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STATE OF MICHIGAN
 DEPARTMENT OF NATURAL RESOURCES
 Geological Survey Division



**ANNUAL STATISTICAL SUMMARY
 38
 MICHIGAN'S OIL AND GAS FIELDS, 1982**

Drilling Statistics
 Production
 Exports and Imports

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Raymond H. Ellison, Supervisor, Production-Proration Unit. Contribution: All Michigan oil and gas production data, oil and gas valuation figures (Table 14), import and export figures (Tables 15-17), LPG and condensate figures (Table 13), secondary recovery projects (Table 24).

D. Michael Bricker, Supervisor, Subsurface and Petroleum Geology Unit. Contribution: All general drilling statistics and well completion data, discovery well and deep test data, cumulative records, and all other summary information not specifically provided by other Unit supervisors or by other agencies. Annual Statistical Summary compilation and manuscript preparation by staff members of the Subsurface and Petroleum Geology Unit.

The compilers also acknowledge the assistance of the Interstate Supply personnel, Office of Utilities Operation, Gas Division, Department of Commerce, in providing figures on natural gas imports via interstate pipelines, and the Lands Division, Department of Natural Resources, in providing figures for state revenue derived from various oil and gas transactions.

Michigan oil and gas production figures maintained by the Production-Proration Unit are compiled by the Unit from records obtained from the Michigan Department of Treasury and from records filed by producers and purchasers. All hydrocarbon production figures cited herein are subject to correction as warranted.

Inquiries concerning information contained in this publication should be directed to the appropriate Unit supervisor as noted earlier.

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Lansing, Michigan
May, 1984

MICHIGAN'S OIL AND GAS FIELDS, 1982

INTRODUCTION

To help foster the development of Michigan's hydrocarbon resources, statistical data have been maintained and published for many years. This issue of the oil and gas field statistical summary brings together information on various facets of Michigan's oil and gas industry activities.

The information contained in this oil and gas summary has been treated as uniformly as possible from year to year so that the data reflect accurately the actual figures and other information that should be credited to this year. The data found herein are mainly derived from records maintained by the Oil and Gas Section, Geological Survey Division, Department of Natural Resources.

This publication is divided into three parts. Part 1 summarizes significant statistics on oil and gas field activities and includes numerous other related records kept by the Oil and Gas Section. Part 2 contains specific information on Michigan's oil and gas fields, gas storage fields, and other related subjects. Part 3 contains cumulative records important to the oil and gas industry.

Certain well completion data are furnished to the American Petroleum Institute (API) and the American Association of Petroleum Geologists (AAPG) on a regular basis. Reports citing preliminary oil and gas statistics and production figures are also prepared for the Interstate Oil Compact Commission (IOCC). API publishes the data in monthly and quarterly reports. Year-end printouts of the data are made available to authors of the AAPG yearly Development Papers and to others. Year-end figures published by API are in general agreement with figures for similar categories published in this summary. Oil and gas production data are supplied by request to the United States Bureau of Mines for publication in their minerals yearbook.

Statistical data on Michigan oil and gas activities, derived from outside sources, are also published by the Oil and Gas News, Mt. Pleasant, Michigan; Petroleum Information, Incorporated, Denver, Colorado; American Petroleum Institute, Washington, D.C.; American Association of Petroleum Geologists, Tulsa, Oklahoma; Interstate Oil Compact Commission, Oklahoma City, Oklahoma; World Oil, Houston, Texas; and Oil and Gas Journal, Tulsa, Oklahoma.

It should be noted that certain figures for the number of exploratory, development, and service wells drilled and completed, the number of new fields and pools discovered, oil and gas production figures, and other data published in this summary may differ from figures

reported by regional or national trade publications or by industry reporting services. The differences in the various statistics are generally minor and are due to methods of gathering and reporting well data, determining cutoff dates for reporting yearly statistics, and the necessity for making projections and estimates for certain types of reports.

Other factors which may result in statistical differences are internal decisions of the Oil and Gas Section regarding final year-end status of completed wells and decisions resulting from public hearings on oil and gas matters. For example, a well originally classified as a development well, and reported as such to one of the above organizations, may later be reclassified as the discovery well for a new pool or field, or a gas well might later be declared an oil well completion on the basis of new evidence. Frequently the changes in well status cannot be readily passed on to these outside organizations so that their records can be updated prior to publications of their final statistics.

PART 1 GENERAL STATISTICAL INFORMATION

OIL AND GAS PERMITS

Michigan's oil and gas permit system began in 1927 with the issuance of permit number 1. Since then, permit numbers have been issued in numerically consecutive order. Permits issued under Act 61, P.A. of 1939, as amended are terminated one year after date of issue if actual drilling operations have not begun.

The distribution of oil and gas drilling permits (including terminated permits) according to districts (oil and gas district map, Illustration 1) through a five year period is seen in Table 2.

Deepening permits were issued for 51 wells during 1982 as compared with 54 the previous year. Deepening permits issued in 1982 began with number 2062 and ended with number 2115.

Directionally Drilled Holes

Environmental and economic considerations have necessitated the drilling of a large number of directional holes since 1972, particularly to help locate Niagaran reefs. During 1982 there were 217 permits issued to drill directional holes. Many of these holes involve using the upper part of a previously drilled hole which, after being initially completed as a dry hole, was plugged back and directionally drilled to a more favorable subsurface location. Only one producing well is allowed per well bore, regardless of the number of holes directionally drilled from the same well bore.

Each new directional hole, even if drilled from the same surface location and using the upper part of a previously

drilled well, is treated as a separate test and is assigned its own unique permit number.

TABLE 1 INITIAL WELL CLASSIFICATION

INITIAL CLASSIFICATION	1980	1981	1982
Exploratory wells	356	561	509
Development wells	456	470	536
Gas storage facility wells	25	10	7
LPG storage facility wells	0	0	0
Brine disposal wells	5	2	0
Water injection wells	5	5	0
Total	847	1,048	1,052

TABLE 2 DRILLING PERMITS BY DISTRICT

DISTRICT	Permits Issued				
	1978	1979	1980	1981	1982
Basin	146	161	251	359	374
Northern	284	271	284	296	322
Southeastern	98	63	109	91	74
Southwestern	47	60	104	180	166
Western	115	94	108	122	116
Totals	690	649	856	1,048	1,052

TABLE 3 NEW WELL COMPLETIONS BY DISTRICT

Classifications of New Well Completions	Basin		Northern		Western		Southwestern		Southeastern		Totals	
	1981	1982	1981	1982	1981	1982	1981	1982	1981	1982	1981	1982
Exploratory Wells												
Oil	14	11	18	23	3	8	15	6	1	6	51	54
Gas	3	7	6	11	2	3	5	9	2	4	18	34
DMA	57	68	127	167	55	59	58	62	33	24	330	380
Total	74	86	151	201	60	70	78	77	36	34	399	468
Development Wells												
Oil	99	198	27	37	21	25	25	45	29	11	201	316
Gas	2	3	13	13	3	0	3	6	4	1	25	23
DMA	18	33	51	53	18	15	24	19	9	5	120	125
Total	119	234	91	103	42	40	52	70	42	17	346	464
Service												
MI	9	5	5	3	0	2	0	0	2	3	16	13
EDM	1	3	3	2	2	1	0	0	0	0	6	8
CS	3	0	9	9	0	0	0	0	0	0	12	13
LPG	0	0	0	0	0	0	0	0	0	0	0	0
Total	13	8	17	14	2	3	0	2	2	7	34	34
Total Completions	206	328	259	318	104	113	130	149	80	58	779	966

TABLE 4 OIL AND GAS PRODUCTION BY DISTRICT IN 1981

District	Barrels Oil	MCF Gas
Basin	5,495,526	9,467,529
Northern	14,836,341	69,825,074
Southeastern	1,970,954	14,759,748
Southwestern	1,276,735	2,177,952
Western	7,755,885	45,958,481
Totals	31,335,441	142,190,784

[Illustration 1 — Oil and Gas Districts]

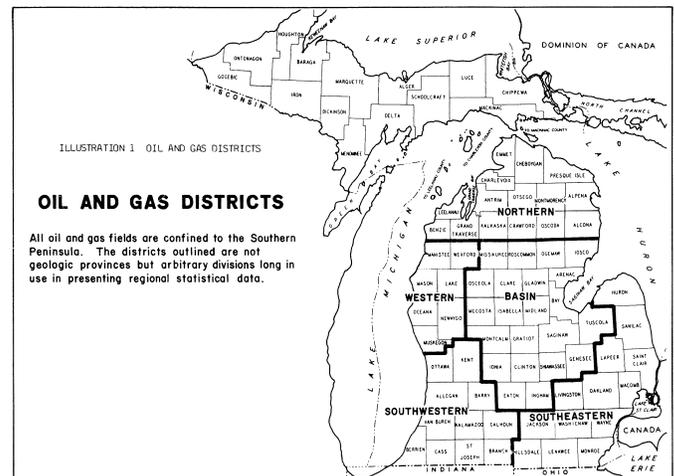


TABLE 5 TERMINATED PERMIT NUMBERS

31795	34436	34760	34921
31796	34469	34762	34945
31797	34497	34804	34950
31798	34523	34835	34959
31799	34524	34836	34969
31800	34451	34840	34974
31801	34630	34841	34975
31802	34631	34842	34976
34247	34632	34843	34977
34257	34634	34844	34978
34294	34649	34845	34979
34356	34650	34853	DP#1989
34368	34661	34854	34984
34387	34665	34862	35319
34423	34670	34884	35471

TABLE 6 PERMITS ISSUED FOR DIRECTIONAL HOLES

Barry	1 Permit
35407	
Calhoun	23 permits
35366, 35435, 35480, 35569, 35602, 35616, 35620, 35635, 35641, 35648, 35665, 35727, 35731, 35867, 35875, 35891, 35923, 36042, 36153, 36165, 36176, 36374, 36378	
Cheboygan	3 permits
35708, 35729, 36119	
Crawford	3 permits
35870, 36247, 36357	
Eaton	4 permits
35365, 35423, 35840, 35928	
Gd. Traverse	68 permits
35377, 35381, 35390, 35397, 35424, 35483, 35492, 35493, 35516, 35529, 35567, 35574, 35580, 35597, 35615, 35625, 35628, 35633, 35636, 35638, 35671, 35703, 35706, 35751, 35795, 35824, 35827, 35839, 35865, 35884, 35888, 35897, 35900, 35901, 35907, 35921, 35934, 35935, 35936, 35957, 36003, 36004, 36011, 36012, 36023, 36031, 36058, 36059, 36107, 36148, 36157, 36158, 36169, 36199, 36207, 36217, 36244, 36249, 36254, 36266, 36272, 36284, 36293, 36299, 36302, 36315, 36359, 35979	
Ingham	6 permits
35401, 35801, 35908, 35841, 35368, 36318	
Isabella	3 permit
35787, 36161, 36380	
Jackson	1 permit
35526	
Kalkaska	30 permits
35404, 35489, 35538, 35541, 35595, 35674, 35681, 35684, 35701, 35707, 35743, 35769, 35881, 35910, 35916, 35918, 35971, 35995, 36027, 36043, 36072, 36094, 36120, 36216, 36240, 36301, 36320, 36360, 36388, 36391	
Livingston	5 permits
35621, 36170, 36322, 36351, 36162	
Macomb	4 permits
35561, 35770, 35906, 35959	
Manistee	39 permits
35355, 35479, 35481, 35501, 35514, 35570, 35599, 35611, 35629, 35639, 35672, 35685, 35691, 35772, 35859, 35937, 35996, 36021, 36041, 36066, 36074, 36079, 36092, 36093, 36133, 36144, 36150, 36160, 36180, 36242, 36246, 36255, 36275, 36276, 36279, 36285, 36314, 36326, 36389	
Mason	2 permits
35823, 36331	
Mecosta	1 permit
35515	
Montmorency	2 permits
35486, 36145	
Newaygo	2 permits
35952, 35980	
Oakland	1 permit
35771	
Oceana	2 permits
35387, 35434	
Osceola	1 permit
36068	
Otsego	28 permits
35374, 35376, 35452, 35531, 35752, 35796, 35803, 35825, 35836, 35837, 35849, 35878, 35925, 35941, 35683, 35530, 35984, 35992, 36025, 36025, 36116, 36117, 36141, 36257, 36278, 36323, 36347, 36377, 36392	

Presque Isle	15 permits
35445, 35487, 35667, 35678, 35694, 35780, 35782, 35879, 36138, 36167, 36182, 36200, 36208, 36224, 36298	
Roscommon	1 permit
36166	
St. Clair	2 permit
35388, 35402	
Wexford	1 permits
35954	

Rework Applications, Transfers of Ownership

In addition to issuance of permits for various types of wells covered under Act No. 61, P.A. of 1939, as amended, 330 applications were received and approved for rework operations on existing wells. Letters of termination were sent out for 60 previously issued permits. Transfers of ownership were processed for 205 wells. Corrections of location, well name, or other detail involving specific permits were made for 114 wells, and cancel and transfer of permit were made for 50 others. The surface location as well as the projected bottom-hole location is published for each permitted directionally drilled hole. After the well is drilled and the directional survey is filed, the correct bottom-hole location is determined from the survey record and then published as a correction for the initial projected bottom-hole location. Corrections of this type were published for 218 wells.

Oil and Gas Hearings

Oil and Gas Section activities included scheduling and preparation for hearings on oil and gas matters and the issuance of orders resulting from these hearings. These activities are summarized in Table 7.

TABLE 7 SUMMARY OF OIL AND GAS HEARINGS

Advisory Board Hearings held	10
Administrative Hearings held	25
Total Orders issued	36
Total Causes heard	36
Includes matters related to:	
15 Spacing Orders	
6 Proration Orders	
7 Special Orders	
1 Unitization	
2 General Rules	
4 Compulsory Pooling	
1 Gas Storage	

WELL COMPLETIONS

TABLE 8 EXPLORATORY AND DEVELOPMENT WELL COMPLETIONS

Year	Exploratory Wells			Development Wells			Totals
	Oil	Gas	Dry	Oil	Gas	Dry	
1977	35	36	230	101	34	111	547
1978	29	25	214	117	32	111	528
1979	42	28	187	131	30	103	521
1980	41	21	257	167	30	159	675
1981	51	18	330	201	25	120	745
1982	54	34	380	316	23	125	932

TABLE 9 SERVICE WELL COMPLETIONS

Year	GS	INJ	LPG	BDW	Totals
1977	43	2	1	4	50
1978	60	11	0	3	74
1979	51	13	0	4	68
1980	41	9	2	5	57
1981	12	16	0	6	34
1982	13	13	0	8	34

GS = Gas Storage; INJ = Injection well; LPG = Liquefied Petroleum Gas well; BDW = Brine Disposal Well

Major and Independent Company Well Completions

Requests are frequently made for statistics on major oil company drilling activities in Michigan. The figures cited for the major companies do not include wells drilled by independents under farmout agreements with a major company or wells drilled by independents but partially supported by dry hole money or some other significant assistance from a major oil company. Independent oil companies, who have drilled most of Michigan's wells, are too numerous to cite individually. All figures cited for majors and independents were derived from inspection of operator names appearing on completion records. In Table 10, in cases where two or more companies were joint operators in a drilling venture, the well completion was attributed to the company whose name appears first (generally the major interest holder) on the official records.

Well Casing Used in Well Completion

Periodically, inquiries are made concerning the amount of casing (pipe) used in Michigan wells during a given year. Almost all oil and gas tests drilled in this state utilize rotary drilling techniques and require the setting of surface pipe and an intermediate casing string. A conductor pipe is set on many holes, and all wells completed as producers require a string of production casing.

OIL AND GAS PRODUCTION

Oil and gas production figures are derived from records submitted to the Production-Proration Unit, Oil and Gas Section, Geological Survey Division, Department of Natural Resources and from tax records from the Michigan Department of Treasury. Treasury Department records are primarily concerned with gross production figures needed to calculate revenues. These data are supported by reports required from producing companies and purchasers by the Geological Survey Division.

Delays in reporting and changes in methods of reporting used by producing companies and purchasers result in a continuous correction and refinement of production figures. Consequently all monthly, yearly, or other production figures are subject to correction as warranted.

TABLE 10 WELL COMPLETIONS BY MAJORS AND INDEPENDENTS

MAJOR COMPANY	EXPLORATORY			DEVELOPMENT			SERVICE WELLS	TOTALS
	OIL	GAS	DRY	OIL	GAS	DRY		
AMOCO	1	1	9	1	0	9	0	21
MARATHON	0	0	0	7	0	0	5	12
SHELL	7	5	62	21	2	22	4	123
TEXACO	0	0	1	0	0	0	0	1
OTHER	0	0	3	91	0	2	3	99
SUBTOTAL	8	6	75	120	2	33	12	256
INDEPEND.	46	28	305	196	21	92	22	710
TOTALS	54	34	380	316	23	125	34	966

TOTAL WELLS DRILLED BY MAJORS AND INDEPENDENTS

EXPLORATORY WELLS	468
DEVELOPMENT WELLS	464
SERVICE WELLS	34

EXPLORATORY WELLS DRILLED

PERCENTAGE FOR MAJORS	19%
PERCENTAGE FOR INDEPENDENTS	81%

EXPLORATORY DISCOVERIES

PERCENTAGE FOR MAJORS	16%
PERCENTAGE FOR INDEPENDENTS	84%

DEVELOPMENT WELLS DRILLED

PERCENTAGE FOR MAJORS	33%
PERCENTAGE FOR INDEPENDENTS	67%

PRODUCING DEVELOPMENT WELLS DRILLED

PERCENTAGE FOR MAJORS	36%
PERCENTAGE FOR INDEPENDENTS	64%

DISCOVERY SUCCESS RATIO (TOTAL EXPLORATORY WELLS DIVIDED BY NUMBER OF DISCOVERY WELLS)

AVERAGE FOR MAJORS	1:6
AVERAGE FOR INDEPENDENTS	1:5

In an attempt to obtain national uniformity of data as recommended by the Interstate Oil Compact Commission, all annual and cumulative gas production figures for Michigan were converted to a standard base pressure for volumetric measurement of 14.73 pounds per square inch in 1978. This conversion and subsequent adjustment of gas production figures resulted in slight changes in cumulative production volumes in those fields which had been measured at varying pressure bases in prior years.

A no-flare order, enacted as a conservation measure, prohibits the flaring of oil-well gas and requires Salina-Niagaran oil wells in specified counties to be shut-in until a market connection is achieved for the sale of the gas or an exception to the order is granted. Consequently, Special Order No. 3-71, amended, in effect since late 1971, tends to temporarily curtail production from Salina-Niagaran oil wells until gas gathering pipelines are laid and connections made.

Another order, Special Order No. 1-73, deals with spacing and proration of Salina-Niagaran wells in specific counties. This order established basic 80-acre drilling units (either stand-up or lay-down units) for Salina-Niagaran oil and/or gas wells and state-wide proration for Salina-Niagaran oil reservoirs in the specified counties or parts of counties covered by the order. These prudent and justifiable conservation measures effectively prevent waste of millions of cubic feet of valuable and much needed gas that might have been flared in past years, and these measures should ultimately result in more efficient drainage of reef

reservoirs and a greater recovery of the liquid hydrocarbons.

TABLE 11 DRILLED FOOTAGE BY COUNTY

County	Exploratory Wells	Development Wells	Service Wells
Allegan	7,249	33,975	- - -
Antrim	28,279	- - -	- - -
Arenac	15,700	17,633	- - -
Barry	3,440	- - -	- - -
Bay	6,843	69,638	- - -
Benzie	- - -	11,596	- - -
Berrien	- - -	4,045	- - -
Calhoun	168,154	56,209	3,315
Cass	18,924	19,885	1,509
Cheboygan	12,221	6,821	- - -
Clare	37,332	51,804	- - -
Clinton	6,716	- - -	- - -
Crawford	32,861	26,450	- - -
Eaton	35,545	14,542	- - -
Gd. Traverse	457,111	191,012	2,200
Genesee	6,425	- - -	- - -
Gladwin	45,131	64,630	- - -
Hillsdale	11,313	8,238	- - -
Ingham	43,729	12,535	- - -
Isabella	33,916	162,065	6,834
Jackson	10,569	4,466	- - -
Kalamazoo	4,358	- - -	- - -
Kalkaska	209,186	125,472	35,804
Kent	3,125	- - -	- - -
Lapeer	- - -	25,463	9,460
Lenawee	8,021	- - -	- - -
Livingston	14,577	- - -	- - -
Macomb	23,297	8,115	- - -
Manistee	190,700	147,065	6,477
Mason	21,467	- - -	- - -
Mecosta	29,118	8,385	- - -
Midland	11,928	12,922	- - -
Missaukee	73,239	268,985	- - -
Monroe	5,694	- - -	- - -
Montcalm	- - -	33,459	5,181
Montmorency	22,663	- - -	- - -
Muskegon	3,850	1,672	- - -
Newaygo	15,510	7,840	- - -
Oakland	16,141	4,054	- - -
Oceana	29,908	3,360	1,662
Ogemaw	- - -	46,124	13,891
Osceola	44,430	- - -	1,212
Oscoda	28,021	8,655	- - -
Otsego	186,418	83,320	33,558
Ottawa	3,133	4,376	- - -
Presque Isle	54,372	30,596	- - -
Roscommon	10,165	141,234	- - -
Saginaw	16,882	5,145	- - -
Sanilac	7,824	- - -	- - -
Shiawassee	1,860	- - -	- - -
St. Clair	16,301	5,686	9,442
St. Joseph	1,334	- - -	- - -
Tuscola	17,831	22,173	- - -
Van Buren	4,726	8,890	- - -
Washtenaw	2,501	- - -	- - -
Wexford	28,395	- - -	- - -
State Total	2,088,433	1,758,535	130,545

TABLE 12 1982 OIL AND GAS PRODUCTION BY COUNTY

County	Barrels Oil	MCF Gas
Allegan	114,908	11,422
Antrim	91,873	311,582
Arenac	168,754	0
Barry	7,172	0
Bay	281,312	0
Benzie	181,986	191,100
Berrien	638	0
Calhoun	943,647	2,033,437
Cass	80,673	0
Cheboygan	858	0
Clare	431,351	456,873
Crawford	1,483,947	2,696,092
Eaton	620,081	3,969,646
Gd. Traverse	3,558,310	27,869,369
Genesee	19,924	58,483
Gladwin	289,975	0
Gratiot	6,967	0
Hillsdale	1,032,759	5,413,183
Huron	1,882	0
Ingham	904,119	2,217,482
Isabella	262,112	0
Jackson	1,380	0
Kalamazoo	1,128	0
Kalkaska	3,358,642	26,463,333
Kent	99,401	0
Lake	63,389	0
Lapeer	331,385	1,883,658
Lenawee	483	0
Livingston	1,177	284,460
Macomb	6,185	4,221,680
Manistee	6,966,356	41,892,896
Mason	157,054	1,209,293
Mecosta	17,382	5,710
Midland	172,419	0
Missaukee	1,051,199	2,208,182
Monroe	5,211	0
Montcalm	95,475	0
Muskegon	9,313	0
Newaygo	32,923	0
Oakland	197,541	1,575,624
Oceana	19,119	0
Ogemaw	551,131	58,645
Osceola	68,037	4,318
Oscoda	3,696	0
Otsego	6,133,240	12,293,598
Ottawa	10,389	133,093
Presque Isle	23,789	0
Roscommon	416,684	490,190
Saginaw	40,761	0
Shiawassee	6,309	0
St. Clair	388,221	1,381,143
Tuscola	91,534	0
Van Buren	18,779	0
Washtenaw	706	0
Wayne	4,024	0
Wexford	507,731	2,856,292
Totals	31,335,441	142,190,784

NATURAL GAS LIQUIDS

The amount of liquids produced from gas-condensate reservoirs are included in the yearly oil production totals shown in tabulations in this publication. Wells officially determined to be gas wells are assigned to the Public Service Commission for well connection permits and determination and jurisdiction of gas production rates. There is no restriction on the amount of liquids produced along with the gas. Gas plants operated by Shell Oil Company and Amoco Production Company in Kalkaska County strip natural gas liquids from the gas. The liquids are then sold to another company through the Shell pipeline that terminates at Marysville, Michigan.

An attempt has been made to maintain records of condensate production from the northern reef reservoirs discovered since 1969. Production-Proration Unit records are show in Table 13 for condensate liquids.

TABLE 13 CONDENSATE PRODUCTION

Year	Barrels	Cumulative
1969	0	0
1970	18,946	18,946
1971	98,668	117,614
1972	125,768	243,382
1973	335,041	578,423
1974	1,187,498	1,765,921
1975	1,863,338	3,629,259
1976	1,896,870	5,526,129
1977	1,991,330	7,517,459
1978	2,295,263	9,812,722
1979	1,801,928	11,614,650
1980	1,582,638	13,197,288
1981	1,433,198	14,630,486
1982	1,031,671	15,662,157

Gas plant operations are summarized in Table 25. It should be noted that the LPG recovery figures for the Amoco and Shell plants in Kalkaska County include stabilized condensate as well as LPGs.

TABLE 14 OIL AND GAS VALUATION

Year	Average Wellhead Price*		Gross Value*	
	Oil per Bbls.	Gas per MCF	Oil	Gas
1969	\$ 3.07	\$.26	\$ 37,494,318	\$ 9,296,332
1970	3.10	.27	36,246,376	10,476,482
1971	3.27	.26	38,858,706	6,775,629
1972	3.20	.31	41,556,432	10,314,222
1973	4.07	.40	59,412,710	17,494,727
1974	8.55	.51	154,746,373	35,181,955
1975	10.74	.63	262,351,653	65,103,875
1976	10.84	.88	329,636,770	120,252,528
1977	10.95	1.10	360,994,743	145,969,976
1978	12.34	1.11	427,881,248	166,920,524
1979	14.94	1.75	524,257,112	279,121,269
1980	21.55	2.36	728,607,821	372,855,197
1981	30.38	2.86	992,435,836	436,936,911
1982	32.53	3.19	1,023,472,164	461,049,971

*Source: Production-Proration Unit records

OIL AND GAS IMPORTS AND EXPORTS

Michigan refineries import some U.S. domestic and foreign crude oil each year. Overseas foreign sources include Libya and Nigeria. Canadian crude oil brought via pipeline from western Canada oil fields constitutes

another important source of imports. Imports by month were reported by refineries and are shown in Table 15.

TABLE 15 1982 MONTHLY CRUDE OIL REPORTS (Bbls.)

	Domestic & Foreign	Canadian	Total
January	1,192,793	0	1,192,793
February	766,133	0	766,133
March	689,716	64,688	759,404
April	659,916	0	659,916
May	824,464	0	824,464
June	875,696	0	875,696
July	885,088	0	885,088
August	816,266	0	816,266
September	715,303	0	715,303
October	727,632	0	727,632
November	1,369,852	0	1,369,852
December	815,377	0	815,377
Totals	10,338,236	64,688	10,402,924

Most Michigan produced crude oil goes to Michigan refineries but some is exported. Records provided to the Production-Proration Unit by companies reporting exports of Michigan crude are summarized in Table 16.

TABLE 16 1982 MONTHLY CRUDE OIL EXPORTS (Bbls.)

January	688,802
February	1,127,357
March	1,051,087
April	1,217,265
May	1,185,923
June	788,967
July	962,312
August	1,153,030
September	969,526
October	1,061,545
November	1,060,047
December	1,158,980
Total	12,424,841

TABLE 17 1982 MONTHLY PIPELINE GAS IMPORTS (Mcf)*

January	77,108,810
February	63,770,916
March	43,011,621
April	62,946,407
May	50,577,614
June	56,420,659
July	52,024,025
August	54,080,464
September	42,222,912
October	36,642,679
November	39,921,503
December	38,592,641
Total	617,320,251

*Compiled by the Federal Pipeline Tariff Analysis Section, Michigan Public Service Commission

NEW FIELD AND POOL DISCOVERIES

All the new discoveries are tentatively classified as Class E pools having possible oil and gas recoveries as defined by the Committee of Statistics of Drilling, American Association of Petroleum Geologists. These classes are used to give some estimate or measure of reserves found by a discovery well.

Class A - Over 50 million barrels oil or 300 BCF gas

- Class B - 25-50 million barrels oil or 150-300 BCF gas
- Class C - 10-25 million barrels oil or 60-150 BCF gas
- Class D - 1-10 million barrels oil or 6-60 BCF gas
- Class E - 1 million barrels or less oil, or less than 6 BCF gas
- Class F - Abandoned as non-profitable

Michigan wells are initially classified as near as possible according to guidelines established by AAPG and API (AAPG Bulletin, Volume 58/8, August 1974, pages 1501-1503). Classifications such as exploratory, development, and the various types of service wells, are made after inspection of appropriate oil and gas maps and noting the location of the test in reference to established fields, dry holes, etc. Gas storage facility wells, water injection wells and other types of service wells are generally designated as such by the operator. The Lahee classification system for designating exploratory or development wells is particularly adaptable to structural traps but does not adapt to all situations involving small reefs such as are found in Michigan. Because of the apparent small areal extent of most reefs as shown by seismic anomalies and the close proximity of one reef to another, especially in the northern and southern reef belts, it has become increasingly difficult to classify with certainty all new well locations as exploratory or development.

Reservoir performance may show that a well previously classified as a development well should actually be considered as being in a separate reservoir or pool. Likewise, a so-called discovery well may actually turn out to be a development well to a nearby reef reservoir. Changes in classification may be the result of action by the regulating agency after enough data has been accumulated on the well or wells, or may result from new data presented at public hearings and the decision of the Supervisor of Wells after thorough consideration of the new data.

TABLE 18 DISCOVERY WELLS BY GEOLOGIC SYSTEM

SYSTEM	FORMATION OR PAY	NO. OF DISCOVERIES		
		1980	1981	1982
PENNSYLVANIAN		-	-	-
MISSISSIPPIAN	"MICHIGAN STRAY SS."	1	-	1
	"BEREA SS."	2	3	5
DEVONIAN	ANTRIM SHALE	2	-	1
	"TRAVERSE LIME"	5	3	3
	DUNDEE	1	-	1
	DETROIT RIVER	-	-	1
	"SOUR ZONE"	2	3	2
SILURIAN	RICHFIELD	3	1	3
	SALINA-NIAGARAN	46	58	65
ORDOVICIAN	TRENTON-BLACK RIVER	-	-	4
	PRAIRIE DU CHIEN	-	1	2

WELL RECORDS & OIL AND GAS MAPS

Descriptive geological logs and driller's logs are available for over 35,000 tests, including exploratory, development, facility and other types of wells. Individual well records may be purchased at a nominal cost from the Geological Survey Division. Drillers logs are available on 16 mm reel microfilm. For details please contact the Information and Technical Services Unit, Box

30028, Lansing, Michigan 48909, telephone (1-517) 373 1256. Electric or radiation logs of any type are not available for distribution or sale.

Blueprint copies of oil and gas field maps are available for every county in the Southern Peninsula. The maps show locations of oil and gas tests but do not show geological data or structural contour lines. County map scales are 1 inch equals 1 mile. Blueprint field maps are available for many oil and gas fields. These maps show well locations, well permit numbers, operators and lease names. They do not show geological data or structural contour lines. Field map scales are mainly 4 inches equals 1 mile. All manuscript maps or tracings from which blueprint copies are made are posted on a regular basis. An oil and gas field maps list may be obtained from the Geological Survey Division upon request.

TABLE 19 DRILLING OBJECTIVES BY GEOLOGIC SYSTEM

SYSTEM	FORMATION OR PAY	PERCENTAGE		
		1980	1981	1982
PENNSYLVANIAN		-	-	.2
MISSISSIPPIAN	"MICHIGAN STRAY SS."	2.9	1.1	.9
	"BEREA SS."	2.6	3.8	5
DEVONIAN	ANTRIM SHALE	1.4	1.2	1
	"TRAVERSE LIME"	4.5	6.9	8
	DUNDEE	7.7	6.4	6
	DETROIT RIVER	-	-	2
	"SOUR ZONE" & RICHFIELD	12.7	15.2	18
SILURIAN	SALINA-NIAGARAN	64.1	58.5	54
ORDOVICIAN	TRENTON-BLACK RIVER	3.6	1.5	1
	PRAIRIE DU CHIEN	0.1	3.9	3
CAMBRIAN		-	1.2	.6
PRECAMBRIAN		.4	.3	.3

PART 2 EXPLANATION

Part 2 brings together general information on Michigan's oil and gas fields, gas storage reservoirs, LPG storage facilities, gas plant operations, refinery facilities and other items.

Table 22 list Michigan's oil and gas fields and gas storage reservoirs. The symbol on the left margin of the table indicates the official classification of fields and pools at the end of the year. Classifications may be changed as warranted. Official field names are listed alphabetically in the first column and the producing pool, or pools, are shown under the heading Producing Formation or Pool. Most fields consist of one pool with oil or gas production coming from a single reservoir within a formation. Some fields have two or more separate pools, each producing from a different formation or stratigraphic interval and at a different depth. Most multi-pool fields are associated with a common structural feature. Salina-Niagaran reef oil or gas accumulations are mostly single-pool fields. Some, however, have several separate reef reservoirs designated as Pool A, Pool B and so on. Most have been so designated by administrative action following public hearings. Also, a few of the listed fields actually

condensate fields are shown under the oil production column.

WELL SAMPLE SETS

Well cuttings for over 9,000 wells are available for inspection at the Geological Survey Division, Michigan Department of Natural Resources, Lansing. Samples are contained in either glass vials or in envelopes and are arranged in open trays. In addition, several thousand shallow geological test samples are also available for inspection. The Division does not maintain a core collection. Other sample and core repositories, not connected with the Division, are located at:

- [1] Subsurface Laboratory, Department of Geology, The University of Michigan, Ann Arbor, Michigan.
- [2] Department of Geology, Wayne State University, Detroit, Michigan.
- [3] Department of Geology, Western Michigan University, Kalamazoo, Michigan.
- [4] Department of Geology, Michigan State University, East Lansing, Michigan.
- [5] Department of Geology, Central Michigan University, Mt. Pleasant, Michigan.

PAST 3 CUMULATIVE RECORDS EXPLANATION

Part 3 contains cumulative statistics principally of oil and gas production, well completions, and oil field brine production and disposal from 1925 through the most recent year-end compilations.

OIL AND GAS PRODUCTION TABLES

Oil and gas production figures for individual years prior to 1960 can be found in issues of "Summary of Operations, Oil and Gas Fields" for 1962 and prior years, and in "Michigan's Oil and Gas Fields" 1963 to present. The tables show the year of the first recorded production from a particular formation, and the yearly and cumulative production totals from 1925 through the most recent year-end compilations. Cumulative oil and gas production by county is shown on a separate table. Refer to Part 1 for county production figures for the past year, and prior issues for previous years.

CUMULATIVE WELL COMPLETIONS

These tables show the cumulative number of yearly completions in a county. Well density figures include field development wells, exploratory wells, and service wells of all types.

DRILLING PERMITS, WELL COMPLETIONS, FIELDS DISCOVERED

These tables show the number of drilling permits issued by year from 1927 through the most recent year-end compilations. Initial classification of well completions by year, the number of new fields or pools discovered, and the number of producible oil or gas wells on a yearly basis are all shown on the same table.

TABLE 20 1982 DISCOVERY WELLS

COUNTY	TOWNSHIP, T.R., SEC.	FIELD NAME	OPERATOR & LEASE	PERMIT NO	DEPTH TO REF	TOTAL DEPTH	INITIAL PRODUCTION OIL WELLS	PRODUCING GAS WELLS	FORMATION	APPG POOL CLASS
KALAMAZOO	BLUE LAKE-06, 20N, 02W	BLUE LAKE	PENNSLANA, OAG/GRIT LYS INC	35277	6774	7002	225 BOPD		NIAGARAN	E
KALAMAZOO	BLUE LAKE-06, 20N, 02W	BLUE LAKE	SINGER #1-6		(90)		+355 MCF		NIAGARAN	E
KALAMAZOO	BLUE LAKE-08, 20N, 02W	BLUE LAKE	SCHMIDT & FRINGBORN	35433	6786	7000	300 BOPD		NIAGARAN	E
KALAMAZOO	BLUE LAKE-23, 20N, 02W	BLUE LAKE	STATE-BLUE LAKE #1-8	34752	7257	7373	352 BOPD	+603 MCF	NIAGARAN	E
KALAMAZOO	BLUE LAKE-23, 20N, 02W	BLUE LAKE	STATE-BLUE LAKE #3-23A		(90)	(1745)	+18 BOPD		NIAGARAN	E
KALAMAZOO	COLD SPRINGS-10, 20N, 02W	COLD SPRINGS	STATE-OLD SPRINGS	35916	4797	6964	75 BOPD		NIAGARAN	E
KALAMAZOO	COLD SPRINGS-13, 20N, 02W	COLD SPRINGS	STATE-OLD SPRINGS	36240	7146	7252	300 BOPD		NIAGARAN	E
KALAMAZOO	COLD SPRINGS-13, 20N, 02W	COLD SPRINGS	LITTLE TWIN #1-30		(90)	(6950 TAD)	+333 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35372	7114	7285	360 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+4378 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35404	6605	(6899 TAD)	252 BOPD	+200 MCF	NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+6 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35669	2358	3367	16 BOPD	2100 MCF	TRAVERSE	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.						NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35689	3976	4220	1 BOPD		FRUITVILLE DU CHEN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+10 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35544	3880	4168	30 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+23 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	36206	2722	2835	235 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+168 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35202	4613	4785	288 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+400 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35570	5906	6103 TAD	2 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+80 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35639	5914	6056 TAD	30 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+30 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35221	3950	4378	321 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+134 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35008	5818	5870 TAD	420 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+40 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	36225	4158	4300	96 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+2 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35823	4922	5110 TAD	10 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+2 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35426	4633	5100	40 BOPD		DETROIT REVER	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+30 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	36090	2445	2550	6 BOPD		BEREA	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+35 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35961	1985	2182	10 BOPD		TRENTON	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+143 MCF		"SIC CITY"	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	39716	3404	3459	20 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+30 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	36240	3894	4206	7 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+4445 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35337	3875	4102	64 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+2000 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	34778	3800	3920	500 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+1000 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35800	8137	8769	1438 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+24 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	34070	7676	11691	10 BOPD		A-C CONDENSATE	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+10 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	34748	4197	4268	10 BOPD		DETROIT REVER	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+15 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35029	5157	5573	300 BOPD		"SIC CITY"	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+330 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35115	7839	8710	30 BOPD		FRUITVILLE DU CHEN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+625 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35894	1456	1565	100 MCF		ANDROM	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+20 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35993	4526	4694	48 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+2575 MCF		34 BOPD	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35374	4681	4825	72 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+3000 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35375	4490	4802	1100 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+363 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35710	4792	5014	420 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+365 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	34963	5076	5226	158 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+100 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35970	4812	5330	40 BOPD		DETROIT REVER	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+16 MCF		"SIC CITY"	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	36240	2840	3091	2607 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+24 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35348	2706	2960 TAD	163 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+2300 MCF		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.	35954	6333	6714 TAD	163 BOPD		NIAGARAN	E
KALAMAZOO	28-27N-07W, P1C	REEF PETROLEUM CORP.	REEF PETROLEUM CORP.				+2300 MCF		NIAGARAN	E

TABLE 21 DRILLING PERMITS, WELL COMPLETIONS, MAJOR DRILLED FOOTAGE BY COUNTY, 1982

COUNTY	OIL/GAS PERMITS ISSUED	Classification of New Hole Completions										Average Well Depth	
		OIL & GAS TESTS		RESULTS		SERVICE WELLS		TOTAL FOOTAGE DRILLED		Average Well Depth			
		Completed	Devel.	Oil	Gas	Dry	Completed	Drilled	Explor.		Devel.		
Alcona	15	12	10	0	0	0	14	7,249	33,975	0	2,945		
Antisip	6	5	0	0	0	0	5	28,279	0	0	5,655		
Arenac	10	2	5	4	0	3	0	7	15,700	17,633	0	4,762	
Barry	2	1	0	0	0	1	0	1	3,440	0	0	3,440	
Bay	36	3	28	22	0	9	0	31	6,843	69,638	0	2,467	
Benzie	3	0	2	1	0	1	0	0	11,596	0	0	3,798	
Berrien	5	0	5	4	0	1	0	0	4,045	0	0	809	
Branch	1	0	0	0	0	0	0	0	0	0	0	0	
Calhoun	78	53	18	13	13	45	0	1	72	168,154	56,209	3,315	3,162
Cass	50	13	25	14	2	20	0	1	39	18,924	19,885	1,509	1,034
Charlevoix	1	0	0	0	0	0	0	0	0	0	0	0	0
Chazy	1	0	0	0	0	0	0	0	0	0	0	0	
Chelan	14	4	3	2	0	5	0	0	7	12,221	6,821	0	2,720
Clare	14	5	11	6	0	6	0	0	16	37,332	51,804	0	5,771
Cleburn	1	2	0	0	0	2	0						

BRINE PRODUCTION AND DISPOSAL

Oil field brine production records other than for individual fields were discontinued in 1968. These tables listed the reported amount of produced brine and the method of disposal from 1937 up to 1967. Most of field brine is still returned to subsurface formations. Small quantities are used for dust control or ice and snow removal on county roads in local areas.

SERVICE WELLS

Service wells as listed in this publication are those wells which were drilled to serve some purpose other than the initial production of oil or gas. Oil or gas wells are sometimes converted to salt water disposal, observation, or facility wells in gas storage or pressure maintenance projects. There are several types of service wells:

LPG Wells. These are wells drilled for underground storage of liquified petroleum gas. In Michigan, these storage reservoirs are in manmade cavities in salt beds. The cavities have been made by dissolving the salt with water and then pumping out the brine.

Gas Storage Wells. These are wells drilled in gas storage reservoirs. They are frequently referred to as facility wells, and are generally used to inject gas into or extract gas from the reservoir. Certain facility wells may sometime in the history of the field be used as salt water disposal wells or observation wells.

Observation Wells. Most observation wells are related to gas storage projects. They are used to observe underground movement of gas, brines and other fluids, or to observe pressures.

Brine Disposal Wells. These wells are used in the disposal of oil and gas field brines back into some suitable subsurface formation.

Injection and Pressure Maintenance Wells. These are wells used in secondary recovery, or pressure maintenance projects. They may be new wells drilled specifically for injection or pressure maintenance, or they may be converted oil or gas wells; their status can change from time to time.

Oil or gas wells are sometimes converted to salt water disposal, observation, facility wells in gas storage reservoirs, or water injection wells used in secondary recovery or pressure maintenance projects. The types of service wells listed under "Classification of Well Completions" do not include oil or gas wells converted to service wells.

[CROSS-REFERENCE LISTS]

CROSS-REFERENCE LIST by COUNTY

ALLEGAN

Allegan; Casco; Cheshire; Crooked Lake; Diamond Springs; Dorr; Dunningville; Hawkhead; Heath; Milliards; Hopkins; Hopkins, South; Hopkins, West; Lee; Lee, South; Martin; Monterey; New Richmond; Otsego; Overisel; Pullman; Pullman, East; Pullman, East; Rabbit River; Salem; Trowbridge; Wayland; Wayland, North

ALPENA

Alpena

ANTRIM

Mancelona

ARENAC

Adams; Adams, North; Au Gres; Clayton; Deep River; Lincoln; Moffatt; Standish; Sterling

BARRY

Freeport; Hope; Johnstown; Thornapple

BAY

Beaver; Crump; Essexville; Gibson; Kawkawlin; Lucht; Mt. Forest; Pinconning; Williams

BENZIE

Colfax

BERRIEN

Niles; Pipestone

CALHOUN

Albion; Cal-lee; Clarence; Convis; Lee; Pennfield; Tekonsha

CASS

Adamsville; Calvin; Jefferson; Juno Lake; North Porter

CHEBOYGAN

Forest

CLARE

Clare City; Cranberry Lake; Cranberry Lake, East; Freeman; Freeman-Lincoln; Freeman-Redding; Garfield; Greenwood; Hamilton; Harrison; Hatton; Lake George; McKay; Redding; Skeels; Surrey; Winterfield

CLINTON

Dallas; Lebanon

CRAWFORD

Beaver Creek Unit; Frederic; Hickeys Creek; Maple Forest; South Branch

EATON

Eaton; Eaton Rapids; Hamlin; Olivet

GENESEE

Otisville; Otter Lake

GLADWIN

Bard; Beaverton; Beaverton, South; Beaverton, West; Bentley; Billings; Billings, South; Buckeye, North; Buckeye, South; Butman; Grout; Hay; Sage; Secord; Skeels

GRAND TRAVERSE

Blair; East Bay; Grant; Mayfield; Paradise; Paradise; Union; Whitewater

GRATIOT

Elba; Ithaca; Newark; North Star; Pine River; Sumner

HILLSDALE

Adams; Albion-Pulawski-Scipio Trend; Lime Lake; Reading

HURON

Dwight; Grant

INGHAM

Aurelius; Ingham; Leslie; Onondaga; Stockbridge; Vevay; White Oak

IONIA

Hubbardston

ISABELLA

Brinton; Broomfield; Chippewa; Clare City; Coldwater; Coldwater, South; Currie; Fremont; Gilmore; Isabella; Leaton; Lincoln; Rolland; Rosebush; Sherman; Union; Vernon; Wise

JACKSON

Concord; Hanover; Henrietta; Springport

KALAMZOO

Alamo; Comstock; Cooper

KALKASKA

Blue Lake; Boardman; Cold Springs; Excelsior; Kalkaska; Rapid River

KENT

Rockford; Tyrone; Walker; Wyoming Park

LAKE

Chase; Luther; Luther, North; Peacock; Sauble

LAPEER

Marathon; Rich

LENAWEE

Blissfield; Demings Lake; Franklin; Macon Creek; Medina; Newburg; North Morenci; Ridgeway; Woodstock

LIVINGSTON

Fowlerville; Green Oak; Hamburg; Iosco

MACOMB

Armada; Bruce; Chesterfield; Coon Creek; Lenox; Mt. Clemens; Richmond; Washington

MANISTEE

Bear Lake; Brown; Cleon; Filer; Manistee; Maple Grove; Marilla; Onkama; Pleasanton; Springdale

MASON

Eden; Fountain; Grant; Hamlin; Logan; Oxbow; River-ton; Riverton; Scottville; St. Mary's Lake; Victory; Wiley

MECOSTA

Sevens Lake; Big Rapids; Colfax; Fork, East; Fork; Fork, West; Green; Hardy Dam; Martiny; Mecosta; Mecosta Lake; Morton; Paris; Sheridan; Wheatland

MIDLAND

Edenville; Geneva; Jerome; Larkin; Mills; Mt. Haley; Mt. Pleasant; Porter; Sanford

MISSAUKEE

Cannon Creek; East Norwich; Enterprise; Falmouth; Forward; McBain; Pioneer; Prosper; Prosper, South; Reeder; Riverside; Vogel Center

MONROE

Deerfield; Summerfield

MONTCALM

Belly Achers; Bloomer; Bushnell; Cato; Crystal; Day; Douglass; Edmore; Edmore-Richland; Entrican; Home; Maple Valley; Pine; Reynolds; Richland; Stanton; Turk Lake; Winfield

MONTMORENCY

Atlanta; Montmorency

MUSKEGON

Blue Lake; Cedar Creek; Dalton; Egelston; Holton; Laketon; Montague; Muskegon; Ravenna; Trent; White River; Wolf Lake

NEWAGO

Ashland; Barton; Big Prairie; Bishop; Cole Lake; Croton; Ensley; Goodwell; Goodwell, East; Huber; Kimball Lake; Reeman; Sheridan; Thompson Corners; White Cloud; Woodville

OAKLAND

Addison; Avon; Leonard; Lyon; Northville; Pontiac

OCEANA

Benona; Claybanks; Crystal Valley; Crystal Valley, South; Elbridge; Ferry; Forest River; Gilbert Lake; Hart; Mears; Otto; Otto; Pentwater; Pentwater Lake; Rothbury; Shelby; Stony Lake; Weare

OGEMAW

Edwards; Logan; Rose City; West Branch

OSCEOLA

Ashton; Ashton, East; Burdell; Cat Creek; Cedar; Evert; Fork, North; Hartwich; Hersey; Leroy; Middle Branch; Mineral Springs; Pecks Lake; Reed City; Reed City, East; Rose Lake; Sears; Sylvan

OSCODA

Mio

OSTEGO

Bagley; Charlton; Chester; Dover; Hayes; Otsego; Otsego Lake

OTTAWA

Coopersville; Dennison; Fillmore; Marne; Polkton; Robinson; Wright; Zeeland

PRESQUE ISLE

Allis; Belknap; Bismarck; Case; North Allis; Pulawski

ROSCOMMON

Headquarters; Nellsville; St. Helen

SAGINAW

Birch Run; Birch-Bela; Chesaning; Fremont; Lakefield; New Lothrop; Richland; Saginaw; St. Charles; Taymouth

ST. CLAIR

Adair; Algonac; Alpine; Berlin; Big Hand; Boyd; China; China Belle; China, South; Columbus; Columbus, North; Cottrellville; Diamond Crystal Salt; East China; Kimball; Marine City; Marine City, South; Peters; Peters, East; Port Huron; St. Clair; Starrville; Wales; Yankee

TUSCOLA

Akron; Akron, East; Arbela; Elkland; Elmwood; Fostoria; Vassar

VAN BUREN

Bangor; Bloomingdale; Breedsville; Clear Lake; Coffee Lake; Geneva; Lacota; Lawton; Paw Paw

WASTENAW

Clinton; Freedom; Lyndon; Northville

WAYNE

New Boston; Northville; Romulus

WEXFORD

Cherry Grove; Henderson; Wexford

CROSS-REFERENCE FIELDS by PRODUCING FORMATION

A 2 CARBONATE - Silurian

Akron; Fillmore; Pentwater; Pullman, East

A 2 CARBONATE-NIAGARIAN - Silurian

Charlton

A 1 CARBONATE - Silurian

Akron; Alpena; Charlton; Chester; Dover; Fillmore; Lee; Olivet; Romulus; Stockbridge; Washington; Lee

A 1 CARBONATE-NIAGARIAN - Silurian

Bagley; Lee

ANTRIM - Devonian

Algonac; Charlton; Chester; Dover; Mayfield; Otsego; Otsego Lake

BEREA - Mississippian

Adams, North; Beaver; Birch Run; Blue Lake; Buckeye, South; Cedar Creek; Chase; Clayton; Coopersville; Deep River; Dorr; Edenville; Egelston; Ferry; Fostoria; Fremont; Hay; Huber; Kawkawlin; Larkin; Logan; Marathon; Marne; New Lothrop; Otisville; Otter Lake; Otto; Porter; Ravenna; Ravenna; Rich; Rothbury; Saginaw; Stony Lake; Walker; Williams; Wolf Lake; Wright; Zeeland

BEREA-TRAVERSE-DETROIT RIVER -

Mississippian/Devonian Walker

DETROIT RIVER - Devonian

Atlanta; Billings; Dorr; Dwight; Edenville; Essexville; Excelsior; Fostoria; Garfield; Grant; Kawkawlin; Lyndon; Otter Lake; Salem; Walker; Wise

DETROIT RIVER SOUR ZONE - Devonian

Adams; Akron; Au Gres; Buckeye, South; Cannon Creek; Clayton; Cranberry Lake; Grout; Headquarters; Marathon; Reed City; Rich; Skeels; Sterling; Vassar; Vernon; West Branch

DUNDEE - Devonian

Adams; Adams, North; Akron; Arbela; Ashton; Bard; Beaverton; Beaverton, South; Beaverton, West; Belly Achers; Bentley; Sevens Lake; Big Prairie; Big Rapids; Billings; Billings, South; Birch Run; Birch-Bela; Brinton; Broomfield; Buckeye, North; Buckeye,-South; Burdell; Bushnell; Butman; Cat Creek; Cedar; Clayton; Coldwater; Coldwater, South; Colfax; Cranberry Lake; Cranberry Lake, East; Crump; Crystal; Crystal Valley; Currie; Day; Deep River; Douglass; East Norwich; Eden; Edenville; Edwards; Elkland; Elmwood; Entrican; Essexville; Ewart; Falmouth; Fork; Fork, North; Freedom; Freeman; Freeman-Lincoln; Freeman-Redding; Fremont; Geneva; Gibson; Gibson; Gilmore; Goodwell, East; Greenwood; Grout; Hamilton; Harrison; Hatton; Headquarters; Home; Hubbardston; Isabella; Jerome; Kawkawlin; Lake George; Lakefield; Laketon; Leaton; Lincoln; Marathon; McBain; Mears; Mills; Mineral Springs; Moffatt; Mt. Forest; Mt. Haley; Mt. Pleasant; Nellsville; Northville; Otisville; Paris; Pecks Lake; Pentwater; Pinconning; Pine River; Port Huron; Porter; Prosper; Prosper, South; Reed City; Riverside; Robinson; Rolland; Rosebush; Sage; Sanford; Secord; Sherman; Skeels; Sterling; Sylvan; Vernon; Vogel Center; West Branch; Wheatland; White River; Winterfield; Wise

DUNDEE-REED CITY - Devonian

Colfax; Winfield

E UNIT - Silurian

Lee

GLACIAL DRIFT - "Pleistocene"

Grant

LOWER NIAGARAN - Silurian
Blue Lake; Chester

MARSHALL - Mississippian
Barton; Ensley

MICHIGAN STRAY - Mississippian
Ashton; Ashton, East; Sevens Lake; Big Prairie;
Big Rapids; Broomfield; Cedar; Cherry Grove;
Clare City; Colfax; Day; Douglass; Edmore-
Richland; Elba; Enterprise; Ewart; Falmouth; Fork,
East; Fork, North; Fork, West; Forward; Fremont;
Gilmore; Goodwell, East; Green; Hamilton;
Harrison; Hartwich; Headquarters; Hersey;
Isabella; Ithaca; Leaton; Maple Valley; Martiny;
McKay; Mecosta; Mecosta Lake; Middle Branch;
Mineral Springs; Morton; Newark; North Star;
Paris; Pine; Prosper; Redding; Reeder; Richland;
Rolland; Sears; Sheridan; Surrey; Sylvan; Turk
Lake; Union; Vernon; Wheatland; Wise

NIAGARAN - Silurian
Addison; Allis; Alpine; Armada; Aurelius; Avon;
Bag-ley; Bear Lake; Belknap; Benona; Berlin; Big
Hand; Bismarck; Blair; Blue Lake; Boardman;
Brown; Bruce; Cal-lee; Case; Charlton; Chester;
Chesterfield; China; China Belle; Clarence;
Claybanks; Cleon; Cold Springs; Colfax;
Columbus; Columbus, North; Convis; Coon
Creek; Cottrellville; Diamond Crystal Salt; Dover;
East Bay; East China; Eaton; Eaton Rapids;
Excelsior; Filer; Forest; Frederic; Grant; Green
Oak; Hamburg; Hamlin; Hayes; Ingham; Iosco;
Kalkaska; Kimball; Lee; Lee Twp.; Lenox;
Leonard; Lyon; Mancelona; Manistee; Maple
Forest; Maple Grove; Marilla; Mayfield;
Montmorency; North Allis; Northville; Onekama;
Onondaga; Otsego Lake; Paradise; Pennfield;
Pleasanton; Pontiac; Port Huron; Rapid River;
Richmond; Springdale; Starrville; Union; Vevay;
Victory; Washington; Wexford; White Oak;
Whitewater; Yankee

PRAIRIE DU CHIEN - Ordovician
Falmouth; Franklin; Lime Lake

REED CITY - Devonian
Burdell; Cato; Eden; Fountain; Goodwell, East;
Hardy Dam; Kimball Lake; Leroy; Luther, North;
Peacock; Reed City; Reynolds; Scottville

RICHFIELD - Devonian
Adams; Akron; Akron, East; Au Gres; Beaver
Creek Unit; Bentley; Butman; Cedar; Clayton;
Cranberry Lake; Cranberry Lake, East; East
Norwich; Enterprise; Ewart; Falmouth; Fork;
Freeman-Lincoln; Grout; Hamilton; Headquarters;
Henderson; Hickeys Creek; Logan; Marathon;
Mio; Nellsville; Prosper; Prosper, South; Reed
City; Rose City; Rosebush; Skeels; South Branch;
St. Helen; Standish; Sterling; West Branch;
Winterfield

SALINA - Silurian
China; Crystal Valley; Dorr; Hopkins, West;
Kawkawlin; Manistee; Mt. Clemens; Salem;
Wayland; Zeeland

SALINA A 1 CARBONATE - Silurian
Clarence; Hilliards

SALINA B UNIT - Silurian
Cooper

SALINA E UNIT - Silurian
Diamond Springs; Lee

SALINA-NIAGARANN - Silurian
Adair; Bear Lake; Blue Lake; Boyd; Brown;
Charlton; China, South; Clarence; Cold Springs;
Convis; Cottrellville; Dover; East Bay; Eaton
Rapids; Fowlerville; Grant; Hamlin; Hayes;
Ingham; Kalkaska; Lee; Leslie; Manistee; Maple
Grove; Marine City; Marine City, South; Mayfield;
Montague; Northville; Onondaga; Otsego Lake;
Paradise; Pennfield; Peters; Peters, East;
Pulawski; Springdale; St. Clair; Union; Wales;
Washington; White Oak

SAGINAW - Pennsylvanian
Edenville

SLYVANIA - Silurian
Jefferson

TRAVERSE-DUNDEE - Devonian
Muskegon

TRAVERSE-DUNDEE-DETRIOT RIVER - Devonian
Muskegon

TRAVERSE - Devonian
Adams; Adamsville; Alamo; Albion; Allegan;
Ashland; Ashton; Bangor; Barton; Beaverton,
South; Benona; Bentley; Sevens Lake; Bishop;
Bloomer; Bloomingdale; Breedsville; Broomfield;
Buckeye, South; Butman; Calvin; Cannon Creek;
Casco; Cedar Creek; Cherry Grove; Chesaning;
Cheshire; Chester; Chippewa; Clear Lake;
Clinton; Coffee Lake; Coldwater; Cole Lake;
Comstock; Concord; Cranberry Lake; Cranberry
Lake, East; Crooked Lake; Croton; Crystal;
Crystal Valley; Crystal Valley, South; Dallas;
Dalton; Day; Demings Lake; Demison; Diamond
Springs; Dorr; Douglass; Dunningville; East
Norwich; Eden; Edmore; Elba; Elbridge; Ensley;
Entrican; Excelsior; Falmouth; Ferry; Fill-more;
Forest River; Freedom; Freeport; Fremont;
Geneva; Gibson; Gilbert Lake; Goodwell;
Greenwood; Hart; Hawkhead; Headquarters;
Heath; Hilliards; Holton; Home; Hope; Hopkins;
Hopkins, South; Hopkins, West; Huber; Jefferson;
Johnstown; Juno Lake; Kimball Lake; Lacota;
Laketon; Lawton; Lebanon; Lee; Lee, South;
Lincoln; Lucht; Luther; Lyndon; Martin; Mears;
Moffatt; Monterey; Mt. Forest; Nellsville; New
Richmond; Niles; North Morenci; North Porter;
Otisville; Otsego; Otto; Overisel; Oxbow;

Paradise; Paris; Paw Paw; Peacock; Pentwater;
 Pentwater Lake; Pinconning; Pine; Pine River;
 Pioneer; Pipestone; Polkton; Prosper; Pullman;
 Pullman, East; Rabbit River; Rapid River;
 Ravenna; Reed City; Reed City, East; Reeman;
 Reynolds; Richland; Riverside; Riverton;
 Rockford; Rose Lake; Salem; Sanford; Sauble;
 Scottville; Shelby; Sheridan; Sherman; Skeels; St.
 Charles; St. Mary's Lake; Stanton; Sterling; Stony
 Lake; Sumner; Taymouth; Thompson Corners;
 Thornapple; Trent; Trowbridge; Tyrone; Vevay;
 Victory; Walker; Wayland; Wayland, North;
 Weare; West Branch; White Cloud; Wiley;

Winterfield; Wise; Wolf Lake; Woodstock;
 Woodville; Wright; Wyoming Park; Zeeland

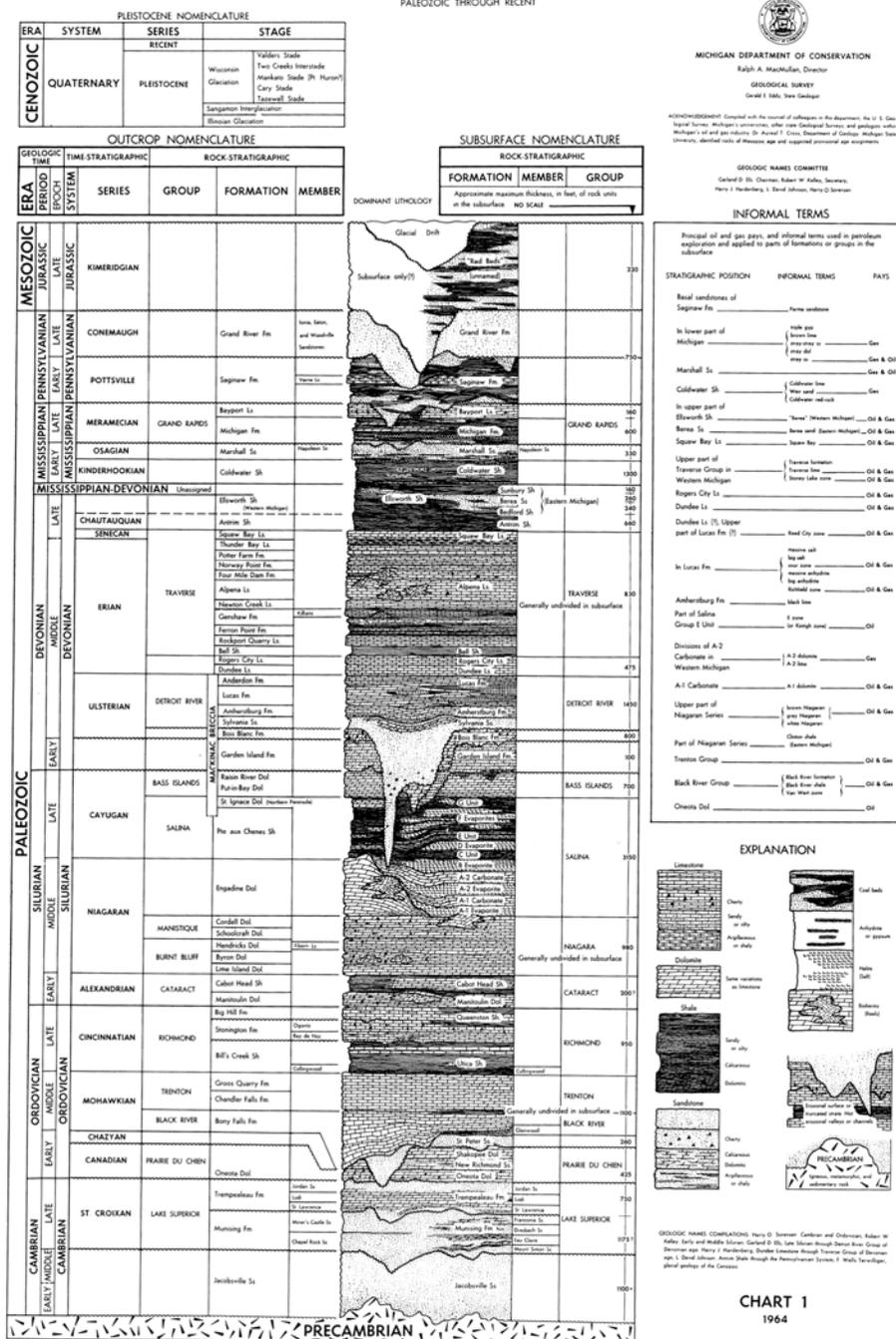
TRENTON - Ordovician
 Deerfield; Freedom; Henrietta; New Boston;
 Newburg; Reading; Ridgeway; Tekonsha

TRENTON-BLACK RIVER - Ordovician
 Albion-Pulawski-Scipio Trend; Blissfield; Green
 Oak; Hanover; Macon Creek; Medina; Northville;
 Olivet; Springport; Summerfield

WEIR - Mississippian
 Logan

ILLUSTRATION 2

STRATIGRAPHIC SUCCESSION IN MICHIGAN



MICHIGAN DEPARTMENT OF CONSERVATION
 Ralph A. MacMillan, Director
 GEOLOGICAL SURVEY
 Gerald E. Hall, State Geologist

ACKNOWLEDGMENT: Compiled with the consent of colleagues in this Department, the U. S. Geological Survey, Michigan's universities, other state Geological Surveys, and geologists within Michigan and of paleontologists Dr. Arnold F. Cooper, Department of Geology, Michigan State University, identified units of Mesozoic age and suggested regional group assignments.

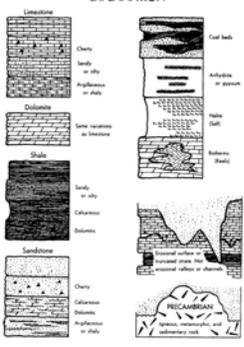
GEOLOGIC NAMES COMMITTEE
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 Harry J. Henshaw, L. David Johnson, Harry O. Sorenson

INFORMAL TERMS

Principal oil and gas plays, and informal terms used in petroleum exploration and applied to parts of formations or groups in the subsurface

STRATIGRAPHIC POSITION	INFORMAL TERMS	PAYS
Recent conditions of Saginaw Fm.	_____	_____
In lower part of Michigan	_____	_____
Marshall Sh.	_____	_____
Coldwater Sh.	_____	_____
In upper part of Ellettsworth Sh.	_____	_____
Berea Sh.	_____	_____
Saginaw Bay Ls.	_____	_____
Upper part of Traverse Group in Western Michigan	_____	_____
Rogers City Ls.	_____	_____
Dundee Ls.	_____	_____
Dundee Ls. (7), Upper part of Lucas Fm. (7)	_____	_____
In Lucas Fm.	_____	_____
Ambulatory Fm.	_____	_____
Part of Salina Group E Unit	_____	_____
Divisions of A-2 Carbonate in Western Michigan	_____	_____
A-1 Carbonate	_____	_____
Upper part of Niagara Series	_____	_____
Part of Niagara Series	_____	_____
Traverse Group	_____	_____
Black River Group	_____	_____
Onondaga Dol.	_____	_____

EXPLANATION



GEOLOGIC NAMES (CONTINUED): Names of Silurian, Carboniferous and Devonian, Permian, Triassic, and Middle Miocene, Gerald D. Eli, Lake Superior through Trenton Group of Devonian age, Harry J. Henshaw, L. David Johnson, Harry O. Sorenson, Michigan State University, identified units of Mesozoic age and suggested regional group assignments.

CHART 1
1964



STATE OF MICHIGAN
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