Engineering 101

Freshman Engineering Design

Project No.1

Johann Cooke

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Executive Summary

Background

An opportunity exists for investment in an oil well. The prospective investor requires an evaluation in order that he may select the well that will yield him the highest return on his investment.

Methodology

The methodology used takes into consideration the most recent data available on the production of oil and gas from three wells which is used in forecasting the oil and gas production over the next ten years

Estimated costs and revenues have been used in projecting the financial results over the next ten year period.

Significant assumptions

The price of oil and gas is expected to increase in the future. Therefore an average of the price over the next ten years has been used in forecasting revenue. The accuracy of the price forecast is not expected to affect the comparative analysis since this will be common to all wells

Costs are estimated at current levels and no provision has been made for escalation in cost, since this will not affect a comparative analysis.

However it must be noted that the projections may be used only for purpose of comparison between the three wells and may not represent an accurate estimate of the actual results.

Conclusion

Since the prices of gas and oil and the cost of production are common to all wells the factor, which determines the profitability of the wells, is its production capacity.

The individual profitability forecasts quantify the results more clearly and indicate that the well Brown JT # 14 will yield the best results.

Table of Content

Introduction

An opportunity exists for investment in an oil well. The prospective Investor requires a comparative analysis of the production capacity and the profitability forecasts of three wells in order that he may select the well which will yield him the highest return on his investment.

The three have been selected from 94 wells based on comparable total gas production.

The methodology adopted takes into consideration the most recent data available on the production of oil and gas from the three wells, in forecasting the oil and gas production for the next ten years.

Estimated costs and revenues have been used in projecting the financial results over the said period in arriving at a conclusion as to which of the oil wells will yield the best results.

Methodology

Identification of Comparable Oil Wells For Evaluation

The locations of the wells available for evaluation were plotted on a bubble map in order to identify comparable wells for evaluation.

Three wells viz. Brown JT #14
Jones # 7-85
Flower # 1-80
which were most comparable in their gas production were selected for further evaluation.

Projected Oil Production in the next ten years

1. For clarity and ease of reference past oil and gas production levels were plotted on two separate graphs for each well.

2. A hyperbolic curve was used to predict the oil and gas production for the next ten years. The hyperbolic curve was obtained by using the formula

$$Q = Q_i * (1 + b * D_i * t) ^ (-1/b)$$.

Where Q is the rate
Qi is the initial rate
b is the decline rate
Di is the decline exponent, and t is time.

The values for Qi, b and Di were first inserted at random and then altered to produce a line of best-fit.

Projected Cost/Earnings in the next ten years

1. The price of oil and gas is expected to rise in the future. As such an average of the expected price over the next ten years was used in calculating the revenue from each well.
Irrespective of the accuracy of the price forecast, the profitability of the wells for the purpose of comparison is not expected to be affected.

2. Direct operating cost was estimated at $0.65 per MCF of gas and $4.35 per barrel (BBL) of oil. Since an escalation in cost over the ten year period is expected to be common to all wells, for the purpose of this evaluation the cost of production is assumed to remain constant.
Taxation was estimated at rate of 48% and is expected to remain constant during the ten year period.

The annual expected return was converted to represent present value using the formula

P = F/(1 + i) ^ n.

where P is the present value, F is the future value, i is the interest rate which is 10% and n is the year.

The net present value of the combined gas and oil production from each well is used to compare the three wells and determine which well represents the best investment opportunity.

Results and Discussions

Given below are the graphs and tables used in evaluating the three wells

Two graphs and two tables one for gas and one for oil production represent each well

i The x-axis of the graph represents time and the y-axis the oil or gas production.
ii The blue dots depict the gas or oil production in the last several months
iii The pink line, the estimated production in the future.

The tables present the economics of producing gas and oil from each well.

Well Brown JT # 14.

Gas Production.

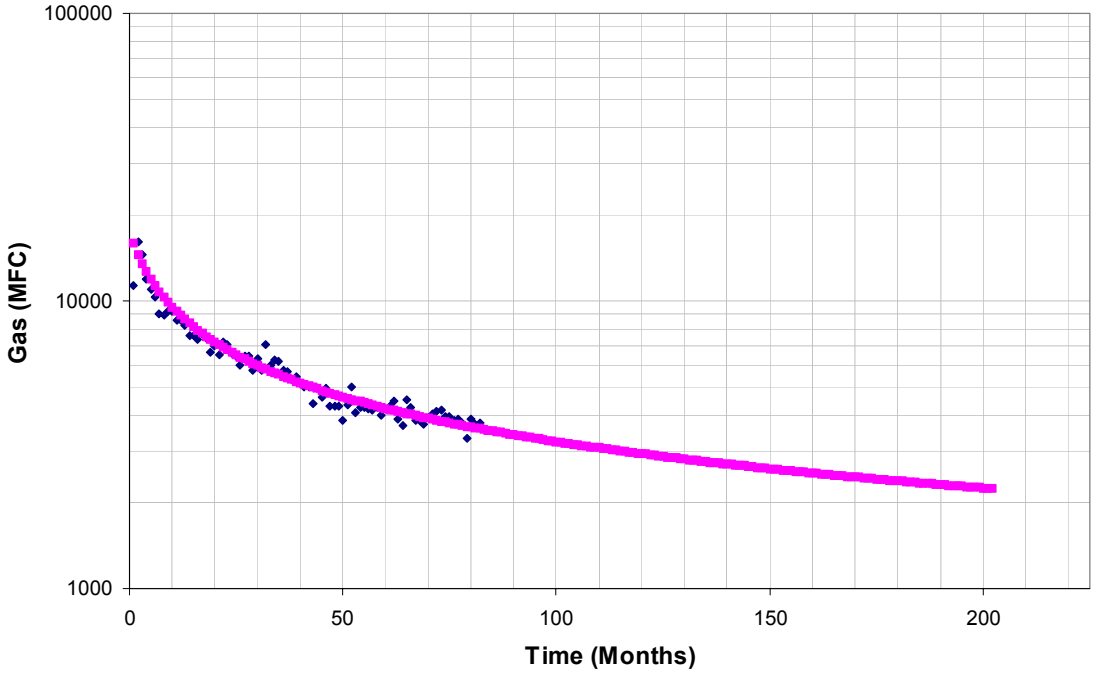

Fig 1. Forecasted gas production of well Brown JT#14 for the next ten years.

Forecasted earnings for gas.

Year	Gas Production (MFC)	Revenue	Operating Cost	Net Cash Flow	Tax	Profit	Net Presant Value
1	39654.0676	$198,270.34	$25,775.14	$172,495.19	$82,797.69	$89,697.50	$81,543.18
2	37067.1473	$185,335.74	$24,093.65	$161,242.09	$77,396.20	$83,845.89	$69,294.12
3	34903.6669	$174,518.33	$22,687.38	$151,830.95	$72,878.86	$78,952.09	$59,317.88
4	33060.4882	$165,302.44	$21,489.32	$143,813.12	$69,030.30	$74,782.82	$51,077.68
5	31466.4123	$157,332.06	$20,453.17	$136,878.89	$65,701.87	$71,177.02	$44,195.33
6	30070.5131	$150,352.57	$19,545.83	$130,806.73	$62,787.23	$68,019.50	$38,395.23
7	28835.2857	$144,176.43	$18,742.94	$125,433.49	$60,208.08	$65,225.42	$33,470.95
8	27732.4247	$138,662.12	$18,026.08	$120,636.05	$57,905.30	$62,730.74	$29,264.36
9	26740.1182	$133,700.59	$17,381.08	$116,319.51	$55,833.37	$60,486.15	$25,652.03
10	25841.2543	$129,206.27	$16,796.82	$112,409.46	$53,956.54	$58,452.92	$22,536.13
						Total	**$454,746.89**

Table 1. Forecasted gas earnings of well Brown JT#14 for the next ten years.

Oil production.

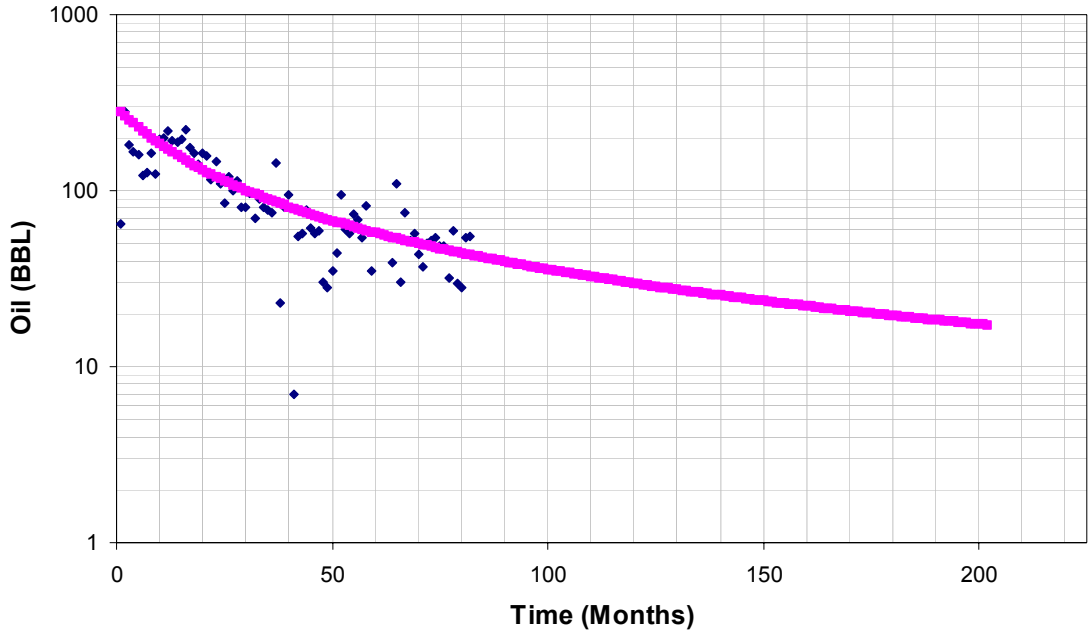

Fig 2. Forecasted oil production of well Brown JT#14 for the next ten years.

Forecasted earnings for oil.

Year	Oil Production (BBL)	Revenue	Operating Cost	Net Cash Flow	Tax	Profit	Net Presant Value
1	483.7296	$19,349.19	$2,104.22	$17,244.96	$8,277.58	$8,967.38	$8,152.16
2	427.2809	$17,091.23	$1,858.67	$15,232.56	$7,311.63	$7,920.93	$6,546.23
3	381.9250	$15,277.00	$1,661.37	$13,615.63	$6,535.50	$7,080.13	$5,319.40
4	344.7426	$13,789.71	$1,499.63	$12,290.07	$5,899.24	$6,390.84	$4,365.03
5	313.7477	$12,549.91	$1,364.80	$11,185.11	$5,368.85	$5,816.26	$3,611.44
6	287.5438	$11,501.75	$1,250.82	$10,250.94	$4,920.45	$5,330.49	$3,008.92
7	265.1214	$10,604.85	$1,153.28	$9,451.58	$4,536.76	$4,914.82	$2,522.08
8	245.7334	$9,829.34	$1,068.94	$8,760.39	$4,204.99	$4,555.41	$2,125.13
9	228.8154	$9,152.62	$995.35	$8,157.27	$3,915.49	$4,241.78	$1,798.93
10	213.9335	$8,557.34	$930.61	$7,626.73	$3,660.83	$3,965.90	$1,529.03
						Total	**$38,978.34**

Table 2. Forecasted oil earnings of well Brown JT#14 for the next ten years.

Total Earnings	**$493,725.24**

Well Jones # 7-85.

Gas production.

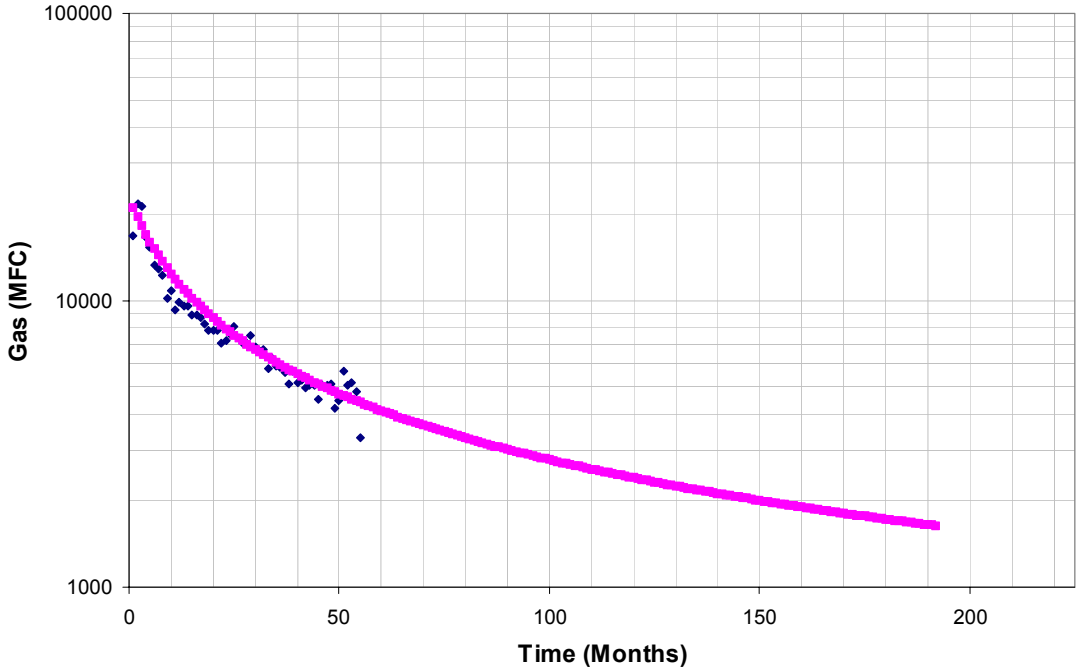

Fig 3. Forecasted gas production of well Jones #7-85 for the next ten years.

Forecasted earnings for gas.

Year	Gas Production (MFC)	Revenue	Operating Cost	Net Cash Flow	Tax	Profit	Net Presant Value
1	36041.3025	$180,206.51	$23,426.85	$156,779.67	$75,254.24	$81,525.43	$74,114.02
2	32178.0330	$160,890.16	$20,915.72	$139,974.44	$67,187.73	$72,786.71	$60,154.31
3	29108.2741	$145,541.37	$18,920.38	$126,620.99	$60,778.08	$65,842.92	$49,468.76
4	26606.4192	$133,032.10	$17,294.17	$115,737.92	$55,554.20	$60,183.72	$41,106.29
5	24525.6197	$122,628.10	$15,941.65	$106,686.45	$51,209.49	$55,476.95	$34,446.82
6	22766.0289	$113,830.14	$14,797.92	$99,032.23	$47,535.47	$51,496.76	$29,068.58
7	21257.3072	$106,286.54	$13,817.25	$92,469.29	$44,385.26	$48,084.03	$24,674.71
8	19948.4224	$99,742.11	$12,966.47	$86,775.64	$41,652.31	$45,123.33	$21,050.37
9	18801.4195	$94,007.10	$12,220.92	$81,786.17	$39,257.36	$42,528.81	$18,036.37
10	17787.4645	$88,937.32	$11,561.85	$77,375.47	$37,140.23	$40,235.24	$15,512.43
						Total	**$367,632.65**

Table 3. Forecasted gas earnings of well Jones #7-85 for the next ten years.

Oil production.

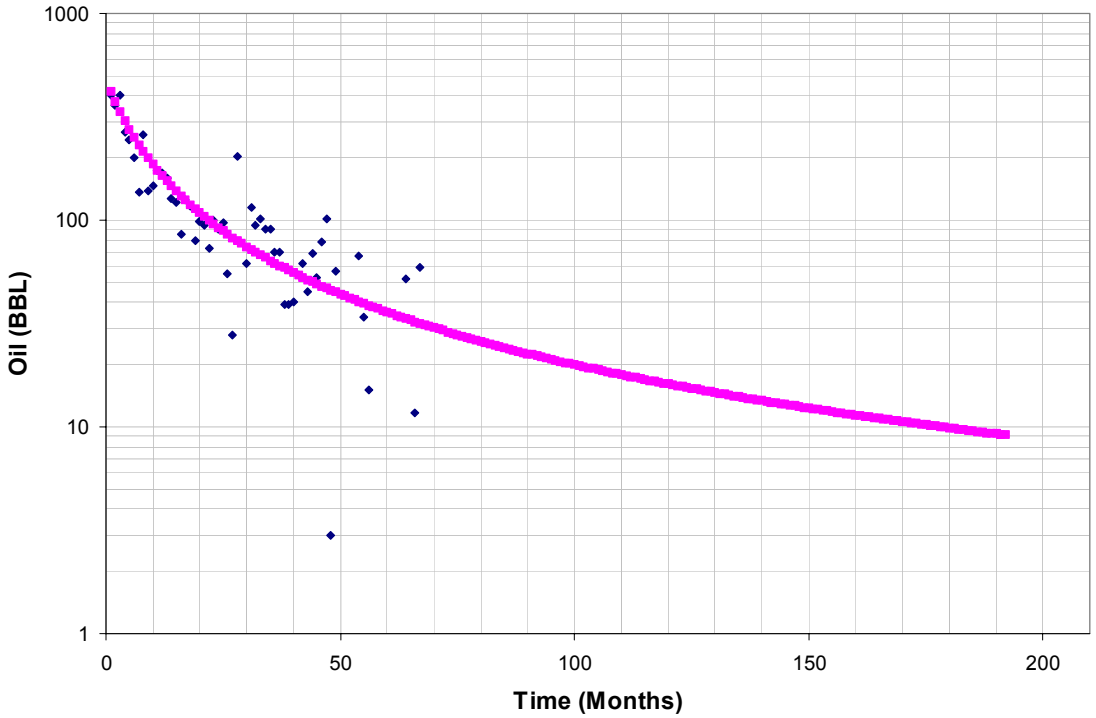

Fig 4. Forecasted oil production of well Jones #7-85 for the next ten years.

Forecasted earnings for oil.

Year	Oil Production (BBL)	Revenue	Operating Cost	Net Cash Flow	Tax	Profit	Net Presant Value
1	292.3191	$11,692.77	$1,271.59	$10,421.18	$5,002.17	$5,419.01	$4,926.37
2	247.5583	$9,902.33	$1,076.88	$8,825.46	$4,236.22	$4,589.24	$3,792.76
3	213.7032	$8,548.13	$929.61	$7,618.52	$3,656.89	$3,961.63	$2,976.43
4	187.2989	$7,491.96	$814.75	$6,677.21	$3,205.06	$3,472.15	$2,371.52
5	166.1937	$6,647.75	$722.94	$5,924.81	$2,843.91	$3,080.90	$1,913.00
6	148.9812	$5,959.25	$648.07	$5,311.18	$2,549.37	$2,761.81	$1,558.97
7	134.7056	$5,388.22	$585.97	$4,802.25	$2,305.08	$2,497.17	$1,281.44
8	122.6962	$4,907.85	$533.73	$4,374.12	$2,099.58	$2,274.54	$1,061.09
9	112.4692	$4,498.77	$489.24	$4,009.53	$1,924.57	$2,084.95	$884.22
10	103.6672	$4,146.69	$450.95	$3,695.73	$1,773.95	$1,921.78	$740.93
						Total	**$21,506.74**

Table 4. Forecasted oil earnings of well Jones #7-85 for the next ten years.

Total Earnings	**$389,139.39**

Well Flowers # 1-80.

Gas production.

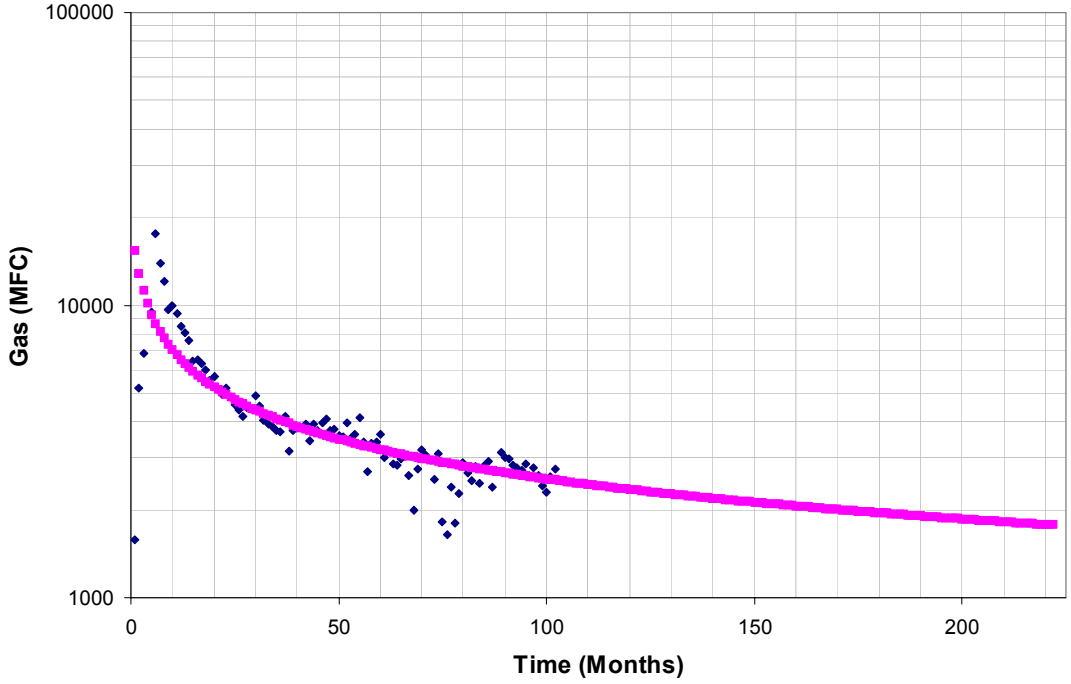

Fig 5. Forecasted gas production of well Flowers #1-80 for the next ten years.

Forecasted earnings for gas.

Year	Gas Production (MFC)	Revenue	Operating Cost	Net Cash Flow	Tax	Profit	Net Presant Value
1	25944.6929	$129,723.46	$16,864.05	$112,859.41	$54,172.52	$58,686.90	$53,351.72
2	24243.1035	$121,215.52	$15,758.02	$105,457.50	$50,619.60	$54,837.90	$45,320.58
3	22795.7484	$113,978.74	$14,817.24	$99,161.51	$47,597.52	$51,563.98	$38,740.78
4	21546.8099	$107,734.05	$14,005.43	$93,728.62	$44,989.74	$48,738.88	$33,289.31
5	20456.0488	$102,280.24	$13,296.43	$88,983.81	$42,712.23	$46,271.58	$28,731.01
6	19493.6595	$97,468.30	$12,670.88	$84,797.42	$40,702.76	$44,094.66	$24,890.28
7	18637.0526	$93,185.26	$12,114.08	$81,071.18	$38,914.17	$42,157.01	$21,633.21
8	17868.7681	$89,343.84	$11,614.70	$77,729.14	$37,309.99	$40,419.15	$18,855.83
9	17175.0791	$85,875.40	$11,163.80	$74,711.59	$35,861.57	$38,850.03	$16,476.20
10	16545.0315	$82,725.16	$10,754.27	$71,970.89	$34,546.03	$37,424.86	$14,428.90
						Total	**$295,717.85**

Table 5. Forecasted gas earnings of well Flowers #1-80 for the next ten years.

Oil production.

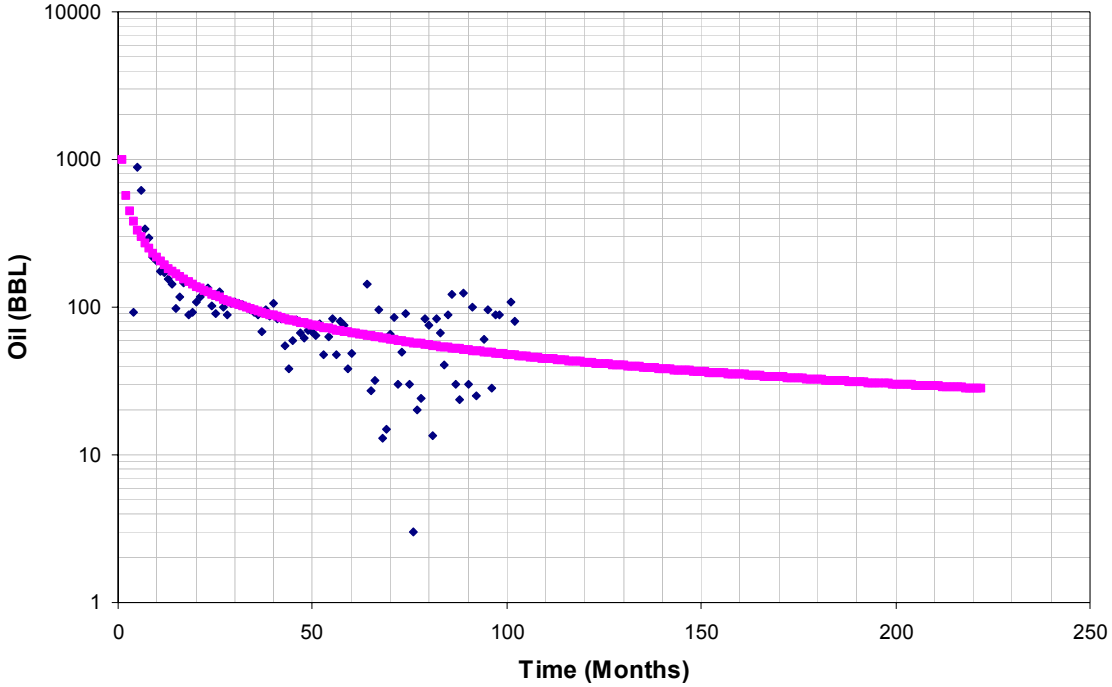

Fig 6. Forecasted oil production of well Flowers #1-80 for the next ten years.

Forecasted earnings for oil.

Year	Oil Production (BBL)	Revenue	Operating Cost	Net Cash Flow	Tax	Profit	Net Presant Value
1	545.5551	$21,822.20	$2,373.16	$19,449.04	$9,335.54	$10,113.50	$9,194.09
2	508.8003	$20,352.01	$2,213.28	$18,138.73	$8,706.59	$9,432.14	$7,795.16
3	477.6731	$19,106.92	$2,077.88	$17,029.05	$8,173.94	$8,855.10	$6,652.97
4	450.9099	$18,036.39	$1,961.46	$16,074.94	$7,715.97	$8,358.97	$5,709.29
5	427.6071	$17,104.28	$1,860.09	$15,244.19	$7,317.21	$7,926.98	$4,922.03
6	407.0999	$16,284.00	$1,770.88	$14,513.11	$6,966.29	$7,546.82	$4,259.98
7	388.8877	$15,555.51	$1,691.66	$13,863.85	$6,654.65	$7,209.20	$3,699.46
8	372.5850	$14,903.40	$1,620.74	$13,282.66	$6,375.67	$6,906.98	$3,222.16
9	357.8905	$14,315.62	$1,556.82	$12,758.80	$6,124.22	$6,634.57	$2,813.71
10	344.5643	$13,782.57	$1,498.85	$12,283.72	$5,896.19	$6,387.53	$2,462.67
						Total	**$50,731.51**

Table 6. Forecasted oil earnings of well Flowers #1-80 for the next ten years.

Total Earnings	**$346,449.36**

Conclusion.

The objective of the study was to determine the profitability of producing gas and oil from the three wells selected for evaluation

The wells were selected on the basis of their locations and total gas production.

Since the unit cost of production and the other costs as well as the price of oil and gas in the ten years remains common to all three wells the principle factor which will determine the profitability of each well will be its production capacity over the ten year period which is determined through the Decline Curve Analysis Technique.

The total oil and gas production of Brown JT # 14 are greater than that of Jones # 7-85 whilst the total oil production of Flower # 1-80 exceeds the oil production of Brown JT# 14 although the gas production is lower.

When comparing Jones # 7-85 and Flower # 1-80 the oil production of Flower # 1-80 is less than that of Jones # 7-85 although the gas production is very much more.

The individual profitability forecasts quantify the results more clearly and may be summarized in diminishing order as follows:

	US$
Brown JT # 14	493,725.29
Jones # 7-85	389,139.39
Flower # 1-80	346,449.36

Accordingly the well Brown JT # 14 is recommended for purchase.