

Ranking of TxDOT Maintenance Sections with Shallow Injection Wells
for Prioritizing Remedial Investigations

Final Topical Report

by

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SUMMARY

Shallow large-diameter injection wells have been used to dispose of waste fluids at approximately 59 Texas Department of Transportation (TxDOT) maintenance sections. Types of waste fluids that might have been discharged to these wells include motor oil, brake and transmission fluid, hydraulic fluid, solvent, carburetor cleaner, waste diesel fuel and gasoline, paint, paint thinner, and possibly herbicides, as well as wastewater from vehicle washracks and workshop sinks. Realizing that these materials have the potential to contaminate local groundwater and impact human health and safety and the environment, TxDOT initiated plans to identify maintenance sections with injection wells and to conduct remediation-focused site assessments to reduce risk to public health and safety and the environment.

The Bureau of Economic Geology conducted a comprehensive, questionnaire-format survey of 311 maintenance sections in 25 districts to confirm the number of maintenance sections that have injection wells and to rank them in order of priority for remediation-focused site investigations. We used 13 environmental scoring criteria to rank the maintenance sections. The scoring was based on results of the questionnaire, information obtained during visits to 46 maintenance sections, and both published and unpublished environmental data. Institutional and other factors, for example, property ownership, also influence the prioritization of funds for further investigations.

We ranked the 59 maintenance sections that we found to have had injection wells. The Amarillo and Lubbock Districts have the greatest number of sections ranked at high priority for further investigation. The Lubbock, Childress, and Corpus Christi Districts have several medium-ranked sections. Wells also were apparently used at a top-ranked maintenance section in the Tyler District and at one

or two medium-ranked maintenance sections within 7 other districts. Total score for all the sections ranged from a high of 200 to a low of 80. The top-ranked 10 percent of the maintenance sections have scores greater than 155. Sensitivity analysis shows that the calculated rank of any given maintenance section has an uncertainty of about ± 2 and that dropping out any one of the 13 environmental ranking criteria resulted in an average score change of less than 3 percent on all but three criteria. These results indicate that (1) priorities are significantly different between first and fourth ranked sections, second and fifth ranked sections, and so forth, and (2) ranking is not overly sensitive to the scoring for most individual criteria. Overall score and rank were most sensitive to the important criterion regarding the type of waste fluid discharged to an injection well.

INTRODUCTION

The Texas Department of Transportation (TxDOT) has initiated plans to identify maintenance sections with shallow waste-injection wells and to conduct remediation-focused investigations to reduce risk to public health and safety and the environment. A preliminary TxDOT inventory identified 47 maintenance sections that were known or thought to have used shallow injection wells to dispose of waste fluids. These include wells that received used motor oil and other waste fluids, asphalt, and wash water from vehicle wash racks and paved area wash down.

Remediation-focused investigations, therefore, are needed to evaluate potential risk to public health and safety and the environment and to determine the need for cleanup activities at the maintenance sections. Investigations have begun at a number of maintenance sections (Leftwich and Rainwater, 1992a, 1992b, 1992c, 199d, 1992e). Because of the number of maintenance sections that have confirmed or reported injection wells, however, it is appropriate to assign the highest priority for

further investigations to the maintenance sections where injection wells pose the greatest potential risk to public health and safety and the environment.

This report presents a ranking of the TxDOT maintenance sections with confirmed injection wells in order of priority for remediation-focused site investigations. To develop this ranking, the Bureau of Economic Geology conducted a written survey of district and maintenance section supervisors (the questionnaire), visited 46 maintenance sections identified as possibly having one or more injection well, compiled environmental data from open-file and published sources, and developed a set of 13 environmental ranking criteria with which to score maintenance sections in terms of relative priority for further investigation. The questionnaire (appendix A) was composed of sets of questions to solicit direct and indirect indications of the presence of injection wells, environmental setting, number and location of nearby water wells, and the type and volume of waste fluids generated on site (Scott and Dutton, 1996).

Sections that have not used injection wells for waste disposal were not included in this priority ranking evaluation. The scope of work did not include sites with surface spills, leaking petroleum storage tanks (LPSTs), or waste buried in landfills, pits, or drums unless injection wells also were present. TxDOT is conducting separate investigations of maintenance sections with LPSTs.

We scored the prioritized ranking on the basis of the results of the questionnaire, site visits (appendix B), interviews with TxDOT personnel, and an environmental data base (appendix C). Environmental ranking criteria (appendix D) were selected to reflect the overall potential risk to public health and safety and the environment and to be readily scored from available data. Institutional and other factors, such as the presence of other sources of potential contaminants (buried oil drums and LPSTs), also influence the prioritization of funds for further

investigations, but are beyond the scope of this task. We also include in this report an analysis of how sensitive the relative ranking is to individual criteria.

DESCRIPTION OF PRIORITIZATION CRITERIA

The environmental ranking criteria (appendix D) are grouped into two categories:

- hydrogeologic setting, and
- injection well characteristics.

Hydrologic Setting Criteria

The first three questions reflect the potential for contaminants to impact surface water or wetland areas or both. Criteria are weighted simply by distance from the maintenance section.

- (Question 1). Distance to surface water (for example, a lake, river, or creek) was measured from 1:24,000-scale USGS topographic maps or determined during section visits or both. Maintenance sections within 100 ft of a surface water body received the highest score (20 points) and sections more than 1,000 ft from surface water received a score of 0 points.
- (Questions 2 and 3). Distance to and number of wetlands within 0.5 mi were determined from 1:24,000-scale National Wetlands Inventory maps prepared by the U.S. Fish and Wildlife Service and filed at the Texas General Land Office. Maintenance sections within 0.5 mi of a wetland received a score of 10 points and sections more than 1 mi from a wetland received a score of 0 points. Sections that had more than 6 wetlands within 0.5 mi received an additional score of 15 points whereas those that had from 1 to 5 wetlands within 0.5 mi received an additional score of 10 points.

The next set of questions address the potential for contaminants to impact groundwater.

- (Question 4). Proximity of a maintenance section to a residence is used as a ranking criterion on the basis of the assumption that a residence might have a water well not otherwise recorded in the data base. Proximity of the maintenance section to a residence was taken from completed maintenance section questionnaires or determined during visits to maintenance sections or both. Maintenance sections that had a residence within 100 ft received the highest score (15 points) and sections that had the closest residence at a distance of more than 500 ft or at an unknown distance received a score of 5 points.
- (Questions 5 and 6). Distance to the nearest water well, whether it is used for municipal, domestic, or irrigation water supply, and the number of water-supply wells within 0.5 mi are additional indicators of the probability of contamination reaching a well at an unacceptable concentration. Distance to the nearest water well and number of nearby wells were taken from 1:24,000-scale USGS topographic maps and from questionnaire information. Maintenance sections with more than 6 wells within 0.5 mile received the highest score (total of 25 points for questions 5 and 6).
- (Question 7). Depth to groundwater in an unconfined or water-table aquifer is used as another criterion because such an aquifer is more susceptible to contamination than groundwater in a confined aquifer. Depth to unconfined groundwater was interpreted from a Texas Water Development Board data base and from information provided during telephone interviews with local water-well drillers and city utility officials. Maintenance sections that had groundwater within 25 ft of ground surface received the highest score (25 points) and sections that had groundwater at a depth of more than 200 ft received a score of 0 points.

The next criteria address infiltration of water and potential for contaminant transport.

- (Questions 8 and 9). Annual precipitation and the amount of rainwater runoff that might enter an injection well affect the potential size of contaminant plumes and the potential rate of contaminant transport. Annual precipitation is a rough indicator of depth to fresh water and the relative abundance of surface water. The hydraulic head caused by runoff entering an injection well provides the energy to drive contaminants through the ground. The potential size of contaminant plumes and the potential rate of contaminant transport might be higher in areas of higher precipitation than in arid regions, assuming other factors, such as aquifer permeability and amount of discharged fluid, are comparable. Precipitation rate was taken from state-wide precipitation map presented in Larkin and Bomar (1983). Maintenance sections in areas that receive more than 40 inches of annual precipitation were assigned the highest score (20 points) and sections that receive less than 10 inches were assigned a score of 0 points. Maintenance sections in the eastern part of the Texas, therefore, are ranked higher by this criterion than sections in the western part of the state. Rainwater runoff was taken from information on the survey questionnaire indicating whether runoff is channeled into an injection well infrequently (10 points), sometimes (15 points), or frequently (20 points). Sections which reported being uncertain about runoff entering an injection well were assigned 5 points.
- (Question 10). Permeability of a soil can control the amount of infiltration or rainwater, which in turn can influence the size and shape of a contaminant plume and the rate at which contaminants migrate. Soil permeability descriptions were taken from reports of the U.S. Soil Conservation Service. Only the Canadian maintenance section (Amarillo District) lies in an area

having a soil with rapid permeability (>20 inches/hr) and accordingly received a score of 20 points. Soils underlying other sections were described as having slow (<0.6 inches/hour) or moderate (0.6 to 6 inches/hour) permeability and were assigned 0 or 10 points, respectively.

- (Question 11) Aquifer classification is an indicator of potential impact on a beneficial use of ground water. It also is an indicator of the potential spread of contaminants because the more significant aquifers are found, of course, in the more permeable formations. Aquifer classification was taken from maps published by the Texas Water Development Board. Prevention of potential contamination of a major aquifer, such as the Ogallala aquifer, is assigned a higher priority (score of 20 points) than prevention of contamination of a minor aquifer (score of 10 points); maintenance sections overlying only a local aquifer that is designated as neither a major nor minor aquifer were assigned a score of 0. Sections in areas where both major and minor aquifers occur were assigned a score of 25 points.

Injection Well Characteristics Criteria

The status of shallow injection wells and the composition of fluids discharged to wells for disposal are critical factors in predicting potential risk.

- (Question 12) Questionnaire results and site visits confirmed that wells at some maintenance sections still contained fluids, whereas other injection wells had been abandoned, had undergone source abatement, had been backfilled, or had been covered. Maintenance sections with no injection wells were not ranked, with the exception of the Amarillo E-way section. Cleanup of contamination has been performed at the Ralls maintenance section (Lubbock District), related to a remedial investigation of a leaking petroleum storage tank (LPST). This one section accordingly was assigned a score of 0

points. For sections where source abatement had been completed, which involves removing waste fluid from the injection well, the ranking criterion is scored lower (5 points) than for sections at which waste fluid remains, which are scored with 15 or 25 points. For some sections, it was not possible to determine from either questionnaires or site visits whether waste fluid remains, for example, because wells had been covered. Such sections received 15 points to anticipate a need to conduct an additional investigation to confirm the status of the reported injection well. Injection wells that were identified in the questionnaire or during site visits of having a standing column of waste fluid within the well bore were assigned the highest score (25 points).

- (Question 13). Several types of waste fluids were identified from the questionnaire or during site visits as having been discharged to injection wells. Wash rack water (water used to clean vehicles and equipment) was assigned the lowest score (5 points per well). Wastewater (gray water) includes wastewater from laundries or workshop sinks and was assigned 10 points per well. Some maintenance sections discharged multiple waste fluids in a given well; wells that received multiple waste fluids or for which the nature of waste fluids could not be determined were assigned an intermediate score (15 points per well). Wells that were known to have received waste motor oil, transmission and brake fluid, hydraulic fluid, asphalt, solvents, pesticides, or more than one of these fluids, received the highest score (20 points per well). Information from questionnaires and site visits were insufficient to separately score these waste fluids. To score this criterion, the waste-fluid scores for each well are added together.

RESULTS

Inventory of Maintenance Sections with Injection Wells

The questionnaire was sent to 311 maintenance sections in 25 districts; responses were received from almost all maintenance sections (Scott and Dutton, 1996). Several districts returned letters instead of questionnaires stating that there were no injection wells in the districts. The Childress District was exempted from the questionnaire because of previous studies conducted in the district by TxDOT (Leftwich and Rainwater, 1992a, 1992b, 1992c, 199d, 1992e).

Table 1 lists the 47 TxDOT maintenance sections included in a preliminary TxDOT inventory of maintenance sections thought to have one or more injection well and the 21 maintenance sections that turned in a questionnaire with results suggesting the presence of injection wells. On the basis of information collected during site visits and follow-up phone calls, we confirmed the presence of injection wells at all but 5 of the 47 maintenance sections identified in the preliminary TxDOT inventory. We also confirmed the presence of injection wells at all but 4 of the 21 additional maintenance sections identified from the questionnaires. These 9 excluded maintenance sections are included in table 1 with a final count of 0 injection wells.

A total of 97 injection wells have been confirmed and inventoried at 59 maintenance sections (table 1). The distribution of the 59 maintenance sections with confirmed injection wells is shown in figure 1. This tally includes injection wells locally referred to as sumps or cisterns. Of the 97 injection wells, 60 were used for disposal of waste oil and possibly other contaminants, 22 were used mainly for capturing the wastewater from vehicle wash racks, and 10 received waste fluid from asphalt trucks. The contents of another 5 reported wells were not reported or determined.

Table 1. Tally of injection wells by (a) district and (b) maintenance section.

(a) Tally by district.

District	Total well count	Well type			
		Waste oil	Wash rack	Asphalt	Uncertain
Abilene	1	1	0	0	0
Amarillo	25	11	3	9	2
Bryan	1	0	0	0	1
Childress	19	14	5	0	0
Corpus Christi	7	3	4	0	0
Dallas	0	0	0	0	0
Houston	0	0	0	0	0
Lubbock	32	26	5	1	0
Lufkin	2	2	0	0	0
Pharr	4	0	4	0	0
San Angelo	2	1	0	0	1
San Antonio	1	0	0	0	1
Tyler	2	1	1	0	0
Wichita Falls	1	1	0	0	0
Grand total	97	60	22	10	5

(b) Tally by maintenance section

District	Section	City	County	Site visit	Well fluid*	Total well count	Well type			
							Waste oil	Wash rack	Asphalt	Uncertain
Abilene	7	Colorado City	Mitchell			1	1	0	0	0
Amarillo	4	Canadian	Hemphill			1	1	0	0	0
Amarillo	5	Canyon	Randall	V		1	1	0	0	0
Amarillo	7	Claude	Armstrong			1	0	0	1	0
Amarillo	9	Dumas	Moore	V	A	4	2	0	2	0
Amarillo	10	Gruver	Hansford	V	W	5	2	1	2	0
Amarillo	12	Pampa	Gray			1	0	0	0	1
Amarillo	13	Panhandle	Carson	V	W	6	2	2	2	0
Amarillo	14	Perryton	Ochiltree			1	0	0	1	0
Amarillo	14	Darrouzett	Lipscomb			2	1	0	1	0
Amarillo	15	Stratford	Sherman	V		1	1	0	0	0
Amarillo	16	Vega	Oldham			1	1	0	0	0
Amarillo	18	Groom	Carson			1	0	0	0	1
Amarillo	18	E-Way	Potter/Randall	V		0	0	0	0	0

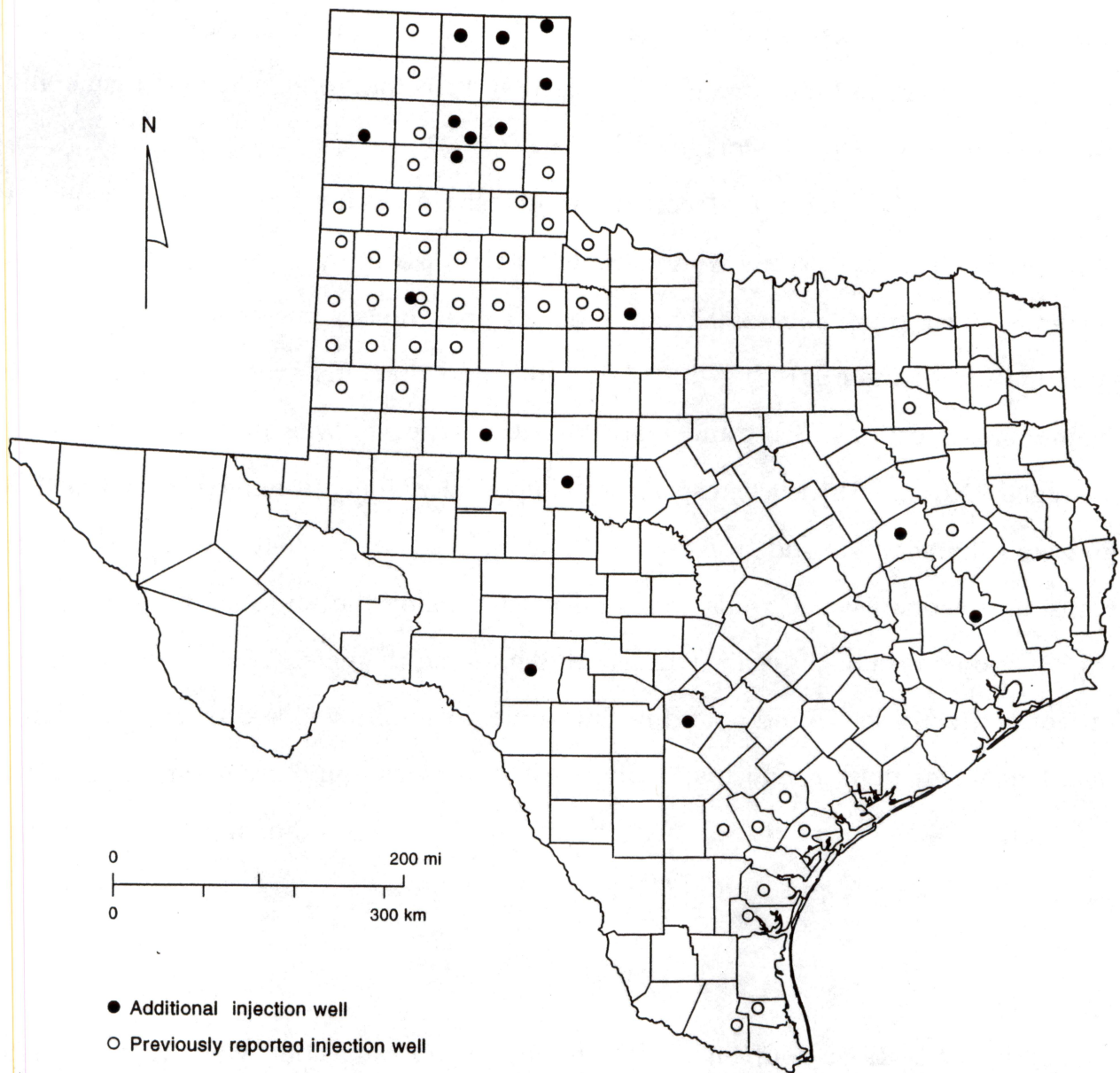
Table 1b (continued). Tally of injection wells by maintenance section

District	Section	City	County	Site visit	Well fluid*	Total well count	Well type			
							Waste oil	Wash rack	Asphalt	Uncertain
Bryan	3	Buffalo	Leon			1	0	0	0	1
Childress	1	Childress	Childress	V		2	2	0	0	0
Childress	2	Clarendon	Donley/Hall	V	O	1	1	0	0	0
Childress	3	Dickens	Dickens/King	V	W/O?	2	2	0	0	0
Childress	3	Guthrie	King	V		2	2	0	0	0
Childress	4	Matador	Motley	V		2	1	1	0	0
Childress	5	Munday	Knox	V	W	3	0	3	0	0
Childress	5	Benjamin	Knox	V	W	2	1	1	0	0
Childress	7	Quanah	Hardeman	V	O	1	1	0	0	0
Childress	9	Wellington	Collingsworth	V	W	2	2	0	0	0
Childress	12	Memphis	Hall	V	W	2	2	0	0	0
Corpus Christi	2	Beeville	Bee	V	W	1	1	0	0	0
Corpus Christi	4	George West	Live Oak	V	W	1	1	0	0	0
Corpus Christi	5	Goliad	Goliad	V	W	1	0	1	0	0
Corpus Christi	7	Kingsville	Kleberg	V	W	1	1	0	0	0
Corpus Christi	8	Robstown	Nueces	V	O	2	0	2	0	0
Corpus Christi	9	Rockport	Aransas			0	0	0	0	0
Corpus Christi	11	Refugio	Refugio	V		1	0	1	0	0
Dallas	36	Dallas	Dallas			0	0	0	0	0
Houston	4	Rosenberg	Fort Bend			0	0	0	0	0
Lubbock	1	Bovina	Parmer	V		2	2	0	0	0
Lubbock	2	Brownfield	Terry	V		2	2	0	0	0
Lubbock	3	Dimmitt	Castro			1	1	0	0	0
Lubbock	4	Floydada	Floyd	V		1	1	0	0	0
Lubbock	5	Lamesa	Dawson	V		3	2	0	1	0
Lubbock	6	Levelland	Hockley	V		2	2	0	0	0
Lubbock	7	Littlefield	Lamb	V		2	2	0	0	0
Lubbock	8	Lubbock (NE 289)	Lubbock	V		1	1	0	0	0
Lubbock	9	Lubbock (SE 84)	Lubbock	V	O	1	1	0	0	0
Lubbock	10	Morton	Cochran			1	1	0	0	0
Lubbock	11	Muleshoe	Bailey	V		1	1	0	0	0
Lubbock	12	Plains	Yoakum	V		1	1	0	0	0
Lubbock	13	Plainview	Hale	V		5	0	5	0	0
Lubbock	14	Post	Garza	V		2	2	0	0	0
Lubbock	15	Ralls	Crosby	V		1	1	0	0	0
Lubbock	16	Seminole	Gaines	V		1	1	0	0	0
Lubbock	17	Tahoka	Lynn	V		1	1	0	0	0
Lubbock	18	Tulia	Swisher			1	1	0	0	0
Lubbock	36/30	Lubbock (Municipal)	Lubbock	V		2	2	0	0	0
Lubbock	HQ	Lubbock (Slaton)	Lubbock			1	1	0	0	0

Table 1b (continued). Tally of injection wells by maintenance section

District	Section	City	County	Site visit	Well fluid*	Well type				
						Total well count	Waste oil	Wash rack	Asphalt	Uncertain
Lufkin	3	Crockett	Houston	V		1	1	0	0	0
Lufkin	6	Lufkin	Angelina	V		0	0	0	0	0
Lufkin	7	Nacogdoches	Nacogdoches	V		0	0	0	0	0
Lufkin	8	San Augustine	San Augustine	V		0	0	0	0	0
Lufkin	9	Shepherd	San Jacinto			1	1	0	0	0
Pharr	2	Edcouch	Hidalgo	V	W	1	0	1	0	0
Pharr	8	Raymondville	Willacy	V		3	0	3	0	0
San Angelo	1	Ballinger	Runnels			1	1	0	0	0
San Angelo	9	Robert Lee	Coke	V		0	0	0	0	0
San Angelo	10	Rock Springs	Edwards			1	0	0	0	1
San Antonio	10	San Antonio	Bexar			1	0	0	0	1
Tyler	2	Canton	Van Zandt	V	W/O	2	1	1	0	0
Wichita Falls	4	Gainsville	Cooke			0	0	0	0	0
Wichita Falls	7	Seymour	Baylor			1	1	0	0	0

* Well fluid includes asphalt (A), waste oil (O), and water (W) that appear to fill the well
ni not included in survey



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Figure 1. Location of 59 maintenance sections with confirmed injection wells. This survey confirmed the presence of injection wells at 17 maintenance sections in addition to 42 found in a preliminary TxDOT survey. We could not confirm injection wells at another 9 maintenance sections included in the preliminary TxDOT survey or questionnaire results.

Wells that received either waste oil and other non-aqueous phase liquids (NAPLs) or wastewater from wash racks are found in a variety of locations near site buildings and around the yard (fig. 2). Injection wells that received asphalt generally are found near the asphalt storage tanks (fig. 2).

We found a variety of construction techniques for the injection wells at maintenance sections. Wells were completed with a variety of materials—metal or cement culvert pipe, and steel casing—or left open hole; some completions used a combination of materials (fig. 3). Well depth and diameter were estimated by 35 maintenance sections (Scott and Dutton, 1996). Reported well depth and diameter averaged 22 ft and 31 inches, respectively. Reported well depth ranged from 3 to 40 ft and well diameter ranged from 16 to 120 inches. Oil waste wells, wash rack waste wells, and asphalt waste wells were constructed using the same kinds of materials (fig. 3) and so do not differ in typical well depth and diameter. Waste fluid (asphalt, oil, or water) was found standing in some injection wells during site visits; maintenance sections at which standing waste fluid was found are identified in table 1 (column labeled well fluid). Additional findings from the questionnaires are summarized in Scott and Dutton (1996).

Prioritized Ranking

The 59 sections confirmed to have one or more injection well were selected for prioritization using the 13 environmental ranking criteria. The results of the prioritized ranking are given in table 2, which includes total scores and scores for each of the 13 environmental ranking criteria. Total score ranged from a high of 200 for the first-ranked Gruver maintenance section (section number 10) to a low of 80 for the Groom maintenance section (section number 18), both in the Amarillo District (table 2). The top-ranked 10 percent of the maintenance sections (total of 7 sections) have scores greater than 155 (fig. 4). The remaining 90 percent of the

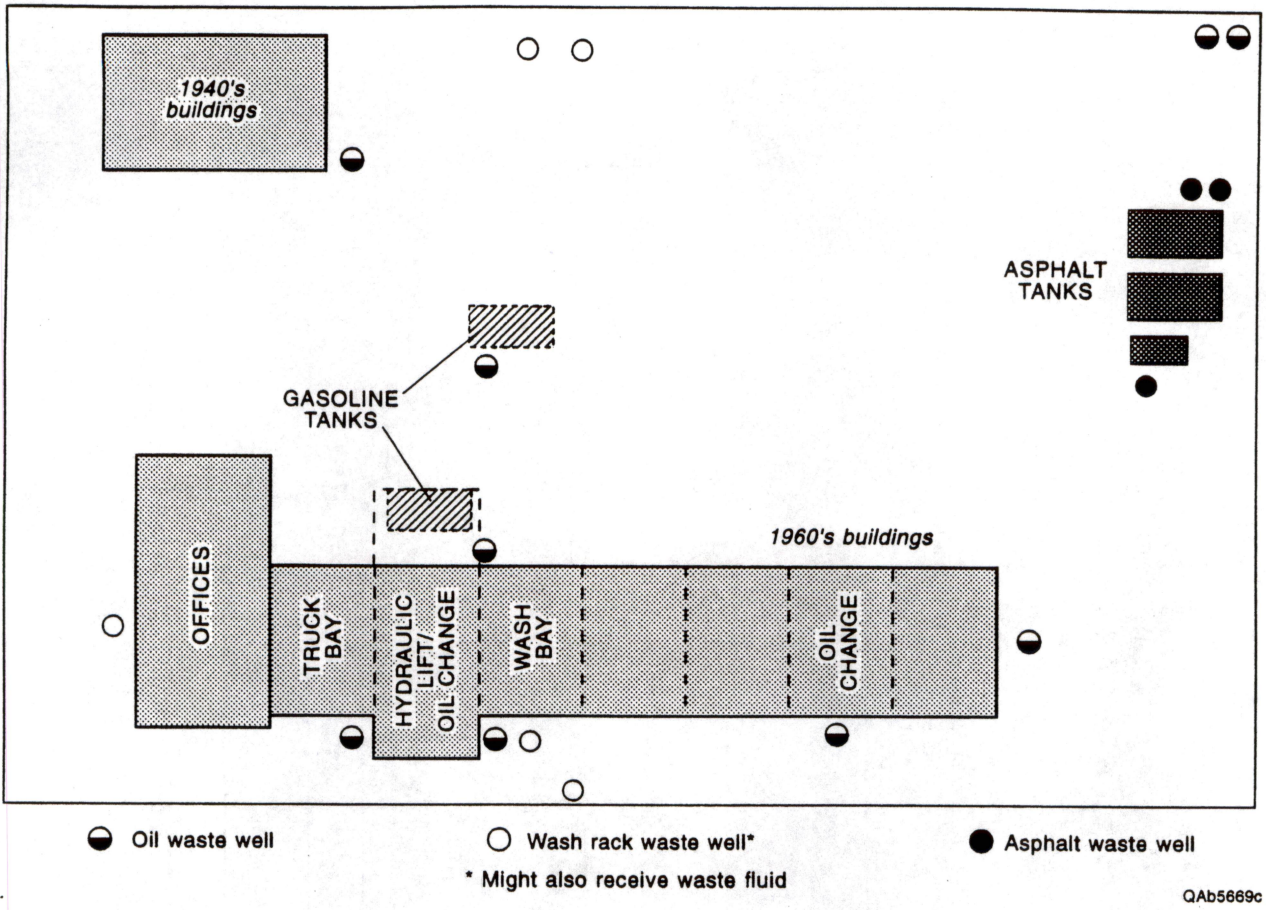
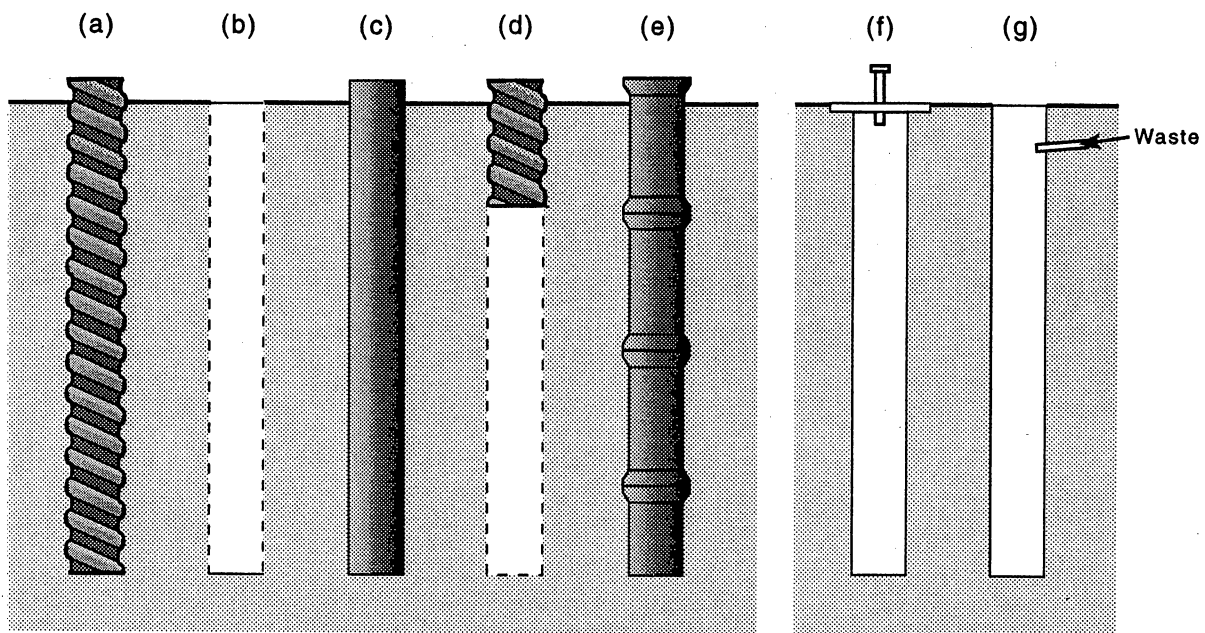


Figure 2. Typical locations of injection wells at a TxDOT maintenance section. The illustration is a composite drawn on the basis of various maintenance sections, none of which has all the wells shown.



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Figure 3. Construction materials and well completions used in TxDOT injection wells. Construction materials: (a) metal culvert pipe, (b) open hole (no casing), (c) steel casing, (d) metal culvert pipe from ground surface to some depth and open hole (no casing) at greater depth, and (e) cement culvert pipe. Well completions: (f) waste poured through a 3-inch-diameter above-ground pipe, and (g) waste piped underground through a 3-inch-diameter flow line from the maintenance building.

Table 2. Priority ranking of maintenance sections for remedial investigation.
 Score is sum of points assigned for the 13 environmental ranking criteria.

Priority ranking	Score	Site visit	District	Section	City	County	1		2		3		4		5	
							Distance to surface water	Distance to nearest wetland	Number of wetlands	Proximity to residences	Distance to nearest water well					
1	200	V	Amarillo	10	Gruver	Hansford	0	10	10	10	10	10	10	10	10	10
2	190	V	Amarillo	13	Parhandle	Carson	0	10	10	15	15	5	5	10	10	10
3	170	V	Amarillo	9	Dumas	Moore	0	0	0	0	0	10	10	10	10	10
3	170	V	Tyler	2	Canton	Van Zandt	10	10	10	10	10	5	5	10	10	10
3*	140	V	Childress	5	Munday	Knox	0	10	10	10	10	5	5	10	10	10
4	165	V	Lubbock	5	Lamesa	Dawson	5	10	10	10	10	5	5	10	10	10
4*	145	V	Lubbock	2	Brownfield	Terry	0	10	10	10	15	5	5	10	10	10
5	160		Amarillo	14	Darrouzett	Lipscomb	0	5	5	10	10	15	15	10	10	10
6	155	V	Lubbock	7	Littlefield	Lamb	0	10	10	10	10	5	5	10	10	10
7	145	V	Childress	4	Matador	Motley	10	10	10	10	10	10	10	0	0	0
7	145	V	Corpus Christi	4	George West	Live Oak	0	5	5	10	10	10	10	10	10	10
7	145	V	Lubbock	6	Levelland	Hockley	5	10	10	10	10	5	5	10	10	10
8	140	V	Childress	3	Guthrie	King	10	5	5	10	10	5	5	0	0	0
8	140	V	Lubbock	9	Lubbock (SE 84)	Lubbock	0	10	10	15	15	5	5	10	10	10
8	140	V	Lubbock	17	Tahoka	Lynn	0	10	10	10	10	5	5	10	10	10
9	135	V	Corpus Christi	8	Robstown	Nueces	0	10	10	10	10	5	5	0	0	0
9	135	V	Lubbock	1	Bovina	Parmer	0	10	10	10	10	15	15	10	10	10
9	135	V	Lubbock	36/30	Lubbock (Municipal)	Lubbock	0	10	10	10	10	5	5	0	0	0
10	130		Bryan	3	Buffalo	Leon	0	5	5	10	10	15	15	5	5	5
10	130	V	Childress	2	Clarendon	Donley/Hall	0	5	5	15	15	5	5	10	10	10
10	130	V	Childress	3	Dickens	Dickens/King	0	10	10	15	15	5	5	10	10	10
10	130	V	Corpus Christi	7	Kingsville	Kleberg	0	10	10	15	15	5	5	0	0	0
10	130	V	Lubbock	11	Muleshoe	Bailey	5	5	5	10	10	5	5	10	10	10
10	130	V	Lufkin	3	Crockett	Houston	15	10	10	15	15	5	5	10	10	10
10	130	V	Pharr	8	Raymondville	Willacy	0	10	10	10	10	5	5	0	0	0
10	130		Wichita Falls	7	Seymour	Baylor	0	5	5	10	10	5	5	10	10	10
11	125	V	Lubbock	8	Lubbock (NE 289)	Lubbock	0	10	10	10	10	5	5	10	10	10
11	125	V	Lubbock	13	Plainview	Hale	5	10	10	10	10	5	5	10	10	10
11	125		Lufkin	9	Shepherd	San Jacinto	0	5	5	10	10	5	5	5	5	5

* Assigned priority ranking higher than that based on score calculated from the 13 environmental criteria as discussed in text.

Table 2 (continued). Priority ranking of maintenance sections for remedial investigation

Priority ranking	Score	City	Section	6 Number of water wells	7 Depth to ground water	8 Annual precipitation	9 Rainwater runoff into well	10 Soil permeability classification	11 Aquifer	12 Injection well status	13 Injection well fluid
1	200	Gruver	10	5	0	5	15	10	20	15	90
2	190	Panhandle	13	5	0	5	15	0	20	15	90
3	170	Dumas	9	5	0	5	20	0	20	25	75
3*	170	Canton	2	5	25	20	0	0	20	25	30
3*	140	Munday	5	5	25	10	0	0	20	25	20
4	165	Lamesa	5	5	10	5	0	10	20	15	60
4*	145	Brownfield	2	5	5	5	0	10	25	15	40
5	160	Darrouzeit	14	5	15	5	10	10	20	15	40
6	155	Littlefield	7	15	10	5	0	10	25	15	40
7	145	Matador	4	0	25	10	0	10	20	15	25
7	145	George West	4	5	15	10	10	10	20	25	15
7	145	Levelland	6	10	5	5	0	10	25	15	35
8	140	Guthrie	3	0	25	10	0	10	10	15	40
8	140	Lubbock (SE 84)	9	5	10	5	0	10	25	25	20
8	140	Tahoka	17	15	15	5	0	10	25	15	20
9	135	Robstown	8	0	15	10	0	0	20	25	40
9	135	Bovina	1	5	0	5	0	10	20	15	35
9	135	Lubbock (Municipal)	36/30	0	15	5	0	10	25	15	40
10	130	Buffalo	3	0	10	15	5	10	25	15	15
10	130	Clarendon	2	5	10	5	0	10*	20	25	20
10	130	Dickens	3	5	10	10	0	10	0	15	40
10	130	Kingsville	7	0	25	10	20	0	20	15	10
10	130	Muleshoe	11	5	15	5	5	10	20	15	20
10	130	Crockett	3	5	5	20	0	10	0	15	20
10	130	Raymondville	8	0	15	10	5	0	20	25	30
10	130	Seymour	7	5	15	10	20	0	20	15	15
11	125	Lubbock (NE 289)	8	5	10	5	0	10	25	15	20
11	125	Plainview	13	5	5	5	0	10	20	15	25
11	125	Shepherd	9	0	10	20	20	10	10	15	15

* Assigned priority ranking higher than that based on score calculated from the 13 environmental criteria as discussed in text.

Table 2 (continued). Priority ranking of maintenance sections for remedial investigation

Priority ranking Score	Site visit	District	Section	City	County	1		2	3	4	5
						Distance to surface water	Distance to nearest wetland				
11	V	Corpus Christi	2	Beeville	Bee	5	5	10	10	5	0
12		Lubbock	10	Morton	Cochran	0	5	5	10	10	10
13		Amarillo	4	Canadian	Hemphill	0	5	5	5	5	10
13		Amarillo	7	Claude	Armstrong	0	5	10	10	5	10
13	V	Childress	1	Childress	Childress	0	10	10	10	5	0
13	V	Childress	5	Benjamin	Knox	0	10	15	15	15	0
13	V	Childress	9	Wellington	Collingsworth	0	0	0	0	5	0
13	V	Corpus Christi	5	Goliad	Goliad	0	5	10	10	5	0
13	V	Corpus Christi	11	Refugio	Refugio	0	10	10	10	5	10
13	V	Pharr	2	Edcouch	Hidalgo	10	10	10	10	15	0
13		San Angelo	1	Ballinger	Runnels	0	5	10	10	10	10
14	V	Childress	7	Quanah	Hardeman	0	10	10	10	10	0
14	V	Lubbock	12	Plains	Yoakum	0	10	10	10	10	0
14	V	Lubbock	14	Post	Garza	15	10	10	10	5	0
14		Lubbock	HQ	Lubbock (Slaton)	Lubbock	0	5	10	10	5	5
15		Abilene	7	Colorado City	Mitchell	0	5	10	10	5	10
15	V	Childress	12	Memphis	Hall	0	10	10	15	10	0
15	V	Lubbock	16	Seminole	Gaines	0	10	10	10	5	0
15		San Antonio	10	San Antonio	Bexar	15	5	10	10	5	5
16	V	Amarillo	5	Canyon	Randall	15	10	5	5	5	0
16		Amarillo	14	Perryton	Ochiltree	0	5	10	10	5	0
16		Amarillo	16	Vega	Oldham	0	5	5	10	10	0
16		Lubbock	3	Dimmitt	Castro	0	5	5	5	5	10
16		Lubbock	18	Tulla	Swisher	0	5	10	10	5	0
17	95	Amarillo	12	Pampa	Gray	0	5	10	10	5	5
17	95	Lubbock	4	Floydada	Floyd	0	10	10	10	5	0
17	95	Lubbock	15	Ralls	Crosby	0	10	10	10	5	10
18	85	V	Amarillo	Stratford	Sherman	0	5	10	10	5	10
18	85	San Angelo	10	Rock Springs	Edwards	0	5	5	10	5	0
19	80	Amarillo	18	Groom	Carson	0	5	5	10	5	0

Table 2 (continued). Priority ranking of maintenance sections for remedial investigation

Priority ranking Score	City	Section	6 Number of water wells	7 Depth to ground water	8 Annual precipitation	9 Rainwater runoff into well	10 Soil permeability classification	11 Aquifer classification	12 Injection well status	13 Injection well fluid
11	125	Beeville	2	0	10	15	0	20	25	15
12	120	Morton	10	5	5	0	10	25	15	20
13	115	Canadian	4	5	10	0	20	20	5	20
13	115	Claude	7	5	5	15	0	20	15	20
13	115	Childress	1	0	15	0	10	10	15	35
13	115	Benjamin	5	0	0	10	0	0	25	30
13	115	Wellington	9	0	15	0	10	20	25	30
13	115	Goliad	5	0	10	5	10	20	25	10
13	115	Refugio	11	5	25	0	0	20	5	10
13	115	Edcouch	2	0	10	0	0	20	25	5
13	115	Ballinger	1	5	25	5	10	0	15	10
14	110	Quanah	7	0	15	0	0	10	25	20
14	110	Plains	12	0	5	0	10	25	15	20
14	110	Post	14	0	0	0	10	0	15	40
14	110	Lubbock (Slaton)	HQ	5	10	5	10	25	15	15
15	105	Colorado City	7	10	5	5	10	10	15	15
15	105	Memphis	12	0	0	0	10	0	20	35
15	105	Seminole	16	0	5	0	10	25	15	20
15	105	San Antonio	10	5	15	5	0	0	15	15
16	100	Canyon	5	0	5	0	0	20	15	20
16	100	Perryton	14	0	0	10	10	20	15	20
16	100	Vega	16	0	0	15	0	20	15	20
16	100	Dimmitt	3	5	0	15	0	20	15	15
16	100	Tulla	18	0	5	0	10	25	15	20
17	95	Pampa	12	0	0	0	0	20	15	15
17	95	Floydada	4	0	5	0	0	25	15	20
17	95	Ralls	15	5	0	0	10	20	0	20
18	85	Stratford	15	5	0	0	0	20	5	20
18	85	Rock Springs	10	0	0	0	10	20	10	15
19	80	Groom	18	0	0	5	0	20	15	15

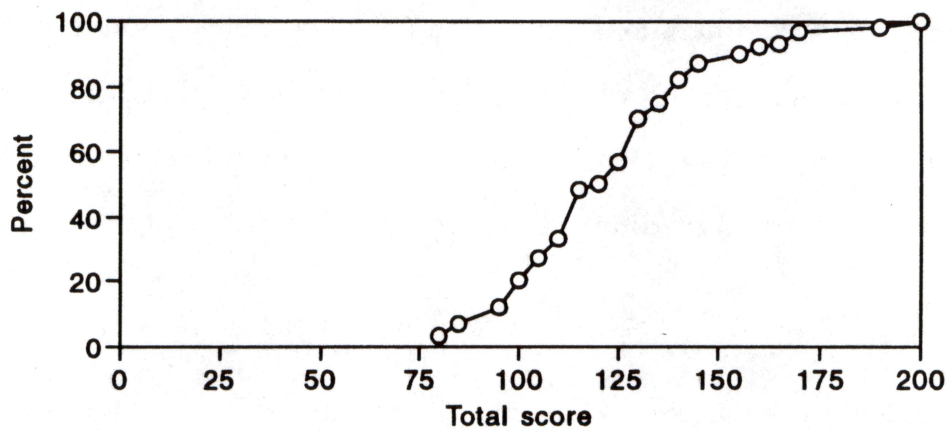


Figure 4. Cumulative distribution of total score for maintenance sections calculated from 13 environmental ranking criteria.

ranked maintenance sections have scores between 80 and 155. The 59 maintenance sections were assigned a relative rank from 1 to 19 on the basis of total score. Several maintenance sections received the same total score and thus tied for a given rank.

The Amarillo and Lubbock Districts have the greatest number of sections ranked at high priority for further investigation (fig. 5b, f). The Tyler District (fig. 5k) includes one top-ranked maintenance section (Canton, table 2). The Lubbock as well as the Childress and Corpus Christi Districts have several medium- and lower-ranked sections (fig. 5f, d, e). In the other 7 districts with injection wells, wells are found at only one or two medium- or lower-ranked maintenance sections.

Sensitivity Analysis

To evaluate how sensitive the final score and priority rank are to the choice of environmental ranking criteria, we successively dropped out each of the 13 criteria and then recalculated the score and redetermined the rank of the maintenance sections. The highest and average scores generally were less, of course, when any one of the criteria were dropped compared to the total score when all criteria were included. We rescaled all scores, therefore, to allow a comparison between the recalculated and original scores and priority ranks. To rescale the scores, we used a standard formula to range the scores by subtracting the minimum score and dividing by the range, as follows

$$\text{Ranged score} = \frac{\text{Score}_{\text{section}} - \text{Score}_{\text{minimum}}}{\text{Score}_{\text{maximum}} - \text{Score}_{\text{minimum}}} \quad (1)$$

where $\text{Score}_{\text{section}}$ is the total score for a given maintenance section on the basis of the ranking criteria and $\text{Score}_{\text{minimum}}$ and $\text{Score}_{\text{maximum}}$ are the lowest and highest scores, respectively, among the ranked maintenance sections. *Ranged score*, calculated by equation 1, varies from 0 to 1 for any given maintenance section regardless of its total initial score. Once the ranged scores were recalculated, relative

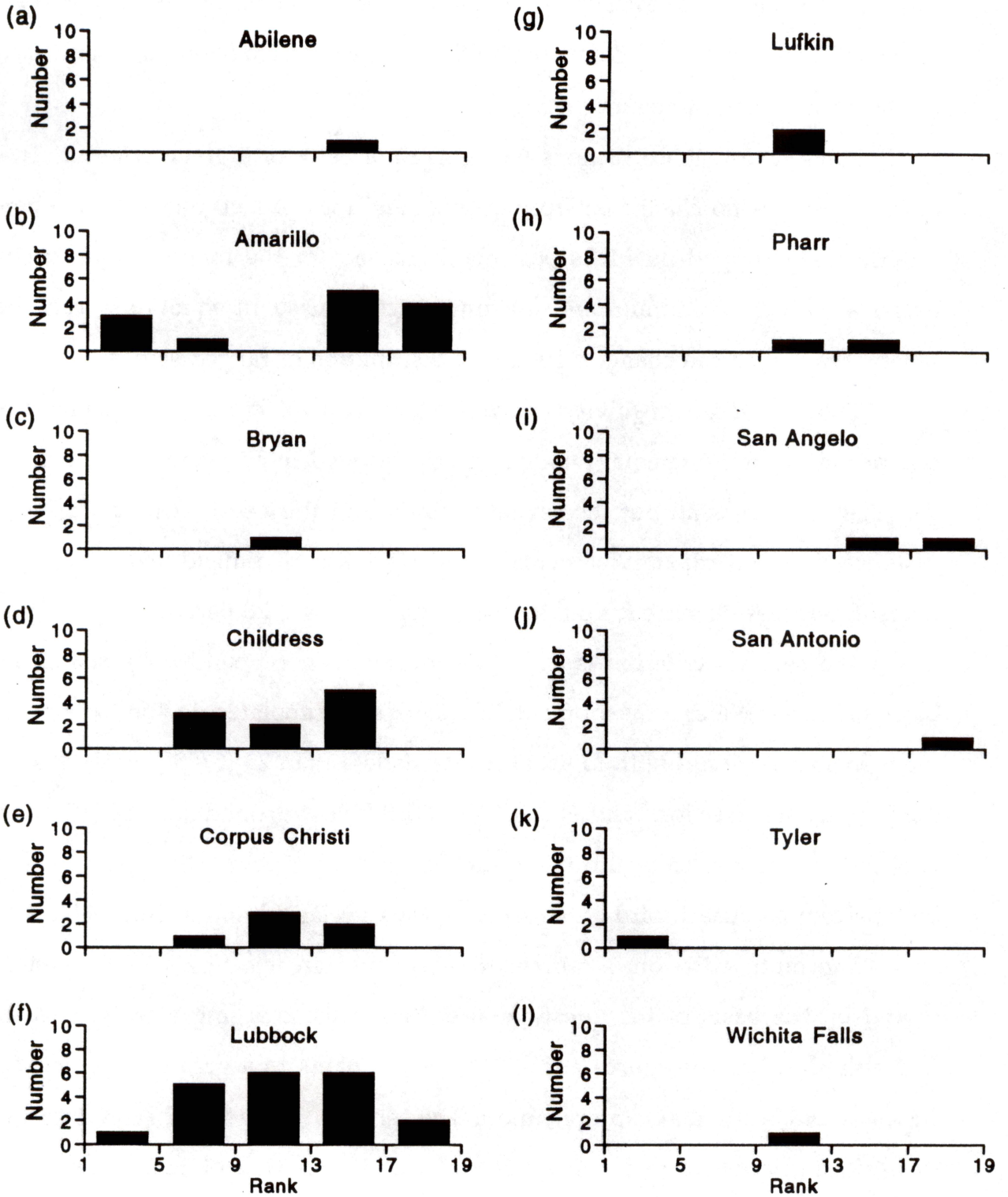


Figure 5. Distribution of priority rank of maintenance sections with injection wells sorted by district.

rank was reassigned to each of the 59 maintenance sections. The recalculated ranged score and rank were then compared to the original ranged score and rank assigned on the basis of all 13 criteria.

Some maintenance sections had a score of zero for a given criterion. In these cases, there was no change between original and recalculated total scores when that criteria was dropped out. It is possible, however, for the ranged score to change, because both the minimum and maximum scores used in equation 1 can change. Relative rank also can change with a new distribution of ranged scores.

The results of sensitivity analysis are shown in figure 6. Dropping out any one of the 13 environmental ranking criteria resulted in an average score change of less than 3 percent all but the seventh, ninth, and thirteenth criteria (fig. 6a). The distance between maximum increase and decrease in ranged score averaged 16 percent, but that distance for the thirteenth criterion was 78 percent.

The seventh criterion is depth to groundwater (appendix D), scored on the basis of Texas Water Development Board data extrapolated to the vicinity of the maintenance section. Depth to groundwater is less than 25 ft (25 points) at seven of the maintenance sections and lies at 25 to 50 ft below ground surface (15 points) at another 12 sections. Thus, dropping out the seventh criterion changes average score by 8 percent because 1 third of the sections have a relatively high score (table 3).

The ninth criterion is rainwater runoff into an injection well (appendix D), scored on the basis of the questionnaire. Rainwater charging a well can increase hydraulic head at the source and drive contaminants to a greater distance than at sites without wells that capture runoff. The sensitivity of ranged score and rank to this criterion appears to be an artifact of the distribution of scores. Less than 40 percent of the maintenance sections reported that rainwater runoff is allowed to enter an injection well or sump or cistern; the remainder received a score of zero (table 3). More than 20 percent of the sections, however, received a score of 10 or

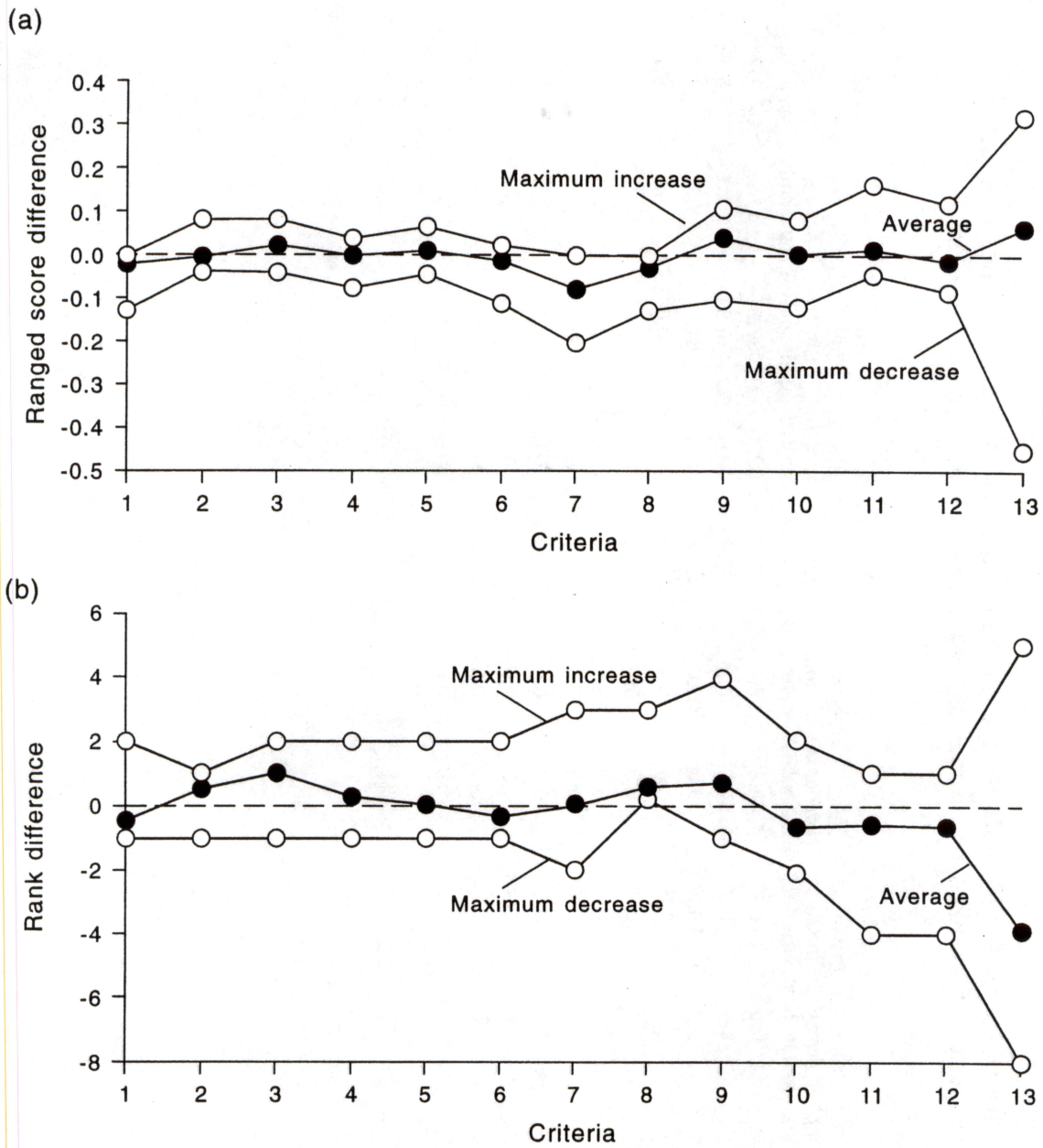


Figure 6. Sensitivity analysis showing how ranged score and rank differ when each of the 13 environmental ranking criteria are deleted.

Table 3. Summary of scores for 13 ranking criteria assigned to TxDOT maintenance sections. Numbers are percent of 59 ranked maintenance sections receiving a given score.

Total score	1		2		3		4		5		6		7		8		9		10		11		12		13	
	Distance to surface water	Distance to nearest wetland	Number of wetlands	Proximity to residences	Distance to nearest water well	Number of water wells	Depth to ground water	Annual precipitation	Rainwater runoff into well	Soil permeability	Aquifer classification	Injection well status	Injection well fluid													
0	78.0	3.4	3.4	0.0	40.7	45.8	25.4	0.0	62.7	37.3	11.9	1.7	0.0													
5	8.5	42.4	5.1	74.6	8.5	47.5	20.3	57.6	13.6	0.0	0.0	5.1	1.7													
10	6.8	54.2	76.3	16.9	50.8	6.8	22.0	28.8	6.8	61.0	8.5	1.7	6.8													
15	6.8	0.0	15.3	8.5	0.0	0.0	20.3	6.8	10.2	0.0	0.0	66.1	20.3													
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	6.8	1.7	55.9	1.7	33.9													
25	0.0	0.0	0.0	0.0	0.0	0.0	11.9	0.0	0.0	0.0	23.7	23.7	3.4													
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8													
35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8													
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.6													
>40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8													

more points on this criterion, reflecting runoff occurring either infrequently, sometimes, or frequently. The combination of (1) a large number of sections (~63 percent) having a score of zero, and (2) a considerable number of sections (~24 percent) having a scores greater than 10, makes rank and ranged score more sensitive to the ninth criterion than to most other criteria.

In comparison, results were much less sensitive to the first criterion (distance to surface water). The minimum and maximum scores remained unchanged when the first criterion was dropped, so relatively few ranged scores changed. For all criteria other than 9 and 13, less than 50 percent of ranked maintenance sections received a score of zero.

The thirteenth criterion is the type of waste fluid discharged to an injection well at a maintenance section, also scored on the basis of the questionnaire (appendix A). Scores are added for each well receiving waste fluid. The results are extremely sensitive to the thirteenth criterion because of the large percentage of sections with high scores. More than 30 percent of ranked sections scored 30 or more points on this question, which is greater than that scored on any other criteria (table 3). The highest score was 90 points for the top-ranked Gruver and Panhandle maintenance sections in the Amarillo District (table 2). In addition, less than 10 percent of the ranked sections scored 10 or fewer points. The minimum and maximum scores changed markedly when the thirteenth criterion was dropped in the sensitivity analysis, which resulted in many changes in ranged score and relative rank.

The priority ranking has an overall uncertainty of approximately ± 2 , based on the difference between original and recalculated rank for all criteria (fig. 6b). This means that we cannot confidently state that, for example, the first-ranked section should have higher priority than a third-ranked section, and so forth. The first-ranked section, however, most likely can be assigned higher priority than a fourth

or lower ranked section. Accordingly, we grouped the ranked maintenance sections, as summarized in figure 6, to take into account the limited sensitivity of calculated rank. The width of the histogram groups shown in figure 6 is ± 2 , or 4, ranks. The first two groups shown in figure 6, with ranks of 1 and 9, account for the top 30 percent of ranked maintenance sections.

Anomalous Rankings

Three maintenance sections have somewhat lower rank than might have been expected:

- the Brownfield maintenance section (Lubbock District), which a total score of 145 and a calculated rank of 7, which was changed to a rank of 4;
- the Munday maintenance section (Childress District), which a total score of 140 and a calculated rank of 8, which was changed to a rank of 3; and
- the Dickens maintenance section (Childress District), which a total score of 130 and a calculated rank of 10 (table 2).

Brownfield Maintenance Section

Only 7 maintenance sections (<12 percent of the ranked sections) received a higher score than the Brownfield maintenance section. The Brownfield maintenance section has 2 abandoned waste oil injection wells. Both are open-hole injection wells (fig. 3b), 36 inches in diameter and 30 ft in depth. Mainly waste oil was discharged into one injection well located at the southwest corner of the warehouse; fluids were pumped out and the well was backfilled with dirt in the mid-1980's and is now covered over. The second injection well, located at the southeast corner of the property, was used for disposal of asphalt, diesel fuel, and kerosene solvents used to clean asphalt from vehicles. This injection well may have

caved in after abandonment. The waste fluids discharged into the injection wells were reported in the questionnaire as unknown.

We have two reasons for considering the ranking score of the Brownfield maintenance section to be too low. First, in addition to municipal water wells located within 0.5 mi, there are water-supply wells located within 1.0 mi downgradient of the maintenance section. The fifth ranking criterion (distance to nearest water well) assigns a score of 10 points for sections where wells are within 0.5 mi or a score of 5 points where wells are within 0.5 to 1 mi (appendix D). Second, the thirteenth ranking criterion (injection well fluid) specifies a score of only 15 points for each well at sections with unknown contaminants (appendix D). If hazardous wastes were known to be discharged to both wells, the total score would be 10 points higher. This minimum 10-point shift would move the Brownfield maintenance section up one step in rank from 7 to 6; points for additional nearby wells at a distance of more than 0.5 mi would move the rank up to 5 or 4 (table 2). To conservatively reflect the potential risk, tables 2 and 4 give a determined rank of 4 for the Brownfield maintenance section, rather than the calculated rank of 7. A priority rank of 4 would be considered significantly greater than a rank of 7, given the ± 2 uncertainty in calculated ranking.

Munday Maintenance Section

Eighteen percent of the maintenance sections received a higher score and rank than the Munday maintenance section. The Childress District, including the Munday maintenance section, was exempted from returning questionnaires. Our findings, therefore, are based on interviews with TxDOT personnel at the maintenance section (appendix B). Two injection wells of the style shown in figure 3a or 3d are visible at the facility; a third was said to now be covered by a sidewalk. The injection wells are reportedly as much as 25 ft deep. Whereas depth to

groundwater in the area typically is at a depth of 40 to 45 ft, depth to water at the maintenance section is 22 ft (Leftwich and Rainwater, 1992c). Because of the proximity of the water table, fluid discharged to these wells has the potential to reach the local groundwater.

A previous study at the Munday maintenance section reported one of these wells as a waste oil injection well and found evidence of local subsurface contamination with the presence of benzene, toluene, ethyl-benzene, and xylene (collectively referred to as BTEX and found in contamination from liquid hydrocarbon fuels as well as other petroleum products, such as motor oil) and trace quantities of chlordane, a pesticide (Leftwich and Rainwater, 1992c). TxDOT maintenance section personnel, however, stated during our site visits that there are two wells that received only wastewater from wash racks, and a third that received wastewater from a workshop sink. To be consistent with the remainder of the data base, these injection wells were scored as wastewater disposal wells on the basis of the information provided to us during site visits. Score and rank would have been significantly higher, of course, if the section was scored as having as many as three injection wells that received waste oil or other potential contaminants. As previously stated, the results are very sensitive to the thirteenth criterion on the type of waste fluid discharged to an injection well. An additional 30 points moves the Munday maintenance section from a rank of 8 to a rank of 3. Tables 2 and 4 give a determined rank of 3 for the Munday maintenance section, rather than the calculated rank of 8, to conservatively reflect the potential risk. This illustrates the importance of accurate information on the type of waste fluid discharged to wells.

Dickens Maintenance Section

The Dickens maintenance section was identified in the preliminary TxDOT list of maintenance sections as having a high-priority for further study in part

because of Dickens Springs, which is less than 0.5 mile northeast of the facility. Possible contamination from injection wells at the maintenance section, however, most likely would move with groundwater to the south and southwest, away from Dickens Springs.

Thirty percent of the ranked sections received a higher score in this study than the Dickens maintenance section. The lower than expected score for the Dickens site is primarily due to the absence of major and minor aquifers in the area (ranking question 11) and relatively low annual precipitation (question 8); the water supply for the City of Dickens is located approximately 14 miles west of town (question 5). The highest-ranking maintenance sites in this study had several waste oil injections wells, which contributed to very high total scores (question 13), whereas the Dickens site reported only two injection wells. Remaining waste fluid already had been removed from the injection wells before this study, which also contributed to a lower total score and ranking (question 12). We found no reason to determine a rank for the Dickens maintenance section different from the calculated rank.

CONCLUSIONS

The Amarillo and Lubbock Districts have the greatest number of sections ranked at high priority for further investigation and the Tyler District includes one top-ranked maintenance section (table 4; fig. 5). The Lubbock as well as the Childress and Corpus Christi Districts have several medium- and lower-ranked sections. In the other 7 districts with injection wells, wells are found at only one or two medium- or lower-ranked maintenance sections. A sensitivity analysis indicates that the priority ranking has an uncertainty of about ± 2 . This means that the first-ranked section, for example, should have higher priority than a fourth- or lower-ranked section, and a fourth-ranked section can be assigned a higher priority than a

Table 4. Priority ranking of maintenance sections for remedial investigation sorted by district. See table 1 for information on injection well types.

Priority ranking	Score	District	Section	City	County	Total well count
15	105	Abilene	7	Colorado City	Mitchell	1
1	200	Amarillo	10	Gruver	Hansford	5
2	190	Amarillo	13	Panhandle	Carson	6
3	170	Amarillo	9	Dumas	Moore	4
5	160	Amarillo	14	Darrouzett	Lipscomb	2
13	115	Amarillo	4	Canadian	Hemphill	1
13	115	Amarillo	7	Claude	Armstrong	1
16	100	Amarillo	5	Canyon	Randall	1
16	100	Amarillo	14	Perryton	Ochiltree	1
16	100	Amarillo	16	Vega	Oldham	1
17	95	Amarillo	12	Pampa	Gray	1
18	85	Amarillo	15	Stratford	Sherman	1
19	80	Amarillo	18	Groom	Carson	1
10	130	Bryan	3	Buffalo	Leon	1
3*	140	Childress	5	Munday	Knox	3
7	145	Childress	4	Matador	Motley	2
8	140	Childress	3	Guthrie	King	2
10	130	Childress	2	Clarendon	Donley/Hall	1
10	130	Childress	3	Dickens	Dickens/King	2
13	115	Childress	1	Childress	Childress	2
13	115	Childress	5	Benjamin	Knox	2
13	115	Childress	9	Wellington	Collingsworth	2
14	110	Childress	7	Quanah	Hardeman	1
15	105	Childress	12	Memphis	Hall	2
7	145	Corpus Christi	4	George West	Live Oak	1
9	135	Corpus Christi	8	Robstown	Nueces	2
10	130	Corpus Christi	7	Kingsville	Kleberg	1
11	125	Corpus Christi	2	Beeville	Bee	1
13	115	Corpus Christi	5	Goliad	Goliad	1
13	115	Corpus Christi	11	Refugio	Refugio	1

Table 4 (continued). Priority ranking of maintenance sections for remedial investigation sorted by district.

Priority ranking	Score	District	Section	City	County	Total well count
4	165	Lubbock	5	Lamesa	Dawson	3
4*	145	Lubbock	2	Brownfield	Terry	2
6	155	Lubbock	7	Littlefield	Lamb	2
7	145	Lubbock	6	Levelland	Hockley	2
8	140	Lubbock	9	Lubbock (SE 84)	Lubbock	1
8	140	Lubbock	17	Tahoka	Lynn	1
9	135	Lubbock	1	Bovina	Parmer	2
9	135	Lubbock	36/30	Lubbock (Municipal)	Lubbock	1
10	130	Lubbock	11	Muleshoe	Bailey	1
11	125	Lubbock	8	Lubbock (NE 289)	Lubbock	1
11	125	Lubbock	13	Plainview	Hale	5
12	120	Lubbock	10	Morton	Cochran	1
14	110	Lubbock	12	Plains	Yoakum	1
14	110	Lubbock	14	Post	Garza	2
14	110	Lubbock	HQ	Lubbock (Slaton)	Lubbock	1
15	105	Lubbock	16	Seminole	Gaines	1
16	100	Lubbock	3	Dimmitt	Castro	1
16	100	Lubbock	18	Tulia	Swisher	1
17	95	Lubbock	4	Floydada	Floyd	1
17	95	Lubbock	15	Ralls	Crosby	1
10	130	Lufkin	3	Crockett	Houston	1
11	125	Lufkin	9	Shepherd	San Jacinto	1
10	130	Pharr	8	Raymondville	Willacy	3
13	115	Pharr	2	Edcouch	Hidalgo	1
13	115	San Angelo	1	Ballinger	Runnels	1
18	85	San Angelo	10	Rock Springs	Edwards	1
15	105	San Antonio	10	San Antonio	Bexar	1
3	170	Tyler	2	Canton	Van Zandt	2
10	130	Wichita Falls	7	Seymour	Baylor	1

* Assigned priority ranking higher than that based on calculated environmental score as discussed in text.

section ranked seventh. The distribution of environmental scores shows that the top 30 percent of ranked maintenance sections have a rank of 9 or more (the first two histogram groups shown in figure 6); the lowest assigned rank was 19 because of tied scores.

This comprehensive ranking assigned a lower priority for further investigations at one maintenance section (Dickens, ranked 10 out of 19) than the high priority assigned to it in the preliminary TxDOT inventory. On the other hand, two maintenance sections (Brownfield and Munday) were assigned a priority higher than that calculated on the basis of the 13 environmental scoring criteria. These increases in assigned priority were made on the basis of environmental characteristics not taken into account by the scoring criteria to conservatively prioritize further investigations to reduce risk to public health and safety. Other adjustments might be made on the basis of criteria that were beyond the scope of this study, for example, potential hazards such as buried waste or LPSTs and institutional factors such as land ownership.

ACKNOWLEDGMENTS

We would like to acknowledge the cooperation of many district and maintenance section supervisors for their assistance. This survey could not have been conducted without the willing candor of these TxDOT staff and their efforts to contact employees, both working and retired, who might have information about injection wells, and to provide accurate and complete responses to the questionnaire. We also thank Martina Blüm, Wan-Joo Choi, Thomas Gustavson, and Juan Jimenez for their assistance in compiling environmental information and data reduction.

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Appendix A

District and Maintenance Section Questionnaire

Texas Department of Transportation Questionnaire

District Name _____

Section Number _____

County _____

Address _____

Telephone Number/Fax _____

Maintenance Supervisor or Area Engineer _____

Length of time at this location? _____

Predecessor's Name? _____

I STORAGE FACILITY INFORMATION

1. Maintenance Section Setting:

Rural

Urban

Residential (closest residence _____ ft).

2. How was liquid waste disposed/stored on site?

Above ground tanks (number _____)

Below ground tanks (number _____)

Waste oil cisterns (number _____)

Injection wells (number _____)

Other. Explain: _____

3. How many injection wells are located at the maintenance yard? _____

4. What are well diameters: _____ (in) and depths? _____ (ft).

_____ (in) and depths? _____ (ft).

_____ (in) and depths? _____ (ft).

5. Are wells cased, uncased, or partially cased? _____

6. Are any of these wells abandoned or no longer used? Yes No

7. If abandoned, are wells:
- Filled with cement
 - Backfilled with soil or rock
 - No longer used
 - Other. Explain: _____
- _____

8. When were injections wells first used? _____ Last used? _____

9. When were storage tanks first used? _____ Last used? _____

10. Is or was there standing oil/waste in the injection wells? Yes No
If so, how deep? _____ ft.

11. Are there monitoring wells in the maintenance yard? Yes No
If so, how many _____

12. Are there septic tanks or drain fields located on site? Yes No
If so, how many? _____

13. Please describe location or provide maps/plans showing locations of injection wells and storage tanks and indicate other features such as surface tanks, septic systems, lateral leach fields, monitoring wells, etc.

14. What is/was the source of drinking water for the maintenance site?

- Water well on site
- Municipal or utility district water
- Bottled water
- Other _____

15. Are there water wells within 0.5 mile of the maintenance section?

- Yes No

Please give the direction and distance to each water well: _____

II. INJECTION PRODUCTS

16. Please try to estimate the types and volumes of wastes. (For example, are there records for the amount of vehicle oil, transmission fluid, and/or hydraulic fluids used annually at site that suggest the amount and type of waste products?). Please provide summary describing the method of calculation: _____

17. What types of fluids were disposed of into the wells:

- Motor oil
- Antifreeze
- Transmission/brake fluids
- Hydraulic fluids
- Paint
- Paint thinner
- Other solvents (carburetor cleaner, etc.)
- Acids

- Herbicides
- Pesticides
- Waste water from general operations.
- Waste water from equipment/vehicle wash racks.
- Sewage
- Other _____
- Other _____
- Other _____
- Other _____

18. Did rain water drain into injection wells? Yes No

If so, when:

- Infrequently (only during heaviest rains).
- Sometimes
- Frequently (every rainfall event).

III. ADDITIONAL INFORMATION

19. Who are the individuals for this section or District most knowledgeable about injection well locations and wash disposal?

Name	Address	Telephone. Number
------	---------	-------------------

Return questionnaire to:

Erin S. Trujillo
 Environmental Quality Specialist
 Texas Department of Transportation
 Environmental Quality Affairs Division
 125 East 11th Street
 Austin, TX 78701-2483

Appendix B

Information Collected During Site Visits

List of maintenance section visit summaries

District	Section	City	County
Amarillo	5	Canyon	Randall
Amarillo	9	Dumas	Moore
Amarillo	10	Gruver	Hansford
Amarillo	13	Panhandle	Carson
Amarillo	15	Stratford	Sherman
Amarillo	18	E-Way	Potter/Randall
Childress	1	Childress	Childress
Childress	2	Clarendon	Donley/Hall
Childress	3	Dickens	Dickens/King
Childress	3	Guthrie	King
Childress	4	Matador	Motley
Childress	5	Munday	Knox
Childress	5	Benjamin	Knox
Childress	7	Quanah	Hardeman
Childress	9	Wellington	Collingsworth
Childress	12	Memphis	Hall
Corpus Christi	2	Beeville	Bee
Corpus Christi	4	George West	Live Oak
Corpus Christi	5	Goliad	Goliad
Corpus Christi	7	Kingsville	Kleberg
Corpus Christi	8	Robstown	Nueces
Corpus Christi	11	Refugio	Refugio
Lubbock	1	Bovina	Parmer
Lubbock	2	Brownfield	Terry
Lubbock	4	Floydada	Floyd
Lubbock	5	Lamesa	Dawson
Lubbock	6	Levelland	Hockley
Lubbock	7	Littlefield	Lamb
Lubbock	8	Lubbock (NE 289)	Lubbock
Lubbock	9	Lubbock (SE 84)	Lubbock
Lubbock	11	Muleshoe	Bailey
Lubbock	12	Plains	Yoakum
Lubbock	13	Plainview	Hale
Lubbock	14	Post	Garza
Lubbock	15	Ralls	Crosby
Lubbock	16	Seminole	Gaines
Lubbock	17	Tahoka	Lynn
Lubbock	36/30	Lubbock (Municipal)	Lubbock

List of maintenance section visit summaries (continued)

District	Section	City	County
Lufkin	3	Crockett	Houston
Lufkin	6	Lufkin	Angelina
Lufkin	7	Nacogdoches	Nacogdoches
Lufkin	8	San Augustine	San Augustine
Pharr	2	Edcouch	Hidalgo
Pharr	8	Raymondville	Willacy
San Angelo	9	Robert Lee	Coke
Tyler	2	Canton	Van Zandt

Amarillo District
Canyon, Section 05
Randall County

Ken W. Prestidge (806) 655-4372

June 13-14, 1996

General Information:

- 1960's vintage building located on the west side of Canyon (figure 1).
- Two 12,000 gallon asphalt tanks.
- City water supply.
- City sewage line runs north-south along west side of facility; residences further to the southeast.
- There is an open field on the west side of facility.
- County truck maintenance barn and warehouses are located on the east side of facility.
- Small business and cattle pen, and residence north of site on other side of SH 60; Distance to residence 0.10 mi.
- Open field with grass on south side of maintenance facility on south side of railroad tracks that border facility.
- Slope of topography is south towards the railroad tracks and away from Palo Duro Creek.
- Trucks cleaned in yard; equipment includes 1 loader, 8 dump trucks, 1 back hoe, 2 graders, 2 tractors, and 4 one-ton pickups; approximately 25 pieces total.
- Wilkes Stevens has been with facility for some time and provided much of the information.

Waste Disposal Information:

- Roller drain from shop building ran into injection well that was covered several years ago; drain backed up and they had to pour waste products into well.
- Injection well would fill up and have to be pumped out every couple of years
- Estimated that 90% water and 10% waste oil products ran into injection well.
- Wash water runs into grease trap located on west side of maintenance building; grease trap runs into sewer system.
- About 1 ft of standing water/oil mix in grease trap; mostly water.

Waste Cistern Description:

- Old injection well is located at southwest corner of shop south of grease trap; this well was pumped out and filled with caliche several years ago.
- Inner diameter of tin-horn pipe 18 to 24 inches
- Total depth of injection well is estimated to be 20 to 25 ft.
- Well was originally described as cement pipe 6 ft in diameter and 6 ft deep filled with gravel; this might have been some type of septic system in yard.
- Grease trap, also located on west side of building, consists of 2 x 3 ft cement tank.
- A 3-4 inch diameter pipe inside cement grease trap is curve downward which allows the waste water to flow up leaving silt and grease in trap.
- Top of grease trap is 4 in above ground level; no runoff can enter grease trap.

Hydrology of Area

- TxDOT employees estimated most water in area wells area are around 180 ft deep.
- Charles Newton with the City of Canyon (806) 655-5003, stated that their water wells are about 160 ft deep with static levels around 140 ft in Ogallala.
- The maintenance section is located on a small hill with SH 60 serving as a ground water divide; north of SH 60, ground water flows northward towards Palo Duro Creek, whereas runoff is southward on the south side of the interstate.
- Palo Duro Creek, located approximately 0.50 miles to the north of the maintenance site, runs from west to east.
- Runoff at the maintenance site flows southward towards railroad tracks and an open field away from Palo Duro Creek.
- Tierro Blanco Creek is located 1.50 miles south of maintenance site.

Canyon (Section 05) Injection Well Summary:

The one abandoned waste injection well at the Canyon maintenance site is located near the southwest corner of the shop building. This well was pumped out and backfilled with caliche several years ago and is now covered. The original well was probably 24 inch diameter in-horn approximately 20 to 25 ft deep. A 20 ft long galvanized steel pipe carried a mixture of approximately 90% water and 10% waste oil/fluids from the maintenance shop to the injection well; the well had to be pumped out every 2 years or so. Eventually, the galvanized pipe plugged up and waste oil products were hand-carried to injection well. Runoff from maintenance site is southward away from Palo Duro Creek but towards Tierro Blanco Creek 1.50 miles south of site. Depth to ground water is estimated to be 140 ft.

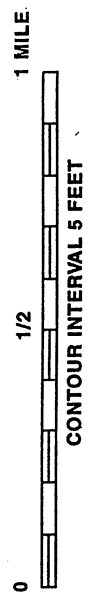
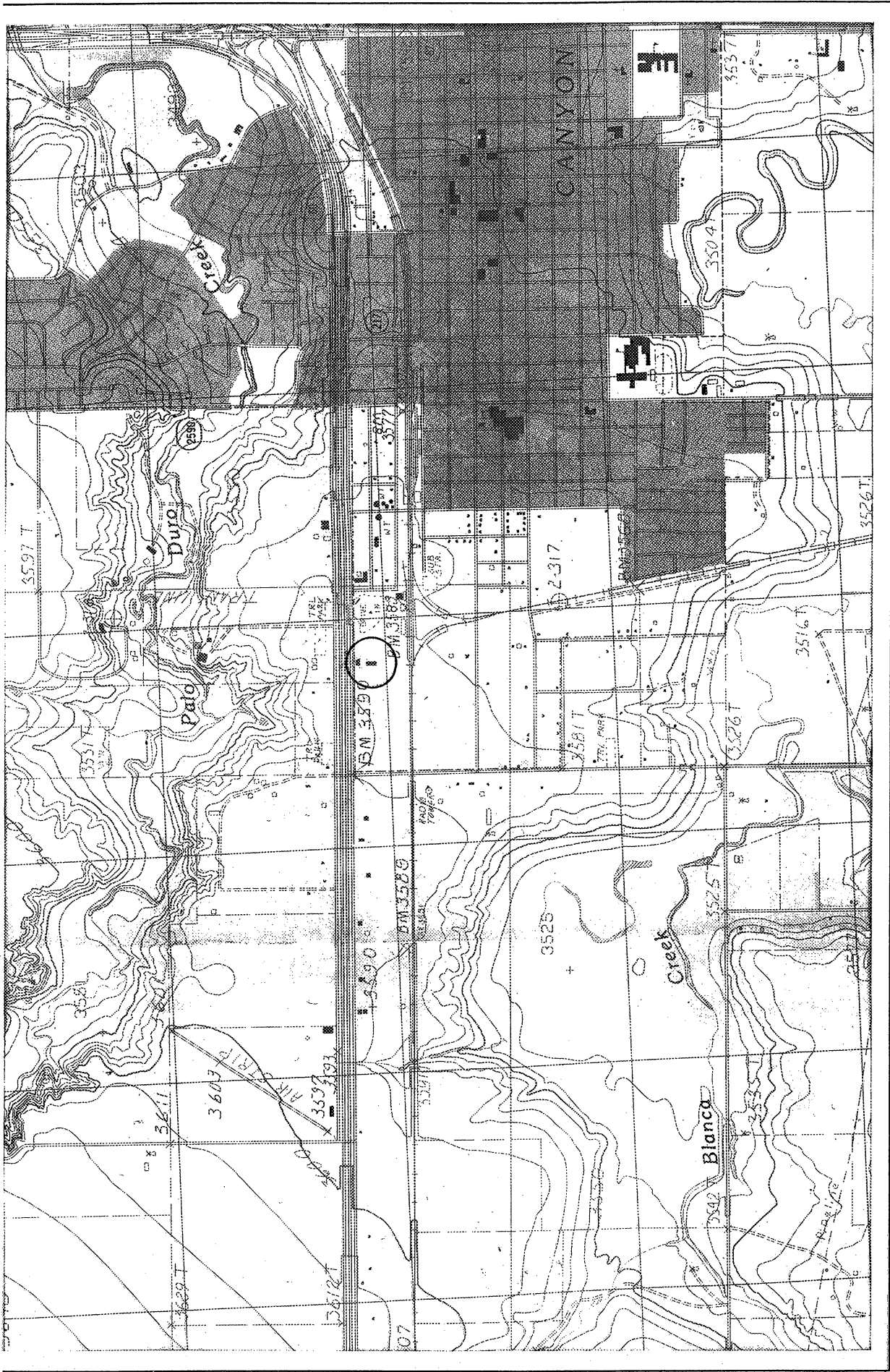


Figure 1. Location of the Canyon maintenance section (05), Randall County, Amarillo District.

Amarillo District
Dumas, Section 09
Moore County

Wes McDugal (806) 935-4501
July 23, 1996

General Information:

- Maintenance section is located close to city limits on the west side of Dumas (figure 1).
- Mostly 1950's-style buildings and one 1940 style building composed of sheet metal.
- There is a possibility that this maintenance section will be moved.
- Maintenance site contained only 2 trucks and one pick-up many years ago.
- Always on city sewer system.
- Old park located west of maintenance section surrounded by cottonwood trees.
- Open fields are located to northwest although a grain silo or tank is located northwest of site.
- Residences are located north and east of maintenance section and these are all on city water; there was no evidence that residences were on well water.
- Small businesses located at southeast corner of site along SH 87 (First Street).
- Warehouses and grain elevator are located on other side of SH 87 immediately south of maintenance site.
- A playa called Bone Lake is located east of town; frequently dry.

Waste Disposal Information:

- A grease trap is located on northwest side on maintenance warehouse.
- Two waste injection wells dug in 1957-58; one hole for trash the other for waste oil and oil filters; the trash injection wells believed to be located east of oil injection well.
- Possibly steel pipe from oil injection well for overflow when well filled up (possible drain field?).
- Stopped using the two injection wells in the late 1980's; dirt from wells was removed and aerated for 5 to 7 years by an environmental firm; holes filled with dirt.
- These two injection wells are now covered with cement and asphalt in parking lot.
- Two asphalt injection wells located near back of yard; currently in use and contain a mixture of asphalt, diesel, and kerosene.
- One asphalt injection well is exposed and the second one has a sheet metal cover over it that might be welded on.
- Approximately 20 -25 ft of standing asphalt in exposed injection well; second covered injection well might be filled with asphalt as well.
- Asphalt injection wells have tin horn at surface and are covered with metal sheet.
- Antifreeze was sometimes disposed of in wash rack drain leading to grease trap and city sewer system; wash bays always on city sewer system.

- Today, asphalt is cleaned from trucks in yard but they use to clean off asphalt in wash bays.
- Cesspool on west side of warehouse was removed before 1950.

Waste Cistern Description:

- Two injection wells are 30 inches in diameter and 20 to 25 ft deep and consist of tin horn extending part way down hole.
- These injection wells were located approximately 50 to 60 yards north of grease trap on north side of warehouse.
- These two injection wells are covered with asphalt and the exact location remains uncertain although there are patches of asphalt in parking lot that might coincide with injection well locations; wells believed to be separated from each other by 10 to 15 ft.
- There are also two asphalt injection wells located next to above ground asphalt tanks in yard that are still in use.
- One is covered with sheet metal that could not be removed; partially covered by dirt from berm surrounding above ground asphalt tanks. The second asphalt injection well is covered with metal cover and is filled with asphalt.
- Tin horn from these wells extends about 4 to 6 inches above ground level and this, in combination with the dirt berm, inhibits rain run off from entering injection well.

Hydrology of Area

- Topography of area is relatively flat with subtle slope to the east.
- Bone Lake is a playa lake located 1.50 miles east of town and 2.50 miles east of maintenance section.
- W.D. Jones Drilling stated that depth to Red Bed in area is from 600 to 900 ft and depth to top of water ranges between 200 to 350 ft.
- Gary Stoval with the City of Dumas Water Department stated that depth to water in their wells was around 400 to 450 ft. There are a few windmills in the county suggesting that there might be a shallow aquifer (City water wells are located 14 miles west of town),
- "Mike" with Soil Conservation Service, (806) 935-4401, confirmed that depth to fresh water was around 400 ft; deeper to west and shallower to east.
- North Plains Underground Water District (806) 935-6401 drilled monitor well last year along main street in Dumas and found top of water to be 300 ft; they have geophysical log of well.
- Monitor well detected presence of benzene (gasoline) in water supply; source of water was gasoline station in town. Leakage of a few drops of gasoline from connection pumps (?) each time a vehicle would fill up over the years eventually reached water table; not high concentrations. Also found benzene in second test hole drilled in east side of town.

- Water supply for Dumas located 14 miles west of city and is not threatened by leak.
- No windmills are near town, suggesting that there is no shallow source of fresh water; however, relatively shallow water occurs north of town towards Canadian River.
- There are a few water wells in city but all are abandoned and plugged.

Dumas (Section 08) Injection Well Summary:

The Dumas Maintenance section contains four waste injection wells. All wells are believe to be 30 inches in diameter and 20 to 25 ft deep with tinhorn extending partially down wells. One well contained “trash”, another waste oil and oil filters, and two are asphalt injection wells. Dirt from the trash and waste oil injection wells, located 50 to 60 yards north of the warehouse, was removed and aerated for 5 to 7 years in the late 1980’s or early 1990’s. These abandoned wells are covered with asphalt in the maintenance yard and the exact location is uncertain although relatively fresh asphalt patches may indicate former well location. The two asphalt injection wells, located adjacent to above ground asphalt storage tanks, are filled with a mixture of asphalt, diesel, and kerosene. There is no shallow windmill water in Dumas and the city water wells are located 14 miles west of town. The depth to ground water in Dumas in approximately 300 ft and this water has been contaminated with gasoline, although concentrations of benzene in the aquifer may be minor.

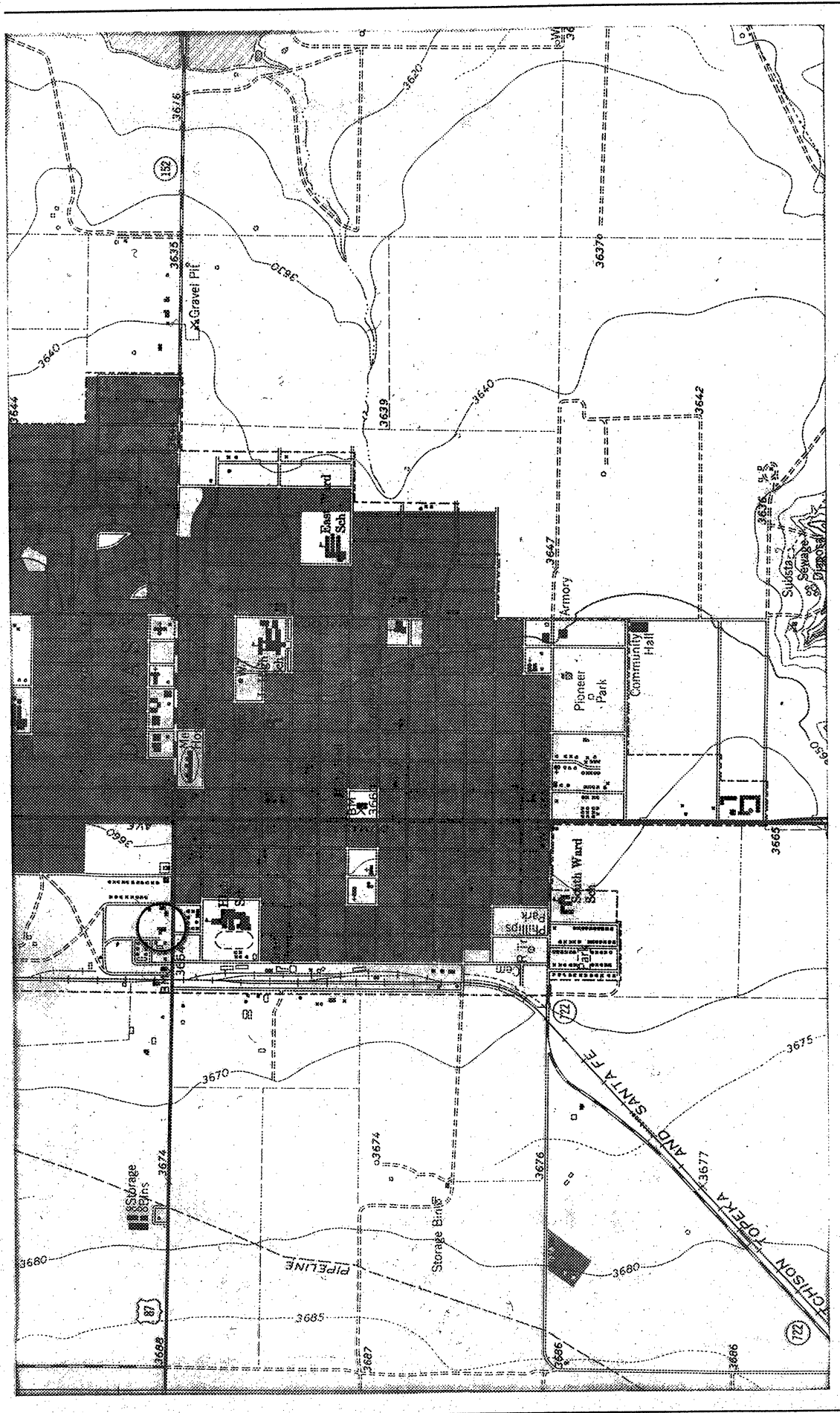


Figure 1. Location of the Dumas maintenance section (09), Moore County, Amarillo District.

Amarillo District
Gruver, Section 10
Hansford County

Thomas (Dwain) Weller (806) 655-4372

June 13-14, 1996

General Information:

- Maintenance site located on the north side of Gruver north of SH 278 near intersection of SH 15, SH 136, and SH 278 (figure 1).
- maintenance section always on city water and sewer.
- Impervious cover is approximately 50%.
- Convenience store and businesses are south of site across SH 15; grain elevators located southwest.
- Open fields and crops located north and east of maintenance site.
- Grain elevator located to northwest of site on SH 136.
- Several residences and North Plains Chemicals located west of maintenance section west of SH 136.
- Additional residences are located to the southeast within 0.50 mile.
- Business district located immediately south of site.
- Topography slopes to southeast towards City of Gruver.

Waste Disposal Information:

- Maintenance site contains five injection wells; three are abandoned and two are in use.
- There are three waste oil wells at the maintenance site; two abandoned and one active.
- The first abandoned waste oil injection well was located near an outside wash rack northeast of the main office; this well was in use from 1975 to 1982.
- The second abandoned oil well is located west of the first well and northeast of the main office; this well was in use from 1950 to 1975.
- The third waste oil injection well is now in use and is connected to the shop floor drain; this well was drilled in 1982 and is still in use; waste oil is now stored in above ground tanks but some waste products were placed into the injection well.
- There is a water drain currently in use near the wash rack west of the main office; this waste water well was drilled in 1982.
- Wash rack water drains into water injection well.
- An abandoned asphalt injection well was located near the asphalt tanks located northwest of the main office building and northeast of the truck bays.
- The asphalt injection well drilled about 1953 and abandoned in 1991; it is now covered over.
- Waste products drained into asphalt injection well include asphalt, diesel, and kerosene.
- The asphalt injection well was pumped out 3 to 4 times over the past 10 years.

- An employee at the Amarillo Maintenance section stated that they dumped “everything” down the injection wells at Gruver while he was there.

Waste Cistern Description:

- The first abandoned was oil injection well is located 28 ft east from the west fence line and 12 ft north of the south fence line.
- First waste oil injection well is possibly tin horn, 30 inches in diameter and 20 to 30 ft deep.
- The location of the second waste oil well is uncertain because it is buried under the road; approximate location is west of first well and northeast of the main office.
- The third waste oil injection well is located approximately 9 ft north of the main office and 18 ft east of garage entrance
- Third injection well is also 30 inches in diameter and approximately 20 to 30 ft deep; this injection well connects to shop floor drain.
- There is a 2 x 3 ft metal sump is located near third waste injection well.
- The wash rack injection well is located 5 ft south of the north fence line and east of the main office.
- The wash rack injection well is an open-hole, 30 inches in diameter, and 20 to 30 ft deep.
- The abandoned asphalt injection well was a tin-horn 24 to 30 inches in diameter and 20 to 30 ft deep; this injection well is now covered.

Hydrology of Area

- The maintenance site is located on a small ridge that trends in a south-southeast direction; the slope on the maintenance site is to the southeast.
- There is a stock tank located approximately 0.65 mile southwest of maintenance site.
- The north-south drainage entering the stock tank is approximately 0.60 mile west of the main office and warehouse.
- Southeast-oriented Farwell Draw is located 0.75 to 1.00 mile southwest and south of the maintenance site; the stock tank drains into Farwell Draw.
- There is a windmill located approximately 0.35 mile northwest of the maintenance site on the topographic map.
- At least two water wells are located within 0.50 mile of the site.
- Depth to water in an irrigation well immediately north of maintenance site is 350 ft
- Larry of L&M Well Services located near maintenance site in Gruver stated that water in area is spotty; depth to top of water in town is around 230 ft and 400 ft south of town and there is no water north of town.
- According to the Gruver City manager, depth to the top of fresh water is 325 ft; TD of wells is around 600 ft.

- Gruver has two well in town producing 700 and 250 GPM and a test well on the south side of town produced 1500 GPM.
- Additional sources of information include H.G. Water Lines (806) 733-2789 and the City Hall (806) 733-2424.

Gruver (Section 10) Injection Well Summary:

There are five injection wells at the Gruver maintenance site which is located on the north side of Gruver, north of SH 278 near intersection of SH 15, SH 136, and SH 278. The Gruver site contains one wash rack, one asphalt, and three waste oil injection wells; three of the injection wells have been abandoned and two are still in use. The wash rack injection well is located 5 ft south of the north fence line east of the main office. This injection well is an open-hole 30 inches in diameter and 20 to 30 ft deep; well has been active since 1982. Of the three waste oil injection wells on the site, two are abandoned and one is still active. All three waste oil injection wells are 30 inches in diameter and 20 to 30 feet deep. The abandoned waste oil injection well near the wash rack was active from 1975 to 1982 and was possibly constructed of tin-horn. The abandoned and covered waste oil injection well, located in the maintenance yard northeast of the main office and shop, was active from 1950 to 1975. The exact location of this well is uncertain. The active waste oil injection well is located north of the main office and is connected to the shop floor drain; this well no longer receives waste oil although some water drains into well. This well was drilled in 1982 to replace waste oil injection well located adjacent to the outside wash rack. The abandoned asphalt injection well collected asphalt drained from hoses and diesel and kerosene used to clean trucks. This 20 to 30 ft deep well was constructed of 30 inch diameter tin-horn and was active from 1953 to 1991. The injection well was pumped out maybe 3 to 4 times over the past 10 years but is now covered.

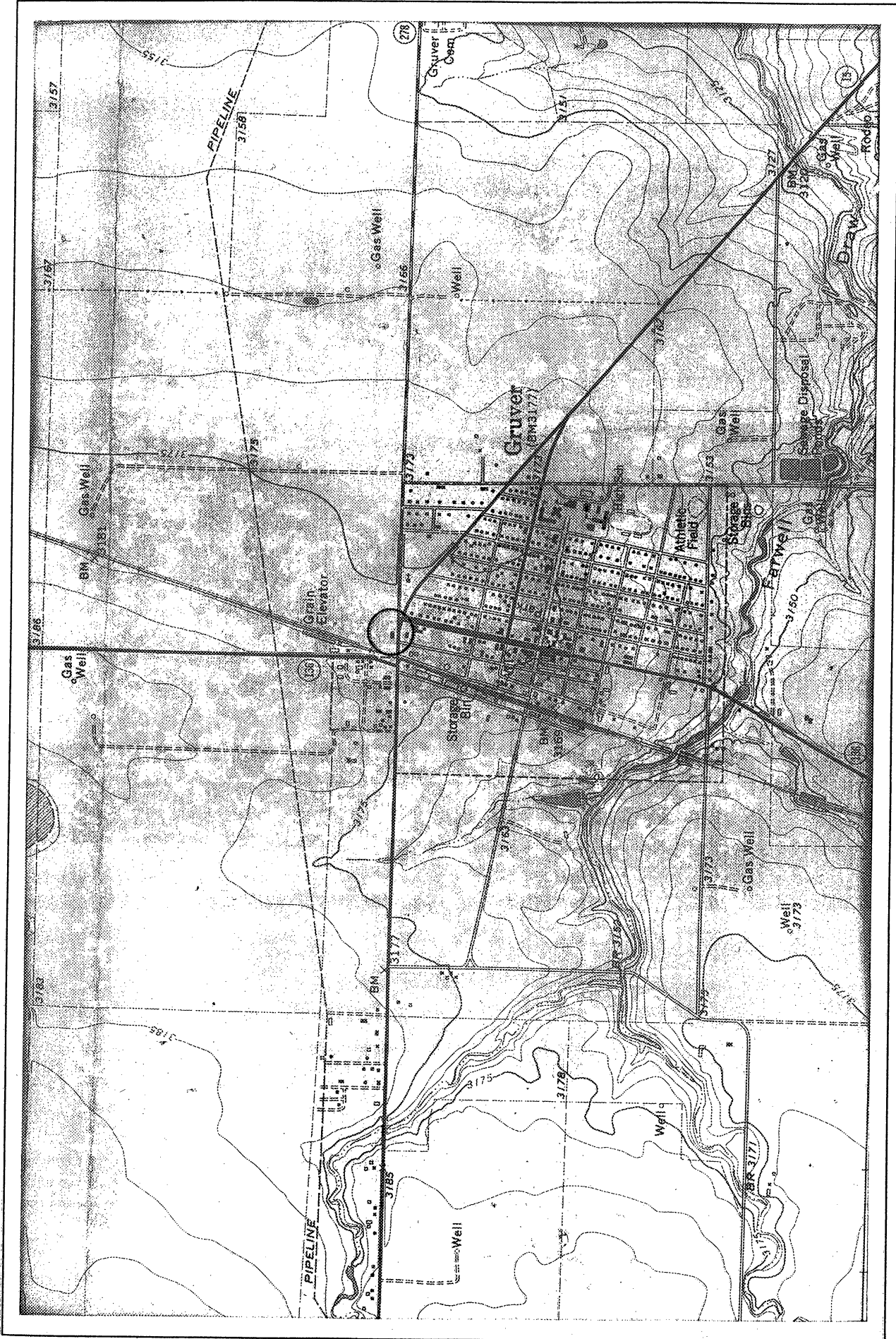


Figure 1. Location of the Gruver maintenance section (10), Hansford County, Amarillo District.

Amarillo District
Panhandle, Section 13
Carson County

Pete Hare (806) 537-3384

July 23, 1996

General Information:

- Maintenance section is located close to city limits on the southeast side of Panhandle (figure 1) between SH 60 and SH 293.
- Approximately 85% impervious cover.
- Water Conservation District in Panhandle has monitoring well southeast corner of Panhandle.
- Mostly crops and open fields on east side of maintenance facility; one residence adjacent to southeast corner of facility.
- Several residences, Saint Ann's Nursing Home, and open fields with crops are located on the south side across SH 293.
- Undeveloped grass field and grain storage warehouse are located west of facility across SH 60.
- No evidence that residences are on well water; probably on city water.
- City has several water wells within city limit.

Waste Disposal Information:

- There are six injection wells at this location.
- Two injection wells were for water drain and building sinks.
- Two oil injection wells, one for waste oil and one for oil filters, are located near the northeast corner of the main warehouse.
- Oil had to be pumped out from waste oil wells every few years as it took several years for them to be filled up.
- Oil filters were possibly placed down one of the waste oil wells.
- These wells were open-hole; no tin horn.
- Two abandoned asphalt injection wells were located near the southeast corner of the maintenance yard and were used for asphalt, diesel, and kerosene mixture.
- These wells were backfilled in early 1990's.
- Antifreeze use to be dumped in yard but is now recycled.
- Trucks were cleaned in yard with diesel and kerosene with a 4:1 mixture; used straight diesel for heavy coatings of tar and asphalt.
- Two septic tanks are located on the east side of the main warehouse and the lateral leach lines run eastward away from the building.
- Asphalt injection wells were filled around 7 to 8 years ago about the time they were abandoned in 1989.

Waste Cistern Description:

- Maintenance site has six injection wells, four abandoned and two active water injection wells.
- The two injection wells were for water drain and building (sinks?); the first waste water well is located on the west side of the maintenance warehouse and the second is on the midway down the south side of the maintenance warehouse.
- Waste water Well #1 collected water from a drain in the warehouse was 24 inches in diameter and about 40 ft deep; waste water Well #2 was 24 inches in diameter and at least 30 feet deep.
- Two oil injection wells are located near the northeast corner of the main warehouse; these wells were 24 inches in diameter and around 40 ft deep and are now covered by mound of dirt.
- These wells were open-hole; no tin horn.
- Two abandoned asphalt injection wells were located near the southeast corner of the maintenance yard; these wells filled with gravel and covered with dirt.

Hydrology of Area

- Topography relatively flat with runoff to the south.
- There are several playas located between 1.00 and 1.50 miles east and southeast of maintenance site.
- According to the Water Conservation District in Panhandle (806) 883-2501, there are no perched aquifers in the area; depth to fresh water in monitoring well on southeast side of Panhandle is 416 ft as of January 1996.
- Magic Circle Drilling telephone number is (806) 537-5186; (806) 669-5542 mobile; (806) 537-3035 nights. Depth to Red Bed is 800 ft and static water level in their well located in town is around 400 ft
- There are no perched aquifers or shallow water in area.
- Although there are no longer perched aquifers in the area, a windmill is located approximately 0.75 miles east-northeast of maintenance site on north side of SH 60 and railroad tracks; a second windmill is shown on topographic sheets approximately 2 miles east-northeast of maintenance site.

Panhandle (Section 13) Injection Well Summary:

The Panhandle Maintenance section, located on the southeast side of town, contains six waste injection wells. Four wells have been abandoned and two are still active. All six wells are estimated to be 24 inches in diameter and 40 deep. The two active wells collect waste from drains and sinks in the main warehouse. The first waste water well is located on the west side of the maintenance warehouse and the second is on the midway down the south side of the maintenance warehouse. The two abandoned waste oil injection wells, located at the northeast corner of the main warehouse, are covered with dirt. One well was for waste fluids whereas used oil filters were disposed of in the second well. These wells were filled in early 1990's but were not pumped out prior to backfilling; the wells contained mostly water at time they were backfilled. There are two abandoned asphalt injection wells located in the southeast corner of the maintenance section near the two above ground asphalt storage tanks. These wells were abandoned in 1989 and backfilled. There are no perched aquifers in Panhandle although there are several playas located 1.50 to 2.00 miles east of the maintenance site. Static water level in monitoring well in southeast part of Panhandle is 416 ft as of January 1996.

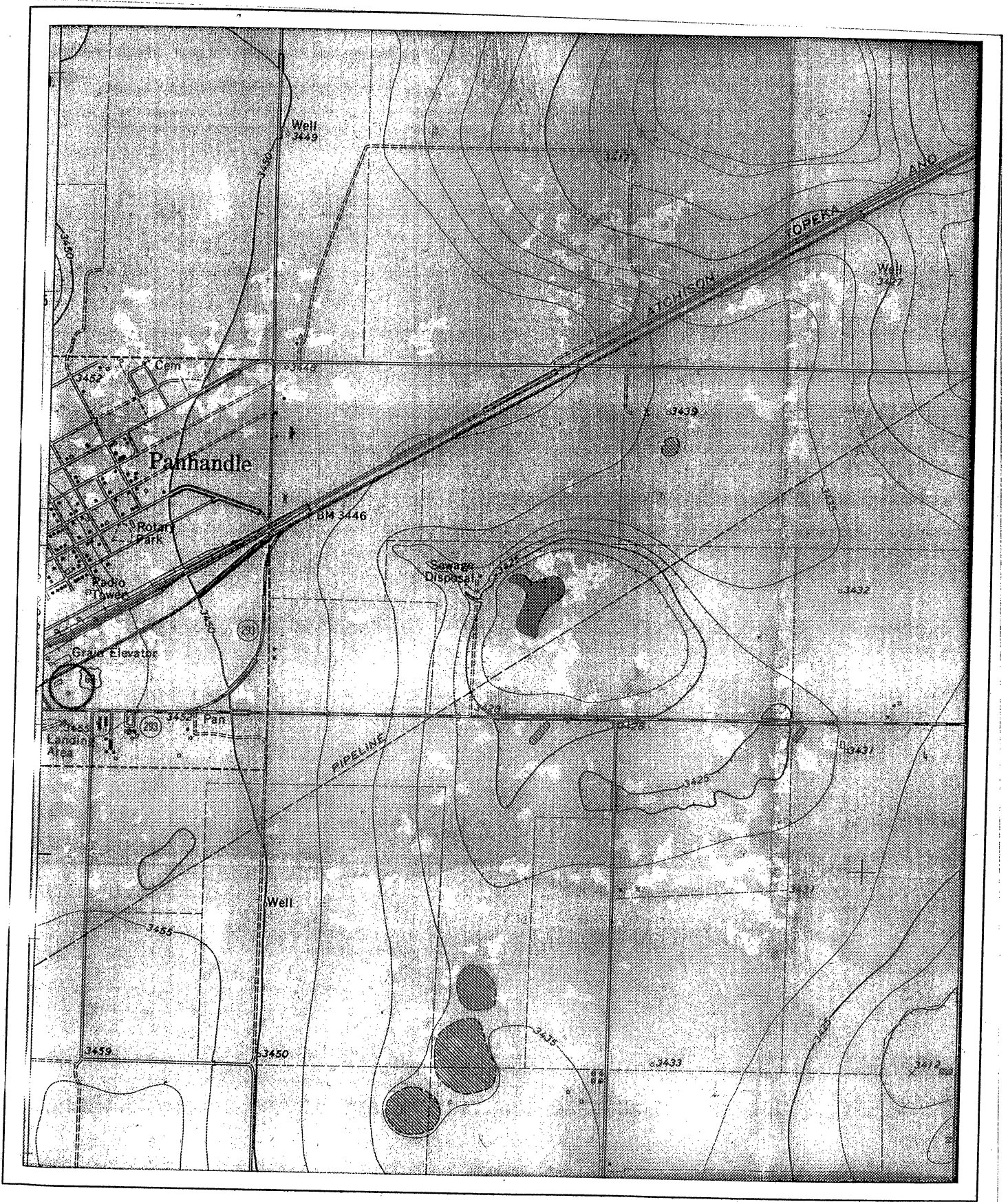


Figure 1. Location of the Panhandle maintenance section (13), Carson County, Amarillo District.

Amarillo District
Stratford, Section 15
Sherman County

Harry Oquin (806) 296-2800
June 13-14, 1996

General Information:

- Maintenance site is located northeast of Stratford on the south side of US 54 near intersection of SH 2677 (figure 1).
- There is not a wash rack at maintenance site
- Vehicles are cleaned in maintenance yard
- On average, the 20 pieces of equipment at the site had an oil change every other month or 3,000 miles; however, the oil was changed every three months on trucks.
- Approximately 60% impervious cover.
- Open fields and businesses and warehouses are present west and east of the maintenance site; the businesses are located along US 54.
- Open fields consisting of crops and grass lands are behind the site and a water well is located less than 0.50 miles south of the site.
- There is a grassy strip between US 54 and railroad tracks and warehouses are located north of railroad tracks.
- There are no residences adjacent to maintenance site.

Waste Disposal Information:

- Abandoned waste oil injection well was active until the late 1980's.
- Waste oil, antifreeze, transmission/brake, and hydraulic fluids were disposed of in injection well.
- There is no wash rack on site. Vehicle cleaning is now subcontracted out but trucks were cleaned in yard prior to subcontracting.
- There was an asphalt storage pit locate between two above ground asphalt storage tanks; served as hose drain for asphalt trucks.
- Kerosene used to clean vehicles was also discharged into pit.
- Fluids from the waste oil injection well and asphalt pit were pumped out twice per year.

Waste Cistern Description:

- Waste oil injection well is located southeast main warehouse; located 6 ft from east fence line and 30 ft from north fence line.
- Waste oil injection well was approximately 24 inches in diameter and 10 to 15 ft deep.
- The injection well was drilled to bedrock and consisted of a cement side with a tin-horn top with lid; composite design.

- Waste oil injection well was abandoned, pumped out, and backfilled with dirt in the late 1980's.
- Asphalt pit was located between two above ground asphalt tanks approximately 20 ft from east fence line.
- Estimated dimensions of asphalt pit are 10 ft wide and 4 ft deep and the pit was carved into the ground so vehicles could easily drain asphalt into pit.

Hydrology of Area

- City water well within 0.50 mile south of site.
- There is a second water well on the topographic map 0.15 mile west of maintenance section.
- Maintenance section slopes to northeast parallel to US 54 and railroad tracks; rain water run off is away from the city.
- Generally east-west-trending Cold Water Creek is located approximately 1.50 miles south of the maintenance site.
- The minor southwest-trending Frisco Creek is located several miles northwest of maintenance site.
- Smith and Smith Well company stated that depth to Red Bed around Stratford is 450 ft and depth to fresh water is approximately 300 ft.
- House wells nearby have depth to static water level of 320 ft.
- City of Stratford may have information on depth of water and location of city water supply (806) 396-5581.

Stratford (Section 15) Injection Well Summary:

There is one abandoned waste oil injection well at the Stratford maintenance site which is located approximately 0.25 mile northeast of Stratford on US 54 near the intersection of SH 2677. The waste oil injection well is located southeast of the main warehouse, 6 ft from east fence line and 30 ft from north fence line. The well, drilled to bedrock and approximately 10 to 15 ft deep, is 24 inches in diameter and of composite design consisting of cement sides and a tin-horn-type upper part with lid. This waste oil injection well was abandoned, pumped out, and backfilled with dirt in the late 1980's; the total length of time the well was active is uncertain. A shallow (4 to 5 feet deep) asphalt pit designed to collect asphalt and kerosene from truck pots was also backfilled some years ago. Two water wells are located within 0.50 miles of the maintenance section; depth to fresh water in the Stratford area is 300 to 320 ft.

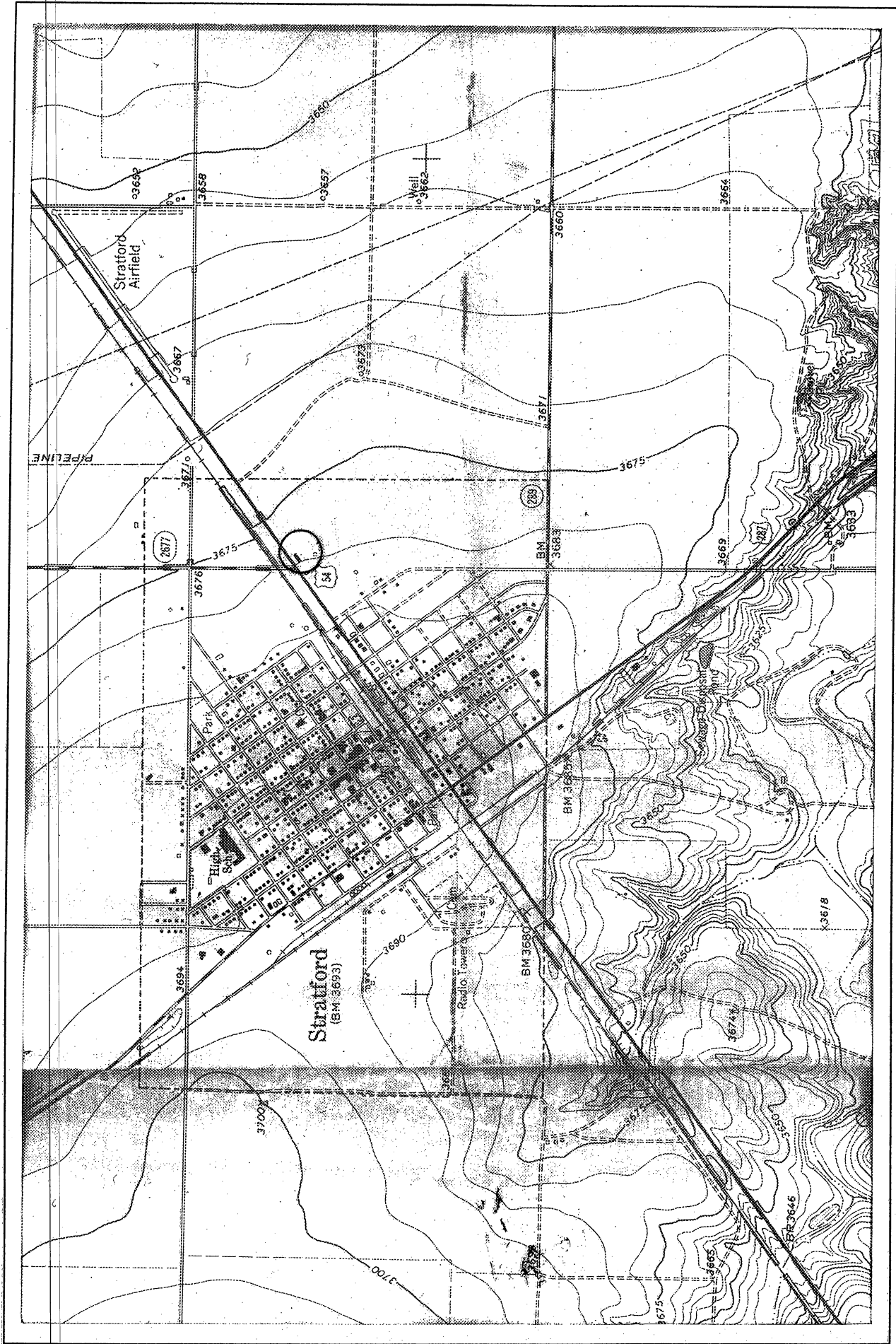


Figure 1. Location of the Stratford maintenance section (15), Sherman County, Amarillo District.

Amarillo District
Amarillo, E-way Maintenance
Potter/Randall Counties

Russel C. Luther (806) 356-3264

July 22, 1996

General Information:

- Maintenance site is located at 5715 Canyon Drive in south Amarillo (figure 1).
- Maintenance site has been recycling oil for the past 22 years.
- Maintenance site has always been on city sewer.
- Approximately 80 to 90% impervious cover.
- James Davenport spent 30 years at the maintenance site and is a good source of information.
- Maintenance site moved from Bowie Street to present location in early 1960's
- Jimmy Cotter was at Gruver maintenance site until 4 or 5 years ago and indicated that they dumped everything down the injection wells at Gruver.
- "Grant" said that there was a water injection well at Gruver.
- Checked with Jesse Velasquez, Shop Foreman, regarding injection wells in other parts of Amarillo Headquarters and he was not aware of any.
- The maintenance site is an urban setting and there are houses within 500 ft of maintenance site.
- Owner of open field adjacent to maintenance site has lot for sale at time of site visit.

Waste Disposal Information:

- There are no injections wells at this location.
- All waste products were disposed of into shallow pit (2 to 3 ft deep) or on ground next to an outside wash rack located at the southeast corner of the property by fence line
- Waste products would run southeastward downhill into an open field next to maintenance site.
- All types of waste products, including motor oil, hydraulic fluid, transmission and brake fluid, paint, diesel, and antifreeze would be disposed of in pit.
- Wash rack water always ran directly into sewer system.

Waste Cistern Description:

- No injection wells were present at site.

Hydrology of Area

- There is a playa lake located approximately 0.50 miles to the southeast; playa lakes are often recharge features for the Ogallala aquifer.
- A large water tower is present less than 0.25 miles to the west of the maintenance section.

E-way (Amarillo) Injection Well Summary:

There are no waste injection wells at E-way Maintenance site at 5715 Canyon Drive in south Amarillo. Waste products, including motor oil, hydraulic fluid, transmission and brake fluid, paint, diesel, and antifreeze were disposed of in a shallow (2 to 3 ft deep) waste pit located near the outside wash rack. The waste fluids drained downhill (southeast) into an open field. Waste oil has been recycled at the E-way maintenance site for at least 22 years.

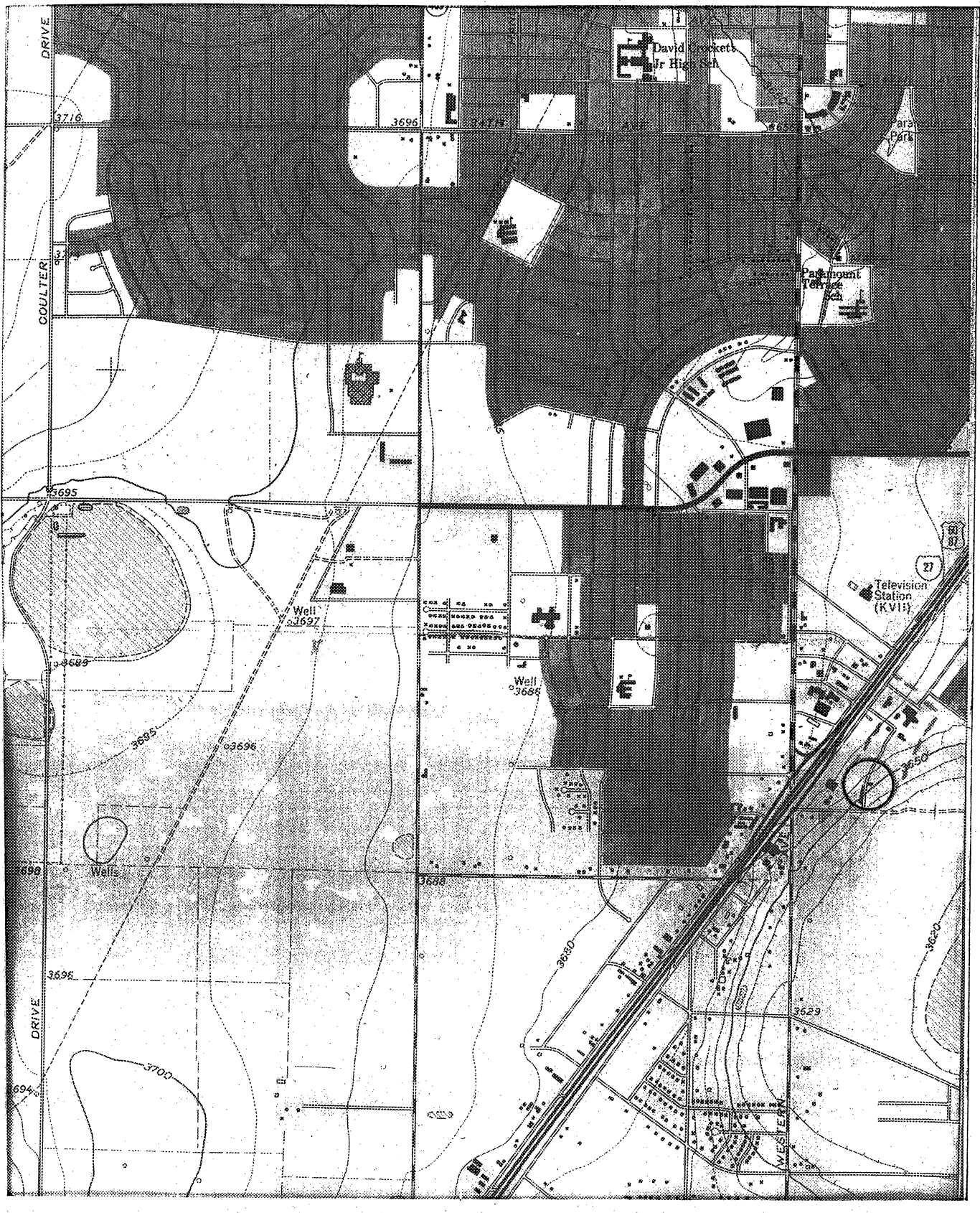


Figure 1. Location of the Amarillo maintenance section (E-way), Potter/Randall County, Amarillo District.

Childress District
Childress, Section 01
Childress County

Doug Campbell (817) 937-2571

Don Newberry

July 22, 1996

General Information:

- Maintenance site is located on the south side of SH 2042 approximately 0.10 mile west of Childress outside of the city limits (figure 1).
- Area in area is relatively flat and predominantly cropland and open fields.
- A warehouse and roofing supply company is located immediately east of facility.
- Residences are located less than 0.10 mile southeast of site.
- Open fields are located south of site and north of site on the north side of SH 2042
- A small trailer park and residences are located west of maintenance site on the west side of a dirt road.
- Cropland is located to the southwest of site.
- Maintenance site is on city water.
- Fire hydrants in residential area and along dirt road immediately west of site indicate that residences in area are on city water; no windmills were noted.
- Trailer park appears to be on city water and sewer.
- Maintenance site is on city water and sewer.

Waste Disposal Information:

- Kerosene from removal of tar was sometimes disposed of in maintenance yard.
- Antifreeze was sometimes disposed on ground.
- At least some wash rack water may have entered cistern which would explain why injection well was partially filled with sand.
- The location of these well is similar to waste injection well locations at other sites.
- Waste oil was run into injection well which had to be pumped out periodically
- Maintenance currently has approximately 20 pieces of equipment including: 1 herbicide truck, 1 asphalt truck, 6 dump trucks, 3 pickup trucks, 2 graders, 1 sweeper, 2 loaders, and 1 roller.

Waste Cistern Description:

- There is water cut off valve in front of resident engineers building and a grease trap for a sink located under a cement slab on the opposite side of the building.
- There is one known injection well and one possible injection well at site.
- Both injection wells are located approximately 30 to 40 ft south of section warehouse
- Injection Well #1 is 30 inches in diameter and consisted of tin horn with a metal lid.
- Tin horn was believed to be 8 to 10 ft deep total but is now filled with sand/dirt and only 4 ft deep.
- Inside injection well are three pipes: one pipe leads to warehouse and the other two lead to east-west oriented drain fields.
- Tin horn injection well was active in early 1960's
- A second possible injection well may be located approximately 20 ft east of injection Well #1.
- Injection Well #2 had a metal lid and was covered with numerous road signs; maintenance personnel were not asked to remove road signs to verify injection well.

Hydrology of Area

- Topography slopes to the north towards SH 2042 but then turns east and then south.
- Lake Scott is located 0.9 mile southeast of facility.
- Farm located south of maintenance site has water at 40 ft but it is reported to be gypsum water.
- Possible contacts for water include City of Childress at (806) 937-3683 or (806) 937-2546.
- A creek and smaller lake are located 0.90 miles west of maintenance site.

Childress (Section 01) Injection Well Summary:

There is one known injection well and one possible injection wells located at the Childress maintenance site which is located approximately 0.10 mile west of the city. These injection wells were probably active from the early 1960 until the 1980's (?). One injection well was 30 inch diameter tin horn approximately 4 ft deep. The well was nearly filled with dirt and sand but believed to be at least 8 to 10 ft deep at one time. Three pipes were visible inside injection well: one pipe leads to the warehouse and the other two pipes connect with drain fields oriented in an east-west direction. The second injection well was covered with metal plate and road signs; TxDOT personnel were not asked to remove signs for well inspection although the presence of this well should be verified. Waste oil was disposed of into injection well in the early 1960's and the well may also have served as a wash rack injection well which would may explain sand in the injection well.

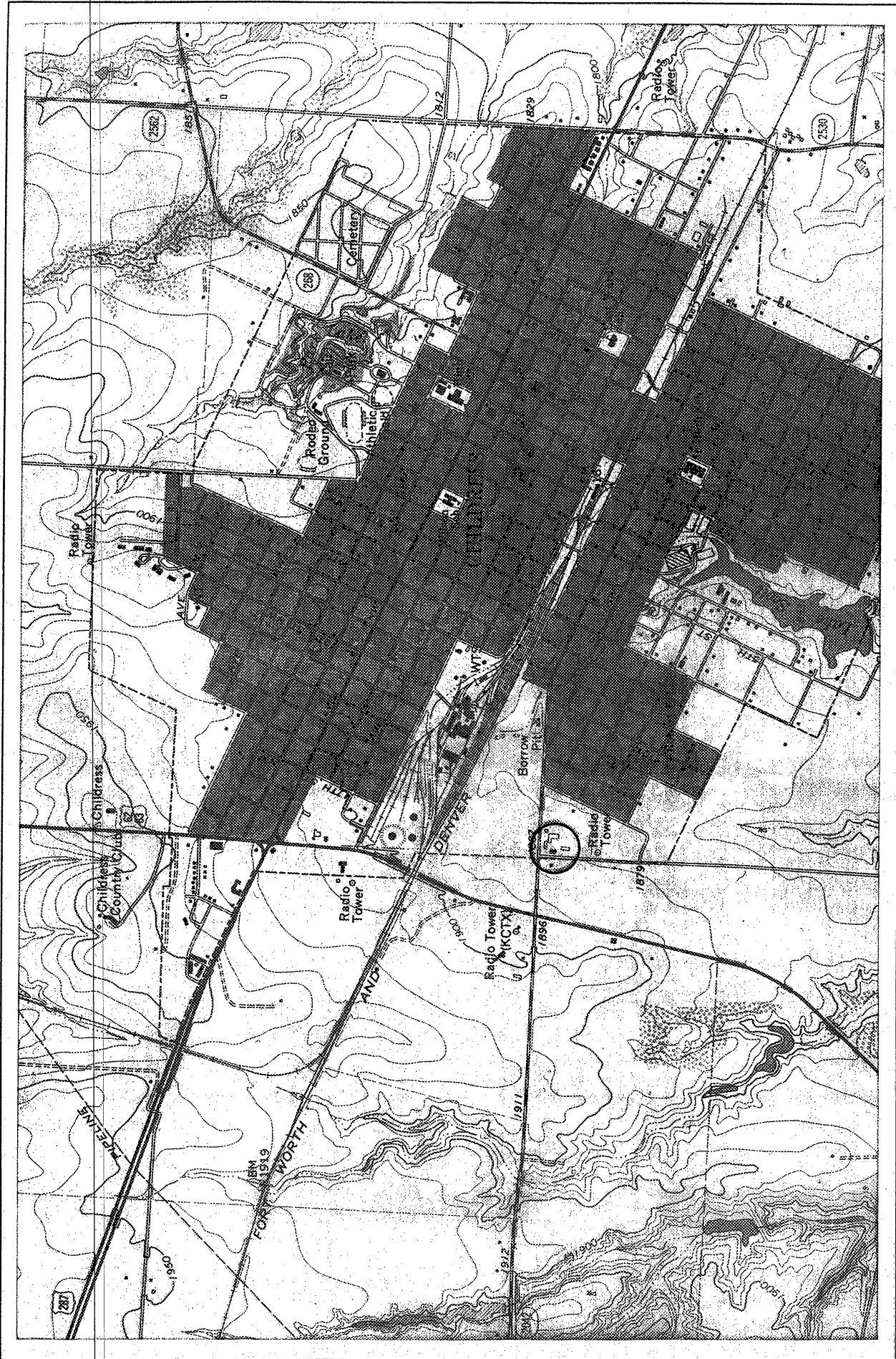


Figure 1. Location of the Childress maintenance section (01), Childress County, Childress District.

Childress District
Clarendon, Section 02
Donley and Hall Counties

Steven Smith (806) 874-3721
July 22, 1996

General Information:

- Maintenance site is located approximately 0.10 mile west of Clarendon on the north side of US 287 near the intersection of US 287 and SH 70 (figure 1).
- Residences are located across the street south of maintenance site on the south side of US 287 and to the southwest
- Fast food and other businesses are located east of maintenance site.
- A railroad track and small woods are located west of maintenance site.
- A maintained grassy field is located on other side of railroad tracks between the maintenance site and SH 70.
- Nursing home is also located north of site.
- A junior college is located 0.30 miles south of site
- A junk yard is located in sandy area 0.40 mile to east of maintenance site on other side of railroad tracks running behind business located along US 287.
- Maintenance site is on city water and sewer although there is an abandoned water well house on site.

Waste Disposal Information:

- This is an active waste oil injection well that contains standing oil and water.
- The outside maintenance rack injection well may have been abandoned but the fluids may not have pumped out.
- Maintenance site started using 55 gallon drums in 1974 suggesting that injection well was possibly active from the early 1960's until the mid 1970's.
- Waste motor oil, paint thinner, hydraulic fluids, and possibly toluene/benzene, from engineers building; "everything".
- Tar and asphalt are removed from vehicles in maintenance yard using citrosol and other solvents; these fluids flow downhill to the east.
- A drain in the warehouse leads to small 5 ft deep grease trap that then leads to sewer system.
- The injection well now contains approximately 10 ft of oil and water; the oil layer on top of the water is estimated to be 2 to 4 inches thick

Waste Cistern Description:

- The injection well is located next to an outside oil change rack where vehicles are driven onto a rack allowing mechanics to work beneath trucks.
- Oil drained from the trucks runs into metal pipe that leads to injection well located very close to oil rack.
- The pipe leading from the oil rack to the injection well enters the injection well at a depth of approximately 6 ft; a second pipe at the same depth leads away from the oil rack to a possible drain field (?) or possibly sewer system.
- The waste injection well is a 30 inch diameter tin horn that is estimated to be 30 ft and possibly 40 ft deep.
- The sides of the tin horn are stained with oil.
- Depth to oil/water mix is estimated to be 20 ft.

Hydrology of Area

- Topography slopes to the east and southeast roughly parallel to US 287.
- Lake Clarendon is located 0.75 mile to the east of maintenance site.
- Depth to water in area is estimated to be 50 ft or less.
- Residence located across the street (US 287) from the maintenance site has a water well and small pond with reeds growing in it in back yard suggesting that depth to water in area may be very shallow.
- A second residence also has an old water well in back yard; people were not home at time and did not respond to a note requesting information.
- Another water well is located 0.40 miles southeast of site on the north side of the railroad tracks near a gravel pit and junk yard.
- Topography slopes from houses towards the maintenance site suggesting that contaminants introduced at the maintenance site probably have not contaminated water wells at these houses.
- However, the well located 0.40 miles southeast of maintenance site lies between the injection well and Lake Clarendon.
- Additional sources of information include City Hall (806) 874-3438; Clarendon Magic Circle Drilling (806) 537-5186; Morrow Drilling and service (806) 874-2704.

Clarendon (Section 02) Injection Well Summary:

There is one active injection well located at the Clarendon maintenance site located 0.10 mile west of Clarendon on the north side of US 287 near the intersection of US 287 and SH 70. The injection well is located near an outside oil change rack near US 287. The well was active from the early 1960's until the mid-1970's when waste material was stored in 55 gallon drums. The injection well is a 30 inch diameter tin horn approximately 30 to 40 ft deep; the sides of the tin horn are stained with oil. There is an estimated 10 ft of standing oil/water; the oil may be 2 to 4 inches thick. Waste oil, hydraulic fluids, paint thinner, and possibly toluene/benzene, from engineers building were disposed of in well. Depth to water in area is estimated to be less than 50 ft; several houses located across the street (US 287) from the maintenance site have water wells in back yards although the houses and the maintenance site are on city water and sewer.

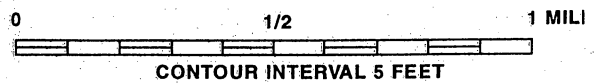
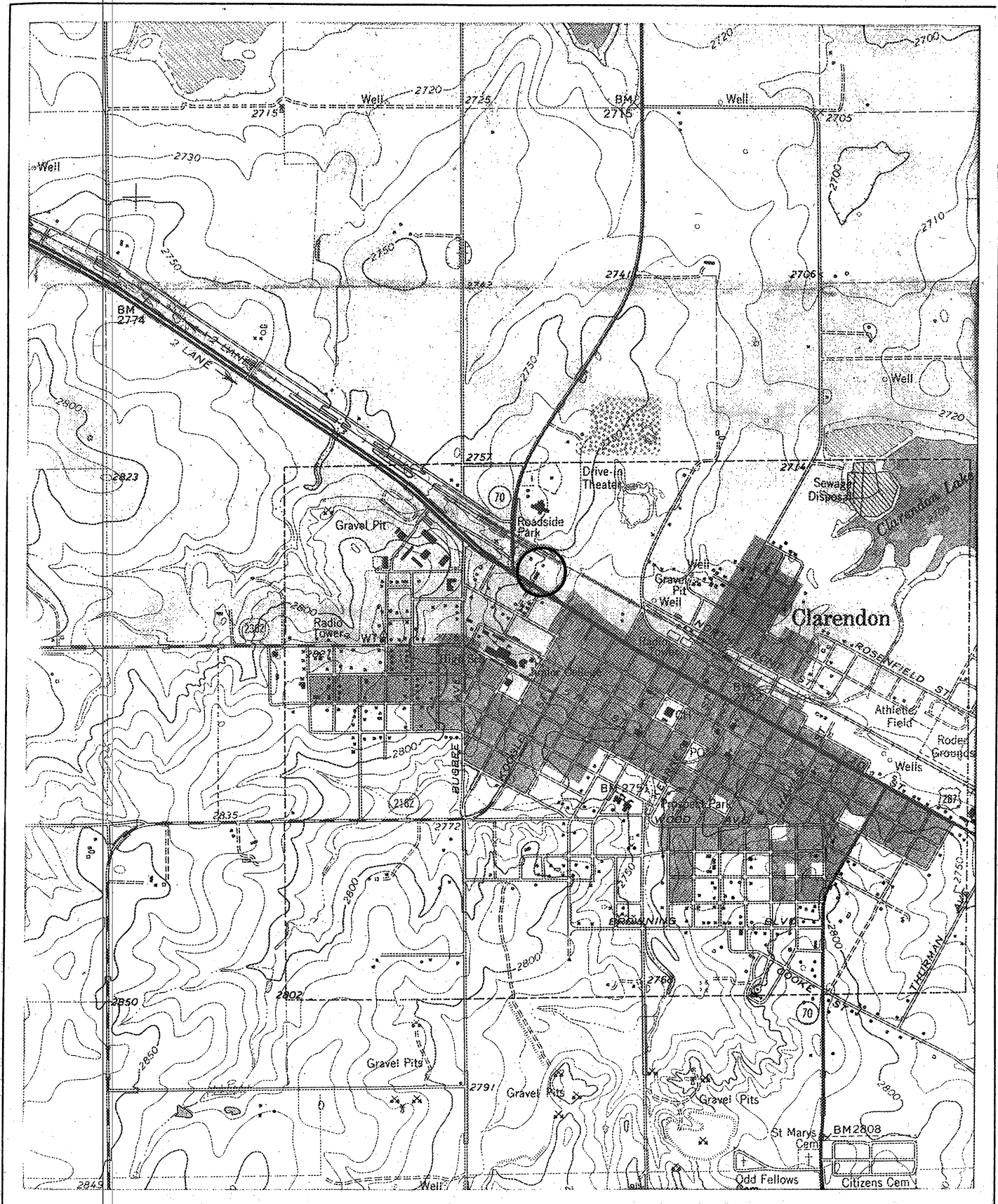


Figure 1 Location of the Clarendon maintenance section (02), Donley and Hall Counties, Childress District.

Childress District
Dickens, Section 03
Dickens and King Counties

Pete Lindsey (806) 623-5341

“Ronnie”

July 18 and 25, 1996

General Information:

- Facility built circa 1963
- Site located east of Dickens on the north side of US 82 at base of hill (figure 1).
- Residences are located immediately to the west and northwest along a road bounding west side of property.
- Trailer and houses located across US 82 to south.
- Several houses along frontage of US 82 to east of site; entrance road to Dickens Springs.
- Ground slopes to southwest towards a north-south oriented dry drainage located 0.20 mi west; marked slope in yard.
- In 1970's and 1980's water and oil from filled cisterns were pumped onto asphalt lot.
- Old oil was pour on ground on the west and north sides of main building; soil has been subsequently cleaned and removed.
- Today maintenance facility uses citrosol to clean asphalt off in yard.
- West and southwest part of yard was dirt until 15 years ago when asphalt was laid down
- Most of town is on City water.
- No windmills or pumps observed in residential; assume they are on city water.
- Site is on City facilities
- Old maintenance section located at southwest corner of property was removed after new facility built in early 1960's; this old site has been paved over but did contain a septic system/drain field and possibly older injection wells; however, no one can remember layout.

Waste Disposal Information:

- Waste oil disposed of in well near buildings and on ground along W and N side of main building.
- Asphalt, diesel, kerosene, antifreeze and wash-rack water went into cistern
- Volumetrics difficult to obtain as records are kept only 5 years.
- Types and quantities of equipment has changed over the years.

- Workers estimated 5 trucks (4.25 gal ea.), 4 pickup trucks (1 gal ea.), 1 grader (5 gal), 1 loader (5 gal) changed every other month; annual total of around 270 gal of oil per year.
- Employees believe that monitoring wells are for an underground gasoline storage tank leak several years ago; this needs to be confirmed with TxDOT.
- Antifreeze placed down Well #1.
- Asphalt was removed from trucks with diesel and kerosene in yard.
- Employees initially did not remember a second waste cistern although there were two drains in garage; Ronnie believed that both went into cistern on west side of building because when he cleaned out grease trap in wash racks the water would run into the cistern on west side of building. This may suggest that the pipe leading to second cistern was obstructed.
- Earliest waste probably entered subsurface but when permeability decreased, waste did not drain and cistern had to be pumped out on ground when cistern filled.

Waste Cistern Description:

- There are two waste oil injection wells located at maintenance site.
- Injection well number 1 is located on the west side of the maintenance building and injection Well #2 is located on the north side of the building. The second injection well is covered by overgrowth and dirt making it somewhat difficult to find.
- Injection Well #1 is corrugated, galvanized steel drainage pipe 24" in diameter.
- The tin horn extends several inches above the ground and is deformed to an oval shape and has steel lid.
- Depth of injection Well #1 is estimated to be 20 to 25 ft.
- Injection Well #2 also consists of 24 inch diameter tin horn and has a metal lid; the tin horn injection Well #2 is not as deformed as injection Well #1.
- Injection Well #2 is approximately 15 to 25 ft deep and is oil-stained; a metal pip runs from this injection well back into maintenance building.
- If cistern is like other ones in area, small vertical slits (0.3 x 5 cm) were made in tin horn to assist in drainage.

Hydrology of Area

- Ground slopes to southwest and south towards Dickens and dry creek immediately to west.
- Nearly of homes immediately adjacent to facility are on city water.
- Sam and Joan Porter live 0.20 mi northwest of facility (along road on west boundary of facility), and have a well for watering plants and grass.
- Around 60 years ago there was hand dug well (< 20 ft deep) near trailer on south side of US 82 across from facility.
- The Dickens Springs are located 0.40 mi to the northeast on opposite side of hill.

- Exposures around springs are believed to be roughly equivalent to rocks encountered in cistern and observation well.
- Water from springs is coming from bedding plane between two fine- to coarse-grained cross-bedded sandstones (possible fluvial channel on channel contact). Red claystone immediately below and above aquifer.
- Water from springs flows to east.
- Some of the massive sandstones contain gravel and the gravel deposits appear to be rather discontinuous as to be expected in fluvial system; cross-bedding often delineated by gravel. Massive 50 ft of conglomerate discussed in the report by Lubbock Christian University was not observed.
- An important observation is that the local dip of beds appears to be to the west or northwest which is opposite to regional hydrologic gradient (Water Development Board Report 158).
- Some interesting structures in area and this site should be visited again.
- Understanding the heterogeneity of the fluvial system, and it's orientation will be critical in delineating migration paths of contaminants.

Dickens (Section 03) Injection Well Summary

There are two waste oil injection wells at the Dickens maintenance section located on east side of Dickens on north side of US 82 at the base of a hill. Both injection wells are 24 inch diameter tin horns approximately 15 to 25 ft deep which are oil-stained. Injection wells were active until the 1980's. Waste oil, hydraulic fluids, and antifreeze were placed into injection wells. When injection wells became filled with waste oil and water, the waste products were pumped onto ground near injection Well #1. Depth to ground water from monitoring wells was estimated to be approximately 89 ft. Dickens Spring is located northeast of the facility on the other side of the hill; water from springs flows to east away from facility. Surface and near-surface ground water is directed to the southwest. Local dip around Dickens Springs suggesting that ground water in deeper horizons could be directed more westerly. The heterogeneous nature of the fluvial system, particularly the orientation of the coarser material in the fluvial systems, suggests that a more detailed geologic evaluation may be required to delineate the extent and orientation of the contaminant plume.

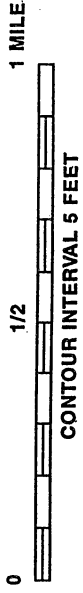
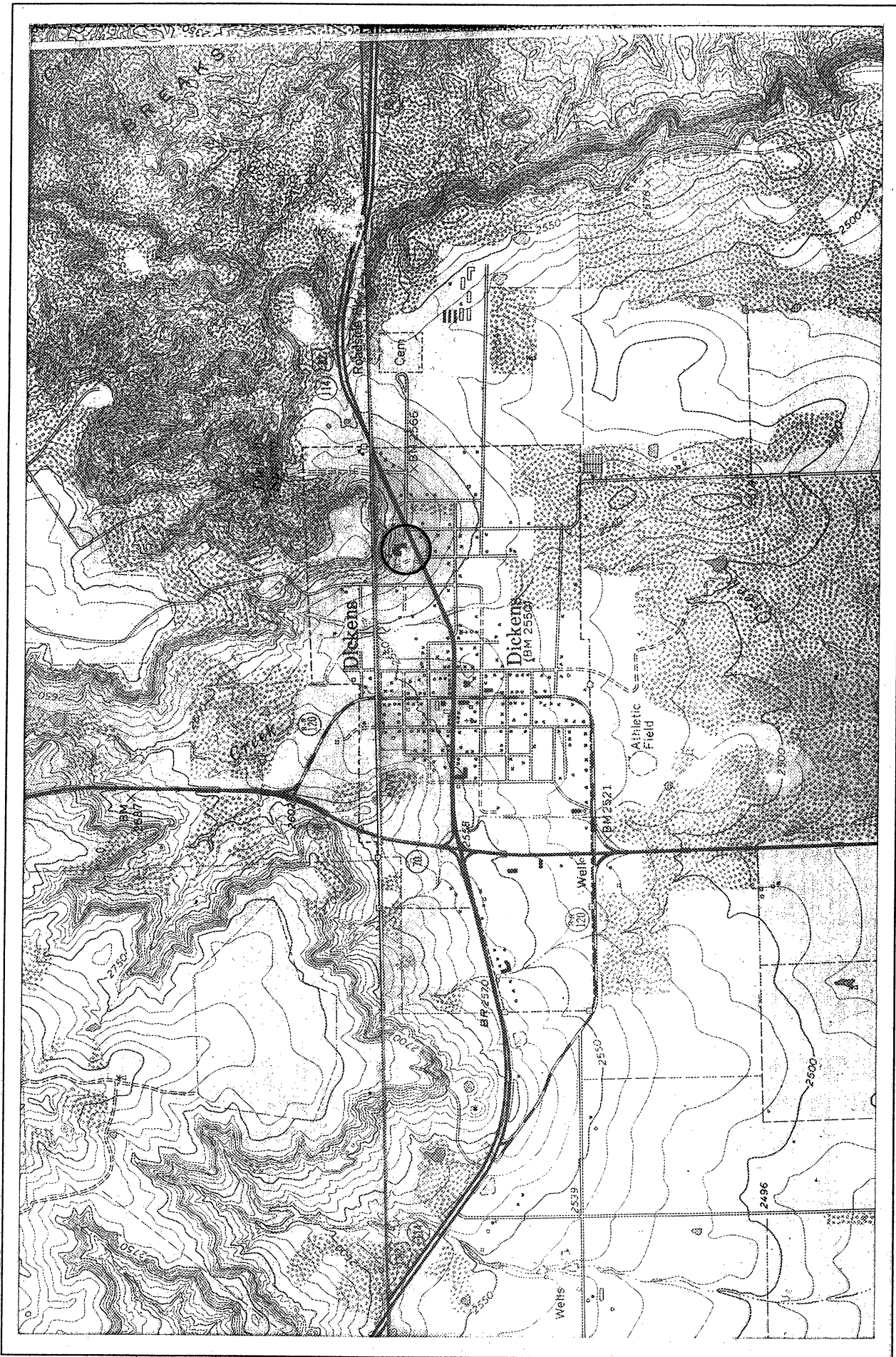


Figure 1. Location of the Dickens maintenance section (03), Dickens and King Counties, Childress District.

Childress District
Guthrie Section 03
Dickens and King Counties

Pete Lindsey (806) 623-5341

July 18, 1996

General Information:

- Site is substation for Dickens and King Counties.
- Maintenance site is located on the south side of Guthrie on the west side of US 83 (figure 1).
- The Wichita River is located along the south boundary of the maintenance site.
- Open fields, consisting predominantly of mesquite scrub lands, are located on the west side of the site and also on the east side of US 83.
- Residences are located along the north side of the maintenance facility and one house is located at the northwest corner of the site.
- Additional residences are located on the east and west side of US 83 across the river.
- Maintenance site has 5 pieces of equipment: 1 loader, 1 big dump truck, 1 small dump truck, a motor grader, and a pickup truck.

Waste Disposal Information:

- Waste motor oil, hydraulic fluids, oil filters, trash, and ashes were placed in injection wells.
- Tar and asphalt were washed from trucks in maintenance yard.
- Antifreeze disposal was uncertain but may have gone down injection wells and/or was poured onto ground; now change antifreeze in Childress
- Waste oil was sometime poured on ground behind maintenance building.
- Maintenance yard started to store waste material in 55 gallon drums in early 1980's.
- It would take an estimated 2 to 3 years to store up 500 gallons of waste suggesting that waste generation was probably less than 200 gallons per year.
- There are two septic systems at the maintenance site.

Waste Cistern Description:

- There are two abandoned waste cisterns at the Guthrie maintenance site
- Well #1 was located near the northwest corner of the maintenance building.
- Well #1 was a 36 inch, brick-lined cistern that was abandoned 25 to 30 years ago; the total depth and exact location of this cistern are uncertain.
- Injection Well #2 is located along the west fence line north of above ground storage tanks.

- Injection Well #2 was drilled for trash such as old oil filter, hydraulic filters, and ash remaining when paper trash was burned.
- Injection Well #2 was 24 inch diameter tin horn approximately 20 ft deep.
- Tin horn from injection Well #2 was pulled up several years ago and during the removal process, the hole collapsed; there was no information regarding remediation of well prior to collapse.
- The exact location of injection Well #2 is uncertain.

Hydrology of Area

- The maintenance site is located next to the Wichita River which is a discharge zone.
- The close proximity of the maintenance site to the river suggests that liquid waste products placed the injection wells could have migrated the short distance to the river; there were no obvious contaminant leaks along the river bank.
- The Wichita River is salty and is not used as a water supply.
- A few people have drilled salty wells but there is no known shallow fresh water wells in area.
- Much of the land in the county (80%) is owned by the 4-6 Ranch who has drilled many water wells; no fresh water has been found.
- TxDOT contact stated that well at his house was around 20 to 30 ft deep.

Guthrie (Section 03) Injection Well Summary:

There are two abandoned waste oil injection wells at the Guthrie maintenance section located on the west side of US 83 on the south side of Guthrie. Waste oil, hydraulic fluids, possibly antifreeze, filters, and waste paper ashes were placed into the injection wells. Some waste oil was disposed of on ground. Total liquid waste products were probably less than 200 gallons per year. The location of both injection wells is uncertain although one is located near the maintenance shed and the other along the west property line. The maintenance site is located next to the Wichita River which acts as a regional discharge area. This suggests that liquid waste material may have migrated the short distance to the river although no obvious contaminants were noted along the river bank. The Wichita River is salty and is not used as a water supply. There is no known source of shallow fresh water in the county.

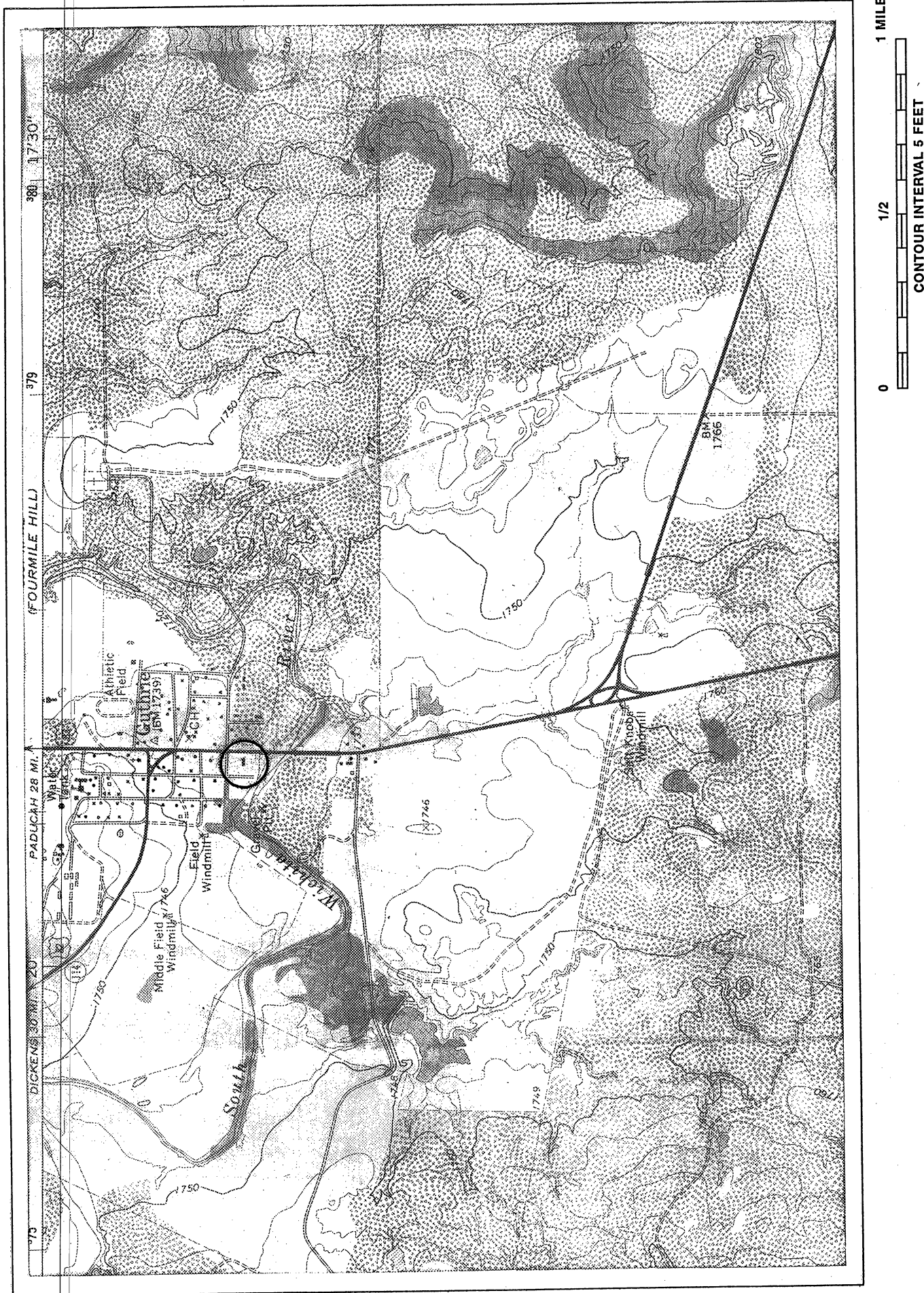


Figure 1. Location of the Guthrie maintenance section (03), Dickens and King Counties, Childress District.

Childress District
Matador, Section 04
Motley County

Garland Cartwright (806) 34702448

July 18, 1996

General Information:

- The maintenance site is located approximately 0.20 miles west of Matador on the south side of US 70 near the intersection of SH 70 and US 62 (figure 1).
- An open field and power substation are located immediately east of the maintenance site.
- An open field with one residence is located on the west side of the facility.
- An open field is located to the south side of the maintenance site.
- Mesquite scrub land and fields are located north of the maintenance site.
- maintenance site is on city water and sewer.
- There is an abandoned water well on maintenance site that once served as the water supply.

Waste Disposal Information:

- Wash rack water and sink water were placed into an wash rack water injection well located behind the maintenance building.
- Waste oil may have been disposed into a waste oil injection well located near the wash rack well.
- Waste products were estimated to be around 220 gallons per year.
- Waste injection wells were active in the middle to early 1960's and .
- The waste oil injection well was abandoned in the early 1980's.
- It is possible that the wash rack injection well was drilled when the waste oil injection well was abandoned.
- Tar and asphalt were cleaned from truck in maintenance yard using diesel and kerosene.
- Trucks are now cleaned in yard with citrosol.

Waste Cistern Description:

- The wash rack cistern 30 to 36 inches in diameter and approximately 15 to 20 ft deep.
- The abandoned waste oil injection well is shown on building blue prints and is believed to be of similar dimensions.
- The waste oil injection well is covered with dirt and remediation efforts before abandonment remain unknown.
- A pipe runs from wash rack injection well ran to septic tank filled with gravel and may be used to collect wash rack water when it overflows..

Hydrology of Area

- The topography at the maintenance site appears to slope to the south and southeast towards a small drainage located 0.10 miles southeast of the facility.
- A second drainage, located 0.10 mile to the northwest, joins the first drainage and both flow through the center of Matador.
- The main drainage is oriented northeast and eventually empties into Ballard Creek approximately 1.25 miles from the maintenance site.
- TD of well at maintenance site is 70 ft; depth to fresh water is 17 ft based on records on wall on well house.
- Water well on the north side of Matador are around 105 ft TD with depth to fresh water generally around 60 ft but sometimes at 40 ft.
- Another well in the area has a TD of 40 ft and fresh water occurs at 17 ft.
- City of Matador water wells have TD's around 100 to 120 ft but information regarding the depth to fresh water in these wells was not readily available.

Matador (Section 04) Injection Well Summary:

There is one wash rack injection well and one possible abandoned waste oil injection well at the Matador maintenance section located on the south side of US 62 approximately 0.20 miles west of the city. The waste oil injection well was probably active in between 1965 to the early 1980's and is now covered with dirt. It is not known if the well was remediated before abandonment. Wash rack water and motor oil were the dominant waste products and approximately 220 gallons of waste motor oil was generated each year. Both injection wells were 30 to 36 inches in diameter and approximately 15 to 20 ft deep. Depth to fresh water at an abandoned water well on the maintenance site is 17 ft., whereas depth to fresh water in the area ranges from 17 ft to 60 ft.

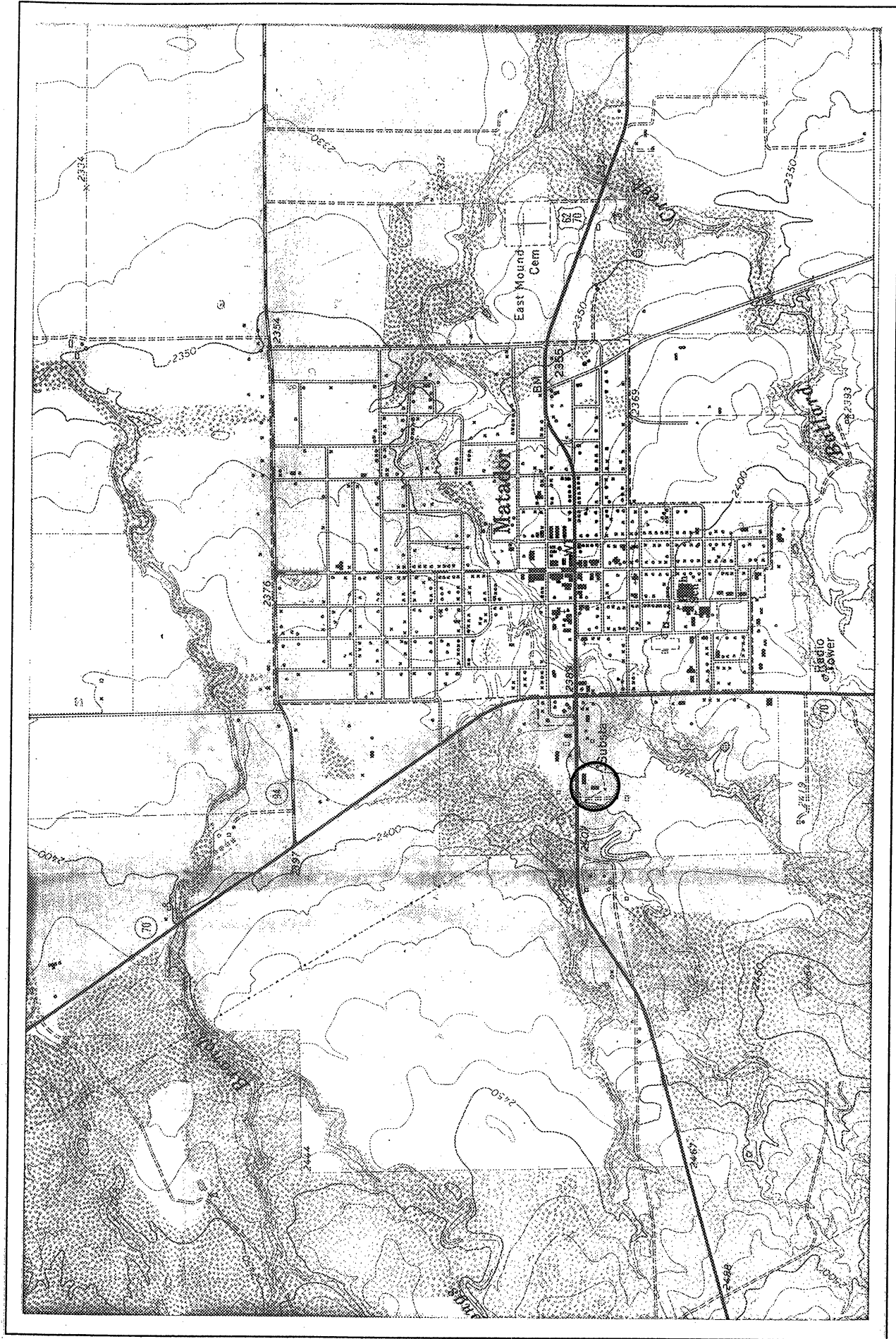


Figure 1. Location of the Matador maintenance section (04), Motley County, Childress District.

Childress District
Munday, Section 05
Knox County

Garland Cartwright (806) 347-2448
July 18, 1996

General Information:

- Maintenance site is located east on Munday on the north side of SH 222 approximately 0.15 miles west of the intersection of SH 222 and SH 267 (figure 1).
- Buildings are from early 1960's.
- Maintenance facility is on city water but does not have city sewer or trash pickup.
- There is approximately 90% impervious cover in yard.
- Residences are located less than 0.10 miles west of the site on the north side of SH 222.
- Crops (cotton and sorghum) are located north of maintenance site.
- Crops, residences, and a farm equipment company are located south of maintenance facility on the south side of SH 222.
- An old house in disrepair is located immediately east of maintenance site.
- Oil fields (pump jacks) are located approximately 0.50 miles northwest of maintenance site.
- Maintenance vehicles at facility include: 5 dump trucks, 2 loaders, 2 graders, 9 pickups, 1 sign truck, 1 roller, 1 broom, 1 sweeper, and 1 asphalt truck.

Waste Disposal Information:

- There are three waste water injection wells at maintenance section.
- The two active injection wells collect wash rack water from the wash bays; one injection well receives water from the ice machine.
- Both injection wells contain approximately 15 to 18 ft of standing water; depth to water is between 2 ft and 4 ft below the top of the injection well.
- The water level in the injection wells remains fairly constant.
- The abandoned (?) water injection well collected water from a sink in the resident engineers office.
- Oil is stored in above ground tanks but at one time waste oil was dispersed on roads in the county.
- It was not determined whether or not citrosol was used to clean asphalt and oil from trucks in wash bays; if so, the wash rack water could be contaminated with waste material.

Waste Cistern Description:

- There are two active and one abandoned (?) waste water injection wells at the maintenance site.
- Injection Wells #1 is located on the north side of the maintenance and service building approximately midway down the building.
- Injection Well #2 is also located behind the maintenance and service building approximately 25 feet west of injection Well #1.
- Both injection wells are constructed of 30 inch diameter tin horn approximately 20 to 25 ft deep.
- Injection Wells #1 and #2 are connected by a pipe; drain fields extend 75 to 100 ft east and west of the injection wells.
- Injection Well #3 is located on the south side of the resident engineers building and is now covered by the sidewalk.
- Injection Well #3 was believed to be 20 ft deep and constructed of 24 inch diameter tin horn.
- There is a septic tank system located near the northeast corner of the section warehouse.

Hydrology of Area

- Topographic relief at the site is minimal, but surface water flows to the east towards Munday.
- There are at least 7 water wells within 0.50 miles of the maintenance site.
- Wells located 1 mile south of the maintenance facility encounter water at 42 ft and the Red Bed at 59 ft.
- Other water wells south of town have fresh water at 40 to 45 ft with TD's of approximately 60 ft.
- Depth to red Bed three miles south is 59 ft and depth to fresh water is 33 ft.
- Water in area may be relatively high in nitrates but this is not confirmed.
- R. C. Voss owns a house with a shallow water well located 0.10 miles west of the site.
- Mr. Voss's water well has a TD of 32 ft and encounters water at 27 ft; his water is used from watering plants and not for drinking. Mr. Voss has been warned against drinking this water but he claims that it is good water.
- Depth to fresh water at maintenance site is 22 ft according to previous study.
- Several years ago, oil wells in area may have been leaking brine into shallow aquifer; once oil wells were plugged, encroachment of saline water stopped.
- Saline water encroached from the west but when oil wells to south were plugged, water quality in area began to improve.
- There are monitoring wells at maintenance site but TxDOT employees did not believe that any contamination was found; however, BTEX and trace quantities of chlordane have been reported in previous studies.

Munday (Section 05) Injection Well Summary:

There are two and possibly three active waste water injection wells at the Munday maintenance section located on the north side of SH 222 approximately 0.35 mile west of the city. The two active wash rack injection wells are 20 to 25 ft deep and constructed of 30 inch diameter tin horn. There is 15 to 18 ft of standing water in these wells. Although these wells are used for wash rack water, previous studies have reported the presence of contaminants in monitoring wells suggesting that other waste products were probably introduced into the wells. The third injection well is 24 inch diameter tin horn and is approximately 20 ft deep. This well collects water from a sink inside the resident engineer building and is now covered by a sidewalk; the sink may still drain into injection well. Depth to fresh water in the area is very shallow ranging between 22 to 45 ft. Depth to fresh water is 22 ft at the maintenance site where injection wells are approximately 20 to 25 ft deep. Therefore, wash rack water and other waste products from the active injection wells may enter the shallow aquifer to be transported east towards Munday.

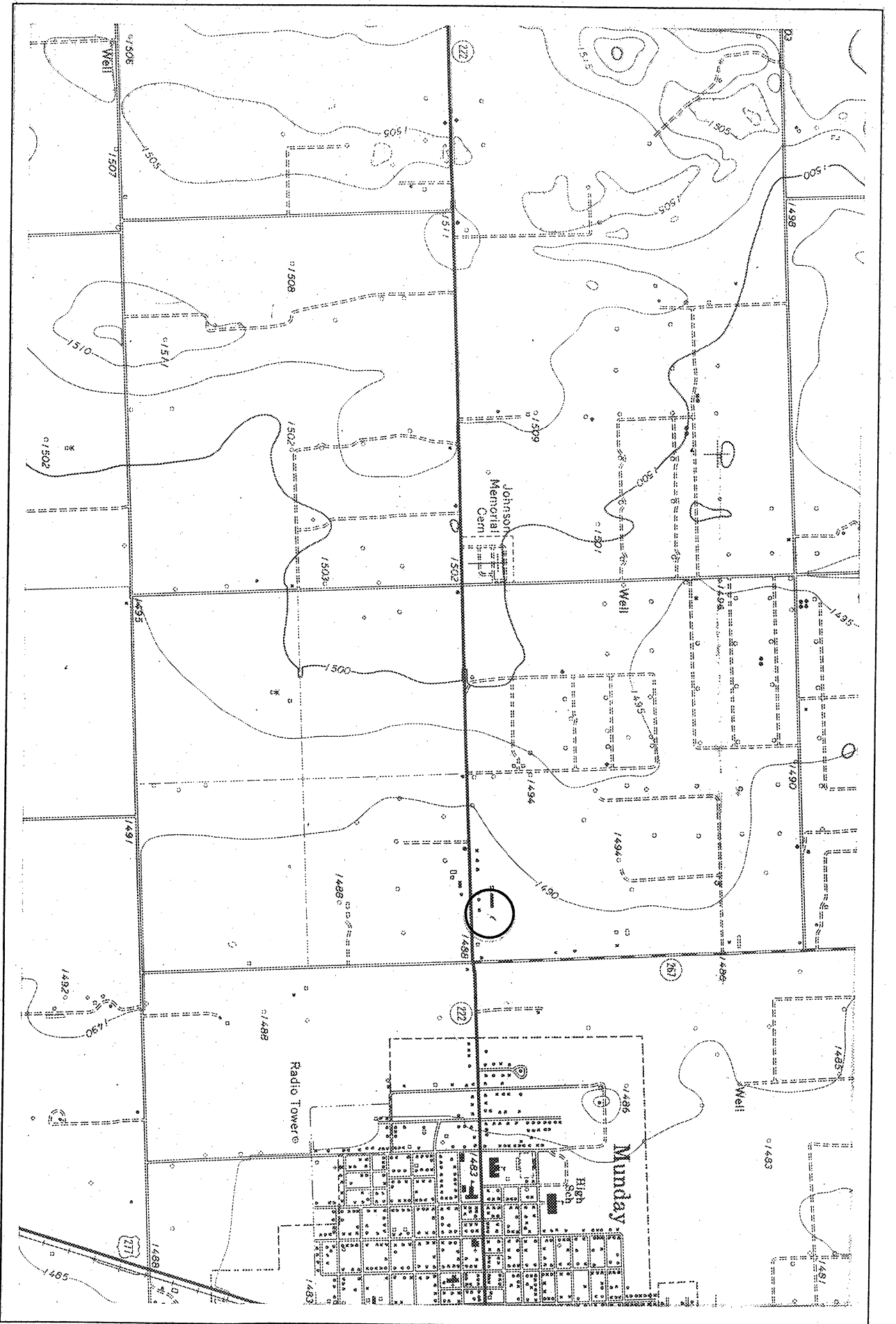


Figure 1. Location of the Munday maintenance section (05), Knox County, Childress District.

Childress District
Benjamin, Section 05
Knox County

Garland Cartwright (806) 347-2448
July 18, 1996

General Information:

- Maintenance site is located within the city limits of Benjamin approximately 0.15 mile south of US 82 on the east side of SH 283 (figure 1).
- Croplands are located to the east of maintenance site.
- Residences are located to the south and west of maintenance side and across the road to the north.
- Closest residence to the east is located only 100 or 200 ft from the injection wells.
- Residences in neighborhood do not have wells but some kind of irrigation system.
- Soil in area appears to be a lower permeability soil.
- Approximately 40 to 50% impervious cover.
- Maintenance site is on city sewer and water.
- Benjamin maintenance site use to be county headquarters but it was reportedly moved to Munday because of political reasons within the state legislature.

Waste Disposal Information:

- Wash rack water was placed into wash rack injection wells; some contamination of water by motor oil, diesel, antifreeze, and other waste products is possible.
- There was a slight oil sheen on top of standing wash rack water which was 5 ft from ground level in one injection well and 10 ft down in the second.
- Drainage lines leading from maintenance building to injection wells may be pinched-shut or clogged; however, this does not explain the presence of water in wells.
- Maintenance site use to clean tar and asphalt from trucks in maintenance yard using diesel and kerosene
- Waste oil was collected and dispose of waste material around road signs and guard rails as an herbicide; oil is no recycled.
- Injection wells were drilled and became active in the early to middle 1960's; a lateral leach field was constructed sometime between 1975 and 1978 to handle injection well overflow.
- Monitoring wells were drilled several years ago.
- There is a slab from an older building on site but it is not known if septic and/or injection wells are associated with this building.

Waste Cistern Description:

- There are two active (?) wash rack water injection wells located at the maintenance site.
- Both injection wells are located approximately 200 ft east of the main building
- Both wells are constructed of tin horn that is standing 6 inches or more above the ground surface.
- The 30 inch diameter tin horn is believed to be 20 to 25 ft deep; small vertical slits in the tin horn were made to assist seepage into surrounding clayey soil.
- The two injection wells are connected by a 3 inch diameter metal pipe.
- A perforated, 3 inch diameter PVC pipe runs 60 to possibly 100 ft north of northernmost injection well; this pipe is buried approximately 3 ft.

Hydrology of Area

- Topography at the maintenance site slopes towards Lake Benjamin located to the southwest.
- Several small ponds are located west and east of the facility in drainages running towards the lake.
- A city water tower is located 0.30 miles west of site.
- The City of Benjamin derives fresh water from surface lakes 12 miles north of the city; however, there may be a water well in town for emergency use.
- One resident in area stated that all shallow water in the area is of poor quality.
- Some water board reports suggested that ground water north of Benjamin contains high amounts of nitrates but this may be incorrect according to local water well driller.
- No windmills were noted in area and the residences surrounding the maintenance site are on city water and sewer.
- There are some perched water tables around 20 ft deep in area but fresh water occurs around 400 ft deep.

Benjamin (Section 05) Injection Well Summary:

There are two wash rack injection wells at the Benjamin maintenance section located on the east side of SH 283 approximately 0.15 miles south of US 82. The maintenance site is located within the city limits. The injection wells were active from the early to middle 1960's until at least the middle 1970's. The 30 inch diameter tin horn wells were approximately 20 to 25 feet deep and now contain approximately 15 to 20 ft of standing water; depth to water ranged between 5 and 10 ft. Although the wells were used primarily as wash rack injection wells, some contaminants such as motor oil and antifreeze may have entered the system; an oil sheen was present on water standing in the wells. Water supply for residences in the area is from lakes located 12 miles north of the city.

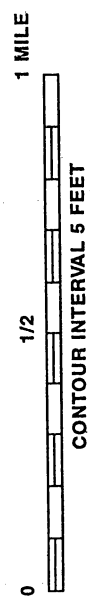
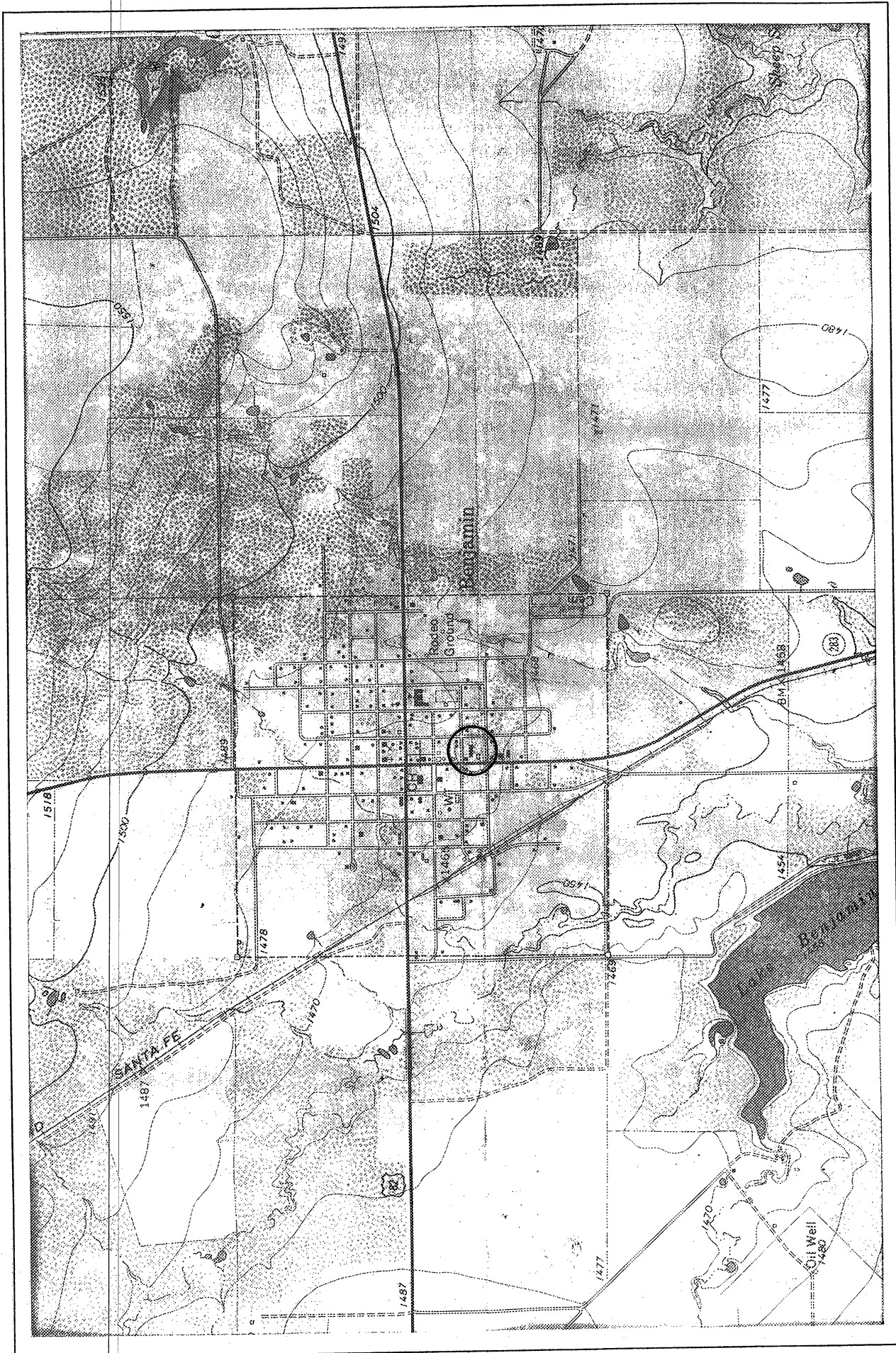


Figure 1. Location of the Benjamin maintenance section (05), Knox County, Childress District.

Childress District
Quanah, Section 07
Hardeman County

Maurice Farris (817) 663-2822

July 22, 1996

General Information:

- Maintenance site is located on the western edge of Quanah on the east side of SH 133 (figure 1).
- Residences are located near the north and west sides of the facility.
- There is an open field across SH 133 to the east.
- An old house, that maybe part of the TxDOT facility, is located on the south side of the maintenance yard.
- Maintenance site has approximately 20 vehicles which include: 1 large dump truck, 4 smaller dump trucks, 2 maintainers, 1 roller, 3 loaders, 1 brush, 4 pick ups, and 3 miscellaneous smaller vehicles.
- Impervious cover is approximately 80 percent.
- Maintenance site is on city water and sewer

Waste Disposal Information:

- Motor oil and hydraulic fluids were disposed of in waste oil injection well; waste oil is now stored in above ground tanks.
- Total depth of well is 20 to 25 ft.
- Injection well contains at least 3 ft of standing oil and 10 to 15 feet of water; however, it was difficult to get good measurements of contaminants in well.
- There are heavy oil stains on sides of waste oil cistern.
- Trucks were always washed in yard so that wash rack water always went to city sewer system.
- Citrosol is used to clean asphalt from trucks in yard.
- Injection well had to be pumped out one per year because the waste products did not drain quickly enough into surrounding soil.
- Based on number of vehicles on site and assuming that the types and numbers remained constant over time, several hundred gallons of waste products were disposed each year into injection well.
- Assuming that there are approximately 50 gallons per ft of a 30 inch diameter well, then the total volume of waste products for a 15 ft deep well would be 750 gallons per year.

Waste Cistern Description:

- Waste oil injection well consists of several sections of cement culvert pipe which extend approximately 6 inches above ground level; there is a metal lid on well.
- Blue prints refer to this injection well as a “French Drain”
- The cistern is approximately 30 inches in diameter and 20 ft deep and there are standing waste products in well.
- A three inch diameter drainage line from building to injection well has been shut off so the source of the contaminants presently in well is uncertain

Hydrology of Area

- The facility is located on a small hill although the topography at maintenance site slopes towards the north.
- Deak Wilson (817) 663-6301 provided information regarding local hydrology.
- There is shallow ground water in area but it has a high TDS (gypsum or saline water) and is very erratic and the wells are not high yield water wells; sometimes water occurs in large cavities.
- Gypsum windmill water is used locally for irrigation.
- According to the Wilson, fresh water may occur around 120 to 180 ft deep although other sources place water depth at 80 to 100 ft
- Fresh water occurs north of town at a depth around 150 ft.
- The City of Quanah derived drinking water from Lake Greenbelt.

Quanah (Section 07) Injection Well Summary:

There is one waste oil injection well the Quanah maintenance site located on the west side of Quanah. Blueprints of the maintenance facility refer to it as a “French Drain”. This injection well probably became active in the early to middle 1960’s and still contains oil and water. The injection well consists of several sections of stacked cement culvert pipe which extend 6 inches above ground level; a large metal lid covers the injection well. The well is estimated to be 20 to 25 ft deep and contains 3 ft of standing oil and approximately 10 to 15 ft of water. There shallow ground water in area but it’s occurrence is erratic and the high TDS of the water restricts its use to irrigation. Estimates of depth to fresh water in Quanah range between 80 to 180 ft but Lake Greenbelt provides the city with drinking water.

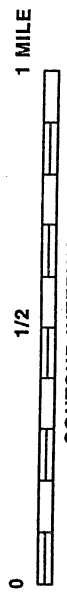
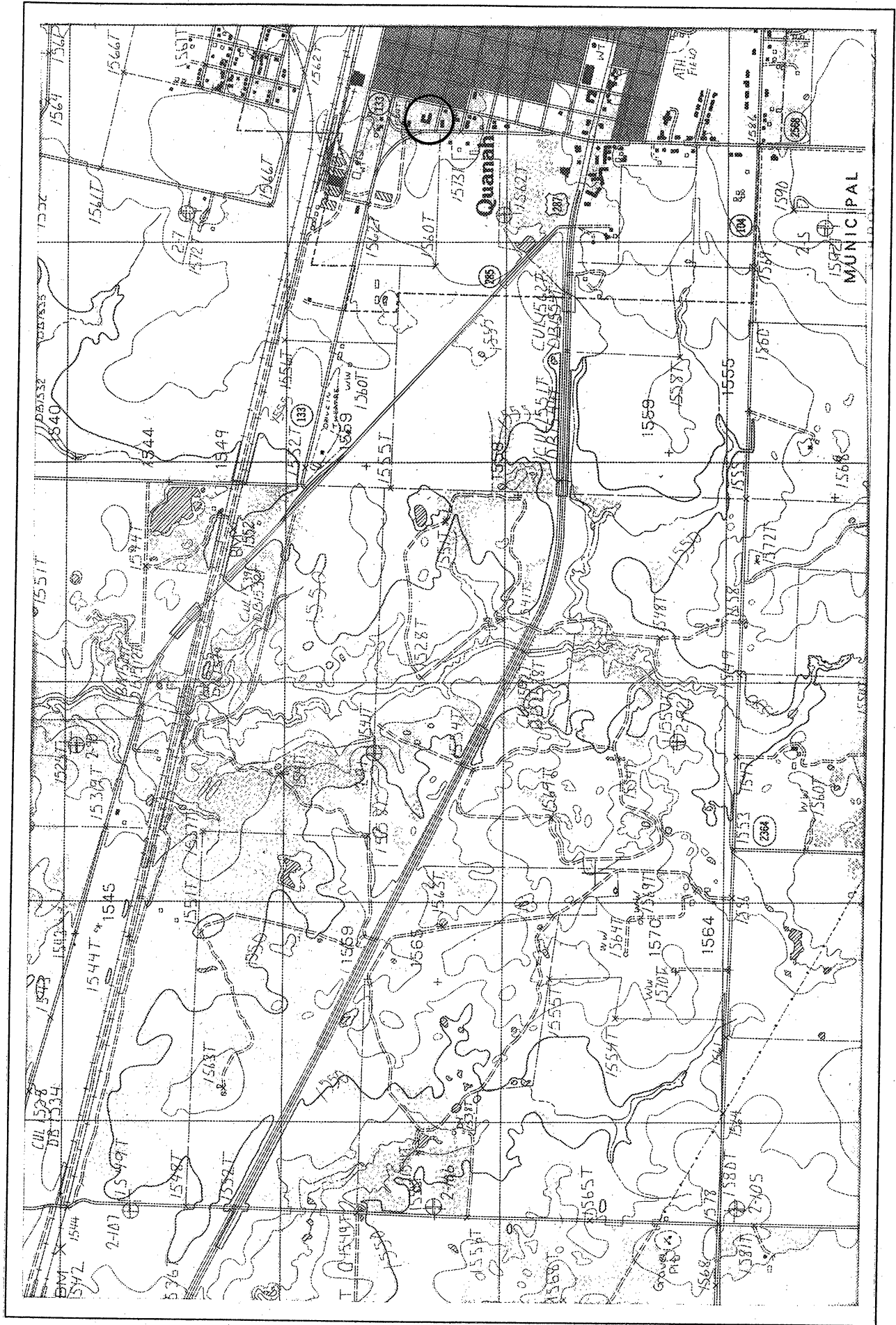


Figure 1. Location of the Quanah maintenance section (07), Hardeman County, Childress District.

Childress District
Wellington, Section 09
Collingsworth County

Jerry Allison (806) 256-3206

July 22, 1996

General Information:

- The maintenance site is located 0.15 miles east of US 83 on the north side of SH 338 east of Wellington (figure 1).
- Open fields are located directly across SH 338 south of the facility but there are some houses located southwest and southeast of the site.
- Maintenance site was always on city water.
- An open field and residence are located on the east side of the facility and a city park is located less than 0.25 miles east of the site.
- Open fields are located north and west of the maintenance site although the City of Wellington is located 0.15 miles west of the maintenance facility.
- Impervious cover at the maintenance site exceeds 60%.
- Maintenance site contains approximately 20 pieces of equipment including: 12 pick up trucks, 1 maintainer, 2 loaders, and 6 dump trucks

Waste Disposal Information:

- There are two waste oil injection wells located at the maintenance site.
- Injection Well #1 is located on the north side of the equipment storage shed, was used for waste oil and hydraulic fluid disposal.
- Injection Well #2 located on the west side of the building near the fence line was used for wash rack water.
- Disposal of waste oil into wells stopped approximately 20 years ago and started using 55 gallon drums
- This suggesting that the wells were active from the early 1960's until the middle to late 1970's.
- Both wells contain 10 to 15 ft of standing water and were oil-stained suggesting that some hydrocarbon waste products were placed into wash rack injection well.
- Antifreeze was taken to Childress for recycling or drained into wash bay.
- Tar and asphalt were cleaned from trucks using diesel and/or kerosene between the maintenance warehouse and equipment storage shed.
- More recently they are using citrosol to clean trucks.

Waste Cistern Description:

- There are two waste oil injection wells at this maintenance site.
- Injection Well #1 was designated for waste oil disposal and injection Well #2 for wash rack water.
- The presence of oil staining on the sides of the wells and the known disposal of waste oil and/or antifreeze into the wells is justification for describing both wells as waste oil injection wells.
- Both injection wells are 36 inch diameter tin horn with an estimated depth of 20 to 25 ft; there are not lids on the wells but steel rebars are welded across the cistern openings.
- Depth to water is approximately 10 ft in injection Well #1 and 5 ft in injection Well #2.
- A drainage pipe extends south from the wash rack injection well running parallel to the fence line.

Hydrology of Area

- Topography of the area is relatively flat but still slopes to the south towards SH 338.
- After crossing SH 338, surface water will flow to the southeast.
- Injection Well #2 is located on the side of a drainage ditch that trends north south, parallel to the fence line.
- A culvert pipe allow water in the ditch to pass out of the property and towards SH 338.
- Potential sources of water depth information include the City of Wellington (817) 447-2588; the Soil Conservation Service, (806) 447-5341; AG extension (806) 447- 2575; and local water well drillers.
- The City of Wellington has three water wells located approximately 7 miles north of town.
- Residences around TxDOT site are on city water although some houses appear to have irrigation wells.
- Depth to fresh water in area ranges from 40 to 240 ft across county.
- One contact reported water at 45 ft in his well located in town although he is not sure of how good the water is.
- Golf course irrigation wells encounter water at around 30 ft.
- Other reports estimate depth to first water at 17 to 37 ft., but shallow aquifers in the area contain small to moderate concentrations of fresh to slightly saline water.

Wellington (Section 09) Injection Well Summary:

There are two abandoned waste oil injection wells at the Wellington maintenance section located 0.15 miles east of US 83 on the north side of SH 338 (east of Wellington). Injection Well #1 was originally dedicated for waste oil disposal and injection Well #2 for wash rack water. However, oil and antifreeze waste products were disposed of in both wells and the cisterns are heavily stained with oil. These injection wells were active from the early 1960's until the middle to late 1970's. Both wells are 36 inch diameter tin horn with a total depth of approximately 20 feet; these wells contain 10 to 15 ft of standing water. Depth to fresh water in county ranges from 40 to 240 ft. Depth to first water in the area around the City of Wellington probably ranges from 17 to 37 ft.; however, these shallow aquifers contain only small to moderate concentrations of fresh to slightly saline water. The City of Wellington derives drinking water from wells located in alluvial aquifers 7 to 10 miles north of town suggesting that wells at residences near maintenance site use shallow water for irrigation purposes.

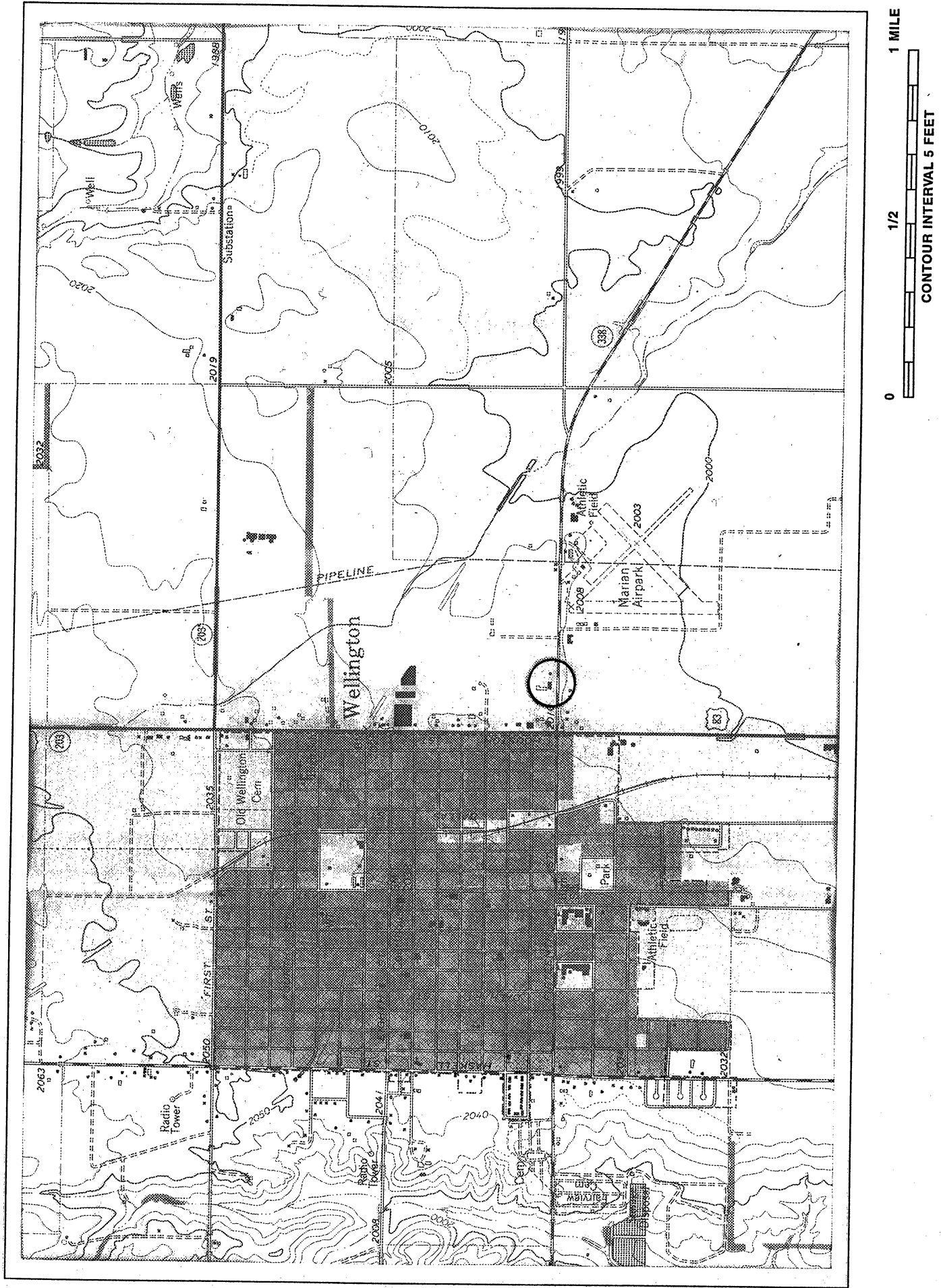


Figure 1. Location of the Wellington maintenance section (09), Collingsworth County, Childress District.

Childress District
Memphis, Section 12
Hall County

Gerald Myers (806) 259-2122

Brent Ford

July 24, 1996

General Information:

- The maintenance site is located east of Memphis on the south side of SH 256 (Noel Street) approximately 0.2 miles east of the railroad tracks (figure 1).
- The facility is in a residential area and there are houses located on the north and east sides of the site.
- Open fields are located on the south and west sides of the facility although houses are also located immediate southwest of the facility.
- Residences around the maintenance site are on city water and sewer; there are no abandoned windmills or visible water wells in area.
- The maintenance yard contains approximately 12 pieces of equipment.
- Maintenance site is on city water and sewer.
- Impervious cover at maintenance site was more than 70%.

Waste Disposal Information:

- There are two waste oil injection wells at the maintenance site.
- Waste oil and hydraulic fluids went into injection Well #1 until 6 to 8 years ago
- Injection Well #1 is located approximately 15 ft north of the building between the building and Noel Street.
- Injection Well #2 was abandoned and covered with asphalt pavement and presumably received the same types of waste products as injection Well #1.
- Wash rack may have gone into septic system until new sewer system was installed several years ago.
- There were conflicting stories regarding disposal of wash rack water; some of wash rack water may have been disposed of in drainage ditch too.
- Asphalt and tar were cleaned from trucks in maintenance yard using diesel and kerosene; now maintenance personnel are using citrosol.
- Injection Well #1 was filled with fluids (waste oil?) until 2 to 3 years ago when it was pumped out; the cistern is oil-stained.
- Injection Well #1 never had to be pumped out while in use suggesting that the soil and rock are permeable enough to accept waste fluids.

- The injection wells were probably active between the early 1960's and the late 1980's.
- Depth to water in well was 3 to 4 ft suggesting there is at least 15 ft of water in the

Waste Cistern Description:

- There are two abandoned waste oil injection wells at this maintenance facility; both were covered.
- Injection Well #1 is located between the north side of the maintenance building and Noel Street.
- Injection Well #1 is a 36 inch diameter tin horn approximately 20 ft deep.
- The well is covered by a metal lid and 4 to 6 inches of dirt and grass.
- Vertical slits were cut in the tin horn to facilitate waste product movement into the soil and rock.
- Injection Well #2 was located approximately 150 ft south of maintenance building in the parking lot.
- Injection Well #2 is covered with dirt and asphalt and the exact location is difficult to determine.
- No information was available regarding remediation of injection Well #2 before it was abandoned.

Hydrology of Area

- Topography at the maintenance site slopes to the northeast towards Parker Creek located 0.25 miles from the maintenance facility.
- Several small ponds are located within 1 mile of the maintenance site.
- Depth to fresh water in area is estimated to be 30 ft although the quality of this water is questionable.
- There is a dry drainage located on the south side of the maintenance site that connects with a small, dry streambed.
- The City of Memphis obtains drinking water from city wells located 10 to 12 north of the town (aquifer is the Ogallala) and from lake Greenbelt.
- City manager is cousin of TxDOT employee at the maintenance facility.

Memphis (Section 12) Injection Well Summary:

There are two abandoned waste oil injection wells at the Memphis maintenance section located on the south side of SH 256 (Noel Street) approximately 0.15 mile east of the city. These injection wells were active from the middle 1960's until the late 1980's and both wells are now covered. Waste oil and hydraulic fluids were placed into both injection wells. Injection Well #1 is a 36 inch diameter oil-stained tin horn approximately 20 ft deep and this well contains standing water. Injection Well #2 is covered by asphalt pavement in the parking lot and remediation efforts before abandonment of this well are unknown. The City of Memphis derives drinking water from the Ogallala aquifer located 10 to 12 miles north of the city and from Lake greenbelt. Depth to first water in the area probably less than 100 ft although the quality of this water may be questionable. Parker Creek located 0.25 miles northeast of the maintenance facility.

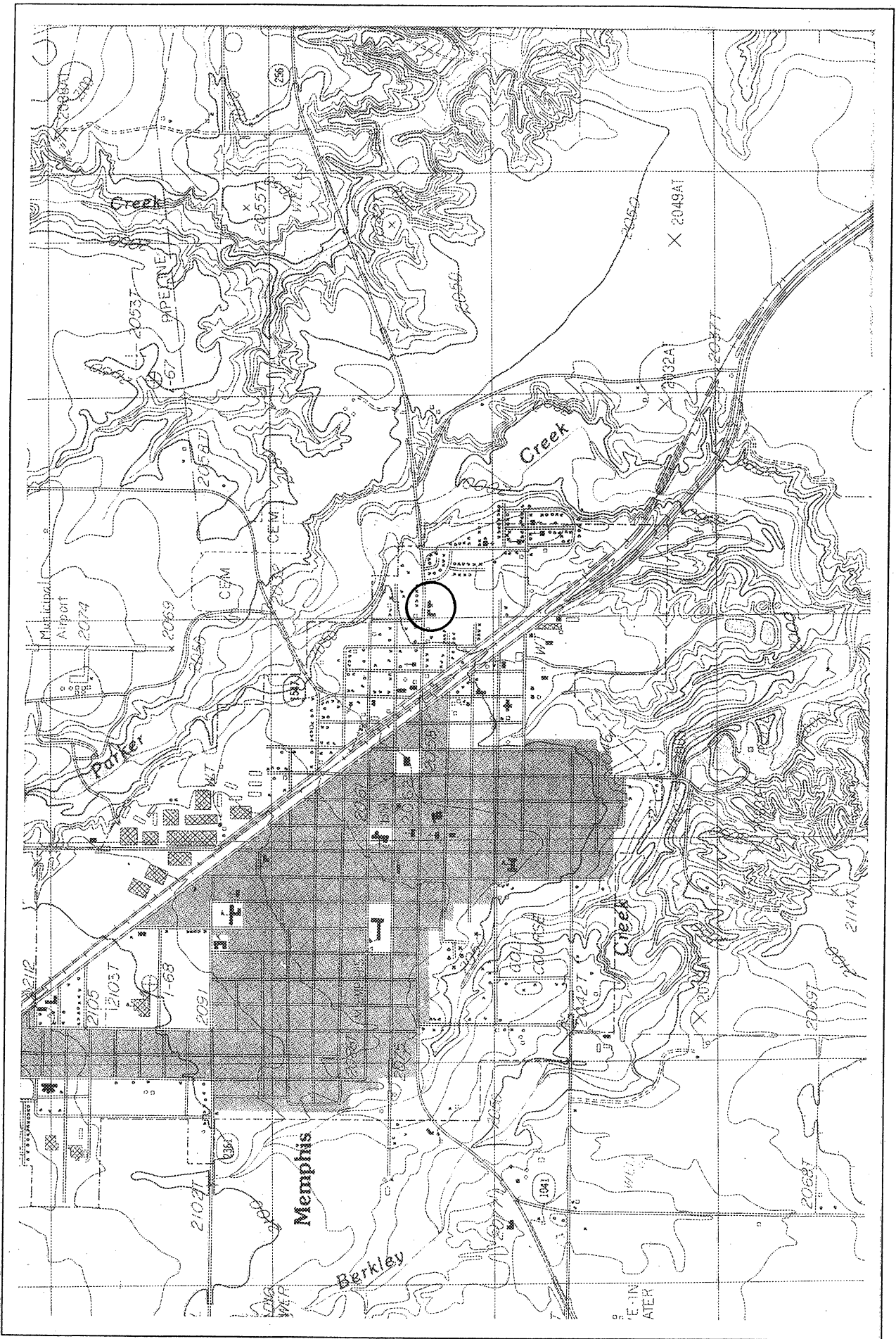


Figure 1. Location of the Memphis maintenance section (12), Hall County, Childress District.

Corpus Christi District
Beeville, Section 02
Bee County

Adan Cantu (512) 358-3178
June 13-14, 1996

General Information:

- Vegetation type in area is mesquite scrub oak and mesquite grassland.
- Facility is located on the southeast corner of Beeville near the intersection of bypass SH 202 and BR 181; it is on the south side of BR 181 (figure 1).
- Grain silos are located on north side of BR 181 across the street from site
- Residences located approximately 0.15 mi northwest of site on other side of small drainage.
- Open field used as a private junk yard located to the southeast of site; mesquite-grassland-type vegetation.
- Immediately northwest of site is corn field and mesquite grassland.
- Open mesquite grassland located behind site to SW.
- Maintenance site is on city water and city sewage.
- Impervious cover is approximately 50%.
- Sometimes vacuum out grease from grease pit in oil-change area.
- Residences in area around maintenance site are on city water.
- There are oil wells located approximately 1.25 miles southwest of maintenance site.

Waste Disposal Information:

- Wash water runs into waste cistern.
- Oil is saved and recycled in 55 gal drums (8 to 12 bbl per year); always has been transported offsite.
- Radiator fluids also saved and transported
- Residue from grease trap is transported off site.
- Sludge from bottom of cistern removed by bucket and transported off site.
- Varsol, used to remove grease, also went into cistern.
- Larger trucks use 16 qts (4 gal) of oil and 2.5 to 3 gal of radiator fluid.

Waste Cistern Description:

- Waste injection well consisted of several 4 to 5 ft sections of cement drainage pipes connected/stack on each other.
- Inner diameter 18 inches.
- Total depth approximately 16 ft with silt and solid (?) on bottom
- Approximately 2 ft of silt on bottom.
- Estimate 10 to 12 ft to top of water; approximately 4 feet of dirty water in cistern.
- The cement cover over waste cistern and location towards top of hill prevent rain runoff from entering system.

Hydrology of Area

- Water becomes saltier south of town.
- There is a small drainage, a branch of Poesta Creek, located approximately 0.10 mile west of site; this drainage is dry.
- There are no windmills in area suggesting that there is no perched aquifers; however, water table would be expected to be closer to surface in vicinity of drainage.
- City of Beeville Waste water Division contact was John C. Standlea (pronounced Stanley), Superintendent Water-Waste Water Division (512) 358-8100
- City of Beeville water well data:

<u>Well Number</u>	<u>TD</u>	<u>Static 1994</u>	<u>Static 1995</u>
4	626	71	78
5	1592	101	122
6	1627	81	87
7	1554	99	102
8	1600	96	101

Beeville (Section 02) Injection Well Summary:

There is one waste water injection well present at the maintenance site in Beeville; the facility is located on the southeast corner of Beeville near the intersection of bypass SH 202 and BR 181. The waste water injection well is constructed of several pieces of cement culvert pipe stacked vertically. The diameter of the well is 18 inches and the total depth is approximately 16 ft; there was 2 ft of silt and sludge on the bottom and 4 ft of standing water. A cement cover over waste cistern and location of well towards the top of hill prevents rain runoff from entering system. Wash rack water drains into cistern although grease from trucks was cleaned with varsol in the wash rack, suggesting that varsol and waste material from the trucks also entered drain. Grease trap associated with cistern and waste oil stored in drums were removed by contractor. Average depth to fresh water in Beeville is 80 to 120 ft.

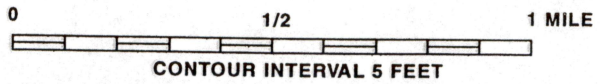


Figure 1. Location of the Beeville maintenance section (02), Bee County, Corpus Christi District.

Corpus Christi District
George West, Section 04
Live Oak/Jim Wells Counties

Jack Jenkins (512) 449-1918

Brent Tanzy

June 13-14, 1996

General Information:

- Mesquite scrub-brush with small hills and caliche in area.
- Located on the northwest corner of George West on the south side of US 281 (figure 1).
- Dry creek bed through center of maintenance section; gravel storage is located northwestward across the creek.
- George West was first maintenance section built in district.
- At least 4 or 5 trucks are stationed at maintenance section.
- There are residences (Travis Street) located on a small hill northwest across creek from maintenance site.
- There are residences located within 500 ft southeast of the maintenance site.
- Open fields, residences, and a high school playing are located next to gravel stacks.
- High school football and baseball fields are located within 0.25 mile upstream from maintenance facility.
- Maintenance sections did not use herbicides many years ago.

Waste Disposal Information:

- Waste oil cistern is located on the southwest corner of the wash rack shed.
- Pre 1970's oil and antifreeze was disposed of in waste oil injection well
- Stopped using injection well sometime in late 1970's or early 1980's
- Date on cement collar of injection well in 6-12-67; used injection well for 10 to 13 years.
- There was standing water in injection well.
- Cement culvert pipes were cracked allowing water into system during rain/ water leakage into surrounding soil/rock.
- Wash rack is cemented off from injection well.
- There was 4 to 5 ft of black water, possibly an oil and water mix, standing in cistern.
- Water in cistern was believed to be left over from wash rack that was disconnected from cistern about a year ago when it was cemented off from wash bay.
- Based in number of trucks and frequency of oil changes, waste oil generated at site is estimated about 80 gallons per year.

Waste Cistern Description:

- Waste injection well is composed of several sections of stacked cement culvert pipe, each section 4 to 5 ft long.
- Date scratched on cement collar around injection well is 1967.
- Total depth of injection well is at least 12 to 14 ft and the inner diameter is 18 in
- Depth to top of standing water in injection well was 8 ft and there is 4.5 to 5 ft of black sludge-like material in bottom of well.
- The wash rack was connected to cistern until approximately 1 year ago when it was sealed off.
- The cement culvert pipes were cracked.

Hydrology of Area

- McKimzey Creek Runs through the middle of the Maintenance section; no water in creek unless there is rain.
- Water was waist deep at maintenance site in the 1970's during a major flood.
- High school football and baseball fields upstream from maintenance section are watered heavily and runoff from these fields goes into the creek.
- Although there normally is no running water in the creek, over time runoff from the sports fields might add additional head to move contaminants downstream.
- There are additional residences approximately 0.50 to 0.75 mi. downstream from maintenance section; these residences are on city water.
- Residences around maintenance section are also on city water.
- "Ed" at a drilling service located on US 281 approximately 1 mile northwest of facility provided information about depth to fresh water in area.
- There are water sands in the area at around 110 ft.
- Depth to fresh water in two wells 6 miles south of George West ranges between 190 and 460 ft.
- A 200 ft deep water well located approximately 0.25 mile downstream from TxDOT facility encountered fresh water at 28 ft.
- There are more residential units downstream from maintenance site.

George West (Section 04) Injection Well Summary:

There is one abandoned waste oil injection well at the George West Maintenance facility located on SH 281 north of the city. This well, probably constructed in 1967, consists of several 4 to 5 ft segments of 18 in diameter cement culvert pipe and has a total depth of 12 to 14 ft. There is a cement lid on the injection well but the culvert pipe is cracked. Approximately 4.5 to 5 ft of black-sludge is on the bottom of the well; depth to water is 8 ft. Well was used for waste oil, wash rack water, and antifreeze for 12 to 13 years from the late 1960's to early 1980's and then for wash rack water only from the early 1980's to 1995. McKimzey Creek run through the middle of the maintenance section but this creek does not flow unless there is a rain. Water was standing waist deep at the maintenance section during major flood in the 1970's. Depth to fresh water in a 200 ft deep well located 0.25 miles downstream from maintenance site is 28 ft.

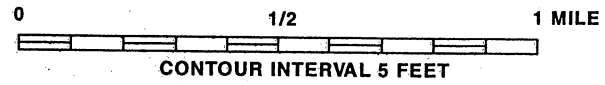
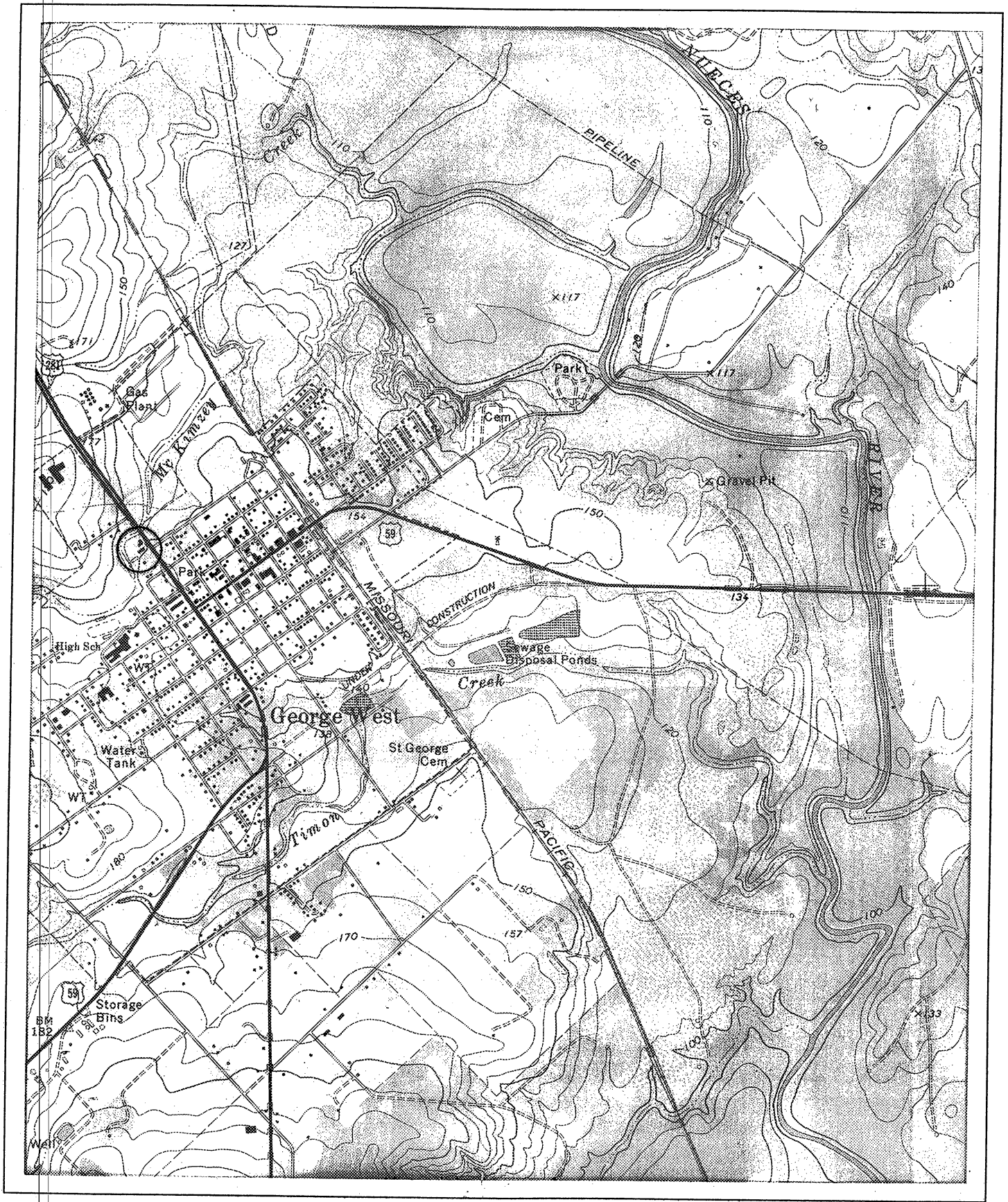


Figure 1. Location of the George West maintenance section (04), Live Oak County, Corpus Christi District.

Corpus Christi District
Goliad, Section 05
Goliad County

Arthur Garcia (512) 645-3452
June 13-14, 1996

General Information:

- The maintenance site is located on the south side of US 59 approximately 0.75 miles west of the intersection of US 59 and US 183 on the west side of Goliad (figure 1).
- There are 13 employees stationed at site.
- Impervious cover over yard is approximately 80%.
- Two 12,000 gal asphalt tanks.
- Residence adjacent to maintenance yard.
- Maintenance site is on city water and city sewer.
- Goliad State Park is located approximately 1 mile southeast of site.
- Herbicide trucks also cleaned at site suggesting some (probably minor) potential for herbicides to enter cistern.
- Area is characterized by oak and scrub brush hills with flatlands in drainages.
- Goliad State Park is located approximately 1 mi southeast of maintenance site on a meander loop of the San Antonio River (figure 1).

Waste Disposal Information:

- Wash water runs into waste cistern.
- Oil is saved and recycled in 55 gal drums (8 to 12 bbl or 440 to 660 gallons per year); waste oil always has been transported offsite.
- Radiator fluids are also saved and transported
- Residue from grease trap is transported off site.
- Sludge from bottom of cistern removed by bucket and transported off site.
- Varsol, used to remove grease, also went into cistern.
- Larger trucks use 16 qts (4 gal) of oil and 2.5 to 3 gal of radiator fluid.

Waste Cistern Description:

- Cistern located on east site a maintenance facility between fence and building.
- Waste cistern consisted of several 4 to 5 ft sections of cement drainage pipes connected/stack on each other.
- Inner diameter 18 inches.
- Total depth approximately 16 ft with silt and solid (?) on bottom
- There are approximately 2 ft of silt and 4 feet of dirty water in cistern.
- Cement cover over waste cistern and location towards top of hill prevents rain runoff from entering system.

Hydrology of Area

- TxDOT employees estimated most water in area wells area range from 185 to 240 ft deep with ground water levels ranging from 160 to 400 ft deep; Depth to fresh water at Refugio is around 170 ft.
- Maintenance site sits at the top of a hill which acts as a potentiometric ridge; therefore, water will flow north, west, or possibly east depending on location at site.
- City water well and tank approximately 0.15 mile downhill (east) from site on the corner of San Patricio (north-south) and Franklin (east-west) streets.
- There is also an abandoned windmill in residential area near water tank.
- Many ranches and residence outside of city limits use own water wells; depth to water estimated to be 180 ft.
- Runoff from injection well is to the north to SH 59 and then downhill to east to a dry creek bed that runs near city water well.
- Alberto Arredono, Assistant City Supervisor, stated that Goliad has three wells: (1) Oak and Commercial Streets, (2) Chilton Street on north side of town, and (3) No. 7 near Franklin and San Patricio Streets. Well #1 produces at 450 GPM, whereas Wells #2 and #3 produce at 600 GPM.
- TD of all wells is approximately 550 ft; depth to water is 60 to 80 ft.
- Water on north side of town is a little saltier than water elsewhere.
- Geophysical logs of wells from Schlumberger are available at City Hall.
- Sewage ponds are located south of maintenance site.

Goliad (Section 05) Injection Well Summary:

There is one waste water injection well present at Goliad maintenance site is located on south side of US 59 approximately 0.75 miles west of the intersection of US 59 and US 183. The waste water injection well is located on the east site of maintenance facility between fence and building. There was no indication of other waste fluids although some waste products, including herbicides, may have entered the well. This cistern consists of several sections of 18 inch diameter, stacked cement culvert pipe and is approximately 16 ft deep; an estimated 2 ft of silt and 4 feet of dirty water are in cistern. Cement cover and the location of the well towards top of hill prevents rain runoff from entering cistern. Waste well is located on small hill and there is city water well approximately 800 ft east of maintenance section; depth to water in area is approximately 60 to 80 ft. At least one windmill is located downhill from the facility but it is not known if it indicates that residents are using shallow water as a drinking source. However, residents around the edge of town do obtain water supply from own water mills.

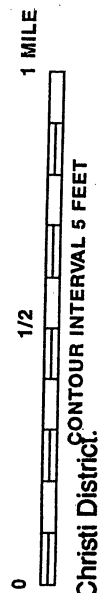
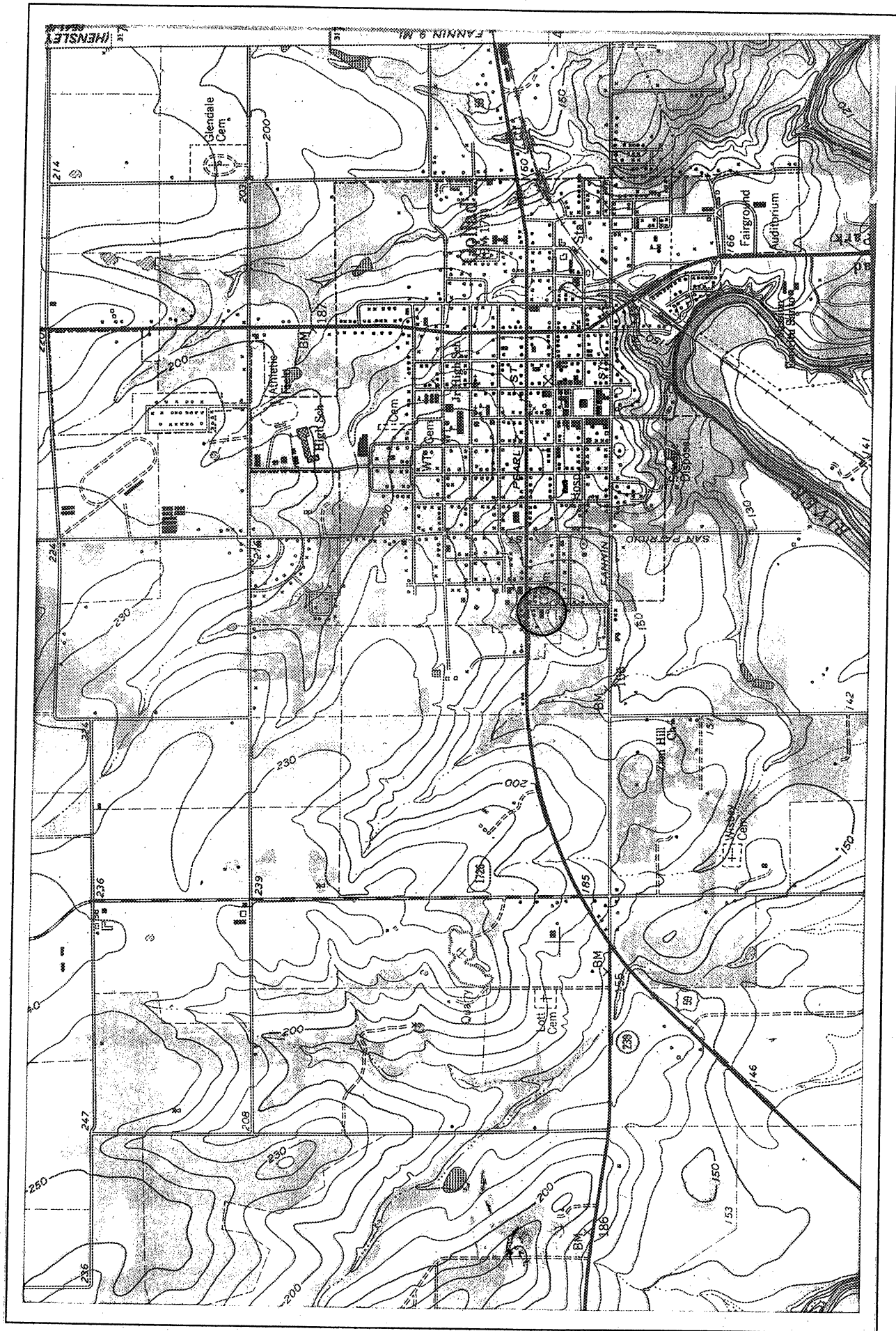


Figure 1. Location of the Goliad maintenance section (05), Goliad County, Corpus Christi District.

Corpus Christi District
Kingsville, Section 07
Jim Wells/Kleberg Counties

D. Bruce Gray (512) 592-7361

Brent Tanzy

June 13-14, 1996

General Information:

- Maintenance site is located on the south side of US 77 northeast of Kingsville near the junction of Bus 77 and US 77 (figure 1).
- Land consists of predominantly mesquite scrub-brush and crops, predominantly corn.
- Maintenance site is on city water.
- There is a plan to hook up cistern to city sewage.
- Approximately 50% impervious cover.
- There is a uranium plant located 2 miles north of TxDOT facility; Celanese Plant.
- There is a fraternity house and a residence located along the frontage of US 77 on the northwest and southeast sides of the maintenance site, respectively.
- Mesquite scrub-brush and corn fields are located north and south behind the buildings on US 77 and a corn field is adjacent to the south side of the facility.
- Corn fields and cropland are located on the north side of US 77.

Waste Disposal Information:

- Injection well is located near the southeast corner of the wash rack shed between the shed and the east property fence line.
- Waste motor oil, antifreeze, transmission and hydraulic fluids, and wash rack waste water were drained into injection well.
- Trucks were cleaned with varsol in wash bay.
- Well use period was from late 1960's to early 1990's.
- At one time there was standing oil in injection well.
- Injection well is no longer used for waste disposal but fills up with rain water.
- Rain water flows parallel to building towards injection well.
- Injection well normally fills to within 2 ft of the top when it rains and then the water level in the injection well drops.
- Water is believed to enter injection well at joints of cement culvert.

Waste Cistern Description:

- Total depth is approximately 8 ft and the inner diameter of the cement culvert pipe is 16 inches; total depth may be more than this if the well is filled with silt.
- There was 4 inches of silt and 1.5 ft of standing water in the injection well at the time of the site visit.
- Injection well stands a few inches above ground surface.
- Waste injection well was abandoned in 1993.
- The culvert pipes leak at the joints allowing rainwater to enter the injection well; the water level drops off after rain.

Hydrology of Area

- Topography in the area is relatively flat but drainage off the maintenance section is to the east and southeast.
- San Fernando Creek is located approximately 1 mile to the northeast and Tranquitas Creek is located 0.75 miles to the southwest.
- Based on the topographic slope, the flow direction distance from the maintenance section to San Fernando Creek is around 1.25 miles.
- Depth to brackish water is 17 to 18 ft, whereas depth to fresh water is 300 to 400 ft.
- Owner of feed store close to maintenance site who owns wells in the area says depth to fresh water ranges from 600 to 1,000 ft.
- Soils and rocks at the vicinity of the maintenance section appear to be reasonably permeable because the water level in the injection well fluctuates with precipitation.

Kingsville (Section 07) Injection Well Summary:

There is one abandoned waste oil injection well at the Kingsville Maintenance facility located on the south side of SH 77 northeast of the city. This well consists of two or more 4 to 5 ft segments of 16 in diameter cement culvert pipe and has a total depth of 7 to 8 ft. The total depth of the well may be greater if it has filled with silt from the wash rack over time. The well was probably constructed in the late 1960's and abandoned in 1993. Waste motor oil, antifreeze, transmission and hydraulic fluids, varsol, and wash rack waste water were drained into the injection well. There are 4 inches of silt and 1.5 ft of standing water in the well. Rain water enters the well through bad joint seals of the cement culvert pipe and the water level in the injection well gradually decreases after a rain suggesting that the soil and/or rocks in the area are somewhat permeable. Depth to brackish water in the area is 17 to 18 ft, whereas depth to fresh water is several hundred feet or more.

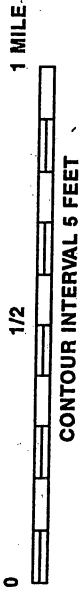
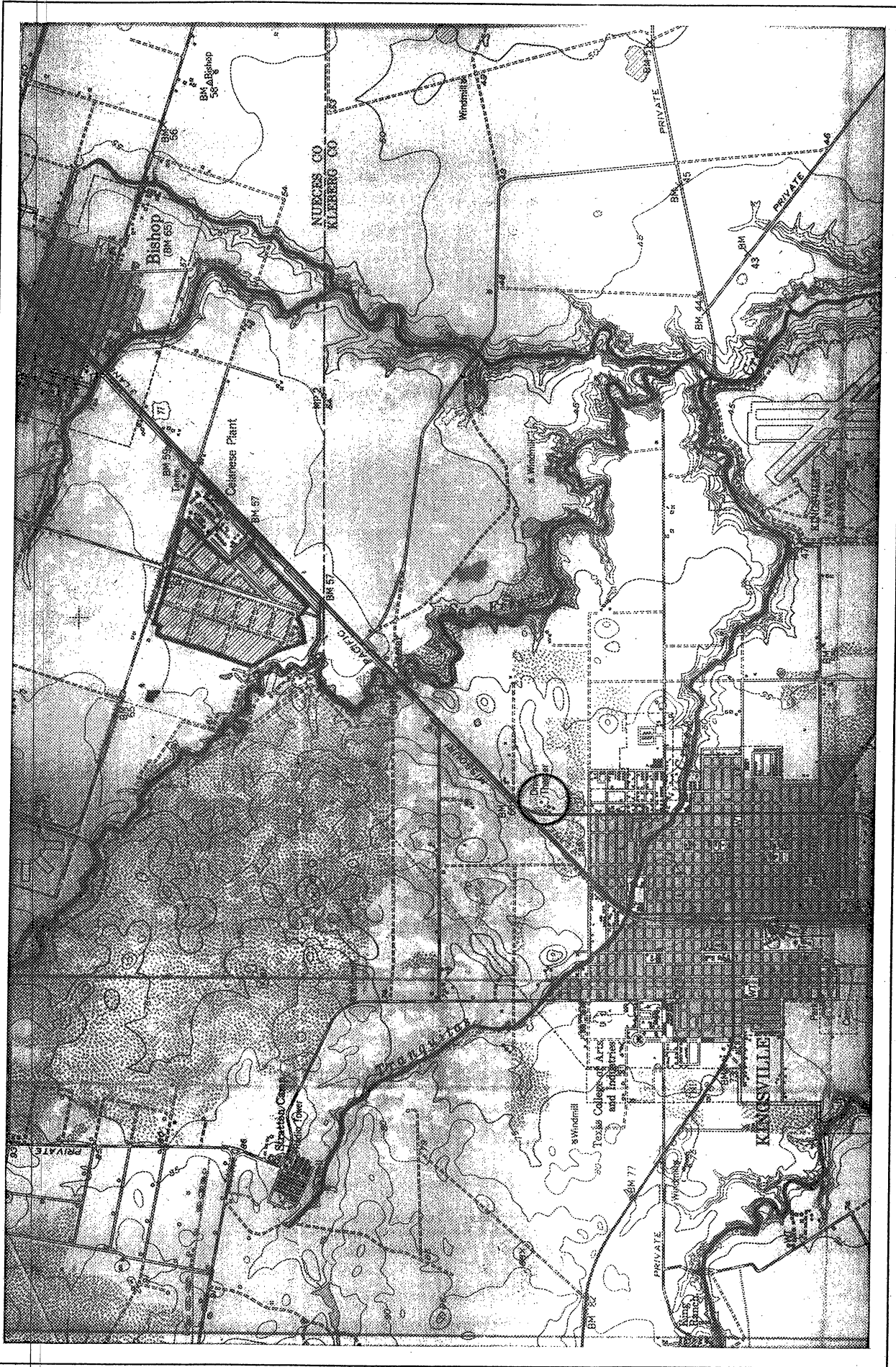


Figure 1. Location of the Kingsville maintenance section (07), Kleberg County, Corpus Christi District.

Corpus Christi District
Robstown, Section 08
Nueces County

Victor Pinon (512) 729-2411
June 13-14, 1996

General Information:

- Facility built circa 1963
- Site located approximately 2 miles south of Robstown on east side of SH 77; rural site (figure 1).
- Area is very flat consisting of farmland; sorghum and cotton are major crops; slight slope to SW.
- Fields on all sides of property; a few abandoned houses less than 0.40 mile away.
- Maintenance facility has at least 4 large dump trucks; 4 pickups, and 4 tractors; 28 vehicles total.
- On city water but have septic system located to west side of office near waste cisterns.
- Impervious cover over much of yard.
- Bill Curra and/or Tony Luther may have information regarding hazardous waste disposal at this site.
- Tri-C Resource Inc., Wright No. 1 (RRC #12473) oil well located less than 1 mile west-southwest of site.

Waste Disposal Information:

- TxDOT facility always on city water.
- Waste oil was believed to always have been removed from site.
- Only wash rack water from grease pit is assumed to have been placed into two cisterns. However, the presence of oil stains and oil in cisterns suggest that at least some oil was disposed of into ground (see below).
- Uncertain as to how antifreeze and other waste material were disposed.
- Volumetrics of oil and waste material placed into cisterns is very difficult to determine because of absence of records on volumes of oil, antifreeze, etc. used at site, changes in types and number of vehicles over the years, some waste products were removed from site while others were placed down cisterns.
- Waste oil volume criteria: 28 vehicles; changed oil maximum of 6 times per year; up to 6 gallons of oil per vehicle. Assuming an average of 5 gallons per vehicle changed 4 times per year, total oil generated per year would be 560 gal per year. Impossible to estimate the amount of oil that migrated into ground.

Waste Cistern Description:

- Two waste cisterns or sumps; (1) located near grease rack on west side of building, and (2) located approximately 100 to 110 ft W of cistern #1 towards SH 77.
- Both cisterns consisted of 18 to 20 inch diameter concrete culvert pipe stacked end on end; both cisterns have covers and surface runoff cannot enter them.
- Uncertain if cisterns contained cement or solid bottom; always possibility of seepage at joints in cement culvert pipe.
- Injection Well #1 is approximately 15 ft deep and contains a few feet of oily water and 1.5 to 2 ft of black silt on bottom; cements side of cistern had black oil stains.
- Two pipes entered cistern #1 one from the grease rack located inside the building to the east and the second consisting of an 8 inch (ID) perforated pipe that was oriented to the west and connected Well #1 with Well #2.
- Injection Well #2 is approximately 3.5 to 4 ft deep and contains approximately 1.5 ft of oil.
- A septic system is located south cisterns and cistern drainage pipe.

Hydrology of Area

- Area has very subtle topographic features and it is difficult to determine slope direction but there appears to be slight slope to the southwest parallel to SH 77.
- There use to be a well located on property immediately west of the grease rack building and near Well #1; TD and depth to water are unknown.
- Residence located 0.50 mile north of maintenance site has well that is used for drinking water and some irrigation. TD of this well is approximately 65 ft but depth to water is uncertain.
- Workers at farm located 0.60 mi south of site did not know water source for irrigation although there are large (approximately 3 ft diameter and 6 ft tall) cement pipes in area that may house irrigation pumps.
- Apparently one well nearby encountered fresh water at a depth of 29 ft but no direction or distance to well was provided.
- There are drainage/irrigation ditches west of maintenance facility; these ditches drain to southeast towards the railroad tracks.
- Published data suggests that fresh water occurs at depth between 43 to 60 ft in the maintenance site area.

Robstown (Section 08) Injection Well Summary

There are two active wash rack or waste oil injection well at the Robstown maintenance site approximately 2 miles south of Robstown on the east side of SH 77. The rural maintenance site is surrounded by open crop land on all sides and small farm houses are the closest residences. Waste oil has been collected in barrels and transported off site for a long time, although there is evidence that at least some waste oil was disposed of into the wash rack injection wells. There are two waste oil/water cisterns (18 to 20" diameter cement culvert pipes) located near a building containing the grease rack near the north-east side of the maintenance facility. Injection Well #1 near the building is 15 ft deep and contains oily water, whereas Well #2 is 4 ft deep and contains 1.5 to 2 ft of standing oil. There is a perforated 8 inch diameter pipe connecting the two cisterns that allows overflow from the first cistern to flow towards the second cistern; the perforated pipe also allows waste water to leach into the surrounding soil. The geometry of the multiple cistern system probably allows oil floating on top of the waste water to move up dip through the perforated pipe to the second cistern. The amount of oil/water that has leaked into the surrounding soil is uncertain because there are no records as to how much oil was disposed of in the wash rack cisterns. However, there is evidence that suggests that oil, either as overflow from the grease pit and/or waste oil poured into the wash rack drain, entered the cisterns.

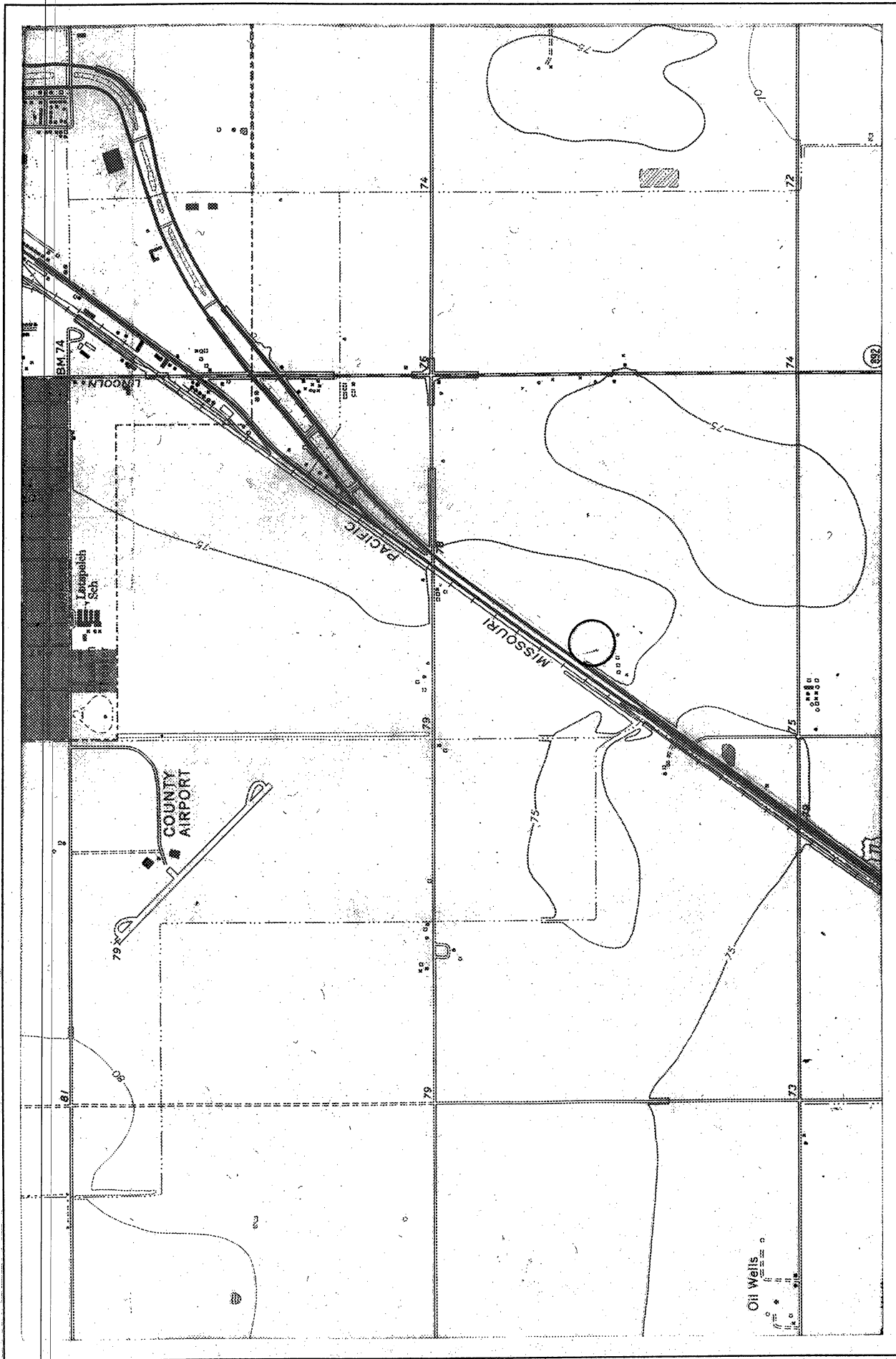


Figure 1. Location of the Robstown maintenance section (08), Nueces County, Corpus Christi District.

Corpus Christi District
Refugio, Section 11
Goliad/Bee/Refugio Counties

Hilario Chapa (512) 526-4421

Brent Tanzy

June 13-14, 1996

General Information:

- The maintenance site is located on the east side of US 77 north of Refugio (figure 1).
- The area around Refugio is predominantly flat mesquite-oak grasslands.
- Residences are located within 200 ft to the southeast of the maintenance facility.
- There is a mesquite grassland and hotel to the east of the maintenance site.
- Residences, and businesses are located north and northwest of the maintenance section on the north side of US 77.
- A north-trending small drainage is located southwest of the maintenance site; further southwest lies an open field, city water well and tank, and additional residences.
- Maintenance facility has 5 or 6 dump trucks whose oil is changed every 4,000 miles or two to three times per year. Smaller one-ton pickups have oil changed at local gas stations.
- A septic tank is located on the east side of the main office.

Waste Disposal Information:

- An injection well received waste oil and wash rack water until two years ago when it was filled with premix.
- Wash rack water runs into a grease trap and then approximately 60 yards to a dry creek bed located on the southwest side of the maintenance facility.
- Wash rack water was seeping into creek bed and there was evidence that deer and other wildlife are using the seep as a water supply during the drought.
- An in-line grease trap collects possible contaminants before water is discharged into drainage.
- There was green algae along the bank of the creek where seepage occurs but no oil sheen or smell.
- Dry drainage is composed of silt and clay
- There is an abandoned water well outside the property line on the eastern side of the facility.

Waste Cistern Description:

- The abandoned injection well is located at the northwest corner of the vehicle shed close to the above ground recycled oil tank.
- The injection well was “cement lined” possibly constructed of cement culvert pipe; well was 24 in diameter and depth was estimated to be between 15 and 20 ft deep.
- Injection well was backfilled two years ago with premix.

Hydrology of Area

- Telephone number for the City of Refugio Water Department is (512) 526-5361; Sid provided information about city water wells.
- City of Refugio has three water wells all drilled to a depth of around 900 ft.
- One water well is isolated less than 0.10 mile to the southwest of the maintenance section on the other side of a dry creek bed.
- Depth to fresh water in the well closest to the maintenance section is 17 ft.
- Closest water well was drilled in 1970 and produced 550 GPM.
- Water wells further away produced around 750 GPM.
- There are two other wells located 0.75 mile to the south of the maintenance section and they were artesian wells in 1930's and 1940's.
- Recharge zone is the outcrop (Goliad and Beaumont sandstones) northwest of Refugio towards Beeville.

Refugio (Section 11) Injection Well Summary:

There is one abandoned waste oil injection well at the Refugio Maintenance facility located on the south side of US 77 northeast of the city. This well, probably consisted of several 4 to 5 ft segments of 24 in diameter cement culvert pipe. Total depth is uncertain because well was filled with premix two years ago; depth is probably 15 to 20 ft based on observations from other maintenance sections in the district. Wash rack water and waste oil were placed into injection well. Wash rack water now flows into small drainage located southwest maintenance site adjacent to the property fence line. An in-line grease trap collects possible contaminants before water discharge. There are three city water wells within one mile of the facility and the closest well is located less than 0.10 mile to the southwest of the maintenance section on the other side of the dry creek bed. Depth to fresh water in this well is 17 ft.

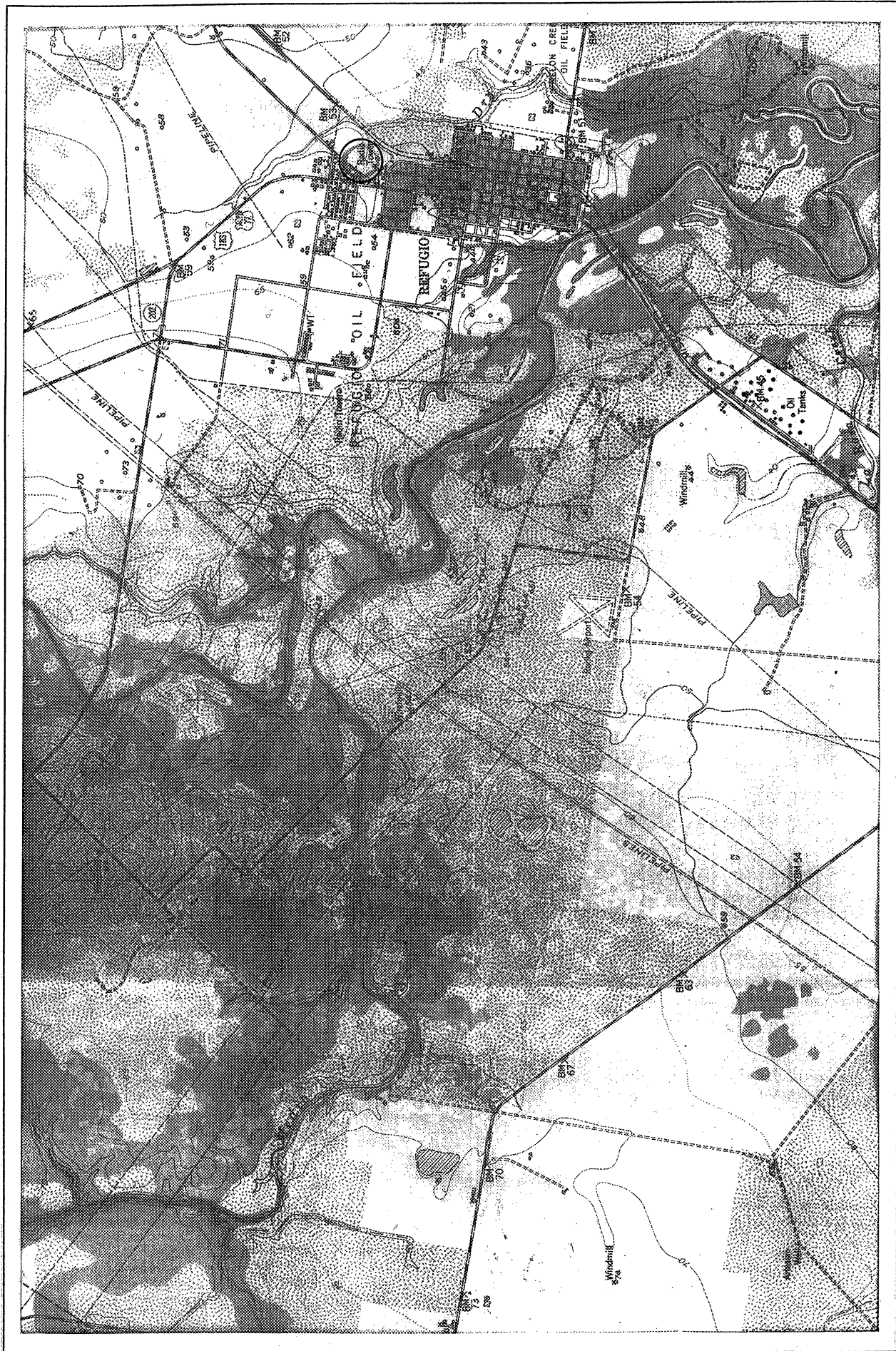


Figure 1. Location of the Refugio maintenance section (11), Refugio County, Corpus Christi District.

Lubbock District
Bovina, Section 01
Parmer County

Eddie (Tiny) Moore (806) 238-1312
July 20 and 22, 1996

General Information:

- Maintenance site is located on the south side of US 86 on the southwest side of Bovina near the city limits (figure 1).
- The layout of the maintenance site is identical to the Plains (Section 12) site.
- Maintenance section is now on city water and sewer.
- A small drainage and field are located along the western side of the maintenance site; land is currently used for cattle grazing.
- A field and residences are located south of the maintenance site.
- A subdivision, build between 1965 and 1980, is located across the alley on the eastern side of the section; the alley probably represents the city limits.
- Metal equipment sheds and Bovina Pump and Service are located across US 86 north of the facility.
- There is an elementary school located 0.10 mile southeast of the site.
- Residences around maintenance site are on city water system.

Waste Disposal Information:

- Waste oil tank was installed 10 to 12 years ago.
- Waste motor oil, hydraulic fluids and transmission fluids were disposed of in well.
- Injection well was drilled in the early 1960's and abandoned in the late 1980's or early 1990's.
- History of waste disposal practices at maintenance section from oldest to most recent was determined to be: injection wells, 55 gallon drums, below ground storage tanks, and above ground storage tanks.
- There is also a possible abandoned waste oil injection well was located in the southwest corner of the yard; this well was reported to be abandoned 26+ years ago and is now covered.
- Wash rack water initially drained into septic system but now disposed of into city sewer.
- Septic tank is located on east side of maintenance site.

Waste Cistern Description:

- Abandoned waste oil injection well was a 24 in diameter, 30 ft deep with dirt sides
- Injection well was located between doors 4 and 5 on the maintenance building approximately 15 to 20 ft off the west side of the building.
- This contaminated waste oil injection well was pumped out and backfilled with dirt; current site and is now covered with asphalt.
- No information is available for the possible injection well located in the southwest corner of the site.
- A 500 gallon below ground waste oil storage tank replaced injection well.
- Site also had a “French Drain” below lifts where used oil drained.

Hydrology of Area

- Topography of maintenance site slopes to the west and southwest.
- Running Water Draw located 0.20 mile to the southwest and a small tributary entering the draw is located 0.20 mile west.
- There is an abandoned windmill located 0.20 mile southeast of maintenance site.
- The City of Bovina (806) 238-1116 has three active water wells and two abandoned water wells’ “Old Sandy” and water well across railroad tracks sanded in.
- Water Well #4, located 0.25 mile southeast of maintenance site was drilled in 1982; depth to top of fresh water was measured at 218 ft and well produced 400 GPM.
- Well log description for this well as follows:

0 to 215 ft	surface material
215-260 ft	fine sandstone and sandy rocks with clay streaks
260-277 ft	fine sandstone, loose
277-284 ft	fine sandstone
284-297 ft	clay
297-315 ft	fine sandstone and clay
315-321 ft	coarse sandstone with clay streaks
321-340 ft	fine sandstone with clay streaks
340-350 ft	Red Bed

- According to Charles with Bovina Pump and Service (806) 238-1596, depth to Red Bed in area ranges from 320 to 380 ft, becoming deeper westward.
- Charles estimated that depth to fresh water averages 240 ft and a well located 1 mile south of city encountered fresh water at 243 ft. There are dry wells in area.
- One resident in area stated that depth to fresh water was up to 100 ft in Bovina area but this may be shallow windmill water.
- Charles with Bovina Pump and Service stated that Ogallala is first aquifer and that there is little or no windmill water in area..

Bovina (Section 01) Injection Well Summary:

There is one and possibly two abandoned waste oil injection wells at the Bovina maintenance section located along the southwest city limits on the south side of US 86. The first injection well, constructed in the early 1960's, was an open-hole, 24 inch diameter and 30 ft deep located between truck bays 4 and 5 approximately 15 to 20 ft west of building. Waste oil and hydraulic and transmission fluids were disposed of in this well. Waste oil was removed and the injection well backfilled with dirt five or more years ago; the old injection well site is now covered with asphalt. A second injection well, possibly located in the southwest corner of the maintenance yard, was abandoned more than 26 years ago. The Bovina maintenance site is identical to the Plains maintenance site where a second injection well, planned near the corner of the maintenance yard, was never drilled. No other information is available on the second injection well at the Bovina maintenance site. Wash rack water initially drained into septic tank but now is disposed of in city sewer system. A city water well is located within 0.25 miles of the maintenance site and depth to the top fresh water in the Bovina area ranges between 218 to 240 ft. Runoff from the maintenance section is towards Running Water Draw located 0.20 miles to the southwest of the site.

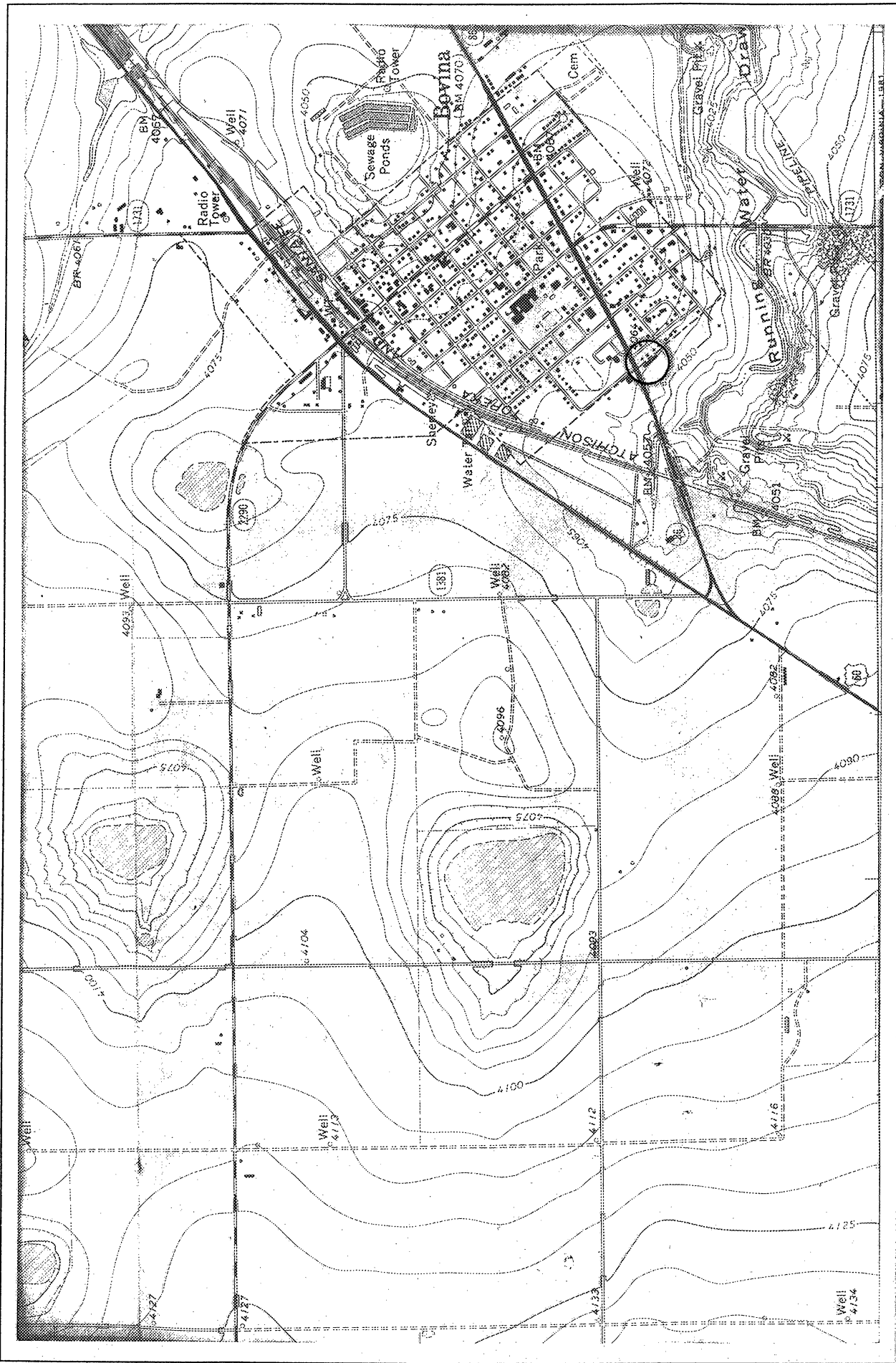


Figure 1. Location of the Bovina maintenance section (11), Parmer County, Lubbock District.

Lubbock District
Brownfield, Section 02
Terry County

Jerry Chancellor (806) 637-8913

July 17, 1996

General Information:

- Facility built circa 1963
- Site located on southwest side of Brownfield on east side of SH 62 (figure 1).
- Rudd correctional institution on south side of property; large field between
- Field and two businesses on east side; pump service and Petrolog
- Abandoned building and field between site and SH 62 to west.
- Field and abandoned building across street to north.
- Residential located 0.10 mile to northeast;
- Residential immediately across SH 62 to west.
- Impervious cover over much of yard.
- Ground slopes to southwest and south towards Rudd correctional institution.
- Today use citrosol to clean asphalt off in pit with caliche and then mix asphalt and caliche to use as filler for roads.
- No windmills or pumps observed in residential suggesting that they are on city water.

Waste Disposal Information:

- TxDOT facility always on city water; no septic system
- Waste oil disposed of in well near buildings.
- Asphalt, diesel/ kerosene solvents for asphalt and unknown materials placed in well near fence line; possibly trash.
- Cistern near building was pumped out and filled with dirt; now covered with impervious cover.
- Always on city water and sewer so no wash rack water went into cisterns.
- Volumetrics difficult to obtain as records are kept only 5 years.
- Types and quantities of equipment has changed over the years.
- Workers estimated 30 to 40 pieces of equipment changed monthly (assume 5 qts per change = 450 to 600 gal per year. Probably very high estimate (see below).
- From 1960-s to 1980's oil changes were made on the road and not in the maintenance facility; used oil was discarded or mixed with gravel/caliche for roads; particularly true for maintainers.
- Antifreeze was placed down Well #1.

- Wells were drilled in caliche which may have a relatively low permeability assuming that there are not faults or joints in area to act as conduits for waste dispersal.
- Oil in Well #1 had to be pumped out periodically suggesting relatively low permeability.

Waste Cistern Description:

- Two waste disposal pits; (1) located near maintenance building, and (2) located southeast corner of property .
- Both cisterns approximately 3 ft diameter and 30 ft deep with no casing or cement pipes; and originally had large cement slabs placed over holes.
- Cisterns drilled in caliche; Well #2 may have caved in after abandonment.
- Holes drilled mid-1970's as part of drilling program; holes also drilled at rest stops/roadside parks in county for trash disposal; holes at rest areas subsequently drilled out (trash removed) and filled.
- Well #1 was a waste oil disposal well that was pumped and then backfilled with dirt.
- Well #2 received asphalt-diesel-kerosene runoff and possibly other waste products.

Hydrology of Area

- City of Brownfield has at least 4 to 5 water wells within 0.50 mile (southwest) of site as does the Rudd correctional institute.
- Ground slopes to southwest and south towards Rudd Correctional Facility; low spot collects water in field approximately 0.25 mile to south; some drainage from Rudd to low spot.
- Joe Cardenas in charge of City of Brownfield water stated that city water wells near Rudd and TxDOT facility have TD of c.a. 220 ft; depth to fresh water at 120-130 ft.
- These wells produce at 350 to 375 GPM.
- City wells on north side of city encounter water at 100 to 110 ft and have TD's of 175 to 180 ft.
- Runoff from maintenance facility is ultimately directed to east towards Sewage Disposal ponds.

Brownfield (Section 02) Injection Well Summary:

There are two abandoned waste oil injection wells at the Brownfield maintenance section located on the east side of SH 62 southwest side of Brownfield. Both open-hole injection wells are 36 in diameter and 30 ft deep; large cement slabs were placed over holes when they were active. Primarily waste oil was disposed of into injection Well #1 located on the southwest corner of the warehouse. This well was pumped out and filled with dirt in the mid 1980's and is now covered with impervious cover. Injection Well #2, located at the southeast corner of the maintenance facility, was used for disposal of asphalt, diesel, and kerosene solvents (used during cleaning of asphalt from vehicles) and unknown materials placed including possibly trash. This injection well may have caved in after abandonment. City of Brownfield has at least 4 to 5 water wells within 0.50 mile southwest of site as does the Rudd Correctional Institute. Depth to fresh water in these wells is 120 to 130 ft and city wells on the north side of the city encounter water at 100 to 110 ft.

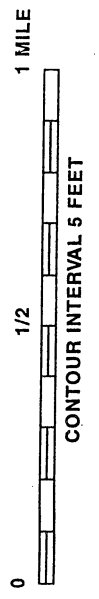
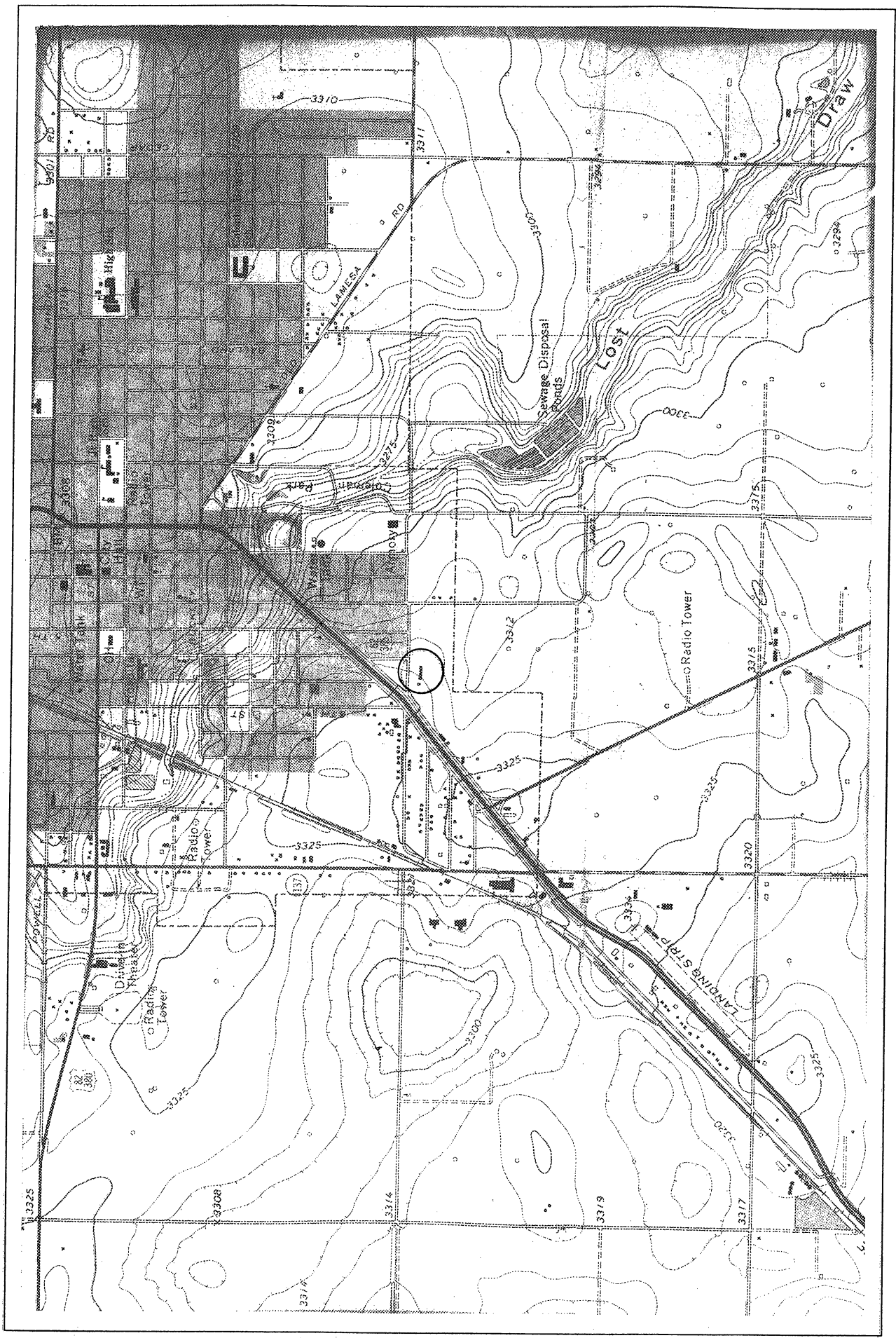


Figure 1. Location of the Brownfield maintenance section (02), Terry County, Lubbock District.

Lubbock District
Floydada, Section 04
Lubbock County

Michael Anderson (806) 983-3320
Dan Golightly and Garland Cartwright
July 19, 1996

General Information:

- Maintenance site is located near the northern city limits on the west side of US 70 (figure 1).
- Old maintenance section was located across the street on the east side of US 70 but this property was sold to Adam's Well Service.
- Maintenance site is on city water and sewer.
- No septic system.
- A residence is located immediately southwest of maintenance site.
- Open fields and crop land are located south and west of maintenance facility.
- An open field and a farm equipment storage yard are located on the northwest side of the facility.
- Below ground fuel and oil tanks were removed 7 to 8 years ago and no leakage was found.
- RV park is located north of maintenance site.
- There is a ditch running between residence located at southwest corner of the site and maintenance facility.

Waste Disposal Information:

- Waste motor oil and hydraulic and brake fluids were disposed of in the injection well.
- Asphalt, kerosene, diesel, and oil were mixed with caliche in yard for road mix.
- Wash rack water has always run into city sewer system..
- Cannot accurately quantify waste products placed in hole; absence of records and older personnel to determine waste products; number and types of vehicles has changed over time.

Waste Cistern Description:

- The one abandoned waste oil injection well the at maintenance site is located west side of metal truck barn near northwest corner.
- The injection well was an open-hole approximately 36 inches in diameter and 25 to 30 ft deep.
- Injection well was active from 1964 to 1988 and is now abandoned and covered with asphalt pavement.

- The well was backfilled with soil, but no information is available regarding remediation.
- No information was available regarding possible abandoned waste oil injection wells that could have been associated with the old maintenance site on the east side of US 70 across from the existing facility; old site is now owned by Adam's Well Service.
- Sam Spence, who retired from TxDOT 20 years was unable to provide more information regarding disposal practices at the old and new maintenance sites.
- A second former employee Charles Hamilton recently passed away.

Hydrology of Area

- Topography in area slopes towards the east where a playa is located 0.25 miles from site.
- A second playa is located 0.70 mile to the northwest.
- There are three water wells located within 0.50 miles of maintenance site.
- City of Floydada obtains drinking water from MacKenzie Reservoir located approximately 40 miles north of city and from water wells within city limits.
- There use to be windmill water in area but this is very discontinuous and difficult to find; this perched water was at approximately 90 ft.
- Top of Ogallala is around 180 ft and the reservoir sand is 30 to 35 ft thick.
- Adam's Well Service, (806) 983-5003, stated that windmill water is 137 ft deep in their well which has a TD of 190 ft.
- The City of Floydada is located the southern flank of a northeast-trending ridge indicating that water levels below the city are shallower than in areas surrounding city.

Floydada (Section 04) Injection Well Summary:

There is one abandoned waste oil injection well located on the west side of US 70 on the north side of Floydada. The injection well was located near the southwest corner of the maintenance shed and was active from 1964 to 1988. Waste motor oil, transmission fluid, and brake fluid were disposed of into well. This well, approximately 36 inches in diameter and 25 to 30 ft deep, was backfilled with soil and is now covered with pavement. No information is available regarding possible remediation efforts prior to abandonment. Wash rack water has always gone into city sewer system. Trucks were cleaned in yard and the waste products, asphalt, diesel, and kerosene, were mixed with caliche as road mix. The City of Floydada derives drinking water from MacKenzie Reservoir located 40 miles north and Ogallala reservoir. Depth to perched water table is 90 to 137 ft but this water is discontinuous had hard to find. Depth to top of Ogallala is approximately 180 ft in city.

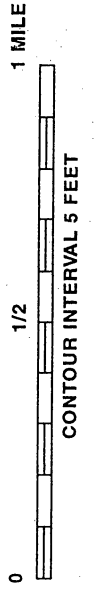
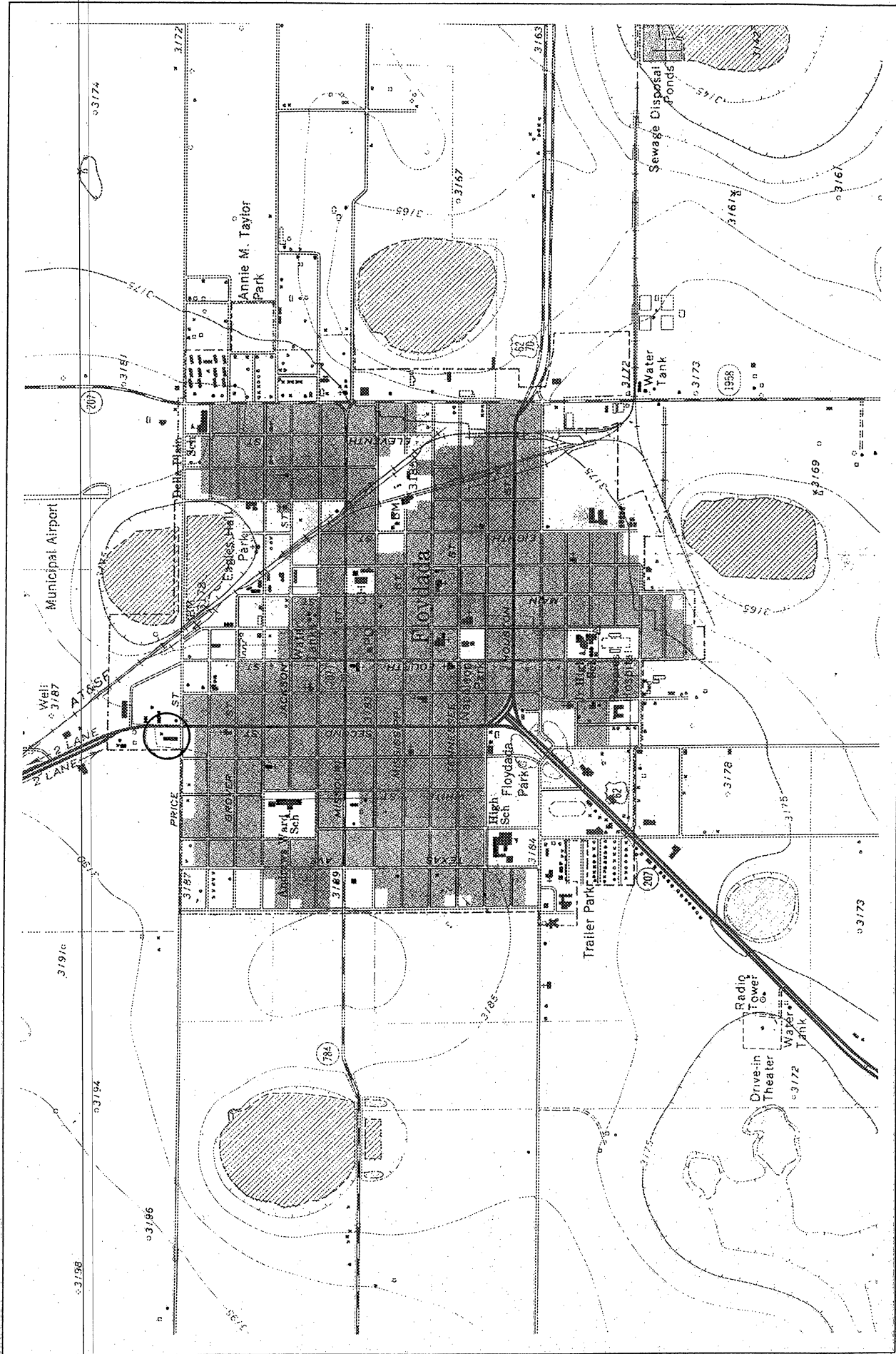


Figure 1. Location of the Floydada maintenance section (04), Floyd County, Lubbock District.

Lubbock District
Lamesa, Section 05
Lamesa County

Boyd Johnson (806) 872-2175

Otis Hutson

July 17, 1996

General Information:

- Maintenance site is located on the east side of US 87 approximately 0.75 mile northeast of Lamesa (figure 1).
- Land around maintenance site is predominantly fields and crops and there are multiple playas and/or depressions in area that can serve as recharge zones for the aquifer.
- Maintenance site is on city water and sewer.
- Open fields and cropland are located east and south of the maintenance site.
- Open fields and cropland are located west of the maintenance site across US 87.
- Farm equipment warehouses, businesses, and a church are located north of the maintenance section.
- Maintenance site is on city sewer system.
- The area is relatively flat with multiple depressions and/or playas

Waste Disposal Information:

- Waste oil, antifreeze, transmission and brake fluid, hydraulic fluids, paint and paint thinner, unspecified solvents, herbicides and pesticides were disposed of in the injection wells.
- Asphalt, diesel, and kerosene were also placed in injection wells.
- Wash rack water was run into septic system but now goes into city sewer.
- Vehicles are steam cleaned and then washed in yard.
- Diesel and kerosene were used to clean trucks until 4 to 5 years ago before citrosol came into use.
- Found gummy tar mixed with gravel on bottom of the remediated injection well.

Waste Cistern Description:

- There are two abandoned waste oil injection wells and one abandoned asphalt injection wells at the maintenance site.
- Waste injection wells were active from 1964 and abandoned in 1984; at least one of the wells was remediated in the early 1980's.
- The injection wells were open-holes 24 to 36 inches in diameter and 20 to 30 ft deep.
- Waste oil injection Well # 1, located on the north side of shop, was remediated by an environmental group at TxDOT.

- Remediation of well consisted of: (1) pumping out waste products, (2) introduce clean sand into hole to remove remaining oil and (3) remove sand and enlarge hole for 500 gallon below-ground fiberglass tank, (4) removed fiberglass tank two years later and backfilled hole with dirt.
- Waste oil injection Well #2 was located at the southeast corner of yard and this well is now covered; no information is available regarding remediation efforts.
- Waste asphalt injection well was located on south side of asphalt tanks and was used for disposal of asphalt, kerosene, and diesel waste products.
- Asphalt injection well is also abandoned and covered; there is no information regarding possible remediation before back-filling.

Hydrology of Area

- Topography slopes to the south parallel to US 87 but then the slope changes to east towards depression approximately 0.10 mi south of site.
- Robert Gordon from City of Lamesa Water Department (806) 872-2124 stated that the town receives water from MacKenzie Reservoir, located 130 miles north-northeast of Lamesa, and water wells.
- According to the City of Lamesa Water Department, water wells at a landfill on south side of town reached perched water 25 to 30 ft.
- Depth to windmill water is generally 30 ft but this water dries up drought conditions and is not used for drinking water.
- There is no contamination of this windmill water which is of higher quality than on north side of town.
- Depth to fresh water on north of town is 175 ft and wells on north side of town have TD's of 130 ft and reach the top of fresh water at 80 to 90 ft.
- Joe Stringer of Stringer Drilling (806) 872-3437, places depth to fresh water around Lamesa at 90 ft.

Lamesa (Section 05) Injection Well Summary:

There are two abandoned waste oil injection wells and one abandoned asphalt injection well at the Lamesa maintenance section located approximately 0.75 mile northeast of the city on the east side of US 87. These injection wells, active from 1964 to 1984, were 2 to 3 ft in diameter and 20 to 30 ft deep. They were abandoned in the mid 1980's and at least one waste oil injection well was remediated when an underground fiberglass storage tank was installed in the early 1990's. No information is available regarding remediation efforts on the other two wells and the three abandoned injection wells are now covered with dirt and/or asphalt pavement. The City of Lamesa derives water from local lakes and water wells. Depth to the top of a perched aquifer at landfill on south side of town is 25 to 30 ft but perched aquifers around Lamesa do not exist during drought conditions. Depth to fresh water aquifers in the area ranges between 80 to 90 ft but may reach 175 ft in irrigation wells located north of town.

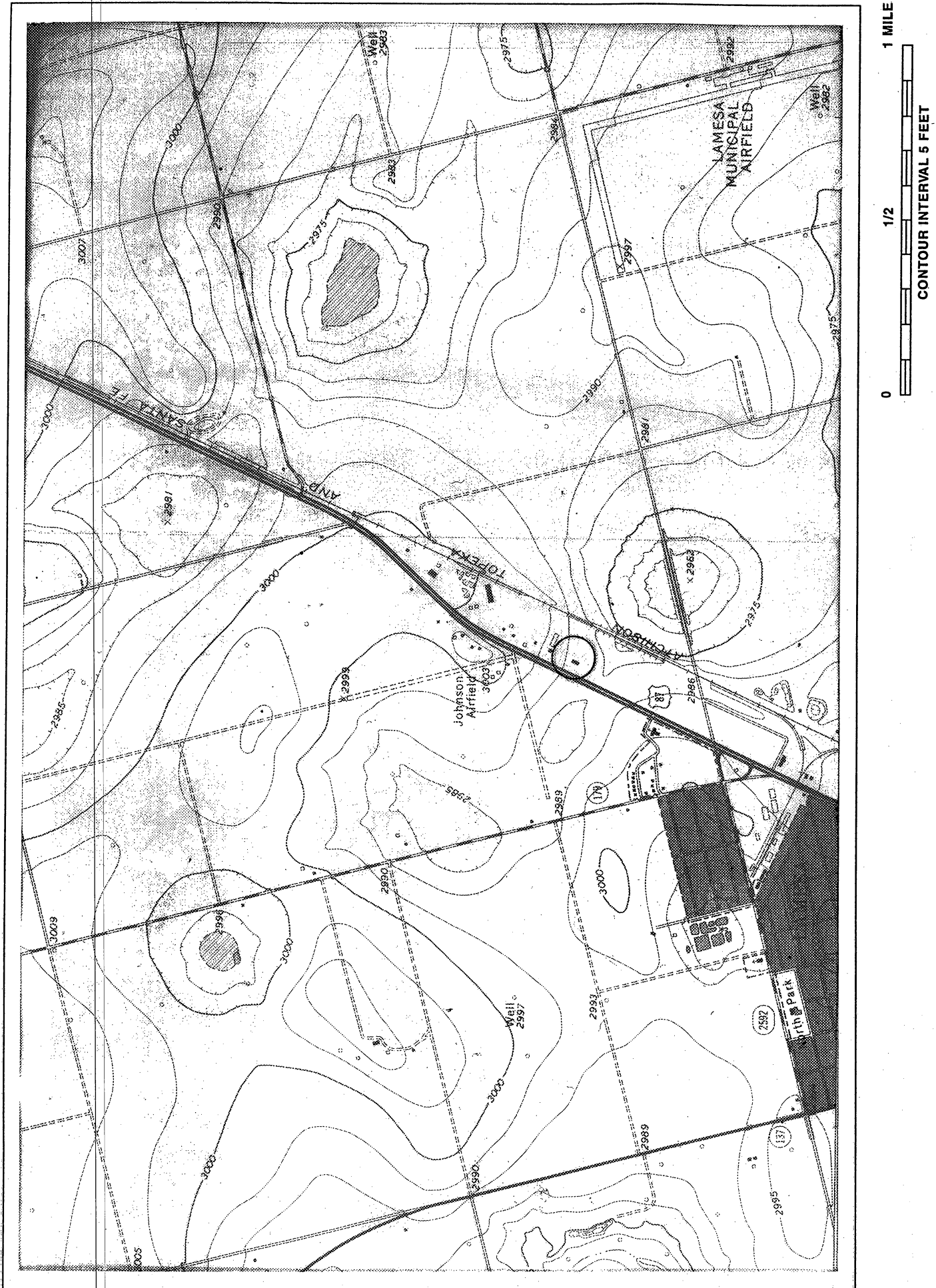


Figure 1. Location of the Lamesa maintenance section (05), Dawson County, Lubbock District.

Lubbock District
Levelland Section 06
Hockley County

Mr. Tracy Crumby (806) 894-4323

“Lynn”

July 20 and 24, 1996

General Information:

- Maintenance site is located 1 mile east of Levelland on the north side of SH 114 (figure 1).
- 80 to 90% impervious cover.
- Maintenance site is on city water and sewage.
- Open fields and cropland is located to the west of the maintenance site.
- A large cotton-oil warehouse with cotton husk storage shed was located immediately east of maintenance site.
- Trailer parks are located 0.65 mile east and 0.25 mile south of maintenance site.
- Open fields are located south of SH 114; however, residential area is located 0.25 mile south of maintenance site.

Waste Disposal Information:

- Waste products placed into injection well included used motor oil, transmission and brake fluids, and hydraulic fluid.
- Diesel and kerosene were used in wash bays to clean trucks.
- Also cleaned trucks in yard with diesel and kerosene and mixed waste asphalt with sand.
- Wash rack water flowed into an underground septic system or underground tank at one time; it is possible that this actually a waste water injection well at one time.
- There is a septic system located at the southwest corner of the maintenance building near the offices and restrooms.

Waste Cistern Description:

- There is one abandoned waste oil injection well and possibly one waste water injection well at maintenance site.
- Based on discussions with current TxDOT employees, an older employee discussed a waste oil injection well located on the west side of the building; this man has since passed away but the comments made on the injection well occurred during the installation of a new above ground tank several years ago.
- Abandoned waste oil injection well was located along the west wall of the maintenance building near the southwest corner of the shop.

- This cistern was believed to be an open-hole, 36 inches in diameter and approximately 30 ft deep.
- A 1963 blueprint had a 1.5 inch galvanized steel pipe running southwest from the hydraulic lift in the shop building to the outside.
- No information is available regarding remediation of site, but the injection well was probably removed when an below ground storage tank was installed.
- There is a capped, 3 inch diameter steel pipe extending above ground behind the wash bay.
- The steel pipe is similar to waste oil injection wells at other maintenance sites in the Lubbock District; however, the proximity to the wash rack suggests that this may be a waste water injection well.
- The cap has not been removed lately and no attempt was made to force TxDOT employees to remove cap; further inspections is warranted.

Hydrology of Area

- Topography at maintenance site generally slope towards the south although the northwest corner of the yard slopes toward the northwest.
- There are at least 12 water wells located within 1 mile of the facility and 6 wells within 0.50 mile of the facility.
- Bugs Spears with Spears Pump Company (806) 894-3393, states that depth to fresh water 1 mile east of Levelland ranges between 168 to 172 ft; average depth to water in area is 170 ft.
- Depth to blue clay is around 190 to 200 feet and there is approximately 30 ft of water in these wells.
- Depth to fresh water at Cactus Drive located 1 mile east and slightly north of Levelland is 168 ft.
- There are no perched aquifers around Levelland; these aquifers were depleted many years ago.
- There is shallow ground water (<50 ft) at Oakland Flats located 10 to 12 miles north of Levelland.
- Levelland derives drinking water from the Canadian River and from water wells within the city limit when water consumption is high; City Water Department number is (806) 894-0113.
- Trailer parks and residences around the maintenance site are on city water.
- A Mr. George Lawless (806) 894-5642 owns a house with water well a mile north of maintenance site.

Levelland (Section 06) Injection Well Summary:

There is one abandoned waste oil injection well and one possible waste water or oil injection at the Levelland maintenance site located 1 mile east of the city on the north side of SH 114. The abandoned open-hole injection well, located near the shop on the west side of the building, was 36 inches in diameter and approximately 30 ft deep. This well received waste motor oil, transmission and brake fluids, and hydraulic fluid while it was active. No information is available regarding remediation efforts although the well was probably back-filled when an below ground storage tank was installed. A three inch metal pipe extending from ground behind wash bay may be a waste injection well for wash rack water. The pipe is capped so there is no information regarding it's purpose; however, the location and type of metal pipe extending from the ground is similar to waste oil injection wells at other maintenance sites in the Lubbock District. The proximity of the pipe to the wash bay suggest that this may be a wash rack water injection well. Possible contaminants include wash rack water, diesel, kerosene, and asphalt. Depth to fresh water in the area approximately 170 ft and perched aquifers in the area were depleted many years ago. The City of Levelland derives drinking water primarily from the Canadian River although water wells inside the city are used when consumption is high.

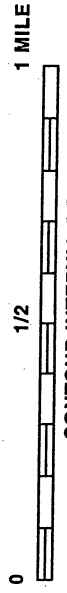
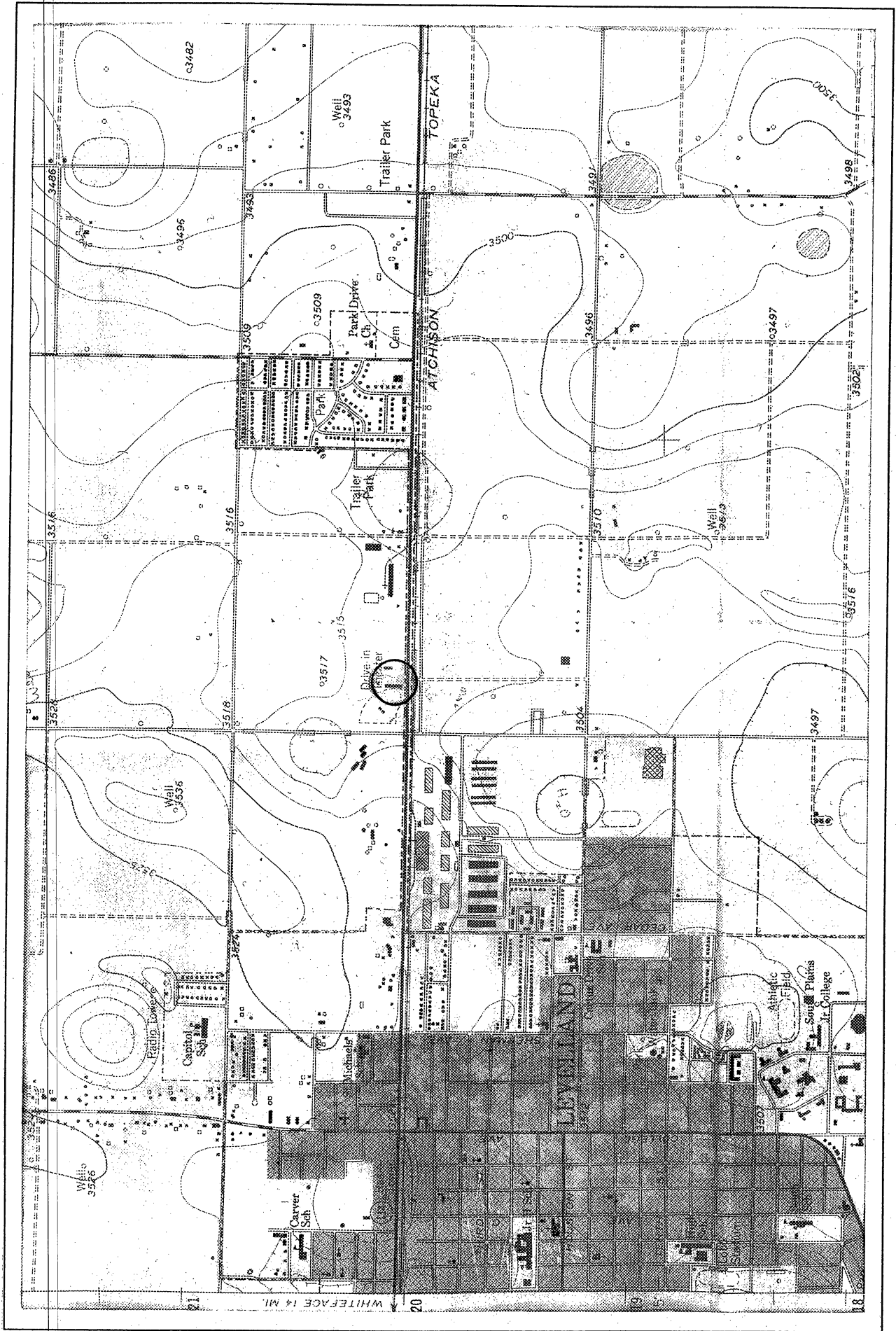


Figure 1. Location of the Levelland maintenance section (06), Hockley County, Lubbock District.

Lubbock District
Littlefield, Section 07
Lamb County

Dickey Self (806) 385-3661

July 24, 1996

General Information:

- Maintenance site is located on the south side of BR 84 approximately 0.60 mile northwest of Littlefield (figure 1).
- There is a cemetery located west of the maintenance section.
- Open fields are located on the south and east sides of the facility; residences are also located within 0.10 mile of the maintenance site on the south and east sides.
- There are residences located 0.25 mile southeast of the facility.
- An open grass field is located on the north of BR 84 and the railroad tracks located north of the facility.
- Residences in area are on city water.
- Dickey Self has 29 year total experience with TxDOT and spent 14 years at Floydada maintenance facility.
- Maintenance facility was always on city water.
- There are two septic tanks at the maintenance site but they will convert to the city sewer system when the new building is constructed.
- An abandoned water well is located in a well house near the west property line.

Waste Disposal Information:

- The two waste oil injection wells at the maintenance site received motor oil, transmission/brake fluids, hydraulic fluids.
- The injection wells became active in 1953 and were abandoned in 1985 and 1990.
- The injection well located near the oldest building (1940's style) was reported to be abandoned in 1965 and backfilled in 1985.
- Cannot accurately quantify waste products placed in hole; absence of records and older personnel to determine waste products; number and types of vehicles has changed over time.
- Vehicles are cleaned in maintenance yard because there are no wash racks at the maintenance facility.

Waste Cistern Description:

- There are two abandoned waste oil injection wells at the maintenance site.
- Both open-hole injection wells are believed to be 24 inches in diameter and 30 ft deep.
- A 3 x 4 ft cement slab covered both injection wells and a metal pipe extending through the slab allowed waste material to be disposed of in wells.
- Injection Well #1 is probably located near the southwest corner of a storage warehouse built in the 1940's.
- The exact location of this injection well is uncertain because it has been abandoned and paved over with asphalt although there may be remnants of the concrete slab.
- Injection Well #2 is located approximately 20 ft from north side of the maintenance warehouse on the west side of the warehouse drive.
- The second injection well is now completely covered by a sidewalk and parking lot.
- Both injection wells have been paved over but no one knows if the waste material was removed before they were backfilled.

Hydrology of Area

- There is an abandoned windmill locate 0.40 miles to the southeast of the maintenance site (corner of Cedar and Dillon streets) within a residential area; depth to water is unknown.
- The topography at the maintenance site slopes to the northeast towards BR 84 but drainage in the area is predominantly towards the southeast.
- There are at least 11 water wells within 0.50 mile of the facility.
- The owner of a radio station near the maintenance section also owns the feed store (across from a white water tower in town) and was a valuable source of information regarding depth to fresh water in the area.
- Depth to fresh water at the radio station located 0.25 mile east of the facility is 83 ft and total depth of well is 120 ft
- Depth to freshwater in a monitoring well at the feed store 1.25 mile southwest of maintenance site is 60 ft with a total depth of 80 ft ("Calvin"); monitoring well was drilled several years ago to verify a gasoline leak in town.
- Wells located southeast of town have a total depths of around 70 ft and depth to fresh water of 50 ft.
- Shallow windmill water in the area generally occurs between 60 to 80 ft, whereas irrigation wells in the area are pumping water at depths greater than 100 ft.

Littlefield (Section 07) Injection Well Summary:

There are two abandoned waste oil injection wells at the Littlefield maintenance section located on the south side of Business 84 approximately 1 mile northwest of the city. These open hole injection wells, active from 1953 to the mid to late 1980's, were 24 inches in diameter and approximately 30 ft deep. A 3 x 4 ft concrete slab covered both injection well and a metal pipe extending through the slab allowed disposal of waste material into well. Motor oil, transmission and brake fluids, and hydraulic fluids were major waste products placed into wells. Both wells are backfilled with dirt and covered with asphalt pavement; there is no information regarding removal of waste products from wells prior to backfilling. There are at least 11 water well located within 1 mile of the facility and depth to fresh water in the area generally ranges from 50 to 80 ft. A water well located at a radio station 0.25 mile east of facility encountered fresh water at 83 ft.

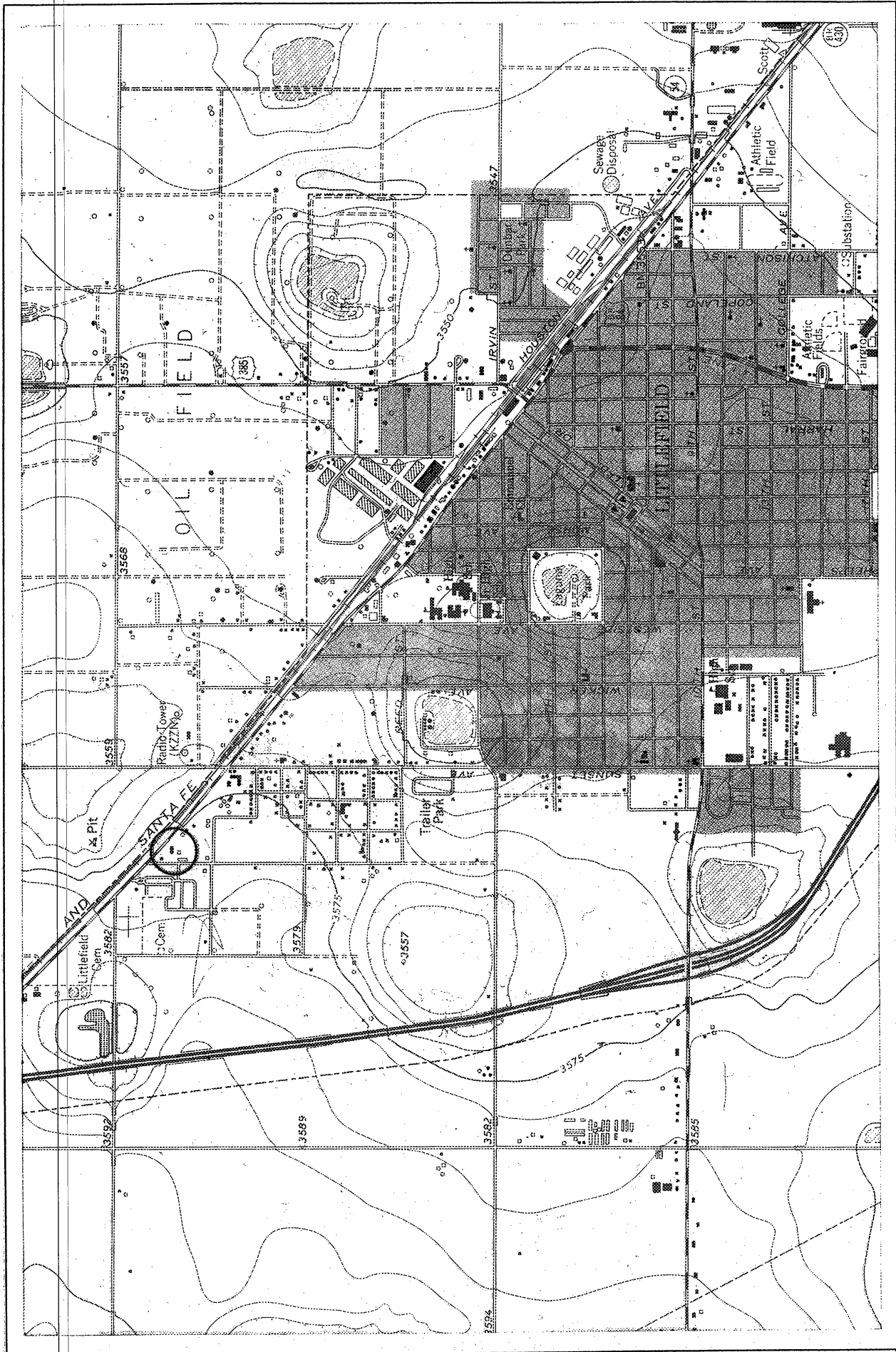


Figure 1. Location of the Littlefield maintenance section (07), Lamb County, Lubbock District.

Lubbock District
Lubbock NE 289, Section 08
Lubbock County

Jerry Thompson (806) 763-8137
July 25, 1996

General Information:

- Maintenance site is located in north Lubbock on the north side of Loop 289 approximately 1.90 miles east of US 27; the site is bordered by Municipal Drive and Loop 289 (figure 1).
- Maintenance site is located in a semi-urban setting.
- Residences are located approximately 0.75 mile north of Municipal drive.
- Warehouses and open fields are located on the east and west side of the maintenance site.
- There an oil well located along the east fence line of the maintenance facility.
- Maintenance site has always been on city water and sewage.
- Impervious cover is estimated to be 33%.
- Maintenance supervisor has been at this site for less than 6 months.

Waste Disposal Information:

- Used motor oil, transmission/brake fluids and hydraulic fluids were probably disposed of in the abandoned injection well.
- Maintenance site has utilized both inside and outside wash rack.
- Inside wash rack is no longer used because of the city's concern regarding oil contamination in waste water.
- Outside wash rack is located near asphalt tanks in the maintenance yard.
- Everything was cleaned off trucks in yard or wash bay.
- Antifreeze was always placed in 55 gal barrels for recycling

Waste Cistern Description:

- There is probably one abandoned waste oil injection well at this location based on the questionnaire survey and site visit.
- The questionnaire reports that the waste oil injection well located 10 ft from the west side of the maintenance building was 36 inches in diameter and 20 ft deep.
- The open-hole oil injection well is covered now.
- There is no information regarding waste product removal prior to removal and abandonment.
- Although no injection wells were observed or reported during site visit, the layout of this facility is identical to other maintenance sections where waste oil drained from the oil change bay to an underground cistern located behind building.
- Fresh dirt is located behind building where the oil injection well would be expected based on observations at other sections; this dirt probably represents the location of the old underground storage tank removed in 1993.
- In other maintenance sections in the district, waste oil injection wells were often removed and replaced with underground storage tanks which were subsequently removed and replaced by above ground tanks.

Hydrology of Area

- Topography slope gently to the west or west southwest off the maintenance site.
- There is one pond located 0.25 mile to the northwest and two ponds located .40 mile to the north.
- Depth to fresh water in this area is estimated to be 50 to 75 ft based on water well data on the area.
- No water wells or windmills were observed in area suggesting that businesses and residences in area are on city water.

Lubbock (Section 08) Injection Well Summary:

There is probably one abandoned waste oil injection well at the maintenance site located at 2705 NE Loop 289 in Lubbock. The maintenance site is located on the north side of Loop 289 approximately 1.90 miles east of US 27. Although no injection wells were observed or reported during site visit, the questionnaire results indicate that a waste oil injection well located 10 ft from the west side of the maintenance building. The questionnaire results indicated that the waste oil injection well had a diameter of 36 inches and was approximately 20 ft deep. Used motor oil, transmission/brake fluids and hydraulic fluids were disposed of in the injection well which was active from 1964 to 1988. The location of the injection well and data collected from the questionnaire and site visit are consistent with injection well locations and disposal practices at other maintenance sites in the district. The area surrounding the maintenance site is on city water and sewer. Depth to fresh water is between 50 to 75 ft.

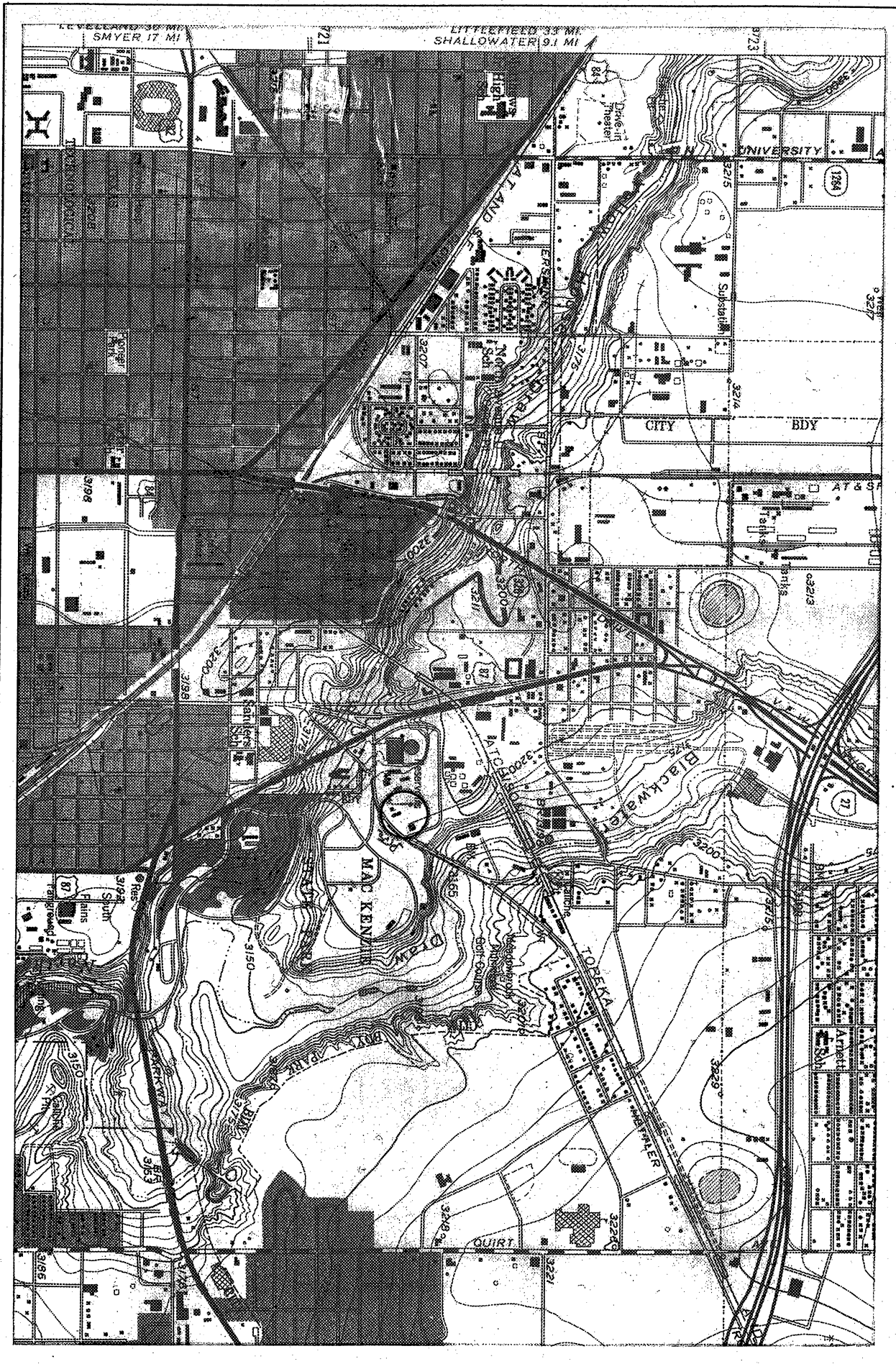


Figure 1. Location of the Lubbock (NE 289) maintenance section (08), Lubbock County, Lubbock District.

Lubbock District
Lubbock SE US 84, Section 09
Lubbock County

James R. Odom (806) 745-4688

July 19, 1996

General Information:

- Maintenance site is located in a semi-urban setting on the south side of US 84 approximately 1.70 mile southeast of the junction of US 84 and loop 289 and 1.25 mile west of the junction of US 84 and South East Drive and 1.65 (figure 1).
- Maintenance site is on city water and sewer.
- Warehouses are located on the north, west, and east sides of the facility.
- Heavy equipment sales and auto salvage are on west side of facility.
- R & T Truck Lines is located on the north side of US 84 (Slaton Highway).
- There is an open field south of the warehouse.

Waste Disposal Information:

- Waste motor oil was placed into an injection well located behind the maintenance building.
- The injection well was active from 1964 to 1990 and still contains 6 ft of standing oil in hole.
- There is also a 500 gallon below ground storage tank located in the lift bay; this tank was installed 6 to 8 years ago.
- TxDOT employees were not certain of where wash rack water goes.
- Diesel and kerosene are used to remove asphalt and grease from trucks in maintenance yard.
- Sometimes diesel, kerosene and asphalt were mixed with caliche in yard for recycling.
- In one truck bay there is a 2 inch diameter pipe in cement that is believed to lead to an underground storage tank located below building.

Waste Cistern Description:

- A waste oil injection well is located behind the west side of the maintenance building.
- The visible part of the injection well consists of a 3 x 4 ft concrete slab, now covered with dirt, and a metal pipe extending through the concrete.
- The six inch diameter steel pipe extends approximately 1 ft above the ground and was used for disposal of waste products into the injection well.
- The injection well is estimated to be 24 inches in diameter and approximately 18 to 20 ft deep; the injection well is an open-hole type of well.

Hydrology of Area

- Topography in the area slopes to the east towards the Brazos River and Blake Lake located approximately 1.3 miles northeast of the facility.
- However, runoff at the maintenance facility is to the northwest but this flow eventually turns to the north and northeast.
- Depth to the top of fresh water in this area is estimated to be 150 to 175 ft.
- One water well is located 0.35 miles west of the facility and a second well is 0.15 mile north of the maintenance site on the north side of US 84.

Lubbock (Section 09) Injection Well Summary:

There is one waste oil injection well located on the south side of US 84 (Slaton highway) approximately 1.70 mile east of Loop 289 on southeast Lubbock. This injection well was active from 1964 to 1990 and still contains 6 ft of standing oil. Waste motor oil was placed into an injection well located on the west side of the maintenance building. The visible part of the injection well consists of a 3x4 ft concrete slab, now covered with dirt, and a metal pipe extending through the concrete for disposal of waste motor oil. The injection well below the concrete slab is estimated to be 24 inches in diameter and approximately 18 to 20 ft deep; the injection well is an open-hole. Depth to fresh water in the area is estimated to be 50 to 75 ft.

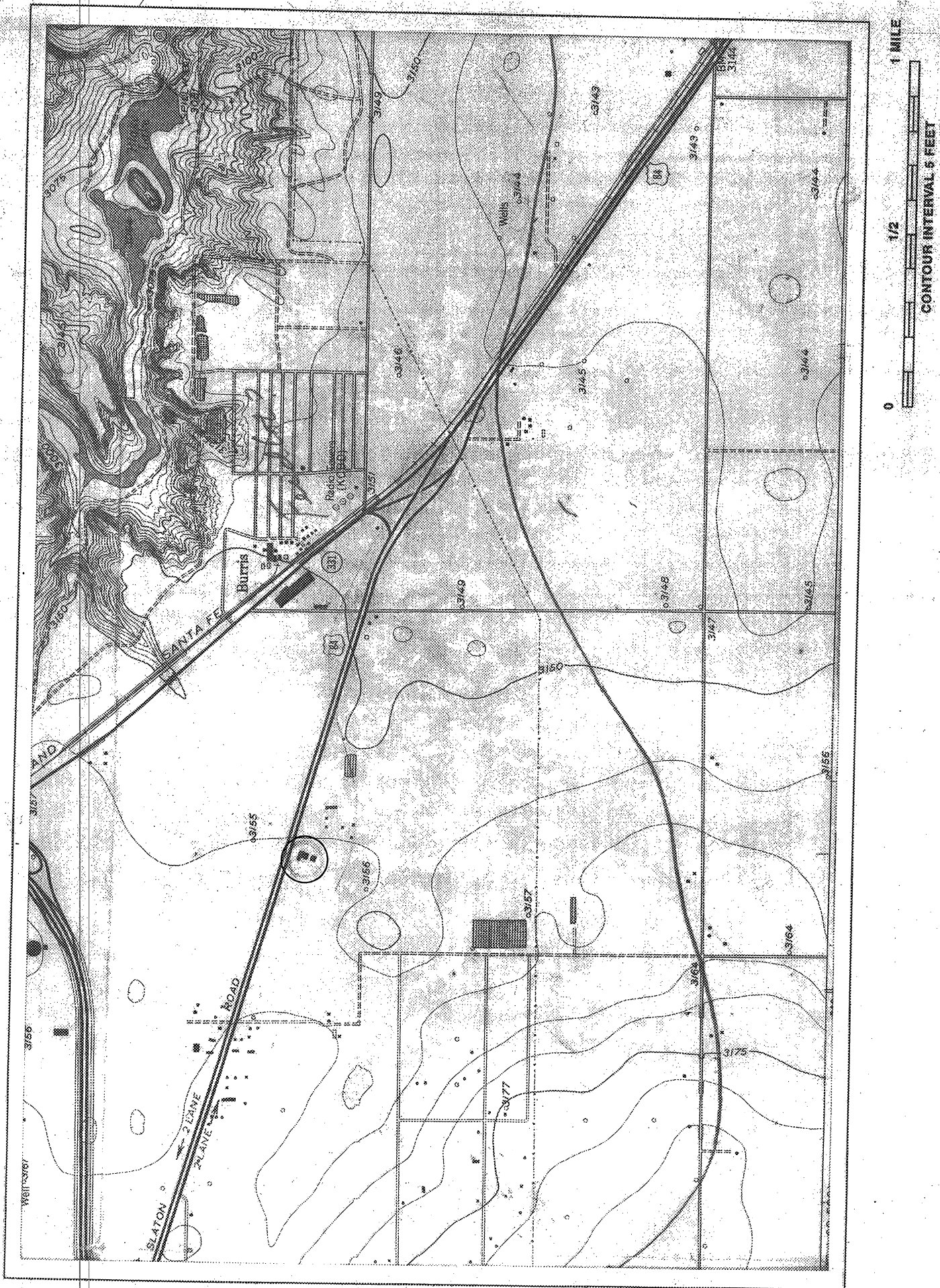


Figure 1. Location of the Lubbock (SE 84) maintenance section (09), Lubbock County, Lubbock District.

Lubbock District
Muleshoe, Section 11
Bailey County

Richard A. Morris (806) 456-7456
July 20 and 22, 1996

General Information:

- Facility built circa 1963
- Site located on west side of Muleshoe on south side of SH 84 (figure 1).
- J.T. Shofner owns residence immediately across road on north side of SH 84
- Grassland with cattle located immediately south of site; cattle currently grazing on land
- Grassy field and hotel located east of site.
- Residential area located along small ridge east and southeast of maintenance site; all residences are on city water.
- Farm equipment warehouse and farm equipment are located on western side of site.
- Low spot where cattle are grazing may contain water at times.

Waste Disposal Information:

- TxDOT facility is on city water.
- Old septic system is located on north side of building with drainage lines running roughly east-west.
- Waste oil was initially disposed of in large cistern located in front of building near old gasoline tanks.
- Uncertain as to what types and quantities of materials went into cistern
- No wash rack water went into cistern; wash rack water possibly drained into city sewer system

Waste Cistern Description:

- Cistern site is paved over.
- Original cistern is described as a cesspool 15 ft deep 12 ft diameter, with dirt sides; uncertainty exists as to the dimensions and volumes of fluids placed in cistern.
- Cistern probably was covered with some type of cement top with vertical pipe allowing access for waste oil.
- Cistern was never pumped out.
- In 1980's cistern was removed and fiberglass tank was installed.
- Approximately 4 years ago, fiberglass tank was removed and waste oil has subsequently been stored in 55 gal bbl.

- Removal of fiberglass tank corresponded with remediation work to replace leaking gasoline tanks in same area; a hole was dug 37 ft deep and cleaned out.
- Workers encountered hard caliche zone at 15 ft.
- This impervious caliche zone may result in waste products migrating laterally; monitoring wells may have determined lateral extent of migration but data from site was not available.
- Excavated all soil from 15 ft around cistern, removed all oil permeated sand and refilled with clean dirt.
- From the remediation work, waste oil migrated only 2 ft down below base of cistern in 24 years.

Hydrology of Area

- Topography on maintenance site shows a marked slope to southeast.
- According to Sain Irrigation and Pumps [(806) 272-4397] depth to water on west side of town is 180 to 200 ft.
- House and well are immediately across street of maintenance site on north side of SH 84 is owned by J.T. Shofner who has been in the area for many years. TD of his well is 185 ft; depth to water is 95 ft. and water level has dropped about 2 ft in drought ; perforated 141-187 ft. Lithologic description of well:

0-2 ft	Red Soil
2-7 ft	Caliche
7-17 ft	Red Sandy Clay
17-40 ft	Caliche rock
40-125 ft	Sand with clay streaks
125-155 ft	Sand and sandstone
155-171 ft	Sand and gravel
171-181 ft	Red clay

- According to Mr. Shofner, “gyp-water” occurs at surface approximately 4 mi west of town.
- Black Water Draw located south of Muleshoe and the maintenance site ran with water from 1924 to 1941.
- City water well located less than 0.25 mi southeast of maintenance site; phone number for city is (806) 272-4528; “Sylvester” with the water department stated that this well was abandoned about 2-3 years ago because the water storage tank was too rusted.
- TD of city well was 180 to 200 ft; depth to fresh water was around 90 ft.
- Possible source of additional well information: Irrigation supply, J.C. or Zona Gatewood (806) 965-2761.

- TxDOT personnel estimated 180 to 200 ft to water in area; they may be assuming depth to red bed (or TD) and not to top of water.
- Annual precipitation in Bailey County about 17 inches.

Muleshoe (Section 11) Injection Well Summary:

There is one abandoned waste oil injection well located on the south side of SH 84 west of Muleshoe. The original injection well is described as an open-hole cesspool 12 ft in diameter and 15 ft deep although there is much uncertainty as to the dimensions of the hole and the volumes of fluids disposed. The injection well was probably covered with some type of cement slab with a vertical pipe allowing for disposal of waste oil. While active, this injection well was never pumped out. Injection well was replaced with underground storage tank which was eventually replaced and the area around the underground tank was remediated. Removal of fiberglass tank corresponded with remediation work to replace leaking gasoline tanks in same area. Soil from a 15 ft diameter hole, 37 ft deep was cleaned out and remediated. During remediation, soil was excavated from 15 ft around cistern and 37 ft deep and all oil permeated sand was removed and refilled with clean dirt. Based on the remediation work, waste oil migrated only 2 ft downward below base of cistern in 24 years. However, a hard impervious caliche zone at 15 ft might have resulted in waste products migrating laterally; monitoring wells may have determined lateral extent of migration but data from site was not available. Depth to fresh water in two water wells located within 0.25 mi of maintenance site is approximately 90 to 95 ft.; TD for these two wells is 180 to 200 ft.

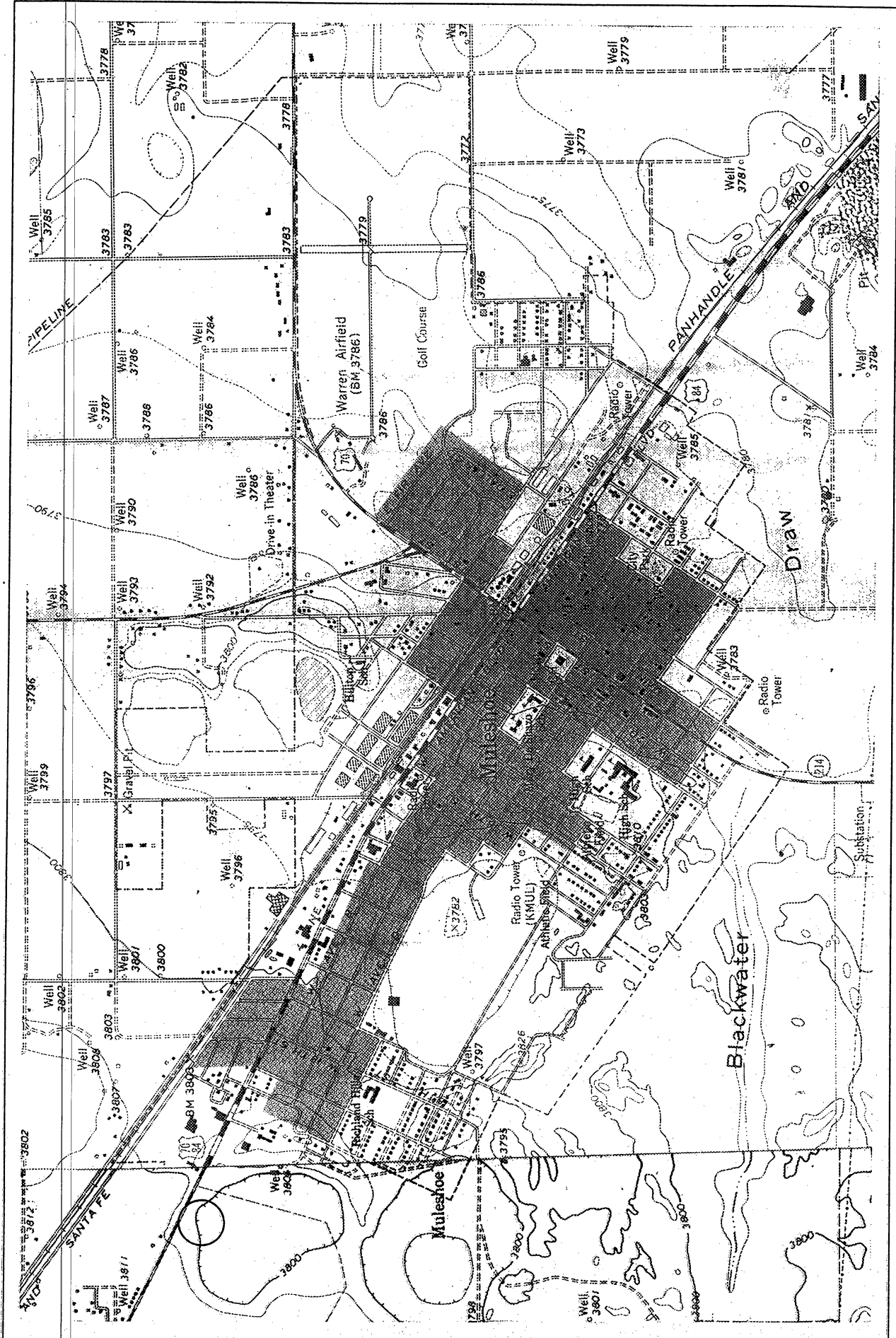


Figure 1. Location of the Muleshoe maintenance section (11), Bailey County, Lubbock District.

Lubbock District
Plains Maintenance Section 12
Yoakum County

Jerry Morphis (806) 456-7456
July 20 and 22, 1996

General Information:

- Maintenance site located 0.35 mi south of junction of US 82 and SH 214 on the east side of SH 214 (figure 1).
- Vegetation around maintenance site is mesquite grasslands.
- Grassy fields are located on east and south sites of maintenance site; abandoned building is located south of site.
- A church is located across site on west side of SH 214.
- Residential area is present approximately 0.40 mi northwest of site, north of SH 82 and west of SH 214.
- Well drilled for gas tanks in maintenance yard several years ago but depth to water is uncertain.
- Caliche pits in area; some pits have caliche up to 40 ft thick.
- Caliche pit 1/2 mile south comprised of very hard caliche; used term "flint" to describe.
- No plans of site; must obtain from Woody Marcy
- Impervious cover over yard is approximately 60 to 70%.
- Maintenance facility is on city water and sewage.

Waste Disposal Information:

- TxDOT facility always on city water; no septic system
- Waste oil, hydraulic fluids, and transmission fluids and possibly other materials placed in hole; waste oil in well had to be pumped out periodically.
- Cannot accurately quantify waste products placed in hole; absence of records and older personnel to verify waste products; furthermore, the number and types of vehicles has fluctuated over time.
- Waste oil and diesel went into pit; old antifreeze possibly given to employees.
- In old days, asphalt rinsed from trucks with diesel and/or kerosene was mixed with sand/gravel or caliche and applied to roads.
- Wash water runs into sewage system.

Waste Cistern Description:

- Cistern site on south side of TxDOT maintenance building.
- Old cistern was constructed around 1961 and subsequently replaced with underground tank; this tank was removed in early 1993 and hole was filled with dirt.
- Old dirt cistern was carved out of caliche that was very hard and believed to be relatively impervious in this area; 2 or 3 miles south of site, the caliche is very soft and more permeable.
- Description of waste cistern was uncertain; either 6 x 8 ft hole approximately 10-15 ft deep or 10 to 10.5 ft diameter circular hole.
- Plastic liner "like farmers used" was placed in hole.
- Cistern drilled in caliche but the fact that a plastic liner was required in cistern may suggest that the caliche was thought to be semi-permeable.
- Oil currently stored in above ground tanks.
- A second waste cistern was suppose to be drilled in southeast corner of yard but this well was never drilled according to retired employee.

Hydrology of Area

- Topography at maintenance site slopes to east; runoff ultimately reaches Sulphur Springs Draw located 1.50 mi east.
- Caliche in area very hard an believed to be impermeable; thickness is 30 to 40 ft in area.
- TxDOT drilled well under radio tower. Could not get good lightning ground on tower because of caliche, so they had to drill to water and set pipe to direct lightning strikes. Depth around 100 ft to water.
- TxDOT also drilled test wells near cistern when study was attempted to determine if underground gasoline tanks that were removed had leaked.
- TxDOT employee owns warehouse 0.50 mi south of maintenance facility and stated that caliche there was very hard and his water well had a TD of 120 ft with top of water in 80 to 90 ft range.
- A house located 1.75 mi south of maintenance site has a well with TD of 143 ft and depth to fresh water of 81 ft; water level measured on 7/16/96 when pump was replaced.
- City water wells located 0.80 mi west of facility; "David" at City Hall has information regarding depth to water and TD (806) 456-2288.
- Windmill located 1.30 mi south and approximately 0.50 mi east of site.
- A second windmill is located 0.60 mi east-northeast of maintenance facility north of SH 82.
- Another windmill appears on the topographic map 1.25 mi due east on SH 82 in Sulphur Springs Draw.

Plains (Section 12) Injection Well Summary:

There is one abandoned waste oil injection well located near the intersection of US 82 and SH 214 on the southeast side of Plains. The injection well, located on the south side of the maintenance building, is described as either 6 x 8 ft hole approximately 10-15 ft deep or 10 to 10.5 ft diameter circular hole drilled in hard caliche. The injection well was drilled in 1961 and used to dispose of waste oil, hydraulic fluids, and transmission fluids and possibly other materials placed in hole. Waste oil and other products in well had to be pumped out periodically suggesting that the sediments have relatively low permeability. The injection well was abandoned in 1993 and filled with dirt. A well was drilled to water under the radio tower at the maintenance site to provide a ground for lightning strikes; depth to fresh water was estimated to be around 100 ft. A second well 0.5 mile south of the facility encountered fresh water at 80 to 90 ft and another well located 1.75 mile south encountered fresh water at 81 ft.

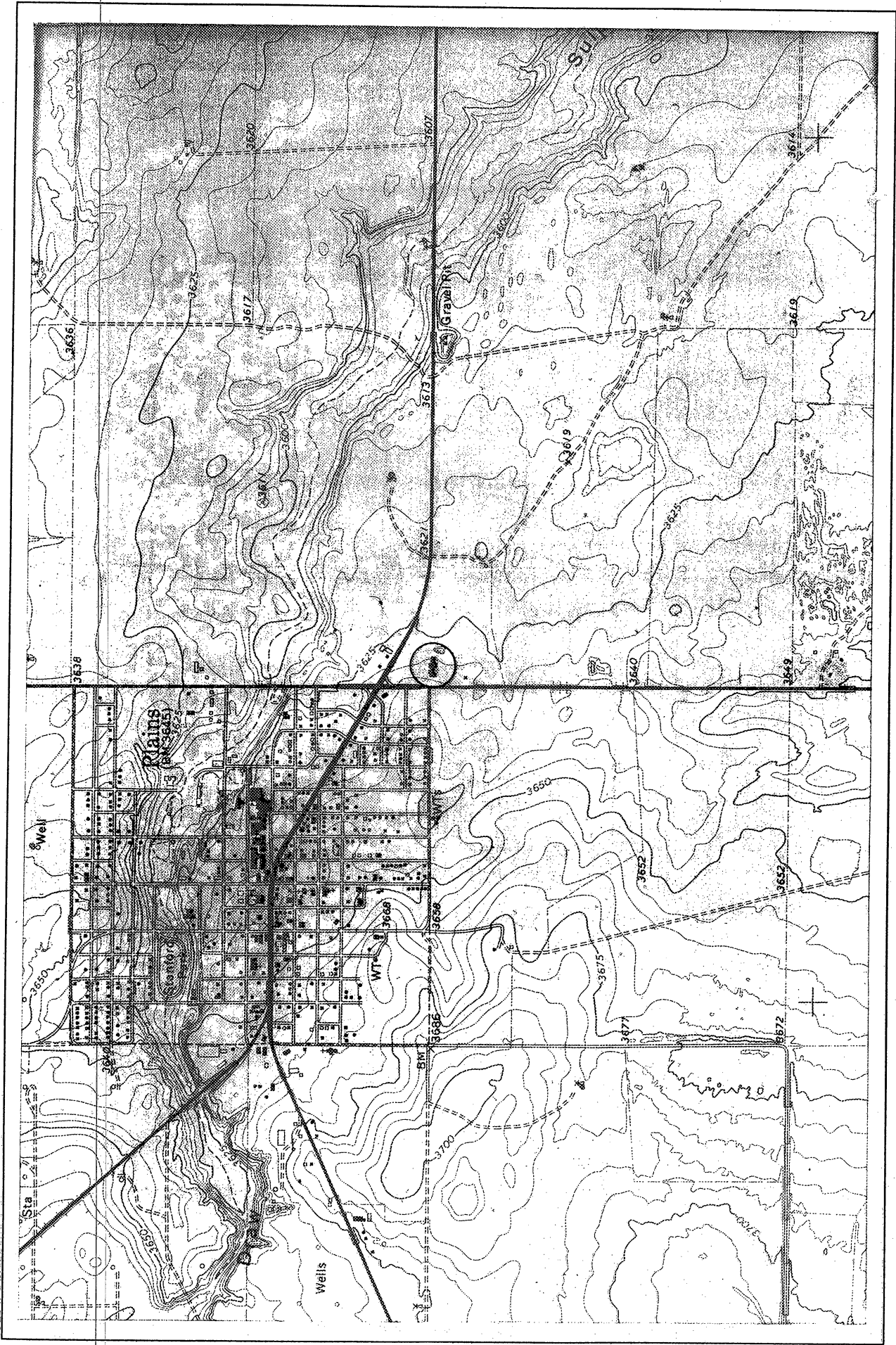


Figure 1. Location of the Plains maintenance section (12), Yoakum County, Lubbock District.

Lubbock District
Plainview, Section 13
Hale County

Randdall L. Woods (806) 293-5101

"Warren"

July 17, 1996

General Information:

- Maintenance site is located on south side of Plainview; rural setting (figure 1).
- Impervious cover at maintenance site is approximately 50%.
- Maintenance site is on city water.
- Maintenance section is on septic system.
- Use to mix old asphalt in with caliche.
- There is a residential trailer park located on the west side of the maintenance facility and more residences located north of the trailer park.
- There is a residence located along US 87 on the other side of the trailer park.
- Open fields and/or crop land are located northwest and north of site and across US 87 on the other side of the railroad tracks paralleling the highway.
- A warehouse is located northeast of maintenance section along the frontage road of US 87,
- A large complex of grain silos or storage bins are located east-northeast of the maintenance site on the south side of US 87.

Waste Disposal Information:

- Wash rack water was disposed on in a series of 3 to 5 holes or pits along the fence line; these holes were connected to wash rack and also interconnected with each other.
- Waste oil products were disposed of in an underground tank with a large concrete lid; this tank was removed 5 to 10 years ago.
- It is possible that this cement tank was some kind of large-diameter cement culvert pipe with a cement lid.
- Asphalt from trucks was cleaned in the maintenance yard behind the maintenance building near the fence line adjacent to the trailer park.

Waste Cistern Description:

- There are 3 to 5 abandoned wash rack water injection wells located along the east fence line.
- Wash rack water would drain into these holes which were interconnected with each other by pipe.
- These holes were believed to be gravel-filled.

- There was no information regarding diameter and depth of these holes.
- These holes were abandoned around 15 years ago and are now covered over.
- There was some type of underground cement tank located behind the maintenance building that was used for waste oil disposal; this tank was removed 5 to 10 years ago.

Hydrology of Area

- Local driller reports depth to fresh water at 185 to 260 feet in area; depth to water under City of Plainview is 170 to 180 ft.
- Depth to fresh water is erratic and water supply in area fluctuates greatly.
- Some drillers now going to the deeper Santa Rosa Formation.
- City of Plainview gets water supply from Lake Meridith 120 miles to north but there are 16 water wells inside city limits.
- According to City of Plainview (806) 296-1153, the depth to Red Bed in their water wells ranges from 298 to 314 ft, and averages 300 ft; depth to top of fresh water averages 160 ft.
- The trailer park located immediately southwest of maintenance section on north side of US 87 probably has a water well; no one answered door at managers/owners house.
- Land around maintenance site is relatively flat but water runs to northeast parallel to US 87.
- There is a playa located approximately 0.30 mile northwest of facility.
- There are two small ponds or depressions located along the north side of US 87 less than 0.40 mile north of the maintenance facility.
- There are at least 10 water well located within a one mile radius of the maintenance section and at least 3 wells within 0.50 mile.

Plainview (Section 13) Injection Well Summary:

There are possibly 3 to 5 abandoned wash rack water injection wells located at the Plainview maintenance site on the north side of US 87 on the south side of the city south of the county airport. Wash rack water ran from the maintenance warehouse to the "holes" which were connected together by underground pipe. The diameter and depth of these holes is unknown but they may have been filled with gravel. These wells were abandoned and are now covered over with dirt. Waste oil was disposed on into a large underground cement tank located behind the back door of the maintenance building. This tank may have been a large-diameter cement cistern that was removed 5 to 10 years ago. Local driller reports depth to fresh water ranges from 185 to 260 feet in area and 170 to 180 ft below the City of Plainview. However, depth to fresh water is erratic and fluctuates greatly. There is a playa lake located 0.30 mile northwest of maintenance site. Rain water run off from the maintenance site is to the northeast.

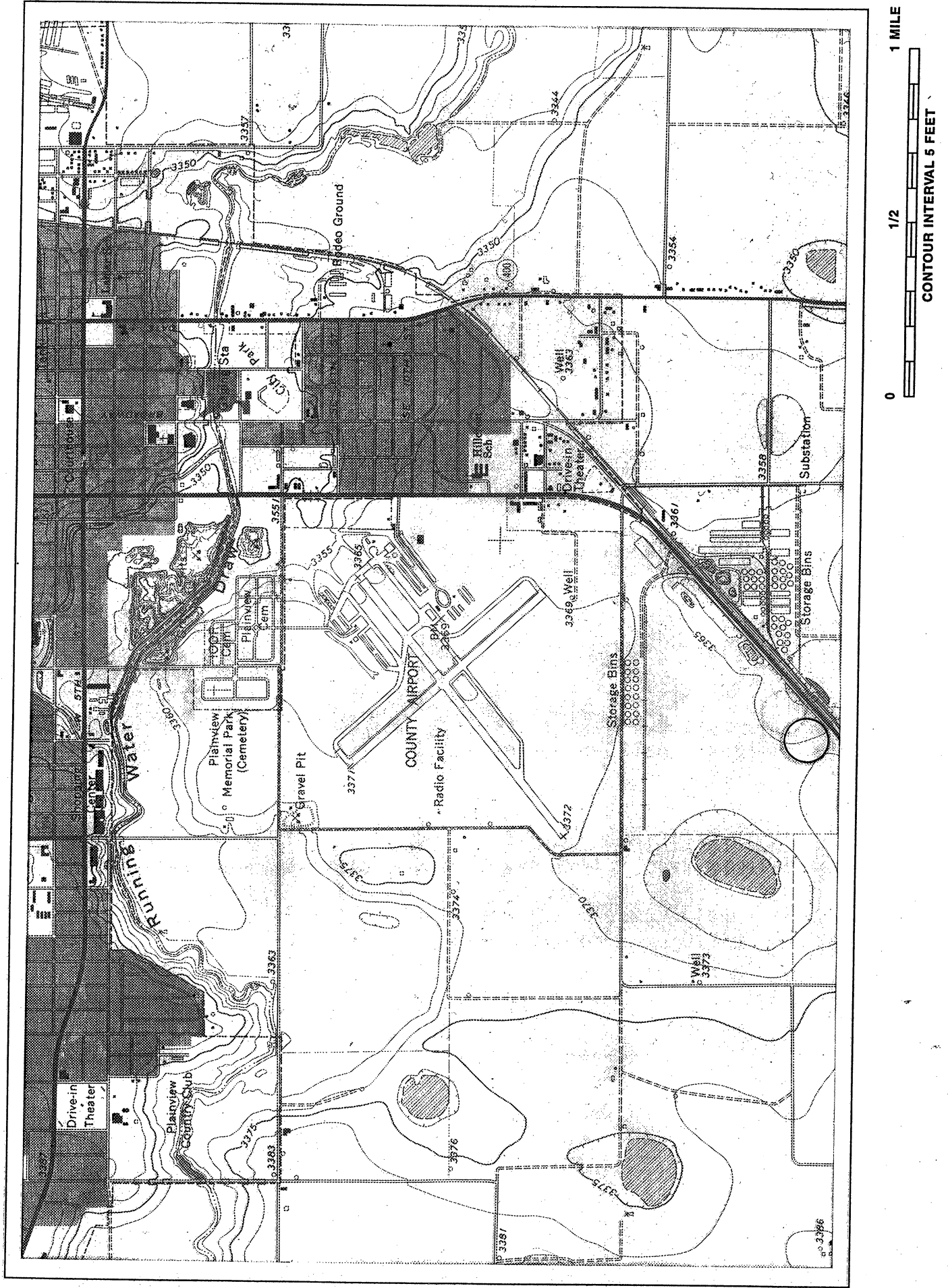


Figure 1. Location of the Plainview maintenance section (13), Hale County, Lubbock District.

Lubbock District
Post, Section 14
Garza County

Jerry Moore (806) 495-2245
July 25, 1996

General Information:

- Maintenance site is located south of Post on the west side of US 84 (figure 1).
- There are 7 pieces of heavy equipment and 11 pieces of light equipment stationed at maintenance site.
- Maintainers have 18 gallons of oil which is changed every 2,000 hour (once per year) and 40 gallons of hydraulic fluid.
- Light equipment contains 1 to 2 gallons of oil.
- Warehouses are located south of the maintenance section between the site and Sand Creek.
- City (?) Parks are located east and south of the maintenance site.
- Residences are located on the other side of a small field west of the maintenance facility.
- Residences and a high school field are also located north of the maintenance site towards the city of Post.
- Garza Oil Field is located less than one mile west and northwest of the maintenance site.
- Maintenance site is on city water supply.
- There are two septic systems at maintenance site which is now on city sewer system.

Waste Disposal Information:

- Waste motor oil, antifreeze, transmission and hydraulic fluids, various unknown solvents, and paint thinner were disposed of in wells.
- Waste oil was also disposed of on roadways but this practice was discontinued 10 to 12 years ago.
- Waste oil was sometimes stored in 55 gallon drums for recycling.
- Wash rack water ran into city sewer but they also washed vehicles in yard.
- Kerosene and diesel were used to remove asphalt from vehicles and all three were mixed on caliche pad and recycled onto roads.
- Waste motor oil was not pumped out of well since at least 1982; if oil was pumped out of well, current TxDOT personnel at site did not know about it.
- Injection wells were active from 1958 and active until mid 1980's

- One septic tank is located on the south side of the maintenance warehouse and a second septic tank is located west of the Engineer Office. There is also a cesspool located on the east side of the maintenance warehouse.

Waste Cistern Description:

- There were two abandoned waste oil injection wells at this maintenance site.
- Injection Well #1 was located near gas station in yard but this was dug up in late 1980's and backfilled with soil when underground storage tanks were removed.
- Injection Well #2 was located between northwest corner of equipment shed and shop, was used for light equipment.
- Injection Well #1 was used waste material from heavy equipment and injection Well #2 was used for light equipment waste disposal.
- Both wells were open-hole type wells 18 to 24 in diameter and 20 to 30 ft deep.
- Waste fluids may have drained directly into injection Well #1, whereas injection Well #2 may have had a concrete top with metal pipe for waste disposal.
- Both injection wells were backfilled with dirt and covered with asphalt pavement and/or soil but no one knows if wells were pumped out first.

Hydrology of Area

- A small lake with parks on the north and south sides is located less than 0.10 mile southeast of the maintenance site.
- Topography at facility slopes to the south away from the city but towards the lake.
- A small berm along the southern fence line of the maintenance site directs runoff eastward through a culvert pipe under US 84 and towards the lake.
- Water in area is gypsum water and is used only for bathing.
- The City Water Department (806) 495-2811 stated that Post obtains drinking water from White River Lake located 25 miles to the southwest.
- Post has no backup supply of water.
- Post has obtained an Arid Area Permit for the landfill.
- The proximity of the maintenance section to the lake suggests that the ground water table may be very close to the surface in this area although the water is not used as a local source for potable water.

Post (Section 14) Injection Well Summary:

There are two abandoned waste oil injection wells at the Post maintenance section which is located on the west side of US 84 immediately south of the city. The injection wells were active from 1958 until 1988 when they were backfilled with soil. These injection wells were open holes 18 to 24 inches in diameter and 20 to 30 ft deep; one injection well possibly had a cement top with protruding pipe for waste disposal. Waste motor oil, antifreeze, transmission and hydraulic fluids, various unknown solvents, and paint thinner were disposed of in wells; no one knows if waste material was removed prior to backfilling. A small lake with parks on the north and south sides is located less than 0.10 mile southeast of the maintenance site. A small berm along the southern fence line of the maintenance site directs runoff eastward through a culvert pipe under US 84 and towards the lake. The City of Post obtains drinking water from White River Lake located 25 miles to the southwest and Post has no backup supply of water. Only gypsum water occurs around and proximity of the maintenance section to the lake suggests that the ground water table is probably very close to the surface in this area

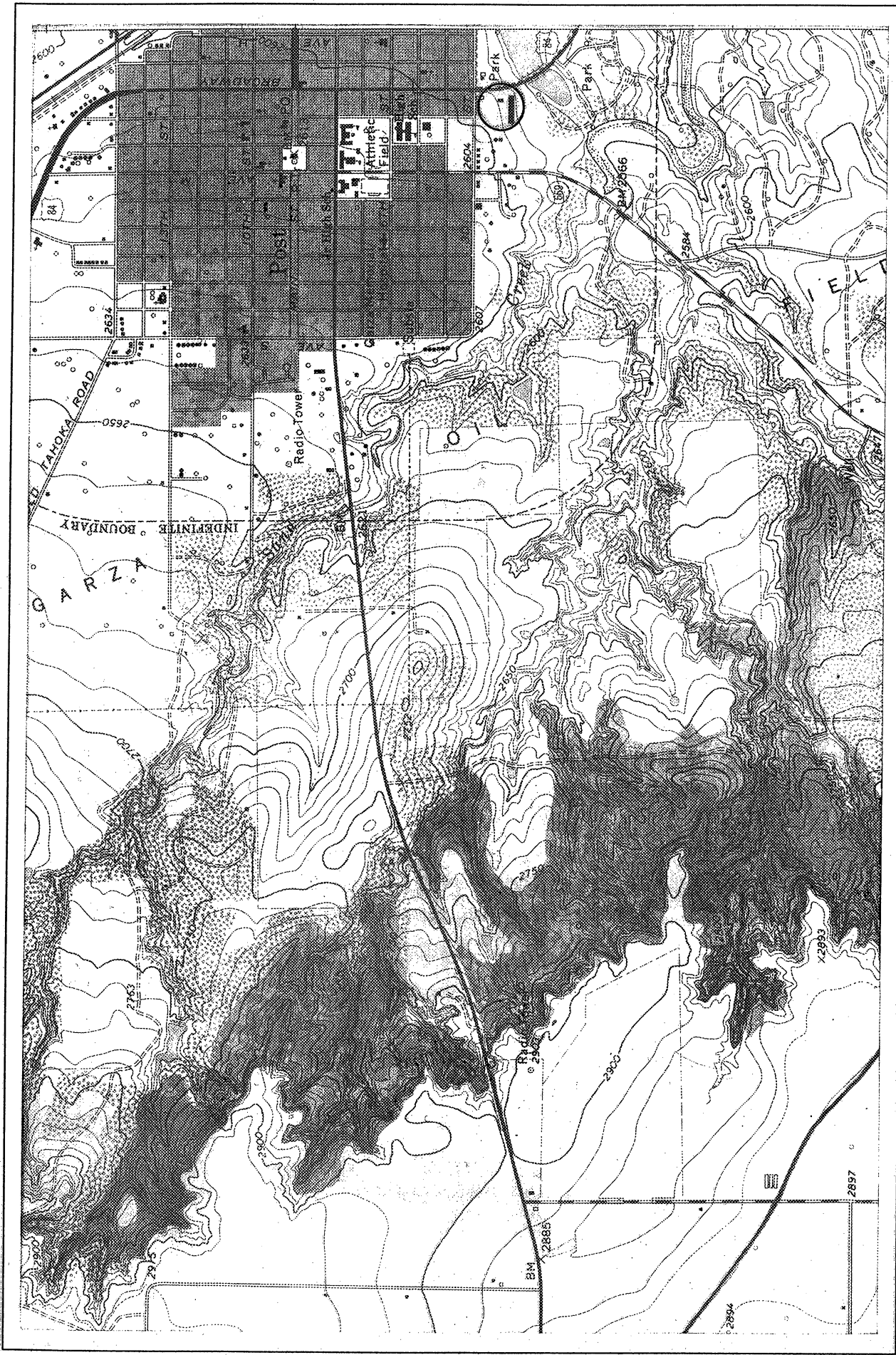


Figure 1. Location of the Post maintenance section (14), Garza County, Lubbock District.

Lubbock District
Ralls, Section 15
Crosby County

Steve Ferguson (806) 253-2575

Charles

July 25, 1996

General Information:

- Area around Ralls is flat and mostly agricultural.
- Maintenance site is located the southern city limit on the east side of SH 207 (figure 1).
- Lions Park and a community swimming pool are located across the street south of the maintenance site.
- The facility is in a residential area and houses are located on the north, west, and east sides of the maintenance site.
- Sewer covers and absence of windmills in residential areas suggest that houses around maintenance site are on city water and sewer; residents in area confirmed that they are on city water.
- An auto junk yard is located immediately northeast of facility.
- Topography at maintenance site is very flat and it is difficult to determine ground slope.
- The street immediately east of the maintenance site acts as a potentiometric divide; water flow eastward from this street and west and southwest west of the street.
- Maintenance site has 18 to 20 vehicles including: 2 rollers, 3 one-ton pickups, 6 dump trucks, 2 maintainers and 1 large dump truck.
- Maintenance site is on city water and sewer system.
- There are at least 6 monitoring wells at maintenance site.

Waste Disposal Information:

- Injection well was used for disposal of waste motor oil, transmission and brake fluid, and hydraulic fluids.
- Injection well was active from early 1960's to 1985 and abandoned in 1987.
- Many years ago, antifreeze was dispersed on roads.
- Waste asphalt was mixed with caliche and/or gravel.
- Wash rack water always ran into city sewer system.
- Unknown if rainwater entered injection well.
- A gasoline leak at the maintenance yard occurred in the late 1980's and gasoline leaked straight down 115 ft to water table; however, only trace quantities of gasoline were detected in water.

Waste Cistern Description:

- Waste oil injection well or pit is located midway down the south side of the maintenance building approximately 6 to 8 ft from the building.
- Waste oil injection well was 24 in (possibly 36 in) diameter and approximately 25 ft deep.
- Well was a straight hole lined with cement, possibly cement culvert pipe.

Hydrology of Area

- TxDOT contacts believed that depth to top of fresh water at maintenance site, based on observation well data, is around 115 ft.
- The City of Ralls (806) 253-2558 obtains most of the drinking water from White River Lake located 22 miles southeast of Ralls, but also has water wells within the city limit.
- Without rainfall, White River lake will go dry and the city will depend solely on the water wells which need refurbishing.
- Depth to top of fresh water in city wells is estimated to be 240 ft.; there is some windmill water in area but very few people pump it; TNNRC is concerned about contamination of this shallow aquifer.
- Depth to windmill water at the maintenance site is 115 ft.
- High Plains Drilling (806) 298-2571 believed that depth to the top of fresh water south of Ralls is 220 ft and depth to Red Bed is 300 ft; there are some perched aquifers in area but these are very rare.
- There is one pond located 0.40 miles southeast of maintenance site and a second pond is located 0.90 miles south of facility.

Ralls (Section 15) Injection Well Summary:

There is one abandoned waste oil injection well at the Ralls maintenance site which is located near the southern city limit on the east side of SH 207. This injection well was drilled in the early 1960's, remained active until 1985, and was remediated in 1987 or 1988. Waste products placed into the cement-lined injection well, which had a 24 to 36 in diameter and was approximately 25 ft deep, include motor oil, transmission and brake fluid, and hydraulic fluids. Data collected from observation wells drilled in the late 1980's after a gasoline leak indicated that the gasoline leaked 115 ft straight down to water table. The City of Ralls obtains most of their drinking water from White River Lake located 22 miles southeast of Ralls, but also has water wells within the city limit. Depth to top of fresh water in Ralls is estimated to be 220 to 240 ft and total depth is around 300 ft. There are some perched aquifers in area but these are relatively rare and very few people pump them.

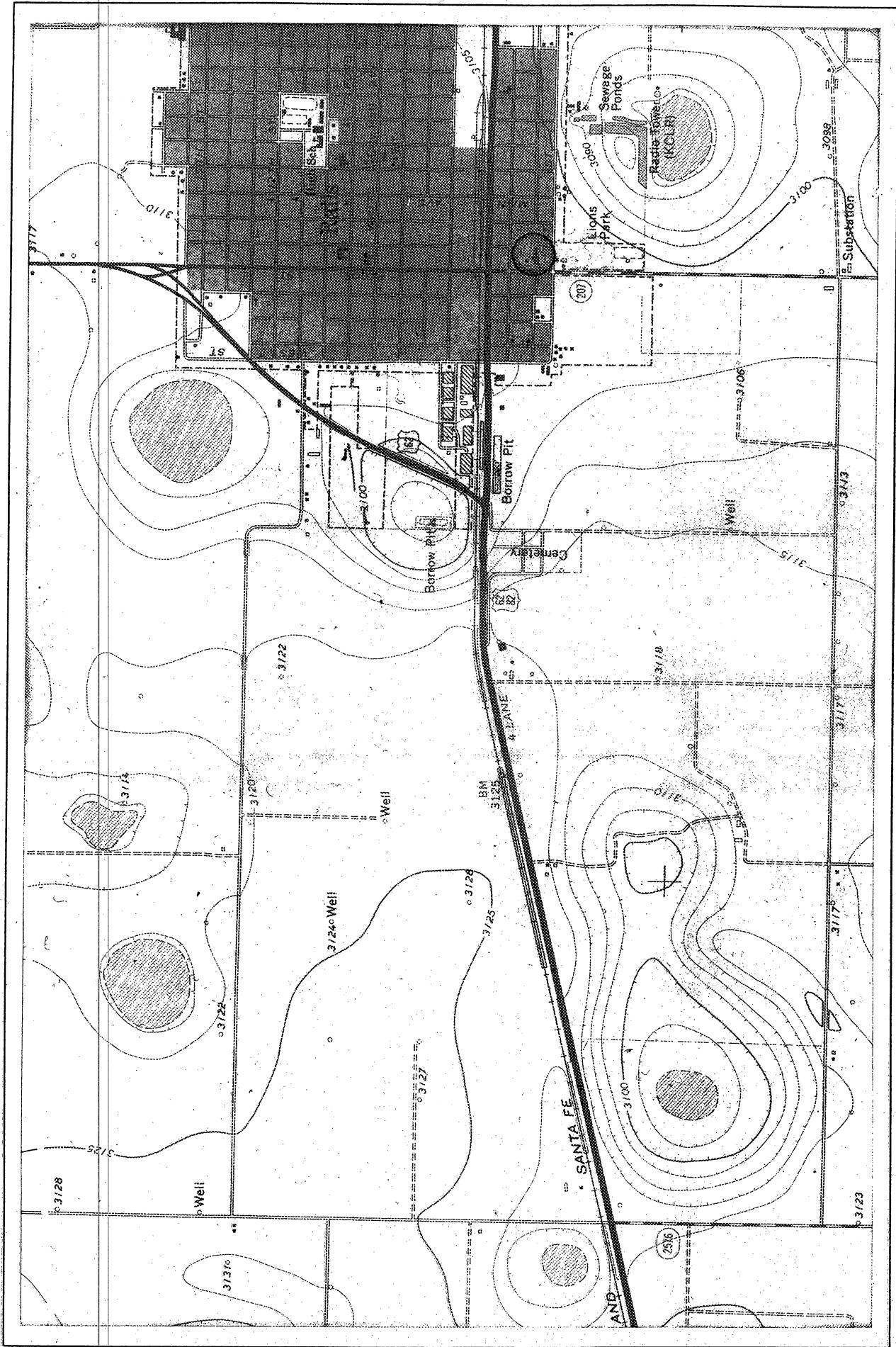


Figure 1. Location of the Ralls maintenance section (15), Crosby County, Lubbock District.

Lubbock District
Seminole Maintenance Section 16
Gaines County

James A. Lytle (806) 758-3632

July 17, 1996

General Information:

- The maintenance section is located east of Seminole on the north side of US 180 near the intersection of US 180 and Southeast Avenue G (figure 1).
- Fields are located north, west, and east sides of the maintenance site.
- There is a trailer and building along the US 180 frontage road on the east and west sides of the facility, respectively.
- A Mennonite community is located south of the maintenance site on the south side of US 180.
- Buildings are located 0.15 mile west of facility and houses are located approximately 0.20 mile northwest of the maintenance section.
- A second residential community occurs southwest of the maintenance site on the south side of US 180, west of the Mennonite community.
- Maintenance section is on city water and sewer.

Waste Disposal Information:

- Waste oil, antifreeze, and hydraulic fluid were disposed of in injection well.
- Injection well was drilled in 1964 and disposal of waste materials began in 1966.
- Waste material had to be pumped from the injection well in the late 1970's.
- Injection well was replaced with fiberglass tank in late 1980's.

Waste Cistern Description:

- Waste oil injection well was located along the west side of the maintenance building adjacent to the lift bay.
- Injection well was an open-hole 36 in diameter and approximately 30 ft deep; the well had a cement slab over it and a metal pipe extending through the slab for waste oil disposal.
- Waste oil was removed and hole filled with dirt in 1988.
- The injection well was normally covered such that little rainwater entered the well.
- A heavy rainstorm occurred in the evening after the injection well waste material was pumped out filling the open hole to overflowing; remaining waste oil floated out of hole.
- The morning after the storm, the well was holding water within 2 ft of surface but little oil was observed on top of the water.

- The fact that the injection well did not have to be pumped for 14 years after installation and because water levels dropped in the well dropped within hours of being filled by a rainstorm, suggest that the strata encountered by well are permeable and that waste products entered the surrounding rocks.

Hydrology of Area

- Topography of maintenance site slopes to the east away from the City of Seminole.
- There are no surface water features located within one mile of the maintenance site.
- TxDOT employees estimated depth to fresh water at around 40 ft; top soil is very thin only about 6 inches thick.
- There are several water wells across the street from the TxDOT facility that supply water to the Mennonite community living there; community size is estimated to be 50 to 100 people.
- According to one resident of the community, one well located 0.2 miles southeast of the maintenance site reaches a total depth of 120 ft. Depth to first water is 55 ft and depth to the top of second water occurs at 100 to 105 ft; the pump is set at 110 ft.
- The residential area located to the west of the Mennonite community is on city water.
- Owners of a feed store located in Seminole stated that the shallow aquifers used by the Mennonites are going dry and that depth to fresh water below the windmill water is at 235 to 250 ft.
- Contacts at the feed store estimate that 90 to 95 percent of the fresh water produced in this area is used for water flooding operations in oil fields located north of Seminole.
- Additional contacts for water supply are Jeeter Drilling (806) 758-5521; Ford Drilling (806) 758-6382; and Drexter Drilling (806) 758-3748.
- Top 2 to 8 ft of soil is very hard and depth to first water-bearing sand is often 60 to 80 and these sands are usually 10 to 15 ft thick; the first sand is nearly dry. Rock below first sand is very hard and of low permeability. Ogallala occurs at depths greater than 100 ft and has a net thickness of 60 to 80 ft.

Seminole (Section 16) Injection Well Summary:

There is one abandoned waste oil injection well at the Seminole maintenance section located on the north side of US 180 east of the city. This waste oil injection well was drilled in 1964 and remained active from 1966 until 1988 when the remaining waste products were removed and the hole filled with dirt. The abandoned well, 36 in diameter and 30 ft deep, was located along the west side of the maintenance building adjacent to the lift bay. A cement slab covered the open-hole and a metal pipe protruding through the cement allowed waste products to be disposed of into well. The strata encountered by the injection well are permeable and waste products introduced into the well probably entered the surrounding rocks because: (1) the well was pumped out 14 years after installation, and (2) during remediation water levels dropped in the well within hours of being filled by a rainstorm. There are numerous water wells in the area, but several shallow water wells are located across the street from the TxDOT facility supply water to a Mennonite community. Depth to first water in one of the wells is estimated to be 55 ft and depth to the top of second water occurs between 100 to 105 ft. The total depth of the well is 120 ft and the pump is set at 110 ft. Topography at the maintenance site generally slopes towards the east such that runoff flows parallel to the Mennonite community located south of the maintenance site.

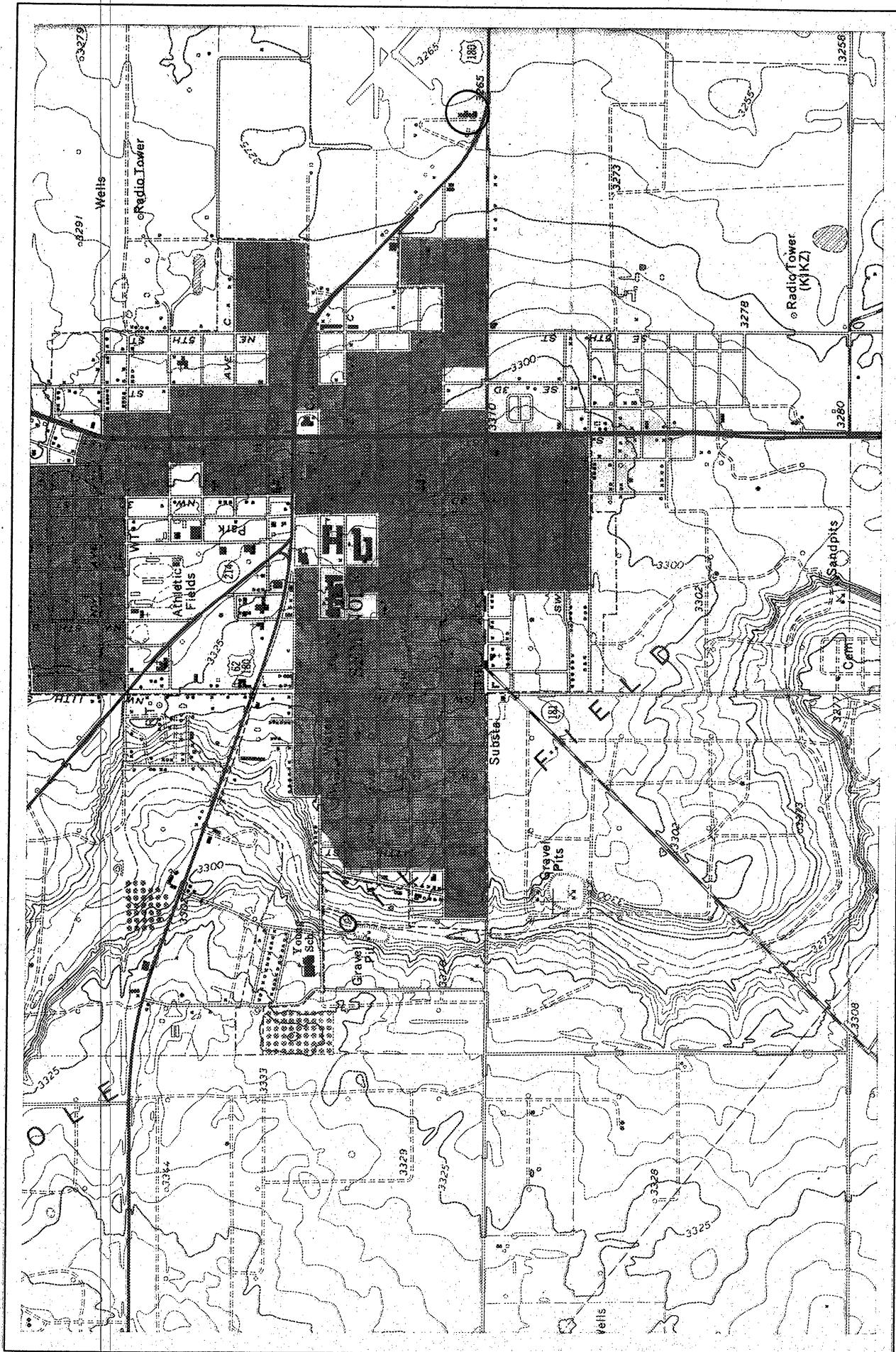


Figure 1. Location of the Seminole maintenance section (16), Gaines County, Lubbock District.

Lubbock District
Tahoka, Section 17
Lynn County

Dewey P. Engle (806) 998-4004
July 17, 1996

General Information:

- Area around maintenance section is very flat and mostly crop land.
- Maintenance site is located on the east side of US 87 approximately 0.50 mile north of Tahoka (figure 1).
- Several residences are located north of maintenance facility along frontage road of US 87.
- Another residence is located immediately south of maintenance site along US 87 frontage.
- There are open fields behind residences and behind maintenance facility; rural setting.
- House located approximately 0.25 mi to the north has water well as does the house immediately south of maintenance facility.
- There was a fuel spill a two blocks west of the intersection of US 87 and US 380 several years ago.
- Water drains southward off of site.
- Maintenance section is on city water and city sewer.

Waste Disposal Information:

- Waste oil is now stored in above ground tanks but many years ago, waste oil was spread onto roads; could never find any 55 gal drums to store oil in.
- Wash rack water drained into series of rock cisterns 3 or more feet in diameter.
- Wash rack water now goes into city sewer.
- While active, the wash rack water drained into the ground.
- There is an abandoned waste oil injection well located on the northwest side of the shop.
- Motor oil, transmission and brake fluids and antifreeze were disposed of in the injection well.
- The waste oil injection well has been cleaned out and covered with dirt.

Waste Cistern Description:

- There is an abandoned 24 in diameter 30 ft deep waste oil injection well located midway down the north side of the maintenance building next to the main shop bay.
- A pipe running from the main shop bay carried waste oil and other products to the injection well.
- This injection well was active from 1968 until 1986 when above ground storage tanks were used to store waste products.
- Waste oil injection well has been cleaned out and is covered with dirt.
- A 3 ft diameter gravel pit immediately behind wash rack was used for waste water from the wash rack.
- This gravel pit is connected to a series of gravel pits located east of the maintenance building.

Hydrology of Area

- The land around Tahoka is relatively flat but rain water drains to the south parallel to US 87.
- There are two water wells at residences on the north and south side of the maintenance facility.
- A well at the residence located to the north of the maintenance section encountered fresh water at 46 ft; well produces at 60 to 90 gal/min.
- TxDOT employee estimated depth to fresh water in his well located nearby to be 50 to 100 ft in area.
- There are at least 12 water wells located within a 0.50 mile radius of the maintenance section and perhaps a total of 32 water wells within a 1 mile radius of the facility.
- There is a small pond located 0.75 mile south of the maintenance section.

Tahoka (Section 17) Injection Well Summary:

There is one abandoned waste oil injection well at the Tahoka maintenance section north of the city on the east side of US 87. This injection well was 24 in diameter and approximately 30 ft deep and located midway down the north side of the main building adjacent to the shop. Motor oil, transmission and brake fluids and antifreeze were disposed of in the injection well while it was active between 1968 to 1986. Wash rack water was disposed of in a series of 3 ft diameter gravel pits behind the wash rack shed. These gravel pits were abandoned and the maintenance section now disposes wash rack water into the city sewer system. There are at least 30 water wells within a 1 mile radius of the maintenance site; 12 of them are within 0.5 mi. Houses on either side of the maintenance section have water wells. The depth to water at the house north of the maintenance site is 46 ft and other water wells in area encounter fresh water at 50 to 100 ft.

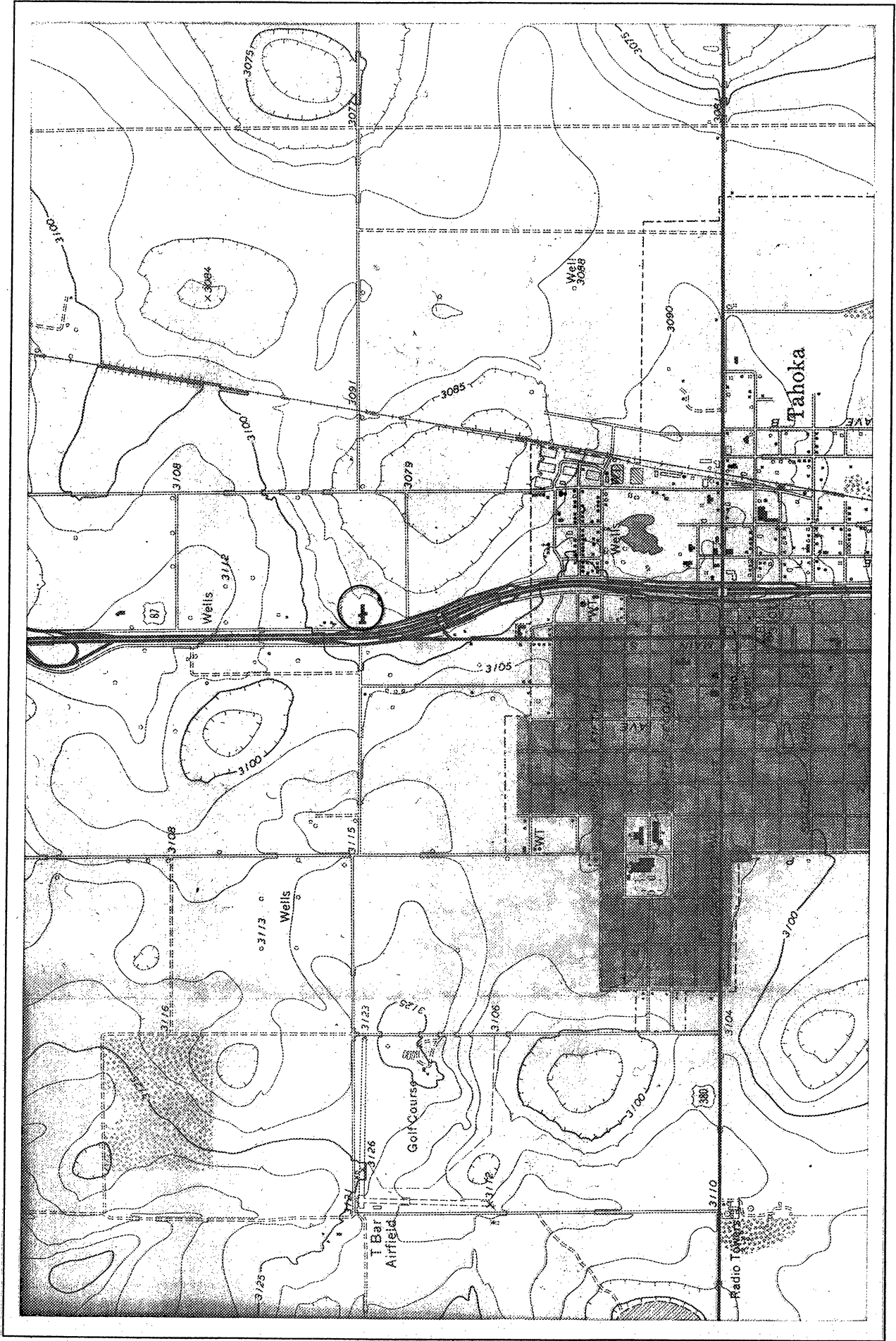


Figure 1. Location of the Tahoka maintenance section (17), Lynn County, Lubbock District.

Lubbock District
Lubbock 308 Municipal, Sections 30/36
Lubbock County

Charlie Langford (806) 456-7456

Philip Taylor

July 19, 1996

General Information:

- Maintenance site is located in an urban setting on the north side of Municipal drive near the intersection of Municipal and US 27 in north Lubbock (figure 1).
- A police academy and firing range are located west of the maintenance section.
- The city of Lubbock owns a heavy equipment storage facility yard north of the facility.
- There are warehouses and building to the east of the site.
- McKenzie State Park is located on the south side of Municipal Drive across from the maintenance site.
- There is a limestone and caliche outcrop located approximately 0.20 mile east of the facility in a roadcut leading to Blackwater Draw; this outcrop is probably representative of the strata in which waste material has been disposed.
- Maintenance site is on city water and sewer although there are two septic tanks located beside buildings at the site.
- Impervious cover is 100%
- There are several water cut off valves located in shallow holes adjacent to buildings.
- There is a cement foundation in the back of the yard where an old building was destroyed by tornado in the 1970's.

Waste Disposal Information:

- Waste products disposed in the injection wells include: used motor oil, antifreeze, transmission/brake fluid, hydraulic fluids, paint and paint thinner, and unspecified solvents.
- Waste injection wells were active between 1950 to 1988.
- An above ground plastic drum was used after injection wells were abandoned.
- Injection wells had to be pumped out periodically when they filled with waste products.
- An estimated 1,000 gallons per year were disposed of in injection wells according to questionnaire.
- Assuming a diameter of 36 inches, one linear foot of the injection well would contain approximately 53 gallons of oil. Therefore, a 20 ft deep well would hold over 1,050 gallons of oil.

Waste Cistern Description:

- There are two abandoned waste oil injection wells at the maintenance facility.
- Injection Well #1 was located near the southwest corner of the maintenance shed adjacent to the west fence line.
- Injection Well #2 was located on the west side of the maintenance shed approximately 15 to 20 ft north of the southwest corner of the building.
- These open-hole injection wells were 36 inches in diameter and approximately 20 ft deep.
- The injection wells were abandoned and backfilled with dirt in mid-1980's; no one knows if waste products were removed from the wells before they were filled with dirt.
- Both wells are now covered with asphalt and only the approximate locations can be determined.

Hydrology of Area

- There was a water well at this location many years ago.
- Blackwater Draw is located 0.20 mile northeast of the maintenance section; there was water in the creek at time of visit.
- Yellow House Draw is located 0.30 mile to the southwest of the maintenance site; this creek runs through MacKenzie State Park.
- Maintenance section sits on top of southeast-trending caliche hill between Blackwater Draw and Yellow House Draw.
- There is approximately 6 to 8 ft of soil on top of hill and at least 15 to 20 ft of hard caliche below the soil horizon.
- The caliche/limestone is exposed in a road cut 0.15 mi northeast of the facility.
- Caliche is relatively hard based on the difficulty TxDOT had in digging holes for underground storage tanks.
- The caliche hill is approximately 40 ft above the level of Black Water and Yellow House Draws suggesting that depth to ground water in this area is less than 40 ft.

Lubbock (Sections 30 and 36) Injection Well Summary:

There are two abandoned waste oil injection wells on the north side of Municipal Drive approximately 0.25 mile east of US 87 in north Lubbock. These injection wells are near the southwest corner and the western side of the maintenance building along the west property line. These wells were approximately 36 inches in diameter and 20 ft deep and active from 1950 to 1988. Waste products disposed in the injection wells include motor oil, antifreeze, transmission/brake fluid, hydraulic fluids, paint and paint thinner, and unspecified solvents. Both wells became filled with waste products over time which required the wells to be pumped out periodically. The injection wells are now backfilled with dirt and covered with asphalt; no one knows if waste products were removed out before filling. The injection wells were drilled into a 15 to 20 ft layer of hard caliche which is exposed in a roadcut 0.15 mile northeast of the site. Blackwater and Yellow House Draws are located 0.2 mile northeast and 0.30 mile to the southwest, respectively, of the maintenance site; Blackwater Draw had running water. The maintenance site on top of a potentiometric ridge although runoff from the site is towards Blackwater Draw to the northeast. Depth to fresh water at the maintenance site is less than 40 ft.

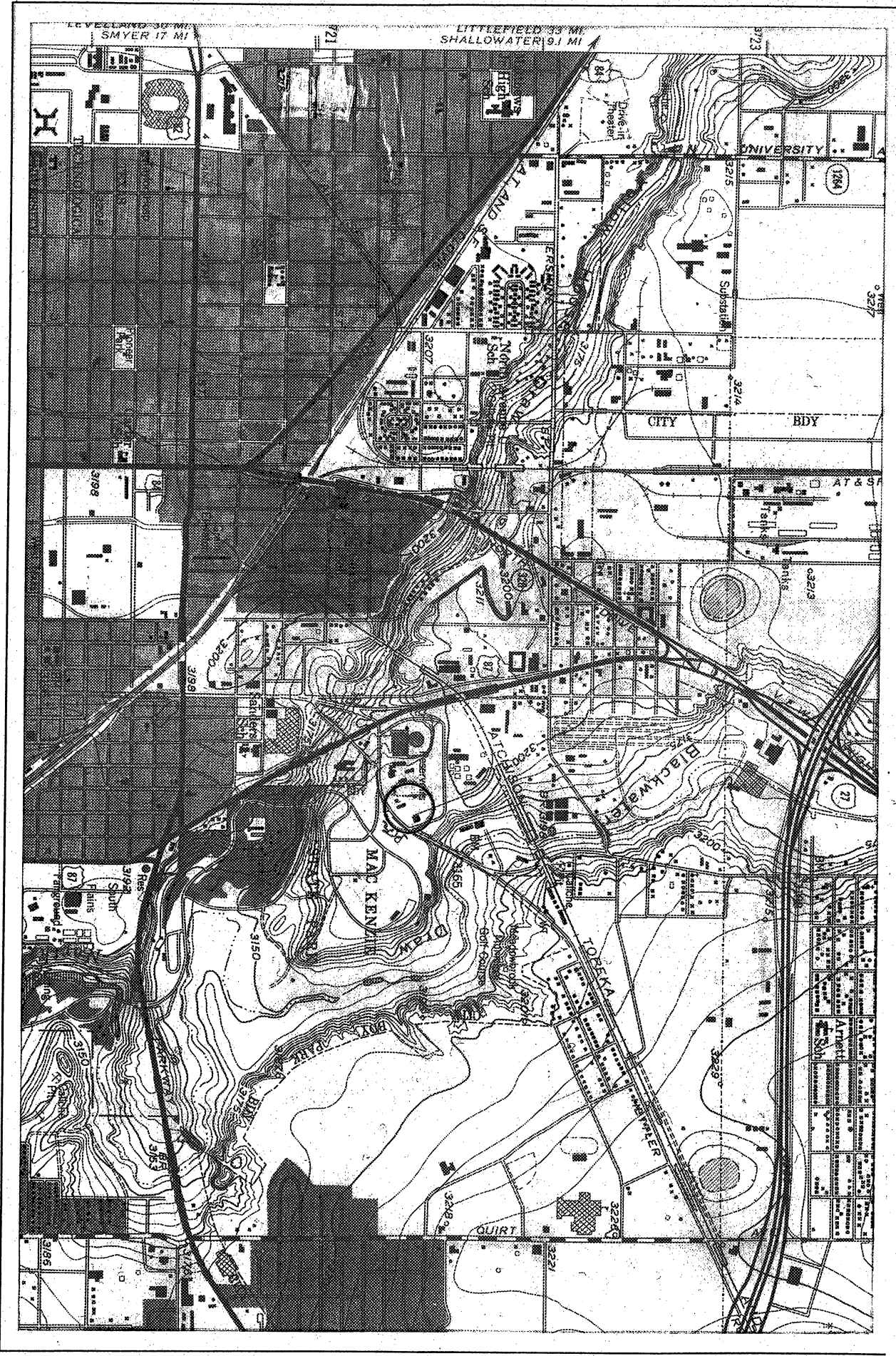


Figure 1. Location of the Lubbock (municipal) maintenance section (36/30), Lubbock County, Lubbock District.

Lufkin District
Crockett Section 03
Houston, County

Joe Melson (409) 544-2264

July 11, 1996

General Information:

- Maintenance site is located in an urban setting on the east side of Crockett on new loop 304 connecting SH 7 and SH 21 (figure 1); the maintenance facility is located on the east side of the loop 304.
- Open fields are located on the north, east, and south side of the maintenance site.
- A small stock tank is located approximately 30 yards from the south fence line.
- Small businesses are located along the loop road south and north of the maintenance site.
- Numerous businesses and a hospital are located across the loop 304 from the maintenance site.
- Facility currently contains 14-22 vehicles including: pickup trucks (6 qts every 5,000 miles); dump truck (18 qts every 6,000 mile); Large dump truck (42 qt every 8,000 miles); 2 loaders (200 hrs or 4 times per years, 18 qts each); 3 tractors (2 times per years, 18 qts each); 1 grader (2 times per year, 42 qts); 2 rollers (3 times per years, 10 qts).
- Area around maintenance site consists of pine trees, grassy fields (no crops) and large deciduous trees.
- Approximately 40 percent impervious cover.

Waste Disposal Information:

- Waste oil products were disposed on into waste oil injection well but are currently stored in barrels and/or above ground storage tanks.
- Waste oil would fill cistern which would have to be periodically be pumped out.
- Based on information provided by TxDOT maintenance personnel, the facility probably generates around 300 quarts (75 gallons) of waste oil per year. However, this estimate is based on the current number and types of vehicles at the maintenance site and may not reflect waste product generation in previous years.
- Old antifreeze was placed into septic system that was abandoned 10 years ago.
- The antifreeze may have been disposed of in sewer system as well.
- Trucks were washed in yard and wash water ran downhill towards stock tank located on south side of facility.

Waste Cistern Description:

- Waste oil injection well was located on the north side of the maintenance building near the location of old septic system.
- Injection well consisted of three 6 ft cement culvert pipe stacked vertically; cement culvert pipe was 18 inches in diameter.
- Injection well was active from 1964 to 1989.
- Waste oil injection well was backfilled in 1989; no information was available regarding remediation before backfilling.
- Old injection well site is covered with dirt.

Hydrology of Area

- Topography slopes to the east and southeast at maintenance site and towards a small stock tank located south of the maintenance facility.
- There are several small ponds located within 0.50 mile of the maintenance site although these may be stock tanks.
- There are no windmills in area and businesses and residences are probably on city water and sewer system.
- Depth to fresh water in area is estimated to be 100 to 120 ft.

Crockett (Section 03) Injection Well Summary:

There is one abandoned waste oil injection well located at the Crockett maintenance section located on the east side of loop 304 east of Crockett. This injection well consisted of 3 cement culvert pipes stacked vertically; the well was 18 inches in diameter and approximately 15 to 18 ft deep. This well was active from 1964 until 1989 when it was back-filled and covered with topsoil. The types and quantities of waste products placed into injection well are unknown, but the waste products had to be periodically removed from injection well when it became filled. No information was available regarding removal of standing waste products or remediation efforts at time of abandonment.

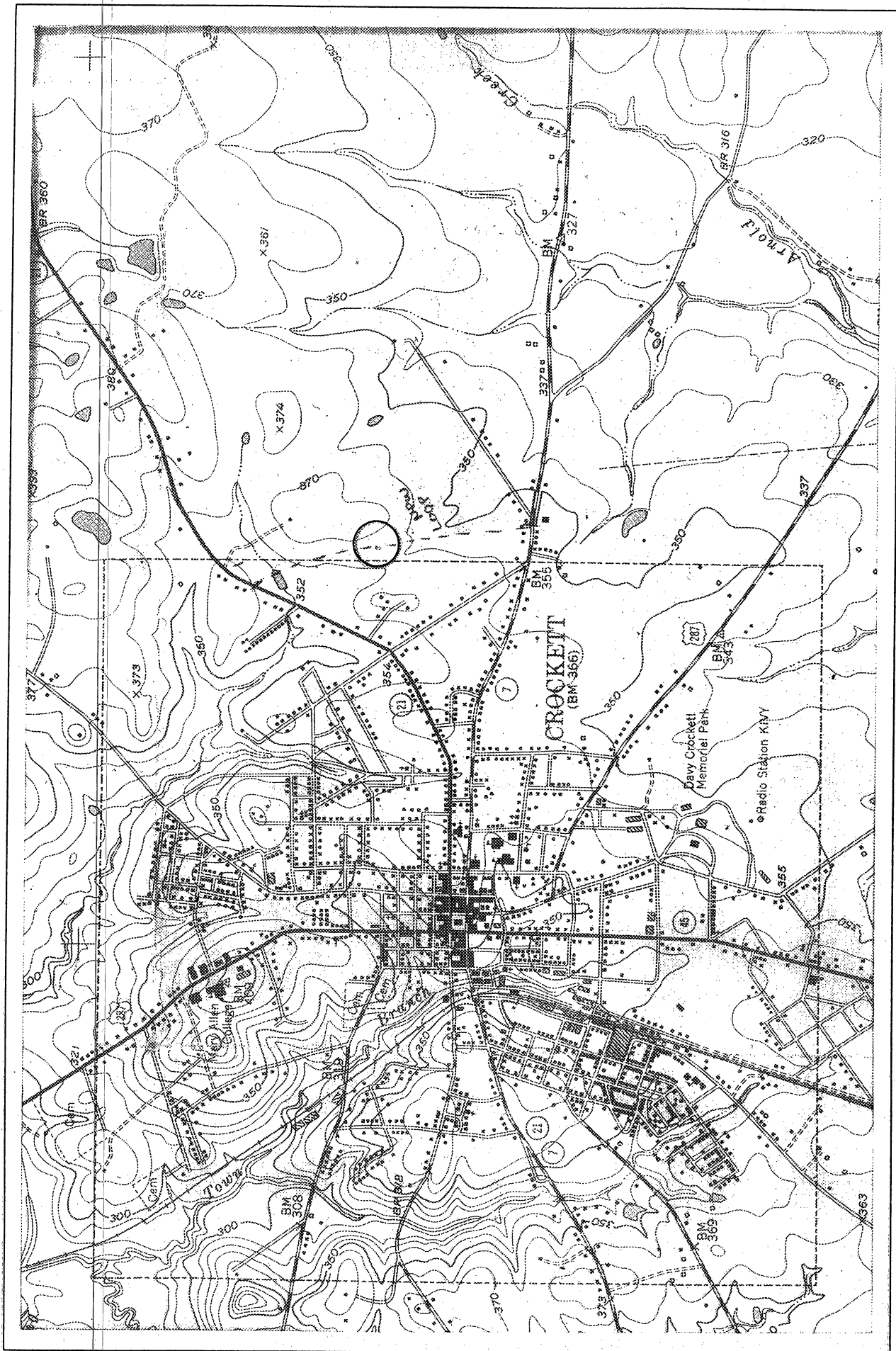


Figure 1. Location of the Crockett maintenance section (03), Houston County, Lufkin District.

Lufkin District
Lufkin, Section 06
Angelina, County

Robert Favor (409) 634-3414

July 11, 1996

General Information:

- Maintenance site is located in an urban setting on the northwest side of Lufkin (figure 1).
- Maintenance section was always on city water and sewage.
- Site only had 2 to 3 vehicles many years ago.
- Part of maintenance site is built on dirt brought onto site.
- General rule of thumb for estimating waste products is to average 5 quarts of oil per vehicle twice per year (2.5 gallons annually)
- Residences located adjacent to TxDOT facility along northeast fence line on other side of small drainage/creek.
- Residences also located on southeast side of US 69.
- Open pasture land and oak trees located north and northwest side of maintenance site.

Waste Disposal Information:

- There are no waste oil injection wells at this location; waste products were either mixed with sand or transported off site.
- Wash rack is located separate from maintenance building downhill and consists of cement slab.
- Wash rack water runs into drain in slab and then through underground pipe to ditch where it flows into cement pipe with steel grating and into another underground pipe that carries water underground to creek running along northeast side of facility.
- Waste asphalt products were mixed with sand and redistributed on roadway; this practice was stopped approximately 20 years ago.

Waste Cistern Description:

- There are no injection wells located at maintenance site although there was a small depression in a location common to injection wells at other maintenance sites.
- This depression is 4 ft from building approximately 30 ft from door behind wash bay (?).
- TxDOT personnel did not know what small depression on southeast side of maintenance building next to metal pipe extending from building (between down spouts from gutter); however, they were certain that this was not an injection well.

Hydrology of Area

- Topography slopes to East and northeast at maintenance site and there is a small stream located along northeast and north property lines.
- Creek was dry at time of site visit but could contain water during periods of normal to above normal precipitation.
- Creek flows northward towards City Lake.
- Lakes Myriad and Jones are located 0.60 mile east and 0.80 mile east-southeast of maintenance facility.
- There are no windmills or water wells in area suggesting that residences are probably on city water.

Lufkin (Section 06) Injection Well Summary:

There are no waste injection wells located at the Angelina County maintenance site in Lufkin. Waste products were either transported offsite or mixed with sand and redistributed on roadways; mixing of waste products in sands stopped 20 years ago. A small depression located on the east side of the maintenance building is in a location similar to injection well locations at other maintenance sites. However, TxDOT personnel are certain that there were never any injection wells at this location.

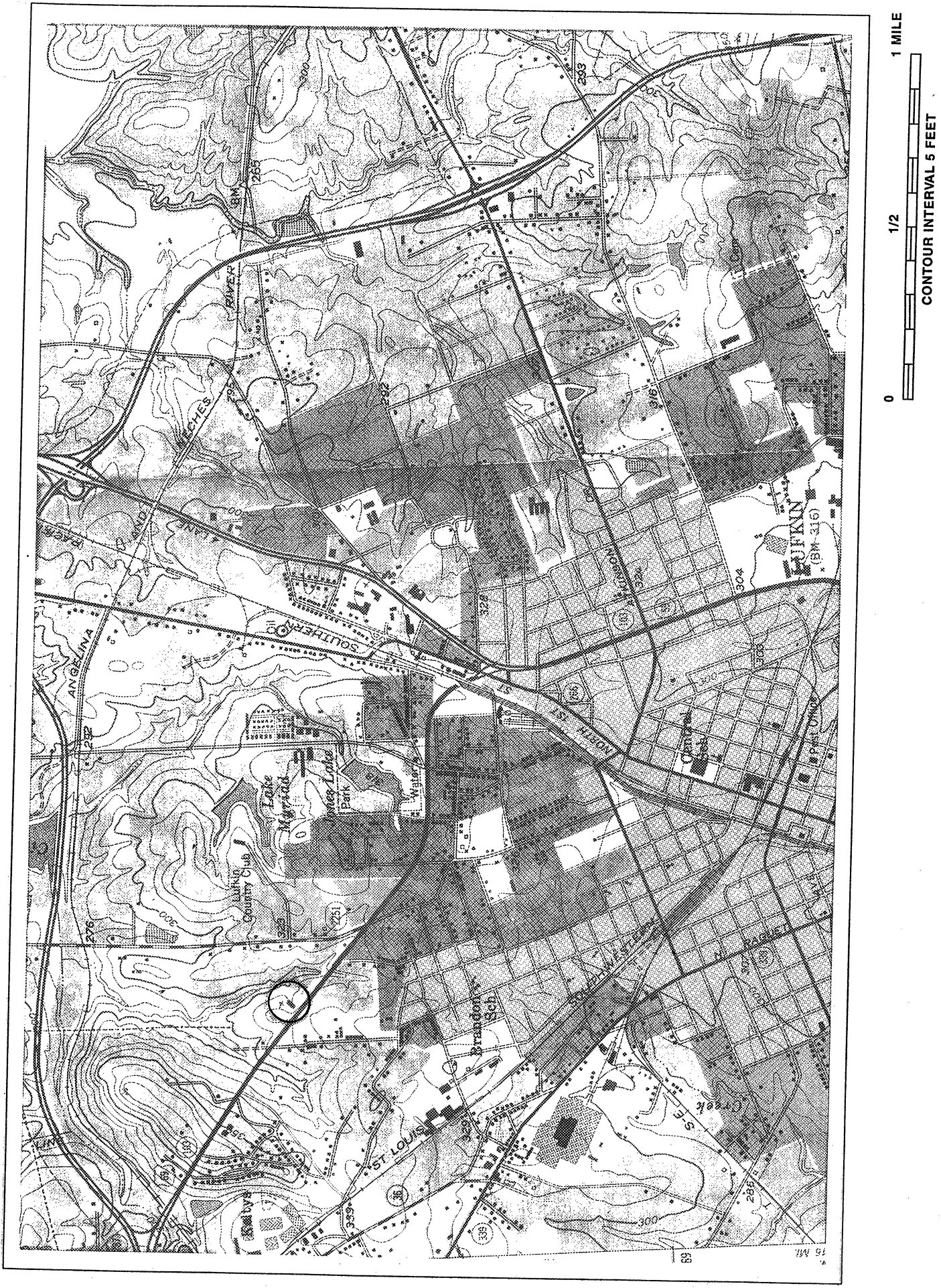


Figure 1. Location of the Lufkin maintenance section (06), Angelina County, Lufkin District.

Lufkin District
Nacadoches, Section 07
Nacadoches, County

Jim Jackson (409) 564-4871

July 11-12, 1996

General Information:

- The Nacadoches maintenance site is located between Nacadoches and Redfield on the north side of in an rural setting on the north side of SH 343 (figure 1).
- This maintenance site was built in the 1980's and has always been on city water and sewer.
- The site is located on a small hill and groundwater runs off to the south towards SH 343 and then towards a small creek located immediately east of maintenance facility.
- There was water in the creek at the time of the site visit.

Nacadoches (Section 07) Injection Well Summary:

There are no waste injection wells located at the Nacadoches maintenance site. This maintenance facility is only 6 or 7 years old and has never had waste injection wells; all waste products are transported offsite for recycling. Wash rack water is connected to city sewer system.

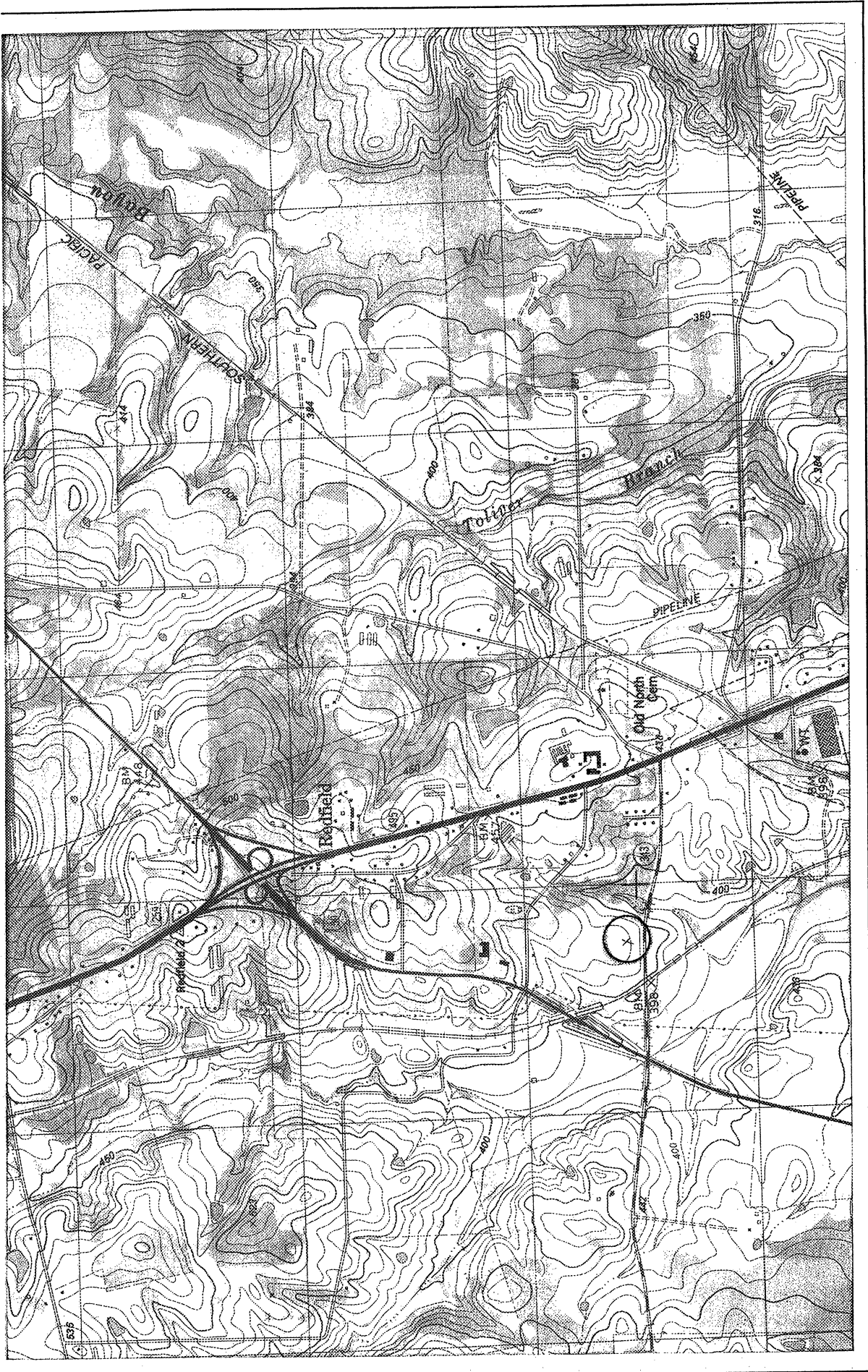


Figure 1. Location of the Nacogdoches maintenance section (07), Nacogdoches County, Lufkin District.

Lufkin District
San Augustine, Section 08
San Augustine and Shelby, Counties

John Mathews (409) 275-9571

July 11-12, 1996

General Information:

- The San Augustine maintenance site is located south of San Augustine on the west side on west side of US 86 in a semi-rural setting (figure 1).
- This maintenance site was built in the 1980's and has always been on city water and sewer.
- Groundwater runs off to the south towards a small creek and then towards the city sewage ponds located 0.6 mile east-southeast of the maintenance site.

San Augustine (Section 08) Injection Well Summary:

There are no waste injection wells located at the San Augustine maintenance site. This maintenance facility is only 6 or 7 years old and has never had waste injection wells; all waste products are transported offsite for recycling. Wash rack water is connected to city sewer system.

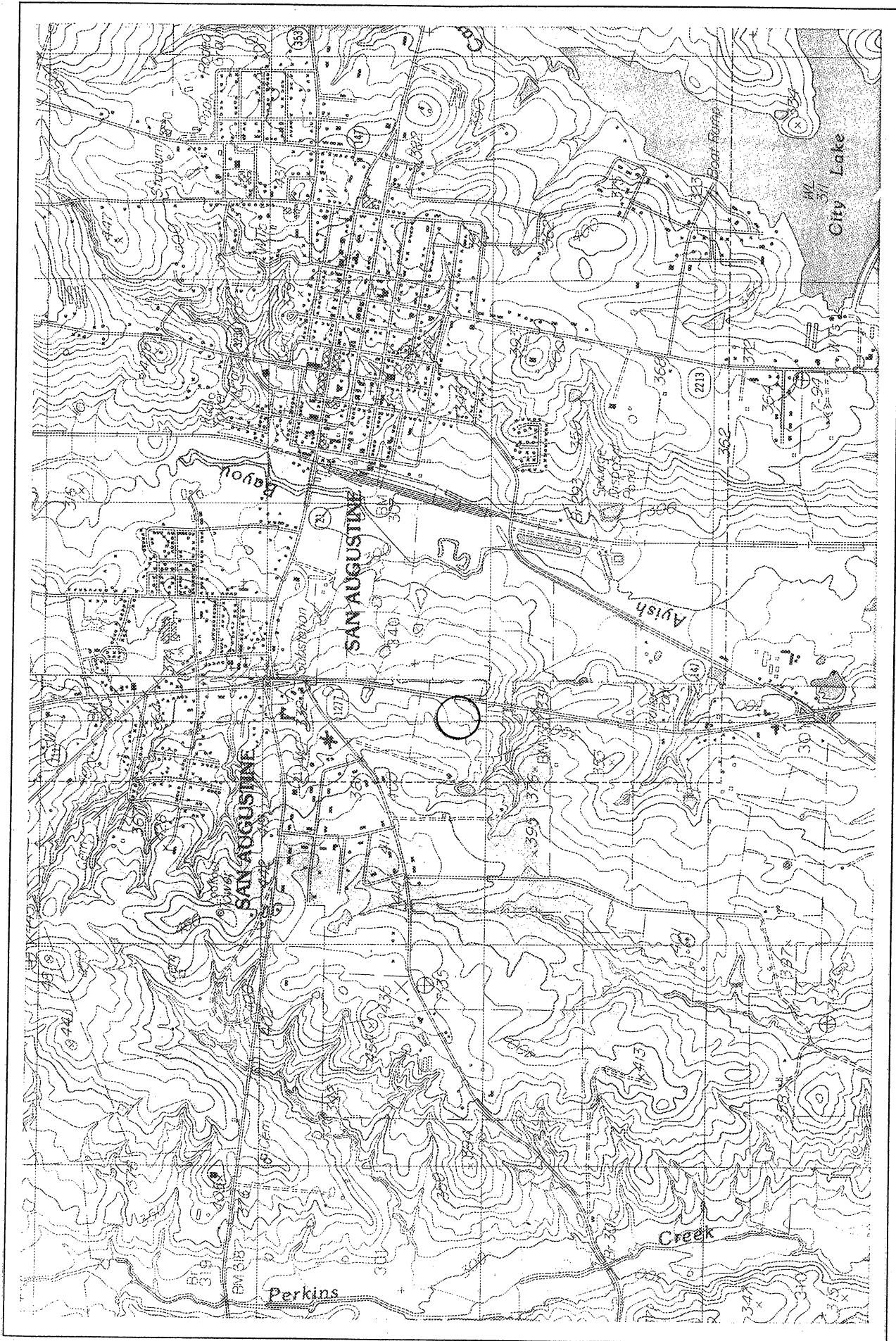


Figure 1. Location of the San Augustine maintenance section (08), San Augustine County, Lufkin District.

Pharr District
Edcouch, Section 02
Willacy County

Richard Villarreal (210) 262-1254

June 20-21, 1996

General Information:

- Maintenance site is located on the north side of SH 107 approximately 0.35 miles east of intersection of SH 107 and SH 1015 east of Edcouch.
- Residences are located east and west of the maintenance facility along SH 107; open fields and/or crops are located north of these houses.
- Open fields, businesses, and residences are located on the south side of SH 107 across from the maintenance site.
- The northern boundary of the maintenance site corresponds with an above ground canal that is lined with trees.
- Maintenance site is on city water and sewer.
- Maintenance site has approximately 50% impervious cover.
- There are asphalt storage tanks at maintenance site.
- Maintenance site contains approximately 20 vehicles which include: 4 pickups, 2 dump trucks, 2 tractors, 1 maintainer, 1 activator truck, 1 flatbed, and 1 sign truck.
- Number of vehicles kept at maintenance site has decreased over the years.

Waste Disposal Information:

- The wash rack is located north of the shop and garage.
- Wash rack water disposed of in cistern may also contain varsol, citrosol or other solvents used to remove oil from vehicles.
- Waste oil is recycled in above ground storage tanks.
- Many years ago, waste oil was mixed with caliche or poured on gravel piles to be recycled; sometimes oil was used to control fire ants and weeds.
- Antifreeze is now being recycled but before recycling antifreeze was never changed in vehicles although more antifreeze was added to radiators when required.

Waste Cistern Description:

- There is one active wash rack injection well at the maintenance site; this is an outside wash rack located north of the garage and shop and along the east fence line.
- The wash rack injection wells are large cement culvert pipe stacked vertically in the ground.
- The main cistern is approximately 48 inches in diameter and an estimated 6 to 10 feet deep; although the well could be deeper if it has been partially filled with silt.
- A second smaller cistern is located just north of the main cistern but it is partially buried and may be filled with silt; an underground pipe connects the two cisterns.
- North-south oriented drain lines run parallel to the fence line and extend approximately 75 to 100 ft north of the cisterns.
- Both cisterns are covered by a plywood sheets' although the smaller cistern is partially buried.

Hydrology of Area

- The topography in the area is very flat although water drains to the east and southeast.
- A sewage disposal pond is located 0.25 miles northeast of maintenance site.
- There is not a shallow supply of fresh water in the area although saline water may be found at depth between 50 and 100 ft.
- Drinking and irrigation water is taken from the Rio Grande River and transported cross country via above ground canals or elevated ditches.
- Contamination of cement-lined elevated ditches by waste fluids injected into the ground is highly unlikely.

Edcouch (Section 02) Injection Well Summary:

There is one wash rack injection well at the Edcouch maintenance site located on the north side of SH 107 east of the city. The outside wash rack is located on the north side of the garage and shop building near the above ground asphalt tanks. One 6 to 10 ft deep, 48 inch diameter cement culvert pipe is located on the east side of the wash rack; a second smaller cistern is located north of the first one but is partially buried. A drain field extends 75 to 100 ft north of the cisterns and runs parallel to the fence line. Waste oil is now recycled at site but at one time was mixed with caliche or gravel in yard and recycled. Sometimes waste oil was used for ant and weed control. There is not a shallow supply of fresh water in the area although saline water may be found at depth between 50 and 100 ft. Drinking and irrigation water is taken from the Rio Grande River and transported cross country via above ground canals or elevated ditches. Contamination of cement-lined elevated ditches by waste fluids injected into the ground is highly unlikely.

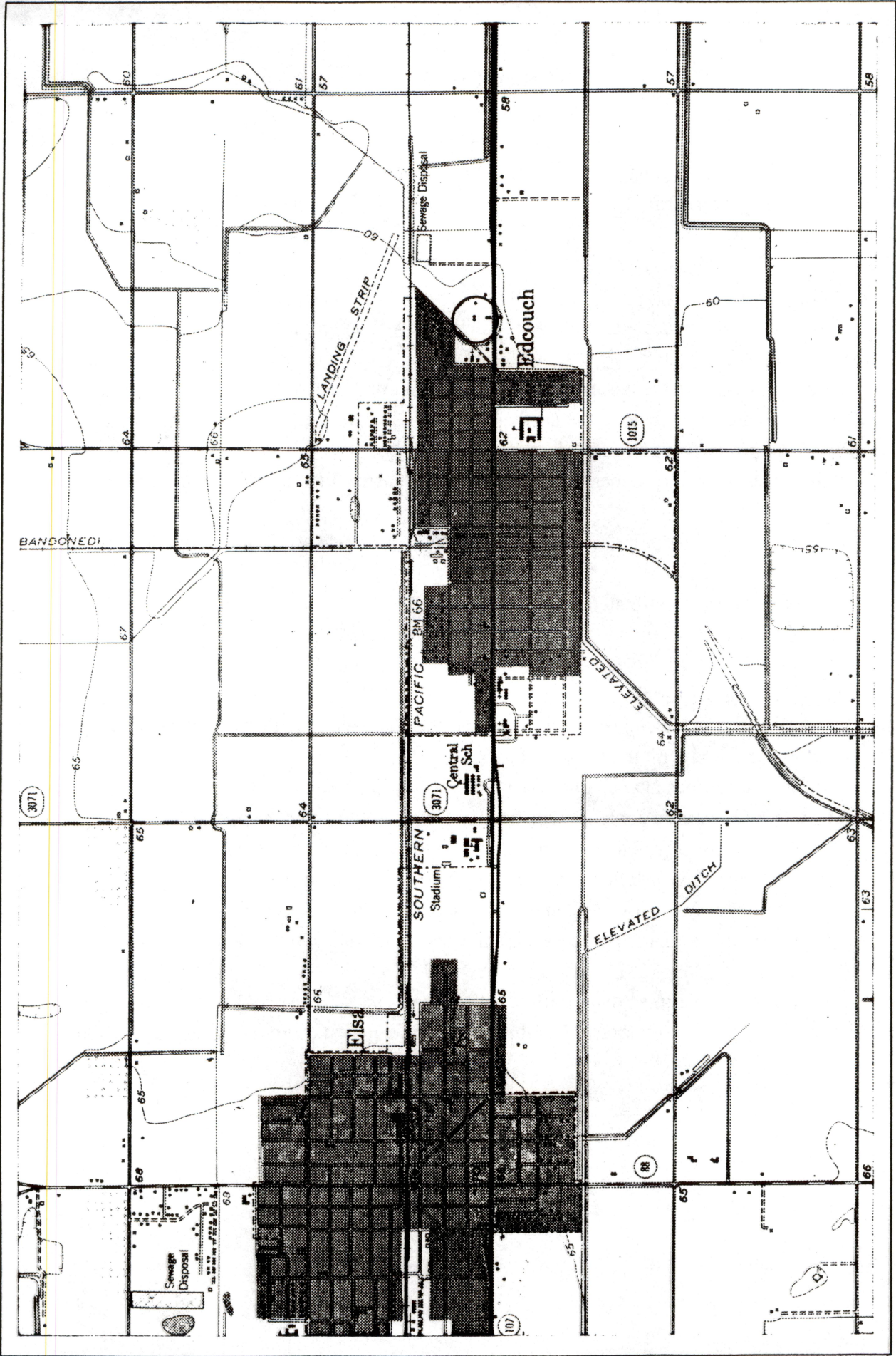


Figure 1. Location of the Edcouch maintenance section (02), Hidalgo County, Pharr District.

Pharr District
Raymondville, Section 08
Willacy County

Ray Llanes (210) 689-2184

June 20-21, 1996

General Information:

- Maintenance site is located on the west side of SH 448 approximately 0.20 miles north of Raymondville (figure 1).
- Crops are located on the eastern and southeastern boundaries of the maintenance site.
- Residences are located along the northern property line and also at the southwestern part of the property along SH 448.
- Additional residences are located west of the maintenance facility across the railroad tracks.
- Co-ops and a cotton compress company is located 0.10 mile north of the maintenance site.
- Impervious cover is estimated to be 85%.
- Citrosol was used to remove grease and oil from vehicles.

Waste Disposal Information:

- Open wash rack is located on the west side of the garage and there are three wash rack cisterns associated with the wash rack.
- Wash rack water has always gone into these cisterns and there is always the possibility that some hydrocarbon contaminants from the truck could enter the system.
- Antifreeze is now recycled, although it may have been disposed of on ground in past.
- Before cisterns were installed and waste oil recycled, wash rack water, waste oil (changed on the wash rack pad), and solvents (citrosol?) for removing asphalt drained eastward through a 12 inch pipe towards the east fence line which is approximately 100 ft away.
- Waste oil was sometimes dispersed on ground.
- Estimate that the facility today goes through three 55 gallon drums of waste fluids each year.

Waste Cistern Description:

- The three wash rack cisterns are located near the wash rack pad.
- The two smallest cisterns, 2 and 3 ft in diameter and 3 to 4 ft deep are located just north of the wash rack
- The smaller cisterns are probably cement culvert pipe and act as grease traps for the system.
- The two smaller cisterns drain into a larger cistern that is a 5 ft diameter and 6 ft deep segment of cement culvert pipe.
- A 40 ft drain field extends westward from the larger cistern.

Hydrology of Area

- The topography is very flat although waste material from the wash rack drained to the east suggesting a slight slope in that direction.
- Windmills were observed in the area suggesting that some residences may be tapping into shallow water.
- Sewage disposal ponds for the city are located 0.50 mile southeast of the maintenance site.
- Cement-lined elevated ditches are also present east of the facility.
- TxDOT employees placed the depth to fresh water in the area as shallow as 10 ft, although most of the water is around 80 ft.
- Small ranch located 0.40 miles to the north has water well with total depth of 45 ft; however, individual did not know the static water level of the well.
- City water is very dirty because of old and rusted pipes.

Raymondville (Section 08) Injection Well Summary:

There are three wash rack injection wells located on the west side of SH 448 approximately 0.20 miles north of the Raymondville maintenance site. The waste cisterns consist of vertically stacked cement culvert pipe and are located near an outside wash rack located west of the garage and storage building. Two cisterns are 2 to 3 ft in diameter and approximately 4 ft deep and act as grease traps for the wash rack. These two cisterns are connected to a larger cistern that is approximately 5 ft in diameter and 6 ft deep. Before cisterns were installed and waste oil recycled, wash rack water, waste oil (changed on the wash rack pad), and solvents (citrosol?) for removing asphalt drained eastward through a 12 inch pipe towards the eastern fence line which is approximately 100 ft away. Depth to water in the area is variable although fresh water probably ranges between 10 and 80 ft; depth to water in most of the area is around 45 ft.

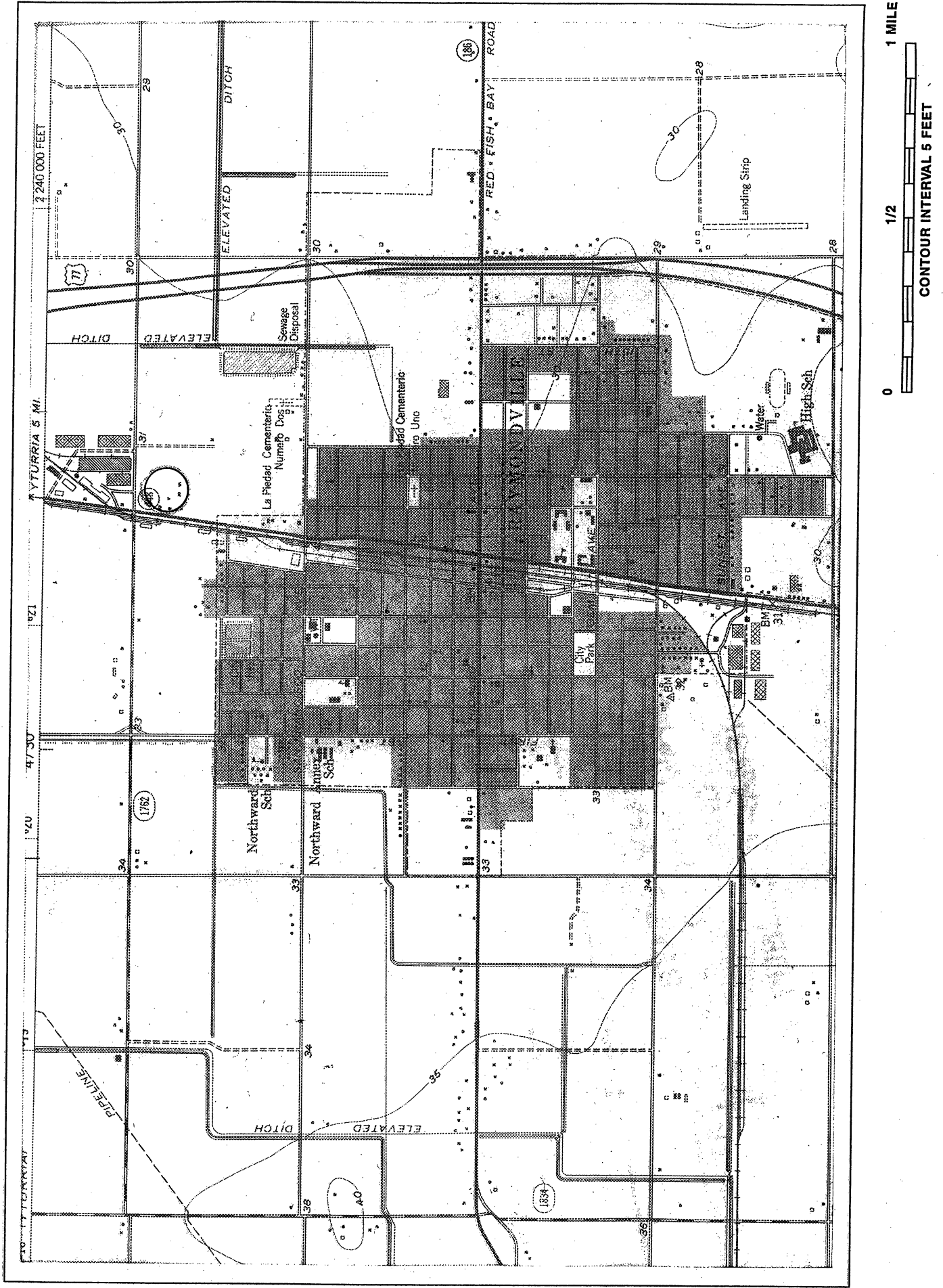


Figure 1. Location of the Raymondville maintenance section (08), Willacy County, Pharr District.

San Angelo District
Robert Lee, Section 09
Coke and Tom Green Counties

Gary Bilbrey (915) 453-2890

“Douglas”

July 16, 1996

General Information:

- Maintenance site is located in an rural setting on the south side of SH 158 approximately 1 mile northeast of Robert Lee (figure 1).
- Mesquite scrub brush and grasslands; rolling hills south of town.
- Mesquite field is located on eastern and western sides of maintenance site.
- Houses with pecan orchard are located at the southeast corner of the facility.
- Mesquite scrub brush is located north of the facility across SH 158.
- Impervious cover is approximately 60%.
- Oil field/storage tanks are located 0.75 mile east-northeast of maintenance site.
- Mountain Creek Reservoir is located on the north side of SH 158 across the road from the maintenance section.
- Two tin-horns in maintenance yard are for water cut-off valves; very shallow with water valves in them.

Waste Disposal Information:

- Waste oil was stored in 55 gallon drums and then removed for recycling; a used oil storage tank was installed 6 years ago.
- Pipe extending from building was originally designed to carry waste oil from the building into yard; however, no injection well was drilled .
- Wash rack water flows into a series of gravel-filled pits or septic system located on the north; there may be two or more sets of gravel-filled pits
- A rock-tank septic system is located on north side of building opposite from storage rooms.

Waste Cistern Description:

- There have never been waste injection wells at the San Angelo maintenance site.

Hydrology of Area

- The topography at maintenance site slopes north and northwest towards Mountain Creek Reservoir; this reservoir is used by the City of Robert Lee in times of drought as a water supply.
- Keith Cummins (915) 453-2232 stated that wells located near the lake encountered fresh water at 100 to 150 ft;.
- Depth to fresh water in area probably ranges from 50 to 150 but most likely n range of 100 to 150 ft.
- There is also windmill water in area at depth less than 10 ft.
- SH 158 follow a potentiometric divide and east of the maintenance site depth to fresh water is 200 to 300 ft and even 400 ft in some areas.
- The Colorado River is located 1.5 miles south of maintenance site.

Robert Lee (Section 09) Injection Well Summary:

Although injection wells were originally planed for the Robert Lee maintenance section, no injection wells were ever drilled. Waste oil has always been stored in 55 gallon drums and/or storage tanks and then removed for recycling. Wash rack water flows into a series of gravel-filled pits or septic system located on the north; there may be two or more sets of gravel-filled pits.

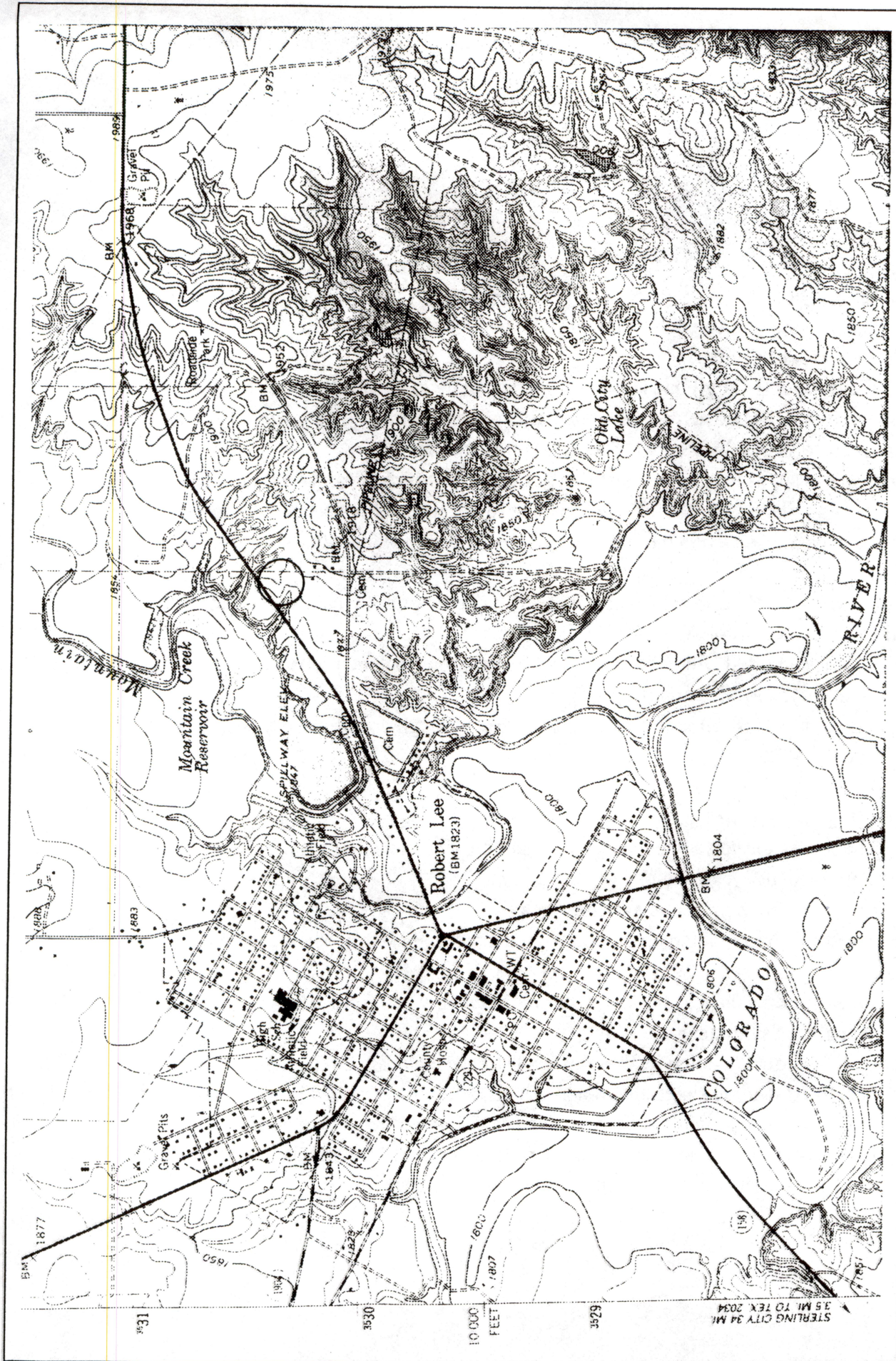


Figure 1. Location of the Robert Lee maintenance section (09), Coke County, San Angelo District.

Tyler District
Canton, Section 02
Van Zandt County

Mark McClanhan (903) 567-6574

July 12, 1996

General Information:

- Maintenance site is located in an urban setting on the north side of SH 64 approximately 0.75 mile east of Canton.
- Van Zandt County fairgrounds is located immediately to the northwest of the site.
- Residences are located across SH 64 and along a road bordering the maintenance site.
- Approximately 33 vehicles are located at maintenance facility.
- Maintenance site is located just east flank of Red Hill which is part of a Flea Market and Tourist attraction called Wild Willies held the first weekend of every month; most of the shops/stands are located in the flats west of Red Hill approximately 0.60 mile west of the maintenance site.
- Dog Town and RV parks are located along Mill Creek south of maintenance site and Red Hill and are part of Wild Willies.
- Wild Willies and Red Hill are popular tourist attractions that are probably very important for the local economy.
- Vegetation in area is primarily oak and pine trees although open fields are located north of Canton

Waste Disposal Information:

- The 33 vehicles located at the maintenance facility generate an estimated 120 gallons of waste products per year.
- Wash racks are now on septic system.
- Antifreeze was once poured on ground but this practice has been abandoned a long time ago.
- Wash rack water is disposed of in a cistern located 50 yards from warehouse near a vacant engineer's building.
- Waste oil is currently stored in above ground storage tanks although a large cement cistern is filled with oil suggesting that some oil is still being placed into cistern.
- There are two septic systems at the maintenance site; one is located adjacent to maintenance office, and another is located next to the engineers building.
- Waste oil and possibly hydraulic fluids may have entered well.

Waste Cistern Description:

- There is a waste oil cistern located on the northwest side of the shop building.
- The waste oil cistern consists of a 4 ft diameter culvert pipe with a square cement lid that is slightly larger than the cistern; the top of the cistern has been chipped.
- Cistern first became active 30 years ago and was abandoned 10 to 15 years ago.
- Waste oil cistern is now approximately 4 ft deep and contains standing approximately 3 ft of oil and water; original cistern depth may have exceeded 6 to 8 ft.
- The bottom of the cistern may be sand or cement and the total depth may be greater than 4 ft if the hole has been filled with sand or sludge over time.
- An active wash rack injection well is located approximately 50 yards from the warehouse.
- Wash rack well consists of cement culvert pipe that is 48 inches in diameter and approximately 6 to 8 ft deep;
- The well was covered by a cement lid with a 18 inch diameter opening; the well is completely filled with water.
- It is possible that original depth wash rack injection well exceeded 6 ft.
- An underground waste line and drain field runs from the shop building southeastward towards SH 64.
- The drain field, used as a mud and grease trap, consisted of perforated pipe. It is not known if waste oil products were disposed of in the drain field.

Hydrology of Area

- There are numerous small ponds within 0.50 mile of maintenance site.
- Developers 0.25 mile north of maintenance site have added small artificial lakes along stream.
- Topography at maintenance site slopes to the west and west-southwest towards a small creek that runs into Mill Creek located approximately 0.60 mile to the west.
- The creek near the maintenance facility contains water as do small ponds formed by earth dams.
- Mill Creek probably flows even during most drought conditions.
- No water wells were noted around RV parks, Dog Town, and residences near the maintenance site, suggesting that these businesses may be on City water;
- According to a local water well driller (Chambers and Phillips), there are a few 36 inch hand dug wells in areas extending into a low permeability clayey layer.
- Exposed west flank of Red Hill consists of variegated clay ranging in colors from gray to red.
- The shallow water supply in this area is sporadic, whereas the deeper water is more continuous.

- An iron-bearing water formation occurs around 200 to 300 ft deep and Wilcox sands occur at 300 to 450 ft deep.
- A good water-bearing sand occurs at 450 to 500 ft.
- Artesian springs are located at least several miles south of maintenance facility.

Canton (Section 02) Injection Well Summary:

There is one abandoned waste oil injection well and one active wash rack injection well at the Canton maintenance section located on the north side of SH 64 approximately 0.75 mile east of Canton. There is also an underground mud and grease line leading to a drain field. The waste oil injection well became active 30 years ago and was reported to be abandoned 10 to 15 years ago. However the 4 ft diameter, 4 ft deep cement culvert pipe contains 3 ft of standing oil and water suggesting that some waste products were introduced more recently. It is not know if the bottom of this injections well is sand or cement or if the original depth was greater than 6 to 8 ft. The active wash rack injection well is located approximately 50 yards from the shop area near a vacant engineers building. This injection well consists of 48 inch diameter cement culvert pipe and is approximately 6 to 8 ft deep; the well was completely filled with water. A drain field located west-southwest of the shop building was part of the waste mud and grease disposal system; it is not known if waste oil also entered this system or if there is contamination present.

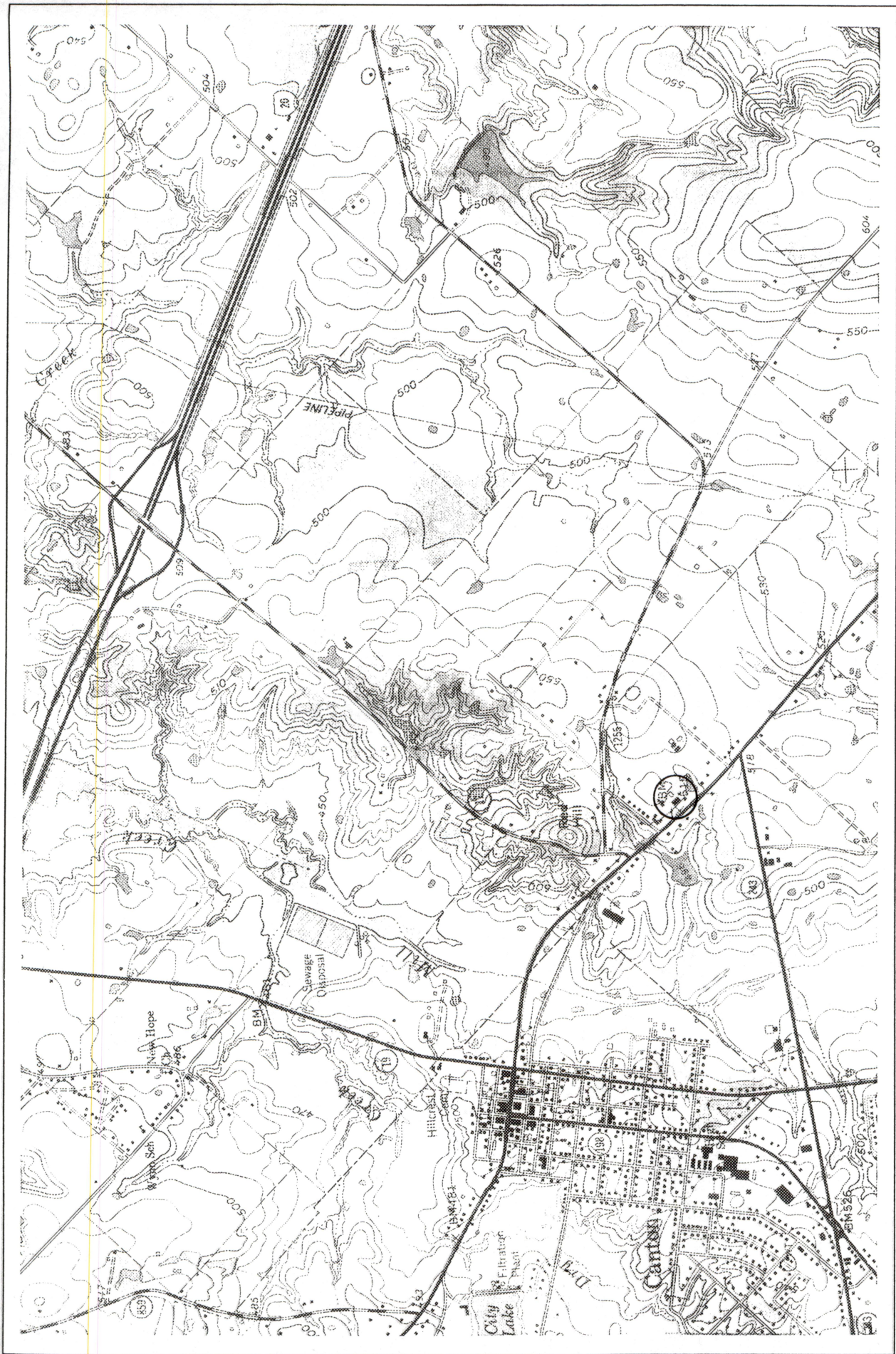


Figure 1. Location of the Canton maintenance section (02), Van Zandt County, Tyler District.

Appendix C

Environmental Data Base
Used for Assigning Scores to the Ranking Criteria

Section	City	County	Site visited	Soils association ¹	Soil series ²	Texture ³
Abilene District						
7	Colorado City	Mitchell	no	Cobb-Miles	Miles	loamy fine sand
Amarillo District						
4	Canadian	Hemphill	no	Lincoln-Sweetwater	Lincoln	fine sand to loamy fine sand and fine sandy loam
5	Canyon	Randall	yes	Ulysses-Mansker	Pullman	clay loam
7	Claude	Armstrong	no	Pullman-Randall	Pullman	silty clay loam
9	Dumas	Moore	yes	Sherm	Sherm	silty clay loam
10	Gruver	Hansford	yes	Pullman-Zita	Pullman	silty clay loam
12	Pampa	Gray	no	Pullman	Pullman	clay loam
13	Panhandle	Carson	yes	Pullman-Randall	Pullman	silty clay loam
14	Perryton	Ochiltree	no	Pullman-Randall	Ulysses	silty clay loam
14	Darrouzett	Lipscomp	no	Acuff-Olton-Darrouzett	Darrouzett	silty clay loam
15	Stratford	Sherman	yes	Sherm-Gruver	Sherm	clay loam
16	Vega	Oldham	no	Pullman	Pullman	clay loam
18	Groom	Carson	no	Pullman-Randall	Pullman	silty clay loam
E-Way	Amarillo	Potter/Randall	yes	Pullman	Pullman	clay loam
Bryan District						
3	Buffalo	Leon	no	Wolfpen-Pickton-Cuthbert	Wolfpen	loamy fine sand
Childress District						
1	Childress	Childress	yes	Carey-Woodward	St. Paul	silt loam
2	Clarendon	Donley/Hall	yes	Miles-Veal-Acuff	Miles	fine sandy loam
3	Dickens	Dickens/King	yes	Olton-Weymouth-Abilene	Randall Series/rough broken land	sandstone, clay
3	Guthrie	King	yes	Carey-Woodward	no info	silt loam to very fine sandy loam
4	Matador	Motley	yes	Miles-Flomot	Miles	fine sandy loam
5	Munday	Knox	yes	Miles-Rotan	Rotan	clay loam
5	Benjamin	Knox	yes	Tillman-Hollister-Wichita	Tillman	clay loam
7	Quanah	Hardeman	yes	Tillman- Vernon-Weymouth	Vernon	clay loam
9	Wellington	Collingsworth	yes	Miles-Carey	Wichita	loam
12	Memphis	Hall	yes	Olton-Weymouth-Abilene	Abilene	clay loam
Corpus Christi						
2	Beeville	Bee	yes	Weesatche-Clareville	Orelia	fine sandy loam
4	George West	Live Oak	yes	no county soil survey	no county soil survey	no county soil survey
5	Goliad	Goliad	yes	Goliad-Kimbrough	no info	fine sandy loam to clay loam or loam to clay loam
7	Kingsville	Kleberg	yes	Victoria-Orelia	no info	clay or fine sandy loam to clay loam
8	Robstown	Nueces	yes	Victoria	Victoria	clay
11	Refugio	Refugio	yes	Papalote-Orelia	Orelia	fine sandy loam
Dallas District						
36	Dallas	Dallas	no	Trinity -Frio	Urban land	altered and covered
Lubbock District						
1	Bovina	Parmer	yes	Berda-Estaco-Bippus	Estacado	clay loam
2	Brownfield	Terry	yes	no info	Brownfield	fine sand
3	Dimmit	Castro	no	Pullman	Pullman	clay loam
4	Floydada	Floyd	yes	Pullman	Pullman	clay loam
5	Lamesa	Dawson	yes	Amarillo	Amarillo	fine sandy loam
6	Levelland	Hockley	yes	Amarillo	Amarillo	fine sandy loam
7	Littlefield	Lamb	yes	Amarillo	Amarillo	fine sandy loam
8	Lubbock	Lubbock	yes	Amarillo-Acuff	Amarillo-Urban land complex	fine sandy loam
9	Lubbock	Lubbock	yes	Amarillo-Acuff	Amarillo	fine sandy loam
10	Morton	Cochran	no	Amarillo	Amarillo	fine sandy loam
11	Muleshoe	Bailey	yes	Portales	Portales	fine sandy loam
12	Plains	Yoakum	yes	Spur-Potter	Kimbrough	loam
13	Plainview	Hale	yes	Pullman-Olton	Pullman	clay loam
14	Post	Garza	yes	Olton-Acuff	Olton	clay loam
15	Ralls	Crosby	yes	Pullman	Olton	loam
16	Seminole	Gaines	yes	Simona-Kimbrough-Potter	Simona	fine sandy loam
17	Tahoka	Lynn	yes	Amarillo-Acuff	Amarillo	fine sandy loam
18	Tulia	Swisher	no	Pullman	Pullman	clay loam
36/30	Lubbock	Lubbock	yes	Amarillo-Acuff	Potter-Kimbrough-Urban land complex	loam
HQ	Lubbock	Lubbock	yes	Amarillo-Acuff	Amarillo-Urban land complex	fine sandy loam
Lufkin District						
3	Crockett	Houston	yes	Crockett-Wilson	no info	sandy loam to clay loam
6	Lufkin	Angelina	yes	Keltys-Kurth	Kurth-Urban land complex	fine sandy loam
7	Nacogdoches	Nacogdoches	yes	Nacogdoches-Trawick	Nacogdoches	fine sandy loam
8	San Augustine	San Augustine	yes	Nacogdoches-Bub	no information	sandy loam to clay loam
9	Shepherd	San Jacinto	no	no county soil survey	no county soil survey	no county soil survey
Pharr District						
2	Edcouch	Hidalgo	yes	Raymondville-Mercedes	Raymondville	clay loam
8	Raymondville	Willacy	yes	Raymondville-Mercedes	Raymondville	clay loam
San Angelo District						
1	Ballinger	Runnels	no	Portales-Potter-Mereta	Mereta	clay loam
9	Robert Lee	Coke	yes	Kimbrough-Olton-Mereta	Weymouth	loam to fine sandy loam
10	Rocksprings	Edwards	no	no county soil survey	no county soil survey	no county soil survey
San Antonio District						
8	San Antonio	Bexar	no	Venus-Frio-Trinity	Venus	clay loam
Tyler District						
2	Canton	Van Zandt	yes	no information	Kirvin	fine sandy loam
Wichita Falls District						
7	Seymour	Baylor	no	Miles-Enterprise-Hardeman	Chaney	loamy fine sand

Section	City	Permeability ⁴	Soil drainage ⁵	Geomorphic setting ⁶	Topographic relief at site ⁷
Abilene District					
7	Colorado City	moderate	well	upland ridge	flat to intermediate
Amarillo District					
4	Canadian	rapid	somewhat excessively	gently sloping plain	flat
5	Canyon	very slow to slow	well	plain between two canyons	flat
7	Claude	very slow	no info	upland plain	flat
9	Dumas	very slow	well	gently sloping plain	flat
10	Gruver	no information	no information	gently sloping plain	flat
12	Pampa	very slow	well	upland plain	flat
13	Panhandle	very slow	no info	upland plain	flat
14	Perryton	moderate	well	upland plain	flat
14	Darrouzett	moderate slow	well	ridge between creeks	flat
15	Stratford	very slow	well	gently sloping plain	flat
16	Vega	very slow	well	upland plain	flat
18	Groom	very slow to slow	well	upland plain	flat
E-Way	Amarillo	very slow to slow	well	upland plain	intermediate
Bryan District					
3	Buffalo	moderate	well	ridge between creeks	intermediate
Childress District					
1	Childress	moderate to moderate slow	fairly well	large upland ridge	flat
2	Clarendon	moderate	well	slope on side of a ridge	intermediate
3	Dickens	no info	no info	caprock escarpment	intermediate to steep
3	Guthrie	moderate to moderate slow	fairly well	river valley	flat
4	Matador	moderate	well	ridge between two creeks	flat
5	Munday	slow percolation rate	well	flat upland area	flat
5	Benjamin	slow percolation rate	well	gentle sloping valley	flat
7	Quanah	slow to moderate	well	rolling hill	flat
9	Wellington	moderately slow	well	gentle sloping ridge	flat
12	Memphis	moderately slow	no info	gentle sloping upland area	flat
Corpus Christi					
2	Beeville	very slow	poor	valley	flat
4	George West	no county soil survey	no county soil survey	creek valley	intermediate
5	Gollad	no info	no info	ridge between creeks	intermediate
7	Kingsville	slow to very slow	poor	Rio Grande Plain	flat
8	Robstown	slow	poor	Gulf Coast Plain	flat
11	Refugio	very slow	poor	ridge between river and creek	flat
Dallas District					
36	Dallas	moderate slow	poor to well	ridge between two valleys	intermediate to steep
Lubbock District					
1	Bovina	moderate	well	valley side	intermediate
2	Brownfield	moderate	well	ridge	intermediate
3	Dimmit	very slow	well	upland plains	flat
4	Floydada	very slow	well	upland plain	flat
5	Lamesa	moderate	well	upland plain	flat
6	Levelland	moderate	well	upland plain	flat
7	Littlefield	moderate	well	upland plain	flat
8	Lubbock	moderate	well	upland plain	flat
9	Lubbock	moderate	well	upland plain	flat
10	Morton	moderate	well	upland plain	flat
11	Muleshoe	moderate to moderate rapid	well	?	?
12	Plains	moderate slow	no info	draw	intermediate
13	Plainview	moderate slow	well	upland plain	flat
14	Post	moderate slow	well	alluvial fan	intermediate
15	Ralls	moderate slow	well	High Plains	flat
16	Seminole	moderate rapid	no info	draw	flat
17	Tahoka	moderate	no info	playa edge	intermediate
18	Tulia	moderate slow	well	upland plain	flat
36/30	Lubbock	moderate	well	ridge	flat
HQ	Lubbock	moderate	well	upland plain	flat to intermediate
Lufkin District					
3	Crockett	no info	moderately well	plain	flat
6	Lufkin	slow	poor to moderate well	small ridge between two valleys	intermediate
7	Nacogdoches	moderate slow	well	upland hillside	intermediate to steep
8	San Augustine	no info	well	hillside	intermediate
9	Shepherd	no county soil survey	no county soil survey		
Pharr District					
2	Edcouch	very slow to slow	moderately well	Gulf Coast Plain	flat
8	Raymondville	very slow to slow	moderately well	Gulf Coast Plain	flat
San Angelo District					
1	Ballinger	0.8-2.5 in/hr, moderate	no info	ridge	intermediate
9	Robert Lee	moderate	well	valley side on ridge	intermediate to steep
10	Rocksprings	no county soil survey	no county soil survey		
San Antonio District					
8	San Antonio	moderate	well	river valley, terrace	flat
Tyler District					
2	Canton	slow	well	small ridge between two valleys	intermediate
Wichita Falls District					
7	Seymour	slow	well	terrace	flat

Section	City	Geologic age ^a	Geologic formation ^b
Abilene District			
7	Colorado City	Triassic, Upper Triassic	Dockum Group, undivided
Amarillo District			
4	Canadian	Tertiary, Miocene and Pliocene	Ogallala
5	Canyon	Quaternary, Pleistocene	Blackwater Draw
7	Claude	Quaternary, Pleistocene	Blackwater Draw
9	Dumas	Quaternary, Pleistocene	Blackwater Draw
10	Gruver	Quaternary, Pleistocene	Blackwater Draw
12	Pampa	Quaternary, Pleistocene	Blackwater Draw
13	Panhandle	Quaternary, Pleistocene	Blackwater Draw
14	Perryton	Quaternary, Pleistocene	Blackwater Draw
14	Darrouzett	Tertiary, Miocene and Pliocene	Ogallala
15	Stratford	Quaternary, Pleistocene	Blackwater Draw
16	Vega	Quaternary, Pleistocene	Blackwater Draw
18	Groom	Quaternary, Pleistocene	Blackwater Draw
E-Way	Amarillo	Quaternary, Pleistocene	Blackwater Draw
Bryan District			
3	Buffalo	Tertiary, Eocene	Queen City Sand
Childress District			
1	Childress	Permian, Guadalupe series	Whitehorse Group
2	Clarendon	Quaternary, Holocene	sand sheet
3	Dickens	Triassic, Upper Triassic	Dockum Group
3	Guthrie	Permian, Guadalupe Series/Quaternary undivided	Blaine/Quaternary undivided
4	Matador	Quaternary, Pleistocene/Permian, Guadalupe Series	Lingos/Quartermaster
5	Munday	Quaternary, Pleistocene	Seymour
5	Benjamin	Permian, Leonard Series	Clear Fork Group
7	Quanah	Permian, Guadalupe Series	Blaine
9	Wellington	Quaternary, Holocene	sand sheet
12	Memphis	Quaternary, Pleistocene	Lingos
Corpus Christi			
2	Beeville	Tertiary, Miocene	Goliad
4	George West	Quaternary, Holocene and Pleistocene	terrace
5	Goliad	Tertiary, Miocene	Goliad
7	Kingsville	Quaternary, Pleistocene	Beaumont
8	Robstown	Quaternary, Pleistocene	Beaumont
11	Refugio	Quaternary, Pleistocene	Beaumont/Lissie
Dallas District			
36	Dallas	Cretaceous, Upper Cretaceous/Quaternary, Holocene and Pleistocene	Austin Chalk/alluvium and terrace
Lubbock District			
1	Bovina	Tertiary, Miocene and Pliocene/Quaternary, Pleistocene	Ogallala/Blackwater Draw
2	Brownfield	Quaternary, Pleistocene	Blackwater Draw
3	Dimmit	Quaternary, Pleistocene	Blackwater Draw
4	Floydada	Quaternary, Pleistocene	Blackwater Draw
5	Lamesa	Quaternary, Pleistocene	Blackwater Draw
6	Levelland	Quaternary, Pleistocene	Blackwater Draw
7	Littlefield	Quaternary, Pleistocene	Blackwater Draw
8	Lubbock	Quaternary, Pleistocene/Tertiary, Pliocene	Blackwater Draw/Blanco
9	Lubbock	Quaternary, Pleistocene/Tertiary, Pliocene	Blackwater Draw/Blanco
10	Morton	Quaternary, Pleistocene	Blackwater Draw
11	Mulshoe	Quaternary, Pleistocene	Blackwater Draw
12	Plains	Tertiary, Miocene and Pliocene/Quaternary, Pleistocene	Double Lakes/Ogallala/Blackwater Draw
13	Plainview	Tertiary, Miocene and Pliocene	Ogallala
14	Post	Quaternary, Pleistocene	Lingos
15	Ralls	Quaternary, Pleistocene	Blackwater Draw
16	Seminole	Quaternary, Pleistocene	Blackwater Draw
17	Tahoka	Quaternary, Pleistocene	Blackwater Draw
18	Tulia	Quaternary, Pleistocene	Blackwater Draw
36/30	Lubbock	Quaternary, Pleistocene/Tertiary, Pliocene	Blackwater Draw/Blanco
HQ	Lubbock	Quaternary, Pleistocene/Tertiary, Pliocene	Blackwater Draw/Blanco
Lufkin District			
3	Crockett	Tertiary, Eocene	Cook Mountain
6	Lufkin	Tertiary, Eocene	Yegua
7	Nacogdoches	Tertiary, Eocene	Sparta Sand/Weches
8	San Augustine	Tertiary, Eocene	Weches
9	Shepherd	Quaternary, Pleistocene	Lissie
Pharr District			
2	Edcouch	Quaternary, Pleistocene	Lissie
8	Raymondville	Quaternary, Pleistocene	Beaumont
San Angelo District			
1	Ballinger	Permian, Leonard Series/Quaternary Holocene/Quaternary Pleistocene	Clear Fork Group/alluvium/terrace
9	Robert Lee	Quaternary Holocene and Pleistocene/Quaternary undivided	terrace/Quaternary undivided
10	Rocksprings	Cretaceous/Upper Cretaceous	Buda Limestone and Del Rio clay
San Antonio District			
8	San Antonio	Quaternary, Holocene and Pleistocene/Quaternary Pleistocene/Cretaceous, U. Cretaceous	Terrace/Uvalde Gravel/Austin Chalk/Navarro and Marlbrook, undivided/Pecan Gap Chalk
Tyler District			
2	Canton	Cretaceous, Paleocene and Eocene	Wilcox Group, undivided
Wichita Falls District			
7	Seymour	Quaternary, Holocene and Pleistocene	terrace

Section	City	Lithology ¹⁰	Annual precipitation (inches) ¹¹
Ablene District			
7	Colorado City	sandstone, clay, shale and conglomerate	20
Amarillo District			
4	Canadian	sand, silt, clay, gravel, caliche	21
5	Canyon	clay, silt, sandy	19
7	Claude	clay, silt, sandy	20
9	Dumas	clay, silt, sandy	18
10	Gruver	clay, silt, sandy	18
12	Pampa	clay, silt, sandy	20
13	Panhandle	clay, silt, sandy	19
14	Perryton	clay, silt, sandy	19
14	Darrouzett	sand, silt, clay, gravel, caliche	20
15	Stratford	clay, silt, sandy	17
16	Vega	clay, silt, sandy	16
18	Groom	clay, silt, sandy	19
E-Way	Amarillo	clay, silt, sandy	19
Bryan District			
3	Buffalo	quartz sand	40
Childress District			
1	Childress	sandstone, sand, shale, gypsum and dolomite interbedded	20
2	Clarendon	windblown sand	20
3	Dickens	sandstone, clay shale, and conglomerate	21
3	Guthrie	shale, sandston, gypsum and dolomite interbedded/sand, clay, silt, caliche and gravel undivided	22
4	Mataador	fluvial, gravel, eolian, silt/shale, sandstone, gypsum and dolomite interbedded	21
5	Munday	sand, silt, gravel, caliche, clasts	25
5	Benjamin	shale and sandstone interbedded	24
7	Quanah	shale, sandston, gypsum and dolomite interbedded	23
9	Wellington	windblown sand	21
12	Memphis	fluvial, gravel, eolian, silt	20
Corpus Christi			
2	Beeville	clay, sand, sandstone, marl, caliche, limestone, and conglomerate; clay locally.	31
4	George West	gravel, sand, silt	28
5	Gollad	clay, sand, sandstone, marl, caliche, limestone, and conglomerate; clay locally.	34
7	Kingsville	clay and sand	27
8	Robstown	clay	30
11	Refugio	clay/clay, silt, sand, minor gravel	38
Dallas District			
36	Dallas	chalk, calcite, clay, marl/clay, silt, sand/gravel, sand, silt	34
Lubbock District			
1	Bovina	sand, silt, clay, gravel, caliche/clay, silt, sandy	16
2	Brownfield	clay, silt, sandy	17
3	Dimmit	clay, silt, sandy	17
4	Floydada	clay, silt, sandy	19
5	Lamesa	clay, silt, sandy	16
6	Levelland	clay, silt, sandy	18
7	Littlefield	clay, silt, sandy	17
8	Lubbock	clay, silt, sandy/sand, clay and limestone	18
9	Lubbock	clay, silt, sandy/sand, clay and limestone	18
10	Morton	clay, silt, sandy	17
11	Muleshoe	clay, silt, sandy	16
12	Plains	sand, silt, clay, gravel, caliche/clay, silt, sandy	16
13	Plainview	sand, silt, clay, gravel, caliche	19
14	Post	fluvial, gravel, eolian, silt	19
15	Ralls	clay, silt, sandy	20
16	Seminole	clay, silt, sandy	15
17	Tahoka	clay, silt, sandy	18
18	Tulia	clay, silt, sandy	18
36/30	Lubbock	clay, silt, sandy/sand, clay and limestone	18
HQ	Lubbock	clay, silt, sandy/sand, clay and limestone	18
Lufkin District			
3	Crockett	clay, marl, sand,	42
6	Lufkin	clay, silt	44
7	Nacogdoches	quartz sand/glaucanite, glaucanite marl, quartz sand and clay	45
8	San Augustine	glaucanite, glaucanite marl, quartz sand and clay	48
9	Shepherd	clay, silt, sand, minor gravel	46
Pharr District			
2	Edcouch	clay, silt, sand, minor gravel	23
8	Raymondville	clay	27
San Angelo District			
1	Ballinger	shale and sandstone interbedded/clay, silt, sand/gravel, sand, silt	23
9	Robert Lee	gravel, sand, silt/undivided	20
10	Rocksprings	limestone and clay	23
San Antonio District			
8	San Antonio	gravel, sand, silt/gravel/chalk, calcite, clay, marl	30
Tyler District			
2	Canton	mudstone, sandstone	41
Wichita Falls District			
7	Seymour	gravel, sand, silt	25

Section	City	Depth to water (ft) ¹²	Major aquifer ¹³	Major aquifer confined/unconfined ¹⁴	Minor aquifer ¹⁵
Abilene District					
7	Colorado City	120 to 150	none	none	Santa Rosa
Amarillo District					
4	Canadian	70 to 140	Ogallala	unconfined	none
5	Canyon	140+	Ogallala	unconfined	none
7	Claude	150 to 236	Ogallala	unconfined	none
9	Dumas	300	Ogallala	unconfined	none
10	Gruver	230 to 400	Ogallala	unconfined	none
12	Pampa	350 to 380	Ogallala	unconfined	none
13	Panhandle	400 to 450	Ogallala	unconfined	none
14	Perryton	250 to 300	Ogallala	unconfined	none
14	Darrouzett	35 to 60	Ogallala	unconfined	none
15	Stratford	300 to 320	Ogallala	unconfined	none
16	Vega	220 to 250	Ogallala	unconfined	none
18	Groom	250 to 350	Ogallala	unconfined	none
E-Way	Amarillo	150 to 250	Ogallala	unconfined	none
Bryan District					
3	Buffalo	aproximately 75	Subcrop Carrizo-Wilcox	unconfined	Queen City
Childress District					
1	Childress	Greenbelt Reservoir; 30 to 110 ft to gyp water	none	none	Blaine Gypsum
2	Clarendon	60 to 160; water source is sporadic	Ogallala	unconfined	none
3	Dickens	90	none	none	none
3	Guthrie	20 to 30	none	none	Blaine Gypsum
4	Mataador	17 to 40	Seymour	unconfined	none
5	Munday	20 to 25	Seymour	unconfined	none
5	Benjamin	20 to discontin. unconfined; 400 to fresh	none	none	none
7	Quanah	20 to 50 gyp water; 120 to 180 fresh	none	none	Blaine Gypsum
9	Wellington	40 to 240; city water at 58	Seymour	unconfined	none
12	Memphis	30 to 40 gyp; no fresh water	none	none	none
Corpus Christi					
2	Beeville	70 to 120	Gulf Coast	unconfined and semi-confined	none
4	George West	28 to 110+	Gulf Coast	unconfined and semi-confined	none
5	Goliad	60 to 80	Gulf Coast	unconfined and semi-confined	none
7	Kingsville	17 to 18 brackish; 300 to 400 fresh	Gulf Coast	unconfined and semi-confined	none
8	Robstown	43 to 60	Gulf Coast	unconfined and semi-confined	none
11	Refugio	17+	Gulf Coast	unconfined and semi-confined	none
Dallas District					
36	Dallas	12 unconfined; approx 350 confined	Subcrop Trinity	confined	Woodbine Subcrop
Lubbock District					
1	Bovina	218 to 240	Ogallala	unconfined	none
2	Brownfield	100 to 130	Ogallala	unconfined	Edwards-Trinity (High Plains)
3	Dimmit	275 to 300	Ogallala	unconfined	none
4	Floydada	MacKenzie Lake.; 180 Ogallala; 90 thin, discont.	Ogallala	unconfined	none
5	Lamesa	80 to 90; minor shallow water	Ogallala	unconfined	none
6	Levelland	170	Ogallala	unconfined	Edwards-Trinity (High Plains)
7	Littlefield	50 to 83	Ogallala	unconfined	Edwards-Trinity (High Plains)
8	Lubbock	50 to 75	Ogallala	unconfined	Edwards-Trinity (High Plains)
9	Lubbock	50 to 75	Ogallala	unconfined	Edwards-Trinity (High Plains)
10	Morton	150 to 200	Ogallala	unconfined	Edwards-Trinity (High Plains)
11	Muleshoe	30 to 70 gyp water; 90 to 95 fresh	Ogallala	unconfined	none
12	Plains	80 to 100	Ogallala	unconfined	Edwards-Trinity (High Plains)
13	Plainview	170 to 260	Ogallala	unconfined	none
14	Post	White River Reservoir	none	none	none
15	Ralls	220 to 240	Ogallala	unconfined	none
16	Seminole	100 to 105; unconfined shallow at 55	Ogallala	unconfined	Santa Rosa Subcrop/Edwards-Trinity (High Plains)
17	Tahoka	46 to 100	Ogallala	unconfined	Edwards-Trinity (High Plains)
18	Tulia	100 to 160	Ogallala	unconfined	none
36/30	Lubbock	<40	Ogallala	unconfined	Edwards-Trinity (High Plains)
HQ	Lubbock	50 to 75	Ogallala	unconfined	Edwards-Trinity (High Plains)
Lufkin District					
3	Crockett	100 to 120	Subcrop Carrizo Wilcox	confined and semi-confined	Queen City Subcrop/Sparta Subcrop
6	Lufkin	240 to 280; 12 to 50 shallow	Subcrop Carrizo Wilcox	confined and semi-confined	Sparta Subcrop
7	Nacogdoches	17 to 242	Subcrop Carrizo Wilcox	confined and semi-confined	Sparta/Queen City Subcrop
8	San Augustine	90 to 150	Subcrop Carrizo Wilcox	confined and semi-confined	Sparta
9	Shepherd	75 to 150	Gulf Coast	confined and semi-confined	none
Pharr District					
2	Edcouch	50 to 100	Gulf Coast	unconfined	none
8	Raymondville	45 to 65	Gulf Coast	unconfined	none
San Angelo District					
1	Ballinger	9 to 35	none	none	none
9	Robert Lee	Spence Reservoir; minor water 75 to 150	none	none	none
10	Rocksprings	350 to 450	Edwards-Trinity	unconfined	none
San Antonio District					
8	San Antonio	30 unconfined; 1,100 confined	Subcrop Edwards-Trinity	confined	none
Tyler District					
2	Canton	20 to 40 discont. sands; 300 to 400 deep water	Carrizo Wilcox	unconfined and semi-confined	none
Wichita Falls District					
7	Seymour	30 to 40	Seymour	unconfined	none

Section	City	Minor aquifer confined/ unconfined ¹⁶	Vegetation ¹⁷	1988-89 population ¹⁸	Surface water in proximity of 1,000 ft ¹⁹
Abilene District					
7	Colorado City	unconfined	Harvard Shin Oak/Mesquite Brush	5,549	no
Amarillo District					
4	Canadian	none	Mesquite Shrub/Grassland	4,098	no, but creeks close
5	Canyon	none	Mesquite Shrub/Grassland	11,153	100 ft from playa, 1000 ft. from creek
7	Claude	none	Crops	1,077	no
9	Dumas	none	Crops	12,900	no
10	Gruver	none	Crops	1,199	no
12	Pampa	none	Crops	22,275	no, close to playas
13	Panhandle	none	Crops	2,362	no, 2000 ft from playa
14	Perryton	none	Crops	9,266	no
14	Darrouzett	none	Crops	511	no
15	Stratford	none	Mesquite Shrub/Grassland	1,993	no
16	Vega	none	Crops	916	no
18	Groom	none	Crops	725	-
E-Way	Amarillo	none	Crops	162,863	no, .5 miles playa
Bryan District					
3	Buffalo	unconfined	Post Oak Woods, Forest and Grassland Mosaic	1,921	no
Childress District					
1	Childress	unconfined	Mesquite Brush	5,510	no
2	Clarendon	none	Mesquite Shrub/Grassland	2,316	no
3	Dickens	none	Crops	458	1000 ft creek
3	Guthrie	unconfined	Mesquite Juniper Brush/Mesquite Lotebush Shrub	160	300 ft river
4	Matador	none	Crops/Mesquite Brush	1,019	200 ft creek, 1000 ft creek
5	Munday	none	Crops	1,751	no
5	Benjamin	none	Crops	237	no/two creeks more than 1000 ft away
7	Quanah	unconfined	Crops	3,963	no
9	Wellington	none	Crops	2,653	no
12	Memphis	none	Crops	3,114	1000 ft creek
Corpus Christi					
2	Beeville	none	Urban area	15,977	500 ft creek
4	George West	none	Crops/Mesquite Blackbrush Shrubs	2,795	dry creek runs though site
5	Goliad	none	Post Oak Woods, Forest and Grassland Mosaic	2,089	creeks, 1000 ft E and 1300 W; River 0.6 mi S
7	Kingsville	none	Urban area/Mesquite Granjeno Woods	29,949	no
8	Robstown	none	Crops	13,325	no; irrigation canals in area
11	Refugio	none	Mesquite Blackbrush Shrubs	3,707	1000 ft creek
Dallas District					
36	Dallas	semi-confined	Urban area/crops/Post Oak Woods/other native and/or introduced grasses	974,239	no
Lubbock District					
1	Bovina	none	Crops	1,580	no, 1500 ft to creek
2	Brownfield	unconfined	Crops	10,848	no
3	Dimmit	none	Crops	4,875	no
4	Floydada	none	Crops	3,769	no, 1700 ft playa
5	Lamesa	none	Crops/Mesquite Shrub, Grasland	12,303	1000 ft playa
6	Levelland	unconfined	Crops	14,625	1000 ft playa
7	Littlefield	unconfined	Crops	7,088	no, 1500 ft playa
8	Lubbock	unconfined	Urban area/Crops	178,529	no
9	Lubbock	unconfined	Urban area/Crops	178,529	no
10	Morton	unconfined	Crops	2,578	no
11	Muleshoe	none	Crops	5,048	small lake/playa 500 ft from site
12	Plains	unconfined	Mesquite Shrub, Grassland/Crops	1,414	no
13	Plainview	none	Mesquite Shrub, Grassland/Crops	22,414	500 ft playa
14	Post	none	Mesquite Lotebush Brush	4,162	100 ft lake
15	Ralls	none	Crops	2,263	no, but draining to playa
16	Seminole	unconfined	Crops	6,794	no
17	Tahoka	unconfined	Crops	3,058	no, but site draining into playa
18	Tulia	none	Crops/Mesquite Shrub, Grassland	4,445	no
36/30	Lubbock	unconfined	Urban area/Crops	178,529	no
HQ	Lubbock	unconfined	Urban area/Crops	178,529	no, 2000 ft playa
Lufkin District					
3	Crockett	semi-confined	Other native and/or introduced grasses	7,550	small pond/ stock tank 150
6	Lufkin	semi-confined	Young Forest, Grassland	30,616	creek 500 ft
7	Nacogdoches	unconfined	Young Forest, Grassland	28,744	500 ft creek
8	San Augustine	unconfined	Young Forest, Grassland	2,983	300 ft stock tank, 2000 ft creek
9	Shepherd	none	Other native and/or introduced grasses/Pine Hardwood Forest	1,983	creek borders NE property line
Pharr District					
2	Edcouch	none	Urban area, Crops	3,550	200 ft elevated ditch
8	Raymondville	none	Crops	10,082	no
San Angelo District					
1	Ballinger	none	Mesquite Lotebush Brush	4,536	1000 ft from creek
9	Robert Lee	none	Crops	1,391	200 ft creek
10	Rocksprings	none	Live Oak, Mesquite, Ashe Juniper Parks	1,454	no; creeks 0.25 mi E and W
San Antonio District					
8	San Antonio	none	Urban area	842,779	100 ft creek
Tyler District					
2	Canton	none	Post Oak Woods, Forest	2,975	100 ft lake, 200 ft lake, 1000 ft creek, lake
Wichita Falls District					
7	Seymour	none	Crop	3,754	no

Section	City	Wetlands ²⁰
Abilene District		
7	Colorado City	not interpreted
Amarillo District		
4	Canadian	not interpreted
5	Canyon	R4SP (0.4 NNE), POW (0.7 N), R2SB (0.8 SW), P SS/EM (0.9 NNW)
7	Claude	not interpreted
9	Dumas	no wetland
10	Gruver	PEMA/POWfx (0.15 S), PSS1A (0.4 E), POW (0.3 NE, 0.7 SW), P SS1/EM5 A (0.55 SSW)
12	Pampa	not interpreted
13	Panhandle	POWfx (0.3 SE, 0.6 SE), PEMA (0.28-0.62 SE, 0.92 W, 0.8 NNW), PEMC (0.93 W)
14	Perryton	not interpreted
14	Darrouzett	not interpreted
15	Stratford	POW (0.9 NE, 0.9 NEE, 1.0 SSSW)
16	Vega	not interpreted
18	Groom	not interpreted
E-Way	Amarillo	POWfx (0.3 SSE), PEMCx (0.4 SSE), PEMA (0.4-0.8 SSE, 0.7 S), POW (0.45 E, 0.9 SW)
Bryan District		
3	Buffalo	not interpreted
Childress District		
1	Childress	POW (0.3 E, 0.8 SW), PEM (0.8 SW), PSS (0.85 W), PEM/ P SS/EM/L1OW (0.65 SEE-0.9 SSE)
2	Clarendon	P SS/EM A (0.3 SW), PEM (0.5 E), POW (0.5 E), POWfx (0.8 E), PEMA (1.0 E), Pf (0.8 N)
3	Dickens	POW (0.75 SSE, 0.7 SSE, 1.0 SSE, 0.8 S, 0.8 SW, 1.0 NNW)
3	Guthrie	wetland map N/A
4	Mataador	POW (0.05 S)
5	Munday	PUSC (0.2 E, 0.15 W), PUSA (0.7 S), PEM1A (0.15 W)
5	Benjamin	PEM1Ah (0.5 N, 0.6 N), PUSCh (0.6 NNE), PUSC (0.7 NNE), PUBHh (0.8 NNE, 1.0 E), PUSAh (0.2 NE), L1UBHh (0.9 SW)
7	Quanah	PEM1A/PEM1Fx (0.8 NE - 0.5 E), PEM1A (0.3-0.4 NE, 0.25 NW, 0.4 SE, 0.5 SE, 0.6 SW), PEM1C (0.35 E), PSS1A/PEM1A/PUBFx (0.5 NNW)
9	Wellington	no wetland
12	Memphis	PSS (0.9 E), POW (0.5 NE, 0.6 S), PFO (0.8 N, 0.8 W), P FO/SS (0.8 SW), R4SB (0.4 SE)
Corpus Christi		
2	Beeville	R4SBCx (0.5 N) PUBFh (0.85 SW, 1.0 SW)
4	George West	P FO/SS (1.0 E), P SS/EM (0.5 NEE), POW (0.8 NE, 1.0 NE, 0.8 W)
5	Goliad	PEM1Fh (0.25 SW), PUBFx (0.55 SSW), PUBFh/PFO1A/PSS1C (0.5 SE), SAN ANTONIO RIVER (0.7 SE)
7	Kingsville	PEM1A/PEM1Fx (0.8 NE - 0.5 E), PEM1A (0.3-0.4 NE, 0.25 NW, 0.4 SE, 0.5 SE, 0.6 SW), PEM1C (0.35 E), PSS1A/PEM1A/PUBFx (0.5 NNW)
8	Robstown	PEM1Cx (0.45 SW), R4SBCx (0.13 W)
11	Refugio	PUBFx (0.5 W, 0.7 NW), R4SBC (0.3 E), PUSAx (0.75 SE)
Dallas District		
36	Dallas	not interpreted
Lubbock District		
1	Bovina	POW (0.5 SE, 0.6 W), PEMC/POWf/POWfx/PEMJ (0.8-1.0 NE)
2	Brownfield	Pf (0.15 S, 0.9 S, 0.8 SSE, 0.8 W), POW (0.6 SE), PEMJ (0.5-0.6 E)
3	Dimmit	not interpreted
4	Floydada	PEMJ/POWfx/PEMA (0.3-0.55 E), POWfx/PEMAd/PEMF (1.0 SSW), PEMC/POWfx (0.7 NNW), PEMA (0.9 NW)
5	Lamesa	PEM1Jf (0.2 W), PUBFx/PEM1Cx (0.8 SW), PEM1A (0.35 SE, 0.8 SSSW)
6	Levelland	PEMA/PEMC (0.2-0.4 NW), PEMC/Pf (0.55-0.7 SW), PEMA (0.9 SE)
7	Littlefield	Pf/PEMA/POWfx (0.4-0.6 NNW), PEMJ (0.3-0.45 NE), PEMA (0.8 SSE), PEMA/PEMJd/POWfx (0.7-0.9 SSW)
8	Lubbock	R4SB (0.25 NE, 0.3 SW), POW (0.2 W)
9	Lubbock	PEMA (0.4 N), PEMJ (0.3 NW, 0.5 SW), POWfx/PEMA (0.7 W), Pf (0.7 SE)
10	Morton	not interpreted
11	Muleshoe	POW (1.1 E), Pf (0.6 SSSW, 0.7 SSW, 0.7 SW, 1.1 NW)
12	Plains	PEMJ (0.4-0.5 W, 0.8 SSW, 0.95 SSW, 0.45 SSE)
13	Plainview	POWfx/Pf/PEMC/PEMA (0.05-0.25 SE), POWfx/POWC/Pf (0.5 NE), Pf (0.75-1.0 E)
14	Post	L1OW (0.05 SE, 0.8 SEE), R4SB (0.25 SW), POW (0.65 SEE, 0.75 W)
15	Ralls	POWfx/PEMA/PEMC/PEMAd (0.4-0.65 SE), POWfx/PEMA (0.6-0.8 NNW), PEMJ/PEMA/PEMC/POWfx/P SS/EM Cd/P SS/EM Ad (0.85-1.1 NNW)
16	Seminole	PUSAx (0.85 NNW), PEMJf (0.65-0.8 S), PUSC/P/PEM1C/PUBKHx (0.4-0.6 SE), PEM1Jf (0.9 SE)
17	Tahoka	PEMJ/Pf/POWfx (0.25-0.5 SE), Pf (0.4-0.5 NW, 0.85-1.0 NNW, 0.9 NE), P EM/OW F/PEMA (0.75-0.9 SSSE), PEMJ (0.82-0.92 NNE)
18	Tulia	not interpreted
36/30	Lubbock	PEMJ (0.25 SW), PEMJ/POWfx (0.75 SSW), PEMC (0.6 SSW), POW (0.25 SE), PEMJ/Pf (0.65 SE), PEMC/Pf (0.9 W)
HQ	Lubbock	not interpreted
Lufkin District		
3	Crockett	POWHx (0.1 SW, 0.5 NNE, 1.0 NE), POWHh (0.3 N, 0.9-1.0 NNE, 0.35 E), POWHh/PAB4Fh (0.8 N), POWHh/PEM1A (0.5 SEE)
6	Lufkin	not interpreted
7	Nacogdoches	PFO1A (0.05-0.2 E, 0.65 NE, 0.8 NEE), R2OWHx (0.3 SSW)
8	San Augustine	PEM5A (0.15 S), PSS1A (0.4 E), POW (0.3 NE, 0.7 SW), P SS1/EM5 A (0.55 SSW)
9	Shepherd	not interpreted
Pharr District		
2	Edcouch	PEM1Cx (0.05 NW, 0.5 NE, 0.8 S), PEM1C (0.6 NW)
8	Raymondville	PEM1Cx (0.4 E, 0.7 W), PFO6C (0.35 SE), P EM1/OW Fx (0.45 SE), POWFhx (0.4 SW)
San Angelo District		
1	Ballinger	not interpreted
9	Robert Lee	PUBFh (0.35 SSW, 0.8 NW), PUSCh (0.4 SSW, 0.7 W, 0.4 NW, 0.5 NW), R4SBA (0.4 SEE)
10	Rocksprings	not interpreted
San Antonio District		
8	San Antonio	not interpreted
Tyler District		
2	Canton	many unclassified wetlands within 1 mile radius
Wichita Falls District		
7	Seymour	not interpreted

- 1 Soil association data were taken from county U. S. Soil Conservation reports.
- 2 Soil series information was obtained from U. S. Soil Conservation reports.
- 3 Soil textural information was obtained from U. S. Soil Conservation reports.
- 4 Soil permeability was estimated from U. S. Soil Conservation reports. Slow is defined by <0.6 inches/hr; moderate is defined by 0.6 to 6 inches/hr; rapid is > 6 inches per hour.
- 5 Soil drainage reflects the ability of a soil to retain rainwater runoff.
- 6 Geomorphic setting information was derived from 7.5 minute topographic maps.
- 7 Topographic relief at the maintenance site was determined from topographic maps and site visits.
- 8 The geologic age of rocks exposed at the surface was determined from the 1:250,000 scale Geologic Atlas of Texas maps published by The Bureau of Economic Geology, The University of Texas at Austin.
- 9 The formation or formations exposed at the surface was determined from the 1:250,000 scale Geologic Atlas of Texas maps published by The Bureau of Economic Geology, The University of Texas at Austin.
- 10 The lithologic descriptions of rocks in the subsurface were based on text from the 1:250,000 scale Geologic Atlas of Texas maps published by The Bureau of Economic Geology, The University of Texas at Austin.
- 11 Annual precipitation data are from Larkin and Bomar (1983).
- 12 Depth to water ranges near the maintenance site was determined from multiple sources including a Texas Water Development Board data base, site visit interviews and/or telephone conversations with water well drillers, city utility officials, the Soil Conservation Service, Underground Water Conservation Districts, and residents with water wells in the area.
- 13 Major aquifer classification was taken from maps published by the Texas Water Development Board.
- 14 Aquifer classification as confined, semi-confined, or unconfined was based on maps published by the Texas Water Development Board and the knowledge and experience of Bureau staff.
- 15 Minor aquifer classification was taken from maps published by the Texas Water Development Board.
- 16 Aquifer classification as confined, semi-confined, or unconfined was based on maps published by the Texas Water Development Board and the knowledge and experience of Bureau staff.
- 17 The major vegetation assemblages at the maintenance facility were determined from a Vegetation Types of Texas map (1:1,000,000 scale) published by Texas Parks and Wildlife and confirmed by site visits.
- 18 Population is based on the 1990 census.
- 19 The proximity of surface water to the TxDOT maintenance site was determined from the site visits and topographic maps.
- 20 Wetland data were collected from National Wetlands Inventory maps prepared by the U. S. Fish and Wildlife Service and filed at the Texas General Land Office.

L1OW = Lacustrine, limnetic, open water-unknown bottom

L1UBHh = Lacustrine, limnetic, unconsolidated bottom, permanently flooded, diked-impounded

P SS/EM = Palustrine, scrub-shrub/emergent

P FO/SS = Palustrine, forested/scrub-shrub

P SS/EM A = Palustrine, scrub-shrub/emergent, temporarily flooded

P SSI/EM5 A = Palustrine, scrub-shrub (broad-leaved deciduous)/emergent (mesohaline), temporarily flooded

P SS/EM Ad = Palustrine, scrub-shrub/emergent, temporarily flooded, partially drained-ditched

P SS/EM Cd = Palustrine, scrub-shrub/emergent, seasonally flooded, partially drained/ditched

P EM/OW F = Palustrine, emergent/open water-unknown bottom, semipermanently flooded

P EM1/OW Fx = Palustrine, emergent (persistent)/open water-unknown bottom, semipermanently flooded, excavated

PAB4Fh = Palustrine, aquatic bed (floating vascular), semipermanently flooded, diked-impounded

PEM = Palustrine, emergent

PEM5A = Palustrine, emergent, mesohaline, temporarily flooded

PEMA = Palustrine, emergent, temporarily flooded

PEMAd = Palustrine, emergent, temporarily flooded, partially drained-ditched

PEMC = Palustrine, emergent, seasonally flooded

PEMCx = Palustrine, emergent, seasonally flooded, excavated

PEMF = Palustrine, emergent, semipermanently flooded

PEM1A = Palustrine, emergent (persistent), temporarily flooded

PEM1Ah = Palustrine, emergent (persistent), temporarily flooded, diked-impounded

PEM1C = Palustrine, emergent (persistent), seasonally flooded

PEM1Cx = Palustrine, emergent (persistent), seasonally flooded, excavated

PEM1Fh = Palustrine, emergent (persistent), semipermanently flooded, diked-impounded

PEM1Fx = Palustrine, emergent (persistent), semipermanently flooded, excavated

PEM1Jf = Palustrine, emergent (persistent), intermittently flooded, farmed

PEMJ = Palustrine, emergent, intermittently flooded

PEMJd = Palustrine, emergent, intermittently flooded, partially drained-ditched

PEMJf = Palustrine, emergent, intermittently flooded, farmed

Pf = Palustrine, farmed

PFO = Palustrine, forested

PFO6C = Palustrine, forested (deciduous), seasonally flooded

PFO1A = Palustrine, forested (broad leaved, deciduous), temporarily flooded

POW = Palustrine, open water-unknown bottom

POWC = Palustrine, open water-unknown bottom, seasonally flooded

POWF = Palustrine, open water-unknown bottom, semipermanently flooded

POWFhx = Palustrine, open water-unknown bottom, semipermanently flooded, diked-impounded, excavated

POWFx = Palustrine, open water-unknown bottom, semipermanently flooded, excavated

POWHh = Palustrine, open water-unknown bottom, permanently flooded, diked-impounded

POWHx = Palustrine, open water-unknown bottom, permanently flooded, excavated
PSS = Palustrine, scrub-shrub
PSS1A = Palustrine, scrub-shrub (broad leaved, deciduous), temporarily flooded
PSS1C = Palustrine, scrub-shrub (broad leaved, deciduous), seasonally flooded
PUBF = Palustrine, unconsolidated bottom, semipermanently flooded
PUBFh = Palustrine, unconsolidated bottom, semipermanently flooded, diked-impounded
PUBFx = Palustrine, unconsolidated bottom, semipermanently flooded, excavated
PUBHh = Palustrine, unconsolidated bottom, permanently flooded, diked-impounded
PUBKHx = Palustrine, unconsolidated bottom, artificially flooded, permanently flooded, excavated
PUSA = Palustrine, unconsolidated shore, temporarily flooded
PUSAh = Palustrine, unconsolidated shore, temporarily flooded, diked-impounded
PUSAx = Palustrine, unconsolidated shore, temporarily flooded, excavated
PUSC = Palustrine, unconsolidated shore, seasonally flooded
PUSCh = Palustrine, unconsolidated shore, seasonally flooded, diked-impounded
PUSCx = Palustrine, unconsolidated shore, seasonally flooded, excavated
R2OWHx = Riverine, lower perennial, open water-unknown bottom, permanently flooded, excavated
R2SB = Riverine, lower perennial, streambed
R4SB = Riverine, intermittent, streambed
R4SBA = Riverine, intermittent, streambed, temporarily flooded
R4SBC = Riverine, intermittent, streambed, seasonally flooded
R4SBCx = Riverine, intermittent, streambed, seasonally flooded, excavated
R4SP = Riverine, intermittent, temporary-tidal, irregularly flooded

Appendix D

Maintenance Section Injection Well Ranking Criteria

Maintenance Section Injection Well Ranking Criteria

District: _____

Section number: _____

County: _____

Hydrogeologic Setting Criteria

- | | | |
|-----|--|----|
| (1) | Distance to surface water: | |
| | ≥1,000 ft or unknown | 0 |
| | 300 to 1,000 ft | 5 |
| | 200 to 300 ft | 10 |
| | 100 to 200 ft | 15 |
| | <100 ft | 20 |
| (2) | Distance to nearest wetland: | |
| | ≥1 mile | 0 |
| | 0.5 to 1.0 miles | 5 |
| | <0.5 mile | 10 |
| (3) | Number of wetlands within 0.5 mile: | |
| | none | 0 |
| | 1 to 6, or not determined | 10 |
| | ≥ 6 | 15 |
| (4) | Proximity of maintenance section to residences: | |
| | Residence > 500 ft or unknown | 5 |
| | Residence within 100 to 500 ft | 10 |
| | Residence ≤ 100 ft | 15 |
| (5) | Distance to nearest municipal, domestic, or irrigation well: | |
| | No wells | 0 |
| | ≥0.5 mile or unknown | 5 |
| | Within 0.5 mile | 10 |

Ranking Criteria

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(6)	Number of water wells within 0.5 mile of maintenance section:	
	none	0
	1 to 3	5
	3 to 6	10
	≥6	15
(7)	Depth to groundwater in uppermost unconfined aquifer:	
	≥200 ft	0
	100 to 200 ft	5
	50 to 100 ft	10
	25 to 50 ft, or unknown	15
	<25 ft	25
(8)	Annual precipitation:	
	≤10 inches	0
	10 to 20 inches	5
	20 to 30 inches	10
	30 to 40 inches	15
	>40 inches	20
(9)	Rainwater runoff into injection well	
	None	0
	Uncertain	5
	Infrequently	10
	Sometimes	15
	Frequently	20
(10)	Soil permeability:	
	Slow (<0.6 inches/hour)	0
	Moderate (0.6 to 6 inches/hour)	10
	Rapid (>6 inches/hour)	20
(11)	Classification of aquifer:	
	No aquifer or unclassified aquifer	0
	Minor aquifer	10
	Major aquifer	20
	Both major and minor aquifer present	25

Injection Well Characteristics Criteria

(12) Class V injection well status:	
No injection well identified	0
Site remediation performed	0
Source abatement completed	5
Unknown status of waste fluid	15
Waste source remaining	25
 (13) Class V injection well fluid (multiply by number of wells):	
No injection well	0
Clean wash rack water	5
Waste (grey) water	10
Multiple or unknown contaminants	15
Refined or hazardous products	20

Comments: _____

