



# MICHIGAN'S OIL AND GAS FIELDS, 1964

ANNUAL STATISTICAL SUMMARY 2



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GEOLOGICAL SURVEY

THE STATE GEOLOGICAL SURVEY OF MICHIGAN

History

The State Geological Survey was established originally in 1837 by the First Legislature, which provided funds through 1845. The office was instituted again from 1859 through 1862. The present Survey was organized in 1869, and has served from that date without interruption. In 1921, however, agencies administering natural resources were combined into a single organization. Thus the Geological Survey, headed by the State Geologist, became part of the Department of Conservation.

Mission

To collect, interpret, and disseminate basic geologic information for understanding and developing the mineral and water resources in this state, to carry out the oil and gas conservation laws, and to evaluate all metallic mining properties.

Principal Governing Statutes (Compiled Laws, 1948):

Geological Survey, organic act . . . . . 321.1  
Department of Conservation, organic act. . . . . 299.2  
Oil and gas conservation . . . . . 319.1  
Mines appraisal. . . . . 211.24  
Mineral statistics . . . . . 319.202  
Aerial and topographic surveys . . 321.51, 321.101, 321.151



GEOLOGICAL SURVEY

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MICHIGAN'S OIL AND GAS FIELDS, 1964

STATE OF MICHIGAN  
George Romney, Governor  
DEPARTMENT OF CONSERVATION  
Ralph A. MacMullan, Director

GEOLOGICAL SURVEY

Gerald E. Eddy, State Geologist, Chief, and Supervisor of Wells

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D E D I C A T I O N



WILLIAM LOUIS DAOUST

13th STATE GEOLOGIST OF MICHIGAN, 1952-1963

William Daoust, who retired in August 1963, guided the State Geological Survey for a term of office exceeded in length by only two other state geologists during the 128-year history of our organization.

Most of the present staff received their training during his tenure. Bill's gentlemanly qualities, his more-than-usual capacity for understanding people, and long experience in oil and gas regulatory work earned him the regard, not only of this staff, but also the administrators of other geological agencies.

It is highly appropriate that this particular report be dedicated to him, because, to a considerable extent, he fostered its development.

Residence: 1357 Kimberly, Lansing

PREFACE

This publication, the second of the new series of annual statistical summaries, contains essentially the same information as the former "Summaries of Operations" that appeared annually from 1946 through 1962. Most of the information pertains to Michigan's oil and gas field drilling activities as they relate to new field and pool exploration and development, and to oil and gas production. In addition, the report has been expanded to include other information of historical and general interest, preserving valuable records for future reference.

The report brings together under one cover many related statistical data not usually found in any other industry or government publication. Little, if any, of the data can be used directly to find a new oil or gas field. It is, however, a source of information most useful in evaluating Michigan's past and future prospects as a petroleum province.

Contents are organized into 3 parts. Part 1 is a general review of oil and gas exploration drilling activities, production, and other items of interest during 1964. Some of this information is summarized from the succeeding Parts 2 and 3. Part 2, probably the most used section, has been color indexed. Indi-

vidual oil field statistics and related items are on green pages. Individual gas field statistics, gas storage reservoirs, and related items are on pink pages. Part 3 is mostly cumulative statistics of past drilling activities, oil and gas production, and other related subjects for which records have been kept for many years.

Current oil and gas production figures are provided by the Michigan Department of Revenue. All other statistics are based upon data gathered and maintained by the Geological Survey.

This report is compiled from records kept by staff members of the Oil and Gas Unit supervised by L. W. Price, with the assistance of R. M. Acker, geologist and head, Regulatory Control; W. G. Smiley, geologist and head, Production and Proration; R. E. Ives, geologist and head, Petroleum Geology.

Lansing, Michigan  
April 23, 1965

G. D. Ellis, Geologist  
Petroleum Geology

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ABBREVIATIONS

A.P.I.	American Petroleum Institute	MCFGPD	Thousand Cubic Feet Gas Per Day
(A) I.P.	(Acid) Initial Production or Potential	Mich.	Michigan formation
A-1 Carb.	A-1 Carbonate	Miss.	Mississippian
A-2 Carb.	A-2 Carbonate	Mt. Simon ss.	Mt. Simon ss.
BbIs.	Barrels	NFW	New Field Wildcat
B.B.	Bois Blanc formation	(N) I.P.	(Natural) Initial Production or Potential
B.D.	Brine Disposal	Niagar.	Niagaran
BDW	Brine Disposal Well	Nt.	Nontechnical
BOPD	Barrels Oil Per Day	OBS	Observation Well
B.R.	Black River	OP	Out Post Well
Camb.	Cambrian	Ord.	Ordovician
"Camb."	Unidentified Cambrian	OWDD	Old Well Drilled Deeper
Cat.	Cataract formation	P.D.C.	Prairie du Chien formation
C.H.	Cabot Head formation	Penn.	Pennsylvanian
Cinn.	Cincinnati	Pilot Wtr.	Pilot Water
Cl.	Clinton formation	P.M.	Pressure Maintenance
Cold.	Coldwater formation	Prod. Form.	Producing Formation
Compl.	Completion	R.C.	Reed City formation
Coop.	Cooperative	RW	Reworked Well
D & A	Dry and Abandoned	Rich.	Richfield formation
Dev.	Devonian	Sag.	Saginaw formation
D.R.	Detroit River formation	Sal.-Niag.	Salina-Niagaran
D.R. SZ	Detroit River Sour Zone	SD	Shut Down
Dres.	Dresbach formation	Seis.	Seismograph
Dd., DD	Dundee	S.P.	St. Peter formation
Dd.-R.C.	Dundee-Reed City	Stray	Michigan Stray formation
E.C.	Eau Claire formation	Sub.	Subsurface geology
Explor.	Exploratory	SW	Service Well
DFT	Deeper Pool Test	SWD	Salt Water Disposal
Fran.	Franconia formation	Syiv.	Sylvania formation
Geo. Test	Geological Test	SZ	Sour Zone (in Detroit River)
Grav.	Gravity, Gravimeter	Thick.	Thickness
GS	Gas Storage	(T) I.P.	(Treatment) Initial Production or Potential
GSW	Gas Storage Service Well	Trav.	Traverse
Gw	Glenwood	Trempe.	Trempealeau formation
Incs.	Includes	Trenton-Blk. River	Trenton-Black River
Inj.	Injection	Trent.	Trenton
L.P.G.	Liquid Petroleum Gas	Unit.	Unitized
Marsh.	Marshall formation		
MCF	Thousand Cubic Feet		



related to exploratory or oil and gas pool development drilling.

**EXPLORATORY AND DEVELOPMENT WELL COMPLETIONS**

	Exploratory Wells		Development Wells			Totals
	Oil	Gas	Dry	Oil	Gas	
1962	8	8	278	140	54	197
1963	11	7	220	124	66	163
1964	7	5	221	75	43	155

\*\*\* DRILLED FOOTAGE \*\*\*

The total drilled footage for exploratory and development wells completed in 1964 decreased slightly from the prior year. The average (arithmetical) footage per exploratory well (233 completed) was about 2,808 feet, and for development wells (273 completed) 3,387 feet. Total drilled footage for service wells (gas storage, etc.) more than doubled. Service wells (122 completed) averaged 1,779 feet per well. The fluctuation in drilled footage through a 3-year period is as follows:

Footage Class	Amount of Drilled Footage	
	1962	1963
Exploratory	883,535	698,551
Development	1,012,711	1,064,645
Service	133,375	88,800
Total	2,029,621	1,851,996

\*\*\* DISCOVERY WELLS \*\*\*

The ratio of discoveries to exploratory tests increased from 1:13 in 1963 to about 1:19 in 1964. Only 12 discoveries of all types were made as compared with 20 in 1963. Seven of the 12 are classed as new field discoveries, 3 as new pools, and 2 as field extensions. Subsurface geology is credited for most of the discoveries; only one (Columbus field) resulted from gravimeter surveying. Details on all 1964 discoveries are tabulated and shown on the page below. Silurian and

Ordovician formations which have been heavily explored the past few years yielded but 1 new field, a Niagara reef gas pool. The following chart gives an analysis of discoveries by geologic system through a 3-year period.

System	Formation or Pay	Number of Discoveries	
		1962	1963
Pennsylvanian		0	0
Mississippian	"Michigan Stray "Berea"	3	1
Devonian	"Traverse Lime"	0	0
	Dundee	7	7
	"Reed City"	0	4
Silurian	Detroit River	1	0
	"Sour Zone"	0	0
	Richfield	1	0
	Salina-Niagara reef	0	0
Ordovician	Niagara reef	7	5
	Trenton-Black River	0	3
	Prairie du Chien	0	0

\*\*\* GEOPHYSICAL EXPLORATION \*\*\*

Exploration for possible oil and gas traps by geophysical methods continued at about the same level as in 1963. Based on informal sources in the petroleum industry, 5 gravimeter crews are estimated to have worked a total of 38 crew months, and 6 seismograph parties a total of 7 crew months. Most geophysical work was done in eastern and northern parts of the state.

\*\*\* DEEP TESTS \*\*\*

Fewer Trenton-Black River and Prairie du Chien (Lower Ordovician) tests were drilled, but there was a significant increase in the number of wells that penetrated Cambrian or older rocks. In 1963, only 3 Cambrian or deeper tests were drilled, but 12 were drilled in 1964, two of which penetrated Precambrian granites. Wells designated as deep tests are listed on the page below.

**1964 DISCOVERY WELLS**

Field	County and Location	Operator and Lease	Permit Number	Comp. Date	Total Depth	Depth to Pay	Initial Production		Basis for Form. Loc.
							(N) IP=n BOPD	(T) IP=t MCFGPD	
Riverton, Sec. 21	Mason	Oil Producers, Inc. - Buck #1	25675	10-12	1687	1683	P6+6 wtr. t		Trav. Sub.
Reeder	Missaukee	Consumers Power Co. - Stroth-McBain #1	25553	7-14	1389	1385		1200 t	Stray Sub.
Home, Sec. 26	Montcalm	B. C. White & H.D. Atha	20804	12-7	PB3110	3096	P2 + wtr./week t		Trav. Sub.
Middle Branch	Osceola	Hacket-Fouts #1	25575	7-31	1641	1630		2046 t	Stray Sub.
	Osceola	L. C. Sibley Carmichael-Rose #1	25385	5-28	PB1651	1492		200 t	Stray Sub.
Columbus	St. Clair	R. & W. Cook - Wimmer #1	25219	1-14	PB3000	2738		62,400 t	Niag. Grav.
	Van Buren	M.C.G.C. - Dupont #1	23434	1-14	1032	1029	P 1 t		Trav. Nt.

\*\*\* NEW FIELDS \*\*\*

\*\*\* NEW POOLS \*\*\*

Moffatt, Sec. 34	Arenac	Basin Oil Co. & W. Stewart-State-Moffatt#1	25287	3-23	3027	2100	P17 t		Trav. Nt.
Cranberry Lake, East	Clare	Sun Oil Co. - Amstutz et al #1	25198	2-10	5139	5087	F35 t		Rich. Sub.
	Gladwin	American Hydrocarbons, Inc. - McMahon #1	25370	4-21	4842	4481	F50 t		D.R. Sub.
Beaverton	Gladwin	Harry E. Roberts - Crockett #1	24733	3-18	3976	3898	P3 & 11 wtr. t		Dd. Sub.
	Lenawee	T. & W. Oil Co. - R. & E. Beck #1	25088	6-8	661	658		SIGW	Trav. Nt.

\*\*\* EXTENSION DISCOVERIES \*\*\*

<sup>1</sup>Note: (T) IP refers to Initial Potential after acid, sand-fracture, or a combination of well stimulation methods. (N) IP refers to Natural Initial Potential or Production.

The deepest hole drilled in Michigan to date was drilled on the Rose City structure, Ogemaw County, in 1964. This well reached a total depth of 12,996 feet in Cambrian sandstones and dolomites of the Eau Claire (?) member of the Munising formation. Only 2 other wells have been drilled to depths greater than 10,000 feet. (See preceding District map for location of these wells)

Special drilling information on the Rose City deep test (photo at right) was furnished by courtesy of North American Drilling Company, contractors, Mt. Pleasant, Michigan.

No. Bits	Size Bits	Hole Size
1	30' reamer	30" to 95 ft.
1	22' reamer	22" to 948 "
3	17½" bit	13 3/4" to 4,408 "
17	13 3/4" bit	9 5/8" to 10,428 "
41	9 5/8" bit	7 7/8" to 11,637 "
15	7 7/8" bit	7 27/32" to 12,996 "
19	7 27/32" diamond bit	

CASING RECORD: 24" csg. set at 89' with 25 cement; 16" csg. set at 929' with 1150 cement; 10 3/4" csg. set at 4396' with 150 cement.

DRILLING MUDS AND AGENTS USED:

Zeogel 662 sacks @100 lbs. ( 66,200 lbs.)  
 Impermex 989 sacks @ 50 lbs. ( 49,450 lbs.)  
 Q-Broxin 251 sacks @ 50 lbs. ( 12,550 lbs.)  
 Soda ash 88 sacks @100 lbs. ( 8,800 lbs.)  
 Condet 69 sacks @ 5 gals. ( 345 gals.)  
 Salt 4100 sacks @100 lbs. (410,000 lbs.)  
 Baroid 243 sacks @100 lbs. ( 24,300 lbs.)  
 X-Cor. 41 sacks @ 14 gals. ( 574 gals.)  
 DeFoamer 21 sacks @ 75 lbs. ( 1,575 lbs.)  
 Fibertex 20 sacks @ 40 lbs. ( 800 lbs.)  
 Cottonseed Hulls 16 sacks @100 lbs. ( 1,600 lbs.)  
 Mila Tex 1 sack @ 50 lbs. ( 50 lbs.)  
 Jel Flaka 2 sacks @ 25 lbs. ( 50 lbs.)  
 Cement 125 sacks

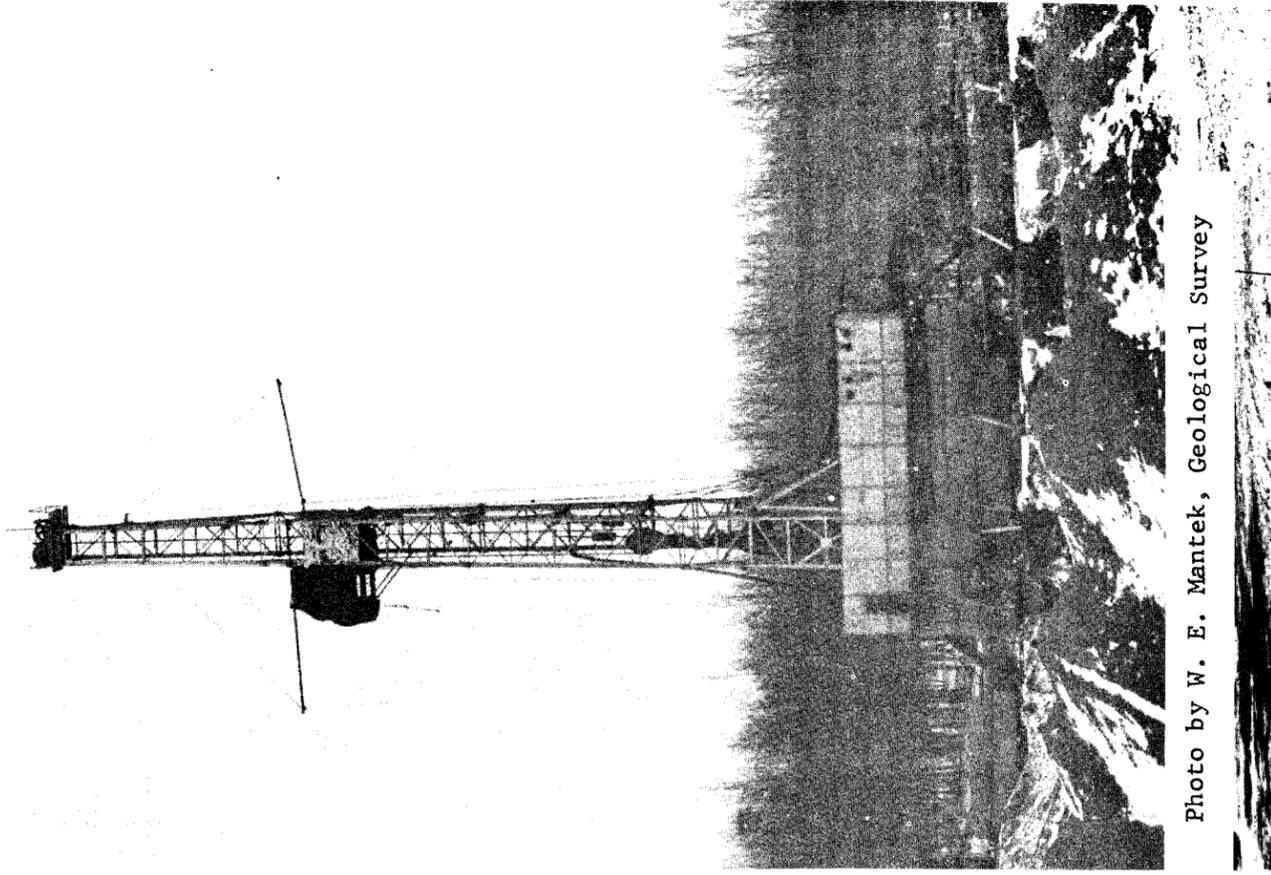


Photo by W. E. Mantek, Geological Survey

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TABLE 1.-IMPORTANT 1964 DEEP TESTS

County	Operator and Lease	Location	Permit Number	Basis for Location	Comp Date	Total Depth	System and Formation	Expl. Class	Results
Alcona	Gallaher & Bachelder--Elliott #1	23-27N-9E	25161	Gravity	7-18	5566	Sil., Niag.	NFW	D & A
Allegan	A. G. Hill--Conklin #1	31-2N-15W	25757	Subsurface	12-12	3037	Ord., Trent.	NFW	D & A
Alpena	P.E.P.L. Co.--Ford Motor #1-5	5-31N-9E	25690	Gravity	12-5	6380	Cambrian	NFW	D & A
Berrien	R. Hogerwerf-Blighton #1 (Old well drilled deeper)	5-5S-17W	24045	Nt.	8-26	1525	Sil., Sal.	NFW	D & A
Branch	Algonquin Petro. Co.--Marsh #1	25-7S-5W	25758	Grav.-Seis.	12-12	3757	Camb., Tremp.	NFW	D & A
Eaton	Merrill Drlg. Co.--Hulsebos #1	9-2N-6W	22516	Gravity	3-14	5350	Ord., BR.	NFW	D & A
Hillsdale	C.A. Perry & Son, Inc.--Rymal #1	15-7S-1W	25508	Nt.	7-7	4210	Camb., Tremp.	NFW	D & A
Kalkaska	Otterbine & Donley-Ruttan #1	12-28N-8W	25587	Subsurface	10-22	3385	Dev., Rich.	NFW	D & A
Lapeer	Good & Good Drlg. Co.--Thom #GG-1	10-8N-9E	23946	Gravity ?	11-22	5906	Sil., Niag.	NFW	D & A
Livingston	Parila Oil & Gas--Aschenbrenner #1	15-1N-4E	23074	Nt.	7-14	4023	Sil., Cl.	NFW	D & A
Mason	J. Swierenga--Barothy #1	29-17N-15W	24690	Nt.	7-27	4500	Sil., Sal.	NFW	D & A
Mason	D. Van Raalte--Bahr #1 (1500' wtr./5 hrs. @5880-5890)	18-17N-16W	25001	Subsurface	5-5	5890	Ord., St. P.	DPT	D & A
Monroe	Bernhardt Oil & Gas--Allen #2	19-7S-6E	25378	Subsurface	6-1	2763	Camb., Tremp.	DPT	D & A
Monroe	Ferguson & Garrison--Shimp #1	16-7S-6E	25494	Gravity	11-23	3671	Granite	NFW	D & A
Monroe	Humble Oil & Refining--Oger #1 (Porosity & SO & G in Trenton-Black Rv.)	15-5S-7E	24405	Sub.-Seis.	2-11	3260	Camb., Tremp.	NFW	D & A
Muskegon	E. C. Ford--Wickstrom #1	14-11N-17W	25376	Subsurface	5-26	3880	Sil., Niag.	NFW	D & A
Ogemaw	Brazos et al--State-Foster #1 (SG (?) @1126-1128 in Oneota)	28-24N-2E	25099	Subsurface	6-12	12996	Camb., Tremp.	DPT	D & A
Oscoda	Muskegon Devel.--Webberville Club #1	9-26N-1E	25175	Subsurface	3-30	4145	Dev., D.R.	NFW	D & A
Ottawa	C.P. Co.--Van Kampen #1	32-6N-15W	25200	Subsurface	1-19	3345	Ord., Cinn.	NFW	D & A
Ottawa	Smith Petroleum Co.--Fenske #4 (DPT in Walker Field)	34-7N-13W	8002	Subsurface	9-24	2723	Sil., Sal.	DPT	D & A
Presque I.	United Drlrs. & Prod.--Skinner #1	3-33N-2E	25663	Gravity	10-27	4302	Sil., Cl.	NFW	D & A
Sanilac	Humble Oil & Refining--Hopenthal #1	16-9N-15E	25357	Gravity	6-28	6787		NFW	D & A
St. Clair	Consumers Power Co.--C.P.C. BDW #1 (Cambrian BDW in Boyd Field)	31-4N-15E	BD139		3-19	4634	Granite		BDW
St. Clair	Lanphar Oil & Gas--Lyle #1 (DPT in Capac Field)	28-7N-13E	25632	Nt.	10-27	6337	Camb., M.S.	DPT	D & A
St. Clair	Goll, Graves et al--Baldwin et al #1	6-6N-16E	25024	Nt.	1-25	5492	Camb., E.C.	NFW	D & A
St. Clair	H. E. Walton--Varel-Lee #1	PC 198	24961	Subsurface	3-9	3264	Ord., Trent.	NFW	D & A
Tuscola	C. J. Simpson--Novesta Twp. #1	16-13N-11E	25609	Gravity	9-20	9300	Camb., M.S.	NFW	D & A
Washtenaw	A. E. Rovsek--Wabash R.R. Co. #1	24-3S-7E	25482	Gravity	9-15	3973	Ord., P.D.C.	NFW	D & A
Wayne	P.E.P.L. Co.--Ford Motor #1	19-2S-11E	25560	Gravity	8-28	3917	Camb., E.C.	NFW	D & A

\*\*\* OIL AND GAS PRODUCTION \*\*\*

Oil production continued to dip slightly. No significant oil reserves were found or developed that would offset the decline. Production dropped to 15,601,239 barrels as compared with 15,971,747 barrels in 1963. The Albion-Scipio Trend fields produced over 58 per cent of the state's oil production in 1964. Gas production, which has steadily increased the past 6 years, continued to rise. Production amounted to 32,615,685 MCF as compared with 31,895,701 MCF in 1963. The Albion-Scipio Field led in gas production in 1964. Oil and gas production by month and by geographic district is shown in the following charts. Gas and oil production by county in 1964 is shown on Table 3. Production by individual field or pool is found in Part 2.

OIL AND GAS PRODUCTION BY MONTH

Month	Production	
	Barrels Oil	MCF Gas
January	1,361,349	3,499,256
February	1,242,922	2,696,552
March	1,311,373	2,248,737
April	1,312,384	2,148,825
May	1,293,345	2,386,957
June	1,306,639	2,295,371
July	1,330,157	2,304,122
August	1,289,103	2,340,615
September	1,277,766	2,164,498
October	1,313,236	2,729,868
November	1,254,107	2,952,925
December	1,308,858	4,847,960
Totals	15,601,239	32,615,685

OIL AND GAS PRODUCTION BY DISTRICT

District	Production	
	Barrels Oil	MCF Gas
Basin	4,120,243	3,426,542
Northern	104,433	466,412
Southeastern	7,944,818	24,156,762
Southwestern	2,998,598	4,493,452
Western	433,147	72,518
Totals	15,601,239	32,615,685

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\*\*\* OIL AND GAS VALUATION \*\*\*

The average price paid per barrel of oil at the wellhead was about \$2.81. The total valuation of oil produced in Michigan in 1964 amounted to about \$43,879,393.

The price of gas sold at the wellhead averaged about \$.26 per MCF. The total valuation of this product was about \$3,466,921 in 1964.

\*\*\* CRUDE OIL IMPORTS AND EXPORTS \*\*\*

Crude oil imports to Michigan refineries dropped over 2 million barrels in 1964. Imports via interstate pipelines from western and mid-western states amounted to 32,730,110 barrels as compared with 33,013,238 barrels in 1963. Imports of Canadian crude, delivered by pipeline from western Canada oil fields, dropped the most -- 4,913,385 barrels as compared with 6,663,971 barrels in 1963.

Oil exported to northern Indiana (Ft. Wayne) refineries increased from 86,604 barrels in 1963 to 170,779 barrels the past year. Oil exported to Indiana is produced in southern and southeastern Michigan fields.

\*\*\* LPG EXTRACTION \*\*\*

LPG products from wet gas processing increased from 54,186,242 gallons to 66,187,177 gallons in 1964. The top 3 fields in LPG production were: Albion-Scipio 30,851,432 gallons, Boyd 14,269,454 gallons, and Belle River Mills 7,021,308 gallons. The Willow Run plant, which processes gas delivered via interstate pipeline, extracted 12,561,089 gallons of LPG. Most of the gain in total production was from this plant. Details on casinghead gas plant operations are found on Table 13. LPG storage facilities, surface and subsurface, are shown on Table 11.

\*\*\* OIL FIELDS \*\*\*

New oil field discoveries in 1964 increased the number of active oil fields to 184. In addition, 4 new pools were added to older fields. There were 7 fields or pools abandoned during the year, and 1 pool (Reed City Zone, Reed City Field) converted to gas storage and secondary recovery.

New well completions, including reworks and wells deepened to new pay zones, increased the year-end total of producible wells in the state to 4588. The 4588 wells include 436 wells which were shut down or shut in, but it does not include gas wells or injection wells which produced some oil during the year. The number of producing wells at year's end was 4151.

There were 115 abandonments. These included pay zones where wells were deepened, re-completed in new pay zones, or converted to injection wells. Data on individual oil fields are found in Part 2.

\*\*\* GAS FIELDS \*\*\*

The discovery of 4 new gas fields in 1964 increased the number of producible dry gas fields to 83. However, only 32 fields produce gas commercially. The total number of wells in the 83 fields was 404. Of these 134 were shut in pending a market, 71 are used for household or lease fuel.

The discovery of 4 new gas fields in 1964 increased the number of producible dry gas fields to 83. However, only 32 of these fields produce gas for commercial sale. The total number of wells in the 83 fields amounted to 404. Of these, 136 were actually producing at the end of 1964, 134 were shut in pending market, 71 are used for household or lease fuel, and 63 were shut in and no longer commercial.

The Lynn Field, St. Clair County, was consolidated with Capac, North Capac, and South Capac (the latter 3

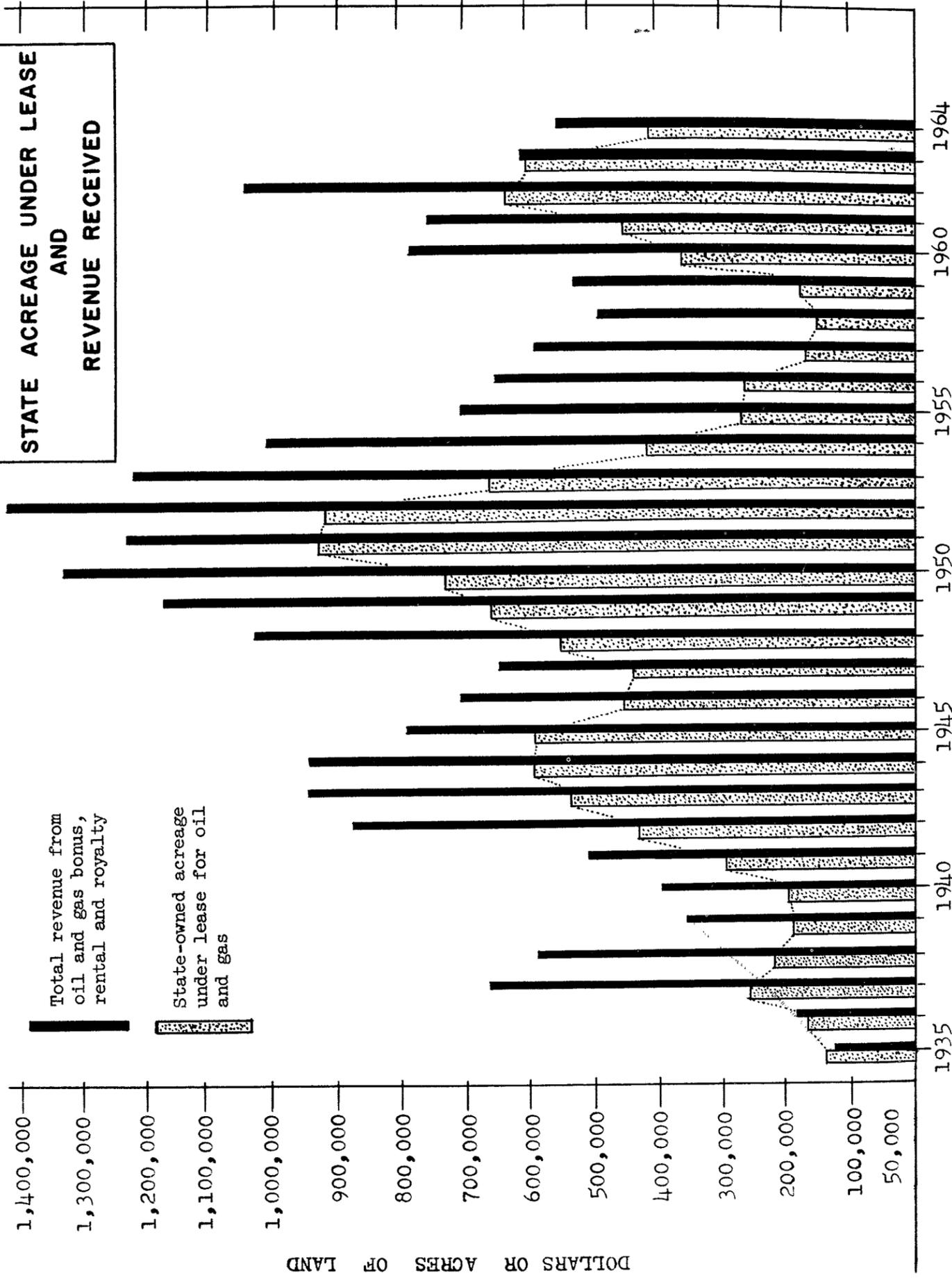
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were combined in 1963) in 1964. The fields were consolidated for administrative and statistical handling rather than from a gas production aspect. The small gas wells in the Capac field have been drilled on the basis of 1 well per 160-acre unit. Thus the combined drilled acres now credited to Capac field amount to 3680. "Drilled acres" as shown on the oil and gas field tables is not necessarily synonymous with "productive acres", or lateral productive extent of a given oil or gas pool. In early 1965 the spacing order was changed to provide for 320-acre drilling units and 160-acre drilling units according to area specified in the order. Subsequent gas wells completed in the field will be credited with either 320 or 160 acres per well.

\*\*\* UNDEVELOPED ACREAGE \*\*\*

Figures for the total amount of undeveloped acreage leased for oil and gas, on a statewide basis, are not available. Some indication of the amount of land under lease by a part of the industry is shown by figures and estimates provided by companies and other industry sources. At the end of 1964, 28 companies held a combined total of 1,424,183 acres under lease. Of this total, about two-thirds was held by 13 major companies, most of whom held less undeveloped acreage than in the previous year. Most of the other companies also indicated less acreage under lease. Other independents and individuals not included or reported in the above survey, presumably held an excess of 50,000 undeveloped acres. State lands under lease are included in the 1,424,183 acres.

The amount of state-owned lands under lease for oil and gas also decreased during 1964. Records indicate 410,000 acres of state land under lease. The total revenue from oil and gas bonus, rental and royalty, amounted to \$553,692 in 1964. The fluctuations in the amount of state lands under lease, and the derived revenue over a period of years, are shown graphically on the next page.



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TABLE 2. -- DRILLING PERMITS AND NEW WELL COMPLETIONS BY DISTRICTS AND BY MONTHS - 1964

	DISTRICTS												Totals							
	Basin	Northern	Western	Southwestern	Southeastern	MONTHS						Totals								
PERMITS ISSUED (1)	166	9	64	77	267	583	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Totals	
<b>CLASSIFICATION OF NEW WELL COMPLETIONS</b>																				
Oil Wells (2)	16	1	3	20	42	82														
Gas Wells	12	0	2	2	32	48														
Gas Storage Wells	96	0	1	10	14	121														
Brine Disposal Wells	0	0	0	0	1	1														
Water Injection Wells	0	1	0	0	0	1														
LPG Salt Water Disposal Wells	0	0	0	0	2	2														
Geological Information Test	0	0	0	0	1	1														
Dry Holes	58	9	61	56	192	376														
<b>Total Well Completions (3)</b>	<b>182</b>	<b>11</b>	<b>67</b>	<b>88</b>	<b>284</b>	<b>632</b>														
<b>EXPLORATORY WELLS COMPLETED</b>																				
Exploratory Tests D & A	37	9	49	37	89	221														
Successful Exploratory Tests	8	0	1	1	2	12														
<b>Total Exploratory Tests</b>	<b>45</b>	<b>9</b>	<b>50</b>	<b>38</b>	<b>91</b>	<b>233</b>														
<b>PERMITS ISSUED (1)</b>																				
<b>CLASSIFICATION OF NEW WELL COMPLETIONS</b>																				
Oil Wells (2)	8	10	6	9	7	12	4	5	8	7	5	8	7	5	8	7	5	1	82	
Gas Wells	7	2	2	3	7	4	5	6	5	3	1	3	1	3	48					
Gas Storage Wells	15	3	0	2	11	12	25	14	10	10	9	10	9	10	121					
Brine Disposal Wells	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1					
Water Injection Wells	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1					
LPG Salt Water Disposal Wells	0	0	0	0	0	0	0	0	0	1	1	0	1	1	2					
Geological Information Test	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1					
Dry Holes	41	27	17	22	28	36	40	34	37	29	34	37	29	34	30	376				
<b>Total Well Completions (3)</b>	<b>71</b>	<b>42</b>	<b>26</b>	<b>36</b>	<b>53</b>	<b>65</b>	<b>74</b>	<b>59</b>	<b>60</b>	<b>50</b>	<b>52</b>	<b>44</b>	<b>44</b>	<b>44</b>	<b>632</b>					
<b>EXPLORATORY WELLS COMPLETED</b>																				
Exploratory Tests D & A	23	12	8	12	17	24	28	18	18	24	17	20	18	20	18	221				
Successful Exploratory Tests	2	1	2	1	1	1	2	0	0	1	0	1	0	1	12					
<b>Total Exploratory Tests</b>	<b>25</b>	<b>13</b>	<b>10</b>	<b>13</b>	<b>18</b>	<b>25</b>	<b>30</b>	<b>18</b>	<b>18</b>	<b>24</b>	<b>18</b>	<b>20</b>	<b>19</b>	<b>19</b>	<b>233</b>					

(1) Includes 120 gas storage permits, 1 water injection well permit, and 1 permit for geological information.  
 (2) Does not include 6 oil wells resulting from rework operations.  
 (3) Does not include reworks and deepened wells, but does include service wells.

TABLE 3. -- DRILLING PERMITS, WELL COMPLETIONS, OIL AND GAS PRODUCTION BY COUNTY -- 1964 (SHEET 1 of 2)

County	Permits Issued	Classification of 1964 well completions					Total Completions	County Production	
		Oil Wells	Gas Wells	Service Wells		Dry Holes		Barrels Oil	MCF Gas
				GS	Wtr. Inj. Info.				
Alcona	0					1			
Allegan	26	5		10		7	250,527	438,463	
Alpena	1					1			
Arenac	7	2				7	330,638		
Barry	2					1	17,541		
Bay	1					1	352,172		
Branch	4					5			
Calhoun	3	2	2			6	2,311,054	3,864,580	
Cass	3					3	9,247		
Clare	18	4	1	5		10	614,137	192,886	
Crawford	6	1		1		4	84,749	439,739	
Eaton	0					1			
Genesee	5	4				0	2,269		
Gladwin	2					3	463,533		
Gratiot						2	67,043	7,551	
Hillsdale	74	28				54	5,078,833	3,949,250	
Huron	1					1	1,461		
Ionia	3					3			
Isabella	1					1	361,508	4,044	
Jackson	10	2				9	1,884,740	2,044,827	
Kalamazoo	1					0			
Kalkaska	1					1	17,809		
Kent	2	2				0	119,176	20,054	
Lake	3					3	1,412		
Lapeer	3	1				3	35,189		
Lenawee	6		2			5	483		
Livingston	1					1		10,172	
Macomb	33	9				29	4,991	5,302,329	

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TABLE 3. -- DRILLING PERMITS, WELL COMPLETIONS, OIL AND GAS PRODUCTION BY COUNTY -- 1964 Continued (SHEET 2 of 2)

Mason	25	3				26	29	230,374	13,289
Mecosta	31	2	32			4	39	25,945	129,098
Midland	0					0	0	259,939	8,027
Missaukee	19		8			7	18	448,780	1,160,659
Monroe	3					4	4	8,304	
Montcalm	55		51			8	59	285,466	88,582
Montmorency	0					0	0	75	
Muskegon	8					7	7	10,117	8,617
Newaygo	9		1			10	11	21,479	50,612
Oakland	1					0	0	1,012	109
Oceana	12					10	10	169,765	
Ogemaw	3	1				2	5	335,978	645,400
Osceola	14					8	13	265,234	218,903
Oscoda	0					1	1	1,799	
Otsego	0					0	0		26,673
Ottawa	26	9				24	33	266,755	170,355
Presque Isle	1					1	1	192,816	971,392
Roscommon	1					0	0	32,372	
Saginaw	0					0	0		
Sanilac	3					3	3		
Shiawassee	1					1	1		
St. Clair	97	7	1	1	1	79	109	882,650	12,257,908
Tuscola	5	3				1	4	82,413	
Van Buren	10	2				10	12	24,299	
Washtenaw	14	1	4			3	9	31,123	216,045
Wayne	21	3	9			1	15	16,032	376,122
Wexford	7					5	7		
Totals	583	82	48	3	121	376	632	15,601,239	32,615,685
55 Counties									

Includes gas storage field observation wells.

Includes 2 wells drilled as LPG salt water disposal wells.

\*\*\* OIL FIELD BRINE PRODUCTION \*\*\*

Oil field brine production in 1964 amounted to 148,972 barrels per day as compared with 149,696 barrels per day in 1963. There were 17 fields that produced brine in excess of 2,000 barrels per day, and these fields account for 71 per cent of the state's daily oil field brine production. Nine of the fields had an increase and 8 had a decrease in brine production over the 1963 amount. The decrease in the Coldwater field is the result of "shut in" wells which may be utilized in a secondary recovery project, or be plugged and abandoned. The decrease in the Reed City field is due to "shut in" wells which are in the process of being converted to gas storage and secondary recovery wells. Other decreases are due to "shut in" wells scheduled for plugging and abandonment. The significant increase in brine production is the result of natural advance of formation water. The 17 fields are listed on the small chart. Other details on brine production are shown on Tables 4 and 23. See Oil and Gas Field Tables for brine production by individual field.

MAJOR BRINE PRODUCING FIELDS

Field	1964	1963	1962
Coldwater	31,945	35,701	29,674
Albion-Scipio Trend	8,798	6,323	6,321
Porter	8,547	9,677	9,222
Deep River	7,570	8,800	8,375
Freeman-Redding	6,695	7,630	7,699
Stony Lake	6,362	6,371	8,445
McBain	5,524	4,526	2,495
Reed City	4,951	6,532	7,920
Reynolds	4,210	4,031	3,720
Vernon	3,850	2,925	3,320
Ewart	3,025	2,410	1,985
Prosper	2,925	2,600	4,300
Adams, North	2,857	3,664	3,774
Fork	2,475	2,486	2,500
Scottville	2,404	1,714	748
Elbridge	2,219	1,881	960
Buckeye, North	2,115	1,710	1,489
Total	106,472	108,981	102,947
State Total	148,972	149,696	149,428

TABLE 4 -- OIL FIELD BRINE PRODUCTION AND DISPOSAL DATA IN 1964

Producing Formation	Amount Produced	Amount Returned to Formation	BARRELS OF BRINE RETURNED TO SUBSURFACE PER DAY										SURFACE DISPOSAL		
			Basal Drift	Parma	Marshall	Coldwater	Berea	Traverse	Dundee Reed City	Salina	Niagara	Cambrian	Per Day	Barrels	
Marshall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Berea	74	0	0	55	0	0	0	0	0	0	0	0	0	0	19
Traverse	31,966	19,570	0	2,395	2,842	521	0	19,570	3,207	0	0	0	0	0	3,130
Dundee	104,786	88,287	0	4,939	3,796	0	73	7,127	88,287	0	0	0	0	0	367
Detroit															197
River	890	0	0	14	267	0	0	49	397	0	0	0	0	0	154
Salina-Niagara	1,764	0	0	0	0	0	0	41	1,535	0	0	0	128	0	60
Trenton	9,492	0	0	0	0	0	0	443	0	8,145	0	0	0	739	165
Totals	148,972	107,857	0	7,348	6,960	521	73	27,230	93,426	8,145	128	0	128	4,245	896
			Total brine returned to subsurface: 143,831 Bbls. or 96.55 per cent												
Per cent	100	72.40	0	4.93	4.67	0.35	0.05	18.30	62.71	5.46	0.08	0	0.08	2.85	.60

\*\*\* SAMPLE LIBRARY \*\*\*

In Michigan as in most oil and gas provinces, petroleum geologists are concerned primarily with subsurface geology in the search for oil and gas accumulations. The main source of subsurface geological data is well cuttings (commonly called samples or well samples) and cores. By personal examination of well samples and cores the individual geologist can make a first-hand analysis of the geology of specific wells. Examination of well cuttings or cores may be of definite advantage because a descriptive well log written by another individual may not contain all significant geological data obtainable from sample examination. The Geological Survey maintains a sample library as a part of its function in gathering and preserving geological data useful to industry, government agencies, universities, and to individuals.

The Survey's sample library consists almost entirely of washed and bottled well cuttings from Michigan oil and gas tests. Core chips have been incorporated into the sets whenever available. A small number of sets from contiguous states are also available. The collection contains mostly exploratory wells but many selected field wells are also available.

Cuttings (rotary and cable tool) are contained in 2 dram (17 mm. x 60 mm.) glass vials with cork stoppers. Individual vials are marked with the well permit number and the footage interval. These are kept in cardboard trays 16 3/8" x 2 3/4" x 3/4" in dimensions. Each tray of a set is marked with the well permit number, operator and farm, location, and the footage interval contained in the tray. Sets are filed systematically in open-front steel cabinets. A color system also helps to quickly identify sets which may consist of 1 to as many as 150 trays.

The library is operated by the Petroleum Geology Unit. It is supervised by a staff geologist who is also available for consultation on matters relating to well sets, stratigraphy, and so forth. In addition to library

maintenance, the geologist uses the sample sets to prepare for publication detailed sample descriptions of important wildcat and field wells. Sample examination and preparation of well logs is a continuous function of the Petroleum Geology Unit.

The sample library is operated as a lending library; no fee is charged for use or examination of the sample sets. Some restrictions are necessary for orderly management, service, and preservation of the sets. Individual sets, or parts of sets, may not be "robbed" of cuttings for insoluble residue studies or otherwise destroyed or mutilated. The Survey attempts to supply, on a limited basis, well cutting for use in insoluble residue studies. Sample sets may not be shipped by mail or freight, and they may not be removed from the State of Michigan. In general, most sets may be placed on loan for periods of 2 to 3 weeks and for longer periods depending on demand for particular sets. Policy is geared to general oil and gas field activities which vary from year to year. The Survey has limited space for sample examination on the premises. Operators are encouraged to make sample examinations at their own facilities and with their own equipment.

Michigan's oil and gas laws provide for the saving and acquisition of well cuttings from wells drilled under oil and gas regulations. Because of inadequate storage facilities at the present time, acquisition is limited to important exploratory tests, deeper pool tests, and key field wells.

In 1964, 84 new sets (about 39,376 individual cuts) were acquired, catalogued, and placed in the active library which at the end of the year contained approximately 7,350 sets. In addition to those placed in the active library, 22 sets from St. Clair and Macomb Counties were acquired, through donation, from Consumers Power Company, and 112 sets were obtained from Marathon Oil Company. The latter sets are mainly from the Albion-Scipio Trend. The sets donated to the Survey by the 2 companies are in temporary storage and will eventually

be incorporated into the active library.

The Survey also assisted in placing 2 other core and sample set collections in Michigan Universities. These collections were offered to the Survey but were declined because of duplication and lack of storage facilities. A library of several hundred sets belonging to Turner Petroleum Corporation was placed at Western Michigan University. The second collection, owned by Humble Oil and Refining Company and consisting of over 425 individual well sets and about 20 cores, was accepted by Michigan State University.

During 1964 about 128 sets were loaned to major oil companies for study and examination, and 76 sets were loaned to independent oil companies. Consulting geologists borrowed 12 sets, and Universities borrowed 62 sets. In addition, about 60 sets were examined at the Survey.

The Water Unit of the Survey also maintains a library of about 2200 sets of water well samples. These sets are primarily samples of the glacial drift but many of them include bedrock, especially those from the Northern Peninsula. They are contained in glass vials and cardboard trays, and are labeled similar to oil well sample sets. The material may be of use in bulk density studies of the glacial drift.

Oil well sample and core libraries owned and managed by Michigan Universities are as follows:

The University of Michigan  
Department of Geology and Mineralogy  
Subsurface Laboratory  
Ann Arbor, Michigan

Wayne State University  
Department of Geology  
Detroit 1, Michigan

Michigan State University  
Department of Geology  
East Lansing, Michigan

Western Michigan University  
Department of Geography and Geology  
Kalamazoo, Michigan

\*\*\* DESCRIPTIVE WELL LOG LIBRARY \*\*\*

Over 600 new well logs were processed, published, and incorporated into the well log files of the Petroleum Geology Unit in 1964. More than 25,000 published well logs are now available for use or inspection at Survey offices. Logs may be purchased at the Lansing office by individual log order or by yearly subscription.

\*\*\* GEOLOGIC COLUMN \*\*\*

Red and green-gray shales, sandstones, and gypsum beds previously classified as Permo-Carboniferous or Permian, have been reclassified. Work being done by Dr. A. T. Cross at Michigan State University shows these rocks to be Jurassic in age. They occur beneath the glacial drift in the central part of the state. The new columnar chart presented in this publication shows the change from Permo-Carboniferous to Jurassic. The chart also shows surface and subsurface terminology, and informal terms used in the oil and gas industry.

\*\*\* TRENDS IN OIL AND GAS HEARINGS \*\*\*

New developments during 1964 were reflected in the adoption of an increased number of orders for directional drilling of wells, compulsory pooling to form specified drilling units, and for the unitization of oil fields.

There was an increased demand for the issuance of permits to drill exceptions to spacing orders. Nearly all of these were for locations in the Albion-Scipio Trend Field in southern Michigan and the reef fields of eastern Michigan.

The first oil field spacing order providing for 80-acre drilling units was adopted for the South Buckeye Detroit River Formation Pool in Gladwin County. The chart on the following page summarizes the number of

hearings and the items heard during 1964.

\*\*\* PUBLIC HEARINGS \*\*\*

Act No. 61 of the Public Acts of 1939, as amended, provides for hearings on oil and gas matters. Act No. 326 of the Public Acts of 1937, as amended, provides for hearings on matters pertaining to natural dry gas. Hearings on matters of local concern involving the administration of rules and regulations, such as exceptions to spacing orders, or pooling of interests to form drilling units, are conducted by the Supervisor of Wells. Hearings on matters involving broad policies and practices having field-wide or state-wide application are conducted by the Supervisor of Wells and before the Advisory Board.

\*\*\* ADVISORY BOARD \*\*\*

A history of the activities of the Supervisor of Wells, of the Advisory Board, and of the Interstate Oil Compact Commission during the first 15 years of the administration of Act 61 was published in 1954 as Publication 47, Oil and Gas Conservation in Michigan, by Lee S. Miller. It was revised and brought up to date, under the same title, by Gordon H. Hautau and Lee S. Miller in 1960. A limited supply of mimeograph copies of the latter report is available from the Geological Survey. The revised document was also published in Interstate Oil Compact Commission Committee Bulletin, Vol. 2, No. 1, June, 1960. In this report a chart of past and present Advisory Board members, and an explanation of the Advisory Board functions, is included as a part of the historical records.

OIL AND GAS HEARINGS IN 1964

Hearings Per Month Items or Causes Heard	January	February	March	April	May	June	July	August	September	October	November	December	Total
Spacing Orders:													
Adopted	1	1	1	1	1	1	1	1	1	1	1	1	3
Amended	1	1	1	1	1	1	4	1	1	1	1	1	8
Abrogated											1		1
Proration Orders:													
Adopted						1							1
Amended		1											1
Abrogated				1						1			2
Unitization-Adopted				1									2
Compulsory Pooling-Adopted	1	1											5
Directional Drilling-Approved	1	1									1		4
Exceptions to Spacing Orders- Approved	2	1	5	2	7	10	4	3	3	5	3	1	1
Status of Wells-Changed	1												1
No action, or Matter tabled	1	1	1	1	1	1	2	1	1	3	2	1	13
Total Items or Causes	7	7	5	5	8	14	3	13	5	9	8	2	86

ANNUAL MEETING	MEMBERS AND TENURE						SUPERVISOR OF WELLS	SECRETARY TO ADVISORY BOARD	STATE GEOLOGIST	EXPLANATION
	INDEPENDENT	MAJOR	INDEPENDENT	MAJOR	INDEPENDENT	MAJOR				
5-17-39	H. M. McClure	W. P. Clarke	C. A. Smith	E. F. Claggett	Russell L. Furbee	Kurt deCousser	F. R. Frye Deceased 8-4-47	R. A. Smith Retired 8-1-46	To date 30 members of the Michigan oil and gas industry have served on the Advisory Board. Thirteen of these members represented the independent companies and 17 represented the major companies. Their respective terms of service are indicated in the table at the left.	
6-10-40			C. A. Smith Edward Stewart 10-4-41	E. F. Claggett	J. C. Graves	Kurt deCousser				
5-12-41			Edward J. Bouwman 12-7-43	Glen Bish 12-7-43	J. C. Graves	T. G. Bowler	P. J. Hoffmaster Deceased 3-19-51	Act No. 61 of the Public Acts of the State of Michigan, 1939, as amended, provides that the Director of Conservation shall act as the Supervisor of Wells. The Supervisor shall appoint the Advisory Board after consultation with and recommendation by the Michigan Oil and Gas Association. These appointments are subject to the approval of the Conservation Commission.		
5-26-42	H. M. McClure	W. P. Clarke	Edward J. Bouwman	Glen Bish	J. C. Graves	T. G. Bowler				
5-18-43			Edward J. Bouwman	C. G. Irby 8-12-46	J. C. Graves	T. G. Bowler	The Advisory Board consists of six members, three of whom shall be representatives of independent oil and gas producers operating in Michigan, and three members representing major oil companies operating in Michigan and which are producers in five or more states. The terms of the members were staggered in the original appointments so that now the three-year term of one independent member and one major member expires each year. Members are reappointed or reappointed to fill out unexpired terms in case of vacancies.			
5-24-44			Edward J. Bouwman	Kurt deCousser	Chas. W. Teater 9-15-47	Guy E. Chapman 10-28-48				
5-28-45			Charles E. Nyler 11-7-49	Kurt deCousser	Guy E. Chapman	C. F. Knollenberg	The statute requires that the Advisory Board hold monthly meetings and that an annual meeting be held to elect a chairman and vice chairman. Four members constitute a quorum. The secretary of the Board is selected, with the approval of the Supervisor of Wells, from the staff of the Geological Survey.			
6-25-46			Charles E. Nyler	Kurt deCousser	I. W. Hartman 12-7-51	C. F. Knollenberg				
5-27-47			Charles E. Nyler	Kurt deCousser	I. W. Hartman	C. F. Knollenberg	Public hearings related to oil and gas matters are held before the Supervisor of Wells and the Advisory Board. The function of the Board is to review the evidence and testimony submitted and make a recommendation to the Supervisor. Matters such as the adoption of drilling units and spacing patterns, proration orders, unitization of fields, etc., are considered at these hearings. Except for emergency orders, which may not be effective for more than 21 days, the Supervisor may issue rules, regulations, or orders only after a public hearing and after receiving a recommendation by the Board.			
6-18-48	Don F. Rayburn	J. D. Wheeler R. B. Newcombe 9-2-48	Charles E. Nyler	Kurt deCousser	I. W. Hartman	M. E. Austin 10-15-54				
6-13-49			Charles E. Nyler	Kurt deCousser	I. W. Hartman	M. E. Austin	Requirements for membership on the Advisory Board are:			
5-12-50			Charles E. Nyler	Kurt deCousser	I. W. Hartman	M. E. Austin				
5-28-51	Don F. Rayburn	R. B. Newcombe	Charles E. Nyler	Kurt deCousser	I. W. Hartman	Harold E. Rudel 10-11-56	(1) Not more than one representative from one company or its subsidiary or affiliate.			
6-19-52			Charles E. Nyler	Kurt deCousser	I. W. Hartman	George E. Haas	(2) Residence in Michigan for at least two years previous to date of appointment.			
5-25-53	T. Glenn Caley	Marshall R. Joy 10-16-53	Charles E. Nyler	Kurt deCousser	E. Allan Morrow 3-11-60	George E. Haas	(3) Five years of practical or technical experience as a producer, or operator, or managing representative of a producer or operator.			
5-10-54	T. Glenn Caley	Marshall R. Joy Willard A. Sanger 9-24-54	Charles E. Nyler	Kurt deCousser	E. Allan Morrow	George E. Haas	(4) Selection of members shall be made with special reference to training, experience, and standing as an operator or his representative.			
5-23-55			Charles E. Nyler	Kurt deCousser	E. Allan Morrow	George E. Haas				
5-25-56			Charles E. Nyler	Kurt deCousser	E. Allan Morrow	George E. Haas				
5-15-57	T. Glenn Caley	Harold B. Wright 12-14-56	Charles E. Nyler	Kurt deCousser	E. Allan Morrow	George E. Haas				
5-22-58			Charles E. Nyler	Kurt deCousser	E. Allan Morrow	George E. Haas				
5-28-59			Charles E. Nyler	Kurt deCousser	E. Allan Morrow	George E. Haas				
5-19-60	T. Glenn Caley	O. R. Elliott 8-7-59	Charles E. Nyler	Kurt deCousser	E. Allan Morrow	George E. Haas				
5-25-61			Charles E. Nyler	Kurt deCousser	E. Allan Morrow	George E. Haas				
5-24-62			Charles E. Nyler	Kurt deCousser	E. Allan Morrow	George E. Haas				
5-23-63	T. Glenn Caley	O. R. Elliott	Charles E. Nyler	Kurt deCousser	E. Allan Morrow	George E. Haas				
5-28-64			Charles E. Nyler	Kurt deCousser	E. Allan Morrow	George E. Haas				

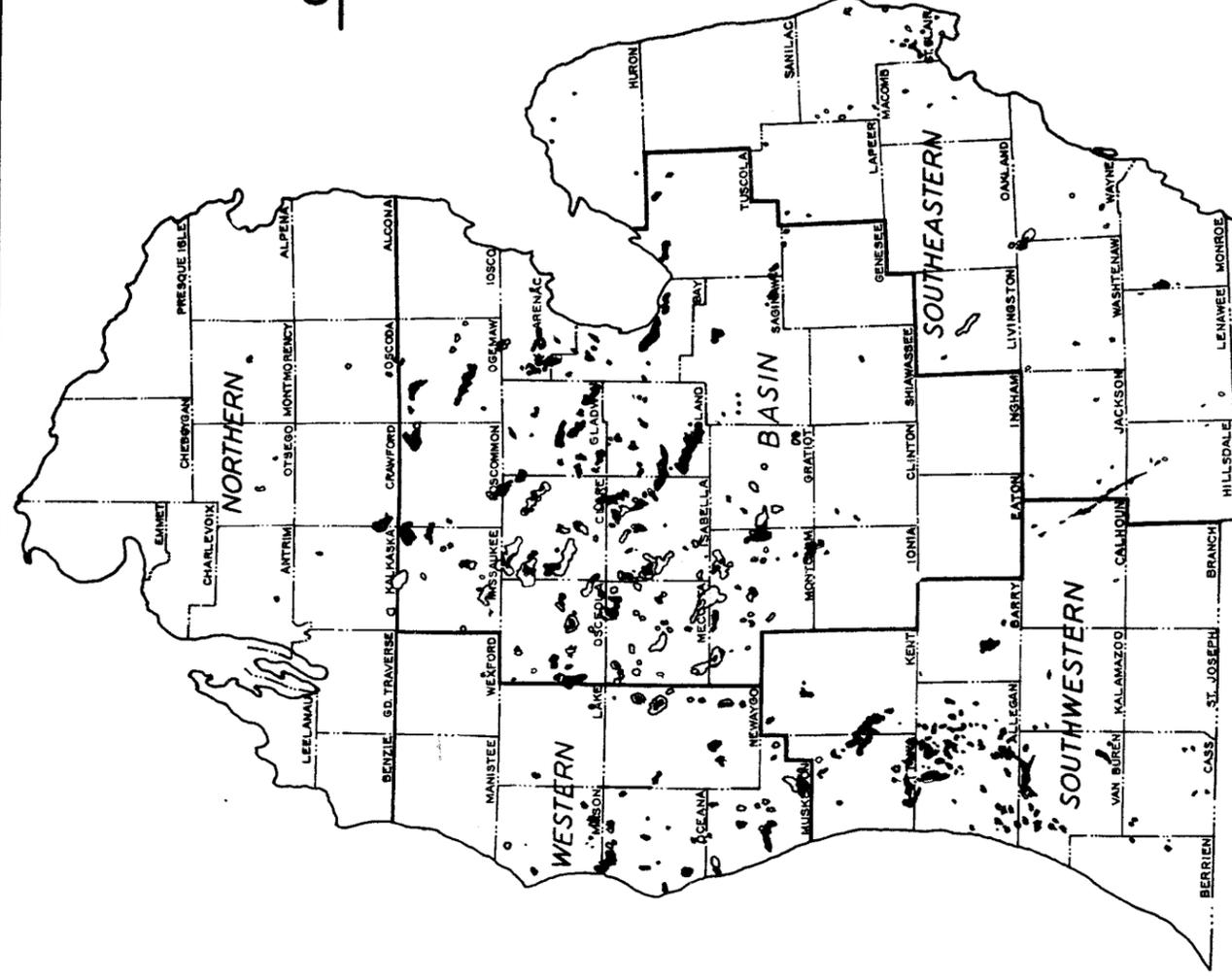
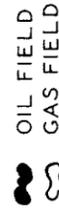
\*\* ACTIVE MICHIGAN OIL REFINERIES \*\*

COMPANY	REFINERY LOCATION	NOMINAL CAPACITY* BBLs. ?/DAY
Bay Refining, Division Dow Chemical Company	Bay City	15,000
Crystal Refining Company	Crystal City	6,200
Delta Terminal Company	Rapid River	4,000
Lakeside Refining Company	Kalamazoo	3,500
Leonard Refineries, Inc.	Alma	29,000
Leonard Division	Mt. Pleasant	7,500
Roosevelt Division	Detroit	45,000
Marathon Oil Company	Muskegon	15,000
Marathon Oil Company	Muskegon	10,000
Naph-Sol Refining Company	West Branch	5,000
Osceola Refining Company	Flat Rock (Inactive)	6,500
Petroleum Specialties, Inc.	Trenton	37,500
Socony Mobil Oil Company	Total Refinery Capacity	184,200

\*Individual refinery operating rates may be less or slightly more than nominal rates shown.

## LOCATION OF SIGNIFICANT OIL AND GAS FIELDS

ALL FIELDS CONFINED  
TO THE  
SOUTHERN PENINSULA



### PART 2, OIL AND GAS FIELDS (EXPLANATION)

Part 2 brings together general information on Michigan's oil and gas fields, gas storage reservoirs and related items. The tables summarize information relating to oil and gas accumulations which have been designated and named as oil or gas fields.

**LOCATION OF SIGNIFICANT OIL AND GAS FIELDS.** All fields are confined to the Southern Peninsula of Michigan. The map indicates the general distribution of the more important oil and gas fields within the several districts. The division of the Southern Peninsula into Basin, Northern, Western, Southeastern, and Southwestern Districts is arbitrary and convenient in presenting regional statistical data.

**PRODUCING AREAS BY ROCK UNIT.** The several maps show the producing areas by rock unit or formation. The stippled areas on the individual maps DO NOT delineate the lateral limits of the rock unit or formation, but indicate the general area of known production from that individual unit.

**OIL AND GAS FIELDS.** Most fields consist of one pool with oil or gas production coming from a single formation. A few fields have 2 or more separate pools, each producing from a different formation or stratigraphic interval and a different depth. Pools for individual fields are shown under **PRODUCING FORMATION OR POOL**. The **PAY ZONE** part of the table generally refers to the discovery well for the specific pool. The **PAY THICKNESS** shown on the tables does not necessarily indicate net producing pay for the reservoir. The **DEEPEST FORMATION TESTED** column indicates the deepest total depth and formation penetrated in the field.

**ABANDONED OIL AND GAS FIELDS.** Oil and gas fields are considered abandoned when all wells have been plugged to the surface and the equipment has been removed from the area. Fields abandoned during a given year are entered into the abandoned field tables in the following

year. Abandoned oil fields with less than 500 barrels of cumulative oil production are not shown in the tables. Production from the fields having less than 500 barrels cumulative production is accounted for in the table summaries.

**GAS FIELDS.** Many gas fields are listed as "shut in" because of lack of marketing facilities, slow field development, or lack of substantial reserves. Production from fields listed as "Domestic" or "Lease Fuel" is not metered or considered commercial.

**GAS STORAGE RESERVOIRS.** Most gas storage reservoirs were originally classified as gas fields or pools and upon depletion, or near depletion, they were converted to storage reservoirs. Undeveloped gas storage reservoirs are gas pools that have been designated to become storage reservoirs at some future time.

**LPG STORAGE.** Surface and underground storage facilities for liquefied petroleum gas.

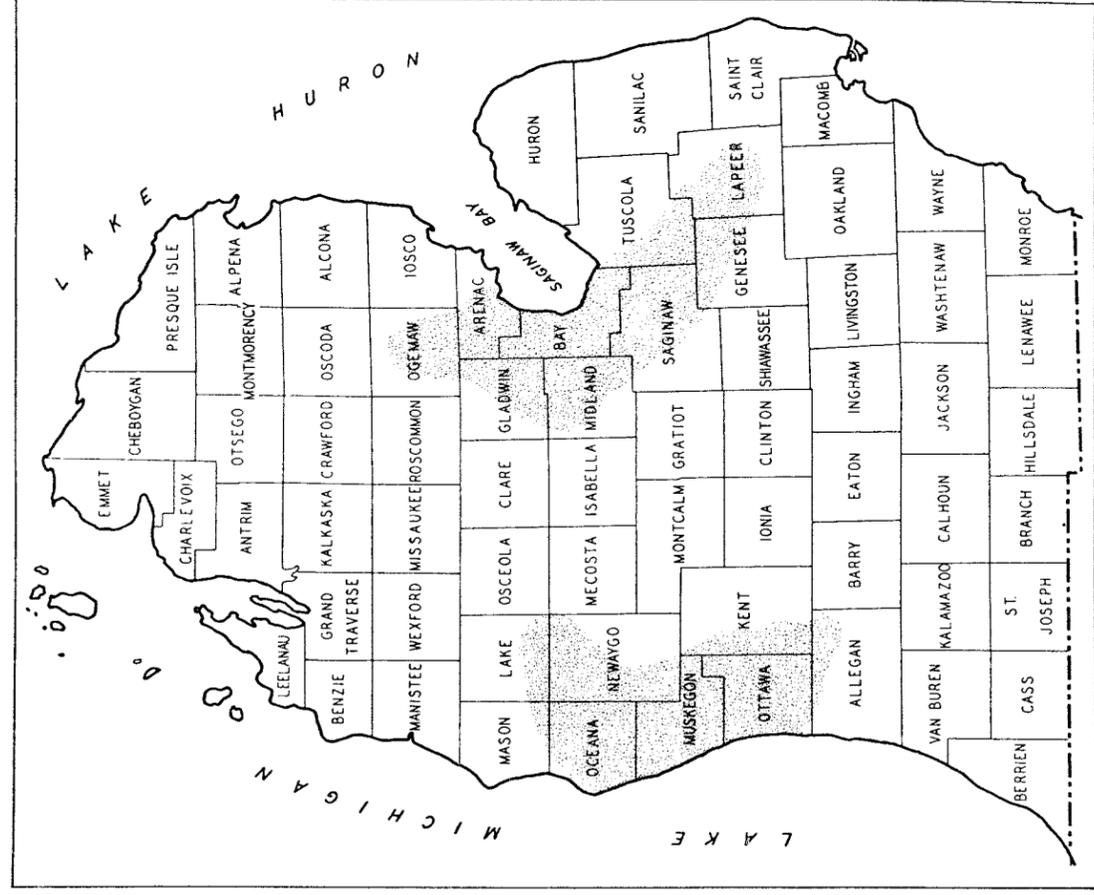
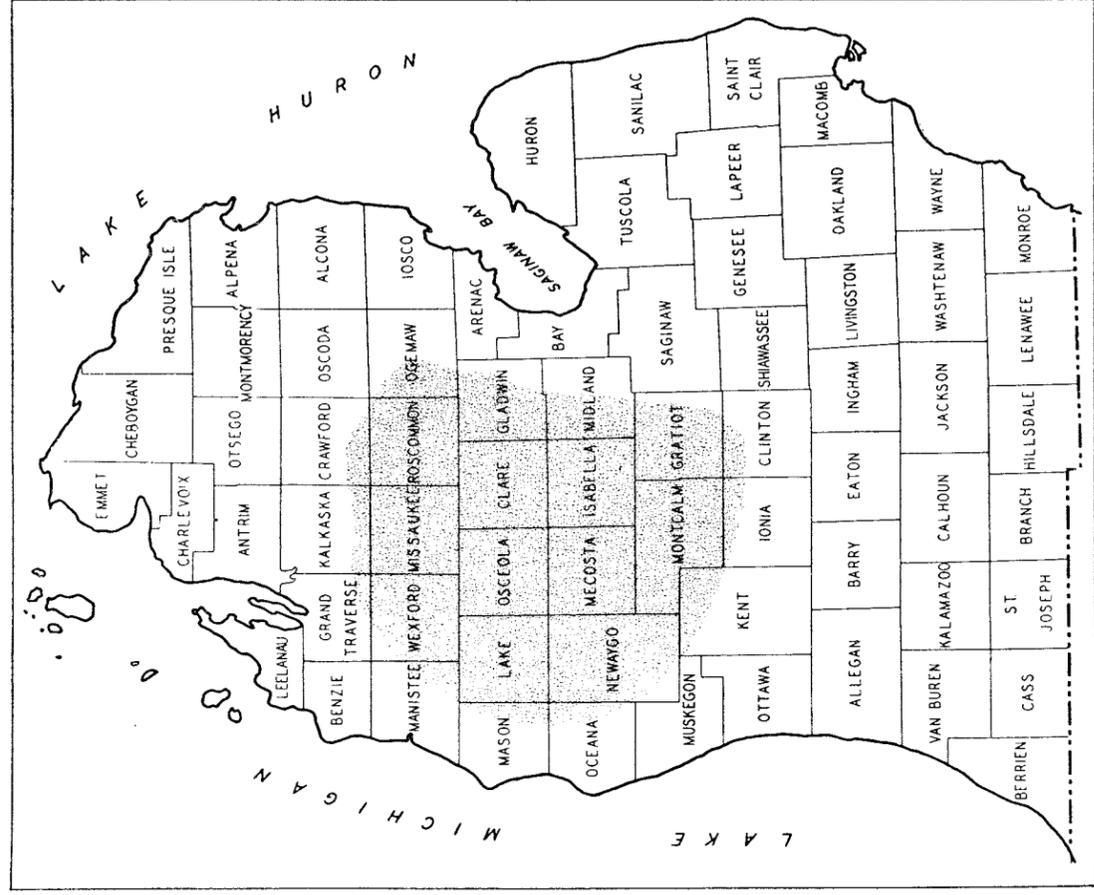
**OIL WELL GAS.** This is casinghead gas produced incidental to the production of oil from pools or fields generally classified as oil accumulations.

**CASINGHEAD GAS PLANT DATA.** These tables indicate the distribution of gross input gas to plants and the resulting net hydrocarbons available for market.

**FLUID INJECTION INTO PRODUCING FORMATIONS.** A number of fields have secondary recovery projects in operation. In most fields listed in these tables, the injection of oil field brines back into the producing formation is a combination brine disposal and pressure maintenance project.

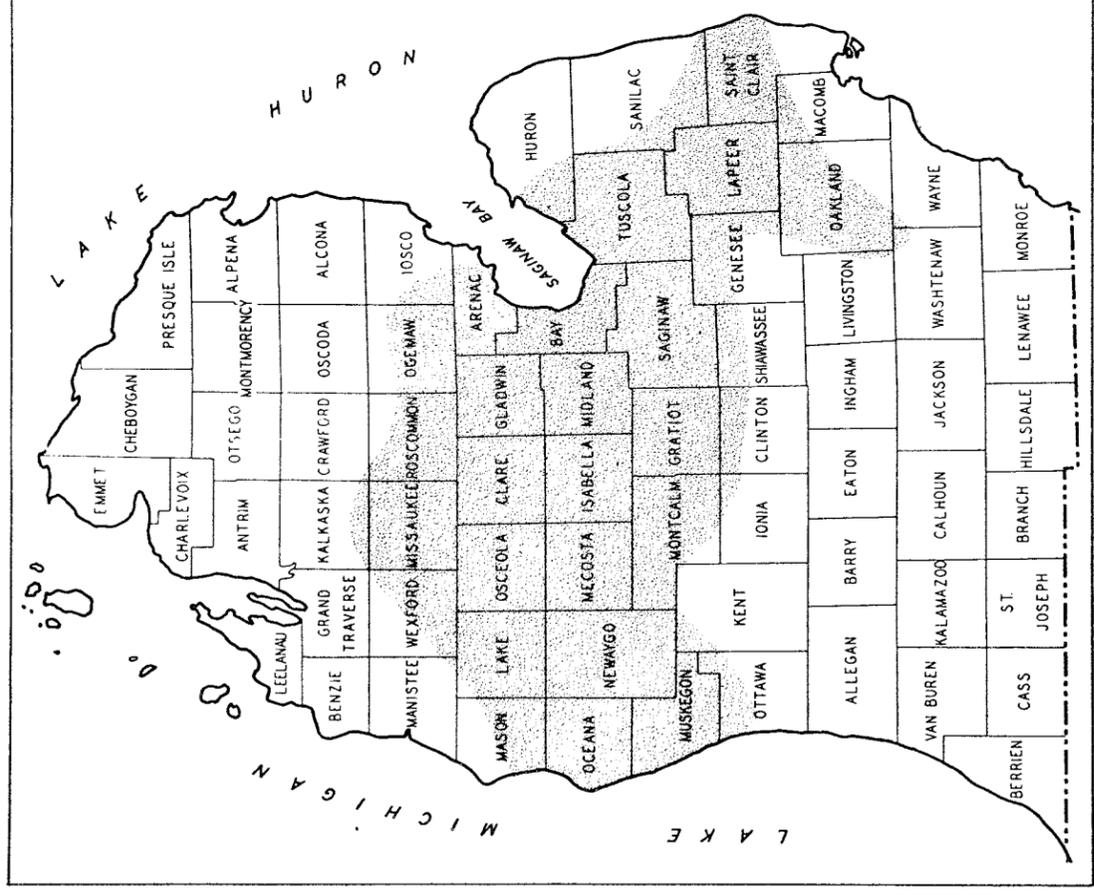
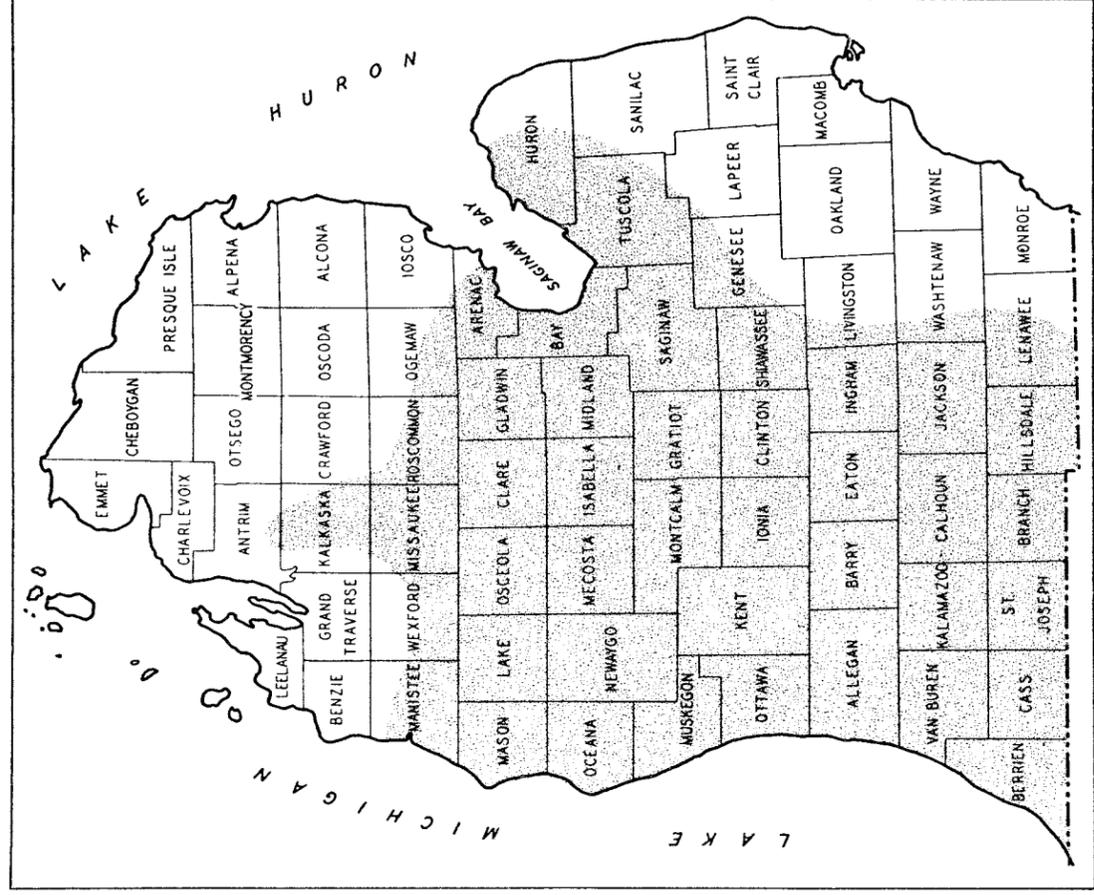
# PRODUCING AREAS BY ROCK UNIT

GENERAL PROVED AREA



MICHIGAN STRAY

BEREA

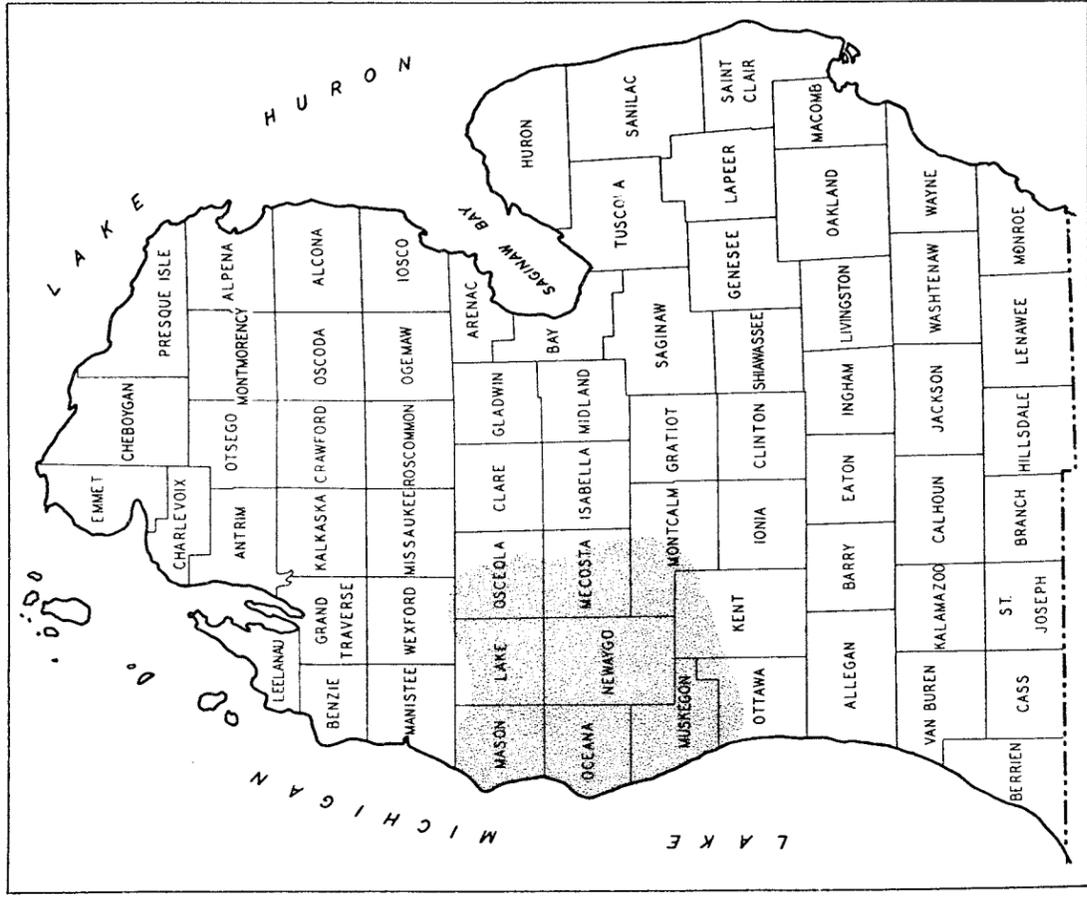


TRAVERSE GROUP

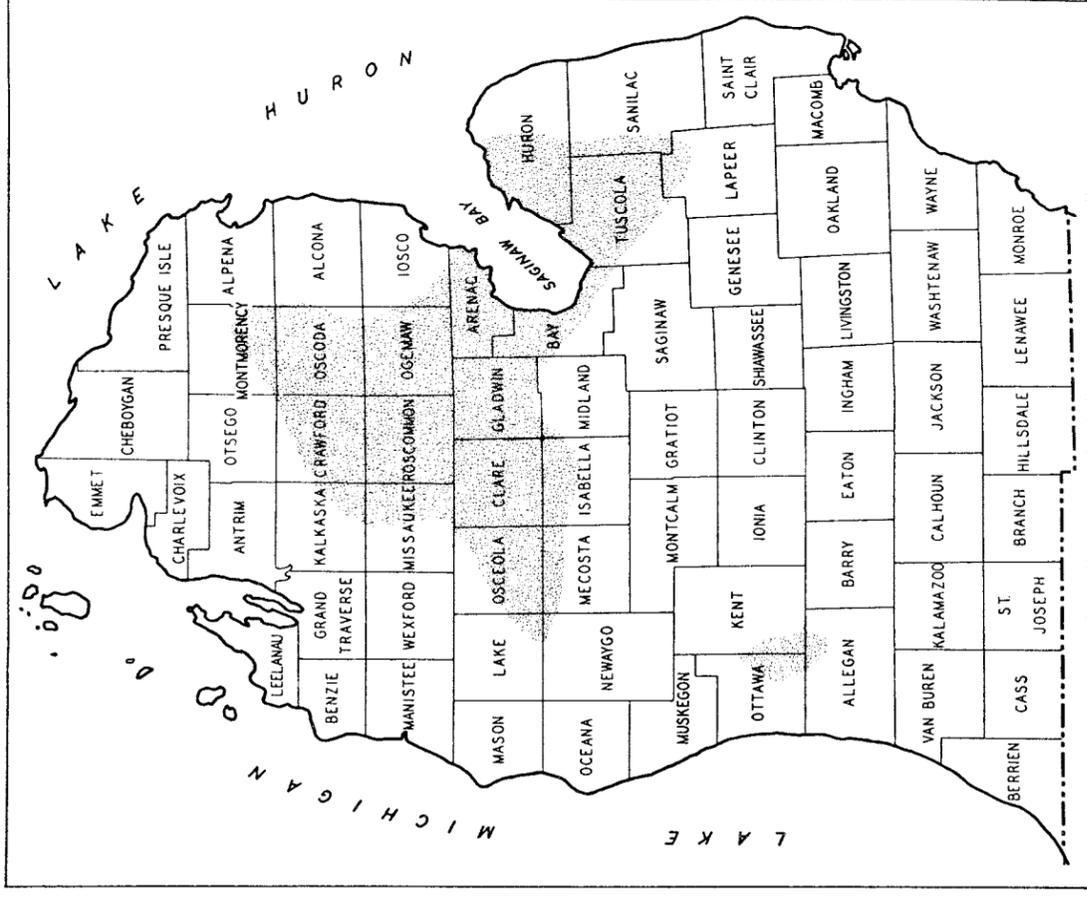
DUNDEE

# PRODUCING AREAS BY ROCK UNIT

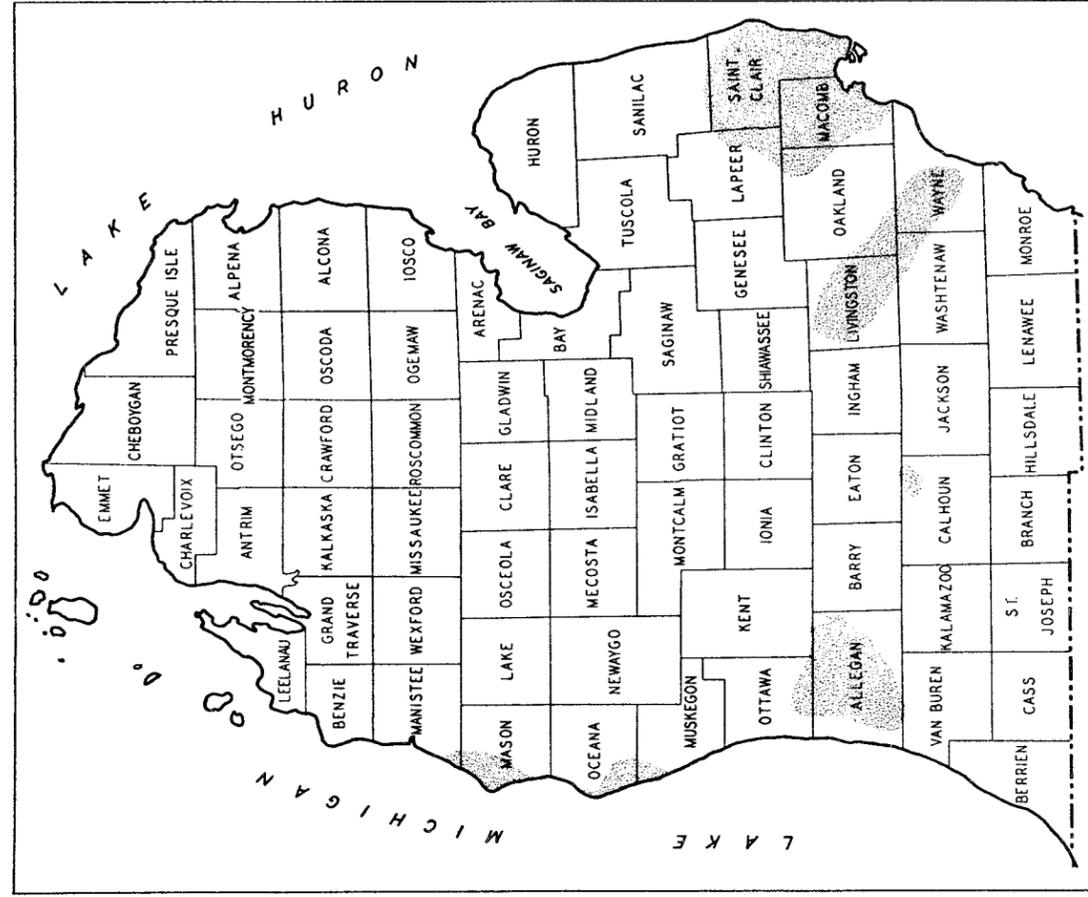
GENERAL PROVED AREA



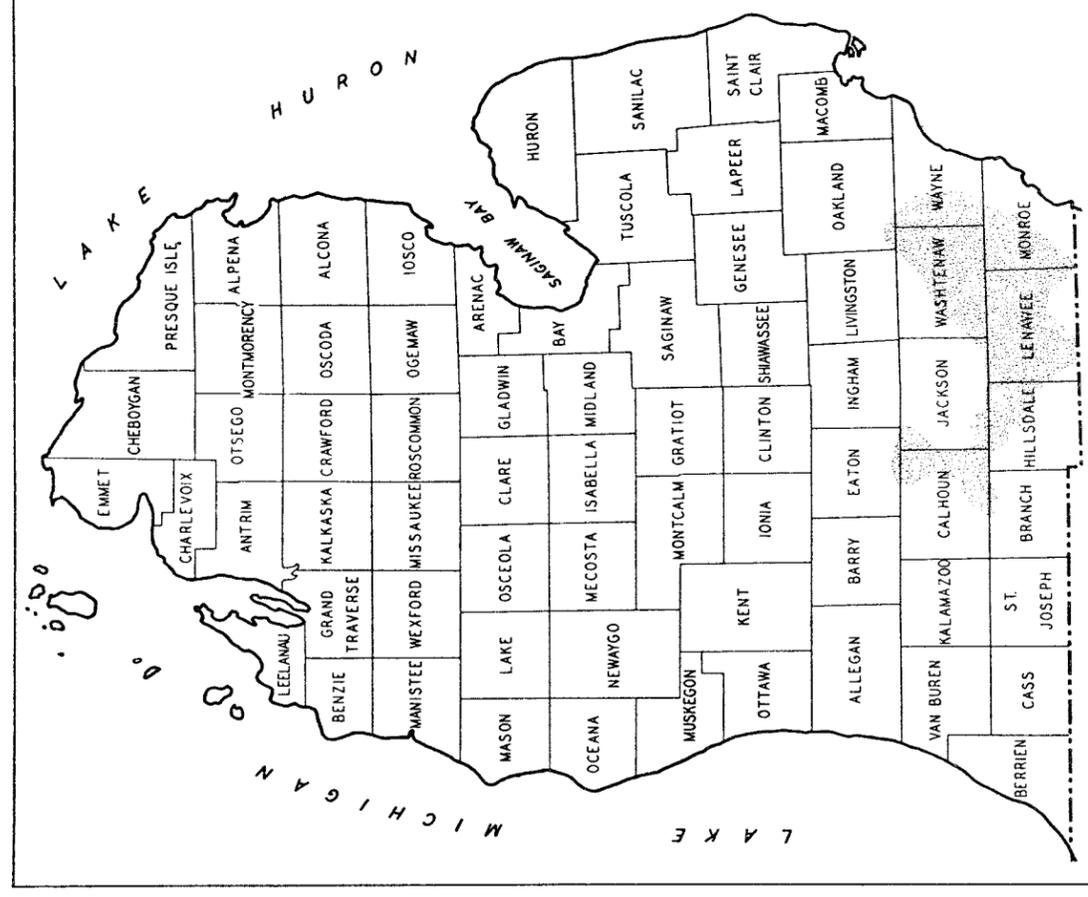
REED CITY ZONE



DETROIT RIVER GROUP



SALINA AND NIAGARAN



TRENTON AND BLACK RIVER



