BORING NO. PP - 10

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/25/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
0			Silty Clay, Fill								
			Clay, Loamy, Dark Brown 3 / 2 / 7.5YR								
5			Clay, Brown 5 / 4 / 7.5YR								
10											
20											
25			Clay, Caliche, Pink, Soft 7 / 3 / 7.5YR								
30			Clay, Soft, Slightly Moist, Slight Plasticity, Light Brown 6 / 4 / 7.5YR								
35											
40											

BORING NO. PP - 10

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/25/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
45			Clay, Soft, Slightly Moist, Slight Plasticity, Light Brown 6 / 4 / 7.5YR								
50											
55											
60			Sand, Unconsolidated, Very Fine Grain, Pinkish Gray 6 / 1 / 7.5YR								
65											
70			Caliche, Hard, Lithifield, Angular Fragments, Dry								
75			* T.D. - 75' *								
80											

BORING NO. PP - 11

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/25/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
0			Clay, Fill Material For Roadway Area, Brown 4 / 4 / 7.5YR								
5			Clay, Native Materials, Brown 5 / 4 / 7.5YR								
10											
20			Caliche, Pink, Soft 7 / 3 / 7.5YR								
25			Silty Clay, Grainy Texture, Dry 6 / 4 / 7.5YR								
30			Sand, Very Fine Grain, Very Pale Brown 8 / 3 / 10YR								
35			Silty Clay, Grainy Texture, Dry 6 / 4 / 7.5YR								
40											

BORING NO. PP - 11

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/25/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
45			Silty Clay, Grainy Texture, Dry 6 / 4 / 7.5YR								
50											
55											
60											
65											
			Sand, Very Fine Grain, Reddish Yellow 7 / 6 / 5YR								
70			Caliche, Hard, Angular Fragments, Lithifield 7 / 1 / 7.5YR								
			Sand, Very Pale Brown 8 / 3 / 10YR								
75			* T.D. - 75' *								
80											

BORING NO. PP - 12

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/26/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
0			Caliche, Hard, Consolidated, Pink 8 / 3 / 7.5YR								
10			Sand, Silty, Very Fine Grain, Unconsolidated, Reddish Yellow, Dry								
20			(Some Caliche Fragments)								
25											
30											
35											
40											

BORING NO. PP - 12

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/26/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
45			Sand, Silty, Very Fine Grain, Unconsolidated, Reddish Yellow, Dry								
50											
55											
60											
65											
70											
75			* T.D. - 75' *								
80											

KLEINFELDER

1999 – Dyess – Peterson Testing Laboratory, Inc.

Monitoring Wells MW-10 through MW-13

BORING NO. MW - 10

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/26/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
0			Silty Clay, Grainy Texture, Dry, Brown 5 / 4 / 7.5YR								
5											
10											
20											
25											
30											
35											
40											

BORING NO. MW - 10

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/26/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
45			Silty Clay, Grainy Texture, Dry, Brown 5 / 4 / 7.5YR								
50											
55			Caliche, Pinkish White, Some Hard Streaks Mixed with Soft Layers 8 / 2 / 7.5YR								
60											
65			Caliche, Hard, Angular Fragments, Lithified, Light Gray 7 / 1 / 7.5YR								
70			Sand, Very Fine Grain, Unconsolidated, Pinkish Gray 6 / 1 / 7.5YR								
75											
80											

BORING NO. MW - 10

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/26/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth / Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
85											
90			Sand, Very Fine Grain, Unconsolidated, Pinkish Gray 6 / 1 / 7.5YR								
95											
105											
110											
115											
120											
125											

BORING NO. MW - 10

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/26/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth / Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
130											
135											
140											
			Sand, Very Fine Grain, Unconsolidated, Pinkish Gray 6 / 1 / 7.5YR								
145											
150											
155											
			Air Drilling Terminated at 160'								
160			Continue with Mud Rotary to 255'								
165											

BORING NO. MW - 10

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/26/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
170			Sand, Very Fine Grain, Unconsolidated, Pinkish Gray 6/1/7.5YR								
175											
180											
190			Sand								
195											
200											
205											
210											

BORING NO. MW - 10

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/26/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
215			Sand								
220											
225											
230											
235											
240											
245											
250											

BORING NO. MW - 10

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/26/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
255			* T.D. - 255' *								
			Drilled to 260' with water - let stabilize for water level								
260											
265											
270											
275											
280											
285											
290											
295											

BORING NO. MW - 11

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/27/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
0			Silty Clay, Dry, Brown 5 / 4 / 7.5Yr								
10			Silty Clay, Dry, Light Brown, Slightly Moist, Caliche 6 / 3 / 7.5YR								
20			Silty Clay, Brown, Powdery								
25			Clay, Reddish Brown, Slightly Moist 4 / 4 / 5YR								
30			Clay, No Change, Slightly Moist, Some Small Caliche Pieces								
35											
40											

BORING NO. MW - 11

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/27/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
45			Clay, No Change, Slightly Moist, Some Small Caliche Pieces								
50											
55											
60			Caliche, Hard Drilling, Pinkish Gray, Angular Fragments 7/2/7.5YR								
65											
70			Silty Sand, Very Fine Grain, Some Caliche Fragments 6/6/7.5YR								
75			Caliche, Hard								
80											
			Silty Sand, Very Fine Grain, Very Pale Brown,								

BORING NO. MW - 11

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/27/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
85			Thin Caliche Layer 7/3/10YR								
90			Thin Caliche Layer								
			Sand (Several Thin Caliche Layers in Sand)								
95											
105											
110											
115											
120											
125											

BORING NO. MW - 11

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/27/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
130			Sand (Several Thin Caliche Layers in Sand)								
135											
140											
145											
150											
155											
160											
165											

BORING NO. MW - 11

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/27/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
170			Sand (Several Thin Caliche Layers in Sand)								
175											
180											
190			Air Drilling Terminated at 200'								
195											
200			Continued with Mud Rotary								
205											
210											

BORING NO. MW - 11

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/27/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
215											
220											
225			Sand (Several Thin Caliche Layers in Sand)								
230											
235											
240											
245											
250											

BORING NO. MW - 11

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 10/27/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
255			* T.D. - 255' *								
260											
265											
1											
275											
280											
285											
290											
295											

BORING NO. MW - 12

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 11/15/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
0			Caliche Fill Material								
			Clay, Very Dark Grayish Brown, Loamy 3 / 2 / 10YR								
5			Silty Clay, Strong Brown, Slightly Moist 4 / 4 / 7.5YR								
10			Silty Clay, Reddish Yellow, Some Caliche Fragments, Dry 7 / 6 / 7.5YR								
20			Silty Clay, Yellowish Red, Slightly Moist 5 / 6 / 5YR								
25											
30											
35											
40											

BORING NO. MW - 12

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 11/15/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
45			Silty Clay, Yellowish Red, Slightly Moist, 5 / 6 / 5YR								
50											
55			Clay, Yellowish Red, Less Silt, Slightly Moist 5 / 8 / 5YR								
60											
65			Silty Sand, Very Fine Grain, Reddish Yellow, Dry 6 / 6 / 5YR								
70			Caliche, Light Grey, Hard Consolidated, Chalky, Dry 7 / 1/ 7.5YR								
75											
80			Sand, Very Fine Grain, Unconsolidated, Very Pale Brown, Some Silt 8 / 3/ 10YR								

BORING NO. MW - 12

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 11/15/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
85			Sand, Very Fine Grain, Unconsolidated, Very Pale Brown, Some Silt 8 / 3 / 10YR								
90			Sand, Very Fine Grain, Unconsolidated, Very Pale Brown 8 / 3 / 10YR								
95											
105											
110											
115											
120											
125											

BORING NO. MW - 12

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 11/15/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
130			Drilling with air terminated at 130' Continued to 245' with Mud Rotary								
135											
140			Sand, Very Fine Grain, Unconsolidated. Very Pale Brown 8 / 3 / 10YR								
145											
150											
155											
160											
165											

BORING NO. MW - 12

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 11/15/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
170											
175											
180											
185											
190											
			Sand, Very Fine Grain, Unconsolidated, Very Pale Brown 8 / 3 / 10YR								
195											
200											
205											
210											

BORING NO. MW - 12

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 11/15/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
215			Sand, Very Fine Grain, Unconsolidated, Very Pale Brown 8 / 3 / 10YR								
220											
225											
230											
235											
240											
245			* T.D. - 245' *								
250											

BORING NO. MW - 13

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 11/15/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
0			Clay, Very Dark Grayish Brown, Topsoil, Loamy 3 / 2/ 10YR								
			Clay, Brown, Dry 5 / 3 / 7.5YR								
30			Silty Clay, Reddish Brown, Dry 4 / 4/ 5YR								
			Caliche, Reddish Yellow, Some Consolidated Hard Pieces 5 / 4 / 5YR								
35			Clay, Reddish Brown, Dry 4 / 4/ 5YR								
40											

BORING NO. MW - 13

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 11/15/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
45			Caliche, Pink, Hard, Consolidated (some layers of unconsolidated clay) 7 / 3 / 7.5YR								
50											
55											
60			Sand, Very Fine Grain, Very Pale Brown 8 / 3 / 10YR								
65											
70											
75											
80											

BORING NO. MW - 13

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 11/15/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
85			Sand, Very Fine Grain, Very Pale Brown 8 / 3 / 10YR								
90											
95											
105											
110											
115											
120			Drilled with Air to 120' Depth Continued to 205' Depth with Mud Rotary								
125											

BORING NO. MW - 13

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 11/15/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
130			Sand, Very Fine Grain, Very pale Brown 8 / 3/ 10YR								
135											
140											
145											
150											
155											
160											
165											

BORING NO. MW - 13

Dyess-Peterson Testing Laboratory, Inc.

PROJECT: City of Amarillo Landfill #73
CLIENT: City of Amarillo
DRILLED DATE: 11/15/99
DRILLING METHOD: Gardner Denver Drilling Unit

LOCATION: Amarillo, Texas
LOGGED BY: M. Todd
DRILLED BY: G. Perez
ELEVATION: Existing

Depth Feet	Sample	Soil Log	Description	SPT Blows/Ft	Moisture Percent	Dry Density pcf	LL	PL	PI	Unconfined Compressive Strength TSF	Passing 200 Sieve
170			Sand, Very Fine Grain, Very Pale Brown 8 / 3 / 10YR								
175											
180											
190											
195											
200											
205			* T.D. - 205' *								
210											

KLEINFELDER

1994 – Dyess – Peterson Testing Laboratory, Inc.

Logs of Borings TB-1 through TB-2

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: TB-1
LOCATION: Amarillo, Texas

Date: 7-5-94 thru 7-9-94

Ground Elevation: 3808.14

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air Drilled to 210' groundwater encountered at 215'.

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
0			Sandy Clay: Dark Brown -Stiff, Dry (CL)								
			Sandy Clay: Reddish Brown, Stiff Dry (CL)								
5		X	Sandy Clay: Reddish Tan w/Scattered Calcareous Nodules (8%),Stiff-Dry (CL)	11-6"	8.7		30	15	15	2.0	94.1
				29-12"							
				50-18"							
10		X		7-6"	8.9		29	13	16		82.6
				25-12"							
				41-18"							
15		X	$K = 6.35 \times 10^{-6}$	17.6"	11.2		35	13	22		86.6
				50-12"							
20		X		18-6"	11.0		34	18	16		83.2
				38-12"							
				50-18"							
25		X		13-6"	8.2		26	15	11	1.0	84.0
				29-12"							
				47-18"							
30		X	Continued on Page 2								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: TB-1
LOCATION: Amarillo, Texas

Date: 7-5-94 thru 7-9-94

Ground Elevation: 3808.14

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air Drilled to 210' groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
30		X	Sandy Clay: Reddish Tan, w/Scattered Calcareous Nodules (10%) Stiff-Dry (CL)	17-6"	9.0		30	13	17		77.2
				50-12"							
35		X		28-6"	11.1		35	20	15		84.0
				50-10"							
40		X		12-6"	11.1		32	21	11		82.3
				27-12"							
				44-18"							
45		X		35-6"	8.6		32	22	10	2.75	77.8
				50-8"							
50		X		18-6"	9.9		33	26	7		81.7
				50-12"							
55		X	Becomes Harder	50-6"	8.4		26	19	7	3.0	65.5
60		X	Continued on Page 3								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: TB-1
LOCATION: Amarillo, Texas

Date: 7-5-94 thru 7-9-94

Ground Elevation: 3808.14

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 210' groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
60		X	K = 3.34 X 10^{-5}	50-5"	7.2		21	18	3	2.50	44.9
65		X		33-6"	6.1		21	16	5		59.2
				50-9"							
70		X	Caliche: Light Tan Limestone Layers, Fractures, Hard (CL)	50-3"	5.3		23	18	5		66.0
75		X		50-3"						4.0+	
80		X		50-4"							
85		X	Clayey Sand:Reddish Tan to Tan w/Scattered Calcareous Nodules, (10%) Dry (SC)	28-6"	3.8		21	18	3		28.2
				50-9"							
90			Continued on Page 4								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: TB-1
LOCATION: Amarillo, Texas

Date: 7-5-94 thru 7-9-94

Ground Elevation: 3808.14

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 210' groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
90		X		50-6"	3.7		21	17	4		21.2
95		X		50-5"	3.2		17	13	4	3.25	21.7
100		X		50-6"	3.6		23	20	3		26.9
105		X	Clayey Sand: Reddish Tan to Tan w/Scattered Calcareous Nodules (10%) Dry (SC)	18-6"	1.9		15	10	5		8.7
				42-12"							
				50-14"							
110		X		15-6"	1.8		14	11	3		7.4
				50-12"							
115		X		30-5"							
				50-8.5"							
120			Continued on Page 5								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: TB-1
LOCATION: Amarillo, Texas

Date: 7-5-94 thru 7-9-94
Ground Elevation: 3808.14

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 210' groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT, PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
120		X		19-6"	1.7		16	13	3		7.8
				50-9"							
125		X	K = 7.15 X 10^{-5}	50-6"	2.6				NP		16.1
130			No Sample								
135		X		40-6"	2.2		15	11	4		21.3
				50-6.5"							
140			No Sample								
145		X		36-6"	3.8				NP	2.0	17.7
				50-8"							
150			Continued on Page 6								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: TB-1
LOCATION: Amarillo, Texas
Date: 7-5-94 thru 7-9-94
Ground Elevation: 3808.14

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION: Air Drilled to 210' groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
150											
155		X		21-6"	4.0		21	16	5		15.0
				50-8"							
160											
165		X		38-6"	4.5		19	16	3	2.50	11.6
170											
175		X		50-5"	3.7		18	14	4		11.7
180											

Continued on Page 7

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: TB-1
LOCATION: Amarillo, Texas

Date: 7-5-94 thru 7-9-94

Ground Elevation: 3808.14

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 210' groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
180											
185		X	Sand: Well Sorted Fine Grain(SC)	50-5"	3.7				NP		14.4
190											
195		X		33-6"	4.0		20	16	4		10.0
				50-8"							
200											
205		X		50-5"	5.1		20	16	4		19.2
			Sand: Light Tan, Fine Grain, w/Small Pea Gravel(15%) (SC)								
210			Continued on Page 8								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: TB-1
LOCATION: Amarillo, Texas

Date: 7-5-94 thru 7-9-94

Ground Elevation: 3808.14

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air Drilled to 210' groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
210											
215		X	Organic Carbon Content(*) *257.32 MG/KG	39-6"	MD		13	7	6		12.6
				50-6.5"							
220											
225		X	*523.32 MG/KG	35-6"	MD				NP		36.5
				50-7.5"							
230											
235		X	*741.97 MG/KG	50-4"	MD						27.1
240			Continued on Page 9								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: TB-1
LOCATION: Amarillo, Texas

Date: 7-5-94 thru 7-9-94

Ground Elevation: 3808.14

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air Drilled to 210' groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
240											
245		X	*491.65 MG/KG	50-4"	MD				NP		24.0
250											
255		X	*1155.23 MG/KG	50-3"	MD						
			Clayey Sand: Light Tan, Hard Calcareous Limestone Cap w/Black Coarse Gravel(SC)								
260											
265											
			Silty Clay: Red to Deep Red, Red Bed (MH)								
270			Continued on Page 10								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
Date: 7-5-94 thru 7-9-94

BORING NO.: TB-1
LOCATION: Amarillo, Texas
Ground Elevation: 3808.14

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION: Air Drilled to 210' groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
270		X	*225.22 MG/KG	50-4.5"	MD		37	25	12		85.4
275											
280		X	*310.35 MG/KG	50-5"	MD		40	30	10		63.1
			* T.D. - 280' *								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: TB-2
LOCATION: Amarillo, Texas
Date: 7-12-94 thru 7-15-94
Ground Elevation: 3686.34

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION:
Air Drilled to 85'
Mud Drilled to 180'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
0			Clayey Sand: Tan w/Calcareous Nodules, Well Sorted, Dry (SC)		7.6		20	16	4		29.2
5		X		7-6"	3.3		19	17	2	4.0+	25.5
				14-12"							
				20-18"							
10		X	Caliche: Light Tan Limestone Cap, Fractures, Hard, Dry (CL)								
15											
20		X		19-6"	3.6		27	24	3		8.9
				50-11.5"							
25		X	Clayey Sand: Light Tan to Reddish w/Calcareous Nodules(15%) Dry(SC)	27-6"	3.7				NP		13.9
				50-11.5"							
30			Continued on Page 2								

DYESS-PETERSON TESTING LABORATORY, INC.

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: TB-2
LOCATION: Amarillo, Texas
Date: 7-12-93 thru 7-15-94
Ground Elevation: 3686.34

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION:
Air Drilled to 85'
Mud Drilled to 180'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
30		X	Becoming Hard	50-6"	4.9				NP	3.5	12.1
35		X		40-6"	5.5				NP		14.2
				50-6.5"							
40		X		31-6"	4.9		25	20	5		15.4
				50-9.5"							
45		X		28-6"	5.8				NP	2.0	11.9
				50-10"							
50		X		30-6"	4.9		25	20	5		15.4
				50-9"							
55		X		31-6"	4.9		24	19	5		8.9
				50-9"							
60			Continued on Page 3								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: TB-2
LOCATION: Amarillo, Texas
Date: 7-12-94 thru 7-15-94
Ground Elevation: 3686.34

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION:
Air drilled to 85'
Mud drilled to 180'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
60		X		22-6"	5.0						7.6
				50-11"							
65		X		18-6"	5.5						7.9
				44-12"							
70		X		50-6"	5.1						26.0
75		X	Clayey Sand: Reddish Brown w/Calcareous Nodules(12%) Fine Grain (SC)	17-7"	7.6					2.25	6.5
				50-12"							
80		X	Clayey Sand: Reddish Tan w/Pea Size Gravel & Fine Grain (SC)	34-6"	4.6						10.1
				50-18"							
85		X	Increasing Coarse Gravels Organic Carbon Content(*) *1044.53 MG/KG	4-6"	MD		20	14	6		23.2
				11-12"							
				27-18"							
90			Continued on Page 4								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: TB-2
LOCATION: Amarillo, Texas

Date: 7-12-94 thru 7-15-94

Ground Elevation: 3686.34

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air drilled to 85'
Mud drilled to 180'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
90		X		23-6"	MD						86.2
				50-12.5"							
95		X	Silty Clay: Red to Green, Dense (MH) *313.52 MG/KG $K = 4.72 \times 10^{-9}$ cm/sec	36-6"	MD		46	24	22		83.1
				50-12"							
100		X	Silty Clay: Red Dense, w/Pea Size Gravel (8%) (MH)	50-4.5"	MD		39	22	17	4.0	82.6
105		X	Silty Clay: Light Green, Dense (MH) *258.68 MG/KG	50-6"	MD		40	21	19	3.25	73.1
110		X		50-4"	MD		29	12	17		88.2
115		X	Silty Clay: Dark Red, Dense (MH)	50-5"	MD		37	18	19		79.7
120			Continued on Page 5								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: TB-2
LOCATION: Amarillo, Texas

Date: 7-12-94 thru 7-15-94

Ground Elevation: 3686.34

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air drilled to 85'
Mud drilled to 180'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
120											
125		X	*271.65 MG/KG	50-4"	MD		36	16	20		65.2
130											
135		X	K = 8.21 x 10^{-10}	50-3.5"	MD		34	15	19		93.4
140											
145		X	Silty Clay: Dark Red Silty Clay, w/Brown Silty Stringers, Dense (MH) *343.71 MG/KG	50-3"	MD		34	15	19		87.2
150			Continued on Page 6								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: TB-2
LOCATION: Amarillo, Texas

Date: 7-12-94 thru 7-15-94

Ground Elevation: 3686.34

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air drilled to 85'
Mud drilled to 180'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
150			Silty Clay: Reddish Brown, Dense (MH)								
155		X		50-3"	MD		35	16	19		70.5
160											
165		X	Silty Clay: Light Green to Brown, Dense (MH)	50.3"	MD		39	18	21		68.0
170			Silty Clay: Reddish Brown (MH)								
175											
180			Continued on Page 7								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: TB-2
LOCATION: Amarillo, Texas

Date: 7-12-94 thru 7-15-94

Ground Elevation: 3686.34

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air drilled to 85'
Mud drilled to 180'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
180		X	Silty Clay: Dark Red(Red Bed) Dense(MH)	50-2"	MD		32	14	18		82.4
			$K = 3.47 \times 10^{-10}$ cm/sec								
			*373.89 MG/KG								
			* T.D. - 180' *								

KLEINFELDER

1994 – Dyess – Peterson Testing Laboratory, Inc.

Monitoring Wells MW-1 through MW-6

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-1
LOCATION: Amarillo, Texas

Date: 8-4-94 thru 8-9-94

Ground Elevation: 3814.85'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 125' Groundwater encountered at 225'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS/FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
0			Sandy Clay: Dark Brown, Stiff, Dry (CL)		13.1		34	13	21		94.1
5		X	Sandy Clay: Reddish Tan w/Calcareous Nodules (8%) Stiff, Dry (CL)	4-6"	9.9		26	15	11		84.6
				14-12"							
				38-18"							
10		X		7.6"	8.8		29	13	16		90.7
				16-12"							
				27-18"							
15		X		18-6"	10.1		34	13	21		88.9
				41-12"							
				50-13"							
20		X		23-6"	9.9		35	20	15		87.7
				50-12"							
25		X	Sandy Clay: Reddish Tan w/Calcareous Nodules (8%) Stiff, Dry (CL)	15-6"	9.6		26	15	11		92.1
				35-12"							
				50-16"							
30		X	Continued on Page 2								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-1
LOCATION: Amarillo, Texas

Date: 8-4-94 thru 8-9-94

Ground Elevation: 3814.85'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 125' Groundwater encountered at 225'

DESCRIPTION OF STRATUM

DEPTH, FEET	SYMBOL	SAMPLE	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
30		X	16-6"	8.3		32	22	10		80.6
			36-12"							
			50-17"							
35		X	15-6"	9.1		33	24	9		81.4
			33-12"							
			50-15.5"							
40		X	12-6"	8.7		32	20	12		77.9
			30-12"							
			50-17"							
45		X	21-6"	7.1		33	21	12		76.1
			50-11.5"							
50		X	15-6"	8.4		34	23	11		77.8
			36-12"							
			50-15"							
55		X	18-6"	8.7		26	17	9		66.8
			45-12"							
			50-13"							
60		X								

Continued on Page 3

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: MW-1
LOCATION: Amarillo, Texas
Date: 8-4-94 thru 8-9-94
Ground Elevation: 3814.85'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION: Air drilled to 125' Groundwater encountered at 225'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
60				50-2"	7.4		19	14	5		21.5
65			Sandy Clay: Light Tan, Caliche, Stiff, Dry (CL)	40-6" / 50-7.5"	6.8		21	15	6		55.1
70			Caliche: Light Tan, Limestone, Fractures, Hard (CL)	29-6"	5.1		23	18	5		50.9
75				28-6" / 50-10.5"	4.5		19	16	3		20.9
80			Sandy Clay: Light Tan, Caliche (CL)	33-6" / 50-7"	3.7		21	17	4		41.1
85				50-3"	3.2		21	17	4		29.1
90			Continued on Page 4								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-1
LOCATION: Amarillo, Texas

Date: 8-4-94 thru 8-9-94

Ground Elevation: 3814.85'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 125' Groundwater encountered at 225'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
90				40-6"	3.6		23	20	3		27.4
				50-7"							
95		X		36-6"	3.7		17	13	4		26.9
				50-8.5"							
100		X		50-5"	3.6		19	16	3		15.3
105		X	Clayey Sand: Reddish Tan, w/Calcareous Nodules (10%) Stiff, Dry (SC)								
110		X		26-6"	2.7		15	10	5		12.1
				50-12"							
115											
120		X	Continued on Page 5								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-1
LOCATION: Amarillo, Texas

Date: 8-4-94 thru 8-9-94

Ground Elevation: 3814.85'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 125' Groundwater encountered at 225'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS/FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
120				24.6"	1.7		16	12	4		14.9
				50-10"							
125											
130		X		50-4"							
135			Lost Circulation Not Able to Sample from 130' to 190'								
140											
145											
150			Continued on Page 6								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-1
LOCATION: Amarillo, Texas

Date: 8-4-94 thru 8-9-94

Ground Elevation: 3814.85'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air Drilled to 125' Groundwater encountered at 225'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS/FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
150											
155											
160											
165											
170											
175											
180			Continued on Page 7								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-1
LOCATION: Amarillo, Texas

Date: 8-4-94 thru 8-9-94

Ground Elevation: 3814.85'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 125' Groundwater encountered at 225'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
210											
215											
220											
225											
230											
235											
240			Continued on Page 9								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-1
LOCATION: Amarillo, Texas

Date: 8-4-94 thru 8-9-94

Ground Elevation: 3814.85'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 125' Groundwater encountered at 225'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
180											
185											
190											
195			Regained Circulation								
200		X	Clayey Sand: Reddish Tan, w/Calcareous Nodules (10%) Stiff, Dry (SC)	50-5"	MD		20	16	4		14.1
205			Lost Circulation Not Able to Sample from 205' to 253'								
210			Continued on Page 8								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-1
LOCATION: Amarillo, Texas

Date: 8-4-94 thru 8-9-94

Ground Elevation: 3814.85'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 125' Groundwater encountered at 225'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS/FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
240'											
245											
250											
255			* T.D. - 253' *								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-2
LOCATION: Amarillo, Texas

Date: 7-15-94 thru 7-20-94

Ground Elevation: 3805.39'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Auger drilled to 74' Groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
0		X	Sandy Clay: Dark Brown, Stiff Dry (CL) $K = 4.5 \times 10^{-8}$ cm/sec	13-6"	9.5		38	18	20	1.5	94.5
				18-12"							
5		X	Sandy Clay: Reddish Tan w/Calcareous Nodules(8%) Stiff, Dry (CL)	50-5"	8.5		36	15	21	3.5	92.1
10		X		50-4"	6.2		29	18	11	3.0	91.7
15		X		50-5"	8.6		32	13	19	3.25	85.4
20		X		50-4"	9.7		35	15	20		91.4
25		X		50-5"	9.3		38	23	15	3.5	91.8
30											

Continued on Page 2

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-2
LOCATION: Amarillo, Texas

Date: 7-15-94 thru 7-20-94

Ground Elevation: 3805.39'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Auger Drilled to 74' Groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
30		X		50-3"	5.8		32	21	11	4.0+	81.1
35		X	Caliche: Light Tan, Limestone, Fractures, Hard (CL)	50-3"	11.9		29	20	9	4.0+	79.2
40		X	Sandy Clay: Reddish Tan w/Calcareous Nodules(10%) Stiff, Dry (CL)	50-4"	11.5		32	19	13	3.25	74.4
45		X		50-4"	10.5		31	18	13	3.50	73.0
50		X		50-5"	7.7		37	15	22	2.50	73.9
55		X		50-4"	5.5		34	22	12	2.0	82.6
60											

Continued on Page 3

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-2
LOCATION: Amarillo, Texas

Date: 7-15-94 thru 7-20-94

Ground Elevation: 3805.39'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Auger drilled to 74' Groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
60		X		50-4"	4.2		31	15	16	2.5	62.2
65											
70											
75		X	Caliche: Light Tan Limestone Layers, Fractures, Hard (CL)	50-3"	MD		31	17	14	3.5	45.9
80		X		50-5"	MD		28	18	10		40.8
85		X		22-6"	MD		23	18	5	1.5	30.7
				50-11.5"							
90			Continued on Page 4								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-2
LOCATION: Amarillo, Texas

Date: 7-15-94 thru 7-20-94

Ground Elevation: 3805.39'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Auger drilled to 74' Groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS/FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
90		X		24-6"	MD		27	20	7	1.0	83.4
				50-12"							
95		X		50-6"	MD		34	20	14	2.5	81.0
100		X		25-6"	MD		21	17	4	1.25	17.'
105		X	Clayey Sand: Reddish Tan w/Calcareous Nodules(10%) Stiff Dry (SC)	50-5"	MD		25	21	4	3.0	30.1
110		X		50-5"	MD		22	19	3		27.8
115											
120			Continued on Page 5								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: MW-2
LOCATION: Amarillo, Texas
Date: 7-15-94 thru 7-20-94
Ground Elevation: 3805.39'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION: Auger drilled to 74' Groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
120		X		36-6"	MD		21	18	3		22.4
				50-8"							
125											
130		X	Clayey Sand:Reddish Tan, w/Calcareous Nodules(10%) Stiff, Dry (SC)	33-6"	MD		25	21	4	1.75	23.1
				50-8"							
135											
140		X		50-5"	MD		24	20	4	3.0	17.9
145											
150			Continued on Page 6								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-2
LOCATION: Amarillo, Texas

Date: 7-15-94 thru 7-20-94

Ground Elevation: 3805.39'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Auger drilled to 74' Groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS/FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
150		X		40-6"	MD				NP		16.0
				50-7.5"							
155											
160		X		39-6"	MD				NP		22
				50-8"							
165											
170		X	Clayey Sand: Reddish Tan, w/Calcareous Nodules(15%) Stiff, Dry (SC)	50-5"	MD				NP	3.0	20.7
			Organic Carbon Content (*) *237.1 MG/KG								
175											
180			Continued on Page 7								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-2
LOCATION: Amarillo, Texas

Date: 7-15-94 thru 7-20-94

Ground Elevation: 3805.39'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Auger drilled to 74' Groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
180		X	Clayey Sand: Reddish Tan, w/Calcareous Nodules (15%) (SC)	50-3.5"	MD				NP		
185											
190		X	Sand: Tan, Well sorted, Fine Grain (SC) *444.12 MG/KG	50-4"	MD				NP		
195											
200		X		50-3.5'	MD				NP		
205			Sand: Tan, Fine Grain w/Small Pea Gravel (30%) (GW)								
210			Continued on Page 8								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-2
LOCATION: Amarillo, Texas

Date: 7-15-94 thru 7-20-94

Ground Elevation: 3805.39'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Auger drilled to 74' Groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
210		X	*482.80 MG/KG Sand: Tan, Well Sorted, Fine Grain (SC)	50.4"	MD				NP		
215											
220		X		50-1"	MD						
225											
230		X	Sand: Tan, Coarse Grain w/Small Pea Gravel (30%) (SC) *336.34 MG/KG	50-1"	MD						
235											
240			Continued on Page 9								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: MW-2
LOCATION: Amarillo, Texas
Date: 7-15-94 thru 7-20-94
Ground Elevation: 3805.39'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION: Auger Drilled to 74' Groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS/FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
240		X	Sand: Tan, Coarse Grain w/Small Pea Gravel (SC) *529.70 MG/KG	50-3"	MD				NP		2.0
245		X		50-2.5"	MD						
			* T.D. - 245' *								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-3
LOCATION: Amarillo, Texas

Date: 7-19-94 thru 7-26-94

Ground Elevation: 3789.57'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: (Continous Core) Auger Drilled to 70' Groundwater encountered at 200'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
0			Sandy Clay: Brown, Stiff, Dry (CL) (R) K = 2.98 X 10^{-8} cm/sec		11.3		33	14	19		93.7
5			Sandy Clay: Reddish Brown with Scattered Calcareous Nodules, Stiff, Dry (CL)		10.1		32	15	17		92.6
10			Sandy Clay: Tan with a Caliche Stringer (CL)		8.2		21	8	13		63.3
15			Sandy Clay: Reddish Tan with Scattered Calcareous Nodules, Stiff, Dry (CL)		8.3		32	16	16		85.8
20					9.8		31	14	17	3.5	90.7
25			Sandy Clay: Tan with Caliche Stringers (CL)		8.7		31	16	15		90.4
30			Continued on Page 2								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-3
LOCATION: Amarillo, Texas

Date: 7-19-94 thru 7-26-94

Ground Elevation: 3789.57'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: (Continous Core) Auger Drilled to 70' Groundwater encountered at 200'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
30											
35			Sandy Clay: Reddish Tan with Scattered Calcareous Nodules Stiff, Dry (CL)		8.2		32	70	12		72.9
40											
45			$K = 3.45 \times 10^{-5}$ cm/sec (R)		7.6						
50											
55											
60			Continued on Page 3								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-3
LOCATION: Amarillo, Texas

Date: 7-19-94 thru 7-26-94

Ground Elevation: 3789.57'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: (Continous Core) Auger Drilled to 70' Groundwater encountered at 200'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
60			Clayey Sand: Reddish Tan with Scattered Calcareous Nodules Stiff, Dry (SC)		7.2		30	20	10		32.8
65					6.9		25	12	13		53.1
70					7.4		27	16	11		44.1
75		X		21-6"	MD		26	19	7		34.7
				46-12"							
				50-13"							
80		X		50-1"	MD						
85		X		50-3"	MD						
90											

Continued on Page 4

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-3
LOCATION: Amarillo, Texas

Date: 7-19-94 thru 7-26-94

Ground Elevation: 3789.57'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION(Continous Core) Auger Drilled to 70' Groundwater encountered at 200'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
90		X	Clayey Sand: Light Tan with Scattered Calcareous Nodules, Stiff (SC)	50-6"	MD		25	18	7		31.9
95		X		50-4"	MD		26	19	7		30.8
100		X		50-5"	MD		21	16	5		16.8
105											
110		X		34-6"	MD		23	19	4		28.1
				50-8"							
			Clayey Sand: Reddish Tan with Scattered Calcareous Nodules, Stiff (SC)								
115											
120			Continued on Page 5								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-3
LOCATION: Amarillo, Texas

Date: 7-19-94 thru 7-26-94

Ground Elevation: 3789.57'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: (Continous Core) Auger Drilled to 70' Groundwater encountered at 200'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
120		X		38-6"	MD		19	16	3		21.8
				50-7"							
125											
130		X		38-6"	MD		22	19	3		22.6
				50-7.5"							
135			Clayey Sand: Reddish Tan with Scattered Calcareous Nodules, Stiff (SC)								
140		X		50-5"	MD		19	16	3		17.0
145											
150			Continued on Page 6								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: MW-3
LOCATION: Amarillo, Texas
Date: 7-19-94 thru 7-26-94
Ground Elevation: 3789.57'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION: (Continous Core) Auger Drilled to 70' Groundwater encountered at 200'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
150				50-6"	MD		19	16	3		15.7
155											
160				50-4"	MD		18	16	2		21.
165			Clayey Sand: Reddish Tan with Scattered Calcareous Nodules Stiff (SC)								
170				50-4"	MD		19	17	2		20.1
175			Tan Sand: Well Sorted with Calcareous Nodules (SC)								
180			Continued on Page 7								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: MW-3
LOCATION: Amarillo, Texas
Date: 7-19-94 thru 7-26-94
Ground Elevation: 3789.57'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION: (Continous Core) Auger Drilled to 70' Groundwater encountered at 200'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
180				50-4.5"	MD				NP		12.6
			Tan Sand: Pea Size Caliche Nodules (SC)								
185											
190				50-5"	MD				NP		13.0
195											
200				50-6"	MD				NP		14.1
205											
210			Continued on Page 8								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-3
LOCATION: Amarillo, Texas

Date: 7-19-94 thru 7-26-94

Ground Elevation: 3789.57'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: (Continous Core) Auger Drilled to 70' Groundwater encountered at 200'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
210				50-5"	MD				NP		14.9
215											
220				50-4"	MD				NP		23.7
225											
230				50-5.5"	MD				NP		
235			Clayey Sand: Tan with Scattered Calcareous Nodules, Stiff (SC)								
240			Continued on Page 9								

COPY

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-3
LOCATION: Amarillo, Texas

Date: 7-19-94 thru 7-26-94

Ground Elevation: 3789.57'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: (Continous Core) Auger Drilled to 70' Groundwater encountered at 200'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS/FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
240											
245		X		50-2.5"	MD				NP		24.4
			* T.D. - 245' *								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: MW-4
LOCATION: Amarillo, Texas
Date: 8-11-94 thru 8-17-94
Ground Elevation: 3746.88'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION: Air drilled to 150' Groundwater encountered at 155'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS/FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
0			Sandy Clay: Dark Brown,Dry (CL)		9.2		34	15	19		93.8
5		X	Sandy Clay: Reddish Tan w/Scattered Calcareous Nodules (8%) Stiff, Dry (CL) K = 2.83 X 10^{-7} cm/sec	13-6"	8.5		32	15	17		89.7
				30-12"							
				47-18"							
10		X		20-6"	7.2		32	14	18	2.50	91.3
				50-12"							
15		X		20-6"	8.2		31	14	17		88.3
				50-11.5"							
20		X		42-6"	7.6					2.25	86.3
25		X		50-5.5"	6.4						85.5
30											

Continued on Page 2

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-4
LOCATION: Amarillo, Texas

Date: 8-11-94 thru 8-17-94

Ground Elevation: 3746.88'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 150' Groundwater encountered at 155'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS/FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
30		X		50-6"	7.4		30	19	11		83.7
			Caliche: Light Tan, Limestone Cap, Very Hard (CL) (R)								
35											
40		X		50-1.5"	3.8						
			Clayey Sand: Reddish Tan Scattered Calcareous Nodules (10%) Stiff, Dry (SC)								
45		X		31-6"	6.9		33	17	16		44.5
				50-10"							
50		X		28-6"	6.1		28	17	11	2.25	39.1
				50-9"							
55		X		40-6"	6.9		30	17	13		37.3
				50-7.5"							
60			Continued on Page 3								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-4
LOCATION: Amarillo, Texas

Date: 8-11-94 thru 8-17-94

Ground Elevation: 3746.88'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 150' Groundwater encountered at 155'

DESCRIPTION OF STRATUM

DEPTH, FEET	SAMPLE	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
60	X	11-16"	5.7		25	15	10		36.3
		36-12"							
		50-15"							
65	X	16-6"	6.4		25	16	9		49.4
		48-12"							
		50-12.5"							
70	X	50-1.5"							
75	X	30-6"	4.9		25	16	9		31.9
		50-8.5"							
80	X	19-6"	5.6		23	19	4		27.7
		50-10.5"							
85	X	36-6"	4.1		23	14	9		28.9
		50-8.5"							
90									

Continued on Page 4

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-4
LOCATION: Amarillo, Texas

Date: 8-11-94 thru 8-17-94

Ground Elevation: 3746.88'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 150' Groundwater encountered at 155'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
90		X		50-6"	3.7		24	16	8		28.1
95		X		35-6"	4.3		22	15	7		27.7
				50-6.5"							
100		X		37-6"	3.3		23	18	5		15
				50-7.5"							
			Clayey Sand: Reddish Tan w/Scattered Calcareous Nodules(10%) Stiff, Dry (SC)								
105											
110		X		50-5.5"	3.0					3.5	24.5
115											
120											

Continued on Page 5

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-4
LOCATION: Amarillo, Texas

Date: 8-11-94 thru 8-17-94

Ground Elevation: 3746.88'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 150' Groundwater encountered at 155'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
120		X		50-5"	3.4					3.5	26.3
125											
130		X		50-6"	2.7		19	15	4		17.7
135											
140		X		50-5.5"	3.1				NP		19.3
145			Sand: Tan, Fine Grain w/Scattered Pea Gravel (SC)								
150			Continued on Page 6								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-4
LOCATION: Amarillo, Texas

Date: 8-11-94 thru 8-17-94

Ground Elevation: 3746.88'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 150' Groundwater encountered at 155'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETRIOMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
150		X	K = 8.34 X 10^{-5} cm/sec Sand: Tan w/Pea Size Calcareous Nodules(15%) Well Sorted (SC)(R)	23-6"	MD						14.1
155											
160		X		50-3"	MD				NP		15.
165											
170		X	Sand: Tan w/Scattered Calcareous Nodules(10%) Well Sorted (SC)	45-6"	MD						21.3
				50-6.5"							
175											
180											

Continued on Page 7

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-4
LOCATION: Amarillo, Texas

Date: 8-11-94 thru 8-17-94

Ground Elevation: 3746.88'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 150' Groundwater encountered at 155'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS/FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
180		X	Sand: Reddish Tan w/Scattered Calcareous Nodules (SC)	50-5"	MD		22	20	NP		13.1
			* T.D. - 180' *								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-5
LOCATION: Amarillo, Texas

Date: 8-19-94 thru 8-21-94

Ground Elevation: 3736.64

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 115'
Mud Drilled to 140'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
0			Sandy Clay: Reddish Brown w/Calcareous Nodules, Stiff, Dry (CL)								
5		X	Caliche: Light Tan, Limestone Layers, Fractures, Hard (CL)	19-6"	7.7		28	25	3		24
				43-12"							
				50-13.5"							
10		X	Clayey Sand: Reddish Brown with Calcareous Nodules, Stiff, Dry (SC)	50-4.5"						4.0	
15		X		50-5"	6.9		25	22	3		34
			Clayey Sand: Reddish Tan with Scattered Calcareous Nodules(SC)								
20		X		50-2"							
25		X	Clayey Sand: Light Tan with Caliche(Very Hard)(SC)	50-5.5"	5.7		18	16	2		22
30			Continued on Page 2								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-5
LOCATION: Amarillo, Texas

Date: 8-19-94 thru 8-21-94

Ground Elevation: 3736.64

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 115'
Mud Drilled to 140'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
30		X	K = 7.73 X 10^{-4} cm/sec (R) Clayey Sand: Reddish Tan with Scattered Calcareous Nodules, Dry (SC)	22-6"	5.2		25	21	4		17
				50-11"							
35		X		50-3"							
40		X		24-6"	6.1		19	16	3		24
				50-11"							
45		X		27-6"	5.6				NP		11
				50-10"							
50		X	Clayey Sand: Reddish Brown Stiff, Dry (SC)	31-6"	4.8				NP		11
				50-9"							
55		X	Clayey Sand: Reddish Tan with Scattered Calcareous Nodules Dry (SC)	50-6"	4.2		19	16	3		10
60			Continued on Page 3								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-5
LOCATION: Amarillo, Texas

Date: 8-19-94 thru 8-21-94

Ground Elevation: 3736.64

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 115'
Mud Drilled to 140'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
60		X	Clayey Sand: Reddish Tan to Tan with Scattered Calcareous Nodules Dry (SC)	50-4"	3.3						
65		X		50-6"	4.6		25	22	3		15
70		X		34-6"	4.3				NP		24
				50-7"							
75		X		50-5.5"	3.1		28	24	4		14
80		X		50-6"	1.3				NP		2
			Gravel: Medium Coarse								
85		X		45-6"	1.9						3
				50-7"							
			Clayey Sand: Reddish Tan to Tan with Coarse Gravel (SC)								
90											

Continued on Page 4

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-5
LOCATION: Amarillo, Texas

Date: 8-19-94 thru 8-21-94

Ground Elevation: 3736.64

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 115'
Mud Drilled to 140'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
90		X	Clayey Sand: Reddish Tan to Tan with Coarse Gravel (SC)	31-6"	1.6						4
95											
100											
105											
110		X		16-6"	6.1				NP		85
				50-9"							
115					MD						
120					MD						

Continued on Page 5

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-5
LOCATION: Amarillo, Texas

Date: 8-19-94 thru 8-21-94

Ground Elevation: 3736.64

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 115'
Mud Drilled to 140'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
120			Clayey Sand: Reddish Tan to Tan With Coarse Gravel (SC)		MD						
125			Silty Clay: Red to Deep Red, Red Bed (MH)		MD						
130					MD						
135					MD						
140					MD						
			* T.D. - 140' *								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
Date: 7-8-94 thru 7-12-94
8-17-94 thru 8-19-94

BORING NO.: MW-6
LOCATION: Amarillo, Texas
Ground Elevation: 3746.38'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION:
Air Drilled to 155'
Mud Drilled to 180'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
0			Caliche: Limestone Cap, Extremely Hard, Outcropping Existing at Surface (CL)								
5		X									
10		X	Clayey Sand: Light Tan Large Caliche Nodules (SC)	50-4"	9.7		35	28	7		23.3
15		X		20-6"	6.6		25	22	3		33.8
				50-12"							
20		X		50-6"	6.2		28	25	3		23.1
25		X	Clayey Sand: Reddish Tan with Scattered Calcareous Nodules Stiff, Dry (SC)	50-5.5"	7.2		28	22	6		30.5
30			Continued on Page 2								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
Date: 7-8-94 thru 7-12-94
8-17-94 thru 8-19-94

BORING NO.: MW-6
LOCATION: Amarillo, Texas
Ground Elevation: 3746.38'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION:
Air Drilled to 155'
Mud Drilled to 180'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
30		X	Clayey Sand: Reddish Tan with Scattered Calcareous Nodules Stiff, Dry (SC)	23-6"	4.2				NP		22.6
				50-12"							
35		X		33-6"	5.5		23	20	3		19.6
				50-3"							
40		X		22-6"	4.2		21	18	3		34
				50-6"							
45		X		22-6"	4.0				NP		10.6
				50-12"							
50		X		17-6"	3.3				NP		6.4
				50-12"							
55		X		20-6"							
				50-10"							
60											

Continued on Page 3

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
Date: 7-8-94 thru 7-12-94
8-17-94 thru 8-19-94

BORING NO.: MW-6
LOCATION: Amarillo, Texas

Ground Elevation: 3746.38'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 155'
Mud Drilled to 180'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
60				50-6"	3.7		19	16	3		11.6
65				33-6"	5.3				NP		18.2
				50-8"							
70				50-6"	4.6				NP	2.75	21.5
			Clayey Sand: Reddish Tan with Scattered Calcareous Nodules Stiff, Dry (SC)								
75				50-6"	6.3				NP		22.6
80				37-6"	6.1				NP		21.5
				50-8"							
85				34-6"	5.8				NP		19.0
				50-7.5"							
90											

Continued on Page 4

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
7-8-94 thru 7-12-94
Date: 8-17-94 thru 8-19-94

BORING NO.: MW-6
LOCATION: Amarillo, Texas

Ground Elevation: 3746.38'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 155'
Mud Drilled to 180'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
90		X		24-6"	4.8				NP		16.3
				50-9"							
95		X		50-5.5"	4.0		22	17	5	3.0	12.7
100		X		35-6"	5.5		23	20	3		17
				50-7"							
			Clayey Sand: Reddish Tan with Scattered Calcareous Nodules Dry, Stiff (SC)								
105		X		35.6"	4.9		24	20	4		16.3
				50-7.5"							
110		X		35-6"	5.4		22	19	3		15.2
				50-7.5"							
115		X	K = 7.73 X 10^{-4} cm/sec (R)	25-6"	4.7		28	24	4		8.9
				50-10"							
120			Continued on Page 5								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
Date: 7-8-94 thru 7-12-94
8-17-94 thru 8-19-94

BORING NO.: MW-6
LOCATION: Amarillo, Texas
Ground Elevation: 3746.38'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION:
Air Drilled to 155'
Mud Drilled to 180'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
120											
125		X	Organic Carbon Content (*) *1141.73	33-6"	4.4		26	21	5		10.8
				50-8"							
130											
135		X		30-6"	4.1		19	16	3		19.8
				50-8"							
140											
145		X	Sand: Tan with Scattered Calcareous Nodules (SC) * 343.77	20-6"	9.2				NP		14.0
				50-11.5"							
150			Continued on Page 6								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
Date: 7-8-94 thru 7-12-94
8-17-94 thru 8-19-94

BORING NO.: MW-6
LOCATION: Amarillo, Texas
Ground Elevation: 3746.38'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION:
Air Drilled to 155'
Mud Drilled to 180'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
150			Sand: Tan, Well Sorted with Scattered Calcareous Nodules with Pea Gravel (GW)								
155		X		18-6"	MD				NP		11.0
				50-11.5"							
160		X		50-3"							
165			Sand: Reddish Tan with Scattered Calcareous Nodules (SC)								
170		X		45-6"							
				50-6.5"							
175			Clayey Sand:Reddish Brown (SC)								
180			Continued on Page 7								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
Date: 7-8-94 thru 7-12-94
8-17-94 thru 8-19-94

BORING NO.: MW-6
LOCATION: Amarillo, Texas
Ground Elevation: 3746.38'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION:
Air Drilled to 155'
Mud Drilled to 180'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
180		X		50-5"							
			* T.D. - 180' *								

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Logs of Borings PZ-1 through PZ-3

Subsequently designated MW-7 through MW-9

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-1
LOCATION: Amarillo, Texas

Date: 7-30-94 thru 8-2-94

Ground Elevation: 3808.04'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 199'
Mud Drilled to 245'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
0			Sandy Clay: Brown (CL)		7.4		31	14	17		94.7
			Sandy Clay: Reddish Brown (CL)								
5		X	Sandy Clay: Reddish Tan with Scattered Calcareous Nodules Stiff, Dry (CL)	50-6"	7.9		32	15	17	2.50	92.1
10		X		17-6"	8.9		28	13	15	1.25	86.1
				30-12"							
				50-18"							
15		X		21-6"	8.3		35	13	22		86.1
				50-12"							
20		X		50-5"	7.9		34	17	17	3.25	87.2
25		X		12-6"	8.1		32	20	12	2.50	91.6
				25-12"							
				50-18"							
30											

Continued on Page 2

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-1
LOCATION: Amarillo, Texas

Date: 7-30-94 thru 8-2-94

Ground Elevation: 3808.04'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 199'
Mud Drilled to 245'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT, PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
30		X		21-6"	6.2		31	16	15		80.1
35		X		50-6"	7.1		30	13	17		81.1
40		X		50-5"						3.0	
45		X		50-6"	8.7		31	20	11		76.8
50		X		50-6"	8.3		35	19	16		78.2
55		X	Caliche: Light Tan Limestone, Layers, Fractures, Hard (CL)	50-5"	7.2		30	19	11	3.0	68.2
60			Continued on Page 3								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-1
LOCATION: Amarillo, Texas

Date: 7-30-94 thru 8-2-94

Ground Elevation: 3808.04'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 199'
Mud Drilled to 245'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
60		X		50-4"	6.1						
65											
70		X	Clayey Sand: Reddish Tan with Scattered Calcareous Nodules Stiff Dry (SC)	50-3"	4.8						52.1
75		X		50-4"	5.0						
80		X		50-3"	4.7		27	16	11		41.5
85		X		50-6"	5.1		24	18	6		28.4
90											

Continued on Page 4

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-1
LOCATION: Amarillo, Texas

Date: 7-30-94 thru 8-2-94

Ground Elevation: 3808.04'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 199'
Mud Drilled to 245'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS/FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
90				22-6"	4.5		26	19	7		30.1
				50-12"							
95				50-6"	3.8		21	16	5	3.0	26.4
100				50-6"	3.6		21	17	4	3.0	15.8
105			Clayey Sand: Reddish Tan with Scattered Calcareous Nodules Stiff, Dry (SC)	50-4"							
110				50-3"							
115											
120											

Continued on Page 5

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-1
LOCATION: Amarillo, Texas

Date: 7-30-94 thru 8-2-94

Ground Elevation: 3808.04'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 199'
Mud Drilled to 245'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
120		X	Clayey Sand: Reddish Tan with Scattered Calcareous Nodules Stiff, Dry (SC)	31-6"	4.0				NP		15.1
				50-7							
125											
130		X									
135											
140		X		50-6"	3.2				NP		17.4
145											
150			Continued on Page 6								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-1
LOCATION: Amarillo, Texas

Date: 7-30-94 thru 8-2-94

Ground Elevation: 3808.04'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 199'
Mud Drilled to 245'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
150				35-6"							
				50-8"							
155											
160			Clayey Sand: Reddish Tan with Scattered Calcareous Nodules Stiff, Dry (SC)	39-6"	2.9				NP		16.1
				50-8"							
165											
170				50-6"	14.6						
175											
180			Continued on Page 7								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-1
LOCATION: Amarillo, Texas

Date: 7-30-94 thru 8-2-94

Ground Elevation: 3808.04'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 199'
Mud Drilled to 245'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
180		X		50-4"	2.9				NP		13.0
185											
190		X		50-3"							
195											
200		X	Sand: Tan, Fine Grain w/Small Pea Gravel (GW)	50-4"	MD				NP		14.5
205					MD						
210			Continued on Page 8								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-1
LOCATION: Amarillo, Texas

Date: 7-30-94 thru 8-2-94

Ground Elevation: 3808.04'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 199'
Mud Drilled to 245'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
210				50-5"	MD				NP		15.8
215					MD						
220				50-3"	MD				NP		24.5
225											
230			Clayey Sand: Tan with Scattered Calcareous Nodules (SC)	50-2"	MD						31.8
235											
240											

Continued on Page 9

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-1
LOCATION: Amarillo, Texas

Date: 7-30-94 thru 8-2-94

Ground Elevation: 3808.04'

DRILLING METHOD: Air/Mud Drilled

GROUNDWATER INFORMATION:
Air Drilled to 199'
Mud Drilled to 245'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
240		X	Clayey Sand: Tan with Scattered Calcareous Nodules (SC)	50-3"	MD						25.6
245					MD						
			* T.D. - 245' *								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-2
LOCATION: Amarillo, Texas

Date: 7-27-94 thru 7-30-94

Ground Elevation: 3793.86'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 195'
Mud Drilled to 235'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
0			Sandy Clay: Brown								
			Sandy Clay: Reddish Brown								
5		X		41-6"	8.7		31	15	16	2.75	93.1
				50-6.6"							
			Sandy Clay: Reddish Tan with Scattered Calcareous Nodules(CL)								
10		X	K = 6.72 X 10^{-6} cm/sec	21-6"	9.0		28	13	15		87.2
				38-12"							
				50-15"							
15		X		31-6"	8.1		34	14	20		86.0
				50-7.5"							
20		X		50-6"	7.6		37	15	22	2.50	87.3
25		X		20-6"	7.8		34	20	14	2.0	87.9
				50-12"							
30			Continued on Page 2								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-2
LOCATION: Amarillo, Texas

Date: 7-27-94 thru 7-30-94

Ground Elevation: 3793.86'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 195'
Mud Drilled to 235'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
30		X	Sandy Clay: Reddish Tan with Scattered Calcareous Nodules(CL) $K = 9.21 \times 10^{-6}$ cm/sec	50-6"	7.2		30	18	12		79.2
35		X		50-6"	6.3		33	16	17	3.0	81.6
40		X		50-5"	7.8		32	20	12		78.4
45		X	Sandy Clay: Reddish Tan with Scattered Calcareous Nodules, Stiff, Dry (CL)	39-6"	7.1		33	18	15		75.4
				50-6.5"							
50		X		50-6"	6.7		30	18	12		77.8
55		X		50-3"						4.0+	
			Caliche: Light Tan Limestone Layers, Fractures, Hard (CL)								
60			Continued on Page 3								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-2
LOCATION: Amarillo, Texas

Date: 7-27-94 thru 7-30-94

Ground Elevation: 3793.86'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 195'
Mud Drilled to 235'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
60				50-4"	5.2						33.1
65			Clayey Sand: Reddish Tan with Scattered Calcareous Nodules Stiff, Dry (SC)	41-6"	6.3		24	18	6		52.9
				50-6.5"							
70				50-4"	5.7		27	17	10	4.0+	43.6
75				50-6"	4.9		25	16	9	3.0	33.7
80				50-5"	4.3		23	19	4	4.0	29.1
85			K = 3.75 X 10^{-5} cm/sec	50-5"	3.9		25	17	8		29.5
90			Continued on Page 4								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-2
LOCATION: Amarillo, Texas

Date: 7-27-94 thru 7-30-94

Ground Elevation: 3793.86'

DRILLING METHOD: Air/Mud Rotary.

GROUNDWATER INFORMATION:
Air Drilled to 195'
Mud Drilled to 235'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
90			Clayey Sand: Reddish Tan with Scattered Calcareous Nodules(SC)	39-6"	4.4		24	18	6		27.3
				50-7"							
95				39-6"	4.7		20	15	5	3.0	26.4
				50-7"							
100				50-5"	3.2		21	17	4	3.5	15.9
105											
110				50-3"	4.7					4.0	25.4
115											
120			Continued on Page 5								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
Date: 7-27-94 thru 7-30-94

BORING NO.: PZ-2
LOCATION: Amarillo, Texas
Ground Elevation: 3793.86'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION:
Air Drilled to 195'
Mud Drilled to 235'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
120		X		40-6"	4.4					2.75	25.1
				50-7"							
125											
130		X	Clayey Sand: Reddish Tan with Scattered Calcareous Nodules, Stiff, Dry (SC)	50-6"	3.1		22	19	3	3.0	19.9
135											
140		X		50-5"	3.8		19	16	3		19.0
145											
150			Continued on Page 6								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
Date: 7-27-94 thru 7-30-94

BORING NO.: PZ-2
LOCATION: Amarillo, Texas
Ground Elevation: 3793.86'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 195'
Mud Drilled to 235'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
150		X	Clayey Sand: Reddish Tan with Scattered Calcareous Nodules(SC)	50-6"	3.2						15.0
155											
160		X		31-6"	2.7		18	16	2		16.6
				50-8"							
165											
170		X		50-3"	3.8						
175											
180											

Continued on Page 7

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-2
LOCATION: Amarillo, Texas

Date: 7-27-94 thru 7-30-94

Ground Elevation: 3793.86'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 195'
Mud Drilled to 235'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
180			Sand: Tan, Fine Grain with Scattered Calcareous Nodules (SC)	50-4"					NP		13.0
185											
190				50-3"	MD						12.2
195			Sand: Tan with Small Pea Gravel (GW)								
200				50-5"	MD						14.6
205			Sand: Tan, Fine Grain with Scattered Calcareous Nodules (SC)								
210											

DUESS-PETERSON TESTING LABORATORY, INC.

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-2
LOCATION: Amarillo, Texas

Date: 7-27-94 thru 7-30-94

Ground Elevation: 3793.86'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 195'
Mud Drilled to 235'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
210			Sand: Tan, Fine Grain with Scattered Calcareous Nodules (SC)	50-3"	MD				NP		
215											
220		X		50-2"	MD				NP		24.6
225											
230				50-3'	MD				NP		
235			* T.D. - 235' *								

DIESS-PETERSON TESTING LABORATORY, INC.

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City Of Amarillo

BORING NO.: PZ-3
LOCATION: Amarillo, Texas

Date: 8-22-94 thur 8-25-94

Ground Elevation: 3742.08'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 140'
Mud Drilled to 165'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
0											
5			Too Hard to Sample								
10			Caliche Cap: Very Hard Light Tan								
15			Too Hard to Sample								
20			Too Hard to Sample								
25				50-2"	5.4					4.0+	
30			Clayey Sand: Reddish Brown With Calcareous Nodules (SC)								

Continued on Page 2

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-3
LOCATION: Amarillo, Texas

Date: 8-22-94 thur 8-25-94

Ground Elevation: 3742.08'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 140'
Mud drilled to 165'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
30			Too Hard to Sample								
			Clayey Sand: Reddish Tan With Calcareous Nodules (SC)								
35		X		15-16"	4.6				NP	1.50	21.3
				42-12"							
				50-12"							
40		X		15-6"	4.1				NP		36.6
				37-12"							
				50-12"							
45		X		18-6"	4.0				NP		12.1
				50-12"							
50		X		10-6"	3.7				NP		9.1
				36-12"							
				50-18"							
55		X		32-6"	3.4		21	19	3	2.50	13.9
				50-9"							
60		X	Continued on Page 3								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-3
LOCATION: Amarillo, Texas

Date: 8-22-94 thur 8-25-94

Ground Elevation: 3742.08'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 140'
Mud Drilled to 165'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
60		X	Clayey Sand: Reddish Tan With Calcareous Nodules (SC)	36-6"	3.1				NP		15.9
65		X		39-6"	4.0					2.75	24.7
70		X		43-6"	3.8						23.1
				50-7"							
75		X		32-6"	3.0						24.3
				50-8"							
80		X		37-6"	2.8						15.2
				50-8"							
85											
90		X	Continued on Page 4								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-3
LOCATION: Amarillo, Texas

Date: 8-22-94 thur 8-25-94

Ground Elevation: 3742.08'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 140'
Mud Drilled to 165'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
90			Clayey Sand: Reddish Tan With Calcareous Nodules (SC)	19-6"	3.7				NP		10.1
				50-12"							
95											
100				50-5"	3.1		22	18	4		19.6
105											
110				44-6"	2.8				NP		12.1
115											
120			Continued on Page 5								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-3
LOCATION: Amarillo, Texas

Date: 8-22-94 thur 8-25-94

Ground Elevation: 3742.08'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 140'
Mud Drilled to 165'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
120		X	Clayey Sand: Reddish Tan With Calcareous Nodules (SC)	42-6"	3.0				NP		9.9
				50-9"							
125											
130		X		50-6"	1.8				NP		15.3
135			Sand: Tan (Well Sorted) Fine Grain With Pea Gravel (GW)								
140		X	Clayey Sand: Reddish Tan With Pea Gravel (SC)	12-6"	2.7		26	22	4		16.9
				50-12"							
145			Sand: Reddish Tan (Well Sorted) Fine Grain With Small Gravel (GW)		MD						
150			Continued on Page 6								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: PZ-3
LOCATION: Amarillo, Texas

Date: 8-22-94 thur 8-25-94

Ground Elevation: 3742.08'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 140'
Mud Drilled to 165'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT, PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
150			Clayey Sand: Reddish Tan With Occasional Small Pea Gravel (SC)		MD						
155											
160					MD						
165			*T.D. - 165'								

KLEINFELDER

1979 – Dyess – Peterson Testing Laboratory, Inc.

Logs of Borings No. 1 through No. 4
Location of borings unknown

LOG OF BORING

PROJECT: A Landfill for the City of Amarillo, Texas
CLIENT: City of Amarillo - % Pat Christal
BORING NO.: 1 & 2
LOCATION: As Directed by Pat Christal
Date: 9/27/79
Ground Elevation: Existing

Legend: Sample | Penetration | Water

Depth, Feet	Symbol	Sample	Description of Stratum
			BORING NO. 1
			Reddish Tan Silty & Clayey Sands (SM-SC)
5			Dk. Reddish Tan Silty Sand (SM)
10			
15			Dk. Reddish Tan Silty Sand (SM)
20			Lt. Reddish Tan Silty & Clayey Sands (SM-SC)
25			Dk. Reddish Tan Silty Sand (SM)
			Borings Nos. 1 & 2 were advanced to the 26-ft. depth without the use of drilling fluid. No groundwater or hard rock was encountered to the drilled depth.
			BORING NO. 2
			Brown Silty & Clayey Sands (SM-SC)
5			Lt. Reddish Silty & Clayey Sands (SM-SC)
10			
15			
20			Reddish Tan Silty Sand (SM)
25			

DYESS TESTING LABORATORY, Inc.

LOG OF BORING Texas

PROJECT: A Landfill for the City of Amarillo, BORING NO.: 3 & 4

CLIENT: City of Amarillo - % Pat Christal LOCATION: As Directed by Pat Christal

Date: 9/27/79 Ground Elevation: Existing

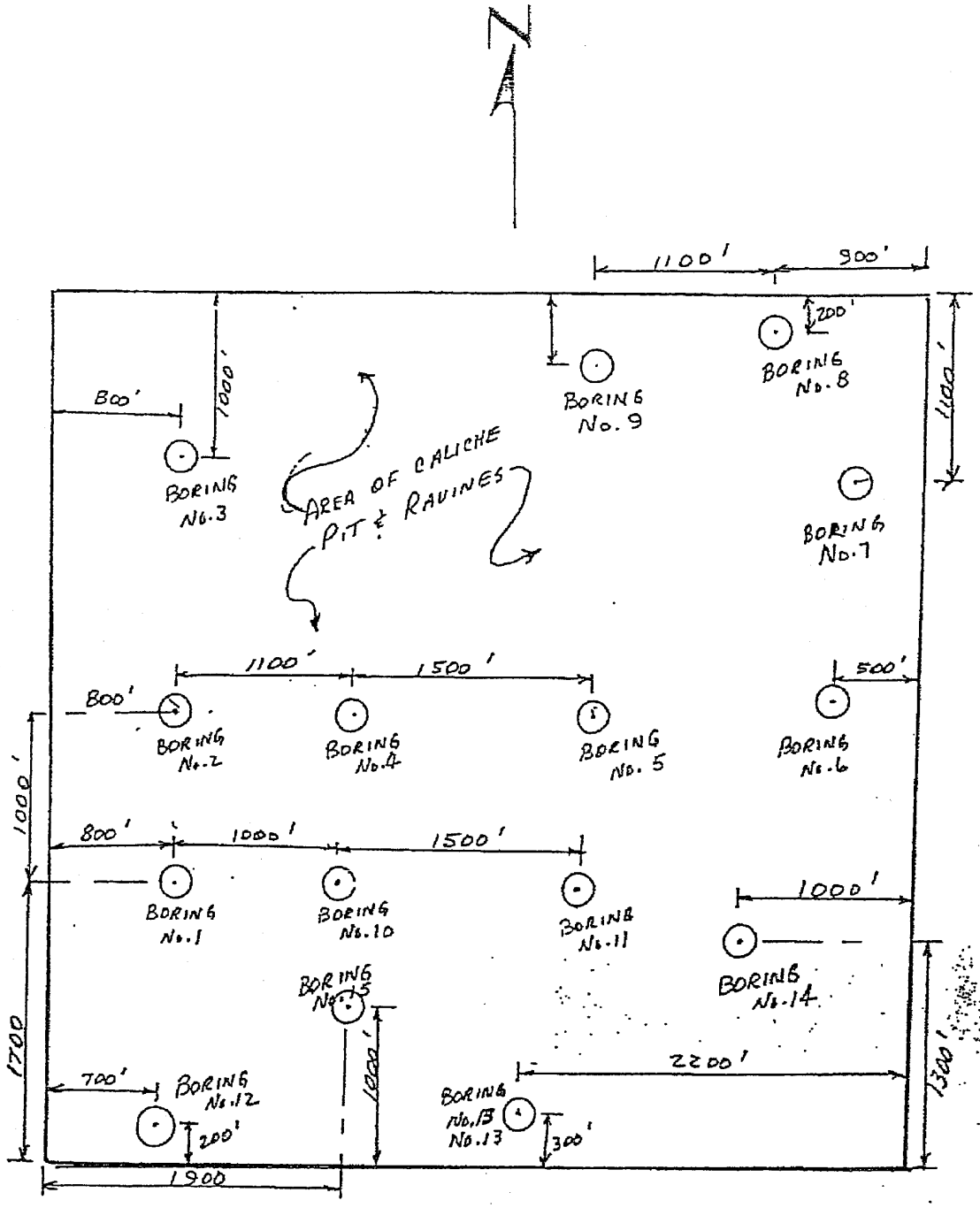
Legend: Sample | Penetration | Water

Depth, Feet	Symbol	Sample	Description of Stratum
			BORING NO. 3
			Dk. Brown Clayey Sand (SC)
5			Lt. Reddish Tan Silty & Clayey Sands (SM-SC)
			4" Limestone Rock
			Lt. Reddish Tan Silty & Clayey Sands (SM-SC)
10			Reddish Tan Silty Sand (SM)
15			
20			Lt. Reddish Tan Silty & Clayey Sands (SM-SC)
25			
			Borings No. 3 & 4 were advanced to the 26-ft. depth without the use of drilling fluid. No groundwater was encountered. Hard rock was encountered in both borings, in No. 3 @ 8' & in Boring No. 4 @ 18'
			BORING NO. 4
			Dk. Brown Sandy Clay (CL)
5			Brown Sandy Clay (CL)
10			Dk. Tan Sandy Clay (CL)
			Reddish Tan Silty Sand (SM)
15			Lt. Reddish Tan Silty & Clayey Sands
			4" Limestone
20			Lt. Reddish Tan Silty & Clayey Sands
25			

DYESS TESTING LABORATORY, Inc.

1975 – Dyess – Peterson Testing Laboratory, Inc.

Logs of Borings No. 1 through No. 15



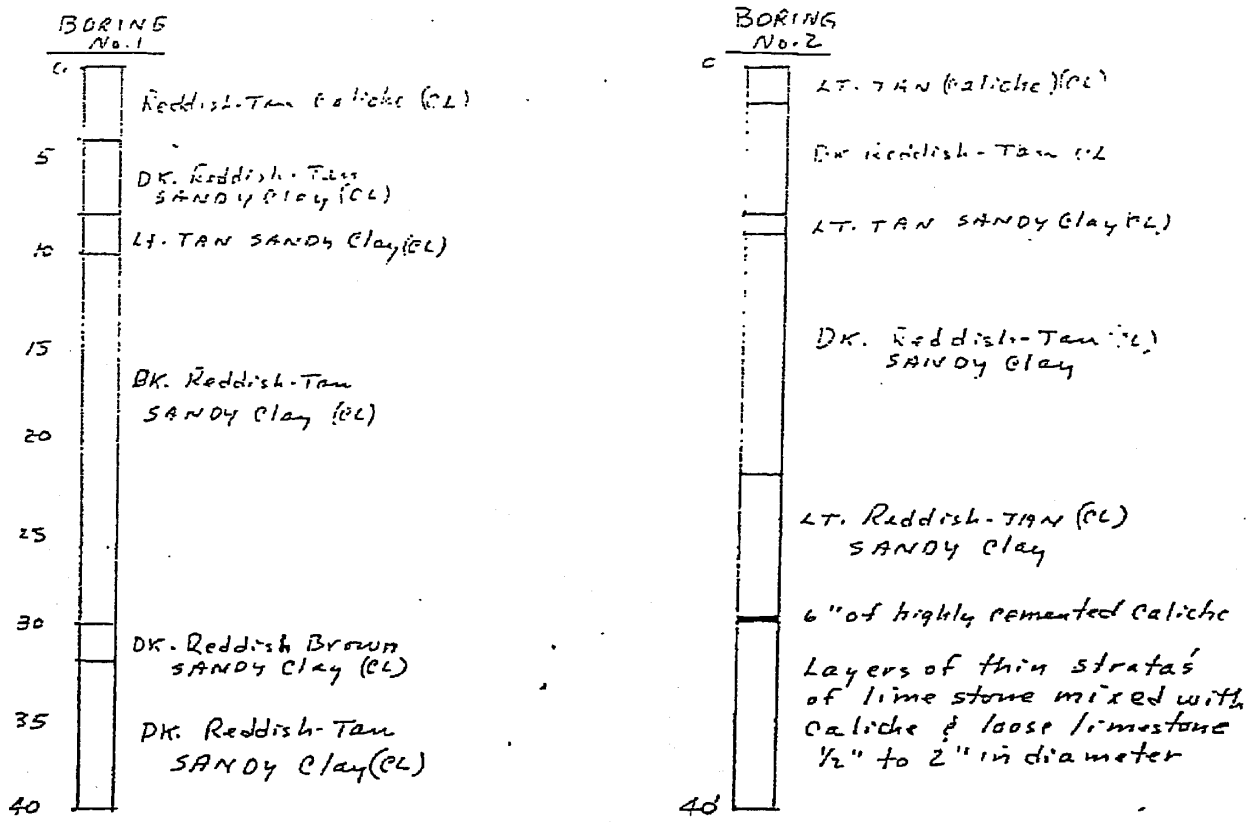
LOCATION OF BORINGS

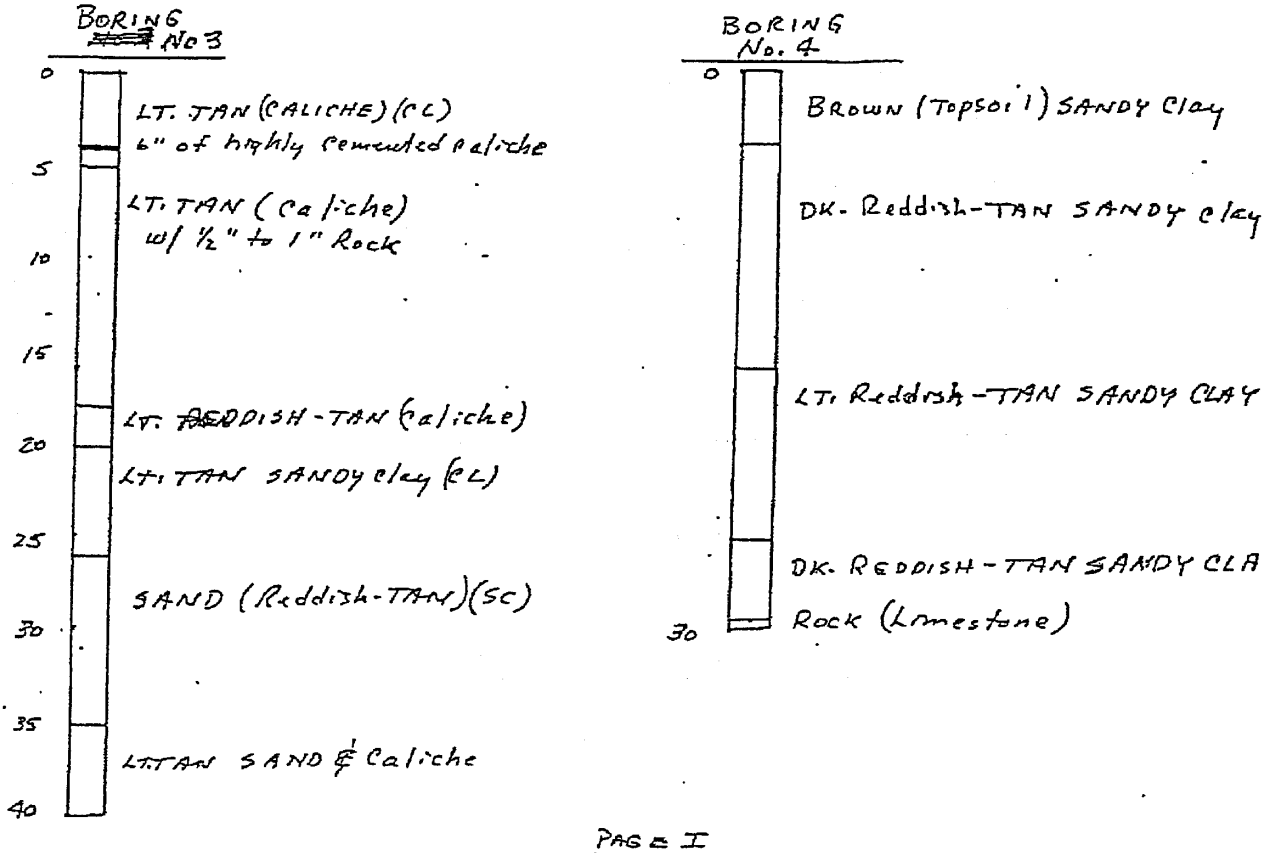
SECTION 126, BLOCK 9 - BS&F SURVEY

2/26/75

1" = 1000'

L.S OF BORINGS





LOG OF BORINGS

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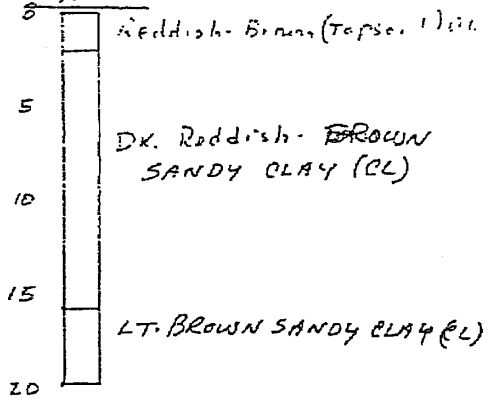

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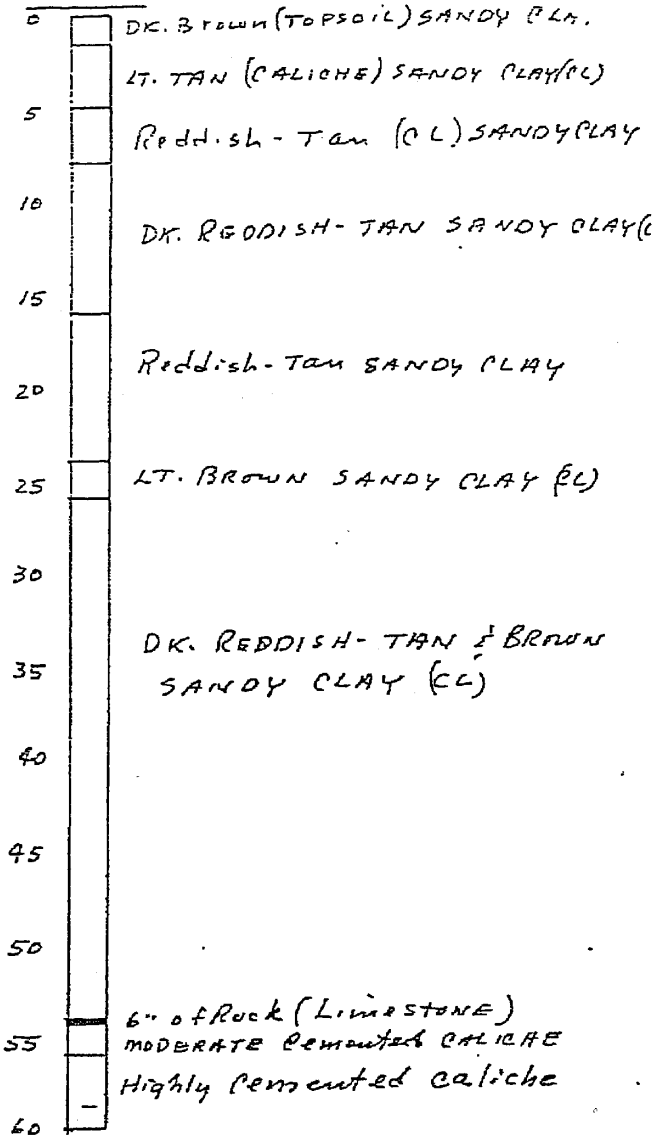

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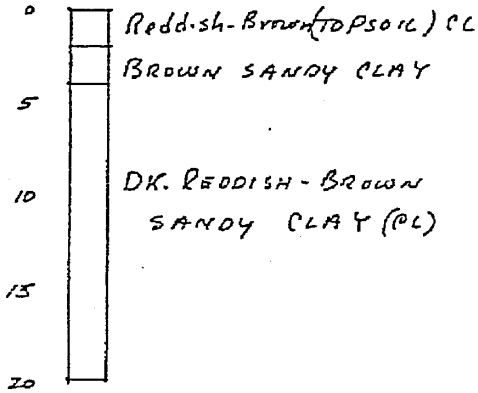

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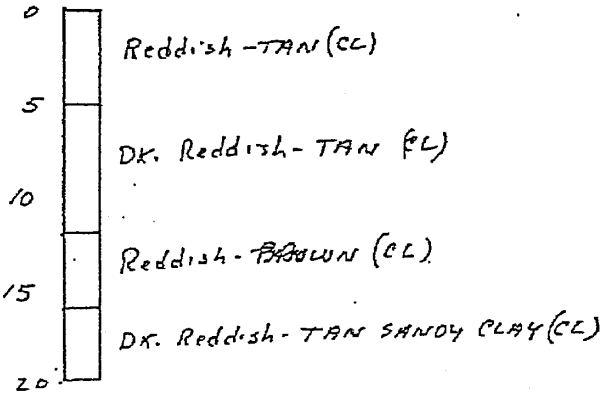

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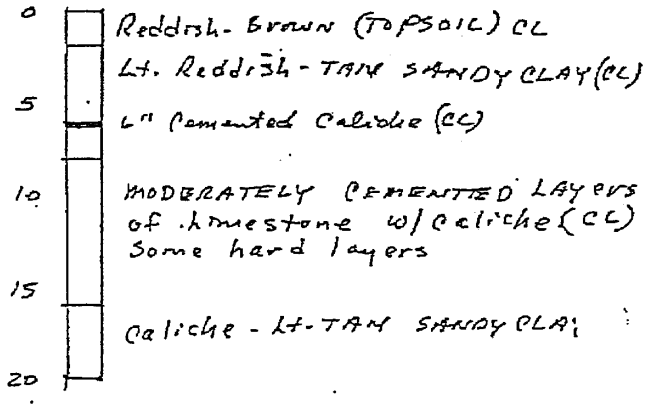
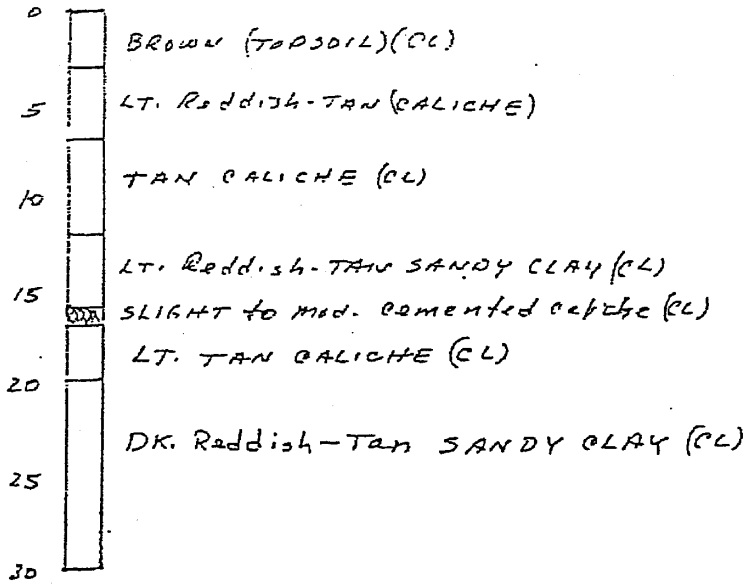
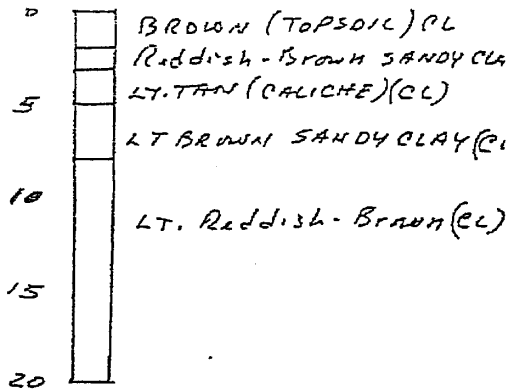


BORING
No. 10



BORING
No. 11



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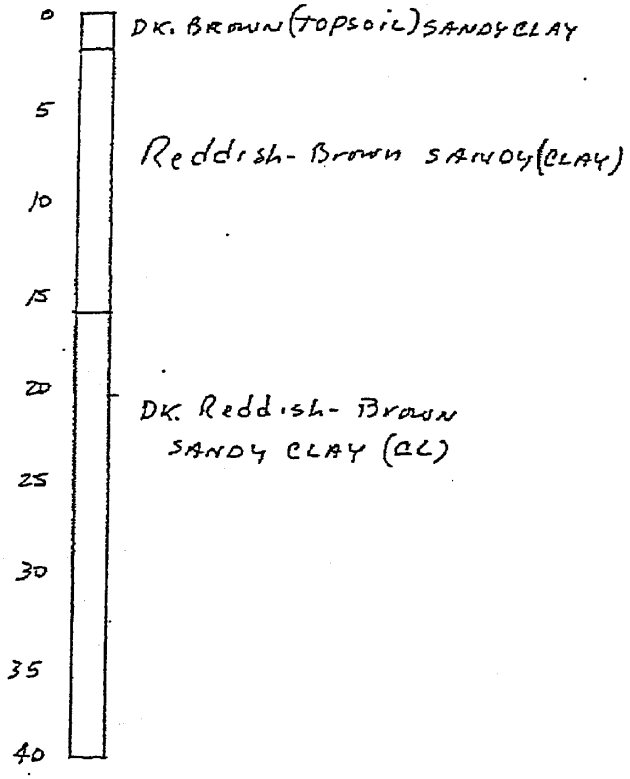
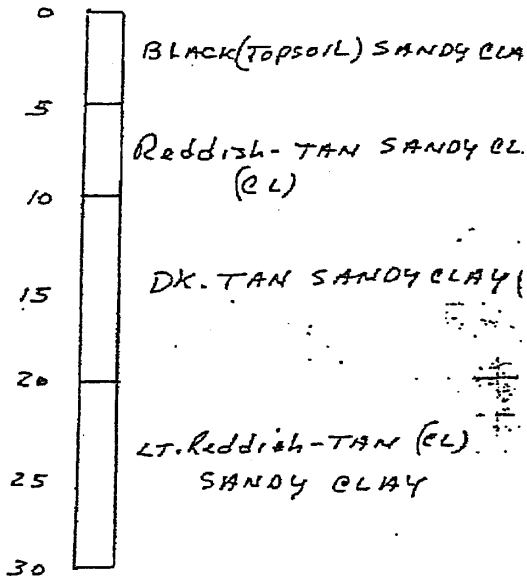
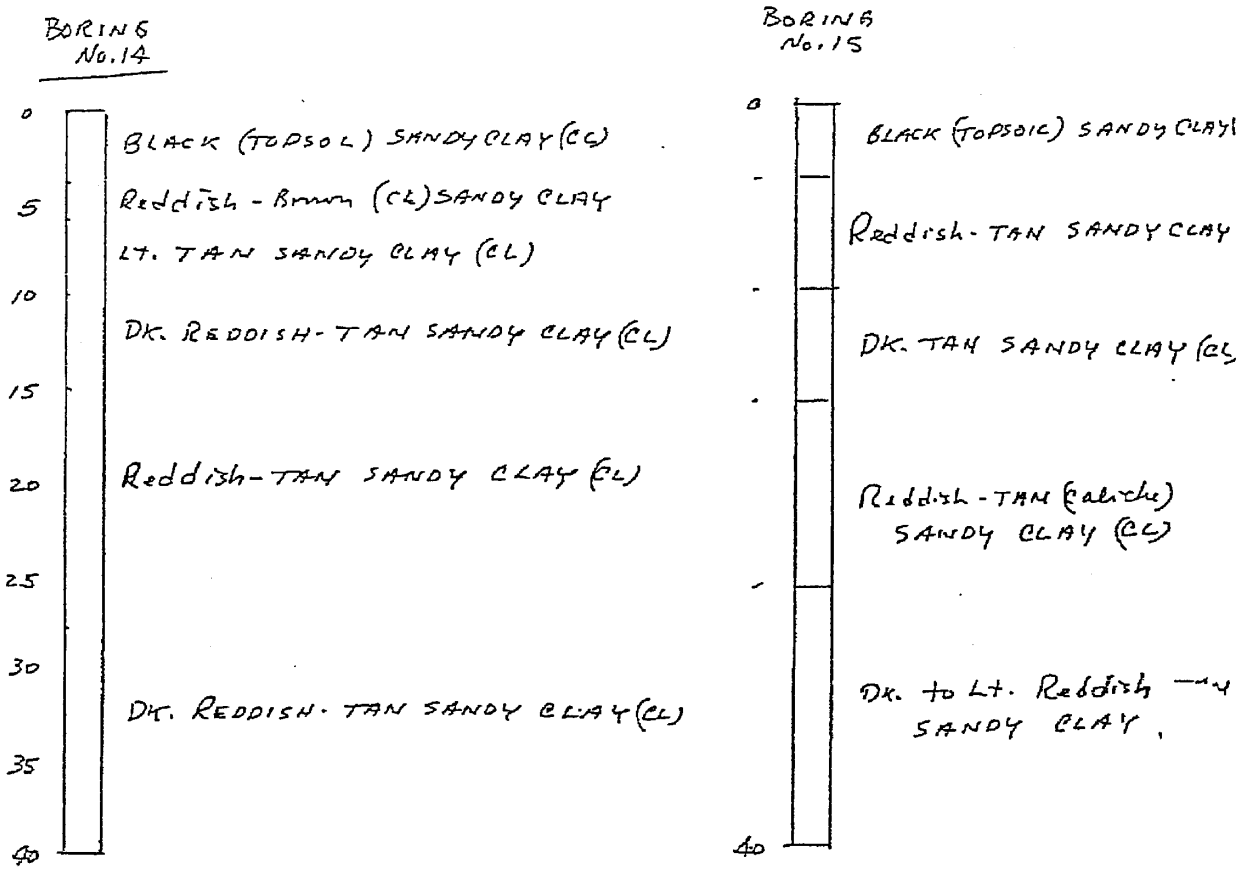


BORING
No. 13



LOG OF BORINGS



KLEINFELDER

APPENDIX 5A

1994 Limited Groundwater Characterization Investigation

LIMITED GROUNDWATER CHARACTERIZATION INVESTIGATION

CITY OF AMARILLO
MUNICIPAL SOLID WASTE LANDFILL PERMIT NO. 73
POTTER COUNTY, TEXAS

Prepared by:

HDR Engineering, Inc.
12700 Hillcrest Road, Suite 125
Dallas, Texas 75230
(214) 960-4400

December 1994

Brad A. McCardell
Geologist
12/15/94

CITY OF AMARILLO
MUNICIPAL SOLID WASTE LANDFILL PERMIT NO. 73
POTTER COUNTY, TEXAS

TABLE OF CONTENTS

1.0 INTRODUCTION

The City of Amarillo operates a Type I Municipal Solid Waste Landfill (MSWL) under permit No. 73 issued by the Texas Department of Health, dated March 17, 1975. This report presents data collected during a limited groundwater characterization investigation at the existing facility. In conjunction with the groundwater data, a soils investigation report has been prepared by Dyess-Peterson Drilling and Testing, Inc. (Amarillo, Texas). Both of these reports were prepared to satisfy the requirements of Attachments 4 and 5 in the Texas Natural Resource Conservation Commission (TNRCC) MSWL 30 TAC 330 regluations.

The purpose of this limited groundwater characterization investigation was to 1) drill, sample borings, and install monitor wells to assess subsurface soil and groundwater conditions, and 2) bring the facility into compliance with the MSWL regulations for groundwater monitoring. The monitor wells were installed in accordance with the HDR Engineering, Inc (HDR) plan entitled, Groundwater Monitoring System Plan, For City of Amarillo Municipal Solid Waste Landfill Permit No. 73, Potter County, Texas, dated August 31, 1993 and approved by Mr. Dick Smith of the TNRCC (letter, dated December 14, 1993).

2.0 BACKGROUND

2.1 Site Conditions

The permitted landfill consists of one square mile of property located approximately 4 miles west of the City of Amarillo and two miles north of Interstate 40 (Figure 1). Currently, approximately 80 - 90 acres of property have been developed as landfill. Landfilling is currently taking place near the center of the one square mile and consists of an areal fill method (Figure 2).

Prior to this investigation, 19 borings were drilled during two geotechnical investiagtions conducted in February 1975 and August 1979. These two investigations focused on characterizing the soil conditions for development of the landfill. A groundwater ivestigation was not performed during either of these previous investigations. These two investigations indicated that the site consisted of a sandy clayey top soil that is underlain by sandy clay, silty sand, clayey sand, and caliche to the total depth drilled of 50 feet.

2.2 Physiography and Topography

The site lies within the Southern High Plains (High Plains) physiographic region in theTexas Panhandle (Figure 3). The High Plains ecompasses approximately 22,000

square miles and extends eastward where it is defined by a sharp escarpment several hundred feet high (Cronin, 1971). The Southern High Plains form a relatively flat plateau that slopes toward the southeast at approximately 10 feet per mile. The surficial deposits consist mainly of clays and loams (Nativ, 1988) and also sandy and silty loams and fine sandy loams (Knowles, 1984). Figure 4 shows a distribution of soil types within Potter County, Texas.

Immediately to the north of the site is the Canadian River Basin, which has eroded much of the overlying surficial material and created essentially a large valley or canyon feature. Several tributaries branch off the main system creating valley and plateau features which gives rise to a much more pronounced relief in this area compared to areas farther south on the High Plains.

The site topography ranges from approximately elevation 3,700 feet on the northern section to approximately 3,800 feet on the southern section (Figure 5). The majority of the site is fairly flat with little relief. However, the northern section of the property is dissected by three main drainage features that divert drainage from the site to the north. These drainage features are most likely associated with the Canandian River Basin. The change in relief on the northern section of the site can be as much as 100 feet.

2.3 Climate and Precipitation

The High Plains area is essentially characterized as a semi-arid climate with an average mean precipitation ranging from 13 to nearly 20 inches annually (NOAA, No. 81, 1992). According to the data collected for a 30 year average, precipitation averages approximately 19 inches annually in the Amarillo area (TxDOT, 1993). The greatest amount of rainfall occurs during the months of May through July. In the High Plains area, evaporation rates typically range from 60 to 91 inches annually. This portion of Texas is typically windy with an average velocity of 15.5 mph in the winter months. The average annual wind velocity is 13.7 mph.

2.4 Area Well Survey

A review of agency files was conducted to locate existing wells in the area of the landfill. The agency search consisted of reviewing file records from the TNRCC, Texas Department of Water Resources, and the Texas Water Development Board (TWDB). At least 23 wells are reported. Of the 23 wells reported, 14 wells are within a one-mile radius of the site. Three of the 23 wells are located on the western portion of the landfill property. The first well, No. 07-56-301, is used by the landfill periodically to control dust on the access roads; the second well, identification unknown, is used as a source of potable water, and the third well, identification

unknown, is connected to a windmill that is not operational. Figure 6 shows the location of the wells relative to the landfill. Except for the wells on site, the remaining wells are used for irrigation purposes and draw water from the Ogallala Formation. One well (State No. 07-56-307) is also used as an observation well. This well is located just to the south of the landfill. Data from the TWDB indicates that the yields from these wells when they were installed ranged from 400 to 800 gallons per minute. Recent data is unavailable. Information for the wells found during the search is presented in Appendix A.

Water quality data collected from well No. 07-56-307 in 1980 indicated a total dissolved solids (TDS) concentration of 350 milligrams per liter (MGL).

3.0 REGIONAL GEOLOGY

3.1 Stratigraphy

The stratigraphy of the High Plains consists of deposits ranging in age from the Permian to Recent. In general, the deposits consist of sandstone, shales, limestones clays, sands, and windblown deposits of sands and clays near the surface. The primary water-bearing deposits in the High Plains area are usually from the Cretaceous and Tertiary deposits. Of these deposits, the Ogallala (Pliocene Age) and the Washita, Fredericksburg, and Trinity groups (Cretaceous Age) supply the majority of the usable water in the High Plains. The general stratigraphy for the area is summarized in Figure 7.

In the vicinity of the Amarillo area, the Jurassic and Cretaceous deposits are absent. The stratigraphy consists in general of the Ogallala Formation unconformably overlying rocks of Triassic and Permian Ages (Nativ, 1988). In the Amarillo area, the Ogallala Formation specifically overlies rocks of Triassic age (Figure 8). Directly overlying the Ogallala are deposists consisting primarily of silty sands, fine sands, clays, and loams of the Blackwater Draw Formation that have been deposited by either wind or fluvial deposition. Near the top of the Ogallala Formation, caliche is typically encountered which is usually referred to as the "Caprock". The caprock forms an east facing escarpment toward the eastern most extent of the High Plains area. Triassic deposits are exposed north of Amarillo along the Canadian River Basin where the Canadian River has eroded the overlying Ogallala Formation. The thickness of these deposits has been measured upto 150 feet along portions of the Canadian River valley. The Triassic deposits are of continental origin (Cronin, 1971) and have been named the "Dockum Group" and typically consist of varicolored shale to sandy shale, sandstone, and conglomerate. Depending on the location within the High Plains, the Dockum Group can be subdivided into at least three formations consisting of 1) Tecovas Formation (basal member), 2) Santa Rosa Formation (middle member), and

3) Chinle Formation (upper member). The Triassic deposits also are typically referred to as the "redbed" because of their reddish color throughout the section.

3.2 Depositional History

According to Seni (1980), the Ogallala Formation was deposited in a deltaic environment as a series of overlapping alluvial fans derived from deposits from the uplift of the southern Rocky Mountains to the west. Figure 9 shows a generalized depositional facies map of the Ogallala. Prior to the deposition of the Ogallala, streams originating from the west eroded the existing Permian, Triassic, Jurassic, and Cretaceous strata forming valleys and basins. The erosion of these strata occurred until at least late Miocene to early Pliocene at the time when the climate was arid.

The Dockum Group is of continental origin and is believed to have been deposited as river-channel and flood-plain deposits (Cronin, 1971). Seni, 1988 indicates the depositional setting involved braided and meandering streams, alluvial fan deltas, lacustrine deltas, lacustrine systems, and mud-flats. These deposits were laid down in a basin feature that underwent folding prior to and after deposition. The resultant surface of the Triassic deposits was one of valleys and basins.

3.3 Structure

The site lies within the northern portion of the Palo Duro Basin, which is considered a small subbasin to the Permian Basin of southwest Texas (Gustavson and others, 1981). To the northeast is the Amarillo uplift and to the south is the Matador Arch. The uplifts are thought to have occurred as the result of movement along high-angle reverse faults. Faulting within the region created displacement of small blocks which in turn formed subbasins, such as the Palo Duro Basin and others in this area. Figure 10 shows a generalized structure map of the region.

4.0 REGIONAL HYDROGEOLGOY

4.1 Ogallala Formation

The Ogallala Formation (also called the High Plains aquifer) is the major aquifer of the High Plains area. In Texas, the areal extent of the Ogallala is approximately 111,000 square kilometers (Figure 11). The Ogallala consists primarily of fluvial unconsolidated clastic depostis of sand, silt, clay and basal gravel. As discussed in Section 3.2, the Ogallala was deposited as a series of overlapping alluvial fans or lobes. Seni, 1980 describes three distinct fan lobes consisting of 1) Dalhart-Amarillo, 2) Clovis-Plainview, and 3) Brownfield-Lubbock. The site lies within the Dalhart-Amarillo fan lobe.

Throughout much of the High Plains, the Ogallala Formation is unconfined (water table conditions). In the Amarillo area, the depth to groudwater is approximately 200 to 230 feet below ground surface and the saturated thickness ranges from 0 (near the Canadian Breaks) to approximately 100 feet (Mcreynolds, 1990). The Canadian River Basin as well as withdrawal of groundwater are controlling factors on the depth and saturated thickness. The regional groundwater flow direction is toward the south-southeast (Figure12) which is controlled by the structure of the High Plains. The rate of movement is on the order of 60 to 150 feet per year. The rate of movement is controlled by the gradient (approximately 0.008 ft/ft) and permeability of the material in the saturated zone. According to data presented by Knowles and others, 1984, transmissivities in the Ogallala range from approximately 315 to 201,000 gallons per day per foot (gpd/ft) with an average of 30,400 gpd/ft. In the Amarillo area, the transmissivities have been calculated to range from 6,000 to 7,000 gpd/ft (Cronin, 1971). The data presented by Cronin is in agreement with aquifer test data published by the Texas Water Development Board, Report 98 for wells in nearby Randall County. The hydraulic conductivity can range from several hundred to over 1,000 gallons per day per square foot (gpd/ft^2). Based on data published by Nativ, 1988, from an aquifer test conducted near the Randall/Potter County line, the hydraulic conductivity was approximately less than or equal to 200 gpd/ft^2.

Recharge to the Ogallala Formation is usually small. According to data published by Knowles and others, 1984, an average of less than 0.2 inches of water reaches the water table as natural recharge. Areas where natural recharge is the highest are usually associated with where the Ogallala outcrops and caliche layers are absent, through Quaternary deposits that overlie the Ogallala, and potentially along river channels of flowing streams.

Discharge from the Ogallala occurs through natural outlets such as seeps and springs or as leakage to the underlying formations (Nativ, 1988). Similar chemical composition between the Ogallala aquifer and underlying formations that the Ogallala is in contact with suggest that flow between the Ogallala and deeper aquifers does occur. Pumping, however accounts for the greatest amount of discharge from the Ogallala.

4.1.1 Water Quality

The water quality of the Ogallala aquifer is acceptable for numerous applications. Generally, the concentrations of total dissolved solids and chloride increase from north to south on the High Plains. This is usually caused by a thinning of the aquifer and its shallower depths which make it susceptible to surface contamination from various activities. Total dissolved solids (TDS) in the Amarillo area as reported by Nativ, 1988 and Knowles and others, 1984 indicate that TDS are around 400 milligrams per liter (mg/L). Chemical data collected in August 1980 from well 07-56-307 , located just

south of the site, indicated a TDS and chloride concentration of 350 and 7 mg/L, respectively. More recent data collected in September 1988 from well 06-49-101, located approximately one mile east of the site, indicated TDS and chloride concentrations of 321 and 4 mg/L, respectively. These values are well within acceptable drinking water limits.

4.2 Dockum Group

The Dockum Group is divided into at least three distinct formations. The lowermost or basal formation is the Tecovas Formation that consists of shales and clays. In localized areas the Tecovas contains lenses of fine-grained sandstone and conglomerates. The middle member is the Santa Rosa Sandstone, which is the major water-producing unit within the Dockum Group. The Santa Rosa consists of fine to coarse-grained, cross-bedded sandstone and conglomerate with interbedded shale and clay (Knowles and others, 1984). The upper formation is the Chinle Formation that consists of clays and shales. In certain areas of the section, thin layers of micaceous sandstone and conglomerate are present, which can yield small quantities of water.

The water-bearing formations of the Dockum Group are under confined conditions, except where the formation outcrops toward the east and Canadian River Basin. Groundwater flow is generally toward the east-southeast direction. Over most of the High Plains, the Dockum Group is not in hydraulic communication with the overlying Ogallala or the Cretaceous Edwards/Trinity Group. This is because of the potentiometric head difference between the Dockum Group and overlying aquifers. Also, the chemical makeup of the water between the aquifers indicates that hydraulic connection is not occurring. In the Amarillo area, the head difference between the Ogallala and underlying Dockum Group is approximately 200 feet (Dutton and others, 1986 and Nativ, 1988). Other areas within the High Plains suggest hydraulic interconnection. Recharge to the Dockum Group is negligible and according to data published by Dutton and others, 1986 it may be as low as 0.188 inches per year. Dutton and others, 1986 suggest that recharge to the Dockum Group may come from the overlying Ogallala and Edward/Trinity Formations where a downward component of flow occurs. Recharge from precipitation on the outcrop is also believed to be negligible (Dutton and others, 1986).

Water quality within the Dockum Group tends to be variable depending on it's location, but generally is considered poor because of mineralization.

5.0 SITE CONDITIONS

5.1 Groundwater Level Measurements

The groundwater encountered on site is from the Ogallala Formation. No perched groundwater above the saturated zone of the Ogallala was encountered during the drilling program. Groundwater was encountered in the eleven borings ranging from approximately 143 to 148 feet below ground surface (bgs) on the northern portion of the site to approximately 205 to 215 feet bgs on the southern portion of the site. Groundwater level measurements have been collected in the monitor wells since July 1994. Since September 20, 1994, water level measurements have been collected once a week. Table 1 summarizes the post-development stabilized groundwater elevations from July to December 7, 1994. Groundwater elevations range from approximately 3,614 feet in MW-5 to approximately 3,590 feet in MW-1 through MW-3. Hydrographs for the wells are shown on Figures 13 and 14. Except for two measurements for P-3 on October 5 and 12, 1994, the water level readings are fairly consistent for all of the wells. The two measurements for P-3 are believed to be measurement errors. The groundwater elevations are in agreement with the data in the Hydrologic Atlas for Potter County, Texas, published by the High Plains Underground Water Conservtion District No. 1 (HPUWCD).

5.1.1 Groundwater Flow and Gradients

Groundwater level measurements for three dates, September 28, October 12, and October 26, 1994 are plotted on Figures 15 through 17). The data indicates that the groundwater flow is toward the southwest in the northern portion of the site and then becomes more southerly toward the southern portion of the site. Groundwater flow on the southern portion of the site is in good agreement with regional maps from the HPUWCD. The gradient in the northern portion of the site ranges from approximately 0.005 to 0.007ft/ft, and in the southern portion of the site the gradient is approximately 0.003 ft/ft. Variations in the gradient for the Ogallala are not uncommon because of the depositional history of the formation. Since the Ogallala was deposited on an irregular surface consisting of valleys and ridges, the thickness of the formation is not uniform which can cause variations in the hydraulic properties. In addition, groundwater withdrawal from pumping can also cause variations in the gradient and flow direction over time.

5.2 Aquifer Testing

On September 20 and 21, 1994, Slug tests were conducted in wells MW-2, MW-3, MW-6, P-1, P-2, and P-3 to estimate the horizontal hydraulic conductivity. The procedure involved lowering a submersible pump in the wells and pumping them for

approximately one hour. The discharge rate was checked periodically during pumping. After one hour the pump was shut off and the water level recovery was measured using an electric well sounder and a Hermit 2000 data logger. The rate of recovery was measured until the water level was nearly equal to the static level prior to pumping. The data was analyzed using Hvorslev's Method G, Bouwer and Rice (1976), and an equilibrium well equation (Driscoll, 1986). Table 2 summarizes the results of the slug tests. The data and calculations are presented in Appendix B.

The results of the hydraulic conductivity using the Bouwer and Rice method range from approximately 6.58 x 10^{-4} centimeters per second (cm/sec) in well MW- 3 to approximately 1.47 x 10^{-3} cm/sec in well P-1. The results using the Hvorslev method range from approximately 1.80 x 10^{-4} cm/sec in well MW-3 to approximately 3.77 x 10^{-2} cm/sec in well P-1. The two methods show comparable results. When the two methods are averaged, the hydraulic conductivity ranges from 4.52 x 10^{-4} cm/sec in well MW-3 to 1.96 x 10^{-2} cm/sec in well P-1. These average values are in the range of fine-grained sand to silty sand mixtures. An equilibrium equation (Driscoll, 1986) was also used to compare the results. The results from the equilibrium equation are comparable to the other two methods.

5.3 Estimated Groundwater Velocity

Based on the slug test values for the two methods, an estimated rate of groundwater movement can be calculated using a variation of Darcy's equation. Using an effective porosity of approximately 30 percent and a hydraulic gradient of 0.006 ft/ft calculated for the northern portion of the site and 0.003 ft/ft for the southern portion of the site, the flow velocity ranges from approximately 20 to 50 feet per year.

$$K = \frac{K\,i}{n}$$

K = Hydraulic Conductivity, 2.01 x 10^{-3} (north) 5.54 x 10^{-3} (south), cm/sec
i = Hydraulic Gradient, 0.006 ft/ft (north), 0.003 ft/ft (south)
n = Effective Porosity, 0.30

TABLE 1

CITY OF AMARILLO
MUNICIPAL SOLID WASTE LANDFILL
PERMIT NO. 73

GROUNDWATER ELEVATIONS

DATE MEASURED

WELL NO.	ELEVATION (FT) TOC	7/26/94	8/9/94	8/10/94	8/15/94	8/17/94	8/19/94	8/23/94	8/24/94	9/20/94
MW-1	3816.82	NA	NA	3599.07	3594.42	3592.22	NA	NA	NA	3590.24
MW-2	3809.54	3593.14	3593.04	NA	NA	3592.94	NA	NA	NA	3590.44
MW-3	3792.72	NA	3591.12	NA	NA	3592.17	NA	NA	NA	NA
MW-4	3750.26	NA	NA	NA	NA	3597.87	NA	NA	NA	3596.26
MW-5	3737.39	NA	NA	NA	NA	NA	NA	3617.34	3617.09	3613.78
MW-6	3750.40	NA	NA	NA	NA	NA	3603.90	NA	3603.88	3601.55
P-1	3812.31	NA	3596.96	NA	NA	3596.98	NA	NA	NA	3595.12
P-2	3797.95	NA	3597.49	NA	NA	3597.49	NA	NA	NA	3594.75
P-3	3746.34	NA	3545.88	NA	NA	3545.88	NA	NA	NA	3599.57

REFERENCES

1) Cronin, J. G., A Summary of the Occurrence and Development of Ground Water in the Southern High Plains of Texas, October 1971, Bulletin 6107, Texas Water Development Board.

2) Dutton, A. R. and others, Hydrogeochemistry and Water Resources of theTriassic Lower Dockum Group in the Texas Panhandle and Eastern New Mexico, 1986, Report of Investigations No. 161, Bureau of Economic Geology: The University of Texas at Austin.

3) Gustavson, T. C., Geology and Geohydrology of the Palo Duro Basin, Texas Panhandle, A Report on the Progress of Nuclear Waste Isolation Feasibiltiy Studies (1980), 1981, Geological Circular 81-3, Bureau of Economic Geology: the University of Texas at Austin.

4) Knowles , T. C. and others, Evaluating the Ground-Water Resources of the High Plains of Texas, Volume 1, Report 288, May 1984. Texas Department of Water Resources.

5) McReynolds, D., Hydrologic Atlas for Potter County, Texas, 1990, High Plains Underground Water Conservation District No. 1, Lubbock, Texas.

6) Nativ, R., Hydrogeology and Hydrochemistry of the Ogallala Aquifer, Southern High Plains, Texas Panhandle and Eastern New Mexico, 1988, Report No. 177, Bureau of Economic Geology: The University of Texas at Austin.

7) NOAA, Climatography of the United States No. 81, for 1961-1990.

8) Seni, S.J., Sand-Body Geometry and Depositional Systems, Ogallala Formation, Texas, 1980, Report No. 105, Bureau of Economic Geology: The University of Texas at Austin.

9) Texas Department of Transportation, Climate Data for Texas, September 1993.

10) Soil Survey of Potter County, Texas, USDA SCS, Feb. 1980.

TABLE 1 cont.

CITY OF AMARILLO
MUNICIPAL SOLID WASTE LANDFILL
PERMIT NO. 73

GROUNDWATER ELEVATIONS

DATE MEASURED

WELL NO.	ELEVATION (FT) TOC	9/28/94	10/5/94	10/12/94	10/19/94	10/26/94	10/31/94	11/9/94	11/16/94	11/23/94
MW-1	3816.82	3588.65	3590.32	3590.27	3590.32	3590.27	3590.22	3590.17	3590.22	3590.22
MW-2	3809.54	3587.34	3590.44	3590.44	3590.44	3590.44	3590.39	3590.39	3590.39	3590.34
MW-3	3792.72	3588.98	3590.12	3590.07	3590.12	3590.12	3589.97	3589.97	3590.02	3590.02
MW-4	3750.26	3595.69	3596.51	3596.56	3596.51	3596.66	3596.66	3596.76	3596.81	3596.91
MW-5	3737.39	3613.03	3613.84	3613.89	3613.84	3613.94	3613.99	3614.09	3614.24	3614.34
MW-6	3750.40	3601.06	3601.55	3601.55	3601.55	3601.50	3601.50	3601.50	3601.45	3601.45
P-1	3812.31	3594.51	3595.20	3595.01	3595.11	3595.16	3594.96	3595.01	3595.06	3595.11
P-2	3797.95	3594.11	3594.80	3594.75	3594.75	3594.80	3594.65	3594.65	3594.75	3594.75
P-3	3746.34	3599.24	3597.59	3597.54	3599.59	3599.54	3599.44	3599.44	3599.44	3599.49

TABLE 1 cont.

CITY OF AMARILLO
MUNICIPAL SOLID WASTE LANDFILL
PERMIT NO. 73

GROUNDWATER ELEVATIONS

DATE MEASURED

WELL NO.	ELEVATION (FT) TOC	11/30/94	12/7/94							
MW-1	3816.82	3589.92	3590.12							
MW-2	3809.54	3590.34	3590.24							
MW-3	3792.72	3590.02	3590.02							
MW-4	3750.26	3597.06	3597.06							
MW-5	3737.39	3614.39	3614.39							
MW-6	3750.40	3601.45	3601.40							
P-1	3812.31	3595.01	3594.65							
P-2	3797.95	3594.75	3594.65							
P-3	3746.34	3599.44	3599.39							

TABLE 2

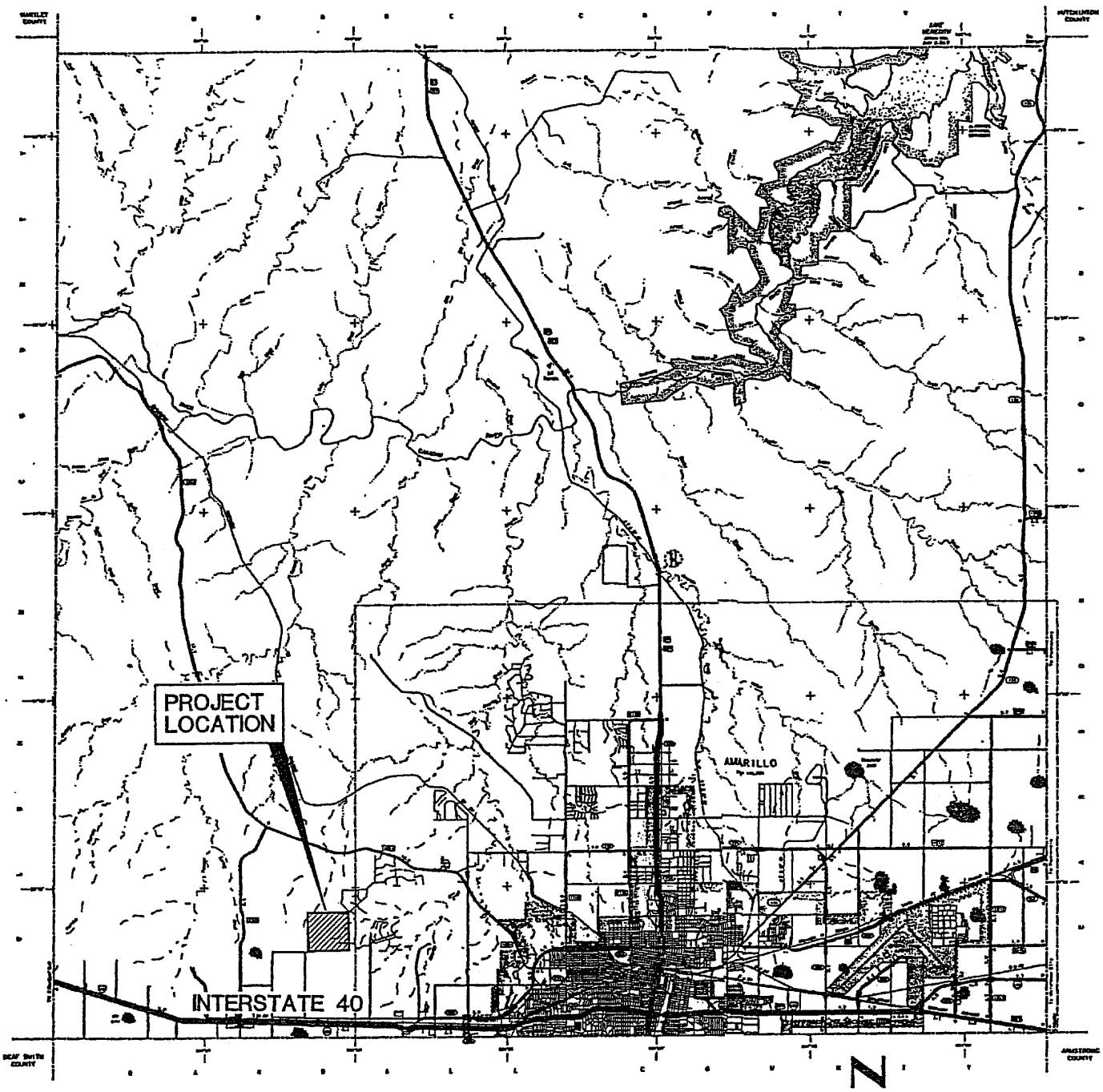
SUMMARY OF SLUG TESTING RESULTS

Well No.	Bouwer and Rice	Hvorslev Method G	Equilibrium Well Equation
MW-2	6.58×10^{-4}	1.32×10^{-3}	3.34×10^{-3}
MW-3	7.24×10^{-4}	1.80×10^{-4}	4.40×10^{-4}
MW-6	1.35×10^{-3}	1.33×10^{-3}	3.30×10^{-3}
P-1	1.47×10^{-3}	3.77×10^{-2}	-------
P-2	1.25×10^{-3}	1.03×10^{-3}	-------
P-3	1.09×10^{-3}	4.28×10^{-3}	3.77×10^{-3}

AVERAGE OF THE BOUWER AND RICE AND HVORSLEV METHODS

MW-2	9.89×10^{-4}
MW-3	4.52×10^{-4}
MW-6	1.34×10^{-3}
P-1	1.96×10^{-2}
P-2	1.14×10^{-3}
P-3	2.69×10^{-3}

All values reported in centimeters per second (cm/sec)



MAP SOURCE:
GENERAL HIGHWAY MAP,
POTTER COUNTY, TEXAS
1989

0 5 10
SCALE IN MILES

HDR

HDR Engineering, Inc.

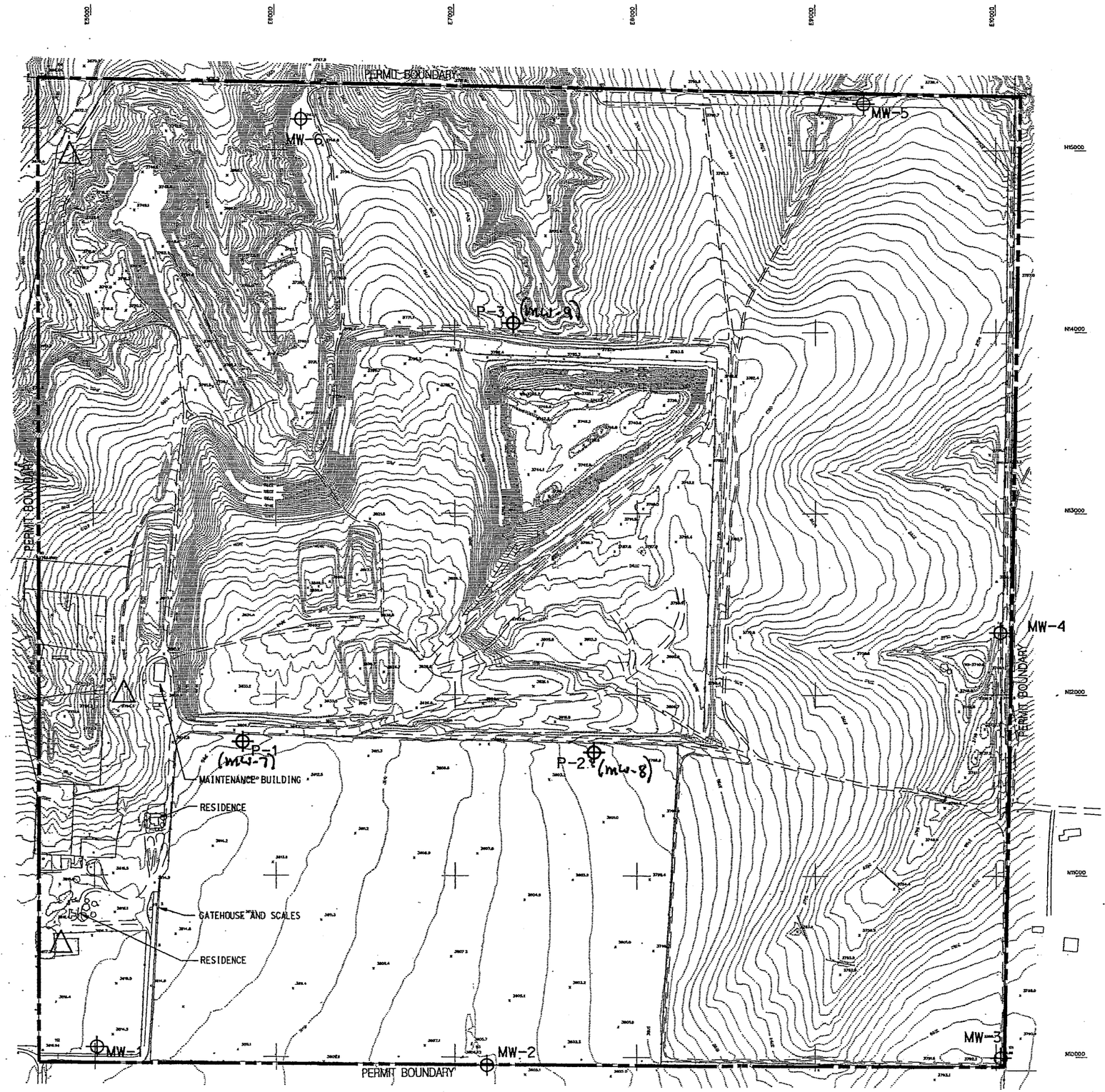
CITY OF AMARILLO, TEXAS
MUNICIPAL LANDFILL

VICINITY MAP

Date
11/94

Figure
1

FILENAME: E:\AMARILLO\DWG\AMAVMAP



N

0 300 600

SCALE IN FEET

LEGEND

- EXISTING WATER WELLS
- MONITOR WELL LOCATION
- PERMIT BOUNDARY

NOTES

1. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY UNITED AERIAL MAPPING, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED MARCH 9,1993. VERTICAL DATUM BASED ON MEAN SEA LEVEL. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO. COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.
2. PROPERTY BOUNDARY INFORMATION BASED ON BOUNDARY SURVEY DATA PROVIDED BY THE CITY OF AMARILLO.

HDR

HDR Engineering, Inc.

CITY OF AMARILLO
MUNICIPAL LANDFILL
PERMIT MODIFICATIONS

SITE MAP

Project Manager	T. HOTCHKISS
Designed	HDR
Drafted	HDR
Checked	
Project Number	06625-015-037
Date	DECEMBER, 1994 NOVEMBER, 1994

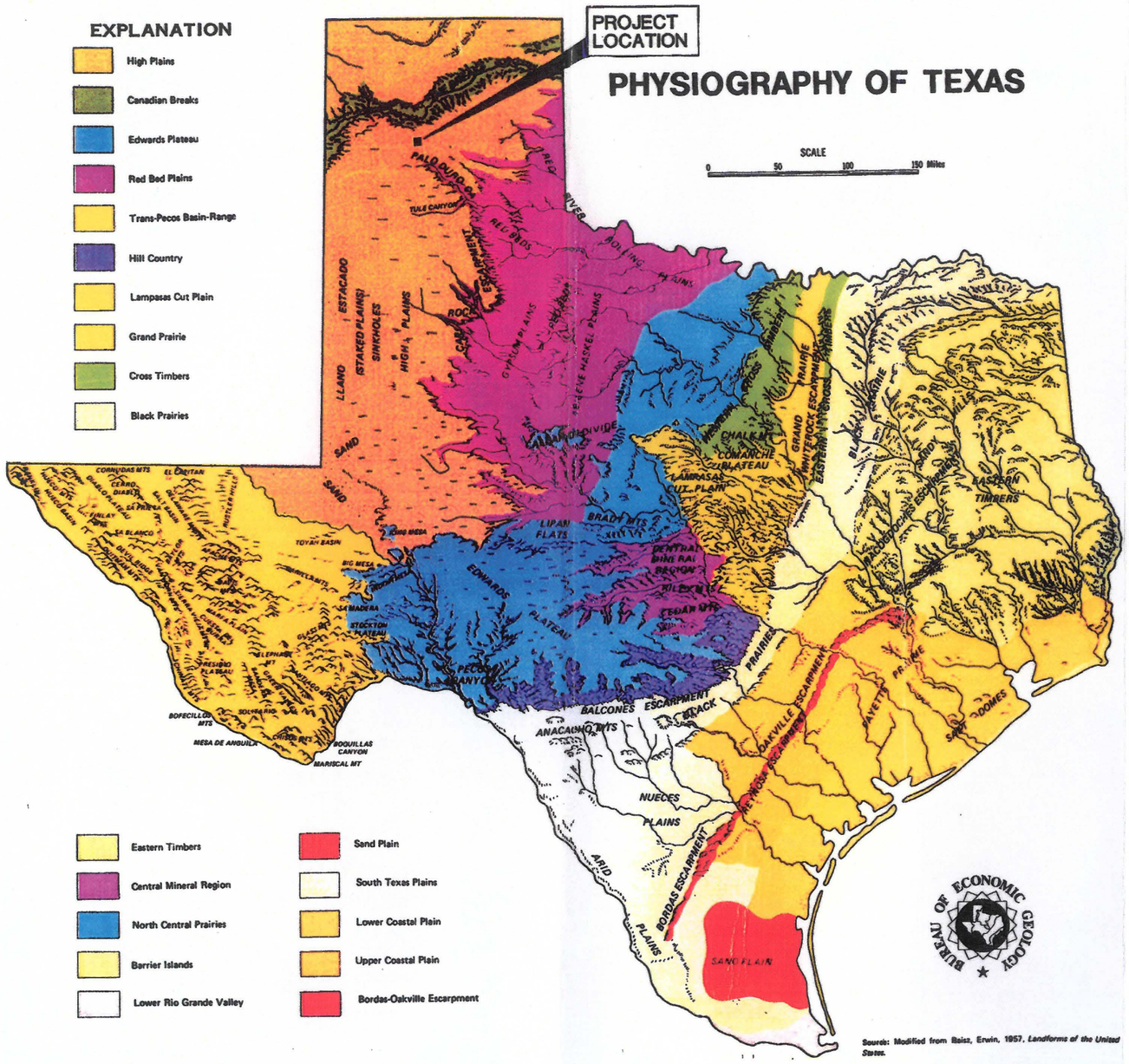
Figure III.5A.2

NOT FOR CONSTRUCTION

Drawing Number
Figure Number
2

FILE: p:\amarillo\subdmods\amsitema.dgn

PHYSIOGRAPHY OF TEXAS



Source: Modified from Raisz, Erwin, 1957, *Landforms of the United States.*

HDR
HDR Engineering, Inc.

CITY OF AMARILLO
MUNICIPAL LANDFILL

PHYSIOGRAPHIC MAP

Project Manager	T. HOTCHKISS
Designed	HDR
Drafted	HDR
Checked	
Project Number	06625-015-037
Date	NOVEMBER. 1994
Issue	

Figure III.5A.3

Figure Number 3

FILE: e:\amarillo\subdmods\amgwphys.dgn
DATE: 1-Dec-94 18:54

FILENAME: AMASOIL

HDR

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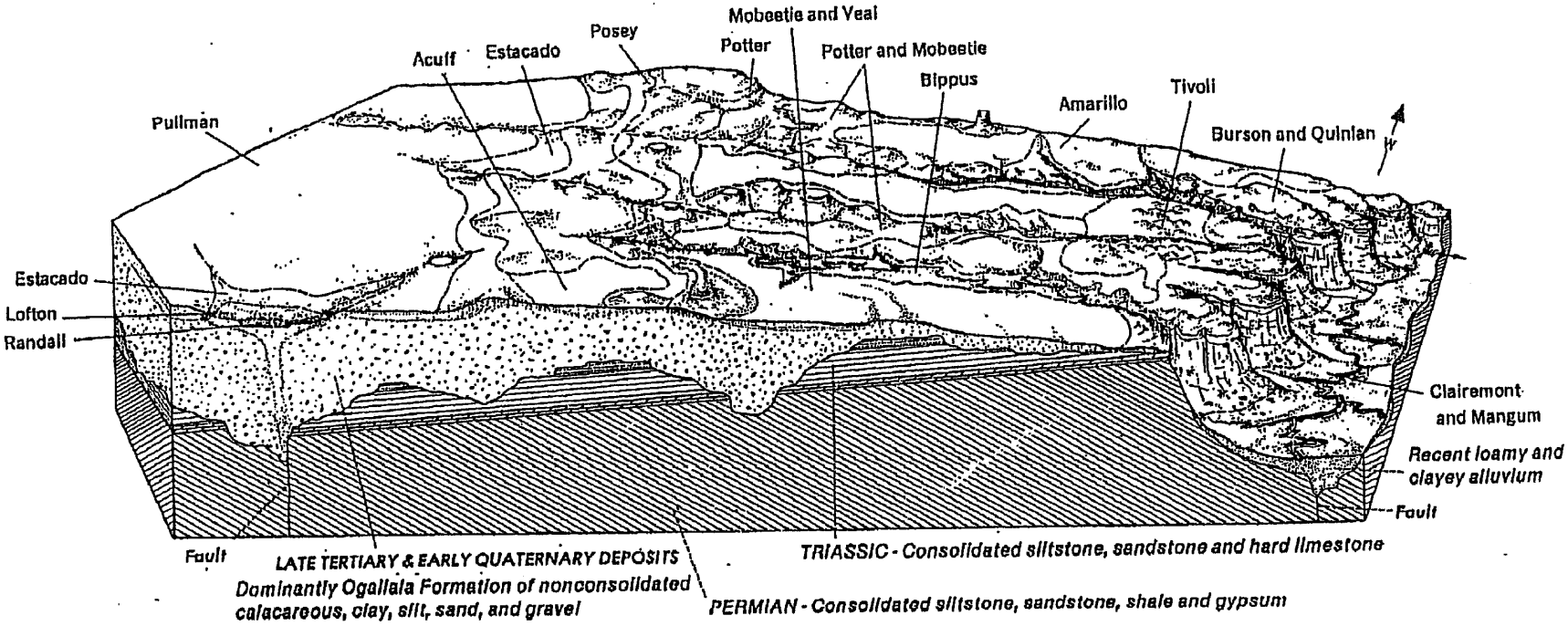
CITY OF AMARILLO, TEXAS
MUNICIPAL LANDFILL

DISTRIBUTION OF SOIL TYPES

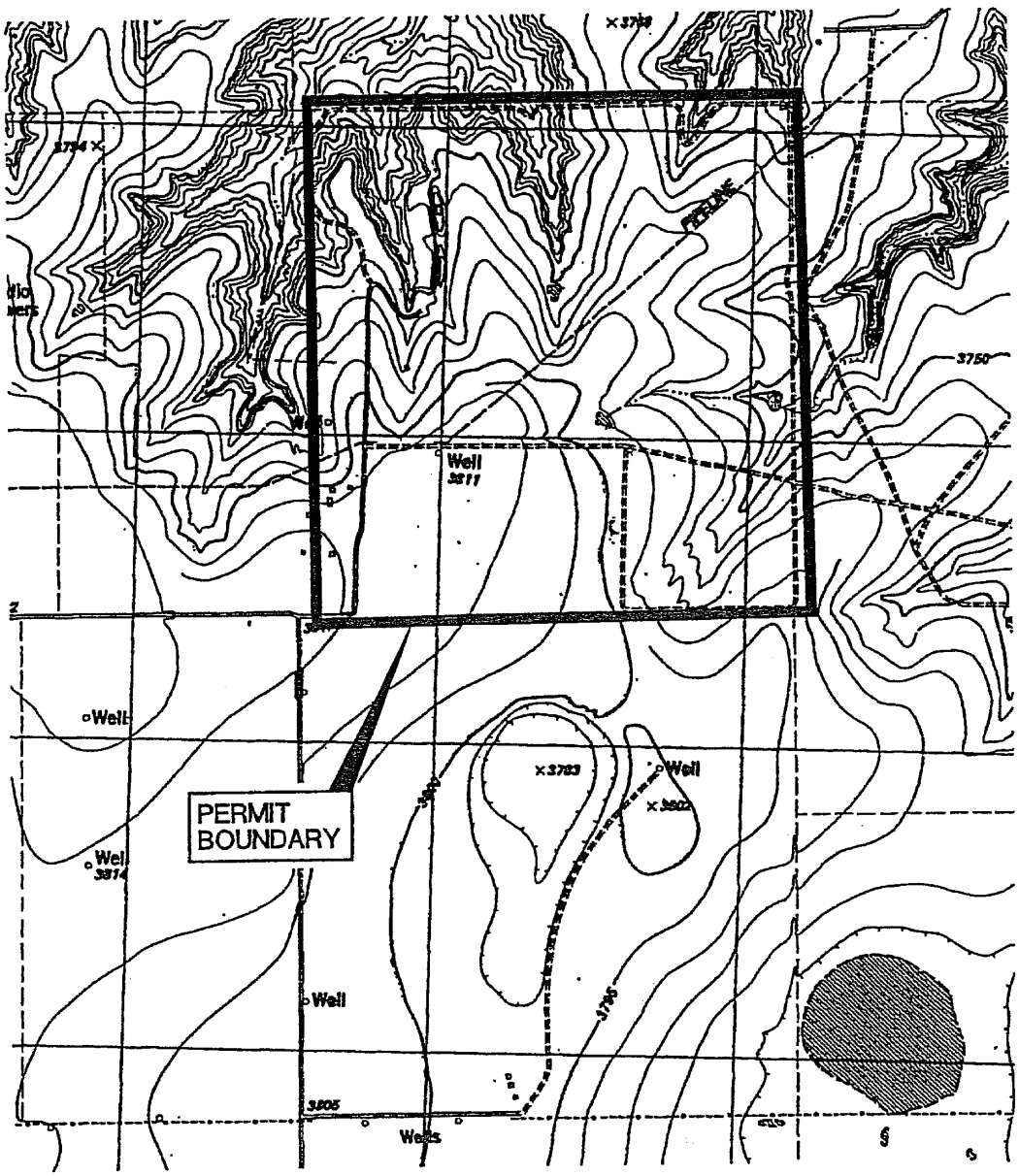
Date 11/94

Figure 4



Pattern of soils in Potter County.

MAP SOURCE:
UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL SURVEY OF POTTER COUNTY, FEBRUARY, 1980



MAP SOURCE:
USGS 7.5 MINUTE QUADRANGLE, BUSHLAND, TEXAS, 1984

0 2000 4000

SCALE IN FEET

HDR

HDR Engineering, Inc.

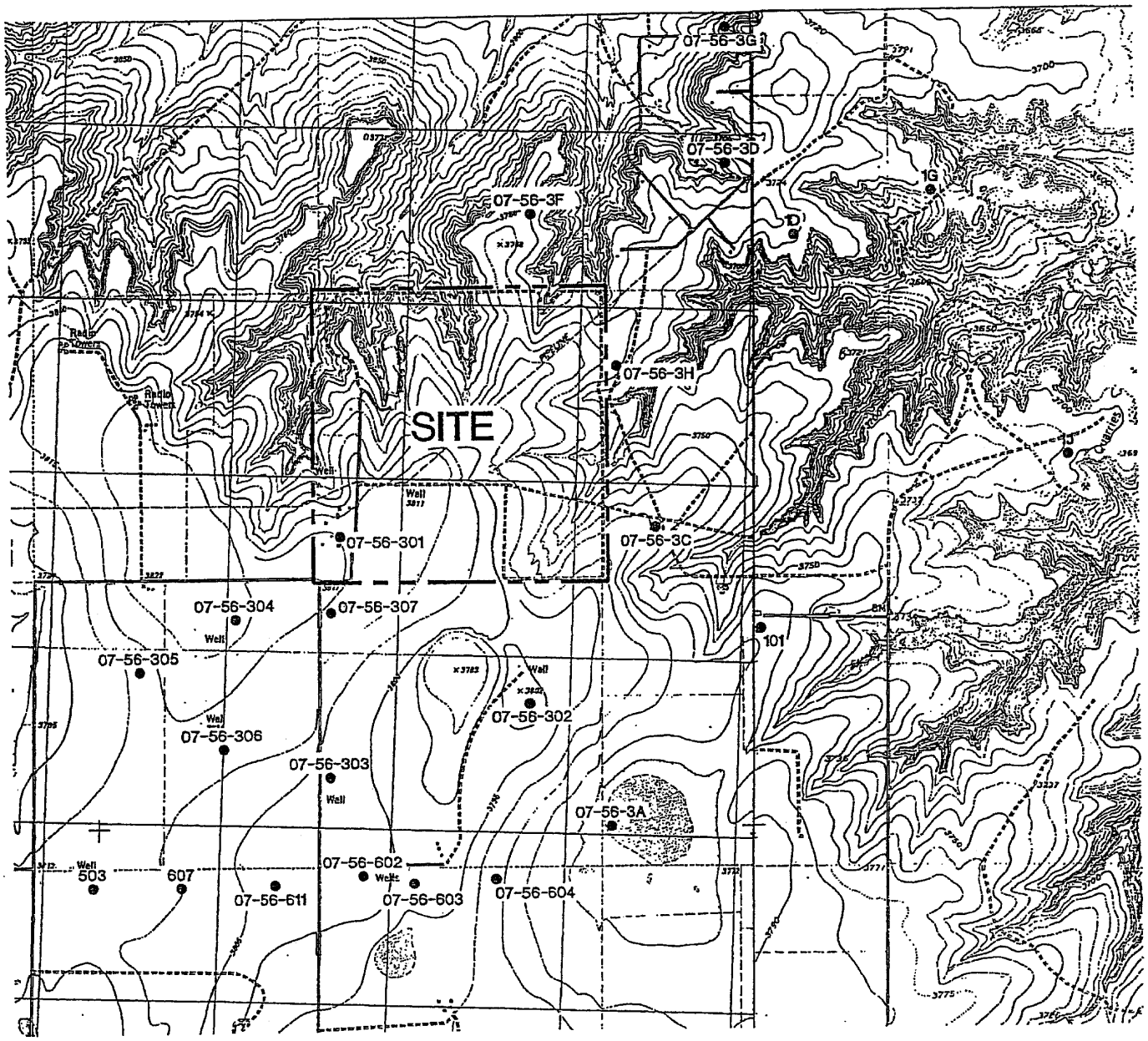
CITY OF AMARILLO, TEXAS
MUNICIPAL LANDFILL

TOPOGRAPHIC MAP

Date
11/94

Figure
5

FILENAME: E:\AMARILLO\DWG\AMATOPO



MAP SOURCES:
USGS 7.5 MINUTE QUADRANGLES
BUSHLAND, TEXAS, 1984
AMARILLO WEST, TEXAS, 1960
(PHOTOREVISED 1967 AND 1973)

0 3000 6000

SCALE IN FEET

HDR

HDR Engineering, Inc.

CITY OF AMARILLO, TEXAS
MUNICIPAL LANDFILL

AREA WELL SURVEY

Date
11/94

Figure
6

FILENAME: E:\AMARILLO\DWG\AMAWLDAT

FILENAME: AMAGNST

System	Series	Formation or Group	Thickness (feet)	Lithologic Description	Water Supply
Quaternary	Recent		0–15	Chiefly Windblown sand and silt.	Yields no water to wells. Sandy areas form excellent recharge facilities.
	Pleistocene		0–144	Sand, clay, diatomaceous earth, volcanic ash, limestone.	Mostly above water table. Does not yield large supplies.
Tertiary	Pliocene	Ogallala Formation	0–500	Fine to coarse sand and gravel; clay, silt, and caliche.	Yields large supplies of water throughout the Southern High Plains
Cretaceous		Not present in Amarillo area.	Unconformity		
Triassic		Dockum Group Tecovas Formation Santa Rosa sandstone Chinle Formation equivalent	150–1800+	Varicolored shale and sandy shale, gray or brown crossbedded sandstone and conglomerate.	Probably capable of yielding small to moderate supplies of water; most of the water is at least slightly saline.
Permian		Not present in Amarillo area.			

REFERENCE:
SENI, S.J.
SAND-BODY GEOMETRY AND DEPOSITIONAL SYSTEMS, OGALLALA FORMATION, TEXAS
REPORT NO. 105, 1980

HDR

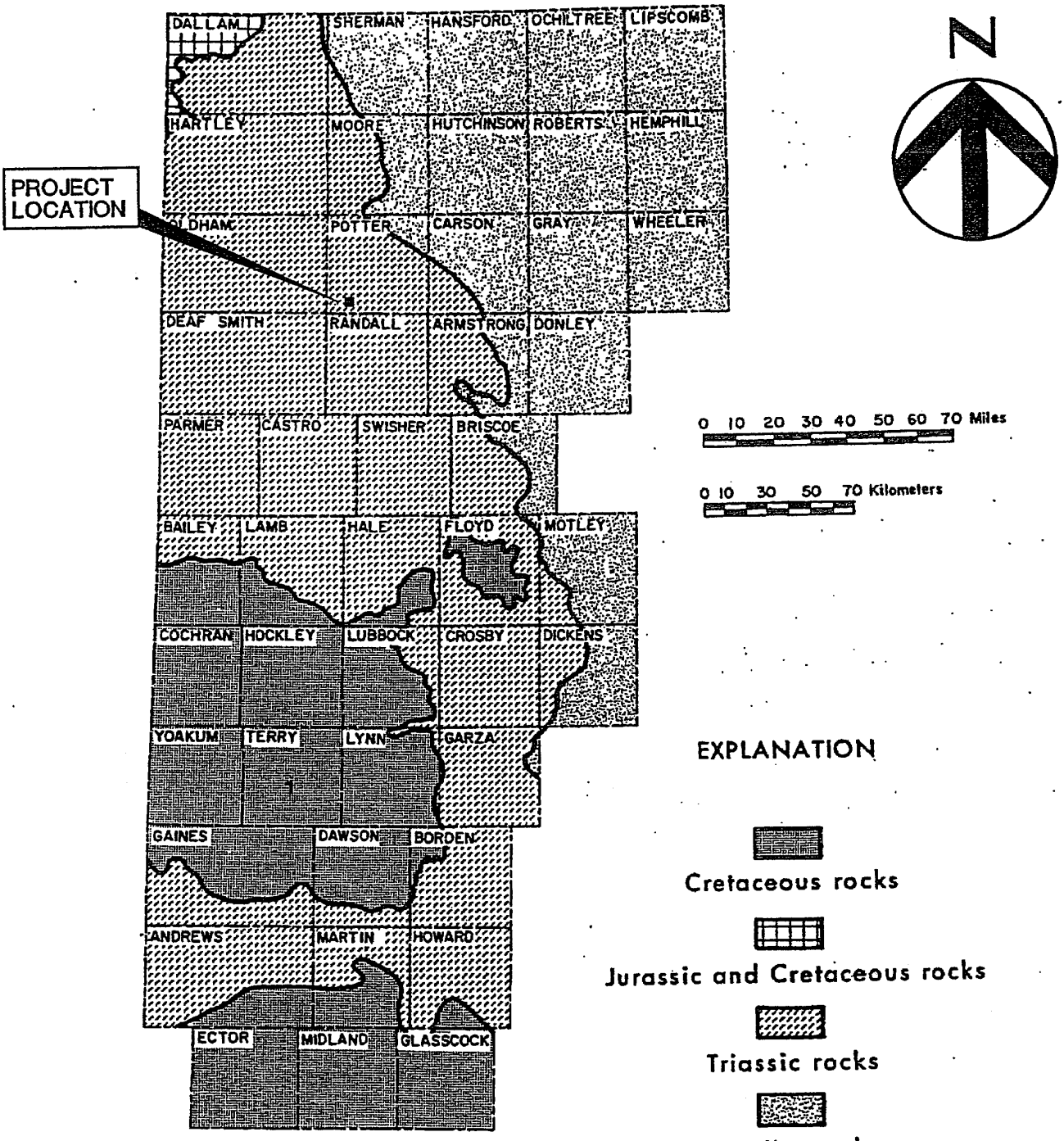
HDR Engineering, Inc.

CITY OF AMARILLO, TEXAS
MUNICIPAL LANDFILL

GENERALIZED STRATIGRAPHY

Date 11/94

Figure 7



MAP SOURCE:
EVALUATING THE GROUNDWATER RESOURCES OF THE HIGH PLAINS OF TEXAS,
REPORT 288, VOL. I, MAY, 1984.
TEXAS DEPARTMENT OF WATER RESOURCES

HDR

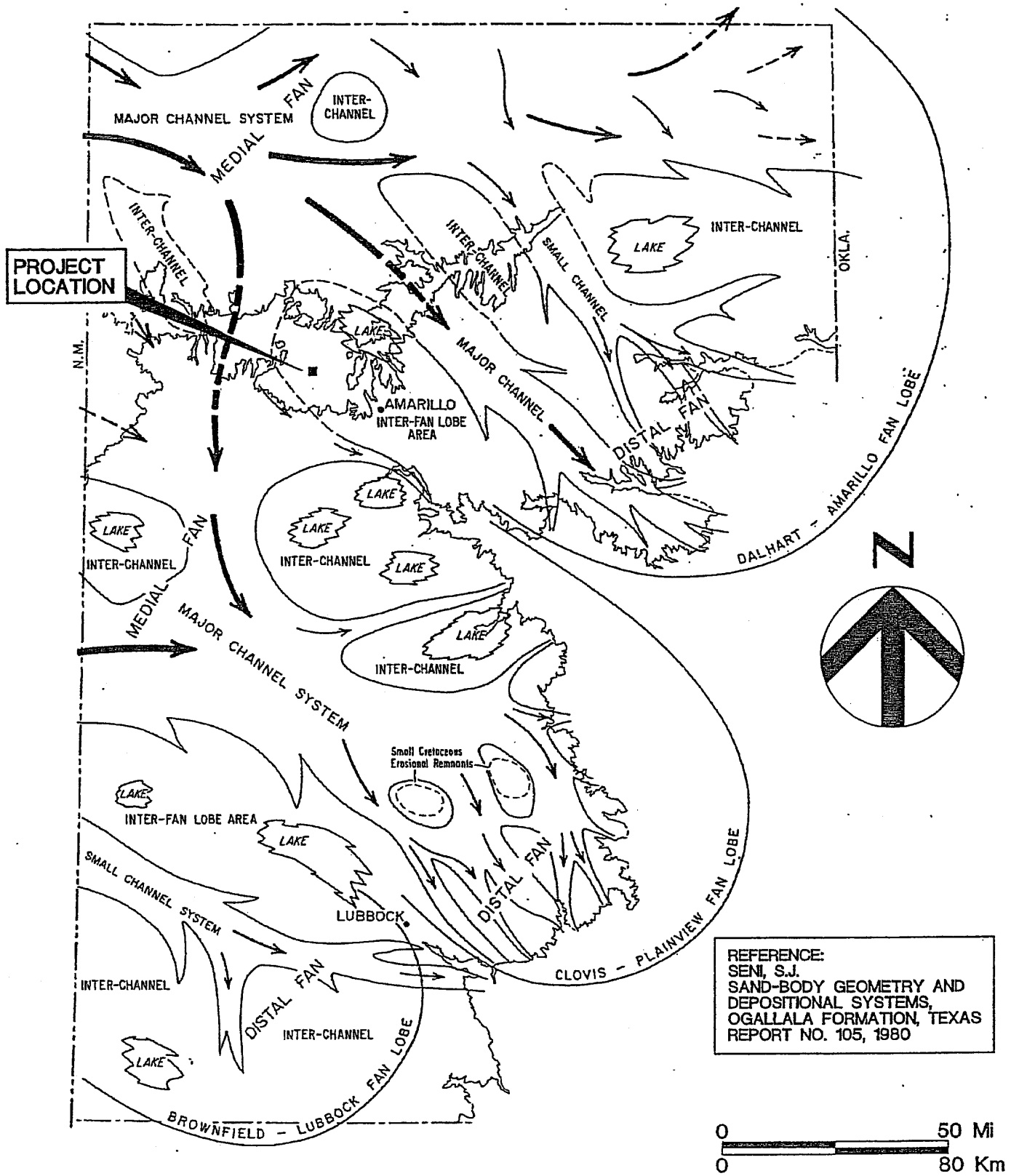
HDR Engineering, Inc.

CITY OF AMARILLO, TEXAS
MUNICIPAL LANDFILL
GEOLOGIC UNITS UNDERLYING THE OGALLALA FORMATION

Date 11/94

Figure 8

FILENAME: E:\AMARILLO\DWG\AMAFIG2



REFERENCE:
SENI, S.J.
SAND-BODY GEOMETRY AND DEPOSITIONAL SYSTEMS, OGALLALA FORMATION, TEXAS
REPORT NO. 105, 1980

HDR Engineering, Inc.

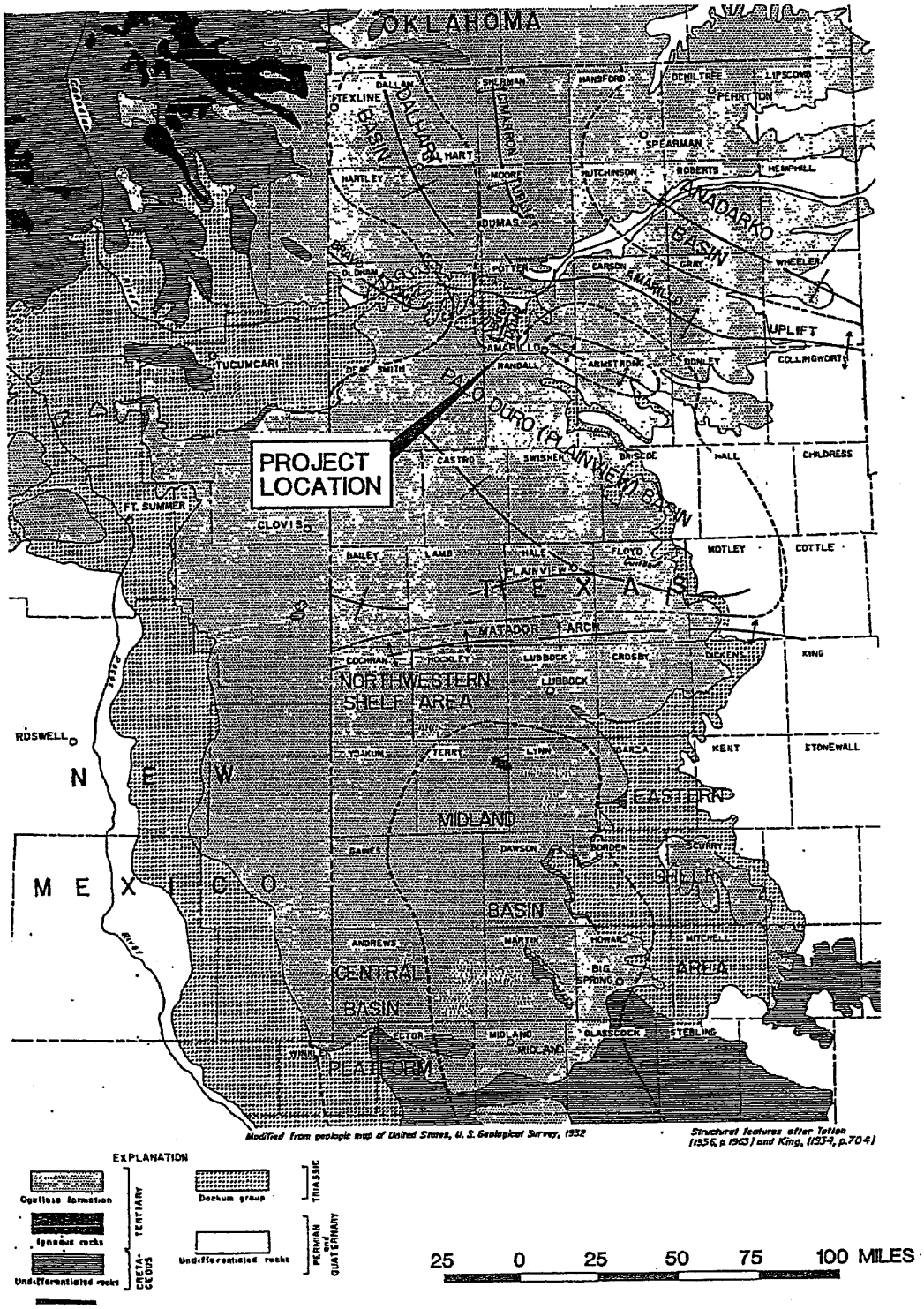
CITY OF AMARILLO, TEXAS MUNICIPAL LANDFILL

DEPOSITIONAL FACIES MAP

Date: 11/94

Figure: 9

FILENAME: E:\AMARILLO\DWG\AMADPFAC



REFERENCE: CRONIN, J.G.
A SUMMARY OF THE OCCURRENCE AND DEVELOPMENT OF GROUNDWATER IN THE SOUTHERN HIGH PLAINS OF TEXAS, TEXAS BOARD OF WATER ENGINEERS, BULLETIN 6107, 1971.

HDR

HDR Engineering, Inc.

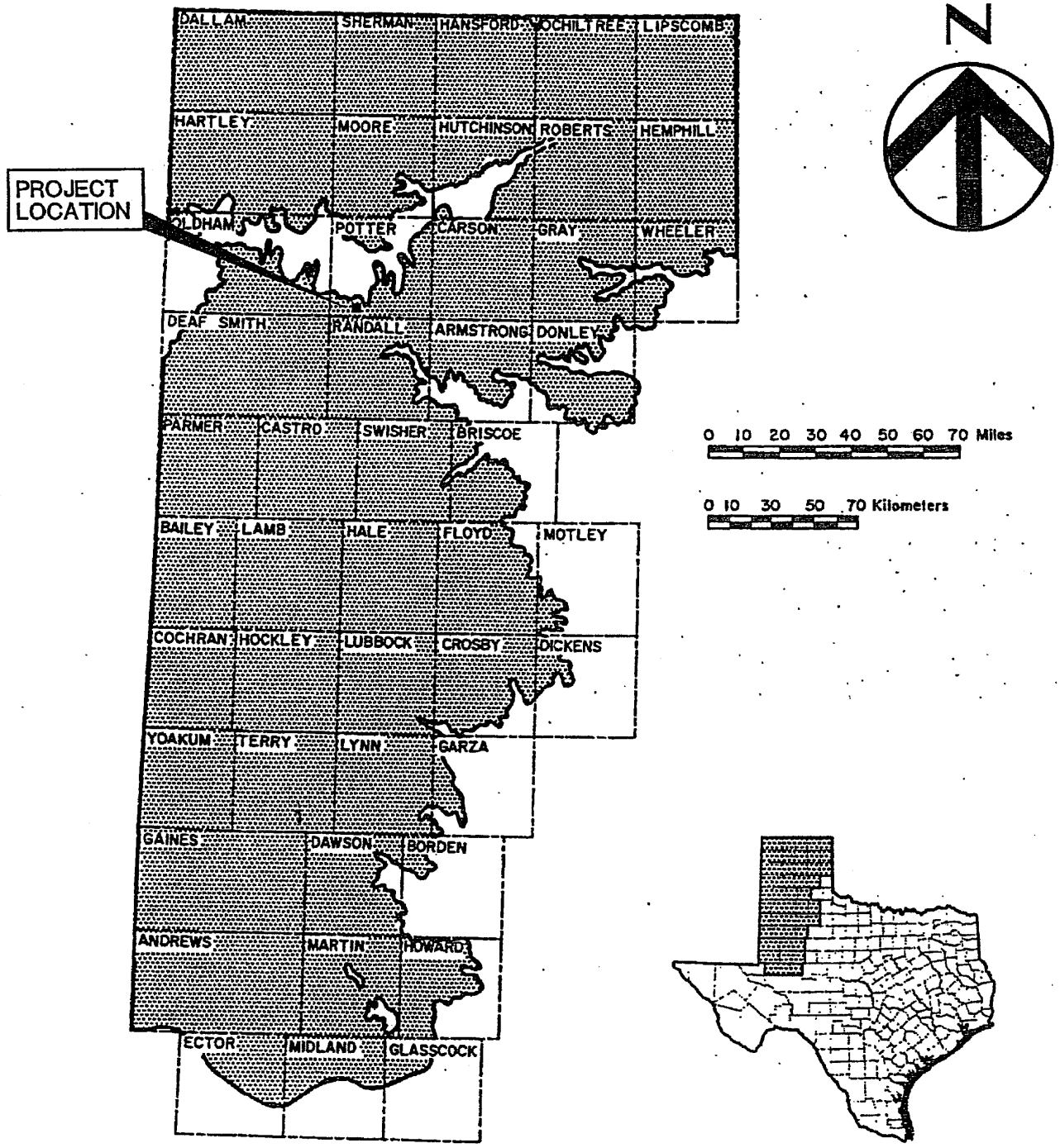
CITY OF AMARILLO, TEXAS MUNICIPAL LANDFILL

REGIONAL STRUCTURE MAP

Date: 11/94

Figure: 10

FILENAME: AMARGSTC



MAP SOURCE:
EVALUATING THE GROUNDWATER RESOURCES OF THE HIGH PLAINS OF TEXAS, FINAL REPORT, VOL. I, AUGUST, 1982.
TEXAS DEPARTMENT OF WATER RESOURCES

HDR

HDR Engineering, Inc.

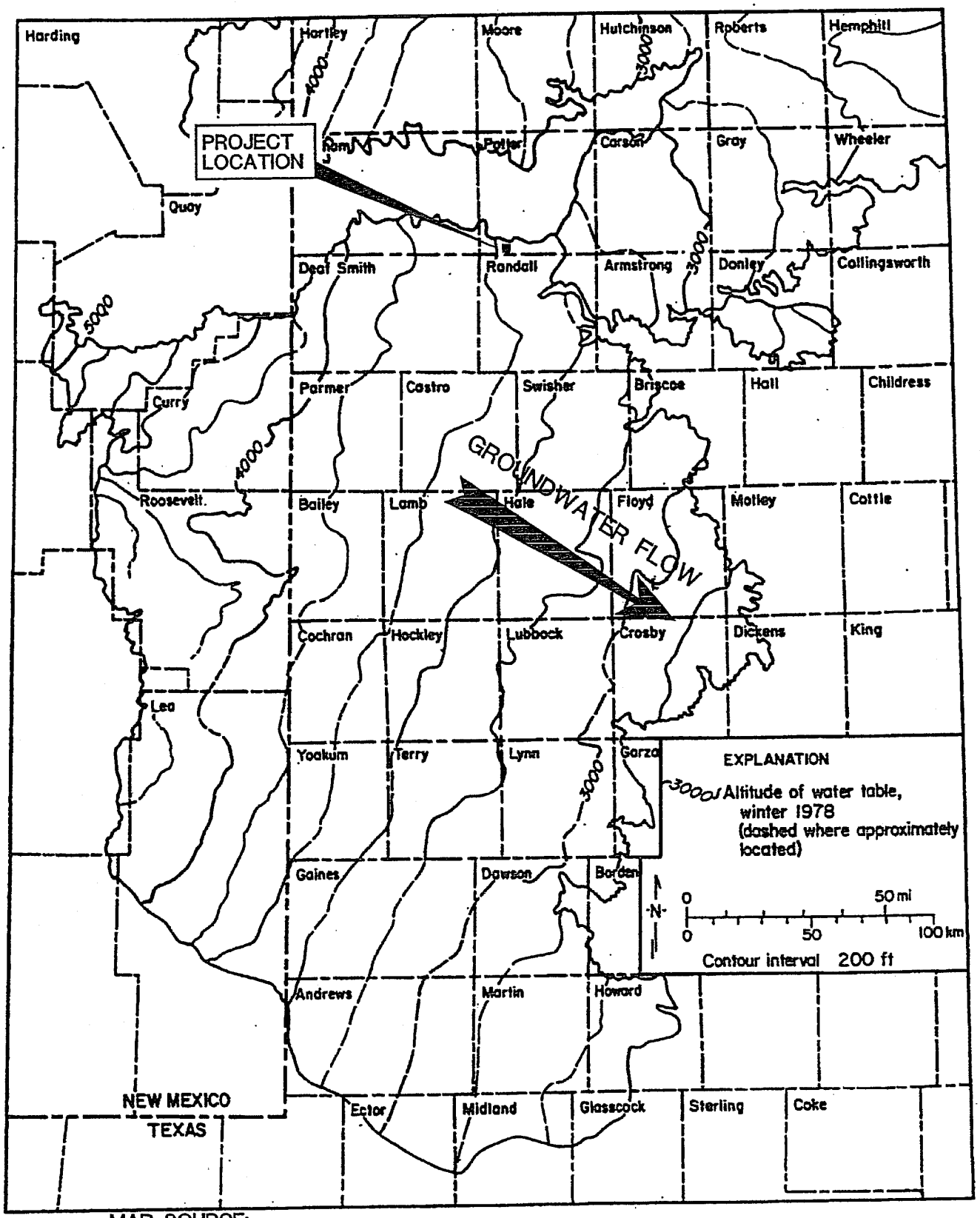
CITY OF AMARILLO, TEXAS
MUNICIPAL LANDFILL

HIGH PLAINS AQUIFER

Date
11/94

Figure
11

FILENAME: E:\AMARILLO\DWG\AMAFIG1



MAP SOURCE:
HYDROGEOLOGY AND HYDROCHEMISTRYOF THE OGALLALA AQUIFER, SOUTHERN HIGH PLAINS, TEXAS PANHANDLE AND EASTERN NEW MEXICO, 1988.
BUREAU OF ECONOMIC GEOLOGY

HDR

HDR Engineering, Inc.

CITY OF AMARILLO, TEXAS
MUNICIPAL LANDFILL

REGIONAL GROUNDWATER CONTOUR MAP

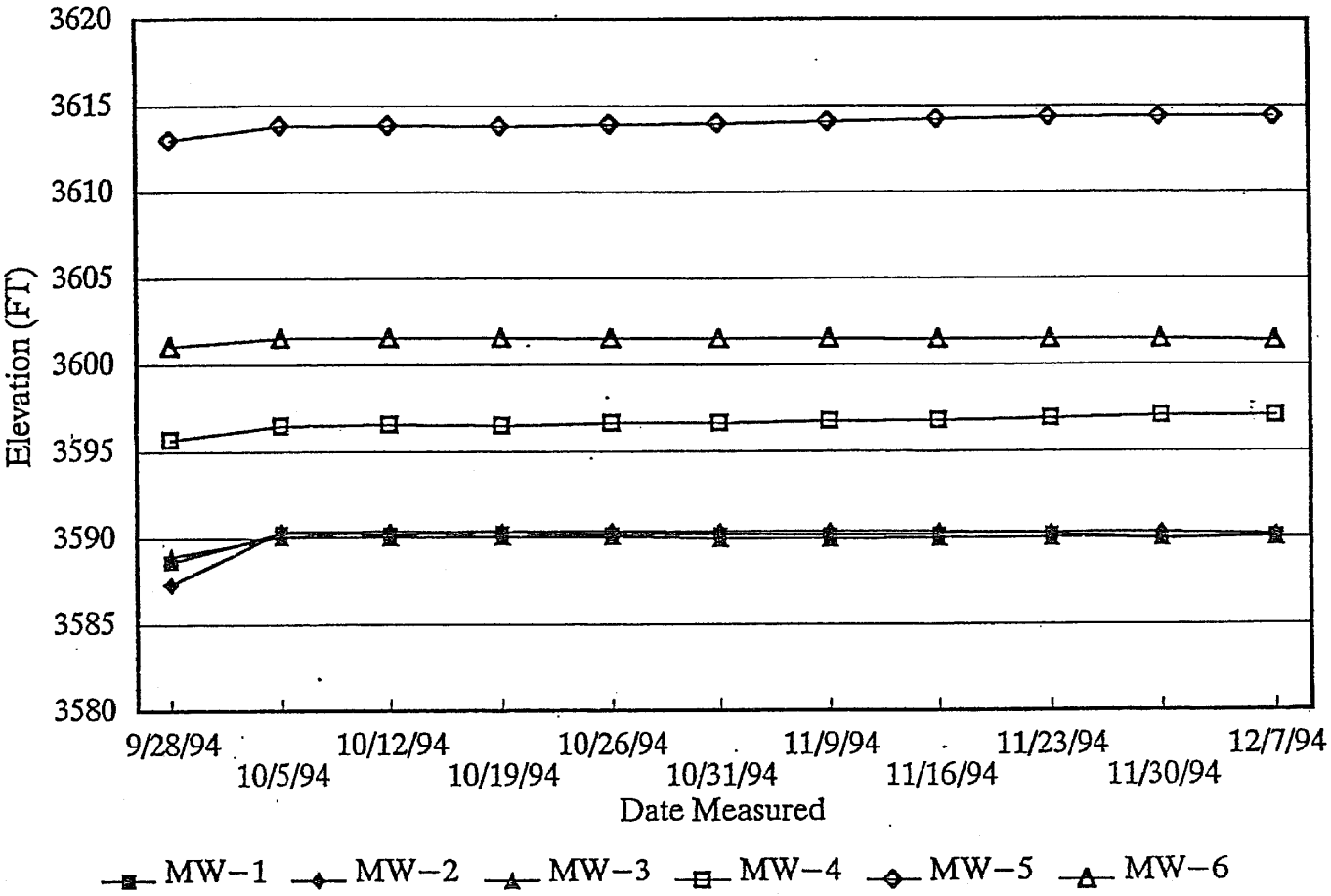
Date 11/94

FIGURE 12

FILENAME: E:\AMARILLO\DWG\OGALLA

Groundwater Elevations

Amarillo Landfill



HDR Engineering, Inc.

CITY OF AMARILLO, TEXAS
MUNICIPAL LANDFILL
HYDROGRAPHS
MW-1 THROUGH MW-6

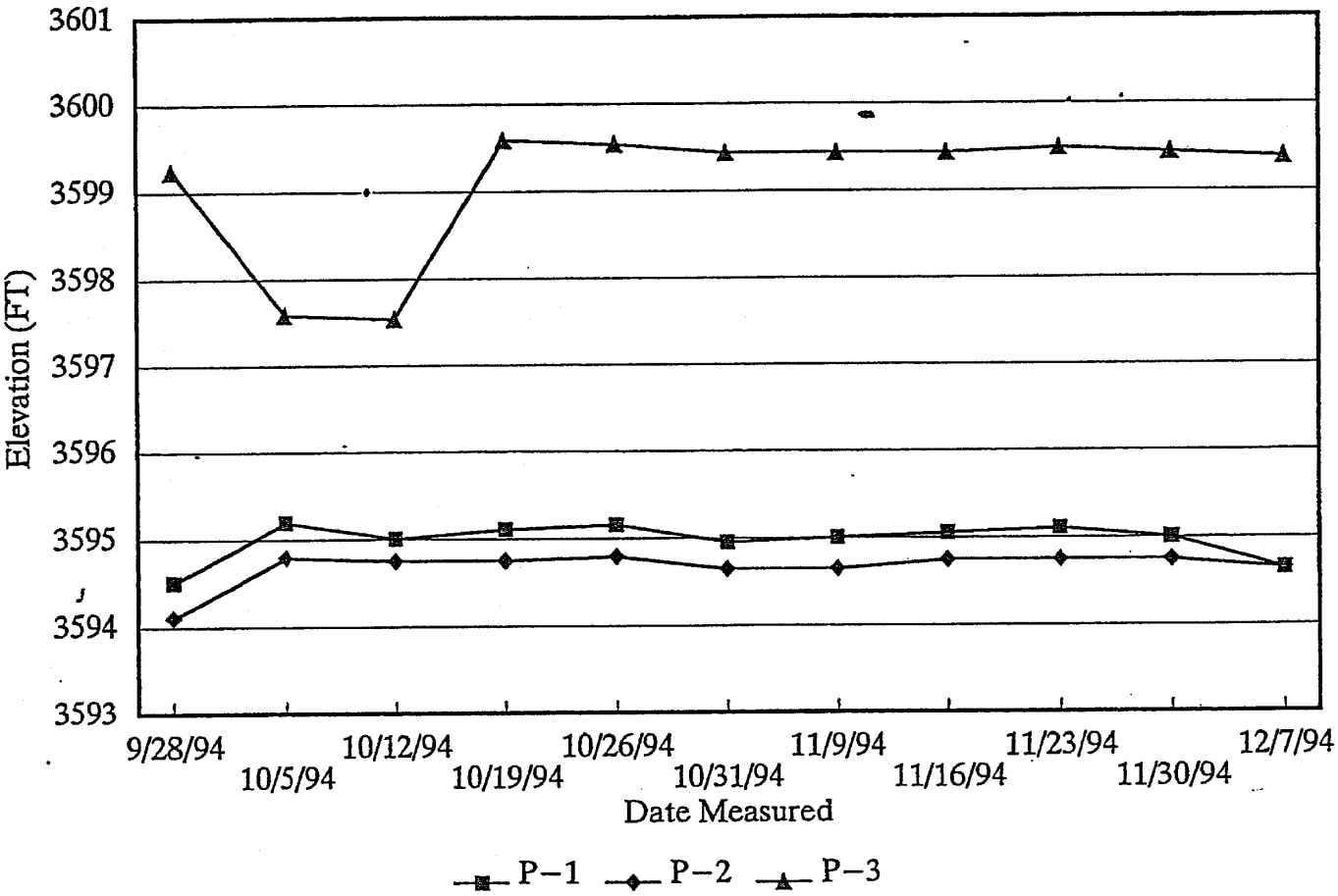
Date
11/94

Figure
13

FILENAME: E:\AMARILLO\DWG\AMAHYD1

Groundwater Elevations

Amarillo Landfill



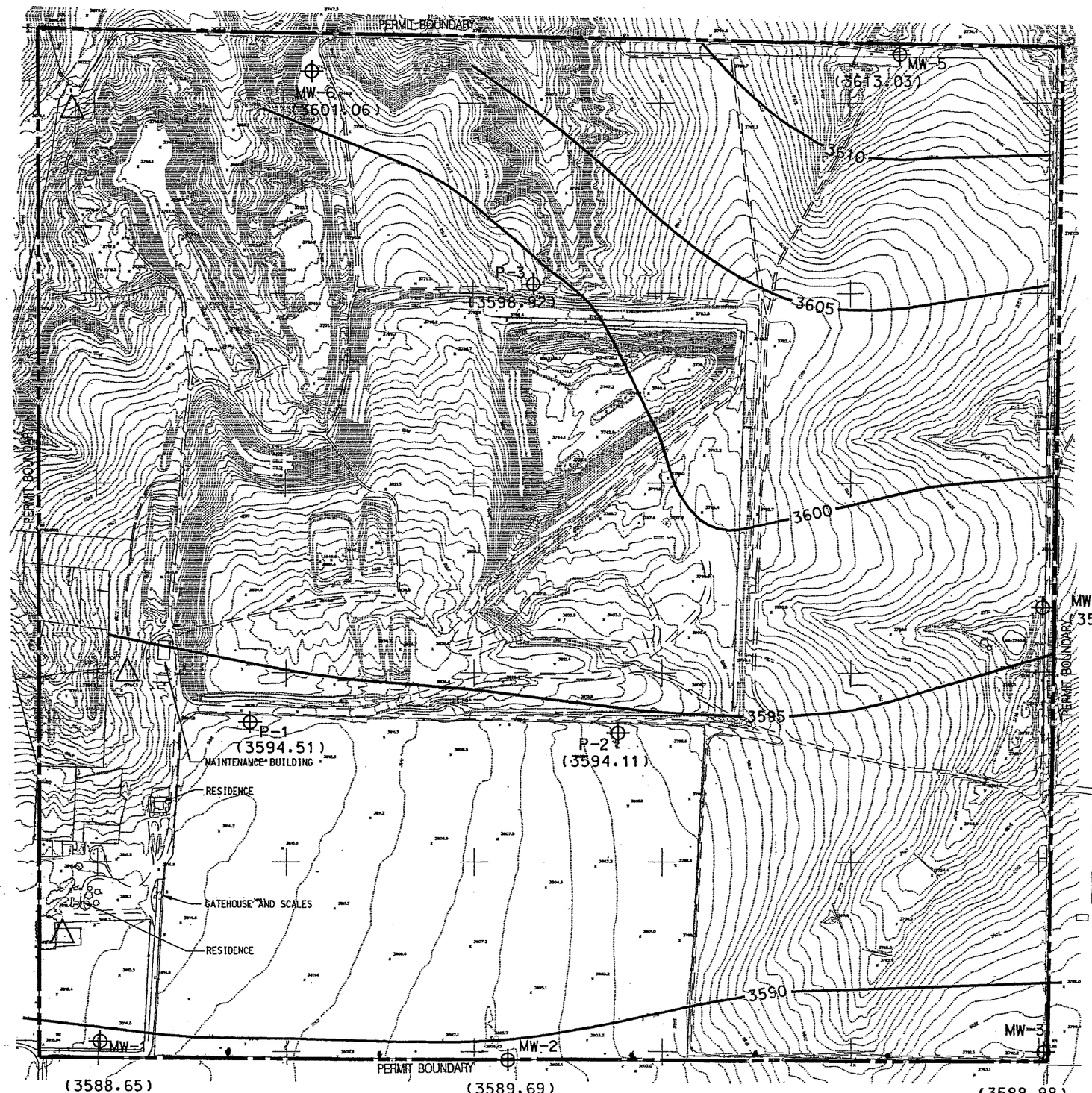
FILENAME: AMAMWHYD

HDR Engineering, Inc.

CITY OF AMARILLO, TEXAS
MUNICIPAL LANDFILL
HYDROGRAPHS
P-1 THROUGH P-3

Date
11/94

Figure
14



N

0 300 600

SCALE IN FEET

LEGEND

- EXISTING WATER WELLS
- MONITOR WELL LOCATION
- PERMIT BOUNDARY
- 3600 — GROUNDWATER ELEVATION CONTOUR IN FEET, MSL
- (3595.69) GROUNDWATER ELEVATION IN WELL, MEASURED ON SEPTEMBER 28, 1994

NOTES

1. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY UNITED AERIAL MAPPING, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED MARCH 9,1993. VERTICAL DATUM BASED ON MEAN SEA LEVEL. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.
2. PROPERTY BOUNDARY INFORMATION BASED ON BOUNDARY SURVEY DATA PROVIDED BY THE CITY OF AMARILLO.

HDR

HDR Engineering, Inc.

CITY OF AMARILLO
MUNICIPAL LANDFILL
PERMIT MODIFICATIONS

GROUNDWATER CONTOUR MAP SEPT. 28, 1994

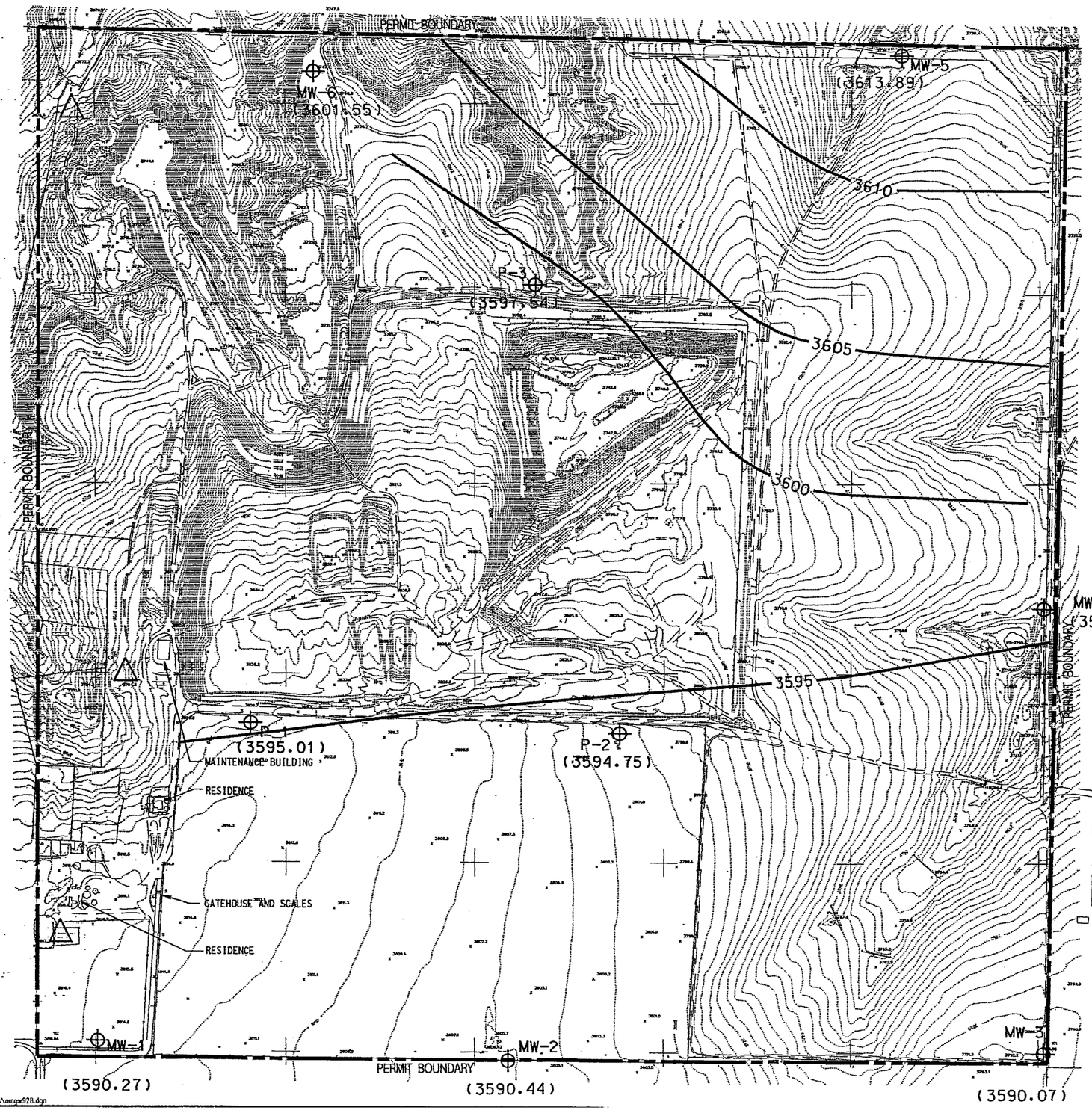
Project Manager	T. HOTCHKISS
Designed	HDR
Drafted	HDR
Checked	
Project Number	D6625-015-037
Date	DECEMBER, 1994 NOVEMBER, 1994

Figure III.5A.15

NOT FOR CONSTRUCTION

Drawing Number
Figure Number
15

FILE: e:\amarillo\satdmods\amgw928.dgn



N

0 300 600

SCALE IN FEET

LEGEND

- EXISTING WATER WELLS
- MONITOR WELL LOCATION
- PERMIT BOUNDARY
- 3600 — GROUNDWATER ELEVATION CONTOUR IN FEET, MSL
- (3595.69) GROUNDWATER ELEVATION IN WELL, MEASURED ON OCTOBER 12, 1994

NOTES

1. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY UNITED AERIAL MAPPING, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED MARCH 9,1993. VERTICAL DATUM BASED ON MEAN SEA LEVEL. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.
2. PROPERTY BOUNDARY INFORMATION BASED ON BOUNDARY SURVEY DATA PROVIDED BY THE CITY OF AMARILLO.

FILE: e:\amarillo\subdmods\amgw928.dgn

HDR

HDR Engineering, Inc.

CITY OF AMARILLO
MUNICIPAL LANDFILL
PERMIT MODIFICATIONS

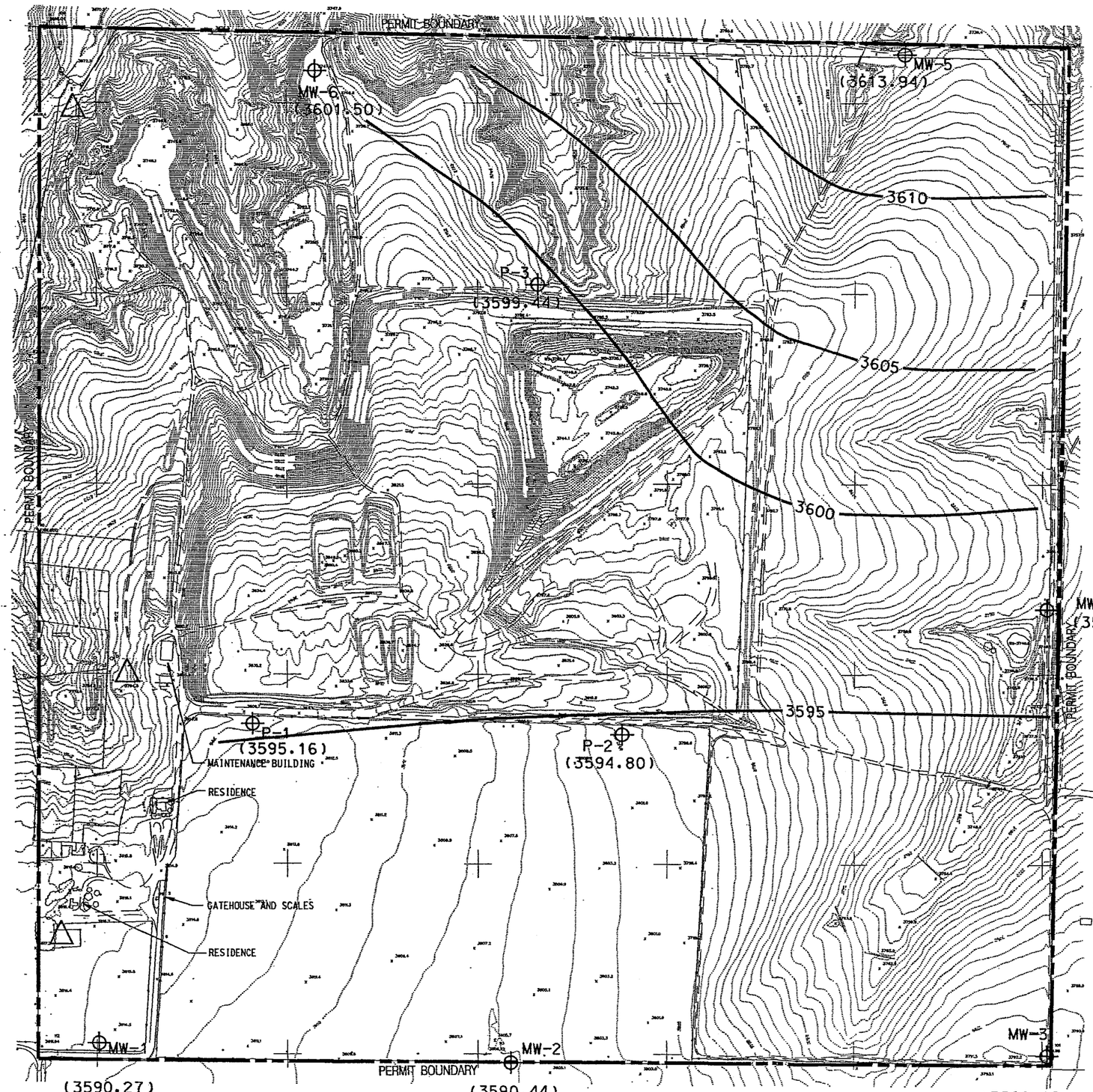
GROUNDWATER CONTOUR MAP OCT. 12, 1994

Project Manager	T. HOTCHKISS
Designed	HDR
Drafted	HDR
Checked	
Project Number	06625-015-037
Date	DECEMBER. 1994 NOVEMBER. 1994

Figure III.5A.16

NOT FOR CONSTRUCTION

Drawing Number
Figure Number
16



N

0 300 600

SCALE IN FEET

LEGEND

- EXISTING WATER WELLS
- MONITOR WELL LOCATION
- PERMIT BOUNDARY
- 3600 — GROUNDWATER ELEVATION CONTOUR IN FEET, MSL
- (3595.69) GROUNDWATER ELEVATION IN WELL, MEASURED ON OCTOBER 26, 1994

NOTES

1. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY UNITED AERIAL MAPPING, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED MARCH 9,1993. VERTICAL DATUM BASED ON MEAN SEA LEVEL. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.
2. PROPERTY BOUNDARY INFORMATION BASED ON BOUNDARY SURVEY DATA PROVIDED BY THE CITY OF AMARILLO.

HDR

HDR Engineering, Inc.

CITY OF AMARILLO
MUNICIPAL LANDFILL
PERMIT MODIFICATIONS

GROUNDWATER CONTOUR MAP OCT. 26, 1994

Project Manager	T. HOTCHKISS
Designed	HDR
Drafted	HDR
Checked	
Project Number	06625-015-037
Date	DECEMBER. 1994 NOVEMBER. 1994

Figure III.5A.17

NOT FOR CONSTRUCTION

Drawing Number
Figure Number
17

FILE: e:\amarillo\subdmods\amqw1026.dgn

APPENDIX A

DATA FROM AREA WELL SURVEY

James W. Sansom, Jr.
Consulting Geologist
Certified Professional Geologist
AIPG No. 2406

9506 Queenswood Drive
Austin, Texas 78748
512/282-1598
FAX 512/280-1761

October 29, 1994

Mr. Brad McCardell
HDR Engineering, Inc.
12700 Hillcrest Road
Suite 125
Dallas, Texas 75230-2096

Dear Brad,

In reference to your telephone call on October 26, 1994, about my supplementing the ground water inventory that I did for Troy Hotchkiss west of Amarillo, Texas in May, 1993, the following information is enclosed:

1. I reviewed the locations and data for the wells within the radius that Troy requested in 1993. I did not find pump test data for any of the wells. Two of the wells were found to have water quality analyses: 06-49-101 and 07-56-307
2. Logs and maps are provided for well numbers 07-56-3E and 07-56-3J since you are interested in the wells on site. Please note that two logs for well number 3J are included.
3. Three new wells were found; 07-56-3, 06-49-1, and a unnumbered well drilled in 1993.

The two 3J well logs look like duplicates because they are almost exactly the same in all aspects (TD, water level, etc.). Upon close examination the wells were completed two days apart. As to the three new wells, well data is continuously added to the files, and often it is a very slow process from the time the log is received until it is placed in the Central Records File.

I hope this will be of some benefit to you.

Sincerely,

James W. Sansom, Jr., CPG

Texas Water Development Board
Well Schedule

State Well No. 07 56 307 Previous Well No. _____ County Potter 375

River Basin Red River- 02 Zone 1 Region _____ Lat. 35 13 07 Long. 102 01 37 Source of Coord. V

Owner's Well No. _____ Location NW 1/4, NW 1/4, Section 127, Block B-9, Survey B.S&F

Owner CAROLINE B. EMERY

Driller BUD GIBBONS

Address P.O. Box 1230, Amarillo Tx Tenant/Oper. VICTOR PLUNK RT 1, Box 544 Amar

Date Drilled 03 08 1974 Depth 295 Source of Depth Datum D Altitude 3515 Source of Alt. Datum _____

Aquifer OGALLALA 121064 Well Type W User _____

Well Construction Const. Method Rotary R Casing Material Steel S

Completion Perforated P Screen Material Steel S

Lift Data Pump Mfr. NONE Type _____ No. Stages _____

Bowls Diam. _____ in. Setting _____ ft. Column Diam. _____ in.

Motor Mfr. NONE Fuel or Power _____ Horsepower _____

Yield Flow _____ GPM Pump _____ GPM Meas., Rept., Est. _____ Date _____

Performance Test Date _____ Length of Test _____ Production _____ GPM

Static Level _____ ft. Pumping Level _____ ft. Drawdown _____ ft. Sp.Cap. _____ GPM/ft.

Quality (Remarks _____

Water Use Primary UNUSED U Secondary _____ Tertiary _____

Other Data Available: Water Level C, Water Quality _____, Logs _____, Other Data _____

Water Levels Date	01 01 1993	Meas. 226.59	Below LSD.
Date		Meas.	
Date		Meas.	

Casing or Blank Pipe (C)
Well Screen or Slotted Zone (S)
Open Hole (O)
Cemented from ___ to ___

	Diam. (in.)	From	To
1	C 14	0	19
2	S 14	197	295
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

Recorded By DAN SEALE Date Record Collected or Updated 07 25 1994 (20 max) Reporting Agency

Remarks: ID PLATE INTACT ON WELLSTICK OF STAND PIPE APPROX. 3FT ABOVE G.L.

MP-HOLE IN TOP OF PUMP BASE COVER

CASING = +1.00ft

Aquifer 06

Well No. 02

NTY Potter

NO. 07-56-307

LOCATION SKETCH

BY DAN SEALE

DATE 9-13-76

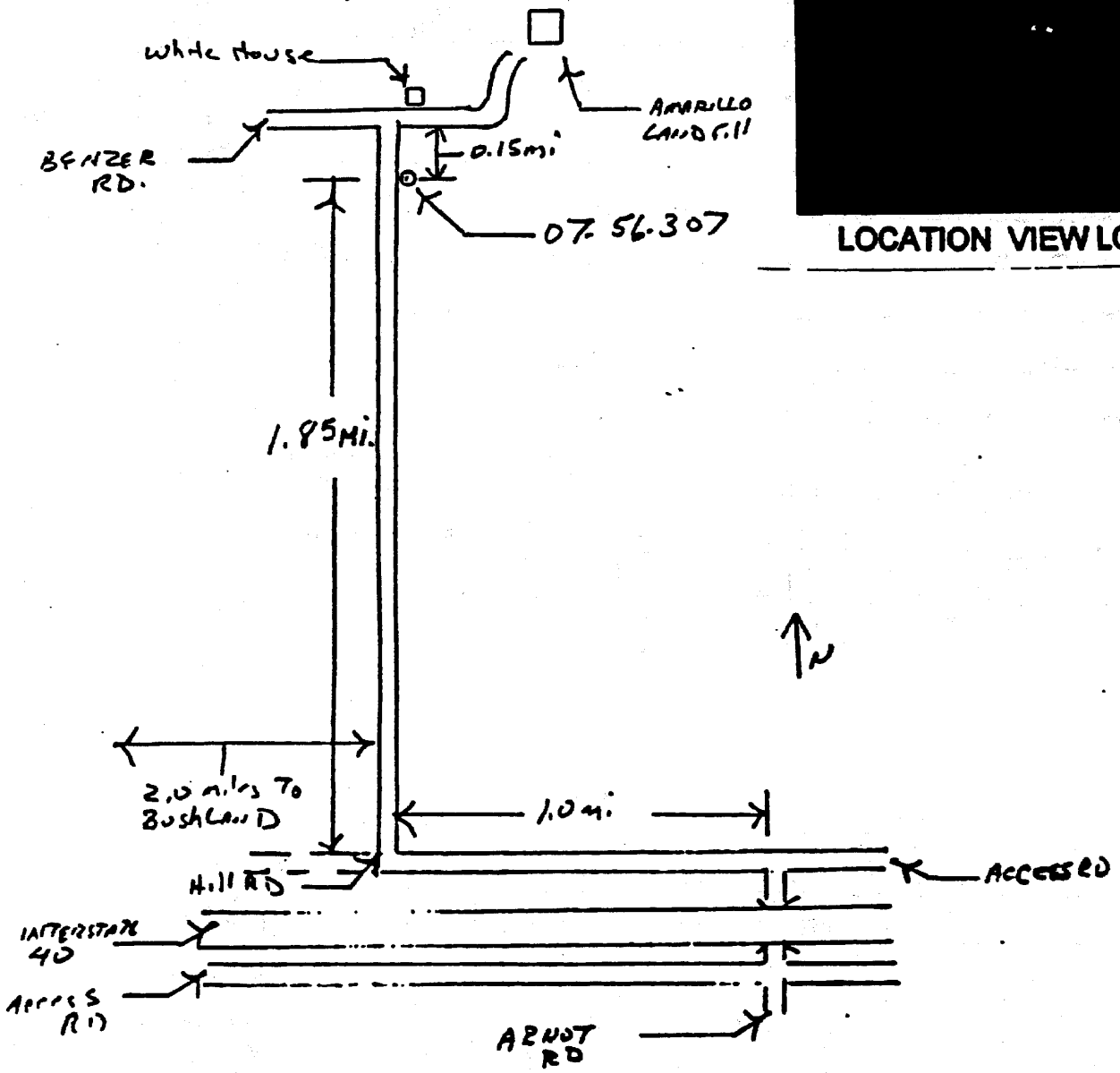
PHOTOGRAPHS

BY DAN SEALE

DATE 7-21-94

MP-ID VIEW LOOKING E.

LOCATION VIEW LOOKING N.



NO. 07-56-307

Send original copy by certified mail to the Texas Water Development Board P. O. Box 13087 Austin, Texas 78711

State of Texas

WATER WELL REPORT

For TWDB use only
Well No. 07-56
Located on map
Received:

1) OWNER:
Person having well drilled Caroline B. Denney (Name) Address Box 1230 (Street or RFD) Amarillo (City) Texa (St

Landowner Same (Name) Address Same (Street or RFD) (City) (St

2) LOCATION OF WELL:
County Potter 3/4 N & 2-E miles in NE (N.E., S.W., etc.) direction from Bushland, Texas (Town)

Locate by sketch map showing landmarks, roads, creeks, hiway number, etc.*

North

(Use reverse side if necessary)

or

Give legal location with distances and directions from adjacent sections or survey lines.

Labor League

Block 9 Survey BS & F

Abstract No.

(NW/4; NE/4; SW/4; SE/4) of Section 127

3) TYPE OF WORK (Check):
New Well XX Deepening
Reconditioning Plugging

4) PROPOSED USE (Check):
Domestic Industrial Municipal
Irrigation XX Test Well Other

5) TYPE OF WELL (Check):
Rotary XX Driven Dug
Cable Jetted Bored

6) WELL LOG:
Diameter of hole 18" in. Depth drilled 295' ft. Depth of completed well ft. Date drilled 3-8-

All measurements made from ft. above ground level.

From (ft.)	To (ft.)	Description and color of formation material
00	4	Top Soil
4	82	Caliche Clay
82	153	Clay Sand Rock & Sand
153	259	Clay and Layers Sand
259	279	Fine sand
279	289	Course Sand
289	295	Blue Clay and Red Bed

(Use reverse side if necessary)

9) Casing:
Type: Old New XX Steel XX Plastic Othe

Cemented from ft. to

Diameter (inches)	Setting From (ft.)	To (ft.)	Ga
14"OD.	0	295	.188
(197' - 295' - 4 row Perforation			

10) SCREEN:
Type

Perforated Slotted

Diameter (inches)	Setting From (ft.)	To (ft.)	S S

7) COMPLETION (Check):
Straight wall XX Gravel packed Other
Under reamed Open Hole

8) WATER LEVEL:
Static level ft. below land surface Date

Artesian pressure lbs. per square inch Date

Depth to pump bowls, cylinder, jet, etc., ft.

below land surface.

11) WELL TESTS:
Was a pump test made? Yes No XX If yes, by

Yield: gpm with ft. drawdown afte

Bailer test gpm with ft. drawdown after

Artesian flow gpm

Temperature of water

12) WATER QUALITY:
Was a chemical analysis made? Yes No

Did any strata contain undesirable water? Yes

Type of water? depth of strata

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

NAME Bud Gibbons (Type or Print) Water Well Drillers Registration No. 295

ADDRESS 1004 E. 5th, P.O.Box 1972 (Street or RFD) Plainview (City) Texas (State)

(Signed) Bud Gibbons (Water Well Driller) Bud Gibbons Drilling Contractor (Company Name)

Please attach electric log, chemical analysis, and other pertinent information, if available. UU07-56-3

*Additional instructions on reverse side.

TEXAS WATER DEVELOPMENT BOARD

WELL SCHEDULE

Aquifer Ogallala Field No. Permit # 276 State Well No. 07-56-307

Owner's Well No. _____ County Potter

1. Location: NW1/4, NW1/4 Sec. 127, Block B-9 Survey B.S. & F

2. Owner: Caroline B. Emery Address: Box 1230, Amarillo, Tx.
   Tenant: Victor Plunk Address: R+1, Box 544, Amarillo, Tx.
   Driller: Bud Gibbons Address: Plainview TX

3. Elevation of _____ is 3814 ft. above msl, determined by _____

4. Drilled: 3-8 19 74; Dug, Cable Tool (Rotary)

5. Depth: Rept. 295 ft. Meas. _____ ft. Red Bed Reported @ 287 SFL

6. Completion: Open Hole (Straight Wall) Underreamed, Gravel Packed _____

7. Pump: Mfgr. Johnston p.b., Amarillo Co. Type Turbine
   No. Stages 7, Bowls Diam. 10 in., Setting 280 ft.
   Column Diam. 6 in., Length Tailpipe 10 ft.

8. Motor: Fuel NAT. GAS Make & Model M.M. 6 Cyl. HP. _____

9. Yield: Flow _____ gpm, Pump 400 gpm, Meas., (Rept.) Est. Driller

10. Performance Test: Date _____ Length of Test _____ Made by _____
    Static Level _____ ft. Pumping Level _____ ft. Drawdown _____ ft.
    Production _____ gpm Specific Capacity _____ gpm/ft.

CASING & BLANK PIPE
Cemented From _____ ft. to _____ ft.

Diam. (in.)	Type	Setting, ft. from	to
14	Steel	Surface	295

11. Water Level: 227.98 ft. (static) meas. 9/13 1976 above/below See MP Below which is +0.50 ft. above/below surface
    _____ ft. rept. meas. _____ 19__ above/below _____ which is _____ ft. above/below surface
    _____ ft. rept. meas. _____ 19__ above/below _____ which is _____ ft. above/below surface
    _____ ft. rept. meas. _____ 19__ above/below _____ which is _____ ft. above/below surface

12. Use: Dom., Stock, Public Supply, Ind. (Irr.) Waterflooding, (Observation) Not Used, _____

13. Quality: (Remarks on taste, odor, color, etc.) _____
    Temp. ___ °F, Date sampled for analysis _____ Laboratory _____
    Temp. ___ °F, Date sampled for analysis _____ Laboratory _____
    Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

WELL SCREEN
Screen Openings _____

Diam. (in.)	Type	Setting, ft. from	to
14	Perforated	197	295
	Casing Perforated with 3/8" slots 4 row pattern.		

14. Other data available as circled: (Driller's Log) Radioactivity Log, Electric Log, Formation Samples, Pumping Test, _____

15. Record by: DAN SCALE Date 9/13 1976
    Source of Data Field & HPUWCD #1 Records

16. Remarks: Permission from Mr. F. E. Collard III, Manager to enter this well into the program

Obs Well

14
38 289
35 25

M.P. - Edge of Airline hole inside pump port S. side = +0.50 ft

(Sketch)

07-56-307

Typewrite (Black ribbon) or Print Plainly
(soft pencil or black ink)
Do not use ball point pen

Texas Department of Health Laboratories
1100 West 49th Street
Austin, Texas 78756

TDWR ONLY
Organization No. _____ Lab No. [ ]
Work No. _____

CHEMICAL WATER ANALYSIS REPORT

S. R. S.

SEP 19 1980

Send report to:
Data Collection and Evaluation Section
Texas Department of Water Resources
P.O. Box 13087
Austin, Texas 78711

County 188 Potter
State Well No. 07-56-307
Well No. 276
Date Collected 08-01-80

Location NW¼, NW¼, Sec. 127, Blk B-9, BS&F Survey Sample No. [ ] By HPAWCD#1 B
Source (type of well) turbine Owner Caroline Embry
Date Drilled 3-8-74 Depth 295 ft. WBF Ogallala
Producing intervals _____ Water level _____ ft. Sample depth [ ] ft.
Sampled after pumping cont. hrs. Yield _____ GPM meas. est. Temperature [ ]°F [ ]°C
Point of collection faucet on discharge Appearance ☑ clear ☐ turbid ☐ colored ☐ oth
Use Irr. Remarks _____

(FOR LABORATORY USE ONLY)

CHEMICAL ANALYSIS

Laboratory No. CO15975 Date Received AUG 18 1980 Date Reported SEP 17

		MG/L	ME/L
Silica	00955	57	
Calcium	00915	47	2.36
Magnesium	00925	26	2.11
Sodium	00929	29	1.26
Total			5.73
☐ Potassium	00937		
[3] ☐ Manganese	01055		
☐ Boron	01022		
[3] ☐ Total Iron	01045		
☐ (other) _____		MG/L	

%Na _____
SAR _____
RSC _____

		MG/L	ME/L
Carbonate	00445	0	
Bicarbonate (144)	00440	293	4.8
Sulfate	00945	30	0.6
Chloride	00940	7	0.2
Fluoride	00951	2.4	0.1
Nitrate	71850	2.9	
pH	00403	8.2	Total 5.7
[1] Dissolved Solids (residue at 180°C)	70300		35
Phenolphthalein Alkalinity as $CaCO_3$	00415		
Total Alkalinity as $CaCO_3$ (4.80)	00410		24
Total Hardness as $CaCO_3$ (4.47)	00900		22
[2] Nitrogen Cycle			
Ammonia - N	00610		
Nitrite - N	00615		
Nitrate - N JUL 25 1981	00620		
Organic Nitrogen	00605		

Specific Conductance (micromhos/cm³) 00095 480
Diluted Conductance (micromhos/cm³) 4 x 144 = 576

" items will be analyzed if checked.

[1] The bicarbonate reported in this analysis can be converted by computation (multiplying by 0.4917) to an equivalent amount of carbonate, and the carbonate figure used in the computation of dissolved solids.
[2] Nitrogen cycle requires separate sample.
[3] Total Iron and Manganese require separate sample.

Analyst _____ Checked By _____

TDWR 0148 (Rev. 1-8-80)

TEXAS WATER DEVELOPMENT BOARD

WELL SCHEDULE

te Well No. 06 49 101 (10–17) Previous Well No. (19–26) County Potter 375 (28–30)

er Basin Canadian 01 (32–33) Zone 2 (35) Lat. 35 13 05 (37–42) Long. 101 59 59 (44–50) Source of Coor 1

ner's Well No. _____ Location NW 1/4, NE 1/4, Section 112, Block 9, Survey B.S.&F.

ner Marshall Cutwright, Jr. (10–31) Driller Whitaker Well Service (33–52)

ress P.O. Box 3176, Amarillo, Tx. 79116 Address Amarillo, Tx.

ant _____ Address _____

Drilled (10–17) Depth (19–23) Source of Depth Datum (25) Altitude 3764 (27–30) Source of Alt. Datum (31)

ifer Ogallala 121QGLL (34–41) Well Type W (43) User (45–53)

Construction Const. Method _____ (55) Casing Material steel S (57)

Screen Material Steel S (59) Completion _____ (61)

Casing or Blank Pipe (C)
Well Screen or Slotted Zone (S)
Open Hole (O)
Cemented from ____ to ____

Diam. (in.)	Setting (feet) From	To
	10	26
	42	58
	10	26
	42	58
	10	26
	42	58
	10	26
	42	58

ata Pump Mfr. _____ Type Submersible S (63) No. Stages _____

Bowls Diam. _____ in. Setting _____ ft. Column Diam. _____ in. Length Tailpipe _____ ft.

Motor Mfr. _____ Fuel or Power electric E (65) Horsepower (67–73)

Flow _____ GPM Pump _____ GPM Meas., Rept., Est. _____ Date _____

mance Test Date _____ Length of Test _____ Production _____ GPM

Static Level _____ ft. Pumping Level _____ ft. Drawdown _____ ft. Sp. Cap. _____ GPM/ft.

y (Remarks on Taste, Odor, Color, Etc.) _____

Use Primary Use Domestic H (10) Secondary Use _____ (12) Tertiary Use _____ (14)

Data ile Water Level N (16) Water Quality _____ (18) Logs _____ (20–25) Other Data _____ (27–31)

Date _____ Meas. _____ ft. (+) Above (–) Below Landsurface

Date _____ Meas. _____ ft. (+) Above (–) Below Landsurface

d By Keith Whitworth Date Record Collected or Updated 08 04 1988 (33–40) Reporting Agency 05 (42–43)

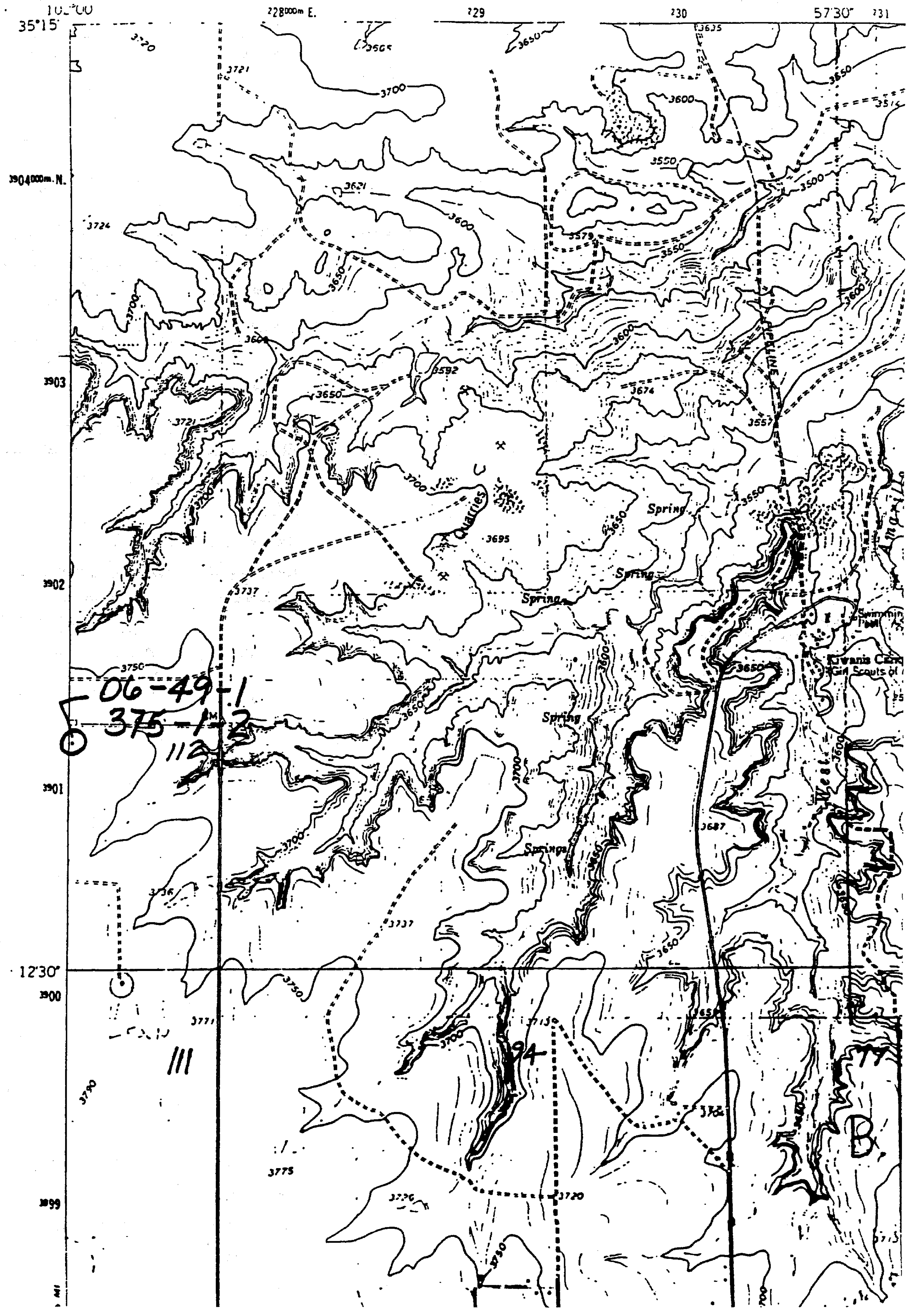
10	44		
46	80		
10	44		
46	80		
10	44		
46	80		

Well Schedule In TWDB File

Aquifer Ogallala

409 (02-26-88) 375-1-2

Well No. 06.49.101


35°15'
228000m E.
229
230
57'30"
3904000m. N.
3903
3902
3901
12'30"
3900
3899
3700
3600
3550
3500
3650
3621
3724
3721
3592
3674
3557
3695
3737
3750
3736
3771
3775
3720
3687
Quarries
Spring
Springs
Swimming Pool
06-49-1
375-1-2
111
94
77
B

TEXAS WATER DEVELOPMENT BOARD

CHEMICAL WATER ANALYSIS REPORT
DW3900 FORM 1/DG#5

Send Reply To:
Water Availability Data
and Studies Section
Texas Water Development Board
Stephen F. Austin Building
1700 Congress Avenue
Austin, Texas 78711

Attn: Phil Nordstrom Room: ____

TWDB ONLY
Organization No. 375-1-2
Work No. ____

Laboratory Code 01 (10 11)

County Potter State Well No. 06 (13) 49 101 (20)

Date Collected 08 (22) 04 1988 (29) Sample No. 1 (31) Time 14 (33 34) : 43 (36 37)

By HPUWCD #1 D.S. + C.G. Code for Sample Collecting Agency 07 (39 40)

Temperature 18 (42 43) °C

If Different From Completed Well

Analysis Reliability Remark (45 46)

Chemical Constituent Remark (48 49)

Aquifer (51 58)	Producing Interval Top (60 63)	Producing Interval Bottom (65 68)

Remarks (10 39)

Owner Marshall Cutwright, Jr. ____ Send copy to owner

Address P.O. Box 3176, Amarillo, Tx. 79116

Date Drilled ____ Depth ____ ft. WBF 1210611 Point of collection faucet

Sampled after pumping .75 hrs. Yield ____ GPM (megs. / est.) Use domestic

[redacted] Date Received SEP 07 '88 Date Reported KEY PUNCHED OCT 17 '88

CHEMICAL ANALYSIS

Laboratory No. EB9-135 Date Received 090888 Date Reported 101088

		MG/L.	Flag	MG/L.
Silica	00955			49
Calcium	00915	2.14		42.00
Magnesium	00925	2.22		27.00
Sodium	00930	.91		21
Potassium	00935	.13		5.0
T.Cations(+)		5.4		
Carbonate	00445	.12		3.0
Bicarbonate	00440	4.7		287.0
Sulfate	00946	.46		22
Chloride	00940	.11		4
Fluoride	00950	.09		1.7
Nitrate as NO3	71851	.06		3.46
Total Anions(-)		5.54		
pH		00403		8.6
Dissolved Solids (Sum)		70301		321
P.Alk asCaCO3		00415		3
T.Alk as CaCO3		00410		241
T.Hardness as CaCO3		00900		218
Specific Conductance (umhos @ 25 C)		00095		548

Phenol Alk as $CaCO_3$	00415	(26)	(27 32)
Total Alk as $CaCO_3$	00410	(34)	(36 41)
Total Hardness as $CaCO_3$	00900	(43)	(46 50)
Specific Conductance (umhos at 25C)	00095	(52)	(54 59)

Send original copy by certified mail to the Texas Department of Water Resources P. O. Box 13087 Austin, Texas 78711

State of Texas
WATER WELL REPORT

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

For TDWR use only
Well No. 07-56-3E
Located on map yes
Received: C.F.S

OWNER John Porter (Name) Address Box 162 (Street or RFD) Cactus (City) Texas (State) 79013 (Zip)

LOCATION OF WELL: County Potter 5 miles in NW (N.E., S.W., etc.) direction from Amarillo, Tex. (Town)

Well Location Bishop Hills Estate

Driller must complete the legal description to the right with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ Legal description:
Section No. _____ Block No. _____ Township _____
Abstract No. _____ Survey Name _____
Distance and direction from two intersecting section or survey lines _____
X ☐ See attached map.

3) TYPE OF WORK (Check):
☒ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check):
☒ Domestic ☐ Industrial ☐ Public Supply ☐ Irrigation ☐ Test Well ☐ Other _____

5) DRILLING METHOD (Check):
☒ Mud Rotary ☐ Air Hammer ☐ Driven ☐ Bored ☐ Air Rotary ☐ Cable Tool ☐ Jetted ☐ Other _____

6) WELL LOG:

Date drilled March 19,1981

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
8 3/4	Surface	350

7) BOREHOLE COMPLETION:
☐ Open Hole ☐ Straight Wall ☐ Underreamed
☒ Gravel Packed ☐ Other _____
If Gravel Packed give interval ... from 0 ft. to 350 ft.

From (ft.)	To (ft.)	Description and color of formation material
0	28	Topsoil & Caliche
28	48	Caliche & rock
48	92	Rock & Clay
92	136	White Clay & Sand
136	180	Sand & Gravel
180	202	Sand & Gray clay
202	246	Gray & white clay
246	268	White, gray, & red clay
268	290	Gray & red clay
290	312	Red clay & gravel
?	334	Red clay
	350	Red clay
	350	TD

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mgf., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
5	New	Steel, Perf.	250	350	

CEMENTING DATA
Cemented from _____ ft. to _____ ft.
Method used _____
Cemented by _____ (Company or Individual)

9) WATER LEVEL:
Static level 250 ft. below land surface Date 3-19-81
Artesian flow _____ gpm. Date _____

10) PACKERS: Type Depth

(Use reverse side if necessary)

11) TYPE PUMP:
☐ Turbine ☐ Jet ☒ Submersible ☐ Cylinder
☐ Other _____
Depth to pump bowls, cylinder, jet, etc., 315 ft.

13) WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable water? ☐ Yes ☒ No
If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? _____ Depth of strata _____
Was a chemical analysis made? ☐ Yes ☒ No

12) WELL TESTS:
☐ Type Test: ☐ Pump ☒ Bailer ☐ Jetted ☐ Estimated
Yield: 23 gpm with 25 ft. drawdown after 3 hrs.

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

Jimmy McCaskill (Type or Print) Water Well Drillers Registration No. 1771

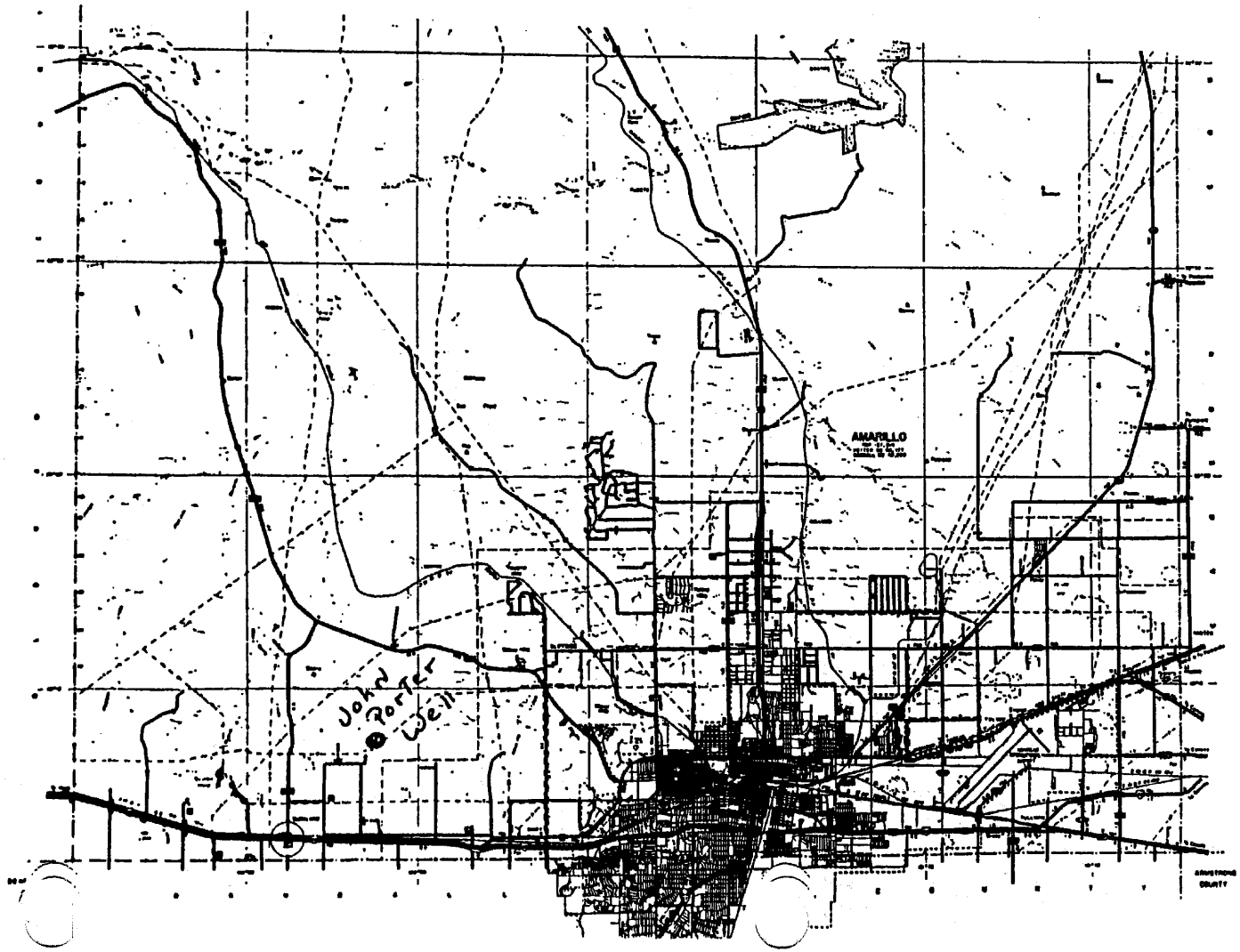
Address 8018 River Road (Street or RFD) Amarillo (City) Texas (State) 79108 (Zip)

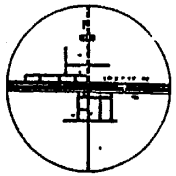
Signed Jimmy McCaskill (Water Well Driller) A & A Drilling Company (Company Name)

Please attach electric log, chemical analysis, and other pertinent information, if available.

WR 0292 (Rev 1-12-79)

DEPARTMENT OF WATER RESOURCES COPY





GENERAL HIGHWAY MAP

POTTER COUNTY TEXAS

PREPARED BY THE
STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
TRANSPORTATION PLANNING DIVISION
IN COOPERATION WITH THE
U S DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

1971

end original copy by
ertified mail to the
exas Department of Water Resources
. O. Box 13087
ustin, Texas 78711

State of Texas
WATER WELL REPORT
ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

Texas Water Well Drillers Board
P. O. Box 13087
Austin, Texas 78711

DAY and Company (Name) Address 6309 S. Indiana (Street or RFD) Lubbock (City) Tx (State) 79413 (Zip)

ON OF WELL: County Potter 6 miles in W.N.W. (N.E., S.W., etc.) direction from Amarillo (Town)

riller must complete the legal description to the right ith distance and direction from two intersecting sec- on or survey lines, or he must locate and identify the ell on an official Quarter- or Half-Scale Texas County eneral Highway Map and attach the map to this form.

☐ Legal description:
Section No. ______ Block No. ______ Township ______
Abstract No. ______ Survey Name ______
Distance and direction from two intersecting section or survey lines ______

☒ See attached map. map on 07-56-31

TYPE OF WORK (Check): ☒ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check): ☒ Domestic ☐ Industrial ☐ Public Supply ☐ Irrigation ☐ Test Well ☐ Other ______

5) DRILLING METHOD (Check): ☒ Mud Rotary ☐ Air Hammer ☐ Driven ☐ Bored ☐ Air Rotary ☐ Cable Tool ☐ Jetted ☐ Other ______

WELL LOG:

Date drilled 3/14/85

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
8 3/4"	Surface	300'

7) BOREHOLE COMPLETION:
☐ Open Hole ☐ Straight Wall ☐ Underreamed
☒ Gravel Packed ☐ Other ______
If Gravel Packed give interval ... from 10 ft. to 300 ft.

From (ft.)	To (ft.)	Description and color of formation material
	-15	Topsoil w/sandy caliche
	-60	caliche + caliche rock
	-75	caliche w/sandy clay
	-105	med. to coarse sand w/sandstone
		fine sand w/cemented sand
		Fine sand
5	-240	fine to med. sand w/stk cemented sand
0	-255	fine to med. sand w/fine gravel
5	-270	gray sandy clay w/sand strips
0	-285	Red + gray clay w/Sandstone (Cemented Sand)
5	-300	Red + gray clay w/Sandstone (Cemented)
	0'	Red clay

(Use reverse side if necessary)

RECEIVED
APR - 8 1985
DEPT. OF
WATER RESOURCES

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mgf., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
4½"	N	Plastic	0	180'	
4½"	N	P.V.C. Perforated	180'	300'	

CEMENTING DATA
Cemented from 0 ft. to 10' ft.
Method used ______
Cemented by A-1 Pump + Well Service (Company or Individual)

9) WATER LEVEL:
Static level 170' ft. below land surface Date 3/15/85
Artesian flow ______ gpm. Date ______

10) PACKERS: Type Depth

11) TYPE PUMP:
☐ Turbine ☐ Jet ☒ Submersible ☐ Cylinder
☐ Other ______
Depth to pump bowls, cylinder, jet, etc., 240' ft.

WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable water? ☐ Yes ☒ No
If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? Fresh Depth of strata 130' ft
Was a chemical analysis made? ☐ Yes ☒ No

12) WELL TESTS:
☐ Type Test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: 12 gpm with 60' ft. drawdown after 2 hrs.

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

ME A-1 Pump + Well Service (Type or Print) Water Well Driller's License No. 2119

RESS Rt 2 Box 54-G (Street or RFD) Amarillo (City) Tx. (State) 79101 (Zip)

ed) [signature] (Licensed Water Well Driller) (Signed) Ricky G. [signature] (Registered Driller Trainee) DWB

e attach electric log, chemical analysis, and other pertinent information, if available.

For TDWR use only
Well No. 07-56-31
Located on map YES C.T.S.

0192 Rev 5 27 82)

DEPARTMENT OF WATER RESOURCES COPY

Send original copy by certified mail to the Texas Department of Water Resources P. O. Box 13087 Austin, Texas 78711

State of Texas
WATER WELL REPORT

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

Texas Water Well Drillers B. P. O. Box 13087 Austin, Texas 78711

1) OWNER DAY and Company (Name) Address 6309 B. Indiana (Street or RFD) Lubbock (City) Tx. (State)

2) LOCATION OF WELL: County Potter 6 miles in W.N.W (N.E., S.W., etc.) direction from Amarillo (Town)

Driller must complete the legal description to the right with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ Legal description:
Section No. _____ Block No. _____ Township _____
Abstract No. _____ Survey Name _____
Distance and direction from two intersecting section or survey lines _____
☒ See attached map.

3) TYPE OF WORK (Check): ☒ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check): ☒ Domestic ☐ Industrial ☐ Public Supply ☐ Irrigation ☐ Test Well ☐ Other _____

5) DRILLING METHOD (Check): ☒ Mud Rotary ☐ Air Hammer ☐ Driven ☐ Bored ☐ Air Rotary ☐ Cable Tool ☐ Jetted ☐ Other _____

6) WELL LOG:

Date drilled 3/12/85

DIAMETER OF HOLE Dia. (in.)	From (ft.)	To (ft.)
8 3/4"	Surface	300'

7) BOREHOLE COMPLETION: ☐ Open Hole ☐ Straight Wall ☐ Underreamed ☒ Gravel Packed ☐ Other _____
If Gravel Packed give interval . . . from 10 ft. to 300

From (ft.)	To (ft.)	Description and color of formation material
0	15	Top soil w/sandy caliche
15	60	Caliche & caliche rock
60	75	Caliche w/sandy clay
75	105	Med. to coarse sand w/sandstone
105	120	Fine sand w/cemented sand
120	135	Fine sand
135	240	Fine to med. sand w/stks. cemented sand
240	255	Fine to med. sand w/fine gravel
255	270	Gray sandy clay w/sand strips
270	285	Red & gray clay w/Sandstone & Coarse Sand
285	300	Red & gray clay w/Sandstone & Coarse Sand
300'		Red clay

(Use reverse side if necessary)

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mgf., if commercial	Setting (ft.) From	To
4½"	N	Plastic	0	180'
4½"	N	P.V.C. Perforated	180'	300'

CEMENTING DATA
Cemented from 0 ft. to 10
Method used _____
Cemented by A-1 Pump & Well Service (Company or Individual)

9) WATER LEVEL:
Static level 170' ft. below land surface Date 3/14/85
Artesian flow _____ gpm. Date _____

10) PACKERS: Type Depth

11) TYPE PUMP: ☐ Turbine ☐ Jet ☒ Submersible ☐ Cylinder ☐ Other _____
Depth to pump bowls, cylinder, jet, etc., 240' ft.

12) WELL TESTS: ☐ Type Test: ☐ Pump ☒ Bailer ☐ Jetted ☐ Estima
Yield: 12 gpm with 160' ft. drawdown after 2 h

13) WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable water? ☐ Yes ☒ No
If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? Fresh Depth of strata 130' ft.
Was a chemical analysis made? ☐ Yes ☒ No

RECEIVED
APR - 8 1985
DEPT. OF WATER RESOURCES

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

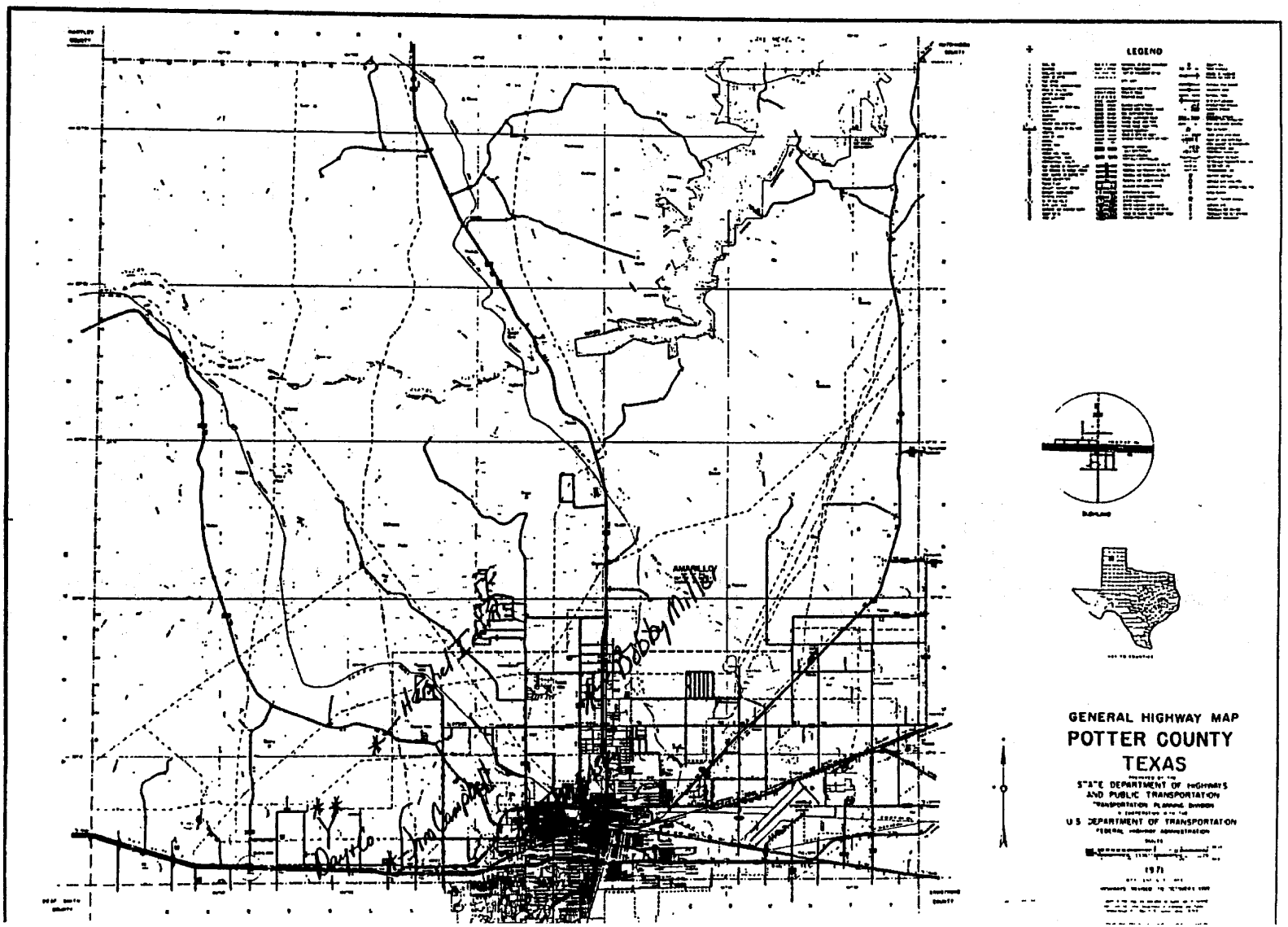
COMPANY NAME A-1 Pump & Well Service (Type or Print) Water Well Driller's License No. 2119

ADDRESS Rt. 2 Box 54-G (Street or RFD) Amarillo (City) Tx. (State) 79101 (Zip)

(Signed) _____ (Licensed Water Well Driller) (Signed) _____ (Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

For TDWR use only
Well No 97-56-3
Located on map 1855


LEGEND
GENERAL HIGHWAY MAP
POTTER COUNTY
TEXAS
STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION
U.S. DEPARTMENT OF TRANSPORTATION
1971

Please use black ink.
Send original copy by certified mail to the Texas Water Commission P.O. Box 13087 Austin, Texas 78711

State of Texas
WATER WELL REPORT

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

Texas Water Well Drillers Board P.O. Box 13087 Austin, Texas 78711

1) OWNER Robert Young (Name) Address Estates & Big Sky (Street or RFD) Amarillo (City) Texas (State)

2) LOCATION OF WELL: County Potter 10 miles in Northwest (N.E., S.W., etc.) direction from Amarillo (Town)

Driller must complete the legal description to the right with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ Legal description:
Section No. _____ Block No. _____ Township _____
Abstract No. _____ Survey Name _____
Distance and direction from two intersecting section or survey lines _____
☒ See attached map.

3) TYPE OF WORK (Check): ☒ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check): ☒ Domestic ☐ Industrial ☐ Monitor ☐ Public Supply ☐ Irrigation ☐ Test Well ☐ Injection ☐ Other _____

5) DRILLING METHOD (Check): ☐ Driven ☒ Mud Rotary ☐ Air Hammer ☐ Jetted ☐ Bored ☐ Air Rotary ☐ Cable Tool ☐ Other _____

6) WELL LOG:
Date Drilling: Started 1-14-88 19__ Completed _____ 19__

DIAMETER OF HOLE	Dia. (in.)	From (ft.)	To (ft.)
	9	Surface	460

7) BOREHOLE COMPLETION: ☐ Open Hole ☐ Straight Wall ☐ Underreamed ☒ Gravel Packed ☐ Other _____
If Gravel Packed give interval . . . from 17 ft. to 460

From (ft.)	To (ft.)	Description and color of formation material
0	25	Topsoil, caliche, caprock.
25	50	Caliche, lt. brown sandy clay.
50	72	Lt. brown sandy clay.
72	94	Lt. brown sandy clay w/strks. sandstone.
94	116	Fine tight sand and sandstone, gravel @ 105'.
116	138	Gravel-hard, red clay & shale at 120'.
138	160	Red clay & shale.
160	182	Red clay & shale w/strks. gray clay.
182	204	Red clay & shale " " " .
204	226	Grey & red clay w/strks. fine tight sandstone.
226	248	Grey & red clay w/strks. fine tight sandstone.
248	270	Red and grey clay & shale.
270	292	Red and grey clay & shale.
292	314	Red and grey shale, yellow clay & shale.
314	336	Yellow clay & shale.
336	358	Yellow clay & shale, red clay.
358	380	Red clay w/ shale strks.
380	402	Red clay w/ shale strks.
402	424	Red clay w/ shale strks.
424	446	Red clay w/strks. fine tight sand.

(Use reverse side if necessary)

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mgf., if commercial	Setting (ft.) From	Setting (ft.) To	G C S
9	N	PVC	0	260	
		.050 Perforations	260	460	

9) CEMENTING DATA [Rule 319.44(b)]
Cemented from 17 ft. to 2 ft. No. of Sacks 1
_____ ft. to _____ ft. No. of Sacks
Method used Mixed
Cemented by Mark Randall

10) SURFACE COMPLETION
☐ Specified Surface Slab Installed [Rule 319.44(c)]
☒ Pitless Adapter Used [Rule 319.44(d)]
☐ Approved Alternative Procedure Used [Rule 319.71]

11) WATER LEVEL:
Static level 240 ft. below land surface Date _____
Artesian flow _____ gpm. Date _____

12) PACKERS: Type Depth

13) TYPE PUMP:
☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder
☐ Other _____
Depth to pump bowls, cylinder, jet, etc. _____ ft

15) WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable water? ☐ Yes ☒ No
If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? _____ Depth of strata _____
Was a chemical analysis made? ☐ Yes ☐ No

14) WELL TESTS:
Type Test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: _____ gpm with _____ ft. drawdown after _____ hrs

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 12 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME K-Ran Drilling, Inc, (Type or Print) Water Well Driller's License No. 2848-W

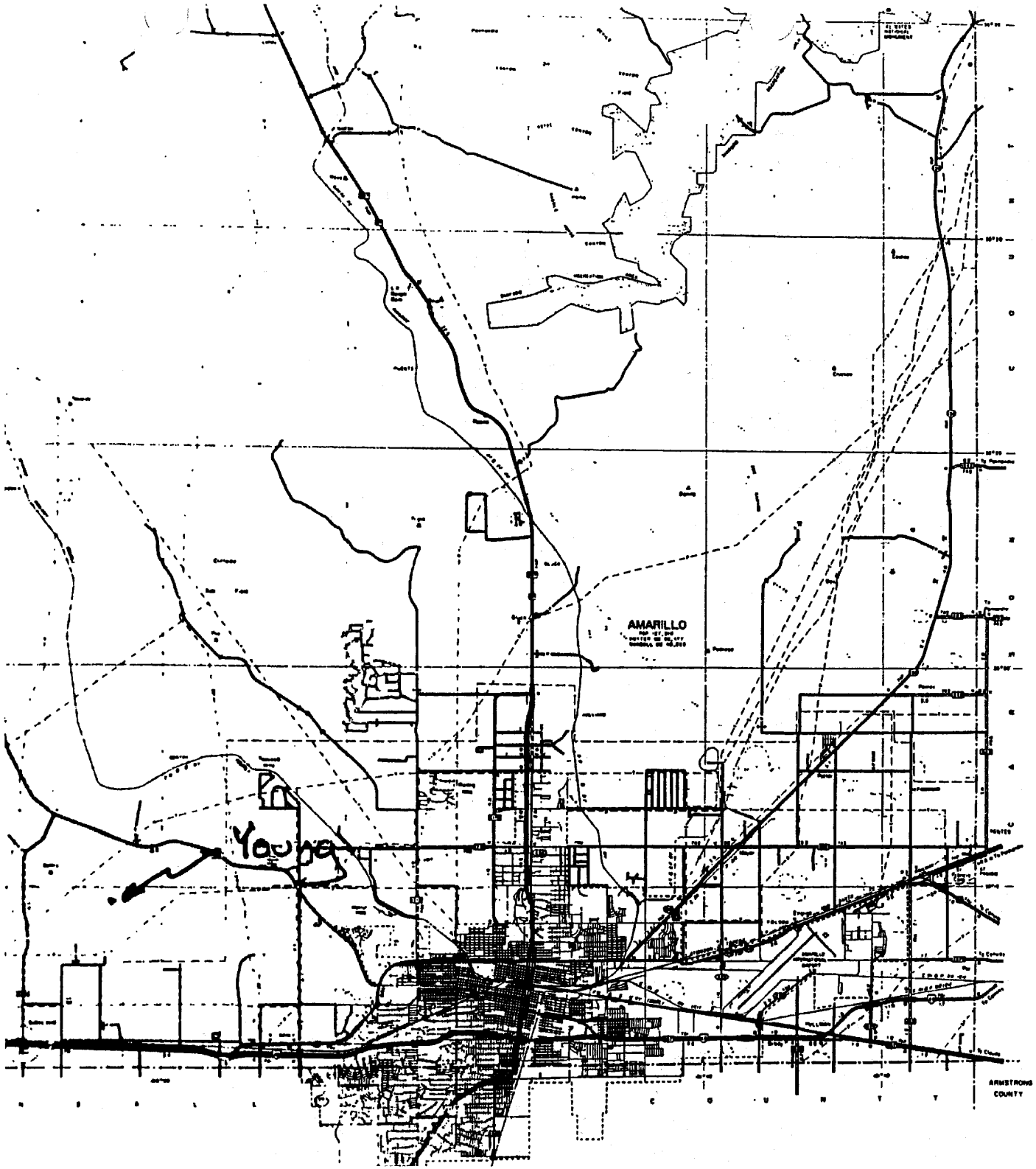
ADDRESS Rt. 6, Box 106 (Street or RFD) Amarillo, Texas (City) 79106 (State) (Zip)

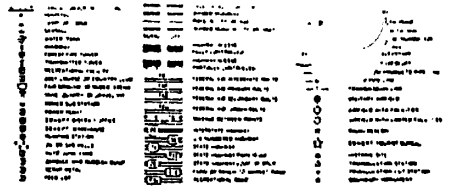
(Signed) _____ (Licensed Water Well Driller) (Signed) _____ (Registered Driller Trainee)

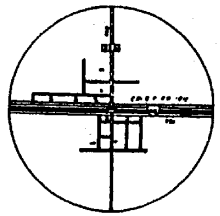
Please attach electric log, chemical analysis, and other pertinent information, if available.

For TWC use only
Well No 67-56
Located on map _____

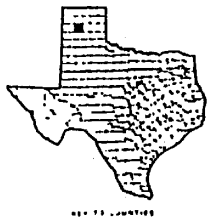
TWC 0582 (Rev 08-10-85) TEXAS WATER COMMISSION COPY







BUSHLAND



GENERAL HIGHWAY MAP
POTTER COUNTY
TEXAS

PREPARED BY THE
STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION
TRANSPORTATION PLANNING DIVISION
IN COOPERATION WITH THE
U S DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE

1971

HIGHWAYS REVISED TO OCTOBER 1 1980

ginal copy by certified mail to: Texas Water Commission, P.O. Box 13087, Austin, Texas 78711 — Please use black ink.

NTION OWNER: Confidentiality
ge Notice on Reverse Side

State of Texas
WELL REPORT

Texas Water Well Drillers Board
P.O. Box 13087
Austin, Texas 78711

OWNER Steve Shamlin (Name) ADDRESS Eagletree (Street or RFD) Amarillo (City) Texas (State) (Zip)

LOCATION OF WELL: County Potter . 10 miles in West (NE, SW, etc.) direction from Amarillo (Town)

must complete the legal description below with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official or- or Half-Scale Texas County General Highway Map and attach the map to this form.

EGAL DESCRIPTION:

ection No. _____ Block No. _____ Township _____ Abstract No. _____ Survey Name _____

istance and direction from two intersecting section or survey lines _____

EE ATTACHED MAP

YPE OF WORK (Check):
☐ New Well ☐ Deepening
☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check):
☒ Domestic ☐ Industrial ☐ Monitor ☐ Public Supply
☐ Irrigation ☐ Test Well ☐ Injection ☐ De-Watering

5) DRILLING METHOD (Check):
☒ Mud Rotary ☐ Air Hammer ☐ Jetted ☐ Bored
☐ Air Rotary ☐ Cable Tool ☐ Other _____ ☐ Driven

VELL LOG:
Drilling:
Started 12-13 19 93
Completed _____ 19 __

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
9	Surface	355

7) BOREHOLE COMPLETION:
☐ Open Hole ☐ Straight Wall ☐ Underreamed
☒ Gravel Packed ☐ Other _____
If Gravel Packed give interval . . . from 17 ft. to 355 ft.

From (ft.)	To (ft.)	Description and color of formation material
	15	Topsoil, caprock.
15	70	Caliche.
70	110	Green sandstone, conglomerate.
110	150	Red clay, shale.
150	185	Brn and gray clay, w/sandstone strks.
185	270	Red & white clay & shale w/ sandstone strks.
270	320	Reddish brn clay w/sand strks.
320	345	Red clay w/strks sand loose fast (Use reverse side if necessary) drilling.

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
5	N	Sch 40 PVC	0	225	
		.030 Perforations	225	345	
		10' blank on bottom			

9) CEMENTING DATA [Rule 287.44(1)]
Cemented from 2 ft. to 17 ft. No. of Sacks Used 4
_____ ft. to _____ ft. No. of Sacks Used _____
Method used Cement
Cemented by Mixed

TYPE PUMP:
☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder
Other _____
Depth to pump bowls, cylinder, jet, etc., _____ ft.

WELL TESTS:
Type Test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: _____ gpm with _____ ft. drawdown after _____ hrs.

WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable constituents?
☐ Yes ☒ No If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? _____ Depth of strata _____
Was a chemical analysis made? ☐ Yes ☐ No

10) SURFACE COMPLETION
☐ Specified Surface Slab Installed [Rule 287.44(2)(A)]
☐ Specified Steel Sleeve Installed [Rule 287.44(3)(A)]
☒ Pitless Adapter Used [Rule 287.44(3)(B)]
☐ Approved Alternative Procedure Used [Rule 287.71]

11) WATER LEVEL:
Static level 110 ft. below land surface Date _____
Artesian flow _____ gpm. Date _____

12) PACKERS: Type Depth

TEXAS WATER COMMISSION

Certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

DRILLER'S NAME K-Ran Drilling, Inc. (Type or print) WELL DRILLER'S LICENSE NO. 2848-WI

Rt. 6, Box 106 (Street or RFD) Amarillo (City) Texas (State) 79124-9502 (Zip)

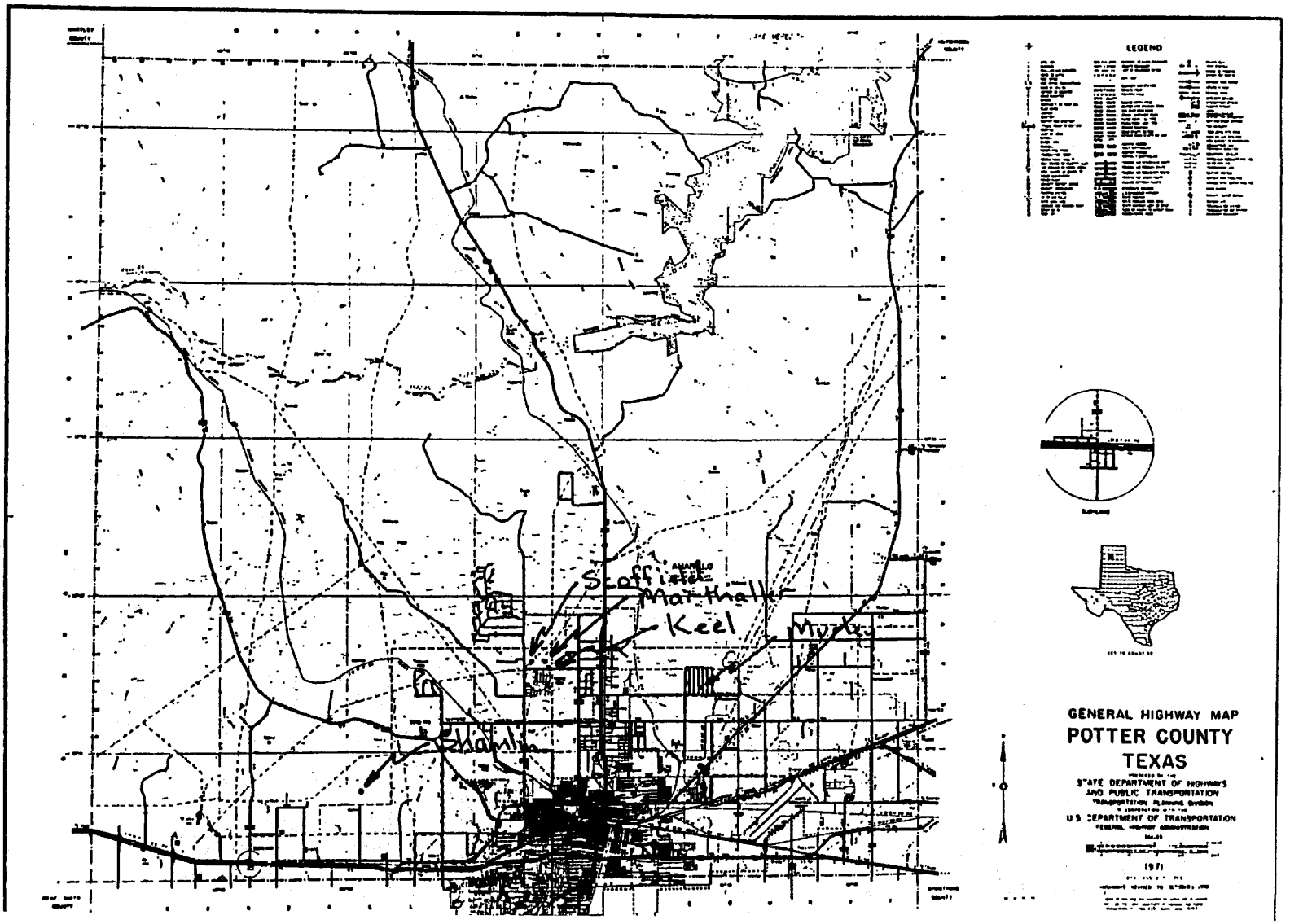
(Licensed Well Driller) (Signed) William M. Baker (Registered Driller Trainee)

Attach electric log, chemical analysis, and other pertinent information, if available.

For TWC use only: Well No. _____ Located on map _____

(Rev. 05-18-80)

TEXAS WATER COMMISSION COPY


LEGEND
Scott
Mat Thaller
Keel
Hamlin
GENERAL HIGHWAY MAP
POTTER COUNTY
TEXAS
STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION
U.S. DEPARTMENT OF TRANSPORTATION
1971

e black ink.
inal copy by
mail to the
partment of Water Resources
13087
exas 78711

State of Texas
WATER WELL REPORT

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

Texas Water Well Drillers Board
P. O. Box 13087
Austin, Texas 78711

ER Harold Knight (Name) Address 8112 Coronado (Street or RFD) Amarillo (City) Texas (State) 79110 (Zip)

LTION OF WELL:
inty Potter miles in I-40 West (N.E., S.W., etc.) direction from Amarillo, Turn North (Town)
owell Rd 2 miles, 1/4 back west

☐ Legal description:
ust complete the legal description to the right
ance and direction from two intersecting sec-
urvey lines, or he must locate and identify the
n official Quarter- or Half-Scale Texas County
ighway Map and attach the map to this form.

Section No. _____ Block No. _____ Township _____
Abstract No. _____ Survey Name _____
Distance and direction from two intersecting section or survey lines _____

☒ See attached map.

OF WORK (Check):
Well ☐ Deepening
nditioning ☐ Plugging

4) PROPOSED USE (Check):
☒ Domestic ☐ Industrial ☐ Public Supply
☐ Irrigation ☐ Test Well ☐ Other _____

5) DRILLING METHOD (Check):
☒ Mud Rotary ☐ Air Hammer ☐ Driven ☐ Bored
☐ Air Rotary ☐ Cable Tool ☐ Jetted ☐ Other _____

. LOG:

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
8 3/4	Surface	555

rilled 4-8- 1989

7) BOREHOLE COMPLETION:
☐ Open Hole ☐ Straight Wall ☐ Underreamed
☒ Gravel Packed ☐ Other _____
If Gravel Packed give interval . . . from 15 ft. to 555 ft.

To (ft.)	Description and color of formation material
	Soil
	Brown Sandy Clay
2	White Sandy Clay & Soft Rock
105	Brown Sandy Clay
135	Brown Sandy Clay & Soft Rock
154	White & Brown Rock
68	Red Clay
260	Red Clay & Blue Clay Streaks
81	Gray Clay & Soft Rock
285	Brown Clay & Soft Rock
342	Red & Gray Clay
398	Brown Clay & Soft Rock
405	Red with White Clay & Soft Rock
428	Red Clay & Soft Rock(loose)
36	Red & White Clay & Soft Rock
476	Red Clay
05	Red & Gray Clay & Soft Rock
520	Yellow, Red & Gray Clay & Rock
24C	Brown Sandy Clay & course Sand
545	Red, Yellow, Brown Clay & Rock
550	Course Sand
555	Red Bed

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mgf., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
5	N	160 PVC	0	555	.020
		Perf 130 Ft			
		325-345/365- 385			
		405-425/445-465			
		485-505/525-555			

9) CEMENTING DATA [Rule 319.44(b)]
Cemented from 0 ft. to 15 ft.
_____ ft. to _____ ft.
Method used Hand Mixed
Cemented by Don DeHay

10) SURFACE COMPLETION
☐ Specified Surface Slab Installed [Rule 319.44(c)]
☒ Pitless Adapter Used [Rule 319.44(d)]
☐ Approved Alternative Procedure Used [Rule 319.71]

11) WATER LEVEL:
Static level 140 ft. below land surface Date 12-8-89
Artesian flow _____ gpm. Date _____

12) PACKERS: Type Depth
None None

13) TYPE PUMP:
☐ Turbine ☐ Jet ☒ Submersible ☐ Cylinder
☐ Other _____
Depth to pump bowls, cylinder, jet, etc., 540 ft.

14) WELL TESTS:
Type Test: ☐ Pump ☐ Bailer ☒ Jetted ☐ Estimated
Yield: 15 gpm with 1 ft. drawdown after _____ hrs.

RECEIVED
DEC 20 1989

(Use reverse side if necessary)

R QUALITY:
u knowingly penetrate any strata which contained undesirable
☐ Yes ☒ No
submit "REPORT OF UNDESIRABLE WATER"
f water? _____ Depth of strata 520
chemical analysis made? ☐ Yes ☒ No

ere by certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my owledge and belief. I understand that failure to complete items 1 thru 12 will result in the log(s) being returned for completion and resubmittal.

NAME D. & L. Drilling (Type or Print) Water Well Driller's License No. 2558

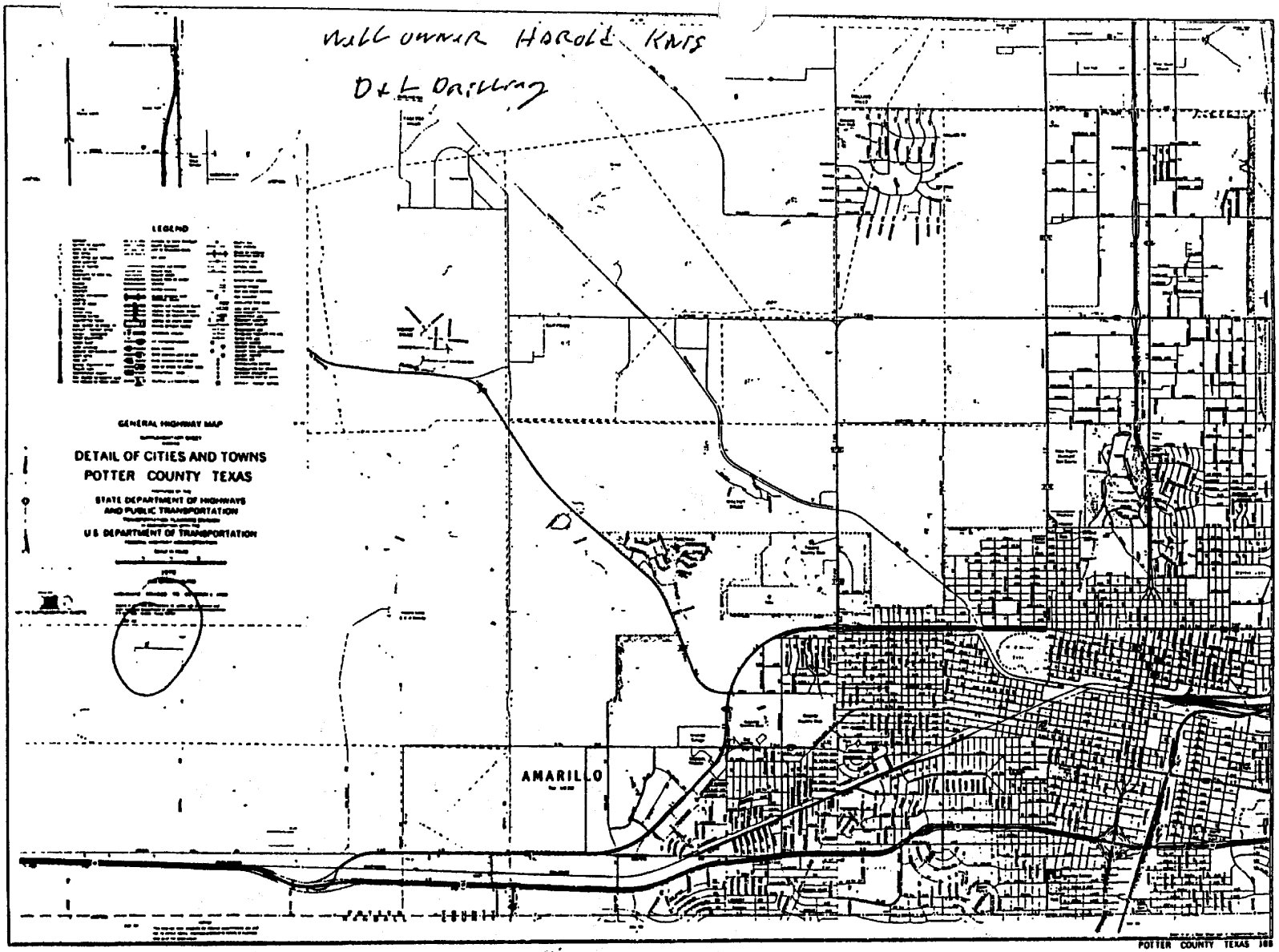
5606 McCormick Rd (Street or RFD) Amarillo, Texas (City) (State) 79118 (Zip)

(Licensed Water Well Driller) (Signed) _____ (Registered Driller Trainee)

electric log, chemical analysis, and other pertinent information, if available.

For TDWR use only
Well No. CF-79-1
Located on map _____

DEPARTMENT OF WATER RESOURCES COPY


Mill owner Harold Knis
D+L Drilling
LEGEND
GENERAL HIGHWAY MAP
DETAIL OF CITIES AND TOWNS
POTTER COUNTY TEXAS
STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
U.S. DEPARTMENT OF TRANSPORTATION
AMARILLO
POTTER COUNTY TEXAS 188

TEXAS WATER DEVELOPMENT BOARD

Telecommunications Cover Page
Fax Number
(512) 445-1488

DATE: 10/18/93

TO: Todd Lee
PERSON TO CONTACT

FROM: Phil Nordstrom
PERSON SENDING FAX

HDR
COMPANY NAME

TWDB
COMPANY NAME

TOWN STATE

TOWN STATE

214 960 4471
TELEFAX NUMBER

512 445 1488
TELEFAX NUMBER

COMMENTS: Requested data on located wells

Number of Pages Transmitting (including this cover page) 3

For verification of telecommunications transmission, please contact the operator at (512) 445-1488.

OPERATOR:

P.O. Box 13231 • 1700 N. Congress Avenue • Austin, Texas 78711-3231
Telephone (512) 463-7847 • Telefax (512) 475-2053

TEXAS WATER DEVELOPMENT BOARD
WATER LEVEL OBSERVATION WELL REPORT

STATE WELL NUMBER: 0756307
PREVIOUS WELL NUMBER: P276
WELL LOCATION: LAT: 35 13 07
LONG: 102 01 37
WELL USE: I

CURRENT DATE: Oct 18 1993
YEAR RECORD BEGINS: 1976
ELEVATION OF LAND SURFACE: 3814
DEPTH OF WELL: 295

DATE OF CURRENT MEASUREMENT MO DAY YEAR	CURRENT DEPTH TO WATER FROM LAND SURFACE	CHANGE IN LEVEL SINCE LAST STATIC MEASUREMENT	MEASUREMENT NUMBER	ELEVATION OF WATER LEVEL	MEASURING AGENCY	MEASUREMENT METHOD	REMARKS
09/13/1976	-227.48		01	3587	06	1	
01/03/1977	-232.87		01	3581	06	1	04
01/05/1978	-222.92	4.56	01	3591	06	1	
01/19/1979	-223.88	-0.96	01	3590	06	1	
12/05/1979	-225.07	-1.19	01	3589	06	1	
01/06/1981	-225.77	-0.70	01	3588	06	1	
01/19/1982	-224.64	1.13	01	3589	06	1	
02/22/1983	-223.77	0.87	01	3590	06	1	
01/03/1984	-224.45	-0.68	01	3590	06	1	
01/24/1985	-224.52	-0.07	01	3589	06	1	
[illegible]/02/1986	-224.78	-0.26	01	3589	06	1	
[illegible]07/1987	-225.22	-0.44	01	3589	06	1	
[illegible]10/1988	-224.53	0.69	01	3589	06	1	
01/03/1989	-224.88	-0.35	01	3589	06	1	
01/04/1990	-224.41	0.47	01	3590	06	1	
01/28/1991	-225.56	-1.15	01	3588	06	1	
01/20/1992	-226.23	-0.67	01	3588	06	1	
01/06/1993	-226.59	-0.36	01	3587	06	1	

AQUIFER: OGALLALA FORMATION
BASIN : Red River
COUNTY : Potter

WELL CLASS AND NUMBER: CURRENT 07563

SWN	USE	WQ	GPM YIELD	
0649101	Domestic	Y 319 TDS	— —	
0756301	Irr	N	--	
302	Irr	N	560	
303	Irr	N	800	
304	Irr	N	500	
305	Irr	N	--	
306	Irr	N	600	
*307	Irr	Y 350 TDS	400	Current Obs
602	Irr	N	700	
603	Irr	N	550	
604	Irr	N	500	
611	Irr	N	— —	

* Yield reported by driller during pump test.

0649101 Sampled in 1988 TDS = 320

0756307 Sampled in 1980 TDS = 350

Please use black ink.

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

State of Texas
WELL REPORT

Texas Water Well Drillers Board
P.O. Box 13087
Austin, Texas 78711

1) OWNER Lonnie Eaves (Name) ADDRESS _____ (Street or RFD) (City) (State) (Zip)

2) LOCATION OF WELL: County Potter, 9 miles in W (NE, SW, etc.) direction from Amarillo (Town)

Driller must complete the legal description below with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ LEGAL DESCRIPTION:

Section No. _____ Block No. _____ Township _____ Abstract No. _____ Survey Name _____

Distance and direction from two intersecting section or survey lines _____

☒ SEE ATTACHED MAP

3) TYPE OF WORK (Check):
☒ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check):
☒ Domestic ☐ Industrial ☐ Monitor ☐ Public Supply ☐ Irrigation ☐ Test Well ☐ Injection ☐ De-Watering

5) DRILLING METHOD (Check):
☒ Mud Rotary ☐ Air Hammer ☐ Jetted ☐ Bored ☐ Air Rotary ☐ Cable Tool ☐ Other _____

6) WELL LOG:
Date Drilling: Started 6-19-92 19__ Completed _____ 19__

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
9	Surface	336

7) BOREHOLE COMPLETION:
☐ Open Hole ☐ Straight Wall ☐ Underreamed
☒ Gravel Packed ☐ Other _____
If Gravel Packed give interval ... from 17 ft. to 336 ft.

From (ft.)	To (ft.)	Description and color of formation material
0	25	Topsoil, brn dirty sand w/ caliche layers.
25	50	Brn clean med sand, large broken gravel & cong @ 40'.
50	72	Conglamerate to 57', red clay.
72	94	Red clay w/shale strks.
94	116	" " " "
116	138	" " " "
138	160	" " " "
160	182	" " " "

(Use reverse side if necessary)

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
5	N	PVC	0	154	
		.050 Perforations	154	314	
		10' blank on bottom			

9) CEMENTING DATA [Rule 287.44(1)]
Cemented from 2 ft. to 17 ft. No. of Sacks Used 4
_____ ft. to _____ ft. No. of Sacks Used _____
Method used Mixed
Cemented by Mark Randall

10) SURFACE COMPLETION
☐ Specified Surface Slab Installed [Rule 287.44(2)(A)]
☐ Specified Steel Sleeve Installed [Rule 287.44(3)(A)]
☒ Pitless Adapter Used [Rule 287.44(3)(B)]
☐ Approved Alternative Procedure Used [Rule 287.71]

11) WATER LEVEL:
Static level 65' ft. below land surface Date _____
Artesian flow _____ gpm. Date _____

12) PACKERS: Type _____ Depth _____

13) TYPE PUMP:
☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder
☐ Other _____
Depth to pump bowls, cylinder, jet, etc., _____ ft.

14) WELL TESTS:
Type Test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: _____ gpm with _____ ft. drawdown after _____ hrs.

15) WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable constituents? ☐ Yes ☒ No If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? _____ Depth of strata _____
Was a chemical analysis made? ☐ Yes ☐ No

RECEIVED
JUL 1 1992
TEXAS WATER COMMISSION

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME K-Ran Drilling, Inc. (Type or print) WELL DRILLER'S LICENSE NO. 2848-W

ADDRESS Rt. 6, Box 106 (Street or RFD) Amarillo, Texas (City) 79124-9502 (State) (Zip)

_____ (Licensed Well Driller) (Signed) _____ (Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

For TWC use only: Well No. _____ Located on map _____

WWD-012 (Rev. 05-18-90)

TEXAS WATER COMMISSION COPY

Send original copy by certified mail to: Texas Water Commission, P.O. Box 13087, Austin, Texas 78711 — *Please use black ink.*

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

State of Texas
WELL REPORT

Texas Water Well Drillers Board
P.O. Box 13087
Austin, Texas 78711

1) OWNER Charlene Barnard (Name) ADDRESS Eagle Tree (Street or RFD) Amarillo (City) Texas (State)

2) LOCATION OF WELL: County Potter . 10 miles in West (NE, SW, etc.) direction from Amarillo (Town)

Driller must complete the legal description below with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ LEGAL DESCRIPTION:
Section No. _____ Block No. _____ Township _____ Abstract No. _____ Survey Name _____
Distance and direction from two intersecting section or survey lines _____

☒ SEE ATTACHED MAP

3) TYPE OF WORK (Check):
☒ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check):
☒ Domestic ☐ Industrial ☐ Monitor ☐ Public Supply ☐ Irrigation ☐ Test Well ☐ Injection ☐ De-Watering

5) DRILLING METHOD (Check):
☒ Mud Rotary ☐ Air Hammer ☐ Jetted ☐ Bored ☐ Driven ☐ Air Rotary ☐ Cable Tool ☐ Other _____

6) WELL LOG:
Date Drilling: Started 8-22 19 90 Completed _____ 19 __

DIAMETER OF HOLE		
Dia. (in.)	From (ft.)	To (ft.)
8 3/4	Surface	338

7) BOREHOLE COMPLETION:
☐ Open Hole ☐ Straight Wall ☐ Underreamed
☒ Gravel Packed ☐ Other _____
If Gravel Packed give interval ... from 17 ft. to 338 ft.

From (ft.)	To (ft.)	Description and color of formation material
0	25	Topsoil, caliche, med. gravel.
25	50	Med gravel, red clay.
50	72	Red & grey clay.
72	94	Red & grey clay w/strks. of shale.
94	116	Red & grey clay w/strks. sandstone.
116	138	Red & grey clay w/strks. sandstone.
138	160	Red & grey clay w/strsk. sandstone.

(Use reverse side if necessary)

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
5	N	PVC	0	178	
		.050 Perforations	178	338	

9) CEMENTING DATA [Rule 287.44(1)]
Cemented from 2 ft. to 17 ft. No. of Sacks Used 4
_____ ft. to _____ ft. No. of Sacks Used _____
Method used Mixed
Cemented by Mark Randall

13) TYPE PUMP:
☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder ☐ Other _____
Depth to pump bowls, cylinder, jet, etc., _____

RECEIVED
APR 13 1990
TEXAS WATER COMMISSION

14) WELL TESTS:
Type Test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: _____ gpm with _____ ft. drawdown after _____ hrs.

15) WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable constituents?
☐ Yes ☒ No If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? _____ Depth of strata _____
Was a chemical analysis made? ☐ Yes ☐ No

10) SURFACE COMPLETION
☐ Specified Surface Slab Installed [Rule 287.44(2)(A)]
☐ Specified Steel Sleeve Installed [Rule 287.44(3)(A)]
☒ Pitless Adapter Used [Rule 287.44(3)(B)]
☐ Approved Alternative Procedure Used [Rule 287.71]

11) WATER LEVEL:
Static level 125 ft. below land surface Date _____
Artesian flow _____ gpm. Date _____

12) PACKERS: Type Depth

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME K-Ran Drilling, Inc. (Type or print) WELL DRILLER'S LICENSE NO. 2848-W

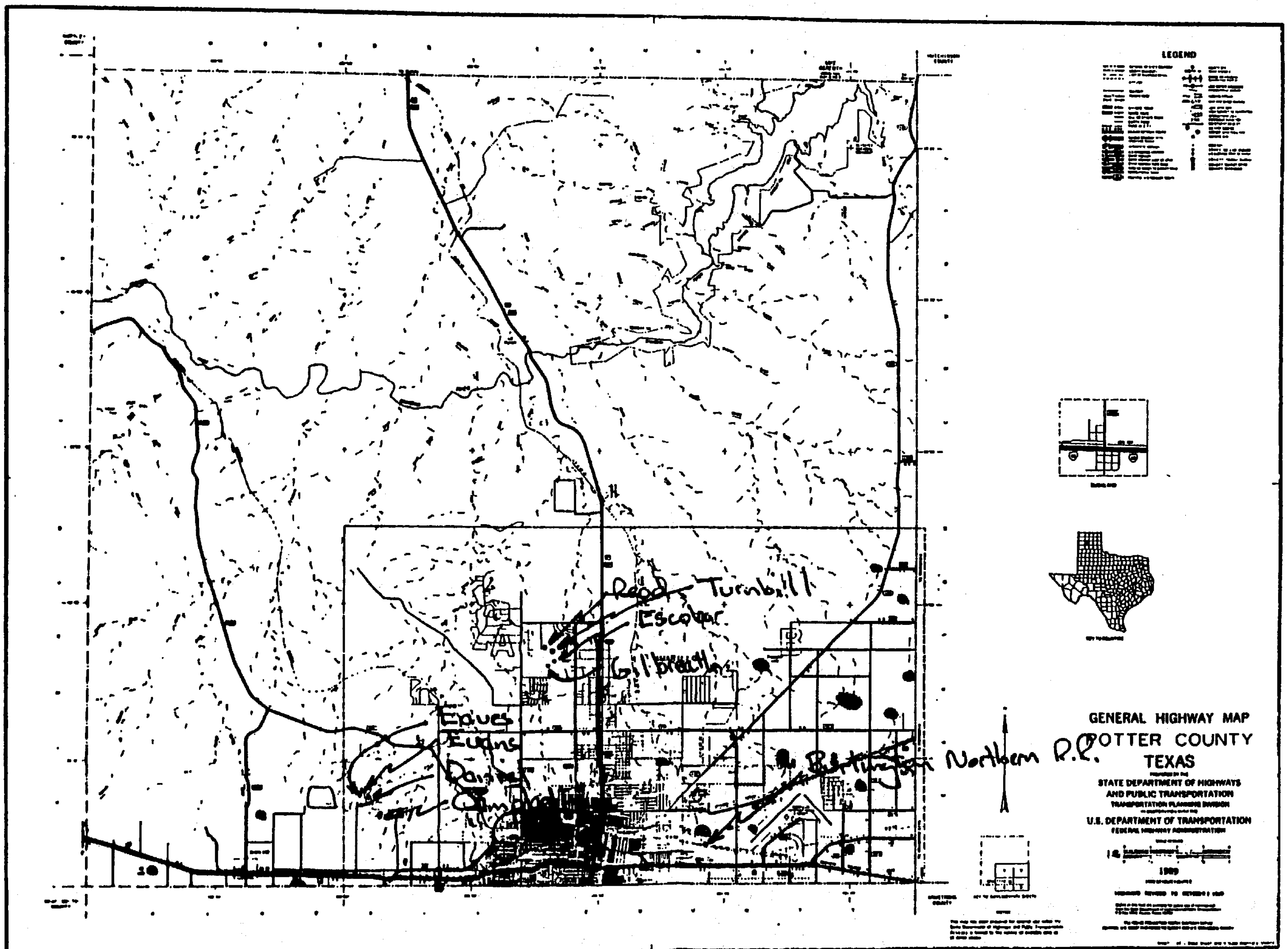
ADDRESS Rt. 6, Box 106 (Street or RFD) Amarillo (City) Texas (State) 79124-950 (Zip)

(Signed) _____ (Licensed Well-Driller) (Signed) _____ (Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

For TWC use only: Well No. _____ Located on map _____

WD-012 (Rev. 05-18-90)


LEGEND
GENERAL HIGHWAY MAP
POTTER COUNTY
TEXAS
STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION
TRANSPORTATION PLANNING DIVISION
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
1989
Reed
Turnbull
Escobar
Gilbreath
Eaves
Evans
Northern R.R.
POTTER COUNTY TEXAS

Send original copy by certified mail to: Texas Water Commission, P.O. Box 13087, Austin, Texas 78711 — Please use black ink.

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

State of Texas
WELL REPORT

Texas Water Well Drillers Board
P.O. Box 13087
Austin, Texas 78711

1) OWNER Evan Evans (Name) ADDRESS Eagle Tree (Street or RFD) (City) (State)

2) LOCATION OF WELL:
County Potter . 9 miles in W (NE, SW, etc.) direction from Amarillo (Town)

Driller must complete the legal description below with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ LEGAL DESCRIPTION:
Section No. _____ Block No. _____ Township _____ Abstract No. _____ Survey Name _____
Distance and direction from two intersecting section or survey lines _____
☒ SEE ATTACHED MAP

3) TYPE OF WORK (Check):
☒ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check):
☒ Domestic ☐ Industrial ☐ Monitor ☐ Public Supply ☐ Irrigation ☐ Test Well ☐ Injection ☐ De-Watering

5) DRILLING METHOD (Check):
☒ Mud Rotary ☐ Air Hammer ☐ Jetted ☐ Bored ☐ Driven ☐ Air Rotary ☐ Cable Tool ☐ Other _____

6) WELL LOG:
Date Drilling: Started 6-17-92 19__ Completed _____ 19__

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
9	Surface	370

7) BOREHOLE COMPLETION:
☐ Open Hole ☐ Straight Wall ☐ Underreamed
☒ Gravel Packed ☐ Other _____
If Gravel Packed give interval ... from 17 ft. to 370 ft.

From (ft.)	To (ft.)	Description and color of formation material
0	25	Topsoil, fine brn sand.
25	50	Fine brn sand, coarse sand & gravel @ 40'.
50	72	Red & grey clay @ 51'.
72	94	Red clay, grn shale & s/s @ 82'.
94	116	Red clay w/shale strks.
116	138	" " " "
138	160	" " " "
160	182	Red clay w/sand strks.
182	204	Blue shale cemented brn sand.

(Use reverse side if necessary)

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
5	N	PVC	0	162	
		PVC	302	342	
		.050 Perforations	162	302	
		.050 Perforations	342	362	

9) CEMENTING DATA [Rule 257.44(1)]
Cemented from 2 ft. to 17 ft. No. of Sacks Used 4
_____ ft. to _____ ft. No. of Sacks Used _____
Method used Mixed
Cemented by Mark Randall

10) SURFACE COMPLETION
☐ Specified Surface Slab Installed [Rule 257.44(2)(A)]
☐ Specified Steel Sleeve Installed [Rule 257.44(3)(A)]
☒ Pitless Adaptor Used [Rule 257.44(3)(B)]
☐ Approved Alternative Procedure Used [Rule 257.71]

13) TYPE PUMP:
☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder ☐ Other _____
Depth to pump bowls, cylinder, jet, etc., _____ ft.

14) WELL TESTS:
Type Test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: _____ gpm with _____ ft. drawdown after _____ hrs.

11) WATER LEVEL:
Static level 60' ft. below land surface Date _____
Artesian flow _____ gpm. Date _____

15) WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable constituents?
☐ Yes ☒ No If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? _____ Depth of strata _____
Was a chemical analysis made? ☐ Yes ☐ No

12) PACKERS: Type Depth

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME K-Ran Drilling, Inc. (Type or print) WELL DRILLER'S LICENSE NO. 2848-W

ADDRESS Rt. 6, Box 106 (Street or RFD) Amarillo, Texas (City) (State) 79124-9502 (Zip)

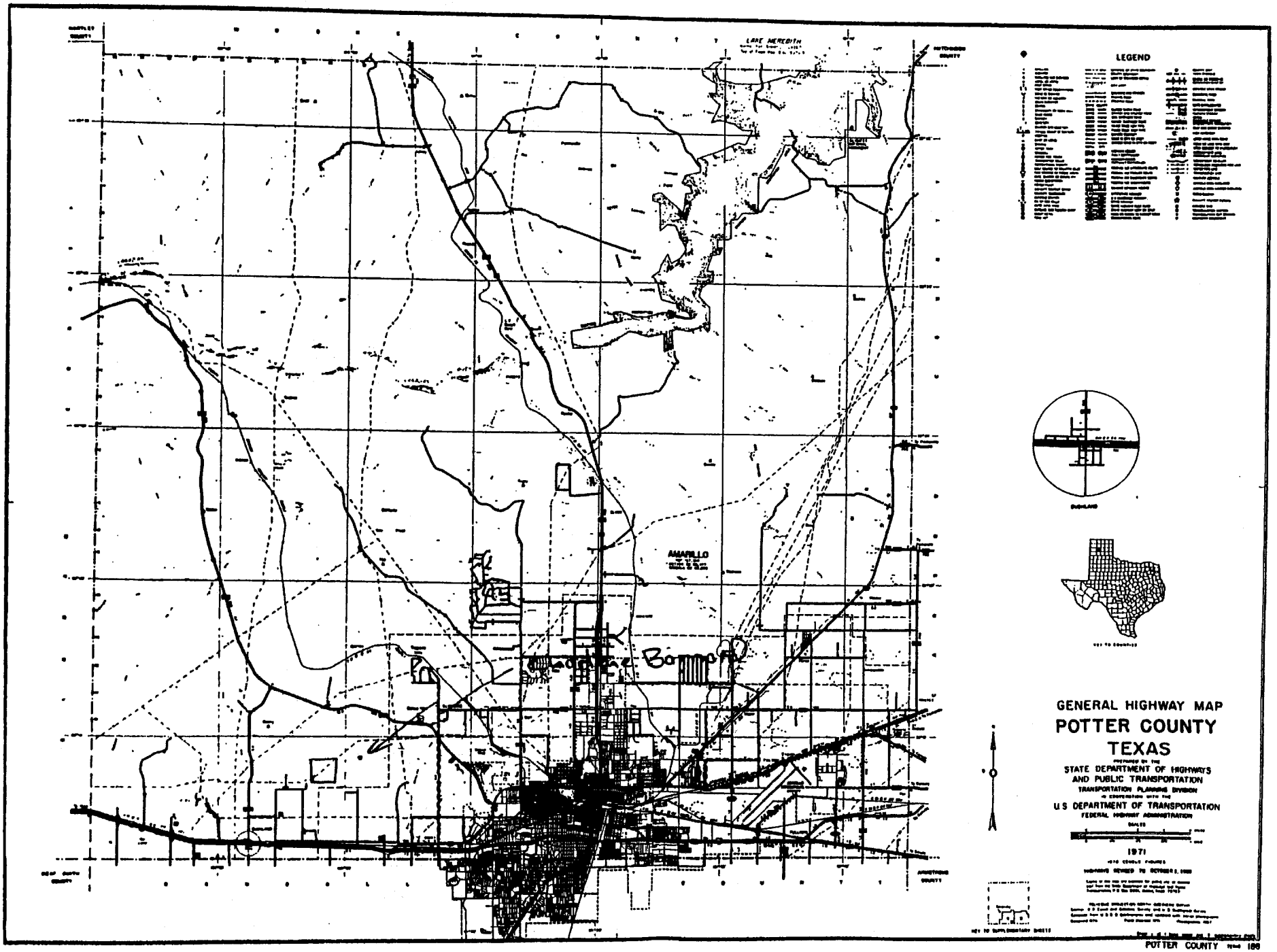
(Signed) _____ (Licensed Well Driller) (Signed) _____ (Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

For TWC use only: Well No. _____ Located on map _____

WD-012 (Rev. 05-16-89)

TEXAS WATER COMMISSION COPY


LEGEND
LAKE MEREDITH
AMARILLO
GENERAL HIGHWAY MAP
POTTER COUNTY
TEXAS
STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION
TRANSPORTATION PLANNING DIVISION
U.S DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
1971

Form CW 8
Form CW 9

...er having well drilled Sul' osL tr (Name) Address Box 1130 Amarillo Texas (Street or RFD) (City) (State)

...owner ... (Name) Address Same (Street or RFD) (City) (State)

...ATION OF WELL:
...ty Potter Labor League Abstract No.
...) NE 1/4 SW 1/4 NE 1/4 of Section 127 Block No. 9 Survey
...es in ... direction from Amarillo (Town)

Victor Plunk Farm

NORTH

Sketch map of well location with distances from adjacent section or survey lines, and to landmarks, roads, and creeks.

☐ AmA

...E OF WORK (Check): ... Well ☒ Deepening ☐ ...onditioning ☐ Plugging ☐

4) PROPOSED USE (Check): Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

5) TYPE OF WELL (Check): Rotary ☐ Driven ☐ Dug ☐ Cable ☒ Jetted ☐ Bored ☐

...L LOG:
...meter of hole 7 in. Depth drilled 290 ft. Depth of completed well 290 ft. Date drilled Dec. 68
All measurements made from 0 ft. above ground level.

To (ft.)	Description and color of formation material	From (ft.)	To (ft.)	Description and color of formation material
2	Blk. clay topsoil	275	278	red clay
8	Yellow clay	278	285	sand & gravel
120	sandy caliche	285	290	red bed clay
14	sand, sandstone stringers			
17	soft sand			
246	sandstone			
25	rock			
275	Ogallala sand			(Use reverse side if necessary)

...PLETION (Check): ...aight wall ☒ Gravel packed ☐ Other ☐ ...der reamed ☐ Open hole ☐

8) WATER LEVEL: Static level 190 ft. below land surface Date Dec. 68
Artesian pressure ___ lbs. per square inch Date ___

...ING: ...pe: old ☒ New ☐ Steel ☒ Plastic ☐ Other ☐
...mented from ___ ft. to 5 ft.

10) SCREEN: Type Torch cut casing
Perforated ☐ Slotted ☐

Diameter (inches)	Setting From (ft.)	Setting To (ft.)	Gage
6 5/8	0	290	.156

Diameter (inches)	Setting From (ft.)	Setting To (ft.)	Slot size
6 5/8	255	290	1/16

...L TESTS:
...s a pump test made? ☐ Yes ☒ No If yes by whom?
...eld: ___ gpm with ___ ft. drawdown after ___ hrs.
...iler test 10 gpm with 1 ft. drawdown after 7 hrs.
...tesian flow ___ gpm Date ___
...mperature of water ___
...s a chemical analysis made? ☐ Yes ☒ No
...d any strata contain undesirable water? ☐ Yes ☒ No
...pe of water: Ogallala depth of strata 190-287

12) PUMP DATA:
Manufacturer's Name Aermotor
Type Submersible H.P. 1
Designed pumping rate 10 gpm ☒ gph ☐
Type power unit Electric
Depth to bowls, cylinder, jet, etc., ___ ft. below land surface.

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

... A. Biggers (Type or Print) Water Well Drillers Registration No. 286
...s 77 Valley Ave. (Street or RFD) Amarillo Texas 79108 (City) (State)
...ned) [signature] C. A. Biggers, Water Well Service (Company Name)

7-56-3(A-J)

[redacted]

...iginal copy by ...ed mail to the ...ater Development Board ...ox 12386 ..., Texas 78711

State of Texas

WATER WELL REPORT

For TWDB use only
Well No. 07-56-3[illegible]
Located on map [illegible]
Received: [illegible]

...on having well drilled WM H BUSH CAT Address AMARILLO TEX
(Name) (Street or RFD) (City) (State)

...owner SAME AS ABOVE Address
(Name) (Street or RFD) (City) (State)

...ATION OF WELL
...nty POTTER , [illegible] miles in direction from BUSHLAND
(N.E., S.W., etc.) (Town)

...ate by sketch map showing landmarks, roads, creeks, ...ay number, etc.*

North

(Use reverse side if necessary)

or

Give legal location with distances and directions from adjacent sections or survey lines.
SEC. 127 [redacted] League
Block 9 Survey BS+F
Abstract No.
(NW¼ NE¼ SW¼ SE¼) of Section

...E OF WORK (Check): ...w Well Deepening ...onditioning Plugging

4) PROPOSED USE (Check): Domestic Industrial Municipal Irrigation Test Well Other

5) TYPE OF WELL (Check): Rotary Driven Dug Cable Jetted Bored

...L LOG
...meter of hole 18" in. Depth drilled 356 ft. Depth of completed well 356 ft. Date drilled 6-30-67

All measurements made from ft. above ground level.

From (ft.)	To (ft.)	Description and color of formation material
	14	SOIL + CALICHE
	60	SANDY CLAY
	85	SHALE + CLAY
	95	CAPROCK
	130	TIGHT SAND + SHALE
	275	FINE SAND
	305	COARSE SAND
	345	ROCK + SAND STKS
	356	RED BED

(Use reverse side if necessary)

9) Casing:
Type: Old New Steel Plastic Other
Cemented from ft. to ft.

Diameter (inches)	Setting From (ft.)	Setting To (ft.)	Gage
16"	0	356	250

10) SCREEN:
Type
Perforated Slotted

Diameter (inches)	Setting From (ft.)	Setting To (ft.)	Slot Size
16	250	356	3/16 x 10

...MPLETION (Check)
Straight wall Gravel packed Other
Under reamed Open Hole

...ATER LEVEL:
...tatic level ft. below land surface Date
Artesian pressure lbs. per square inch Date
Depth to pump bowls, cylinder, jet, etc., ft.
below land surface.

11) WELL TESTS:
Was a pump test made? Yes No If yes, by whom? PEERLESS PUMP CO PLAINVIEW
Yield: gpm with ft. drawdown after hrs.
Bailer test gpm with ft. drawdown after hrs.
Artesian flow gpm
Temperature of water

12) WATER QUALITY:
Was a chemical analysis made? Yes No
Did any strata contain undesirable water? Yes No
Type of water? depth of strata

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

...me W G Coyne Water Well Drillers Registration No. 306
(Type or Print)

...dress 1306 HOLIDAY DR PLAINVIEW TEX
(Street or RFD) (City) (State)

...gned) W H Coyne Coyne Drilling Co
(Water Well Driller) (Company Name)

...ase attach electric log, chemical analysis, and other pertinent information, if available.

WATER RESOURCES

Form CW 8
Form CW 9

...ER:
...ner having well drilled: W. H. Bush Estate (Name) Address: Box 1230, Ama. Texas, 79105 (Street or RFD) (City) (State)

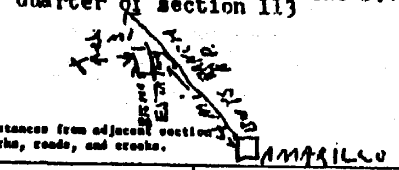
...downer: Same (Name) Address: Same (Street or RFD) (City) (State)

LOCATION OF WELL:
County: Potter Labor ______ League ______ Abstract No. ______

NE¼ SW¼ of Section 113 Block No. 9 Survey BS&F

...tance is NW (N.E. S.W. etc.) direction from Amarillo, Texas (Town)

In NOrtheast corner of the S.W. quarter of Section 113 — NORTH



Sketch map of well location with distances from adjacent section or survey lines, and to landmarks, roads, and creeks.

...PE OF WORK (Check): New Well ☒ Deepening ☐ Reconditioning ☐ Plugging ☐

4) PROPOSED USE (Check): Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☒ stock

5) TYPE OF WELL (Check): Rotary ☐ Driven ☐ Dug ☐ Cable ☒ Jetted ☐ Bored ☐

...LL LOG:
Diameter of hole 9" in. Depth drilled 350' ft. Depth of completed well 350' ft. Date drilled Sept. 78

All measurements made from 0 ft. above ground level.

From (ft.)	To (ft.)	Description and color of formation material
	3	sandy brwn. top soil
	40	yellow sandy clay
	70	limestone w caliche & sandst.
	140	sandy clay w sandstone st.
	162	gravel
	220	hard & soft str. red & grey shale
	225	grey sandy shale w sandstone str.
225	230	sandy red shale
230	240	grey shale w cem. sandst. str.
240	264	red, blue & white shale str.
264	320	red & brown shale
320	342	soft white sandst. w blue shale str. (water bearing)
342	350	Hard brn. shale

(Use reverse side if necessary)

...MPLETION (Check): Straight wall ☒ Gravel packed ☐ Other ☐ Under reamed ☐ Open hole ☐

8) WATER LEVEL:
Static level 210 ft. below land surface Date Sept. 78
Artesian pressure ____ lbs. per square inch Date ______

...SING:
Type: Old ☐ New ☒ Steel ☒ Plastic ☐ Other ☐
Cemented from 0 ft. to 5 ft.

Diameter (Inches)	Setting From (ft.)	Setting To (ft.)	Gage
...5/8	2' above	350	.188

10) SCREEN:
Type Torch cut perforation
Perforated ☐ Slotted ☒

Diameter (Inches)	Setting From (ft.)	Setting To (ft.)	Slot size
6 5/8	305	350	1/16

...LL TESTS:
Was a pump test made? ☐ Yes ☒ No If yes by whom?

Yield: ______ gpm with ______ ft. drawdown after ______ hrs
Bailer test 4 gpm with 100 ft. drawdown after 7 hrs
Artesian flow ______ gpm Date Sept. 78
Temperature of water ______
Was a chemical analysis made? ☐ Yes ☒ No
Did any strata contain undesirable water? ☐ Yes ☒ No
Type of water? Potable sweet Depth of strata 320-342

12) PUMP DATA:
Manufacturer's Name Aermotor windmill
Type 10 Ft H.P. ______
Designed pumping rate 3 gpm ☐ gph ☐
Type power unit ______
Depth to bowls, cylinder, jet, etc., 343 ft. below land surface.

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

C. A. Biggers (Type or Print) Water Well Drillers Registration No. 286

...ress 700 Valley Av (Street or RFD) Amarillo (City) Texas (State)

(Signed) Clifford Biggers (Driller) C. A. Biggers, Drilling & Repair Serv. (Company Name)

...s Department of Water Resources
O Box 13087
...n Texas 78711

WATER WELL REPORT

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

Well No. 07-56-310
Located on map YES
Received: 4-4

OWNER Robert Jac... (Name) Address ... (Street or RFD) (City) (State) (Zip)

LOCATION OF WELL
County Potter 7 miles in N.W. (N.E., S.W., etc.) direction from Amarillo (Town)

...ator must complete the legal description to the right ...h distance and direction from two intersecting sec... ...n or survey lines, or he must locate and identify the ...ll on an official Quarter or Half-Scale Texas County ...neral Highway Map and attach the map to this form.

☐ Legal description:
Section No 114 Block No. 9 Township ...
Abstract No. ... Survey Name Jimmy Nail (Bishop Estates)
Distance and direction from two intersecting section or survey lines B.S.+F.
☐ See attached map.

TYPE OF WORK (Check)
☐ New Well ☐ Deepening
☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check)
☑ Domestic ☐ Industrial ☐ Public Supply
☐ Irrigation ☐ Test Well ☐ Other ...

5) DRILLING METHOD (Check):
☑ Mud Rotary ☐ Air Hammer ☐ Driven ☐ Bored
☐ Air Rotary ☐ Cable Tool ☐ Jetted ☐ Other ...

WELL LOG

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
8 3/4	Surface	230

Date drilled 3-15-80

7) BOREHOLE COMPLETION:
☐ Open Hole ☐ Straight Wall ☐ Underreamed
☑ Gravel Packed ☐ Other ...
If Gravel Packed give interval ... from 0 ft. to 230 ft.

From (ft.)	To (ft.)	Description and color of formation material
	140	Surface Red Clay
140	160	Sandstone W/ Clay Strips
160	180	Hard Sandstone & Red Clay
180	200	Red & Brown Clay.
200	220	Red & Blue Clay W/ Sandstone Strips
220	230	Red Clay

6) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfr., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
5	N	Plastic	0	230	.050
		Perf.	120	220	

CEMENTING DATA
Cemented from ... ft. to ... ft.
Method used ...
Cemented by ... (Company or Individual)

9) WATER LEVEL:
Static level ... ft. below land surface Date 3-15-80
Artesian flow ... gpm. Date ...

10) PACKERS: Type Depth

11) TYPE PUMP:
☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder
☐ Other ...
Depth to pump bowls, cylinder, jet, etc., ... ft.

12) WELL TESTS:
☐ Type Test: ☐ Pump ☐ Bailer ☑ Jetted ☐ Estimated
Yield: 3 gpm with ... ft. drawdown after ... hrs.

(Use reverse side if necessary)

I WATER QUALITY
Did you knowingly penetrate any strata which contained undesirable water? ☐ Yes ☐ No
If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? ... Depth of strata ...
Was a chemical analysis made? ☐ Yes ☐ No

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

ME Lester L. Taylor (Type or Print) Water Well Drillers Registration No. 1849

DRESS Box 781 (Street or RFD) Sunray (City) Texas (State) 79086 (Zip)

... Lea Taylor Drilling Co.

IER Martin Birken Field (Name) Address 3611 A Washington (Street or RFD) Amarillo (City) Texas (State) 79101 (Zip)

ATION OF WELL

unty Potter 7 miles in N. W. (N.E., S.W., etc.) direction from Amarillo (Town)

Legal description:

Section No. 114 Block No. 9 Township

Abstract No. Survey Name Jimmy Nail B.S+F

Distance and direction from two intersecting section or survey lines

See attached map.

must complete the legal description to the right terms and direction from two intersecting sec- survey lines, or he must locate and identify the on official Quarter or Half-Scale Texas County Highway Map and attach the map to this form.

'E OF WORK (Check)

w Well ☐ Deepening

conditioning ☐ Plugging

4) PROPOSED USE (Check)

☒ Domestic ☐ Industrial ☐ Public Supply

☐ Irrigation ☐ Test Well ☐ Other

5) DRILLING METHOD (Check):

☒ Mud Rotary ☐ Air Hammer ☐ Driven ☐ Bored

☐ Air Rotary ☐ Cable Tool ☐ Jetted ☐ Other

LL LOG

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
8 3/4	Surface	180

drilled 3-11 80

7) BOREHOLE COMPLETION:

☐ Open Hole ☐ Straight Wall ☐ Underreamed

☒ Gravel Packed ☐ Other

If Gravel Packed give interval . . . from 0 ft. to 180 ft.

From (ft.)	To (ft.)	Description and color of formation material
	100	Surface Red & Blue Clay W/ Sand & stone
100	120	Sandstone W/ Blue Clay Strip
120	140	Sandstone W/ Red & Blue Clay Stripe
140	160	Red & Blue Shale W/ sand & sandstone stripe
160	180	Red & Yellow Clay

(Use reverse side if necessary)

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfr., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
5	N	Plastic	0	180	.050
		Perf.	90	170	

CEMENTING DATA

Cemented from ft. to ft.

Method used

Cemented by (Company or Individual)

9) WATER LEVEL:

Static level 98 ft. below land surface Date 3-11-80

Artesian flow gpm. Date

10) PACKERS: Type Depth

11) TYPE PUMP:

☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder

☐ Other

Depth to pump bowls, cylinder, jet, etc., ft.

12) WELL TESTS:

☐ Type Test: ☐ Pump ☐ Bailer ☒ Jetted ☐ Estimated

Yield: 12 gpm with ft. drawdown after hrs.

ATER QUALITY

id you knowingly penetrate any strata which contained undesirable ater? ☐ Yes ☒ No

yes, submit "REPORT OF UNDESIRABLE WATER"

ype of water? Depth of strata

as a chemical analysis made) ☐ Yes ☐ No

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

Lester J. Taylor (Type or Print) Water Well Drillers Registration No. 1849

ESS Box 71 (Route or No.) Sunray (City) Texas (State) 79086 (Zip)

Lester J. Taylor

Les Taylor Drilling Co. (Company Name)

...ail to the
...Department of Water Res...
... Box 13087
...tin, Texas 78711

State of Texas
WATER WELL REPORT

DEPT. OF
WATER RESOURCES

For TDWR use only
Well No. 07-56-3D
Located on map Yes
Received: 79 BHC

1) OWNER Gary Alexander (Name) Address Box 2502 (Street or RFD) Amarillo (City) Tex (State) 79106 (Zip)

2) LOCATION OF WELL
County Potter, 5 miles in N.W. (N.E., S.W., etc.) direction from Amarillo (Town)

...ler must complete the legal description to the right ... distance and direction from two intersecting sec... or survey lines, or he must locate and identify the ... on an official Quarter or Half-Scale Texas County ...eral Highway Map and attach the map to this form.

☐ Legal description:
Section No. 914 Block No. 9 Township
Abstract No. Survey Name Jimmy ... Hale
Distance and direction from two intersecting section or survey lines

☐ See attached map. Bishop Estates.

3) TYPE OF WORK (Check): ☒ New Well ( ) Deepening ☐ Reconditioning ( ) Plugging

4) PROPOSED USE (Check): ☒ Domestic ☐ Industrial ☐ Public Supply ☐ Irrigation ☐ Test Well ☐ Other

5) DRILLING METHOD (Check): ☒ Mud Rotary ☐ Air Hammer ☐ Driven ☐ Bored ☐ Air Rotary ☐ Cable Tool ☐ Jetted ☐ Other

6) WELL LOG

Date drilled 12-7-78

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
9 7/8"	Surface	177'

7) BOREHOLE COMPLETION:
☐ Open Hole ☐ Straight Wall ☐ Underreamed
☒ Gravel Packed ☐ Other
If Gravel Packed give interval ... from 0 ft. to 177 ft.

From (ft.)	To (ft.)	Description and color of formation material
0	100	Surface clay
100	120	Red clay & sandstone
120	140	Red clay & sandstone
140	160	Red clay & sandstone
160	177	Red clay

(Use reverse side if necessary)

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mgf., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
5	N	Plastic	0	177	
5"	N	Plastic .50 slots	100	170	

CEMENTING DATA
Cemented from ______ ft. to ______ ft.
Method used ______
Cemented by ______ (Company or Individual)

9) WATER LEVEL:
Static level 95' ft. below land surface Date ______
Artesian flow ______ gpm. Date ______

10) PACKERS: Type Depth

11) TYPE PUMP:
☐ Turbin ☐ Jet ☒ Submersible ☐ Cylinder
☐ Other ______
Depth to pump bowls, cylinder, jet, etc., ______ ft.

12) WELL TESTS:
☐ Type Test: ☐ Pump ☐ Bailer ☒ Jetted ☐ Estimated
Yield: 15 gpm with ______ ft. drawdown after ______ hrs.

WATER QUALITY.
Did you knowingly penetrate any strata which contained undesirable water? ( ) Yes ☒ No
If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? ______ Depth of strata ______
Was a chemical analysis made? ☐ Yes ☐ No

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

NAME Lester J Taylor (Type or Print) Water Well Drillers Registration No. 1849

ADDRESS Box 284 (Street or RFD) Sunray (City) Tex. (State) 79086 (Zip)

(Signed) [signature] (Water Well Driller) [signature] Taylor Drilling Co. (Company Name)

NER William A. Bowers (Name) Address 2 Cambridge (Street or RFD) Amarillo, Tx. 79106 (City) (State) (Zip)

CATION OF WELL
County Potter 10 miles in W (N E, S W., etc.) direction from Amarillo (Town)

must complete the legal description to the right
istance and direction from two intersecting sec-
survey lines, or he must locate and identify the
on official Quarter or Half-Scale Texas County
Highway Map and attach the map to this form.

☐ Legal description:
Section No. 1114 Block No. 9 Township
Abstract No. Survey Name BS&F
Distance and direction from two intersecting section or survey lines
Unit 1 Track 80, Bishop Estates
☐ See attached map.

PE OF WORK (Check)
ew Well ☐ Deepening
econditioning ☐ Plugging

4) PROPOSED USE (Check)
☒ Domestic ☐ Industrial ☐ Public Supply
☐ Irrigation ☐ Test Well ☐ Other

5) DRILLING METHOD (Check):
☒ Mud Rotary ☐ Air Hammer ☐ Driven ☐ Bored
☐ Air Rotary ☐ Cable Tool ☐ Jetted ☐ Other

LL LOG

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
	Surface	
10	0	352

te drilled 6/22/80

7) BOREHOLE COMPLETION:
☐ Open Hole ☐ Straight Wall ☐ Underreamed
☒ Gravel Packed ☐ Other
If Gravel Packed give interval ... from top ft. to bottom ft.

From (ft.)	To (ft.)	Description and color of formation material
0	3	top soil
3	64	Caliche
64	80	Clay & hard rock
80	187	Red clay
187	190	Blue clay
190	196	Sandy clay & sandstone
196	210	Blue clay
210	231	Speckled caly w/ sandstone
231	253	Hard gray rock
253	318	Hard gray rock & clay
318	332	Red clay & rock
332	352	Sand & sandstone
352		Yellow clay & rock

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfr., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
5	N	Plastic	-2	352	190
		Perfs 120 ft. on bottom			
		232-352 ?			

CEMENTING DATA
Cemented from ft. to ft.
Method used
Cemented by (Company or Individual)

9) WATER LEVEL:
Static level 217 ft. below land surface Date 6/22/80
Artesian flow gpm. Date

10) PACKERS: Type Depth

11) TYPE PUMP:
☐ Turbine ☐ Jet ☒ Submersible ☐ Cylinder
☐ Other
Depth to pump bowls, cylinder, jet, etc., 320 ft.

12) WELL TESTS:
☐ Type Test: ☐ Pump ☒ Bailer ☐ Jetted ☐ Estimated
Yield: 12 gpm with 0 ft. drawdown after 1 hrs.

OCT 07 1981

(Use reverse side if necessary)

WATER QUALITY
Did you knowingly penetrate any strata which contained undesirable water? ☐ Yes ☒ No
If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? Depth of strata
Was a chemical analysis made? ☐ Yes ☒ No

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

ME Charles Hooley (Type or Print) Water Well Drillers Registration No. 674

DRESS Box 177 (Street or Miami (City) Tx. (State) 79059 (Zip)

Miami Water Well Service (Firm Name)

...s Department of Water Res...
...Box 13087
...th Texas 78711

WATER WELL REPORT

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

Well No. 07-56-3E
Located on map YC5
Received: C.F.S

OWNER John Pot (Name) Address Box 162 (Street or RFD) Cactus (City) Texas (State) 79013 (Zip)

LOCATION OF WELL
County Potter 5 miles on NW (N.E.S.W., etc.) direction from Amarillo, Tex. (Town)
Well Location Bishop Hills Estate

...ter must complete the legal description to the right ...h distance and direction from two intersecting sec... ...or survey lines, or he must locate and identify the ...l on an official Quarter or Half-Scale Texas County ...ural Highway Map and attach the map to this form.

☐ Legal description:
Section No. _____ Block No. _____ Township _____
Abstract No. _____ Survey Name _____
Distance and direction from two intersecting section or survey lines _____
X ☐ See attached map.

TYPE OF WORK (Check)
☐ New Well ☐ Deepening
☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check)
☒ Domestic ☐ Industrial ☐ Public Supply
☐ Irrigation ☐ Test Well ☐ Other _____

5) DRILLING METHOD (Check):
☒ Mud Rotary ☐ Air Hammer ☐ Driven ☐ Bored
☐ Air Rotary ☐ Cable Tool ☐ Jetted ☐ Other _____

WELL LOG

Date drilled March 19,198

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
8 3/4	Surface	350

7) BOREHOLE COMPLETION:
☐ Open Hole ☐ Straight Wall ☐ Underreamed
☒ Gravel Packed ☐ Other _____
If Gravel Packed give interval ... from 0 ft. to 350 ft.

From (ft.)	To (ft.)	Description and color of formation material
0	28	Topsoil & Caliche
28	48	Caliche & rock
48	92	Rock & Clay
92	136	White Clay & Sand
136	180	Sand & Gravel
180	202	Sand & Gray clay
202	246	Gray & white clay
246	268	White, gray, & red clay
268	290	Gray & red clay
290	312	Red clay & gravel
312	334	Red clay
334	350	Red clay
	350	TD

(Use reverse side if necessary)

6) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
5	New	Steel, Perf.	250	350	

CEMENTING DATA
Cemented from _____ ft. to _____ ft.
Method used _____
Cemented by _____ (Company or Individual)

9) WATER LEVEL:
Static level 250 ft. below land surface Date 3-19-81
Artesian flow _____ gpm. Date _____

10) PACKERS: Type Depth

11) TYPE PUMP:
☐ Turbine ☐ Jet ☒ Submersible ☐ Cylinder
☐ Other _____
Depth to pump bowls, cylinder, jet, etc., 315 ft.

12) WELL TESTS:
☐ Type Test: ☐ Pump ☒ Bailer ☐ Jetted ☐ Estimated
Yield: 23 gpm with 25 ft. drawdown after 3 hrs.

8) WATER QUALITY
Did you knowingly penetrate any strata which contained undesirable water? ☐ Yes ☒ No
If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? _____ Depth of strata _____
Was a chemical analysis made? ☐ Yes ☒ No

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

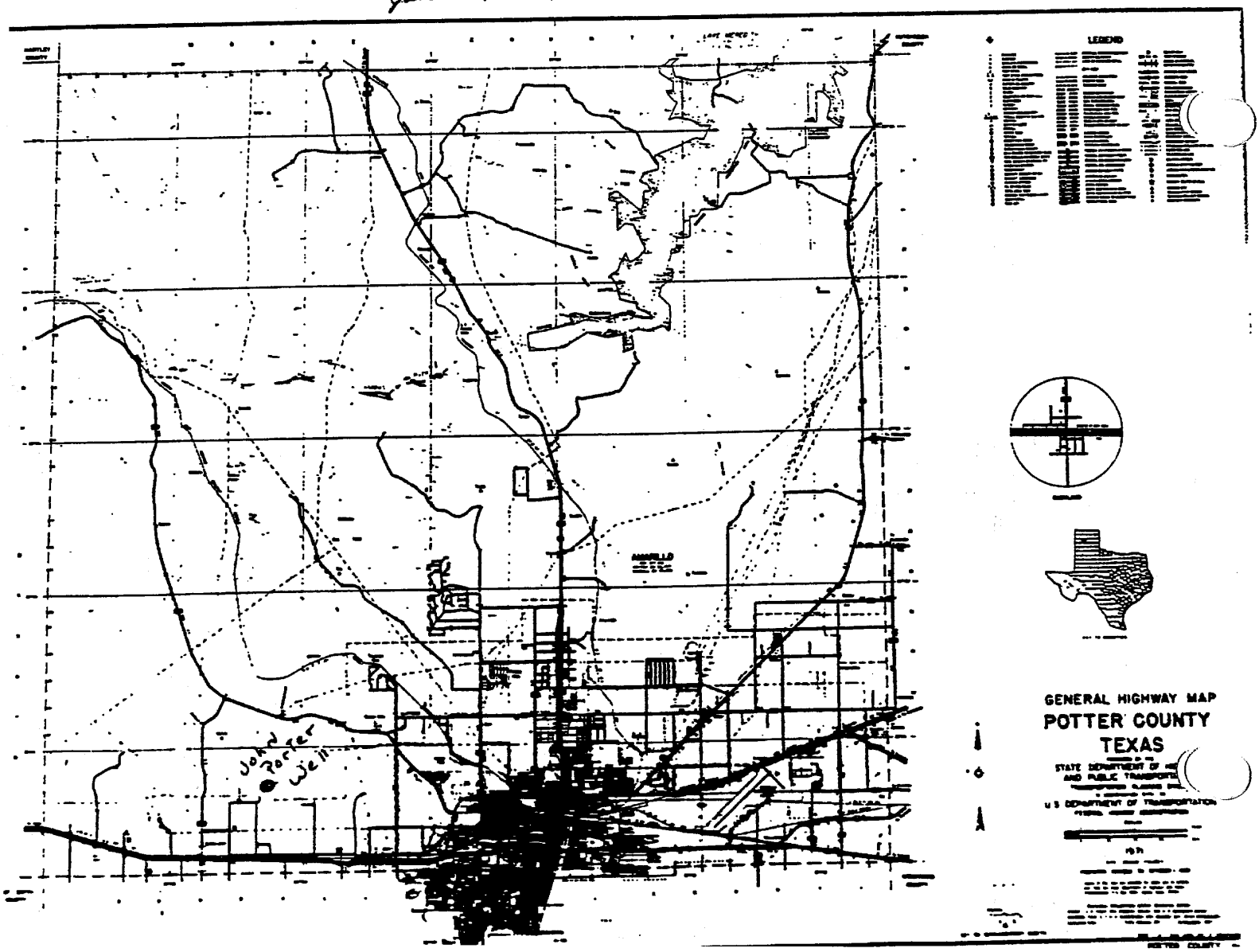
NAME Jimmy McCaskill (Type or Print) Water Well Drillers Registration No. 1771

ADDRESS 8018 River Road (Street or RFD) Amarillo (City) Texas (State) 79108 (Zip)

Signed Jimmy McCaskill A & A Drilling Company

(806) 935-4453
Dimmas

John Porter's Well



...as Department of Water Reso...
...Box 13087
...stin, Texas 78711

WATER WELL REPORT

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

For TWDB use only
Well No. 07-56-3F
Located on map YES
Received: KLW

OWNER Jules Bragg (Name) Address 3534 Barclay (Street or RFD) Amarillo (City) Texas (State) 79109 (Zip)

LOCATION OF WELL
County Potter 10 miles in N.W. (NE, SW, etc.) direction from Amarillo (Town)

...ner must complete the legal description to the right ...h distance and direction from two intersecting sec... ...or survey lines, or he must locate and identify the ...t on an official Quarter or Half-Scale Texas County ...ral Highway Map and attach the map to this form.

☐ Legal description:
Section No. _____ Block No. _____ Township _____
Abstract No. _____ Survey Name _____
Distance and direction from two intersecting section or survey lines _____
☑ See attached map. Map on 06-44-70

TYPE OF WORK (Check)
☐ New Well ☐ Deepening
☐ Recondi...oning ☐ Plugging

4) PROPOSED USE (Check)
☑ Domestic ☐ Industrial ☐ Public Supply
☐ Irrigation ☐ Test Well ☐ Other _____

5) DRILLING METHOD (Check):
☑ Mud Rotary ☐ Air Hammer ☐ Driven ☐ Bored
☐ Air Rotary ☐ Cable Tool ☐ Jetted ☐ Other _____

WELL LOG

Date drilled 4-14-81

DIAMETER OF HOLE

Dia (in.)	From (ft.)	To (ft.)
8 3/4	Surface	345

7) BOREHOLE COMPLETION:
☐ Open Hole ☐ Straight Wall ☐ Underreamed
☑ Gravel Packed ☐ Other _____
If Gravel Packed give interval ... from Surface ft. to 350 ft.

From (ft.)	To (ft.)	Description and color of formation material
0	15	Top Soil + Caliche + Rock
15	30	Caliche + Rock
30	45	Red clay + Rock
45	60	" " "
60	75	" " "
75	90	Red clay + stks Blue shale
90	105	" " " " "
105	120	" " " " "
120	135	Red clay + Rock
135	150	" " "
150	165	Red + Blue clay + stks Rock
165	180	" " " " stks Lime stone
180	195	Blue shale + stks Lime stone
195	210	" " " " "
210	225	" " " " "
225	240	Red + Blue shale + stks Limestone
240	255	" " " " "
255	270	" " " " + stks yellow clay
270	285	yellow clay
285	300	" "
300	315	" "
315	330	" "
330	345	yellow clay

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mgf., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
5	N	P.V.C.	Surface	350	40
		300 ft of Perf			

CEMENTING DATA
Cemented from _____ ft. to _____ ft.
Method used _____
Cemented by _____ (Company or Individual)

9) WATER LEVEL:
Static level 135 ft. below land surface Date 4-14-81
Artesian flow _____ gpm. Date _____

10) PACKERS: Type Depth

11) TYPE PUMP:
☐ Turbine ☐ Jet ☑ Submersible ☐ Cylinder
☐ Other _____
Depth to pump bowls, cylinder, jet, etc., _____ ft.

12) WELL TESTS:
☐ Type Test. ☐ Pump ☑ Bailer ☐ Jetted ☐ Estimated
Yield. 6 gpm with 90 ft. drawdown after 2 hrs.

(Use reverse side if necessary)

13) WATER QUALITY
Did you knowingly penetrate any strata which contained undesirable water? ☐ Yes ☑ No
If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? _____ Depth of strata _____
Was a chemical analysis made? ☐ Yes ☐ No

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

NAME Joe Gillen (Type or Print) Water Well Drillers Registration No. 2053

ADDRESS Rt 5 Box 22E (Street or RFD) Amarillo (City) Texas (State) 79118 (Zip)

A. Allen FFA Drilling Co.

Certified mail to the Texas Department of Water Re: P O Box 13087 Austin, Texas 78711

WATER WELL REPORT

P.O. Box 13087 Austin, Texas 78711

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

1) OWNER LEWIS LANCHETTIN (Name) Address 103 RATON (Street or RFD) AMARILLO (City) TX (State) (Zip)

2) LOCATION OF WELL: County POTTER 6 miles in N.W. (N.E., S.W., etc.) direction from AMARILLO (Town)

Driller must complete the legal description to the right with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ Legal description:
Section No. _____ Block No. _____ Township _____
Abstract No. _____ Survey Name _____
Distance and direction from two intersecting section or survey lines _____

☒ See attached map. 07-56-36

3) TYPE OF WORK (Check): ☒ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check): ☐ Domestic ☐ Industrial ☐ Public Supply ☐ Irrigation ☐ Test Well ☐ Other _____

5) DRILLING METHOD (Check): ☐ Mud Rotary ☐ Air Hammer ☐ Driven ☐ Bored ☐ Air Rotary ☐ Cable Tool ☐ Jetted ☐ Other _____

6) WELL LOG:

Date drilled 12-11-84

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
8¾"	Surface	290

From (ft.)	To (ft.)	Description and color of formation material
0	15	TOP SOIL + CALICHE
15	30	CALICHE W/BROWN SHALE + SANDY CLAY
30	60	BROWN SHALE + SANDY CLAY
60	120	SANDY CLAY W/RED + GRAY SHALE
120	150	RED + GRAY SHALE W/ROCK + GRAVEL
150	195	FINE SAND W/RED + GRAY SHALE
195	290	FINE SAND W/RED + GRAY SHALE W/STKS. RED CLAY

7) BOREHOLE COMPLETION: ☐ Open Hole ☐ Straight Wall ☐ Underreamed ☒ Gravel Packed ☐ Other _____
If Gravel Packed give interval . . . from 10 ft. to 290 ft.

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mgf., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
4½	N	PVC PLASTIC	0	190	
4½	N	PVC PERFORATED	190	290	

CEMENTING DATA
Cemented from 0 ft. to 10 ft.
Method used _____
Cemented by A-1 PUMP + WELL SERVICE (Company or Individual)

9) WATER LEVEL:
Static level 130 ft. below land surface Date 12-13-84
Artesian flow _____ gpm. Date _____

10) PACKERS: Type Depth

11) TYPE PUMP: ☐ Turbine ☐ Jet ☒ Submersible ☐ Cylinder ☐ Other _____
Depth to pump bowls, cylinder, jet, etc., 260 ft.

12) WELL TESTS: ☐ Type Test: ☐ Pump ☒ Bailer ☐ Jetted ☐ Estimated
Yield: 12 gpm with 200 ft. drawdown after 2 hrs.

RECEIVED
JAN 4 1985
DEPT. OF WATER RESOURCES

(Use reverse side if necessary)

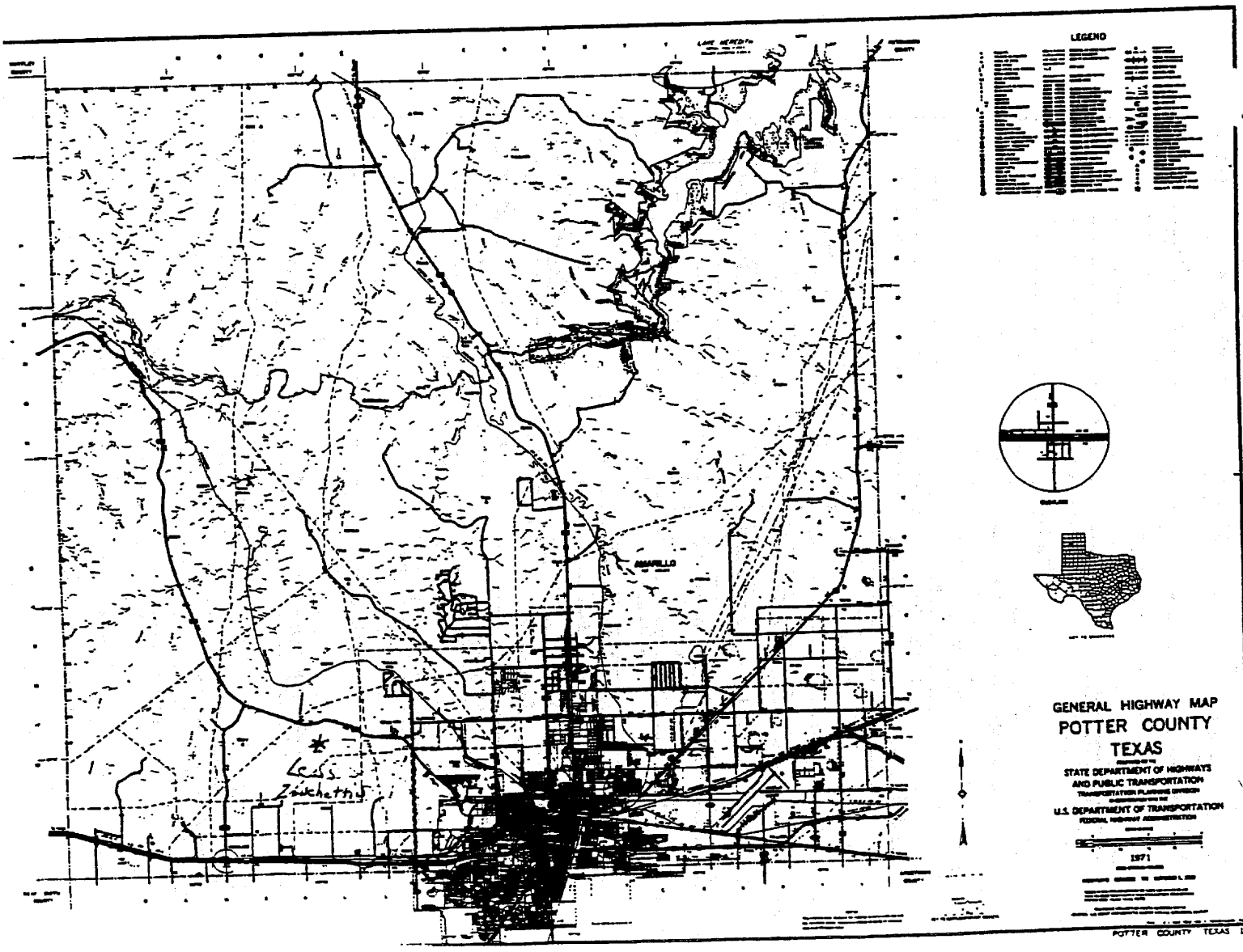
13) WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable water? ☐ Yes ☒ No
If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? FRESH Depth of strata 160' ft.
Was a chemical analysis made? ☐ Yes ☐ No

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

COMPANY NAME A-1 PUMP + WELL SERV. (Type or Print) Water Well Driller's License No. 2119

ADDRESS RT. 2 BOX 54-G (Street or RFD) AMARILLO (City) TX (State) 79101 (Zip)

DRILLER


LEGEND
AMARILLO
GENERAL HIGHWAY MAP
POTTER COUNTY
TEXAS
STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION
U.S. DEPARTMENT OF TRANSPORTATION
1971
POTTER COUNTY TEXAS

Texas Department of Water R
P O Box 13087
Austin, Texas 78711

WATER WELL REPORT

Austin, Texas 78711

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

1) OWNER Chuck Wesley (Name) Address 2507 S Spring (Street or RFD) Amarillo (City) TX (State) 79103 (Zip)

2) LOCATION OF WELL: County Potter 10 miles in N.W. (N.E., S.W., etc.) direction from Amarillo (Town)

Driller must complete the legal description to the right with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ Legal description:
Section No. _____ Block No. _____ Township _____
Abstract No. _____ Survey Name _____
Distance and direction from two intersecting section or survey lines _____

☒ See attached map.

3) TYPE OF WORK (Check):
☒ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check):
☒ Domestic ☐ Industrial ☐ Public Supply ☐ Irrigation ☐ Test Well ☐ Other

5) DRILLING METHOD (Check):
☒ Mud Rotary ☐ Air Hammer ☐ Driven ☐ Bored ☐ Air Rotary ☐ Cable Tool ☐ Jetted ☐ Other

6) WELL LOG:
Date drilled 11-2-84

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
8¾"	Surface	350

7) BOREHOLE COMPLETION:
☐ Open Hole ☐ Straight Wall ☐ Undereamed
☒ Gravel Packed ☐ Other
If Gravel Packed give interval . . . from 0 ft. to 350 ft.

From (ft.)	To (ft.)	Description and color of formation material
0	15	Top soil & caliche
15	30	Sandy Clay w/caliche & fine sand
30	60	fine sand w/cemented sand & Sandstone
60	105	Fine to med. sand w/cemented sand & Sandstone
105	165	Med. to coarse sand w/stks. Sandstone
165	210	Med. to coarse sand w/stks. Sandstone & red shale
210	285	Red shale w/stks. Sandstone & Red clay
285	350	Red shale w/stks Sandstone & Red w/Gray clay

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfr., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
4½"	N	Plastic	0	150	
4½"	N	P.U.C. Perforated	150	350	

CEMENTING DATA
Cemented from 0 ft. to 10' ft.
Method used
Cemented by A-1 Pump & Well Service (Company or Individual)

9) WATER LEVEL:
Static level 150' ft. below land surface Date 11/4/84
Artesian flow _____ gpm. Date _____

10) PACKERS: Type Depth

11) TYPE PUMP:
☐ Turbine ☐ Jet ☒ Submersible ☐ Cylinder ☐ Other
Depth to pump bowls, cylinder, jet, etc., 340' ft.

12) WELL TESTS:
☐ Type Test: ☐ Pump ☒ Bailer ☐ Jetted ☐ Estimated
Yield: 10 gpm with 140 ft. drawdown after 2 hrs.

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DEPT. OF WATER RESOURCES

13) WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable water? ☐ Yes ☒ No
If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? Fresh Depth of strata 200' ft.
Was a chemical analysis made? ☐ Yes ☒ No

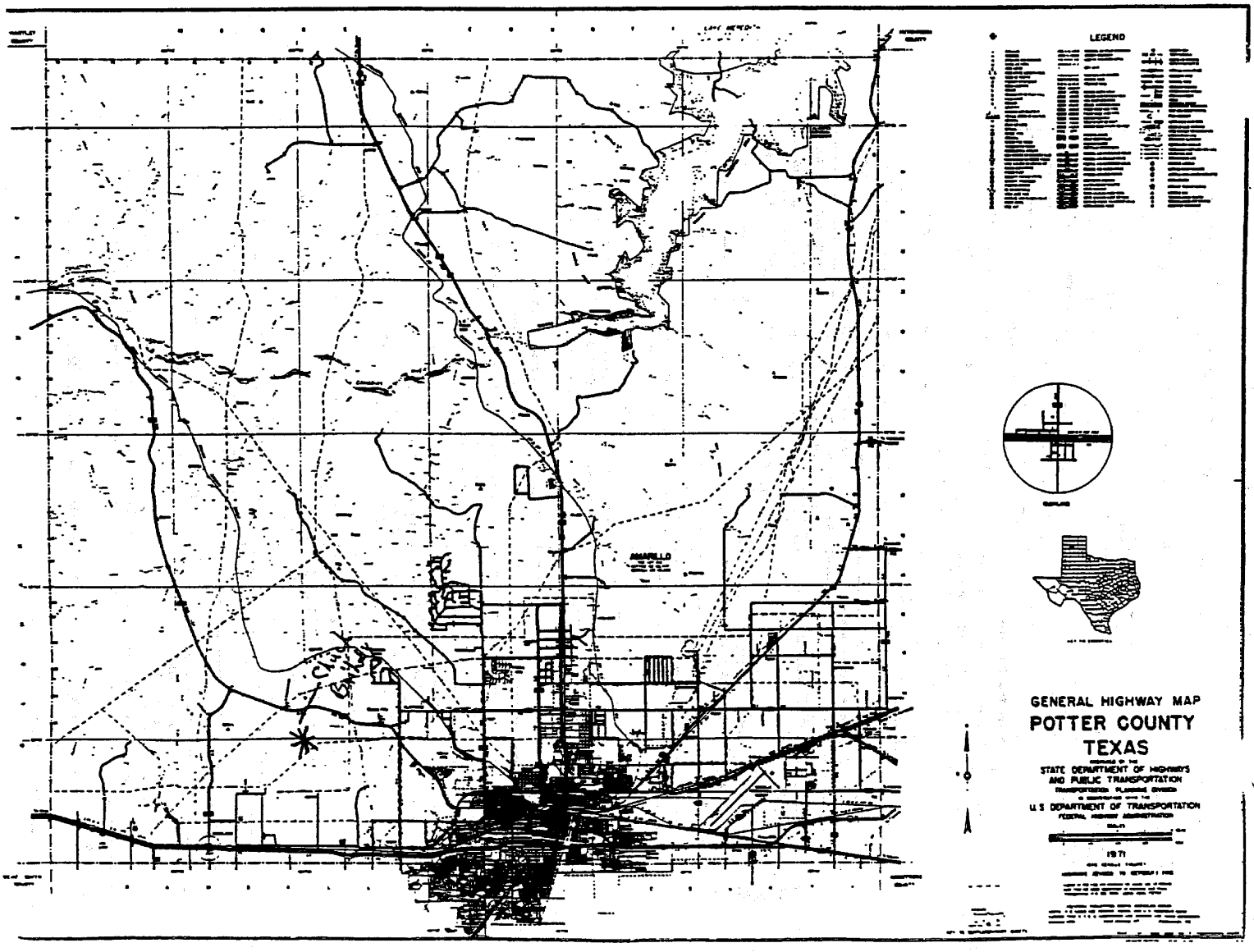
(Use reverse side if necessary)

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

COMPANY NAME A-1 Pump & Well Service (Type or Print) Water Well Driller's License No. 2119

ADDRESS Rt. 2 Box 54-G (Street or RFD) Amarillo (City) Tx. (State) 79101 (Zip)

(Signed) Richard D Bostick (Signed)


LEGEND
AMARILLO
GENERAL HIGHWAY MAP
POTTER COUNTY
TEXAS
STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
U.S. DEPARTMENT OF TRANSPORTATION
1971

nd original copy by
rtified mail to the
exas Department of Water Resources
O. Box 13087
ustin, Texas 78711

WATER WELL REPORT

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

P. O. Box 13087
Austin, Texas 78711

OWNER DAY & COMPANY (Name) Address 6309 Bo Indiana Lubbock, Texas 79413 (Street or RFD) (City) (State) (Zip)

LOCATION OF WELL:
County Potter 8 miles in N. W. (N.E., S.W., etc.) direction from Amarillo (Town)

☐ Legal description:
Section No. 113 Block No. 9 Township
Abstract No. Survey Name B B & F
Distance and direction from two intersecting section or survey lines

☐ See attached map.

driller must complete the legal description to the right
th distance and direction from two intersecting sec-
n or survey lines, or he must locate and identify the
ell on an official Quarter- or Half-Scale Texas County
ineral Highway Map and attach the map to this form.

TYPE OF WORK (Check):
☒ New Well ☐ Deepening
☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check):
☒ Domestic ☐ Industrial ☐ Public Supply
☐ Irrigation ☐ Test Well ☐ Other

5) DRILLING METHOD (Check):
☒ Mud Rotary ☐ Air Hammer ☐ Driven ☐ Bored
☐ Air Rotary ☐ Cable Tool ☐ Jetted ☐ Other

WELL LOG:

Date drilled 1-6-85

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
8 3/4	Surface	295

7) BOREHOLE COMPLETION:
☐ Open Hole ☐ Straight Wall ☐ Underreamed
☒ Gravel Packed ☐ Other
If Gravel Packed give interval . . . from 15 ft. to 295 ft.

From (ft.)	To (ft.)	Description and color of formation material
0	115	SURFACE CALICHE (CLAY & SAND)
115	155	Sand & gravel
155	195	Red clay
195	235	Red clay w/ sandstone strips
235	275	Red & green clay w/ sandstone strips
275	295	Blue clay

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mgf., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
5	N	Plastic Perf	115	285	.050

9) CEMENTING DATA [Rule 319.44(b)]
Cemented from Plug 1 ft. to 15 ft.
ft. to ft.
Method used Hand Mixed
Cemented by Les Taylor Drilling

10) SURFACE COMPLETION
☐ Specified Surface Slab Installed [Rule 319.44(c)]
☐ Pitless Adapter Used [Rule 319.44(d)]
☒ Approved Alternative Procedure Used [Rule 319.71]

11) WATER LEVEL:
Static level ft. below land surface Date
Artesian flow gpm. Date

12) PACKERS: Type Depth

13) TYPE PUMP:
☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder
☐ Other
Depth to pump bowls, cylinder, jet, etc., ft.

14) WELL TESTS:
Type Test: ☐ Pump ☐ Baller ☒ Jetted ☐ Estimated
Yield: 25 gpm with ft. drawdown after hrs.

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DEPT. OF
WATER RESOURCES

(Use reverse side if necessary)

15) WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable water? ☐ Yes ☒ No
If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? Depth of strata
Was a chemical analysis made? ☐ Yes ☐ No

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 12 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME LES TAYLOR DRILLING (Type or Print) Water Well Driller's License No. 2366

ADDRESS P. O. Box 784 Sunray, Texas 79086 (Street or RFD) (City) (State) (Zip)

...xas Department of Water Resources
...O. Box 13087
...ustin, Texas 78711

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

...) OWNER: DAy and Company (Name) — Address: 6309 S. Indiana (Street or RFD) Lubbock (City) TX (State) 79413 (Zip)

...) LOCATION OF WELL: County: Potter — 6 miles in W.N.W. (N.E., S.W., etc.) direction from Amarillo (Town)

...riller must complete the legal description to the right ...th distance and direction from two intersecting sec...tion or survey lines, or he must locate and identify the ...ell on an official Quarter- or Half-Scale Texas County ...eneral Highway Map and attach the map to this form.

☐ Legal description:
Section No. ______ Block No. ______ Township ______
Abstract No. ______ Survey Name ______
Distance and direction from two intersecting section or survey lines ______

☒ See attached map. map on 07-56-31

...) TYPE OF WORK (Check): ☒ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check): ☒ Domestic ☐ Industrial ☐ Public Supply ☐ Irrigation ☐ Test Well ☐ Other

5) DRILLING METHOD (Check): ☒ Mud Rotary ☐ Air Hammer ☐ Driven ☐ Bored ☐ Air Rotary ☐ Cable Tool ☐ Jetted ☐ Other

...) WELL LOG:

Date drilled 3/14/85

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
8 3/4"	Surface	300'

7) BOREHOLE COMPLETION:
☐ Open Hole ☐ Straight Wall ☐ Underreamed
☒ Gravel Packed ☐ Other
If Gravel Packed give interval ... from 10 ft. to 300 ft.

From (ft.) – To (ft.)	Description and color of formation material
-15	Topsoil w/sandy caliche
...-60	caliche + caliche rock
...-75	caliche w/sandy clay
...5-105	med. to coarse sand w/sandstone
...5-120	fine sand w/cemented sand
...0-135	fine sand
...5-240	fine to med. sand w/stk cemented sand
...40-255	fine to med. sand w/fine gravel
...55-270	gray sandy clay w/sand strips
...70-285	Red + gray clay w/sandstone (Cemented Sand)
...85-300	Red + gray clay w/sandstone (Cemented)
...00'	Red clay

(Use reverse side if necessary)

RECEIVED
APR - 8 1985
DEPT. OF
WATER RESOURCES

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mgf., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
4 1/2	N	Plastic	0	180'	
4 1/2"	N	PVC. Perforated	180'	300'	

CEMENTING DATA
Cemented from 0 ft. to 10' ft.
Method used ______
Cemented by A-1 Pump + Well Service (Company or Individual)

9) WATER LEVEL:
Static level 170' ft. below land surface Date 3/15/85
Artesian flow ______ gpm. Date ______

10) PACKERS: Type Depth

11) TYPE PUMP:
☐ Turbine ☐ Jet ☒ Submersible ☐ Cylinder
☐ Other ______
Depth to pump bowls, cylinder, jet, etc., 240' ft.

...) WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable water? ☐ Yes ☒ No
If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? Fresh Depth of strata 130' ft
Was a chemical analysis made? ☐ Yes ☒ No

12) WELL TESTS:
☐ Type Test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: 12 gpm with 60' ft. drawdown after 2 hrs.

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

...OMPANY NAME A-1 Pump + Well Service (Type or Print) — Water Well Driller's License No. 2119

...DDRESS Rt. 2 Box 54-G (Street or RFD) Amarillo (City) TX. (State) 79101 (Zip)

...igned) [signature] (Licensed Well Driller) (Signed) Ricky G. [signature] (Registered Driller Trainee) Owp

...ase attach electric log, chemi... ...s, and other pertinent information, if available.

For TDWR use only
Well No. 07-56-31
Located on map YES C.T.S.

Karen
(806) 622-0852

Texas Department of Water ...
P. O. Box 13087
Austin, Texas 78711

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

Austin, Texas ...

1) OWNER DAY L Company (Name) Address 6309 B. Indiana (Street or RFD) Lubbock (City) Tx. (State) 7941 (Zip)

2) LOCATION OF WELL: County Potter 6 miles in W.N.W (N.E., S.W., etc.) direction from Amarillo (Town)

Driller must complete the legal description to the right with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ Legal description:
Section No. _____ Block No. _____ Township _____
Abstract No. _____ Survey Name _____
Distance and direction from two intersecting section or survey lines _____
☒ See attached map.

3) TYPE OF WORK (Check): ☒ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check): ☒ Domestic ☐ Industrial ☐ Public Supply ☐ Irrigation ☐ Test Well ☐ Other _____

5) DRILLING METHOD (Check): ☒ Mud Rotary ☐ Air Hammer ☐ Driven ☐ Bored ☐ Air Rotary ☐ Cable Tool ☐ Jetted ☐ Other _____

6) WELL LOG:

Date drilled 3/12/85

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
8 3/4"	Surface	300'

7) BOREHOLE COMPLETION:
☐ Open Hole ☐ Straight Wall ☐ Underreamed
☒ Gravel Packed ☐ Other _____
If Gravel Packed give interval ... from 10 ft. to 300 ft.

From (ft.)	To (ft.)	Description and color of formation material
0	15	Top soil w/sandy caliche
15	60	Caliche + caliche rock
60	75	Caliche w/sandy clay
75	105	Med. to coarse sand w/sandstone
105	120	Fine sand w/cemented sand
120	135	Fine sand
135	240	Fine to med. sand w/ltle. cemented sand
240	255	Fine to med. sand w/fine gravel
255	270	Gray sandy clay w/sand strips
270	285	Red + gray clay w/Sandstone + Cemented Sand
285	300	Red + gray clay w/Sandstone Cemented Sand
300		Red clay

(Use reverse side if necessary)

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mgf., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
4½"	N	Plastic	0	180'	
4½"	N	P.V.C., Perforated	180'	300'	

CEMENTING DATA
Cemented from 0 ft. to 10 ft.
Method used _____
Cemented by A-1 Pump + Well Service (Company or Individual)

9) WATER LEVEL:
Static level 170 ft. below land surface Date 3/14/85
Artesian flow _____ gpm. Date _____

10) PACKERS: Type Depth

11) TYPE PUMP:
☐ Turbine ☐ Jet ☒ Submersible ☐ Cylinder
☐ Other _____
Depth to pump bowls, cylinder, jet, etc., 240' ft.

12) WELL TESTS:
☐ Type Test: ☐ Pump ☒ Baller ☐ Jetted ☐ Estimated
Yield: 12 gpm with 100' ft. drawdown after 2 hrs.

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APR 8 1985
DEPT. OF WATER RESOURCES

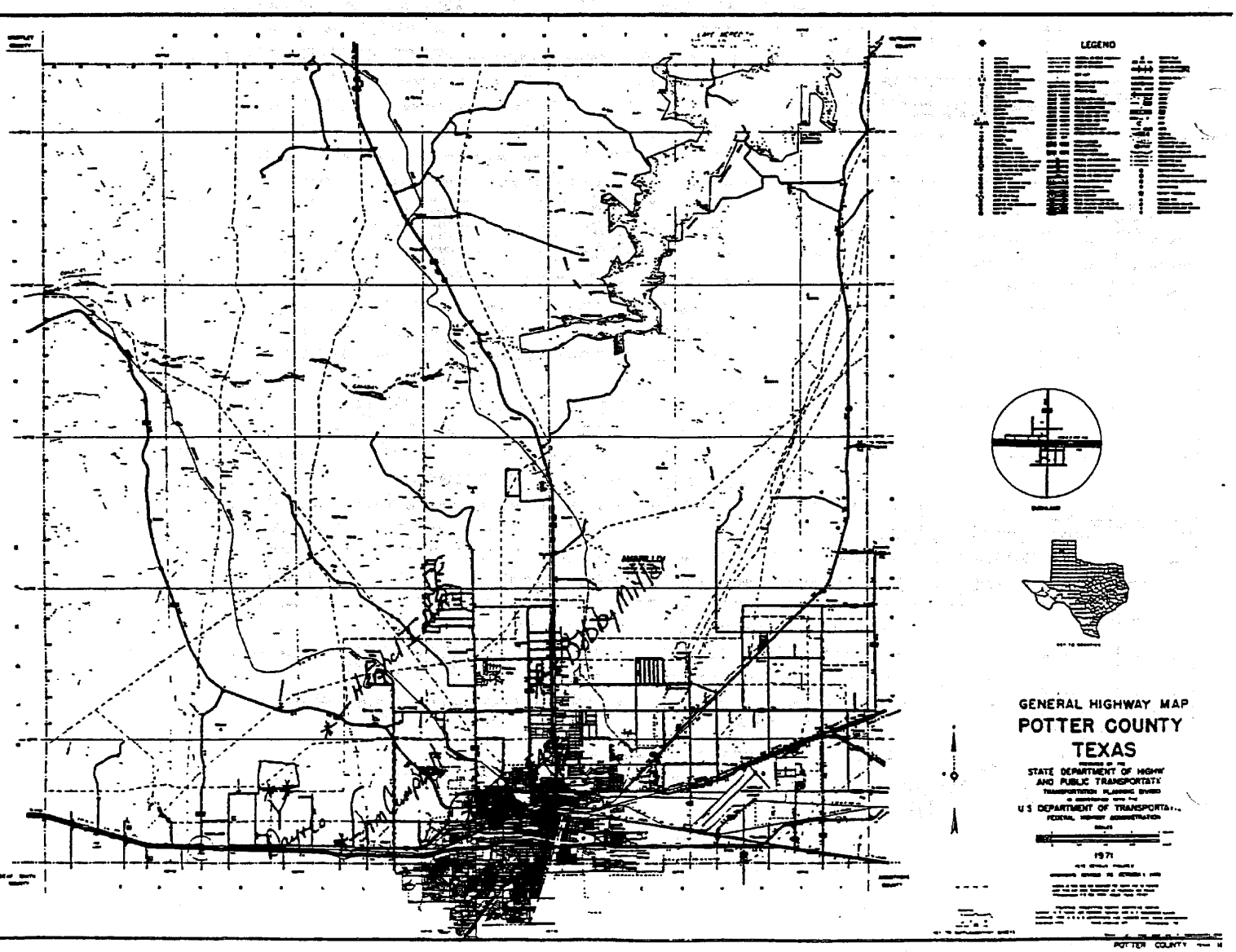
13) WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable water? ☐ Yes ☒ No
If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? Fresh Depth of strata 130' ft.
Was a chemical analysis made? ☐ Yes ☒ No

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

COMPANY NAME A-1 Pump + Well Service (Type or Print) Water Well Driller's License No. 2119

ADDRESS Rt. 2 Box 54-G (Street or RFD) Amarillo (City) Tx. (State) 79101 (Zip)

Signed Ricky D. Bostick (Licensed Water Well Driller) (Signed) Ricky D. Bostick


LEGEND
GENERAL HIGHWAY MAP
POTTER COUNTY
TEXAS
STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
TRANSPORTATION PLANNING DIVISION
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
1971

TEXAS WATER DEVELOPMENT BOARD

WELL SCHEDULE

Aquifer _____ Field No. _____ State Well No. Hill 07-56 301

Owner's well No. _____ County Potter

1. Location: SW 1/4 SW 1/4 Sec. 126, Block 9, Survey B.S. & F.

2. Owner: J.W. Hill Address: _____

Tenant: _____ Address: _____

Driller: _____ Address: _____

3. Elevation of LSD is 3816 ft. above msl, determined by 7½ min. topo.

4. Drilled: _____ 19 ___; Dug, Cable Tool, Rotary,

5. Depth: Rept. _____ ft. Meas. _____ ft.

6. Completion: Open Hole, Straight Wall, Underreamed, Gravel Packed

7. Pump: Mfgr. Pomona Type Turbine

No. Stages ___, Bowls Diam. ___ in., Setting ___ ft.

Column Diam. 6 in., Length Tailpipe ___ ft.

8. Motor: Fuel Elec. Make & Model _____ HP. 50GH

9. Yield: Flow ___ gpm, Pump ___ gpm, Meas., Rept., Est.

10. Performance Test: Date _____ Length of Test ___ Made by _____

Static Level ___ ft. Pumping Level ___ ft. Drawdown ___ ft.

Production ___ gpm Specific Capacity ___ gpm/ft.

CASING & BLANK PIPE

Cemented From ___ ft. to ___ ft.

Diam. (in.)	Type	Setting, ft. From	to

11. Water Level: ___ ft. rept. meas. ___ 19 ___ above below which is ___ ft. above below surface.

___ ft. rept. meas. ___ 19 ___ above below which is ___ ft. above below surface.

___ ft. rept. meas. ___ 19 ___ above below which is ___ ft. above below surface.

___ ft. rept. meas. ___ 19 ___ above below which is ___ ft. above below surface.

12. Use: Dom., Stock, Public Supply, Ind., (Irr.) Waterflooding, Observation, Not Used.

13. Quality: (Remarks on taste, odor, color, etc.)

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

14. Other data available as circled: Driller's Log, Radioactivity Log, Electric Log,

Formation Samples, Pumping Test,

15. Record by: D. Müller Date 3-7-1972

Source of Data Obs

16. Remarks: Access E-side pump base

WELL SCREEN

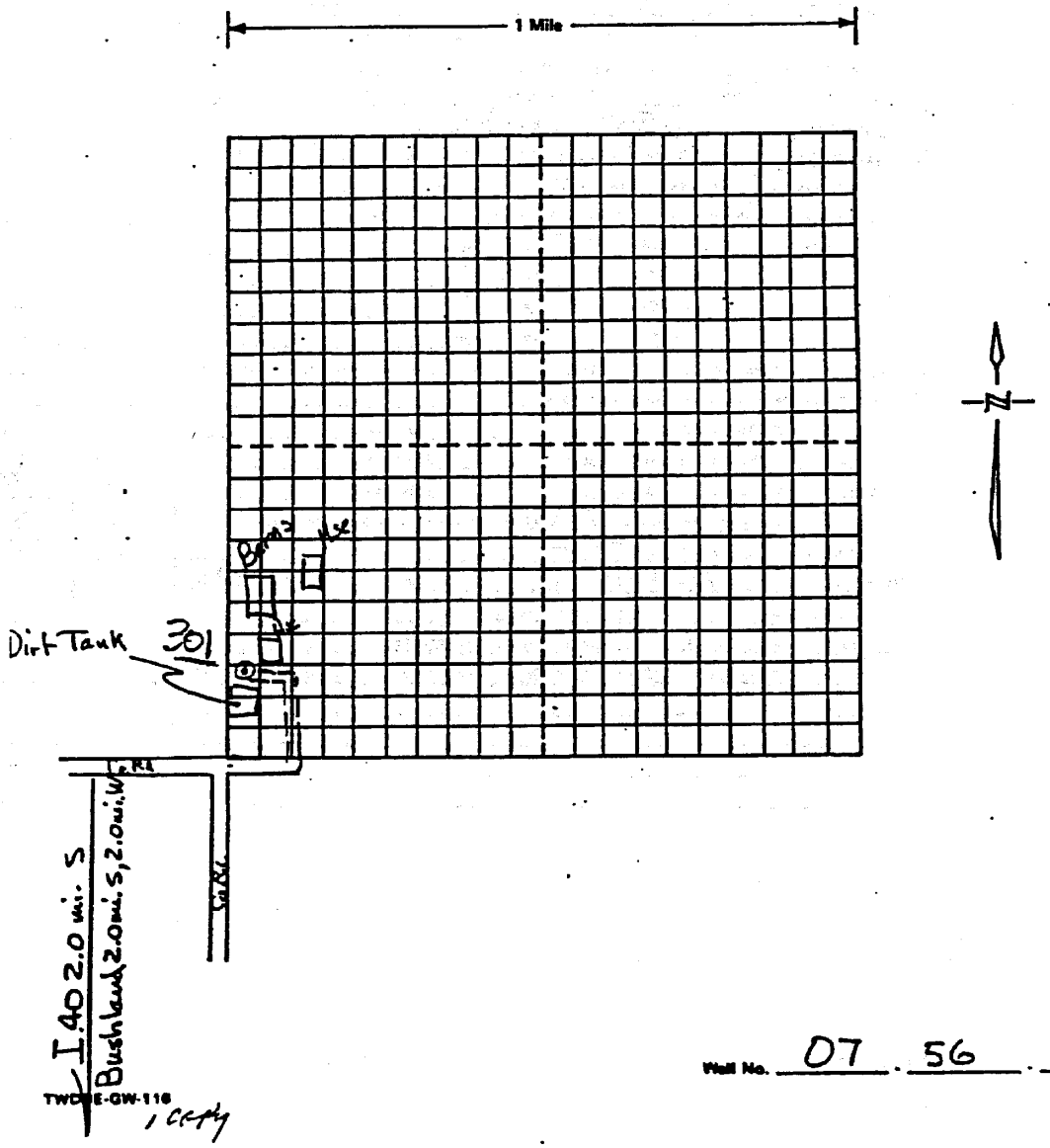
Screen Openings _____

Diam. (in.)	Type	Setting, ft. From	to

TWDBE-GW-49 (Rev-6-69)

WATER WELL LOCATION SKETCH
TEXAS WATER DEVELOPMENT BOARD
GROUND WATER DIVISION

Section 126 in Block 9
Potter County
2½-minute Quadrangle 3 in
7½-minute Quadrangle 56
Sketch by D. Müller Date 3-7-72



Well No. 07 . 56 . 301

TWDB-GW-116
1 copy

TEXAS WATER DEVELOPMENT BOARD

WELL SCHEDULE

Permit No. 25?

Aquifer _____ Field No. _____ State Well No. 111 07 56 302

Owner's Well No. _____ County Potter

1. Location: SE 1/4, NE 1/4 Sec. 127, Block 9 Survey BS & F

2. Owner: Caroline B. Emery Address: _____

Tenant: _____ Address: _____

Driller: W. G. Gayle Address: Plainview, Texas

3. Elevation of LSD is 3801 ft. above msl, determined by 7½ Min Topo.

4. Drilled: 5-15-1969, Dug, Cable Tool, (Rotary)

5. Depth: Rept. 317 ft. Meas. _____ ft.

6. Completion: Open Hole, Straight Wall, Underreamed, Gravel Packed

7. Pump: Mfgr. Peerless Type Turbine

No. Stages 7, Bowls Diam. 10 in., Setting 270 ft.

Column Diam. 6 in., Length Tailpipe _____ ft.

8. Motor: Fuel NG Make & Model Minn - Moline HP. 40 GH

9. Yield: Flow _____ gpm, Pump 560 gpm, Meas. (Rept.), Est. _____

10. Performance Test: Date 5-15-69 Length of Test _____ Made by DRILLER

Static Level 190 ft. Pumping Level 255 ft. Drawdown _____ ft.

Production 560 gpm Specific Capacity _____ gpm/ft.

11. Water Level: 190 ft. (obt.) meas. 5-15-1969 above/below _____ which is _____ ft. above/below surface.

_____ ft. rept./meas. _____ 19__ above/below _____ which is _____ ft. above/below surface.

_____ ft. rept./meas. _____ 19__ above/below _____ which is _____ ft. above/below surface.

_____ ft. rept./meas. _____ 19__ above/below _____ which is _____ ft. above/below surface.

12. Use: Dom., Stock, Public Supply, Ind. (Irr.) Waterflooding, Observation, Not Used. _____

13. Quality: (Remarks on taste, odor, color, etc.) _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

14. Other data available as circled: (Driller's Log) Radioactivity Log, Electric Log, Formation Samples, Pumping Test, _____

15. Record by: D. Muller Date 3-8-1972

Source of Data D.L. Tenant

16. Remarks: Access W-side pump base

Base of Ogallala 280' (Lm)

CASING & BLANK PIPE

Cemented From _____ ft. to _____ ft.

Diam. (in.)	Type	Setting, ft. From	to
16		0	317

WELL SCREEN

Screen Openings _____

Diam. (in.)	Type	Setting, ft. From	to
16	Perf.	290	317

TWDBE-GW-49 (Sketch)

FORM NO? 3500-LW

Quadruplicate---Applicant's Copy

High Plains Underground Water Conservation District No. 1

REGISTRATION and LOG OF WELL

INSTRUCTIONS: Fill out in quadruplet. Submit all copies to County Committee for recommendation. (PLEASE TYPE OR PRINT)

FOR USE OF COMMITTEEMEN
Field Well No. 253
Date Received 4-29-69
Permit Size Maximum
of Pump 6 in Yield 600 GPM

1. Land Owner Caroline B Finney Address P.O. Box 1220 Amarillo, Texas

2. Well located 1 miles N, ____ miles S, 2 miles E, ____ miles W of town of Bushland

3. County Potter Labor ____ League ____ Abstract No. ____

4. NW¼ (NE¼) SW¼ SE¼ Section 127 Block 9 Survey BS&F
MARK OUT THOSE THAT DO NOT APPLY
670 N
400 E

DRILLER'S LOG OF WELL

Method of Drilling: Rotary ____ ~~Spudder~~ ____ Diameter of Well: 18 inches.
MARK OUT ONE THAT DOES NOT APPLY

FROM (FEET)	TO (FEET)	DESCRIPTION OF FORMATION MATERIAL	FROM (FEET)	TO (FEET)	DESCRIPTION OF FORMATION MATERIAL
0	12	Soil & caliche			
12	60	Sdy Cly			
60	90	Red Cly			
90	98	Cap Rk			
95	150	Fn Sd (Tight)			
150	170	Brkn Rk			
170	225	Tight Sd & RK Strks			
225	265	Fn Sd			
265	280	Coarse Sd.			
280	317	Red Bed			

REMARKS:

I hereby certify that this well was drilled by me (or under my supervision), and that each and all of the statements herein are true to the best of my knowledge and belief.

Driller W.G. Guyne Address Plainview, Texas Date Drilled 5-15- 1962

DESCRIPTION OF WELL AND PRODUCTION EQUIPMENT

(This Does Not Mean Testing or Development Pump)

6. Casing: new, used, gas line, or shop made. Diameter 16 in Total casing length 288

7. Casing perforations: from 280 ft. to 317 ft. Size 3/16 X 10" Number of rows 6

8. Pump Column: Size 6 in. Column, shaft length 270 ft. Suction pipe size 6 in. Suction pipe length 3

9. Pump bowls: Size 10 Number of stages 7 Pump discharge pipe: Size 6

10. Depth to water level 190 ft. Pump yield 560 GPM. Pumping level: 255

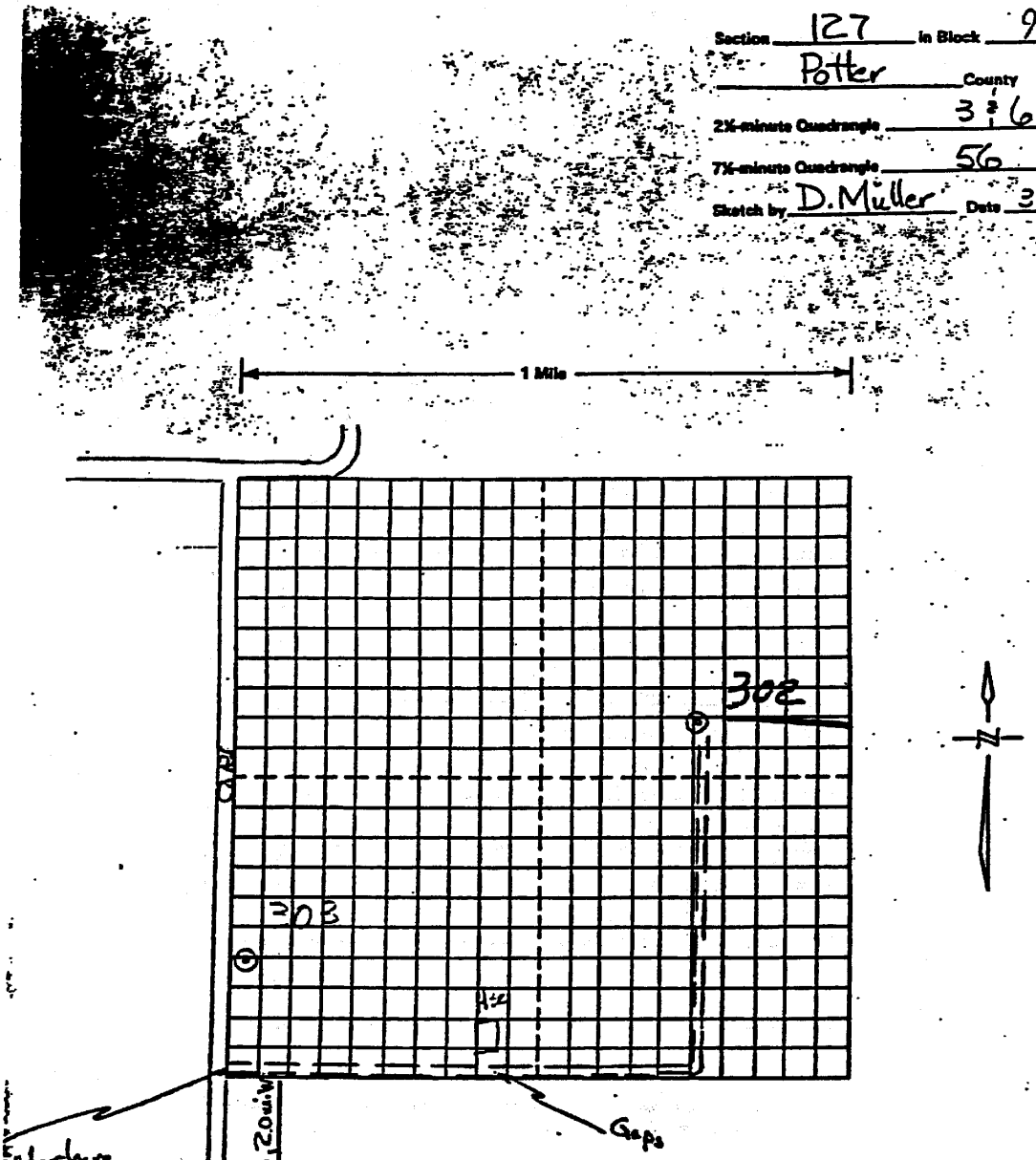
11. Power Unit: Electrical, (Natural Gas), Butane, Other ____ Horsepower 60

Signature ____
LANDOWNER OR AGENT TITLE ADDRESS

07-56-3

WATER WELL LOCATION SKETCH
TEXAS WATER DEVELOPMENT BOARD
GROUND WATER DIVISION

Section 127 in Block 9
Potter County
2½-minute Quadrangle 3 6 in
7½-minute Quadrangle 56
Sketch by D. Muller Date 3-7-72



Well No. 07 56 302

TWDB-GW-116
3 Copies

TEXAS WATER DEVELOPMENT BOARD

WELL SCHEDULE

Permit No. 242

Aquifer _____ Field No. _____ State Well No. UU 07 56 303

Owner's Well No. _____ County Potter

1. Location: SW¼ SW¼ ¼ Sec. 127, Block 9, Survey B.S. & F

2. Owner: Caroline B. Emeny Address: _____

Tenant: _____ Address: _____

Driller: Dicks Drlg Co. Address: Hereford, Texas

3. Elevation of _____ LSD is 3804 ft. above msl, determined by 7½ min. topo

4. Drilled: 5-25-1966, Dug, Cable Tool (Rotary)

5. Depth: Rept. 305 ft. Meas. _____ ft.

6. Completion: Open Hole, Straight Wall, Underreamed, Gravel Packed

7. Pump: Mfg. Deming Type Turbine

No. Stages 6, Bowls Diam. 12 in., Setting 290 ft.

Column Diam. 8 in., Length Tailpipe _____ ft.

8. Motor: Fuel NG Make & Model Minn-Moline HP. —

9. Yield: Flow _____ gpm, Pump 800 gpm, Meas. (Rept.), Est.

10. Performance Test: Date 5-25-66 Length of Test _____ Made by DRILLER

Static Level 181 ft. Pumping Level 262 ft. Drawdown _____ ft.

Production 800 gpm Specific Capacity _____ gpm/ft.

CASING & BLANK PIPE

Cemented From _____ ft. to _____ ft.

Diam. (in.)	Type	Setting, ft. From	to
16		0	305

11. Water Level: 181 ft. (Calc.) meas. 5-25-1966 above / below surface.

_____ ft. rept. meas. 19__ above / below surface. which is _____ ft. above / below surface.

_____ ft. rept. meas. 19__ above / below surface. which is _____ ft. above / below surface.

_____ ft. rept. meas. 19__ above / below surface. which is _____ ft. above / below surface.

12. Use: Dom., Stock, Public Supply, Ind., (Irr.) Waterflooding, Observation, Not Used, _____

13. Quality: (Remarks on taste, odor, color, etc.) _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

14. Other data available as circled: (Driller's Log), Radioactivity Log, Electric Log, Formation Samples, Pumping Test, _____

WELL SCREEN

Screen Openings _____

Diam. (in.)	Type	Setting, ft. From	to
16	Perf	210	305

15. Record by: D. Müller Date 3-7-1972

Source of Data Obs. Dr.

16. Remarks: No access

Base of Ogallala 295' (LW)

3804
295
3509

TWDBE-GW-49 (Sketch)

FORM NO. 3358-LW

Triplicate—County Co[illegible]itteeman

High Plains Underground Water Conservation District No. 1

REGISTRATION and LOG OF WELL

INSTRUCTIONS: Fill out in quadruplet. Submit all copies to County Committee for recommendation. (PLEASE TYPE OR PRINT)

FOR USE OF COMMITTEEMEN
Field Well No. [illegible]
Date Received
Permit Size of Pump [illegible] Maximum in Yield [illegible] GPM

1. Land Owner Buck Estate Address Amarillo, Texas

2. Well located 1¼ miles N, ____ miles S, 2 miles E, ____ miles W of town of Panhandle

3. County Potter Labor ____ League ____ Abstract No. ____

4. NW¼ NE¼ (SW¼) SE¼ Section 127 Block 9 Survey B.S.&F.
MARK OUT THOSE THAT DO NOT APPLY

360 S
10 W

DRILLER'S LOG OF WELL

Method of Drilling: Rotary ____ Spudder ____ Diameter of Well: ____ inches.
MARK OUT ONE THAT DOES NOT APPLY

FROM (FEET)	TO (FEET)	DESCRIPTION OF FORMATION MATERIAL	FROM (FEET)	TO (FEET)	DESCRIPTION OF FORMATION MATERIAL
0	4	Top Soil	218	220	Hd wh sd rk
4	86	Caliche and clay	220	224	Sd rk
86	98	Hd caliche rk	224	295	Med. course Lt. Br sd & sd rk layers
98	105	Soft caliche rk	295	305	Red Red
105	122	Sd rk, clay and caliche			
122	145	Sd. sd rk and caliche			
145	147	Hd sd rk			
147	158	Sd and sd rk			
158	181	Fine Lt. Brn sd.			
181	218				

REMARKS:

I hereby certify that this well was drilled by me (or under my supervision), and that each and all of the statements herein are true to the best of my knowledge and belief.

Driller Dirks Drlg Co. Address Hereford, Texas Date Drilled 5-25-19 66

DESCRIPTION OF WELL AND PRODUCTION EQUIPMENT

(This Does Not Mean Testing or Development Pump)

8. Casing: (new), used, gas line, or shop made. Diameter 16 in. Total casing length 305 ft.

7. Casing perforations: from 210 ft. to 305 ft. Size 1/4 - 3/8 Number of rows 12-8

8. Pump Column: Size 8 in. Column, shaft length 250 ft. Section pipe size 8 in. Section pipe length 1 ft.

9. Pump bowls: Size 12 Number of stages 6 Pump discharge pipe: Size 8 in.

10. Depth to water level 181 ft. Pump yield 900 GPM. Pumping level: 262 ft.

11. Power Unit: Electrical, (Natural Gas), Butane, Other ____ Horsepower ____

Signature ____
LANDOWNER OR AGENT TITLE ADDRESS

07-56-303

TEXAS WATER DEVELOPMENT BOARD

WELL SCHEDULE

Aquifer________ Field No. Permit No. 241 State Well No. UU 07-56-304

Owner's Well No. ________ County Potter

1. Location: NW 1/4, NE 1/4 Sec. 146, Block 9, Survey B.S. & F.

2. Owner: R. D. Durrett Address:

Tenant: Leo Begner Address:

Driller: Dirks Drlg. Co. Address: Hereford, Texas

3. Elevation of LSD is 3821 ft. above msl, determined by 7½ min. topo.

4. Drilled: 4-6-1966; Dug, Cable Tool, (Rotary)

5. Depth: Rept. 286 ft. Meas. ____ ft.

6. Completion: Open Hole, Straight Wall, Underreamed, Gravel Packed

7. Pump: Mfgr. U.S. Pumps Type Turbine

No. Stages 7, Bowls Diam. 10 in., Setting 280 ft.

Column Diam. 5 in., Length Tailpipe ____ ft.

8. Motor: Fuel NG Make & Model Minn. Moline HP. 50 GH

9. Yield: Flow ____ gpm, Pump 500 gpm, Meas. (Rept.) Est.

10. Performance Test: Date 4-6-66 Length of Test ____ Made by Driller

Static Level 200 ft. Pumping Level 256 ft. Drawdown 56 ft.

Production 500 gpm Specific Capacity ____ gpm/ft.

11. Water Level: 200 ft. (rept.) meas. 4-6-1966 above below ________ which is ____ ft. above below surface.

____ ft. rept. meas. ____ 19__ above below ________ which is ____ ft. above below surface.

____ ft. rept. meas. ____ 19__ above below ________ which is ____ ft. above below surface.

____ ft. rept. meas. ____ 19__ above below ________ which is ____ ft. above below surface.

12. Use: Dom., Stock, Public Supply, Ind., (Irr.), Waterflooding, Observation, Not Used.

13. Quality: (Remarks on taste, odor, color, etc.)

Temp. ___ °F, Date sampled for analysis ________ Laboratory ________

Temp. ___ °F, Date sampled for analysis ________ Laboratory ________

Temp. ___ °F, Date sampled for analysis ________ Laboratory ________

14. Other data available as circled: (Driller's Log) Radioactivity Log, Electric Log, Formation Samples, Pumping Test,

15. Record by: D. Müller Date 2-7-1972

Source of Data Obs., DL

16. Remarks: Access top conc. N-side

Base of Ogallala 284' (LW)

CASING & BLANK PIPE

Cemented From ____ ft. to ____ ft.

Diam. (in.)	Type	Setting, ft. from	to
16		0	286

WELL SCREEN

Screen Openings ________

Diam. (in.)	Type	Setting, ft. from	to
16	Perf.	206	286

3821
284
3537

TWDBE-GW-49

(Sketch)

FORM NO. [illegible]

Original—District Office Copy

High Plains Underground Water Conservation District No. 1

REGISTRATION and LOG OF WELL

INSTRUCTIONS: Fill out in quadruplet. Submit all copies to County Committee for recommendation. (PLEASE TYPE OR PRINT)

FOR USE OF COMMITTEEMEN	
Field Well No.	[illegible]
Date Received	5-10-56
Permit Size of Pump	6
Maximum in Yield	[illegible] GPM

1. Land Owner Delmer Durrett Address Amarillo

2. Well located 2 miles N, ______ miles S, 1½ miles E, ______ miles W of town of [illegible]

3. County Potter Labor ______ League ______ Abstract No. ______

4. NW¼ (NE¼) SW¼ SE¼ Section 146 Block 9 Survey [illegible]

MARK OUT THOSE THAT DO NOT APPLY

324 N
626 W

DRILLER'S LOG OF WELL

Method of Drilling: Rotary ______ ~~Spudder~~ ______ Diameter of Well: 19 inches.

MARK OUT ONE THAT DOES NOT APPLY

FROM (FEET)	TO (FEET)	DESCRIPTION OF FORMATION MATERIAL	FROM (FEET)	TO (FEET)	DESCRIPTION OF FORMATION MATERIAL
0	4	Top soil			
4	51	caliche & cly			
51	53	caliche rk			
53	103	Caliche cly & caliche rk			
103	121	Med course [illegible]			
121	225	Med course sd [illegible]			
225	280	Med [illegible] sd rk [illegible]			
280	284	Course sd & [illegible]			
284	286	Red Bed			

REMARKS:

I hereby certify that this well was drilled by me (or under my supervision), and that each and all of the statements herein are true to the best of my knowledge and belief.

Driller Dirks Drilling Co. Address Hereford Date Drilled 4-6- 19 56

DESCRIPTION OF WELL AND PRODUCTION EQUIPMENT

(This Does Not Mean Testing or Development Pump)

6. Casing: new, used, gas line, or shop made. Diameter 16 in. Total casing length 286 ft.

7. Casing perforations: from 206 ft. to 286 ft. Size 1/4-3/16 Number of rows 8-10

8. Pump Column: Size 6 in. Column, shaft length 250 ft. Suction pipe size 6 in. Suction pipe length 1 ft.

9. Pump bowls: Size 10 Number of stages 7 Pump discharge pipe: Size 6 in.

10. Depth to water level 200 ft. Pump yield 500 GPM. Pumping level: 250 ft.

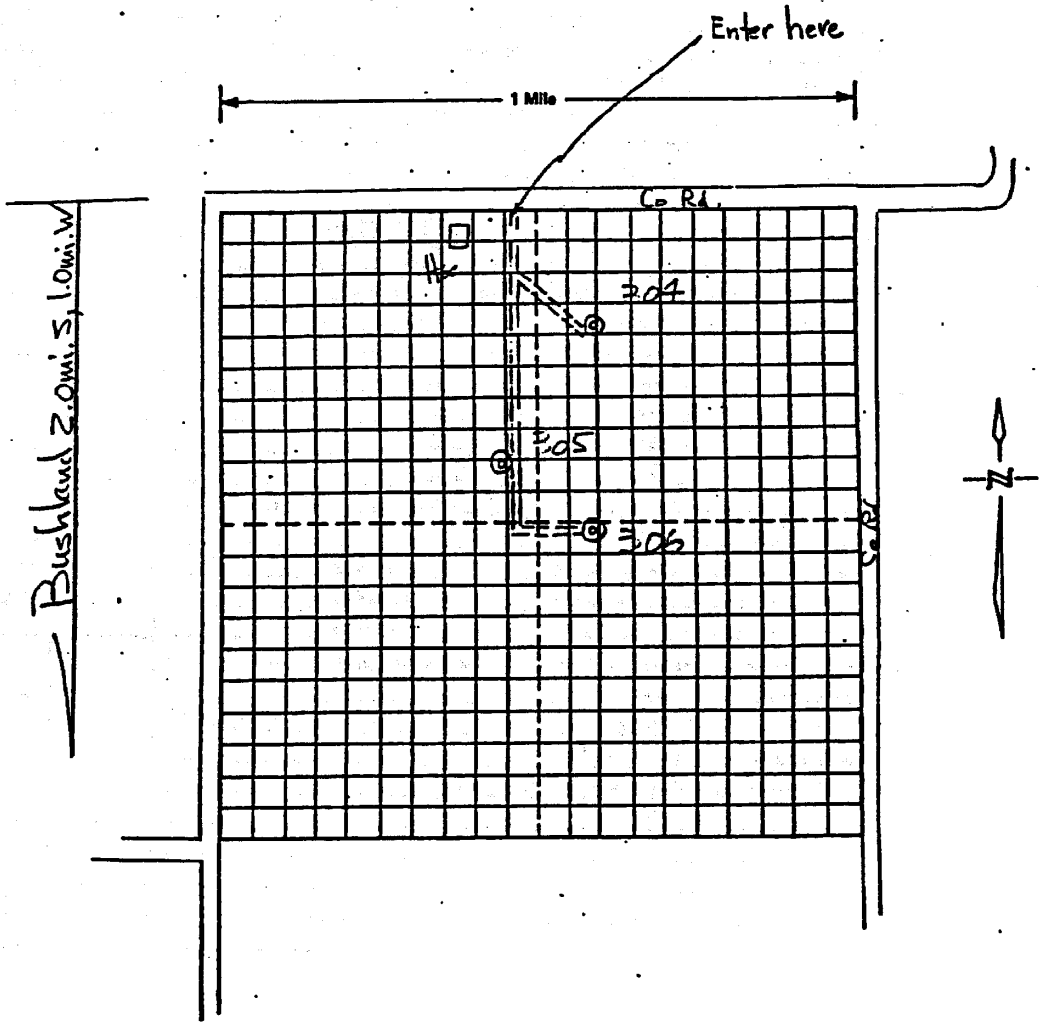
11. Power Unit: Electrical, (Natural Gas), Butane, Other ______ Horsepower 70

Signature ______________________

LANDOWNER OR AGENT TITLE ADDRESS

WATER WELL LOCATION SKETCH
TEXAS WATER DEVELOPMENT BOARD
GROUND WATER DIVISION

Section 146 in Block 9
Potter County
2½-minute Quadrangle 2, 3, 5, 6 in
7½-minute Quadrangle 56
Sketch by D. Müller Date 3-7-72



Well No. 07 . 56 . 304

TWDBE-GW-116
5 Copies

TEXAS WATER DEVELOPMENT BOARD

WELL SCHEDULE

Aquifer

Field No. Permit No. 246

Owner's Well No.

State Well No. 1111 07-56-305

County Potter

1. Location: SE 1/4 NW 1/4 Sec. 146, Block 9 Survey B.S. & F

2. Owner: Leo Bezner Address:

Tenant: Address:

Driller: Address:

3. Elevation of LSD is 3815 ft. above msl, determined by 7½ min. topo

4. Drilled: 19 ; Dug, Cable Tool, Rotary,

5. Depth: Rept. ft. Meas. ft.

6. Completion: Open Hole, Straight Wall, Underreamed, Gravel Packed

7. Pump: Mfgr. Wistroeth Type Turbine

No. Stages , Bowls Diam. in., Setting ft.

Column Diam. 6 in., Length Tailpipe ft.

8. Motor: Fuel NG Make & Model Minn.-Moline HP. 75GH

9. Yield: Flow gpm, Pump gpm, Meas., Rept., Est.

10. Performance Test: Date Length of Test Made by

Static Level ft. Pumping Level ft. Drawdown ft.

Production gpm Specific Capacity gpm/ft.

11. Water Level: ft. rept. / meas. 19 above / below which is ft. above / below surface.

ft. rept. / meas. 19 above / below which is ft. above / below surface.

ft. rept. / meas. 19 above / below which is ft. above / below surface.

ft. rept. / meas. 19 above / below which is ft. above / below surface.

12. Use: Dom., Stock, Public Supply, Ind., (Irr.) Waterflooding, Observation, Not Used,

13. Quality: (Remarks on taste, odor, color, etc.)

Temp. °F, Date sampled for analysis Laboratory

Temp. °F, Date sampled for analysis Laboratory

Temp. °F, Date sampled for analysis Laboratory

14. Other data available as circled: Driller's Log, Radioactivity Log, Electric Log, Formation Samples, Pumping Test,

15. Record by: D. Miller Date 3-7- 1972

Source of Data Obs., Rh

16. Remarks: Access top of sure blk

CASING & BLANK PIPE

Cemented From ft. to ft.

Diam. (in.)	Type	Setting, ft. from	to

WELL SCREEN

Screen Openings

Diam. (in.)	Type	Setting, ft. from	to

TWDBE-GW-40

(Sketch)

TEXAS WATER DEVELOPMENT BOARD

WELL SCHEDULE

Aquifer ____ Field No. Permit No. 207 State Well No. UU 07-56-306

Owner's Well No. ____ County Potter

1. Location: NW 1/4, SE 1/4 Sec. 146, Block 9 Survey B.S.&F.

2. Owner: R.D. Durrett Address:

Tenant: Leo Bezner Address:

Driller: J.H. Fish Address: Hereford, Texas

3. Elevation of LSD is 3814 ft. above msl, determined by 7½ min. topo.

4. Drilled: 11-9-1954, Dug, Cable Tool, (Rotary)

5. Depth: Rept. 305 ft. Meas. ____ ft.

6. Completion: Open Hole, Straight Wall, Underreamed, Gravel Packed

7. Pump: Mfgr. Pomona Type Turbine

No. Stages 6, Bowls Diam. 12 in., Setting 270 ft.

Column Diam. 6 in., Length Tailpipe ____ ft.

8. Motor: Fuel NG Make & Model Minn-Moline HP. 75GH.

9. Yield: Flow ____ gpm, Pump 600 gpm, Meas. (Rept), Est.

10. Performance Test: Date 11-9-54 Length of Test ____ Made by DRILLER

Static Level 185 ft. Pumping Level 250 ft. Drawdown ____ ft.

Production 600 gpm Specific Capacity ____ gpm/ft.

11. Water Level: 185 ft. (rept.) meas. 11-9-1954 above below ____ which is ____ ft. above below surface.

____ ft. rept. meas. ____ 19__ above below ____ which is ____ ft. above below surface.

____ ft. rept. meas. ____ 19__ above below ____ which is ____ ft. above below surface.

____ ft. rept. meas. ____ 19__ above below ____ which is ____ ft. above below surface.

12. Use: Dom., Stock, Public Supply, Ind., (Irr.), Waterflooding, Observation, Not Used,

13. Quality: (Remarks on taste, odor, color, etc.)

Temp. ____ °F, Date sampled for analysis ____ Laboratory ____

Temp. ____ °F, Date sampled for analysis ____ Laboratory ____

Temp. ____ °F, Date sampled for analysis ____ Laboratory ____

14. Other data available as circled: (Driller's Log), Radioactivity Log, Electric Log, Formation Samples, Pumping Test,

15. Record by: D. Muller Date 3-7-1972

Source of Data Obs, DL

16. Remarks: Access N-side pump base

Base of Ogallala 302' (Lwl)

CASING & BLANK PIPE

Cemented From ____ ft. to ____ ft.

Diam. (in.)	Type	Setting, ft. from	to
16		0	305

WELL SCREEN

Screen Openings ____

Diam. (in.)	Type	Setting, ft. from	to
16	Perf.	215	305

TWDBE-GW-40 (Sketch)

Quadruplicate---Applicant's Copy

High Plains Underground Water Conservation District No. 1

REGISTRATION and LOG OF WELL

INSTRUCTIONS: Fill out in quadruplet. Submit all copies to County Committee for recommendation. (PLEASE TYPE OR PRINT)

Field Well No. 207
Date Received 1-11-55
Permit Size of Pump 6 Maximum in Yield 700 GPM

1. Land Owner Delmar Durrett Address Amarillo

2. Well located 1½ miles N, ____ miles S, 1½ miles E, ____ miles W of town of Bushland

3. County Potter Labor ____ League ____ Abstract No. ____

4. NW¼ (NE¼) SW¼ SE¼ Section 146 Block 9 Survey BS&F
MARK OUT THREE THAT DO NOT APPLY
880 N
740 E

DRILLER'S LOG OF WELL

Method of Drilling: Rotary ✓ Spudder ____ Diameter of Well: ____ inches.
MARK OUT ONE THAT DOES NOT APPLY

FROM (FEET)	TO (FEET)	DESCRIPTION OF FORMATION MATERIAL	FROM (FEET)	TO (FEET)	DESCRIPTION OF FORMATION MATERIAL
0	4	Caliche			
4	60	Clay			
60	160	Sd & cly			
160	161	RK			
161	220	Cly			
220	267	Fu sd			
267	302	Sd & gravel			
302	305	Red Bed			

REMARKS:

I hereby certify that this well was drilled by me (or under my supervision), and that each and all of the statements herein are true to the best of my knowledge and belief.

Driller J.H. Fish Address Hereford Date Drilled 11-9- 1954

DESCRIPTION OF WELL AND PRODUCTION EQUIPMENT

(This Does Not Mean Testing or Development Pump)

8. Casing: new, used, gas line, or shop made. Diameter 16 in Total casing length ____ ft.

7. Casing perforations: from 215 ft. to 305 ft. Size ¼ X 12 Number of rows 8

8. Pump Column: Size 6 in. Column, shaft length 270 ft. Suction pipe size 6 in. Suction pipe length 10 ft.

9. Pump bowls: Size 12 Number of stages 6 Pump discharge pipe: Size 6 in.

10. Depth to water level 185 ft. Pump yield 600 GPM. Pumping level 250 ft.

11. Power Unit: Electrical, Natural Gas, (Butane) Other ____ Horsepower 75

Signature ____
LANDOWNER OR AGENT TITLE ADDRESS

TEXAS WATER DEVELOPMENT BOARD

WELL SCHEDULE

Aquifer Ogallala Field No. Permit # 276 State Well No. 07-56-307

Owner's Well No. County Potter

1. Location: NW1/4, NW1/4 Sec. 127, Block B-9, Survey B.S. & F

2. Owner: Caroline B. Emery Address: Box 1230, Amarillo, Tx.
   Tenant: Victor Pluark Address: RT 1, Box 544, Bonita, Tx.
   Driller: Bud Gibbens Address: Plainview, TX

3. Elevation of is 3814 ft. above msl, determined by

4. Drilled: 3-8 19 74, Dug, Cable Tool (Rotary)

5. Depth: Rept. 295 ft. Meas. ft. Red Bed Reported @ 287 SFZ

6. Completion: Open Hole (Straight Wall) Underreamed, Gravel Packed

7. Pump: Mfgr. Johnston p.b., Amarillo Co. Type Turbine
   No. Stages 7, Bowls Diam. 10 in., Setting 280 ft.
   Column Diam. 6 in., Length Tailpipe 10 ft.

8. Motor: Fuel NAT. GAS Make & Model M.M. 6 Cyl. HP.

9. Yield: Flow gpm, Pump 400 gpm, Meas. (Rept.) Est. Driller

10. Performance Test: Date Length of Test Made by
    Static Level ft. Pumping Level ft. Drawdown ft.
    Production gpm Specific Capacity gpm/ft.

11. Water Level: 227.98 ft. water meas. 9/13 1976 above below Sec MP Below which is +0.50 ft. above below surface.
    ft. rept. meas. 19 above below which is ft. above below surface.
    ft. rept. meas. 19 above below which is ft. above below surface.
    ft. rept. meas. 19 above below which is ft. above below surface.

12. Use: Dom., Stock, Public Supply, Ind. (Irr.) Waterflooding, (Observation) Not Used.

13. Quality: (Remarks on taste, odor, color, etc.)
    Temp. °F, Date sampled for analysis Laboratory
    Temp. °F, Date sampled for analysis Laboratory
    Temp. °F, Date sampled for analysis Laboratory

14. Other data available as circled: (Driller's Log) Radioactivity Log, Electric Log, Formation Samples, Pumping Test,

15. Record by: DAN SCALE Date 9/13 1976
    Source of Data Field & HPUWCD #1 Records

16. Remarks: Permission from Mr. F. E. Colbert III, manager to enter this well into the program

CASING & BLANK PIPE
Cemented From ft. to ft.

Diam. (in.)	Type	Setting, ft. from	to
14	Steel	Surface	295

WELL SCREEN
Screen Openings

Diam. (in.)	Type	Setting, ft. from	to
14	Perforated	197	295
Casing Perforated with 3/8" slots 4 row pattern.			

Sec 127

Obs Well

38 14
289
325
35

MP - Edge of Airline hole inside pump port S. side = +0.50 ft

(Sketch)

07-56-307

Typewrite (Black ribbon) or Print Plainly
— (soft pencil or black ink)
Do not use ball point pen

Texas Department of Health Laboratories
1100 West 49th Street
Austin, Texas 78756

TDWR ONLY
Organization No. ______ Lab No. ______
Work No. ______

CHEMICAL WATER ANALYSIS REPORT

Send report to:

Data Collection and Evaluation Section
Texas Department of Water Resources
P.O. Box 13087
Austin, Texas 78711

S. R. S.

SEP 19 1980

County 188 Potter
State Well No. 07 56 3 d 7
Well No. 276
Date Collected 08 01 80

Location NW/4, NW/4, Sec. 127, Blk B-9, BS+F Survey Sample No. ___ By HPBWCD#1 BB
Source (type of well) turbine Owner Caroline Embry
Date Drilled 3-8-76 Depth 295 ft. WBF Ogallala
Producing intervals ______ Water level ______ ft. Sample depth ______ ft.
Sampled after pumping cont. hrs. Yield ______ GPM Temperature ___ °F ___ °C
Point of collection faucet on discharge Appearance ☑ clear ☐ turbid ☐ colored ☐ other
Use Irr. Remarks ______

(FOR LABORATORY USE ONLY)

CHEMICAL ANALYSIS

Laboratory No. CO15975 Date Received AUG 18 1980 Date Reported SEP 17 1980

	Code	MG/L	ME/L
Silica	00955	57	
Calcium	00915	47	2.36
Magnesium	00925	26	2.11
Sodium	00929	29	1.26
Total			5.73
☐ Potassium	00937		
[3] ☐ Manganese	01055		
☐ Boron	01022		
[3] ☐ Total Iron	01045		

	Code	MG/L	ME/L
Carbonate	00445	0	—
Bicarbonate	00440	293 (144)	4.80
Sulfate	00945	30	0.62
Chloride	00940	7	0.20
Fluoride	00951	2.4	0.1[illegible]
Nitrate	71850	2.9	
pH	00403	8.2	
Total			5.75

%Na ______
SAR ______
RSC ______

☐ (other) ______ MG/L

Specific Conductance (micromhos/cm³) 00095 — 480
Diluted Conductance (micromhos/cm³) 4 x 144
576

	Code	Value
[1] Dissolved Solids (residue at 180°C)	70300	250
Phenolphthalein Alkalinity as $CaCO_3$	00415	0
Total Alkalinity as $CaCO_3$ (4.80)	00410	240
Total Hardness as $CaCO_3$ (4.47)	00900	224
[2] Nitrogen Cycle		
Ammonia - N	00610	
Nitrite - N	00615	
Nitrate - N	00620	
Organic Nitrogen	00605	

RE... JUL 25 1981 CHAIN...

"☐" Items will be analyzed if checked.

[1] The bicarbonate reported in this analysis can be converted by computation (multiplying by 0.4917) to an equivalent amount of carbonate, and the carbonate figure used in the computation of dissolved solids.
[2] Nitrogen cycle requires separate sample.
[3] Total Iron and Manganese require separate sample.

TDWR-0149 (Rev. 1-8-80)

Analyst ______ Checked By ______

Send original copy by certified mail to the Texas Water Development Board P. O. Box 13087 Austin, Texas 78711

State of Texas

WATER WELL REPORT

For TWDB use only Well No. 07-56- Located on map Received: 7-

1) OWNER: Person having well drilled Caroline B. Emney (Name) Address Box 1230 (Street or RFD) Amarillo (City) Texa (State)

Landowner Same (Name) Address Same (Street or RFD) (City) (State)

2) LOCATION OF WELL: County Potter 3/4-N & 2-E miles in NE (N.E., S.W., etc.) direction from Bushland, Texas (Town)

Locate by sketch map showing landmarks, roads, creeks, hiway number, etc.* North (Use reverse side if necessary)

or Give legal location with distances and directions from adjacent sections or survey lines.

Labor ___ League ___ Block 9 Survey BS & F Abstract No. ___ of Section 127

3) TYPE OF WORK (Check): New Well XX Deepening Reconditioning Plugging

4) PROPOSED USE (Check): Domestic Industrial Municipal Irrigation XX Test Well Other

5) TYPE OF WELL (Check): Rotary XX Driven Dug Cable Jetted Bored

6) WELL LOG: Diameter of hole 18" in. Depth drilled 295' ft. Depth of completed well ___ ft. Date drilled 3-8-

All measurements made from ___ ft. above ground level.

From (ft.)	To (ft.)	Description and color of formation material
00	4	Top Soil
4	82	Caliche Clay
82	153	Clay Sand Rock & Sand
153	259	Clay and Layers Sand
259	279	Fine sand
279	289	Course Sand
289	295	Blue Clay and Red Bed

(Use reverse side if necessary)

9) Casing: Type: Old New XX Steel XX Plastic Other

Cemented from ___ ft. to ___

Diameter (inches)	Setting From (ft.)	To (ft.)	Gage
14"OD.	0	295	.188
(197' - 2 95' - 4 row Perforation			

10) SCREEN: Type ___ Perforated ___ Slotted ___

Diameter (inches)	Setting From (ft.)	To (ft.)	Sl

7) COMPLETION (Check): Straight wall XX Gravel packed Other Under reamed Open Hole

8) WATER LEVEL: Static level ___ ft. below land surface Date ___

Artesian pressure ___ lbs. per square inch Date ___

Depth to pump bowls, cylinder, jet, etc., ___ ft. below land surface.

11) WELL TESTS: Was a pump test made? Yes No XX If yes, by

Yield: ___ gpm with ___ ft. drawdown after

Bailer test ___ gpm with ___ ft. drawdown after

Artesian flow ___ gpm

Temperature of water ___

12) WATER QUALITY: Was a chemical analysis made? Yes No

Did any strata contain undesirable water? Yes

Type of water? ___ depth of strata ___

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

NAME Bud Gibbons (Type or Print) Water Well Drillers Registration No. 299

ADDRESS 1004 E. 5th, P.O.Box 1972 (Street or RFD) Plainview (City) Texas (State)

(Signed) Bud Gibbons (Water Well Driller) Bud Gibbons Drilling Contractor (Company Name)

Please attach electric log, chemical analysis, and other pertinent information, if available. UU 07-56-3

*Additional instructions on reverse side.

TEXAS WATER DEVELOPMENT BOARD

WELL SCHEDULE

Aquifer _____ Field No. Permit No. 248 State Well No. 11L 07 56 603

Owner's Well No. _____ County Potter

1. Location: NE 1/4 NW 1/4 Sec. 128, Block 9 Survey B.S. & F.

2. Owner: Fritz Menke Address: _____

Tenant: _____ Address: _____

Driller: Bud Gibbons Address: Plainview, Texas

3. Elevation of LSD is 3797 ft. above msl, determined by 7½ min. topo.

4. Drilled: 4-5-1969; Dug, Cable Tool, (Rotary)

5. Depth: Rept. 314 ft. Meas. _____ ft.

6. Completion: Open Hole, Straight Wall, Underreamed, Gravel Packed

7. Pump: Mfgr. Western Type Turbine

No. Stages 7, Bowls Diam. 10 in., Setting _____ ft.

Column Diam. 6 in., Length Tailpipe _____ ft.

8. Motor: Fuel NG Make & Model Chrysler Ind. HP. 50 GH

9. Yield: Flow _____ gpm, Pump 550 gpm, Meas. (Rept.), Est.

10. Performance Test: Date 4-5-69 Length of Test _____ Made by DRILLER

Static Level 200 ft. Pumping Level 250 ft. Drawdown 50 ft.

Production 550 gpm Specific Capacity _____ gpm/ft.

11. Water Level: 200 ft. (Rept.) meas. 4-5-1969 above / below which is _____ ft. above / below surface.

_____ ft. rept. / meas. _____ 19__ above / below which is _____ ft. above / below surface.

_____ ft. rept. / meas. _____ 19__ above / below which is _____ ft. above / below surface.

_____ ft. rept. / meas. _____ 19__ above / below which is _____ ft. above / below surface.

12. Use: Dom., Stock, Public Supply, Ind., (Irr.) Waterflooding, Observation, Not Used, _____

13. Quality: (Remarks on taste, odor, color, etc.) _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

14. Other data available as circled: (Driller's Log) Radioactivity Log, Electric Log, Formation Samples, Pumping Test, _____

15. Record by: D. Müller Date 3-7-1972

Source of Data Obs., DL

16. Remarks: Access S-side pump base

Base of Ogallala: 306' (Est.)

CASING & BLANK PIPE

Cemented From _____ ft. to _____ ft.

Diam. (in.)	Type	Setting, ft. from	to
16		0	314

WELL SCREEN

Screen Openings

Diam. (in.)	Type	Setting, ft. from	to
16	Perf.	250	305

TWDBE-GW-49 (Sketch)

FORM NO. 8888-LW

Triplicate—County Committeeman

High Plains Underground Water Conservation District No. 1

REGISTRATION and LOG OF WELL

INSTRUCTIONS: Fill out in quadruplet. Submit all copies to County Committee for recommendation. (PLEASE TYPE OR PRINT)

FOR USE OF COMMITTEEMEN
Field Well No. 248
Date Received
Permit Size of Pump 6 Maximum Yield 560 GPM

1. Land Owner Fritz Menke Address Amarillo

2. Well located ____ miles N, 1 miles S, ____ miles E, 2 3/4 miles W of town of Bushland

3. County Potter Labor ____ League ____ Abstract No. ____

NW¼ NE¼ SW¼ SE¼ (MARK OUT THOSE THAT DO NOT APPLY) Section 128 Block 9 Survey BS&F

10 N
530 W

DRILLER'S LOG OF WELL

Method of Drilling: Rotary ____ Spudder ____ (MARK OUT ONE THAT DOES NOT APPLY) Diameter of Well: 18 inches.

FROM (FEET)	TO (FEET)	DESCRIPTION OF FORMATION MATERIAL	FROM (FEET)	TO (FEET)	DESCRIPTION OF FORMATION MATERIAL
0	4	Top Soil	295	306	Es
4	12	Caliche	306	314	Red bed
12	70	Sdy Cly			
70	85	RK			
85	220	Ss			
220	228	RK			
228	240	Ss			
240	255	Sd			
255	258	RK			
258	295	Sd Gravel			

REMARKS:

I hereby certify that this well was drilled by me (or under my supervision), and that each and all of the statements herein are true to the best of my knowledge and belief.

Driller Bud Gibbons Address Plainview, Texas Date Drilled 4-5- 19 69

DESCRIPTION OF WELL AND PRODUCTION EQUIPMENT

(This Does Not Mean Testing or Development Pump)

6. Casing: new, (used) gas line or shop made. Diameter 16 in Total casing length 314 ft.

7. ~~Casing perforations~~: from 250 ft. to 305 ft. Size ¼ Number of rows 6

8. Pump Column: Size 6 in. Column, shaft length 2 ft. Suction pipe size ____ in. Suction pipe length ____ ft.

9. Pump bowls: Size 10 Number of stages 7 Pump discharge pipe: Size 6 in.

10. Depth to water level 200 ft. Pump yield 550 GPM. Pumping level 250 ft.

11. Power Unit: Electrical (Natural Gas, Butane, Other ____ Horsepower 55

Signature ____
LANDOWNER OR AGENT TITLE ADDRESS

07-56-603

TEXAS WATER DEVELOPMENT BOARD

WELL SCHEDULE

Aquifer _____ Field No. Permit No. 224 State Well No. 111 07-56-602

Owner's Well No. _____ County Potter

1. Location: NW 1/4 NW 1/4 Sec. 128, Block 9 Survey B.S. & F.

2. Owner: Fritz Menke Address: _____

Tenant: _____ Address: _____

Driller: Charlie McCaskill Address: Amarillo, Texas

3. Elevation of _____ LSD is 3803 ft. above msl, determined by 7½ min. Topo.

4. Drilled: 4-10-1963; Dug, Cable Tool, Rotary

5. Depth: Rept. _____ ft. Meas. _____ ft.

6. Completion: Open Hole, Straight Wall, Underreamed, Gravel Packed

7. Pump: Mfgr. Western Type Turbine

No. Stages 5, Bowls Diam. 12 in., Setting 280 ft.

Column Diam. 6 in., Length Tailpipe _____ ft.

8. Motor: Fuel NG Make & Model Chrysler Int. Hp. 50GH

9. Yield: Flow _____ gpm, Pump 700 gpm, Meas. (Rept.) Est.

10. Performance Test: Date 9-10-63 Length of Test _____ Made by DRILLER

Static Level 190 ft. Pumping Level 280 ft. Drawdown 90 ft.

Production 700 gpm Specific Capacity _____ gpm/ft.

CASING & BLANK PIPE

Cemented From _____ ft. to _____ ft.

Diam. (in.)	Type	Setting, ft. From	to

11. Water Level: 190 ft. (rept.) meas. 4-10-1963 above below which is _____ ft. above below surface.

_____ ft. rept. meas. _____ 19__ above below which is _____ ft. above below surface.

_____ ft. rept. meas. _____ 19__ above below which is _____ ft. above below surface.

_____ ft. rept. meas. _____ 19__ above below which is _____ ft. above below surface.

12. Use: Dom., Stock, Public Supply, Ind., (Irr.) Waterflooding, Observation, Not Used.

13. Quality: (Remarks on taste, odor, color, etc.)

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

14. Other data available as circled: (Driller's Log), Radioactivity Log, Electric Log, Formation Samples, Pumping Test,

WELL SCREEN

Screen Openings

Diam. (in.)	Type	Setting, ft. From	to

15. Record by: D. Müller Date 3-7-1972

Source of Data Obs, DL

16. Remarks: Access S-side pump base.

Base of Ogallala 300' (Est.)

TWDBE-GW-49 (Sketch)

FORM NO. 3529-LW

Quadruplicate—Applicant's Copy 07-56-602

High Plains Underground Water Conservation District No. 1

REGISTRATION and LOG OF WELL

INSTRUCTIONS: Fill out in quadruplet. Submit all copies to County Committee for recommendation. (PLEASE TYPE OR PRINT)

FOR USE OF COMMITTEEMEN
Field Well No. 2329
Date Received 7-30-63
Permit Size of Pump 6 Maximum Yield 600 GPM

1. Land Owner Fritz Nikke Address Amarillo

2. Well located 1 miles N, ____ miles S, ____ miles E, 2 miles W of town of Rural

3. County Potter Labor ____ League ____ Abstract No. ____

4. (NW¼) NE¼ SW¼ SE¼ Section 128 Block 9 Survey BS&F
MARK OUT THOSE THAT DO NOT APPLY
10 N
200 W

DRILLER'S LOG OF WELL

Method of Drilling: Rotary ____ Spudder ____ Diameter of Well: ____ inches.
MARK OUT ONE THAT DOES NOT APPLY

FROM (FEET)	TO (FEET)	DESCRIPTION OF FORMATION MATERIAL	FROM (FEET)	TO (FEET)	DESCRIPTION OF FORMATION MATERIAL
0	5	Top Soil	267	285	Coarse Sd
5	85	Caliche	285	300	Sd & Gravel
85	115	Sd & Clay	300	305	Red Bed
115	119	Wh Rk			
119	145	Sd & Cly			
145	180	Coarse Sd			
180	240	Sd & Cly			
240	243	Hd Rk			
243	265	Coarse Sd			
265	267	Hd Rk			

REMARKS:

I hereby certify that this well was drilled by me (or under my supervision), and that each and all of the statements herein are true to the best of my knowledge and belief.

Driller Charlie McCaskill Address Amarillo Date Drilled 4-10- 19 63

DESCRIPTION OF WELL AND PRODUCTION EQUIPMENT

(This Does Not Mean Testing or Development Pump)

6. Casing (new) used, gas line, or shop made. Diameter 16 in Total casing length 305 ft.

7. Casing perforations: from 203 ft. to 305 ft. Size 1/9 Number of rows 14

8. Pump Column: Size 6 in. Column, shaft length 280 ft. Section pipe size ____ in. Section pipe length ____ ft.

9. Pump bowls: Size 12 Number of stages 5 Pump discharge pipe: Size 6 in.

10. Depth to water level 190 ft. Pump yield 700 GPM. Pumping level: 280 ft.

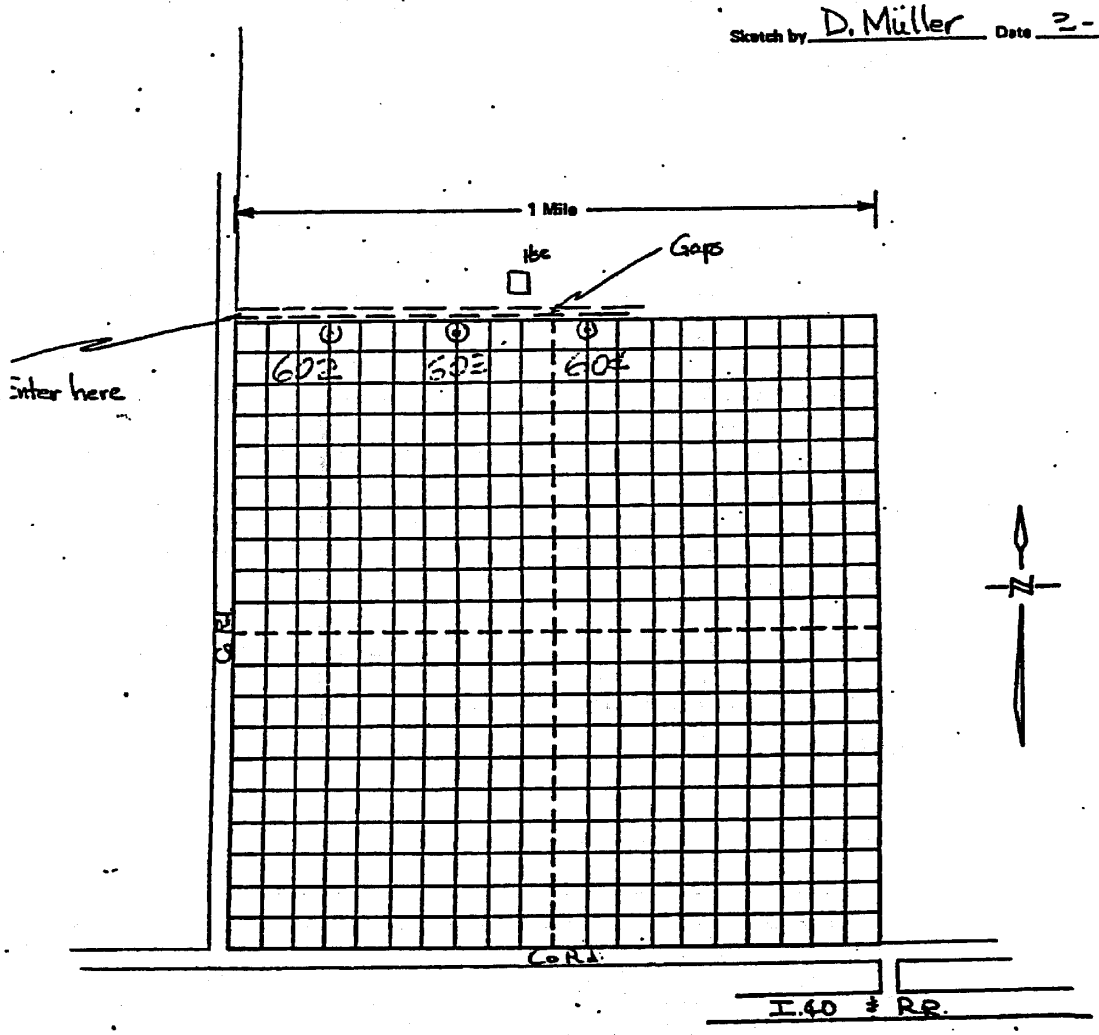
11. Power Unit: Electrical, (Natural Gas), Butane, Other ____ Horsepower ____

Signature ____
LANDOWNER OR AGENT TITLE ADDRESS

07-56-602

WATER WELL LOCATION SKETCH
TEXAS WATER DEVELOPMENT BOARD
GROUND WATER DIVISION

Section 128 in Block 9
Potter County
2½-minute Quadrangle 6 in
7½-minute Quadrangle 56
Sketch by D. Müller Date 2-7-72



TWDBE-GW-116

Well No. 07.56.602

TEXAS WATER DEVELOPMENT BOARD

WELL SCHEDULE

Aquifer _____ Field No. Permit No. 247 State Well No. 111-07-56-604

Owner's Well No. _____ County Potter

Location: NW 1/4, NE 1/4 Sec. 128, Block 9 Survey B.S. & F.

Owner: Fritz MenKe Address: Amarillo, Texas

Tenant: _____ Address: _____

Driller: Bud Gibbons Address: Plainview, Texas

Elevation of _____ LSD is 3791 ft. above msl, determined by 7½ Min. Topo.

Drilled: 4-3-1969, Dug, Cable Tool (Rotary)

Depth: Rept. _____ ft. Meas. _____ ft.

Completion: Open Hole, Straight Wall, Underreamed, Gravel Packed _____

Pump: Mfgr. A & C Type Turbine

No. Stages 7, Bowls Diam. 10 in., Setting 284 ft.

Column Diam. 6 in., Length Tailpipe _____ ft.

Motor: Fuel NG Make & Model Chrysler Ind HP. 50GH

Yield: Flow _____ gpm, Pump 500 gpm, Meas. (Rept), Est.

Performance Test: Date 4-3-69 Length of Test _____ Made by DRILLER

Static Level 200 ft. Pumping Level 265 ft. Drawdown 65 ft.

Production 500 gpm Specific Capacity _____ gpm/ft.

CASING & BLANK PIPE

Cemented From _____ ft. to _____ ft.

Diam. (in.)	Type	Setting, ft. from	to
16		0	312

1. Water Level: 200 ft. (rept) meas. 4-3-1969 above below _____ which is _____ ft. above below surface.

_____ ft. rept. meas. _____ 19__ above below _____ which is _____ ft. above below surface.

_____ ft. rept. meas. _____ 19__ above below _____ which is _____ ft. above below surface.

_____ ft. rept. meas. _____ 19__ above below _____ which is _____ ft. above below surface.

2. Use: Dom., Stock, Public Supply, Ind., (Irr.) Waterflooding, Observation, Not Used, _____

3. Quality: (Remarks on taste, odor, color, etc.) _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

4. Other data available as circled: (Driller's Log), Radioactivity Log, Electric Log, Formation Samples, Pumping Test, _____

WELL SCREEN

Screen Openings _____

Diam. (in.)	Type	Setting, ft. from	to
16	Perf.	250	305

5. Record by: D. Muller Date 3-8-1972

Source of Data Obs. DL

6. Remarks: Access S-side pump base

Base of Ogallala 305' (Est.)

TWDBE-GW-49 (Sketch)

FORM NO. 3588-LW

Duplicate—File Copy 07-56-60

High Plains Underground Water Conservation District No. 1

REGISTRATION and LOG OF WELL

INSTRUCTIONS: Fill out in quadruplet. Submit all copies to County Committee for recommendation. (PLEASE TYPE OR PRINT)

FOR USE OF COMMITTEEMEN
Field Well No. 247
Date Received
Permit Size of Pump 6 Maximum in Yield 560 GPM

1. Land Owner Fritz Mcuke Address Rt. Amarillo Texas

2. Well located ____ miles N, 1 miles S, ____ miles E, 2½ miles W of town of Bushland

3. County Potter Labor ____ League ____ Abstract No. ____

4. NW¼ (NE¼) SW¼ SE¼ Section 128 Block 9 Survey BS&F
MARK OUT THOSE THAT DO NOT APPLY
1B 870 N W

DRILLER'S LOG OF WELL

Method of Drilling: Rotary ____ Spudder ____ Diameter of Well: 18 inches.
MARK OUT ONE THAT DOES NOT APPLY

FROM (FEET)	TO (FEET)	DESCRIPTION OF FORMATION MATERIAL	FROM (FEET)	TO (FEET)	DESCRIPTION OF FORMATION MATERIAL
0	4	Top Soil			
4	15	Caliche			
15	90	Sdy Cly			
90	220	Ss			
220	250	Rk			
250	295	Sd Gravel			
295	305	Ss			
305	312	Red Bed			

REMARKS:

I hereby certify that this well was drilled by me (or under my supervision), and that each and all of the statements herein are true to the best of my knowledge and belief.

Driller Bud Gibbens Address Plainview, Texas Date Drilled 4-3-19 69

DESCRIPTION OF WELL AND PRODUCTION EQUIPMENT

(This Does Not Mean Testing or Development Pump)

8. Casing: new, used, ~~gas line~~ or shop made. Diameter 16 in. Total casing length 313 ft.

7. Casing perforations: from 250 ft. to 305 ft. Size ¼ Number of rows 6

8. Pump Column: Size 6 in. Column, shaft length 234 ft. Suction pipe size 6 in. Suction pipe length 2 ft.

9. Pump bowls: Size 10" Number of stages 7 Pump discharge pipe: Size 6" in.

10. Depth to water level 200 ft. Pump yield 500 GPM. Pumping level: 265 ft.

11. Power Unit: Electrical, Natural Gas, Butane, Other ____ Horsepower 56

Signature ____
LANDOWNER OR AGENT TITLE ADDRESS

TEXAS WATER DEVELOPMENT BOARD

WELL SCHEDULE

Aquifer _____ Field No. _____ State Well No. 44 07.56.611

Owner's Well No. _____ County Potter

1. Location: NE 1/4 NE 1/4 Sec. 145, Block 9, Survey B.S. & F

2. Owner: Georgianne Menke Address: Amarillo, Texas

Tenant: _____ Address: _____

Driller: _____ Address: _____

3. Elevation of 1SO in 3805 ft. above msl, determined by 7½ Min. topo

4. Drilled: _____ 19___; Dug, Cable Tool, Rotary, _____

5. Depth: Rept. _____ ft. Meas. _____ ft.

6. Completion: Open Hole, Straight Wall, Underreamed, Gravel Packed _____

7. Pump: Mfgr. Wintroath Type Turbine

No. Stages _____, Bowls Diam. _____ in., Setting _____ ft.

Column Diam. 6 in., Length Tailpipe _____ ft.

8. Motor: Fuel NG Make & Model Chrysler Ind. HP. 70 GH

9. Yield: Flow _____ gpm, Pump _____ gpm, Meas., Rept., Est. _____

10. Performance Test: Date _____ Length of Test _____ Made by _____

Static Level _____ ft. Pumping Level _____ ft. Drawdown _____ ft.

Production _____ gpm Specific Capacity _____ gpm/ft.

CASING & BLANK PIPE

Cemented From _____ ft. to _____ ft.

Diam. (in.)	Type	Setting, ft. From	to

11. Water Levels: _____ ft. rept. meas. _____ 19___ above/below _____ which is _____ ft. above/below surface.

_____ ft. rept. meas. _____ 19___ above/below _____ which is _____ ft. above/below surface.

_____ ft. rept. meas. _____ 19___ above/below _____ which is _____ ft. above/below surface.

_____ ft. rept. meas. _____ 19___ above/below _____ which is _____ ft. above/below surface.

12. Use: Dom., Stock, Public Supply, Ind. (Irr.) Waterflooding, Observation, Not Used, _____

13. Quality: (Remarks on taste, odor, color, etc.) _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

14. Other data available as circled: Driller's Log, Radioactivity Log, Electric Log,

Formation Samples, Pumping Test, _____

15. Record by: D. Müller Date 3-2-1972

Source of Data Obs

16. Remarks: Access W-side top conn. bk

WELL SCREEN

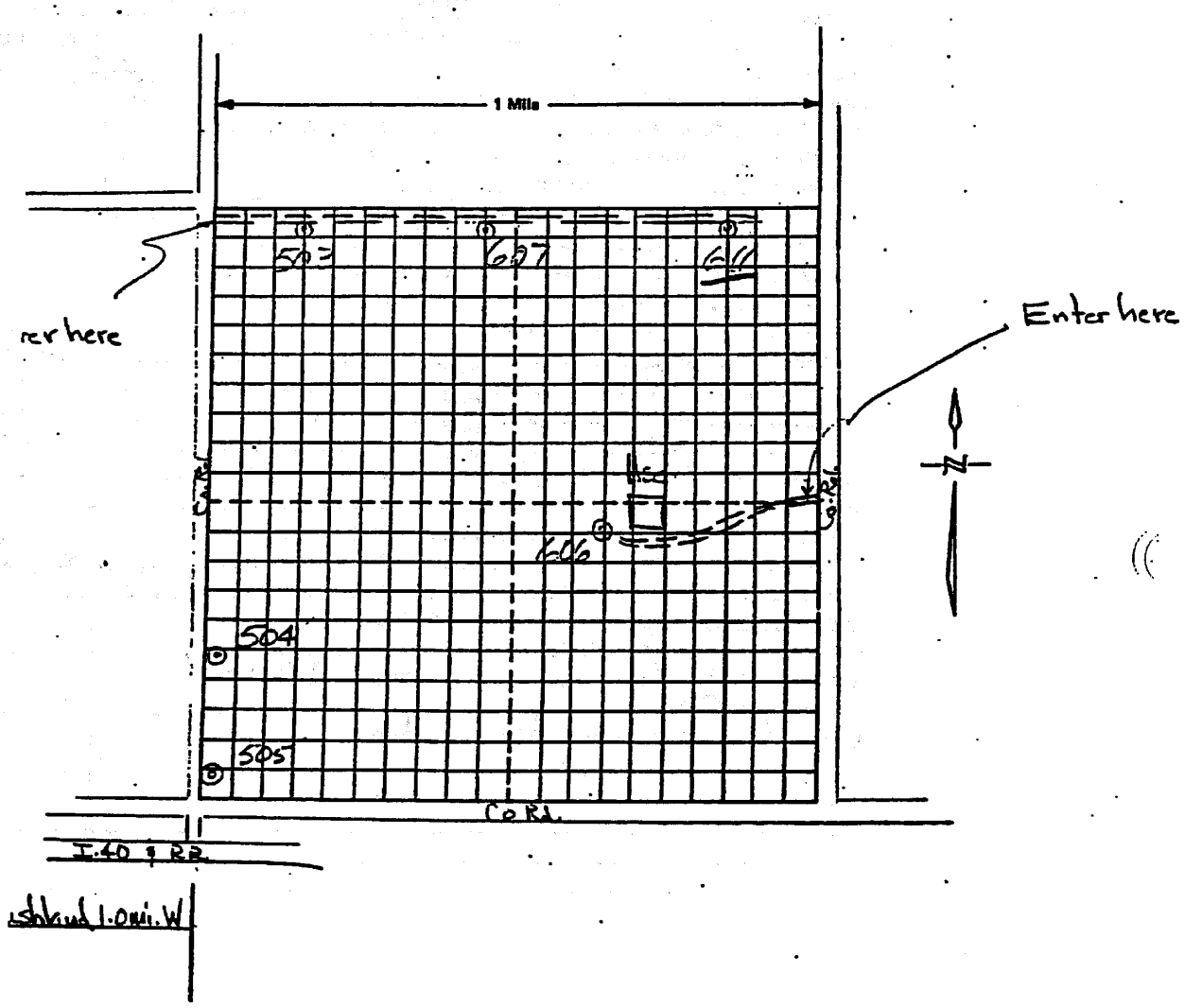
Screen Openings _____

Diam. (in.)	Type	Setting, ft. From	to

TWDBE-GW-49 (Sketch)

WATER WELL LOCATION SKETCH
TEXAS WATER DEVELOPMENT BOARD
GROUND WATER DIVISION

Section 145 in Block 9
Potter County
2½-minute Quadrangle 5 & 6 in
7½-minute Quadrangle 56
Sketch by D. Müller Date 3-7-72



Well No. 07 . 56 . 611

TWDBE-GW-116
11 Copies

APPENDIX B

SLUG TESTING DATA AND CALCULATIONS

Job No. 06625-015-037 | No.

HDR Engineering, Inc.

HDR

Project City OF Amarillo MSWLF	Computed BAM	Date 10/19/94
Subject In-Situ Permeability Calculations	Checked	Date
Task Summary	Sheet 1	Of 1

	B&R	Hvorslev	Equivalent Well Ec
MW-2	6.58×10^{-4} cm/sec	1.32×10^{-3} cm/sec	3.34×10^{-3} cm/s
MW-3	7.24×10^{-4} cm/sec	1.80×10^{-4} cm/sec	4.4×10^{-4} cm/se
MW-6	1.35×10^{-3} cm/sec	1.33×10^{-3} cm/sec	3.3×10^{-3} cm/sec
P-1	1.47×10^{-3} cm/sec	3.77×10^{-2} cm/sec	— —
P-2	1.25×10^{-3} cm/sec	1.03×10^{-3} cm/sec	— —
P-3	1.09×10^{-3} cm/sec	4.28×10^{-3} cm/sec	3.77×10^{-3} cm/s

Average OF B&R and Hvorslev

MW-2	9.89×10^{-4} cm/sec
MW-3	4.52×10^{-4} cm/sec
MW-6	1.34×10^{-3} cm/sec
P-1	1.96×10^{-2} cm/sec
P-2	1.14×10^{-3} cm/sec
P-3	2.69×10^{-3} cm/sec

Job No. 06625 - 315 - 031 | No.

HDR Engineering, Inc.

HDR

Project City of Amarillo MSWLF	Computed BAm	Date 10/19/94
Subject In-situ Permeability Calculations	Checked	Date
Task Bouwer and Rice Method	Sheet 1	Of 2

Static WL 219.1

MW-2

$$K = \frac{r_c^2 \ln(R_e/R_w)}{2Lt} \ln \frac{y_0}{y_t}$$

K = hydraulic Conductivity, cm/sec
r_c = radius of well Casing, cm
R_e = effective radius of influence
R_w = radius of Boring, cm
L = length of screen or saturated thickness if entire screen is not Saturated, cm
t = selected time from time/drawdown semi-log plot
y_0 = intial drawdown at time t = 0, sec
y_t = drawdown at time t, sec

R_w = 5-inches = 0.417 12.7 cm/sec
r_c = 5-inches = 0.417 12.7 cm/sec
L = 40 ft = 1219.2 cm
y_0 - 4.90 ft =
y_t 4.95 ft =
t = 60 sec

$$\ln \frac{R_e}{r_w} = \left[\frac{1.1}{\ln(H/r_w)} + \frac{C}{L/r_w} \right]^{-1}$$

$$\left[\frac{1.1}{\ln(26/0.417)} + \frac{3.9}{40/0.417} \right]^{-1}$$

(12.7) (1219.2) (12.7)

= 0.266 (1.535) + 0.041

= 3.26

log time sec

$$K = \frac{0.183 \ln(7.26)}{2(40)(60)} \cdot \ln \frac{4.9}{3.15}$$

$$= 0.00000426 \cdot 0.507143$$

$$= 2.16 \times 10^{-5} \text{ ft/sec}$$

$$= 6.58 \times 10^{-4} \text{ cm/sec}$$

mW-2

$t_1 = 40$ sec $\quad \Delta_1 = 4.9$

$n_1 = 4.9$

$t_2 = 100$ sec $\quad \Delta_2 = 4.05$

$n_2 = 8.95$

CITY OF AMARILLO
MUNICIPAL SOLID WASTE LANDFILL
PERMIT NO. 73

SLUG TEST
RECOVERY

WELL NO.	STATIC WATER ELEV.,FT	TIME SEC	WATER LEVEL, FT	H/Ho	WATER ELEV.,FT	TIME SEC	WATER LEVEL, FT	H/Ho	WATER ELEV.,FT
			~~217.15~~ 219.15						
MW-2	3590.64	0	228.00		3581.89	215	220.20	7.80	3589.69
		5	226.20	1.80	3583.69	220	220.15	7.85	3589.74
		10	225.80	2.20	3584.09	225	220.15	7.85	3589.74
		15	225.55	2.45	3584.34	230	220.10	7.90	3589.79
		20	225.25	2.75	3584.64	235	220.05	7.95	3589.84
		25	224.90	3.10	3584.99	240	220.00	8.00	3589.89
		30	224.60	3.40	3585.29	245	220.00	8.00	3589.89
		35	224.40	3.60	3585.49	250	219.95	8.05	3589.94
		40	224.10	3.90	3585.79	255	219.95	8.05	3589.94
		45	223.55	4.45	3586.34	260	219.90	8.10	3589.99
		55	223.30	4.70	3586.59	265	219.90	8.10	3589.99
		60	223.10	4.90	3586.79	270	219.85	8.15	3590.04
		65	223.00	5.00	3586.89	275	219.80	8.20	3590.09
		70	222.80	5.20	3587.09	280	219.80	8.20	3590.09
		75	222.60	5.40	3587.29	285	219.80	8.20	3590.09
		80	222.50	5.50	3587.39	290	219.80	8.20	3590.09
		85	222.35	5.65	3587.54	295	219.80	8.20	3590.09
		90	222.20	5.80	3587.69	300	219.75	8.25	3590.14
		95	222.05	5.95	3587.84	305	219.75	8.25	3590.14
		100	221.90	6.10	3587.99	310	219.70	8.30	3590.19
		105	221.80	6.20	3588.09	315	219.70	8.30	3590.19
		110	221.75	6.25	3588.14	320	219.70	8.30	3590.19
		115	221.65	6.35	3588.24	325	219.70	8.30	3590.19
		120	221.55	6.45	3588.34	330	219.65	8.35	3590.24
		125	221.45	6.55	3588.44	335	219.65	8.35	3590.24
		130	221.35	6.65	3588.54	340	219.65	8.35	3590.24
		135	221.25	6.75	3588.64	345	219.65	8.35	3590.24
		140	221.20	6.80	3588.69	350	219.60	8.40	3590.29
		145	221.05	6.95	3588.84	355	219.60	8.40	3590.29
		150	221.00	7.00	3588.89	360	219.60	8.40	3590.29
		155	220.19	7.81	3589.7	365	219.60	8.40	3590.29
		160	220.80	7.20	3589.09	370	219.60	8.40	3590.29
		165	220.75	7.25	3589.14	375	219.55	8.45	3590.34
		170	220.65	7.35	3589.24	380	219.55	8.45	3590.34
		175	220.65	7.35	3589.24	385	219.55	8.45	3590.34
		180	220.55	7.45	3589.34	390	219.55	8.45	3590.34
		185	220.45	7.55	3589.44	395	219.55	8.45	3590.34
		190	220.40	7.60	3589.49	400	219.55	8.45	3590.34
		195	220.35	7.65	3589.54	405	219.55	8.45	3590.34
		200	220.30	7.70	3589.59	410	219.55	8.45	3590.34
		205	220.30	7.70	3589.59	415	219.55	8.45	3590.34
		210	220.20	7.80	3589.69	420	219.55	8.45	3590.34

Job No. 06625-05-037 | No.

HDR Engineering, Inc.

HDR

Project City of Amarillo MSWLF	Computed BAM	Date 10/19
Subject In-Situ Permeability Calculations	Checked	Date
Task Bouwer and Rice Method	Sheet 1	Of 3

MW-3

$$K = \frac{r_c^2 \ln (Re/Rw)}{2Lt} \ln \frac{Yo}{Yt}$$

Rw = 0.417
r_c = 0.417
L = 40 ft
Yo = 11.10 ft
Yt = 4.70 ft
t = 100. sec

$$\ln Re/r_w = \left[\frac{1.1}{\ln(H/r_w)} + \frac{C}{L/r_w} \right]^{-1}$$

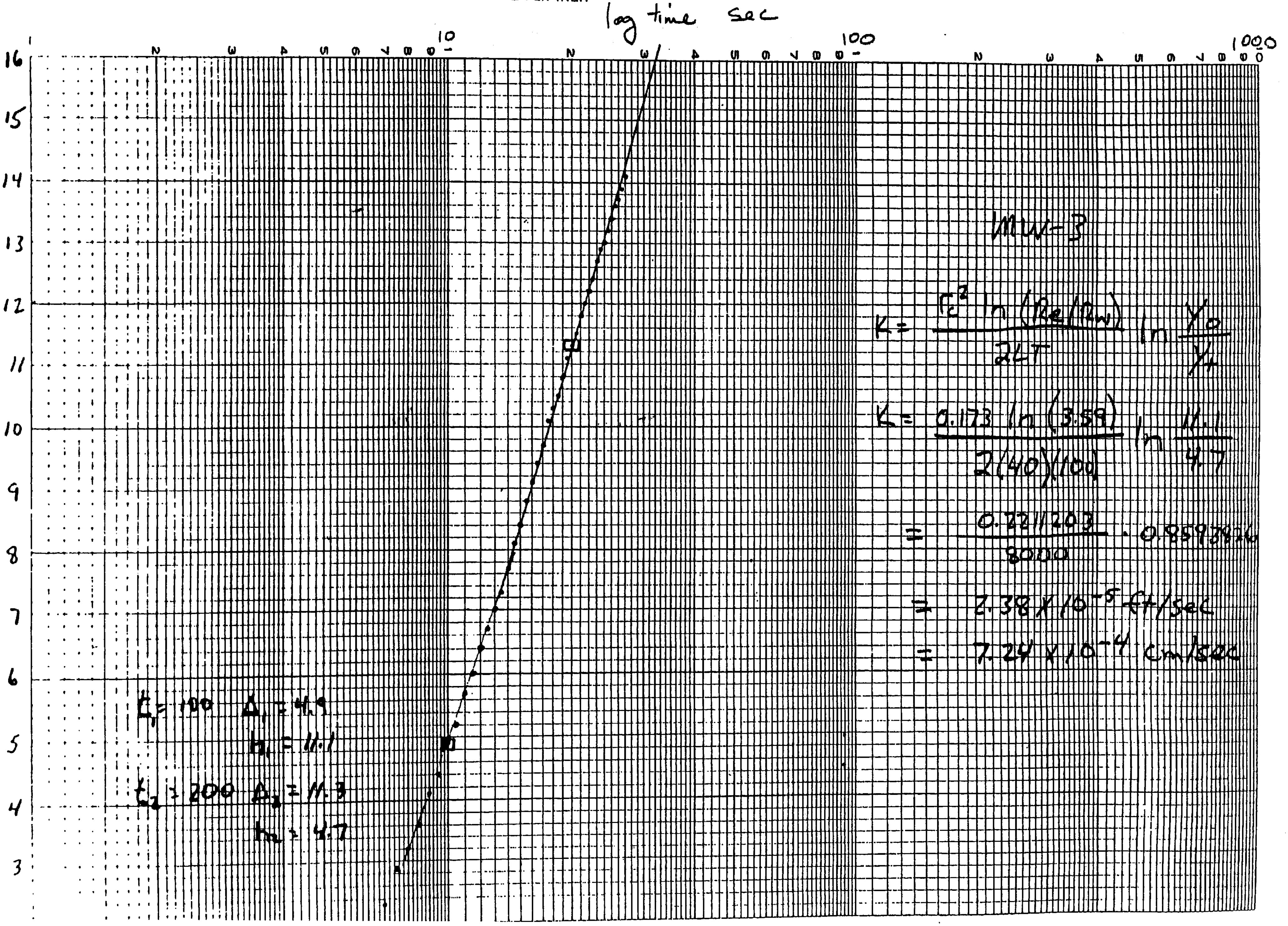
$$\frac{1.1}{\ln (43.35/0.417)} + \frac{3.9}{40/0.417}^{-1}$$

$$= 0.237 + 0.041^{-1}$$

$$= 3.59$$

NO. 340-L310 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.



CITY OF AMARILLO
MUNICIPAL SOLID WASTE LANDFILL
PERMIT NO. 73

SLUG TEST
RECOVERY

WELL NO.	STATIC WATER ELEV.,FT	TIME SEC	WATER LEVEL, FT	H/Ho	WATER ELEV.,FT	TIME SEC	WATER LEVEL,FT	H/Ho	WATER ELEV.,FT
MW-3	3589.16	0				245	212.1	13.20	3580.71
		5	225.3		3567.51	250	211.9	13.40	3580.91
		10	224.8	0.50	3568.01	255	211.7	13.60	3581.11
		15	224.8	0.50	3568.01	260	211.6	13.70	3581.21
		20	226.4	-1.10	3566.41	265	211.4	13.90	3581.41
		25	226.4	-1.10	3566.41	270	211.2	14.10	3581.61
		30	226.0	-0.70	3566.81	275	211.1	14.20	3581.71
		35	225.6	-0.30	3567.21	280	210.8	14.50	3582.01
		40	225.2	0.10	3567.61	285	210.7	14.60	3582.11
		45	225.0	0.30	3567.81	290	210.6	14.70	3582.21
		55	224.5	0.80	3568.31	300	210.4	14.90	3582.41
		60	224.1	1.20	3568.71	310	210.1	15.20	3582.71
		65	223.5	1.80	3569.31	320	209.9	15.40	3582.91
		70	223.0	2.30	3569.81	330	209.7	15.60	3583.11
		75	222.4	2.90	3570.41	340	209.4	15.90	3583.41
		80	222.1	3.20	3570.71	350	209.2	16.10	3583.61
		85	221.7	3.60	3571.11	360	208.9	16.40	3583.91
		90	221.2	4.10	3571.61	370	208.8	16.50	3584.01
		95	220.9	4.40	3571.91	380	208.5	16.80	3584.31
		100	220.4	4.90	3572.41	390	208.4	16.90	3584.41
		105	220.1	5.20	3572.71	400	208.1	17.20	3584.71
		110	219.6	5.70	3573.21	410	207.9	17.40	3584.91
		115	219.3	6.00	3573.51	420	207.8	17.50	3585.01
		120	218.9	6.40	3573.91	430	207.4	17.90	3585.41
		125	218.6	6.70	3574.21	440	207.3	18.00	3585.51
		130	218.3	7.00	3574.51	450	207.2	18.10	3585.61
		135	218.0	7.30	3574.81	460	207.0	18.30	3585.81
		140	217.6	7.70	3575.21	470	206.8	18.50	3586.01
		145	217.2	8.10	3575.61	480	206.6	18.70	3586.21
		150	216.9	8.40	3575.91	490	206.5	18.80	3586.31
		155	216.5	8.80	3576.31	500	206.3	19.00	3586.51
		160	216.2	9.10	3576.61	510	206.2	19.10	3586.61
		165	215.9	9.40	3576.91	520	206.1	19.20	3586.71
		170	215.6	9.70	3577.21	530	205.9	19.40	3586.91
		175	215.2	10.10	3577.61	540	205.8	19.50	3587.01
		180	215.0	10.30	3577.81	550	205.7	19.60	3587.11
		185	214.8	10.50	3578.01	560	205.6	19.70	3587.21
		190	214.5	10.80	3578.31	570	205.5	19.80	3587.31
		195	214.2	11.10	3578.61	580	205.4	19.90	3587.41
		200	214.0	11.30	3578.81	590	205.3	20.00	3587.51
		205	213.8	11.50	3579.01	600	205.2	20.10	3587.61
		210	213.5	11.80	3579.31	610	205.1	20.20	3587.71
		215	213.3	12.00	3579.51	620	205.1	20.20	3587.71
		220	213.1	12.20	3579.71	630	205.0	20.30	3587.81
		225	212.9	12.40	3579.91	640	204.9	20.40	3587.91
		230	212.6	12.70	3580.21	650	204.8	20.50	3588.01
		235	212.4	12.90	3580.41	660	204.8	20.50	3588.01
		240	212.3	13.00	3580.51	670	204.7	20.60	3588.11

HDR Engineering, Inc.

Project City OF Amarillo MSWLF	Computed BAM	Date 10/19/94
Subject In-Situ Permeability Calculations	Checked	Date
Task Bouwer and Rice Method	Sheet 1	Of 3

MW-6

$$K = \frac{r_c^2 \ln (Re/Rw)}{2LT} \ln \frac{Y_o}{Y_t}$$

$Rw = 0.417$
$r_c = 0.417$
$L = 40$
$Y_o = 4.2$
$Y_t = 1.5$
$t = 60$

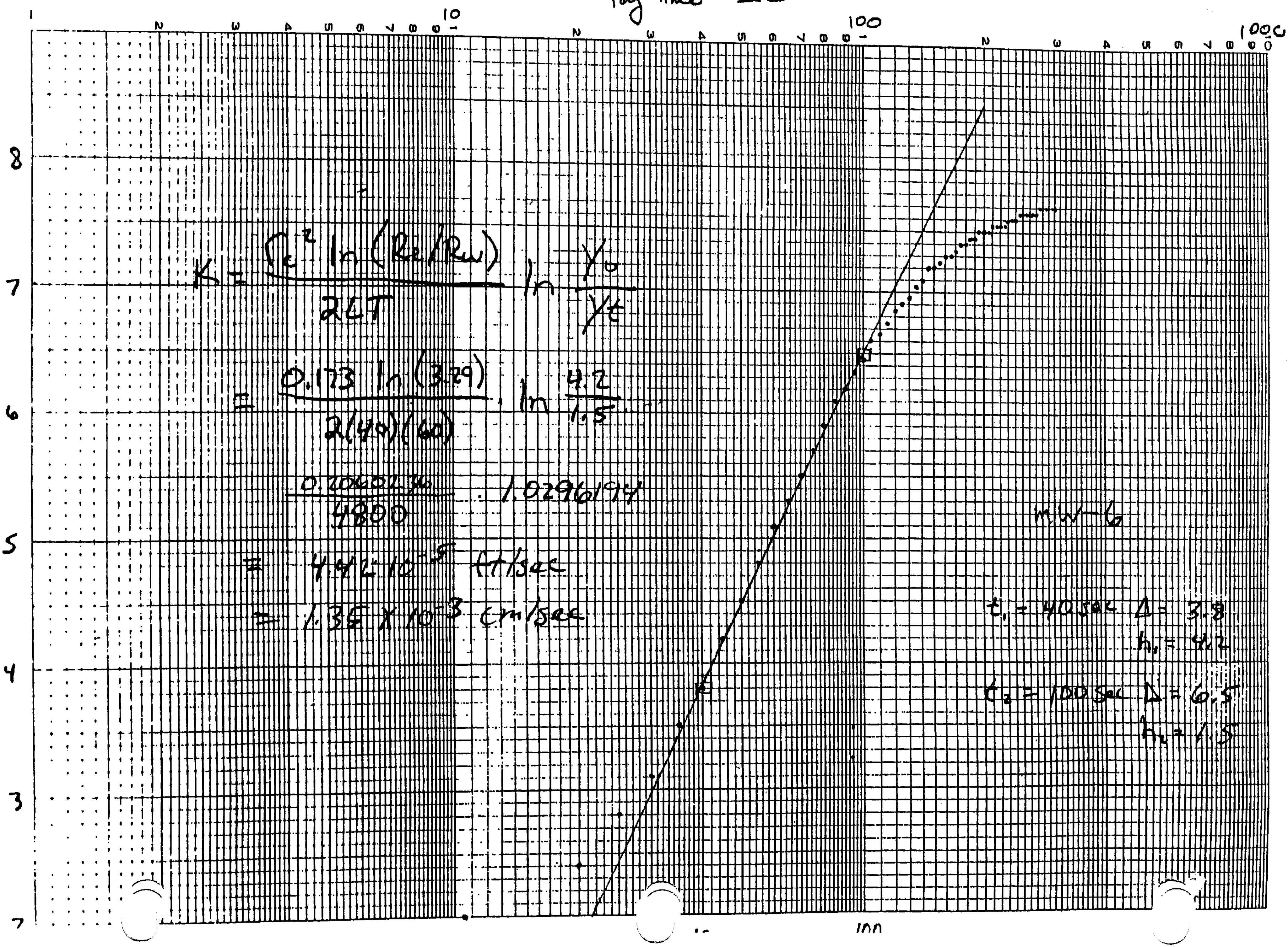
$$\ln Re/Rw = \left[\frac{1.1}{\ln (27.15/0.417)} + \frac{3.9}{40/0.417} \right]^{-1}$$

$$= 0.263 + 0.041$$

$$= 3.29$$

SEMI-LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH

MADE IN U. S. A.



$$K = \frac{r_c^2 \ln(R_e/R_w)}{2LT} \ln \frac{Y_0}{Y_t}$$

$$= \frac{0.173 \ln(3.29)}{2(40)(60)} \ln \frac{4.2}{1.5}$$

$$\frac{0.2060236}{4800} \cdot 1.0296194$$

$$= 4.42 \times 10^{-5} \text{ ft/sec}$$

$$= 1.35 \times 10^{-3} \text{ cm/sec}$$

CITY OF AMARILLO
MUNICIPAL SOLID WASTE LANDFILL
PERMIT NO. 73

SLUG TEST
RECOVERY

WELL NO.	STATIC WATER ELEV.,FT	TIME SEC	WATER LEVEL,FT	H/Ho	WATER ELEV.,FT	TIME SEC	WATER LEVEL,FT	H/Ho	WATER ELEV.,FT
			149.85						
MW-6	3601.52	5	157.00		3593.72	155	149.75	7.25	3600.97
		10	156.90	0.10	3593.82	160	149.70	7.30	3601.02
		15	155.00	2.00	3595.72	165	149.70	7.30	3601.02
		20	154.60	2.40	3596.12	170	149.65	7.35	3601.07
		25	154.20	2.80	3596.52	175	149.60	7.40	3601.12
		30	153.90	3.10	3596.82	180	149.60	7.40	3601.12
		35	153.50	3.50	3597.22	185	149.55	7.45	3601.17
		40	153.20	3.80	3597.52	190	149.55	7.45	3601.17
		45	152.80	4.20	3597.92	195	149.50	7.50	3601.22
		50	152.50	4.50	3598.22	200	149.50	7.50	3601.22
		55	152.20	4.80	3598.52	205	149.50	7.50	3601.22
		60	151.90	5.10	3598.82	210	149.45	7.55	3601.27
		65	151.70	5.30	3599.02	215	149.45	7.55	3601.27
		70	151.50	5.50	3599.22	220	149.45	7.55	3601.27
		75	151.30	5.70	3599.42	225	149.45	7.55	3601.27
		80	151.10	5.90	3599.62	230	149.40	7.60	3601.32
		85	150.90	6.10	3599.82	235	149.40	7.60	3601.32
		90	150.80	6.20	3599.92	240	149.40	7.60	3601.32
		95	150.65	6.35	3600.07	245	149.35	7.65	3601.37
		100	150.55	6.45	3600.17	250	149.35	7.65	3601.37
		105	150.40	6.60	3600.32	255	149.35	7.65	3601.37
		110	150.35	6.65	3600.37	260	149.35	7.65	3601.37
		115	150.25	6.75	3600.47	265	149.35	7.65	3601.37
		120	150.15	6.85	3600.57	270	149.35	7.65	3601.37
		125	150.10	6.90	3600.62	275	149.30	7.70	3601.42
		130	150.05	6.95	3600.67	280	149.30	7.70	3601.42
		135	149.95	7.05	3600.77	285	149.30	7.70	3601.42
		140	149.90	7.10	3600.82	290	149.30	7.70	3601.42
		145	149.80	7.20	3600.92	295	149.30	7.70	3601.42
		150	149.80	7.20	3600.92	300	149.30	7.70	3601.42

Job No. | No.

Computation

HDR

Project City of Amarillo MSWLF	Computed BAM	Date	
Subject In-Situ Permeability Calculation	Checked	Date	
Task Bouwer and Rice Method	Sheet 1	Of 1	

P-1

$$K = \frac{r_c^2 \ln (Re/Rw)}{2LT} \ln \frac{Y_o}{Y_t}$$

$Rw = 0.417$ ft
$r_c = 0.417$ ft
$L = 40$ ft
$Y_o = 2.9$
$Y_t = 1.0$

$$\ln Re/rw = \left[\frac{1.1}{\ln(H/rw)} + \frac{C}{L/r_w} \right]^{-1}$$

$$= \frac{1.1}{\ln(37.23/0.417)} + \frac{3.90}{40/0.417}^{-1}$$

$$= 0.2448916 + 0.0406575^{-1}$$

$$= 3.50$$

NO. 340-L310 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

log time sec

10 100 1000

$$K = \frac{\Gamma_c^2 \ln (R_e/R_w)}{2LT} \cdot \ln \frac{Y_0}{Y_t}$$

$$= \frac{0.173 \ln (3.50)}{2(40)(60)} \ln \frac{2.9}{1.0}$$

$$= \frac{0.216728}{4800} \cdot 1.0647107$$

$$= 4.81 \times 10^{-5} \text{ ft/sec}$$

$$= 1.47 \times 10^{-3} \text{ cm/sec}$$

P-1

$t_1 = 40$ sec $= \Delta_1 = 3.1$
$h_1 = 2.9$

$t_2 = 100 = \Delta_2 = 5.0$
$h_2 = 1.0$

SE2000
Environmental Logger
10/07 10:11

Unit# 9600 Test 4

Static W.L = 997.240

Setups:	INPUT 1
Type	Level (F)
Mode	TOC
I.D.	P1
Reference	1000.00 2,000
SG	1.000
Linearity	0.011
Scale factor	10.095
Offset	0.030
Delay mSEC	50.000

Step 0 09/21 18:02:37

Elapsed Time	INPUT 1	W.L.	H/Ho
0.0000	1003.16	~~996.84~~	
0.0333 2	1003.17	996.83	0.01
0.0666 4	1002.90	997.10	0.26
0.1000 6	1002.66	997.34	0.50
0.1333 8	1002.45	997.55	0.71
0.1666 10	1002.26	997.74	0.90
0.2000 12	1002.05	997.95	1.11
0.2333 14	1001.86	998.14	1.30
0.2666 16	1001.68	998.32	1.48
0.3000 18	1001.52	998.42	1.58
0.3333 20	1001.36	998.64	1.80
0.3666 22	1001.21	998.79	1.95
0.4000 24	1001.06	998.94	2.10
0.4333 26	1000.92	999.08	2.24
0.4666 28	1000.79	999.21	2.37
0.5000 30	1000.66	999.34	2.50
0.5333 32	1000.54	999.46	2.62
0.5666 34	1000.41	999.59	2.75
0.6000 36	1000.30	999.70	2.86
0.6333 38	1000.19	999.81	2.97
0.6666 40	1000.08	999.92	3.08

0.7000	42	999.980	1000.02	3.18
0.7333	44	999.875		
0.7666	46	999.783		
0.8000	48	999.691		
0.8333	50	999.605		
0.8666	52	999.516		
0.9000	54	999.443		
0.9333	56	999.373		
0.9666	58	999.296		
1.0000	60	999.226	1000.774	3.934
1.0333	62	999.153		
1.0666	64	999.089		
1.1000	66	999.038		
1.1333	68	998.972		
1.1666	70	998.911		
1.2000	72	998.854		
1.2333	74	998.797		
1.2666	76	998.749		
1.3000	78	998.692		
1.3333	80	998.644	1001.356	4.516
1.3666	82	998.596		
1.4000	84	998.552		
1.4333	86	998.507		
1.4666	88	998.469		
1.5000	90	998.421		
1.5333	92	998.386		
1.5666	94	998.341		
1.6000	96	998.306		
1.6333	98	998.271		
1.6666	100	998.233	1001.767	4.927
1.7000	102	998.198		
1.7333	104	998.166		
1.7666	106	998.135		
1.8000	108	998.106		
1.8333	110	998.074		
1.8666	112	998.046		
1.9000	114	998.020		
1.9333	116	997.995		
1.9666	118	997.966		
2.0000	120	997.940	1002.06	5.22
2.0333	122	997.921		
2.0666	124	997.899		
2.1000	126	997.877		
2.1333	128	997.848		
2.1666	130	997.820		

2.2000	132	997.797		
2.2333	134	997.781		
2.2666	136	997.759		
2.3000	138	997.743		
2.3333	140	997.718	1002.282	5.442
2.3666	142	997.708		
2.4000	144	997.692		
2.4333	146	997.673		
2.4666	148	997.657		
2.5000	150	997.644		
2.5333	152	997.629		
2.5666	154	997.616		
2.6000	156	997.603		
2.6333	158	997.594		
2.6666	160	997.574	1002.426	5.586
2.7000	162	997.562		
2.7333	164	997.552		
2.7666	166	997.543		
2.8000	168	997.530		
2.8333	170	997.520		
2.8666	172	997.508		
2.9000	174	997.498		
2.9333	176	997.489		
2.9666	178	997.482		
3.0000	180	997.473	1002.527	5.687
3.0333	182	997.463		
3.0666	184	997.457		
3.1000	186	997.447		
3.1333	188	997.441		
3.1666	190	997.434		
3.2000	192	997.425		
3.2333	194	997.415		
3.2666	196	997.412		
3.3000	198	997.406		
3.3333	200	997.399	1002.601	5.761
3.3666	202	997.393		
3.4000	204	997.390		
3.4333	206	997.380		
3.4666	208	997.374		
3.5000	210	997.371		
3.5333	212	997.364		
3.5666	214	997.358		
3.6000	216	997.355		
3.6333	218	997.352		
3.6666	220	997.342	1002.658	5.819

3.7000	222	997.336		
3.7333	224	997.336		
3.7666	226	997.329		
3.8000	228	997.326		
3.8333	230	997.323		
3.8666	232	997.320		
3.9000	234	997.313		
3.9333	236	997.310		
3.9666	238	997.307		
4.0000	240	997.304	1002.696	5.856
4.0333	242	997.301		
4.0666	244	997.298		
4.1000	246	997.294		
4.1333	248	997.291		
4.1666	250	997.288		
4.2000	252	997.285		
4.2333	254	997.282		
4.2666	256	997.282		
4.3000	258	997.275		
4.3333	260	997.275	1002.725	5.885
4.3666	262	997.272		
4.4000	264	997.269		
4.4333	266	997.266		
4.4666	268	997.266		
4.5000	270	997.263		
4.5333	272	997.263		
4.5666	274	997.256		
4.6000	276	997.259		
4.6333	278	997.256		
4.6666	280	997.253	1002.747	5.907
4.7000	282	997.253		
4.7333	284	997.250		
4.7666	286	997.247		
4.8000	288	997.247		
4.8333	290	997.247		
4.8666	292	997.247		
4.9000	294	997.243		
4.9333	296	997.243		
4.9666	298	997.240		
5.0000	300	997.240	1002.76	5.92
5.0333		997.237		
5.0666		997.237		
5.1000		997.237		
5.1333		997.234		
5.1666		997.234		

5.2000		997.234		
5.2333		997.231		
5.2666		997.231		
5.3000		997.231		
5.3333	320	997.228-	1002.772	5.932
5.3666		997.228		
5.4000		997.224		
5.4333		997.224		
5.4666		997.224		
5.5000		997.221		
5.5333		997.221		
5.5666		997.224		
5.6000		997.221		
5.6333		997.221		
5.6666	340	997.221	1002.779	5.939
5.7000		997.221		
5.7333		997.218		
5.7666		997.218		
5.8000		997.218		
5.8333		997.215		
5.8666		997.215		
5.9000		997.215		
5.9333		997.215		
5.9666		997.215		
6.0000	360	997.212	1002.788	5.948
6.0333		997.208		
6.0666		997.212		
6.1000		997.212		
6.1333		997.212		
6.1666		997.212		
6.2000		997.208		
6.2333		997.208		
6.2666		997.205		
6.3000		997.205		
6.3333	380	997.205	1002.795	5.955
6.3666		997.208		
6.4000		997.205		
6.4333		997.205		
6.4666		997.205		
6.5000		997.205		
6.5333		997.205		
6.5666		997.202		
6.6000		997.205		
6.6333		997.199		
6.6666	400	997.202	1002.798	5.958

6.7000		997.205		
6.7333		997.202		
6.7666		997.199		
6.8000		997.202		
6.8333		997.199		
6.8666		997.199		
6.9000		997.199		
6.9333		997.196		
6.9666		997.193		
7.0000	420	997.193	1982.807	5.967
7.0333		997.202		
7.0666		997.196		
7.1000		997.199		
7.1333		997.196		
7.1666		997.196		
7.2000		997.196		
7.2333		997.196		
7.2666		997.196		
7.3000		997.193		
7.3333		997.196		
7.3666		997.196		
7.4000		997.196		
7.4333		997.193		
7.4666		997.193		
7.5000		997.193		
7.5333		997.193		
7.5666		997.196		
7.6000		997.196		
7.6333		997.193		
7.6666		997.193		
7.7000		997.196		
7.7333		997.196		
7.7666		997.196		
7.8000		997.193		
7.8333		997.193		
7.8666		997.193		
7.9000		997.193		
7.9333		997.189		
7.9666		997.193		
8.0000		997.193		
8.0333		997.193		
8.0666		997.196		
8.1000		997.193		
8.1333		997.193		
8.1666		997.193		

8.2000	997.193
8.2333	997.193
8.2666	997.193
8.3000	997.193
8.3333	997.193
8.3666	997.193
8.4000	997.189
8.4333	997.193
8.4666	997.196
8.5000	997.193
8.5333	997.193
8.5666	997.189
8.6000	997.183
8.6333	997.193
8.6666	997.193
8.7000	997.193
8.7333	997.189
8.7666	997.193
8.8000	997.193
8.8333	997.193
8.8666	997.193
8.9000	997.193
8.9333	997.193
8.9666	997.193
9.0000	997.193
9.0333	997.193
9.0666	997.193
9.1000	997.193
9.1333	997.193
9.1666	997.193
9.2000	997.193
9.2333	997.193
9.2666	997.193
9.3000	997.193
9.3333	997.193
9.3666	997.189
9.4000	997.193
9.4333	997.193
9.4666	997.193
9.5000	997.193
9.5333	997.196
9.5666	997.193
9.6000	997.193
9.6333	997.193
9.6666	997.193

9.7000	997.193
9.7333	997.193
9.7666	997.193
9.8000	997.193
9.8333	997.193
9.8666	997.193
9.9000	997.193
9.9333	997.193
9.9666	997.193
10.0000	997.193
10.0333	997.193

Job No. 06025-015-037 No.

HDR Engineering, Inc.

Project City of Amarillo MSWLF	Computed BAM	Date 10/19/94	
Subject In-Situ Permeability Calculations	Checked	Date	
Task Bouwer and Rice method	Sheet 1	Of 3	

P-2

$$K = \frac{r_c^2 \ln (Re/Rw)}{2LT} \cdot \ln \frac{Y_o}{Y_t}$$

$Rw = 0.417$
$r_c = 0.417$
$L = 40'$
$Y_o = 1.95$
$Y_t = 0.75$
$t = 60$

$$\ln Re/Rw = \left[\frac{1.1}{\ln(27.15/1.417)} + \frac{3.9}{40/0.417} \right]^{-1}$$

$$= 0.263 + 0.041$$

$$= 3.28$$

NO. 340-L310 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

log time sec

1 — 10 — 100 — 1000

4
3
2
1
0.5

$$K = \frac{C^2 \ln(R_e/R_w)}{2tT} \ln \frac{Y_0}{Y_t}$$

$$= \frac{0.173 \ln(3.28)}{2(40)(60)} \cdot \ln \frac{1.95}{0.75}$$

$$= \frac{0.2054969}{4800} \cdot 0.9555115$$

$$= 4.09 \times 10^{-5} \text{ ft/sec}$$

$$= 1.25 \times 10^{-3} \text{ cm/sec}$$

P-2

$t_1 = 40$ sec $\Delta_1 = 2.05$

$h_1 = 1.95$

$t_2 = 100$ sec $\Delta_2 = 3.25$

$h_2 = 0.75$

CITY OF AMARILLO
MUNICIPAL SOLID WASTE LANDFILL
PERMIT NO. 73

SLUG TEST
RECOVERY

WELL NO.	STATIC WATER ELEV.,FT	TIME SEC	WATER LEVEL,FT	H/Ho	WATER ELEV.,FT	TIME SEC	WATER LEVEL,FT	H/Ho	WATER ELEV.,FT
P-2	3595.17	0							
		5	207.40		3590.87	125	203.85	3.55	3594.42
		10	206.90	0.50	3591.37	130	203.80	3.60	3594.47
		15	206.60	0.80	3591.67	135	203.80	3.60	3594.47
		20	206.40	1.00	3591.87	140	203.75	3.65	3594.52
		25	206.20	1.20	3592.07	145	203.70	3.70	3594.57
		30	206.00	1.40	3592.27	150	203.70	3.70	3594.57
		35	205.90	1.50	3592.37	155	203.65	3.75	3594.62
		40	205.80	1.60	3592.47	160	203.65	3.75	3594.62
		45	206.50	0.90	3591.77	165	203.60	3.80	3594.67
		50	205.50	1.90	3592.77	170	203.60	3.80	3594.67
		55	204.90	2.50	3593.37	175	203.55	3.85	3594.72
		60	204.80	2.60	3593.47	180	203.55	3.85	3594.72
		65	204.70	2.70	3593.57	185	203.50	3.90	3594.77
		70	204.50	2.90	3593.77	190	203.50	3.90	3594.77
		75	204.50	2.90	3593.77	195	203.50	3.90	3594.77
		80	204.40	3.00	3593.87	200	203.45	3.95	3594.82
		85	204.30	3.10	3593.97	205	203.45	3.95	3594.82
		90	204.25	3.15	3594.02	210	203.45	3.95	3594.82
		95	204.20	3.20	3594.07	215	203.45	3.95	3594.82
		100	204.15	3.25	3594.12	220	203.40	4.00	3594.87
		105	204.10	3.30	3594.17	225	203.40	4.00	3594.87
		110	204.00	3.40	3594.27	230	203.40	4.00	3594.87
		115	203.95	3.45	3594.32	235	203.40	4.00	3594.87
		120	203.90	3.50	3594.37	240	203.40	4.00	3594.87

Job No. 05022 . 015 - 057 | No.

HDR Engineering, Inc.

Project: City of Amarillo MSWLF	Computed: BAM	Date: 10/17/91
Subject: In-Situ Permeability Calculations	Checked:	Date:
Task: Bouwer and Rice Method	Sheet: 1	Of: 3

P-3

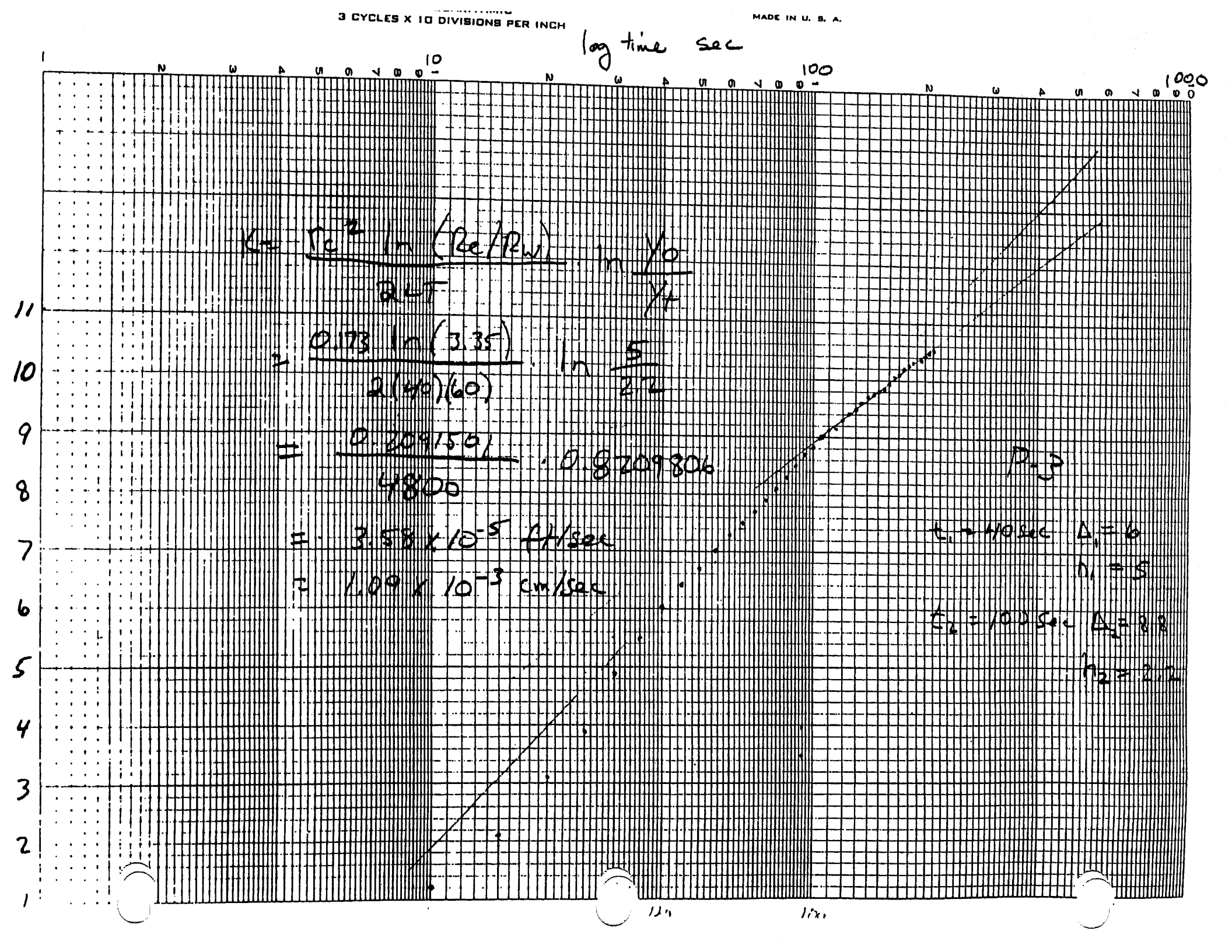
$R_w = 0.417$
$r_c = 0.417$
$L = 40$ ft
$Y_o = 5$ ft
$Y_t = 2.2$ ft
$t = 60$ sec

$$K = \frac{r_c^2 \ln (R_e/R_w)}{2LT} \cdot \ln \frac{Y_o}{Y_t}$$

$$\ln R_e/R_w \left[\frac{1.1}{\ln(29.90/.417)} + \frac{3.9}{40/0.417} \right]^{-1}$$

$$= 0.257 + 0.041$$

$$= 3.35$$


3 CYCLES X 10 DIVISIONS PER INCH
MADE IN U. S. A.
log time sec
$K = \frac{r_c^2 \ln(R_e/R_w)}{2LT} \cdot \ln\frac{y_0}{y_t}$
$= \frac{0.173 \ln(3.35)}{2(40)(60)} \cdot \ln\frac{5}{2.2}$
$= \frac{0.209151}{4800} \cdot 0.8209806$
$= 3.58 \times 10^{-5}$ ft/sec
$= 1.09 \times 10^{-3}$ cm/sec
D-3
$t_1 = 40$ sec $\Delta_1 = 6$
$n_1 = 5$
$t_2 = 100$ sec $\Delta_2 = 8.8$
$n_2 = 2.2$

CITY OF AMARILLO
MUNICIPAL SOLID WASTE LANDFILL
PERMIT NO. 73

SLUG TEST
RECOVERY

WELL NO.	STATIC WATER ELEV.,FT	TIME SEC	WATER LEVEL,FT	H/Ho	WATER ELEV.,FT	TIME SEC	WATER LEVEL,FT	H/Ho	WATER ELEV.,FT
P-3	3599.61	0							
		5	158.10		3588.56	215	147.60	10.50	3599.06
		10	156.90	1.20	3589.76	220	147.55	10.55	3599.11
		15	156.00	2.10	3590.66	225	147.50	10.60	3599.16
		20	155.00	3.10	3591.66	230	147.50	10.60	3599.16
		25	154.20	3.90	3592.46	235	147.50	10.60	3599.16
		30	153.20	4.90	3593.46	240	147.45	10.65	3599.21
		35	152.60	5.50	3594.06	245	147.40	10.70	3599.26
		40	152.10	6.00	3594.56	250	147.40	10.70	3599.26
		45	151.70	6.40	3594.96	255	147.40	10.70	3599.26
		50	151.40	6.70	3595.26	260	147.40	10.70	3599.26
		55	151.10	7.00	3595.56	265	147.40	10.70	3599.26
		60	150.80	7.30	3595.86	270	147.35	10.75	3599.31
		65	150.60	7.50	3596.06	275	147.35	10.75	3599.31
		70	150.40	7.70	3596.26	280	147.35	10.75	3599.31
		75	150.20	7.90	3596.46	285	147.30	10.80	3599.36
		80	150.00	8.10	3596.66	290	147.30	10.80	3599.36
		85	149.80	8.30	3596.86	295	147.30	10.80	3599.36
		90	149.60	8.50	3597.06	300	147.25	10.85	3599.41
		95	149.40	8.70	3597.26	305	147.25	10.85	3599.41
		100	149.30	8.80	3597.36	310	147.25	10.85	3599.41
		105	149.10	9.00	3597.56	315	147.25	10.85	3599.41
		110	149.00	9.10	3597.66	320	147.25	10.85	3599.41
		115	148.95	9.15	3597.71	325	147.25	10.85	3599.41
		120	148.80	9.30	3597.86	330	147.20	10.90	3599.46
		125	148.70	9.40	3597.96	335	147.20	10.90	3599.46
		130	148.60	9.50	3598.06	340	147.20	10.90	3599.46
		135	148.50	9.60	3598.16	345	147.20	10.90	3599.46
		140	148.40	9.70	3598.26	350	147.20	10.90	3599.46
		145	148.35	9.75	3598.31	355	147.20	10.90	3599.46
		150	148.30	9.80	3598.36	360	147.20	10.90	3599.46
		155	148.25	9.85	3598.41	365	147.20	10.90	3599.46
		160	148.15	9.95	3598.51	370	147.20	10.90	3599.46
		165	148.05	10.05	3598.61	375	147.20	10.90	3599.46
		170	148.00	10.10	3598.66	380	147.15	10.95	3599.51
		175	147.90	10.20	3598.76	385	147.15	10.95	3599.51
		180	147.85	10.25	3598.81	390	147.15	10.95	3599.51
		185	147.80	10.30	3598.86	395	147.15	10.95	3599.51
		190	147.75	10.35	3598.91	400	147.15	10.95	3599.51
		195	147.75	10.35	3598.91	405	147.15	10.95	3599.51
		200	147.70	10.40	3598.96	410	147.15	10.95	3599.51
		205	147.65	10.45	3599.01	415	147.15	10.95	3599.51
		210	147.60	10.50	3599.06	420	147.15	10.95	3599.51

Job No. | No.

HDR Engineering, Inc.

HDR

Project City of Amarillo MSWLF	Computed BAM	Date 10/18/
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Task Hvorslev Method G	Sheet 1	Of 3

$$K_h = \frac{d^2 \cdot \ln\left(\frac{2mL}{D}\right)}{8 \cdot L \cdot T} \cdot \ln \frac{H_1}{H_2}$$

K_h = horizontal Hydraulic Conductivity, cm/sec
d = diameter of standpipe, cm
m = Transformation Ratio
L = Length of intake area, cm
D = Diameter of intake area, cm
T = Time Lag, sec

MW-2

Screen (BGS) 205-245 4" 40'
Filter Pack (BGS) 200-245
Static Water Level 219.00 (9/20/94)

Parameters
$m = 3$
$d = 10.16$ cm
$D = 10.16$ cm
$L = 1219.20$ cm
H_1 = Drawdown t_1
H_2 = Drawdown t_2

$$K_h = \frac{(10.16)^2 \cdot \ln\left(\frac{2(3)(1219.2)}{10.16}\right)}{8(1219.2)(\quad)} \cdot \ln \frac{9}{6.8}$$

$t_1 = 228.0$
$t_2 = 225.80$

$$= \frac{103.23\,(6.58)}{97536} \cdot 0.280$$

$$= 1.95 \times 10^{-3} \text{ cm/sec}$$

$t_1 = 228$
$t_2 = 224.60$

$$K_h = \frac{679.2534}{8(1219.2)(\quad)} \cdot \ln \frac{9}{5.6}$$

$$\frac{679.2534}{292608} \cdot 0.474458$$

$$= 1.10 \times 10^{-3} \text{ cm/sec}$$

Job No. | No.

HDR Engineering, Inc.

HDR

Project City of Amarillo MSWLF	Computed BAm	Date 10/18/94
Subject In-situ Field Permeability Calculations	Checked	Date
Task Hvorslev Method G	Sheet 2	Of 3

MW-2 Cont

$t_1 = 228.$ $\quad K_h = \frac{629.2534}{9753.6(60.)} \cdot \ln \frac{9}{4.1}$

$t_2 = 223.10$

$= 0.0011607 \cdot 0.7862376$

$= 9.13 \times 10^{-4}$

Ave $K_h = 1.32 \times 10^{-3}$ cm/sec

MW-3

Screen 207-247'(BGS) 4" 40'
Filter Pack 200-247 (BGS)
Static Water Level 203.65' BGS

Parameters
$m = 3$
$d = 10.16$ cm
$D = 10.16$ cm
$L = 1291.20$
H_1 = drawdown t_1
H_2 = drawdown t_2

$t_1 = 226.4$
$t_2 = 224.5$

$K_h = \frac{103.23(6.58.)}{(9753.6)(240.)} \cdot \ln \frac{22.75}{20.85}$

$= 0.0002902 \cdot 0.0872112$

$= 2.53 \times 10^{-5}$ cm/sec

$t_1 = 224.5$
$t_2 = 221.7$

$K_h = \frac{103.23(6.58)}{(9753.6)(160.)} \cdot \ln \frac{20.85}{18.05}$

$= 0.0004353 \cdot 0.1442683$

$= 6.28 \times 10^{-5}$ cm/sec

Job No. | No.

HDR Engineering, Inc.

HDR

Project City of Amarillo MSWLF	Computed BFM	Date 10/18/9(
Subject In-situ Field Permeability Calculations	Checked	Date
Task	Sheet 3	Of 3

MW-3 Cont.

$$K_h = \frac{103.23(6.58)}{9753.6(100)} \cdot \ln \frac{16.75}{10.35}$$

$t_1 = 220.4$
$t_2 = 214.0$

$$0.0006964 \cdot 0.4814117$$

$$3.35 \times 10^{-4} \text{ cm/sec}$$

$t_1 = 214$
$t_2 = 210.4$

$$K_h = \frac{103.23(6.58)}{9753.6(100)} \cdot \ln \frac{10.35}{6.75}$$

$$= 0.0006964 \cdot 0.427444$$

$$= 2.97 \times 10^{-4} \text{ cm/sec}$$

Average $K_h = 3.80 \times 10^{-4}$ cm/sec

CITY OF AMARILLO
MUNICIPAL SOLID WASTE LANDFILL
PERMIT NO. 73

SLUG TEST
RECOVERY

WELL NO.	STATIC WATER ELEV.,FT	TIME SEC	WATER LEVEL, FT	H/Ho	WATER ELEV.,FT	TIME SEC	WATER LEVEL, FT	H/Ho	WATER ELEV.,FT
MW-2	3590.64	0	228.00		3581.89	215	220.20	7.80	3589.69
		5	226.20	1.80	3583.69	220	220.15	7.85	3589.74
		10	225.80	2.20	3584.09	225	220.15	7.85	3589.74
		15	225.55	2.45	3584.34	230	220.10	7.90	3589.79
		20	225.25	2.75	3584.64	235	220.05	7.95	3589.84
		25	224.90	3.10	3584.99	240	220.00	8.00	3589.89
		30	224.60	3.40	3585.29	245	220.00	8.00	3589.89
		35	224.40	3.60	3585.49	250	219.95	8.05	3589.94
		40	224.10	3.90	3585.79	255	219.95	8.05	3589.94
		45	223.55	4.45	3586.34	260	219.90	8.10	3589.99
		55	223.30	4.70	3586.59	265	219.90	8.10	3589.99
		60	223.10	4.90	3586.79	270	219.85	8.15	3590.04
		65	223.00	5.00	3586.89	275	219.80	8.20	3590.09
		70	222.80	5.20	3587.09	280	219.80	8.20	3590.09
		75	222.60	5.40	3587.29	285	219.80	8.20	3590.09
		80	222.50	5.50	3587.39	290	219.80	8.20	3590.09
		85	222.35	5.65	3587.54	295	219.80	8.20	3590.09
		90	222.20	5.80	3587.69	300	219.75	8.25	3590.14
		95	222.05	5.95	3587.84	305	219.75	8.25	3590.14
		100	221.90	6.10	3587.99	310	219.70	8.30	3590.19
		105	221.80	6.20	3588.09	315	219.70	8.30	3590.19
		110	221.75	6.25	3588.14	320	219.70	8.30	3590.19
		115	221.65	6.35	3588.24	325	219.70	8.30	3590.19
		120	221.55	6.45	3588.34	330	219.65	8.35	3590.24
		125	221.45	6.55	3588.44	335	219.65	8.35	3590.24
		130	221.35	6.65	3588.54	340	219.65	8.35	3590.24
		135	221.25	6.75	3588.64	345	219.65	8.35	3590.24
		140	221.20	6.80	3588.69	350	219.60	8.40	3590.29
		145	221.05	6.95	3588.84	355	219.60	8.40	3590.29
		150	221.00	7.00	3588.89	360	219.60	8.40	3590.29
		155	220.19	7.81	3589.7	365	219.60	8.40	3590.29
		160	220.80	7.20	3589.09	370	219.60	8.40	3590.29
		165	220.75	7.25	3589.14	375	219.55	8.45	3590.34
		170	220.65	7.35	3589.24	380	219.55	8.45	3590.34
		175	220.65	7.35	3589.24	385	219.55	8.45	3590.34
		180	220.55	7.45	3589.34	390	219.55	8.45	3590.34
		185	220.45	7.55	3589.44	395	219.55	8.45	3590.34
		190	220.40	7.60	3589.49	400	219.55	8.45	3590.34
		195	220.35	7.65	3589.54	405	219.55	8.45	3590.34
		200	220.30	7.70	3589.59	410	219.55	8.45	3590.34
		205	220.30	7.70	3589.59	415	219.55	8.45	3590.34
		210	220.20	7.80	3589.69	420	219.55	8.45	3590.34

CITY OF AMARILLO
MUNICIPAL SOLID WASTE LANDFILL
PERMIT NO. 73

SLUG TEST
RECOVERY

WELL NO.	STATIC WATER ELEV.,FT	TIME SEC	WATER LEVEL, FT	H/Ho	WATER ELEV.,FT	TIME SEC	WATER LEVEL,FT	H/Ho	WATER ELEV.,FT
MW-3	3589.16	0				245	212.1	13.20	3580.71
		5	225.3		3567.51	250	211.9	13.40	3580.91
		10	224.8	0.50	3568.01	255	211.7	13.60	3581.11
		15	224.8	0.50	3568.01	260	211.6	13.70	3581.21
		20	226.4	-1.10	3566.41	265	211.4	13.90	3581.41
		25	226.4	-1.10	3566.41	270	211.2	14.10	3581.61
		30	226.0	-0.70	3566.81	275	211.1	14.20	3581.71
		35	225.6	-0.30	3567.21	280	210.8	14.50	3582.01
		40	225.2	0.10	3567.61	285	210.7	14.60	3582.11
		45	225.0	0.30	3567.81	290	210.6	14.70	3582.21
		55	224.5	0.80	3568.31	300	210.4	14.90	3582.41
		60	224.1	1.20	3568.71	310	210.1	15.20	3582.71
		65	223.5	1.80	3569.31	320	209.9	15.40	3582.91
		70	223.0	2.30	3569.81	330	209.7	15.60	3583.11
		75	222.4	2.90	3570.41	340	209.4	15.90	3583.41
		80	222.1	3.20	3570.71	350	209.2	16.10	3583.61
		85	221.7	3.60	3571.11	360	208.9	16.40	3583.91
		90	221.2	4.10	3571.61	370	208.8	16.50	3584.01
		95	220.9	4.40	3571.91	380	208.5	16.80	3584.31
		100	220.4	4.90	3572.41	390	208.4	16.90	3584.41
		105	220.1	5.20	3572.71	400	208.1	17.20	3584.71
		110	219.6	5.70	3573.21	410	207.9	17.40	3584.91
		115	219.3	6.00	3573.51	420	207.8	17.50	3585.01
		120	218.9	6.40	3573.91	430	207.4	17.90	3585.41
		125	218.6	6.70	3574.21	440	207.3	18.00	3585.51
		130	218.3	7.00	3574.51	450	207.2	18.10	3585.61
		135	218.0	7.30	3574.81	460	207.0	18.30	3585.81
		140	217.6	7.70	3575.21	470	206.8	18.50	3586.01
		145	217.2	8.10	3575.61	480	206.6	18.70	3586.21
		150	216.9	8.40	3575.91	490	206.5	18.80	3586.31
		155	216.5	8.80	3576.31	500	206.3	19.00	3586.51
		160	216.2	9.10	3576.61	510	206.2	19.10	3586.61
		165	215.9	9.40	3576.91	520	206.1	19.20	3586.71
		170	215.6	9.70	3577.21	530	205.9	19.40	3586.91
		175	215.2	10.10	3577.61	540	205.8	19.50	3587.01
		180	215.0	10.30	3577.81	550	205.7	19.60	3587.11
		185	214.8	10.50	3578.01	560	205.6	19.70	3587.21
		190	214.5	10.80	3578.31	570	205.5	19.80	3587.31
		195	214.2	11.10	3578.61	580	205.4	19.90	3587.41
		200	214.0	11.30	3578.81	590	205.3	20.00	3587.51
		205	213.8	11.50	3579.01	600	205.2	20.10	3587.61
		210	213.5	11.80	3579.31	610	205.1	20.20	3587.71
		215	213.3	12.00	3579.51	620	205.1	20.20	3587.71
		220	213.1	12.20	3579.71	630	205.0	20.30	3587.81
		225	212.9	12.40	3579.91	640	204.9	20.40	3587.91
		230	212.6	12.70	3580.21	650	204.8	20.50	3588.01
		235	212.4	12.90	3580.41	660	204.8	20.50	3588.01
		240	212.3	13.00	3580.51	670	204.7	20.60	3588.11

Job No. | No.

HDR Engineering, Inc.

Project City of Amarillo MSWLF	Computed BAM	Date 10/19/94
Subject In-situ Permeability Calculations	Checked	Date
Task Hvorslev Method G	Sheet 1	Of 1

Static W.L = 149.20

MW-6

157.00 = H_1

152.20 = H_2

$$K_h = \frac{d^2 \cdot \ln\left(\frac{2mL}{D}\right) \cdot \ln\frac{H_1}{H_2}}{8 \cdot L \cdot T}$$

$$= \frac{(10.16)^2 \cdot \ln\left(\frac{2(3)(1219.20)}{10.16}\right) \cdot \ln\frac{7.8}{3.0}}{8(1219.20)(50)}$$

$$= \frac{103.23 \cdot 6.58}{487680} \cdot -0.841$$

$$= 0.0013928 \cdot 0.9555115$$

$$K_h = 1.33 \times 10^{-3} \text{ cm/sec}$$

CITY OF AMARILLO
MUNICIPAL SOLID WASTE LANDFILL
PERMIT NO. 73

SLUG TEST
RECOVERY

WELL NO.	STATIC WATER ELEV.,FT	TIME SEC	WATER LEVEL,FT	H/Ho	WATER ELEV.,FT	TIME SEC	WATER LEVEL,FT	H/Ho	WATER ELEV.,FT
MW-6	3601.52	5	157.00		3593.72	155	149.75	7.25	3600.97
		10	156.90	0.10	3593.82	160	149.70	7.30	3601.02
		15	155.00	2.00	3595.72	165	149.70	7.30	3601.02
		20	154.60	2.40	3596.12	170	149.65	7.35	3601.07
		25	154.20	2.80	3596.52	175	149.60	7.40	3601.12
		30	153.90	3.10	3596.82	180	149.60	7.40	3601.12
		35	153.50	3.50	3597.22	185	149.55	7.45	3601.17
		40	153.20	3.80	3597.52	190	149.55	7.45	3601.17
		45	152.80	4.20	3597.92	195	149.50	7.50	3601.22
		50	152.50	4.50	3598.22	200	149.50	7.50	3601.22
		55	152.20	4.80	3598.52	205	149.50	7.50	3601.22
		60	151.90	5.10	3598.82	210	149.45	7.55	3601.27
		65	151.70	5.30	3599.02	215	149.45	7.55	3601.27
		70	151.50	5.50	3599.22	220	149.45	7.55	3601.27
		75	151.30	5.70	3599.42	225	149.45	7.55	3601.27
		80	151.10	5.90	3599.62	230	149.40	7.60	3601.32
		85	150.90	6.10	3599.82	235	149.40	7.60	3601.32
		90	150.80	6.20	3599.92	240	149.40	7.60	3601.32
		95	150.65	6.35	3600.07	245	149.35	7.65	3601.37
		100	150.55	6.45	3600.17	250	149.35	7.65	3601.37
		105	150.40	6.60	3600.32	255	149.35	7.65	3601.37
		110	150.35	6.65	3600.37	260	149.35	7.65	3601.37
		115	150.25	6.75	3600.47	265	149.35	7.65	3601.37
		120	150.15	6.85	3600.57	270	149.35	7.65	3601.37
		125	150.10	6.90	3600.62	275	149.30	7.70	3601.42
		130	150.05	6.95	3600.67	280	149.30	7.70	3601.42
		135	149.95	7.05	3600.77	285	149.30	7.70	3601.42
		140	149.90	7.10	3600.82	290	149.30	7.70	3601.42
		145	149.80	7.20	3600.92	295	149.30	7.70	3601.42
		150	149.80	7.20	3600.92	300	149.30	7.70	3601.42

Job No. | No.

Computation

HDR

Project	City of Amarillo MSWLF	Computed BRM	Date
Subject	In-Situ Permeability Calculations	Checked	Date
Task	Hvorslev Method G	Sheet 1	Of 1

P-1

$$K_h = \frac{d^2 \cdot \ln\left(\frac{2mL}{D}\right)}{8 \cdot L \cdot T} \cdot \ln\frac{H_1}{H_2}$$

$$= \frac{(10.16)^2 \cdot \ln\left(\frac{(2)(3)(1219.2)}{10.16}\right)}{8(40)(60)} \cdot \ln\frac{2.9}{1.0}$$

$$= \frac{679.14715}{19200} \cdot 1.0647107$$

$$= 3.77 \times 10^{-2} \text{ cm/sec}$$

Job No. | No.

HDR Engineering, Inc.

HDR

Project City of Amarillo MSWLF	Computed BTM	Date 10/19	
Subject In-situ Permeability Calculations	Checked	Date	
Task Hvorslev Method G	Sheet 1	Of 7	

Static W.L. = 203.10

P-2

$$K_h = \frac{d^2 \cdot \ln\left(\frac{2mL}{D}\right)}{8 \cdot L \cdot T} \cdot \ln \frac{H_1}{H_2}$$

$H_1 = 207.40$
$H_2 = 203.90$

$$= \frac{(10.16)^2 \cdot \ln\left(\frac{2(3)(1219.20)}{10.16}\right)}{8(1219.2)(120)} \cdot \ln \frac{4.3}{0.8}$$

$$= \frac{679.1761}{1170432} \cdot 1.6817586$$

$$= 9.76 \times 10^{-4} \text{ cm/sec}$$

$H_1 = 207.40$
$H_2 = 204.80$

$$K_h = \frac{679.1761}{8(1219.2)(60)} \cdot \ln \frac{4.3}{1.7}$$

$$= 0.5011606 \cdot 0.9279868$$

$$= 1.08 \times 10^{-3} \text{ cm/sec}$$

Average = 1.03×10^{-3} cm/sec

CITY OF AMARILLO
MUNICIPAL SOLID WASTE LANDFILL
PERMIT NO. 73

SLUG TEST
RECOVERY

WELL NO.	STATIC WATER ELEV.,FT	TIME SEC	WATER LEVEL,FT	H/Ho	WATER ELEV.,FT	TIME SEC	WATER LEVEL,FT	H/Ho	WATER ELEV.,FT
P-2	3595.17	0							
		5	207.40		3590.87	125	203.85	3.55	3594.42
		10	206.90	0.50	3591.37	130	203.80	3.60	3594.47
		15	206.60	0.80	3591.67	135	203.80	3.60	3594.47
		20	206.40	1.00	3591.87	140	203.75	3.65	3594.52
		25	206.20	1.20	3592.07	145	203.70	3.70	3594.57
		30	206.00	1.40	3592.27	150	203.70	3.70	3594.57
		35	205.90	1.50	3592.37	155	203.65	3.75	3594.62
		40	205.80	1.60	3592.47	160	203.65	3.75	3594.62
		45	206.50	0.90	3591.77	165	203.60	3.80	3594.67
		50	205.50	1.90	3592.77	170	203.60	3.80	3594.67
		55	204.90	2.50	3593.37	175	203.55	3.85	3594.72
		60	204.80	2.60	3593.47	180	203.55	3.85	3594.72
		65	204.70	2.70	3593.57	185	203.50	3.90	3594.77
		70	204.50	2.90	3593.77	190	203.50	3.90	3594.77
		75	204.50	2.90	3593.77	195	203.50	3.90	3594.77
		80	204.40	3.00	3593.87	200	203.45	3.95	3594.82
		85	204.30	3.10	3593.97	205	203.45	3.95	3594.82
		90	204.25	3.15	3594.02	210	203.45	3.95	3594.82
		95	204.20	3.20	3594.07	215	203.45	3.95	3594.82
		100	204.15	3.25	3594.12	220	203.40	4.00	3594.87
		105	204.10	3.30	3594.17	225	203.40	4.00	3594.87
		110	204.00	3.40	3594.27	230	203.40	4.00	3594.87
		115	203.95	3.45	3594.32	235	203.40	4.00	3594.87
		120	203.90	3.50	3594.37	240	203.40	4.00	3594.87

Job No. | No.

HDR Engineering, Inc.

HDR

Project City of Amarillo MSWLF	Computed BAm	Date 10/19/94	
Subject In-Situ Permeability Calculations	Checked	Date	
Task Hvorslev Method G	Sheet 1	Of 1	

Static W.L. = 147.05

P-3

$$K_h = \frac{d^2 \cdot \ln\left(\frac{2mL}{D}\right)}{8 \cdot L \cdot T} \cdot \ln \frac{H_1}{H_2}$$

$H_1 = 158.10$
$H_2 = 148.80$

$$= \frac{679.1761}{2(2192)(120)} \cdot \ln \frac{11.05}{1.75}$$

$$= 0.0023211 \cdot 1.8428146$$

$$= 4.28 \times 10^{-3} \text{ cm/sec}$$

CITY OF AMARILLO
MUNICIPAL SOLID WASTE LANDFILL
PERMIT NO. 73

SLUG TEST
RECOVERY

WELL NO.	STATIC WATER ELEV.,FT	TIME SEC	WATER LEVEL,FT	H/Ho	WATER ELEV.,FT	TIME SEC	WATER LEVEL,FT	H/Ho	WATER ELEV.,FT
P-3	3599.61	0							
		5	158.10		3588.56	215	147.60	10.50	3599.06
		10	156.90	1.20	3589.76	220	147.55	10.55	3599.11
		15	156.00	2.10	3590.66	225	147.50	10.60	3599.16
		20	155.00	3.10	3591.66	230	147.50	10.60	3599.16
		25	154.20	3.90	3592.46	235	147.50	10.60	3599.16
		30	153.20	4.90	3593.46	240	147.45	10.65	3599.21
		35	152.60	5.50	3594.06	245	147.40	10.70	3599.26
		40	152.10	6.00	3594.56	250	147.40	10.70	3599.26
		45	151.70	6.40	3594.96	255	147.40	10.70	3599.26
		50	151.40	6.70	3595.26	260	147.40	10.70	3599.26
		55	151.10	7.00	3595.56	265	147.40	10.70	3599.26
		60	150.80	7.30	3595.86	270	147.35	10.75	3599.31
		65	150.60	7.50	3596.06	275	147.35	10.75	3599.31
		70	150.40	7.70	3596.26	280	147.35	10.75	3599.31
		75	150.20	7.90	3596.46	285	147.30	10.80	3599.36
		80	150.00	8.10	3596.66	290	147.30	10.80	3599.36
		85	149.80	8.30	3596.86	295	147.30	10.80	3599.36
		90	149.60	8.50	3597.06	300	147.25	10.85	3599.41
		95	149.40	8.70	3597.26	305	147.25	10.85	3599.41
		100	149.30	8.80	3597.36	310	147.25	10.85	3599.41
		105	149.10	9.00	3597.56	315	147.25	10.85	3599.41
		110	149.00	9.10	3597.66	320	147.25	10.85	3599.41
		115	148.95	9.15	3597.71	325	147.25	10.85	3599.41
		120	148.80	9.30	3597.86	330	147.20	10.90	3599.46
		125	148.70	9.40	3597.96	335	147.20	10.90	3599.46
		130	148.60	9.50	3598.06	340	147.20	10.90	3599.46
		135	148.50	9.60	3598.16	345	147.20	10.90	3599.46
		140	148.40	9.70	3598.26	350	147.20	10.90	3599.46
		145	148.35	9.75	3598.31	355	147.20	10.90	3599.46
		150	148.30	9.80	3598.36	360	147.20	10.90	3599.46
		155	148.25	9.85	3598.41	365	147.20	10.90	3599.46
		160	148.15	9.95	3598.51	370	147.20	10.90	3599.46
		165	148.05	10.05	3598.61	375	147.20	10.90	3599.46
		170	148.00	10.10	3598.66	380	147.15	10.95	3599.51
		175	147.90	10.20	3598.76	385	147.15	10.95	3599.51
		180	147.85	10.25	3598.81	390	147.15	10.95	3599.51
		185	147.80	10.30	3598.86	395	147.15	10.95	3599.51
		190	147.75	10.35	3598.91	400	147.15	10.95	3599.51
		195	147.75	10.35	3598.91	405	147.15	10.95	3599.51
		200	147.70	10.40	3598.96	410	147.15	10.95	3599.51
		205	147.65	10.45	3599.01	415	147.15	10.95	3599.51
		210	147.60	10.50	3599.06	420	147.15	10.95	3599.51

Job No. 06625-015-027 | No.

HDR Engineering, Inc.

HDR

Project City of Amarillo MSWLF	Computed BAm	Date 10/25	
Subject Equilibrium Well Equation	Checked	Date	
Task Estimate Hydraulic Conductivity	Sheet 1	Of 3	

$$Q = \frac{K(H^2 - h^2)}{1{,}055 \log R/r}$$

Driscoll, p. 213

Q = pumping rate, gpm
K = hydraulic conductivity of formation, gpd/ft²
H = static head measured from bottom of aquifer, ft
h = depth of water in well while pumping, ft
R = radius of the cone of depression, ft
r = radius of the well, ft

MW-2

Q = 10 gpm
H = 25.75
h = 18.8
R = 10' (assumed)
r = 0.167

$$K = \frac{Q\ 1{,}055 \log R/r}{H^2 - h^2}$$

$$= \frac{10\ (1.055 \log 10/0.167)}{25.75^2 - 18.8^2}$$

$$= \frac{18750.34}{663.06 - 353.44}$$

$$= \frac{18750.34}{309.62}$$

$$= 60.56 \text{ gpd/ft}^2$$

$$= 2.86 \times 10^{-3} \text{ cm/sec}$$

HDR Engineering, Inc.

Project City of Amarillo MSWLF	Computed BAm	Date 10/25/94
Subject Equilibrium Well Equation	Checked	Date
Task Estimate Hydraulic Conductivity	Sheet 2	Of 3

MW-2 Cont.

$R = 20'$ $\quad K = \dfrac{10\,(1{,}055)\log 20/.167)}{25.75^2 - 18.8^2}$

$= \dfrac{21926.21}{663.06 - 353.44}$

$= 70.82$ gpd/ft^2

$= 3.34 \times 10^{-3}$ cm/sec

MW-3

$K = \dfrac{6\,(1{,}055)\log 20/.167}{43.35^2 - 21.70^2}$

$= \dfrac{13155.73}{1879.22 - 470.89}$

$= 9.34$ gpd/ft^2

$= 4.4 \times 10^{-4}$ cm/sec

$Q = 6$ gpm
$H = 43.35$
$h = 21.70$
$R = 20$
$r = 0.167$

Job No. 06625-95-257 | No.

HDR Engineering, Inc.

HDR

Project: City of Amarillo MSWLF	Computed: DRM	Date: 10/25	
Subject: Equilibrium Well Equation	Checked:	Date:	
Task: Estimate Hydraulic Conductivity	Sheet: 3	Of: 3	

MW-6

$$K = \frac{12(1{,}055)\log 20/0.167}{27.15^2 - 19^2}$$

$$= \frac{26311.45}{737.12 - 361}$$

$$= 69.95 \text{ gpd/ft}^2$$

$$= 3.3 \times 10^{-3} \text{ cm/sec}$$

$Q = 12$ gpm
$H = 27.15$
$h = 19$
$R = 20'$
$r = 0.167$

P-3

$$K = \frac{10(1{,}055)\log 20/0.167)}{17.95^2 - 6.9^2}$$

$$= \frac{4926.21}{322.20 - 47.61}$$

$$= 79 \text{ gpd/ft}^2$$

$$= 3.77 \times 10^{-3} \text{ cm/sec}$$

$Q = 10$
$H = 17.95$
$h = 6.9$
$R = 20$
$r = 0.167$

Job No. | No.

HDR Engineering, Inc.

HDR

Project City of Amarillo MSWLF	Computed BRM	Date 10/26/94
Subject Estimate Radius of Influence	Checked	Date
Task	Sheet 1	Of 1

$$r_o^2 = \frac{0.3Tt}{S}$$

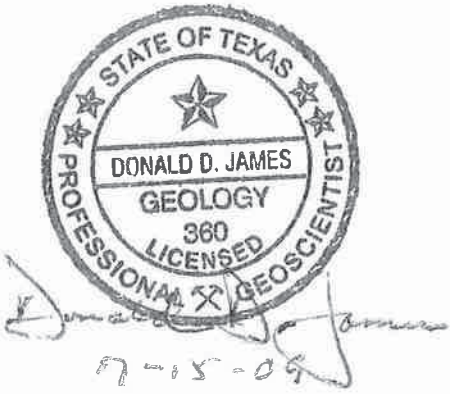
S = Coefficient of Storage
T = Transmissivity, gpd/ft
t = time since pumping started, days
r_o = intercept of extended straight line at zero drawdown, ft

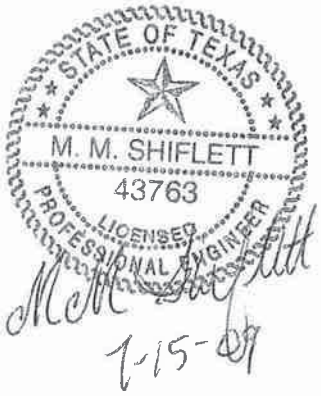
$$r_o^2 = \frac{0.3(6600)(0.042)}{0.2}$$

$$= \sqrt{415.8}$$

$$= 20.39$$

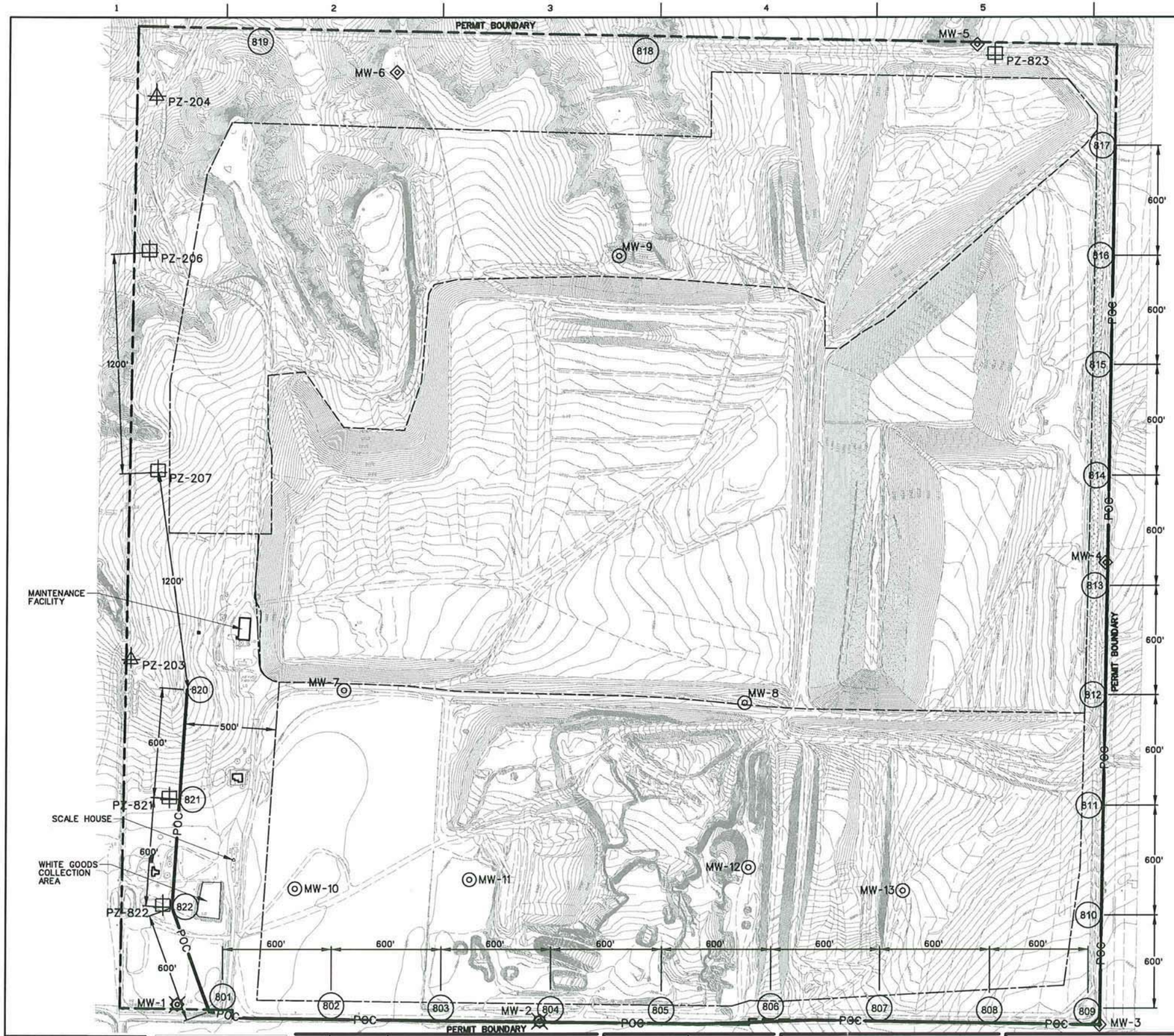
Using average of Transmissivities Computed for wells in Randal County, TWDB Report 98, Compilation of Results of Aquifer Tests in Texas





APPENDIX 5B

Existing and Proposed Monitoring Well Locations
Typical Monitoring Well Detail
Proposed Monitoring Well Network
Groundwater Elevation Summary, September 1994 to April 13, 2009
Groundwater Contour Map with Directional Groundwater Flow and Point of Compliance
Groundwater Contour Map, November 9, 1994
Groundwater Contour Map, April 14, 1995
Groundwater Contour Map, October 16, 1995
Groundwater Contour Map, April 15, 1997
Groundwater Contour Map, October 14, 1998
Groundwater Contour Map, April 17, 2000
Groundwater Contour Map, October 16, 2001
Groundwater Contour Map, April 14, 2003
Groundwater Contour Map, October 18, 2004
Groundwater Contour Map, October 17, 2005
Groundwater Contour Map, April 18, 2006
Groundwater Contour Map, April 18, 2007
Groundwater Contour Map, October 15, 2007
Groundwater Contour Map, March 18, 2008
Groundwater Contour Map, August 14, 2008
Groundwater Contour Map, November 19, 2008
Groundwater Contour Map, January 12, 2009
Groundwater Contour Map, April 13, 2009
Structural Surface Contour Map of the Triassic Dockum Formation
Kleinfelder Logs of Borings 203 and 204 with Piezometer Construction Detail
Monitoring Well Data Sheets and Logs



STATE OF TEXAS
DONALD D. JAMES
GEOLOGY
360
LICENSED
PROFESSIONAL GEOSCIENTIST
9-23-09

STATE OF TEXAS
M. M. SHIFLETT
47788
LICENSED
PROFESSIONAL ENGINEER
9-23-2009
KLEINFELDER
F-5592

Signed for monitoring well locations.

N

0 300 600
SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- 3300 EXISTING CONTOURS, IN FEET, MSL
- LANDFILL FOOTPRINT
- MW-4 EXISTING MONITORING WELL LOCATIONS TO BE PLUGGED AND ABANDONED UPON COMPLETION OF BACKGROUND MONITORING OF THE ADDITIONAL WELLS
- MW-7 EXISTING MONITORING WELL LOCATIONS TO BE PLUGGED AND ABANDONED AS CONSTRUCTION ACTIVITY DICTATES.
- MW-1 MW-1 AND MW-2 TO REMAIN ACTIVE UNTIL OUT OF ASSESMENT MONITORING
- PZ-203 EXISTING PIEZOMETERS
- 822 ADDITIONAL MONITORING WELL LOCATIONS
- POC POINT OF COMPLIANCE
- LIMITS OF WASTE (2009)
- PZ-204 PROPOSED PIEZOMETER (4")

STATE OF TEXAS
MICHAEL W. ODEN
67165
REGISTERED
PROFESSIONAL ENGINEER
9-23-2009
HDR
F-754
For Base Map

NOTES

1. FOR TOPOGRAPHIC INFO SEE SHEET III.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.
3. POINT OF COMPLIANCE FOR GROUNDWATER MONITORING IS SHOWN ON APP.5B PLATE 6.
4. THE GROUNDWATER MONITORING SYSTEM WILL CONSIST OF UPGRADIENT WELLS 818, 819 AND MW-5 DOWNGRADIENT WELLS 801 - 817
5. WELLS 820, 821 AND 822 TO BE INSTALLED ONCE CELL 12 IS DEVELOPED (PRIOR TO WASTE PLACEMENT). INSTALL PZ-821 AND PZ-822 ALONG WITH WELLS 801 - 819.

CITY OF AMARILLO TEXAS

HDR

HDR ENGINEERING, INC.
4500 W. Eldorado Pkwy.
Suite 3500
McKinney, Texas 75070

TEXAS P.E. FIRM
REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
5	9/2009	REVISED SYMBOLS MW-1, MW-2
4	7/2009	REVISED MONITOR WELL LOCATIONS
3	3/2009	REVISED MONITOR WELL LOCATIONS
2	1/2009	ADD POC/DISTANCE/WASTE
1	8/2008	REVISED MONITOR WELL NETWORK

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

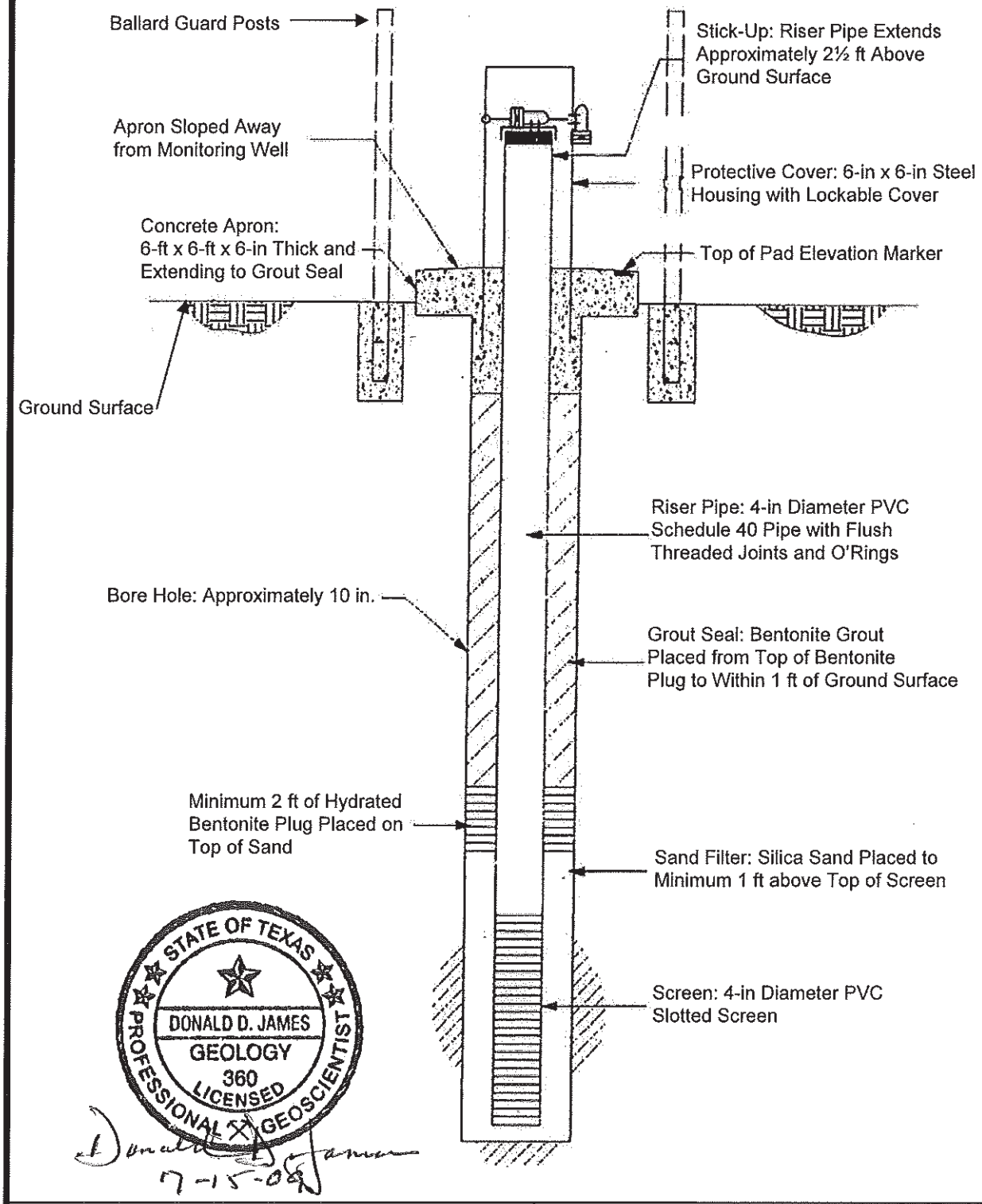
EXISTING AND PROPOSED MONITORING WELL LOCATIONS

0 1" 2"

FILENAME
SCALE

SHEET
Plate 1
App. 5B

USER: RCOX
FILE: ...\DMS15903\AMII105.PLATE1A.DGN
DATE=9/14/2009
TIME: 2:28:28 PM



STATE OF TEXAS
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PROFESSIONAL GEOSCIENTIST

7-15-08

KLEINFELDER
Bright People. Right Solutions.

TYPICAL MONITORING WELL DETAIL
City of Amarillo Landfill
Potter County, Texas

KLEINFELDER
Bright People. Right Solutions.

STATE OF TEXAS
DONALD D. JAMES
GEOLOGY
360
LICENSED
PROFESSIONAL GEOSCIENTIST
7-15-09

Proposed Monitoring Well Network
Screened Interval Elevations
City of Amarillo Landfill
Potter County, Texas

Well No.	Well Location	Ground Surface Elevation	Top of Triassic Elevation, Bottom Elevation	Groundwater Elevation (April 2009)	Groundwater Thickness (ft.) (April 2009)	Groundwater Elevation (projected for 15 yrs. at current trend of 0.2 ft/yr drop)	15 yr. Projected Groundwater Thickness (ft.)	Top of Filter Pack Elevation (Groundwater Elevation-3ft.)	Submerged Top of Bentonite Seal Elevation (projected for 15 yr.)	Screened Interval, Top Elevation	Screened Interval, Bottom Elevation	Screen Length (ft.)
MW-801	Downgradient	3814.00	3532	3586.2	54.2	3583.2	51.2	3580.2	3582.2	3579.2	3532	47.2
MW-082	Downgradient	3811.11	3532	3585.0	53.0	3582.0	50.0	3579.0	3581.0	3578.0	3532	46.0
MW-803	Downgradient	3809.90	3535	3584.6	49.6	3581.6	46.6	3578.6	3580.6	3577.6	3535	42.6
MW-804	Downgradient	3806.66	3535	3583.4	48.4	3580.4	45.4	3577.4	3579.4	3576.4	3535	41.4
MW-805	Downgradient	3805.91	3534	3583.4	49.4	3580.4	46.4	3577.4	3579.4	3576.4	3534	42.4
MW-806	Downgradient	3796.77	3532	3583.4	51.4	3580.4	48.4	3577.4	3579.4	3576.4	3532	44.4
MW-807	Downgradient	3781.07	3533	3583.4	50.4	3580.4	47.4	3577.4	3579.4	3576.4	3533	43.4
MW-808	Downgradient	3789.70	3529	3583.3	54.3	3580.3	51.3	3577.3	3579.3	3576.3	3529	47.3
MW-809	Downgradient	3792.10	3526	3583.1	57.1	3580.1	54.1	3577.1	3579.1	3576.1	3526	50.1
MW-810	Downgradient	3784.08	3538	3584.5	46.5	3581.5	43.5	3578.5	3580.5	3577.5	3538	39.5
MW-811	Downgradient	3768.29	3549	3586.2	37.2	3583.2	34.2	3580.2	3582.2	3579.2	3549	30.2
MW-812	Downgradient	3743.14	3560	3587.8	27.8	3584.8	24.8	3581.8	3583.8	3580.8	3560	20.8
MW-813	Downgradient	3745.44	3571	3589.4	18.4	3586.4	15.4	3583.4	3585.4	3582.4	3571	11.4
MW-814	Downgradient	3745.83	3582	3593.3	11.3	3590.3	8.3	3587.3	3589.3	3586.3	3582	<5.0
MW-815	Downgradient	3746.92	3591	3598.0	7.0	3595.0	<5.0	3592.0	3594.0	3591.0	3591	<5.0
MW-816	Downgradient	3757.68	3600	3602.5	2.5	3599.5	<5.0	3596.5	3598.5	3595.5	3600	<5.0
MW-817	Downgradient	3746.21	3607	3607.5	0.5	3604.5	<5.0	3601.5	3603.5	3600.5	3607	<5.0
MW-818	Upgradient	3702.56	3594	3604.5	10.5	3601.5	7.5	3598.5	3600.5	3597.5	3594	<5.0
MW-819	Upgradient	3688.61	3560	3596.5	36.5	3593.5	33.5	3590.5	3592.5	3589.5	3560	29.5
MW-820	Downgradient	3784.80	3550	3590.5	40.5	3587.5	37.5	3584.5	3586.5	3583.5	3550	33.5
MW-821	Downgradient	3810.00	3543	3589.1	46.1	3586.1	43.1	3583.1	3585.1	3582.1	3543	39.1
MW-822	Downgradient	3815.82	3537	3587.5	50.5	3584.5	47.5	3581.5	3583.5	3580.5	3537	43.5
PZ-823	Upgradient	3738.35	3612	3613.3	1.3	3610.3	<5.0	3607.3	3609.3	3606.3	3612	<5.0
PZ-206	Upgradient	3704.72	3555	3594.8	39.8	3591.8	36.8	3588.8	3590.8	3587.8	3555	32.8
PZ-207	Upgradient	3764.98	3551	3592.7	41.7	3589.7	38.7	3586.7	3588.7	3585.7	3551	34.7
PZ-821	Downgradient	3810.00	3543	3589.1	46.1	3586.1	43.1	3583.1	3585.1	3582.1	3543	39.1
PZ-822	Downgradient	3815.82	3537	3587.5	50.5	3584.5	47.5	3581.5	3583.5	3580.5	3537	43.5

Note: For locations where 15 year project groundwater thickness is less than 5 feet, well screen length and top of bentonite seal will be finalized at the time of well installation, depending upon actual saturated thickness measured in the field.

CITY OF AMARILLO MUNICIPAL SOLID WASTE LANDFILL

PERMIT NO. 73A

Groundwater Elevation Summary

1994-2009

DATE	MW 1	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8	MW 9	MW 10	MW 11	MW 12	MW 13	B203	B204
9/20/1994	3590.24	3590.44	3588.90	3596.26	3613.78	3601.55	3595.12	3594.75	3599.57	N/A	N/A	N/A	N/A	N/A	N/A
9/28/1994	3588.65	3587.34	3588.98	3595.69	3613.03	3601.06	3594.51	3594.11	3599.24	N/A	N/A	N/A	N/A	N/A	N/A
10/5/1994	3590.32	3590.44	3590.12	3596.51	3613.84	3601.55	3595.20	3594.80	3597.59	N/A	N/A	N/A	N/A	N/A	N/A
10/12/1994	3590.27	3590.44	3590.07	3596.56	3613.89	3601.55	3595.01	3594.75	3597.54	N/A	N/A	N/A	N/A	N/A	N/A
10/19/1994	3590.32	3590.44	3590.12	3596.51	3613.84	3601.55	3595.11	3594.75	3599.59	N/A	N/A	N/A	N/A	N/A	N/A
10/26/1994	3590.27	3590.44	3590.12	3596.66	3613.94	3601.50	3595.16	3594.80	3599.54	N/A	N/A	N/A	N/A	N/A	N/A
10/31/1994	3590.22	3590.39	3589.97	3596.66	3613.99	3601.50	3594.96	3594.65	3599.44	N/A	N/A	N/A	N/A	N/A	N/A
11/9/1994	3590.17	3590.39	3589.97	3596.76	3614.09	3601.50	3595.01	3594.65	3599.44	N/A	N/A	N/A	N/A	N/A	N/A
11/16/1994	3590.22	3590.39	3590.02	3596.81	3614.24	3601.45	3595.06	3594.75	3599.44	N/A	N/A	N/A	N/A	N/A	N/A
11/23/1994	3590.22	3590.34	3590.02	3596.91	3614.34	3601.45	3595.11	3594.75	3599.49	N/A	N/A	N/A	N/A	N/A	N/A
11/30/1994	3590.92	3590.34	3590.02	3597.06	3614.39	3601.45	3595.01	3594.75	3599.44	N/A	N/A	N/A	N/A	N/A	N/A
12/7/1994	3590.12	3590.24	3590.02	3597.06	3614.39	3601.40	3594.65	3594.65	3599.39	N/A	N/A	N/A	N/A	N/A	N/A
12/14/1994	3589.87	3590.34	3590.02	3597.11	3614.39	3601.40	3595.01	3594.75	3599.44	N/A	N/A	N/A	N/A	N/A	N/A
2/20/1995	3590.65	3590.25	3589.00	3596.65	3614.10	3601.40	3595.02	3594.65	3599.34	N/A	N/A	N/A	N/A	N/A	N/A
3/14/1995	3590.22	3590.74	3588.87	3595.86	3614.16	3601.45	3595.21	3595.00	3598.64	N/A	N/A	N/A	N/A	N/A	N/A
4/14/1995	3589.82	3590.69	3589.82	3596.56	3614.19	3601.55	3595.11	3594.85	3599.64	N/A	N/A	N/A	N/A	N/A	N/A
5/14/1995	3589.77	3590.64	3590.64	3596.36	3614.09	3601.55	3594.61	3594.85	3599.59	N/A	N/A	N/A	N/A	N/A	N/A
6/14/1995	3589.82	3590.29	3590.29	3597.01	3614.39	3601.45	3595.11	3594.70	3599.54	N/A	N/A	N/A	N/A	N/A	N/A
7/14/1995	3589.82	3590.69	3590.69	3596.46	3614.09	3601.50	3595.11	3594.90	3599.59	N/A	N/A	N/A	N/A	N/A	N/A
8/14/1995	3589.67	3590.49	3589.77	3596.31	3614.19	3601.45	3595.06	3594.80	3599.54	N/A	N/A	N/A	N/A	N/A	N/A
9/14/1995	3589.67	3590.54	3589.72	3597.46	3614.69	3601.40	3594.91	3594.80	3599.64	N/A	N/A	N/A	N/A	N/A	N/A
10/16/1995	3589.65	3589.85	3588.70	3597.25	3614.30	3602.10	3594.67	3594.15	3599.14	N/A	N/A	N/A	N/A	N/A	N/A
11/16/1995	3589.55	3589.75	3588.70	3597.40	3614.35	3600.95	3594.52	3594.55	3599.14	N/A	N/A	N/A	N/A	N/A	N/A
12/14/1995	3589.65	3589.75	3588.75	3597.40	3614.30	3601.10	3594.57	3594.65	3599.14	N/A	N/A	N/A	N/A	N/A	N/A
1/15/1996	3589.70	3589.85	3588.80	3597.45	3614.30	3601.15	3594.62	3594.70	3599.14	N/A	N/A	N/A	N/A	N/A	N/A
2/15/1996	3589.45	3589.55	3588.65	3597.10	3614.10	3600.90	3594.42	3594.45	3599.04	N/A	N/A	N/A	N/A	N/A	N/A
4/16/1996	3589.35	3589.74	3588.67	3596.63	3613.94	3600.94	3594.60	3594.65	3599.14	N/A	N/A	N/A	N/A	N/A	N/A
5/15/1996	3588.45	3589.55	3588.80	3596.30	3613.80	3600.85	3594.32	3594.40	3599.04	N/A	N/A	N/A	N/A	N/A	N/A
6/15/1996	3588.36	3589.60	3588.52	3596.15	3613.78	3600.75	3594.80	3594.38	3599.04	N/A	N/A	N/A	N/A	N/A	N/A
7/16/1996	3588.10	3589.55	3588.50	3595.95	3613.94	3600.67	3594.72	3594.35	3598.94	N/A	N/A	N/A	N/A	N/A	N/A
8/15/1996	3588.00	3589.43	3588.38	3596.10	3613.70	3600.73	3594.47	3594.30	3598.89	N/A	N/A	N/A	N/A	N/A	N/A
9/15/1996	3587.88	3589.12	3588.30	3596.05	3613.30	3600.62	3594.17	3594.40	3598.84	N/A	N/A	N/A	N/A	N/A	N/A
10/16/1996	3587.78	3588.85	3588.26	3596.00	3614.89	3600.40	3593.97	3594.21	3598.83	N/A	N/A	N/A	N/A	N/A	N/A
11/20/1996	3586.92	3588.99	3588.35	3596.13	3614.20	3600.80	3594.07	3594.37	3598.89	N/A	N/A	N/A	N/A	N/A	N/A
12/20/1996	3587.45	3589.10	3588.10	3595.75	3614.65	3600.80	3593.87	3594.42	3599.04	N/A	N/A	N/A	N/A	N/A	N/A
1/15/1997	3588.18	3588.30	3587.22	3595.21	3614.06	3600.24	3593.51	3594.16	3598.49	N/A	N/A	N/A	N/A	N/A	N/A
2/15/1997	3588.31	3588.28	3587.20	3595.14	3613.86	3600.21	3593.54	3594.21	3598.43	N/A	N/A	N/A	N/A	N/A	N/A
3/15/1997	3588.32	3588.24	3587.18	3595.08	3613.72	3600.15	3593.52	3594.15	3598.38	N/A	N/A	N/A	N/A	N/A	N/A
4/15/1997	3588.28	3588.20	3587.13	3595.00	3613.62	3600.15	3593.56	3594.18	3598.36	N/A	N/A	N/A	N/A	N/A	N/A
5/16/1997	3588.28	3588.14	3587.10	3594.90	3613.52	3600.24	3593.49	3594.05	3598.75	N/A	N/A	N/A	N/A	N/A	N/A
6/18/1997	3588.27	3588.11	3587.07	3594.85	3613.43	3600.50	3593.46	3594.00	3599.22	N/A	N/A	N/A	N/A	N/A	N/A

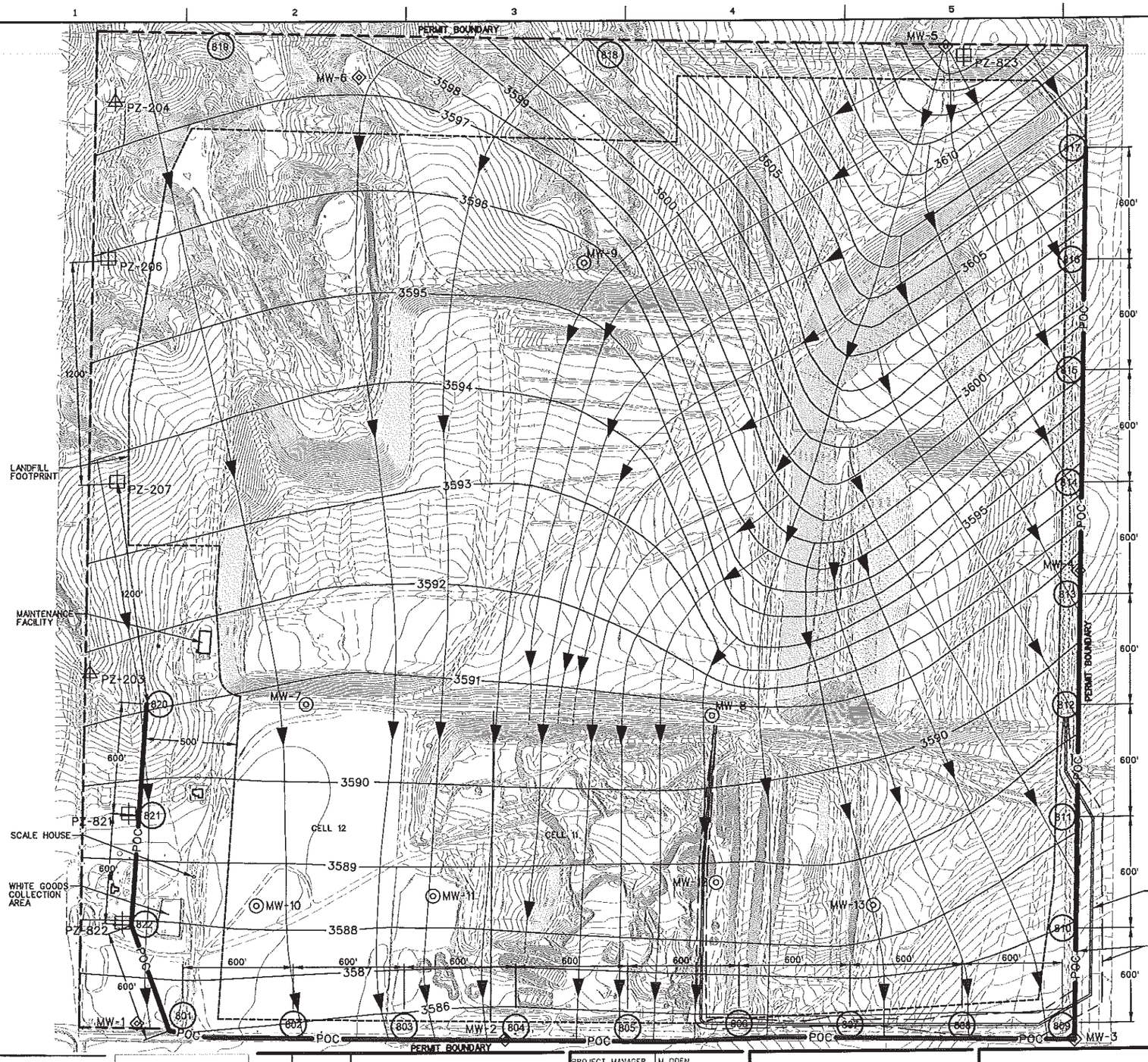
CITY OF AMARILLO MUNICIPAL SOLID WASTE LANDFILL

PERMIT NO. 73A

Groundwater Elevation Summary

1994-2009

DATE	MW 1	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8	MW 9	MW 10	MW 11	MW 12	MW 13	B203	B204
10/14/1997	3587.45	3587.90	3586.89	3594.55	3614.12	3600.40	3593.31	3593.80	3598.79	N/A	N/A	N/A	N/A	N/A	N/A
11/20/1997	3588.18	3587.86	3586.84	3594.45	3614.00	3600.21	3593.23	3593.75	3598.56	N/A	N/A	N/A	N/A	N/A	N/A
4/14/1998	3588.30	3587.72	3586.76	3594.23	3613.43	3599.95	3593.21	3593.51	3598.18	N/A	N/A	N/A	N/A	N/A	N/A
10/14/1998	3587.29	3587.64	3586.45	3593.77	3613.40	3599.69	3593.09	3593.28	3597.87	N/A	N/A	N/A	N/A	N/A	N/A
4/19/1999	3587.68	3587.33	3586.19	3593.41	3613.94	3599.48	3592.57	3592.90	3597.65	N/A	N/A	N/A	N/A	N/A	N/A
10/11/1999	3588.02	3587.23	3585.95	3593.26	3614.53	3599.50	3592.63	3592.68	3597.74	N/A	N/A	N/A	N/A	N/A	N/A
4/17/2000	3587.91	3587.09	3585.76	3593.00	3613.45	3599.19	3592.53	3592.56	3597.34	3590.68	3590.70	3590.74	3590.76	N/A	N/A
10/16/2000	3587.57	3586.95	3585.51	3592.71	3613.25	3598.93	3592.30	3592.40	3596.99	3590.35	3590.47	3590.50	3590.48	N/A	N/A
4/16/2001	3587.21	3586.74	3585.26	3592.41	3613.12	3598.66	3592.10	3592.02	3596.69	3590.41	3590.27	3590.32	3590.20	N/A	N/A
10/16/2001	3586.37	3586.62	3585.09	3592.29	3613.25	3598.49	3591.78	3591.93	3596.49	3589.52	3590.02	3590.16	3590.06	N/A	N/A
4/15/2002	3587.22	3586.50	3584.88	3591.95	3613.07	3598.20	3591.70	3591.71	3596.19	3589.89	3589.98	3590.00	3589.86	N/A	N/A
10/14/2002	3587.32	3586.41	3584.73	3591.63	3613.12	3598.02	3591.54	3591.53	3596.09	3589.79	3589.83	3589.88	3589.67	N/A	N/A
4/14/2003	3587.85	3586.16	3584.44	3591.30	3613.08	3597.75	3591.32	3591.19	3595.73	3589.72	3589.10	3589.54	3589.43	N/A	N/A
10/14/2003	3586.75	3586.04	3584.24	3591.08	3609.34	3597.53	3591.10	3591.02	3595.46	3589.40	3589.45	3589.43	3589.28	N/A	N/A
4/14/2004	3586.77	3585.91	3584.08	3590.82	3613.25	3597.34	3591.01	3590.88	3595.23	3589.31	3589.30	3589.21	3589.07	N/A	N/A
10/18/2004	3586.76	3585.63	3583.77	3590.59	3613.99	3597.30	3590.75	3590.57	3595.61	3589.16	3589.04	3588.90	3588.92	N/A	N/A
10/18/2004	3586.77	3585.63	3583.77	3590.59	3613.99	3597.30	3590.75	3590.57	3595.61	3589.16	3589.04	3588.90	3588.92	N/A	N/A
4/19/2005	3586.28	3585.59	3583.69	3590.55	3614.31	3597.51	3590.67	3590.61	3595.76	3588.88	3589.00	3588.98	3588.92	N/A	N/A
9/16/2005	3586.17	3585.59	3583.63	3590.47	3614.77	3597.38	3590.58	3590.45	3595.56	3588.86	3588.90	3588.86	3588.80	3592.11	3597.41
10/17/2005	3586.09	3585.52	3583.53	3590.41	3614.58	3597.20	3590.51	3590.40	3595.34	3588.69	3588.84	3588.79	3588.68	N/A	N/A
11/18/2005	3586.23	3585.48	3585.49	3590.34	3614.36	3597.11	3590.44	3590.31	3595.19	3588.76	3588.79	3588.73	3588.68	3591.91	3597.22
11/29/2005	3586.37	3585.43	3583.44	3590.33	3614.25	3597.10	3590.39	3590.31	3595.12	3588.76	3588.72	3588.64	3588.90	3591.89	3597.22
4/18/2006	3586.19	3585.51	3583.39	3590.31	3613.73	3596.95	3590.46	3590.17	3594.91	3588.72	3588.78	3588.68	3588.50	N/A	N/A
10/24/2006	3578.75	3585.32	3583.53	3590.05	3616.41	3597.24	3590.25	3590.12	3595.51	3588.52	3588.59	3588.50	3589.50	N/A	N/A
4/18/2007	3586.46	3585.35	3583.29	3590.01	3615.12	3596.85	3590.27	3589.94	3594.74	3588.76	3588.67	3588.55	3588.60	N/A	N/A
10/16/2007	3586.09	3585.28	3583.45	3590.30	3615.26	3596.83	3590.12	3590.07	3595.06	3588.53	3588.52	3588.65	3589.24	N/A	N/A
1/14/2008	3586.35	3585.33	3583.33	3590.44	3615.26	3596.67	3590.07	3589.87	3594.76	3588.54	3588.52	3588.79	3588.93	3591.52	3596.42
2/14/2008	3586.27	3585.51	3583.33	3590.14	3615.26	3596.67	3590.07	3589.87	3594.76	3588.54	3588.52	3588.79	3588.93	3591.57	3596.60
3/18/2008	3586.41	3585.27	3583.19	3590.14	3614.19	3596.67	3590.07	3589.87	3594.63	3588.72	3588.52	3588.79	3588.93	3591.64	3596.60
4/17/2008	3586.41	3585.27	3583.19	3590.14	3614.19	3596.67	3590.07	3589.87	3594.63	3588.72	3588.52	3588.79	3588.93	3591.64	3596.60
5/16/2008	3585.35	3585.19	3583.19	3589.92	3613.88	3596.67	3589.96	3589.87	3594.63	3588.08	3588.52	3588.79	3588.35	3591.64	3596.49
6/18/2008	3585.35	3585.19	3583.19	3590.00	3613.88	3596.42	3589.96	3589.87	3594.50	3588.08	3588.45	3588.79	3588.35	3591.34	3596.51
8/14/2008	3585.15	3585.12	3583.00	3589.00	3613.65	3596.31	3589.80	3589.82	3594.39	3587.93	3588.32	3588.33	N/A	3591.19	3596.44
9/17/2008	3585.44	3585.12	3583.00	3589.90	3613.65	3596.23	3589.80	3589.82	3594.39	3588.04	3588.30	3588.29	N/A	3591.19	3596.41
10/20/2008	3585.44	3584.94	3583.00	3589.34	3613.49	3596.17	3589.61	3589.65	3594.24	3587.91	3588.14	3588.16	N/A	3591.19	3596.41
11/19/2008	3585.63	3584.45	3582.95	3589.45	3613.58	3596.10	3589.68	3589.55	3594.14	3588.16	3588.16	3588.04	N/A	3591.17	3596.19
12/17/2008	3585.85	3584.85	3582.95	3589.65	3613.60	3596.10	3590.02	3589.62	3594.14	3588.27	3588.16	3588.19	N/A	3591.28	3596.22
1/12/2009	3585.88	3585.01	3582.94	3589.79	3613.58	3596.12	3590.17	3589.69	3594.19	3588.29	3588.26	3588.22	3588.50	3591.33	3596.25
2/18/2009	3585.88	3585.01	3582.94	3589.79	3613.58	3596.12	3590.17	3589.69	3594.19	3588.29	3588.26	3588.22	3588.50	3591.33	3596.25
3/19/2009	3585.73	3584.88	3582.80	3589.64	3613.58	3595.95	3589.67	3589.51	3594.19	3588.29	3588.26	3588.05	3588.35	3591.17	3596.19
4/13/2009	3585.77	3583.05	3582.79	3589.64	3613.58	3595.85	3589.68	3589.55	3594.03	3588.16	3588.16	3588.04	3587.41	3591.17	3596.19



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0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 GROUNDWATER CONTOURS
- MW-4 EXISTING MONITORING WELL LOCATIONS TO BE PLUGGED AND ABANDONED UPON COMPLETION OF BACKGROUND MONITORING OF THE ADDITIONAL WELLS
- MW-7 EXISTING MONITORING WELL LOCATIONS TO BE PLUGGED AND ABANDONED AS CONSTRUCTION ACTIVITY DICTATES.
- PZ-203 EXISTING PIEZOMETERS
- 822 ADDITIONAL MONITORING WELL LOCATIONS
- GROUNDWATER FLOW
- POC POINT OF COMPLIANCE
- PROPOSED PIEZOMETER (4")

STATE OF TEXAS
DONALD D. JAMES
GEOLOGY
360
LICENSED
PROFESSIONAL GEOSCIENTIST

STATE OF TEXAS
M. M. SHIFLETT
43763
LICENSED
PROFESSIONAL ENGINEER

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE III.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.
3. FLOWLINES SHOWN AS INDICATORS OF GROUNDWATER FLOW DIRECTION. DRAWING NOT INTENDED TO REPRESENT A COMPLETE FLOWNET.
4. GROUNDWATER ELEVATIONS OBTAINED IN 2008 REMAIN CONSISTENT WITH THE NOVEMBER 2005 ELEVATIONS.
5. WELLS 820, 821 AND 822 TO BE INSTALLED ONCE CELL 12 IS DEVELOPED (PRIOR TO WASTE PLACEMENT). INSTALL PZ-821 AND PZ-822 ALONG WITH WELLS 801 - 819.

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP
WITH DIRECTIONAL GROUNDWATER FLOW
AND POINT OF COMPLIANCE
AUGUST, 2008

0 1" 2"

FILENAME

SCALE

SHEET Plate 6 App. 5B

HDR Engineering, Inc.
4500 W. Eldorado Pkwy.
Suite 3500
McKinney, Texas 75070
TEXAS P.E. FIRM REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
3	7/2009	REVISED MONITOR WELL LOCATIONS
2	3/2009	REVISED MONITOR WELL LOCATIONS
1	8/2008	REVISED MONITOR WELL NETWORK

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

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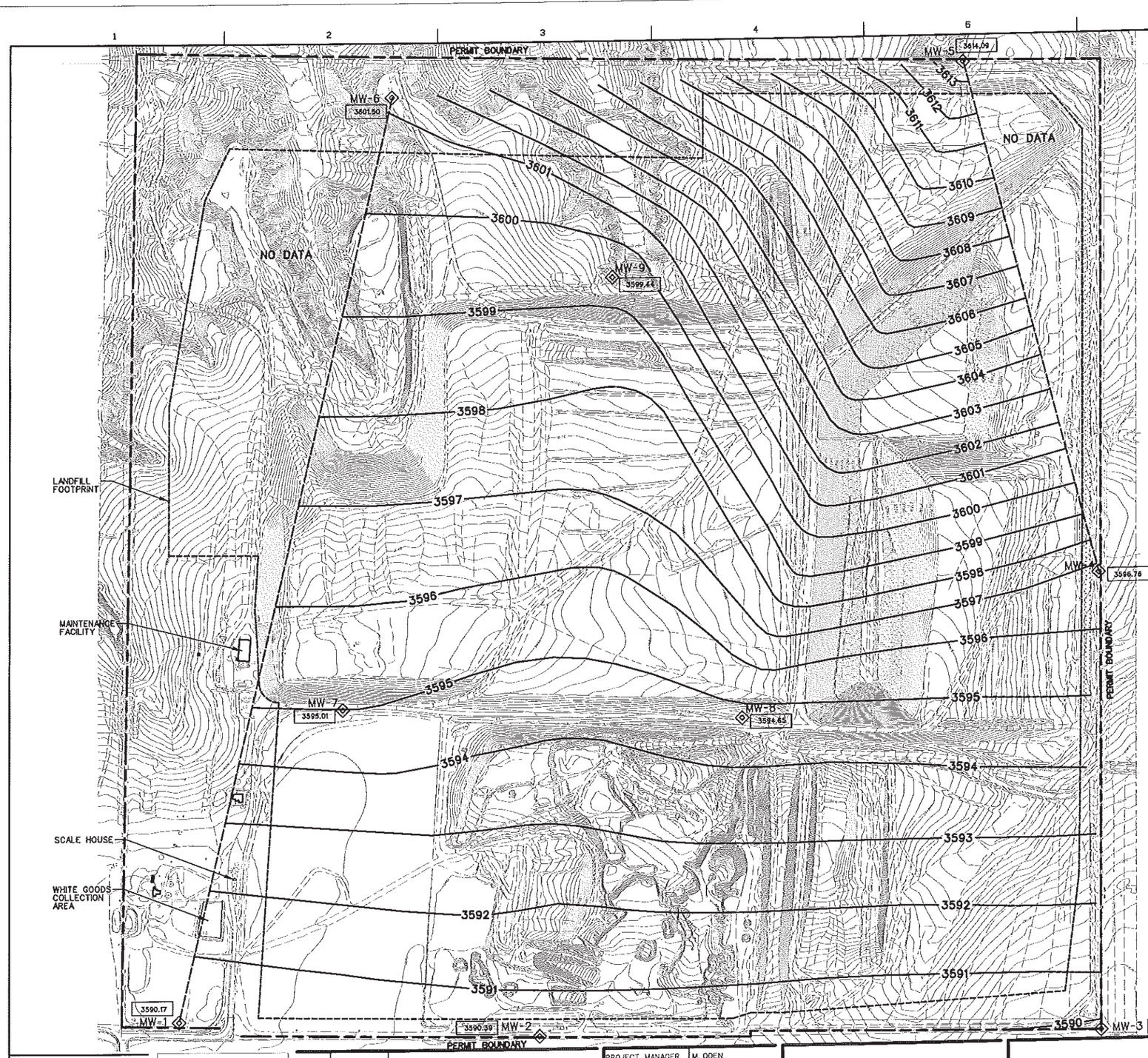

N

0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- 330 EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 GROUNDWATER CONTOURS
- MW-4 3615.28 EXISTING MONITORING WELL LOCATIONS AND ELEVATIONS

STATE OF TEXAS
DONALD D. JAMES
GEOLOGY
360
LICENSED
PROFESSIONAL GEOSCIENTIST

7-15-09

STATE OF TEXAS
M. M. SHIFLETT
43763
LICENSED
PROFESSIONAL ENGINEER

7-15-09

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE III.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.

CITY OF AMARILLO TEXAS

HDR

HDR ENGINEERING, INC.
4500 W. Eldorado Pkwy.
Suite 3500
McKinney, Texas 75070

TEXAS P.E. FIRM REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
3	7/2009	REVISED MONITOR WELL LOCATIONS
2	3/2009	REVISED CONTOURS
1	1/2009	ISSUED FOR TCEQ REVIEW

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP NOVEMBER 9, 1994

FILENAME
SCALE

SHEET
Plate 7
App. 5B

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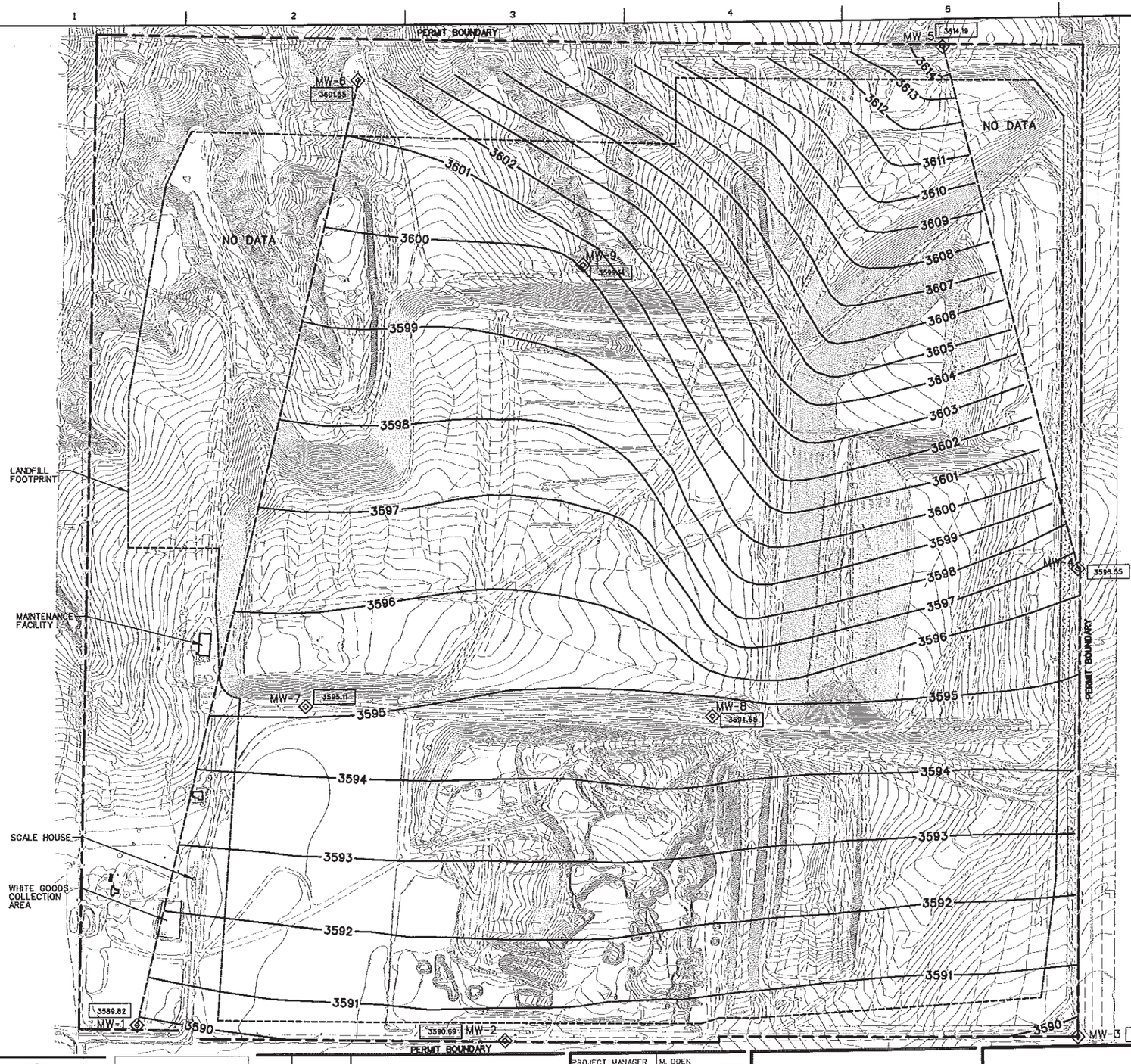

N

0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- 300 EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 GROUNDWATER CONTOURS
- MW-4 3615.28 EXISTING MONITORING WELL LOCATIONS AND ELEVATIONS

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE II.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.

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STATE OF TEXAS
DONALD D. JAMES
GEOLOGY
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LICENSED
PROFESSIONAL GEOSCIENTIST

STATE OF TEXAS
M. M. SHIFLETT 7-15-09
43763
LICENSED
PROFESSIONAL ENGINEER

CITY OF AMARILLO
TEXAS

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Suite 3500
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TEXAS P.E. FIRM REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
3	7/2009	REVISED MONITOR WELL LOCATIONS
2	3/2009	REVISED CONTOURS
1	1/2009	ISSUED FOR TCEQ REVIEW

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP APRIL 14, 1995

FILENAME

SCALE

SHEET
Plate 8
App. 5B

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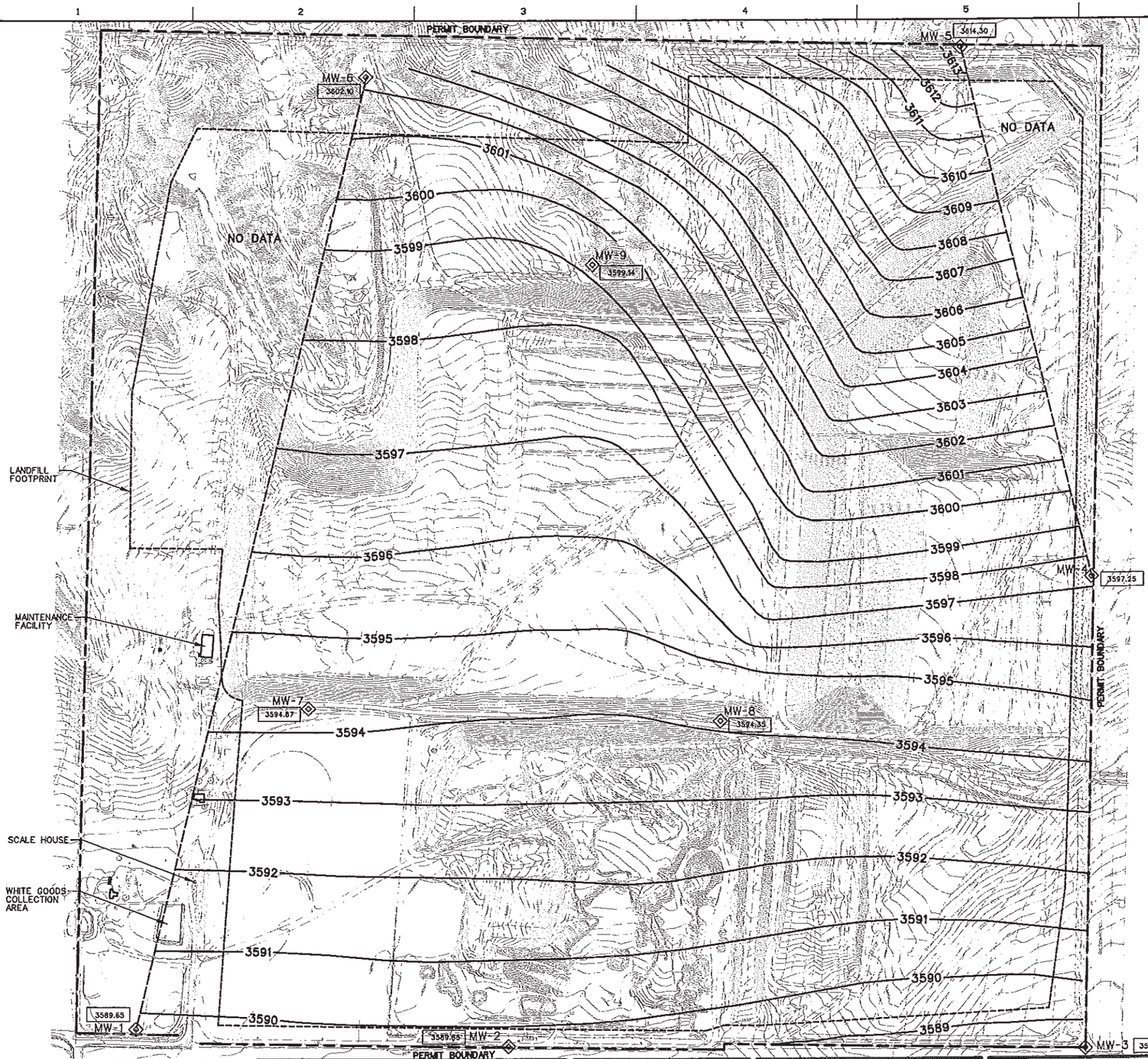

N

0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- 500 EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 GROUNDWATER CONTOURS
- MW-4 3615.28 EXISTING MONITORING WELL LOCATIONS AND ELEVATIONS

STATE OF TEXAS
DONALD D. JAMES
GEOLOGY
360
LICENSED
PROFESSIONAL GEOSCIENTIST

7-15-09

STATE OF TEXAS
M. M. SHIFLETT 7-15-09
43763
LICENSED
PROFESSIONAL ENGINEER

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE II.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.

CITY OF AMARILLO TEXAS

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McKinney, Texas 75070

TEXAS P.E. FIRM
REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
3	7/2009	REVISED MONITOR WELL LOCATIONS
2	3/2009	REVISED CONTOURS
1	1/2009	ISSUED FOR TCEQ REVIEW

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP
OCTOBER 16, 1995

FILENAME
SCALE

SHEET
Plate 9
App. 5B

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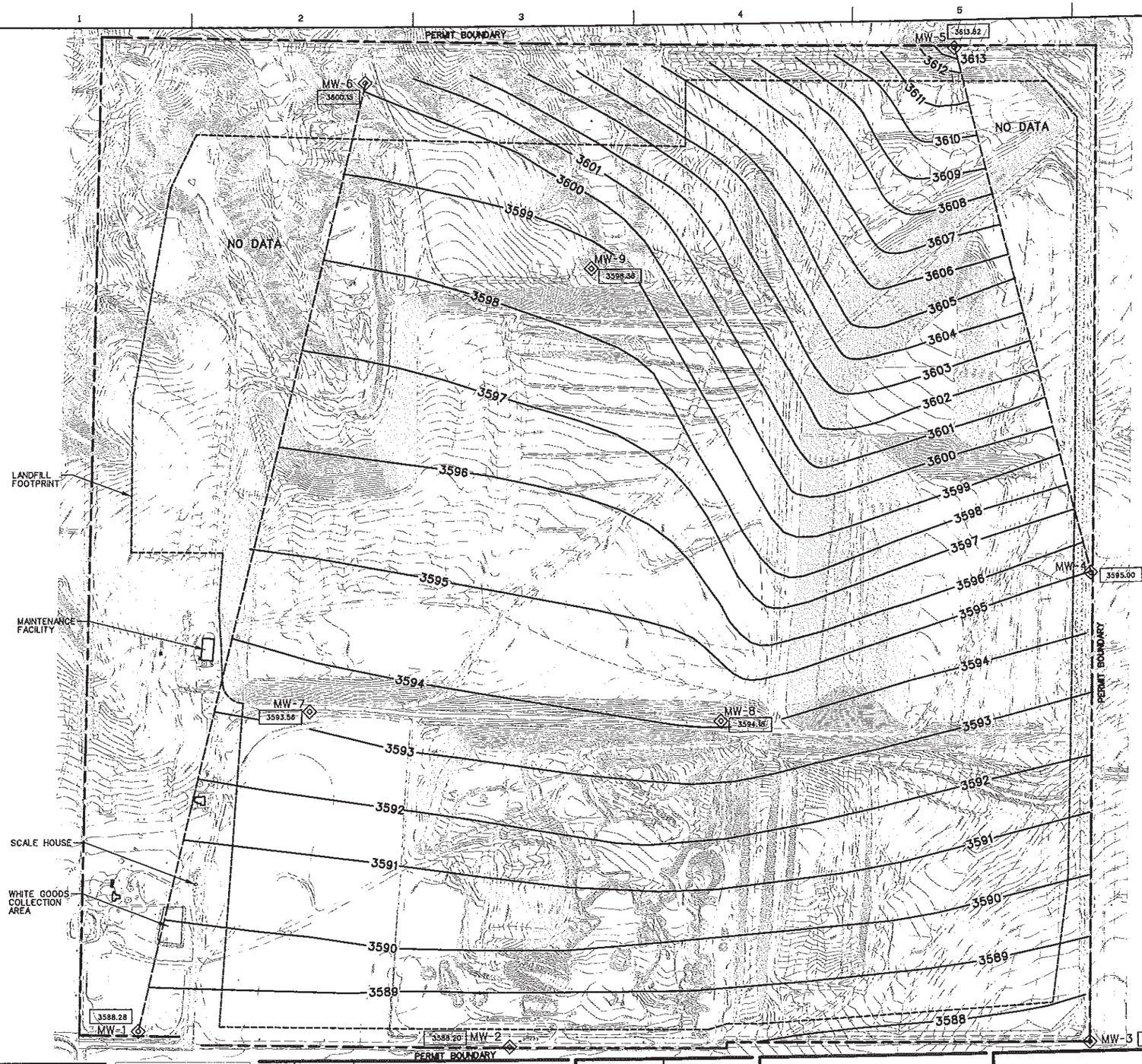

N

0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- 352 EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 GROUNDWATER CONTOURS
- MW-4 3615.28 EXISTING MONITORING WELL LOCATIONS AND ELEVATIONS

STATE OF TEXAS
DONALD D. JAMES
GEOLOGY
360
LICENSED
PROFESSIONAL GEOSCIENTIST

7-15-09

STATE OF TEXAS
M. M. SHIFLETT
43763
LICENSED
PROFESSIONAL ENGINEER

7-15-09

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE III.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.

CITY OF AMARILLO TEXAS

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TEXAS P.E. FIRM REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
3	7/2009	REVISED MONITOR WELL LOCATIONS
2	3/2009	REVISED CONTOURS
1	1/2009	ISSUED FOR TCEQ REVIEW

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP APRIL 15, 1997

FILENAME

SCALE

SHEET
Plate 10
App. 5B

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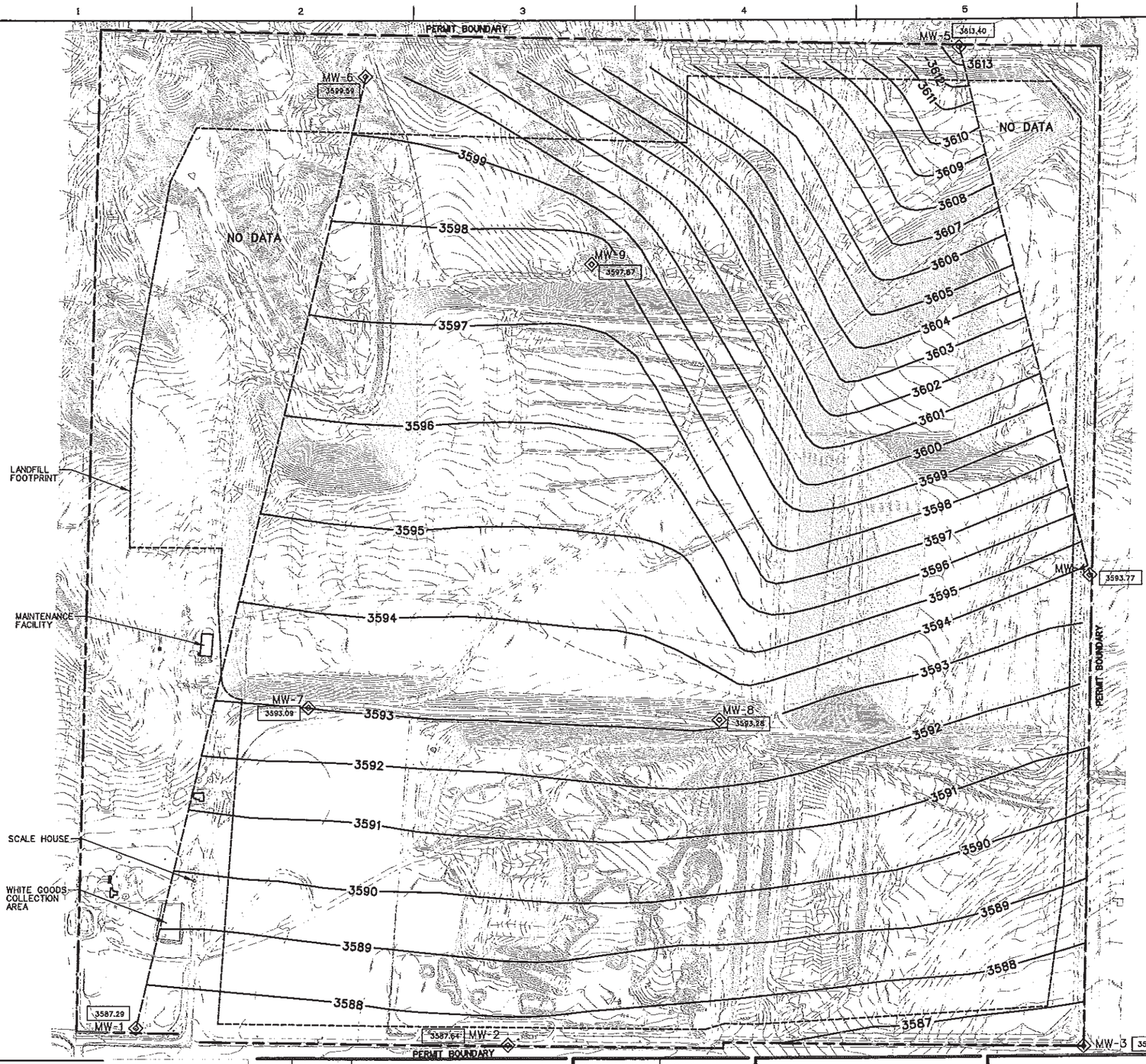

N

0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- 320 EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 GROUNDWATER CONTOURS
- MW-4 3515.26 EXISTING MONITORING WELL LOCATIONS AND ELEVATIONS

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE III.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.

STATE OF TEXAS
DONALD D. JAMES
GEOLOGY
360
LICENSED
PROFESSIONAL GEOSCIENTIST
7-15-09

STATE OF TEXAS
M. M. SHIFLETT
43763
LICENSED
PROFESSIONAL ENGINEER
7-15-09

CITY OF AMARILLO
TEXAS

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Suite 3500
McKinney, Texas 75070

TEXAS P.E. FIRM
REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
3	7/2009	REVISED MONITOR WELL LOCATIONS
2	3/2009	REVISED CONTOURS
1	1/2009	ISSUED FOR TCEQ REVIEW

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP
OCTOBER 14, 1998

FILENAME

SCALE

SHEET
Plate 11
App. 5B

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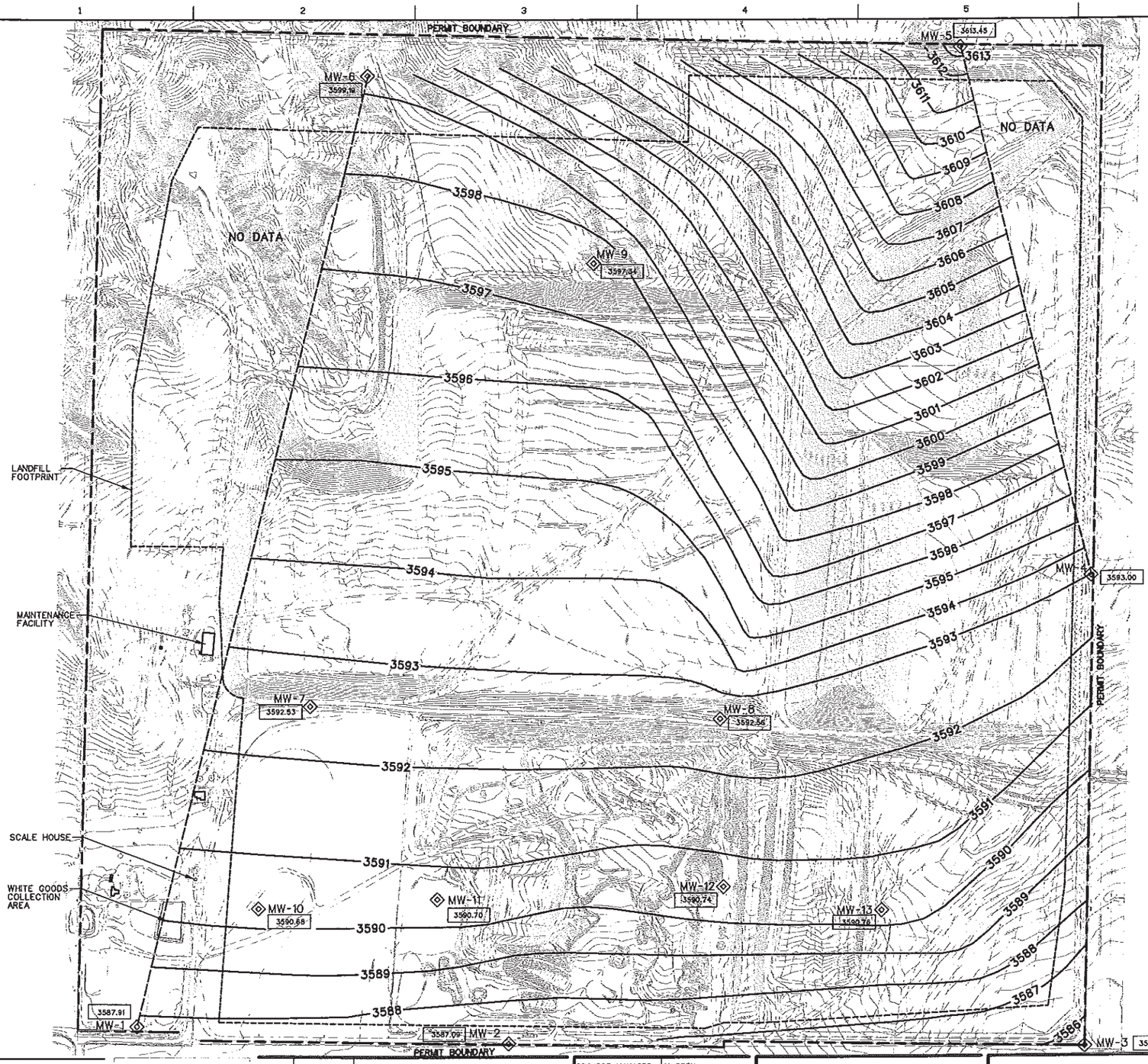

N

0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- 350 EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 GROUNDWATER CONTOURS
- MW-4 3615.26 EXISTING MONITORING WELL LOCATIONS AND ELEVATIONS

STATE OF TEXAS
DONALD D. JAMES
GEOLOGY
360
LICENSED
PROFESSIONAL GEOSCIENTIST

7-15-09

STATE OF TEXAS
M. M. SHIFLETT
43763
LICENSED
PROFESSIONAL ENGINEER

7-15-09

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE III.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.

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TEXAS P.E. FIRM REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
3	7/2009	REVISED MONITOR WELL LOCATIONS
2	3/2009	REVISED CONTOURS
1	1/2009	ISSUED FOR TCEQ REVIEW

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP
APRIL 17, 2000

FILENAME

SCALE

SHEET
Plate 12
App. 5B

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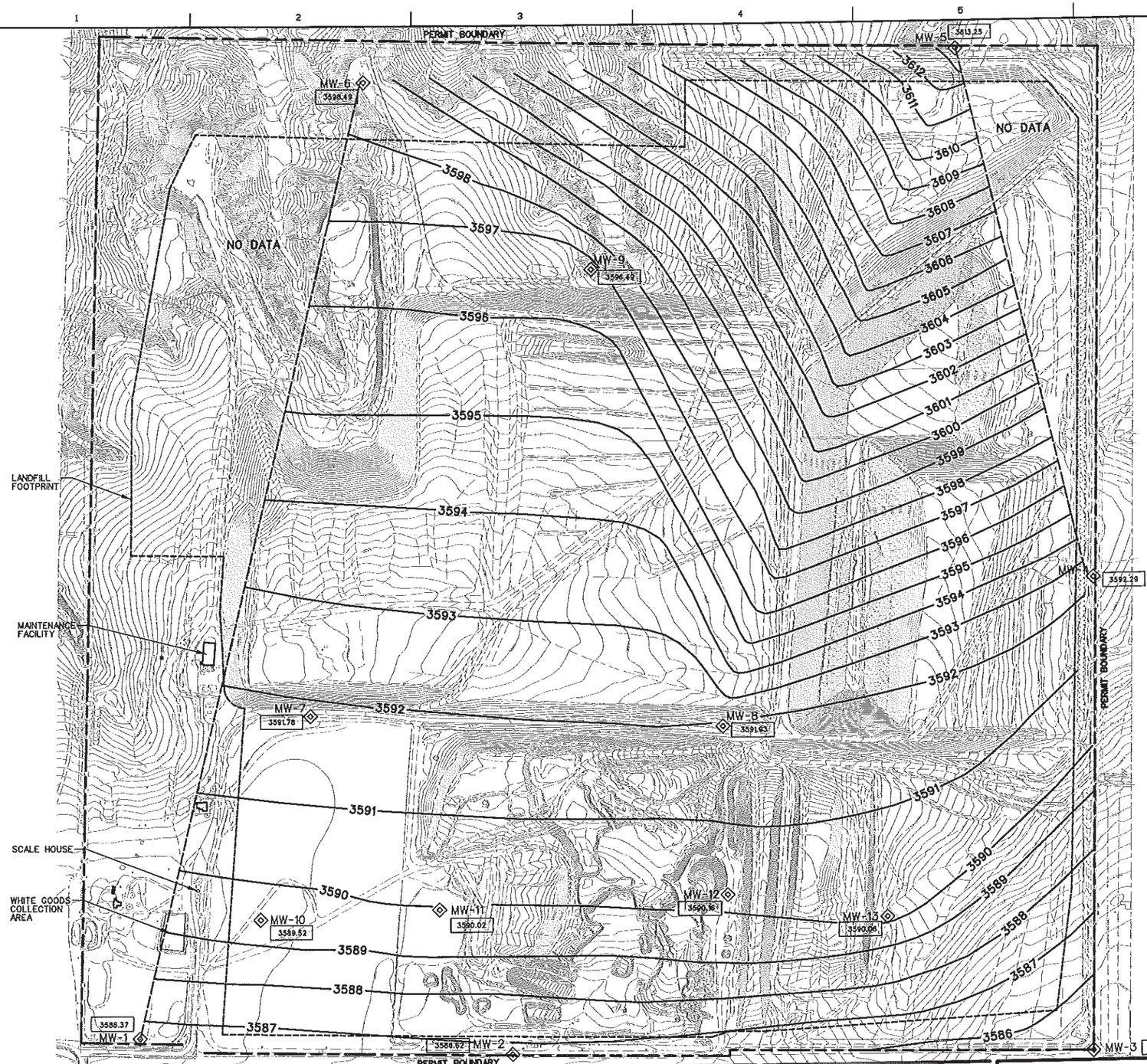

N

0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 GROUNDWATER CONTOURS
- MW-4 3615.28 EXISTING MONITORING WELL LOCATIONS AND ELEVATIONS

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE III.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.

STATE OF TEXAS
DONALD D. JAMES
GEOLOGY
360
LICENSED
PROFESSIONAL GEOSCIENTIST

7-15-09

STATE OF TEXAS
M. M. SHIFLETT
43763
LICENSED
PROFESSIONAL ENGINEER

7-15-09

CITY OF AMARILLO
TEXAS

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Suite 3500
McKinney, Texas 75070

TEXAS P.E. FIRM
REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
3	7/2009	REVISED MONITOR WELL LOCATIONS
2	3/2009	REVISED CONTOURS
1	1/2009	ISSUED FOR TCEQ REVIEW

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP
OCTOBER 16, 2001

FILENAME
SCALE

SHEET
Plate 13
App. 5B

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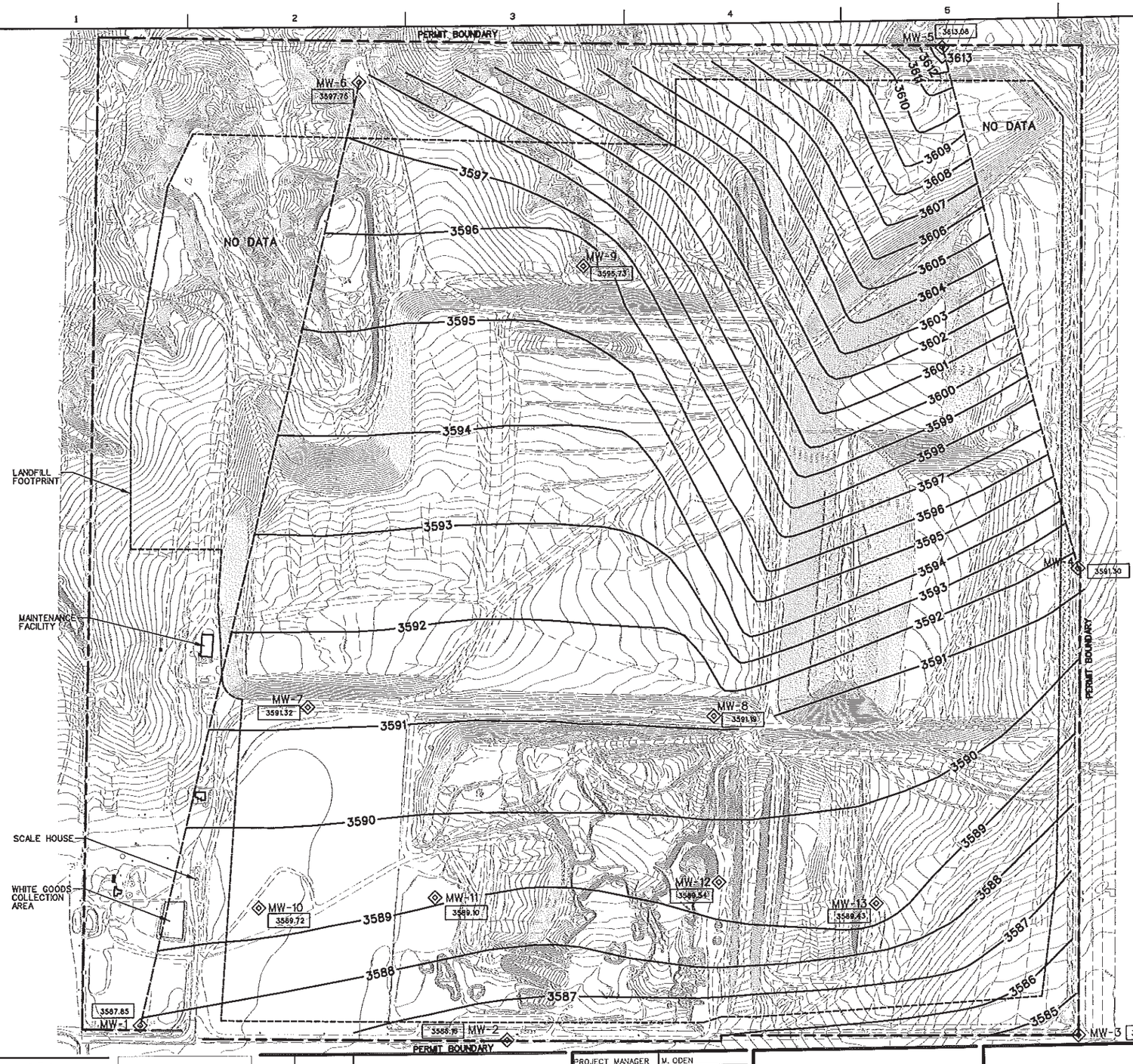

N

0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- 390 EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 GROUNDWATER CONTOURS
- MW-4 3615.28 EXISTING MONITORING WELL LOCATIONS AND ELEVATIONS

STATE OF TEXAS
DONALD D. JAMES
GEOLOGY
360
LICENSED
PROFESSIONAL GEOSCIENTIST

7-15-09

STATE OF TEXAS
M. M. SHIFLETT
43763
LICENSED
PROFESSIONAL ENGINEER

7-15-09

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE II.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.

CITY OF AMARILLO TEXAS

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McKinney, Texas 75070

TEXAS P.E. FIRM REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
3	7/2009	REVISED MONITOR WELL LOCATIONS
2	3/2009	REVISED CONTOURS
1	1/2009	ISSUED FOR TCEQ REVIEW

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP
APRIL 14, 2003

FILENAME
SCALE

SHEET
Plate 14
App. 5B

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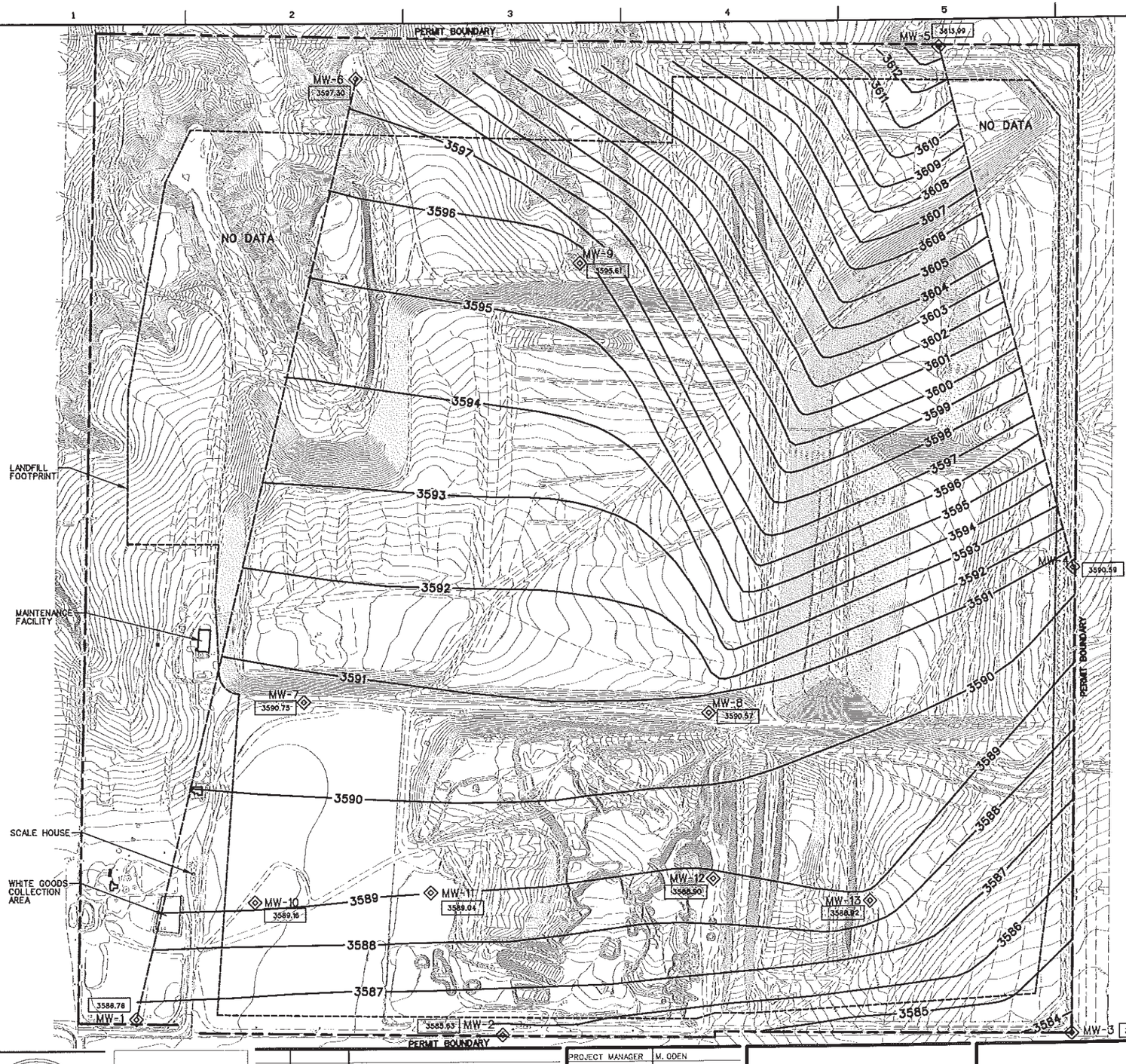

N

0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 GROUNDWATER CONTOURS
- MW-4 3615.28 EXISTING MONITORING WELL LOCATIONS AND ELEVATIONS

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE II.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.

STATE OF TEXAS — DONALD D. JAMES — GEOLOGY — 360 — LICENSED PROFESSIONAL GEOSCIENTIST — 7-15-09

STATE OF TEXAS — M. M. SHIFLETT — 43763 — LICENSED PROFESSIONAL ENGINEER — 7-15-09

CITY OF AMARILLO — TEXAS

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4500 W. Eldorado Pkwy.
Suite 3500
McKinney, Texas 75070

TEXAS P.E. FIRM REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
3	7/2009	REVISED MONITOR WELL LOCATIONS
2	3/2009	REVISED CONTOURS
1	1/2009	ISSUED FOR TCEQ REVIEW

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP OCTOBER 18, 2004

FILENAME

SCALE

SHEET Plate 15 App. 5B

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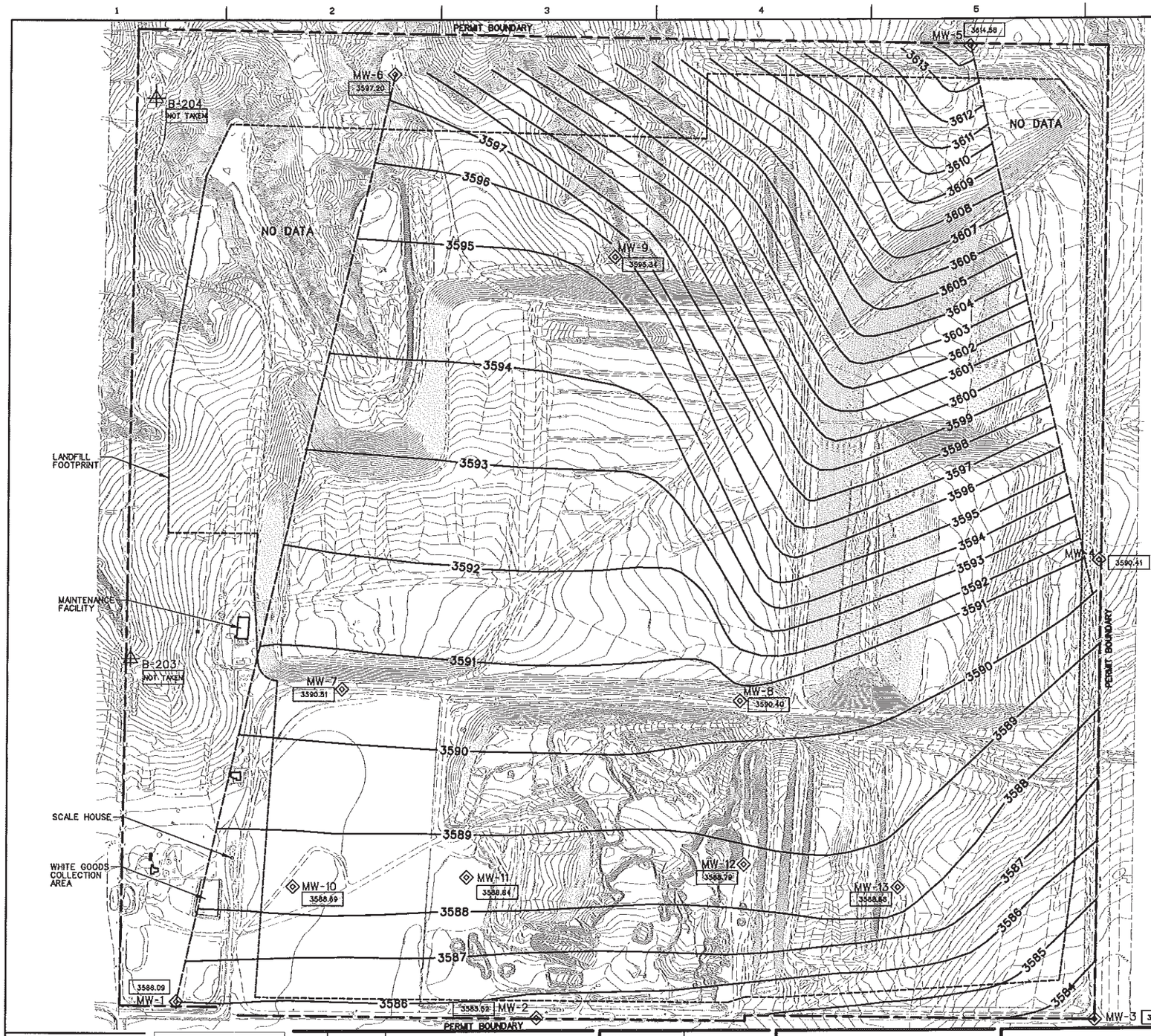

N

0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- 330 EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 GROUNDWATER CONTOURS
- MW-4 3615.28 EXISTING MONITORING WELL LOCATIONS AND ELEVATIONS
- B-204 3615.28 2005 BORING LOCATIONS WITH PIEZOMETER AND ELEVATIONS

STATE OF TEXAS
DONALD D. JAMES
GEOLOGY
360
LICENSED
PROFESSIONAL GEOSCIENTIST
7-15

STATE OF TEXAS
M. M. SHIFLETT
43763
LICENSED
PROFESSIONAL ENGINEER
7-15-09

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE XI.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.

CITY OF AMARILLO TEXAS

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Suite 3500
McKinney, Texas 75070

TEXAS P.E. FIRM REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
3	7/2009	REVISED MONITOR WELL LOCATIONS
2	3/2009	REVISED CONTOURS
1	1/2009	ISSUED FOR TCEQ REVIEW

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP
OCTOBER 17, 2005

FILENAME

SCALE

SHEET
Plate 16
App. 5B

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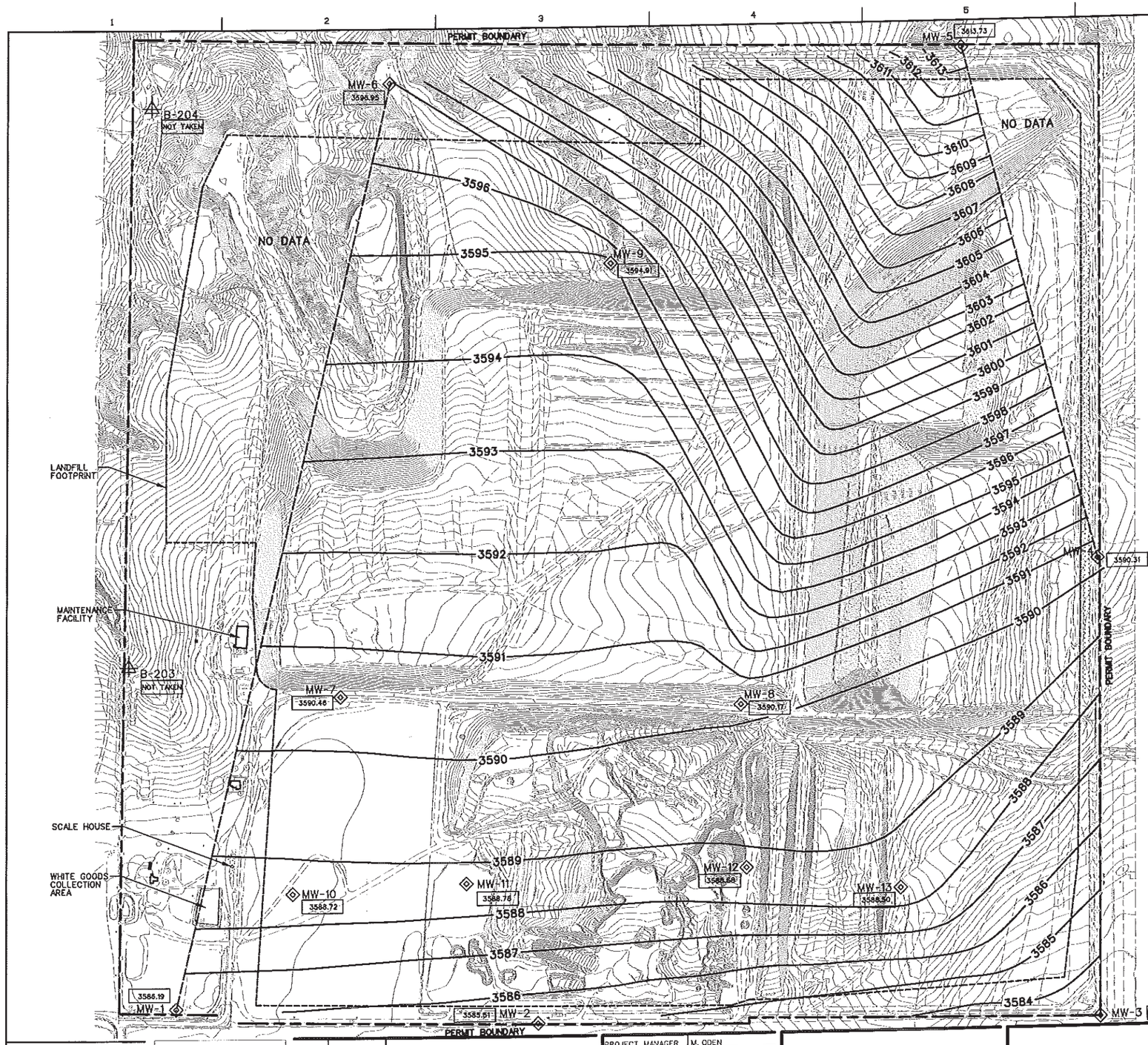

N

0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 — GROUNDWATER CONTOURS
- MW-4 3615.28 — EXISTING MONITORING WELL LOCATIONS AND ELEVATIONS
- B-204 3615.28 — 2005 BORING LOCATIONS WITH PIEZOMETER AND ELEVATIONS

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE XI.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.

STATE OF TEXAS
DONALD D. JAMES
GEOLOGY
360
LICENSED
PROFESSIONAL GEOSCIENTIST
7-15-09

STATE OF TEXAS
M. M. SHIFLETT
43763
LICENSED
PROFESSIONAL ENGINEER
7-15-09

CITY OF AMARILLO
TEXAS

HDR

HDR ENGINEERING, INC.
4500 W Eldorado Pkwy.
Site 3500
McKinney, Texas 75070

TEXAS P.E. FIRM
REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
3	7/2009	REVISED MONITOR WELL LOCATIONS
2	3/2009	REVISED CONTOURS
1	1/2009	ISSUED FOR TCEQ REVIEW

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP
APRIL 18, 2006

FILENAME
SCALE

SHEET
Plate 17
App. 5B

USER: RCOX
FILE: ...\DMS15903\AM_GWC_4-18-06.DGN
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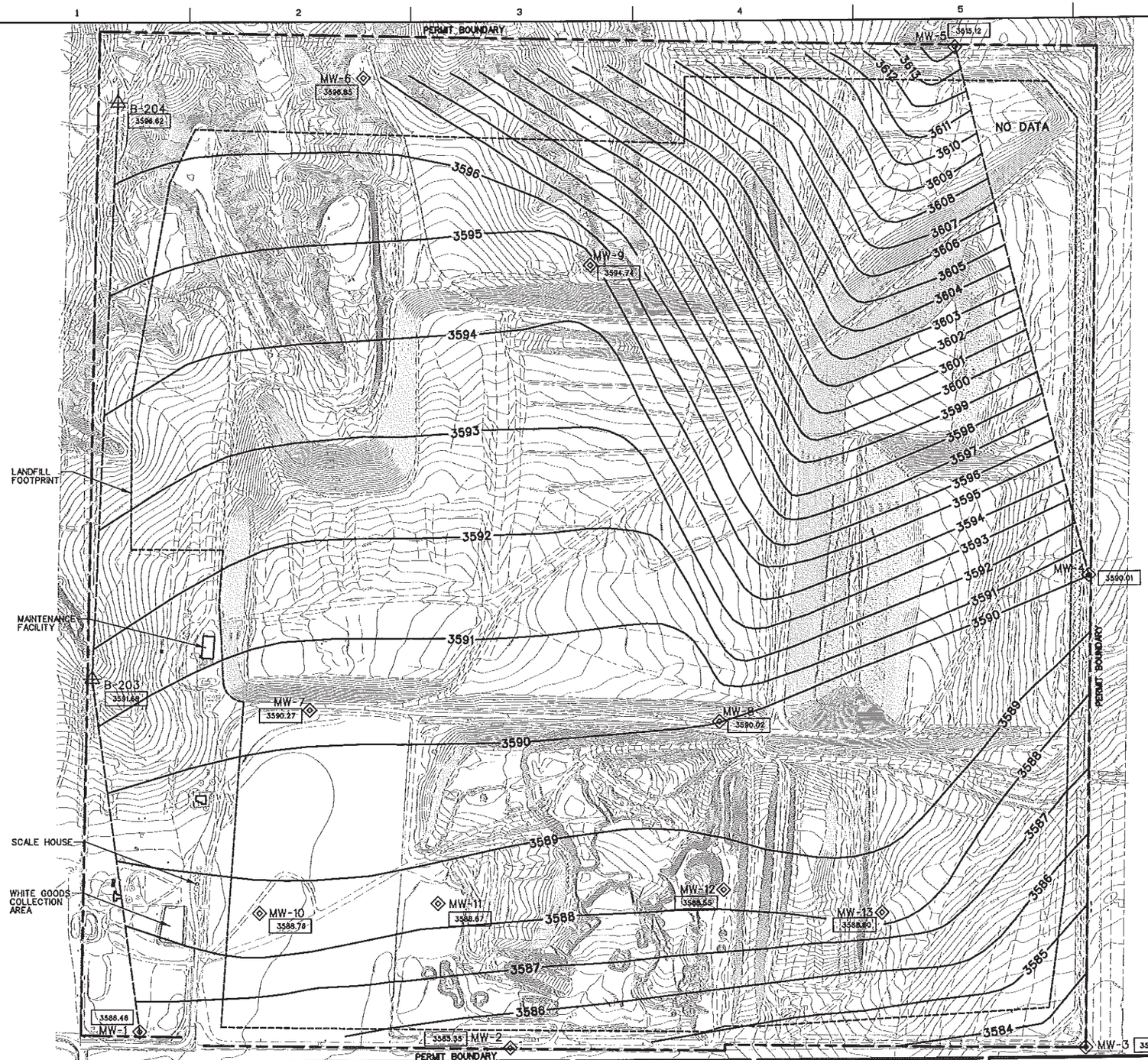

N

0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- 329 EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 GROUNDWATER CONTOURS
- MW-4 3615.28 EXISTING MONITORING WELL LOCATIONS AND ELEVATIONS
- B-204 3615.28 2005 BORING LOCATIONS WITH PIEZOMETER AND ELEVATIONS

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE III.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.

STATE OF TEXAS
DONALD D. JAMES
GEOLOGY
360
LICENSED
PROFESSIONAL GEOSCIENTIST
7-15-09

STATE OF TEXAS
M. M. SHIFLETT
43763
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PROFESSIONAL ENGINEER
7-15-09

CITY OF AMARILLO TEXAS

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4500 W. Eldorado Pkwy.
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TEXAS P.E. FIRM REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
3	7/2009	REVISED MONITOR WELL LOCATIONS
2	3/2009	REVISED CONTOURS
1	1/2009	ISSUED FOR TCEQ REVIEW

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP
APRIL 18, 2007

FILENAME
SCALE

SHEET
Plate 18
App. 5B

USER: RCOX
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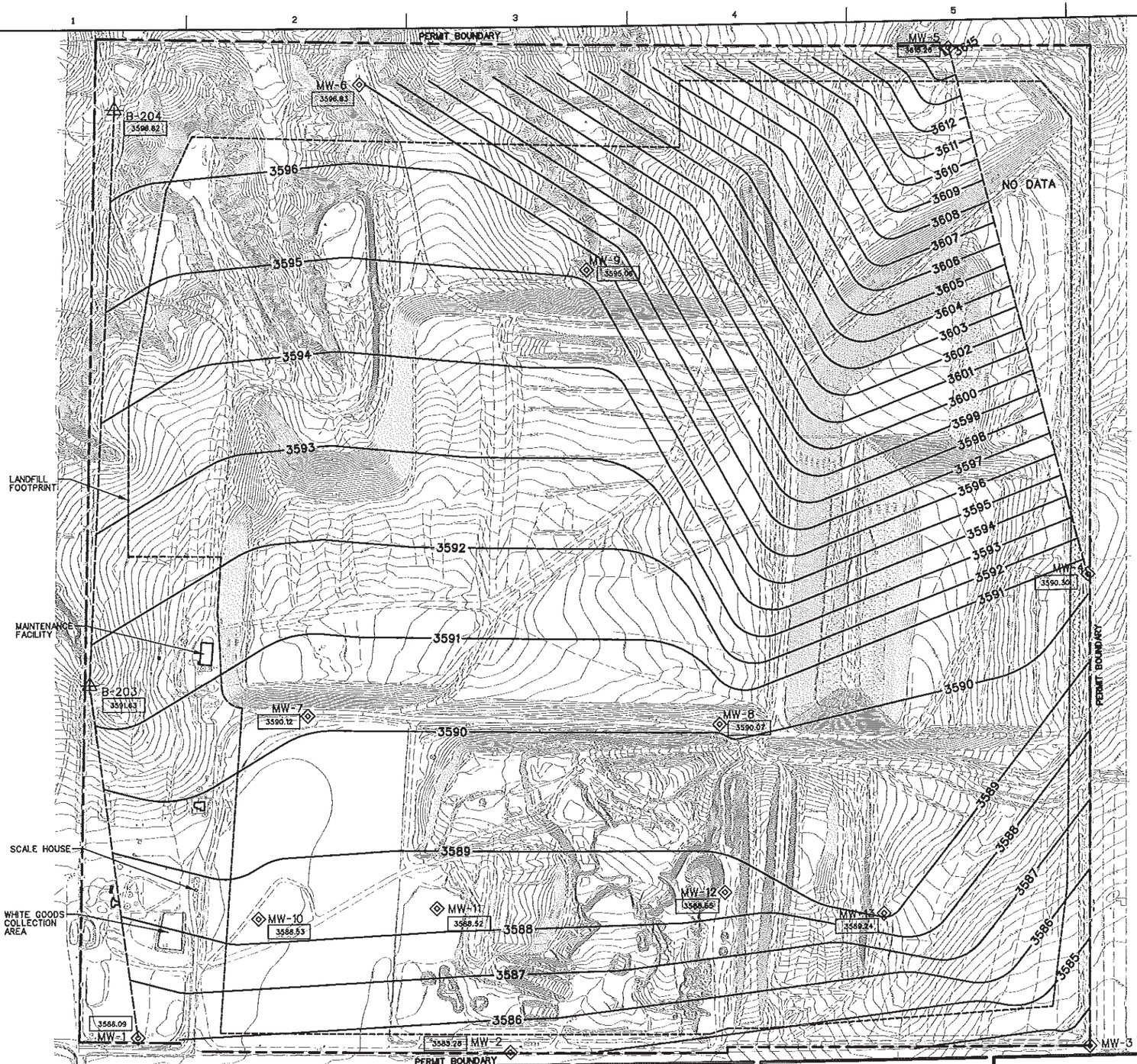

N

0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- 3590 EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 GROUNDWATER CONTOURS
- MW-4 3615.28 EXISTING MONITORING WELL LOCATIONS AND ELEVATIONS
- B-204 3615.28 2005 BORING LOCATIONS WITH PIEZOMETER AND ELEVATIONS

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE III.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.

STATE OF TEXAS
DONALD D. JAMES
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STATE OF TEXAS
M. M. SHIFLETT
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7-15-09

CITY OF AMARILLO TEXAS

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TEXAS P.E. FIRM
REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
3	7/2009	REVISED MONITOR WELL LOCATIONS
2	3/2009	REVISED CONTOURS
1	1/2009	ISSUED FOR TCEQ REVIEW

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP
OCTOBER 15, 2007

FILENAME
SCALE

SHEET
Plate 19
App. 5B

USER: RCOX
FILE: ...\DWS\15983\AM_GWC_10-15-07.DGN
DATE: 7/9/2009
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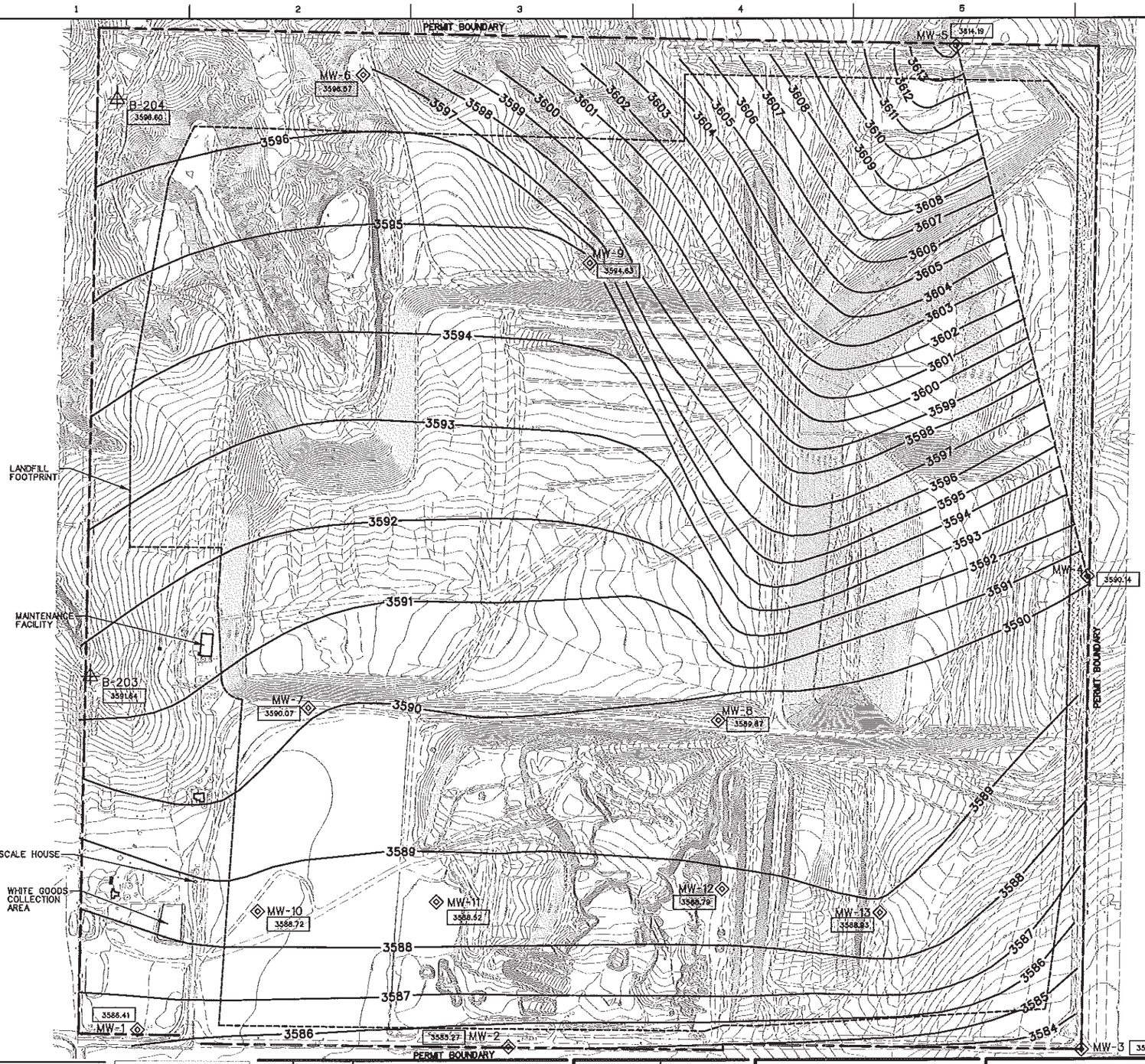

N

0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- 350 EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 GROUNDWATER CONTOURS
- MW-4 3615.28 EXISTING MONITORING WELL LOCATIONS AND ELEVATIONS
- B-204 3615.28 2005 BORING LOCATIONS WITH PIEZOMETER AND ELEVATIONS

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE III.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.

STATE OF TEXAS
DONALD D. JAMES
GEOLOGY
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STATE OF TEXAS
M. M. SHIFLETT
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CITY OF AMARILLO TEXAS

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4500 W. Eldorado Pkwy.
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McKinney, Texas 75070

TEXAS P.E. FIRM REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
3	7/2009	REVISED MONITOR WELL LOCATIONS
2	3/2009	REVISED CONTOURS
1	1/2009	ISSUED FOR TCEQ REVIEW

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP MARCH 18, 2008

FILENAME

SCALE

SHEET
Plate 20
App. 5B

USER: RCOX
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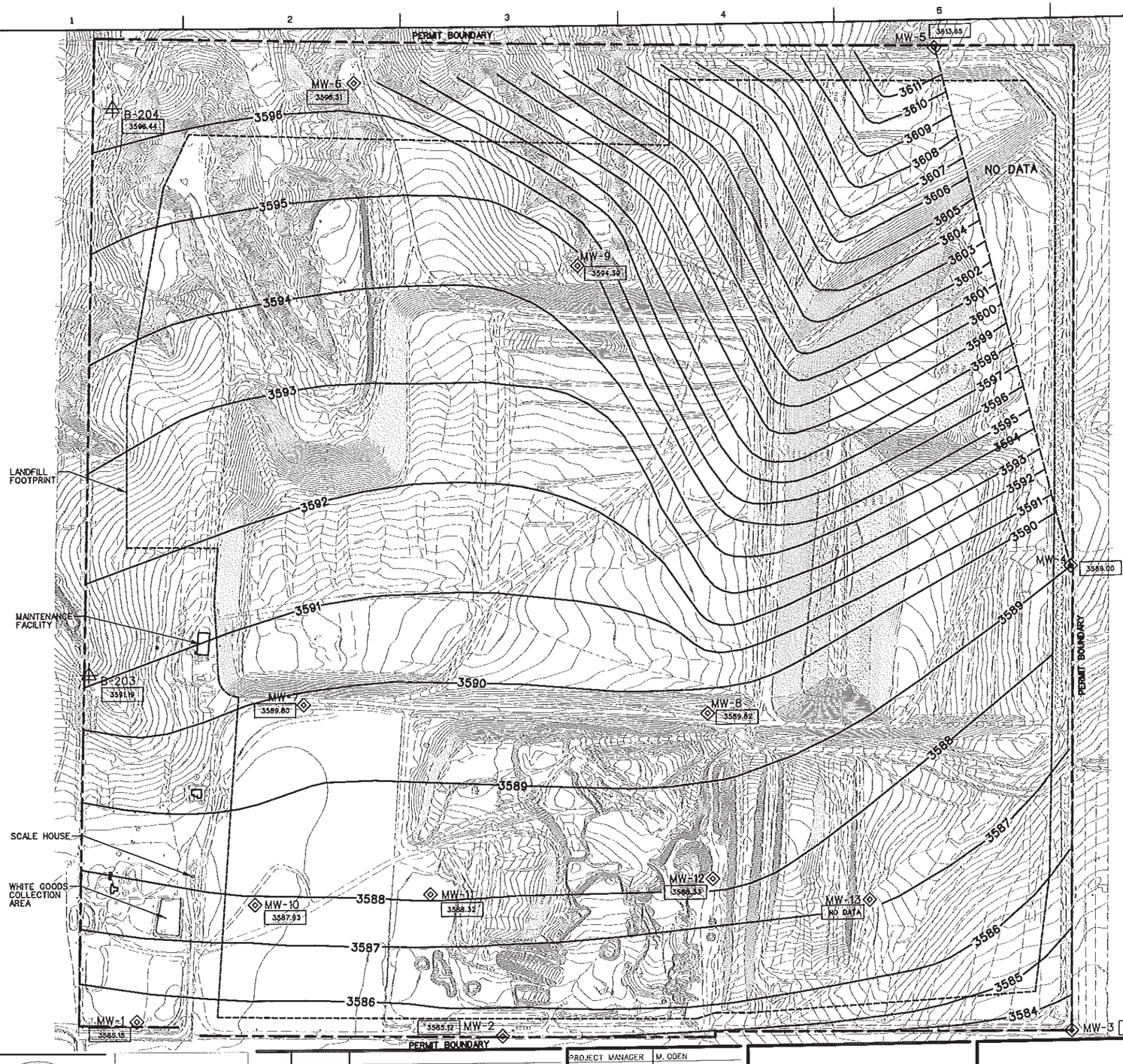

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0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 GROUNDWATER CONTOURS
- MW-4 3615.26 EXISTING MONITORING WELL LOCATIONS AND ELEVATIONS
- B-204 3615.26 2005 BORING LOCATIONS WITH PIEZOMETER AND ELEVATIONS

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE II.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.

STATE OF TEXAS
DONALD D. JAMES
GEOLOGY
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STATE OF TEXAS
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TEXAS P.E. FIRM REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
3	7/2009	REVISED MONITOR WELL LOCATIONS
2	3/2009	REVISED CONTOURS
1	1/2009	ISSUED FOR TCEQ REVIEW

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP
AUGUST 14, 2008

FILENAME
SCALE

SHEET
Plate 21
App. 5B

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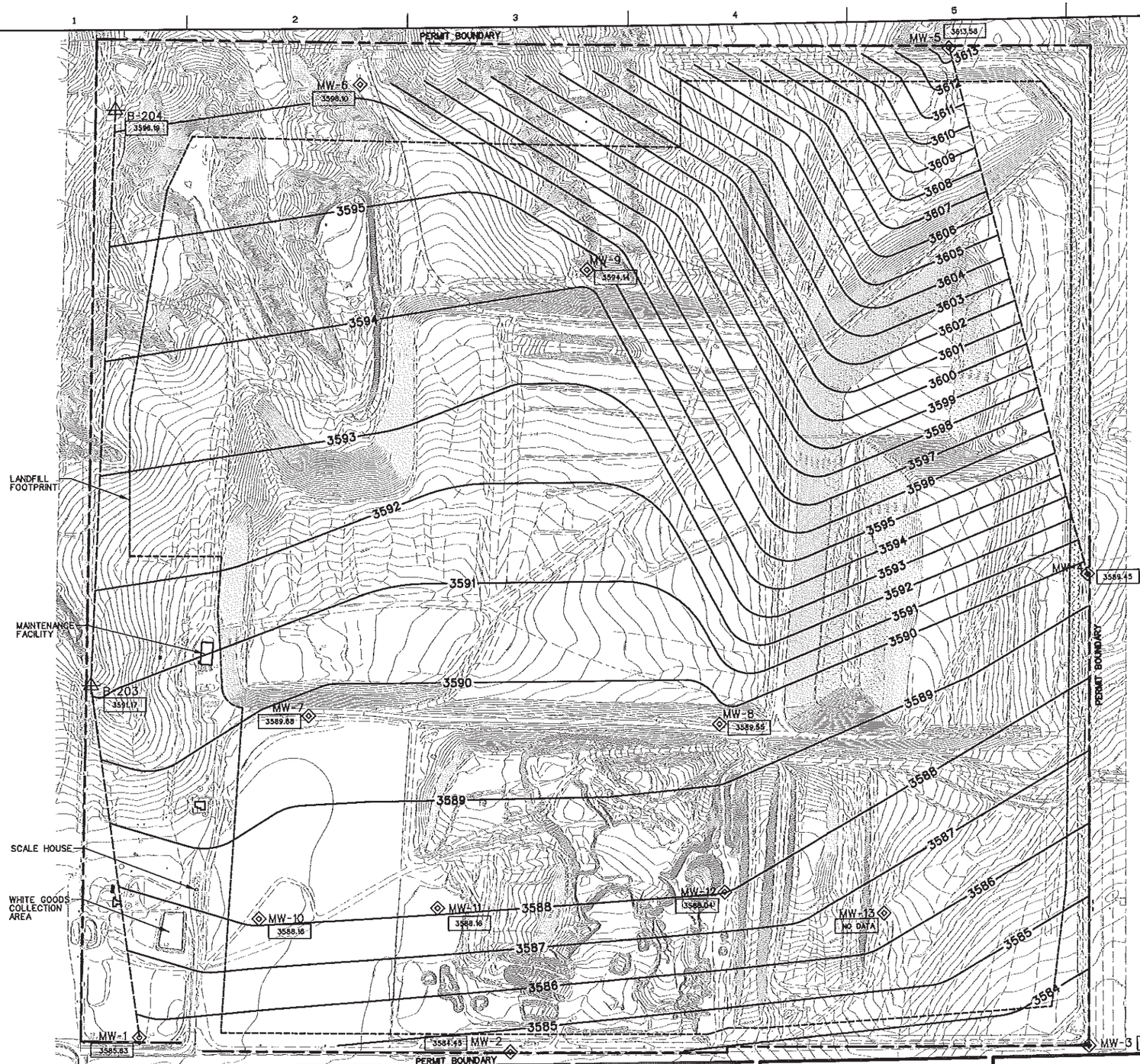

N

0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- 3590 EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 GROUNDWATER CONTOURS
- MW-4 3615.28 EXISTING MONITORING WELL LOCATIONS AND ELEVATIONS
- B-204 3615.26 2005 BORING LOCATIONS WITH PIEZOMETER AND ELEVATIONS

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE II.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.

STATE OF TEXAS
DONALD D. JAMES
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TEXAS P.E. FIRM
REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
1	7/2009	ISSUED FOR TCEQ REVIEW

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP
NOVEMBER 19, 2008

FILENAME
SCALE

SHEET
Plate 22
App. 5B

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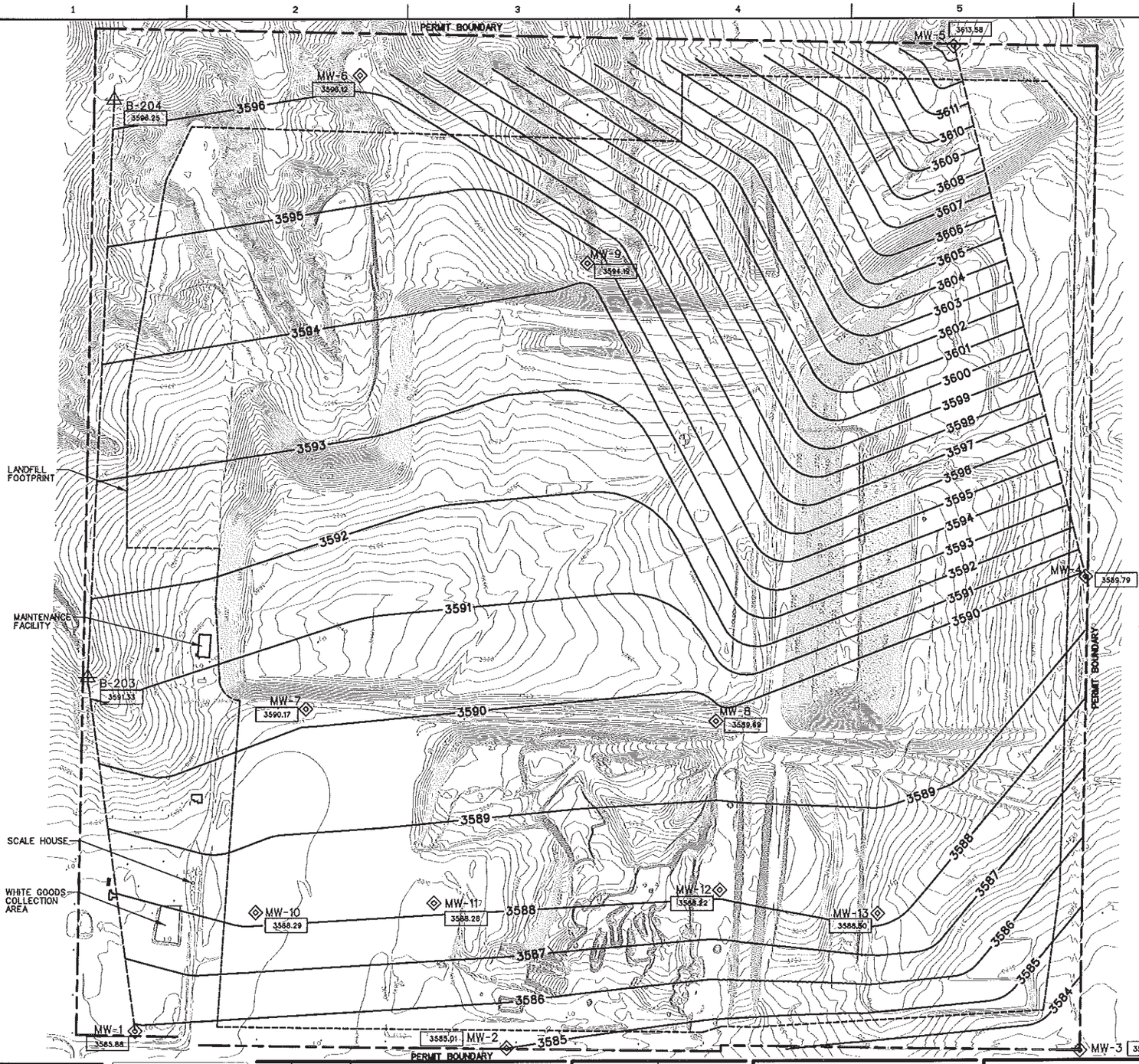

N

0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 GROUNDWATER CONTOURS
- MW-4 3615.28 EXISTING MONITORING WELL LOCATIONS AND ELEVATIONS
- B-204 3615.28 2005 BORING LOCATIONS WITH PIEZOMETER AND ELEVATIONS

STATE OF TEXAS
DONALD D. JAMES
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7-15-09

STATE OF TEXAS
M. M. SHIFLETT
43763
LICENSED
PROFESSIONAL ENGINEER
7-15-09

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE III.1.1.
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CITY OF AMARILLO TEXAS

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TEXAS P.E. FIRM REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
1	7/2009	ISSUED FOR TCEQ REVIEW

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP
JANUARY 12, 2009

FILENAME
SCALE

SHEET
Plate 23
App. 5B

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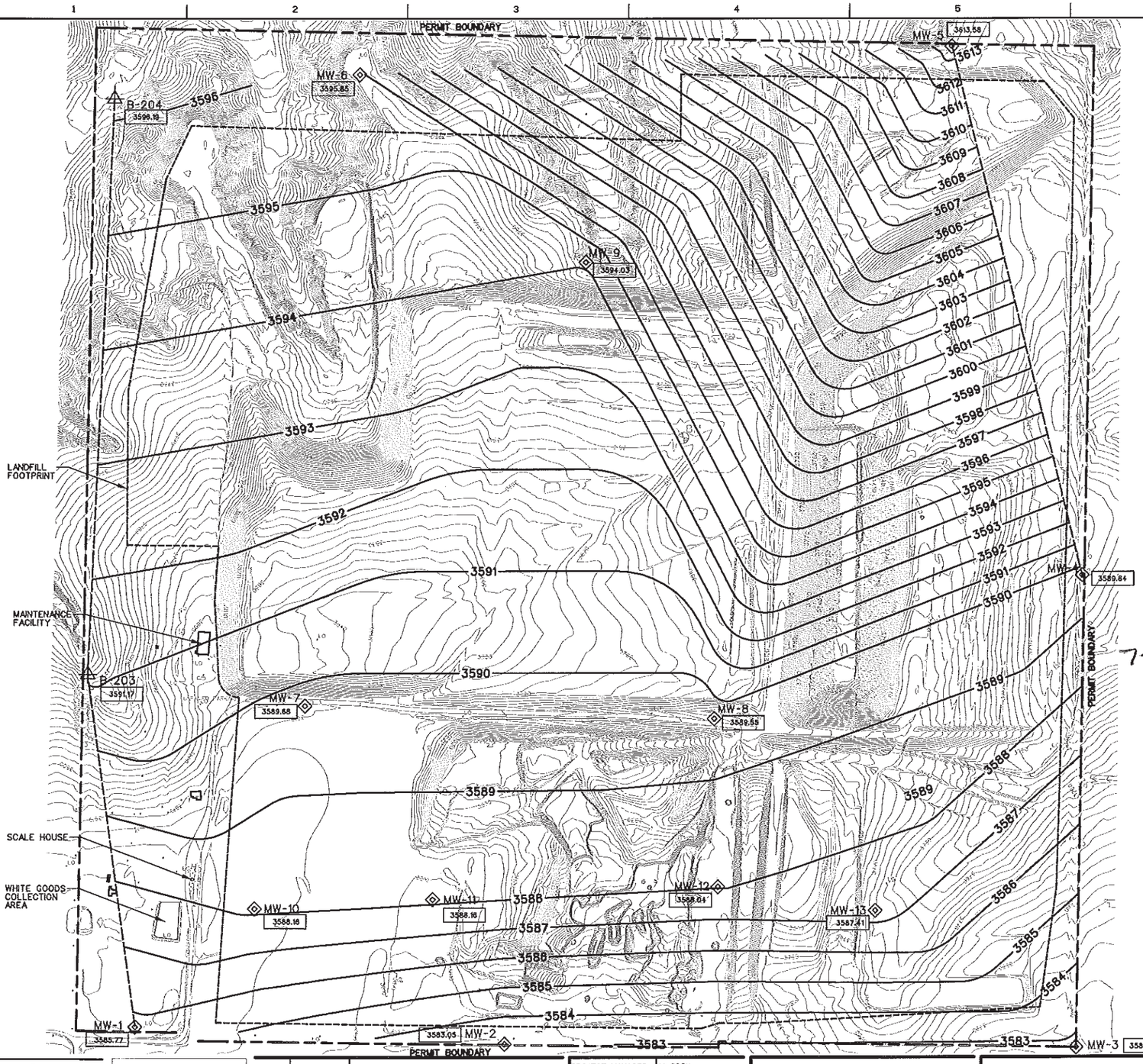

N

0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 GROUNDWATER CONTOURS
- MW-4 3615.26 EXISTING MONITORING WELL LOCATIONS AND ELEVATIONS
- B-204 3615.26 2005 BORING LOCATIONS WITH PIEZOMETER AND ELEVATIONS

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE II.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.

STATE OF TEXAS
DONALD D. JAMES
GEOLOGY
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STATE OF TEXAS
M. M. SHIFLETT
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7-15-09

CITY OF AMARILLO TEXAS

HDR

HDR ENGINEERING, INC.
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Suite 3500
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TEXAS P.E. FIRM REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
1	7/2009	ISSUED FOR TCEQ REVIEW

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

GROUNDWATER CONTOUR MAP
APRIL 13, 2009

FILENAME
SCALE

SHEET
Plate 24
App. 5B

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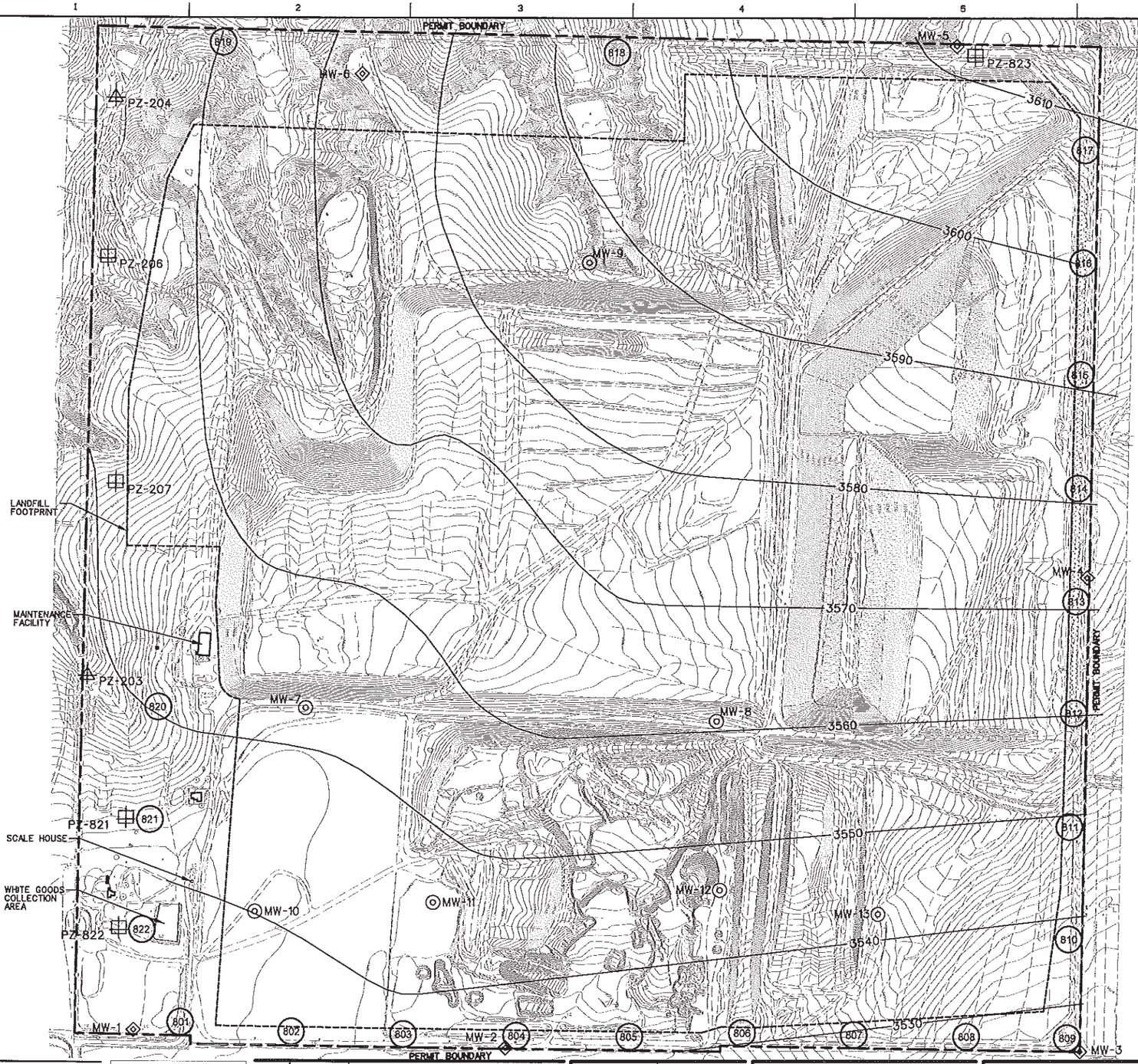

N

0 300 600

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- EXISTING CONTOURS
- LANDFILL FOOTPRINT
- 3605 — STRUCTURAL CONTOURS
- MW-4 — EXISTING MONITORING WELL LOCATIONS TO BE PLUGGED AND ABANDONED UPON COMPLETION OF BACKGROUND MONITORING OF THE ADDITIONAL WELLS
- MW-7 — EXISTING MONITORING WELL LOCATIONS TO BE PLUGGED AND ABANDONED AS CONSTRUCTION ACTIVITY DICTATES.
- PZ-203 — EXISTING PIEZOMETERS
- 822 — ADDITIONAL MONITORING WELL LOCATIONS
- PZ-204 — PROPOSED PIEZOMETER (4")

STATE OF TEXAS
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7-15-09

NOTES

1. FOR TOPOGRAPHIC INFO SEE FIGURE II.1.1.
2. TOPOGRAPHIC MAP WAS COMPILED BY PHOTOGRAMMETRIC METHODS BY STEWART GEO TECHNOLOGIES, SAN ANTONIO, TEXAS FROM AERIAL PHOTOGRAPHY DATED APRIL 7, 2005. VERTICAL DATUM BASED ON NGVD 29. MAPPING GROUND CONTROL PROVIDED BY THE CITY OF AMARILLO, COMPLETED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS.
3. TOP OF TRIASSIC DOCKUM OBTAINED FROM SIX ON SITE WELLS, PZ-204, TB-2, MW-5, PZ-203, MW-10, TB-1, AND TWO OFFSITE WATER WELLS, STATE WELL 73002 AND 89620.
4. WELLS 820, 821 AND 822 TO BE INSTALLED ONCE CELL 12 IS DEVELOPED (PRIOR TO WASTE PLACEMENT). INSTALL PZ-821 AND PZ-822 ALONG WITH WELLS 801 - 819.

CITY OF AMARILLO TEXAS

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TEXAS P.E. FIRM REGISTRATION NO. F-754

ISSUE	DATE	DESCRIPTION
3	7/2009	REVISED MONITOR WELL LOCATIONS
2	3/2009	REVISED MONITOR WELL LOCATIONS
1	8/2008	REVISED MONITOR WELL NETWORK

PROJECT MANAGER	M. ODEN
CIVIL ENGINEER	M. ODEN
CHECKED BY	M. ODEN
DESIGNED	
DRAWN BY	
QA/QC	M. ODEN
PROJECT NUMBER	82070

CITY OF AMARILLO LANDFILL
MSW PERMIT NO. 73A
POTTER COUNTY, TEXAS

STRUCTURAL CONTOUR MAP TOP OF TRIASSIC DOCKUM

0 1" 2"

FILENAME

SCALE

SHEET
Plate 25
App. 5B

USER: RCOX
FILE: ...\DMS15903\AMIII05_PLATE6D.DGN
DATE: 7/9/2009
TIME: 4:34:41 PM

2005 Kleinfelder
Logs of Borings

B-203 and B-204

LOG OF BORING NO. B-203

Project Description: **Amarillo Municipal Landfill - Potter County, Texas**
Location: See Plan of Borings, Plate 1 Appendix 4C
Approx. Surface Elevation: 3763'

Depth	Symbol/USCS	Samples	Hand Penetrometer, tsf	Penetration (1st Drive)	Penetration (2nd Drive)	Core Recovered, %	RQD, %	MATERIAL DESCRIPTION	Piezometer Construction	Depth
0								CALICHE, very light red-brown, hard, jointed, moderate to highly cemented	Cement	0
12.0								El. 3751.1; 12.0' CLAYEY SAND, silty, light red-brown and very light brown, dense, with calcareous accretions and occasional caliche cemented sandstone seams and layers	Bentonite Holeplug	12.0
40									Sand	40

continued on next page

Completion Depth: 220 ft.
Date Boring Started: 9/7/05
Date Boring Completed: 9/7/05
Logged by: D. James
Project No.: 57815

Remarks: Boring dry upon completion. Water at 169.1 feet, 20 hours after completion of drilling and sampling.

KLEINFELDER

LOG OF BORING NO. B-203 (cont'd)

Project Description: **Amarillo Municipal Landfill - Potter County, Texas**
Location: See Plan of Borings, Plate 1 Appendix 4C
Approx. Surface Elevation: 3763'

Depth	Symbol/USCS	Samples	Hand Penetrometer, tsf	Penetration (1st Drive)	Penetration (2nd Drive)	Core Recovered, %	RQD, %	MATERIAL DESCRIPTION	Piezometer Construction	Depth
45								CLAYEY SAND, silty, light red-brown and very light brown, dense, with calcareous accretions and occasional caliche cemented sandstone seams and layers		45
50										50
55									Sand	55
60										60
65										65
70										70
75										75
80									2-in PVC	80

continued on next page

Completion Depth: 220 ft.
Date Boring Started: 9/7/05
Date Boring Completed: 9/7/05
Logged by: D. James
Project No.: 57815

Remarks: Boring dry upon completion. Water at 169.1 feet, 20 hours after completion of drilling and sampling.

KLEINFELDER

LOG OF BORING NO. B-203 (cont'd)

Project Description: **Amarillo Municipal Landfill - Potter County, Texas**
Location: See Plan of Borings, Plate 1 Appendix 4C
Approx. Surface Elevation: 3763'

Depth	Symbol/USCS	Samples	Hand Penetrometer, tsf	Penetration (1st Drive)	Penetration (2nd Drive)	Core Recovered, %	RQD, %	MATERIAL DESCRIPTION	Piezometer Construction	Depth
85								CLAYEY SAND, silty, light red-brown and very light brown, dense, with calcareous accretions and occasional caliche cemented sandstone seams and layers		85
90									2-in PVC	90
95										95
100										100
105										105
110									Sand	110
115										115
120										120
125										125

continued on next page

Completion Depth: 220 ft.
Date Boring Started: 9/7/05
Date Boring Completed: 9/7/05
Logged by: D. James
Project No.: 57815

Remarks: Boring dry upon completion. Water at 169.1 feet, 20 hours after completion of drilling and sampling.

KLEINFELDER

LOG OF BORING NO. B-203 (cont'd)

Project Description: **Amarillo Municipal Landfill - Potter County, Texas**
Location: See Plan of Borings, Plate 1 Appendix 4C
Approx. Surface Elevation: 3763'

Depth	Symbol/USCS	Samples	Hand Penetrometer, tsf	Penetration (1st Drive)	Penetration (2nd Drive)	Core Recovered, %	RQD, %	MATERIAL DESCRIPTION	Piezometer Construction	Depth
130								CLAYEY SAND, silty, light red-brown and very light brown, dense, with calcareous accretions and occasional caliche cemented sandstone seams and layers		130
135										135
140									Sand	140
145										145
150										150
155								- moderate to highly cemented from 155 to 162 feet		155
160								- coarse to medium, subrounded, frosted, gap graded to well graded, yellow-brown, less cemented to non-cemented below 162 feet	Screen	160
165										165

continued on next page

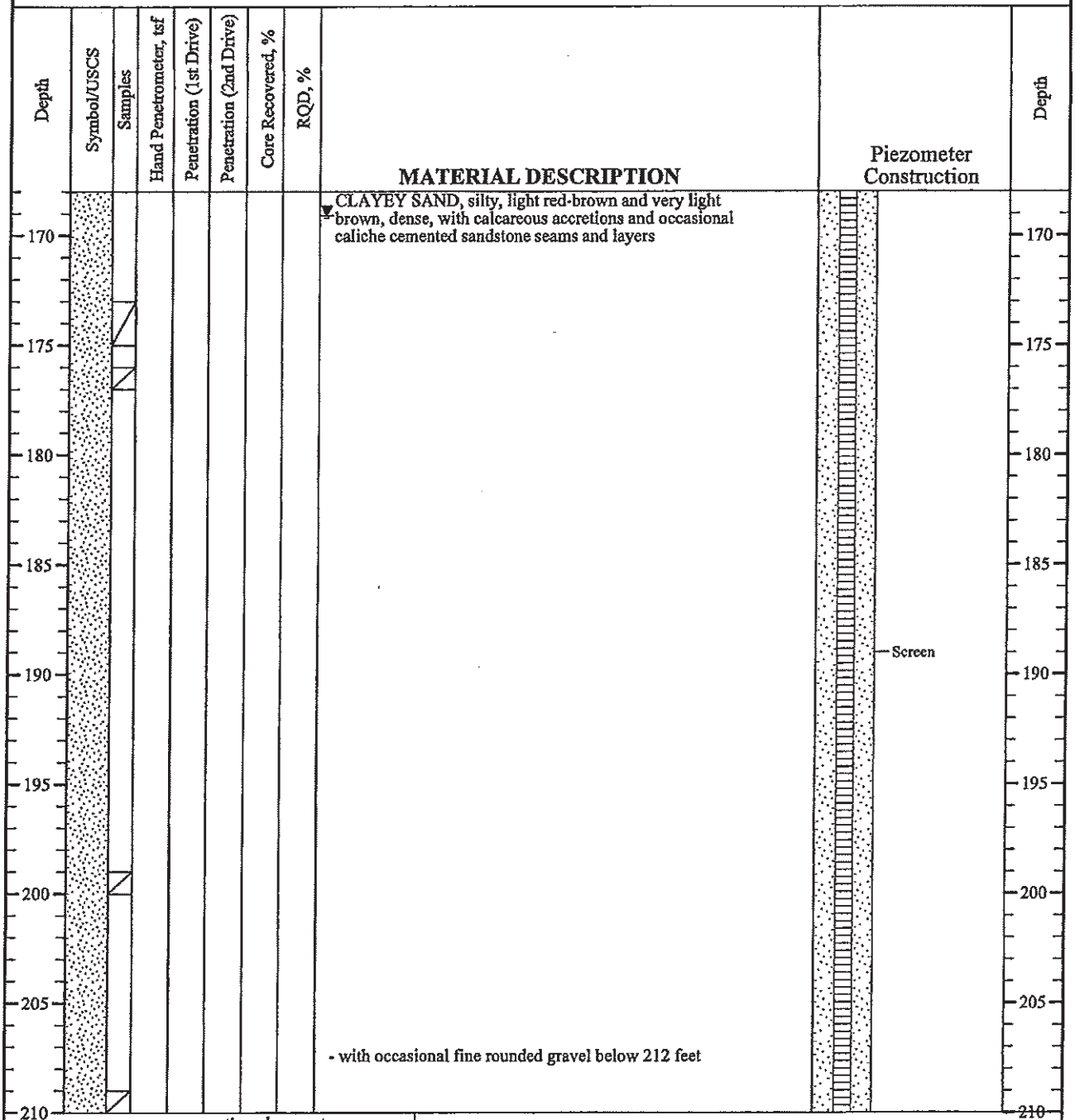
Completion Depth: 220 ft.
Date Boring Started: 9/7/05
Date Boring Completed: 9/7/05
Logged by: D. James
Project No.: 57815

Remarks: Boring dry upon completion. Water at 169.1 feet, 20 hours after completion of drilling and sampling.

KLEINFELDER

LOG OF BORING NO. B-203 (cont'd)

Project Description: **Amarillo Municipal Landfill - Potter County, Texas**
Location: See Plan of Borings, Plate 1 Appendix 4C
Approx. Surface Elevation: 3763'



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Completion Depth: 220 ft.
Date Boring Started: 9/7/05
Date Boring Completed: 9/7/05
Logged by: D. James
Project No.: 57815

Remarks: Boring dry upon completion. Water at 169.1 feet, 20 hours after completion of drilling and sampling.

KLEINFELDER

LOG OF BORING NO. B-203 (cont'd)

Project Description: **Amarillo Municipal Landfill - Potter County, Texas**
Location: See Plan of Borings, Plate 1 Appendix 4C
Approx. Surface Elevation: 3763'

Depth	Symbol/USCS	Samples	Hand Penetrometer, tsf	Penetration (1st Drive)	Penetration (2nd Drive)	Core Recovered, %	RQD, %	MATERIAL DESCRIPTION	Piezometer Construction	Depth
								CLAYEY SAND, silty, light red-brown and very light brown, dense, with calcareous accretions and occasional caliche cemented sandstone seams and layers		
								El. 3549.1; 214.0'		
215								SHALE, red-brown and light green-gray, very stiff to hard, weathered	Screen	215
								El. 3543.1; 220.0'		
220										220

Completion Depth: 220 ft.
Date Boring Started: 9/7/05
Date Boring Completed: 9/7/05
Logged by: D. James
Project No.: 57815

Remarks: Boring dry upon completion. Water at 169.1 feet, 20 hours after completion of drilling and sampling.

KLEINFELDER

Stratification lines represent approximate strata boundaries, as in-situ the transitions may be gradual. This Log of Boring is not intended for bidding or estimating purposes. Boring log(s) should not be reproduced separately from the engineering report unless said report is specifically included by reference.

LOG OF BORING NO. B-204

Project Description: **Amarillo Municipal Landfill - Potter County, Texas**
Location: See Plan of Borings, Plate 1 Appendix 4C
Approx. Surface Elevation: 3680'

Depth	Symbol/USCS	Samples	Hand Penetrometer, tsf	Penetration (1st Drive)	Penetration (2nd Drive)	Core Recovered, %	RQD, %	MATERIAL DESCRIPTION	Piezometer Construction	Depth
0								SAND with gravel, silty, light red-brown and yellow-brown, calcareous accretions and caliche fragments, fine to medium, gap to well graded	Cement	0
5										5
10									Bentonite Holeplug	10
15										15
20								- with occasional weakly to moderately cemented calcareous sandstone seams and layers below 18 feet		20
25										25
30									Sand	30
35								El. 3644.8; 35.0' SAND, yellow-brown, dense, fine to medium, gap to well graded, frosted, subrounded, with occasional caliche seams		35
40										40

continued on next page

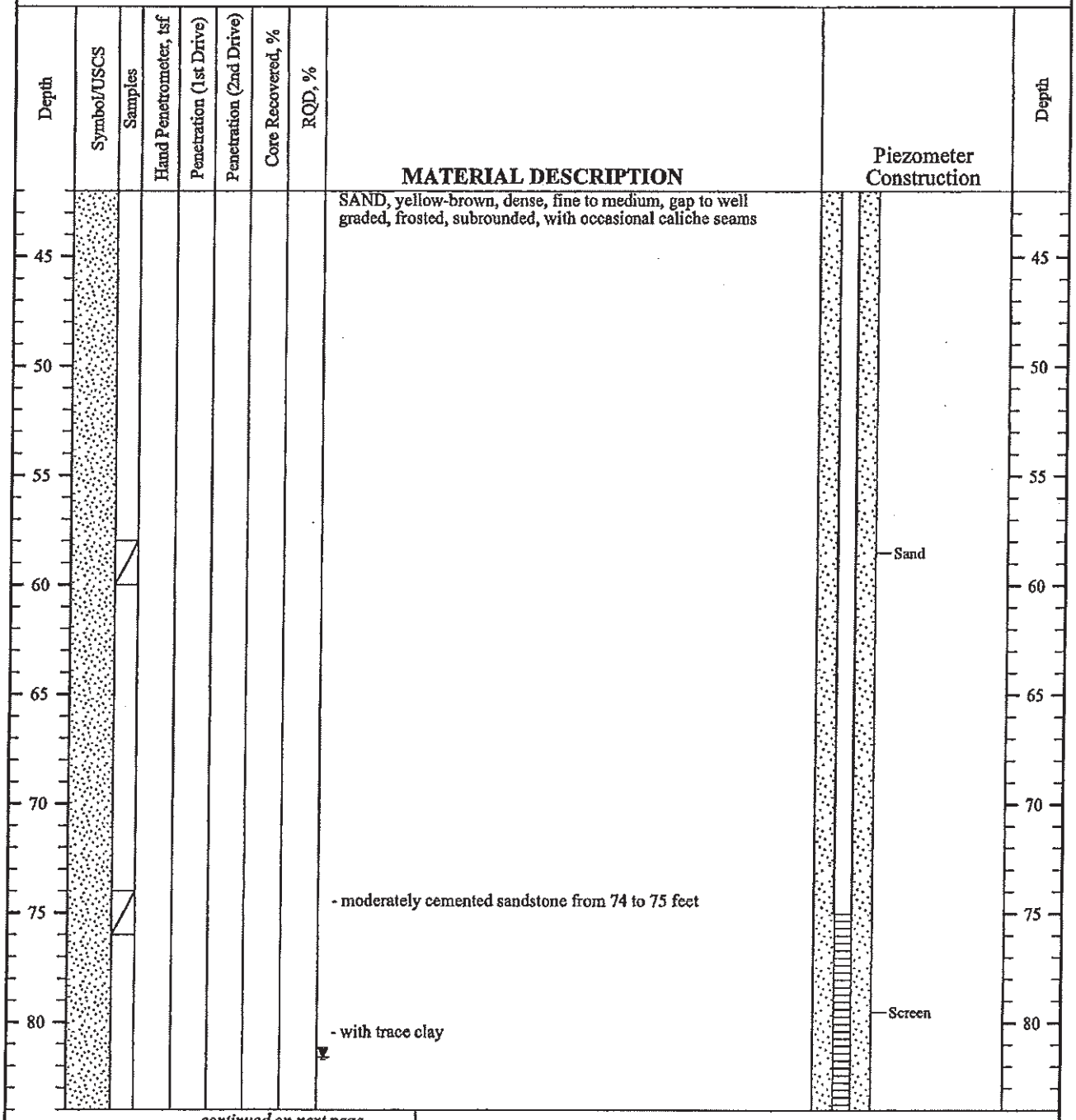
Completion Depth: 135 ft.
Date Boring Started: 9/8/05
Date Boring Completed: 9/8/05
Logged by: D. James
Project No.: 57815

Remarks: Boring dry upon completion. Water at 81.6 feet, 1 hour after completion of drilling and sampling.

KLEINFELDER

LOG OF BORING NO. B-204 (cont'd)

Project Description: **Amarillo Municipal Landfill - Potter County, Texas**
Location: See Plan of Borings, Plate 1 Appendix 4C
Approx. Surface Elevation: 3680'



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Completion Depth: 135 ft.
Date Boring Started: 9/8/05
Date Boring Completed: 9/8/05
Logged by: D. James
Project No.: 57815

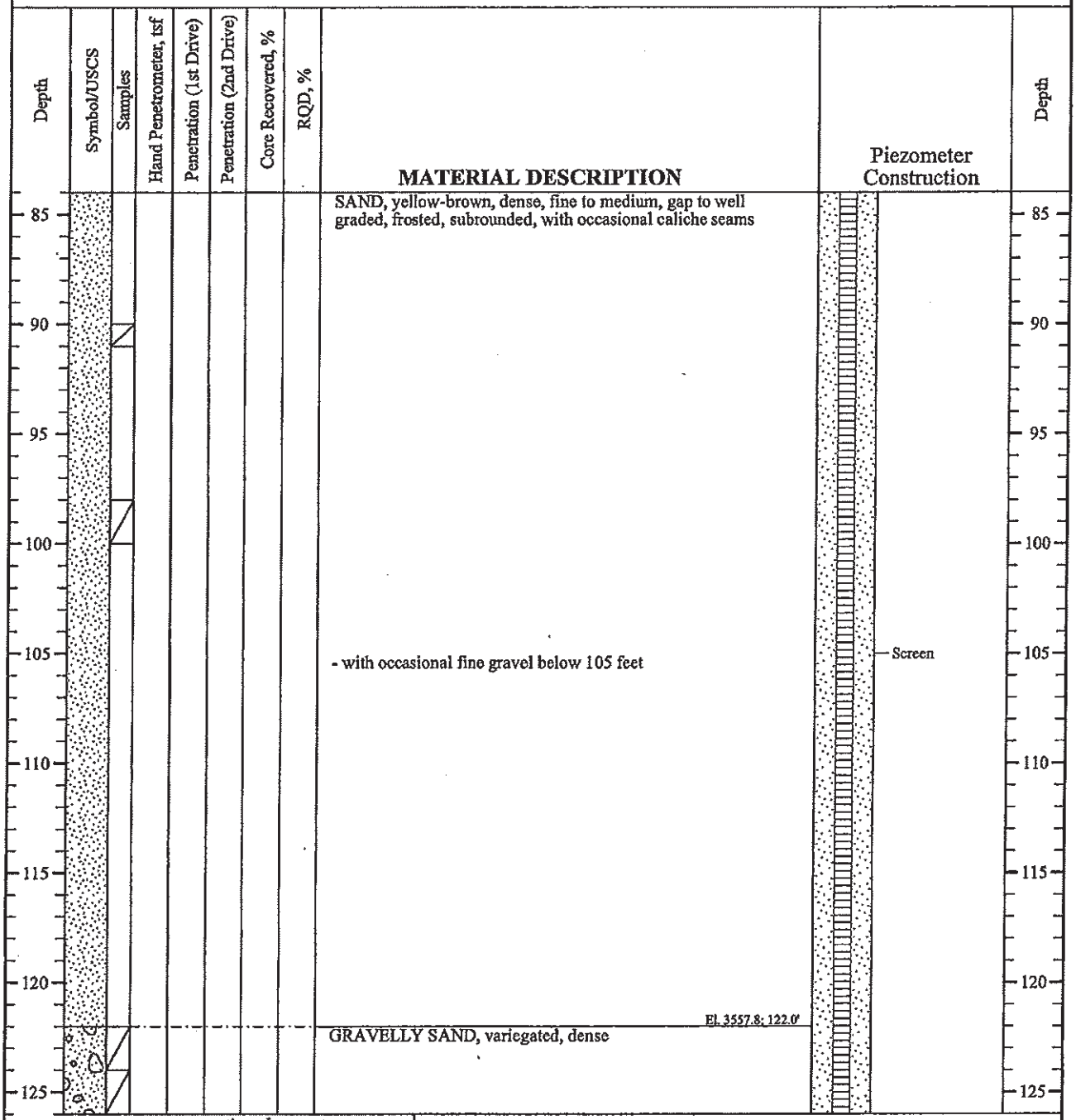
Remarks: Boring dry upon completion. Water at 81.6 feet, 1 hour after completion of drilling and sampling.

KLEINFELDER

Stratification lines represent approximate strata boundaries, as in-situ the transitions may be gradual. This Log of Boring is not intended for bidding or estimating purposes. Boring log(s) should not be reproduced separately from the engineering report unless said report is specifically included by reference.

LOG OF BORING NO. B-204 (cont'd)

Project Description: **Amarillo Municipal Landfill - Potter County, Texas**
Location: See Plan of Borings, Plate 1 Appendix 4C
Approx. Surface Elevation: 3680'



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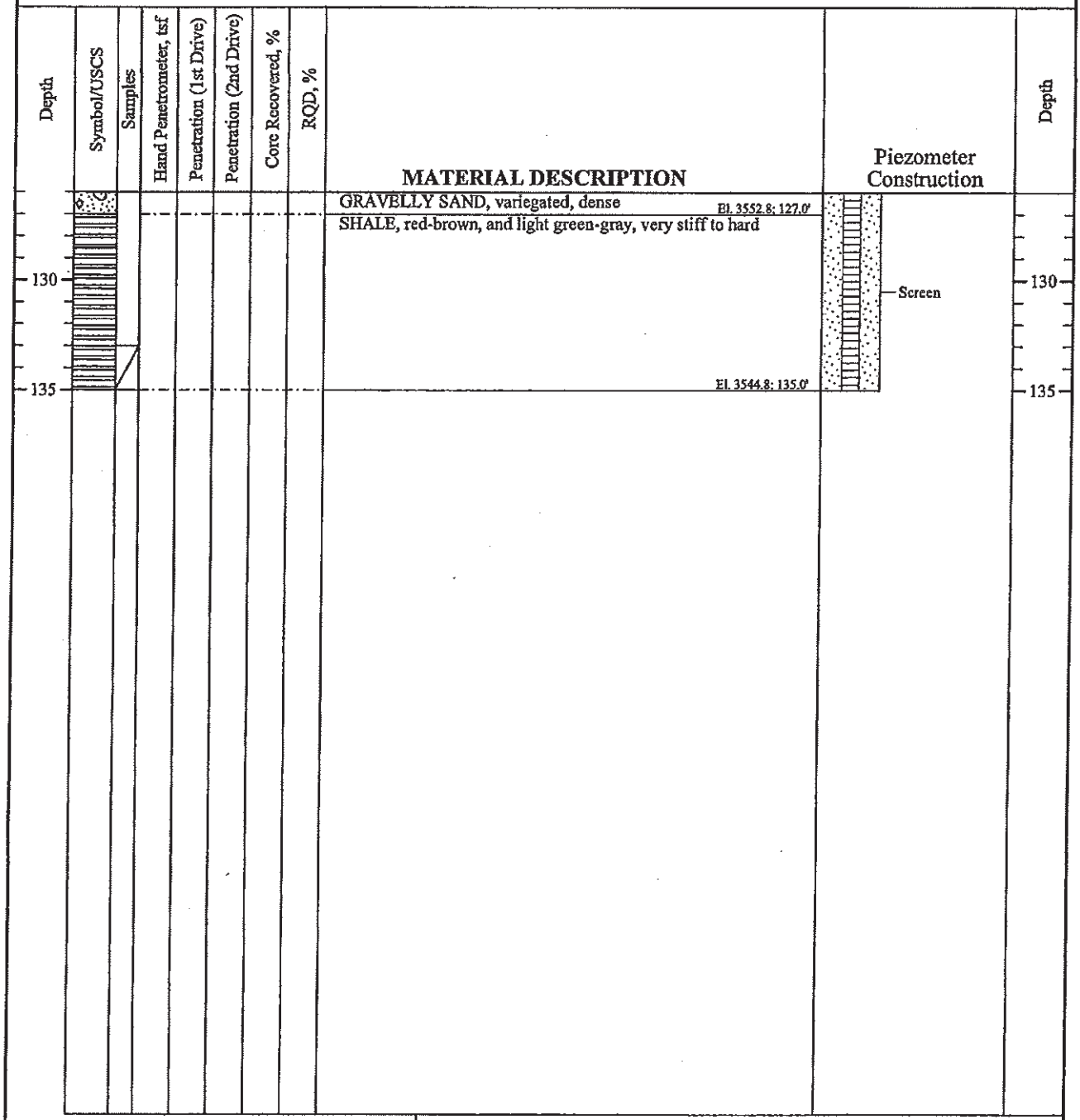
Completion Depth: 135 ft.
Date Boring Started: 9/8/05
Date Boring Completed: 9/8/05
Logged by: D. James
Project No.: 57815

Remarks: Boring dry upon completion. Water at 81.6 feet, 1 hour after completion of drilling and sampling.

KLEINFELDER

LOG OF BORING NO. B-204 (cont'd)

Project Description: **Amarillo Municipal Landfill - Potter County, Texas**
Location: See Plan of Borings, Plate 1 Appendix 4C
Approx. Surface Elevation: 3680'



Completion Depth:	135 ft.
Date Boring Started:	9/8/05
Date Boring Completed:	9/8/05
Logged by:	D. James
Project No.:	57815

Remarks: Boring dry upon completion. Water at 81.6 feet, 1 hour after completion of drilling and sampling.

KLEINFELDER

Stratification lines represent approximate strata boundaries, as in-situ the transitions may be gradual. This Log of Boring is not intended for bidding or estimating purposes. Boring log(s) should not be reproduced separately from the engineering report unless said report is specifically included by reference.

1994 – Dyess - Peterson Testing Laboratory, Inc.
Log of Boring

MW-1

A. Monitor Well Data Sheet

Texas Water Commission
Municipal Solid Waste Division
SE 67

Permittee or Site Name: City of Amarillo MSWLF

County: Potter

Date of Monitor Well Installation: 8-9-94

Monitor Well: Latitude: N35° 13'16" Longitude: W102° 01'35"

Monitor Well Groundwater Gradient: Upgradient ___ Downgradient XX

TDH Permit No.: 73

Monitor Well I.D. No.: MW-1

Date of Monitor Well Development: 8-10-94

Monitor Well Driller Name: Lee Peterson

License No.: 3045M

NOTE:

(A) The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimun distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3".
(D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.
(E) Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist or Engineer Supervising Well Installation: Ray Hamby

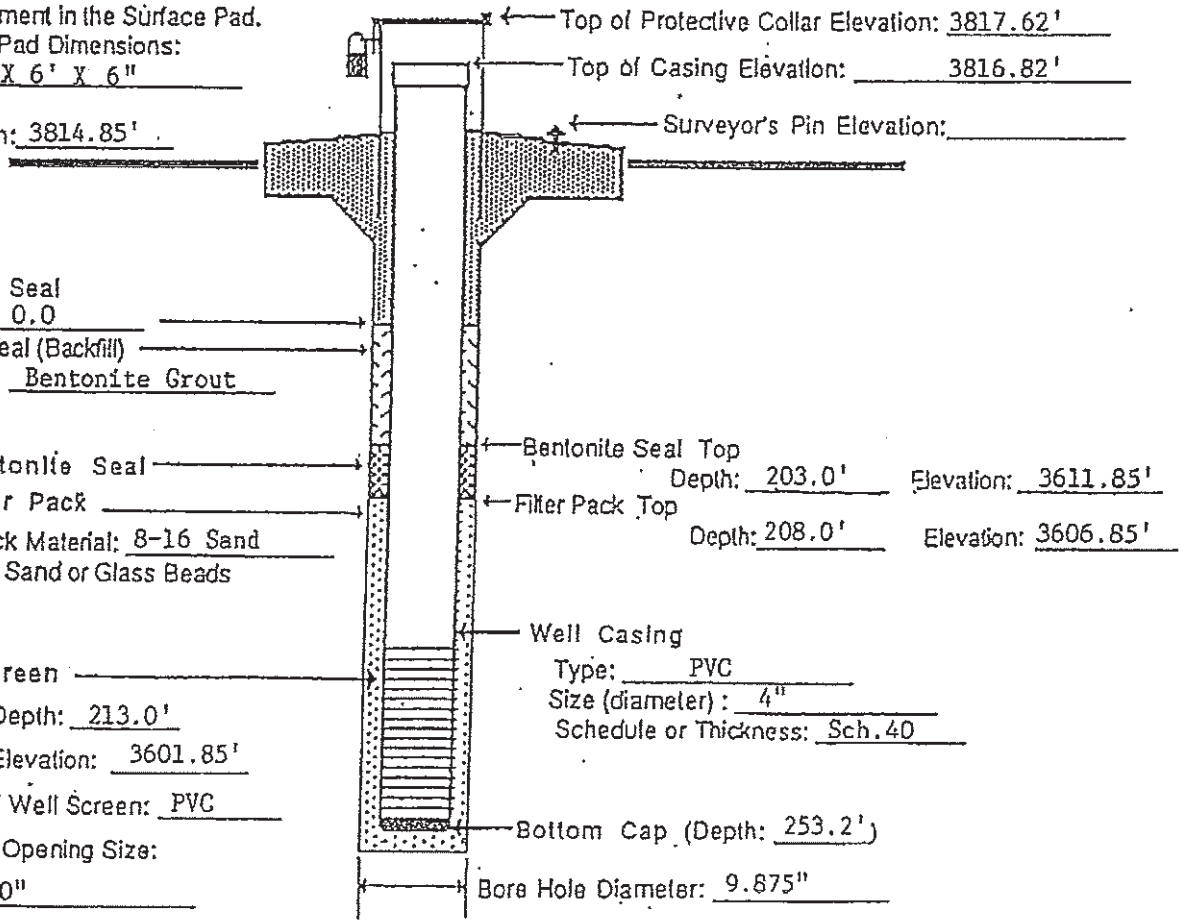
Static Water Level Elevation (with respect to MSL) after Well Development: 3588.30'

Name of Geologic Formation(s) in which Well is completed: Ogallala

Type of Locking Device: Padlock

Type of Casing Protection: Upright Well Protector

Concrete Surface Pad - Recommend steel reinforcement in the Surface Pad.
Surface Pad Dimensions: 6' X 6' X 6"
Surface Elevation: 3814.85'



Top of Protective Collar Elevation: 3817.62'
Top of Casing Elevation: 3816.82'
Surveyor's Pin Elevation: ___

Concrete Seal
Depth: 0.0
Casing Seal (Backfill)
Material: Bentonite Grout

Bentonite Seal
Filter Pack
Filter Pack Material: 8-16 Sand
Sterilized Sand or Glass Beads

Bentonite Seal Top
Depth: 203.0' Elevation: 3611.85'
Filter Pack Top
Depth: 208.0' Elevation: 3606.85'

Well Screen
Top Depth: 213.0'
Top Elevation: 3601.85'
Type of Well Screen: PVC
Screen Opening Size: 0.020"

Well Casing
Type: PVC
Size (diameter): 4"
Schedule or Thickness: Sch.40

Bottom Cap (Depth: 253.2')

Bore Hole Diameter: 9.875"

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-1
LOCATION: Amarillo, Texas

Date: 8-4-94 thru 8-9-94

Ground Elevation: 3814.85'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 125' Groundwater encountered at 225'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
0			Sandy Clay: Dark Brown, Stiff, Dry (CL)		13.1		34	13	21		94.1
5		X	Sandy Clay: Reddish Tan w/Calcareous Nodules (8%) Stiff, Dry (CL)	4-6"	9.9		26	15	11		84.6
				14-12"							
				38-18"							
10		X		7.6"	8.8		29	13	16		90.7
				16-12"							
				27-18"							
15		X		18-6"	10.1		34	13	21		88.9
				41-12"							
				50-13"							
20		X		23-6"	9.9		35	20	15		87.7
				50-12"							
25		X	Sandy Clay: Reddish Tan w/Calcareous Nodules (8%) Stiff, Dry (CL)	15-6"	9.6		26	15	11		92.1
				35-12"							
				50-16"							
30		X	Continued on Page 2								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-1
LOCATION: Amarillo, Texas

Date: 8-4-94 thru 8-9-94

Ground Elevation: 3814.85'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 125' Groundwater encountered at 225'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
30		X		16-6"	8.3		32	22	10		80.6
				36-12"							
				50-17"							
35		X		15-6"	9.1		33	24	9		81.4
				33-12"							
				50-15.5"							
40		X		12-6"	8.7		32	20	12		77.9
				30-12"							
				50-17"							
45		X		21-6"	7.1		33	21	12		76.1
				50-11.5"							
50		X		15-6"	8.4		34	23	11		77.8
				36-12"							
				50-15"							
55		X		18-6"	8.7		26	17	9		66.8
				45-12"							
				50-13"							
60		X									

Continued on Page 3

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: MW-1
LOCATION: Amarillo, Texas
Date: 8-4-94 thru 8-9-94
Ground Elevation: 3814.85'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION: Air drilled to 125' Groundwater encountered at 225'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS/FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
60				50-2"	7.4		19	14	5		21.5
65			Sandy Clay: Light Tan, Caliche, Stiff, Dry (CL)	40-6"	6.8		21	15	6		55.1
				50-7.5"							
70			Caliche: Light Tan, Limestone, Fractures, Hard (CL)	29-6"	5.1		23	18	5		50.9
75				28-6"	4.5		19	16	3		20.9
				50-10.5"							
80			Sandy Clay: Light Tan, Caliche (CL)	33-6"	3.7		21	17	4		41.1
				50-7"							
85				50-3"	3.2		21	17	4		29.1
90			Continued on Page 4								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
Date: 8-4-94 thru 8-9-94

BORING NO.: MW-1
LOCATION: Amarillo, Texas
Ground Elevation: 3814.85'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 125' Groundwater encountered at 225'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
90				40-6"	3.6		23	20	3		27.4
				50-7"							
95		X		36-6"	3.7		17	13	4		26.9
				50-8.5"							
100		X		50-5"	3.6		19	16	3		15.3
105		X	Clayey Sand: Reddish Tan, w/Calcareous Nodules (10%) Stiff, Dry (SC)								
110		X		26-6"	2.7		15	10	5		12.1
				50-12"							
115											
120		X									

Continued on Page 5

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-1
LOCATION: Amarillo, Texas

Date: 8-4-94 thru 8-9-94

Ground Elevation: 3814.85'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 125' Groundwater encountered at 225'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
120				24.6"	1.7		16	12	4		14.9
				50-10"							
125											
130				50-4"							
			Lost Circulation Not Able to Sample from 130' to 190'								
135											
140											
145											
150			Continued on Page 6								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-1
LOCATION: Amarillo, Texas

Date: 8-4-94 thru 8-9-94

Ground Elevation: 3814.85'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air Drilled to 125' Groundwater encountered at 225'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
150											
155											
160											
165											
170											
175											
180			Continued on Page 7								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-1
LOCATION: Amarillo, Texas

Date: 8-4-94 thru 8-9-94

Ground Elevation: 3814.85'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 125' Groundwater encountered at 225'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS/FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
180											
185											
190											
195			Regained Circulation								
200		X	Clayey Sand: Reddish Tan, w/Calcareous Nodules (10%) Stiff, Dry (SC)	50-5"	MD		20	16	4		14.1
205			Lost Circulation Not Able to Sample from 205' to 253'								
210			Continued on Page 8								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-1
LOCATION: Amarillo, Texas

Date: 8-4-94 thru 8-9-94

Ground Elevation: 3814.85'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 125' Groundwater encountered at 225'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
210											
215											
220											
225											
230											
235											
240			Continued on Page 9								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-1
LOCATION: Amarillo, Texas

Date: 8-4-94 thru 8-9-94

Ground Elevation: 3814.85'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 125' Groundwater encountered at 225'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
240'											
245											
250											
			* T.D. - 253' *								
255											

1994 – Dyess Peterson Testing Laboratory, Inc.
Log of Boring

MW-2

A. Monitor Well Data Sheet

Texas Water Commission
Municipal Solid Waste Division
SE-67

Permittee or Site Name: City of Amarillo MSWLF
County: Potter
Date of Monitor Well Installation: 7-20-94
Monitor Well: Latitude: N35° 13'15" Longitude: W102° 01'12"
Monitor Well Groundwater
Gradient: Upgradient ___ Downgradient X

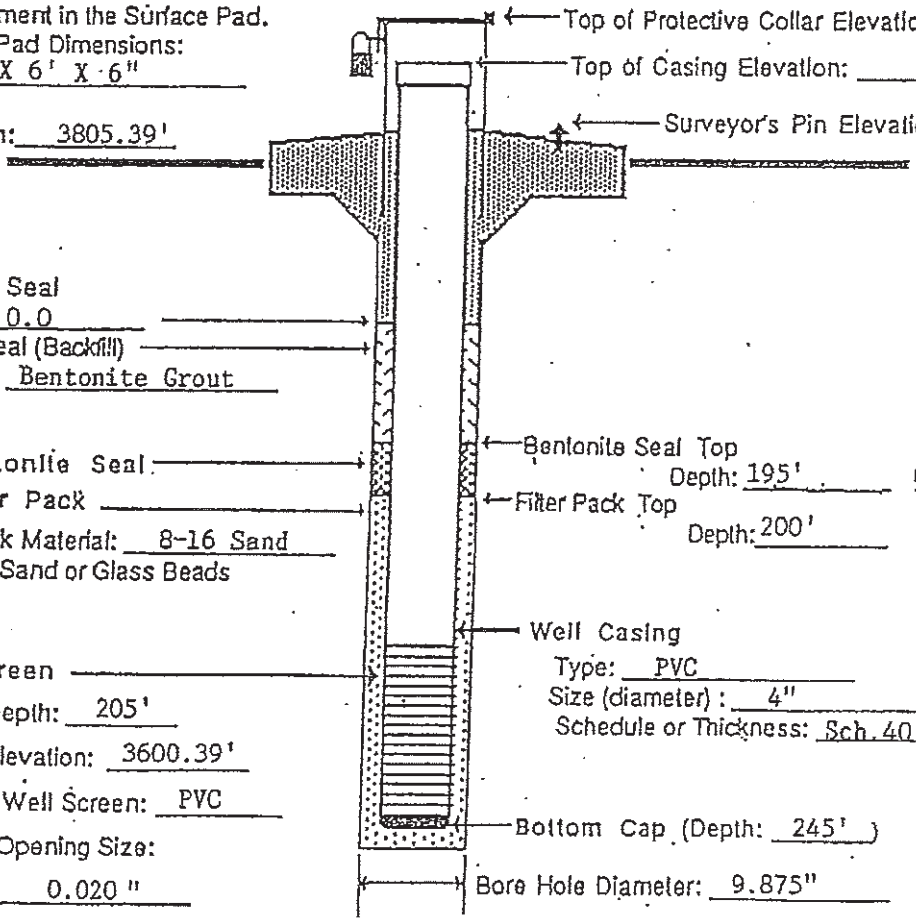
TDH Permit No.: 73
Monitor Well I.D. No.: MW-2
Date of Monitor Well Development: 7-21-94
Monitor Well Driller
Name: Lee Peterson
License No.: 3045M

NOTE:
(A)The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimun distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3".
(D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.
(E) Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist or Engineer Supervising Well Installation: Ray Hamby
Static Water Level Elevation (with respect to MSL) after Well Development: 3586.29'
Name of Geologic Formation(s) in which Well is completed: Ogallala

Type of Locking Device: Padlock.
Type of Casing Protection: Upright Well Protector

Concrete Surface Pad - Recommend steel reinforcement in the Surface Pad.
Surface Pad Dimensions: 6' X 6' X 6"
Surface Elevation: 3805.39'



LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: MW-2
LOCATION: Amarillo, Texas
Date: 7-15-94 thru 7-20-94
Ground Elevation: 3805.39'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Auger drilled to 74' Groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
0		X	Sandy Clay: Dark Brown, Stiff Dry (CL) $K = 4.5 \times 10^{-8}$ cm/sec	13-6"	9.5		38	18	20	1.5	94.5
				18-12"							
			Sandy Clay: Reddish Tan w/Calcareous Nodules(8%) Stiff, Dry (CL)								
5		X		50-5"	8.5		36	15	21	3.5	92.1
10		X		50-4"	6.2		29	18	11	3.0	91.7
15		X		50-5"	8.6		32	13	19	3.25	85.4
20		X		50-4"	9.7		35	15	20		91.4
25		X		50-5"	9.3		38	23	15	3.5	91.8
30			Continued on Page 2								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-2
LOCATION: Amarillo, Texas

Date: 7-15-94 thru 7-20-94

Ground Elevation: 3805.39'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Auger Drilled to 74' Groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
30		X		50-3"	5.8		32	21	11	4.0+	81.1
35		X	Caliche: Light Tan, Limestone, Fractures, Hard (CL)	50-3"	11.9		29	20	9	4.0+	79.2
40		X	Sandy Clay: Reddish Tan w/Calcareous Nodules(10%) Stiff, Dry (CL)	50-4"	11.5		32	19	13	3.25	74.4
45		X		50-4"	10.5		31	18	13	3.50	73.0
50		X		50-5"	7.7		37	15	22	2.50	73.9
55		X		50-4"	5.5		34	22	12	2.0	82.6
60			Continued on Page 3								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-2
LOCATION: Amarillo, Texas

Date: 7-15-94 thru 7-20-94

Ground Elevation: 3805.39'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Auger drilled to 74' Groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO 200 SIEVE
60		X		50-4"	4.2		31	15	16	2.5	62.2
65											
70											
75		X	Caliche: Light Tan Limestone Layers, Fractures, Hard (CL)	50-3"	MD		31	17	14	3.5	45.9
80		X		50-5"	MD		28	18	10		40.8
85		X		22-6"	MD		23	18	5	1.5	30.7
90				50-11.5"							

Continued on Page 4

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-2
LOCATION: Amarillo, Texas

Date: 7-15-94 thru 7-20-94

Ground Elevation: 3805.39'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Auger drilled to 74' Groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
90		X		24-6"	MD		27	20	7	1.0	33.4
				50-12"							
95		X		50-6"	MD		34	20	14	2.5	31.0
100		X		25-6"	MD		21	17	4	1.25	17.4
105		X	Clayey Sand: Reddish Tan w/Calcareous Nodules(10%) Stiff Dry (SC)	50-5"	MD		25	21	4	3.0	30.1
110		X		50-5"	MD		22	19	3		27.8
115											
120			Continued on Page 5								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: MW-2
LOCATION: Amarillo, Texas
Date: 7-15-94 thru 7-20-94
Ground Elevation: 3805.39'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION: Auger drilled to 74' Groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
120		X		36-6"	MD		21	18	3		22.4
				50-8"							
125											
130		X	Clayey Sand:Reddish Tan, w/Calcareous Nodules(10%) Stiff, Dry (SC)	33-6"	MD		25	21	4	1.75	23.1
				50-8"							
135											
140		X		50-5"	MD		24	20	4	3.0	17.9
145											
150											

Continued on Page 6

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: MW-2
LOCATION: Amarillo, Texas
Date: 7-15-94 thru 7-20-94
Ground Elevation: 3805.39'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Auger drilled to 74' Groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
150		X		40-6"	MD				NP		16.0
				50-7.5"							
155											
160		X		39-6"	MD				NP		22
				50-8"							
165											
170		X	Clayey Sand: Reddish Tan, w/Calcareous Nodules(15%) Stiff, Dry (SC)	50-5"	MD				NP	3.0	20.7
			Organic Carbon Content (*) *237.1 MG/KG								
175											
180			Continued on Page 7								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: MW-2
LOCATION: Amarillo, Texas
Date: 7-15-94 thru 7-20-94
Ground Elevation: 3805.39'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION: Auger drilled to 74' Groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
180		X	Clayey Sand: Reddish Tan, w/Calcareous Nodules (15%) (SC)	50-3.5"	MD				NP		
185											
190		X	Sand: Tan, Well sorted, Fine Grain (SC) *444.12 MG/KG	50-4"	MD				NP		
195											
200		X		50-3.5'	MD				NP		
205			Sand: Tan, Fine Grain w/Small Pea Gravel (30%) (GW)								
210			Continued on Page 8								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: MW-2
LOCATION: Amarillo, Texas

Date: 7-15-94 thru 7-20-94
Ground Elevation: 3805.39'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Auger drilled to 74' Groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
210		X	*482.80 MG/KG Sand: Tan, Well Sorted, Fine Grain (SC)	50.4"	MD				NP		
215											
220		X		50-1"	MD						
225											
230		X	Sand: Tan, Coarse Grain w/Small Pea Gravel (30%) (SC) *336.34 MG/KG	50-1"	MD						
235											
240			Continued on Page 9								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: MW-2
LOCATION: Amarillo, Texas
Date: 7-15-94 thru 7-20-94
Ground Elevation: 3805.39'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Auger Drilled to 74' Groundwater encountered at 215'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS/FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
240		X	Sand: Tan, Coarse Grain w/Small Pea Gravel (SC) *529.70 MG/KG	50-3"	MD				NP		2.0
245		X		50-2.5"	MD						
			* T.D. - 245' *								

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Log of Boring

MW-3

A. Monitor Well Data Sheet

Texas Water Commission
Municipal Solid Waste Division
SE 67

Permittee or Site Name: City of Amarillo MSWLF
County: Potter
Date of Monitor Well Installation: 7-20-94
Monitor Well: Latitude: N35° 13'16" Longitude: W102° 00'35"
Monitor Well Groundwater
Gradient: Upgradient ___ Downgradient XX

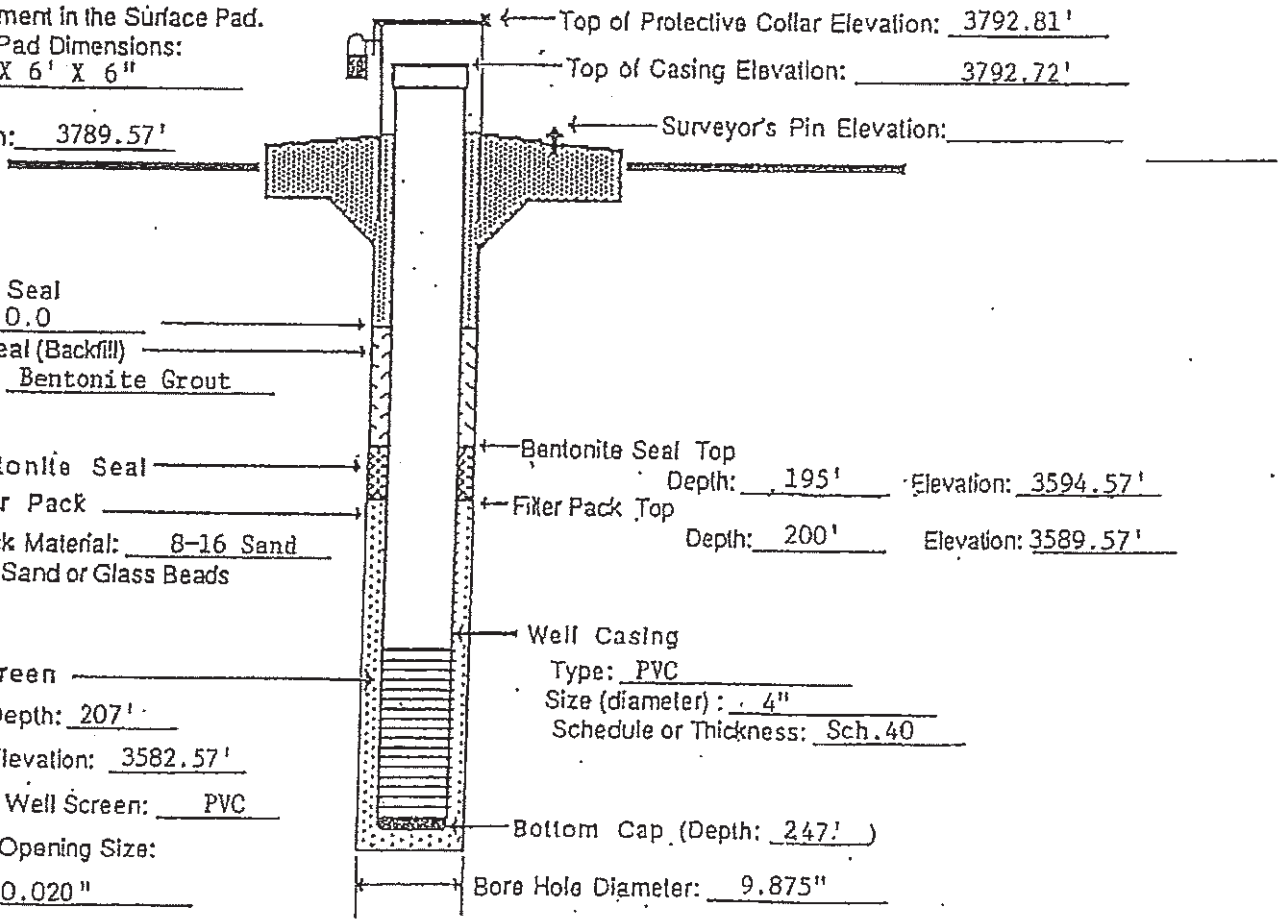
TDH Permit No.: 73
Monitor Well I.D. No.: MW-3
Date of Monitor Well
Development: 7-23-94
Monitor Well Driller
Name: Lee Peterson
License No.: 3045M

NOTE:
(A)The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimun distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3".
(D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.
(E) Well development should continue until water is clear; and pH and conductivity are stable.

Geologist, Hydrologist or Engineer Supervising Well Installation: Ray Hamby
Static Water Level Elevation (with respect to MSL) after Well Development: 3589.92'
Name of Geologic Formation(s) in which Well is completed: Ogallala

Type of Locking Device: Padlock.
Type of Casing Protection: Upright Well Protector

Concrete Surface Pad - Recommend steel reinforcement in the Surface Pad.
Surface Pad Dimensions: 6' X 6' X 6"
Surface Elevation: 3789.57'



LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-3
LOCATION: Amarillo, Texas

Date: 7-19-94 thru 7-26-94

Ground Elevation: 3789.57'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: (Continous Core) Auger Drilled to 70' Groundwater encountered at 200'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
0			Sandy Clay: Brown, Stiff, Dry(CL) (R) $K = 2.98 \times 10^{-8}$ cm/sec		11.3		33	14	19		93.7
5			Sandy Clay: Reddish Brown with Scattered Calcareous Nodules, Stiff, Dry (CL)		10.1		32	15	17		92.6
10			Sandy Clay: Tan with a Caliche Stringer (CL)		8.2		21	8	13		63.3
15			Sandy Clay: Reddish Tan with Scattered Calcareous Nodules, Stiff, Dry (CL)		8.3		32	16	16		85.8
20					9.8		31	14	17	3.5	90.7
25			Sandy Clay: Tan with Caliche Stringers (CL)		8.7		31	16	15		90.4
30			Continued on Page 2								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-3
LOCATION: Amarillo, Texas

Date: 7-19-94 thru 7-26-94

Ground Elevation: 3789.57'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: (Continous Core) Auger Drilled to 70' Groundwater encountered at 200'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
30											
35					8.2		32	70	12		72.9
			Sandy Clay: Reddish Tan with Scattered Calcareous Nodules Stiff, Dry (CL)								
40											
45			$K = 3.45 \times 10^{-5}$ cm/sec (R)		7.6						
50											
55											
60			Continued on Page 3								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-3
LOCATION: Amarillo, Texas

Date: 7-19-94 thru 7-26-94

Ground Elevation: 3789.57'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: (Continous Core) Auger Drilled to 70' Groundwater encountered at 200'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT, PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
60			Clayey Sand: Reddish Tan with Scattered Calcareous Nodules Stiff, Dry (SC)		7.2		30	20	10		32.8
65					6.9		25	12	13		53.1
70					7.4		27	16	11		44.1
75		X		21-6"	MD		26	19	7		34.7
				46-12"							
				50-13"							
80		X		50-1"	MD						
85		X		50-3"	MD						
90											

Continued on Page 4

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: MW-3
LOCATION: Amarillo, Texas
Date: 7-19-94 thru 7-26-94
Ground Elevation: 3789.57'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION(Continous Core) Auger Drilled to 70' Groundwater encountered at 200'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
90		X	Clayey Sand: Light Tan with Scattered Calcareous Nodules, Stiff (SC)	50-6"	MD		25	18	7		31.9
95		X		50-4"	MD		26	19	7		30.8
100		X		50-5"	MD		21	16	5		16.ɩ
105											
110		X		34-6" 50-8"	MD		23	19	4		28.1
			Clayey Sand: Reddish Tan with Scattered Calcareous Nodules, Stiff (SC)								
115											
120			Continued on Page 5								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-3
LOCATION: Amarillo, Texas

Date: 7-19-94 thru 7-26-94

Ground Elevation: 3789.57'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: (Continous Core) Auger Drilled to 70' Groundwater encountered at 200'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
120		X		38-6"	MD		19	16	3		21.8
				50-7"							
125											
130		X		38-6"	MD		22	19	3		22.6
				50-7.5"							
135			Clayey Sand: Reddish Tan with Scattered Calcareous Nodules, Stiff (SC)								
140		X		50-5"	MD		19	16	3		17.0
145											
150			Continued on Page 6								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: MW-3
LOCATION: Amarillo, Texas

Date: 7-19-94 thru 7-26-94
Ground Elevation: 3789.57'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION: (Continous Core) Auger Drilled to 70' Groundwater encountered at 200'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
150		X		50-6"	MD		19	16	3		15.7
155											
160		X		50-4"	MD		18	16	2		21.
165			Clayey Sand: Reddish Tan with Scattered Calcareous Nodules Stiff (SC)								
170		X		50-4"	MD		19	17	2		20.1
175			Tan Sand: Well Sorted with Calcareous Nodules (SC)								
180			Continued on Page 7								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: MW-3
LOCATION: Amarillo, Texas

Date: 7-19-94 thru 7-26-94
Ground Elevation: 3789.57'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION: (Continous Core) Auger Drilled to 70' Groundwater encountered at 200'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT. PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
180		X		50-4.5"	MD				NP		12.6
			Tan Sand: Pea Size Caliche Nodules (SC)								
185											
190		X		50-5"	MD				NP		13.0
195											
200		X		50-6"	MD				NP		14.1
205											
210			Continued on Page 8								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-3
LOCATION: Amarillo, Texas

Date: 7-19-94 thru 7-26-94

Ground Elevation: 3789.57'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: (Continous Core) Auger Drilled to 70' Groundwater encountered at 200'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
210		X		50-5"	MD				NP		14.9
215											
220		X		50-4"	MD				NP		23.7
225											
230		X		50-5.5"	MD				NP		
235			Clayey Sand: Tan with Scattered Calcareous Nodules, Stiff (SC)								
240			Continued on Page 9								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-3
LOCATION: Amarillo, Texas

Date: 7-19-94 thru 7-26-94

Ground Elevation: 3789.57'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: (Continous Core) Auger Drilled to 70' Groundwater encountered at 200'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
240											
245		X		50-2.5"	MD				NP		24.4
			* T.D. - 245' *								

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Log of Boring

MW-4

A. Monitor Well Data Sheet

Texas Water Commission
Municipal Solid Waste Division
SE 67

)mittee or Site Name: City of Amarillo MSWLF

TDH Permit No. : 73

County: Potter

Monitor Well I.D. No.: MW-4

Date of Monitor Well Installation: 8-17-94

Date of Monitor Well Development: 8-19-94

Monitor Well: Latitude: N35° 13'41" Longitude: W102° 00'35"

Monitor Well Groundwater Gradient: Upgradient ___ Downgradient X

Monitor Well Driller Name: Lee Peterson

License No.: 3045M

NOTE:

(A)The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimun distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3".
(D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.
(E) Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist or Engineer Supervising Well Installation: Ray Hamby

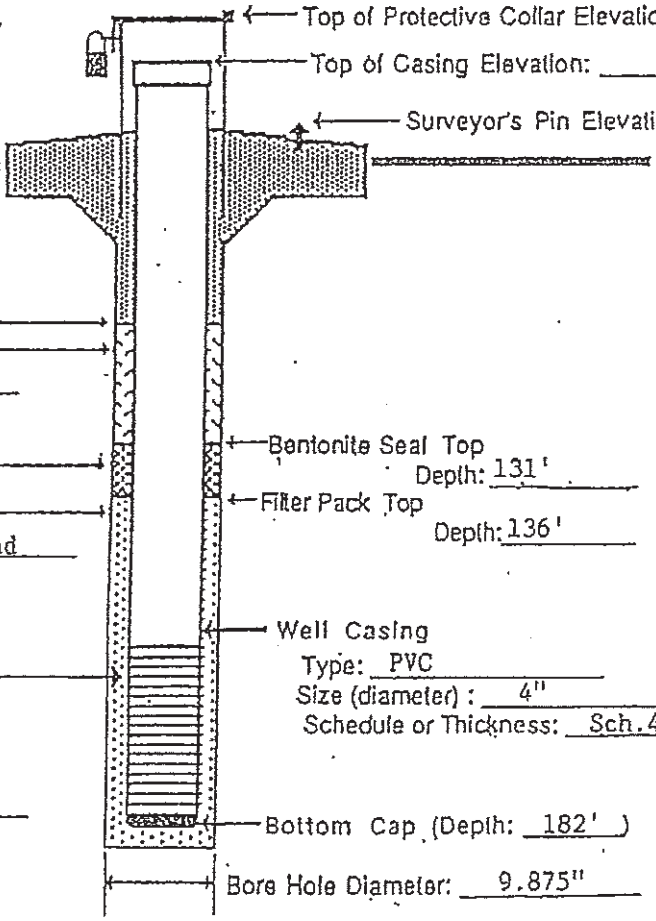
Static Water Level Elevation (with respect to MSL) after Well Development : 3593.18'

Name of Geologic Formation(s) in which Well is completed: Ogallala

Type of Locking Device: Padlock

Type of Casing Protection: Upright Well Protector

Concrete Surface Pad - Recommend steel reinforcement in the Surface Pad.
Surface Pad Dimensions: 6' X 6' X 6"
)face Elevation: 3746.88'



← Top of Protective Collar Elevation: 3750.58'
← Top of Casing Elevation: 3750.26'
← Surveyor's Pin Elevation: ___

Concrete Seal Depth: 0.0
Casing Seal (Backfill) Material: Bentonite Grout

Bentonite Seal
Filter Pack
Filter Pack Material: 8-16 Sand
Sterilized Sand or Glass Beads

← Bentonite Seal Top Depth: 131' Elevation: 3615.88'
← Filter Pack Top Depth: 136' Elevation: 3610.88'

Well Screen
Top Depth: 142'
Top Elevation: 3604.88'
Type of Well Screen: PVC
)creen Opening Size: 0.020"

← Well Casing
Type: PVC
Size (diameter) : 4"
Schedule or Thickness: Sch.40

← Bottom Cap (Depth: 182')

← Bore Hole Diameter: 9.875"

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
BORING NO.: MW-4
LOCATION: Amarillo, Texas

Date: 8-11-94 thru 8-17-94
Ground Elevation: 3746.88'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION: Air drilled to 150' Groundwater encountered at 155'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT, PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
0			Sandy Clay: Dark Brown, Dry (CL)		9.2		34	15	19		93.8
5		X	Sandy Clay: Reddish Tan w/Scattered Calcareous Nodules (8%) Stiff, Dry (CL) K = 2.83 X 10^{-7} cm/sec	13-6"	8.5		32	15	17		89.7
				30-12"							
				47-18"							
10		X		20-6"	7.2		32	14	18	2.50	91.3
				50-12"							
15		X		20-6"	8.2		31	14	17		88.3
				50-11.5'							
20		X		42-6"	7.6					2.25	86.3
25		X		50-5.5"	6.4						85.5
30											

Continued on Page 2

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-4
LOCATION: Amarillo, Texas

Date: 8-11-94 thru 8-17-94

Ground Elevation: 3746.88'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 150' Groundwater encountered at 155'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
'30		X		50-6"	7.4		30	19	11		83.7
			Caliche: Light Tan, Limestone Cap, Very Hard (CL) (R)								
35											
40		X		50-1.5"	3.8						
			Clayey Sand: Reddish Tan Scattered Calcareous Nodules (10%) Stiff, Dry (SC)								
45		X		31-6"	6.9		33	17	16		44.5
				50-10"							
50		X		28-6"	6.1		28	17	11	2.25	39.1
				50-9"							
55		X		40-6"	6.9		30	17	13		37.3
				50-7.5"							
60											

Continued on Page 3

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-4
LOCATION: Amarillo, Texas

Date: 8-11-94 thru 8-17-94

Ground Elevation: 3746.88'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 150' Groundwater encountered at 155'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
60		X		11-16"	5.7		25	15	10		36.3
				36-12"							
				50-15"							
65		X		16-6"	6.4		25	16	9		49.4
				48-12"							
				50-12.5'							
70		X		50-1.5"							
75		X		30-6"	4.9		25	16	9		31.9
				50-8.5"							
80		X		19-6"	5.6		23	19	4		27.7
				50-10.5'							
85		X		36-6"	4.1		23	14	9		28.9
				50-8.5"							
90											

Continued on Page 4

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
Date: 8-11-94 thru 8-17-94

BORING NO.: MW-4
LOCATION: Amarillo, Texas
Ground Elevation: 3746.88'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION: Air drilled to 150' Groundwater encountered at 155'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
90		X		50-6"	3.7		24	16	8		28.1
95		X		35-6"	4.3		22	15	7		27.7
				50-6.5"							
100		X		37-6"	3.3		23	18	5		15
				50-7.5"							
			Clayey Sand: Reddish Tan w/Scattered Calcareous Nodules(10%) Stiff, Dry (SC)								
105											
110		X		50-5.5"	3.0					3.5	24.5
115											
120											

Continued on Page 5

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-4
LOCATION: Amarillo, Texas

Date: 8-11-94 thru 8-17-94

Ground Elevation: 3746.88'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 150' Groundwater encountered at 155'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT, PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
120		X		50-5"	3.4					3.5	26.3
125											
130		X		50-6"	2.7		19	15	4		17.7
135											
140		X		50-5.5"	3.1				NP		19.3
145			Sand: Tan, Fine Grain w/Scattered Pea Gravel (SC)								
150			Continued on Page 6								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-4
LOCATION: Amarillo, Texas

Date: 8-11-94 thru 8-17-94

Ground Elevation: 3746.88'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 150' Groundwater encountered at 155'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
150		X	K = 8.34 X 10^{-5} cm/sec	23-6"	MD						14.1
			Sand: Tan w/Pea Size Calcareous Nodules(15%) Well Sorted (SC)(R)								
155											
160		X		50-3"	MD				NP		15.
165											
170		X	Sand: Tan w/Scattered Calcareous Nodules(10%) Well Sorted (SC)	45-6"	MD						21.3
				50-6.5"							
175											
180											

Continued on Page 7

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-4
LOCATION: Amarillo, Texas

Date: 8-11-94 thru 8-17-94

Ground Elevation: 3746.88'

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION: Air drilled to 150' Groundwater encountered at 155'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
180		X	Sand: Reddish Tan w/Scattered Calcareous Nodules (SC)	50-5"	MD		22	20	NP		13.1
			* T.D. - 180' *								

1994 – Dyess Peterson Testing Laboratory, Inc.
Log of Boring

MW-5

A. Monitor Well Data Sheet

Texas Water Commission
Municipal Solid Waste Division
SE 67

Permittee or Site Name: City of Amarillo MSWLF

County: Potter

Date of Monitor Well Installation: 8-20-94

Monitor Well: Latitude: N35° 14'09" Longitude: W102° 00'44"

Monitor Well Groundwater

Gradient: Upgradient XX Downgradient __

TDH Permit No.: 73

Monitor Well I.D. No.: MW-5

Date of Monitor Well Development: 8-22-94

Monitor Well Driller

Name: Lee Peterson

License No.: 3045M

NOTE:

(A) The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimun distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3".
(D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.
(E) Well development should continue until water is clear: and pH and conductivity are stable.

Geologist, Hydrologist or Engineer Supervising Well Installation: Ray Hamby

Static Water Level Elevation (with respect to MSL) after Well Development: 3610.14'

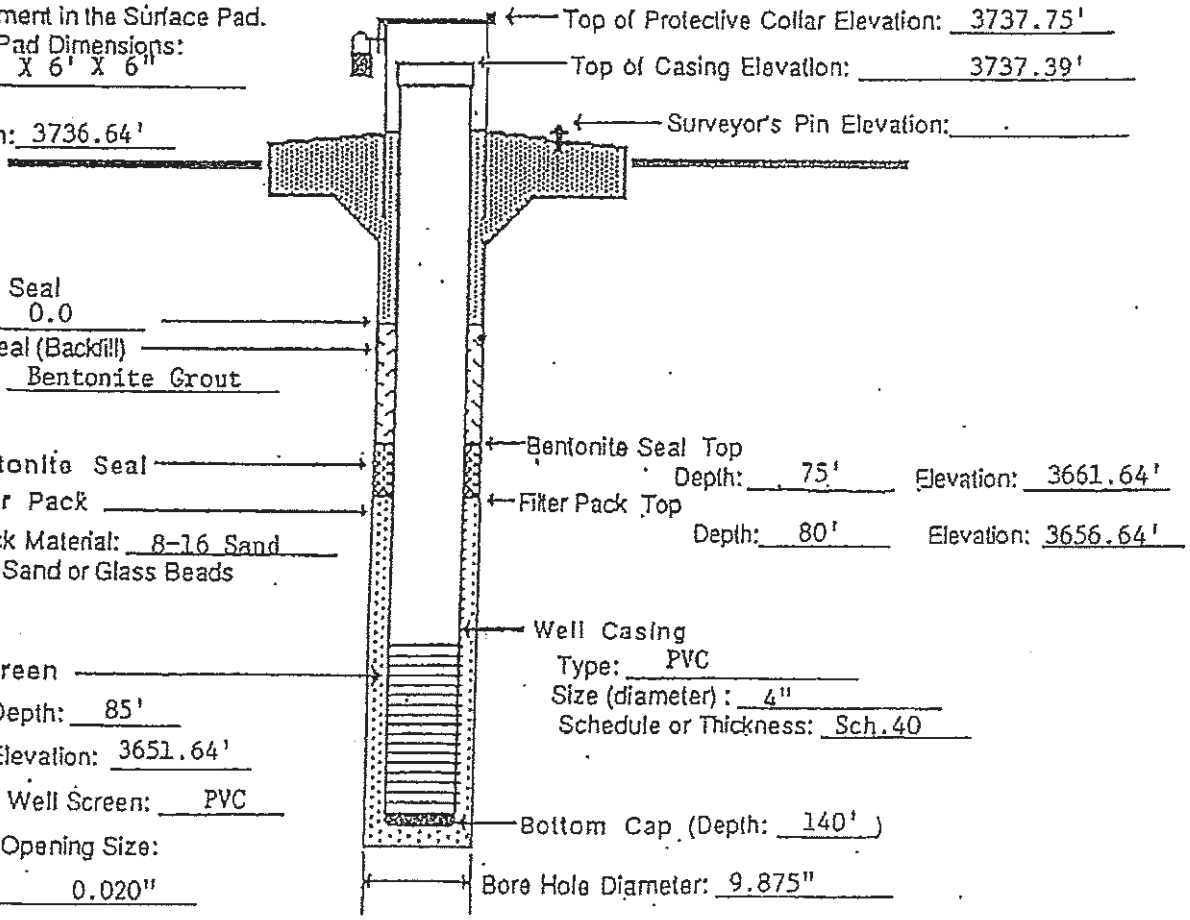
Name of Geologic Formation(s) in which Well is completed: Ogallala

Type of Locking Device: Padlock

Type of Casing Protection: Upright Well Protector

Concrete Surface Pad - Recommend steel reinforcement in the Surface Pad.
Surface Pad Dimensions: 6' X 6' X 6"

Surface Elevation: 3736.64'



LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-5
LOCATION: Amarillo, Texas

Date: 8-19-94 thru 8-21-94

Ground Elevation: 3736.64

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 115'
Mud Drilled to 140'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
0			Sandy Clay: Reddish Brown w/Calcareous Nodules, Stiff, Dry (CL)								
5		X	Caliche: Light Tan, Limestone Layers, Fractures, Hard (CL)	19-6"	7.7		28	25	3		24
				43-12"							
				50-13.5"							
10		X	Clayey Sand: Reddish Brown with Calcareous Nodules, Stiff, Dry (SC)	50-4.5"						4.0	
15		X		50-5"	6.9		25	22	3		34
			Clayey Sand: Reddish Tan with Scattered Calcareous Nodules(SC)								
20		X		50-2"							
25		X	Clayey Sand: Light Tan with Caliche(Very Hard)(SC)	50-5.5"	5.7		18	16	2		22
30			Continued on Page 2								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-5
LOCATION: Amarillo, Texas

Date: 8-19-94 thru 8-21-94

Ground Elevation: 3736.64

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 115'
Mud Drilled to 140'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
30		X	K = 7.73 X 10^{-4} cm/sec (R) Clayey Sand: Reddish Tan with Scattered Calcareous Nodules, Dry (SC)	22-6"	5.2		25	21	4		17
				50-11"							
35		X		50-3"							
40		X		24-6"	6.1		19	16	3		24
				50-11"							
45		X		27-6"	5.6				NP		11
				50-10"							
50		X		31-6"	4.8				NP		11
			Clayey Sand: Reddish Brown, Stiff, Dry (SC)	50-9"							
55		X		50-6"	4.2		19	16	3		10
			Clayey Sand: Reddish Tan with Scattered Calcareous Nodules Dry (SC)								
60			Continued on Page 3								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-5
LOCATION: Amarillo, Texas

Date: 8-19-94 thru 8-21-94

Ground Elevation: 3736.64

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 115'
Mud Drilled to 140'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
60		X	Clayey Sand: Reddish Tan to Tan with Scattered Calcareous Nodules Dry (SC)	50-4"	3.3						
65		X		50-6"	4.6		25	22	3		15
70		X		34-6"	4.3				NP		24
				50-7"							
75		X		50-5.5"	3.1		28	24	4		14
80		X	Gravel: Medium Coarse	50-6"	1.3				NP		2
85		X		45-6"	1.9						3
				50-7"							
			Clayey Sand: Reddish Tan to Tan with Coarse Gravel (SC)								
90			Continued on Page 4								

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-5
LOCATION: Amarillo, Texas

Date: 8-19-94 thru 8-21-94

Ground Elevation: 3736.64

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 115'
Mud Drilled to 140'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT, PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
90		X	Clayey Sand: Reddish Tan to Tan with Coarse Gravel (SC)	31-6"	1.6						4
95											
100											
105											
110		X		16-6"	6.1				NP		85
				50-9"							
115					MD						
120			Continued on Page 5		MD						

LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo

BORING NO.: MW-5
LOCATION: Amarillo, Texas

Date: 8-19-94 thru 8-21-94

Ground Elevation: 3736.64

DRILLING METHOD: Air/Mud Rotary

GROUNDWATER INFORMATION:
Air Drilled to 115'
Mud Drilled to 140'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS / FT, PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
120			Clayey Sand: Reddish-Tan to Tan With Coarse Gravel (SC)		MD						
125			Silty Clay: Red to Deep Red, Red Bed (MH)		MD						
130					MD						
135					MD						
140					MD						
			* T.D. - 140' *								

1994 – Dyess Peterson Testing Laboratory, Inc.
Log of Boring
MW-6

A. Monitor Well Data Sheet

Texas Water Commission
Municipal Solid Waste Division
SE 67

)mittee or Site Name: City of Amarillo MSWLF

TDH Permit No.: 73

County: Potter

Monitor Well I.D. No.: MW-6

Date of Monitor Well Installation: 8-18-94

Date of Monitor Well Development: 8-19-94

Monitor Well: Latitude: N35° 14'07" Longitude: W102° 01'23"

Monitor Well Groundwater Gradient: Upgradient ___ Downgradient X

Monitor Well Driller Name: Lee Peterson

License No.: 3045M

NOTE:

(A)The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimun distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3".
(D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.
(E) Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist or Engineer Supervising Well Installation: Ray Hamby

Static Water Level Elevation (with respect to MSL) after Well Development: 3597.53'

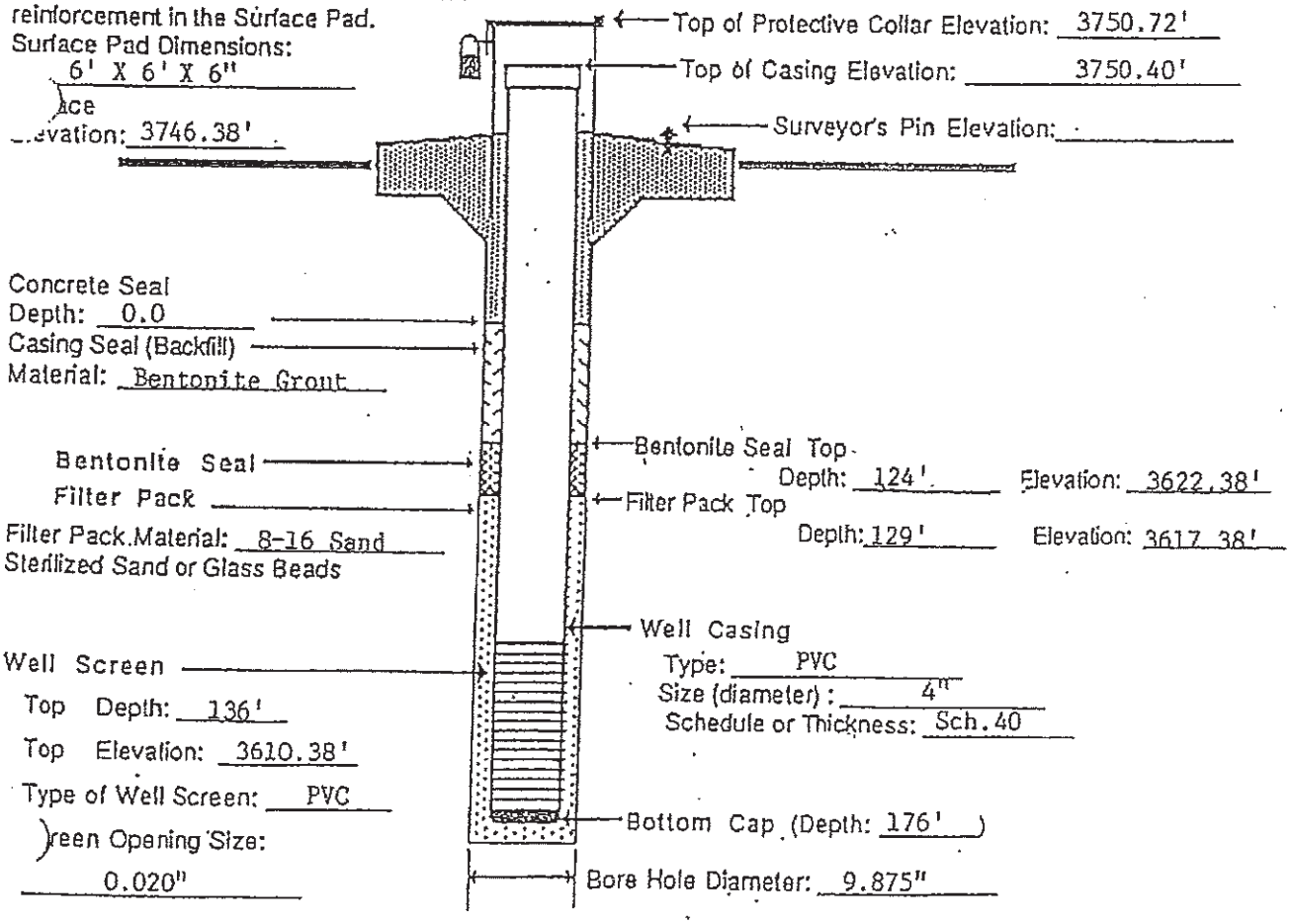
Name of Geologic Formation(s) in which Well is completed: Ogallala

Type of Locking Device: Padlock

Type of Casing Protection: Upright Well Protector

Concrete Surface Pad - Recommend steel reinforcement in the Surface Pad.
Surface Pad Dimensions: 6' X 6' X 6"

)ace)evation: 3746.38'



LOG OF BORING

PROJECT: Amarillo MSWLF
CLIENT: City of Amarillo
Date: 7-8-94 thru 7-12-94
8-17-94 thru 8-19-94

BORING NO.: MW-6
LOCATION: Amarillo, Texas
Ground Elevation: 3746.38'

DRILLING METHOD: Air/Mud Rotary
GROUNDWATER INFORMATION:
Air Drilled to 155'
Mud Drilled to 180'

DEPTH, FEET	SYMBOL	SAMPLE	DESCRIPTION OF STRATUM	SPT BLOWS/FT, PENETROMETER TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	UNCONFINED COMPRESSIVE STRENGTH, TSF	% PASSING NO. 200 SIEVE
0			Caliche: Limestone Cap, Extremely Hard, Outcropping Existing at Surface (CL)								
5		X									
10		X	Clayey Sand: Light Tan Large Caliche Nodules (SC)	50-4"	9.7		35	28	7		23.3
15		X		20-6"	6.6		25	22	3		33.8
				50-12"							
20		X		50-6"	6.2		28	25	3		23.1
25		X	Clayey Sand: Reddish Tan with Scattered Calcareous Nodules Stiff, Dry (SC)	50-5.5"	7.2		28	22	6		30.5
30			Continued on Page 2								

Part III

Attachment 5

Groundwater Characterization Report

Permit - MSW No. 73A
Issued August 22, 2007

City of Amarillo,
Potter County, Texas

Revised December 2009

STATE OF TEXAS
DONALD D. JAMES
GEOLOGY
360
LICENSED
PROFESSIONAL GEOSCIENTIST

12-2-09

Donald D. James, P.G.
Texas P.G. No. 360

STATE OF TEXAS
M. M. SHIFLETT
43763
LICENSED
PROFESSIONAL ENGINEER

Michael M. Shiflett, P.E.
Texas P.E. No. 43763

12-2-2009
Signing for Table of Contents (i, ii) and pages 1-16.

KLEINFELDER
Bright People. Right Solutions.

Kleinfelder Central, Inc. Engineering No. F-5592

City of Amarillo Landfill
Part III, Attachment 5

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Appendix 5B – Updated Hydrogeologic Information (continued)

- Groundwater Contour Map, October 14, 1998
- Groundwater Contour Map, April 17, 2000
- Groundwater Contour Map, October 16, 2001
- Groundwater Contour Map, April 14, 2003
- Groundwater Contour Map, October 18, 2004
- Groundwater Contour Map, October 17, 2005
- Groundwater Contour Map, April 18, 2006
- Groundwater Contour Map, April 18, 2007
- Groundwater Contour Map, October 15, 2007
- Groundwater Contour Map, March 18, 2008
- Groundwater Contour Map, August 14, 2008
- Groundwater Contour Map, November 19, 2008
- Groundwater Contour Map, January 12, 2009
- Groundwater Contour Map, April 13, 2009
- Structural Surface Contour Map of the Triassic Dockum Formation
- Kleinfelder Logs of Borings 203 and 204 with Piezometer Construction Detail
- Monitoring Well Data Sheet and Logs

OVERVIEW OF ATTACHMENT 5 INFORMATION

The City of Amarillo plans to vertically expand its landfill. The waste footprint of the proposed landfill will be identical to the footprint that the TNRCC (now TCEQ) originally approved in 1975 and reviewed again as part of the Alternate Liner Demonstration (ALD) submitted in compliance with the requirements of the RCRA Subtitle D upgrades. The ALD provided for utilizing a flexible membrane liner including a geosynthetic clay liner (FML/GCL). Additionally, the original permit (granted July 2, 1975) had no provision for limiting the depth of excavation. The 1994 Subtitle D upgrade prepared by HDR provided excavation grades for a portion of Cell 4, with the other cells indicating excavation depths. To comply with TCEQ rule changes made March 2006, this permit has been modified.

For this permit modification the hydrogeologic information that is contained in the 1994 Alternate Liner Demonstration (see Appendix 5B) and contained in the 2005 permit amendment has been reviewed. The 1994 Alternate Liner Demonstration interprets the field permeability tests, water level measurements, hydrogeologic units, potentiometric surface, recharge/discharge mechanisms, and groundwater flow regime (including groundwater flow and velocity) of the regional and site geology and the site subsurface data. The information contained in the 1994 report remains applicable to this permit amendment.

Groundwater flow direction and gradients from 2008 data are similar to those interpreted from the 1994 and 2005 data. The recent groundwater measurements indicates the Ogallala aquifer has lowered as much as 1 foot from the 2005 measurements and from 4 to 6 feet lower in elevation than measured in 1994, over the southern half of the site. Six groundwater-monitoring wells have been used for compliance monitoring.

As a portion of the 2005 permit amendment, four additional geotechnical borings were drilled. Borings 201 and 202 were drilled June 7 and 8, 2005 in the northeastern portion of the permitted area. The purpose of these borings was to retrieve soil samples and to review stratigraphic information with existing subsurface information (see Attachment 4 for discussion). Recovered

soil samples were used for further analysis regarding landfill foundation settlement as presented in Attachment 4, 2005 permit document. Borings 203 and 204 were drilled on September 7 and 8, 2005 in the western portion of the permitted area in order to install piezometers, and to gather additional groundwater information.

The groundwater characterization information from the 1994 permit documents is attached and incorporated in its entirety as Appendix 5A to this updated 2005 report. Appendix 5B to this 2008 report contains an updated site plan with monitoring well locations including twenty two new monitoring wells, the revised monitoring well network details, updated groundwater elevations, potentiometric surface map, and updated monitoring well data.

Attachment 5 Appendices

Appendix 5A – Limited Groundwater Characterization Investigation (1994 permit documents)

- 1994 Limited Groundwater Characterization Investigation with attachments

Appendix 5B – Updated Hydrogeologic Information

- Existing and Proposed Monitoring Well Locations
- Typical Monitoring Well Detail
- Proposed Monitoring Well Network
- Groundwater Elevation Summary, September 1994 to April 13, 2009
- Groundwater Contour Map with Directional Flow and Point of Compliance
- Groundwater Contour Map, November 9, 1994
- Groundwater Contour Map, April 14, 1995
- Groundwater Contour Map, October 16, 1995
- Groundwater Contour Map, April 15, 1997
- Groundwater Contour Map, October 14, 1998
- Groundwater Contour Map, April 17, 2000
- Groundwater Contour Map, October 16, 2001
- Groundwater Contour Map, April 14, 2003

Appendix 5B – Updated Hydrogeologic Information (2008) (continued)

- Groundwater Contour Map, October 18, 2004
- Groundwater Contour Map, October 17, 2005
- Groundwater Contour Map, April 18, 2006
- Groundwater Contour Map, April 18, 2007
- Groundwater Contour Map, October 15, 2007
- Groundwater Contour Map, March 18, 2008
- Groundwater Contour Map, August 14, 2008
- Groundwater Contour Map, November 19, 2008
- Groundwater Contour Map, January 12, 2009
- Groundwater Contour Map, April 13, 2009
- Structural Surface Contour Map of the Triassic Dockum Formation
- Kleinfelder Logs of Borings 203 and 204 with Piezometer Construction Detail
- Monitoring Well Data Sheet and Logs

1.0 GROUNDWATER MONITORING SYSTEM

The groundwater monitoring system plan currently in place at the site was approved by TNRCC (TCEQ) in a letter dated March 28, 1995. Subsequent approval was made by the TCEQ for the December 2005 permit amendment for the groundwater monitoring system additions. The entire records of monitoring well installations are on file with the TCEQ. The current monitoring well network consists of six locations labeled MW-1 through MW-6. Piezometers labeled PZ-1, PZ-2, and PZ-3 (drilled July through August 1994) were converted to Monitoring Wells 7, 8, and 9 respectively, and are located interior of the landfill boundary. Monitoring Wells 10, 11, 12, and 13 (drilled October through November 1999) were subsequently constructed south of Monitoring Wells 7 and 8, but north of the southern landfill boundary. Since Monitoring Wells 7 through 13 are interior of the site, but outside the current fill areas, these wells are not the monitoring wells of record, but have been used for recording groundwater data.

For this permit modification and in compliance with the March 2006 TCEQ rule changes, the current monitoring well network is proposed to be replaced with a new network of twenty two (22) new monitoring wells. To spare confusion with previously documented borings and wells the new monitoring wells are to be numbered in an "800" series to relate to this 2008/2009 modification. Plate 1 of Appendix 5B presents the existing and proposed monitoring well locations.

An updated construction detail and table for the updated, proposed monitoring well network is included in Appendix 5B, Plates 2 and 3. The table presented on Plate 3, Appendix 5B, presents monitoring well designations and elevations for screened interval, filter pack, bentonite seal, and bottom of well for the proposed new monitoring well network. A discussion regarding Plate 3, Proposed Monitoring Well Network Screen Interval Elevations, is presented in Section 4.0. A plan to add seven additional proposed monitoring wells (MW-14 through MW-20) was proposed for the 2005 permit amendment but is superseded through this permit modification.

The existing monitoring wells are currently being sampled semi-annually according to the Groundwater Sampling and Analysis Plan (GWSAP). Each monitoring well has been verified by visual observations for the 2005 Amendment as to general location. The surface completions including caps, pads, and guard posts are in acceptable condition. The monitoring well sampling events continue to document that each well is functioning as intended.

The depths to groundwater within the monitoring wells are measured for each sampling event. The elevation of the groundwater as determined from these measurements is summarized in tabular form presented on Plates 4 and 5, Appendix 5B.

The trend in the saturated thickness of each existing monitoring location is a thinning of the saturated zone. The trend is due to increased groundwater usage throughout the region (i.e., not associated with Amarillo Landfill) resulting in a general decline in the groundwater elevations and differing recharge rates to the aquifer from localized percolation and permeability. The soils overlying the saturated zone of the Ogallala provide an unsaturated layer above the water table. No shallow perched water tables within the unsaturated zone have been encountered beneath the landfill. The presence of the unsaturated zone is consistent with regional hydrogeology information.

Each of the six existing network monitoring wells continues to provide samples from screened well sections within the saturated zone of the Ogallala. The depths of sampling within the wells will continue to be monitored at each sampling event. The current monitoring well network continues to function effectively, but will be replaced as discussed in the following sections.

2.0 POTENTIOMETRIC SURFACE

The existing monitoring wells indicate similar trends of increasing and decreasing groundwater elevations among all well locations for each sampling event. As interpreted from the groundwater measurements, the potentiometric surface continues to generally descend from the north to the south. Consistent with 1994, the 2008/2009 groundwater gradient is approximately twice as steep in the northeastern one-third of the site as compared to the southwestern two-thirds of the site. Additionally, a south-southwesterly trending hydraulic ridge is interpreted in the northeastern portion of the site locally forming radial flow to the southwest and southeast.

The 2008/2009 groundwater elevation trends indicate a continued decrease (lower) in the potentiometric surfaces since 2005. Decreases range from one foot along the northern perimeter of the site to ½-foot along the southern perimeter of the site. Saturated thicknesses of the Ogallala Aquifer estimated from the potentiometric surfaces down to the top of the Triassic Dockum formation (Plate 25, Appendix 5B) show thicknesses to be less than 2 feet along the northern perimeter and from approximately 47 to 55 feet along the southern perimeter. A chronology of groundwater elevation data for this site indicates a trend of thinning saturated thickness of the Ogallala aquifer. Regional and national data show this to be the trend for the entire Ogallala aquifer.

Two additional deep borings were drilled during the 2005 Permit Amendment and converted to standpipe piezometers. The borings/piezometers have been designated as B-203 and B-204 and are located along the western side of the permitted landfill. Including the groundwater elevation data from 203 and 204 along with the other monitoring locations, the potentiometric surface has been updated and presented as groundwater contour maps as presented on Plates 18 through 24, Appendix 5B. These groundwater maps provide the more recent historic data from the site. Groundwater contour maps presented upon Plates 7 through 17 provide the older historic data for comparison. Groundwater flow paths for 2008/2009 are similar to those estimated for 2005 and continue to generally indicate the northern and the northern two-thirds of the western boundaries of the landfill are upgradient for the permitted site. These supplemental groundwater elevation

points indicate the equipotential lines within the western quarter of the site bend slightly toward the southeast along the northern two-thirds of the western boundary, and flow direction approximately parallel to the site boundary within the southern one-third of the western boundary. The eastern boundary of the landfill area has maintained a relatively consistent potentiometric surface since 1994. The eastern boundary of the landfill continues to show a slight southeastern groundwater vector, which places the eastern boundary as downgradient to the permitted site, although groundwater flow encountering the eastern boundary has a narrow site entry area east of existing Monitoring Well 5.

The groundwater elevation trends indicate that a slight decrease (lower) in the potentiometric surfaces since 1994, especially in the southern half of the site. This is consistent with the regional groundwater information published by the High Plains Underground Water Conservation District No. 1. The groundwater measuring locations (monitoring wells) confirm groundwater elevation trends and flow directions similar to those measured in 1994 and also measured within the monitoring wells during sampling events since 1994.

3.0 MONITORING WELL LOCATIONS

The existing monitoring well locations were verified in the field. The groundwater data trends indicate that variations in the groundwater elevations within the monitoring wells are similar across the network. This indicates that groundwater flow directions and gradients continue to descend southward. Therefore, the existing monitoring well network continues to monitor both upgradient and downgradient locations as intended. However, a review of well configurations and the thinning of the aquifer saturated thickness has lead the City to desire to upgrade the entire monitoring well network for the site as a part of this modification.

Boring logs for the wells and the on-going groundwater measurements confirm the presence of groundwater within a single hydrogeologic unit (Ogallala) as interpreted by the 1994 permit document. There are no interpreted shallow, perched water pockets above the saturated zone of the Ogallala within the permitted area.

Subchapter J of the TAC Title 30 2006 revisions require that a facility have a point of compliance monitoring network with well spacing not to exceed 600 feet and for the detection of groundwater contamination in the uppermost aquifer at the point of compliance (vertical surface located no more than 500 feet from the hydraulically downgradient waste management boundary). The point of compliance is designated along the southern, eastern, and southern one-third of the western permit boundaries as depicted on Plates 1 and 6, App. 5B, and is the first time the point of compliance has been designated for this landfill site. Groundwater measurements from 2005 to 2009 consistently indicate inward gradients along the entire northern and northern two-thirds of the western side of the site. The southern one-third of the western perimeter of the site has pressure gradients approximately orthogonal, that is, groundwater flow direction parallel to the site boundary. Based on the flow paths, the entire eastern and southern boundaries of the site are indicated to be within outward gradients from the site. Since there are no perched water tables at the site, the monitoring wells are each deep wells placed completely into the groundwater zone depicted by the potentiometric surface. On this premise 20 new monitoring wells will be spaced along the site perimeter at the point of compliance. Two

additional upgradient wells (818, 819) will be installed as well as three upgradient piezometers (PZ-823, 206, and 207). The locations of the monitoring wells and piezometers are presented on Plates 1 and 6, Appendix 5B.

Plate 6, Appendix 5B has been included to show the groundwater contour elevations, selected flow paths and locations for the proposed monitoring wells and piezometers. This plate is intended to help the reader visualize the proposed monitoring well and piezometer network as it relates to the potentiometric surface.

Based on the six existing on site monitoring wells and two off site State registered water wells, a structural map of the top of the Dockum formation has been prepared and is presented as Plate 25, in Appendix 5B of this permit modification. The screened intervals for the new monitoring well network will fully penetrate the Ogallala aquifer and terminate on top of the Triassic Dockum geologic formation. Plate 3, Appendix 5B summarizes the proposed monitoring well network configurations including anticipated screening intervals.

The 6 existing monitoring wells in the currently approved groundwater monitoring system will be left in place until the regulatory background sampling period for the new wells is satisfied, at which time the existing monitoring wells MW-3, MW-4, and MW-6 will be decommissioned. Monitoring Wells 1 and 2 (MW-1 and MW-2) will remain as a point of compliance wells in the facility groundwater monitoring systems until TCEQ approval is granted for decommissioning. Monitoring Well 5 will be evaluated in comparison with PZ-823 to determine if MW-5 should be decommissioned or if it should remain within the monitoring well network. As previously mentioned, it is well documented that the entire Ogallala Aquifer is thinning due to withdrawal rates, due mainly to agricultural irrigation demands. The permitted site is experiencing the same trend. Therefore, replacing the existing monitoring wells allows for adjustment of the screened intervals within the saturated zone.

Therefore, the groundwater monitoring system for the site will consist of Upgradient Monitoring Wells 818, and 819 along with MW-5 and, Downgradient Monitoring Wells 801, 802, 803, 804,

805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, and 817. Downgradient Monitoring Wells 820, 821 and 822 will be installed once Cell 12 is developed, but prior to waste placement within this cell.

As mentioned, the groundwater level beneath the landfill continues to decrease, which is a regional trend. The groundwater flow gradients along the western side of the landfill will probably continue to shift if this groundwater lowering trend continues. Therefore in addition to the existing piezometers PZ-203 and PZ-204, piezometers PZ-206, PZ-207, PZ-821, and PZ-822 will be installed along the western side of the site and groundwater measurements will be made in these piezometers when measurements and sampling occurs within the monitoring well network. Also, in order to further confirm groundwater levels being measured in MW-5, piezometer PZ-823 will be installed near MW-5 and groundwater levels measured during normal sampling events. Each of the piezometers to be constructed as discussed above will be constructed to monitor well specifications per 30 TAC §330.421After each sampling event, a groundwater contour map will be produced and the trend of the pressure gradients and flow directions, particularly along the western side of the site, will be analyzed. If gradients shift, the point of compliance may be altered and the monitoring well network updated to adequately monitor the groundwater flow.

A groundwater contour map will be produced for each monitoring well sampling event and submitted as part of the groundwater monitoring report. Due to the continued decrease in groundwater elevation within the Ogallala, this ongoing evaluation will be useful since it appears that the western portion of the site may be experiencing a slight shift in groundwater flow direction (more southerly without the easterly component). By observing groundwater flow lines as presented on Plate 6, it can be seen that the proposed monitoring well network installed at upgradient locations will intercept groundwater flow, as well as intercepting downgradient flow along the southern and eastern boundaries. As can be observed, the southern boundary of the landfill intercepts most of the groundwater flow entering the site from the north and west.

Each sampling event will include an updated groundwater contour map and a determination whether the point of compliance requires any modification due to the groundwater flow paths. Any recommendation for changes to the system will be made in accordance with 30 TAC §330.407(c)(5). The MSW Permits Section staff (TCEQ) will review the determination of the direction of groundwater flow for each sampling event. The groundwater level data and piezometric surface maps will be submitted on a semi-annual basis for TCEQ review. The submittal will include a table providing all groundwater level data obtained from each piezometer and monitor well since installation. If a determination is made that alters the point of compliance, a permit modification request will be submitted to the TCEQ in accordance with 30 TAC §305.70(j)(26) to alter the permit point of compliance and make necessary adjustment of the downgradient monitoring well plan. The modification will be submitted within 90 days after the determination is made. Once concurrence and approval is received from TCEQ for any permit modification, any additional wells required will be installed or the appropriate piezometers converted and background sampling initiated at or before the next Detection Monitoring Event for the groundwater monitoring system. The point of compliance will be extended to include any new wells installed or piezometers that are converted to monitor wells.

Following acceptable background monitoring by TCEQ, existing Monitoring Wells 3, 4 and 6 will be decommissioned, with MW-5 evaluated at that time.

4.0 MONITORING WELL SCREENED INTERVALS

As discussed, it is well documented that the overall trend of the Ogallala formation that lies beneath the central section of the United States is decreasing in top surface elevation due to withdrawal. While it is the intent of the monitoring well system at the landfill to monitor the saturated zone, it is also necessary to maintain the bentonite seal above the screened interval below the water level for hydration purposes. With the current thinning of the saturated section, the placement of the screen and bentonite seal becomes important.

The groundwater levels at the landfill have been plotted and observed for trends. Although the groundwater level beneath the landfill is decreasing in elevation across the entire site, not every monitoring location presents identical rates of decrease. By observing the trends, an annual decrease of 0.2 feet per year has been approximated. When selecting a life expectancy of a monitoring well of at least 15 years, the elevation of top of seal can be calculated. Plate 3_Appendix 5B presents the calculated screen length for each planned monitoring location. Due to the relatively thin aquifer saturated thickness at locations MW-815, 816, and 817, and also at PZ-823, this projected decrease does not produce a saturated thickness suitable for monitoring.

At each proposed monitoring location, the initial pilot boring will determine saturated thickness at the time of drilling. For the thin sections mentioned above, the field geologist on site will communicate with the permitting engineer to determine the appropriate length of screen and depth of bentonite seal to be installed. The top of seal may be altered from the elevations presented in this document depending upon the actual observations at time of drilling.

4.1 POTENTIAL FLOW PATHWAYS

In the event that the primary composite liner system is compromised and a release occurs, the anticipated primary pathway of contaminant transport would be vertically and to a lesser extent horizontal through the unsaturated materials. The majority of the subsurface materials consist of

sand and clayey sand in the unsaturated zone, and then sand in the saturated zone of the Ogallala Formation. Caliche layers are also present in the upper portion of the unsaturated zone that would have some affect on vertical migration. Some horizontal migration would be expected as a result of the caliche and finer grained material in the unsaturated zone. Because of the relative thickness of the unsaturated zone and the finer grained nature of the unsaturated zone materials, any release of contaminants could likely become entrapped in the soil and slowly released over time. Infiltration of surface water is generally minimal in this area, and therefore it is not expected that percolation of surface water into the subsurface would aid in the leaching of any contaminant that may have been released due to a breach in the liner system.

In the event a contaminant reaches the saturated zone, the primary mechanisms controlling the distribution of chemical transport would be advection and dispersion through the aquifer materials in the direction of groundwater flow as shown on Plate 6, Appendix 5B. The predominant downgradient groundwater-monitoring boundary for the landfill site is the southern boundary. The flow direction and gradient has been consistent at the site since monitoring was initiated during the 1994 permitting process. As previously discussed above, given the consistent nature of the groundwater flow and gradient at the site, the proposed monitoring network is anticipated to be adequate to monitor groundwater conditions at the site.

4.2 GROUNDWATER MONITORING SYSTEM INSTALLATION

Upon approval of the proposed groundwater monitoring system, the City of Amarillo will begin the process of replacing the existing system with the upgraded and approved monitoring well network. The approved network will be installed, and background data developed prior to terminating groundwater testing within the existing monitoring well network. Once background analytical data has been established, the existing monitoring well network will be decommissioned and formally documented. At the time of submission of this permit modification, it is anticipated that 18 months will be required once the system has been formally approved to fully complete the extensive replacement of the existing monitoring well network.

During this time interval, dual sampling events will be occurring and will continue until the upgraded network is fully installed and appropriate background data established.

Notification of the Texas Commission on Environmental Quality (TCEQ) MSW Permits Section will be given at least 45 days prior to initiating any proposed plugging and abandonment procedures.

5.0 EXISTING GROUNDWATER ANALYTICAL DATA

The general water quality of the Ogallala is acceptable for numerous applications. The concentrations of Total Dissolved Solids (TDS) and Chloride increase from north to south. TDS concentrations in the Amarillo area have been reported (Nativ 1988; Knowles and others 1984) to be approximately 400 milligrams per liter (mg/l). Samples obtained in 1980 and in 1988 from water wells near the Amarillo landfill show similar TDS levels and levels of chloride in the range of 4 to 7 mg/l. Groundwater samples have been taken from monitoring wells at the landfill since 1995. These samples indicate that TDS levels range from 300 to 600 mg/l. Chloride levels range from 4 to almost 200 mg/l, with the higher results occurring in upgradient monitoring well, MW-5. Nitrate levels at the landfill historically range from 1 to 20 mg/l; sulfate levels from 10 to 33 mg/l; again the higher concentrations occurring in upgradient monitoring well, MW-5. The water is considered "hard" by the High Plains Underground Water Conservation District.

Some metals have been detected in small concentrations during monitoring events. The most prevalent metal that has been detected is Barium with levels ranging from 180 to about 550 micrograms per liter (µg/l). The higher concentrations of barium occur in upgradient monitoring wells, MW-5 and MW-6.

6.0 GROUNDWATER MONITORING SYSTEM CERTIFICATION

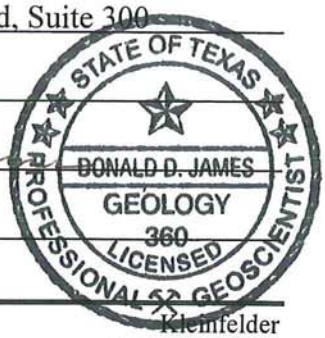
General Site Information

Site:	City of Amarillo Landfill
Site Location:	Amarillo, Potter County, Texas
Permit No:	73A
Date Permit Issued:	1974

Qualified Groundwater Scientist Statement

I, Donald D. James, P.G., have reviewed the groundwater monitoring system and supporting data. In my professional opinion, the existing groundwater monitoring system and the proposed additional monitoring wells is in compliance with the groundwater monitoring requirements specified in 30 TAC §330.230 through §330.235. The monitoring well system is currently operative at the site, but will be replaced. The proposed groundwater monitoring system will consists of: upgradient wells MW-5, MW-818 and MW-819; downgradient wells MW-801, MW-802, MW-803, MW-804, MW-805, MW-806, MW-807, MW-808, MW-809, MW-810, MW-811, MW-812, MW-813, MW-814, MW-815, MW-816, and MW-817. Existing downgradient monitoring wells MW-1 and MW-2 will remain in operation until assessment monitoring has been completed. Groundwater monitoring wells MW-820, MW-821, MW-822 will be installed once Cell 12 is developed, but prior to waste placement. This system has been designed for the exclusive use of the City of Amarillo, Texas for specific application to the Amarillo Landfill (TCEQ Permit No. 73). I am a qualified groundwater scientist as defined by 30 TAC §330.2. The only warranty made by us in connection with this document and specifically with the monitoring well network is that we have used that degree of care and skill ordinarily exercised under similar conditions by reputable members of our profession, practicing in the same or similar locality when designing or reviewing monitoring well systems. No other warranty, expressed or implied, is made or intended.

Firm/Address:	Kleinfelder
	6850 Manhattan Boulevard, Suite 300
	Fort Worth, Texas 76120
Signature:	Donald D. James
Date:	9-23-09



Part III

Attachment 6

Appendix 6D: Intermediate Cover Erosion and Sediment Control Plan

Amarillo Landfill
Permit MSW No. – 73A

City of Amarillo,
Potter County, Texas

Original Submittal
August 2008
Revised November 2008

11-18-2008

This document is released for the purpose of review only under the authority of Michael W. Oden P.E. # 67165. It is not to be used for bidding or construction.

For pages i thru ii

TABLE OF CONTENTS

1.0 INTRODUCTION

This Appendix presents temporary erosion and sediment control devices for the intermediate cover phase of landfill development. Temporary means the time between the construction of intermediate cover and the construction of final cover. The measures described in the Appendix for intermediate topslope surfaces and external side slopes, for compliance with 30 TAC §330.305(d) are for above grade slopes that drain directly to the site perimeter stormwater management system, above grade slopes that have received intermediate cover, and/or above grade slopes that have either reached their permitted elevation, or will subsequently remain inactive for longer than 180 days.

Landfill cover is graded so that stormwater falling on the site is diverted away from the active working area and into drainage areas. Temporary diversion berms constructed upslope of active waste placement and daily cover areas above grade prevent surface water runoff from coming in contact with waste and becoming contaminated. This uncontaminated water is diverted to the surface water drainage system and discharged from the site. Stormwater management facilities will be provided for interim development conditions to prevent stormwater run-on into the active portions of the landfill as the filling progresses. Runoff from intermediate cover will be managed in accordance with the site drainage plan.

Slopes which drain to ongoing waste placement, pre-excavated areas, areas that have received only daily cover or areas under construction which have not received waste are not covered under this Appendix. Soil used as daily cover will be well compacted and graded-to-drain.

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1.1 Overview

Currently fill operations are ongoing in Cell 4A and 4B. Final cover (under previous permit No. MSW 73) has been placed over Cells 1, 2 and 3. These cells will be filled over with additional waste in the future. As exterior intermediate cover slopes of sectors are developed, temporary erosion control measures will be implemented.

Intermediate cover is placed when an area is not expected to receive waste for a period of time. If this period of time is greater than 180 days, then erosion control measures will be implemented. A vegetative cover of 60% will be accomplished within 180 days of the intermediate cover placement. Should 60% vegetative cover not be achieved within this time, supplemental erosion control devices/materials will be applied.

All intermediate cover areas will be managed to control erosion and achieve a predicted soil loss of less than 50 tons per acre per year. Temporary erosion and sediment control features will be installed within 180 days from when the intermediate cover is constructed. Temporary erosion control devices may need to be installed on intermediate cover areas to control erosion and minimize soil loss if these intermediate cover areas have less than 60% vegetative coverage or other measures to control erosion as discussed in this Appendix.

2.0 BEST MANAGEMENT PRACTICES (BMPS)

2.1 Overview

Vegetation and temporary erosion control structures provide the most effective means to reduce the amount of soil loss during operation of the landfill. Along with vegetation, rock or mulch will be implemented for erosion control. Best management practices utilized for erosion and sediment control may be broadly categorized as nonstructural and structural controls.

2.2 Nonstructural Controls

Nonstructural controls addressing erosion include phased development to minimize the area of bare soil exposed at any given time, plans to disturb only the smallest area necessary to perform current activities, minimization of the disruption of the natural features, drainage, topography, vegetative cover features and plans to confine sediment to the construction area during the construction phase.

Additional BMPs will include scheduling of construction activities during the time of year with the least erosion potential, when applicable, specific plans for the stabilization of exposed surfaces in a timely manner, and/or structural controls (discussed below).

2.3 Structural Controls

Structural controls are preventative and also mitigative devices that control erosion and restrict the movement of sediment. These are typically constructed features and include the stabilization of exposed surfaces, the use of perimeter control features, sediment traps and basins, silt fences, filter dams, etc.

Filter dams may be constructed using gravel, rock, gabions, compost socks, or sand bags to reduce flow velocity and therefore erosion in a perimeter channel or detention pond. Filter dams will be placed on prepared subgrade of bedding material along a single contour on little to no slope. Filter dams (see Figure III.6D.3) may be used when the contributing drainage areas are

less than 10 acres (Types 2, 3 or 4), when it is the primary erosion control feature. Multiple filter dams will be installed if drainage areas exceed 10 acres. Filter dams will be used when the volume of runoff is too great for other erosion control features such as silt fences and/or hay bales (see Figure III.6D.3).

Filter berms may be constructed of mulch, woodchips, brush, compost, or shredded woodwaste. Mesh socks may be filled with the same materials. Filter berms or filled mesh socks may be installed at the bottom of slopes, throughout the perimeter drainage system, and on sideslopes. The maximum drainage area to the filter berm or filled mesh sock will not exceed two acres, when it is the primary erosion control item. Runoff must not be allowed to run under or around the filter berm or filled mesh sock. Filter berms may be used in conjunction with other controls. (see Figure III.6D.3).

Other types of erosion control devices include hay bales, straw bales, or baled hay. The bales will be approximately 30 inches in length with the actual dimensions depending on the supplier. Bales shall be bound by either wire or nylon or polypropylene string. The hay bales shall be composed entirely of a vegetable matter and free of seed. Hay bales shall be embedded in the soil a minimum of 4 inches and where possible one-half the height of the hay bale. Hay bales should not be used for more than one year before being replaced (see Figure III.6D.3).

Sediment traps are small excavated areas that function as a sediment basin and allow for the settling of suspended sediment in stormwater runoff. Sediment traps may be constructed in perimeter channels, temporary internal channels, and at entrances to detention ponds. Sediment traps are designed for a maximum drainage area of 10 acres, when it is the primary erosion control item. If an area draining to a sediment trap is greater than 10 acres, additional sediment traps will be installed for every additional 10 acres. Sediment traps will be located to maximize sediment removal and prevent offsite sediment transport. Sediment traps are most effective when installed at frequent intervals, immediately preceding channel inlets and following concentrated flow entry points. Sediment traps can be used with or without filter dams (see Figure III.6D.3).

In areas of sheet flow, temporary control of sediment can be accomplished with silt fences or fabric-type fences. The maximum drainage area to the silt fence will not exceed the manufacturer's specification, but in no case be greater than 0.5 acre per 100 feet of fence, when it is the primary erosion control item. To ensure sheet flow, a gravel collar or level spreader may be used upslope of the silt fence. Silt fences will not be used when there is concentrated flow from channels or drainage ways (see Figure III.6D.3).

Benches, terraces, berms or swales will be constructed of a material with the top 6 inches capable of sustaining native plant growth. These structures direct the flow to the drainage system. The use of these structures is to decrease down slope velocities of runoff that could cause erosion on the intermediate cover slopes.

Letdown chutes are bermed conveyance structures constructed on the intermediate cover side-slopes. Flow will be directed to the letdown chutes via swales, then conveyed to the perimeter drainage system. The letdown chutes will be lined with HDPE geomembrane, turf reinforcement mats, riprap, concrete, gabions, crushed concrete, or stone.

Erosion will be controlled by vegetation, rock or mulch material on topslopes, sideslopes, and in drainage conveyance structures with flow velocities less than or equal to 5 fps. For drainage conveyance structures with flow velocities greater than 5 fps, turf reinforcement, rock riprap, concrete, gabions, or other appropriate materials will be used for surface reinforcement. Suitable rock material has been excavated from previous landfill operations and is currently stored onsite. Additionally, the City of Amarillo currently has 3 brush/tree limb collection sites where the material is ground to create wood chip mulch. Mulch and rock will be used to control erosion.

A high potential for wind erosion of the intermediate cover surface will be mitigated through the placement of the temporary intermediate cover erosion control measures and the establishment of placed rock or mulch material. Temporary measures to be used if wind erosion is observed

include surface roughening, surface wetting, application of tackifiers, placement of rock or mulch armor, or hydromulching the intermediate cover surface.

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3.0 SOIL STABILIZATION SCHEDULE

Areas that will remain inactive for periods greater than 180 days will receive intermediate cover. Intermediate cover on slopes will be stabilized by tracking into the slope with the earth moving equipment. Soil stabilization can be enhanced by mulching, the placement of a rock armor, the addition of soil tackifiers, soil treatment, or any combination of these measures. The intermediate cover will be graded to provide positive drainage. Temporary erosion control structures will be installed within 180 days from when intermediate cover is constructed, if the area is to remain inactive for this period.

The intermediate cover area will be seeded, sodded, or covered with rock or mulch within 180 days following the placement of intermediate cover and will be documented in the site operating record. A 60% vegetative cover will be established over the intermediate cover areas. The type of vegetation will depend on the time of the year. In the event that vegetation is not possible due to climactic events such as drought, rainfall, etc., additional temporary erosion control measures will be implemented.

Rock, mulch, woodchips, or compost may also be used as a layer over the intermediate cover to protect the exposed soil surface from erosive forces and conserve soil moisture. The mulch, woodchips, or compost will be used to stabilize recently graded or seeded areas. If required, the mulch, woodchips, or compost will be spread thinly over a recently seeded area and tracked into the surface to provide additional erosional stability to the intermediate cover surface during the establishment of vegetation. The establishment of a vegetative cover will be postponed, provided sufficient rock and mulch materials are utilized to control erosion for the top dome or sideslopes.

Soil and rock stockpiles are typically not vegetated, as these areas remain active. Erosion and sediment control structures will be installed to reduce erosion and offside sedimentation from these areas.

The intermediate cover and temporary erosion control structures will be maintained as detailed in the Stormwater System Maintenance Plan. Final cover will be constructed as the site develops. Temporary erosion control features will be removed as permanent erosion control structures are constructed.

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4.0 STORMWATER SYSTEM MAINTENANCE PLAN

The Amarillo Landfill will restore and repair the intermediate cover surface and the temporary stormwater systems such as benches, channels, drainage berms/swales, chutes, and flood control structures in the event of wash-out or failure. In addition, the BMPs discussed in this Appendix will also be removed, as needed, so that the drainage structures function as designed. Site inspections by landfill personnel will be performed monthly or within 48 hours of a rainfall event of 0.5 inches or more.

The status of intermediate cover areas, perimeter ditches, temporary benches, chutes, berms/swales, detention ponds, berms, and other drainage features will be evaluated during site inspections. The evaluation will include the potential settlement of intermediate cover areas, final cover areas, ditches, chutes, swales, and other drainage features.

The accumulation of silt or sediment build-up in ditches, chutes, swales, and detention ponds will be noted during inspections. The presence of ponded water on intermediate cover or behind temporary erosion control structures will also be noted and addressed within seven days of detection.

Maintenance activities will be performed to correct damaged or deficient items noted during the site inspections. These activities will be performed as soon as possible after the inspection. Damaged or deficient items will be corrected within seven days of detection, but may vary based on weather, ground conditions, and other site-specific conditions.

Maintenance activities will include placement of additional temporary or permanent vegetation, mulch or rock armor, grading, and placement and stabilization of additional soils in eroded areas or in areas which have settled. Riprap or other structural lining will be replaced within seven days if damaged. The removal of obstructions from drainage features and silt and sediment build-up from the temporary erosion control structures and/or ponded water on the intermediate cover or behind temporary erosion control structures will also be addressed within seven days.

Repairs to erosion and sedimentation controls and/or the installation of additional erosion and sedimentation controls will be included as needed.

Documentation of the site inspection will be included in the Site Operating Record as well as documentation of maintenance activities that were performed to correct damaged or deficient items noted during the site inspections. Landfill personnel will be properly trained to perform inspections, install and maintain temporary erosion control structures.

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5.0 INTERMEDIATE COVER

Landfill cover phases can be defined as daily cover, intermediate cover, and final cover. Top dome surfaces and external embankment side slopes are those above grade slopes that directly drain to the site perimeter stormwater management system, have received intermediate or final cover, and have either reached their permitted elevation, or will subsequently remain inactive for longer than 180 days. Slopes which drain to ongoing waste placement, pre-excavated areas, areas that have received only daily cover or areas under construction which have not received waste are not considered external side slopes.

Daily cover is considered to be 6-inches of well-compacted earthen material not previously mixed with waste. Daily cover may also consist of an approved alternate such as tarps or foams. Erosion control measures are typically not required on areas with daily cover due to the relatively short time before additional waste is placed.

In areas that have received waste but will be inactive for longer than 180 days, an additional 6-inches of cover is required for a minimum of 12-inches. The intermediate cover will be graded to prevent ponding of water and erosion control measures will be implemented as discussed in this Appendix.

Final cover placement and erosion control is discussed elsewhere in this permit.

5.1 Intermediate Cover Evaluation

This section presents the supporting documentation for evaluation of the potential for intermediate cover soil erosion loss at the Amarillo Landfill.

The intermediate cover evaluation is based on the Revised Universal Soil Loss Equation (RUSLE). The evaluation is based on a 12-inch thick intermediate soil cover layer with 60% cover of vegetation, rock or mulch. Sample calculations for the soil loss for intermediate cover on external 33.33% (3H:1V), 25% (4H:1V), and 5% slopes have been provided in Section 5.4.

Soil loss is calculated using the Revised Universal Soil Loss Equation (RUSLE) as presented in NRCS Agricultural Handbook #703. All intermediate cover areas will be managed to control erosion and achieve a predicted soil loss of less than 50 tons per acre per year.

Temporary erosion and sediment control features will be installed within 180 days from when the intermediate cover is constructed. RUSLE calculations were performed for rock, mulch and vegetation cover for 0% and 60% coverage.

5.2 Intermediate Cover Erosion Control Structure Design

As intermediate cover is constructed, temporary benches, chutes, and berms/swales will be constructed to prevent erosion and sedimentation. Erosion control features such as filter berms, rock berms, hay bales, etc. will be constructed on filled areas to minimize erosion on existing slopes. The filter berm or other erosion control feature can be removed once the intermediate cover has been stabilized (60% coverage or greater).

5.3 Design Summary

The Amarillo Landfill will implement the erosion and sediment control features on the intermediate cover as the landfill develops. As filling operations are ongoing, intermediate cover will be established on all areas that have received waste but will remain inactive for periods greater than 180 days. Sufficient permanent and temporary erosion and sediment control features shall be constructed to redirect surface water and prevent erosion. Temporary erosion and sediment control features shall be constructed within 180 days of placement of intermediate cover. Temporary erosion control features will be removed as permanent erosion controls are constructed. Temporary and permanent erosion and sediment control devices will be maintained by landfill personnel to assure proper functioning of the devices.