Oil Heritage Tour of Lambton County: The Birthplace of the Canadian Oil Industry

by Robert O. Cochrane
& Charles O. Fairbank

OIL HERITAGE TOUR OF LAMBTON COUNTY
THE BIRTHPLACE OF THE CANADIAN OIL INDUSTRY

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The Oil Museum of Canada provided the photographs which are reproduced on Exhibit 3. The Petrolia Discovery Foundation Inc. provided the material for Exhibits 4, 31, 33, 34, 36, and 37. It is a joy to use the artwork of Mr. George Rickard of London, Ontario; computer technology cannot create diagrams with the clarity of a pen in the hands of a talented illustrator.

Cairnlins Resources Limited has provided Exhibits, 11, 14, 16, 22, and 23. Exhibits 41 to 45 are reproduced from a calendar issued in 1908 by the R. Stirret Company in Petrolia, Ontario. The other photographs have come from the collection of Mr. C.O. Fairbank. The tour path has been adapted from the "Oil Heritage District Tour" published by the Oil Museum of Canada and the Petrolia Discovery.

Finally, the authors are indebted to our editor, Claudia Cochrane, for her patience, persistence and perspicacity.

SAFETY CONSIDERATIONS*
or
THINK BEFORE YOU STRIKE

* Watch for traffic when disembarking from the bus - partioularly at road crops.

* Wear sturdy ankle-supporting footgear.

* Wear a hat and bring strong sun screen - quarries can get very hot during the day.

* Wear eye protection when using a hammer or chisel - safety glasses, goggles, or a full-face shield.

* Heavy gardening or work gloves will help protect hands from cuts & bruises.

* Carry insect repellent and small first-aid kit.

* Watch out for poison ivy which often grows on outcrops.

* Watch for loose rocks at steep or overhanging exposures - rock slides can be a real hazard!

* Stay clear of unstable quarry faces (most are).

* Keep well away from quarry machinery.

* Wear a hard hat when visiting working quarries - this is a Ministry of Labour requirement and most quarries will provide them.

* Wet shales can be very slippery (Ontario drillers refer to the Devonian shales as 'the soap').

* Be extremely cautious on outcrops adjacent to water.

* Be aware when crossing streams that even the most innocuous-looking flat rock can be slimy with algae and very slippery.

* Be constantly aware of traffic at roadcuts - it is easy to forget this when you are eagerly pursuing the next sample.

* Don't be surprised if the local constabulary asks you to move along - don't argue, just do it.

*Compiled by Claudia Cochrane in November 1999; loosely based on a hand-out from the Royal Ontario Museum

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THE BIRTHPLACE OF THE CANADIAN OIL INDUSTRY

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The Frontispiece is a Photograph from the Lambton County Archives which Shows Many Aspects of the Oil Business in Petrolia in the 1800's.

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TIME LINE FOR EARLY PETROLEUM DEVELOPMENT IN PETROLIA AND OIL SPRINGS AREA

1819	Birth of Queen Victoria
1833	*Completion of Survey of Enniskillen Township*
1837	Queen Victoria Succeeds George IV to British Throne
1842	Creation of the Geological Survey of Canada
1846	*Dr. Abraham Gesner Produces Kerosene Oil from Coal*
1849	Creation of the County of Lambton
1849	Start of Great Western Railway From Niagara Falls to Windsor
1853	*Lambton Becomes an Independent County*
1854	*C.N. Tripp Founds International Mining and Manufacturing Company (IMMC)*
1854	*Dr. A. Gesner Obtains US Letter Patents to Produce Kerosene From Crude Oil*
1855	*Sale of IMMC to James Miller Williams*
1858	*James Miller Williams Produces Oil from Dug Wells in Oil Springs*
1858	Opening of Great Western Railway between Sarnia and London
1859	Col. E.L. Drake Drills an Oilwell at Titusville, Pennsylvania, USA
1861	*J.H. Fairbank Arrives in Oil Springs*
1861 to 1865	American Civil War
1862	*Hugh Nixon Shaw's Oil Gusher in Oil Springs*
1866	*Captain B. King Discovers Oil in Petrolia*
1866	*Founding of Oilwell Supply Company*
1866	*Building of Railway Spur Line from Wyoming to Petrolia*
1866	*Town of Petrolia Incorporated as a Village*
1866	Discovery of Oil at Oil Springs, Texas, USA
1867	Confederation of Canada
1865	*Opening of Van Tuyl & Fairbank*
1869	*Opening of Little Red Bank by Vaughn & Fairbank*
1871	*World's First Oil Exchange at Vaughn & Fairbank*
1874	*Departure of First Foreign Drillers from Petrolia*
1880	*Sixteen Companies Form Imperial Oil Company in London*
1885	Last Spike Driven on CPR Railway
1888	*Construction of Victoria Playhouse*
1890	*Construction of 'Sunnyside', Home of J.H. Fairbank*
1898	*Imperial Oil Refinery Moves to Sarnia*
1898	*Rockefeller's Standard Oil Trust Acquires Control of Imperial Oil*
1901	*Formation of Canadian Oil Refining Company*
1901	Spindletop Oil Discovery in Texas, USA
1901	Death of Queen Victoria
1903	*Construction of Fitzgerald Pumping Rig*
1904	Discovery of Natural Gas in Medicine Hat, Alberta
1910	Discovery of Oil in Turner Valley, Alberta
1914 to 1918	World War One
1914	*Opening of Baines Machine Shop*
1930	Discovery of East Texas Oilfield, USA
1939 to 1945	World War Two
1942	Establishment of Polymer Corp. To Make Synthetic Rubber
1942	Dow Plant in Sarnia to Make Polystyrene
1947	Discovery of Oil in Leduc, Alberta
1952	*Canadian Oil Moves From Petrolia to Corunna*

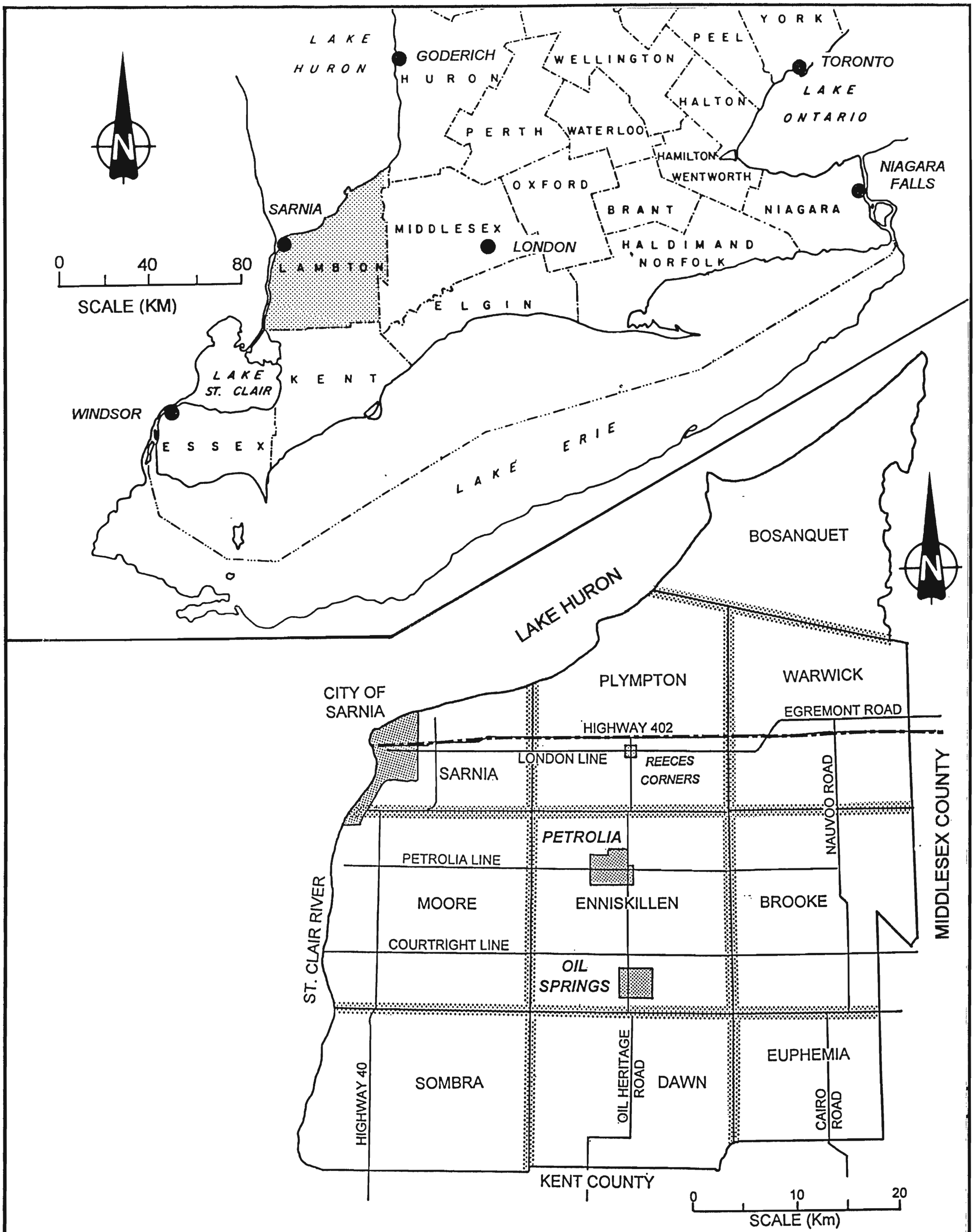


Exhibit 2: Location Map for Oil Heritage District, Lambton County, Ontario

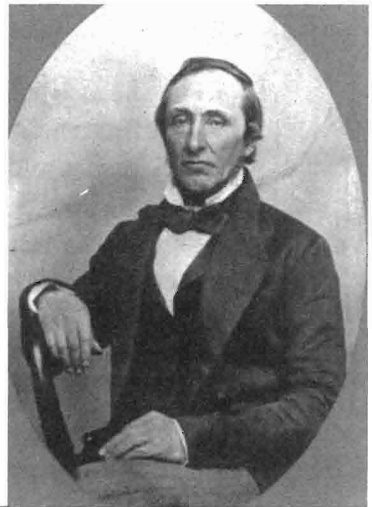
INTRODUCTION

By 1850, the industrial revolution was well underway in western civilization, the British empire had reached its zenith and the development of the United States and Canada was proceeding at a strong pace. For its next great advance, the industrial world needed a portable source of fuel to replace horses, wood and coal. That fuel was petroleum. In the last 150 years, the exploitation of that energy source has changed the face of the Earth. The rapid advance of the oil business can readily be seen on the time line of the petroleum industry in Petrolia and Oil Springs (Exhibit 1).

In the beginning, surface seeps were the best indicators of oil accumulations. The first site for the commercial production of petroleum in North America was established in the swamps of Enniskillen Township in Lambton County, Ontario. Crude oil put Oil Springs and later Petrolia not only on the map of Canada but later all over the globe.

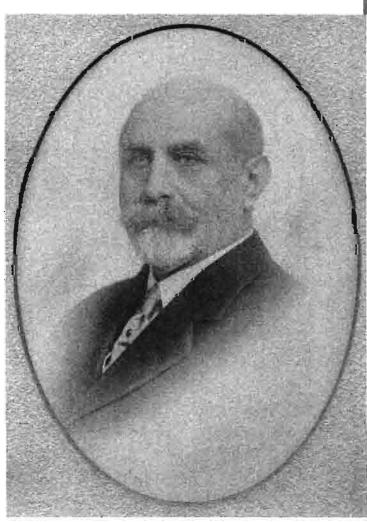
History remains alive in the Oil Heritage District (Exhibit 2). After 142 years of development, the Oil Springs and Petrolia Fields still produce commercial quantities of crude oil from at least six hundred and fifty active wells. Furthermore, many of these wells are still operated by the jerker line system developed in 1863 and many of the methods of early oil production are preserved in these fields. As a result, the area provides an excellent opportunity to revisit the oil business at its origin. This guidebook provides a short synopsis of the history of the oil in Lambton County, demonstrates the geology and historical production of the two fields, and then provides a path for a tour of the key sites in the district.

JAMES MILLER WILLIAMS
1818 – 1890
World's First Oil Producer



HUGH NIXON SHAW
1812 – 1863
Driller of The First Oil Gusher in Oil Springs Field

JOHN H. FAIRBANK
1831 – 1914
Entrepreneur
and
Oil Producer



J. (Jake) L. ENGLEHART
1847 – 1921
Refiner

W. H. McGARVEY
1843 – 1914
Foreign Driller

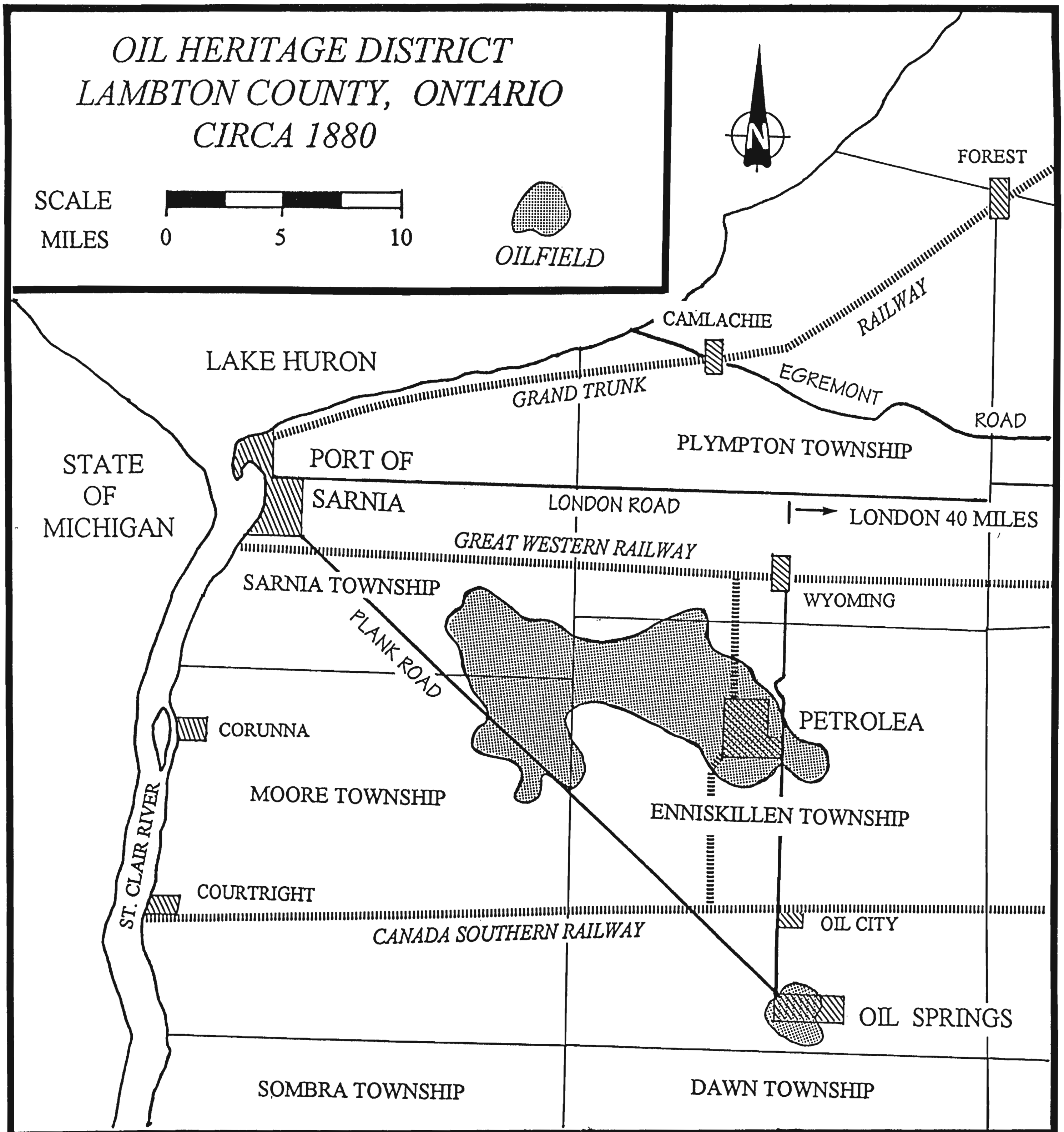
EXHIBIT 3: Key personalities in the early development of the petroleum industry in Lambton County.

HISTORICAL BACKGROUND

It was the gum beds which attracted entrepreneurs to the swamps at the centre of Lambton County. In 1850, a sample of bitumen had found its way to the desk of Sir William Logan, director of the Geological Survey of Canada. The properties of the stuff were described by T. Sterry Hunt in the Geological Survey report of 1849/1850. According to the Geological Survey report for 1852/53, when Alexander Murray of the GSC arrived on the scene, a test pit had already been dug.

Charles Nelson Tripp, a prospector from Schenectady, New York, had visited the gum beds and saw the potential for turning the gum into asphalt. Tripp acquired land in the Oil Springs and Petrolia area, and started to manufacture asphalt by 1852. With his brother and some associates, he formed the International Mining and Manufacturing Company to exploit the gum beds. Asphalt was used at that time to seal the hulls on ships and to construct sidewalks. In 1855, Tripp sent a sample of asphalt to the Universal Exhibition in Paris, France and received an order for asphalt to pave the streets of Paris. Unfortunately, the absence of transportation in and out of the Enniskillen swamp and the lack of capital combined to defeat his efforts.

In the year 1854, Dr. Abraham Gesner from Nova Scotia obtained U.S. letter patents to produce kerosene (lamp fuel) from crude oil. Now the search switched from gum to liquid oil. The stage was set for the entry of James Miller Williams (Exhibit 3), who had a large interest in a successful carriage factory in Hamilton, Ontario. By chance, he obtained an interest in lands owned by Charles Nelson Tripp. After a failed attempt to find oil in Bothwell, Ontario, the two men returned to Oil Springs. In the summer of 1858, Williams found free oil in the glacial drift at a depth of 14 feet (4.3 m). By the time E.L. Drake had drilled his oil well in Pennsylvania on August 27, 1859, Williams was already producing, refining and shipping oil from Oil Springs. The Sarnia Observer of August 26, 1858 tells of "*an abundant supply of mineral oil which the owners of the land were taking steps for making available for the purpose of light, etc. by erecting works thereon for purifying said oil and making if fit for use. ... The ingredient seems to abound over a considerable tract of land where it was discovered; and in fact, the earth is so thoroughly saturated by it, so that a hole dug, 8 or 10 feet in width and about the same depth will collect from 200 to 250 gallons a day, the supply seemingly inexhaustible. As yet no works for manufacturing the oil into a merchantable commodity have been erected on the premises. What has been obtained having been barrelled up and sent to Hamilton to be prepared there; but we believe it is the intention of the proprietor, if the article proves what is expected, to put up suitable works for the purpose with as little delay as possible.*" The Great Western Railway opened the section of the railroad between Sarnia and London in 1858; the oil was hauled 16 km along primitive roads to the railway at Wyoming, Ontario (Exhibit 4) and then shipped by rail to Hamilton.



OIL HERITAGE DISTRICT
LAMBTON COUNTY, ONTARIO
CIRCA 1880
SCALE
MILES
0
5
10
OILFIELD
N
FOREST
RAILWAY
CAMLACHIE
LAKE HURON
GRAND TRUNK
EGREMONT
ROAD
STATE
OF
MICHIGAN
PORT OF
SARNIA
PLYMPTON TOWNSHIP
LONDON ROAD
LONDON 40 MILES
GREAT WESTERN RAILWAY
SARNIA TOWNSHIP
WYOMING
PLANK ROAD
PETROLEA
CORUNNA
MOORE TOWNSHIP
ENNISKILLEN TOWNSHIP
ST. CLAIR RIVER
COURTRIGHT
OIL CITY
CANADA SOUTHERN RAILWAY
OIL SPRINGS
SOMBRA TOWNSHIP
DAWN TOWNSHIP

Exhibit 4

The oil boom had started. The search for surface oil seeps soon spread all over the world. At Oil Springs, cribbed wells were dug by hand to the bedrock at a depth of 46 feet (14.0 metres), and the oil which seeped out of the clay into the well was pumped out by hand. Bedrock was the limit for hand digging, and spring pole rigs were set up to drill through the rock. In 1859, Williams drilled a well to a depth of 146 feet and the well produced 60 barrels of oil per day. In 1860, the first flowing well sparked a full-scale rush to Oil Springs. According to O'Meara (1958), by the year 1861, four hundred wells had been drilled in the Oil Springs Field, 32 of which had been drilled into the bedrock. With a spring pole rig, Hugh Nixon Shaw (Exhibit 3) brought in the first oil gusher on January 16, 1862 from a depth of 62 metres. None of the locals had ever seen oil flow out of the ground at such rates; the well roared out of control for several days and dumped oil into the Black Creek and Sydenham River. It was eventually controlled with a packer of green calfskin and flax by Americans who had seen the same event in Titusville, Pennsylvania. Soon there were thirty big wells, and the oil flowed freely into the flats of Black Creek. At the end of 1862, there were one thousand wells producing 12,000 bbls of oil/day, and ten refineries. Teamsters were hauling 500 loads a day from Oil Springs to Wyoming. However, the boom was curtailed in 1863 when the supply which reached the railway station exceeded the demand and when the wells, one by one, ceased to flow. Oil production and refining continued at Oil Springs but on a much smaller scale.

The Shaw discovery fuelled the growth of Oil Springs from 500 in 1861 to 4,000 in 1866. By the year 1863, Williams and his partners had built a plank toll road between Oil Springs and the railway station at Wyoming. Another plank road between Oil Springs and Sarnia was opened in 1865. The improvements in transportation and the plentiful supply had a negative aspect; the price fell from $2.50 to $0.10/barrel. The oil production at Oil Springs peaked in 1862 and then fell quickly; the stage was set for the discovery of the Petrolia Oilfield.

In 1865, Petrolia (spelled Petrolea at the time) was a small community on the Oil Springs to Wyoming road. Oil seeps had been found in the flats of the Bear Creek and a few small oil wells had been drilled along the banks of the creek. Captain B. King, an entrepreneur from St. Catharines, decided to drill a well a mile or two west of the banks of the creek. Up until this venture, the drillers associated oil fields with stream beds. Not only did King select an unconventional location for this well but he drilled deeper. In the summer of 1866, oil gushed forth from this well. The well was quickly brought under control and produced oil at the rate of 265 barrels per day. The Petrolia boom was on. Land prices soared as men flocked to the new field even though the price of oil fell from $10/bbl to $0.75/bbl. Unlike the Oil Springs Field, the Petrolia Field was larger in size and in oil reserves; the pumping wells and their associated infrastructure sustained a long period of growth. A railway spur built in 1866 between Petrolia and Wyoming ensured the prosperity of this industrial town.

The development of the oil fields brought many adventurers and entrepreneurs into the area primarily from the United States. One of the most influential was John Henry Fairbank (Exhibit 3). He arrived in Oil Springs in 1861 to survey a one hundred acre tract into lots for the construction of wells. He purchased a lot in Oil Springs, dug a well, struck oil and became a pillar of the community. One of his innovations was the jerker line system whereby power from a steam engine at a central location was transferred by jerker rods to a large number of pumping wells. This system is still used in the Oil Springs Field although the steam engine has now been replaced by a small electric motor.

J.H. Fairbank was also a competent businessman. In 1865, in partnership with Benjamin Van Tuyl, he set up a hardware store, Van Tuyl & Fairbank, which continues to operate in Petrolia to this day. In 1869, in partnership with Leonard Vaughn, he set up a bank in Petrolia to finance the developing oil business; the building which housed the Little Red Bank is still located at the corner of Oil and Petrolia Streets in Petrolia. He promoted many business enterprises such as the construction of the spur railway line from Petrolia to Wyoming in 1866 and in an attempt to stabilize crude oil prices he was very active in producers' associations. As a politician, he served on the Petrolia council for three terms, acted as reeve for one term and was the federal Liberal member of Parliament for East Lambton in 1882. His great grandson, Charles O. Fairbank III still operates oil wells in the Oil Springs Field. As he puts it, his family is the oldest oil producer in the world.

Other individuals also made contributions to the development of the oil industry. Leonard Vaughn was the first man to use steam in the operation of drilling rigs. After the disastrous fire in 1867, John D. Noble came up with the idea of building underground storage tanks. Frederick Ardiel Fitzgerald, the first president of the Imperial Oil Company Limited built the giant Fitzgerald pumping rig to provide power at reasonable cost to the wells in the northern part of Petrolia. William Henry McGarvey (Exhibit 3) took his knowledge of the oil industry in Petrolia to Eastern Europe and supervised the development of the industry in that part of the world. And there were the foreign drillers. With their expertise and initiative, drillers from the Petrolia and Oil Springs area travelled all over the world in the period from 1874 to 1934 to drill for oil.

At the outset, the refining of crude oil was a tricky business. The oil had to be heated in a large still to recover the lighter components used for lighting and lubrication. Explosions and fires were routine events. Initially, each producer had his own refinery but as oil supplies increased, companies were formed to refine oil. The city of London, Ontario became the refining centre with a total of 52 refineries. In a limited market, competition was fierce. Refiners, railway owners and oil producers used every available avenue to control the price and the markets, and small refineries were gradually squeezed out of the business. The year 1878 was significant for the Town of Petrolia because Jacob Englehart (Exhibit 3) built the largest refinery in Canada, the Silver Star. It could handle 1,800 barrels of crude oil in one batch.

By 1875, John D. Rockefeller controlled the American oil business and was threatening the existence of the Canadian oil industry. To counter the threat, sixteen oilmen including Jacob Englehart as the Petrolia connection formed the Imperial Oil Company Limited on September 8, 1880. With refineries in London and Petrolia, Imperial Oil supplied petroleum products across Canada. The demand for kerosene, lubricating oil, and gasoline for the internal combustion engine was high. However, Imperial could not raise capital fast enough to sustain its growth, and in 1898, Standard Oil (later known as Standard Oil of New Jersey and Exxon) acquired the controlling interest in Imperial Oil, an interest it still holds to this day.

After the takeover by Standard Oil, the refinery moved from Petrolia to Sarnia. In 1901, the Canadian Oil Refining Company was formed in Petrolia and built a refinery at the corner of Tank Street and Discovery Line. When it moved its operations to Corunna, Ontario in 1952, the last oil refinery in Petrolia was gone. The wells continued to pump oil with increasing quantities of water. The number of wells in Petrolia fell to 68 in the year 1974; however, the industry was revived by an increase in the oil price. In 1994, Petrolia had 224 pumping wells and Oil Springs had 468 wells.

Exhibit 5

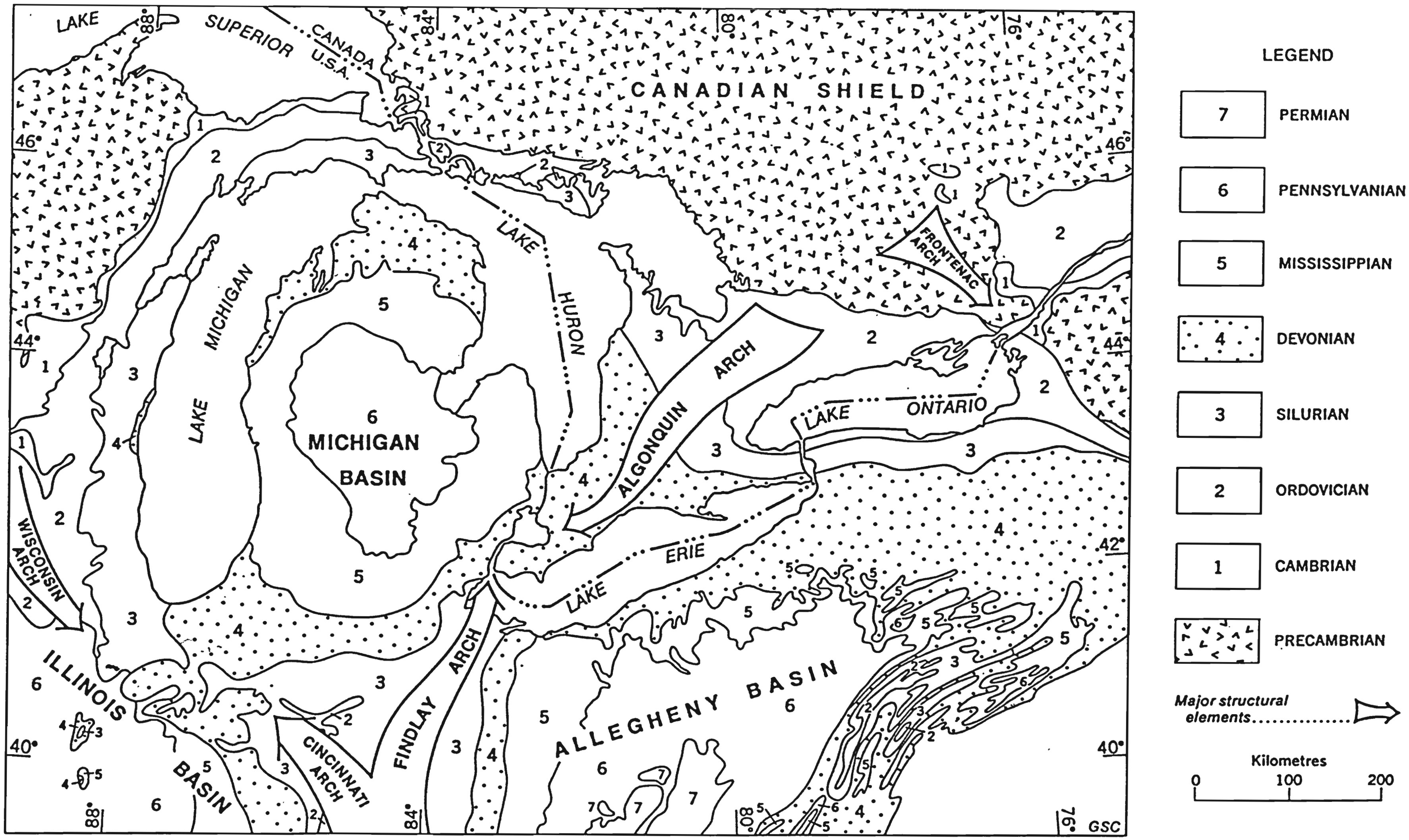


Exhibit 5: **Geological Map of Great Lakes Region of Canada and the United States. (After Uyeno et al , 1982)**

GENERAL GEOLOGY

Southwestern Ontario lies on the eastern edge of the intracratonic Michigan basin (Exhibit 5). In Lambton County, the sedimentary section is 1,430m (4,700 feet) thick and consists of about 30m (100 feet) of unconsolidated glacial sediments of Pleistocene age and 1,400m (4,600') of Palaeozoic sediments. In the stratigraphic succession (Exhibit 6), sediments of Devonian age occur at the top of the succession. Although the thickness of the Devonian section reaches a maximum of 3,700 feet (1,130m) at the centre of the Michigan basin (Exhibit 7), the section is compressed to a maximum of 1,000 feet (305m) in Ontario because of the slow rise of the Algonquin arch during deposition of the sediments. The rocks form the subcrop below the glacial sediments around the fringes of the basin (Unit 4 on Exhibit 5). In Lambton County, the age of the section ranges from Lower to Upper Devonian; Exhibit 8 shows the formation names and succession in the county and adjoining areas. The names of the formations are shown in more detail on Exhibit 9 and the rock units have been described thoroughly by Uyeno et al (1982): Exhibit 10 is a condensed summary of the lithology. The section in Ontario consists mainly of limestone, dolostone and shale with thin lenses of coarse-grained sandstone. Hydrocarbons have been trapped within the carbonates of the Dundee and Lucas Formations. Twenty-five oilfields have been discovered in the Devonian of Southwestern Ontario; seven of which are still producing oil (Exhibit 11). The recoverable oil reserves in Devonian reservoirs was estimated at 6.81 million m^3 (42.8 million bbls) by Bailey & Cochrane (1985), 88.4% of which are found in three fields, namely Petrolia, Oil Springs and Rodney. The cumulative production to the end of 1992 from Devonian reservoirs is 6.74 million m^3 (42.4 million bbls). Two of these fields, Petrolia and Oil Springs are the subjects of this field trip.

PLEISTOCENE				
DEVONIAN	UPPER	Port Lambton	Sunbury Berea Bedford	
			Kettle Point	
	MIDDLE	Hamilton	Ipperwash Widder Hungry Hollow Arkona Rockport Quarry Bell	
			Dundee	
		Detroit River	Lucas Lucas Amherstburg	Anderdon
	L		Bois Blanc	
SILURIAN	UPPER		Bass Islands	
		Salina	G Unit F Unit E Unit D Unit C Unit B Unit	
			A-2 Unit	A-2 Carbonate A-2 Shale A-2 Salt A-2 Anhydrite
			A-1 Unit	A-1 Carbonate A-1 Evaporite
	MIDDLE		Guelph	Eramosa
		Amabel	Goat Island Gasport Rochester	
			Reynales	
	LOW	Cataract	Cabot Head Manitoulin	
ORDOVICIAN	UPPER		Queenston Blue Mountain Collingwood	
	MIDDLE	Trenton	Cobourg Sherman Fall Kirkfield	
		Black River	Coboconk Gull River Shadow Lake	
CAMBRIAN	UPPER	Cambrian	Eau Claire Mt. Simon	
PRECAMBRIAN				

Exhibit 6: Rock-Stratigraphic Succession in Lambton County

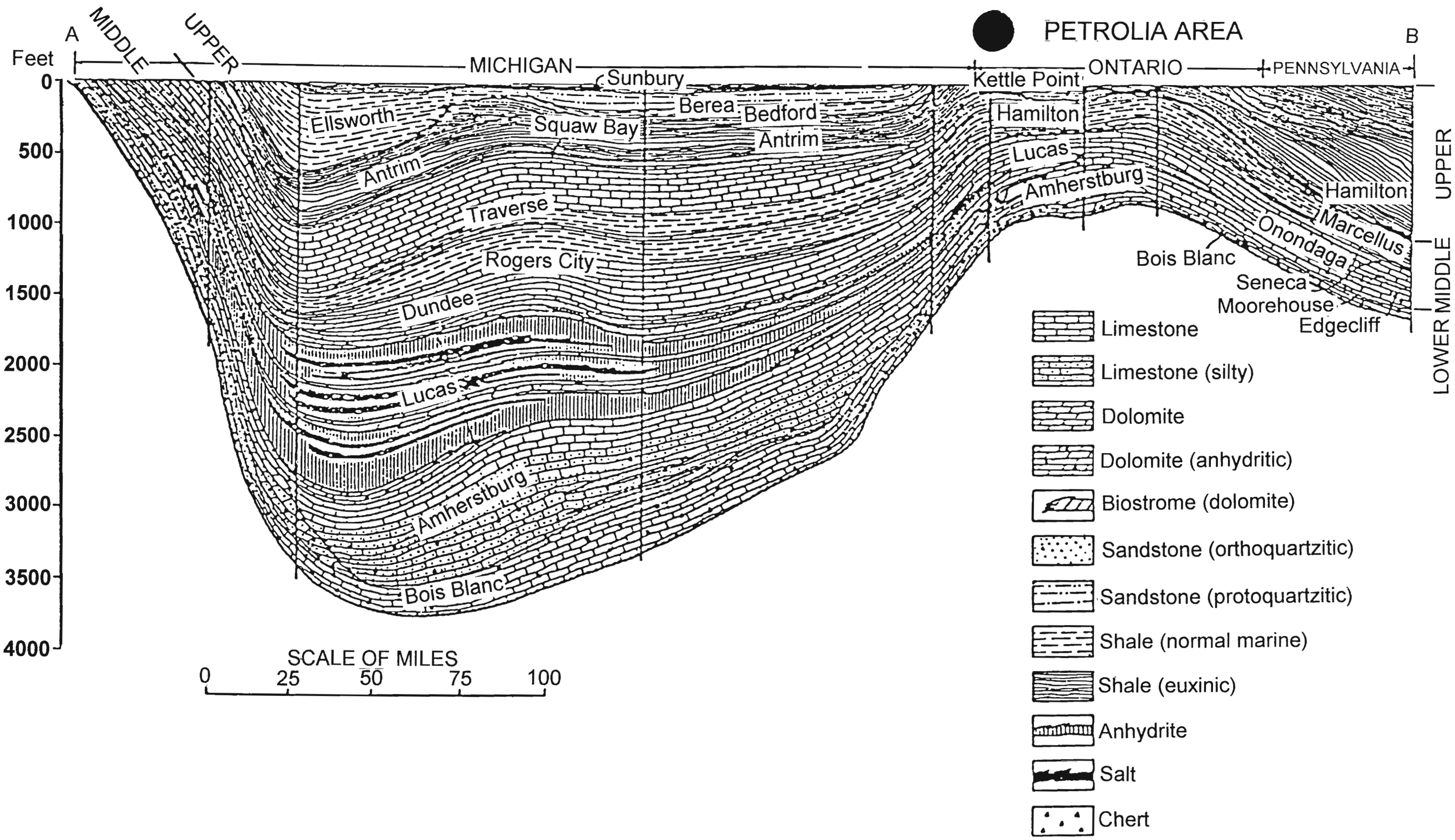


Exhibit 7: **Generalized Devonian Section - Michigan to Pennsylvania**
B.V. Sanford, 1967
International Symposium on the Devonian System, Calgary, Alberta

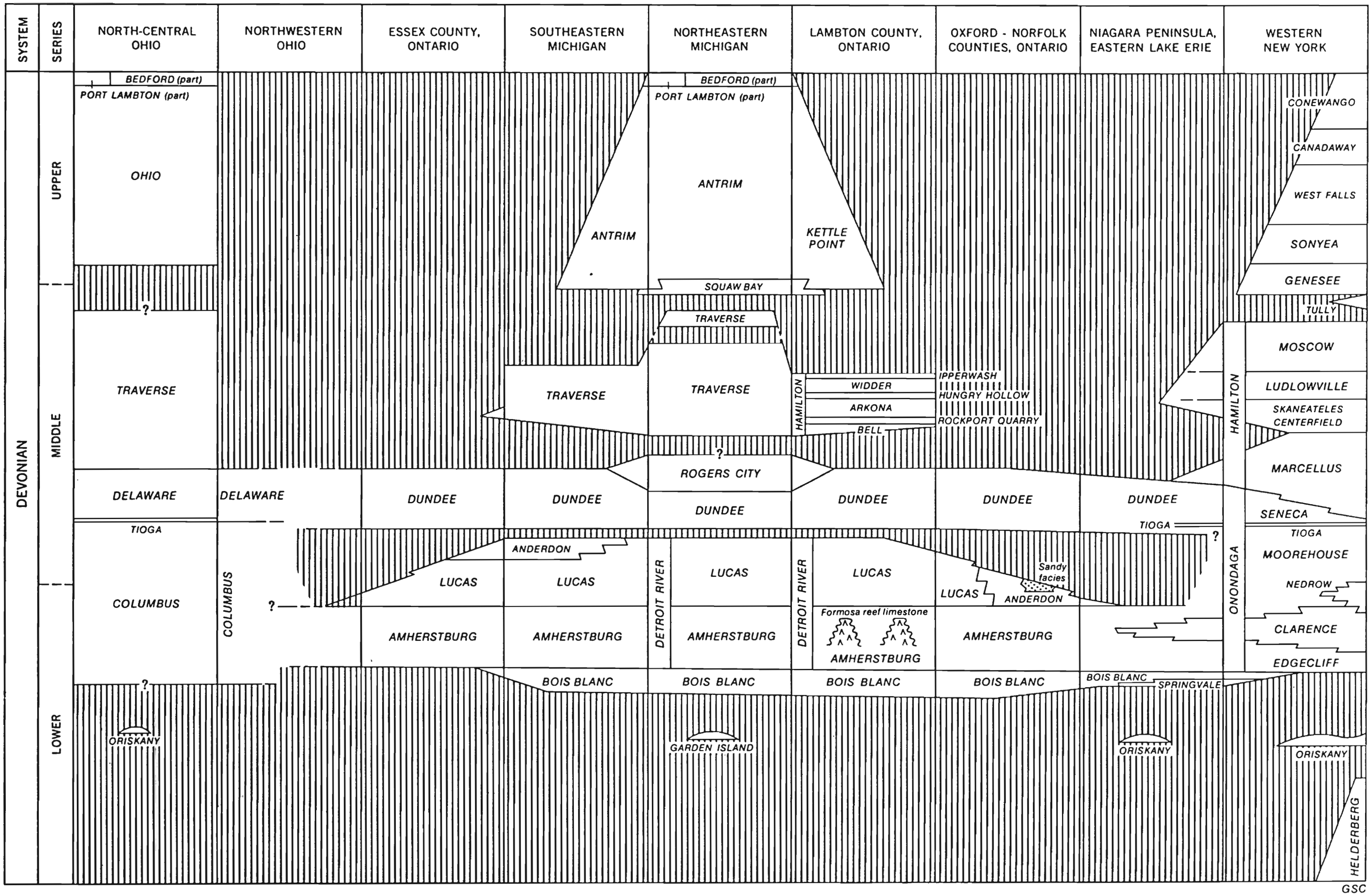


Exhibit 8: **Formational Nomenclature and Correlation of the Devonian Succession in Southwestern Ontario and Adjoining Areas. (After Uyeno et al , 1982)**

Exhibit 8

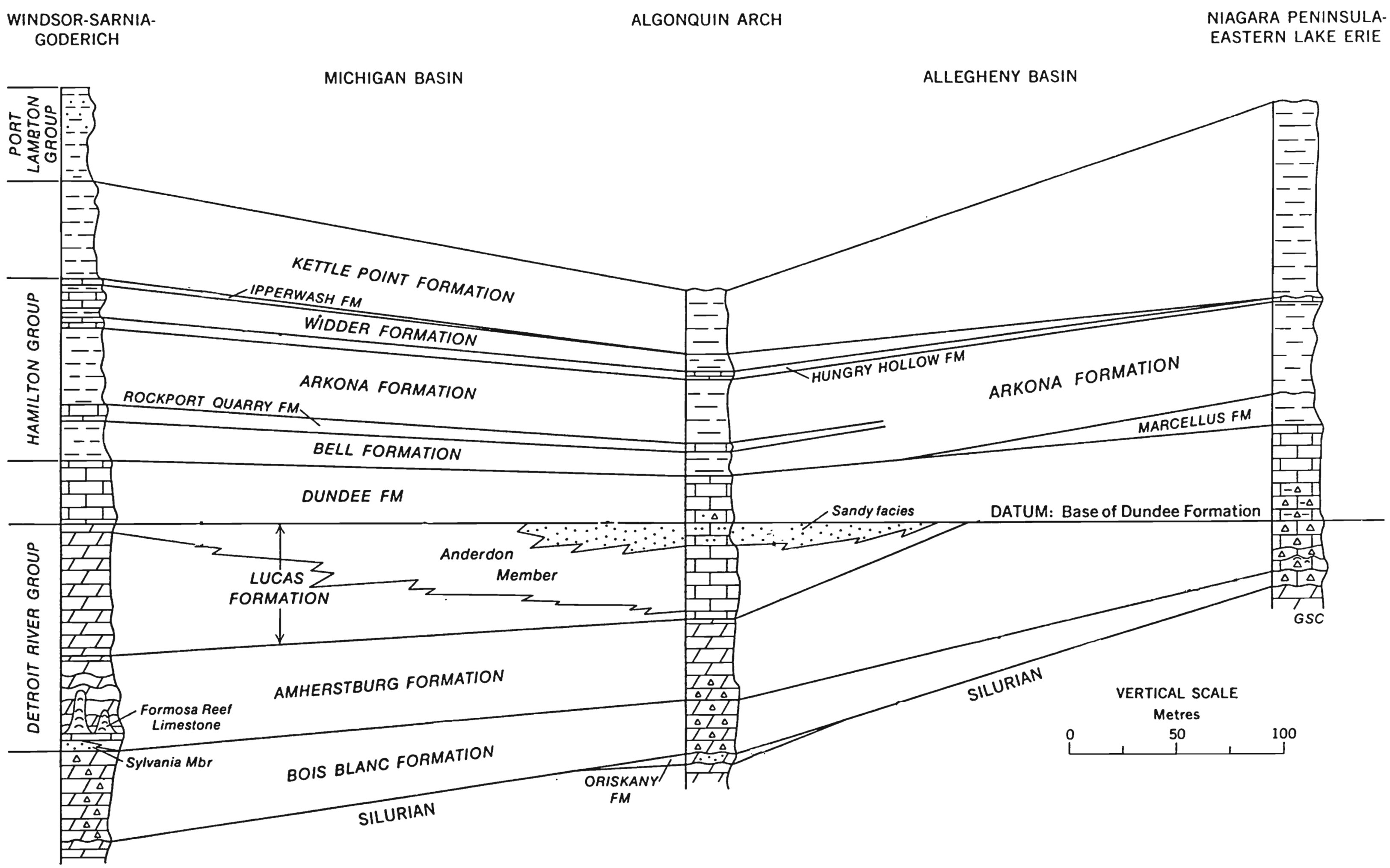


Exhibit 9: Devonian Succession in Southwestern Ontario. (After Uyeno et al , 1982)

Kettle Point	Black highly fissile bituminous shale with minor interbeds of grey-green silty shale with large subspherical concretions called 'kettles'; sharp disconformity with underlying Ipperwash Formation with basal lag bed of dark chert.
HAMILTON GROUP	
Ipperwash	Grey brown medium- to coarse-grained bioclastic limestone with fossiliferous beds and large burrows (?)
Widder	Dominantly grey soft calcareous shale interbedded with blue grey fine-grained argillaceous limestone, coarse-grained crinoidal bioclastic limestone and nodular limestone; abundant fossils.
Hungry Hollow	Grey shale with abundant solitary rugose coral, brachiopods, crinoid debris interbedded with brown coarse-grained crinoidal bioclastic limestone: thickness 1.5-1.8m
Arkona	Blue-grey plastic shale with occasional thin discontinuous limestone lenses and local concentrations of spiriferid brachiopods; also known as Upper Soap.
Rockport Quarry	Grey and brown, very fine-grained limestone with occasional thin shale layers; also known as Middle Lime.
Bell	Grey and blue soft calcareous shale with basal thin limestone lenses. Lower contact disconformable; also known as Lower Soap.
Dundee	Medium to light brown fossiliferous micritic limestone with bituminous laminations and shale partings. Abundant hydrocarbon fluorescence but no effective primary porosity; distinctive hydrocarbon odour at shale shaker; sharp disconformable lower contact.
DETROIT RIVER GROUP	
Anderdon Member, Lucas Formation	Interbeds of fine-grained barren micritic limestone and coarse-grained, very fossiliferous bioclastic limestone, sandy in part with lenses of orthoquartzitic friable sandstone; local zones of good quality intercrystalline and vuggy porosity.
Lucas Formation	Light brown to grey-brown finely crystalline to sucrosic poorly fossiliferous dolostone with dark bituminous laminations, minor chert and numerous beds of anhydrite/gypsum; local zones of good quality intercrystalline and vuggy porosity.
Amherstburg	Grey-brown to dark brown fine-to coarse-grained coral-stromatoporoid bituminous bioclastic dolomite with grey chert nodules.
Bois Blanc	Grey and grey-brown microsucrosic dolostone with abundant thin beds and nodules of light grey to brown chert; no primary porosity, locally known by the drillers as the sharp unit; disconformable lower contact with Bass Island Formation.
Bass Island	Top of Silurian.

Exhibit 10: Condensed Summary of Lithology, Devonian Section in Enniskillen Township, Lambton County, Ontario (After Uyeno et al 1982)

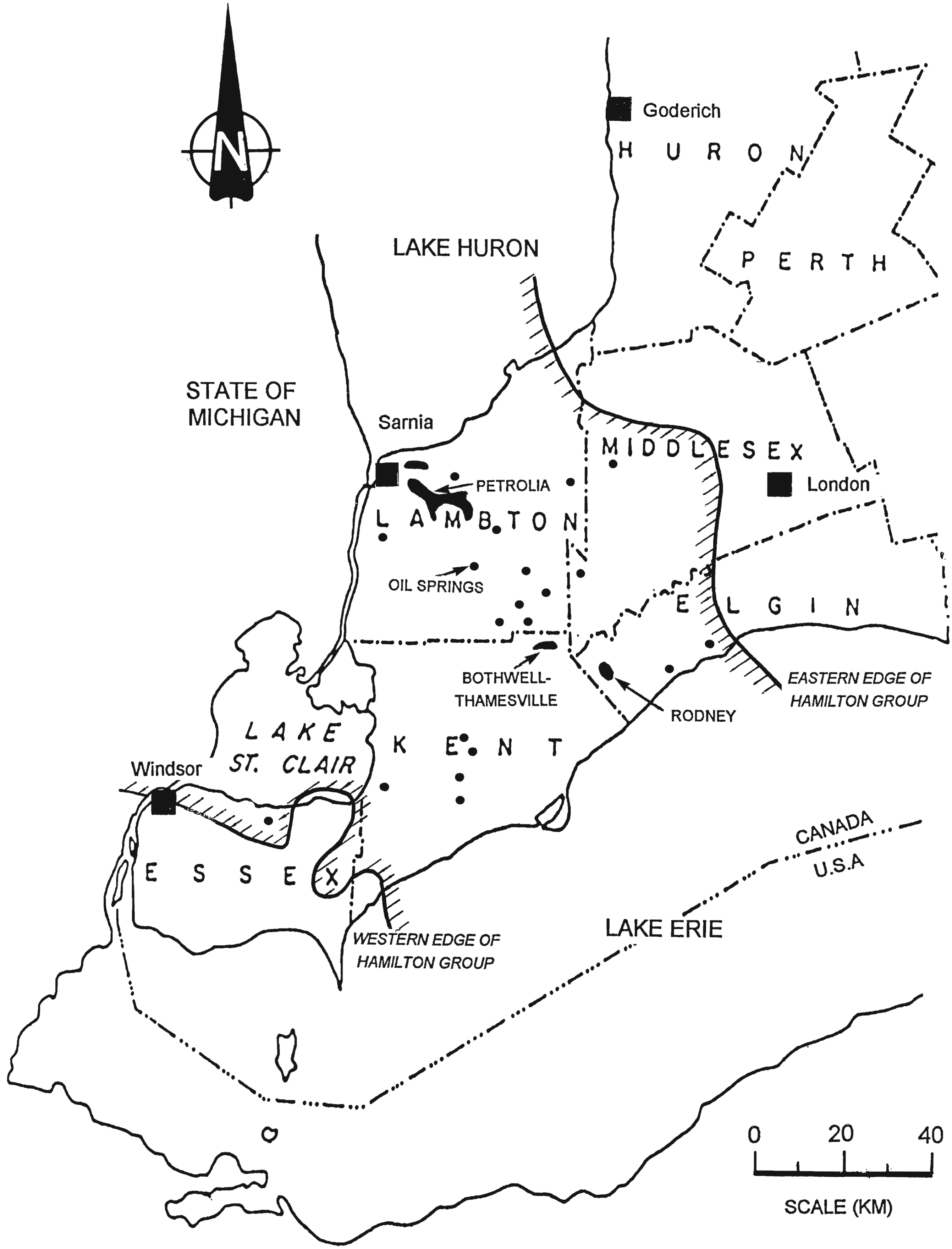


Exhibit 11: Distribution of Devonian Oilfields in Southwestern Ontario

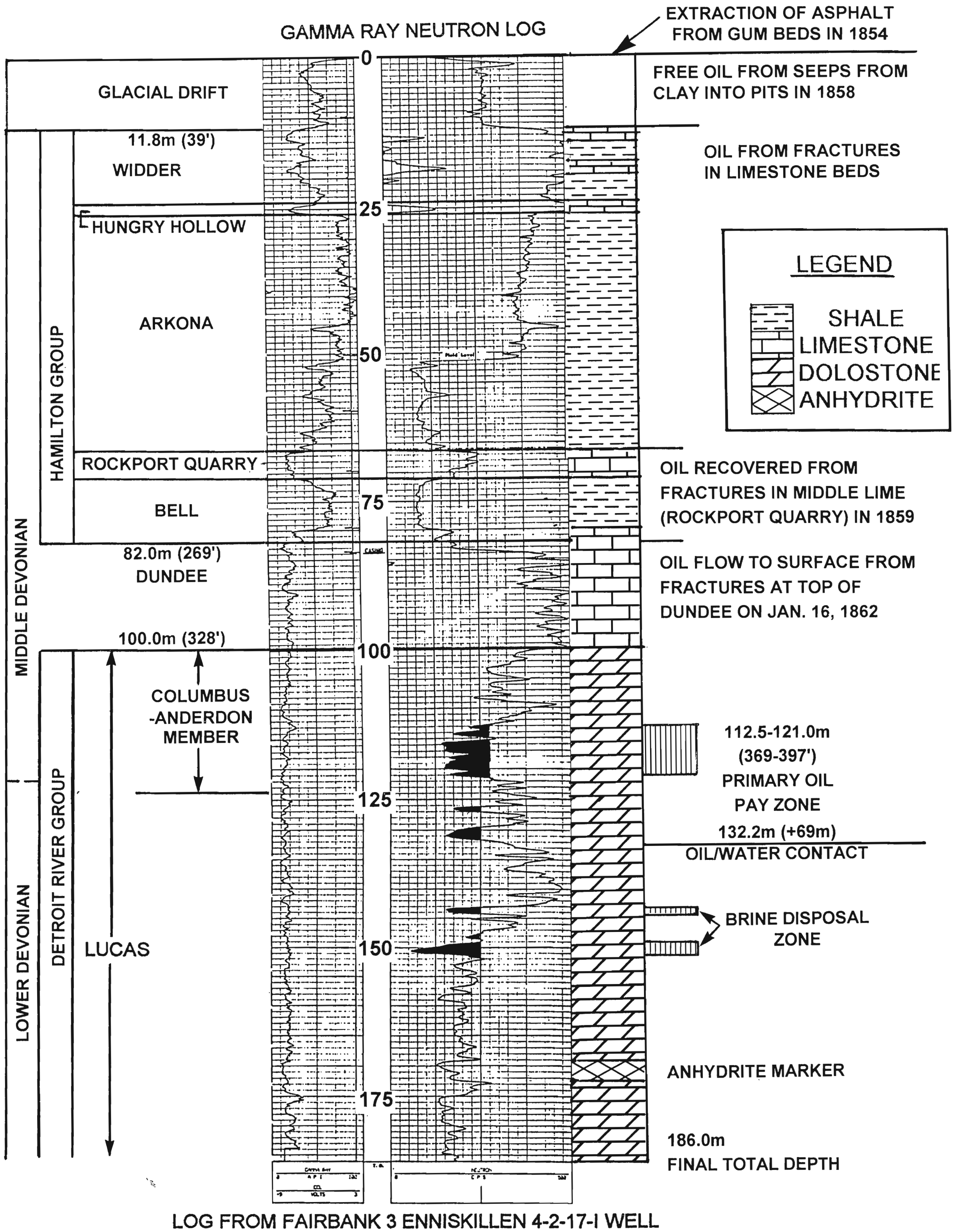


Exhibit 12: Type Log Section for Oil Springs Field

OIL SPRINGS FIELD

Background

As mentioned above, Oil Springs in Enniskillen Township of Lambton County was the site of the first commercial extraction of oil for industrial use. On Exhibit 12, the progressive development of the field has been superimposed on a stratigraphic section. The gum beds at surface were first used as a source of asphalt in 1854. Then in 1858 it was discovered that free oil would seep from porous lenses in the glacial drift into a well hand-dug to 14 feet. The thickness of the glacial sediment varied from 46 to 80 feet (14.0-24.4m), and most wells were dug in the floodplain of the Black Creek where the glacial cover had the least thickness. Regionally, the bedrock is the black shale of the Kettle Point Formation; however, at Oil Springs, this formation has been removed by erosion and the bedrock is the Widder beds of the Hamilton Group. The bedrock limited the depth of hand-dug wells, and the spring pole method of drilling and steam-powered rigs were used to tap the deeper reservoir. Fractures in the thin carbonates of the Widder beds yielded oil from the bedrock at slow rates. In 1859, a well drilled by J.M.Williams reached the top of the Middle Lime (a.k.a. Rockport Quarry by geologists) at a depth of 146 feet. Regionally, the Rockport Quarry is about 4.5m (15') thick and consists of grey and brown very fine-grained impermeable limestones. However, on the Oil Springs anticline, this formation was fractured and yielded 60 barrels of oil/day in the Williams wells. Some of the subsequent wells drilled into this formation flowed oil to surface at low rates.

On January 16, 1862, after punching through 157 feet of rock, Hugh Nixon Shaw drilled the first hole into the top of the Dundee Formation at 203 feet. Although the top of the Dundee consists generally of an impermeable medium brown micritic and bioclastic limestone, the fractures at this location yielded rather spectacular flows of oil. Oil gushers had come to Oil Springs. However, the lives of flowing wells were limited; within one year all but two of the flowing wells had died. Fractured reservoirs typically have high initial flow rates and rapid declines. Wells were eventually drilled into the main oil pay zone across the interval 112.5-134.5m (369-441 feet) in the Anderdon Member of the Lucas Formation. This zone yielded oil at slower rates and is still producing oil after 138 years. The practice of deeper drilling continued at Oil Springs. In 1913, natural gas was discovered at 1,900 feet in a small incipient reef of Silurian age; Oil Springs was one of the first villages to have street lamps powered by natural gas!

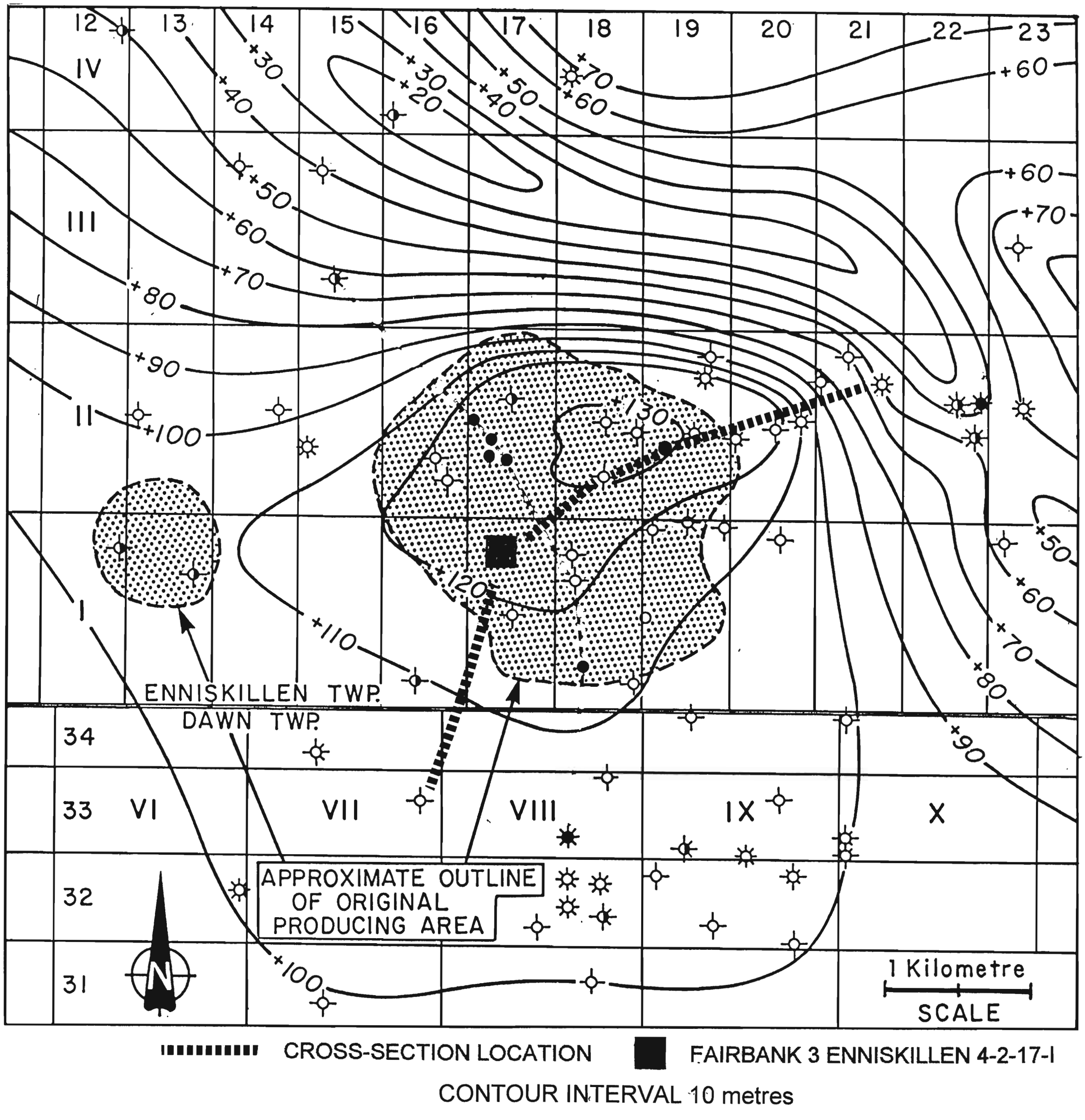


Exhibit 13: Structure on Top of Dundee Formation for Oil Springs Field, Enniskillen Township, Lambton County, Ontario

Geology

The Oil Springs Field located in Lots 16 to 19 of Concessions I & II of Enniskillen Township lies about 28km (17 miles) southeast of the City of Sarnia. As shown on the pool map (Exhibit 13), it covers an area of 1,120 acres (453.5 hectares) and the main part of the field lies on an anticlinal structure. Because of its early development, technical information on the field was sparse; however, the installation of brine disposal wells in 1988 provided good data for a cross-section through the field. The cross-section (Exhibit 14) shows a simple anticlinal structure on the upthrown side of a fault. The primary porosity is stratigraphic in nature and is the result of dolomitization of bioclastic limestones enhanced by dissolution during periods of subaerial exposure.

The structure has been created in part by the effect of the fault on the underlying halite beds in the underlying Silurian Salina Formation. As shown on the schematic diagram (Exhibit 15), the fault which occurred during and after deposition of the Devonian sediments provided a conduit for the solution of halite from the Salina B Unit. The progressive removal of halite caused draping of the overlying beds at the southern limit of the salt solution to create an anticlinal trap. During the adjustment of the rock to the new regime, a network of fractures for the relief of stress was generated in the overlying formations. These fractures not only provided a pathway for hydrocarbon migration into the primary reservoir in the Detroit River Group but allowed some leakage of oil into the overlying formations. The channels created by fractures would soon be healed in the plastic shales but would persist in the brittle carbonates. Subsequent minor tectonic events such as glaciation may have periodically reactivated some of the fractures. Consequently, oil and gas would slowly migrate upwards into the glacial till to create gum beds and accumulate in the fractures of the limestone beds awaiting the first opportunity to gush to surface.

Based on the available data, Bailey and Cochrane (1985) placed the oil/water contact in the reservoir at +84m (+276') above sea level. The well data acquired in 1988 shows that the oil/water contact in the reservoir is closer to +68m (+223') above sea level. The Summary of Log Data Shows and Lithology (Exhibit 16) for the Fairbank 3 Enniskillen 4-2-17-I well demonstrates the distribution of porosity. The Dundee Formation in the interval 82-100m (269-328') is a light brown grey micritic fossiliferous limestone with oil fluorescence but with no effective primary porosity. Shows of oil and water in this interval are related to fractures.

At 100m (328'), there is a sharp contact between the limestone of the Dundee Formation and the limestone of the Anderdon Member of the Lucas Formation as defined by Uyeno et al (1982). These limestones are generally tight.

The primary oil pay zone occurs in the interval 112.5-121m (369-397 feet) in a medium brown sucrosic dolomite. The tight streak on the log at 109m (358') is present throughout the field and below this tight streak is a thick section of good porosity and permeability. It is likely that the tight streak marks a hard ground, and the underlying porous zone has been enhanced by dissolution of carbonates in a fresh water environment.

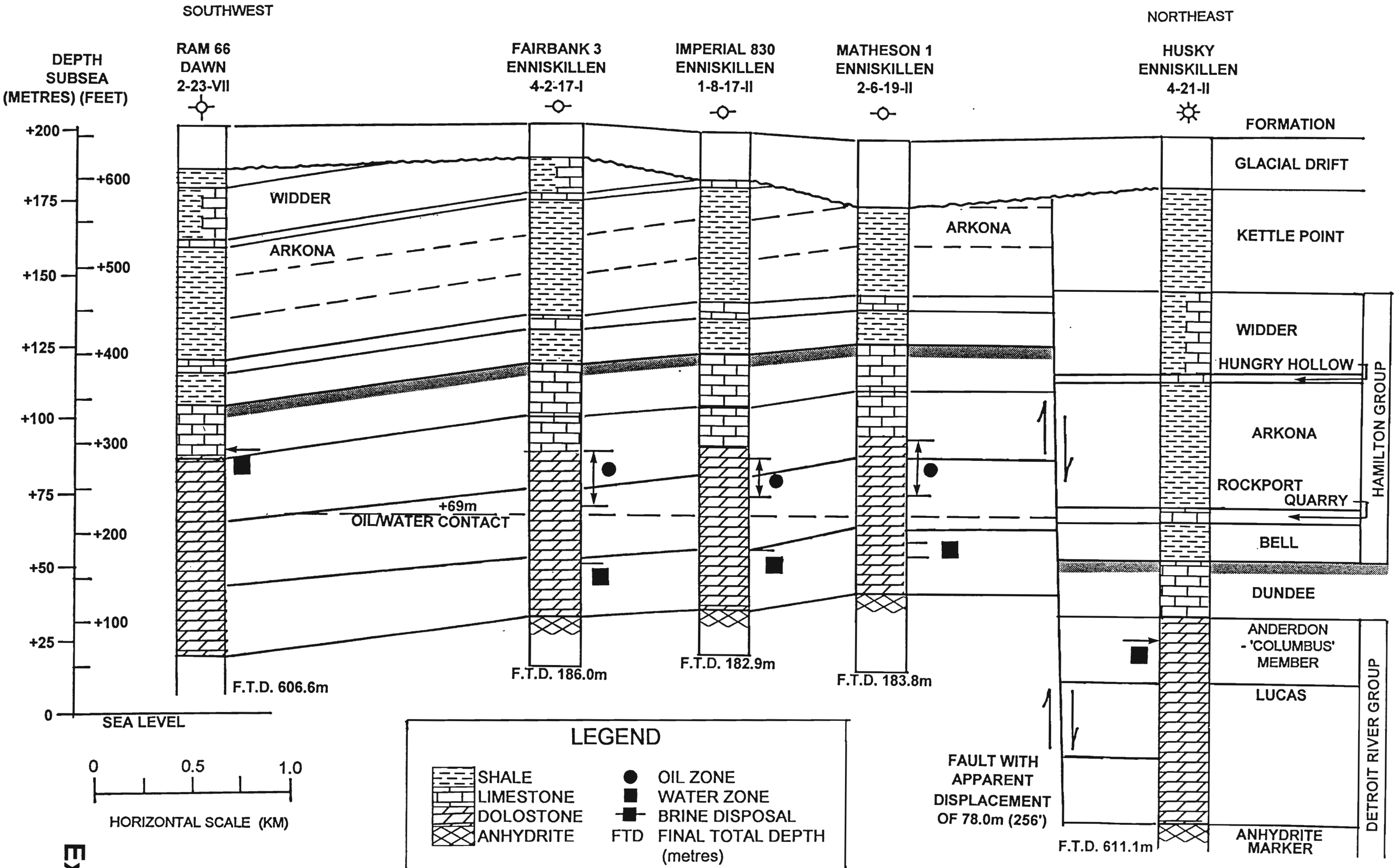


Exhibit 14: Northeast - Southwest Structural Cross-Section Through Oil Springs Field

Exhibit 14

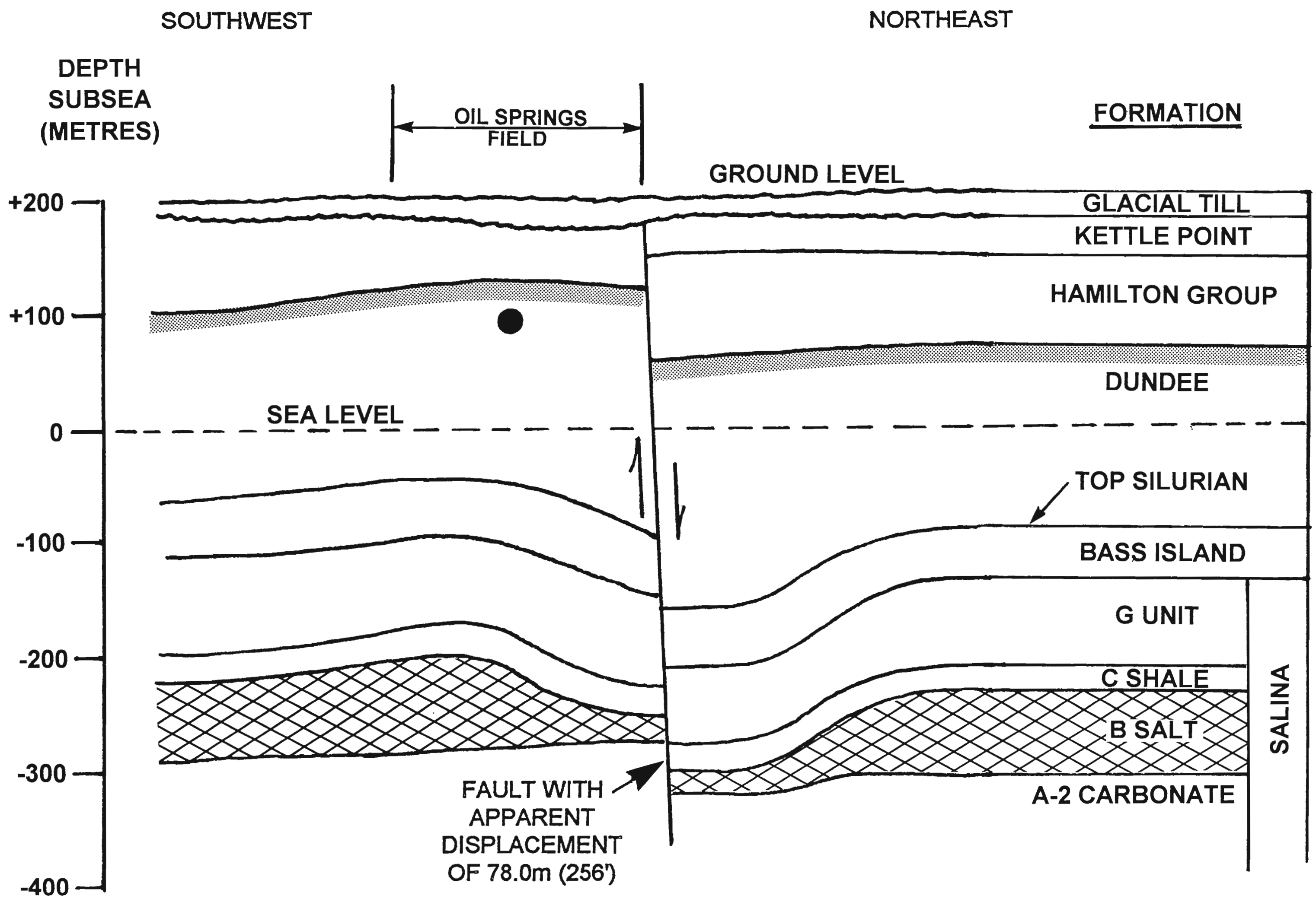
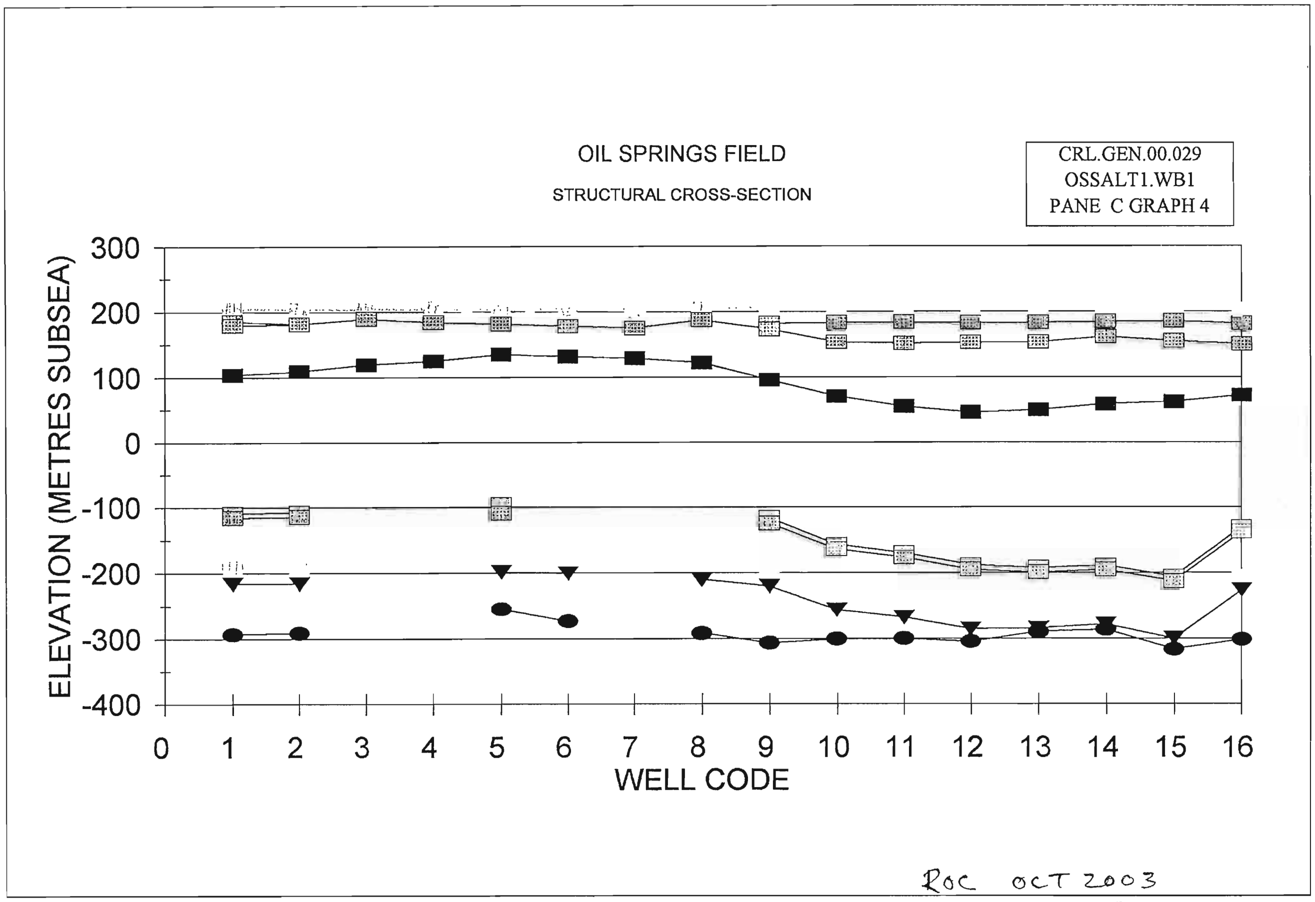


Exhibit 15: Schematic Cross-Section to Show Trap Origin at Oil Springs Field

Another porous zone lies in the interval 142 to 165m (466-541') within the dolostone of the Lucas Formation. This zone is more or less continuous throughout the pool and the adjacent area. The streaks of good permeability within this zone are used for the disposal of produced water from the Oil Springs Field; an example of such a porous zone occurs in the interval 149-151m (489-495') on Exhibit 16.



ROC OCT 2003
perhaps no fault

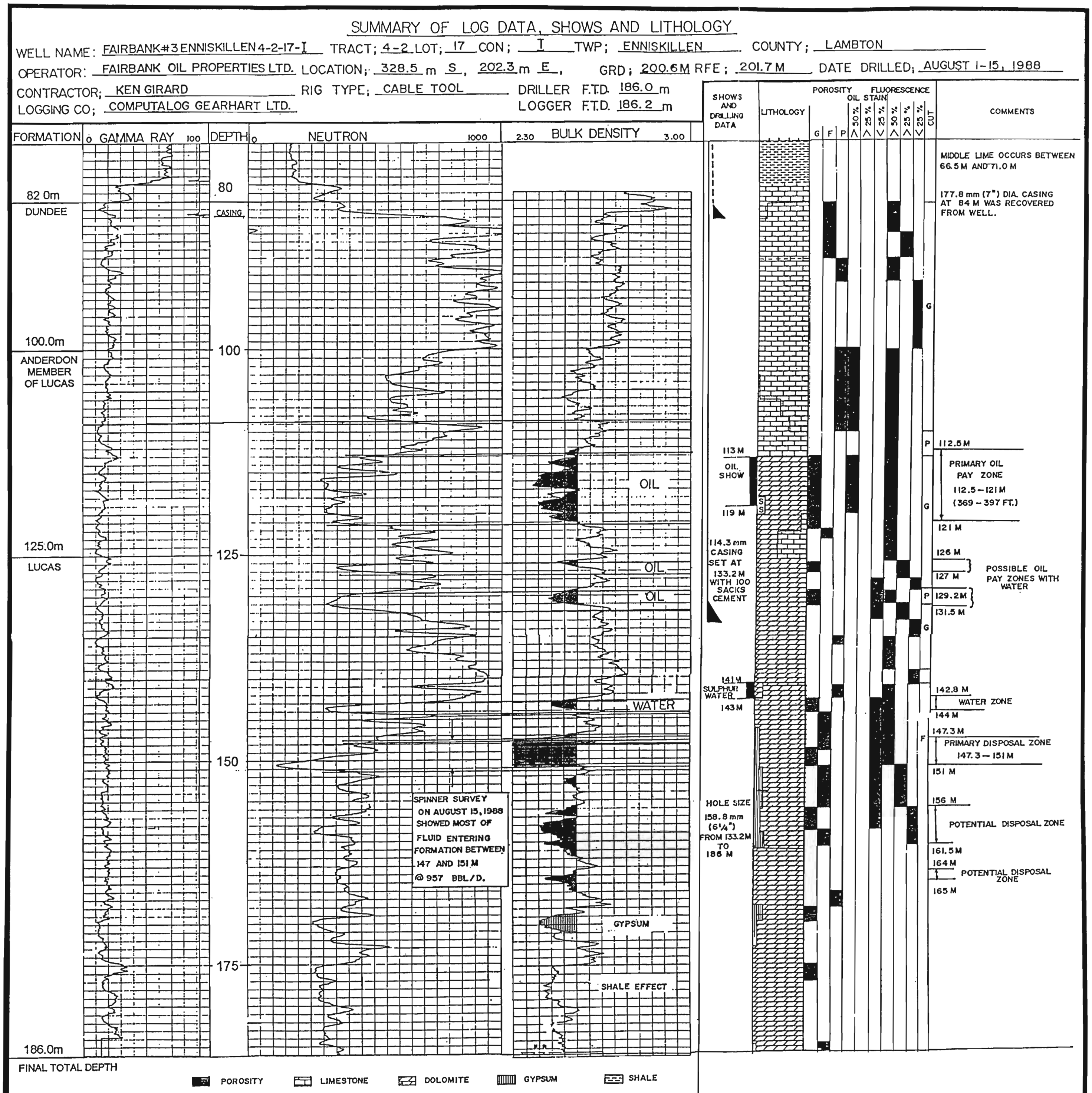

SUMMARY OF LOG DATA, SHOWS AND LITHOLOGY
WELL NAME: FAIRBANK#3 ENNISKILLEN 4-2-17-I TRACT; 4-2 LOT; 17 CON; I TWP; ENNISKILLEN COUNTY; LAMBTON
OPERATOR: FAIRBANK OIL PROPERTIES LTD. LOCATION; 328.5 m S, 202.3 m E, GRD; 200.6M RFE; 201.7M DATE DRILLED; AUGUST 1-15, 1988
CONTRACTOR; KEN GIRARD RIG TYPE; CABLE TOOL DRILLER F.T.D. 186.0 m
LOGGING CO; COMPUTALOG GEARHART LTD. LOGGER F.T.D. 186.2 m
FORMATION
0 GAMMA RAY 100
DEPTH
0 NEUTRON 1000
2.30 BULK DENSITY 3.00
SHOWS AND DRILLING DATA
LITHOLOGY
POROSITY
G F P
OIL STAIN
FLUORESCENCE
50 % 25 % 25 % 50 % 25 % 25 %
CUT
COMMENTS
82 0m
DUNDEE
80
CASING
100.0m
ANDERDON MEMBER OF LUCAS
100
125.0m
LUCAS
125
150
175
186.0m
FINAL TOTAL DEPTH
OIL
OIL
OIL
WATER
SPINNER SURVEY ON AUGUST 15,1988 SHOWED MOST OF FLUID ENTERING FORMATION BETWEEN 147 AND 151 M @ 957 BBL/D.
GYPSUM
SHALE EFFECT
113 M
OIL SHOW
119 M
114.3 mm CASING SET AT 133.2 M WITH 100 SACKS CEMENT
141 M
SULPHUR WATER
143 M
HOLE SIZE 158.8 mm (6¼") FROM 133.2M TO 186 M
MIDDLE LIME OCCURS BETWEEN 66.5 M AND 71.0 M
177.8 mm (7") DIA. CASING AT 84 M WAS RECOVERED FROM WELL.
112.5 M
PRIMARY OIL PAY ZONE 112.5-121 M (369 - 397 FT.)
121 M
126 M
127 M
129.2 M
131.5 M
POSSIBLE OIL PAY ZONES WITH WATER
142.8 M
WATER ZONE
144 M
147.3 M
PRIMARY DISPOSAL ZONE 147.3 - 151 M
151 M
156 M
POTENTIAL DISPOSAL ZONE
161.5 M
164 M
POTENTIAL DISPOSAL ZONE
165 M
POROSITY
LIMESTONE
DOLOMITE
GYPSUM
SHALE
BY: CAIRNLINS PETROLEUM SERVICES
DATE: NOVEMBER 1988

Exhibit 16

Oil Production History

Because the field was developed at the birth of the oil industry, production records do not exist before 1917. So much oil flowed into the creeks during the initial drilling and there were so many producers and refiners with no regulation or inspection that the cumulative production is difficult to estimate. R.B. Harkness (1928), after much detailed research, estimated the cumulative production at the end of 1916 at 7 million barrels (1.1 million m^3). Appendix A is an annual summary of the oil production at Oil Springs in the period from 1917 to 1996. At the end of 1996, the cumulative oil production was 1.56 million m^3 (9.81 million bbls). In 1996, there were about 450 operating wells in the field and the total annual oil production was 5,647m^3 (35,515 bbls).

Exhibit 17 is a plot of the annual production and active wells for the period 1917 to 1996 and Exhibit 18 is a plot of the annual oil production per active well. Between 1917 and 1954, there was a slow decline in the annual production and a reduction in the number of active wells from 1,228 to 623. The annual oil production per well was gradually increasing as the poorer wells were suspended.

In 1954, Mr. N.E. de Mers and his brother Victor introduced to Oil Springs the concept of waterflooding, and segments of the field were flooded. The result was an increase in annual production by a factor of 2.8 between the years 1954 and 1965. The water started to break through into the producing wells in 1970 and, after that event, the waterfloods were mostly suspended.

The Oil Springs Field was revived when the oil prices started to rise in 1973. The increase in annual oil production correlates exactly with the crude oil price as shown in Exhibit 18. In Oil Springs and other stripper fields all over the world, the current level of activity depends on the price of crude oil.

It is interesting to note that the increase in oil production at Oil Springs preceded the increase in the number of active wells in 1980 (Exhibit 17). In that year, the Government of Canada instituted a two-tiered pricing regime, and newly-activated wells received the higher price. So although the annual oil production for the field did not change, those operators with the new wells did derive a short-term benefit from the price structure. In 1986, the price fell drastically and the annual production started to decline once more. Since 1992, the annual oil production from the field has stabilized at 5,500m^3 (34,600 bbls)/year, the same level as it was in the year 1928.

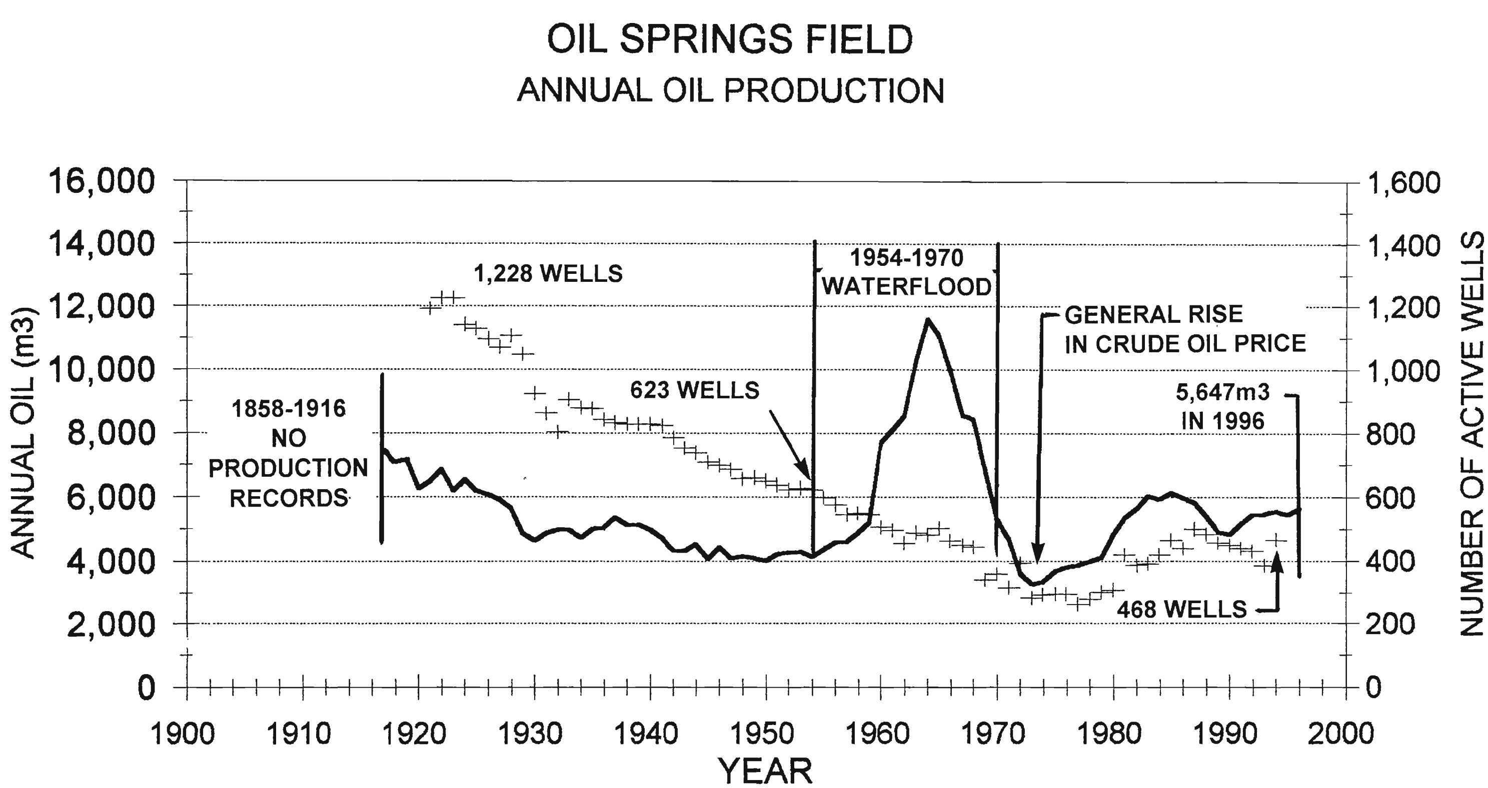
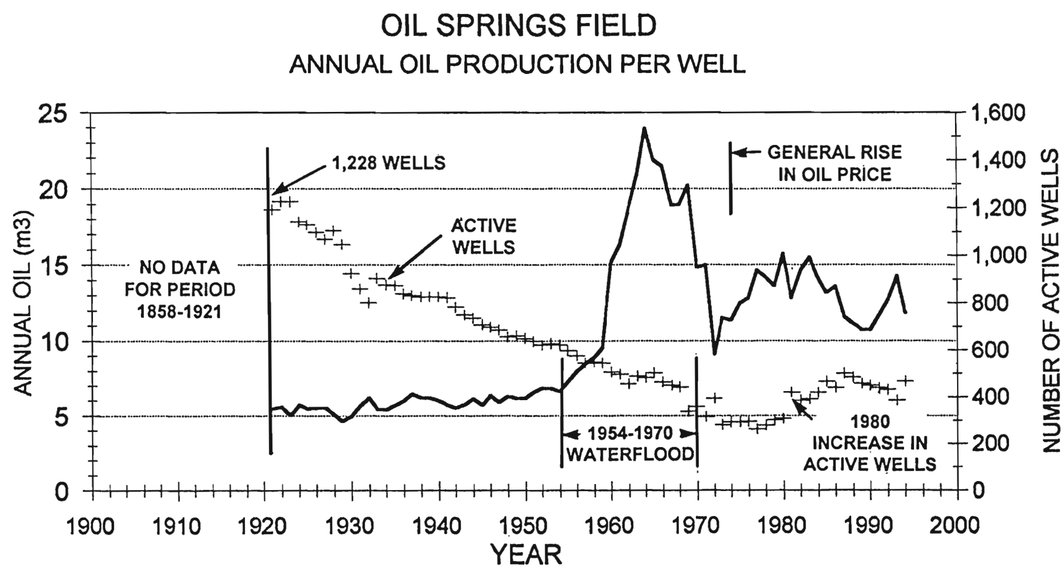


EXHIBIT 17

AAPG FIELD TRIP GUIDE

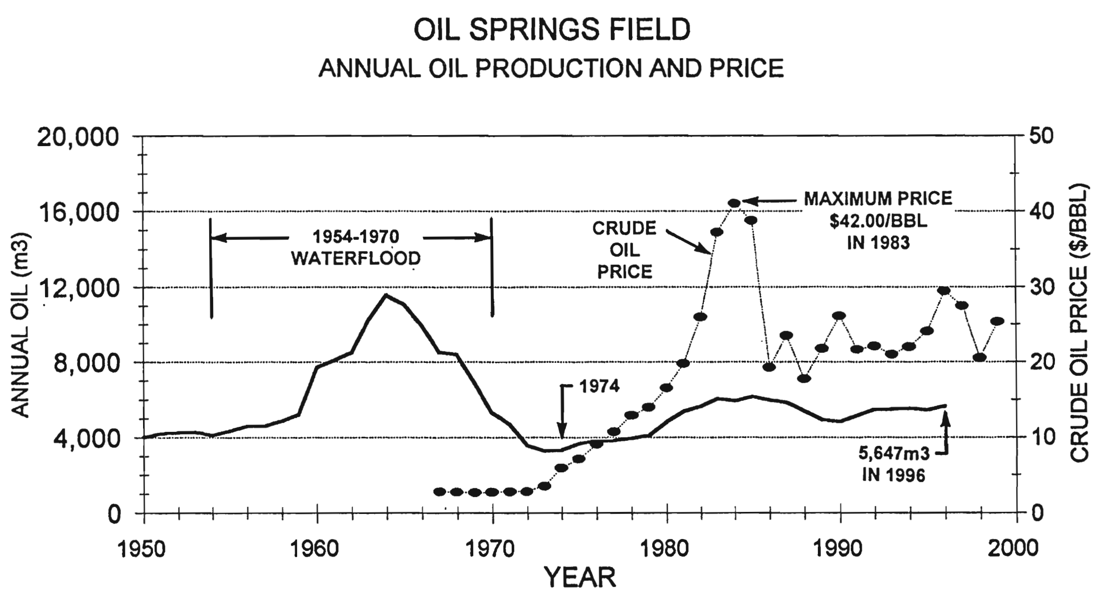
PLOT OF ANNUAL OIL PRODUCTION AND ACTIVE WELLS
FOR YEARS 1917 TO 1996
OIL SPRINGS FIELD
COUNTY: LAMBTON TOWNSHIP: ENNISKILLEN
BY: R.O.C./D.G.K. DATE: AUGUST 18, 2000
CAIRNLINS RESOURCES LIMITED



AAPG FIELD TRIP GUIDE

PLOT OF ANNUAL OIL PRODUCTION PER WELL
FOR YEARS 1917 TO 1996
OIL SPRINGS FIELD
COUNTY: LAMBTON TOWNSHIP: ENNISKILLEN
BY: R.O.C./D.G.K. DATE: AUGUST 18, 2000
CAIRNLINS RESOURCES LIMITED

EXHIBIT 18



AAPG FIELD TRIP GUIDE

PLOT OF ANNUAL OIL PRODUCTION AND PRICE
FOR YEARS 1967 TO 1999
OIL SPRINGS FIELD
COUNTY: LAMBTON TOWNSHIP: ENNISKILLEN
BY: R.O.C./D.G.K. DATE AUGUST 18, 2000
CAIRNLINS RESOURCES LIMITED

EXHIBIT 19

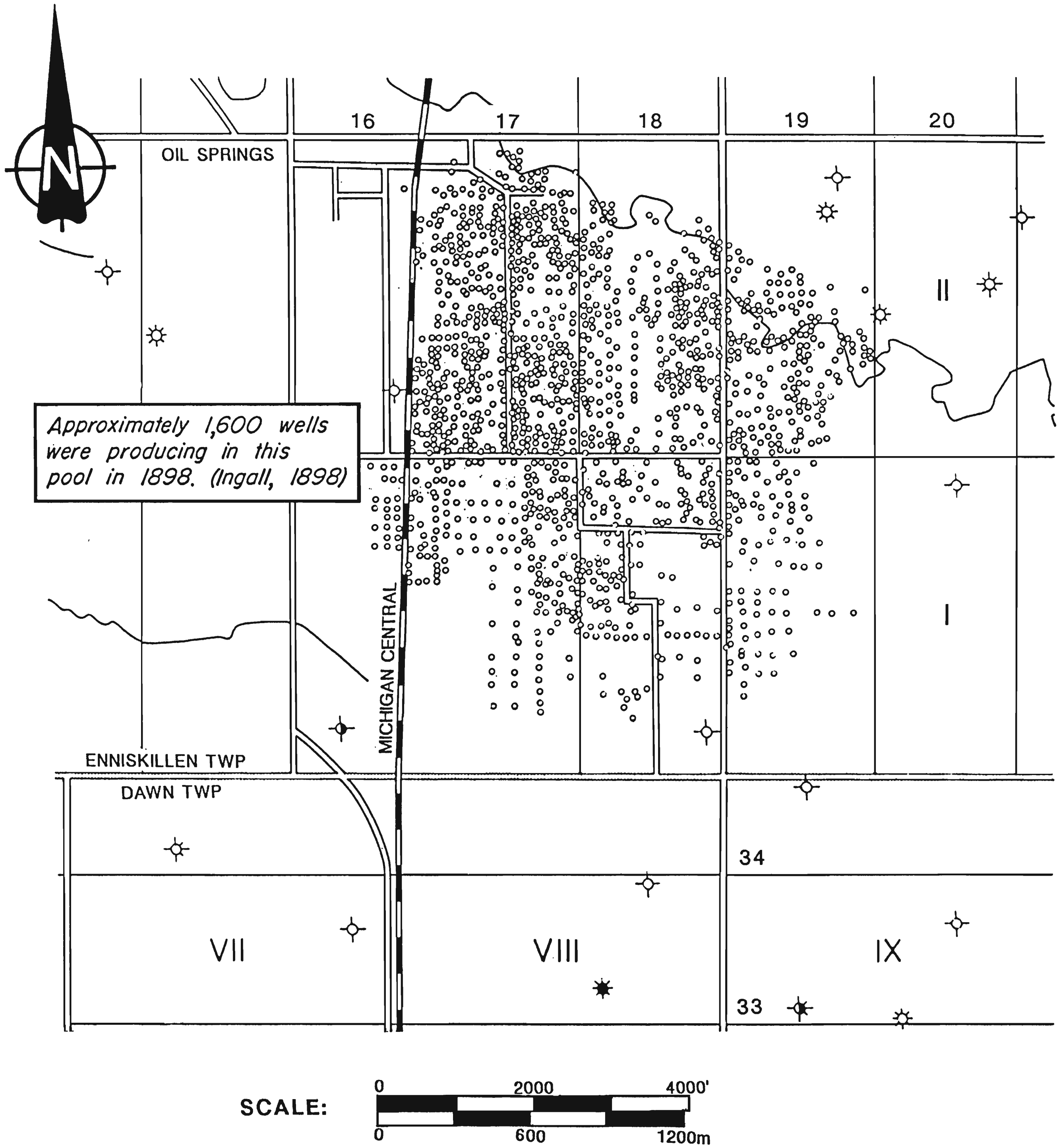


Exhibit 20: Historical Map of Well Locations, Oil Springs Field, Enniskillen Township, Lambton County, Ontario

During the initial development of Oil Springs Field, the drillers assumed that the oil supply was infinite and its recovery was only limited by the number of wells. As a result, Ingall (1898) estimated the number of producing wells in Oil Spring Pool at 1,600 in 1898. In 1921, the number of wells is reported at 1,192. Exhibit 20 is a historical map of well locations in the Oil Springs Field assembled from all available sources by Bailey & Cochrane (1985). They estimated the oil-in-place at 24.2 million barrels (3.85 million m^3). The recovery factor at 40.5% is anomalously high for carbonate reservoirs but is easily justified with a well density of 1.4 wells/acre (3.5 wells/hectare). The current regulated spacing for Devonian wells is one well for each 6.25 acres (2.52 hectares).

Crude oil from Oil Springs Field has a gravity of 36° API and contains 0.71% sulphur. The water cut varies from property to property but ranges from 20% to 40% of the total fluid production at the present time. The average well produces about $12m^3$ (76 bbls) of oil per year; that is equivalent to $0.03m^3$ (0.21 bbls) of oil per day. The oil is separated from the water by gravity and is trucked a distance of 30 km to Marcus Terminals Inc. in Sarnia, Ontario and delivered to the Imperial Oil refinery.

The water produced with oil in Oil Springs Field is brackish (specific gravity 1.05) and sulphurous. Historically after the oil was extracted, the water was dumped into the surface watercourses. On warm still days, the air around the village had a sulphurous fetid flavour. In 1990, environmental regulations were put in place to prevent the discharge of oilfield water into surface streams; as a result operators, drilled wells into the Detroit River Group for the disposal of oilfield brine. Fortunately, a porous water-filled reservoir was present to accept water by gravity flow at suitable rates.

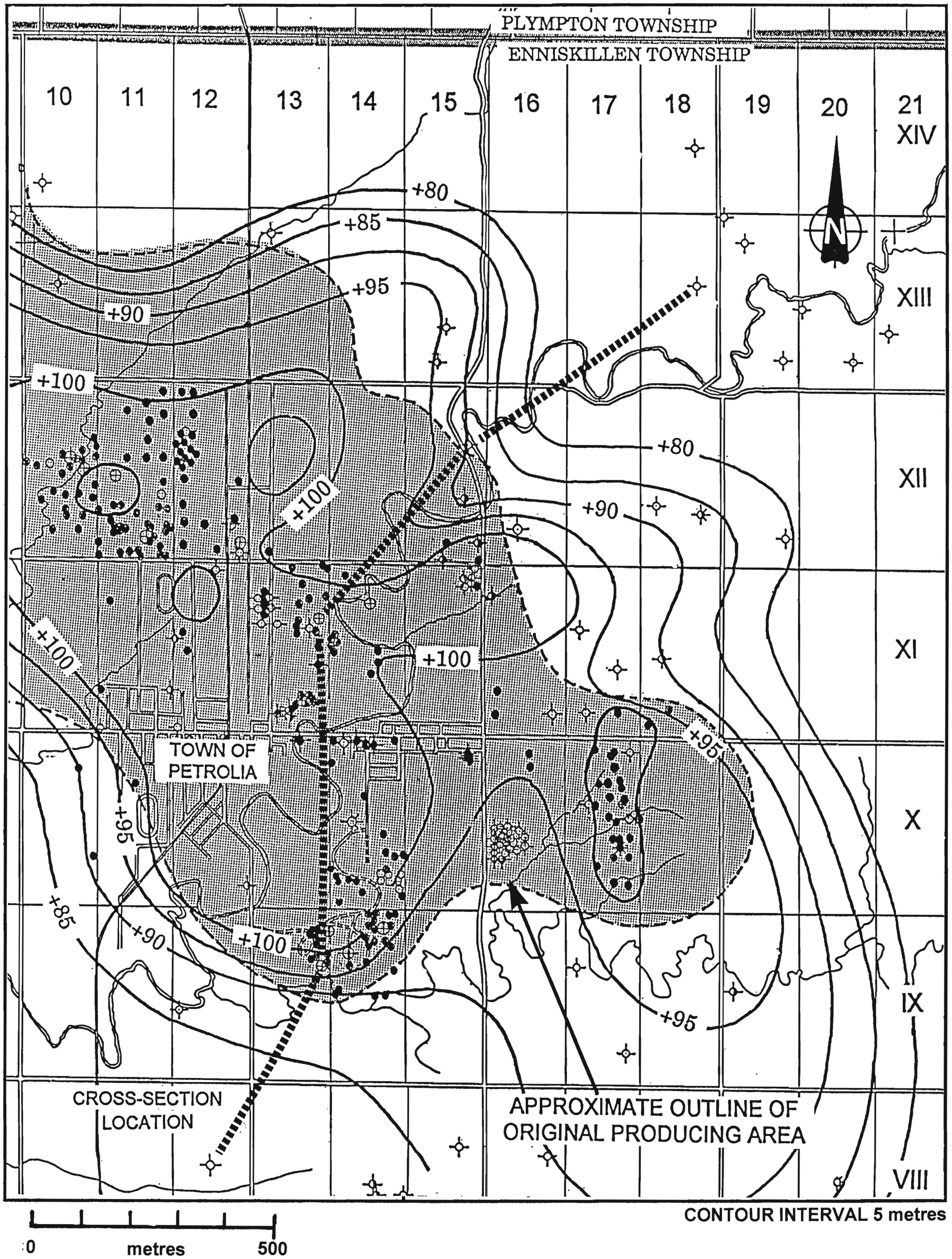


Exhibit 21: **Structure on Top of Dundee Formation in Eastern Segment of Petrolia Oilfield, Enniskillen Township, Lambton County, Ontario (After Bailey & Cochrane, 1985)**

PETROLIA OILFIELD

Background

Oil seeps in the flood plain of the Bear Creek indicated the presence of oil in the Petrolia area. Some wells produced small quantities of oil and there was not much action until Captain B. King drilled the discovery well on Lot 11 Concession XI of Enniskillen Township. Unlike the Oil Springs Field, the Petrolia Field had the reserves to sustain the long term growth of a community.

As shown on Exhibit 4, the Petrolia Oilfield extended from Enniskillen Township into the adjacent townships of Moore and Sarnia and covered an area of 3,847 hectares (9,500 acres); however, the best segment of the field was centred around the Town of Petrolia as shown on Exhibit 21. Although production records are poor, the segments of the field in Moore and Sarnia Townships contributed marginally to the cumulative production of the field although a very large number of wells were drilled in that part of the field.

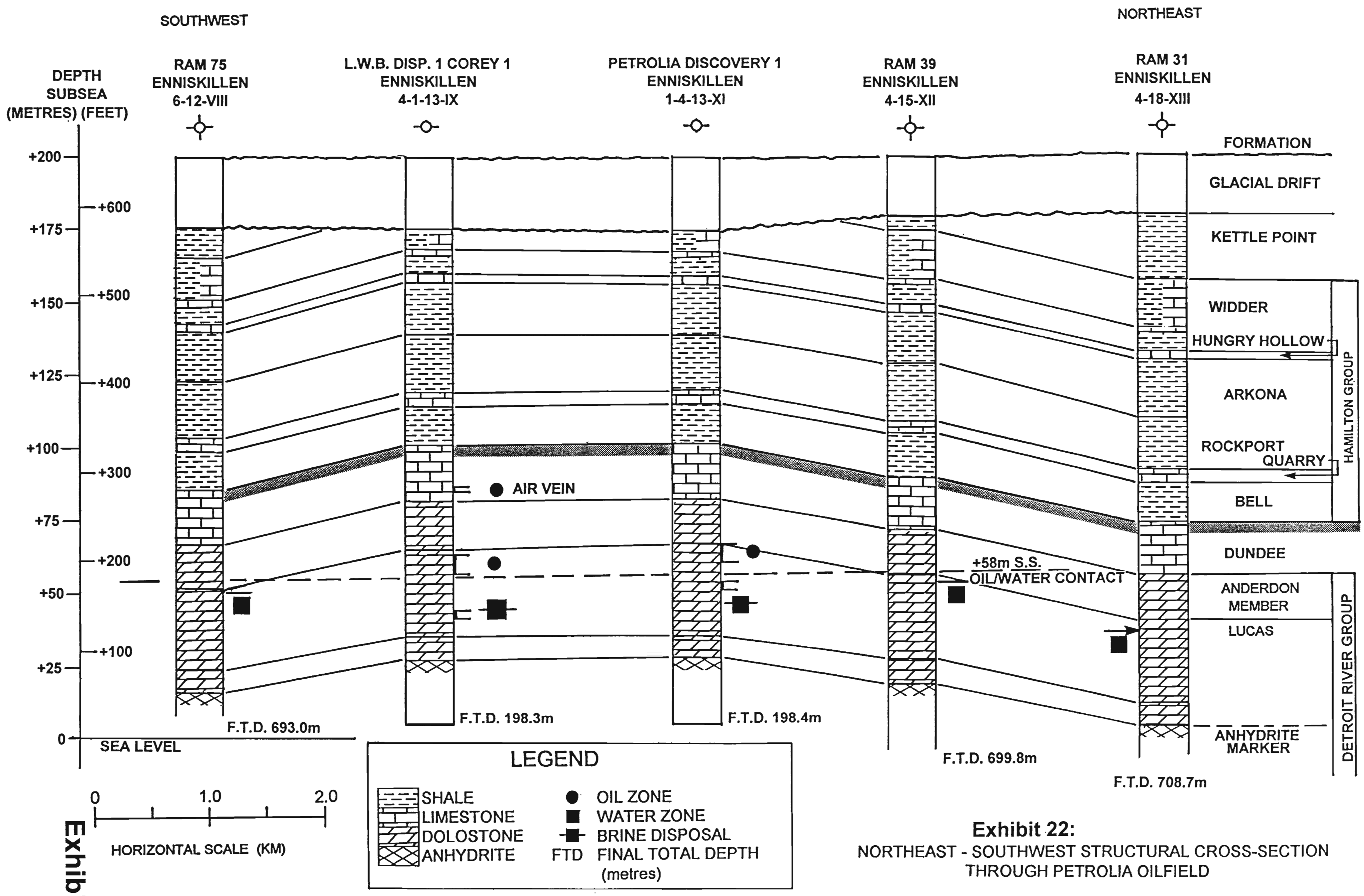


Exhibit 22:
NORTHEAST - SOUTHWEST STRUCTURAL CROSS-SECTION THROUGH PETROLIA OILFIELD

Exhibit 22

Geology

As shown on Exhibit 21, the Petrolia Field is located on a broad anticlinal structure which has its highest point within the Town of Petrolia. Differential solution of the underlying salt beds in the Silurian Salina Formation has created the hydrocarbon trap in the Devonian carbonates. The faulting component which is essential for the formation of the trap in the Oil Springs Field is not present in Petrolia. Even though 7,000 wells had been drilled in this field between 1866 and 1898 (Ingall 1898), there was not much geological data on the field when Bailey & Cochrane (1985) prepared their report on the Devonian fields in Ontario. However, the installation of brine disposal wells in 1988 has provided some good quality information about the reservoir.

A northeast southwest structural cross-section has been drawn at right angles to the anticline as shown on Exhibit 21. The cross-section (Exhibit 22) shows that the structure is a simple anticline and the Kettle Point Formation has been removed from the crest of the structure by erosion. The primary reservoir lies within the Lucas Formation of the Detroit River Group and is controlled by depositional facies. The summary of log data shows and lithology (Exhibit 23) for the Petrolia Discovery 1 Enniskillen 1-4-13-XI well shows the distribution of porosity in more detail.

The Dundee Formation is a light brown and grey fossiliferous micritic limestone with oil fluorescence and staining but with no effective primary porosity. Shows of oil and water are usually related to the fractures. The contact between the limestones of the Dundee Formation and the dolomite of the Lucas Formation is sharp at 121.5m (399'). The upper part of the Lucas Formation is limy dolomite which could be classified as the Anderdon member as defined by Uyeno et al (1982). Although it has oil staining and fluorescent, it is generally impermeable. One thin lens in this unit was called the 'air vein' by the drillers. Initially it flowed oil at good rates but now has been depleted throughout the field and occasionally is a source of water.

The main oil reservoir in the field lies in the interval 138-144.3m (453-473 feet) within a bed of dark brown sucrosic dolomite. This bed is more or less continuous throughout the field but variations in the quality of porosity have a strong influence on the productivity of the wells.

Below 153m (502'), the Lucas Formation is an evaporitic unit with interbedded dolomites and anhydrites. A hard ground is interpreted to lie at 153m, and below it is a zone of high porosity and permeability which has been created or at least enhanced by dissolution of carbonates and evaporates during subaerial exposure in a fresh water environment. This interval lying between 148 and 163 metres (486-535 feet) is presently being used by the Petrolia oil producers for the disposal of oilfield brine. A thick anhydrite bed at 177m (581') provides a good marker for correlation within the Lucas Formation throughout Lambton County.

As shown on Exhibit 22, the oil-water contact in the Petrolia Field lies at +58m (+190') above sea level. The main reservoir is confined to the bedded unit within the Lucas Formation although oil was produced from fractures in the Dundee Formation, in the upper part of the Lucas Formation, and occasionally in the Rockport Quarry Formation when the field was first discovered.

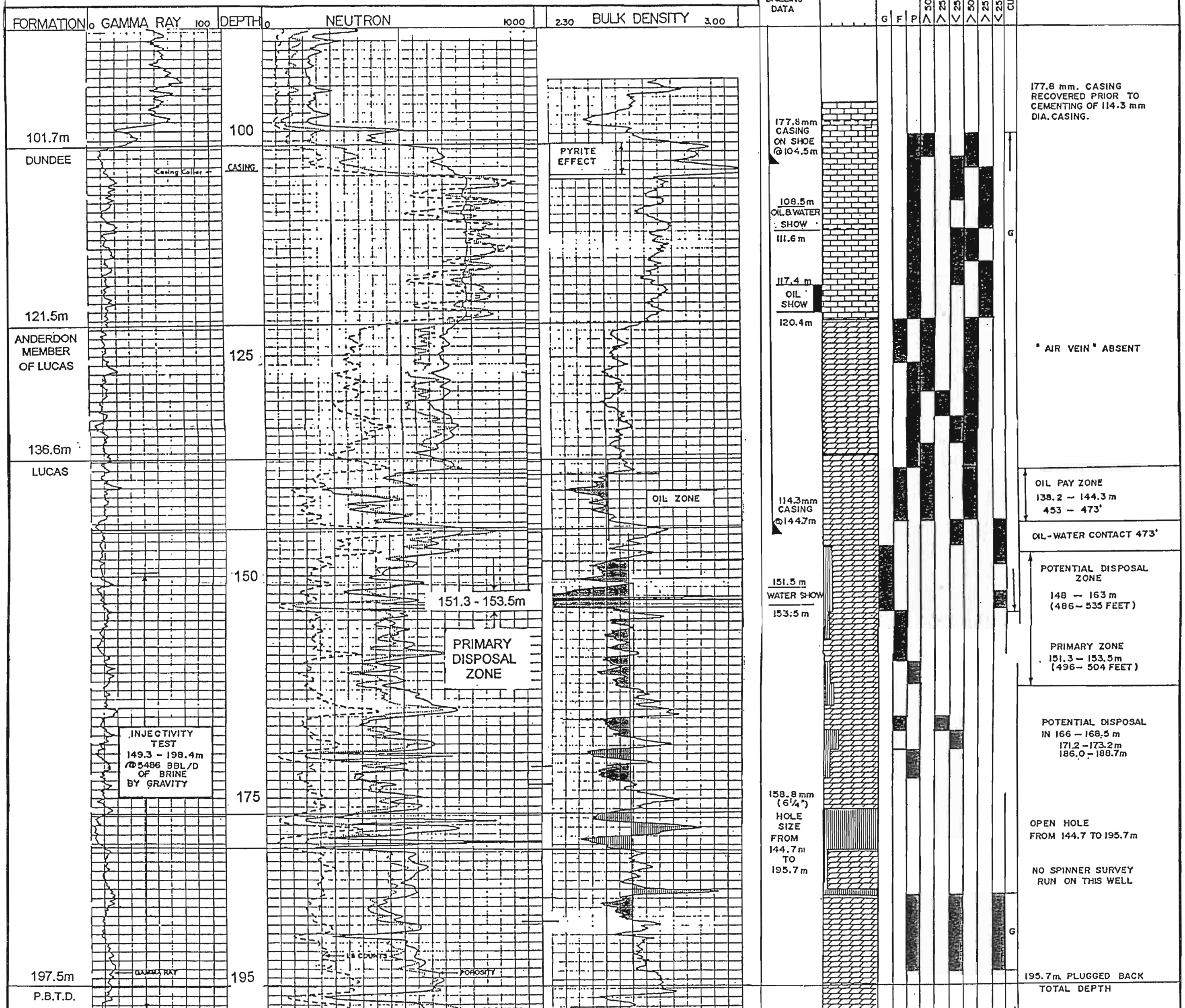
SUMMARY OF LOG DATA, SHOWS AND LITHOLOGY

WELL NAME: PETROLIA DISCOVERY I TRACT; I-4 LOT; 13 CON; XI TWP; ENNISKILLEN COUNTY; LAMBTON

OPERATOR: PETROLIA DISCOVERY FOUNDATION INC. LOCATION; 428.3 m S, 74.4 m W, GRD; 205.9M RFE; 206.7 M DATE DRILLED; AUGUST 17-SEPTEMBER 1, 1989.

CONTRACTOR; KEN GIRARD DRILLING RIG TYPE; CABLE TOOL DRILLER F.T.D. 198.4 m

LOGGING CO; COMPUTALOG GEARHART LTD. LOGGER F.T.D. 198.4 m



198.4m FINAL TOTAL DEPTH

LEGEND

LIMESTONE DOLOMITE POROSITY GYPSUM / ANHYDRITE

BY: CAIRNLINS PETROLEUM SERVICES OCTOBER 30, 1989

Exhibit 23

89-343-002 DRAFTING: M. VAN DEN HOGEN

Production History

Because the Petrolia Field was developed early in the history of the oil industry, production records prior to the year 1917 do not exist. The best estimate of the cumulative production was made by R.B. Harkness (1928) after much detailed research on the subject. Based on this work, the cumulative oil production to the end of 1916 was 2.31 million m^3 (14.5 million barrels).

Appendix B is a summary of the annual oil production from Petrolia Field for the years 1917 to 1996. At the end of 1996, the cumulative oil production was 2.84 million m^3 (17.9 million barrels). In 1996, there were about 225 wells still in operation and the annual oil production was 7,380 m^3 (46,400 bbls).

Exhibit 24 is a plot of the annual oil production and active wells for the period 1917 to 1996, and Exhibit 25 is a plot of the annual oil production per active well for the same period. Between 1917 and 1974, there was a slow decline in the annual oil production at an exponential decline rate of 2.88%/year (Bailey and Cochrane, 1985) and a reduction in the number of active wells from 1,680 to 68 wells. Between 1954 and 1970, waterflood projects were conducted in parts of the field but they had no significant effect on the annual production.

The Petrolia Field was revived in 1975 by an increase in the crude oil prices. As shown on Exhibit 26, the price before 1974 was less than $3.00/bbls and the Petrolia oil producers were struggling for survival. The heady crude prices in 1980 and government incentive programs increased the number of active wells from 69 in 1975 to 202 in 1986. The annual production rose from 2,760 to 7,500m^3 (17,360 to 47,200 bbls) in the same time period and has levelled off at about 7,400m^3 (46,540 bbls).

Crude oil from Petrolia Field has a gravity of 34° API and contains 0.82% sulphur. The water cut varies from property to property but ranges from 60 to 95% of the total fluid production. The average well produces about 33m^3 (208 bbls) of oil per year; that is equivalent to 0.1m^3 (0.6 bbls) of oil per day. The oil is separated from the oil by gravity and is then trucked a distance of 20 km to Marcus Terminals Inc. in Sarnia, Ontario and eventually delivered to the Imperial Oil Refinery.

The produced water is brackish (specific gravity 1.05) and sulphurous. Prior to 1990, the water was dumped into the local streams after the oil was recovered. In 1990, to comply with environmental regulations, the producers installed disposal wells to handle the volume of water. Produced water presently flows by gravity into the water-filled porous zone in the Lucas Formation at a depth of about 152m (500 feet).

Bailey and Cochrane (1985) estimated the oil-in-place in the eastern segment of Petrolia Field at 17.8 million m^3 (112 million barrels) from a volumetric calculation based on the available reservoir parameters. To the end of 1996, the cumulative oil production is 2.84 million m^3 (17.9 million barrels) or 16% of the oil-in-place.

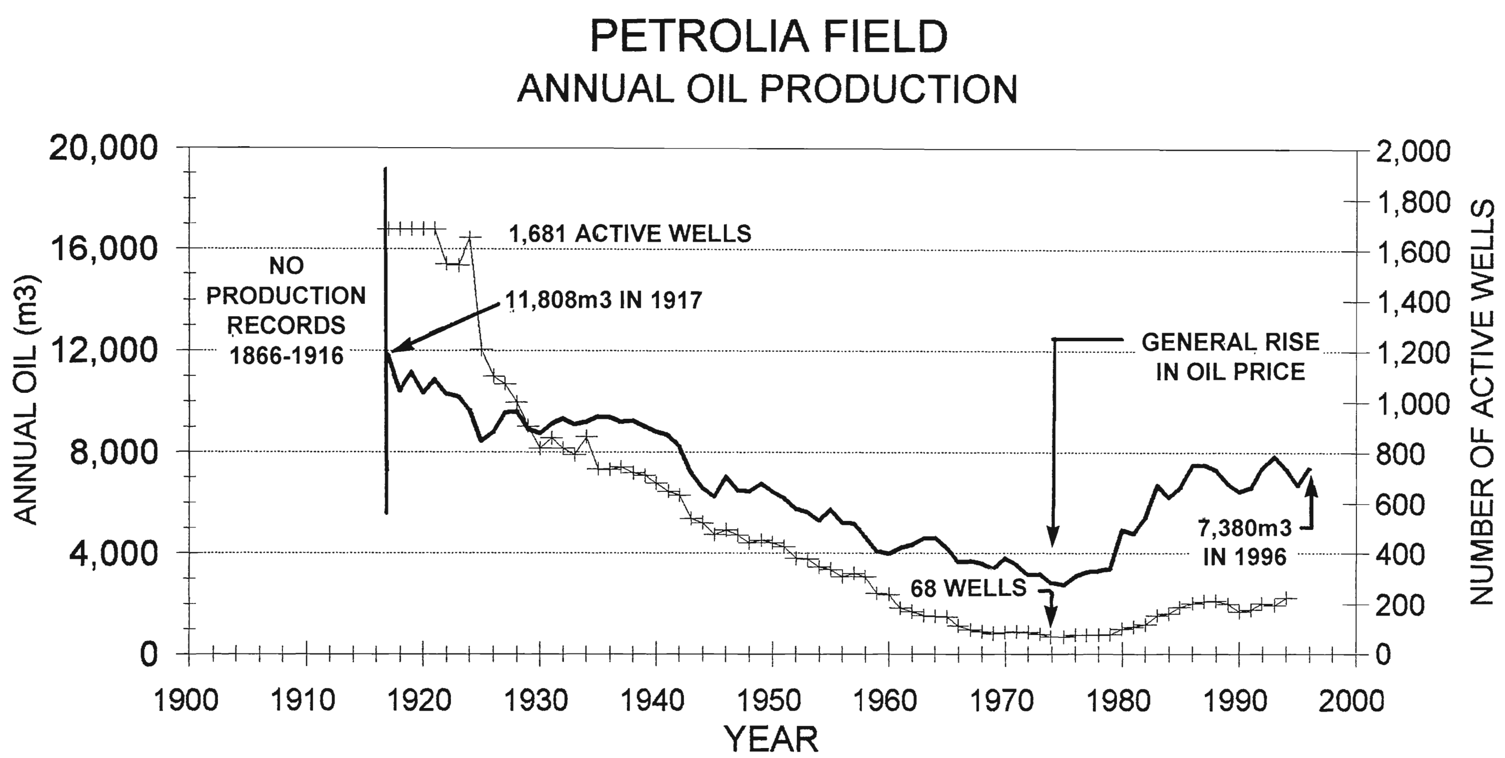


EXHIBIT 24

AAPG FIELD TRIP GUIDE
PLOT OF ANNUAL OIL PRODUCTION AND ACTIVE WELLS FOR YEARS 1917 TO 1996 PETROLIA OILFIELD COUNTY: LAMBTON TOWNSHIP: ENNISKILLEN BY: R.O.C./D.G.K. DATE: AUGUST 18, 2000 CAIRNLINS RESOURCES LIMITED

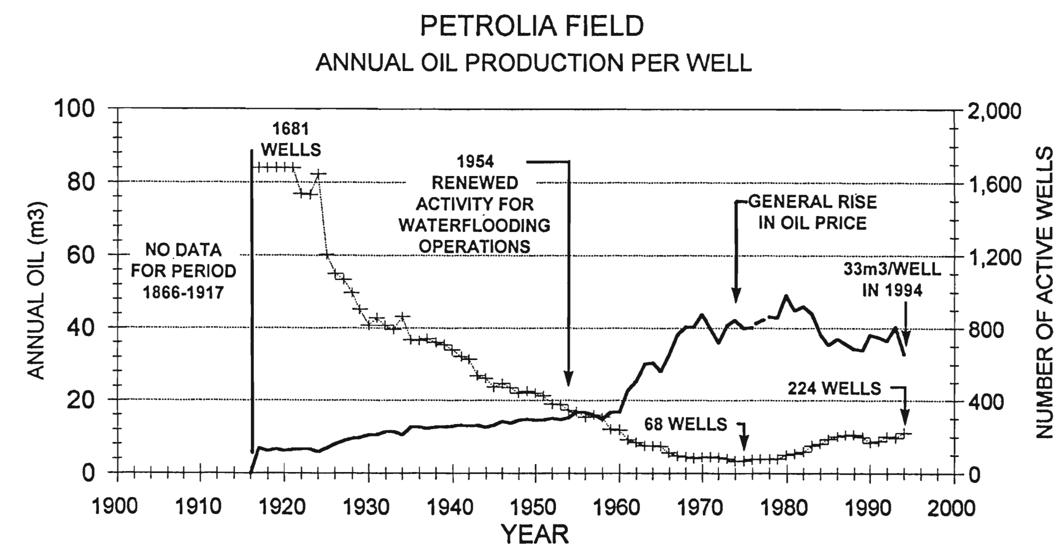


EXHIBIT 25

AAPG FIELD TRIP GUIDE

PLOT OF ANNUAL OIL PRODUCTION PER WELL
FOR YEARS 1917 TO 1996
PETROLIA OILFIELD
COUNTY: LAMBTON TOWNSHIP: ENNISKILLEN
BY: R.O.C./D.G.K. DATE: AUGUST 18, 2000
CAIRNLINS RESOURCES LIMITED

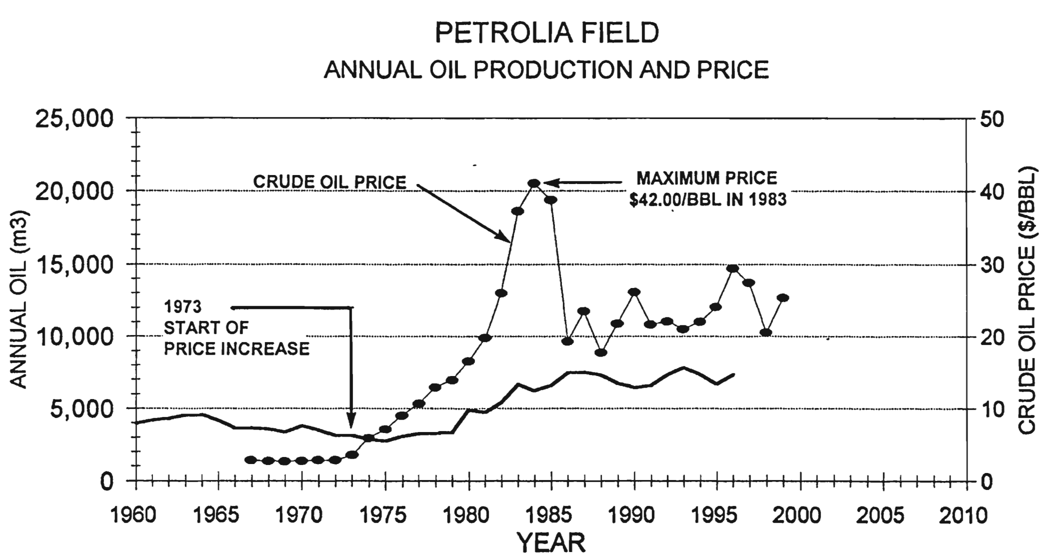


EXHIBIT 26

AAPG FIELD TRIP GUIDE

PLOT OF ANNUAL OIL PRODUCTION AND PRICE
FOR YEARS 1967 TO 1999
PETROLIA OILFIELD
COUNTY: LAMBTON TOWNSHIP: ENNISKILLEN
BY: R.O.C./D.G.K. DATE: AUGUST 18, 2000
CAIRNLINS RESOURCES LIMITED

TECHNOLOGY

There are tools for every trade. The extraction of crude oil started with shovels, and more and more complex tools were developed to make the job more efficient and to meet new challenges as wells were drilled deeper and the volumes of oil increased. Many of the early tools evolved with the industry, some were replaced by new technology and some have persisted to this very day virtually unmodified. Because the Oil Springs Field was located in an unhabited swamp, the earliest oil producers had to improvise with the materials at hand. After 1859, when oil had been found by the Americans in Pennsylvania, technology was routinely traded across the border. Books have already been written and will continue to appear on the technology of well drilling. This chapter of the field trip concentrates on some of the unique techniques developed in the oilfields of Lambton County.

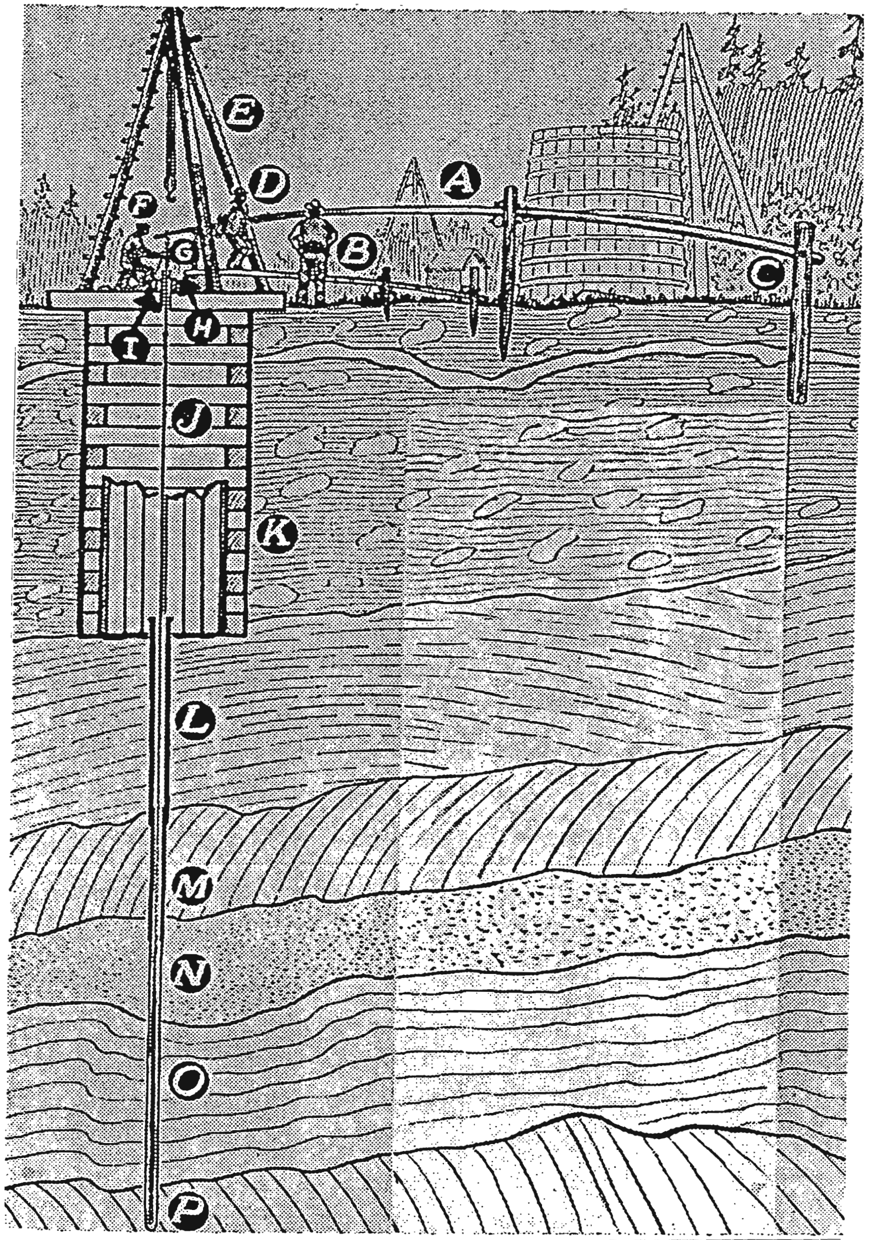
Cribbed Wells

In 1858, James Miller Williams found that free oil would seep into a pit 14 feet below the gum beds at Oil Springs. The unconsolidated clay of the glacial drift would readily slough into the excavation and so the pits were lined with squared wooden logs. Cribbed wells were easy to construct; wood was readily available and a tripod could be built over the well so that the clay could be hauled to surface. When the oil seeped into the hole, it was removed into wooden barrels by pumps operated by hand or by spring pole. The wells were four to six feet square and were dug to the top of the bedrock at depths of 45 to 70 feet. Between 1858 and 1861, at least 350 cribbed wells had been installed in the Oil Springs Field. Cribbed wells were also dangerous; cave-ins, floods and suffocating fumes were the common hazards. One of the casualties was Hugh Shaw, the driller of the first gusher in Oil Springs.

Spring Pole Drill

Shovels were of no use at the bedrock surface. To drill through the bedrock, the spring-pole rig was used. Exhibit 27 is a schematic diagram of a spring pole drilling operation from Oil/Gas World in 1958. The materials were readily available and the technique was easy to learn. After the well was cribbed to the bedrock surface, the rock was crushed as the bit was lifted and dropped in the hole. A bailer was periodically run into the well to remove the cuttings. At least 32 wells had been drilled into the rock before Hugh Shaw used his spring pole to drill the deepest well in Oil Springs and struck the first gusher in the field at 203 feet from surface. The percussion method of drilling is still used by modern cable tool drillers.

Exhibit 27: The Spring Pole Drilling Rig (After H. MacLean's "Oil/Gas World", 1958)



(A) The "spring-pole" in early days, was made of a sapling, 40 to 50 feet long, fixed at an angle of about thirty degrees. The springiness of the pole provided the means of alternately raising and dropping the drilling equipment as the pole was sprung and released. The top end overhung the drill hole.

(B) The spring-board was attached to the spring-pole toward the top end and sprung and released the spring-pole as the operator walked backward and forward.

(C) The butt end of the spring-pole was anchored to a convenient tree or post.

(D) The spring-board operator.

(E) Tripod for hoisting and lowering drilling equipment.

(F) The driller who directs the drill.

(G) Universal joint or swivel which enables the driller to change the direction of the drill.

(H) Guide timber through which the rope passes prevents swaying.

(I) Foundation for surface equipment.

(J) Drill rope.

(K) Pit dug down to solid rock is cribbed to prevent cavein.

(L) Iron pipe, three-inch diameter, driven down fifteen feet.

(M) Liner Pipe.

(N) Unlined boring.

(O) Three-hundred pound drilling weight.

(P) Drill bit attached to drilling weight.

Canadian Drilling Rig

To drill larger diameter holes deeper and faster and to handle the casings necessary for the control of water zones and sloughing shales, bigger rigs run by steam power evolved. Brantly (1971) credits the development of the Canadian pole tool drilling rig in 1866 to W.H. McGarvey (Exhibit 3), an entrepreneur who became the first Mayor of Petrolia and subsequently became the most famous of the foreign drillers for his exploits in central Europe. Percussion was the drilling method but this rig used spliced wooden poles about 36 feet long to conduct motion to the drilling bit. Exhibit 28 is a photograph of the interior of a rig. As shown on Exhibit 29, Canadian drilling rigs were a common site in the development of the Petrolia Field prior to 1900.

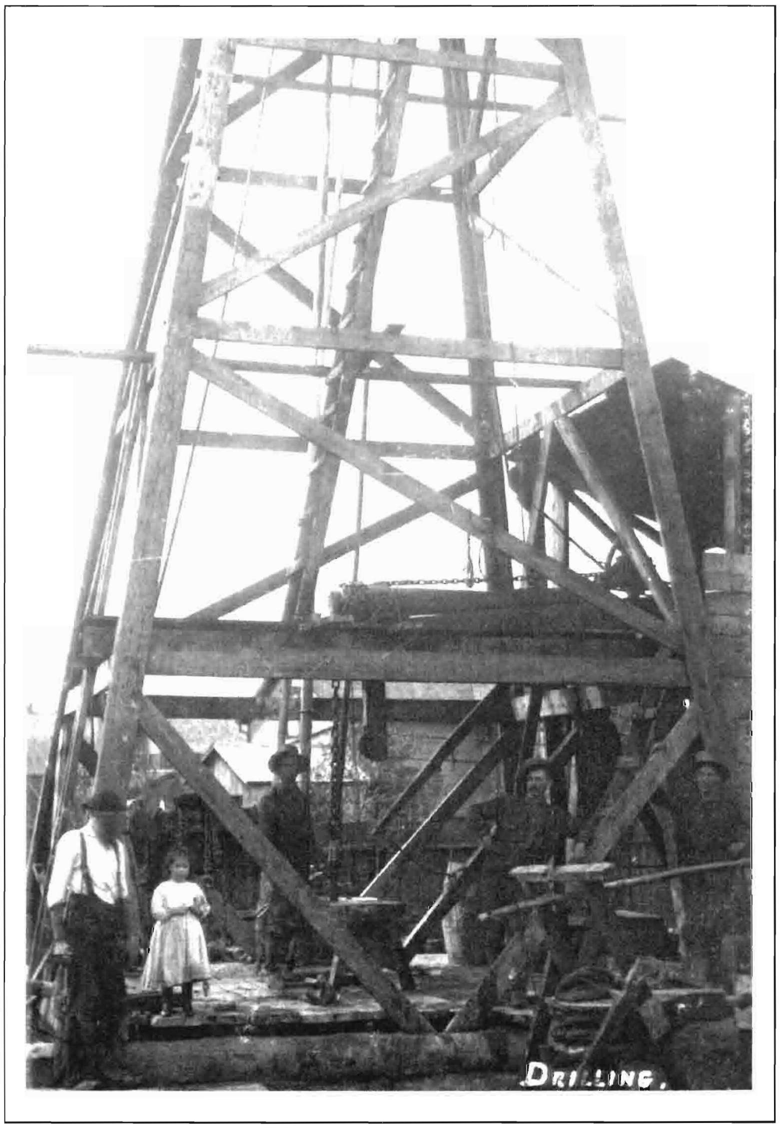


EXHIBIT 28: The Interior of A Canadian Drilling Rig.

Exhibit 29: Canadian Drilling Rigs in Petrolia Oilfield

Well Completion Techniques

Above the bedrock in the Petrolia and Oil Springs area is a veneer of glacial drift ranging in thickness from 45 to 110 feet thick. The drift consists of a soft clay with lenses of sand which contain fresh water. During the initial development of the fields, cribbed holes were dug to the bedrock before the drilling rig moved onto the well. At a later time, the surface material was removed by augers, and casing was installed at the bedrock to prevent sloughing of the clay and to shut off the surface water. Initially, the casing was made of wood. Eight bevelled staves of wood about six feet (2m) in length were drawn into an octagonal shape and held together with metal straps. Alternative staves were made slightly longer so that they would fit into the next section of casing.

The drilling process was described in some detail by Martin Woodward to the Royal Commission in 1890:

> "Now they use a 4 1/2 inch bit and usually drill a hole in about four or five days, at a cost of about $160 a well, the owner furnishing the casing. The driller puts the pump down and tests it for a day. There are men who make a business of putting down wells, and they run night and day. A gang consists of six men, three working in the day and three at night. Pole Tools are now used; they consist of a bit and an iron bar about three and a half inches in diameter, and connected with the beam above by poles. When water is struck now it is shut off with the casing, which is usually at a depth of 270 feet. At 275 feet we get the middle limestone. After putting in the casing they drill in a dry hole, where they can strike a heavier blow than is possible if the well was filled with water. They run with perhaps 30 or 40 feet of water, whatever is required. After the first 275 feet the casing shuts off the water, and in practice that is all the casing put down. The pump is put inside the casing; it is generally from 1 1/4 to 1 1/2 inch in diameter, and is the ordinary lift pump."

The oil zone in Petrolia Field lies between 138 and 144m (453-473 feet). The intermediate casing size was generally 4 5/8" I.D. and 5" O.D. It was not cemented in place but was driven into the rock when necessary to shut off the water flow. The intermediate casing was set in the Middle Lime (a.k.a. Rockport Quarry) Formation. Occasionally in later years, the underlying Bell Shale would start to slough into the well, and a four-inch liner would be run to the top of the Dundee Formation.

The Jerker Line System

When the oil wells no longer had the energy to flow on their own, some means was needed to extract oil from the wells. Steam engines were large, expensive to operate and required constant maintenance. J.H. Fairbank developed the jerker line system in 1863 to solve the problem. In his testimony to the Royal Commission in 1890, he says:

> "The jerker system was adopted about twenty-five years ago. I remember the time the first jerker was put into operation. It was not patented, and I do not know that it could be. I had a well too hard to work by man power; I hadn't an engine, but there was engine power within reach and I applied the present jerker system. I think that was in 1863. The majority of wells were then worked by man power with a spring pole. The jerker is universal now, and it would be impossible to work upon the old system. It was first used with a horizontal walking beam, that was afterwards improved by using the wheel, with which there is a great deal less friction. I think Mr. Reynolds was the first who introduced the wheel; he is still here. With one engine now they work from half a dozen to eighty or ninety wells, with one boiler but often two engines."

Exhibit 30 is a photograph of a wooden jerker system.

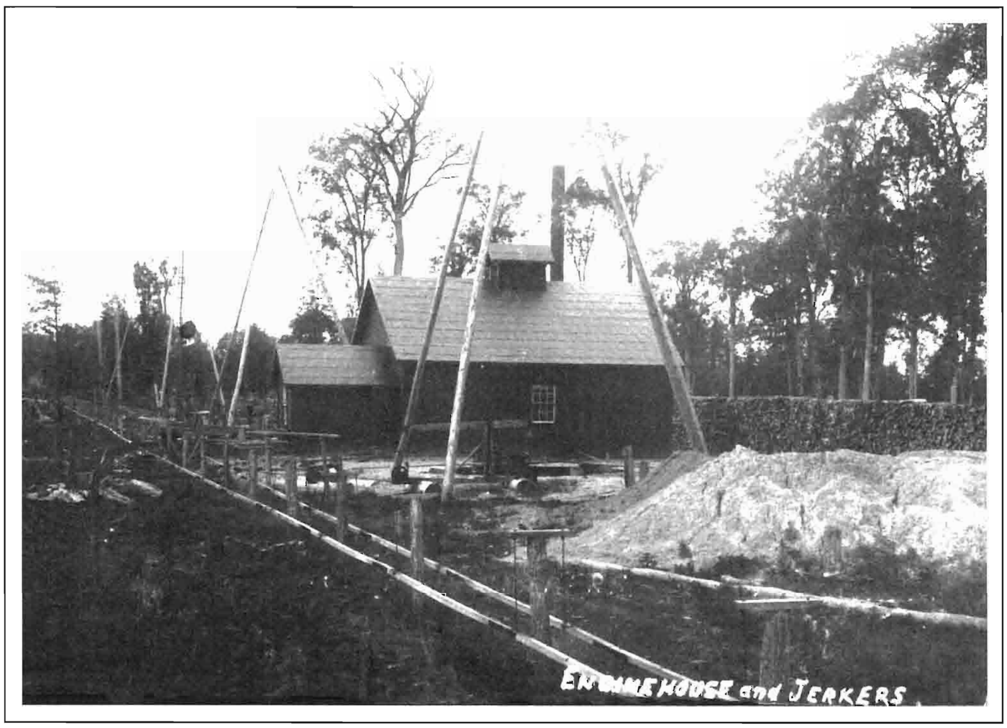


EXHIBIT 30: A Jerker Line Pumping System and Engine House Circa 1900.

As shown on the schematic diagram (Exhibit 31), the jerker line system of well pumping has the following components:

1) a central power source to drive the system;
2) a jerker line of wood, cable or metal rods suspended on wooden posts to conduct power;
3) field wheels to transfer the power in different directions;
4) a pump block at the wellhead to convert horizontal power to vertical lift; and
5) a subsurface pump in the well to recover the oil.

Not only does the method use materials which were readily available, but also because the system is symmetrical, it can be balanced, and a small steam engine can run many wells.

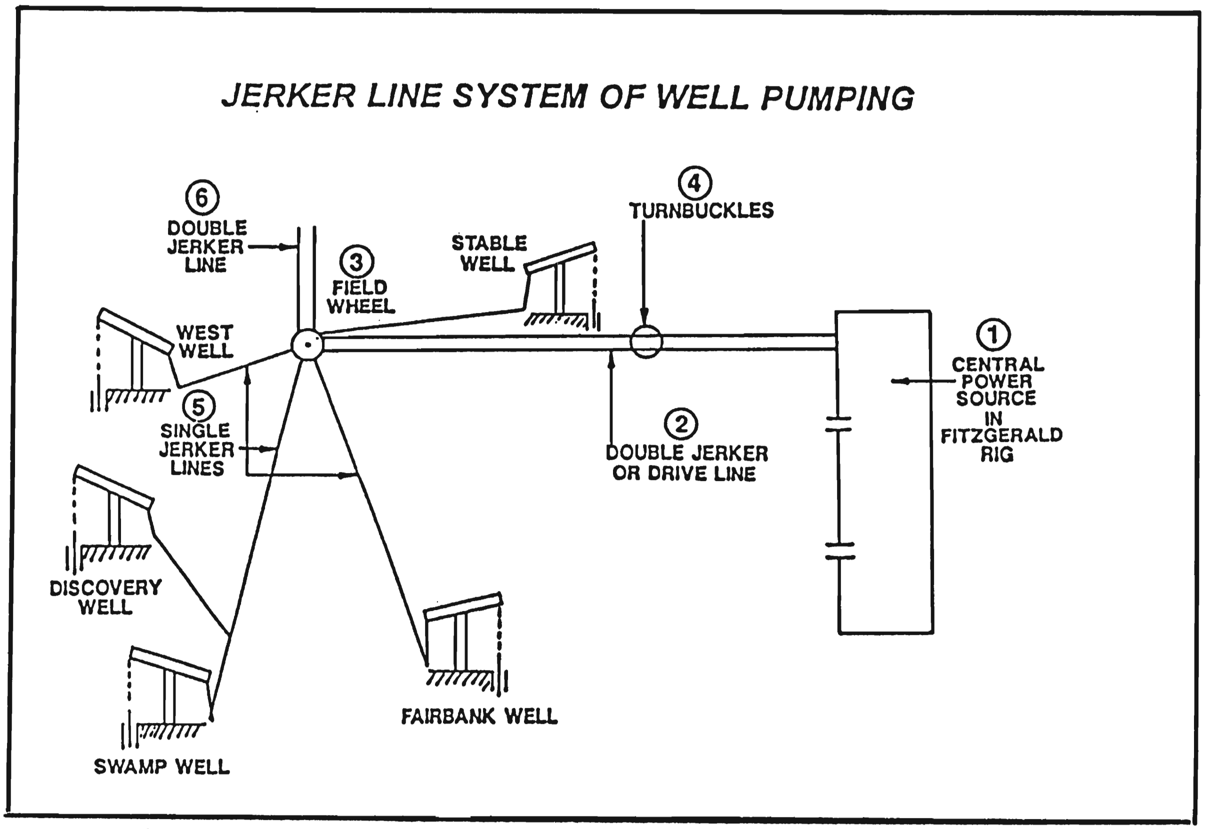


Exhibit 31: Layout of a Jerker Line System for Well Pumping (Courtesy of Petrolia Discovery)

The central power source was called a pumping rig. In the words of Martin Woodward to the Royal Commission in 1890,

> "I have known as many as ninety wells to be pumped by the one engine. In most cases they use a bricked-in boiler. The drive wheel is connected with a wheel which has a pitman on each side that worked a horizontal wheel backwards and forwards. The jerker rods are attached on opposite side of the wheel and connect with the pump over the hole. Iron rods are used in the pump, their weight being sufficient to make it drop".

Power from a single engine is transmitted through a series of large bull wheels to convert its rotational speed to a slow powerful back-and-forth stroke. Pumping rigs were once common throughout Petrolia and Oil Springs but the numbers are declining rapidly. At least eight are still in operation in Oil Springs Field, one of which will be visited in this field trip. The largest pumping rig of its type was the Fitzgerald rig built in 1903 by F.A. Fitzgerald who became the first president of Imperial Oil; it was designed to service 500 wells. The rig (Exhibit 32) is the main attraction at the Petrolia Discovery and still operates every day of the year.

The stroke of the rig is transmitted to the wells by wooden jerker rods suspended by metal hangers from wooden posts (Exhibit 30). Because the line contracts and expands with the weather, turnbuckles placed in the line can be turned to adjust the length of the jerker line within certain limits. A double line or drive line leaves the pumping rig to connect with a field wheel.

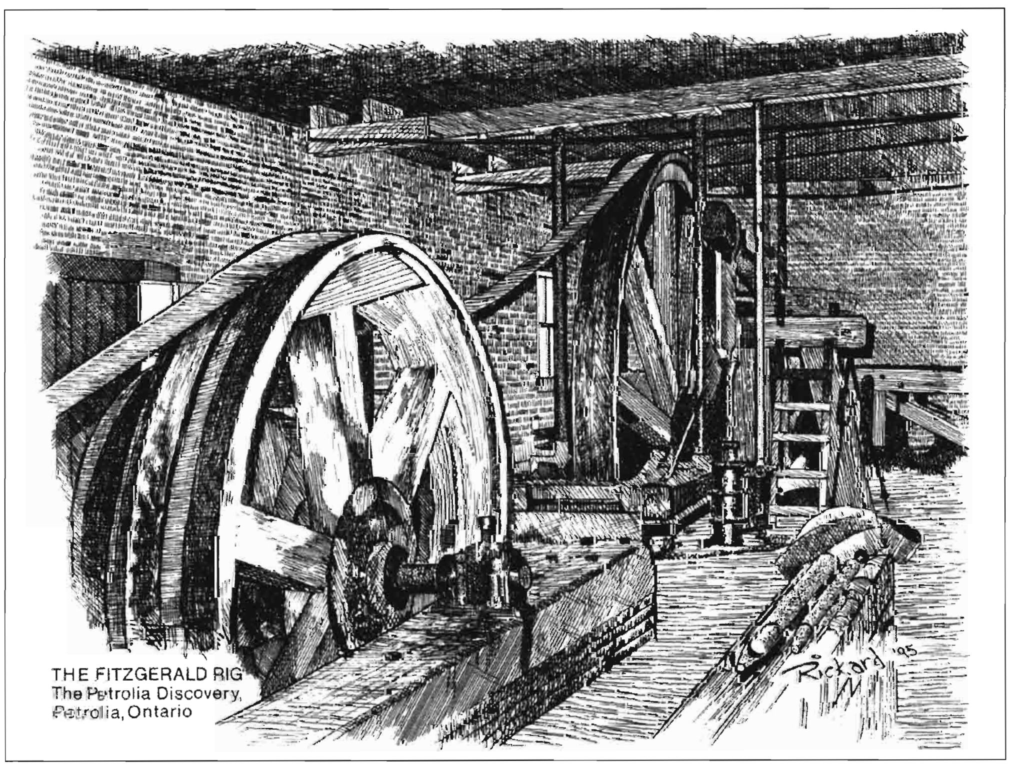


EXHIBIT 32: The Interior of the Fitzgerald Pumping Rig at Petrolia Discovery.

A jerker line can transfer power from a central source in straight-line segments throughout an oilfield. A bend in the jerker line not only results in a loss of power but also becomes a point of weakness where the line will ultimately break. As a result, field wheels are built at strategic locations throughout the field to change the direction of the main double line and to provide power to single lines which are connected to each pumping well. As shown on the diagram of a field wheel at Petrolia Discovery (Exhibit 33), the direction of the power in the double line generated by the Fitzgerald rig on the right is being changed from east-west (1) to north-south (2) at this field wheel. Also single-line connections are made with the Stable, West, Swamp and Fairbank wells (3). Field wheels provide a convenient source of power for other applications. At the bottom right of the diagram lies a transfer pump (4) which can move oil by pipeline from the holding tank at the separator behind you to the shipping tank at the north end of the property. The pump is started by connecting a metal rod to the field wheel.

Power to single wells is conducted from the field wheel to the pump block at the well by a single line (Exhibit 34). A pump block changes the direction of power from horizontal to vertical where it can be applied to run a subsurface pump in an oilwell. The wooden parts of the pump block, shown on Exhibit 34, consists of:

1) the Sill, a heavy horizontal timber which forms the foundation of the pump block;
2) the Samson Post, a heavy vertical timber which supports the walking beam; and
3) the Walking Beam, a heavy horizontal beam which rocks on a bushing called a Saddle mounted on the Samson post and imparts an up-and-down motion to the rods of a subsurface pump.

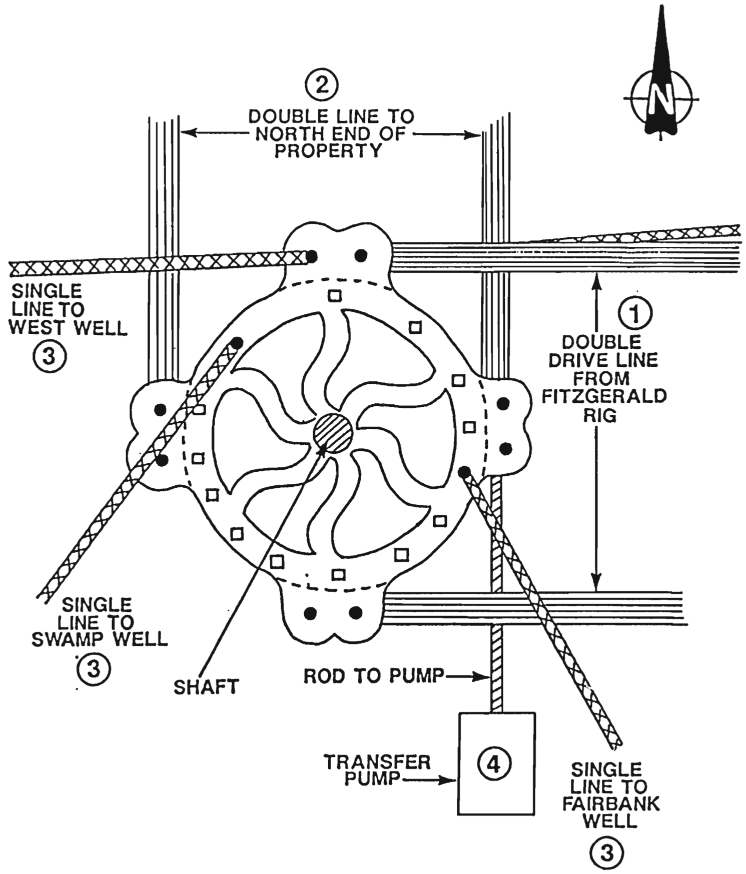
All of these components are constructed of hardwood, usually white oak.

The metal parts of the pump block are:

4) the Triangle, which operates from a bushing on a wooden support to convert horizontal power to vertical power;
5) the Chain or metal rod, which connects the triangle to the bridle on the walking beam, and the bridle to the polish rod of the subsurface pump;
6) the Bushing or Saddle, on the walking beam; and
7) the Bridle or Stirrup, which connects the walking beam to the chain and rods of the subsurface pump, and the pump block to the chain or rod on the triangle.

In Oil Springs, instead of a bridle, a dog ear is used at the front of the pump block. A dog ear is a flat piece of steel about one foot in length with about 2 inches of steel at right angles on one end. A notch is cut in the short end to hold the chain and the long end is bolted to the top of the pumpblock. The metal is usually cast iron although bronze is used in the bushings. The frequency of the pump is controlled by the movement of the jerker line, but the length of the pump stroke can be adjusted by the position of the bridle and chain on the walking beam. A chain on the walking beam of the pump jack is connected to the polish rod of the subsurface pump. A subsurface pump is installed inside a string of tubing to lift the oil and water mixture as it seeps into the wellbore. Exhibit 35 is a photograph of a pumpblock in Oil Springs Field.

OVERHEAD VIEW OF FIELD WHEEL



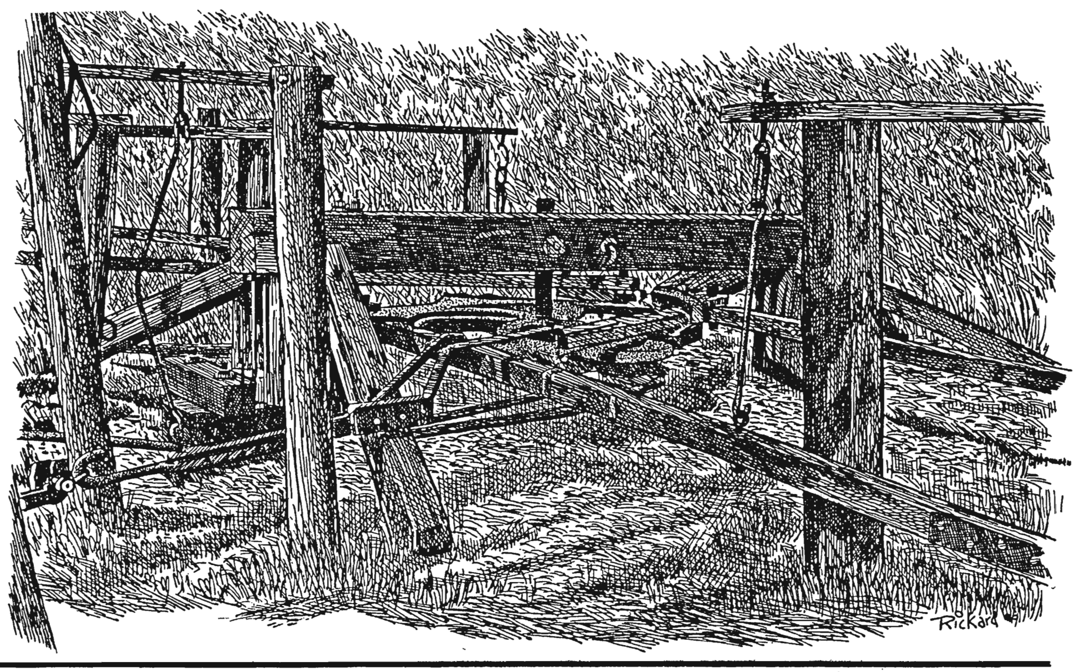


Exhibit 33: Diagram of Field Wheel at Petrolia Discovery (Courtesy of Petrolia Discovery)

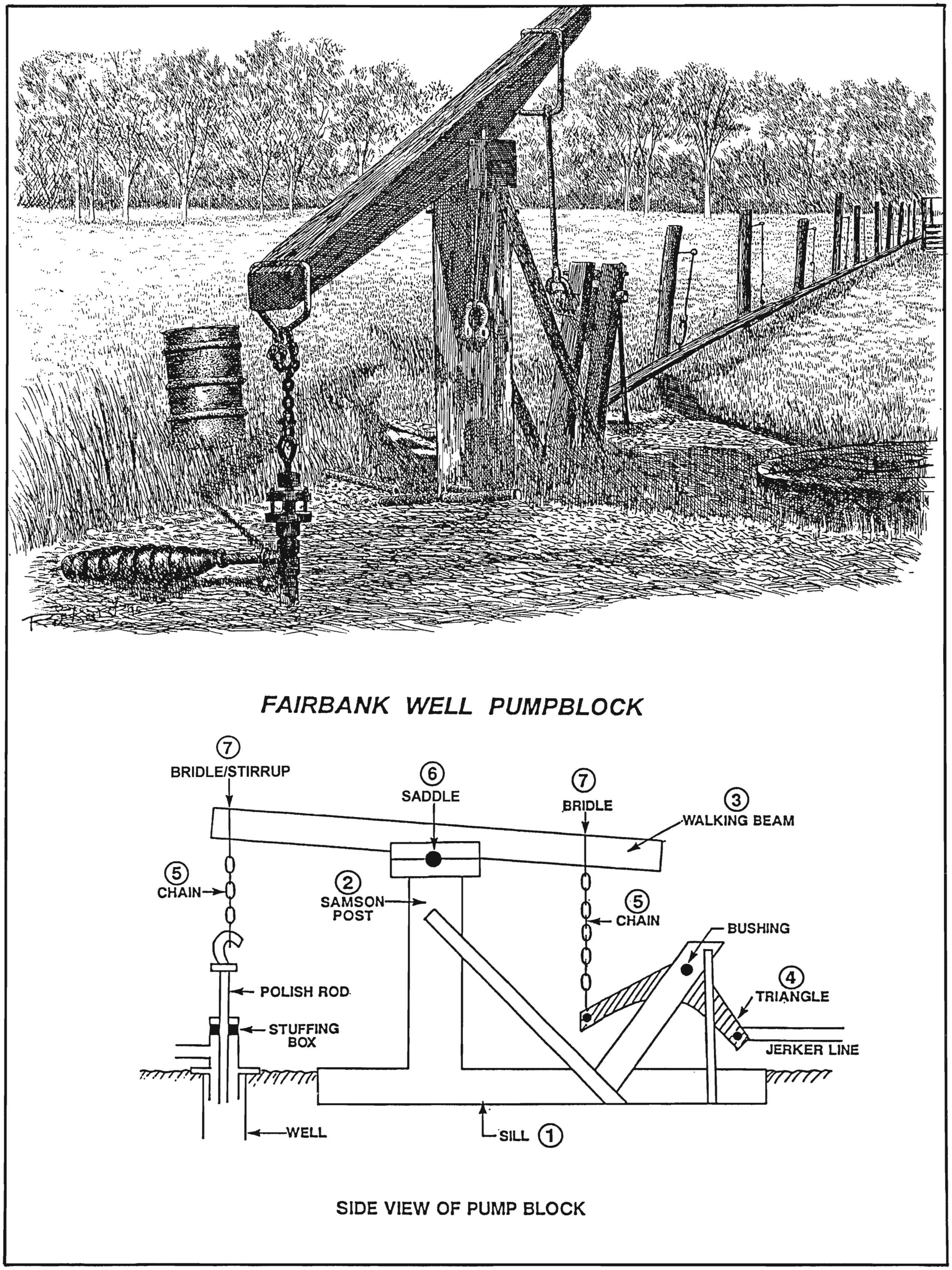


Exhibit 34: Diagram of a Pump Block
(Courtesy of Petrolia Discovery)

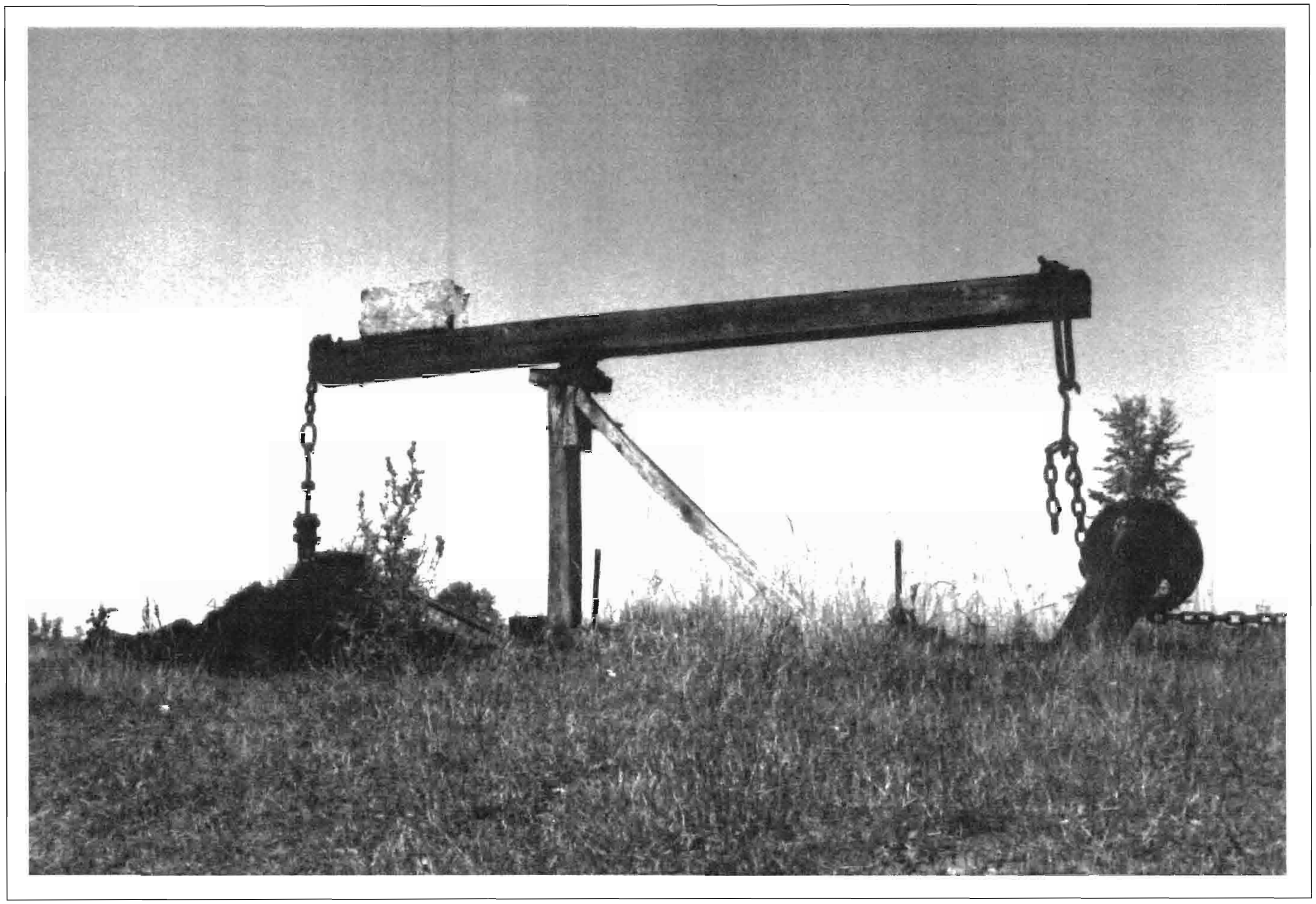


EXHIBIT 35: A pump block in the Oil Springs Field.

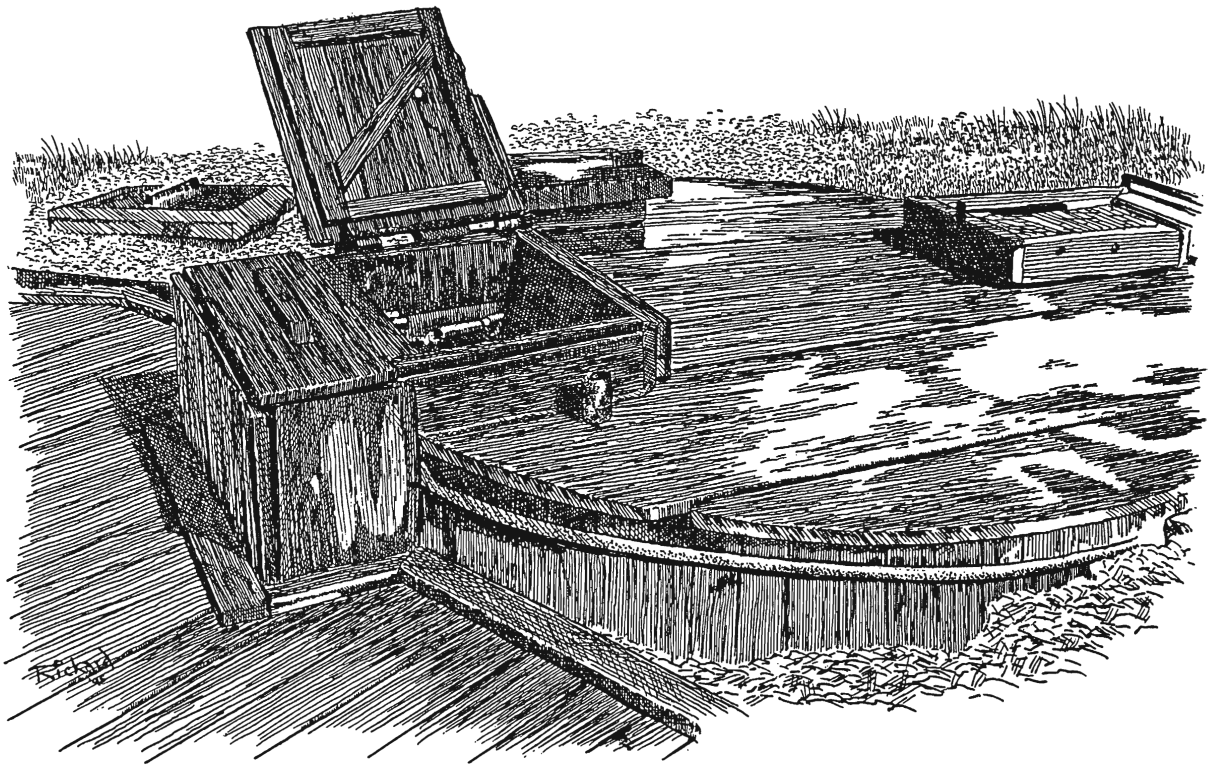


Exhibit 36: An Underground Oil Storage Tank (Courtesy of Petrolia Discovery)

Underground Oil Storage Tanks

The storage of oil is difficult because it is flammable. After some disastrous experiences, the early men finally resorted to underground storage in wooden tanks (Exhibit 36). The following quotation is an excerpt from the testimony of John D. Noble to the Royal Commission on the Mineral Resources of Ontario in 1890.

> "When I got here they had just struck oil at Petrolia; I fancied the place and bought some land. Just at that time the King flowing well was struck, and I bought some property close to it, and put down a well which pumped 260 barrels a day. At that time oil was worth $1.25 a barrel. I sold as quickly as I could, but I had to erect a number of large tanks on the ground to store in till I could sell, so that my land got pretty well covered with large wooden tanks.
>
> A fire broke out on the adjoining property, extended to mine and burned all my tanks and some 7,500 barrels of oil. The fire extended till it covered some twelve acres. It lasted two weeks, the flames shooting up 100 feet. That was in 1867.
>
> I thought over the matter how a recurrence of such a fire could be avoided, and I devised the tanking system. I considered the matter over with some friends, Mr. Jenkins in particular, and we decided to adopt the present underground system. The clay here is of such a nature that it makes a perfect tank in itself.
>
> We formed the Petrolia Crude Oil Tanking Co., and elected Mr. Jenkins president and I was elected vice-president. The company was incorporated under the Joint Stock Act of Ontario.
>
> On top of the clay there is an alluvial deposit of about 15 or 18 feet. Excavations are made about 60 feet deep and 30 feet in diameter, with a capacity of 8,000 barrels of 35 imperial gallons. When we get down 18 or 20 feet to the clay, a wooden sheathing is put round the tank, clay is pounded down firmly, and the wall is brought up about a foot above the surface. At the top it is sloped off so as to prevent water getting into the tank, and it is perfectly water-tight.
>
> I have held oil in my tanks for ten years without leaking a drop. If the tank were empty the pressure from the outside would be considerable; therefore we always keep them full of water or oil. There is no planking on the bottom; the oil is poured in on the clay, which continues for about 100 feet.
>
> To build an 8,000 barrel tank costs about 25 cents a barrel or $2,000 for each tank, but sometimes we get it for 23 1/2 or 24 1/2 cents a barrel. Refined as well as crude oil can be stored in these tanks."

Exhibit 37: Wooden Oil Tank Wagon

Wooden Oil Tank Wagons

Each oilwell had one or more small tanks ("day tanks") beside the pumpblock to hold the daily crude oil production. This oil had to be moved to a large tank for settling and storage until it could be sold in batches to the refinery. Every day, a tank wagon drawn by a team of horses visited the well to pick up the oil of yesterday.

The wagon (Exhibit 37) consisted of a wooden tank strapped onto a heavy frame with two strong metal chains. The tank was built of wooden slats 11 feet (3.35m) long, 1.75 inches (44mm) thick and 5.5 inches (140mm) wide. The slats were cut on a bevel so that they could be held in place by flat metal straps. When the tank was filled with fluid, the wood swelled to form a perfect seal. Each tank could carry about 10 barrels (1.6m^3) of oil. The registration number and the tank volume were carved into the wood at the back of the tank.

At the back of each wagon was a hand-operated plunger pump. When the team stopped at a day tank, the operator would throw a line into the tank and pump by hand the oil into the tank wagon. A metal pipe with a valve at the bottom of each wagon was used to drain the crude oil by gravity into the central tank.

A full load of oil weighed 2,800 pounds (1,270 kilograms), and with the added weight of the tank, the frame and the operator, the team of horses had to be able to haul about 5,000 pounds along the often muddy paths between the wells.

Day tanks and tank wagons were eventually supplanted by pipelines which transmitted the oil directly from the wellhead to the central tank. Because the oil-water mixture caused corrosion in metal pipelines, tank wagons survived on some oil properties until plastic pipe appeared on the scene.

The technology described is a small sampling of the ingenious methods devised by early oilmen to recover oil. In many cases, equipment became obsolete. The wooden pulling rig (Exhibit 38) has been replaced with portable metal equipment. Transportation and refining of oil are fascinating topics which are not touched upon in this report. However, the story of technology in Lambton County would not be complete without a mention of the foreign drillers. After 1860, the search for crude oil became a global phenomena and the drillers in Petrolia and Oil Springs were experts. Because the size of the fields in Lambton county were limited and the price of crude fell quickly due to Rockefeller's control of American oil industry, they took the opportunity to spread their expertise to all parts of the world.

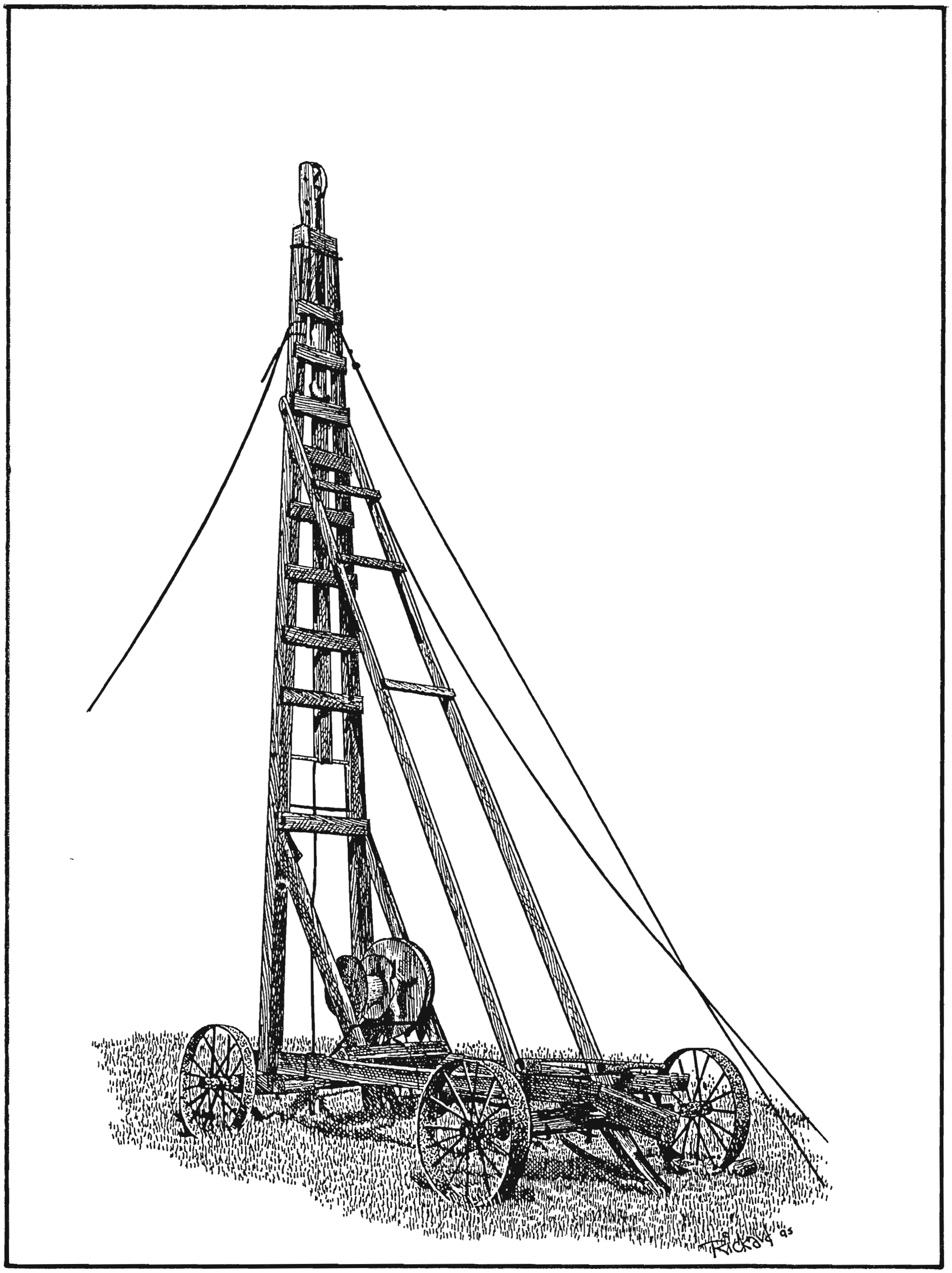
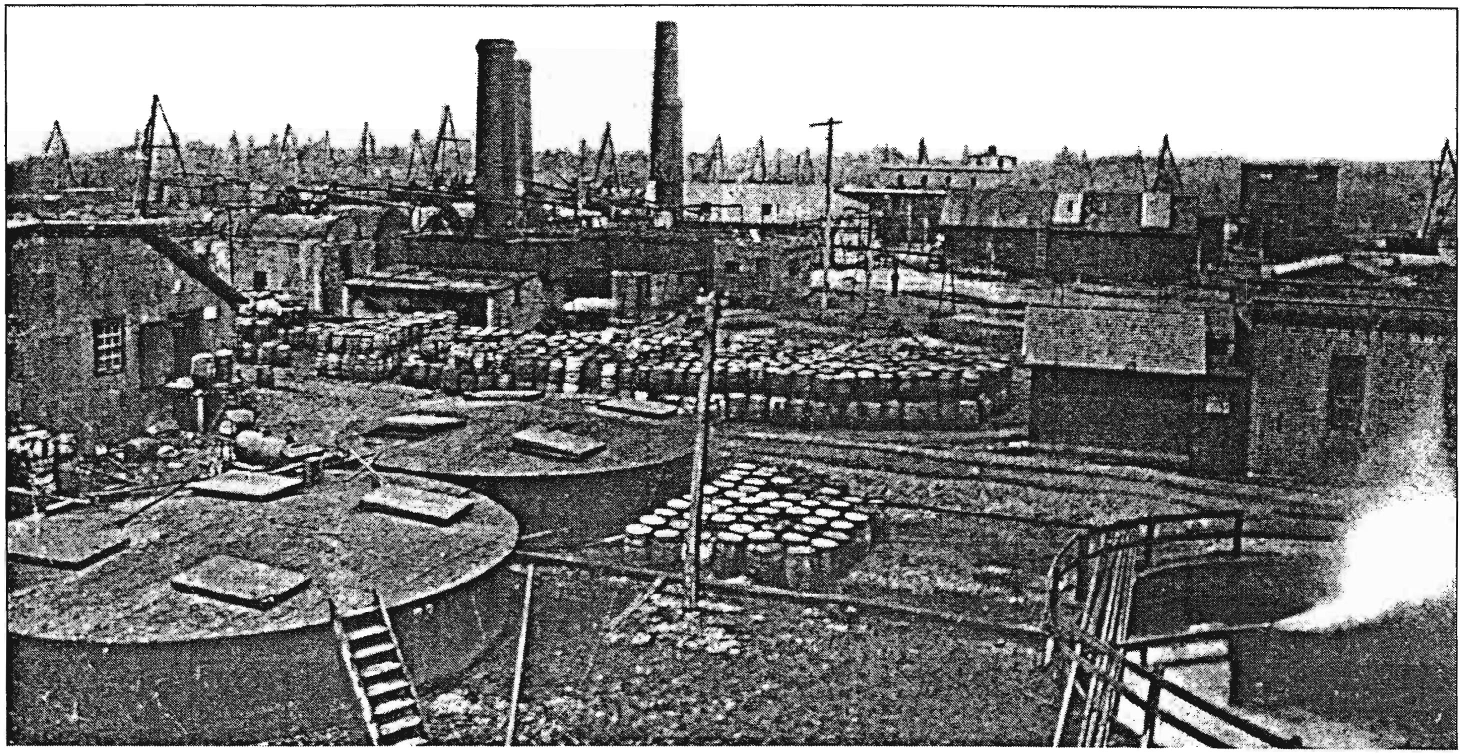


Exhibit 38: The Skeleton of an Early Wooden Pulling Rig

SUMMARY

In 1852, Charles Nelson Tripp began to manufacture asphalt from the gum beds located in the swamps of Enniskillen Township in Lambton County, Ontario. Although his project failed, he set in motion the petroleum industry in Ontario and in Canada. At Oil Springs, James Miller Williams found free oil in the glacial drift at 14 feet, and began to recover, refine, ship, and sell oil by the end of 1858. Hugh Nixon Shaw brought in the first gusher at Oil Springs on January 16, 1862. A few years later, in 1866, Captain B. King discovered oil in the Town of Petrolia. The two communities became the centre for the early development of the oil business in Canada.

The guidebook provides an introduction to the history and geology of these two fields and to the technology used by the pioneers of the industry. The field trip is one day in length and entails visits to the two museums in the Oil Heritage District and a driving tour designed to illustrate the local oil industry as a unique example of living history and to show its past and present effect on the community.



THE CANADIAN OIL REFINING COMPANY, LIMITED,
Operated by Canadian Oil Company, Limited, Toronto, Canada.

EXHIBIT 40: The Canadian Oil Refining Company Limited in Petrolia In 1908.

SCHEDULE FOR AAPG TOUR
SEPTEMBER 24, 2000

Exhibit 39 (at back of this guide book) is a guide map for a driving tour of the Petrolia and Oil Springs Fields.

8:00 a.m. Depart Hilton Hotel, London, Ontario

9:00 a.m. Arrive Petrolia Discovery (1)

The Petrolia Discovery is a working oil field and interpretive centre which opened in 1980. It features pumping wells, the Fitzgerald pumping rig, operating jerker lines, the movie "Hard Oil", and guided tours through the history of oil development in the Petrolia area. Allow at least 1.5 hours to tour this site. A nominal entry fee is charged.

Film - "Hard Oil"
Guided Tour of Site

11:00 a.m. Town of Petrolia Tour

Depart from the north end of The Petrolia Discovery and turn left onto Discovery Line.

Canadian Oil Refinery Property (2)

On the north-west corner of Discovery Line and Tank Streets is the site of the former Canadian Oil Company refinery (Exhibit 40). The independent company was formed in 1901 and a refinery was immediately built. Its main product was kerosene for lighting but, as cars became more abundant, emphasis switched to refining gasoline. The company was a rival of larger Imperial Oil and competition was fierce. In 1907, the company was taken over by the National Refining Co. of Cleveland and the famous "White Rose" trademark was introduced. By 1938, Canadian interests again controlled the company and it had expanded across the country. In 1952, a large, modern refinery near Sarnia replaced the aging Petrolia facility. Shell Oil eventually bought Canadian oil Companies in 1962. Today, an environmental service company occupies the property.

Tank Street (3)

Turn left on Tank Street. Tank Street was named for the oil tank-wagons that lined the road, waiting to be unloaded at the refineries. The nodding heads of beam pumps on oil wells can be seen on both sides of the road.

Van Tuyl and Fairbank (4)

Turn right at Railroad Street, the first street north of Petrolia Street, and left on Station Street. In this block is located Van Tuyl and Fairbank Hardware opened in 1865. Originally a grocery and liquor store, it soon expanded into hardware and oil supplies at the corner of Petrolia Street and Station Street. In the early 1870's it was the largest hardware store west of Toronto (Exhibit 41). After the stock market crash in 1929, the Fairbank family sold the store front on Petrolia Street but has remained in business until the present day. Although entry into the 21st century has required some changes, the products available for the heritage oil industry, farmers and general consumers have not varied widely. You can still buy nails by the pound.

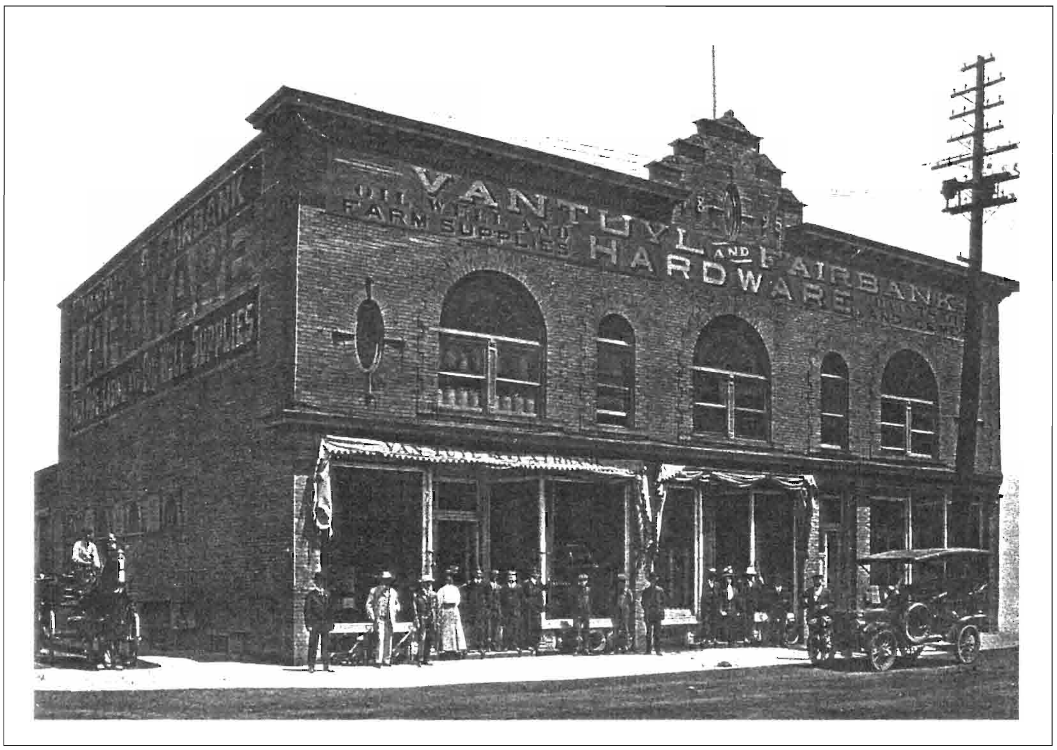


EXHIBIT 41: The Van Tuyl & Fairbank Block in Petrolia, Ontario Circa 1908.

Library (5)

Turn right on Petrolia Street. On the north side of Petrolia Street is an impressive Victorian structure, the Petrolia Public Library. It was built by the Grand Trunk Railway in 1903 and served as a railway station until 1930 (Exhibit 42). After the discovery of oil in Petrolia in 1866, Petrolia needed access to the railway to ship its products. A group of businessmen led by J.H. Fairbank, undertook the construction of an eight kilometre spur-line from Wyoming to Petrolia. It was taken over by Great Western and opened on December 17, 1866. However, the Great Western's monopoly hurt the development of the oil business until 1877. At that time, the Canada Southern Railway ran a spur-line into Petrolia from Oil City. With its arrival, excessive rates for the shipment of crude oil and its products were eliminated, and the oil refineries flourished.

EXHIBIT 42: The Grand Trunk Railway Depot Circa 1908.

Oil Well Supply Company (6)

Turn right on Fletcher Street then left on Robert Street. On the right side, in the first block of Robert Street is the Oil Well Supply Company (Exhibit 43). The firm was started in 1866 by Hector McKenzie, a machinist. He later joined forces with James Joyce, a blacksmith, and the business prospered. The company manufactured drill rigs, special tools for the oil industry, as well as pumps, valves, and many other quality industrial products. The largest drill bit ever produced by Oil Well Supply was 30 inches in diameter, 14 feet long, and weight 5,000 pounds! Tools built by Oil Well Supply in Petrolia accompanied the foreign drillers all over the world.

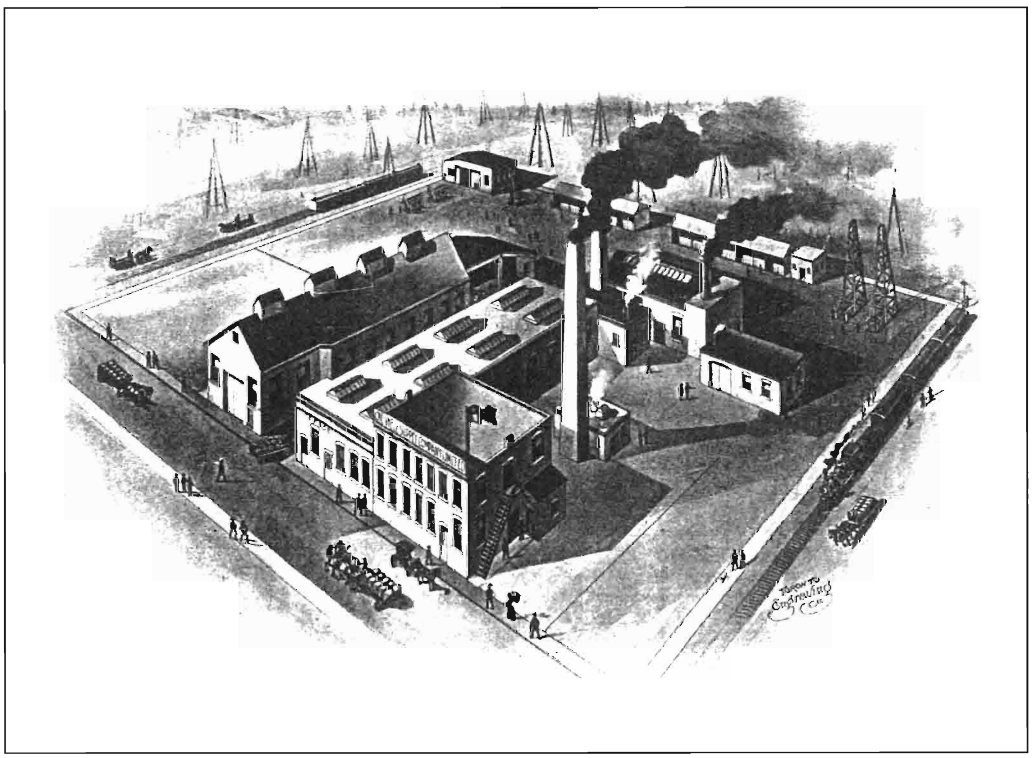


EXHIBIT 43: The Oil Well Supply Company Limited, Petrolia, Ontario Circa 1908.

Baines Machine Shop (7)

Continue down Robert Street to Centre Street and turn right, then left on James Street. The Baines Machine Shop, on the right, is another enduring industry in Petrolia. William Baines and his son, Albert, opened for business in 1914. Blacksmith work was carried on into the 1960's. Custom machining, welding and repairs to oil equipment are still done by Albert Jr. It is the only company in Canada still making leather valve cups for subsurface oil pumps used by the heritage producers. Pulleys on overhead shafts and canvas flat belts still transfer power from a central motor to a variety of lathes, presses and drills just as they did at the turn of the century.

Petrolia Street (8)

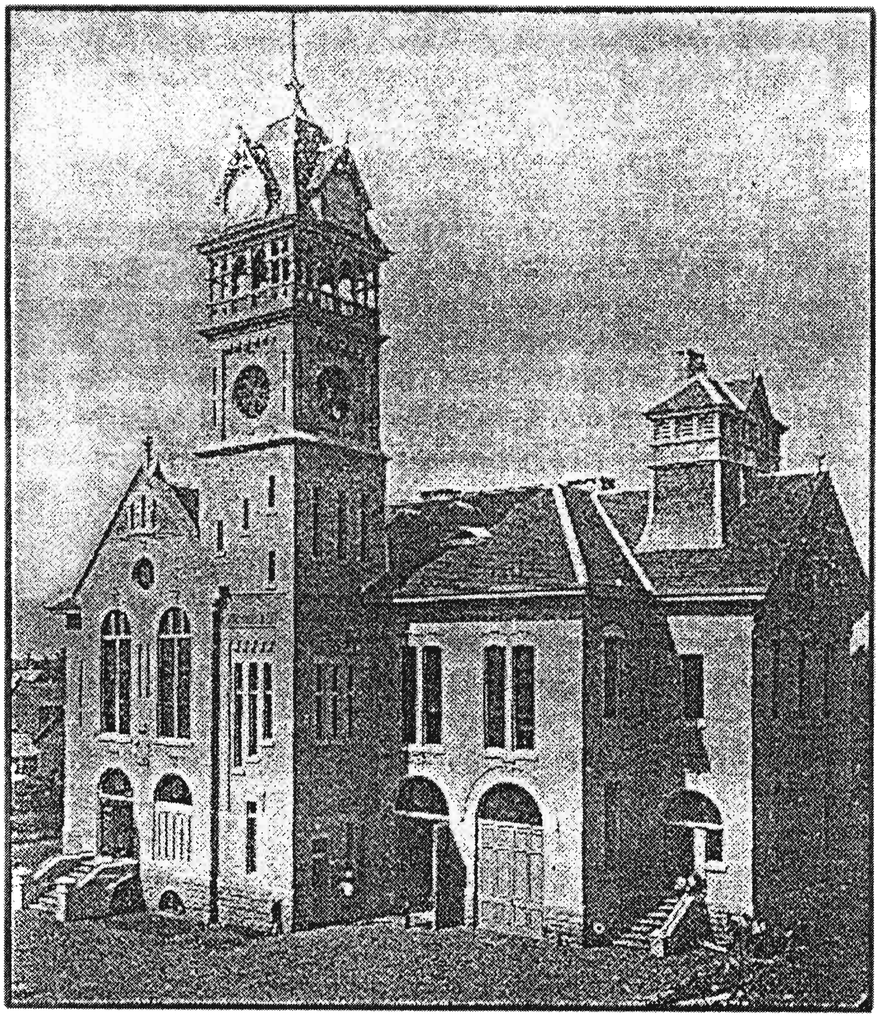
Continue along James Street and turn left on Eureka Street and turn onto Petrolia Street. You will begin to see evidence of the wealth that oil created. Victorian commercial buildings line the main street and graceful churches appear throughout town. To cater to the well-off residents, merchants stocked gourmet foods from Paris and the latest fashions from London and Rome. Grocery bills of $600 per month were not unusual for a Petrolia family at the turn of the century! On the south side of Petrolia Street at Wingfield Street is the original Post Office and Custom Building.

Victoria Hall (9)

Turn right on Greenfield Street. Elegant Victoria Hall stands out on the right. Completed in 1889, the building housed the municipal offices, police and fire stations, and a jail. However, tax-payers of the town had only approved construction on the condition that an opera house also be included (Exhibit 44). The building was extensively renovated in 1970 but on January 25, 1989, was seriously gutted by fire. For a year, with the remaining walls supported by scaffolds, its fate hung by a thread. However, the citizens of the Petrolia area rallied to the cause and the Victoria Hall was restored to its former elegance. Victoria Hall still serves as the town administrative office and houses the Victoria Playhouse on its second floor.

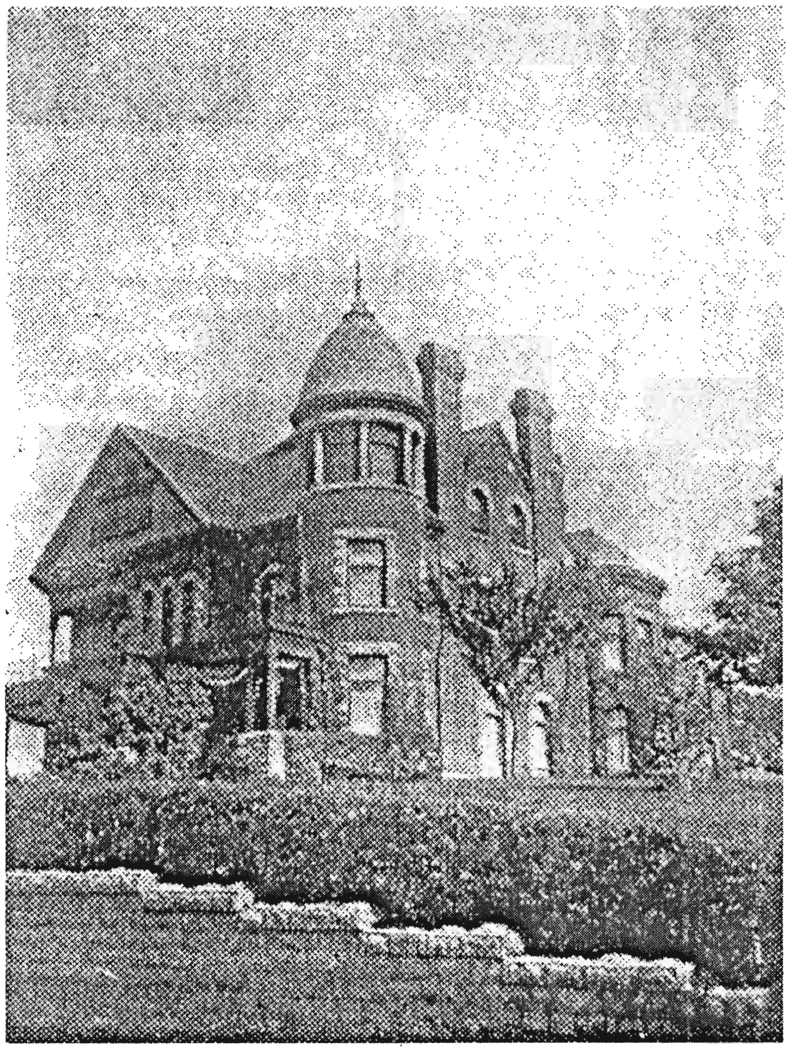
First Baptist Church (10)

Continue along Greenfield Street and turn left on Walnut Street. At the southeast corner of Greenfield and Walnut Streets is the First Baptist Church. It was erected in 1896 in Gothic style. Barrels of oil, it is said, were often given as yearly offerings - a cumbersome but valuable tithe. Unlike many frontier boom-towns, Petrolia was generally law-abiding, peaceful, and civilized. Churches outnumbered saloons and only one near-lynching occurred! Fortunately, logic prevailed, and a vigilante group of oilmen railroaded a suspected robber out of town rather than finish the hanging.



TOWN HALL.

EXHIBIT 44: The Petrolia Town Hall in 1908.



RESIDENCE J. H. FAIRBANK

EXHIBIT 45: Sunnyside, the Residence of J. H. Fairbank

Christ Anglican Church (11)

Continue along Walnut Street and at the end of the street is Christ Anglican Church. The first Anglican church was built on this site in 1882. In 1910, a chime of eleven bells was donated by J.L. Englehart, one of the town's most prominent oilmen, and installed in the tower. The original church burned in 1957 but the tower and bells survived. The present church was built around the tower in 1959 and includes unique stained glass windows. Look closely at the left window on the north side; a three-pole derrick is visible.

Crescent Park (12)

Turn left on Oil Street, right on Henry Street and drive around the crescent. Some of Petrolia's most beautiful and stately homes are located here in Crescent Park (also known by the locals as "Quality Hill"). Henry Warren Lancey, a developer from Maine, purchased the land from the Crescent Petroleum Company in 1872. All the streets are named after Lancey or members of his family. Owners of houses on the crescent were Major Benjamin Van Tuyl, co-owner of Van Tuyl & Fairbank, George Moncrieff, first mayor of Petrolia, Fred Edward, foreign driller of note, A. McQueen, vice-president of Imperial Oil, G. Pitkin, manager of Van Tuyl & Fairbank, Charles Jenkins, co-owner of the Petrolia Crude Oil Tank Company and in more recent times, Charles Oliver Fairbank, II.

Little Red Bank (13)

Continue around the crescent and then right on Oil Street. As you turn right onto Petrolia Street you will see a grey stucco building on the right that was previously the "Little Red Bank". This private bank was owned by John H. Fairbank and Leonard Vaughn, both outstanding citizens with oil and other commercial interests. The bank opened on this site in 1869 after the building was purchased for $70 and moved from Oil Springs. One and one-half million dollars worth of business was carried on in the first year. Fairbank and Vaughn virtually financed the local oil business on their own. When the bank closed in 1924, it was recognized as one of the most successful and long-running private banks in Canada.

Fairbank and Lancey Houses (14)

Further down Petrolia Street on the left is Fairbank House or Sunnyside (Exhibit 45). It was built in 1890 by oil and business magnate John H. Fairbank. All the wood for the mansion came from Fairbank land and was cured for a year before construction. The grand home had twenty-two rooms. They included a ball-room on the third floor, a billiard hall, and a servants' quarters. The Ohio clay bricks for the exterior were individually wrapped in wax paper before shipment to Petrolia.

The lovely, white frame house on the other side of the street was built by Henry Lancey for his daughter in the 1870's. The home, an example of Georgian symmetry, was originally larger by ten rooms. The coat of arms of the U.S. Confederacy crowns the marble fireplace. It's another reminder of the influence and contribution of American pioneers and business men who flocked to Lambton County to take part in the oil boom. Many remained to develop the industry and build local communities alongside the Canadians.

Bear Creek (15)

In the early 1860's, the oil seeps in the flats of Bear Creek attracted oilmen to the Petrolia area. Early oil explorers associated oilfields with stream beds; there was some justification for this theory because the glacial sediments were thinner in the flats of the stream and so it was easier for oil leaking from depth to migrate up into the floodplains. However, it was Captain King's well in the swamps on the heights west of Bear Creek near Eureka Street that put the Petrolia Oilfield on the map.

Union Firehall (16)

Continue along Petrolia Street. Oilfield fires destroyed many early wood buildings so firehalls became as important to Petrolia as the oil derricks. At the corner of First Avenue and Petrolia Street is Union Firehall, built in 1889. There was an ongoing competition between Union Station at the east end and the firestation at Victoria Hall to reach and extinguish fires because only the first crew on the scene was paid. The firehall has been designated as a heritage site and is presently a private residence.

12:00-12:15 p.m. Trip to Oil Springs

Petrolia East Oilfield (17)

Continue along Petrolia Street to the traffic light on Oil Heritage Road. Cross over Oil Heritage Road and drive about 1.5 km along the road. On the south side of the road, you will see the oil storage tanks of the Petrolia East Oilfield. In the adjacent fields, you will see three sizes of pumpjack. The large pump jacks are producing oil from a Silurian pinnacle reef from a depth of 550m (1,800') and the small pumpjacks are producing oil from the Devonian carbonates at 150m (500 feet). The largest pumpjack produces oil from a horizontal well whose wellbore crosses under the road and below the houses on the north side of the road. The Silurian reef in the Guelph (Niagaran) Formation was discovered by seismic exploration in 1972; the shallow Devonian wells have been extracting oil from the westerly extension of the Petrolia Field since 1870.

Geological studies show that the Dundee-Lucas Formation in this area has an incremental structural relief of about 3 metres (10 feet) because of the underlying reef; as a result, this segment of Petrolia Field is still producing oil whereas all the wells in the adjacent area have been abandoned. The Petrolia East Field is the only case in Ontario where crude oil is extracted simultaneously from two levels. One operator owns the oil and gas rights to 1,000 feet and the other operator has leased the oil and gas rights below 1,000 feet.

Corey East Field (18)

Turn around and proceed back to Oil Heritage Road. Turn left onto Oil Heritage Road to Oil Springs. About five kilometres south of Petrolia, on the southwest corner of Oil Heritage Road and Shiloh Line is an example of modern petroleum technology, the Corey East Oilfield. Cream coloured oil storage tanks and three pumpjacks come into view. This field was discovered in 1978 by seismic exploration. The trap is a pinnacle reef in the Guelph Formation of Silurian age. The area of the field is 60 acres, the gross thickness of the oil pay is 57m (186') and the depth is 550m (1,800 feet). Seismic exploration and wildcat drilling continue on a modest scale throughout Lambton County and Southwestern Ontario; new oil and gas resources are still being discovered.

Oil City (19)

Continue south on Oil Heritage Road to Oil City, a two minute drive. The important name obscures Oil City's minor role in the development of the petroleum industry. In 1852, Charles Tripp owned the land where Oil City was eventually built and the property alternated between government control and ownership by oil speculators. In 1873, the Canada Southern Railway constructed a line just north of the present village. Stores, a grain warehouse, blacksmith shops, a hotel, and a stave mill were built to capitalize on the anticipated boom but great prominence was never achieved. Ironically the oil bearing formations by-passed Oil City so no commercial production was possible. The lumber business slowed as the surrounding forest was depleted and heavy industry preferred the St. Clair River shore. Today, Oil City has become a residential community due to its convenient location at the intersection of Highways 21 and 80. The oldest remaining building in Oil City is the United Church at the corner of Shamrock and Main Streets; it was built in 1880 by Methodist parishioners.

Oil City Gas Field (20)

Proceed to the Courtright Line and turn left for a short diversion. At 0.6 km (0.4 miles) on the north side of the road, you will see wellheads sticking out of the ground. These are the wells drilled into the Oil City Gas Field. This field was discovered by seismic exploration in 1975. The trap is a Silurian pinnacle reef in the Guelph (Niagaran) Formation at a depth of 550 m (1,800 feet). About 51 million m^3 (1.8 bcf) of gas has been recovered from the field and the depleted gas reservoir is now used by Union Gas Limited for the seasonal storage of natural gas. Natural gas from Western Canada is injected into the pool during the summer months and then drained out of the pool in winter when the demand for natural gas in Ontario reaches its peak.

The Plank Road (21)

Turn around and cross over the Oil Heritage Road. Continue along the Courtright Line about 3.3 km (2.0 miles) to the South Plank Road. Turn left onto the Plank Road.

When oil was discovered in Oil Springs, in the midst of the Enniskillen swamp, transportation was a problem. There were poor roads and no trains. To move supplies in and crude oil out to a market, the Plank Road was built from Oil Springs to the Port of Sarnia (Exhibit 4). Planks were cut from white oak timbers by portable steam sawmills and laid across the road for a distance of 30 kilometres (18.6 miles). It was completed in 1865 and was a toll road. Can you imagine how many logs would be necessary to build a road 30 kilometres long! Continue along this road and you will be entering Oil Springs as the teamsters did in 1865. Turn left onto Oil Springs Line and cross over onto the Main Street of Village of Oil Springs.

Village of Oil Springs (22)

Oil Springs does not have many of the stately Victorian houses and store fronts found in Petrolia. Although many wells were drilled in the field and some of the wells flowed oil at great rates, the oil reserves were much smaller than in Petrolia; as a result, the oil could not sustain the community for a long period of time.

Watson's Machine Shop (23)

Turn left on Main Street in Oil Springs and then right on Kelly Road. The yellow brick building on the south-east corner of Victoria and Kelly Road is an Oil Springs landmark. The shop was built in 1880 by the Oil Well Supply Company. The founders, Anderson and Murray, designed, built and repaired tools and machinery for the local oilmen. One of their significant innovations was a gas-powered engine that made oil production very efficient; the engines ran on natural gas from the same oil wells that they pumped. Continue south to the Oil Museum of Canada.

12:15-12:45 p.m. **Lunch at Oil Museum of Canada (24)**
Tour of Oil Museum Site

The Oil Museum of Canada (24)

The Oil Museum of Canada, a national historic site, opened in 1960 and is located where James Miller Williams dug the first commercial oil well in 1858. Outside exhibits include spring-pole and Canadian drilling rigs, three-pole derricks, a nineteenth-century oil wagon, and original buildings from boom times. The modern, main building comprises numerous galleries which contain a wealth of petroleum industry artifacts, geological displays and mementoes of the foreign drillers. One unique artifact is a roller drill-bit donated to the museum by recluse billionaire Howard Hughes. Audio-visual presentations and guided tours are available. Nominal admission is charged. Allow from one to one and a half hours to completely tour the museum and outdoor exhibits.

2:00 p.m. **Tour of Oil Properties**

Oil Springs Receiving and Pumping Station (25)

Turn left on Gum Bed Line. On the south-east corner of Gum Bed Line and Kelly Road is the last remaining oil receiving station in Ontario. Numerous stations were built in the Oil Springs and Petrolia area, within a day's travel for teamster and oil wagon. These central storage and transfer facilities allowed local producers to break the monopoly that the Canadian Oil Producing and Refining Co. had on crude oil transportation to the refineries. This particular building was constructed in 1915 and used until 1973. It was designated an official historic site in 1985. As you drive along Gum Bed Line, you will see the wooden jerker lines slowly transferring power from central rigs to each of the wooden pump blocks on the wells. In summer, the sheep will be grazing placidly amidst the lines.

James Rig (26)

Follow along the Gum Bed Line and turn right into the first laneway. About 100m on your left is the building which houses the James pumping rig. Inside the building is a small electric motor whose fast speed of rotation is converted by a system of gears and pulleys to the slow but powerful strokes of the jerker line. Prior to the invention of electric motors, the pumping rig was run by steam engine. The jerker line system invented by J.H. Fairbank in 1863 was, and still remains, an efficient way to provide power to pump the wells from a central source. Note: The James Rig is located on private property. Permission must be obtained from Fairbank Oil Properties before you can enter the building.

Gum Beds (27)

Follow along the Gum Bed Line and turn right onto the Crooked Road. At about 300 metres, follow the road to the left under the hydro line. The road meanders through the oilfield until you come to another tight left bend. At this point, the quality of the road deteriorates to a clay base and in wet weather its condition is reminiscent of earlier days. To see the remnants of the Oil Springs gum beds, it is advisable to walk along this road and into the woods. If the weather is wet, you will need appropriate footwear to make the trek, and insect repellent is a good precaution. Be aware of the presence of poison ivy in the woods. If you have not been frightened by the above precautions, walk to the east along the laneway until it turns sharply to the right. Turn north into the woods along the rough vehicle path. About 100 metres along the path, you will see chunks of black gum on the ground, and as you look around, you will detect small mounds and excavations where the gum was originally extracted by the Tripp brothers in 1855. When crude oil migrates to the surface, the lighter hydrocarbons vaporize and leave behind the asphalt or gum. The asphalt which was used in sealing the hulls of ships and in the construction of the sidewalks in Paris, France at the time was the primary product of Tripp's operations. Note: The gumbeds are located on private property. Permission must be obtained from Fairbank Oil Properties to enter this property.

Oilfield Operations (28)

Return to your vehicle and drive back along the Crooked Road to the Gum Bed Line. Turn right on the Gum Bed Line and proceed to the intersection of Gypsie Flats Road. Along the road, among the trees, you will catch glimpses of wooden and metal oil storage tanks, jerker lines, and wooden and metal pumpjacks. You will often have to stop and watch in order to detect motion, but in most cases, the pump block will be slowly pumping oil. Turn left onto Gypsie Flats Road. Once again as you drive along, you will see jerker lines, tanks and pumpjacks scattered among the brush and trees. When you drive across the concrete bridge on the Black Creek, look to your left at the salt flats. The jerker lines have been working in this area for 130 years. And in the salt flats is the site of Hugh Nixon Shaw's successful well. **(29)** In January 1862, after many discouraging months of drilling, oil gushed from his well at great rates. The oil boom in Oil Springs was rekindled once more. Proceed along the Gypsie Flats Road to Main Street.

Turn left at the stop sign onto Main Street in Oil Springs and then after a distance of one-half kilometre, turn left on Duryee Street. As you look down Duryee Street, a large painted mural can be seen on the Fairbank barn. This oil wagon and horse-team illustration was the logo for the Van Tuyl and Fairbank hardware store as early as 1867.

At the end of Duryee Street, the road becomes private as it descends into the flats of Black Creek. From the top of the hill, you can see the pump blocks working in the flats of Black Creek, and on the other side of the creek on top of the hill is the Fairbank residence. Be aware that the oil field is private property. Permission to enter must be obtained from Fairbank Oil Properties. The Fairbank family welcomes visitors to the Oil Springs Field.

Fairbank Oil Property (30)

On this field trip, we will tour the Fairbank Oil Property and see jerker lines, oil-water separation facilities, underground wooden tanks, dug wells and well-pulling machines. Much of the tour will be walking; if the weather is wet, bring appropriate footwear.

3:45 p.m. **Leave Fairbank Oil Property**

5:00 p.m. **Arrive Hilton Hotel, London**

(Text Adapted from "Oil Heritage District Driving Tour")

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Appendix A:

Annual Oil Production Summary, Oil Springs Field
for Years 1917 to 1996

ANNUAL OIL PRODUCTION SUMMARY
OIL SPRINGS FIELD
ENNISKILLEN TOWNSHIP, LAMBTON COUNTY, ONTARIO

FIELD DISCOVERED IN 1858
NO ANNUAL PRODUCTION RECORDS AVAILABLE UNTIL 1917
CUMULATIVE PRODUCTION TO 1917 ESTIMATED BY R.B. HARKNESS
DATA ASSEMBLED BY: R.O. COCHRANE AUGUST 15, 2000
DATA SOURCE: ONTARIO MINISTRY OF NATURAL RESOURCES
FILE: CRL.GEN.00.013\HSTRCOIL.WB1\C

YEAR	NUMBER OF WELLS ACTIVE	SUSP.	ANNUAL OIL m3	CUMULATIVE OIL m3	OIL RATE PER WELL m3/YEAR
1954	623		4135.2	1,313,886	6.64
1955	599		4365.3	1,318,252	7.29
1956	577		4608.7	1,322,860	7.99
1957	545		4625.4	1,327,486	8.49
1958	551		4903.3	1,332,389	8.90
1959	545		5212.2	1,337,601	9.56
1960	507		7726.1	1,345,327	15.24
1961	497		8120.9	1,353,448	16.34
1962	458		8536.7	1,361,985	18.64
1963	491		10294.1	1,372,279	20.97
1964	484		11592.2	1,383,871	23.95
1965	505		11072.2	1,394,944	21.93
1966	465		9997.9	1,404,941	21.50
1967	451		8553.0	1,413,494	18.96
1968	443		8429.3	1,421,924	19.03
1969	340		6877.9	1,428,802	20.23
1970	359		5337.7	1,434,139	14.87
1971	315		4729.9	1,438,869	15.02
1972	394		3602.0	1,442,471	9.14
1973	283		3268.5	1,445,740	11.55
1974	293		3341.1	1,449,081	11.40
1975	295		3699.1	1,452,780	12.54
1976	297		3817.6	1,456,598	12.85
1977	263		3864.9	1,460,462	14.70
1978	280		3982.8	1,464,445	14.22
1979	302		4123.0	1,468,568	13.65
1980	308		4850.5	1,473,419	15.75
1981	419		5396.0	1,478,815	12.88
1982	386		5660.3	1,484,475	14.66
1983	391		6069.7	1,490,545	15.52
1984	420		5953.9	1,496,499	14.18
1985	467	30	6169.3	1,502,668	13.21
1986	440		5996.8	1,508,665	13.63
1987	503		5861.5	1,514,526	11.65
1988	486		5425.8	1,519,952	11.16
1989	459		4940.1	1,524,892	10.76
1990	450		4849.2	1,529,741	10.78
1991	440		5172.6	1,534,914	11.76
1992	431		5471.9	1,540,386	12.70
1993	385		5500	1,545,886	14.29
1994	468		5565.4	1,551,451	11.89
1995			5452.8	1,556,904	
1996			5646.7	1,562,551	

ANNUAL OIL PRODUCTION SUMMARY
OIL SPRINGS FIELD
ENNISKILLEN TOWNSHIP, LAMBTON COUNTY, ONTARIO

FIELD DISCOVERED IN 1858
NO ANNUAL PRODUCTION RECORDS AVAILABLE UNTIL 1917
CUMULATIVE PRODUCTION TO 1917 ESTIMATED BY R.B. HARKNESS
DATA ASSEMBLED BY: R.O. COCHRANE AUGUST 15, 2000
DATA SOURCE: ONTARIO MINISTRY OF NATURAL RESOURCES
FILE: CRL.GEN.00.013\HSTRCOIL.WB1\C

YEAR	NUMBER OF WELLS ACTIVE	SUSP.	ANNUAL OIL m3	CUMULATIVE OIL m3	OIL RATE PER WELL m3/YEAR
INITIAL CUMULATIVE FROM R.B. HARKNESS 1928					
				1,116,099	
1917			7456.8	1,123,556	
1918			7102.1	1,130,658	
1919			7193.4	1,137,851	
1920			6262.2	1,144,114	
1921	1192		6513.2	1,150,627	5.46
1922	1227		6870.5	1,157,497	5.60
1923	1228		6214.8	1,163,712	5.06
1924	1142		6569.3	1,170,281	5.75
1925	1130		6222.3	1,176,504	5.51
1926	1097		6097.0	1,182,601	5.56
1927	1069		5927.1	1,188,528	5.54
1928	1106		5668.4	1,194,196	5.13
1929	1048		4886.8	1,199,083	4.66
1930	924		4636.1	1,203,719	5.02
1931	863		4895.5	1,208,615	5.67
1932	804		4998.2	1,213,613	6.22
1933	906		4983.1	1,218,596	5.50
1934	877		4747.8	1,223,344	5.41
1935	876		5031.3	1,228,375	5.74
1936	842		5055.0	1,233,430	6.00
1937	832		5382.2	1,238,812	6.47
1938	827		5135.1	1,243,947	6.21
1939	828		5157.9	1,249,105	6.23
1940	827		4990.9	1,254,096	6.03
1941	825		4735.1	1,258,831	5.74
1942	784		4351.3	1,263,182	5.55
1943	752		4335.6	1,267,518	5.77
1944	738		4537.1	1,272,055	6.15
1945	710		4079.1	1,276,134	5.75
1946	700		4450.8	1,280,585	6.36
1947	688		4083.3	1,284,668	5.94
1948	658		4159.9	1,288,828	6.32
1949	662		4084.7	1,292,913	6.17
1950	651		4024.0	1,296,937	6.18
1951	639		4225.2	1,301,162	6.61
1952	623		4285.8	1,305,448	6.88
1953	629		4303.3	1,309,751	6.84

Appendix B:

Annual Oil Production Summary for Petrolia Oilfield in Enniskillen Township
for Years 1917 to 1996

ANNUAL OIL PRODUCTION SUMMARY
PETROLIA OILFIELD IN ENNISKILLEN TOWNSHIP
LAMBTON COUNTY, ONTARIO

FIELD DISCOVERED IN 1862
DATA FOR ENNISKILLEN TOWNSHIP SEGMENT OF FIELD ONLY
NO ANNUAL PRODUCTION RECORDS AVAILABLE UNTIL 1917
CUMULATIVE PRODUCTION TO 1917 ESTIMATED BY R.B. HARKNESS IN 1928
DATA ASSEMBLED BY: R.O. COCHRANE AUGUST 15, 2000
DATA SOURCE: ONTARIO MINISTRY OF NATURAL RESOURCES
FILE: CRL.GEN.00.013\HSTRCOIL.WB1\D

YEAR	NUMBER OF WELLS ACTIVE	SUSP.	ANNUAL OIL m3	CUMULATIVE OIL m3	OIL RATE PER WELL m3/YEAR
INITIAL CUMULATIVE FROM R.B. HARKNESS 1928					
				2,302,631	
1916			3338.6	2,305,970	0.0
1917	1681		11807.5	2,317,778	7.0
1918	1681		10408.4	2,328,186	6.2
1919	1681		11142.9	2,339,329	6.6
1920	1681	67	10347.2	2,349,676	6.2
1921	1681	859	10888.1	2,360,564	6.5
1922	1541	835	10323.8	2,370,888	6.7
1923	1535	723	10200.5	2,381,088	6.6
1924	1647	878	9684.8	2,390,773	5.9
1925	1206	970	8452.7	2,399,226	7.0
1926	1102	1001	8821.4	2,408,047	8.0
1927	1070	836	9566.6	2,417,614	8.9
1928	998	890	9626.2	2,427,240	9.6
1929	905	925	8948.4	2,436,189	9.9
1930	816	898	8765.0	2,444,953	10.7
1931	857	845	9144.1	2,454,098	10.7
1932	817	773	9359.7	2,463,457	11.5
1933	792	697	9109.6	2,472,567	11.5
1934	864	534	9211.4	2,481,778	10.7
1935	736	768	9425.1	2,491,203	12.8
1936	732	644	9394.8	2,500,598	12.8
1937	742	643	9214.9	2,509,813	12.4
1938	721	663	9264.2	2,519,077	12.8
1939	710	674	9054.5	2,528,132	12.8
1940	679	674	8837.9	2,536,970	13.0
1941	646	696	8678.0	2,545,648	13.4
1942	631	707	8254.1	2,553,902	13.1
1943	540	683	7203.4	2,561,105	13.3
1944	522	681	6587.3	2,567,693	12.6
1945	474	241	6256.1	2,573,949	13.2
1946	493	226	7046.8	2,580,995	14.3
1947	473	232	6522.9	2,587,518	13.8
1948	443	235	6455.4	2,593,974	14.6
1949	453	217	6777.9	2,600,752	15.0
1950	442	208	6446.6	2,607,198	14.6
1951	426	312	6208.9	2,613,407	14.6
1952	380	244	5776.0	2,619,183	15.2
1953	378	246	5627.3	2,624,810	14.9
1954	347		5315.1	2,630,126	15.3

ANNUAL OIL PRODUCTION SUMMARY
PETROLIA OILFIELD IN ENNISKILLEN TOWNSHIP
LAMBTON COUNTY, ONTARIO

FIELD DISCOVERED IN 1862
DATA FOR ENNISKILLEN TOWNSHIP SEGMENT OF FIELD ONLY
NO ANNUAL PRODUCTION RECORDS AVAILABLE UNTIL 1917
CUMULATIVE PRODUCTION TO 1917 ESTIMATED BY R.B. HARKNESS IN 192
DATA ASSEMBLED BY: R.O. COCHRANE AUGUST 15, 2000
DATA SOURCE: ONTARIO MINISTRY OF NATURAL RESOURCES
FILE: CRL.GEN.00.013\HSTRCOIL.WB1\D

YEAR	NUMBER OF WELLS ACTIVE	SUSP.	ANNUAL OIL m3	CUMULATIVE OIL m3	OIL RATE PER WELL m3/YEAR
1955	338		5742.8	2,635,868	17.0
1956	310		5237.0	2,641,105	16.9
1957	322		5178.1	2,646,283	16.1
1958	309		4665.6	2,650,949	15.1
1959	243		4092.3	2,655,041	16.8
1960	238		3999.0	2,659,040	16.8
1961	185		4229.9	2,663,270	22.9
1962	170		4330.5	2,667,601	25.5
1963	152		4584.7	2,672,185	30.2
1964	150	25	4606.8	2,676,792	30.7
1965	149		4197.9	2,680,990	28.2
1966	113	4	3683.6	2,684,674	32.6
1967	97	7	3712.0	2,688,386	38.3
1968	89	8	3597.9	2,691,984	40.4
1969	84	8	3403.0	2,695,387	40.5
1970	87	8	3811.2	2,699,198	43.8
1971	89	50	3558.1	2,702,756	40.0
1972	88	65	3166.9	2,705,923	36.0
1973	78		3179.4	2,709,102	40.8
1974	68		2874.2	2,711,976	42.3
1975	69		2761.8	2,714,738	40.0
1976	77		3103.9	2,717,842	40.3
1977	77	27	3279.7	2,721,122	65.6
1978	77	25	3322.7	2,724,445	43.2
1979	79	31	3395.1	2,727,840	43.0
1980	100	17	4917.2	2,732,757	49.2
1981	106	19	4766.6	2,737,523	45.0
1982	118		5445.4	2,742,969	46.1
1983	152		6711.7	2,749,681	44.2
1984	162		6244.6	2,755,925	38.5
1985	187	18	6619.2	2,762,544	35.4
1986	202		7508.2	2,770,053	37.2
1987	210		7534.5	2,777,587	35.9
1988	213		7339.9	2,784,927	34.5
1989	199		6771.4	2,791,698	34.0
1990	169		6454.8	2,798,153	38.2
1991	176		6613.6	2,804,767	37.6
1992	202		7385.1	2,812,152	36.6
1993	194		7852.5	2,820,004	40.5
1994	224		7363.4	2,827,368	32.9
1995			6718.9	2,834,087	
1996			7379.7	2,841,466	

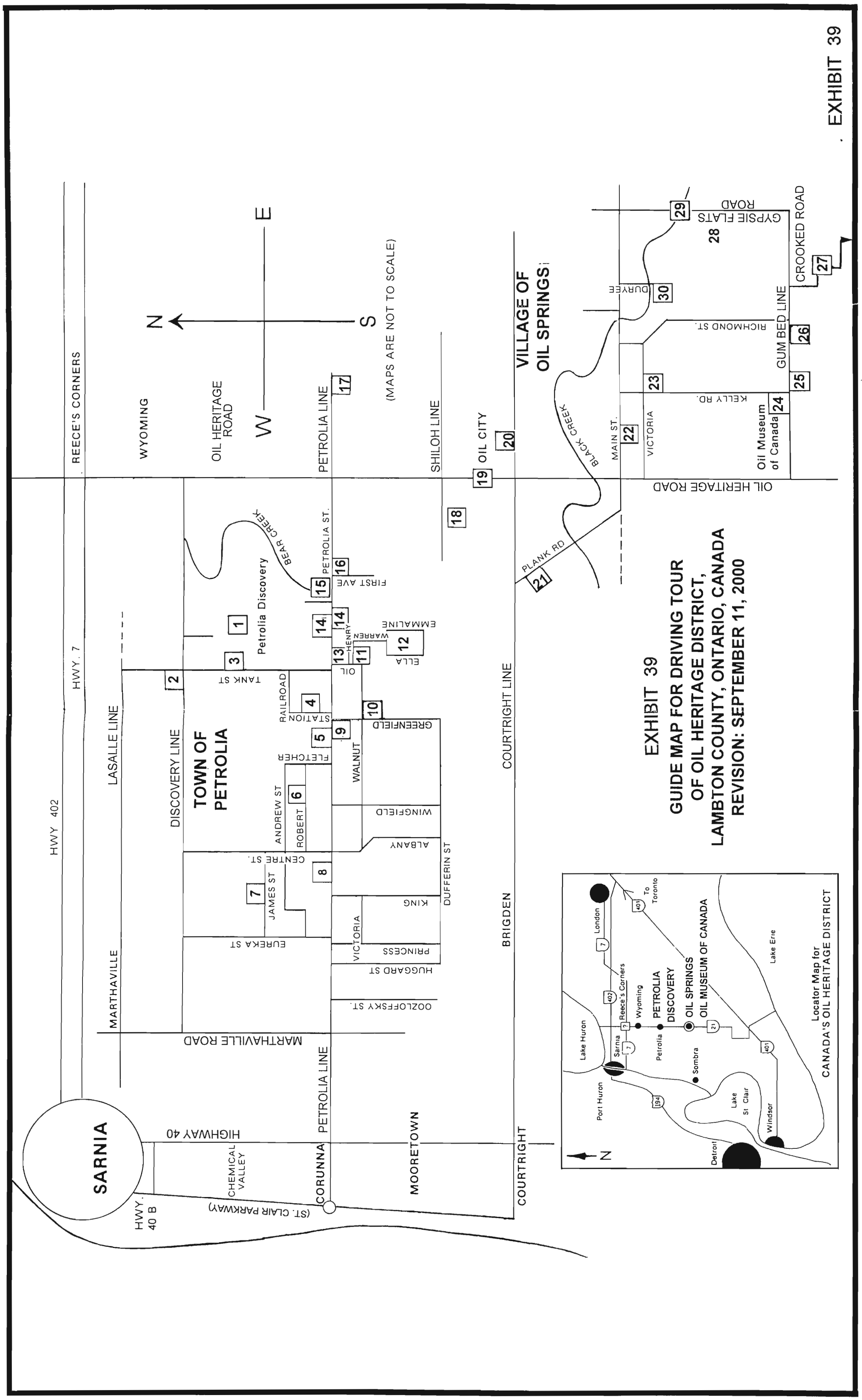
EXHIBIT 39
GUIDE MAP FOR DRIVING TOUR
OF OIL HERITAGE DISTRICT,
LAMBTON COUNTY, ONTARIO, CANADA
REVISION: SEPTEMBER 11, 2000
EXHIBIT 39
(MAPS ARE NOT TO SCALE)
N
S
E
W
SARNIA
HWY. 40 B
CHEMICAL VALLEY
CORUNNA
(ST. CLAIR PARKWAY)
HIGHWAY 40
MOORETOWN
COURTRIGHT
BRIGDEN
COURTRIGHT LINE
PETROLIA LINE
MARTHAVILLE
MARTHAVILLE ROAD
LASALLE LINE
DISCOVERY LINE
HWY 402
HWY. 7
REECE'S CORNERS
WYOMING
OIL HERITAGE ROAD
TOWN OF PETROLIA
Petrolia Discovery
BEAR CREEK
TANK ST
RAILROAD
STATION
FLETCHER
ANDREW ST
ROBERT
CENTRE ST.
JAMES ST
EUREKA ST
VICTORIA
PRINCESS
HUGGARD ST
OOZLOFFSKY ST.
KING
DUFFERIN ST
ALBANY
WINGFIELD
WALNUT
GREENFIELD
OIL
HENRY
WARREN
ELLA
EMMALINE
FIRST AVE
PETROLIA ST.
SHILOH LINE
OIL CITY
PLANK RD
BLACK CREEK
VILLAGE OF OIL SPRINGS
MAIN ST.
VICTORIA
KELLY RD.
RICHMOND ST.
DURYEE
GYPSIE FLATS ROAD
CROOKED ROAD
GUM BED LINE
Oil Museum of Canada
OIL HERITAGE ROAD
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29
30
Lake Huron
Port Huron
Sarnia
Reece's Corners
Wyoming
Petrolia
PETROLIA DISCOVERY
OIL SPRINGS
OIL MUSEUM OF CANADA
Sombra
London
To Toronto
Lake St Clair
Detroit
Windsor
Lake Erie
Locator Map for CANADA'S OIL HERITAGE DISTRICT