

BITUMEN RESOURCES OF THE UPPER
DEVONIAN GROSMONT FORMATION,
Tp 88 TO 98, NORTHERN ALBERTA

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Alberta Energy and Natural Resources

Alberta Research Council
Open File Report
1986 - 1

JOINT REGIONAL SUBSURFACE GEOLOGY PROGRAM
Alberta Research Council
(Geological Survey Department)
Alberta Energy and Natural Resources
(Mineral Resources Division)

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INTRODUCTION

As part of the ARC/AENR joint Regional Subsurface Geology Program, a bitumen resources study of the Grosmont Formation was undertaken by Mr. T. Yoon of Alberta Energy and Natural Resources under the general supervision of Dr. R.S. Harrison, Alberta Research Council, during the period between November 1984 and April 1985. The study reflects the specific interest of AENR's Mineral Agreement Branch in the bitumen potential of the northern portion of the Grosmont belt.

In spite of various studies and ever-increasing interest in the Grosmont bitumen resources, reserve-related data has not been publicly available. ERCB does not publish the Paleozoic reserve data and is not at the present time in a position to provide specific data on a regional basis.

The study area lies between TP 88 to 98, R 19 to 26, W 4 M (figure 1). The area covers approximately 571 000 hectares (62 Tp) in the southeastern part of the Wabasca North Oil Sands area, where the prolific Liege gas field is located. Approximately one-quarter of the study area is presently held as oil sand leases by several companies.

An initial review of all wells (roughly 350) in the study area identified approximately 140 wells from which relevant data was available. Many of these wells were aimed at gas-bearing Cretaceous and uppermost Grosmont zones in the Liege field and bitumen-bearing Nisku zones in the western part of the study area. The raw data for the study was collected from AENR, and ERCB data files at ARC, exclusive of operators' proprietary technical information.

The following information is contained in this report: .

- (1) Computer-generated isopach maps of the Upper Grosmont G3, G2 and G1 stratigraphic units.
- (2) Computer-generated hydrocarbon pore volume maps for the Upper Grosmont G3, G2 and G1 units.
- (3) A table of stratigraphic picks used for the generation of the isopach maps (Table I).
- (4) A table of hydrocarbon pore volumes and potential pay thickness of the G3, G2 and G1 units in each study well (Table 2).
- (5) A table of generalized reservoir characteristics (Table 3a, 3b).
- (6) A table listing wells in the study area for which core analyses data is available (Table 4).

GEOLOGICAL SETTING

The crude bitumen reserves of interest in this study area are contained within southwesterly dipping Paleozoic platform carbonates which are unconformably overlain by a Cretaceous clastic sequence. The specific horizon of interest is the dolomitized Upper Devonian Grosmont Formation.

The eastern updip margin of the Grosmont is truncated by an erosional unconformity, the development of which undoubtedly gave rise to extensive leaching and the development of high secondary porosity. The Grosmont forms an erosional high on the pre-Cretaceous surface and appears to have been a major trap for the accumulation of oil (bitumen) in the study area.

The Grosmont Formation, a shallow marine, carbonate-platform sequence with a total thickness of approximately 170 to 180 meters, is underlain by the deeper water calcareous shales and argillaceous limestones of the Ireton Formation and generally separated from the overlying Nisku Formation by a relatively thin shale horizon.

The primary stratigraphic units of interest in this study are, in descending order, the G3, G2 and G1 units of the Upper Grosmont. These carbonate units are separated by thin but widespread calcareous shale horizons.

On a regional scale the bitumen pay is bounded by the pre-Cretaceous unconformity or by the gas-bitumen contact at + 250 meters (which can vary by 20 to 30 meters), and basally bounded by the bitumen-water contact at approximately + 160 meters (which can vary by 10 to 20 meters). Total dissolved solids of the Grosmont Formation water range from 3000 to 70 000 mg/l. Water resistivity ranges from 0.05 to 2.00 in the study area.

EVALUATION OF BITUMEN RESOURCES

This study was aimed at gaining an understanding of the distribution of bitumen resources contained in the Upper Grosmont units based on a "quick-look" approach.

Clean carbonate zones were identified on logs as possible bitumen-bearing units. Assuming that the pore volume contains only bitumen and water, the bitumen saturation of a carbonate could be determined for known values of water saturation and porosity.

Using porosity and bitumen saturation cut-offs of 6 percent and 50 percent respectively, average porosity and bitumen saturation values for each unit were manually determined from compensated Neutron-Formation Density logs and complemented by the very limited data available from actual core analyses. In addition, generalized regional reservoir characteristics were also summarized and used for areas with

little well control (Table 3a, 3b).

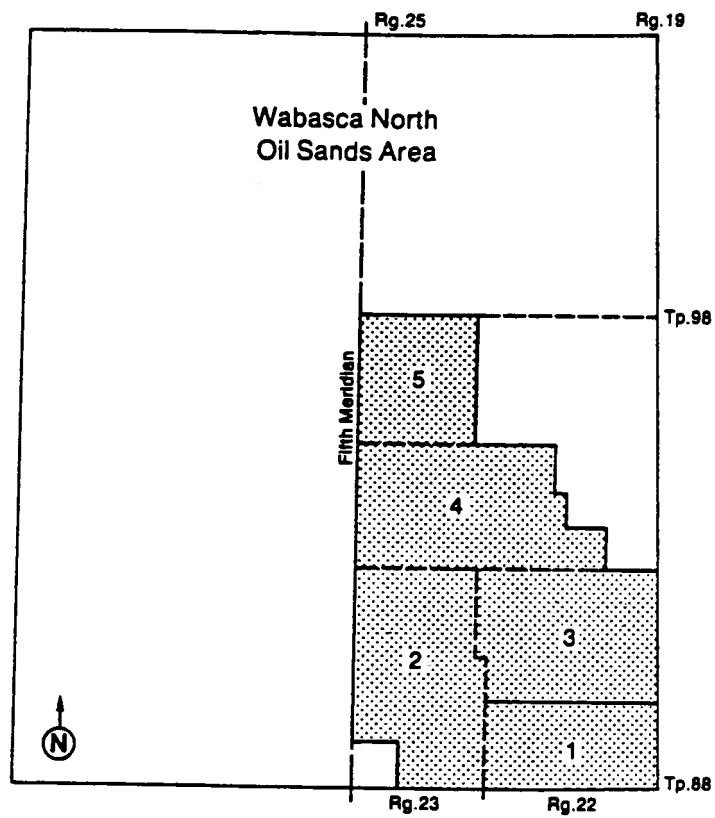
Less than 30 core analyses provided useful data for this study. Average regional bitumen saturation values were applied to uncored and unanalysed wells based on the average values determined at the nearest cored and analysed wells. Due to the scarcity of core analyses, it was necessary to develop a method for rough evaluation of the bitumen pay based on geophysical logs. Resistivity logs were compared with core analyses to determine bitumen saturation versus resistivity relationships. An approximate value of 100 ohms was found to satisfy the bitumen saturation cut-off (50 percent). Bitumen resources in partially flushed zones were included for this estimate, but not those from flushed zones.

SUMMARY OF FINDINGS

Within the total Upper Grosmont sequence, hydrocarbon pore volume values range from 2.5 meters to 9.0 meters with an average of approximately 6.0 meters. Maximum HPV of the G3, G2 and G1 units is approximately 12 meters, 4 meters and 2 meters, respectively. Actual pay thickness varies considerably from one Grosmont unit to the next, with the overall pay thicknesses in the Upper Grosmont ranging from 25 meters to over 80 meters.

The G3 unit is thick and rich in bitumen accumulation, but is less attractive for reservoir stimulation due to proximity of the unconformity and possible thief zones.

The G2 unit appears to be an economically attractive reservoir. There is relatively thick laterally extensive pay, with only moderate water saturation. The unit also contains less gas in comparison with the overlying G3 horizon. The G1 unit generally exhibits relatively low porosity and bitumen saturation and significantly thinner potential pay than either the G2 or G3 units.



Grosmont Bitumen Resources Study,
Subdivision of the Project Area

Figure 1.

SIRATIGRAPHIC SUBDIVISION

- b) kelly bushing elevation.
- c) total depth drilled (FTD).
- d) formation well completed in.
- e) tops & base of clean carbonate in upper Grosmont units (G3,G2,& G1) and top of Lower Grosmont and "Lower" Ireton. units = metres.

WELL NAME LOCATION	KB	FTD	COMPLETED FORMATION	G3		G2		G1		TLG	TLI
				T.	B.	T.	B.	T.	B.		
UNION CHIPEWYAN 14- 5-88-19-4	532	432	L. IRET.	255	282	284	314	317	328	333	376
UNION SIMON OV 7-11-88-19-4	527	353	GSMT.	0	0	255	274	277	288	293	0
UNION MCLEAN OV 7-28-88-19-4	522	341	GSMT.	0	0	256	272	278	289	295	0
SUN CONSUP BUFFALO 2- 3-88-20-4	536	570	BHL	294	317	319	349	352	363	368	409
CONSUP SIMON OV 6-13-88-20-4	527	0	0	277	285	287	317	320	332	337	379
CONSUP SIMON OV 7-16-88-20-4	530	394	GSMT.	282	312	314	350	354	360	365	0
CONSUP ORCHID 7-32-88-20-4	527	490	L. IRET.	286	310	311	340	345	354	359	398
CONSUP SIMON 3-34-88-20-4	521	540	BHL	235	295	296	319	321	332	337	377
SIEBENS CHIPEWYAN 11-29-88-21-4	524	430	L. IRET.	272	330	332	367	370	382	389	420
SIEBENS WOODEN 11-24-88-22-4	523	0	0	307	350	352	382	390	404	410	461
DOME MINK 10-35-88-22-4	520	432	L. IRET.	284	338	340	375	379	392	398	0
PCENT WOODEN 5-24-88-23-4	520	525	L. IRET.	344	390	395	425	434	446	451	501
TEXACO CUIN LK. 16-29-88-23-4	506	526	L. IRET.	339	399	402	439	441	453	457	506

WELL NAME LOCATION	KB	FTD	COMPLETED FORMATION	G3		G2		G1		TLG	TLI
				T.	B.	T.	B.	T.	B.		
PARAMOUNT ET AL. WOODEN 10-35-88-23-4	510	548	COOKING LK.	316	376	379	415	419	431	436	487
HOMESTEAD ET AL WOODEN 5-11-88-24-4	503	1195	PC	383	442	444	479	484	494	498	550
TEXACO CUIN LK. 7-26-88-24-4	533	565	L. IRET.	389	455	457	491	498	510	513	563
TEXACO CUIN LK. 4-32-88-24-4	585	532	GSMT.	457	522	526	0	0	0	0	0
TEXEX WOODEN 7-35-88-24-4	525	408	GSMT.	390	0	0	0	0	0	0	0
UNION CHIPEWYAN 2- 2-89-19-4	497	399	COOKING LK	0	0	0	0	235	245	252	291
PAN AM A-1 CHIPEWYAN 10-16-89-19-4	491	568	BHL	0	0	0	0	239	0	246	289
UNION MINK OV 7- 7-89-20-4	521	0	0	279	300	302	333	336	347	351	389
UNION MINK 6-26-89-20-4	523	382	LEDUC	253	258	260	291	293	305	310	351
UNION CHIPEWYAN 4-28-89-20-4	516	389	GSMT.	261	281	283	313	316	328	333	365
UNION MINK OV 10- 4-89-21-4	522	0	0	261	310	312	346	348	354	369	0

WELL NAME LOCATION	KB	FTD	COMPLETED FORMATION	T. G ³	B.	T. G ²	B.	T. G ¹	B.	TLG	TLI
SIEBENS CHIPEWYAN 6-7-89-21-4	510	329	GSMT.	254	312	315	0	0	0	0	0
UNION CHIPEWYAN 14-21-89-21-4	499	328	0	216	275	279	311	318	0	0	0
UNION CHIPEWYAN 6-25-89-21-4	513	526	BHL	242	272	274	306	309	320	326	370
SIEBENS CHIPEWYAN 7-14-89-22-4	509	422	0	261	319	321	357	361	373	379	433
UNION CHIPEWYAN 16-33-89-22-4	513	458	L. IRET.	258	319	321	356	361	373	379	433
CDNSUP MINK 16-13-89-23-4	514	544	L. IRET.	311	370	372	408	412	424	429	476
GAO MINK 10-29-89-23-4	512	1165	PC	322	378	381	411	420	432	437	486
AMERADA MINK S.T.H. 9 14-36-89-23-4	498	0	0	274	334	338	374	377	391	394	447
TEXEX WOODEN 10-13-89-24-4	509	370	GSMT.	344	0	0	0	0	0	0	0
CDNSUP MINK 7-35-89-24-4	520	546	L. IRET.	340	404	406	437	442	457	461	512
TEXACO CORN LK 6-11-89-25-4	621	695	L. IRET.	495	564	566	598	601	614	620	676
TEXEX CORN 7-14-89-25-4	598	470	GSMT.	464	0	0	0	0	0	0	0
CNDSUP MINK 11-14-90-19-4	516	321	L. IRET.	0	0	0	0	0	0	249	279
UNION CHIPEWYAN 8-6-90-20-4	522	352	GSMT.	271	279	280	308	311	324	329	0

WELL NAME LOCATION	KB	FTD	COMPLETED FORMATION	T. ^{G3}	B.	T. ^{G2}	B.	T. ^{G1}	B.	TLG	TLI
CONSUP MINK 10- 2-90-21-4	503	392	L. IRET.	230	258	261	293	297	311	318	369
CDNSUP MINK 10- 8-90-21-4	513	413	L. IRET.	233	281	283	318	321	334	341	394
CDNSUP LIEGE 7-20-90-21-4	510	412	L. IRET.	233	268	271	306	309	322	329	382
CDNSUP MINK 7-26-90-21-4	519	387	0	237	254	257	291	293	307	314	367
CDNSUP LIEGE 11-32-90-21-4	496	355	L. IRET.	210	247	249	286	287	301	307	0
UNION CHIPEWYAN UV 6- 1-90-22-4	510	364	L. GSMT.	249	298	299	330	337	350	355	0
UNION MINK UV 11-17-90-22-4	493	424	L. GSMT.	246	299	301	333	341	353	359	0
CDNSUP MINK 7-26-90-22-4	517	423	L. IRET.	245	290	293	330	333	345	351	406
CDNSUP MINK UV 10- 5-90-23-4	509	506	0	301	367	370	403	409	421	424	477
CDNSUP MINK 7-19-90-23-4	516	499	L. IRET.	297	363	366	398	401	418	423	478
CDNSUP CHIPEWYAN 11-21-90-23-4	521	480	L. IRET.	285	351	354	391	392	405	411	464
CDNSUP CHIPEWYAN 7-25-90-23-4	520	463	0	258	326	328	368	370	382	387	441
CDNSUP MINK 7-34-90-23-4	536	491	L. IRET.	287	353	356	392	396	410	416	469
CDNSUP MINK 10-23-90-24-4	509	510	L. IRET.	299	369	371	402	404	423	428	483

WELL NAME LOCATION	KB	FTD	COMPLETED FORMATION	T. G3	B.	T. G2	B.	T. G1	B.	TLG	TLI
CANTERRA LIEGE 10-16-91-19-4	529	318	LEDUC	0	0	0	0	0	0	252	297
MIAMI AMOCO CHIPEWYAN 11-29-91-19-4	522	316	L. IRET.	0	0	0	0	249	252	258	301
PAN AM STRAT 1 8-32-91-19-4	532	426	LEDUC	0	0	0	0	0	0	258	299
TEXEX CANOXY LIEGE 10-14-91-20-4	506	381	LEDUC	0	0	228	229	233	244	249	293
PARA LIEGE 11-26-91-20-4	515	458	BHLK	0	0	0	0	239	250	257	310
PARAMOUNT LIEGE 11-28-91-20-4	522	461	0	0	0	242	252	256	269	276	329
AMERADA MINK STM 7 9-33-91-20-4	521	1002	PC	0	0	224	243	247	258	266	319
10- 1-91-21-4	514	376	L. IRET.	0	0	0	0	0	0	0	0
CDNSUP MINK 11- 8-91-21-4	509	389	L. IRET	227	260	266	297	303	316	323	376
CDNSUP LIEGE 7-14-91-21-4	519	380	L. IRET.	228	246	251	280	286	300	306	359
CDNSUP MINK 11-20-91-21-4	514	343	GSMT.	243	272	277	0	0	0	0	0
CDNSUP MINK 7-26-91-21-4	531	374		234	242	247	281	283	296	303	356
CDNSUP LIEGE 10-32-91-21-4	538	412	L. IRET.	252	270	274	306	311	324	331	384
CDNSUP LIEGE 7- 1-91-22-4	528	278	GSMT.	259	0	0	0	0	0	0	0

WELL NAME LOCATION	KB	FTD	COMPLETED FORMATION	T. ^{G3}	B.	T. ^{G2}	B.	T. ^{G1}	B.	TLG	TLI
CDNSUP MINK 11- 5-91-22-4	548	485	L. IRET.	282	341	344	383	386	398	404	458
CDNSUP MINK 7-26-91-22-4	548	419	L. IRET.	271	304	309	343	346	360	366	413
CDNSUP CHIPEWYAN OV 10-34-91-23-4	568	535	0	0	0	0	0	0	0	0	0
CDNSUP GREW 11-12-91-24-4	518	500	L. IRET.	288	361	363	393	396	415	420	474
ARCO IOE SEAFORTH 10-34-91-24-4	541	1220	PC	302	377	379	426	427	432	437	491
MIAMI AMOCO CHIPEWYAN 6- 8-92-19-4	530	337	0	0	0	0	0	0	0	252	294
V 10-16-92-19-4	527	331	0	0	0	0	0	0	0	263	268
UNIGAS LIEGE 11-30-92-19-4	532	310	0	0	0	0	0	0	0	255	285
PARAMOUNT CHIPN 11- 8-92-20-4	521	245	0	0	0	214	240	0	0	0	0
PARA CHIPEWYAN 11-22-92-20-4	522	244	GSMT.	0	0	0	0	226	236	0	0
PARA CHIPEWYAN 6-29-92-20-4	518	243	0	0	0	213	227	233	0	0	0
CDNSUP LIEGE 6- 2-92-21-4	537	415	L. IRET.	242	248	252	289	291	304	311	363
CDNSUP MINK 11- 8-92-21-4	551	400	0	269	272	278	309	313	327	333	386

WELL NAME LOCATION	KB	FTD	COMPLETED FORMATION	T. ^{G3}	B.	T. ^{G2}	B.	T. ^{G1}	B.	TLG	TLI
CDNSUP LIEGE 10-14-92-21-4	544	370	L. IRET.	0	0	242	276	278	292	294	351
CDNSUP LIEGE 1-16-92-21-4	559	416	L. IRET.	257	261	266	301	302	317	323	377
CDNSUP LIEGE 10-20-92-21-4	537	370	L. IRET.	236	237	242	277	279	292	299	352
CDNSUP MINK 6-26-92-21-4	558	306	GSMT.	0	0	243	276	278	0	0	0
CDNSUP LIEGE 10-32-92-21-4	565	375	L. IRET.	0	0	258	294	297	310	317	362
CDNSUP LIEGE 10- 2-92-22-4	555	445	L. IRET.	274	301	304	336	341	357	364	418
CDNSUP LIEGE 10-14-92-22-4	579	457	L. IRET.	294	316	319	352	356	371	377	431
UNIGAS LIEGE 10-22-92-22-4	594	463	L. IRET.	309	331	336	367	370	387	393	447
UNIGAS LIEGE 6-36-92-22-4	601	415	L. IRET.	310	313	318	353	355	370	376	0
HOMESTEAD IDE ARCO LIEGE 5-12-92-24-4	562	1233	PC	318	384	388	433	435	440	446	499
CZAR LIEGE 7-13-92-24-4	585	1186	KEG R.	343	394	397	443	444	449	455	556
CDNSUP GREW 10-21-92-24-4	592	560	L. IRET.	357	415	419	455	463	475	481	536
PARA RABBIT 6- 3-93-20-4	529	248	GSMT.	0	0	0	0	225	229	236	0
PARAMOUNT CHIPM 6-29-93-20-4	589	311	GSMT.	0	0	0	0	287	289	296	0

WELL NAME LOCATION	KB	FTD	COMPLETED FORMATION	T. ^{G3}	B.	T. ^{G2}	B.	T. ^{G1}	B.	TLG	TLI
PARA LIEGE 6-10-93-21-4	558	286	0	0	0	253	266	274	0	0	0
TEXEX CANOXY LIEGE 11-14-93-21-4	570	381	L. IRET.	0	0	268	283	287	299	306	360
PHILLIPS LIEGE OV 10-13-93-23-4	684	566	0	415	428	431	464	468	484	490	0
PHILLIPS LIEGE OV 10- 8-93-24-4	627	0	0	0	0	0	0	0	0	0	0
PHILLIPS LIEGE OV 10-12-93-24-4	671	579	0	423	450	454	474	488	505	510	565
FPC LIEGE 15-34-93-24-4	719	1342	PC	477	491	493	526	527	548	552	606
FPC LIEGE R. 10-15-93-25-4	674	652	L. IRET.	449	509	514	558	561	568	572	628
FPC LIEGE R. 10-33-93-25-4	748	1418	0	524	575	576	621	624	632	636	691
PEX CONSUP LIEGE 6- 8-94-21-4	671	465	GSMT.	0	0	365	388	389	402	409	0
PEX CONSUP LIEGE 10-10-94-21-4	709	485	GSMT.	0	0	360	371	378	392	398	453
PACIFIC ALAX LIEGE 10-17-94-21-4	669	444	0	0	0	372	377	378	392	399	433
PACIFIC CONSUP OSI 11-22-94-21-4	690	462	L. IRET.	0	0	386	388	390	402	410	0
PACIFIC ALAX LIEGE 11-29-94-21-4	764	542	0	0	0	464	471	473	486	492	526
CZAR LIEGE 7-19-94-22-4	751	513	GSMT.	0	0	467	490	497	0	0	0

WELL NAME LOCATION	KB	FTD	COMPLETED FORMATION	G3		G2		G1		TLG	TLI
				T.	B.	T.	B.	T.	B.		
PACIFIC CDNSUP OSI 14-23-94-22-4	763	607	L. IRET.	0	0	466	477	482	499	505	561
IDE HERSHEY SEAFORTH 11-33-94-22-4	777	1349	PC	0	0	492	499	503	522	526	581
WOODS LRI LIEGE 12- 7-94-23-4	792	1355	0	541	545	551	580	583	599	605	659
PHILLIPS LIEGE OV 10-24-94-24-4	783	0	0	530	533	536	565	577	587	596	645
PACIFIC CDNSUP OSI 6- 1-95-21-4	768	558	0	0	0	0	0	0	0	496	528
PACIFIC CDNSUP OSI 7- 6-95-21-4	810	598	L. IRET.	0	0	0	0	510	529	532	588
PACIFIC ALAX LIEGE 10- 8-95-21-4	815	590	0	0	0	517	521	522	536	542	585
PEX CDNSUP LIEGE 11-10-95-21-4	823	595	GSMT.	0	0	0	0	0	0	541	592
PACIFIC CDNSUP OSI 7- 2-95-22-4	824	637	0	0	0	505	525	526	541	548	602
PACIFIC ALAX LIEGE 10-15-95-22-4	795	608	L. IRET.	0	0	0	0	515	522	529	582
CZAR LIEGE 7-21-95-22-4	794	610	L. IRET.	0	0	0	0	519	532	539	594
PEX CDNSUP LIEGE 7-24-95-22-4	818	585	GSMT.	0	0	0	0	530	540	547	0
PEX CDNSUP OSI 6-35-95-22-4	802	606	L. IRET.	0	0	0	0	0	0	532	587

WELL NAME LOCATION	KB	FTD	COMPLETED FORMATION	T. ^{G3}	B.	T. ^{G2}	B.	T. ^{G1}	B.	TLG	TLI
TEXEX BURNT LK. 10-23-95-23-4	775	578	L. IRET.	0	0	0	0	526	539	539	0
GNP NOEF PANNY 10-28-95-24-4	781	1424	0	0	0	541	581	583	600	604	650
PACIFIC ALAX LIEGE 2- 3-96-22-4	791	0	0	0	0	0	0	0	0	525	577
PACIFIC ALAX LIEGE 6-11-96-23-4	743	579	L. IRET.	0	0	0	0	0	0	501	556
DOME LIEGE 12-16-96-23-4	807	678	L. IRET.	0	0	0	0	555	571	576	630
DOME JEAN 11-27-96-23-4	790	641	L. IRET.	0	0	0	0	536	540	545	600
PACIFIC CONSUP JEAN 7- 2-97-23-4	825	643	0	0	0	0	0	0	0	562	615
PAN AM FPC SPUTINA 6- 7-97-23-4	835	1430	GRANITE BASH	0	0	579	600	601	603	604	658
CANOXY JEAN LK 7-34-97-23-4	758	567	0	0	0	0	0	0	0	504	554
AQUIT JEAN 10-15-97-24-4	780	561	GSMT.	0	0	0	0	0	0	519	0
PAN AM SPUTINA 6-24-97-24-4	786	1336	0	0	0	529	533	542	555	561	616
6- 1-97-25-4	708	497	L. IRET.	0	0	457	487	506	508	513	569
PAN AM JEAN LK. 4-11-98-23-4	666	1179	0	0	0	0	0	0	0	413	456

WELL NAME LOCATION	KB	FTD	COMPLETED FORMATION	G3		G2		G1		TLG	TLI
				T.	B.	T.	B.	T.	B.		
CANOXY JEAN LK. 7-30-98-23-4	632	449	L. IRET.	0	0	0	0	365	376	382	436
CANTERRA JEAN 6- 5-98-24-4	0	0		0	0	0	0	0	0	0	0
TEXEX JEAN R. 6-15-98-24-4	740	569	GSMT.	0	0	0	0	498	510	515	568
TEXEX JEAN R. 7-34-98-24-4	619	455	0	0	0	356	367	371	378	382	436

Table No.2. HYDROCARBON PORE VOLUME & PAY THICKNESS

Thickness of pay zone (in meters) and bitumen potential,
expressed as hydrocarbon pore volume (ie - metres of oil).

WELL NAME LOCATION	G3	HPV G2	G1	PAY THICKNESS		
				G3	G2	G1
UNION SIMON OV 7-11-88-19-4	0.00	2.63	1.72	0.0	13.0	11.0
UNION MCLEAN OV 7-28-88-19-4	0.00	1.73	0.84	0.0	12.0	11.0
CDNSUP MINK OV 10-31-88-19-4	0.00	1.18	0.64	0.0	11.0	10.0
CDNSUP SIMON OV 6-13-88-20-4	1.27	2.35	1.03	8.0	25.0	11.0
CDNSUP SIMON OV 7-16-88-20-4	2.70	3.75	0.23	18.0	25.0	4.0
CDNSUP ORCHID 7-32-88-20-4	2.27	2.30	1.02	18.0	18.0	9.0
CDNSUP SIMON 3-34-88-20-4	6.63	1.36	0.86	41.0	12.0	8.0
SIEBENS CHIPEWYAN 11-29-88-21-4	4.33	1.38	0.44	37.0	20.0	11.0
SIEBENS WOODEN 11-24-88-22-4	2.98	1.62	0.39	24.0	19.0	9.0
DOME MINK 10-35-88-22-4	2.05	0.78	0.09	16.0	7.0	2.0
PCENT WOODEN 5-24-88-23-4	6.55	0.00	0.00	39.0	0.0	0.0
TEXACO COIN LK. 7-26-88-24-4	0.00	0.00	0.00	0.0	0.0	0.0
TEXACO COIN LK. 4-32-88-24-4	0.00	0.00	0.00	0.0	0.0	0.0

WELL NAME LOCATION	G3	HPV G2	G1	PAY THICKNESS		
				G3	G2	G1
TEXEX WOODEN 7-35-88-24-4	0.00	0.00	0.00	0.0	0.0	0.0
10-21-88-25-4	0.00	0.00	0.00	0.0	0.0	0.0
11-24-88-25-4	0.00	0.00	0.00	0.0	0.0	0.0
CANTERRA MCLEAN 6-19-89-18-4	0.00	0.00	0.00	0.0	0.0	0.0
UNION CHIPEWYAN 2- 2-89-19-4	0.00	0.00	1.19	0.0	0.0	13.0
UNION MINK 6-26-89-20-4	0.82	3.28	1.39	5.0	28.0	11.0
SIEBENS CHIPEWYAN 6- 7-89-21-4	5.88	0.00	0.00	50.0	0.0	0.0
UNION CHIPEWYAN 14-21-89-21-4	3.87	1.23	0.00	43.0	21.0	0.0
SIEBENS CHIPEWYAN 7-14-89-22-4	5.16	1.25	0.22	43.0	27.0	8.0
UNION CHIPEWYAN 16-33-89-22-4	6.13	1.19	0.50	41.0	15.0	10.0
CONSUP MINK 16-13-89-23-4	5.83	1.05	0.00	30.0	14.0	0.0
CONSUP MINK 7-35-89-24-4	6.25	0.00	0.00	28.0	0.0	0.0
TEXACO CORN LK 6-11-89-25-4	0.00	0.00	0.00	0.0	0.0	0.0
CNDSUP MINK 11-14-90-19-4	0.00	0.00	0.00	0.0	0.0	0.0

WELL NAME LOCATION	G3	HPV G2	G1	PAY THICKNESS		
				G3	G2	G1
UNION CHIPEWYAN 8- 6-90-20-4	0.70	2.28	1.42	5.0	25.0	13.0
CONSUP MINK 10- 2-90-21-4	3.02	2.42	1.34	25.0	29.0	13.0
CONSUP MINK 10- 8-90-21-4	5.92	1.62	1.06	37.0	29.0	11.0
CONSUP MINK 7-26-90-21-4	3.02	3.36	1.34	14.0	25.0	14.0
CONSUP LIEGE 11-32-90-21-4	4.82	2.31	1.61	37.0	31.0	14.0
UNION CHIPEWYAN OV 6- 1-90-22-4	4.98	1.68	0.37	34.0	22.0	4.0
UNION MINK OV 11-17-90-22-4	11.61	3.08	0.00	49.0	27.0	0.0
CANSUP MINK 10- 5-90-23-4	7.05	0.00	0.00	34.0	0.0	0.0
CONSUP MINK 7-19-90-23-4	8.00	0.67	0.00	44.0	8.0	0.0
CONSUP CHIPEWYAN 11-21-90-23-4	8.69	1.74	0.00	55.0	18.0	0.0
CONSUP CHIPEWYAN 7-25-90-23-4	7.95	0.71	0.00	54.0	11.0	0.0
CONSUP MINK 7-34-90-23-4	7.39	0.91	0.00	55.0	14.0	0.0
CONSUP MINK 10-23-90-24-4	6.17	0.00	0.00	61.0	0.0	0.0
MIAMI AMOCO CHIPEWYAN 11-29-91-19-4	0.00	0.00	0.34	0.0	0.0	3.0

WELL NAME LOCATION	G3	HPV G2	G1	PAY G3	THICKNESS G2	G1
TEXEX CANOXY LIEGE 10-14-91-20-4	0.00	0.00	0.79	0.0	0.0	11.0
PARA LIEGE 11-26-91-20-4	0.00	0.00	0.82	0.0	0.0	9.0
AMERADA MINK STH 7 9-33-91-20-4	0.00	0.00	0.00	0.0	0.0	0.0
CDNSUP MINK 11- 8-91-21-4	3.26	2.55	1.05	34.0	28.0	13.0
CDNSUP LIEGE 7-14-91-21-4	2.32	3.22	1.08	14.0	29.0	12.0
CDNSUP MINK 11-20-91-21-4	3.74	0.00	0.00	24.0	0.0	0.0
CDNSUP MINK 7-26-91-21-4	0.00	3.84	1.50	0.0	30.0	13.0
CDNSUP LIEGE 10-32-91-21-4	1.87	3.53	1.17	18.0	31.0	13.0
CDNSUP MINK 11- 5-91-22-4	9.87	1.92	0.00	55.0	27.0	0.0
CDNSUP MINK 7-26-91-22-4	3.63	2.95	1.79	21.0	28.0	14.0
CDNSUP CHIPEWYAN OV 10- 4-91-23-4	8.90	0.45	0.35	53.0	8.0	3.0
CDNSUP GREW 11-12-91-24-4	6.77	0.44	0.00	41.0	5.0	0.0

WELL NAME LOCATION	G3	HPV G2	G1	PAY THICKNESS		
				G3	G2	G1
CDNSUP LIEGE 6- 2-92-21-4	0.64	2.13	1.10	5.0	30.0	12.0
CDNSUP MINK 11- 8-92-21-4	0.43	2.07	1.51	5.0	29.0	13.0
CDNSUP LIEGE 10-14-92-21-4	0.00	1.43	0.79	0.0	28.0	13.0
CDNSUP LIEGE 1-16-92-21-4	0.28	1.29	1.20	3.0	28.0	14.0
CDNSUP LIEGE 10-20-92-21-4	0.00	2.20	1.27	0.0	27.0	13.0
CDNSUP LIEGE 10-32-92-21-4	0.00	0.62	1.19	0.0	13.0	13.0
CDNSUP LIEGE 10-14-92-22-4	3.39	3.20	0.80	22.0	30.0	15.0
UNIGAS LIEGE 10-22-92-22-4	1.00	1.47	0.68	18.0	18.0	8.0
UNIGAS LIEGE 6-36-92-22-4	0.15	1.18	1.19	3.0	21.0	13.0
CDNSUP GREW 10-21-92-24-4	8.04	1.08	0.00	33.0	15.0	0.0
TEXEX CANOXY LIEGE 11-14-93-21-4	0.00	0.32	0.71	0.0	7.0	13.0
PHILLIPS LIEGE OV 10-13-93-23-4	2.16	2.48	0.50	11.0	30.0	11.0
PHILLIPS LIEGE OV 10-12-93-24-4	2.59	1.64	0.79	24.0	21.0	10.0
PEX CDNSUP LIEGE 10-10-94-21-4	0.00	0.00	0.88	0.0	0.0	0.0 12.0

WELL NAME LOCATION	G3	HPV G2	G1	PAY THICKNESS		
				G3	G2	G1
PACIFIC ALAX LIEGE 10-17-94-21-4	0.00	0.14	0.95	0.0	2.0	13.0
PACIFIC ALAX LIEGE 11-29-94-21-4	0.00	0.07	0.81	0.0	1.0	11.0
IOE HERSHEY SEAFORTH 11-33-94-22-4	0.00	0.00	0.81	0.0	0.0	11.0
PHILLIPS LIEGE OV 10-24-94-24-4	0.00	2.07	0.67	0.0	29.0	10.0
PACIFIC CONSUP OSI 6- 1-95-21-4	0.00	0.00	0.00	0.0	0.0	0.0
PEX CONSUP LIEGE 6- 7-95-21-4	0.00	0.00	1.28	0.0	0.0	14.0
PACIFIC ALAX LIEGE 10- 8-95-21-4	0.00	0.00	1.03	0.0	0.0	14.0
PACIFIC ALAX LIEGE 10-15-95-22-4	0.00	0.00	0.40	0.0	0.0	6.0
PEX CONSUP LIEGE 7-24-95-22-4	0.00	0.00	0.92	0.0	0.0	9.0
TEXEX BURNT LK. 10-23-95-23-4	0.00	0.00	0.85	0.0	0.0	7.0
PACIFIC ALAX LIEGE 6-11-96-23-4	0.00	0.00	0.00	0.0	0.0	0.0
DOME LIEGE 12-16-96-23-4	0.00	0.00	0.19	0.0	0.0	4.0
DOME JEAN 11-27-96-23-4	0.00	0.00	0.10	0.0	0.0	4.0
PAN AM FPC SPUTINA 6- 7-97-23-4	0.00	0.00	0.00	0.0	0.0	0.0

WELL NAME LOCATION	G3	HPV G2	G1	PAY THICKNESS		
				G3	G2	G1
CANOXY JEAN LK 7-34-97-23-4	0.00	0.00	0.00	0.0	0.0	0.0
AQUIT JEAN 10-15-97-24-4	0.00	0.00	0.00	0.0	0.0	0.0
DOME JEAN 6- 1-97-25-4	0.00	2.22	0.00	0.0	22.0	0.0
PAN AM JEAN LK. 4-11-98-23-4	0.00	0.00	0.00	0.0	0.0	0.0
CANOXY JEAN LK. 7-30-98-23-4	0.00	0.00	0.00	0.0	0.0	0.0
CANTERRA JEAN 6- 5-98-24-4	0.00	0.00	0.32	0.0	0.0	8.0
TEXEX JEAN R. 6-15-98-24-4	0.00	0.00	0.65	0.0	0.0	12.0

Table 3a

GROSMONT BITUMEN STUDY

Generalized Reservoir Characteristics
for each stratigraphic unit

Unit	Porosity (%)	Bitumen Saturation (%)
G3	<ul style="list-style-type: none"> - Average 18 - upper half - 20 - lower half - 16 	<ul style="list-style-type: none"> - Average 60-80 - higher close to the eastern erosional edge
G2	<ul style="list-style-type: none"> - Average 14 - top - 20 - base- 6 	<ul style="list-style-type: none"> - east: 70-80 - west as low as 10
G1	<ul style="list-style-type: none"> - generally low - 20 to 30 where moldic and fracture porosities present 	<ul style="list-style-type: none"> - generally low - close to the erosional edge averages 60-70

Table 3b

Generalized Reservoir Characteristics for each subdivision of the study area (Figure 1).

Area #1

<u>Unit</u>	<u>(%) Por.</u>	<u>Max. Bitumen Sat. (%)</u>	<u>Water Sat. (%)</u>	<u>Remarks</u>
G3	24	92	8	Sw (to 35%) plus some gas
G2	16	90	10	Sw (to 25%) plus some gas
G1	15	87	13	Some gas

Area #2

<u>Unit</u>	<u>(%) Por.</u>	<u>Max. Bitumen Sat. (%)</u>	<u>Water Sat. (%)</u>	<u>Remarks</u>
G3	24	93	7	Sw (to 22%) plus some gas
G2	12	85	15	Partially flushed (Sw: to 30%), flushed (Sw: to 67%)
G1	Flushed (Sw: to 64%)			-----

Area #3

<u>Unit</u>	<u>(%) Por.</u>	<u>Max. Bitumen Sat. (%)</u>	<u>Water Sat. (%)</u>	<u>Remarks</u>
G3	21	94	6	Gas saturation: to 30%
G2	13	89	11	Gas saturation: to 30%
G1	16	93	7	Partially flushed: Sw to 36%

Area #4

<u>Unit</u>	<u>(%) Por.</u>	<u>Max. Bitumen Sat. (%)</u>	<u>Water Sat. (%)</u>	<u>Remarks</u>
G3	19	70	6	Gas saturation: to 30%
G2	14	60	6	Gas saturation: to 40%
G1	12	70	6	Gas saturation: to 30%

Area #5

<u>Unit</u>	<u>(%) Por.</u>	<u>Max. Bitumen Sat. (%)</u>	<u>Water Sat. (%)</u>	<u>Remarks</u>
G3	-----N/A-----			
G2	16	63	10	Some gas
G1	15	50	20	Some gas

LIST OF CORE ANALYSES

Table No.4. a) well name & location.
 b) core interval.
 c) total length.
 d) interval length tested.
 e) units the core covered.

LEGEND

NI - Nisku
 UI - Upper Ireton
 G3 - Upper unit (Upper Grosmont)
 G2 - Middle unit (Upper Grosmont)
 G1 - Lower unit (Upper Grosmont)
 LG - Lower Grosmont
 ALL- Upper and Lower Grosmont

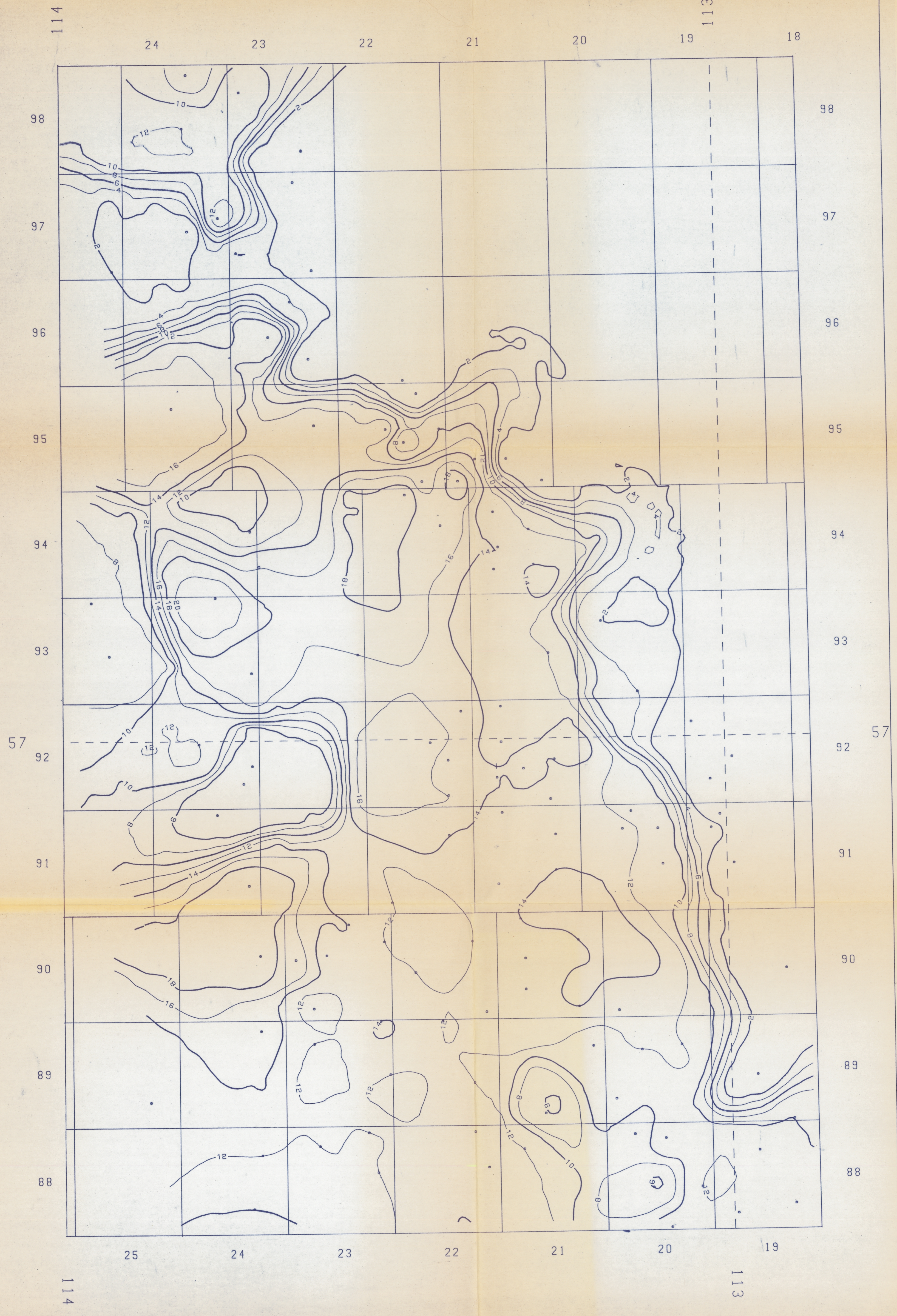
WELL NAME LOCATION	CORE INTERVAL	TOTAL LENGTH	INTERVAL LENGTH TESTED	UNITS	REMARKS
UNION CHIP 14- 5-88 -19-4	259.38-322.54	63.16	64.62	G3,G2,G1	No saturation (oil & water)
CUNSUP SIMON 3-34-88 -20-4	254.81-466.04	211.23	211.53	ALL	
PC MOUDEN HOUSE 5-24-88 -23-4	318.00-446.86	128.86	0.00	NI,G3,G2,G1	
TEXACO CORN LK. 16-29-88 -23-4	274.25-479.30	205.05	208.65	ALL	saturation (oil & water), upper part only
TEXACO CORN LK. 7-26-88 -24-4	315.75-539.75	224.00	228.55	ALL	
TEXACO CORN LK. 4-32-88 -24-4	484.00-531.30	47.30	47.50	G3	
TEXEX MOUDEN 7-35-88 -24-4	286.51-400.51	114.00	116.13	G3	
TEXACO CORN LK. 10-21-88 -25-4	466.00-614.75	148.75	149.25	UI,G3	saturation (oil & water), lower part only
TEXACO CORN LK. 11-24-88 -25-4	427.25-654.80	227.55	230.05	ALL	
UNION CHIP 2- 2-89 -19-4	242.01-251.67	9.66	10.67	G1	No saturation (oil & water)
UNION MINK 6-26-89 -20-4	247.00-272.40	25.40	27.50	G3,G2	
UNION CHIP 4-28-89 -20-4	265.18-358.14	92.96	94.79	ALL	No saturation (oil & water)
SIEMENS CHIP 6- 7-89 -21-4	242.32-291.54	49.22	16.77	UI,G3,	
UNION CHIP 14-21-89 -21-4	222.50-319.74	97.24	97.54	G3,G2,G1	No saturation (oil & water)

WELL NAME LOCATION	CORE INTERVAL	TOTAL LENGTH	INTERVAL LENGTH TESTED	UNITS	REMARKS
UNION CHIP 6-25-89 -21-4	244.75-251.76	7.01	7.32	G3	No saturation (oil & water)
UNION CHIP 16-33-89 -22-4	260.60-297.88	37.28	37.49	G3	No saturation (oil & water)
CONSUP MINK 16-13-89 -23-4	266.80-380.14	114.14	114.25	UI,G3,G2	
TEXEX WOODEN 10-13-89 -24-4	271.27-359.66	88.39	91.44	NI,G3	
CONSUP MINK OV 7-33-89 -24-4	263.40-368.10	84.70	0.00	NI,G3	
TEXACO CURN LK. 6-11-89 -25-4	415.20-636.95	221.75	225.95	ALL	
TEXEX CORN 7-14-89 -25-4	444.09-486.16	42.07	47.25	NI,G3	
CONSUP MINK 11-14-90 -19-4	251.00-268.00	17.00	18.50	LG	
UNION CHIPENYAN 8- 6-90 -20-4	277.37-329.03	51.66	51.81	G2,G1	saturation (oil & water) partly
CONSUP MINK 10- 2-90 -21-4	232.00-243.73	11.73	12.75	G3	
CONSUP MINK OV 10- 5-90 -23-4	284.00-365.00	81.00	0.00	NI,UI,G3	
CONSUP CHIPENYAN 11-21-90 -23-4	266.70-308.76	42.06	42.28	G3	
CONSUP MINK 7-34-90 -23-4	268.00-287.43	19.43	19.75	NI,UI	

WELL NAME LOCATION	CORE INTERVAL	TOTAL LENGTH	INTERVAL LENGTH TESTED	UNITS	REMARKS
CONSUP MINK 10-23-90 -24-4	257.00-361.48	104.48	43.75	G3	
TEXEX CONOXY LIEGE 10-14-91 -20-4	210.31-258.93	48.62	53.35	G2,G1	
CONSUP MINK 10- 1-91 -21-4	248.00-268.50	20.50	14.75	0	
CONSUP LIEGE 7-14-91 -21-4	231.50-244.00	12.50	9.65	G3	
CONSUP MINK 11-20-91 -21-4	249.60-268.67	18.47	16.73	G3	
CONSUP MINK DV 7-26-91 -22-4	276.15-294.44	18.29	18.90	G3	
CONSUP LIEGE 7- 1-91 -22-4	260.70-278.00	17.30	17.13	G3	
CONSUP GREW 11-12-91 -24-4	281.75-371.50	89.75	89.75	G3,G2	
PARAMOUNT CHIP 11- 8-92 -20-4	215.49-245.91	30.42	30.13	G2	
CONSUP LIEGE 6- 2-92 -21-4	229.00-268.00	39.00	0.00	U1,G3,G2	
CONSUP MINK 11- 8-92 -21-4	265.18-274.08	8.90	9.14	G3	
CONSUP LIEGE 10-14-92 -21-4	243.00-258.20	15.20	15.50	G2	
CONSUP LIEGE 10-32-92 -21-4	260.00-296.05	36.05	37.05	G2	
CONSUP LIEGE 10-14-92 -22-4	294.00-309.10	14.90	15.10	G3	

WELL NAME LOCATION	CURE INTERVAL	TOTAL LENGTH	INTERVAL LENGTH TESTED	UNITS	REMARKS
CUNSUP GWEM 10-21-42 -24-4	362.00-434.70	77.70	35.75	G3,G2	
TEXAS CANOXY LIEGE 11-14-93 -21-4	267.58-320.91	53.33	21.61	G2,G1,LG	
PANAMOUNT LIEGE 11-29-93 -21-4	343.00-355.00	12.00	9.66	0	
PAKA DS I 10-15-43 -23-4	446.00-476.00	30.00	0.00	G3,G2	No saturation (oil & water)
PHILLIPS LIEGE DV 10- 8-93 -24-4	397.00-413.50	27.50	9.35	G3	
PHILLIPS LIEGE UV 10-13-93 -23-4	410.00-524.00	119.00	107.50	ALL	
PHILLIPS LIEGE 10-12-43 -24-4	417.50-579.25	161.75	150.30	ALL	saturation (oil & water), upper part only
PEX CUNSUP LIEGE 6- 8-94 -21-4	366.00-420.50	54.50	34.03	G2,G1,LG	
HEKSHY SEAFORTH 11-33-44 -22-4	493.94-580.30	285.00	91.40	G2,G1,LG	No saturation (oil & water)
PHILLIPS LIEGE UV 10-24-44 -24-4	346.00-584.83	243.83	0.00	N1,G3,G2,G1	
PEX CUNSUP LIEGE 6-25-44 -22-4	380.50-545.50	165.00	19.28	0	
PEX CUNSUP LIEGE 6- 7-95 -21-4	513.00-565.00	52.00	22.55	G1,LG	
PEX CUNSUP LIEGE 7-24-95 -20-4	530.00-557.50	28.40	21.70	G1,LG	
TEXAS BURNT LK. 10-23-95 -23-4	535.76-577.58	41.82	4.64	G1,LG	No saturation (oil & water)

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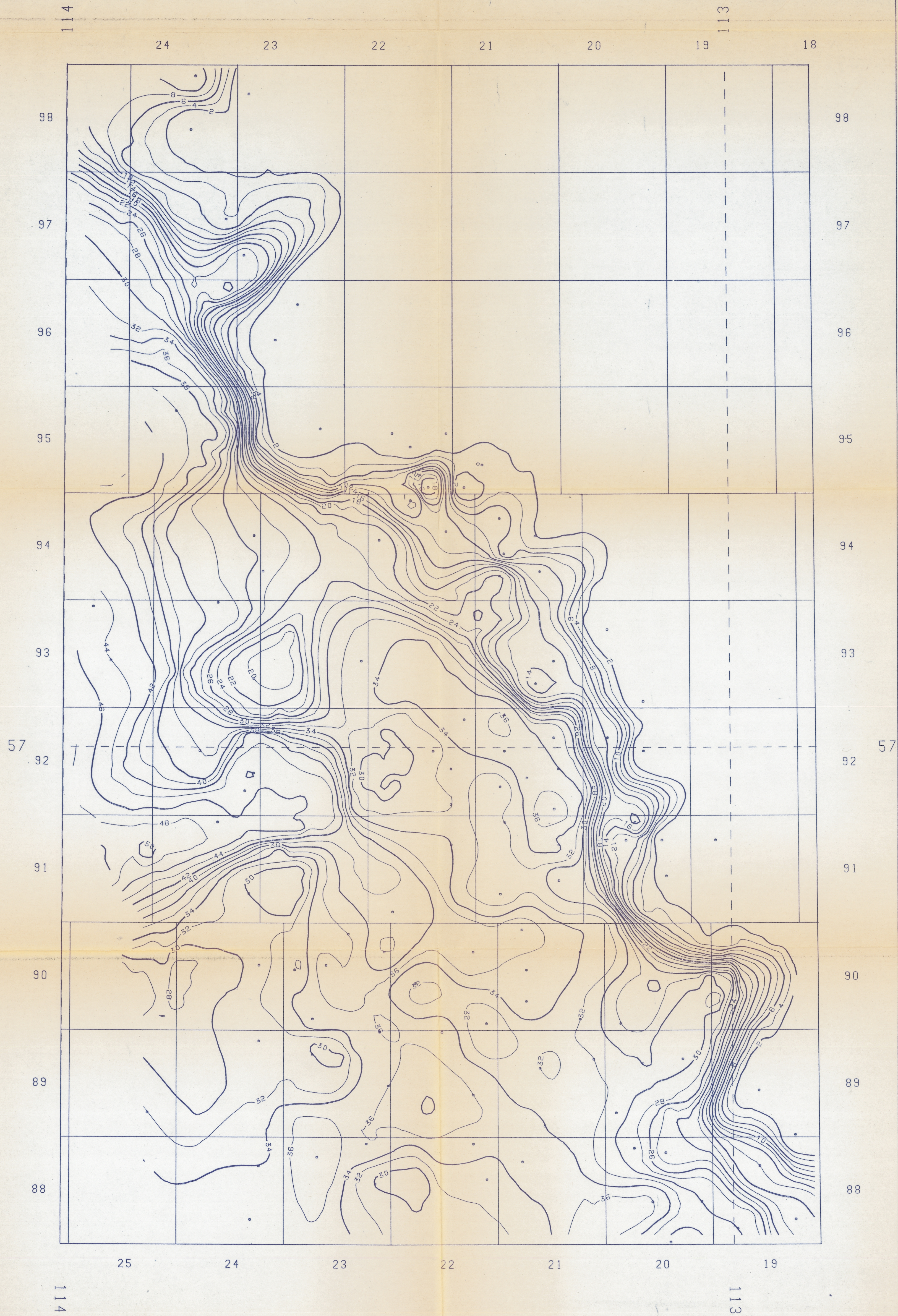
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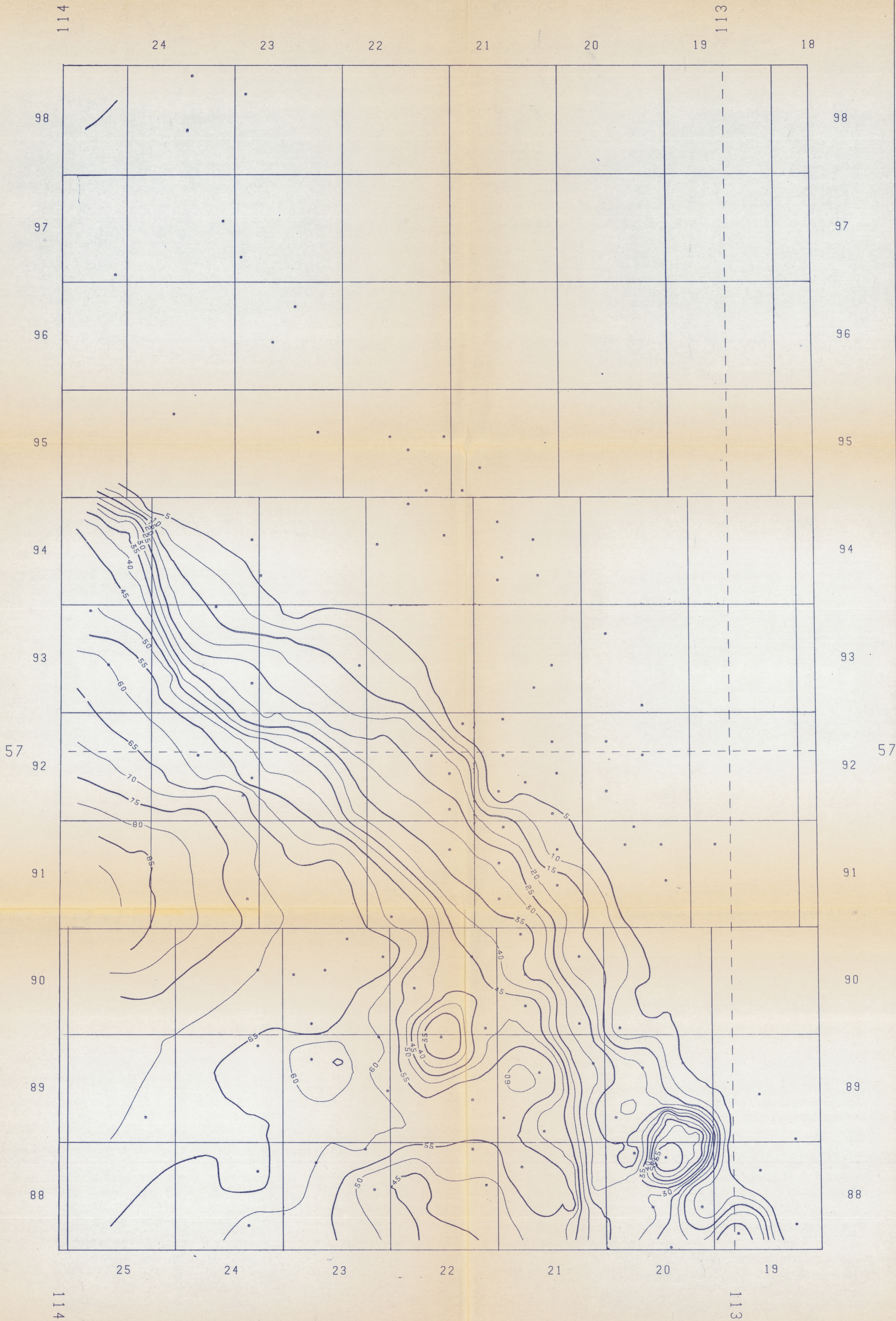
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