SSC-N-621
April 1989

Geology and Geotechnical Considerations of the SSC Site in Texas:

SSC Ring Alignment in Site Geology

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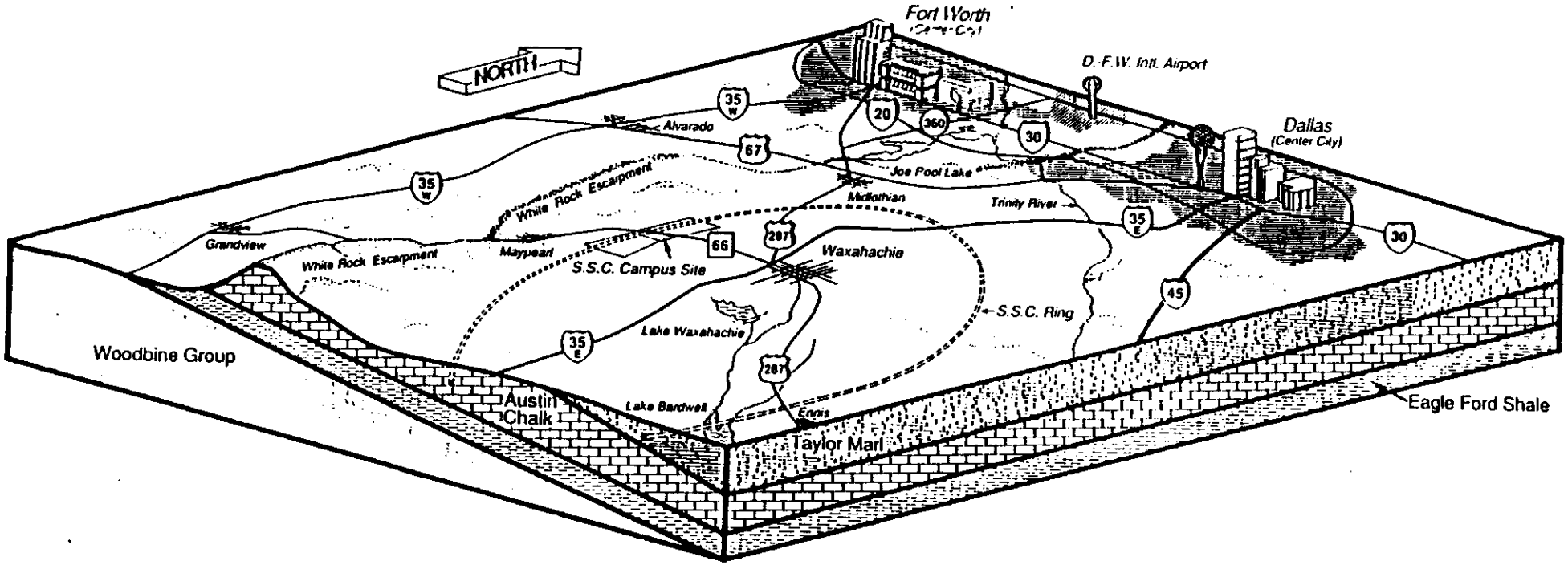
Material Presented at the meeting of the Underground Tunnelling Advisory Panel
April 30, 1989 at the
SSC Laboratory at Lawrence Berkeley Laboratory



Note: Schematic

Figure 3.1-1. Location of SSC Facilities.
The Super Collider Site is convenient to the Dallas - Fort Worth metropolitan area and mainly in rural Ellis County. The tunnel is shallow.

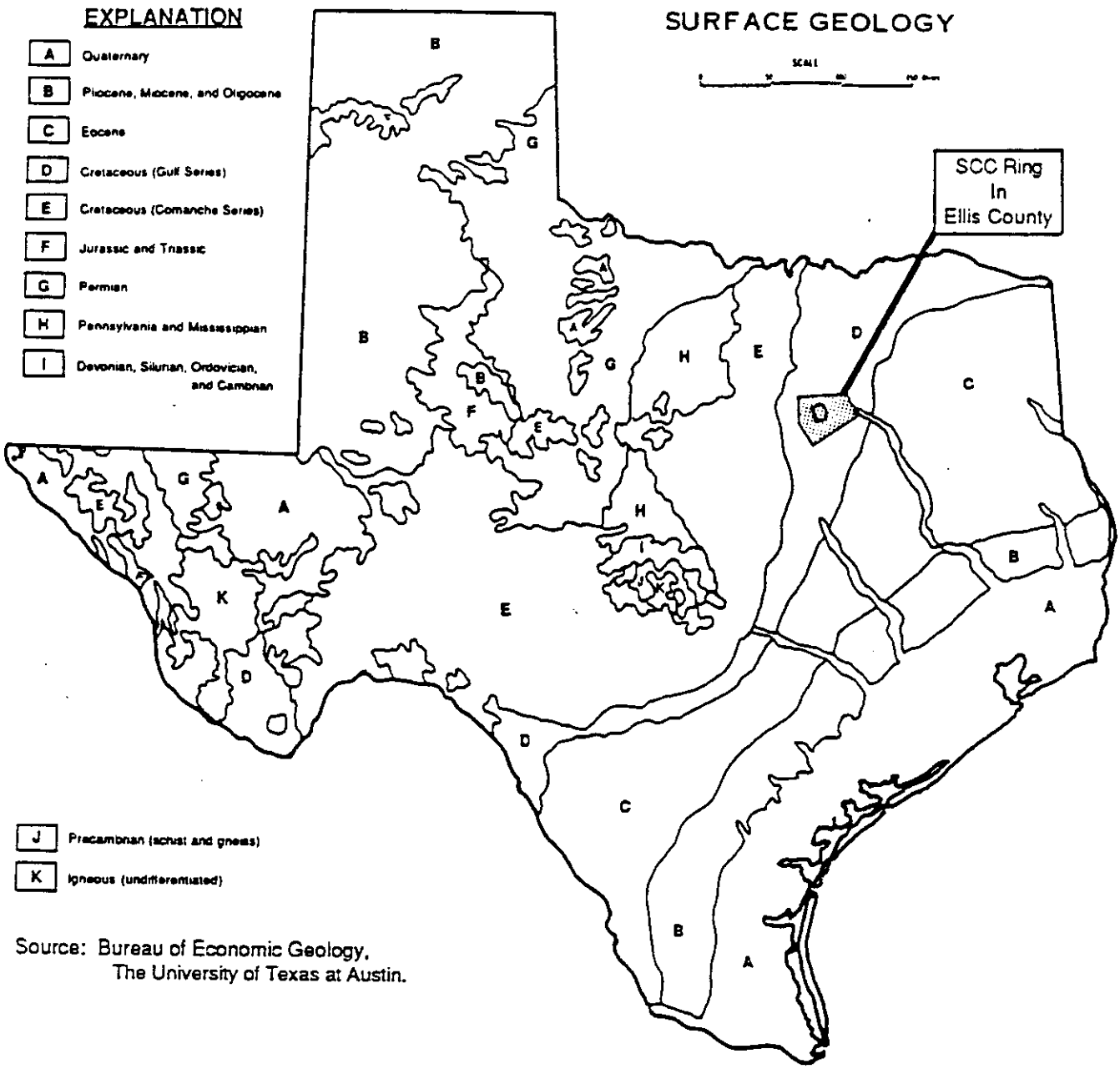
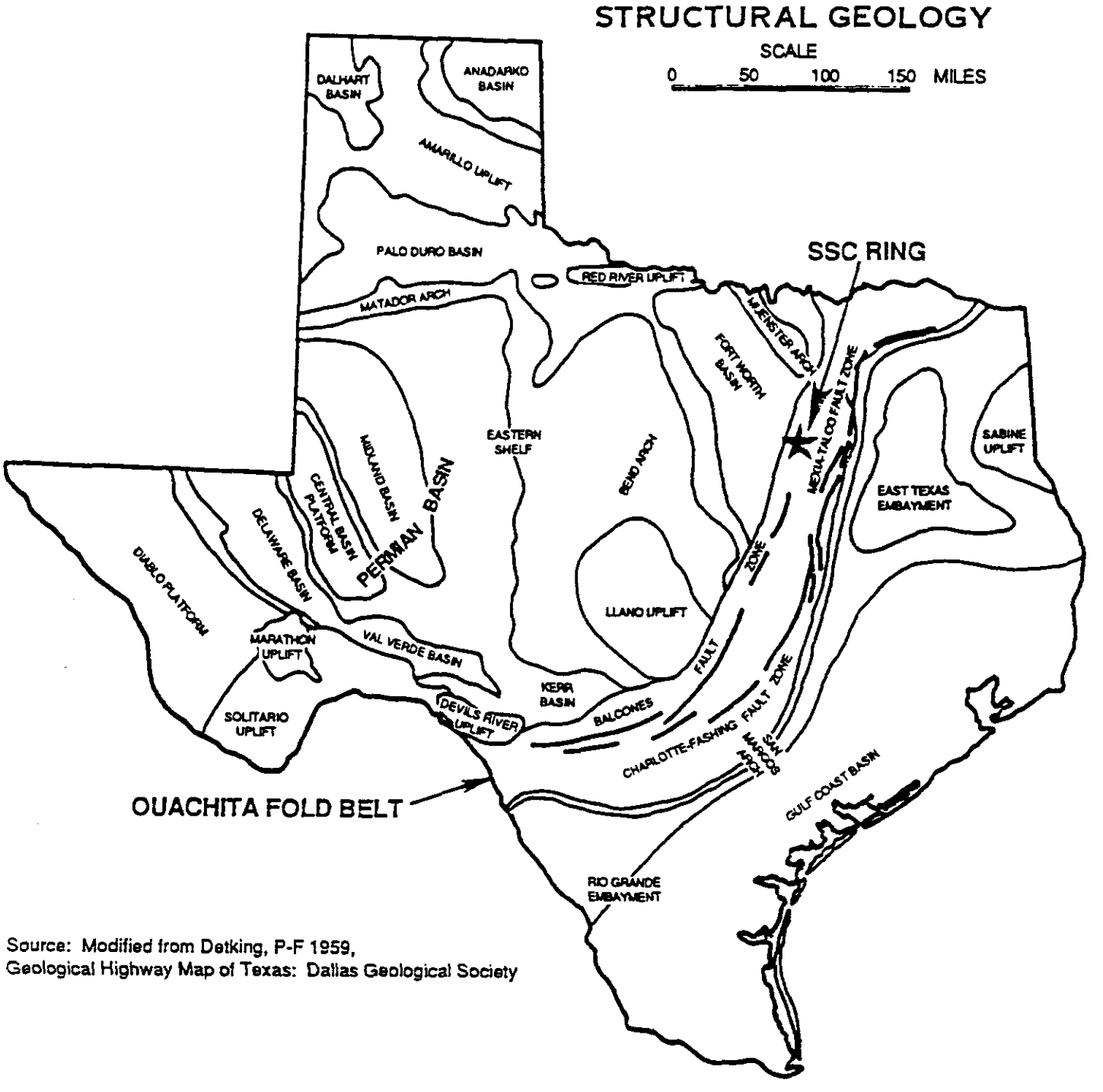


Figure 3.2-2. Surface Geology of Texas.
The geology of north-central Texas allows placement of the SSC site in the stable Cretaceous soft carbonate rocks, one of the best rocks for tunneling.



Source: Modified from Detking, P-F 1959,
Geological Highway Map of Texas: Dallas Geological Society

Figure 3.2-4. Regional Structural Geology of Texas.
There are no active faults in the project area. The region is characterized by tectonic stability.

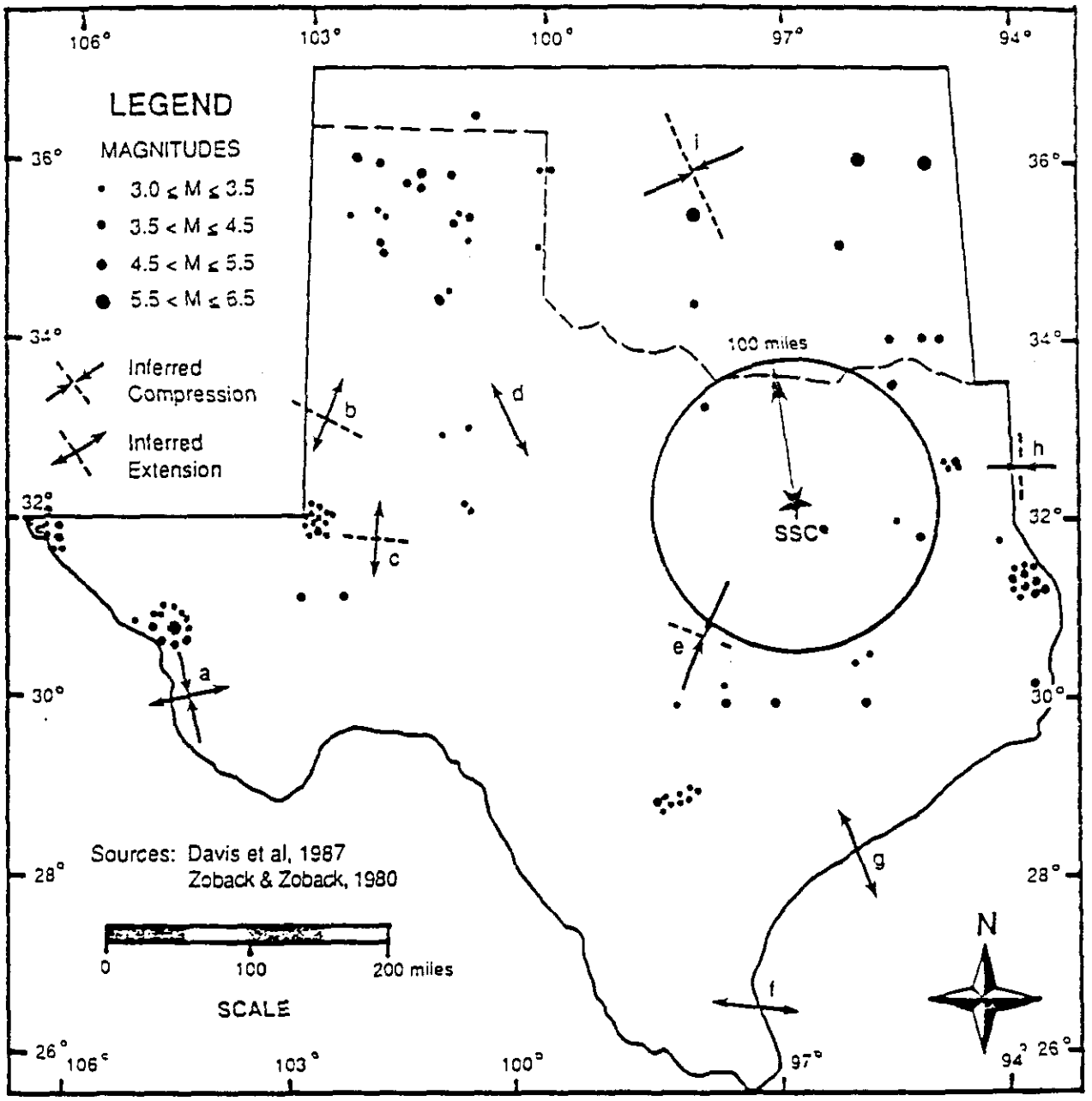
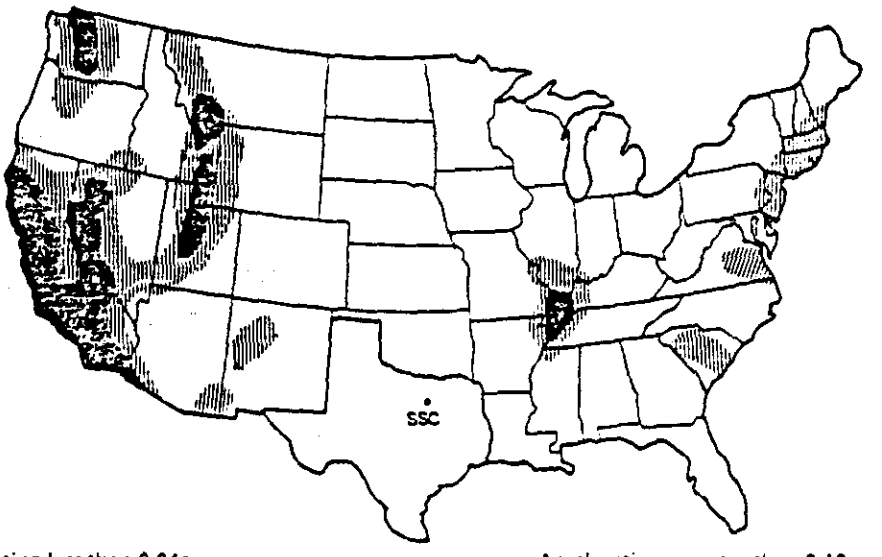


Figure 3.4-3. Seismicity and Stress Regime of Texas.
The Dallas - Fort Worth SSC is located in the least earthquake-prone region of the United States.



Acceleration less than 0.04g.
No damage expected from seismic activity.

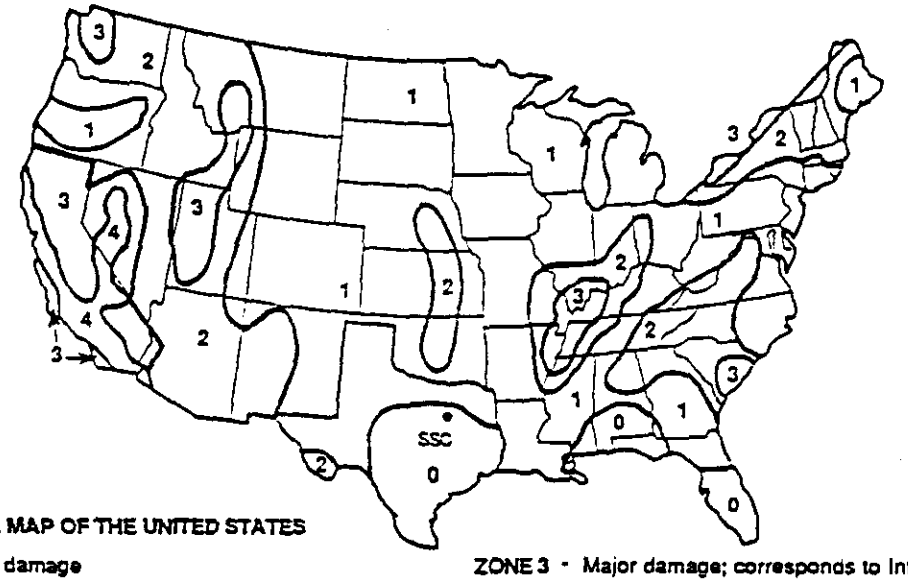
Accelerations greater than 0.04g.
Minor damage: distant earthquakes may cause damage to structures: corresponds to Modified Mercalli Intensity V and VI.

Accelerations greater than 0.10g.
Moderate damage: corresponds to Modified Mercalli Intensity VII.

Accelerations greater than 0.20g.
Major damage: corresponds to Modified Mercalli Intensity VIII and higher.

Map of Horizontal Acceleration in Rock With a 90 Percent Probability of Not Being Exceeded in 30 Years.

SOURCE: ALGERMISSEN ET AL, 1982



SEISMIC RISK MAP OF THE UNITED STATES

ZONE 0 - No damage

ZONE 1 - Minor damage; distant earthquakes may cause damage to structures with fundamental periods greater than 1.0 second; corresponds to intensities V and VI of the M.M.* Scale.

ZONE 2 - Moderate damage; corresponds to intensity of VII of the M.M.* Scale.

ZONE 3 - Major damage; corresponds to Intensity VII and higher of the M.M.* Scale.

ZONE 4 - Those areas within Zone No. 3 determined by the proximity to certain major fault systems.

*Modified Mercalli Intensity Scale of 1931

SOURCE: UNIFORM BUILDING CODE

Figure 3.4-1. Seismic Hazard Maps.
Earthquake hazard at the Dallas - Fort Worth SSC Site is negligible - the lowest possible in the United States.

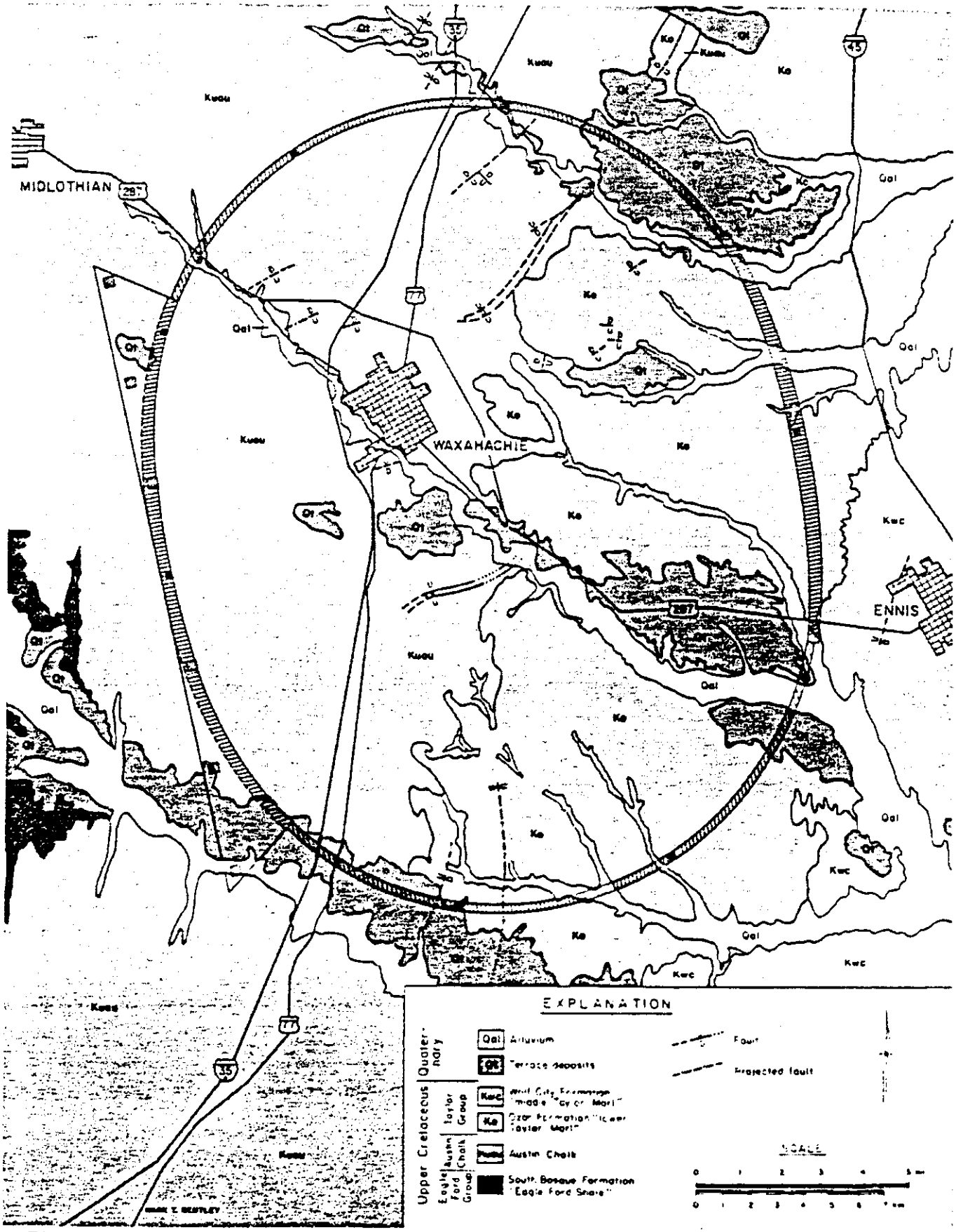


Figure 3.2-8. Generalized Geologic Map.
Surface mapping documents geologic conditions of the site in Austin Chalk and Taylor Marl.

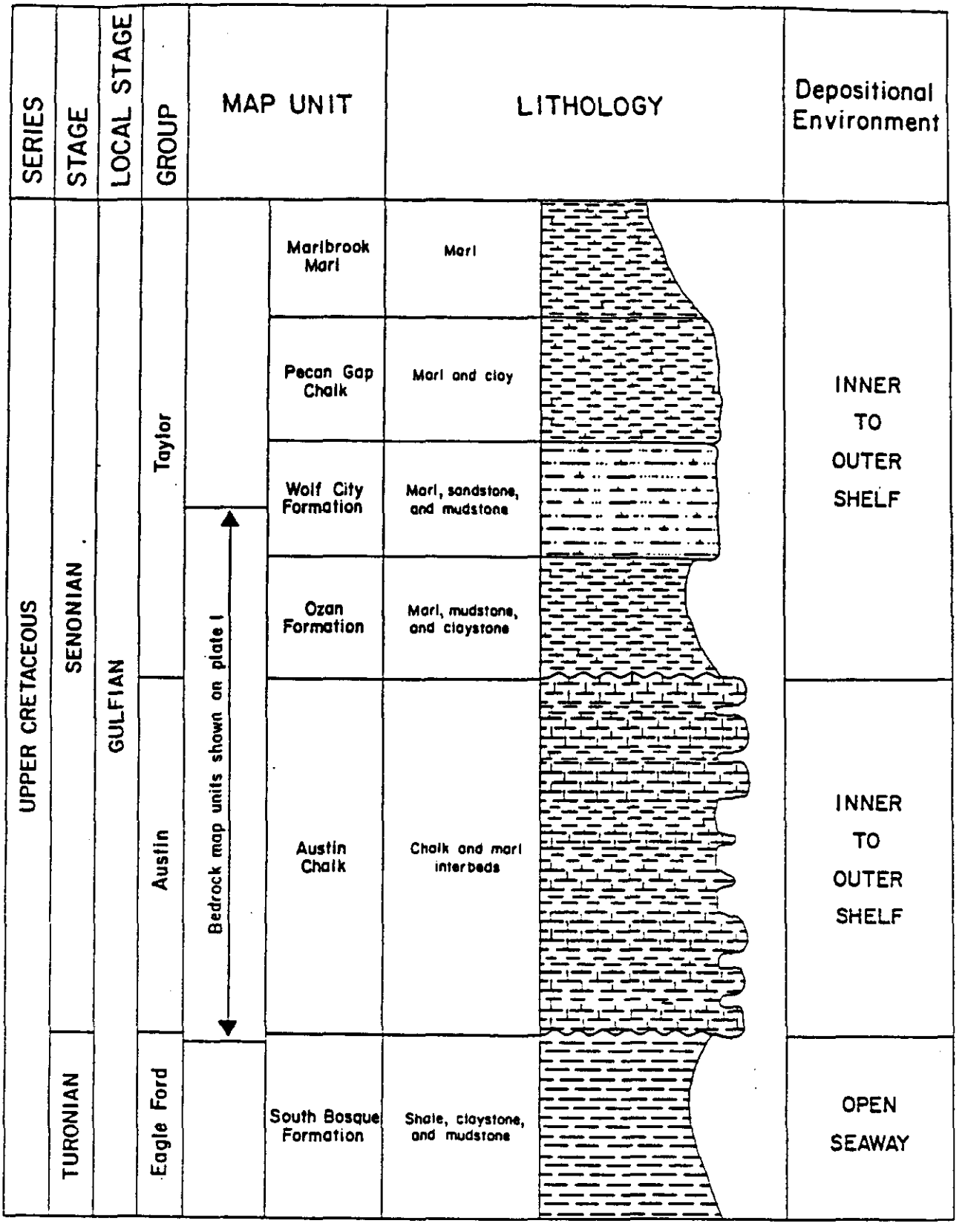


Figure 1. Geologic column for Cretaceous map units in the vicinity of the proposed Dallas - Fort Worth area SSC site.

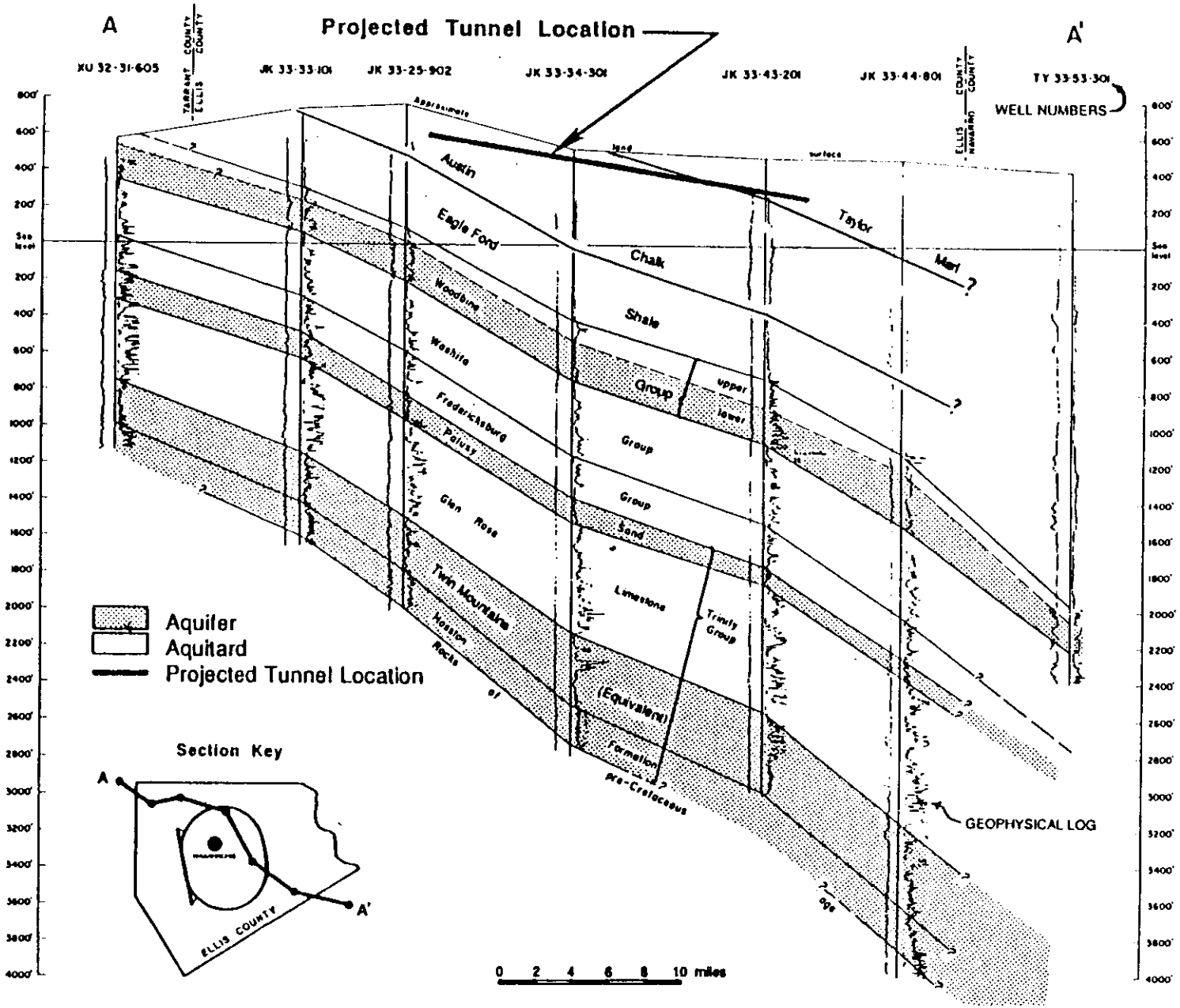


Figure 3.3-1. Geologic Cross Section of Regional Aquifers. The SSC ring will be in the impervious Taylor and Austin groups. At depth, groundwater is available from the Woodbine and Twin Mountain aquifers.

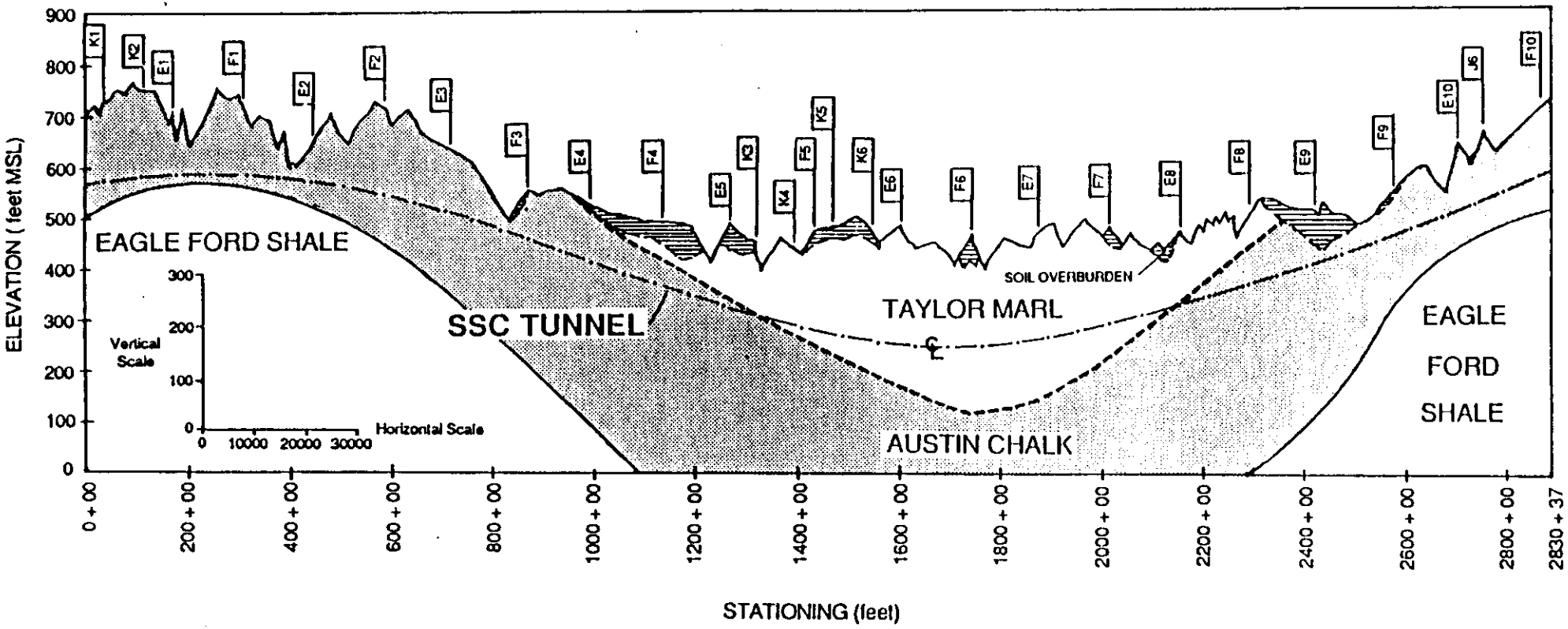


Figure 3.1-2. Geologic Profile Along Collider Ring.
The SSC ring will be almost horizontal in the favorable Austin Chalk and Taylor Marl.

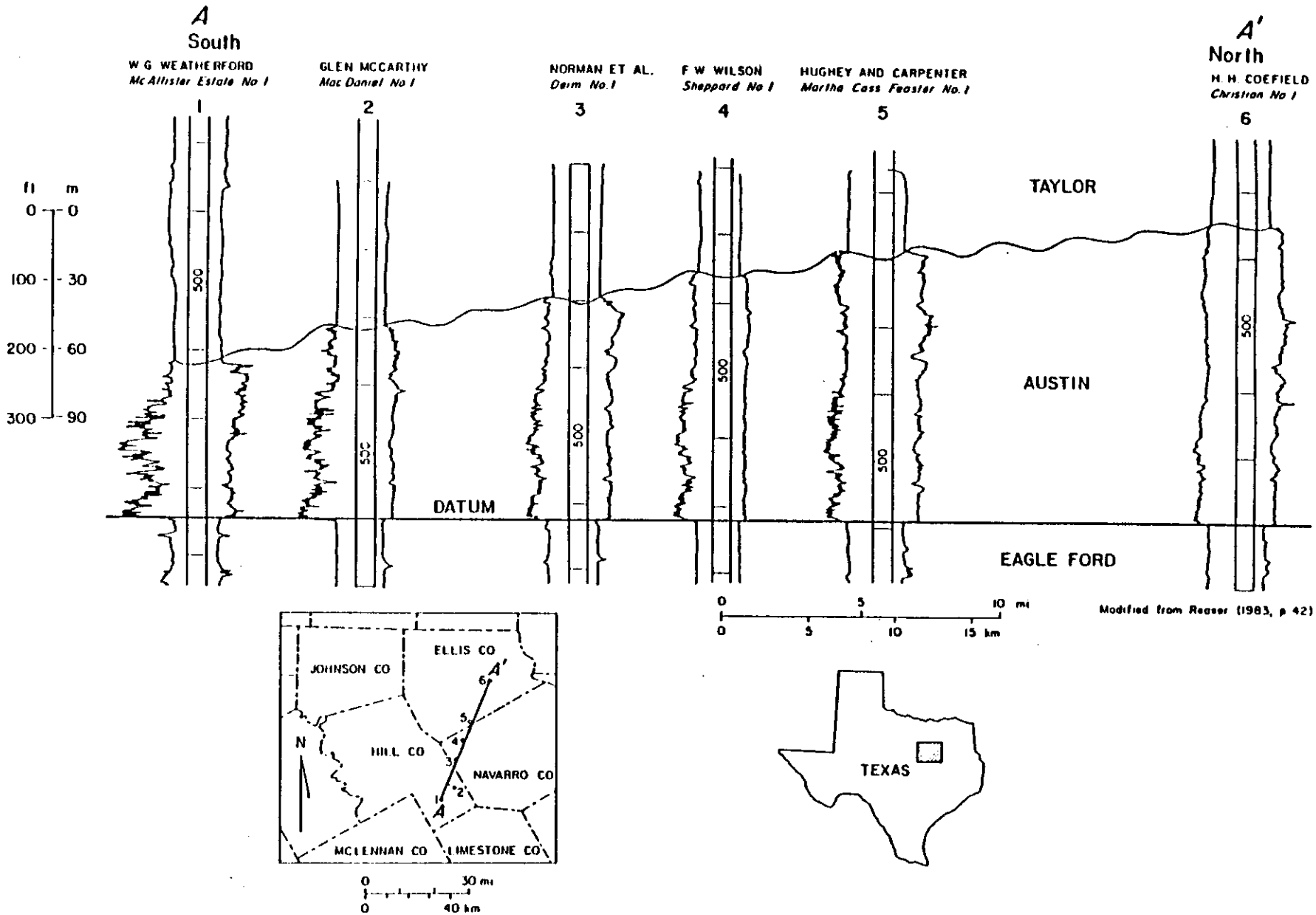
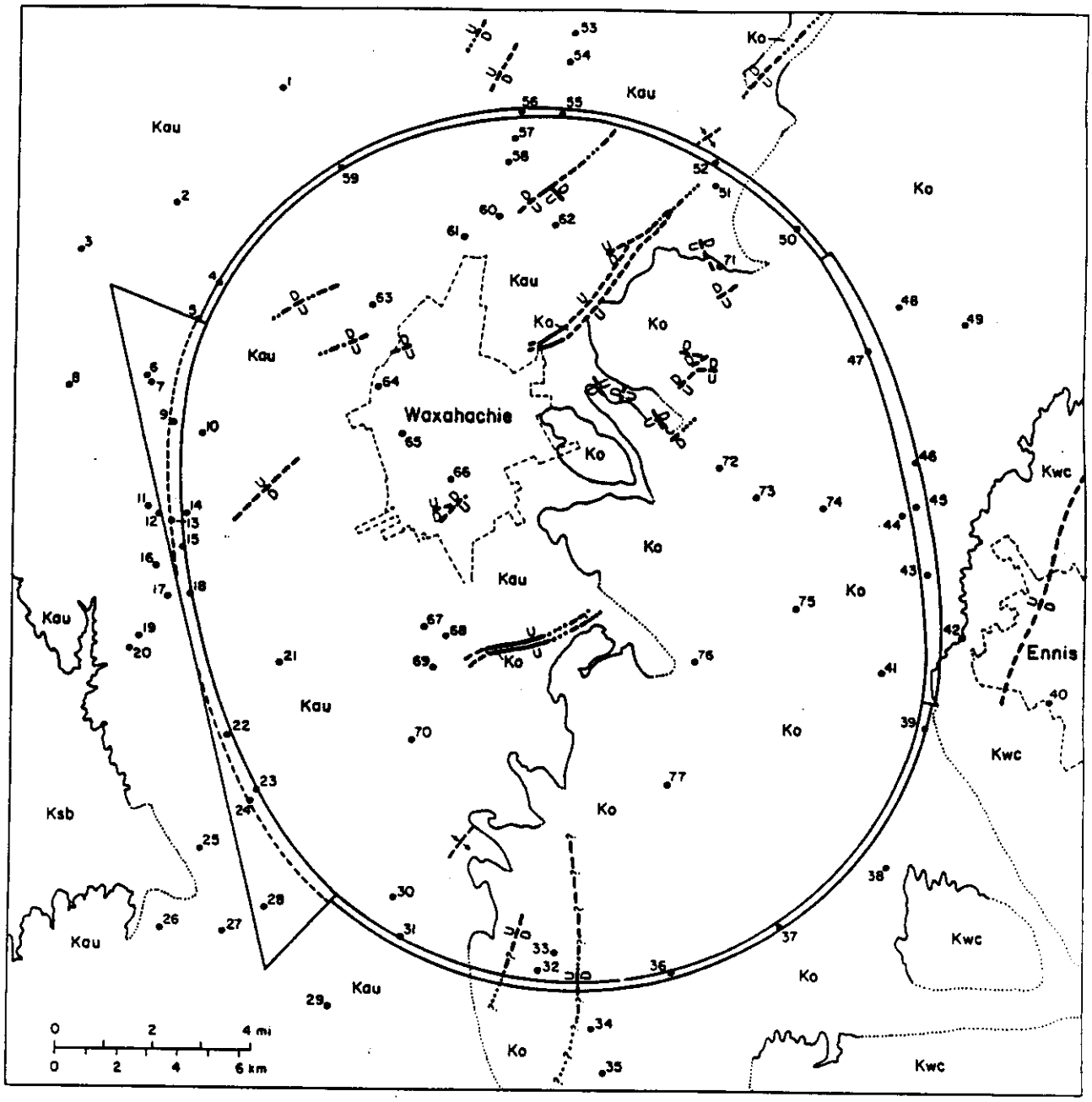


Figure 2. Stratigraphic section of upper Eagle Ford, Austin, and lower Taylor in Ellis, Hill, and Navarro Counties, Texas. Vertical scale: 1 inch = 100 ft.

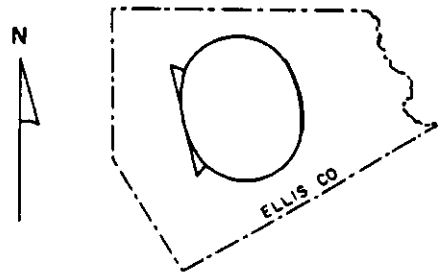


EXPLANATION

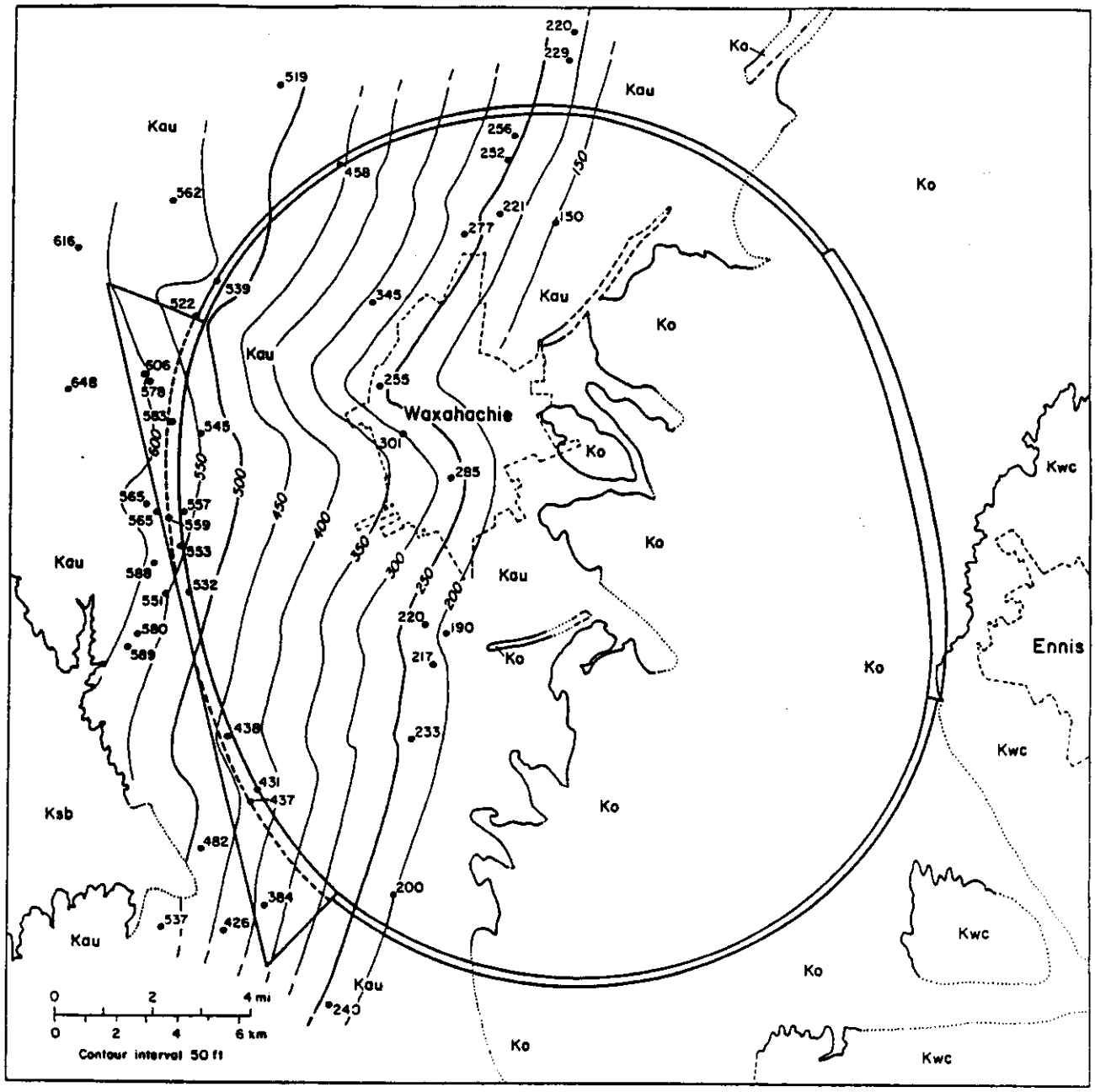
Surface fault, dashed where inferred; dotted where covered

Monocline

Well control



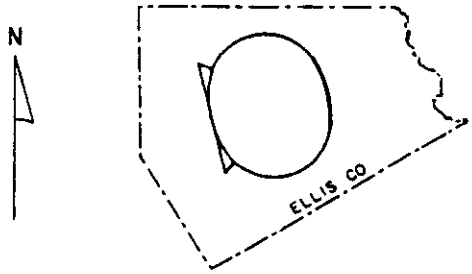
QA 9505



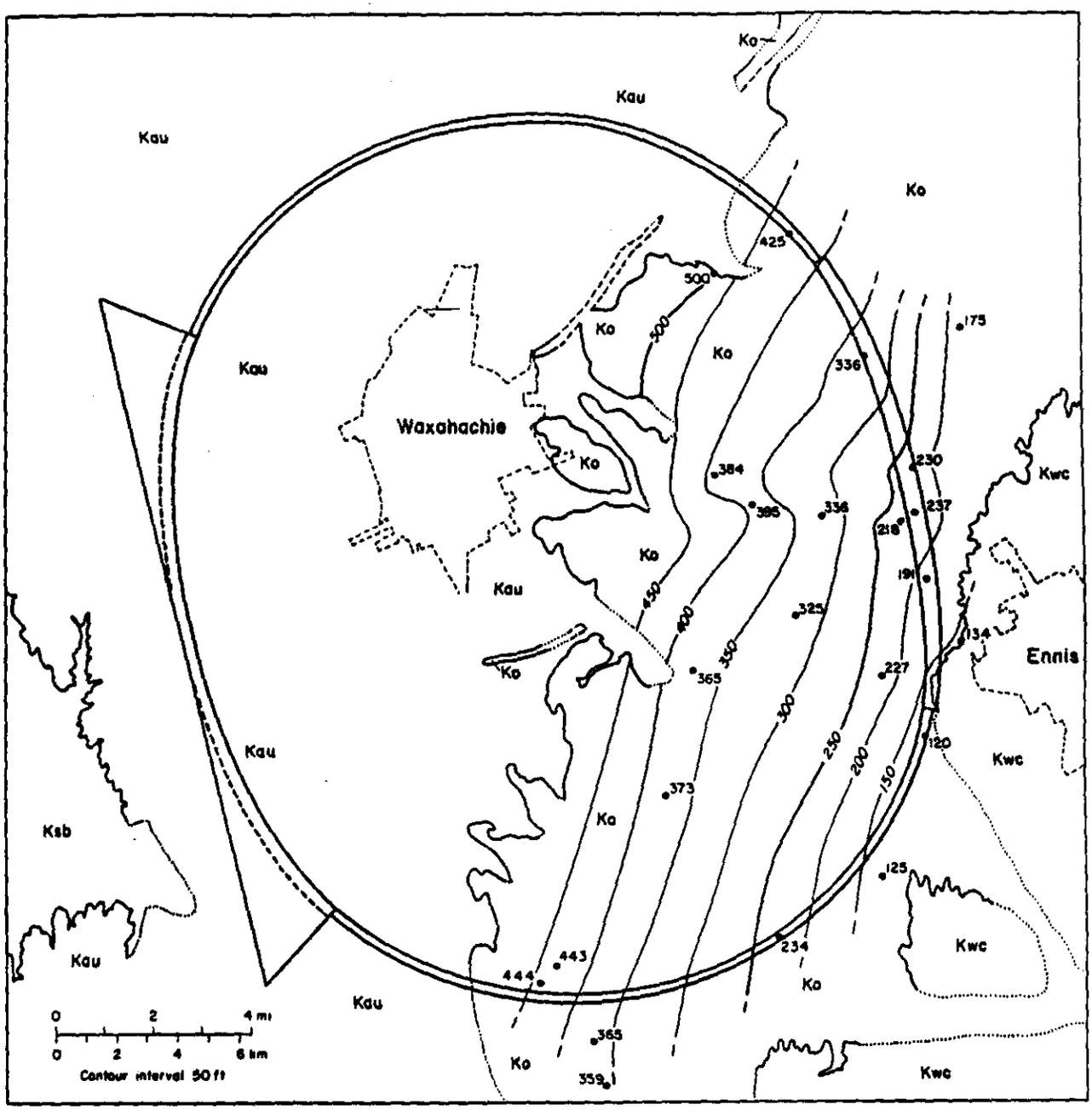
EXPLANATION

—200— Structure contour (ft)

•150 Structure elevation (ft) at well control



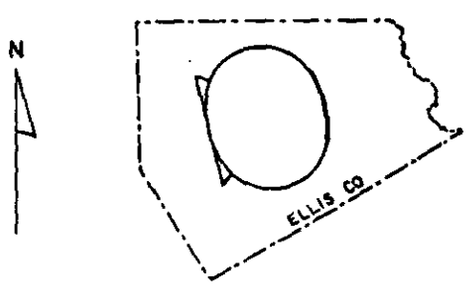
QA 9568



EXPLANATION

—200— Structure contour (ft)

•125 Structure elevation (ft) at well control



QA 9506

SSC FOOTPRINT VALIDATION
PREDICTED STRUCTURE OF BASE OF AUSTIN CHALK

Borehole No.	Ground surface elevation (ft msl)	Predicted elevation of Austin Chalk/Eagle Ford contact (ft msl)	Predicted depth to Austin Chalk/Eagle Ford contact (ft)
1	+675	+490	175
2	+730	+575	155
3	+740	+585	155
4	+710	+575	135
5	+730	+540	190
6	+690	+570	120

Records of wells near the SSC site, Ellis County.

BEG ID	TDWR/SSC Well ID	Well Depth (ft)	Surface Elev. (ft)	Water Level (ft)	Year	Aquifer Unit	Driller's Log Depth (ft)	Driller's Log Rock Type
1	33-25-902	2763	769	625	1964	Kh	-5	soil
							-250	chalk rock
							-685	shale
2	33-33-202	754	700	392	1965	Kwb	-138	white rock
							-505	shale
							-515	sandy shale
3	33-33-404	2490	763	922	1982		-147	fine lime
							-166	shale & lime
							-386	soft shale
							-541	Gumbo
4	GP-2	90	613				-19	clay
							-74	Austin Chalk
5	T1-87	200	704				-1	clay
							-182	Austin Chalk
6	B9-87	105	700/704				-98	Austin Chalk
							--	Eagle Ford
7	J2-87	209	768				-1	clay
							-190	Austin Chalk
8	33-33-705	2475	788	690	1969		-140	chalk rock
							-530	shale
							-705	sandy shale
9	B8-87	100	677				-94	Austin Chalk
10	33-33-803	820	715	420	1969	Kwb	-170	chalk
							-566	blue shale
							-580	sand & shale
11	33-41-204	870	750	435	1967	Kwb	-185	chalk
							-480	blue shale
							-565	brown shale
12	33-41-205	852	735	435	1970	Kwb	-70	white rock
							-170	white rock & shale
							-470	shale
							-510	sandy shale
13	K2-87	225	760/761				-2	clay
							-202	Austin Chalk

Records of wells near the SSC site, Ellis County.

BEG ID	TDWR/SSC Well ID	Well Depth (ft)	Surface Elev. (ft)	Water Level (ft)	Year	Aquifer Unit	Driller's Log Depth (ft)	Driller's Log Rock Type
14	33-41-206	805	731	500	1982		-174	white rock
							-564	shale
							-644	sand
15	B-RR-87	205	747/748				-195	Austin Chalk
							--	Eagle Ford
16	33-41-203	2564	752	726	1975	Kctm	-164	chalk rock
				711	1975		-549	shale
							-815	sand & shale
17	33-41-202	727	681	343	1965	Kwb	-3	topsoil
							-30	sand and clay
							-130	rock, white
							-517	shale
18	K1-87	250	748				-1	clay
							-216	Austin Chalk
19	33-41-402	690	710	290	1962	Kwb	-130	chalk rock
							-500	shale
							-565	sand
20	33-41-401	728	721	380	1965	Kwb	-132	rock
							-510	shale
							-562	sand
21	B1-87	102	668				-5	clay
							--	Austin Chalk
22	J6-87	210	628				-5	clay
							-190	Austin Chalk
23	J3-87	152	564				-9	clay
							-133	Austin Chalk
24	B7-87	150	581				-144	Austin Chalk
25	33-41-802	632	532	203	1965	Kwb	-2	topsoil
							-7	clay
							-50	chalk rock
							-400	shale
							-410	sandy shale
26	33-49-208	668	625	279	1965	Kwb	-1	topsoil
							-88	rock
							-471	shale
27	B6-87	100	490				-16	clay
							-64	Austin Chalk
28	J4-87	162	516				-41	clay
							-132	Austin Chalk

Records of wells near the SSC site, Ellis County.

BEG ID	TDWR/SSC Well ID	Well Depth (ft)	Surface Elev. (ft)	Water Level (ft)	Year	Aquifer Unit	Driller's Log Depth (ft)	Driller's Log Rock Type
29	33-49-301	900	550	365	1986		-2	soil
							-310	chalk rock
							-672	gray shale
							-710	Top Woodbine
30	33-42-702	2850	550	225	1964	Kh	-3	soil
							-9	clay
							-350	chalk rock
							-740	shale
31	E9-87	241	524				-50	clay & sand
							--	Austin Chalk
32	F8-87	165	511				-40	clay
							-67	Taylor Marl
33	B-G1	200	497				-20	clay
							-54	Taylor Marl
34	33-50-202	3204	550	442	1976	Kctm	-6	soil
				495	1977		-44	clay
							-185	shale
							-605	chalk rock
							-978	shale
35	33-50-502	1238	540	320	1963	Kwb	-6	soil
							-50	clay
							-181	shale
							-590	chalk
							-936	shale
36	E8-87	70	430				-21	clay
							--	Taylor Marl
37	F7-87	165	478				-23	clay
							-67	Taylor Marl
38	33-43-801	1517	475	142	1953	Kwb	-38	clay
							-350	shale
							-450	chalk rock
							-533	rock
							-780	chalk rock
							-1153	shale
39	F6-87	327	427				-16	clay
							--	Taylor Marl
40	33-43-602	1806	510	525	1964	Kwb	-7	soil
							-30	clay
							-572	shale
							-858	lime
41	B-XR-87	342	502				-45	clay & sand
							-275	Taylor

Records of wells near the SSC site, Ellis County.

BEG ID	TDWR/SSC Well ID	Well Depth (ft)	Surface Elev. (ft)	Water Level (ft)	Year	Aquifer Unit	Driller's Log Depth (ft)	Driller's Log Rock Type
42	33-43-202	2378	495				-45	surface clay
							-361	shale & lime
							-768	marl
							-852	chalk
43	K6-87	309	480				-27	clay
							-289	Taylor Marl
44	33-43-204	1445	498	398	1985		-280	clay & shale
							-713	chalk, shale, & limestone
45	K5-87	280	496				-19	clay
							-259	Taylor Marl
46	K4-87	270	488				-34	clay
							-258	Taylor Marl
47	K3-87	161	478				-29	clay
							-142	Taylor Marl
48	ROC-1						--	clay
49	33-35-503	1522	467	340	1964	Kwb	-4	soil
				337	1965	Kwb	-64	clay & gravel
							-292	shale
							-720	rock chalk
50	F4-87	150	497				-54	clay and silt
							-71	Taylor Marl
51	33-34-301	230	525				-45	clay
							-230	chalk
52	E4-87	150	536				-34	clay
							-	Austin Chalk
53	33-26-802	1171	620	370	1962	Kwb	-3	soil
				421	1965		-400	chalk rock
							-842	shale
54	33-26-801	944	595/594	140	1943	Kwb	-6	soil
				360	1970		-365	white rock
				384	1975		-803	shale
55	F3-87	164	548				-30	clay & silt
							--	Austin Chalk
56	T3-87	100	579				--	Austin Chalk
57	33-34-208	1035	570				-3	soil
							-314	Austin Chalk
							-630	Eagle Ford
							-750	brown shale
58	33-34-202	1000	622	400	1962	Kwb	-1	soil

Records of wells near the SSC site, Ellis County.

BEG ID	TDWR/SSC Well ID	Well Depth (ft)	Surface Elev. (ft)	Water Level (ft)	Year	Aquifer Unit	Driller's Log Depth (ft)	Driller's Log Rock Type
59	F2-87	289	726/725				-4	clay
							-267	Austin Chalk
60	33-34-207	3088	628				-8	soil
							-407	chalk rock
							-865	shale
61	33-34-102	922	627	390	1963	Kwb	-6	soil
							-350	white rock
							-780	shale
							-830	sandy shale
62	33-34-206	1191	595	360	1971	Kwb	-5	soil
							-445	chalk rock
							-865	shale
63	33-33-601	1017	650	400	1969	Kwb	-10	soil
							-305	chalk rock
							-727	shale
64	33-34-706	839	615	350	1963	Kwb	-360	white rock
							-660	blue shale
							-757	black shale
65	33-34-704	2878	551	135	1948	Kh	-250	Austin Chalk
				283	1965		-644	Eagle Ford
							-975	Woodbine
66	33-34-703	2950	540	+	1931	Kh	-25	surface material
				98	1945		-255	chalk
				120	1948		-645	shale
67	33-42-104	1019	585	302	1965	Kwb	-4	soil
							-365	chalk
							-736	shale
68	33-42-105	1063	590	428	1977	Kwb	-400	white rock
							-790	shale
69	33-42-401	1026	622	357	1963	Kwb	-1	soil
							-405	chalk rock
							-790	shale
70	33-42-405	2900	608	460	1973	Kctm	-375	rock & shale
				480	1975		-701	shale
71	33-34-601	1302	530	290	1962	Kwb	-30	clay and gravel
				313	1965		-520	chalk
							-900	shale

Records of wells near the SSC site, Ellis County.

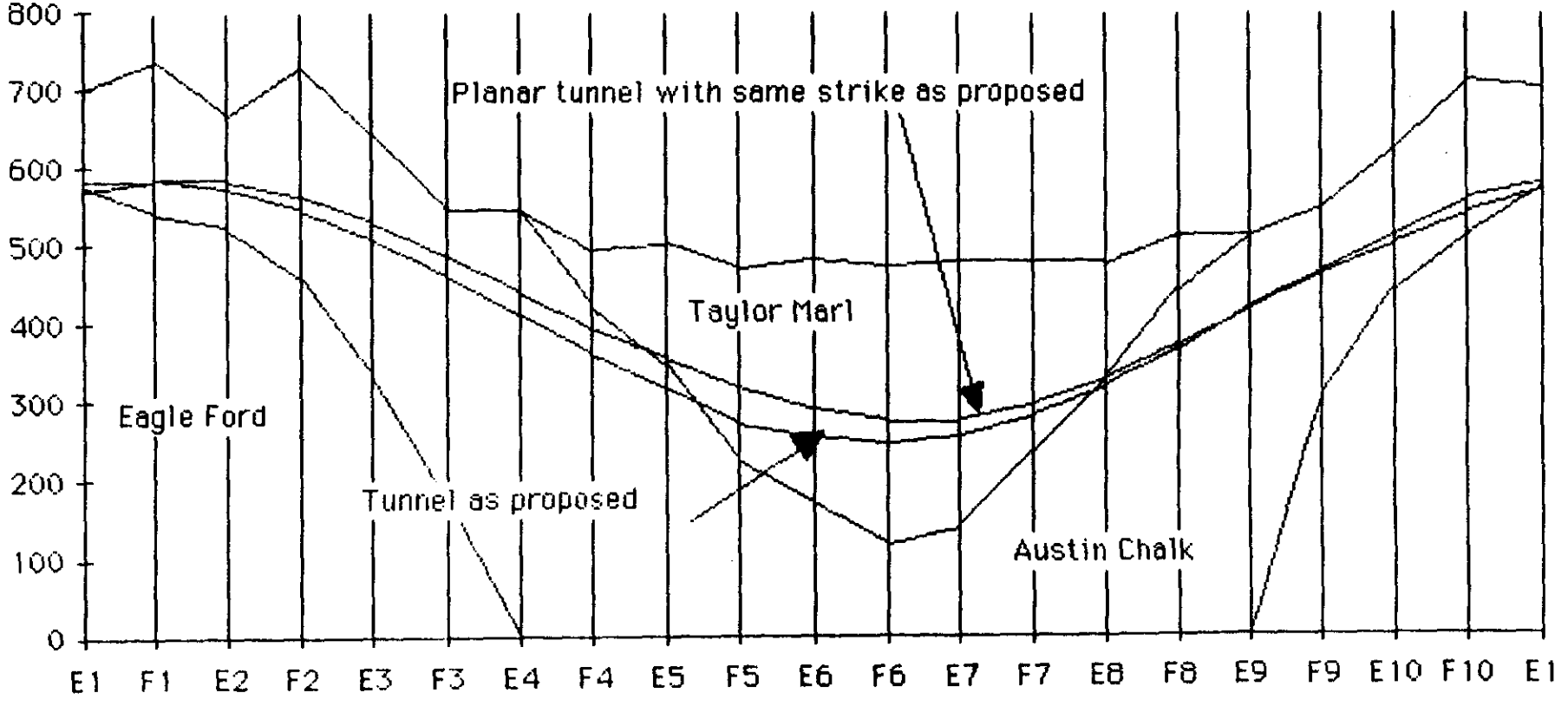
BEG ID	TDWR/SSC Well ID	Well Depth (ft)	Surface Elev. (ft)	Water Level (ft)	Year	Aquifer Unit	Driller's Log* Depth (ft)	Rock Type
72	33-35-702	1321	506	328	1964	Kwb	-6	soil
				378	1965		-50	clay
							-122	shale
							-594	chalk rock
							-994	shale
73	33-35-701	1303	525	117	1947	Kwb	-5	soil
				180	1961		-130	clay
				319	1965		-620	rock
							-672	shale
74	B5-87	188	515/516				-47	clay
							-180	Taylor Marl
75	33-43-101	1370	525	380	1975	Kwb	-10	clay
				395	1977		-200	shale
							-640	chalk rock
							-1048	shale
76	GP-1	158	503				-19	clay & sand
							-138	Taylor Marl
77	33-42-901	1238	513	226	1958	Kwb	-60	clay
				297	1965		-140	shale
							-236	chalk rock
							-462	rock
							-560	soft rock
							-1037	shale

EXPLANATION

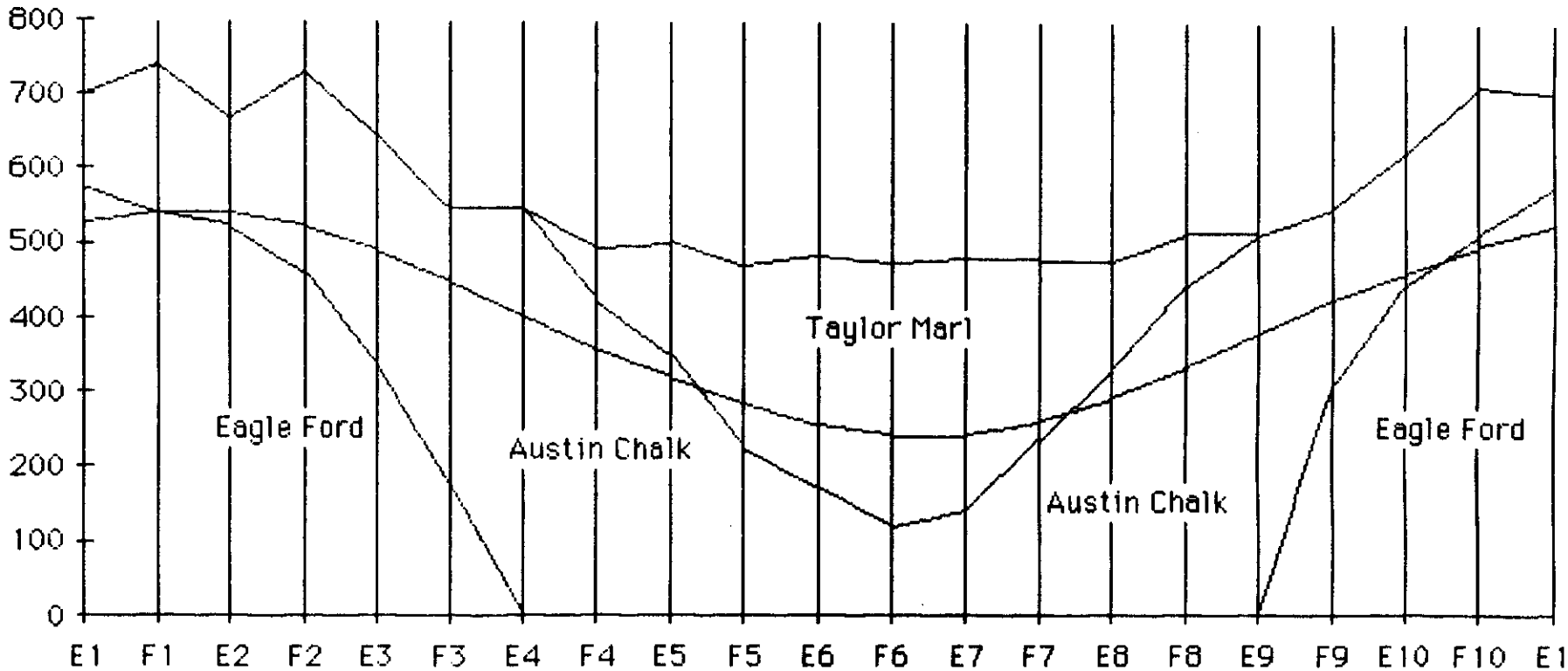
Kwb Woodbine
Kctm Twin Mountains
Kh Hosston

* Notes depth beneath land surface to base of rock type;
-- indicates that base of rock unit not reached in well.

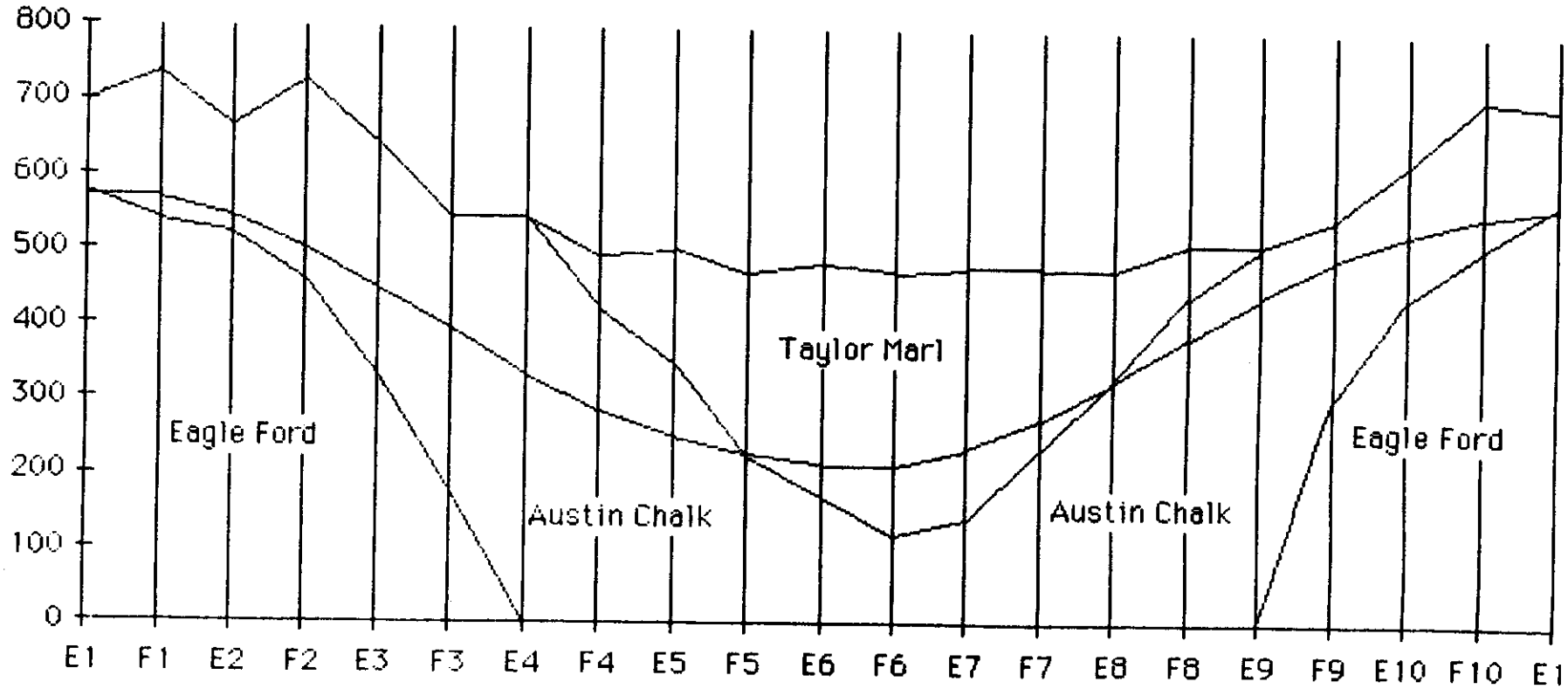
A0 - Proposed Tunnel Location
Strike N 29° E

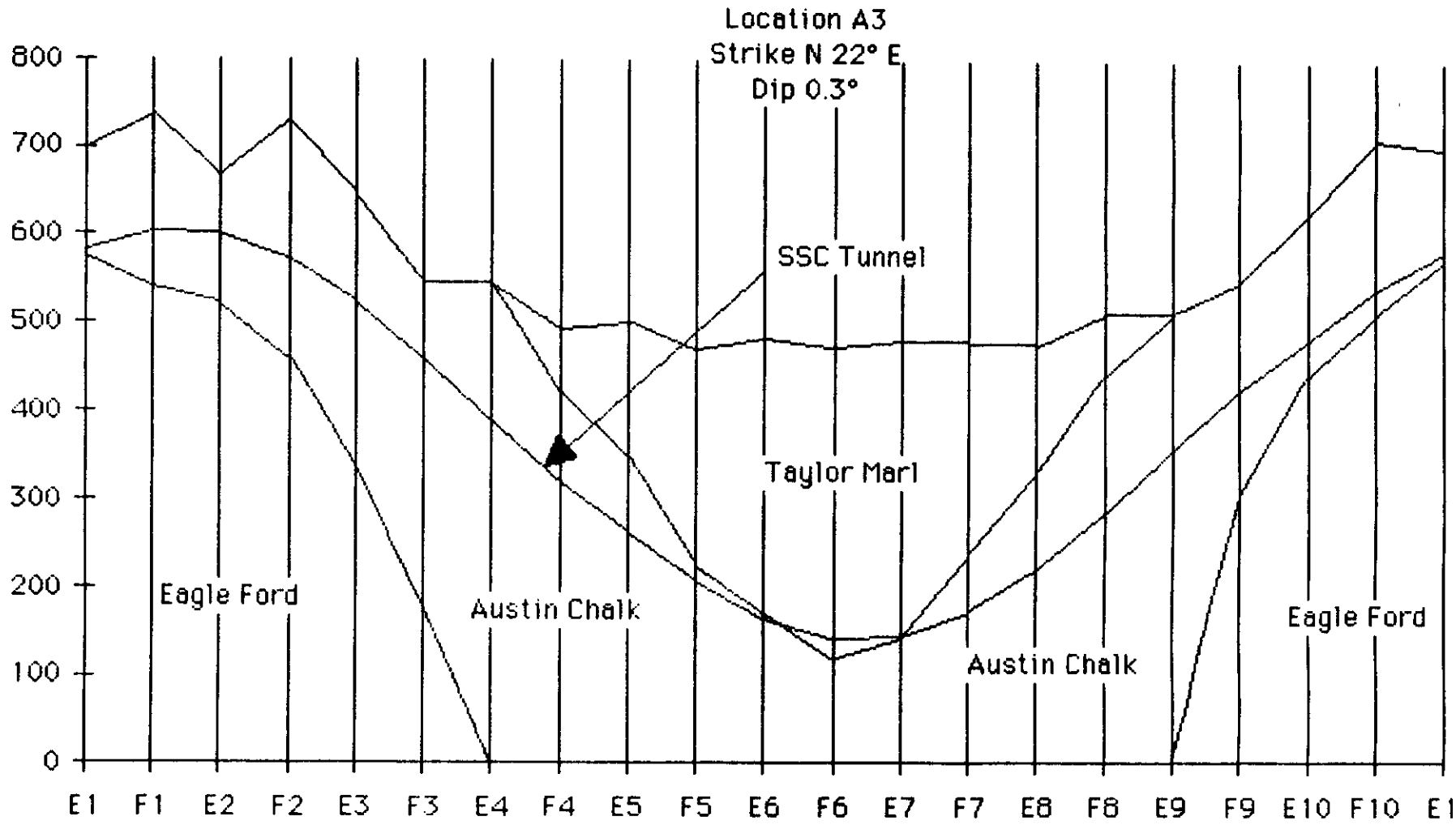


Location - A1
Strike N 22° E
Dip 0.195°



Locaton A2
Strike N 4° E
Dip 0.25




Location A3
Strike N 22° E
Dip 0.3°
800
700
600
500
400
300
200
100
0
SSC Tunnel
Taylor Marl
Eagle Ford
Austin Chalk
Austin Chalk
Eagle Ford
E1
F1
E2
F2
E3
F3
E4
F4
E5
F5
E6
F6
E7
F7
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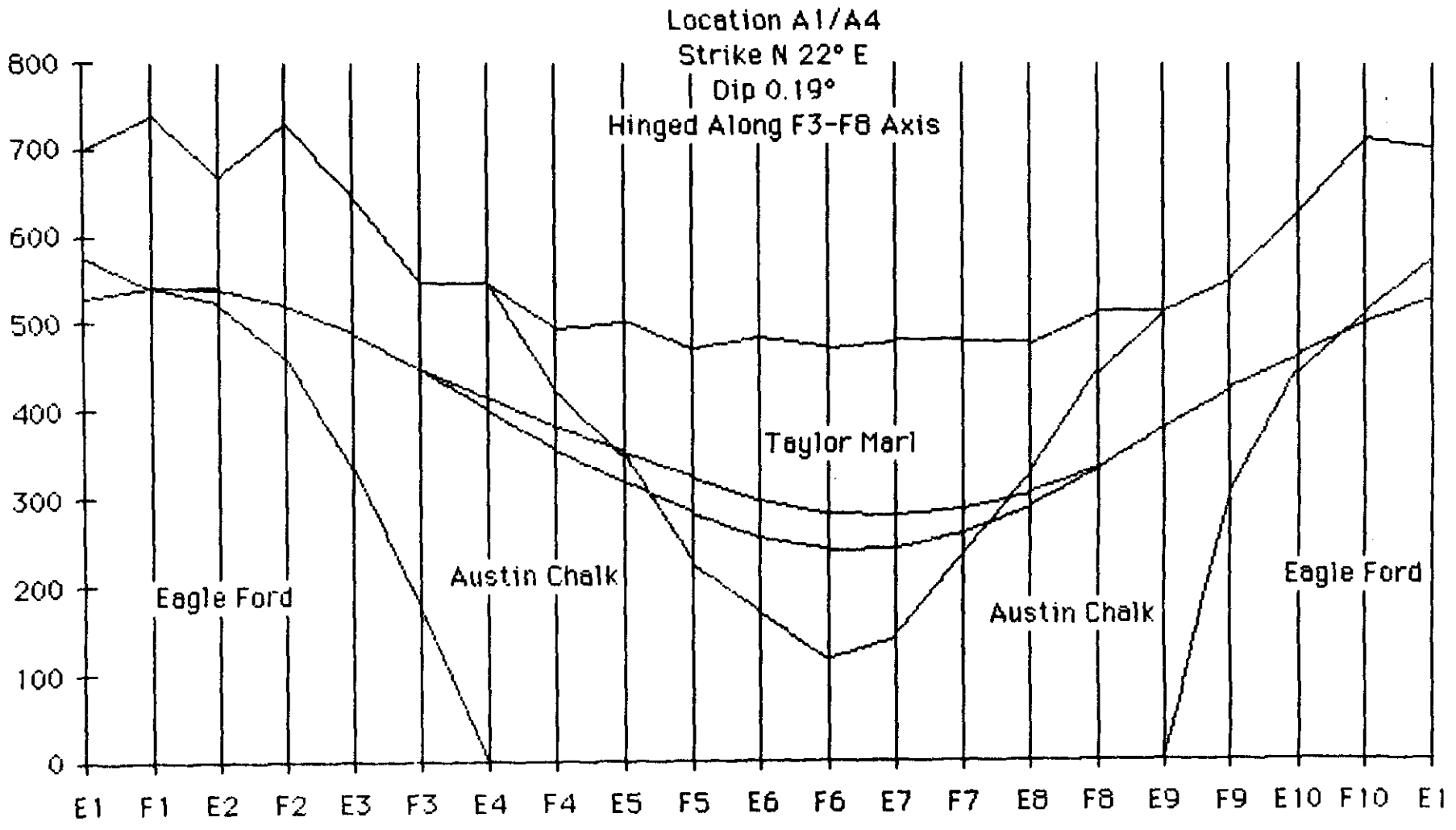
E9
F9
E10
F10
E1


Location A1/A4
Strike N 22° E
Dip 0.19°
Hinged Along F3-F8 Axis
800
700
600
500
400
300
200
100
0
Eagle Ford
Austin Chalk
Taylor Marl
Austin Chalk
Eagle Ford
E1
F1
E2
F2
E3
F3
E4
F4
E5
F5
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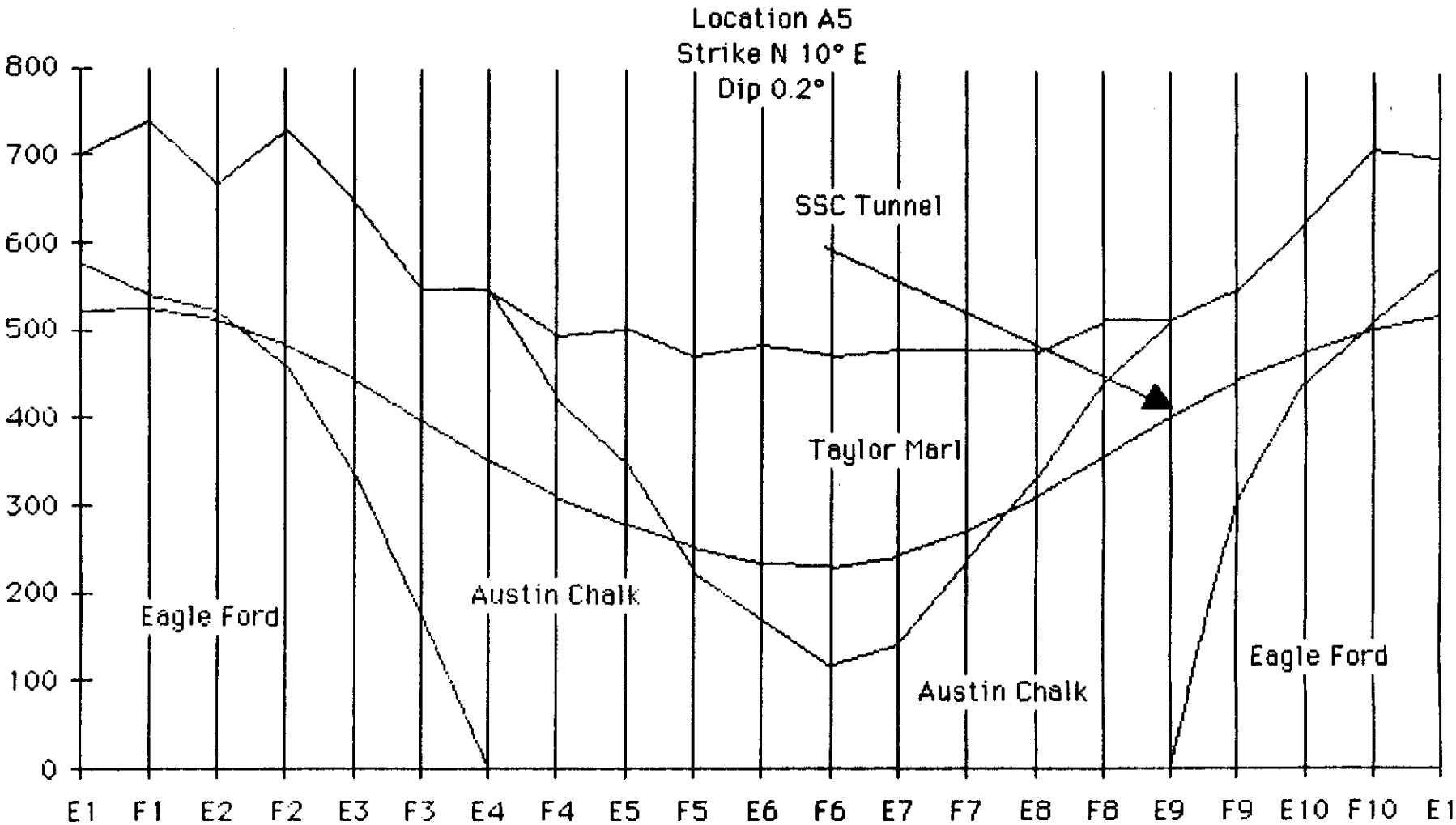
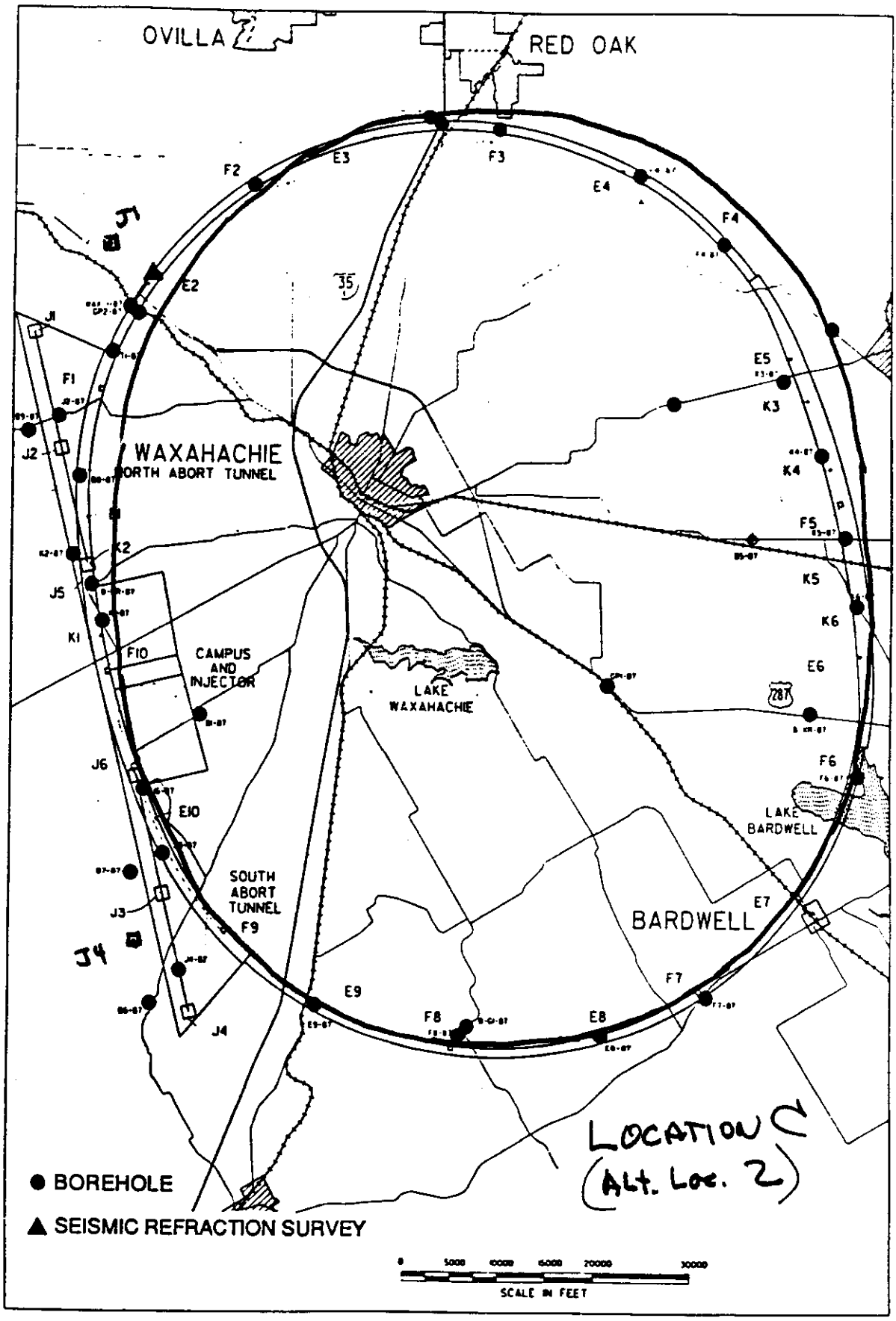
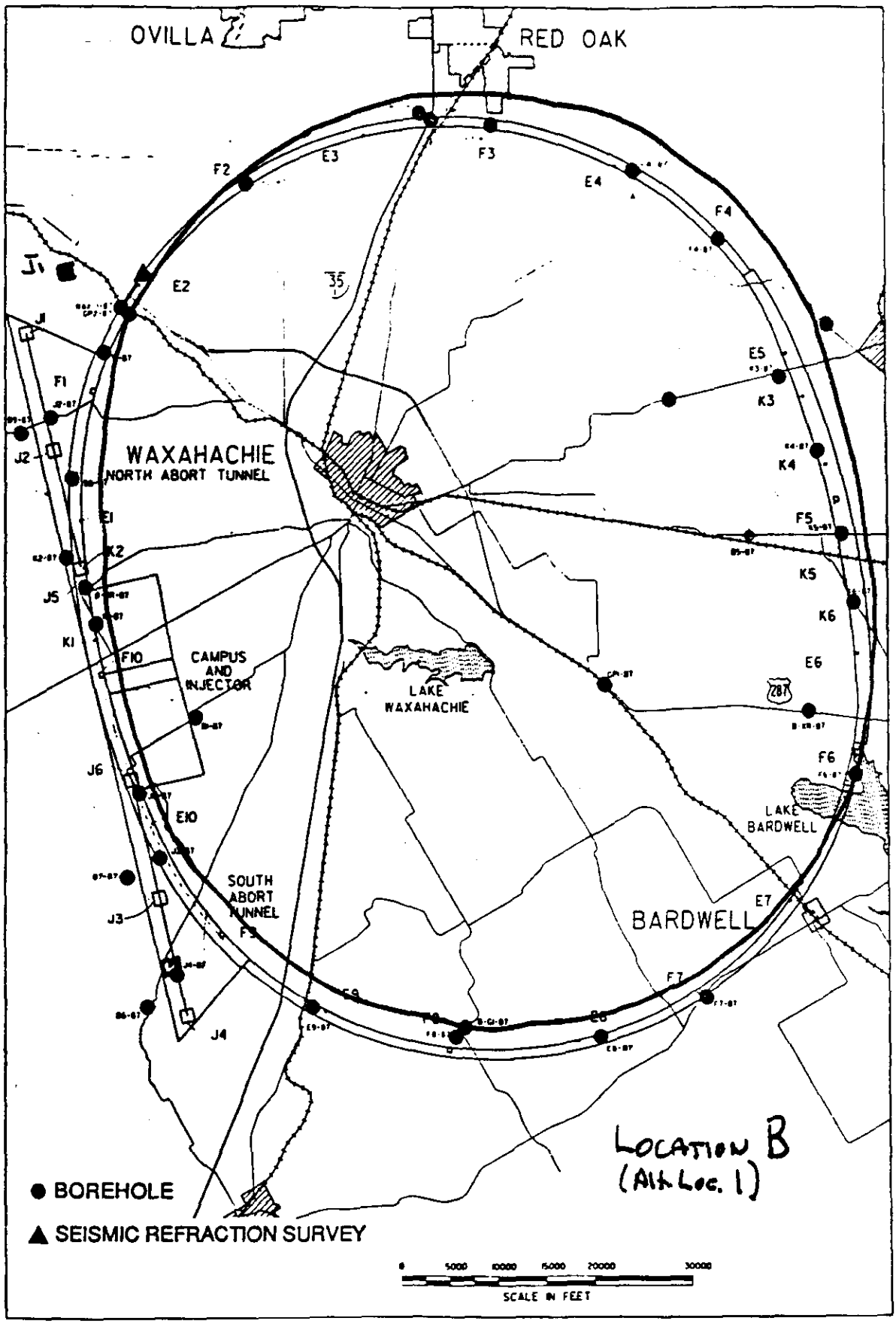
E9
F9
E10
F10
E1


Location A5
Strike N 10° E
Dip 0.2°
800
700
600
500
400
300
200
100
0
SSC Tunnel
Taylor Marl
Austin Chalk
Eagle Ford
Austin Chalk
Eagle Ford
E1
F1
E2
F2
E3
F3
E4
F4
E5
F5
E6
F6
E7
F7
E8
F8
E9
F9
E10
F10
E1


OVILLA
RED OAK
WAXAHACHIE
NORTH ABORT TUNNEL
CAMPUS AND INJECTOR
LAKE WAXAHACHIE
LAKE BARDWELL
BARDWELL
SOUTH ABORT TUNNEL
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
E2
E3
E4
E5
E6
E7
E8
E9
E10
K1
K2
K3
K4
K5
K6
J1
J2
J3
J4
J5
J6
35
287
LOCATION C
(ALT. LOC. 2)
BOREHOLE
SEISMIC REFRACTION SURVEY
0
5000
10000
15000
20000
30000
SCALE IN FEET


OVILLA
RED OAK
WAXAHACHIE
NORTH ABORT TUNNEL
CAMPUS AND INJECTOR
LAKE WAXAHACHIE
SOUTH ABORT TUNNEL
BARDWELL
LAKE BARDWELL
J1
J2
J3
J4
J5
J6
K1
K2
K3
K4
K5
K6
E1
E2
E3
E4
E5
E6
E7
E8
E9
E10
F1
F2
F3
F4
F5
F6
F7
F10
35
287
LOCATION B
(Alt. Loc. 1)
● BOREHOLE
▲ SEISMIC REFRACTION SURVEY
0 5000 10000 15000 20000 30000
SCALE IN FEET