AP - 59

AMENDED

STAGE 1 & 2 WORKPLANS

DATE:

5-23-08

R. T. HICKS CONSULTANTS, LTD.

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May 23, 2008

Edward Hansen
NMOCD
1220 South St. Francis Drive
Santa Fe, New Mexico 87505
Via E-mail

RE: NMOCD Case #: AP-59
F-35 SWD & G-35 SWD, T17S, R35E
Proposed Abatement Plan Amendment

Dear Mr. Hansen,

This letter presents the current status of ground water restoration at the above-mentioned sites and proposes an amendment to the Abatement Plan (submitted December, 2005; Minor Modification submitted April 11, 2006) for the above referenced sites. Plate 1 presents a site vicinity map with well locations.

Ground Water Chemistry

As shown in Figure 1, concentrations of TDS and chloride declined at the F-35 source area (MW-1) from 2002-2005 then remained relatively consistent from 2005-present day with an average chloride concentration of 1,315 mg/L and TDS concentration of 2,745 mg/L. MW-1 is the pumping recovery well at the F-35 site.

Figure 1. Chloride Data for MW-1 at F-35

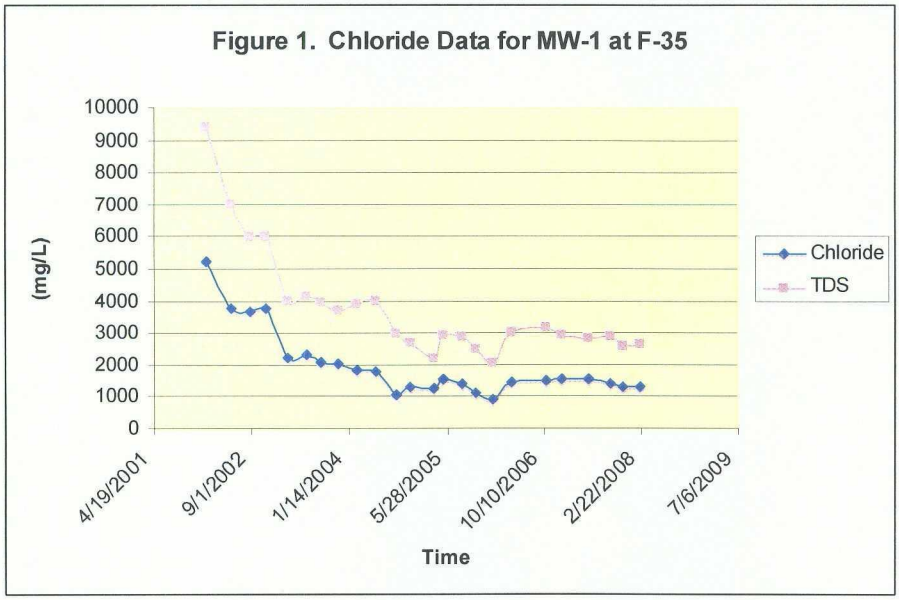


Figure 2 presents the chloride data from the down gradient well (MW-3) and the cross-gradient well (MW-2). Plate 2 presents our interpretation of chloride impact to local ground water caused by historic operations at F-35 and G-35 using chloride data collected in the February 2008 sampling event. Fluctuations in ground water data for MW-3 shallow and deep may be indicative of episodic introduction of chlorides during historic operations at the F-35 SWD facility up-gradient. In a few years the effect of the source removal at the site will become evident in these wells.

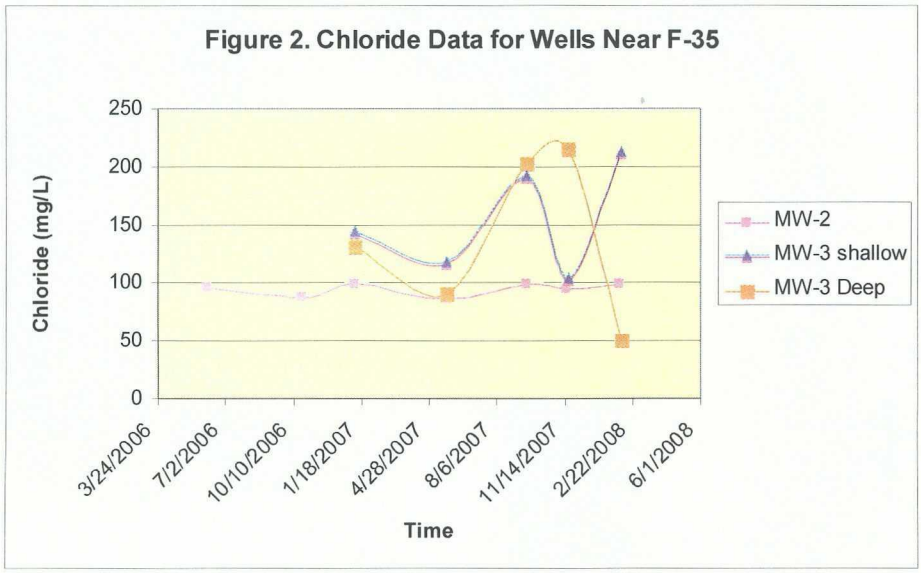


Figure 3 presents chloride concentrations over time for the G-35 site. TDS in MW-1 at G-35 follows a similar trend. Since 2007, TDS at MW-1 has remained below 2,000 mg/L.

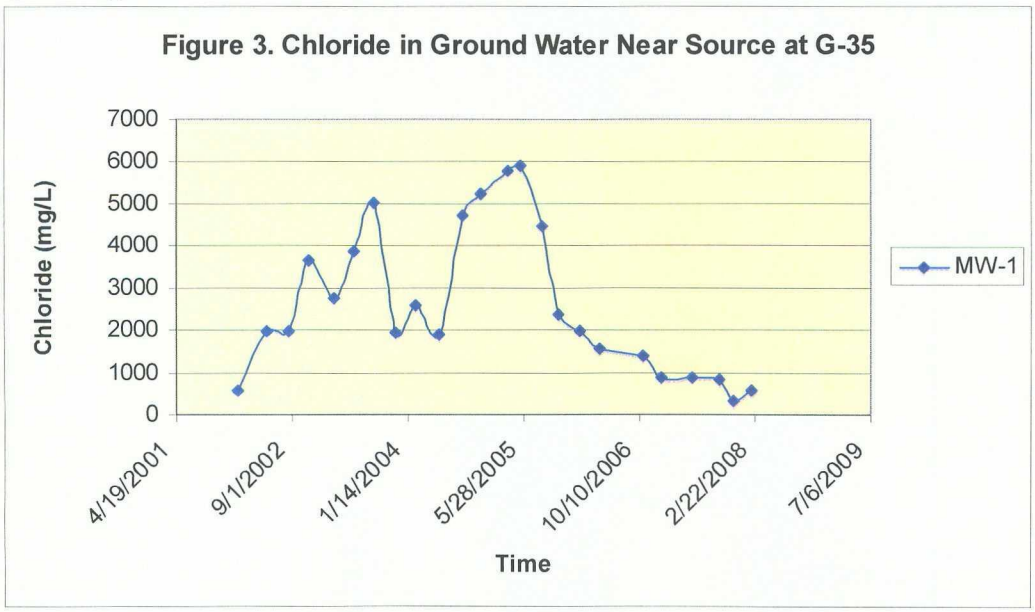
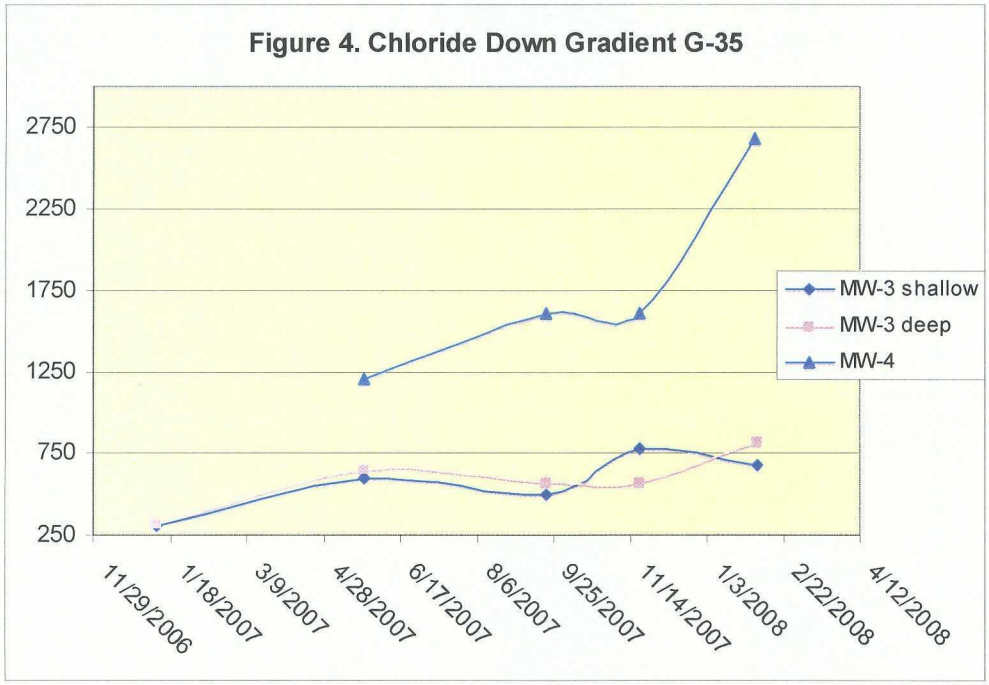


Figure 4 shows the chloride concentrations over time at the well approximately 50 feet down gradient from the excavation (MW-4) and the deep and shallow wells 300 feet down gradient (MW-3). The upward trends in these wells show impairment from the G-35 site, likely exacerbated by leaving the excavation open for as long as it was. As distance from the source area increases, the ameliorating affects of dilution and dispersion are noticeable.



Prediction of Benefit from the Vadose Zone Remedy

Our Vadose Zone Remedy Report (October 2006) predicted that the vadose zone would drain (allow a continued flux of chloride and hydrocarbons to ground water) for 10-18 months after remedy installation if initial conditions were "wet". During the six months since the installation of the vadose zone remedy, ground water chloride concentrations have decreased from 1,500 mg/L in May of 2007 (before remedy installation) to 1,240 mg/L in February of 2008 at F-35. At G-35 the chloride declined from 873 mg/L to 540 mg/L during the same time period. Figure 5 shows the chloride concentration v. time for the most recent eight quarters of ground water monitoring at G-35 (MW-1).

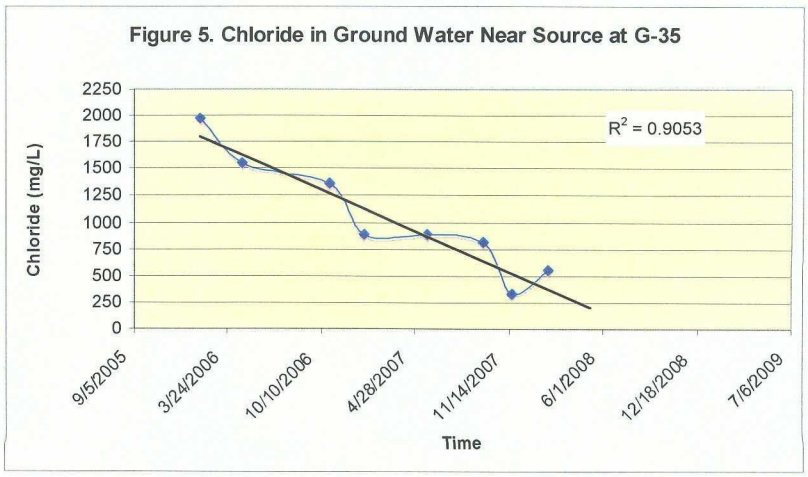
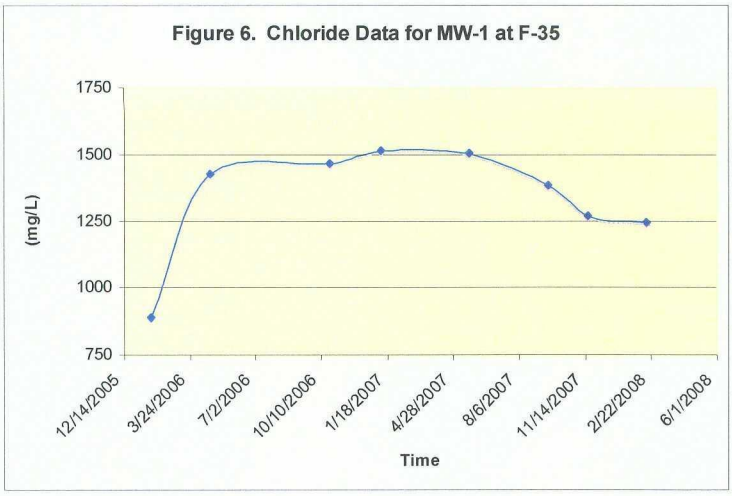
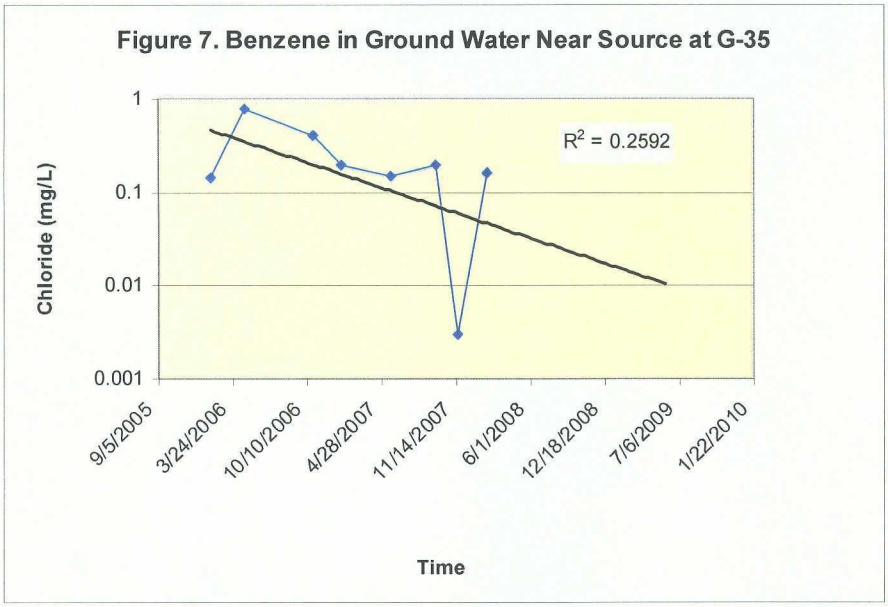


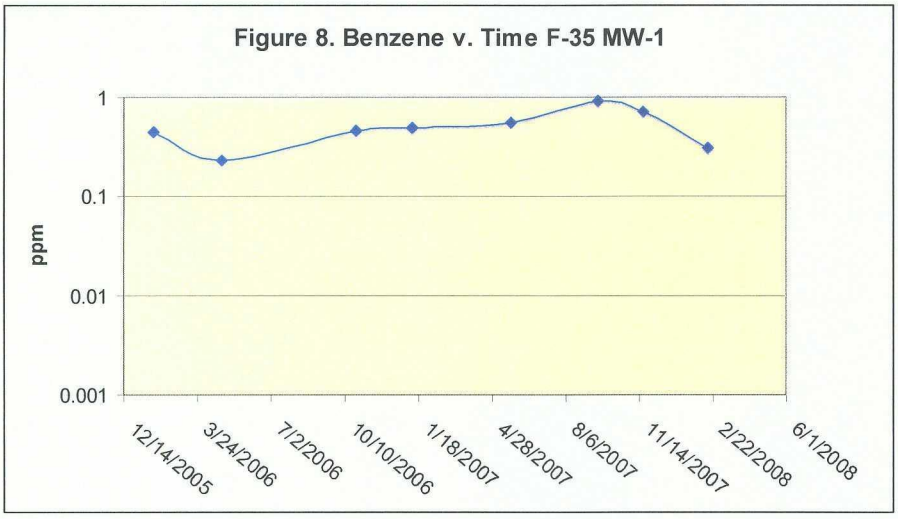
Figure 6 shows data from the same period for F-35 (MW-1).



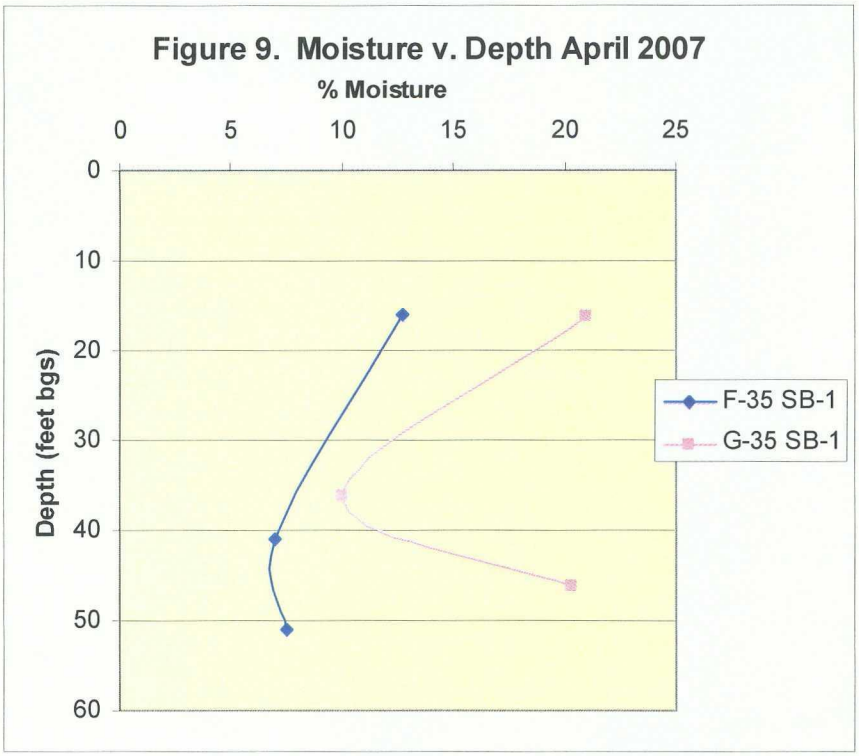
We anticipate that data from the next two quarters will confirm this downward trend at the F-35 site and verify the success of the vadose zone remedy (remedy completed in August of 2007). The decreasing chloride concentration at G-35 is obvious and the next two quarters of data should reveal if the slope of the trendline steepens since installation of the remedy. If the initial condition of the vadose zone was wet, as we suspect, modeling indicates that chloride concentrations in ground water at F-35 will meet standards in about three and a half years without extracting ground water for treatment and use. At G-35, simple regression analysis suggests ground water will meet standards at MW-1 sometime during 2008.

The impact of the vadose zone remedy (the barrier and ventilation wells) on hydrocarbon concentrations in MW-1 at G-35 and MW-1 at F-35 might become apparent over the next several quarters of monitoring. Simple regression analysis for Benzene in ground water at G-35 is presented in Figure 7. Although the correlation coefficient is low, a decreasing benzene concentration trend is evident. The chloride and benzene data suggest that the flux of constituents from the vadose zone to ground water began declining in 2006 at the G-35 site. At the F-35 site, the flux of constituents should decline in response to the installation of the infiltration barrier.





Borings through the center of the excavations at each site in April of 2007 revealed an interested difference in soil moisture content at F-35 and G-35, soil moisture being higher at G-35 (see Figure 9).



Higher soil moisture levels in the boring through the center of the excavation at G-35 than one similarly placed at F-35 may have been caused by storm water run-on at G-35. Whatever the cause, the vadose zone profile at G-35 is significantly wetter than F-35 and the data suggest that infiltration and flushing has effectively removed chloride from the vadose zone at G-35.

Predicted Benefit of Point-of-Use Treatment System

Unpredictability in certain system components, weather, and variable water quality as well as past experience has required ROC to have staff visit the site for maintenance and system checks 3 times a week. When there are no maintenance difficulties, the system produces about 210 gallons of potable water and 490 gallons of brine concentrate each week.

Operating the point of use treatment system has given insight into improving their design and use. We believe there are good applications for systems like this, especially when concentrated efforts to removed chloride mass are expected to yield a large benefit to ground water quality. Declining concentrations of chloride at F-35 MW-1 together with maintenance issues and no use for potable water have decreased the environmental benefit of this system.

May 23, 2008

Proposed Abatement Plan Amendment
Based on observed ground water quality at F-35 and G-35, the installation of a robust vadose zone remedy and the high environmental cost of operating a relatively small point source treatment system providing potable water for no significant beneficial use, we have come to the conclusion that full compliance with NMOCD regulations requires an amendment to the abatement plan.

We propose shutting down the system at F-35, and foregoing a treatment system at G-35 as previously proposed in the 2005 Abatement Plan. Instead, we propose pumping good quality water from F-35 MW-3 to supply wildlife and livestock with water on an as-needed basis. This amendment, together with allowing the vadose zone remedy, natural attenuation, and dilution and dispersion to continue to decrease concentrations of constituents of concern is protective of fresh water, public health, human safety, property and the environment. We propose this abatement plan amendment at these sites because:

- Model predictions and observation shows that the vadose zone remedy, natural attenuation and dilution and dispersion will cause concentrations of chloride to reach WQCC standards within three and a half years regardless of the operation of the system.
- At G-35, site data suggest that ground water will meet WQCC Standards for regulated hydrocarbons within 3-5 years regardless of system operation
- At F-35, additional data are required to predict the time required for ground water to meet standards.
- Maintenance of the system carries an environmental cost through carbon impact of electrical use and gasoline consumption – components switch off and on through the day, system personnel to visit the site 3 times a week, and a water hauling truck must travel 60 miles round trip about every 6 weeks to remove the brine waste.
- The relatively small volume of water being removed and treated (100 gpd) is unlikely to substantially speed ground water clean up in the area, thus the system yields a relatively small environmental benefit,
- The ground water impact is relatively localized,
- There are no ground water supply wells jeopardized by impacted ground water, and
- There remains little use for the water at the site as the land-owner has not elected to keep cattle on the land near the site.
- Down gradient monitoring wells (F-35 MW-3 and G-35 MW-3) may be used as a water supply and exhibit water quality acceptable to cattle if a need is specified.

With your approval of this proposed amendment to the Abatement Plan for F-35 and G-35, ROC will:

a. discontinue operation of the point source treatment system at F-35

b. forego plans for another extraction or treatment system at G-35
c. If there is a need for a nearby water supply, install a solar pump and cattle trough at F-35 MW-3

Given the expected efficacy of the vadose zone remedy and the other reasons listed above, we believe this to be the path forward that yields the highest environmental benefit and does not cause a violation of NMOCD rules through implementation of a remedy that does not provide the appropriate balance of protection of fresh water, property, public health, human safety and the environment. We propose to continue monitoring ground water at these sites to document the drop in levels of constituents of concern in ground water. We hope to dismantle the system at F-35 and use as many components as possible in other locations.

Thank you for your time and consideration. We look forward to your response.

Sincerely,
R.T. Hicks Consultants, Ltd.

Katie Lee

Katie Lee
Project Scientist

Copy: Rice Operating Company

0 150 300 Feet

N W E S

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	F-35 SWD and G-35 SWD Vicinity Map	Plate 1
	Rice Operating Company Stage I/II Abatement Plan Amendment	May 2008

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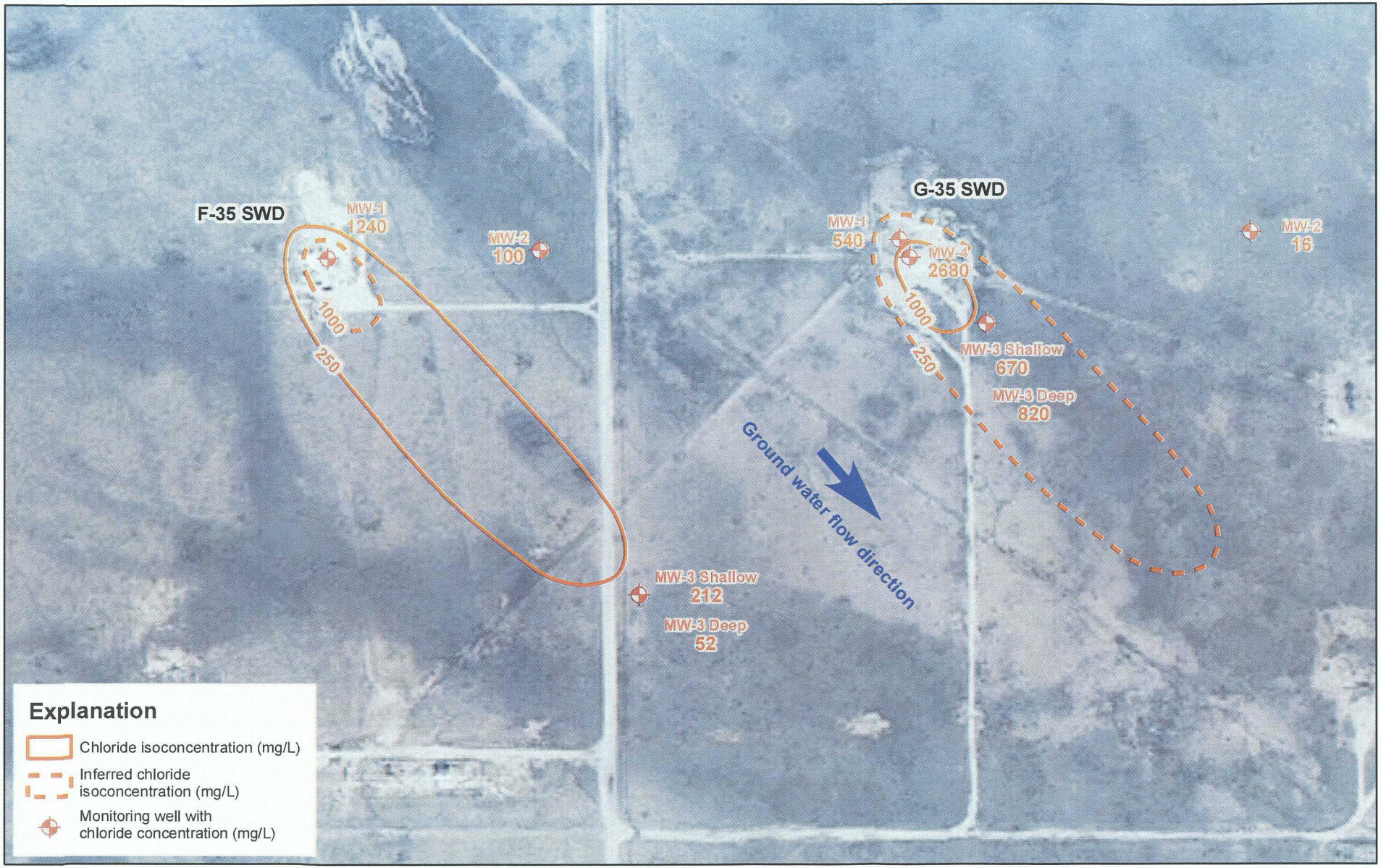

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R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Chloride Concentration in Ground Water (February 2008)	Plate 2
	Rice Operating Company: F-35 and G-35 Proposed Abatement Plan Amendment (SWD System)	May 2008

5/1/2008