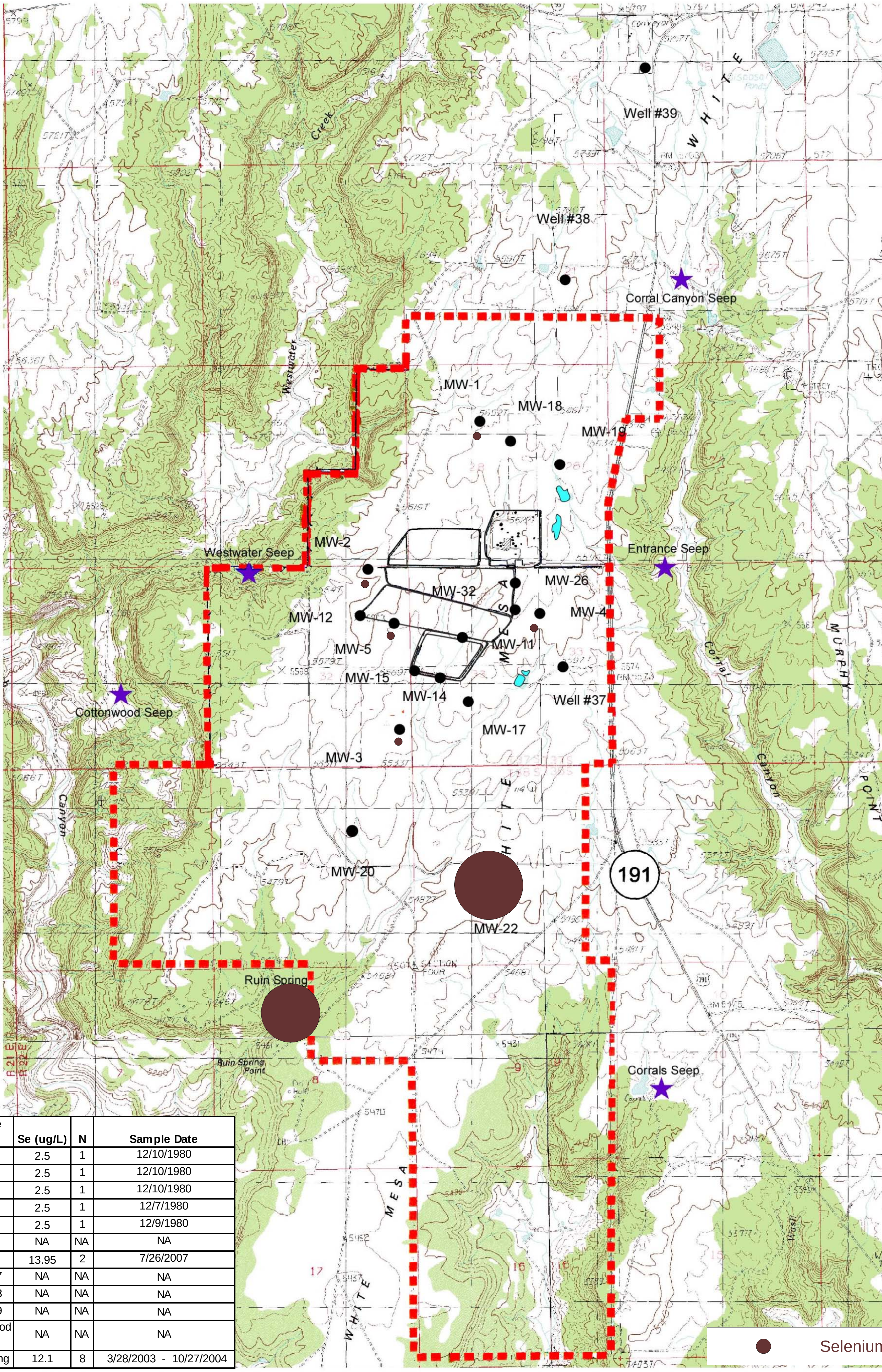
Springs/Seeps

N

0 1 mile

Figure 14
Pre-Operational and Background Concentrations for TDS

INTERA



Sample Point	Se (ug/L)	N	Sample Date
MW-1	2.5	1	12/10/1980
MW-2	2.5	1	12/10/1980
MW-3	2.5	1	12/10/1980
MW-4	2.5	1	12/7/1980
MW-5	2.5	1	12/9/1980
MW-20	NA	NA	NA
MW-22	13.95	2	7/26/2007
Well #37	NA	NA	NA
Well #38	NA	NA	NA
Well #39	NA	NA	NA
Cottonwood Seep	NA	NA	NA
Ruin Spring	12.1	8	3/28/2003 - 10/27/2004

DUSA Property Boundary

DUSA Wildlife Ponds

Burro Canyon Wells

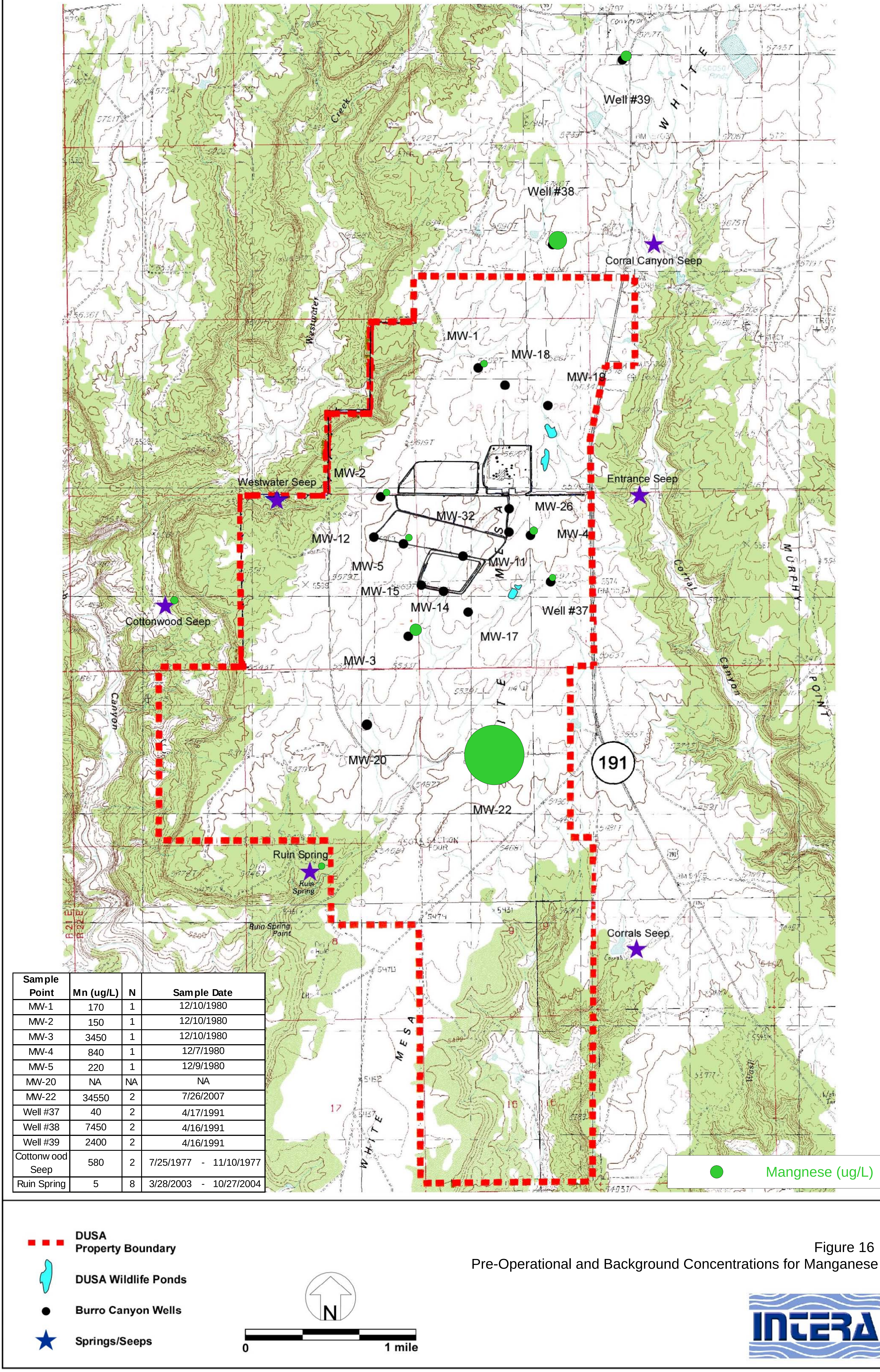
Springs/Seeps

N

0 1 mile

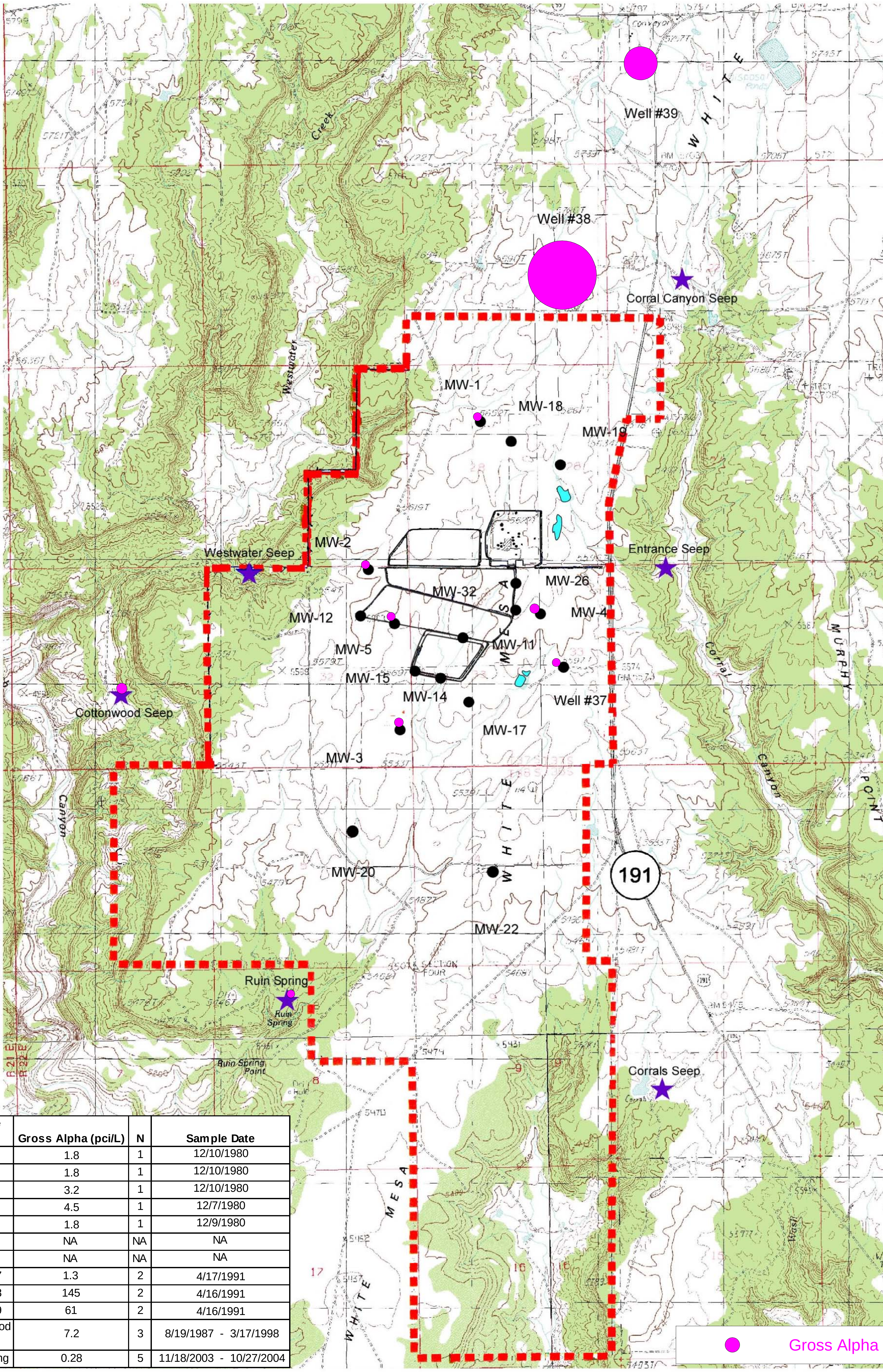
Figure 15
Pre-Operational and Background Concentrations for Selenium

INTERA



Sample Point	Mn (ug/L)	N	Sample Date
MW-1	170	1	12/10/1980
MW-2	150	1	12/10/1980
MW-3	3450	1	12/10/1980
MW-4	840	1	12/7/1980
MW-5	220	1	12/9/1980
MW-20	NA	NA	NA
MW-22	34550	2	7/26/2007
Well #37	40	2	4/17/1991
Well #38	7450	2	4/16/1991
Well #39	2400	2	4/16/1991
Cottonwood Seep	580	2	7/25/1977 - 11/10/1977
Ruin Spring	5	8	3/28/2003 - 10/27/2004

Figure 16
Pre-Operational and Background Concentrations for Manganese



Sample Point	Gross Alpha (pci/L)	N	Sample Date
MW-1	1.8	1	12/10/1980
MW-2	1.8	1	12/10/1980
MW-3	3.2	1	12/10/1980
MW-4	4.5	1	12/7/1980
MW-5	1.8	1	12/9/1980
MW-20	NA	NA	NA
MW-22	NA	NA	NA
Well #37	1.3	2	4/17/1991
Well #38	145	2	4/16/1991
Well #39	61	2	4/16/1991
Cottonwood Seep	7.2	3	8/19/1987 - 3/17/1998
Ruin Spring	0.28	5	11/18/2003 - 10/27/2004

DUSA Property Boundary

DUSA Wildlife Ponds

Burro Canyon Wells

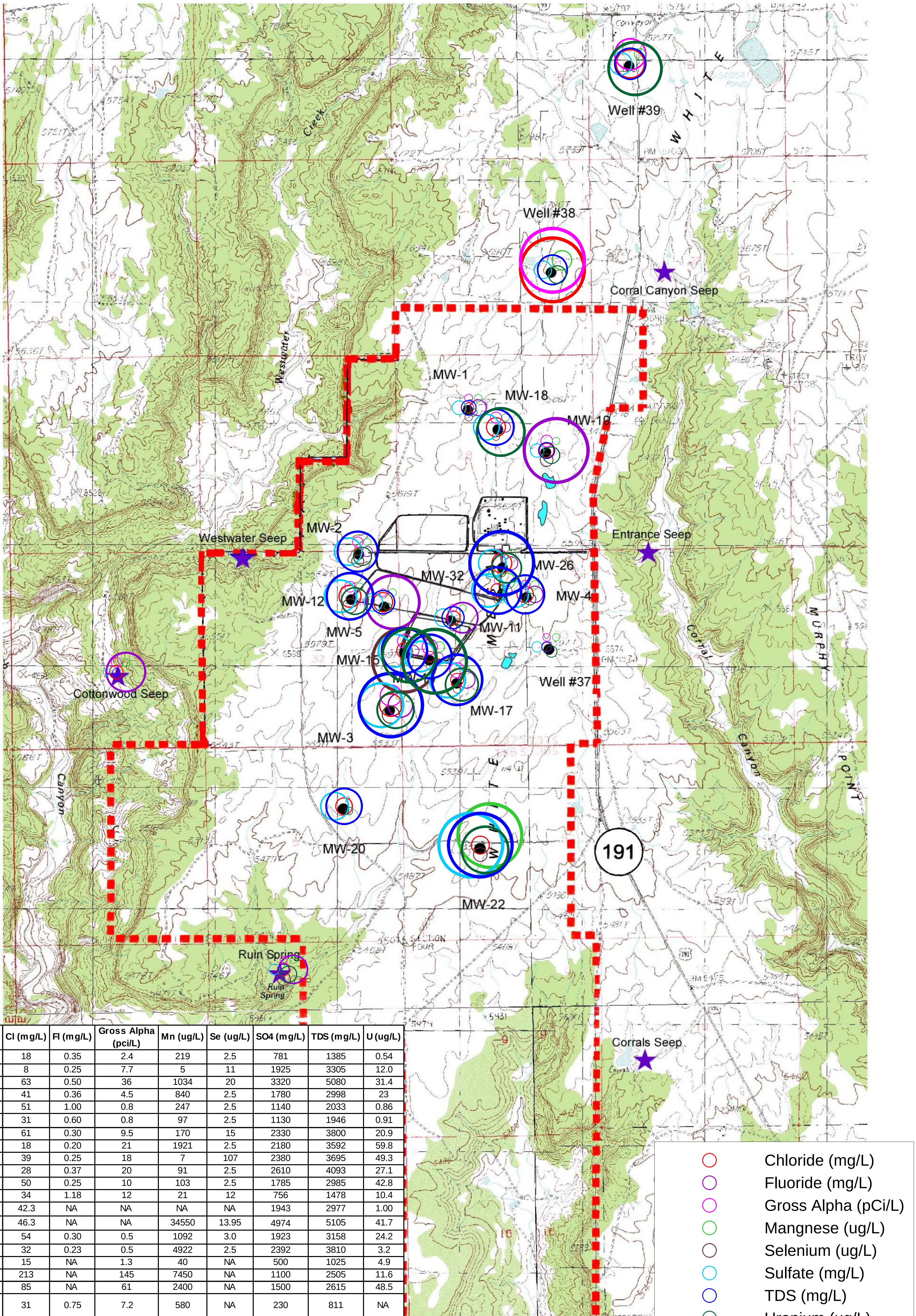
Springs/Seeps

N

0 1 mile

Figure 17
Pre-Operational and Background Concentrations for Gross Alpha

INTERA



Sample Point	Cl (mg/L)	Fl (mg/L)	Gross Alpha (pci/L)	Mn (ug/L)	Se (ug/L)	SO4 (mg/L)	TDS (mg/L)	U (ug/L)
MW-1	18	0.35	2.4	219	2.5	781	1385	0.54
MW-2	8	0.25	7.7	5	11	1925	3305	12.0
MW-3	63	0.50	36	1034	20	3320	5080	31.4
MW-4	41	0.36	4.5	840	2.5	1780	2998	23
MW-5	51	1.00	0.8	247	2.5	1140	2033	0.86
MW-11	31	0.60	0.8	97	2.5	1130	1946	0.91
MW-12	61	0.30	9.5	170	15	2330	3800	20.9
MW-14	18	0.20	21	1921	2.5	2180	3592	59.8
MW-15	39	0.25	18	7	107	2380	3695	49.3
MW-17	28	0.37	20	91	2.5	2610	4093	27.1
MW-18	50	0.25	10	103	2.5	1785	2985	42.8
MW-19	34	1.18	12	21	12	756	1478	10.4
MW-20	42.3	NA	NA	NA	NA	1943	2977	1.00
MW-22	46.3	NA	NA	34550	13.95	4974	5105	41.7
MW-26	54	0.30	0.5	1092	3.0	1923	3158	24.2
MW-32	32	0.23	0.5	4922	2.5	2392	3810	3.2
Well #37	15	NA	1.3	40	NA	500	1025	4.9
Well #38	213	NA	145	7450	NA	1100	2505	11.6
Well #39	85	NA	61	2400	NA	1500	2615	48.5
Cottonwood Seep	31	0.75	7.2	580	NA	230	811	NA
Ruin Spring	26.7	0.57	0.28	5	12.1	521	1053	10

DUSA Property Boundary

DUSA Wildlife Ponds

Burro Canyon Wells

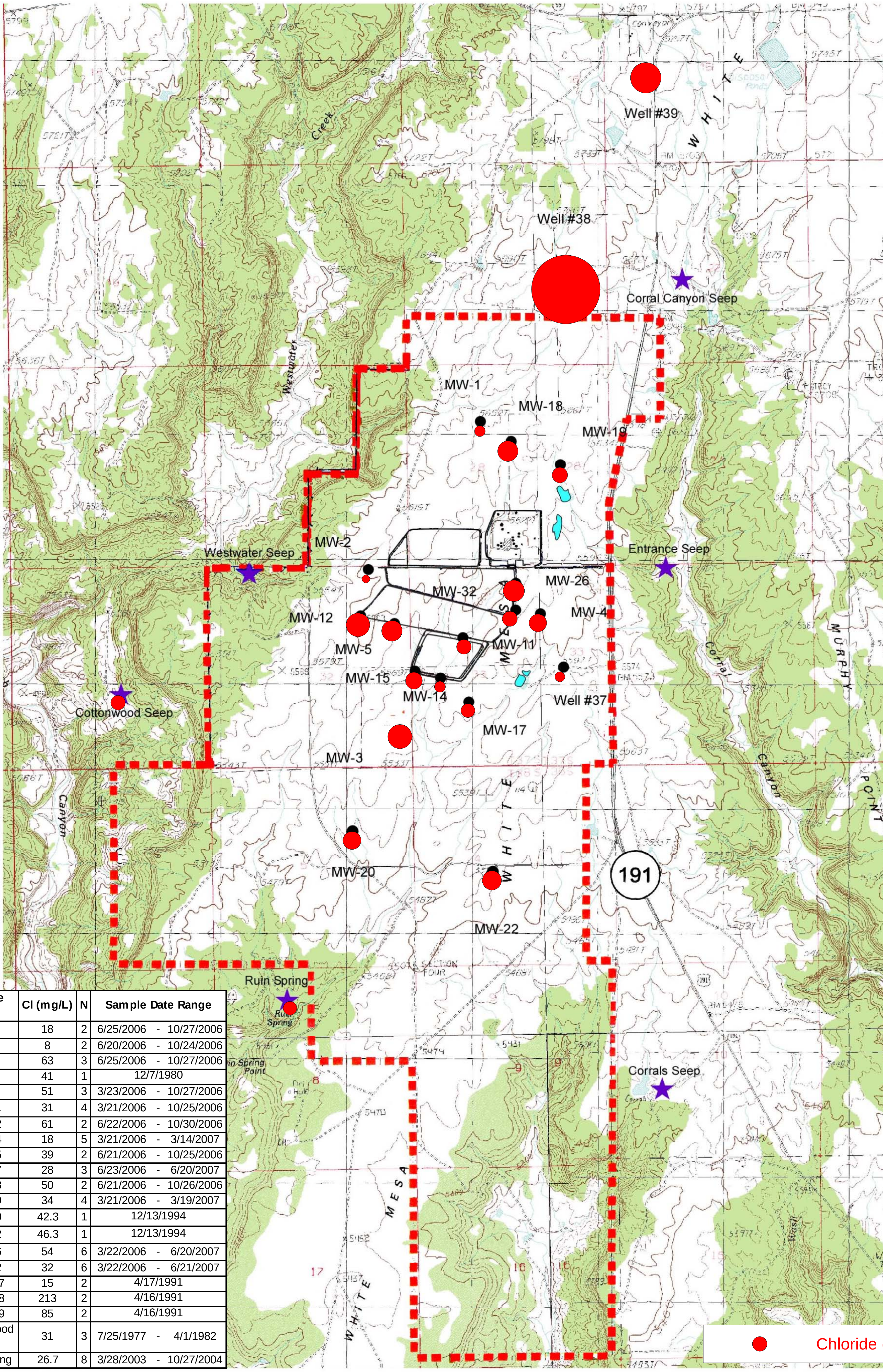
Springs/Seeps

N

0 **1 mile**

Figure 18
Average 2006 and 2007 and Background Concnetration Plots
Plots made with averaged 2006 and 2007 site monitoring well data and available regional background data.

INTERA



Sample Point	Cl (mg/L)	N	Sample Date Range
MW-1	18	2	6/25/2006 - 10/27/2006
MW-2	8	2	6/20/2006 - 10/24/2006
MW-3	63	3	6/25/2006 - 10/27/2006
MW-4	41	1	12/7/1980
MW-5	51	3	3/23/2006 - 10/27/2006
MW-11	31	4	3/21/2006 - 10/25/2006
MW-12	61	2	6/22/2006 - 10/30/2006
MW-14	18	5	3/21/2006 - 3/14/2007
MW-15	39	2	6/21/2006 - 10/25/2006
MW-17	28	3	6/23/2006 - 6/20/2007
MW-18	50	2	6/21/2006 - 10/26/2006
MW-19	34	4	3/21/2006 - 3/19/2007
MW-20	42.3	1	12/13/1994
MW-22	46.3	1	12/13/1994
MW-26	54	6	3/22/2006 - 6/20/2007
MW-32	32	6	3/22/2006 - 6/21/2007
Well #37	15	2	4/17/1991
Well #38	213	2	4/16/1991
Well #39	85	2	4/16/1991
Cottonwood Seep	31	3	7/25/1977 - 4/1/1982
Ruin Spring	26.7	8	3/28/2003 - 10/27/2004

DUSA Property Boundary

DUSA Wildlife Ponds

Burro Canyon Wells

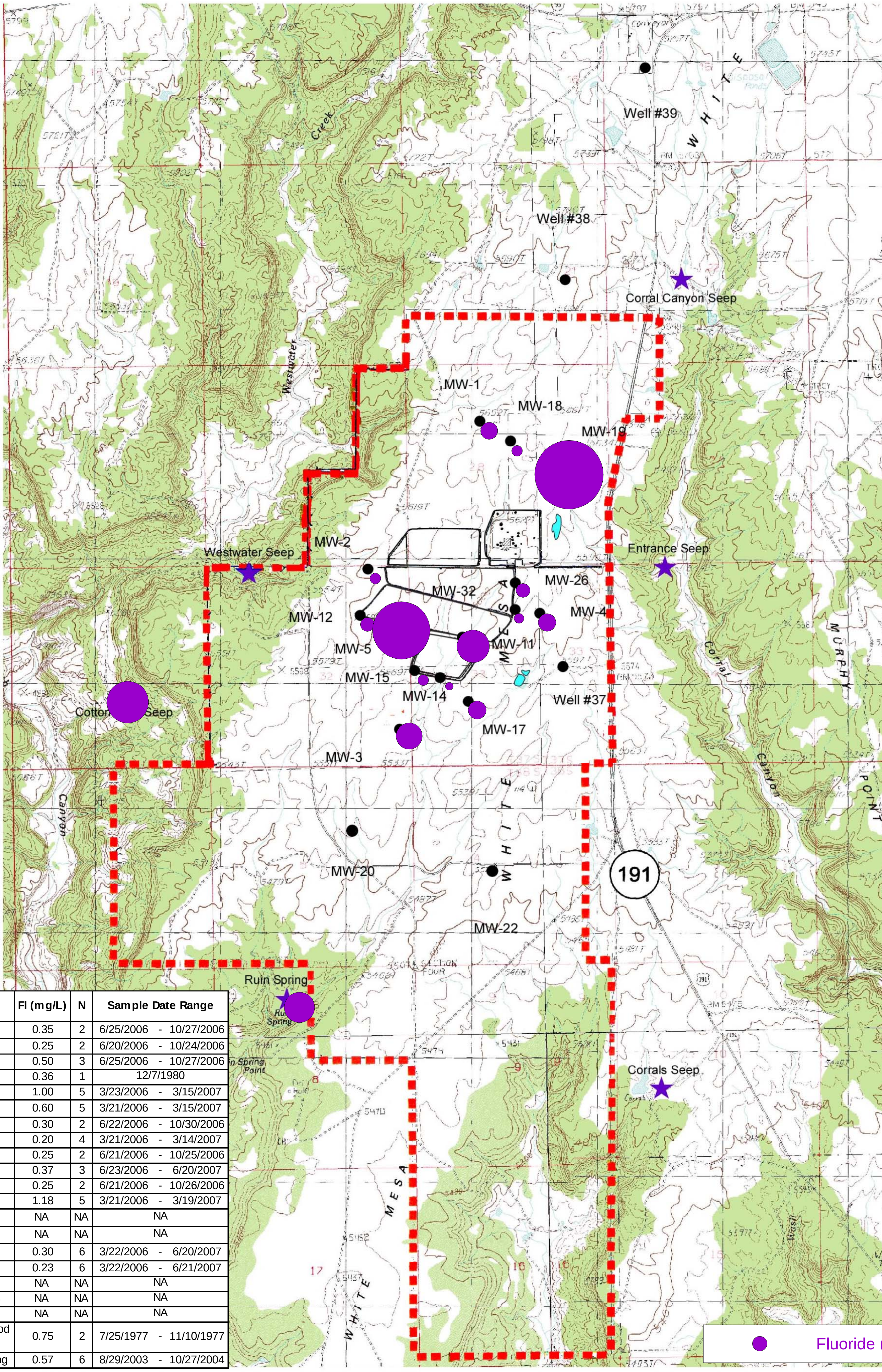
Springs/Seeps

N

0 1 mile

Figure 19
Average 2006-2007 and Backgrouond Concentrations for Chloride

INTERA



Sample Point	Fl (mg/L)	N	Sample Date Range
MW-1	0.35	2	6/25/2006 - 10/27/2006
MW-2	0.25	2	6/20/2006 - 10/24/2006
MW-3	0.50	3	6/25/2006 - 10/27/2006
MW-4	0.36	1	12/7/1980
MW-5	1.00	5	3/23/2006 - 3/15/2007
MW-11	0.60	5	3/21/2006 - 3/15/2007
MW-12	0.30	2	6/22/2006 - 10/30/2006
MW-14	0.20	4	3/21/2006 - 3/14/2007
MW-15	0.25	2	6/21/2006 - 10/25/2006
MW-17	0.37	3	6/23/2006 - 6/20/2007
MW-18	0.25	2	6/21/2006 - 10/26/2006
MW-19	1.18	5	3/21/2006 - 3/19/2007
MW-20	NA	NA	NA
MW-22	NA	NA	NA
MW-26	0.30	6	3/22/2006 - 6/20/2007
MW-32	0.23	6	3/22/2006 - 6/21/2007
Well #37	NA	NA	NA
Well #38	NA	NA	NA
Well #39	NA	NA	NA
Cottonwood Seep	0.75	2	7/25/1977 - 11/10/1977
Ruin Spring	0.57	6	8/29/2003 - 10/27/2004

DUSA Property Boundary

DUSA Wildlife Ponds

Burro Canyon Wells

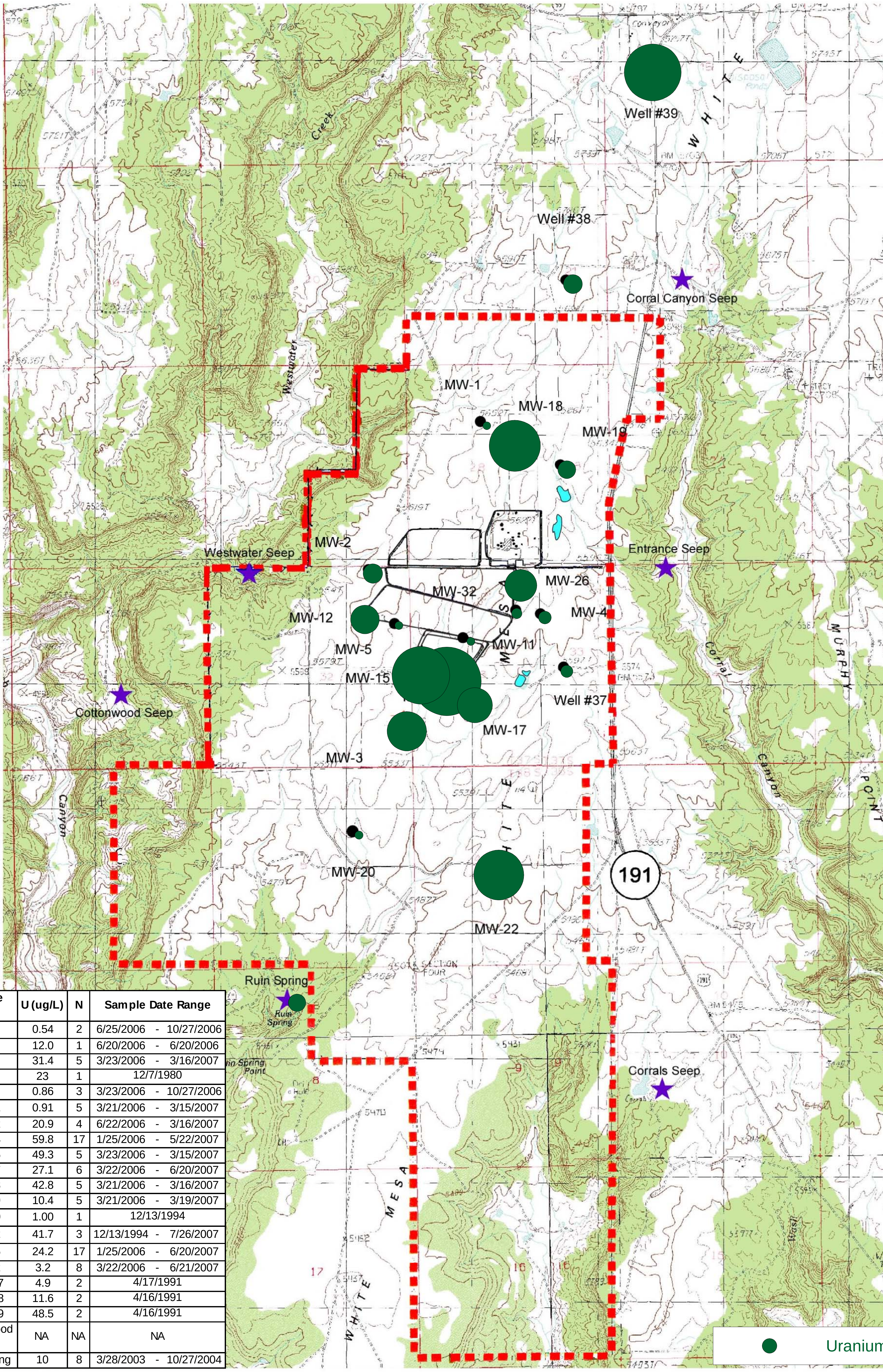
Springs/Seeps

N

0 1 mile

Figure 20
Average 2006-2007 and Background Concentrations for Fluoride

INTERA



Sample Point	U (ug/L)	N	Sample Date Range
MW-1	0.54	2	6/25/2006 - 10/27/2006
MW-2	12.0	1	6/20/2006 - 6/20/2006
MW-3	31.4	5	3/23/2006 - 3/16/2007
MW-4	23	1	12/7/1980
MW-5	0.86	3	3/23/2006 - 10/27/2006
MW-11	0.91	5	3/21/2006 - 3/15/2007
MW-12	20.9	4	6/22/2006 - 3/16/2007
MW-14	59.8	17	1/25/2006 - 5/22/2007
MW-15	49.3	5	3/23/2006 - 3/15/2007
MW-17	27.1	6	3/22/2006 - 6/20/2007
MW-18	42.8	5	3/21/2006 - 3/16/2007
MW-19	10.4	5	3/21/2006 - 3/19/2007
MW-20	1.00	1	12/13/1994
MW-22	41.7	3	12/13/1994 - 7/26/2007
MW-26	24.2	17	1/25/2006 - 6/20/2007
MW-32	3.2	8	3/22/2006 - 6/21/2007
Well #37	4.9	2	4/17/1991
Well #38	11.6	2	4/16/1991
Well #39	48.5	2	4/16/1991
Cottonwood Seep	NA	NA	NA
Ruin Spring	10	8	3/28/2003 - 10/27/2004

DUSA Property Boundary

DUSA Wildlife Ponds

Burro Canyon Wells

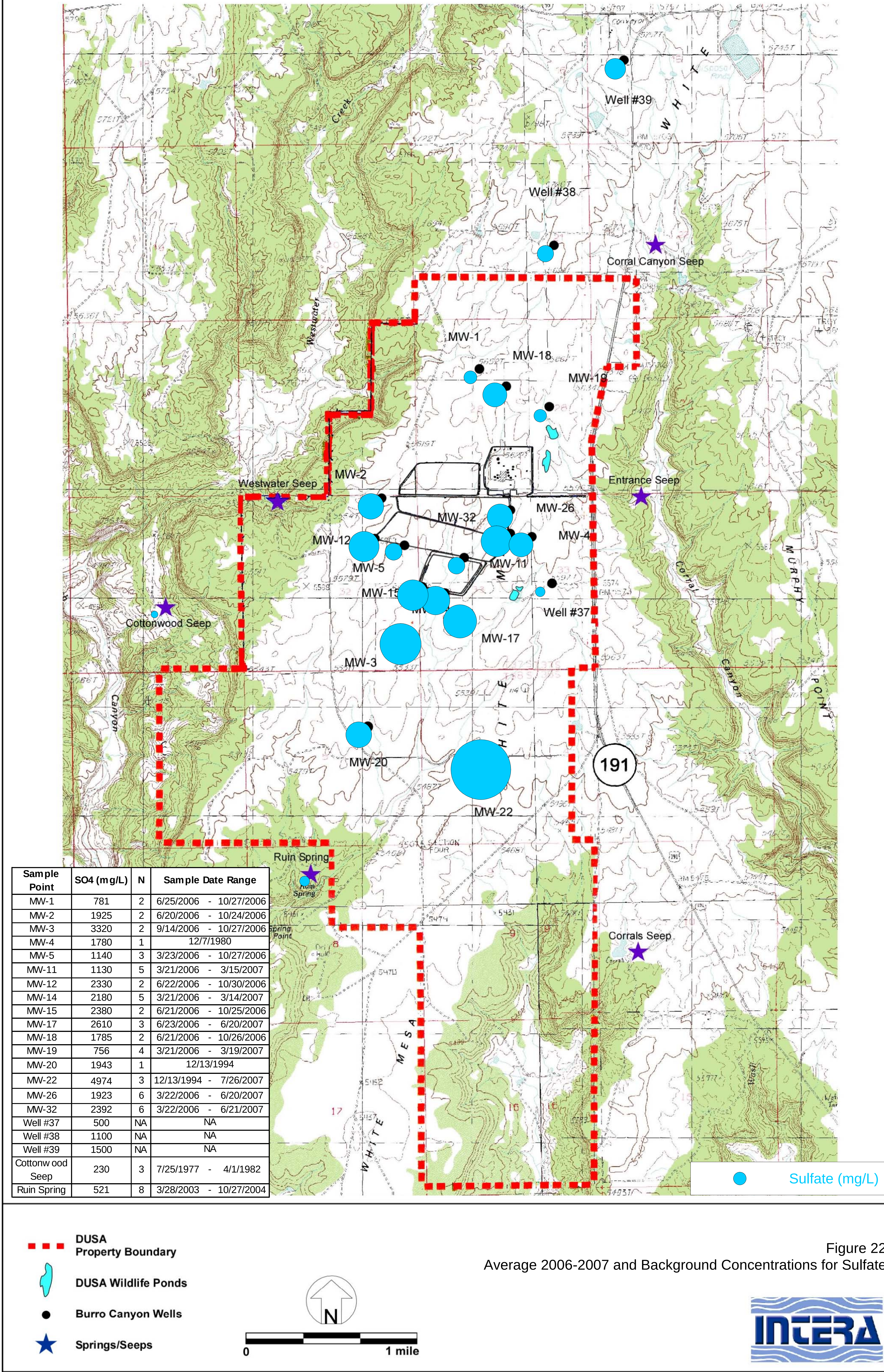
Springs/Seeps

N

0 1 mile

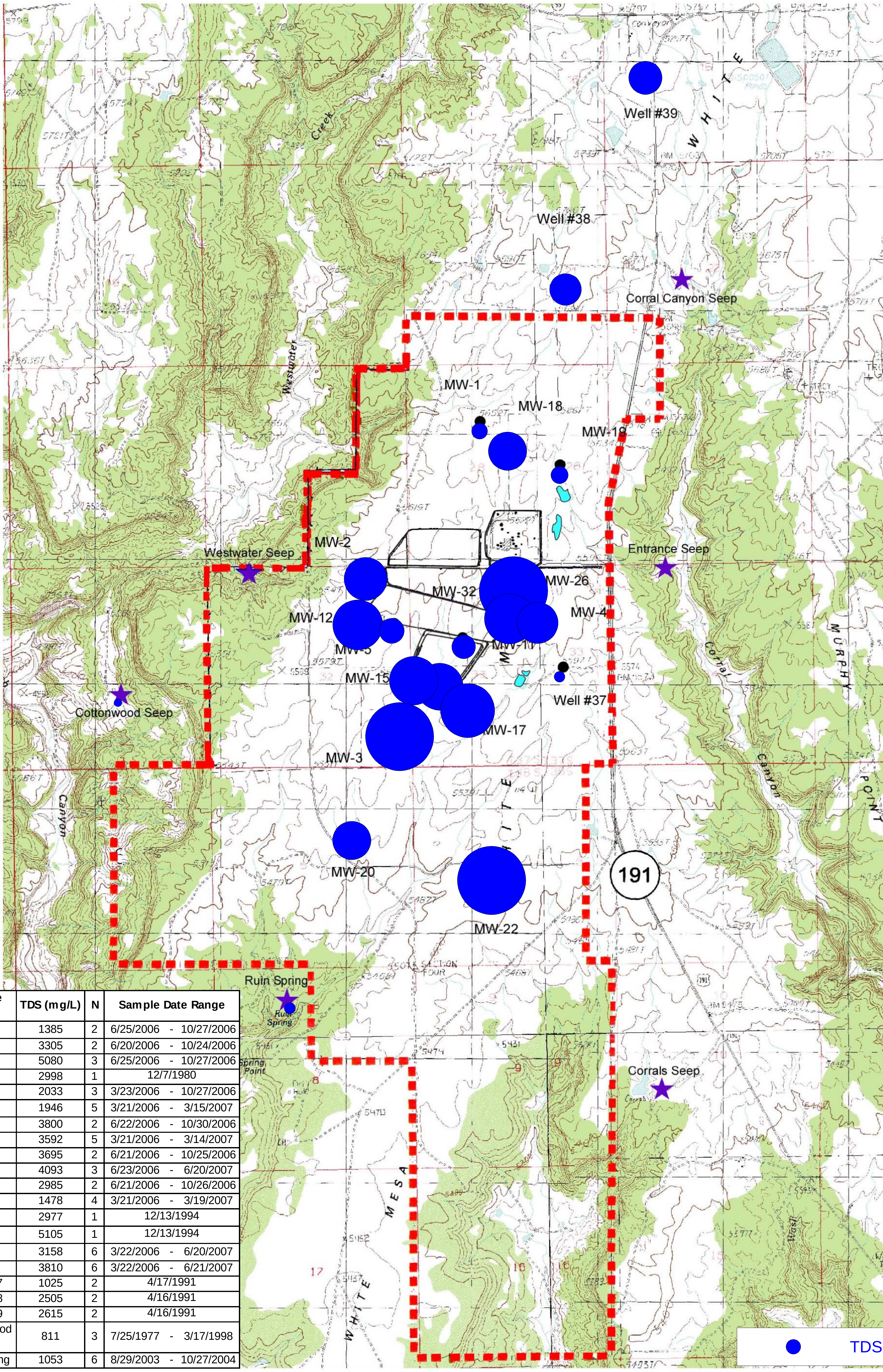
Figure 21
Average 2006-2007 and Background Concentrations for Uranium

INTERA



Sample Point	SO4 (mg/L)	N	Sample Date Range
MW-1	781	2	6/25/2006 - 10/27/2006
MW-2	1925	2	6/20/2006 - 10/24/2006
MW-3	3320	2	9/14/2006 - 10/27/2006
MW-4	1780	1	12/7/1980
MW-5	1140	3	3/23/2006 - 10/27/2006
MW-11	1130	5	3/21/2006 - 3/15/2007
MW-12	2330	2	6/22/2006 - 10/30/2006
MW-14	2180	5	3/21/2006 - 3/14/2007
MW-15	2380	2	6/21/2006 - 10/25/2006
MW-17	2610	3	6/23/2006 - 6/20/2007
MW-18	1785	2	6/21/2006 - 10/26/2006
MW-19	756	4	3/21/2006 - 3/19/2007
MW-20	1943	1	12/13/1994
MW-22	4974	3	12/13/1994 - 7/26/2007
MW-26	1923	6	3/22/2006 - 6/20/2007
MW-32	2392	6	3/22/2006 - 6/21/2007
Well #37	500	NA	NA
Well #38	1100	NA	NA
Well #39	1500	NA	NA
Cottonwood Seep	230	3	7/25/1977 - 4/1/1982
Ruin Spring	521	8	3/28/2003 - 10/27/2004

Figure 22
Average 2006-2007 and Background Concentrations for Sulfate



Sample Point	TDS (mg/L)	N	Sample Date Range
MW-1	1385	2	6/25/2006 - 10/27/2006
MW-2	3305	2	6/20/2006 - 10/24/2006
MW-3	5080	3	6/25/2006 - 10/27/2006
MW-4	2998	1	12/7/1980
MW-5	2033	3	3/23/2006 - 10/27/2006
MW-11	1946	5	3/21/2006 - 3/15/2007
MW-12	3800	2	6/22/2006 - 10/30/2006
MW-14	3592	5	3/21/2006 - 3/14/2007
MW-15	3695	2	6/21/2006 - 10/25/2006
MW-17	4093	3	6/23/2006 - 6/20/2007
MW-18	2985	2	6/21/2006 - 10/26/2006
MW-19	1478	4	3/21/2006 - 3/19/2007
MW-20	2977	1	12/13/1994
MW-22	5105	1	12/13/1994
MW-26	3158	6	3/22/2006 - 6/20/2007
MW-32	3810	6	3/22/2006 - 6/21/2007
Well #37	1025	2	4/17/1991
Well #38	2505	2	4/16/1991
Well #39	2615	2	4/16/1991
Cottonwood Seep	811	3	7/25/1977 - 3/17/1998
Ruin Spring	1053	6	8/29/2003 - 10/27/2004

DUSA Property Boundary

DUSA Wildlife Ponds

Burro Canyon Wells

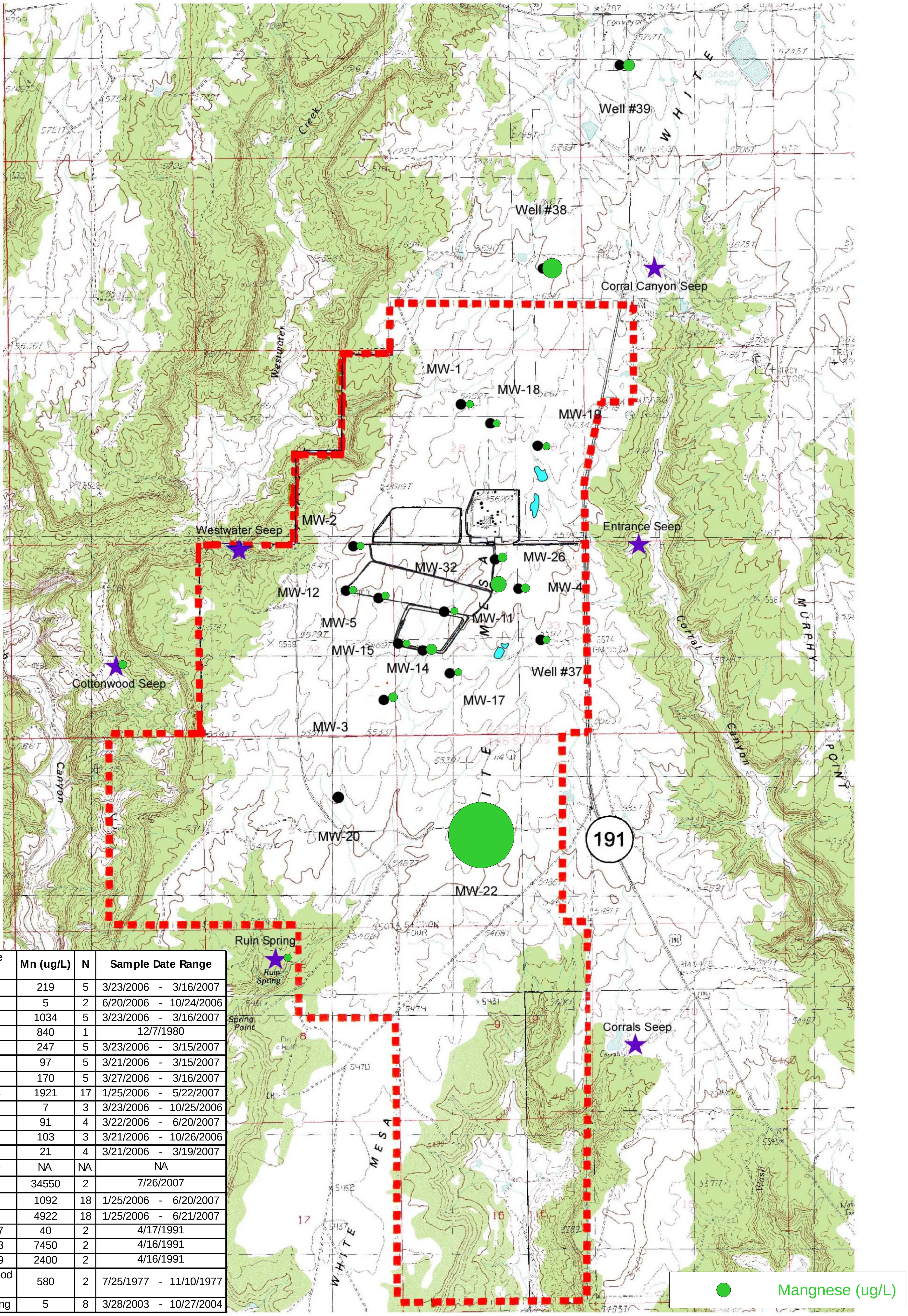
Springs/Seeps

N

0 **1 mile**

Figure 23
Average 2006-2007 and Background Concentrations for TDS

INTERA



Sample Point	Mn (ug/L)	N	Sample Date Range
MW-1	219	5	3/23/2006 - 3/16/2007
MW-2	5	2	6/20/2006 - 10/24/2006
MW-3	1034	5	3/23/2006 - 3/16/2007
MW-4	840	1	12/7/1980
MW-5	247	5	3/23/2006 - 3/15/2007
MW-11	97	5	3/21/2006 - 3/15/2007
MW-12	170	5	3/27/2006 - 3/16/2007
MW-14	1921	17	1/25/2006 - 5/22/2007
MW-15	7	3	3/23/2006 - 10/25/2006
MW-17	91	4	3/22/2006 - 6/20/2007
MW-18	103	3	3/21/2006 - 10/26/2006
MW-19	21	4	3/21/2006 - 3/19/2007
MW-20	NA	NA	NA
MW-22	34550	2	7/26/2007
MW-26	1092	18	1/25/2006 - 6/20/2007
MW-32	4922	18	1/25/2006 - 6/21/2007
Well #37	40	2	4/17/1991
Well #38	7450	2	4/16/1991
Well #39	2400	2	4/16/1991
Cottonwood Seep	580	2	7/25/1977 - 11/10/1977
Ruin Spring	5	8	3/28/2003 - 10/27/2004

DUSA Property Boundary

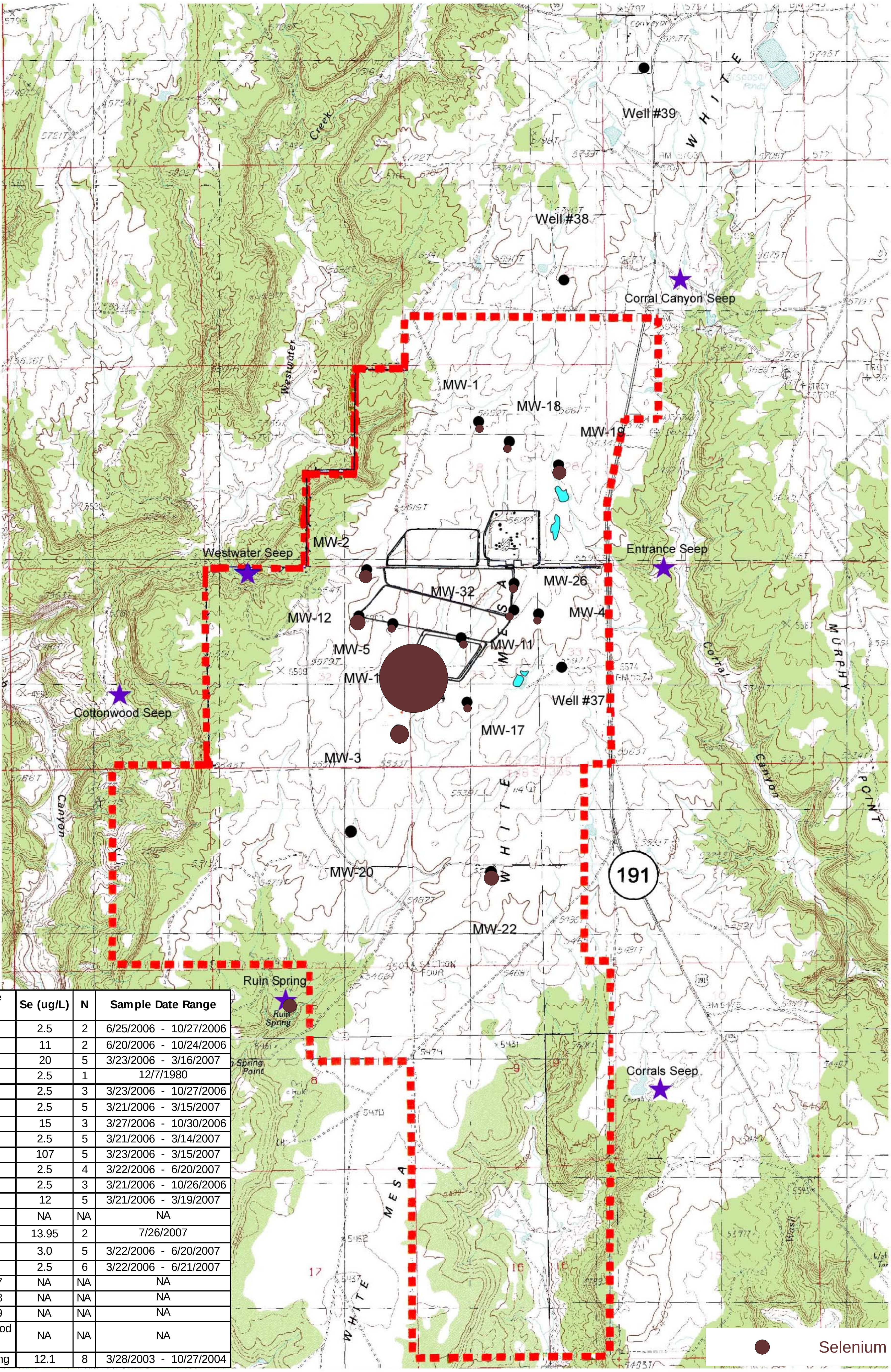
DUSA Wildlife Ponds

Burro Canyon Wells

Springs/Seeps

Figure 24
Average 2006-2007 and Background Concentrations for Manganese

INTERA



Sample Point	Se (ug/L)	N	Sample Date Range
MW-1	2.5	2	6/25/2006 - 10/27/2006
MW-2	11	2	6/20/2006 - 10/24/2006
MW-3	20	5	3/23/2006 - 3/16/2007
MW-4	2.5	1	12/7/1980
MW-5	2.5	3	3/23/2006 - 10/27/2006
MW-11	2.5	5	3/21/2006 - 3/15/2007
MW-12	15	3	3/27/2006 - 10/30/2006
MW-14	2.5	5	3/21/2006 - 3/14/2007
MW-15	107	5	3/23/2006 - 3/15/2007
MW-17	2.5	4	3/22/2006 - 6/20/2007
MW-18	2.5	3	3/21/2006 - 10/26/2006
MW-19	12	5	3/21/2006 - 3/19/2007
MW-20	NA	NA	NA
MW-22	13.95	2	7/26/2007
MW-26	3.0	5	3/22/2006 - 6/20/2007
MW-32	2.5	6	3/22/2006 - 6/21/2007
Well #37	NA	NA	NA
Well #38	NA	NA	NA
Well #39	NA	NA	NA
Cottonwood Seep	NA	NA	NA
Ruin Spring	12.1	8	3/28/2003 - 10/27/2004

DUSA Property Boundary

DUSA Wildlife Ponds

Burro Canyon Wells

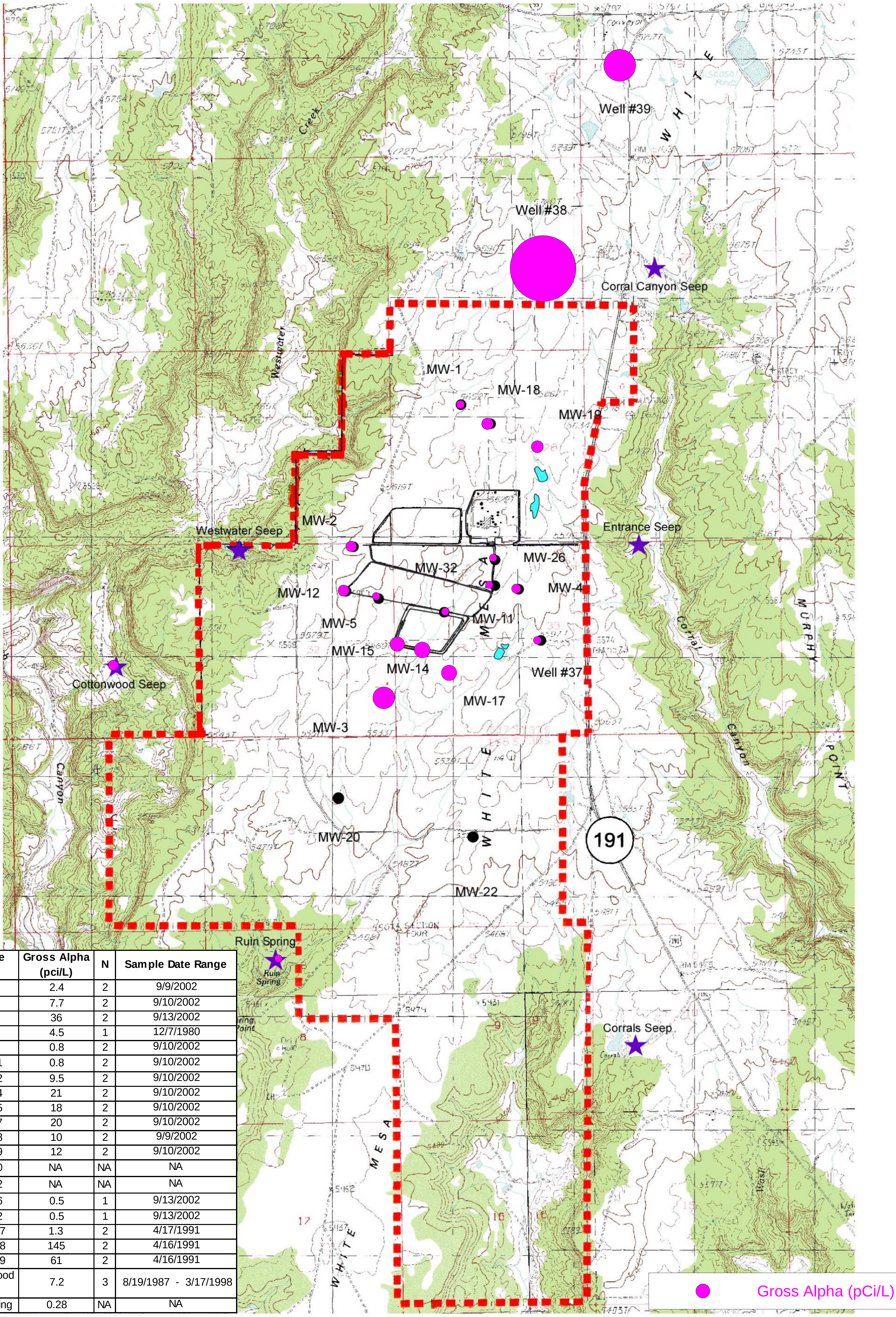
Springs/Seeps

N

0 1 mile

Figure 25
Average 2006-2007 and Background Concentrations for Selenium

INTERA



Sample Point	Gross Alpha (pci/L)	N	Sample Date Range
MW-1	2.4	2	9/9/2002
MW-2	7.7	2	9/10/2002
MW-3	36	2	9/13/2002
MW-4	4.5	1	12/7/1980
MW-5	0.8	2	9/10/2002
MW-11	0.8	2	9/10/2002
MW-12	9.5	2	9/10/2002
MW-14	21	2	9/10/2002
MW-15	18	2	9/10/2002
MW-17	20	2	9/10/2002
MW-18	10	2	9/9/2002
MW-19	12	2	9/10/2002
MW-20	NA	NA	NA
MW-22	NA	NA	NA
MW-26	0.5	1	9/13/2002
MW-32	0.5	1	9/13/2002
Well #37	1.3	2	4/17/1991
Well #38	145	2	4/16/1991
Well #39	61	2	4/16/1991
Cottonwood Seep	7.2	3	8/19/1987 - 3/17/1998
Ruin Spring	0.28	NA	NA

DUSA Property Boundary

DUSA Wildlife Ponds

Burro Canyon Wells

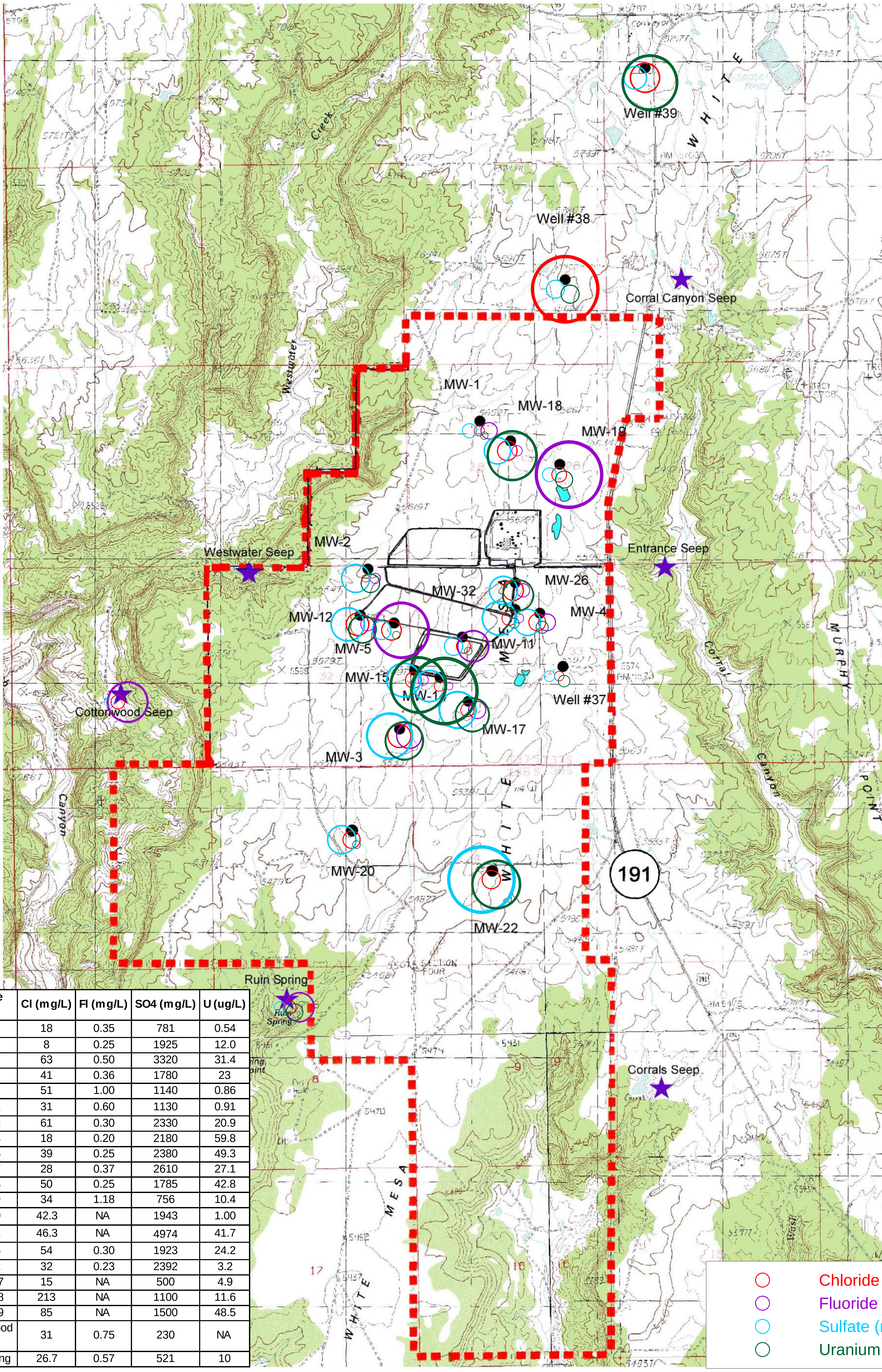
Springs/Seeps

N

0 1 mile

Figure 26
Average 2006-2007 and Backgroumd Concentrations for Gross Alpha

INTERA



Sample Point	Cl (mg/L)	Fl (mg/L)	SO4 (mg/L)	U (ug/L)
MW-1	18	0.35	781	0.54
MW-2	8	0.25	1925	12.0
MW-3	63	0.50	3320	31.4
MW-4	41	0.36	1780	23
MW-5	51	1.00	1140	0.86
MW-11	31	0.60	1130	0.91
MW-12	61	0.30	2330	20.9
MW-14	18	0.20	2180	59.8
MW-15	39	0.25	2380	49.3
MW-17	28	0.37	2610	27.1
MW-18	50	0.25	1785	42.8
MW-19	34	1.18	756	10.4
MW-20	42.3	NA	1943	1.00
MW-22	46.3	NA	4974	41.7
MW-26	54	0.30	1923	24.2
MW-32	32	0.23	2392	3.2
Well #37	15	NA	500	4.9
Well #38	213	NA	1100	11.6
Well #39	85	NA	1500	48.5
Cottonw ood Seep	31	0.75	230	NA
Ruin Spring	26.7	0.57	521	10

DUSA Property Boundary

DUSA Wildlife Ponds

Burro Canyon Wells

Springs/Seeps

N

0 **1 mile**

Figure 27
Average 2006-2007 and Background Concentrations for Chloride, Fluoride, Sulfate, and Uranium

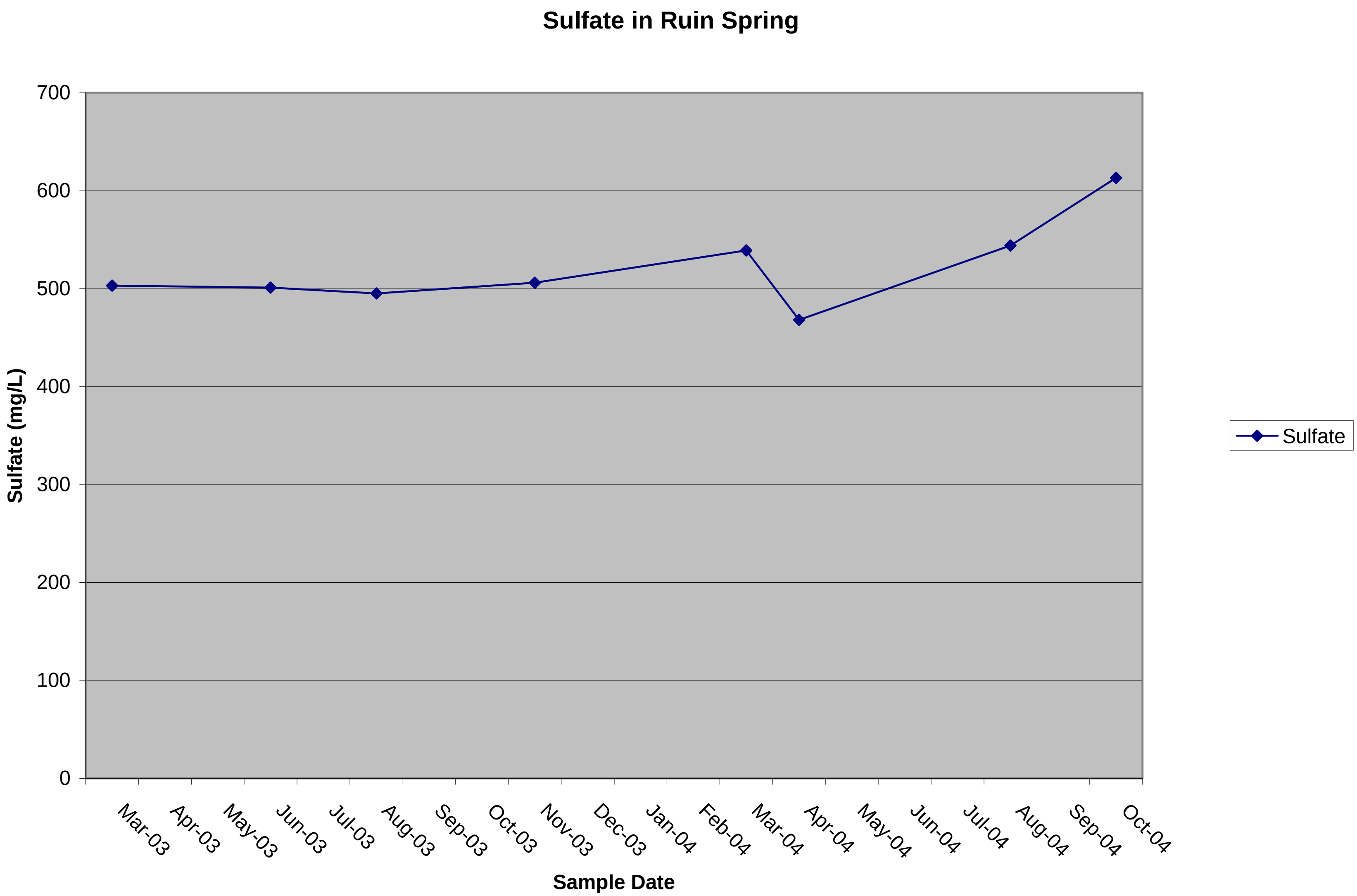


Figure 28
Ruin Spring Sulfate Concentrations Over Time

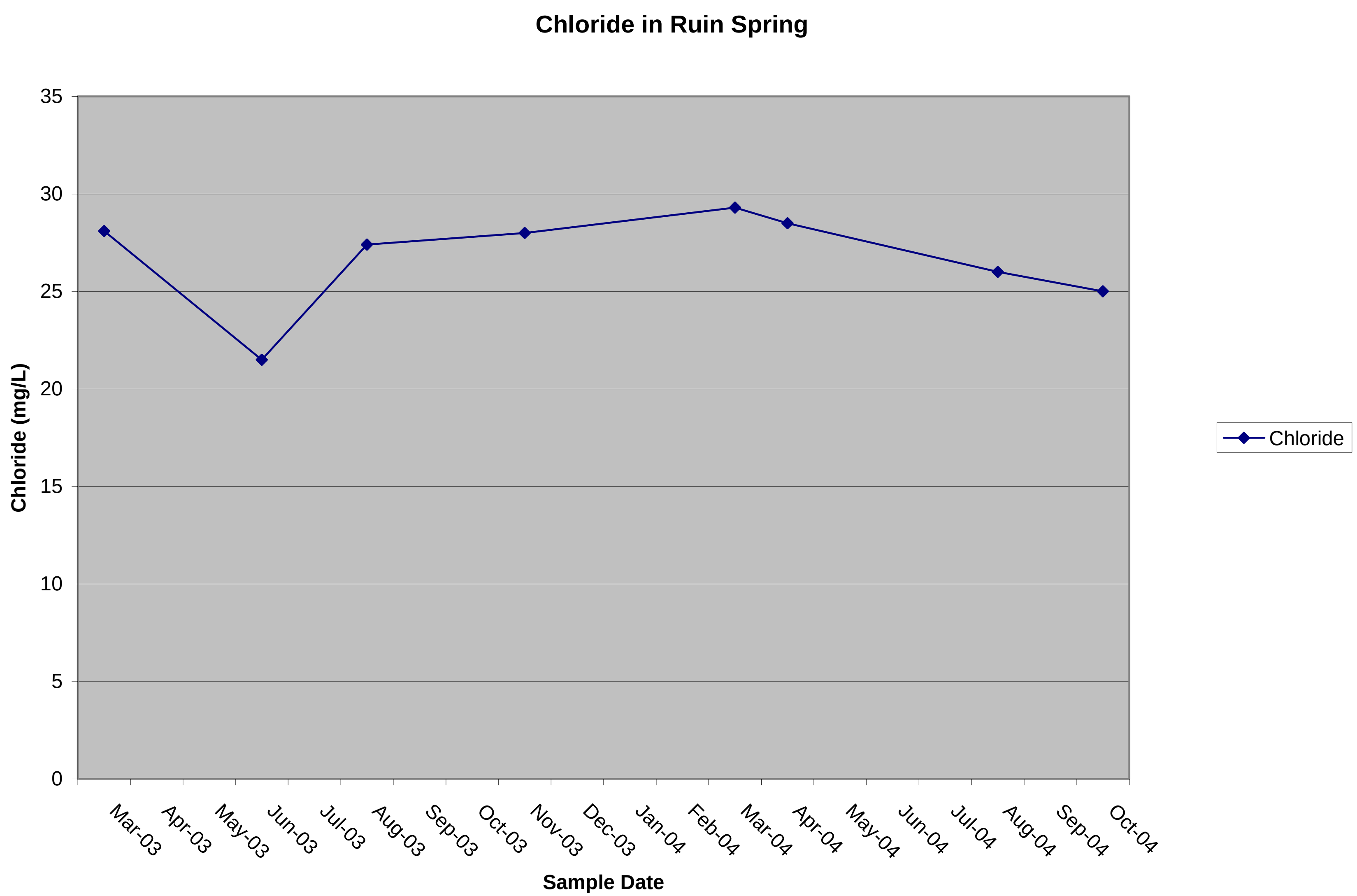


Figure 29
Ruin Spring Chloride Concentrations Over Time

APPENDIX A
LIST OF REFERENCES AND REPORTS REVIEWED FOR THIS ADDENDUM

APPENDIX A

List of References and Reports Reviewed for this Addendum

Historic Reports of Pre-Operational Mill Conditions and the Geohydrology of the White Mesa Uranium Mill

DATE	TITLE	AUTHOR
1/30/1978	Environmental Report, White Mesa Uranium Project	Dames & Moore
5/1/1979	Final Environmental Statement Related to Operation of White Mesa Uranium Project	US Nuclear Regulatory Commission (NRC)
6/1/1979	Engineer's Report, Tailings Management System	D'Appolonia Consulting Engineers, Inc.
7/19/1979	Addendum to Engineer's Report: Tailings Management System, White Mesa Uranium Project	D'Appolonia Consulting Engineers, Inc.
8/7/1979	Source Material License No. SUA1358	NRC Uranium Recovery Licensing Branch
11/16/1979	Letter Report: Preoperational Groundwater Monitoring Well Installations, White Mesa Uranium Project	D'Appolonia Consulting Engineers, Inc.
1/31/1980	Environment Assay	Phillip Sabey
3/1/1980	Environmental Monitoring Programs, White Mesa Uranium Project, Energy Fuels Nuclear, Inc., Volume 1, Initial Baseline and Pre-Operational Monitoring	Dames & Moore
3/1/1980	Environmental Monitoring Programs, White Mesa Uranium Project, Energy Fuels Nuclear, Inc., Volume 2, Operational Monitoring Program	Dames & Moore
5/1/1980	Piezometer Installation Sheet	D'Appolonia Consulting
11/2/1980	Test Results from Water in #2 Dike Stand Pipe	Phillip Sabey
2/26/1981	Proposed Technical Program Groundwater Well Installation Energy Fuels Nuclear, Blanding, Utah White Mesa Uranium Project	D'Appolonia Consulting Engineers, Inc.
3/16/1981	Letter to Dr. Baker	D'Appolonia Consulting Engineers, Inc.
5/1/1981	Transmittal Engineer's Report Second Phase Design - Cell 3 Tailings Management System White Mesa Uranium Project Blanding, Utah	D'Appolonia Consulting Engineers, Inc.
5/1/1981	Engineer's Report, Second Phase Design - Cell 3, Tailings Management System	D'Appolonia Consulting Engineers, Inc.
6/15/1981	Proposal Hydrofracturing of the Water Well(s) White Mesa Uranium Mill Blanding, Utah	D'Appolonia Consulting Engineers, Inc.
7/20/1981	Meeting Notes Hydrofracturing of the Water Well(s) White Mesa Uranium Mill Blanding, Utah	D'Appolonia Consulting Engineers, Inc.
7/20/1981	Meeting Notes: Hydrofracturing of Water Wells	D'Appolonia Consulting Engineers, Inc.
8/20/1981	Tailings Density Variation Study White Mesa Uranium Project Blanding, Utah	D'Appolonia Consulting Engineers, Inc.
9/9/1981	Letter Report: Assessment of Groundwater Quality, White Mesa Project	D'Appolonia Consulting Engineers, Inc.
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9/25/1981	Response to NRC Question 2 White Mesa Project, Blanding, Utah Energy Fuels Nuclear, Inc.	D'Appolonia Consulting Engineers, Inc.
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2/1/1997	Environmental Assessment for Renewal of Source Material License No. SUA-1358	US NRC
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5/28/1999	Groundwater Information Report, White Mesa Uranium Mill, Blanding, UT	IUC
2/7/2000	DRC Request for Additional Information Related to Site Hydrogeology	Utah Division of Radiation Control
6/6/2000	Well Information, Update to the 2000 Survey	IUC
9/7/2000	Letter Regarding Plugging of Hawkins Well	Harold Roberts, PE
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7/13/2001	Background for New Indicator Parameters/Ground Water Discharge Permit Application for White Mesa Mill	Roman Z Pyrih & Associates
9/25/2001	Assessment of the Effectiveness of Using Existing Monitoring Wells for GWDP Detection Monitoring at the White Mesa Uranium Mill, Blanding, Utah	Hydro Geo Chem Inc.
10/3/2001	Compliance Ranges for Groundwater Protection	Roman Z Pyrih & Associates
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4/30/2003	Staff Technical Report Regarding the November 2001 Groundwater Split Sampling Data	Utah Division of Radiation Control
10/20/2004	Hydro Geo Chem Report on Perched Zone Water Movement	Hydro Geo Chem Inc.
11/1/2004	Remediation of the Moab Uranium Mill Tailings, Grand and San Juan Counties, Utah. Draft Environmental Impact Statement	DOE
9/2/2005	Groundwater Discharge Permit Compliance Submittals: Sampling Plan for Seeps and Springs in the Vicinity of the White Mesa Uranium Mill	IUC
1/1/2007	Background Groundwater Quality Report: Existing Wells for Denison Mines (USA) Corp.'s White Mesa Mill Site, San Juan County, Utah	INTERA, Inc.
2/26/2007	Site Hydrogeology and Estimation of Groundwater Travel Times in the Perched Zone	Hydro Geo Chem Inc.
April, 2007	Addendum to Background Groundwater Quality Report : Evaluation of Available Pre-Operational and Regional Background Data	INTERA, Inc.

APPENDIX B
CALCULATED TRAVEL TIMES

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Calculated Travel Times

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CALCULATED TRAVEL TIMES

Hydro Geo Chem (2004) presented estimated rates of perched groundwater travel time in the Burro Canyon formation. Hydraulic conductivities used in the calculation were based on estimates by Hydro Geo Chem, 2002; Hydro Geo Chem, 2004; and UMETCO, 1994. To determine travel time Hydro Geo Chem used the formula:

$$Rate = \frac{Hydraulic\ Conductivity \times Hydraulic\ Gradient}{Porosity}$$

The calculated rates of perched water movement represent interstitial velocities with an average porosity of 0.18. This porosity is an average porosity based on samples collected from monitor wells in the Burro Canyon formation immediately downgradient of the tailing cells. Porosities ranged from 0.02 to 0.291, averaging 0.183. Hydraulic conductivities for each well represent the geometric average of the range of estimates based on well tests performed by Hydro Geo Chem. in 2002. These calculations represent highly conservative assumptions.

Estimated Rates of Perched Water Movement

Well	Hydraulic Conductivity (cm/s)	Hydraulic Conductivity (ft/yr)	Hydraulic Gradient (ft/ft)	Rate (ft/yr)
MW-01	$8.0x10^{-7}$	0.82	0.0057	0.026
MW-02	$4.7x10^{-5}$	48	0.014	3.6
MW-03	$6.4x10^{-6}$	6.54	0.009	0.33
MW-04	$5.4x10^{-5}$	55	0.031	9.4
MW-05	$7.8x10^{-6}$	7.97	0.01	0.44
MW-11	$1.4x10^{-3}$	1430	0.017	135
MW-12	$2.2x10^{-5}$	22.5	0.011	1.4
MW-14	$7.5x10^{-4}$	766	0.015	62
MW-15	$1.9x10^{-5}$	19.4	0.012	1.3
MW-17	$2.7x10^{-5}$	27.6	0.015	2.3
MW-18	$3.6x10^{-4}$	368	0.044	90
MW-19	$1.4x10^{-5}$	14.3	0.039	3.1
MW-20	$7.7x10^{-6}$	7.86	0.0077	0.34
MW-22	$3.5x10^{-6}$	3.58	0.019	0.38

As demonstrated in the above table, downgradient monitor well permeability is generally low with the exception of MW-11 and MW-14. The permeabilities measured in these wells are consistent with a zone of higher permeability found east to northeast of the tailings cells at the site. This zone was identified during installation of temporary monitoring wells in the perched zone used for investigation of chloroform discovered in MW-4 in 1999 (IUSA and Hydro Geo Chem, 2001). This zone is hydraulically cross-gradient to upgradient of the tailings cells with respect to perched groundwater flow, and the higher permeability of MW-11 and MW-14 suggest that this zone may extend beneath the southeastern margin of the cells. This zone of higher permeability is not evident in downgradient monitoring wells MW-3, MW-5, MW-12, MW-15, MW-20, MW-21, or MW-22 based on lithologic log or hydraulic testing of the wells.

It is possible to calculate travel times between various points on White Mesa using these estimated rates. For example, Ruin Spring is approximately 10,000 feet down gradient of Cell 3. Wells MW-03, 05, 12, 15, and 20 are all between Cell 3 and Ruin Spring. The average rate for these five wells is 0.76 ft/yr, producing a total travel time of 7,620 years over 10,000 feet. Using the upper and lower rate values (0.33 and 1.4 ft/yr), travels times could vary from 3,300 years to 14,000 years between Cell 3 and Ruin Spring.

Well MW-05 is approximately 1000 feet down gradient of Cell 2. Using a travel time of 0.44 ft/yr for MW-05, total travel time between Cell 2 and MW-05 would be approximately 440 years.

These calculated travel times do not include a calculation for vertical movement from the base of either Cell 2 or Cell 3 to the perched aquifer.