



## **UKFields Help**

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# **UKFields**

**UK Oil and Gas Field Production Analysis Software**

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*by Petroleum Solutions Ltd*

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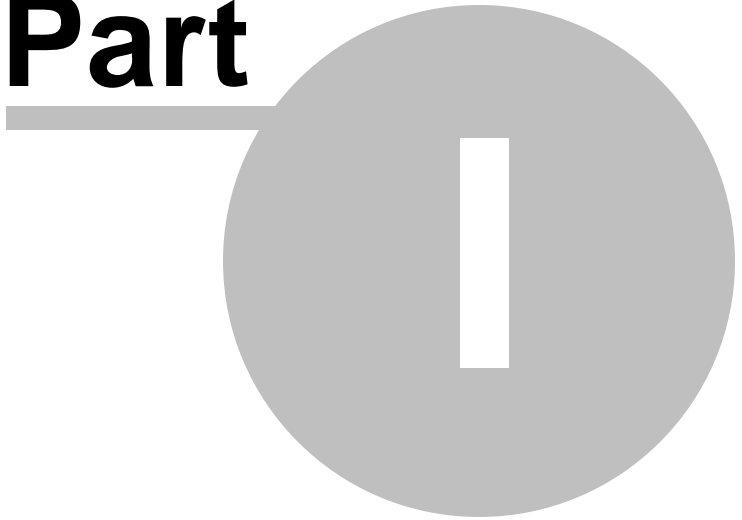
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# UKFields

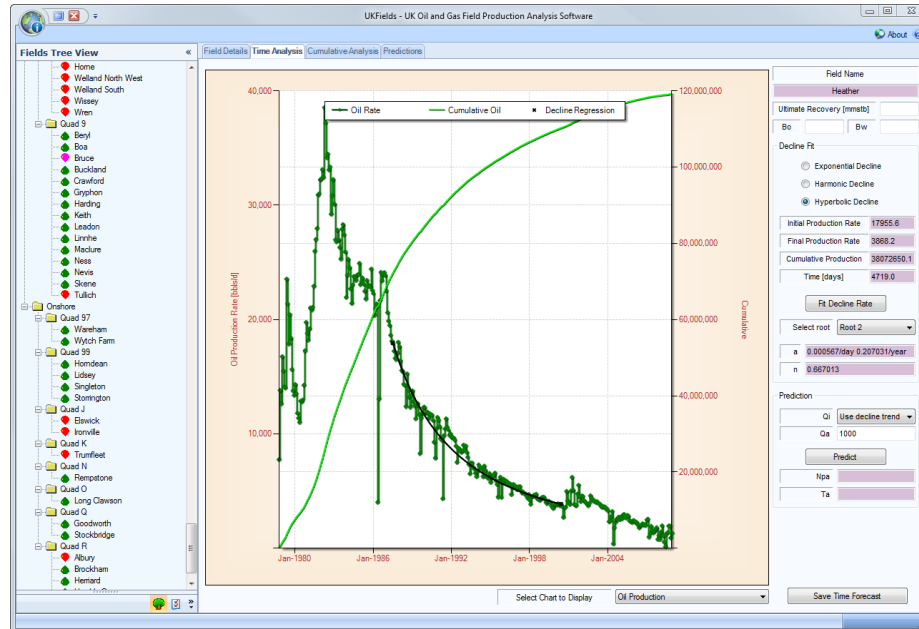
UK Oil and Gas Field Production  
Analysis Software

**Part**



# 1 Welcome to UKFields

## 1.1 Introduction



**UKFields** is a production analysis database containing all UK oil and gas producing fields monthly production and injection data to December 2009. The intent of this application is to periodically re-publish the database once the data becomes available.

Through the use of this application, the user can quickly :

- ➔ Analyse the production and injection history of any field in the UK, based on a rate or ratio vs time basis or rate or ratio vs cumulative basis, for all available data to December 2009.
- ➔ Export the field production and injection histories of any field to any external package via copy and paste and the windows clipboard.
- ➔ Display presentation quality charts of field production and injection histories, and export any of the charts within the application via the clipboard or by saving as JPG / PNG / etc.
- ➔ Obtain well statistics [maximum rates, cumulative recoveries, etc] on a field-by-field basis, for all available data to July 1999.
- ➔ Perform field level decline curve analysis on the oil or gas rate vs time basis, or any rates and ratios displayed on a cumulative basis.

- ➔ Examine the key production profile statistics for any UK oil and gas field for analogue field comparison. Figures are calculated for peak offtake rate, cumulative offtake, decline curve parameters, associated hydrocarbon (gas or condensate) and non-hydrocarbon (water) development with time and versus cumulative hydrocarbon phase.
- ➔ Contrast the production and injection performance for similar fields to enable field acquisition analysis, and future potential production and reserves optimisation.

### License.dat File

The "License.dat" file is located in the Application Startup folder (eg C:\Program Files\Petroleum Solutions\UKFields\)

The contents of this ASCII license file needs to contain the following license information.

[License Settings]

LicensedTO =

Company =

ProductID =

LicenseID =

If any of the above License key information is incorrect or absent, or if the License.dat file is missing then the application will fail to startup.

### .NET Framework

This application requires the presence or installation of Microsoft .Net Framework version 2.

.NET Framework version 2 is a component of the Microsoft Windows® operating system used to build and run Windows-based applications.

Should .NET Framework version 2 not be installed on the destination PC then a link is provided below to download this system software. The user should download and install .NET Framework version 2 before attempting to install this application.

 <http://www.petroleumsolutions.co.uk/downloads.html>

The installation of .Net Framework also requires a minimum software and hardware requirement. Details of which are shown below. Specifically, note that you cannot install the .NET Framework on a computer running the Microsoft Windows 95 operating system.

#### Minimum requirements

To install .NET Framework [Dotnetfx2.exe], you must have one of the following operating systems, with Microsoft Internet Explorer 5.01 or later installed on your computer:

- Microsoft® Windows® 98

- Microsoft® Windows® 98 Second Edition
- Microsoft® Windows® Millennium Edition (Windows Me)
- Microsoft® Windows NT® 4 (Workstation or Server) with Service Pack 6a
- Microsoft® Windows® 2000 (Professional, Server, or Advanced Server) with the latest Windows service pack and critical updates available from the Microsoft Security Web site ([www.microsoft.com/security](http://www.microsoft.com/security)).
- Microsoft® Windows® XP (Home or Professional)

#### Recommended hardware

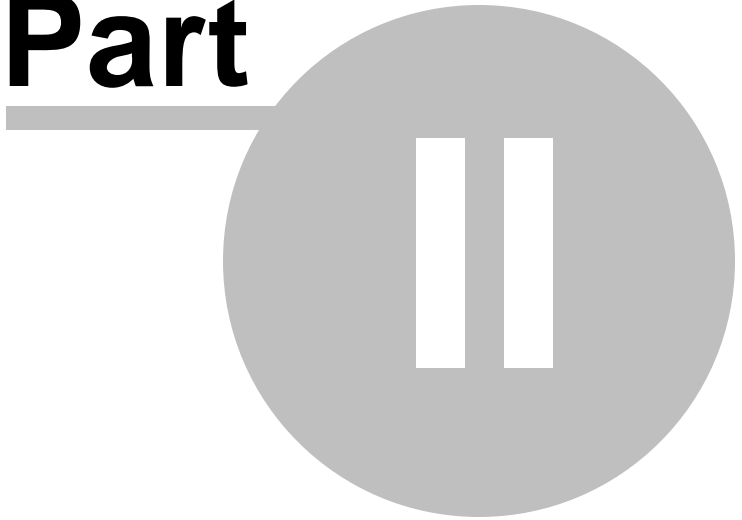
| CPU Recommended          | RAM Recommended |
|--------------------------|-----------------|
| Pentium 90 MHz or faster | 96 MB or higher |



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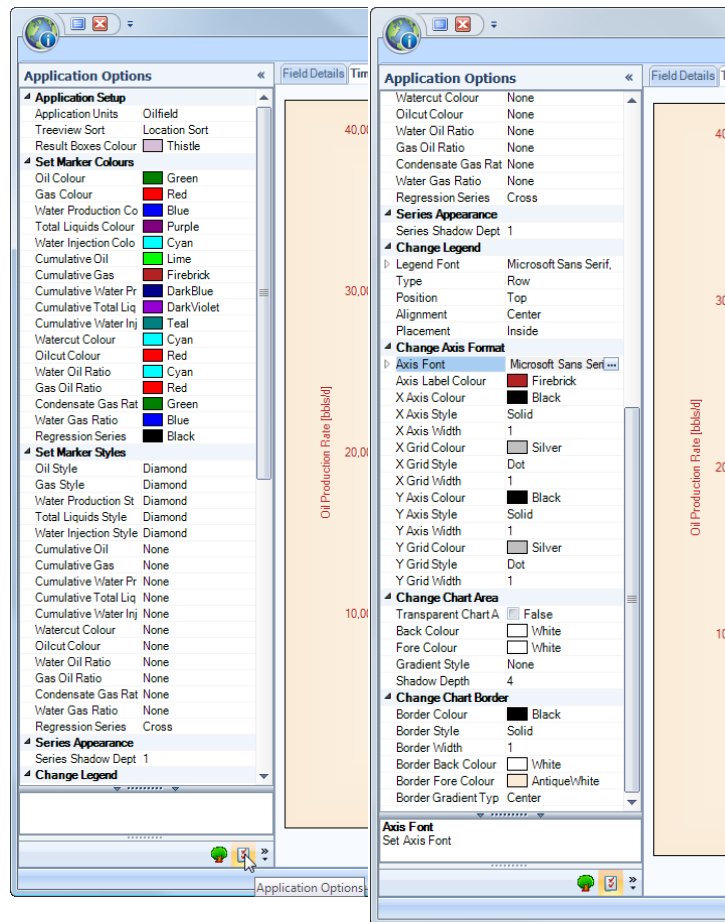


## 2 Application Options

### 2.1 Chart Display Options

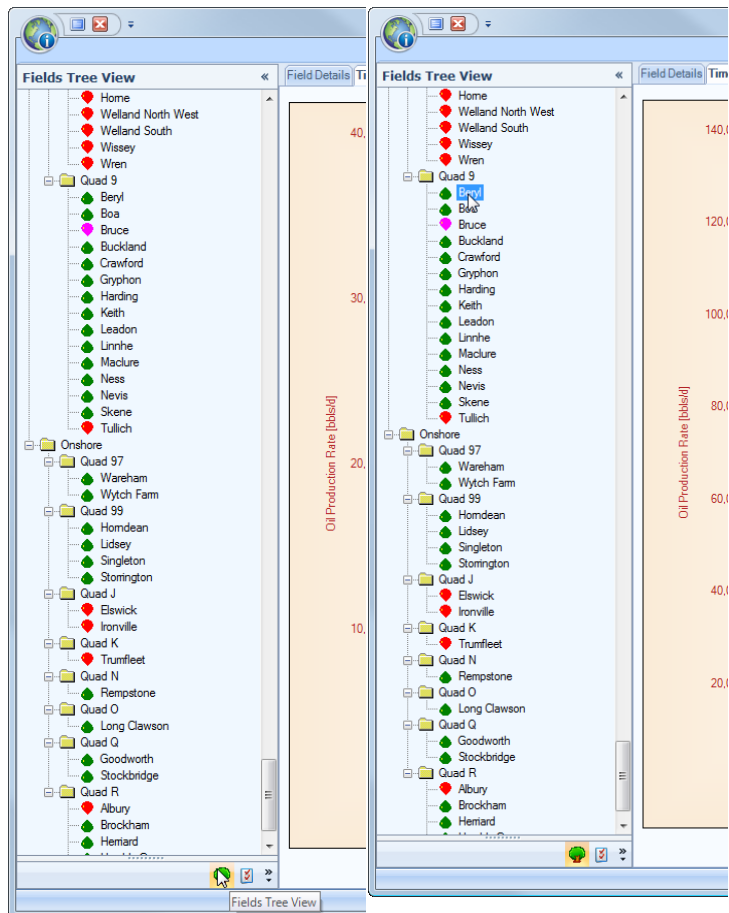
Any part of the chart displays can be changed to suit specific user preferences. These options can be accessed by selecting the Application Options button on the bottom left corner of the application, as highlighted below.

By scrolling up and down within this Application Options property grid and selecting the various options, the user can change any part of the Chart Appearance.

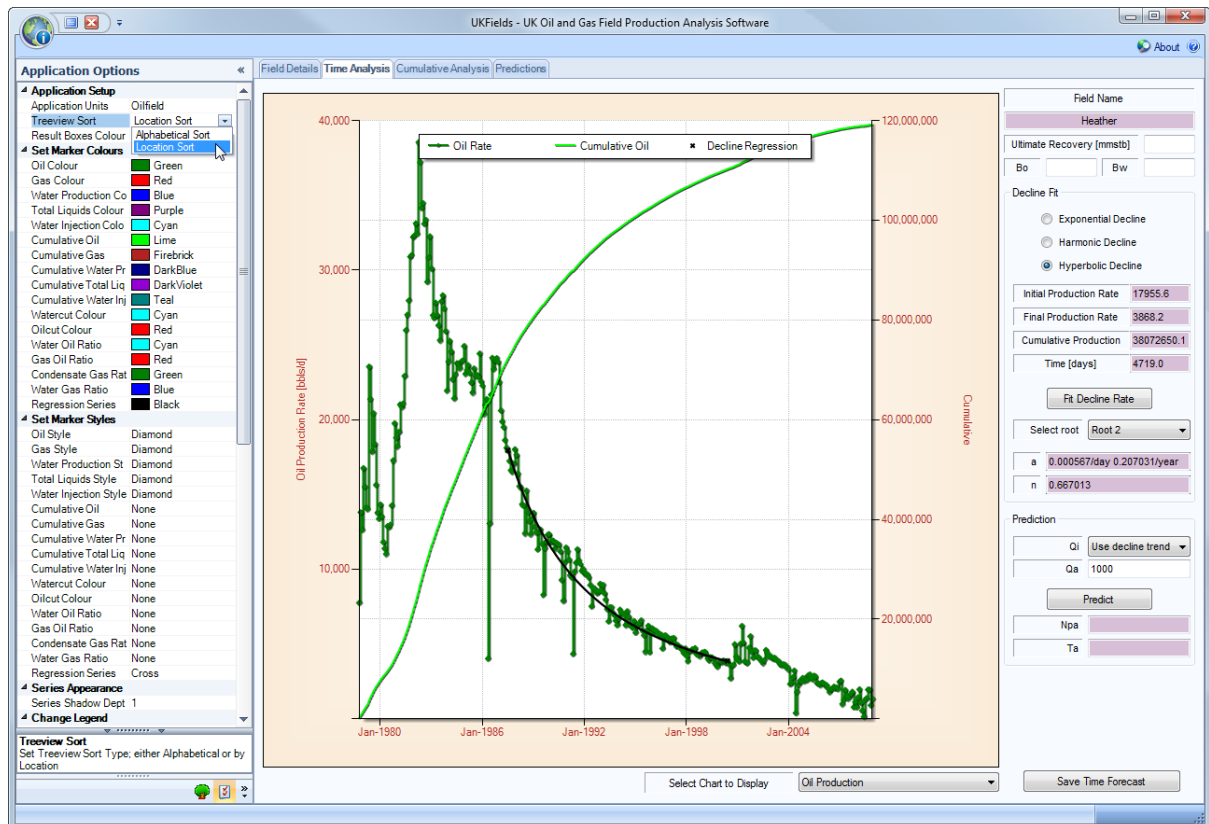


### 2.2 Treeview Navigation

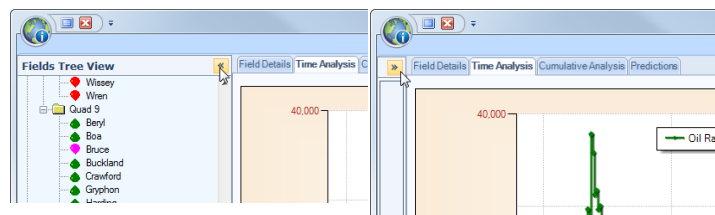
Selecting an oil or gas field for analysis could not be easier, and is done with the Fields Tree View panel. To select a field simply single right mouse click on the field name within the Field View panel, as shown below.



The user can choose to sort the FieldView docking panel, either alphabetically or by UK Quad Location. The selection between these two options is also highlighted below.



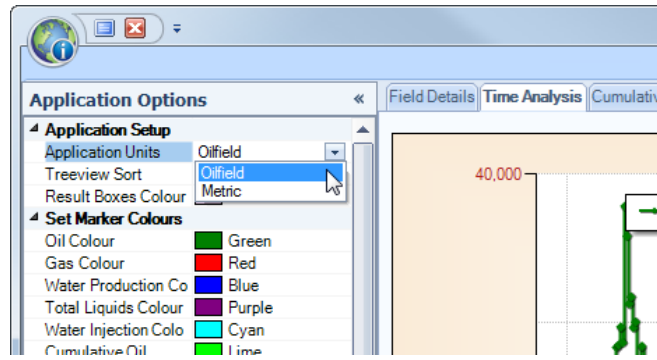
The user can also choose to auto Hide the Panel by selecting the Arrows icon, as shown below. Once selected the Panel should collapse, as shown below. To recover the Fields Tree View Panel just select the Arrows icon again.



## 2.3 Units

The database application units are stored in metric units, however within the application the user can choose to work in either Metric or, more commonly, Oilfield units.

To switch between units, simply select the Oilfield Units or Metric Units menu item as shown below.



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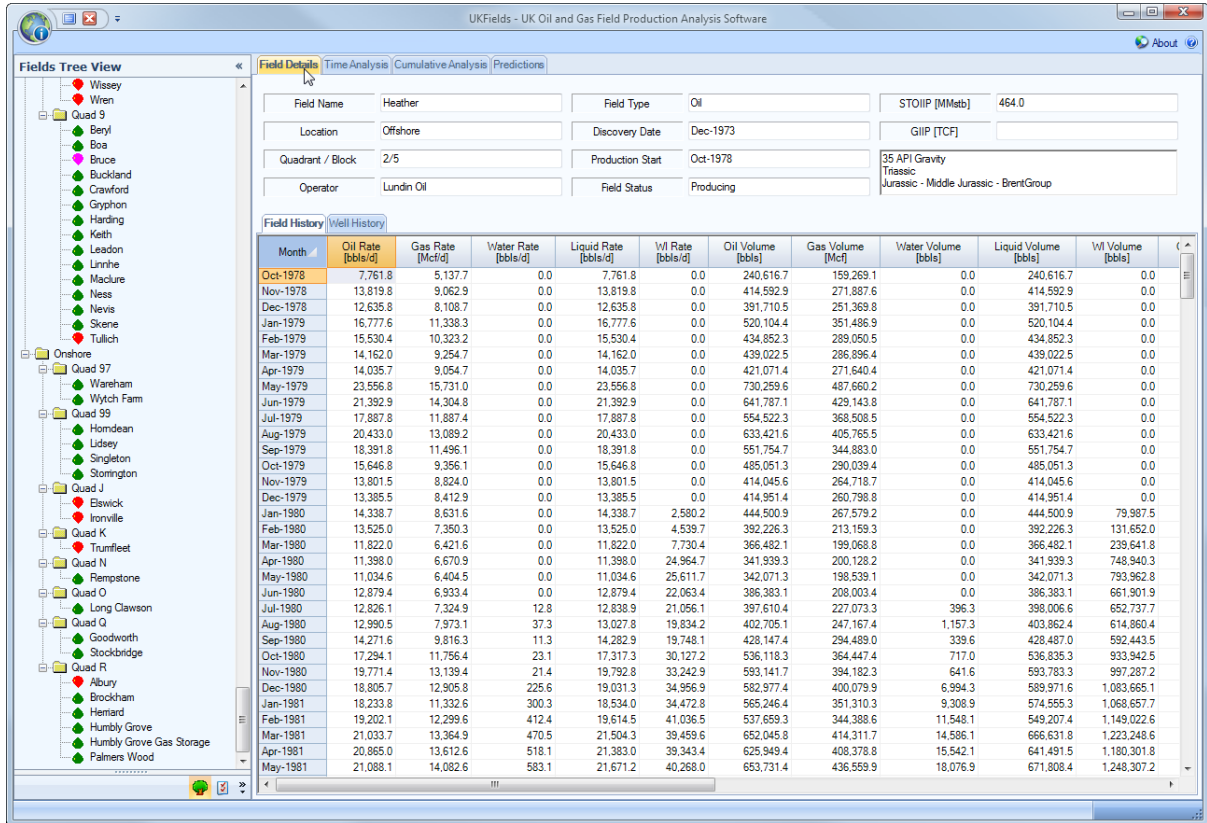
# Part



### 3 Field Details

#### 3.1 Overview and Field History Data

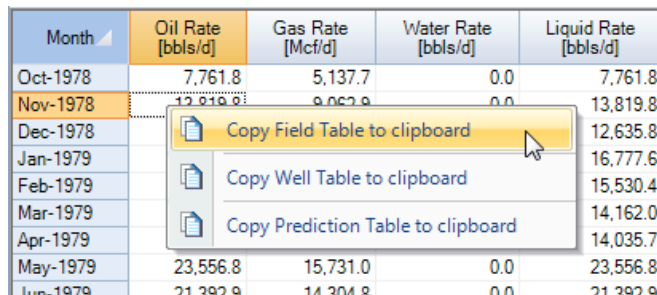
Once the application launches successfully, the following should be displayed.



#### Copy and Paste Datable Information to External Applications

Any of the table data can be copied as pasted into external applications via two methods.

1. Either press the right mouse button once over any of the tables to activate the table context menu, as highlighted below, then select the various menu item to copy a specific table to the clipboard.



2. Or, simply select and drag an area with the mouse, then press the standard windows CTRL+C keys to copy the selected area to the clipboard.

| Month    | Oil Rate [bbls/d] | Gas Rate [Mcf/d] | Water Rate [bbls/d] | Liquid Rate [bbls/d] |
|----------|-------------------|------------------|---------------------|----------------------|
| Oct-1978 | 7,761.8           | 5,137.7          | 0.0                 | 7,761.8              |
| Nov-1978 | 13,819.8          | 9,062.9          | 0.0                 | 13,819.8             |
| Dec-1978 | 12,635.8          | 8,108.7          | 0.0                 | 12,635.8             |
| Jan-1979 | 16,777.6          | 11,338.3         | 0.0                 | 16,777.6             |
| Feb-1979 | 15,530.4          | 10,323.2         | 0.0                 | 15,530.4             |
| Mar-1979 | 14,162.0          | 9,254.7          | 0.0                 | 14,162.0             |
| Apr-1979 | 14,035.7          | 9,054.7          | 0.0                 | 14,035.7             |
| May-1979 | 23,556.8          | 15,731.0         | 0.0                 | 23,556.8             |
| Jun-1979 | 21,392.9          | 14,304.8         | 0.0                 | 21,392.9             |
| Jul-1979 | 17,887.8          | 11,887.4         | 0.0                 | 17,887.8             |
| Aug-1979 | 20,433.0          | 13,089.2         | 0.0                 | 20,433.0             |
| Sep-1979 | 18,391.8          | 11,496.1         | 0.0                 | 18,391.8             |
| Oct-1979 | 15,646.8          | 9,356.1          | 0.0                 | 15,646.8             |
| Nov-1979 | 13,801.5          | 8,824.0          | 0.0                 | 13,801.5             |
| Dec-1979 | 13,385.5          | 8,412.9          | 0.0                 | 13,385.5             |
| Jan-1980 | 14,338.7          | 8,631.6          | 0.0                 | 14,338.7             |
| Feb-1980 | 13,525.0          | 7,350.3          | 0.0                 | 13,525.0             |

### 3.2 Well History Data

Summary well data has also been incorporated into the database. Based on UK published well data to July 1999, individual wells have been summarised in the database and presented by field in the formats presented below. From this data, the user can approximately determine the range of peak production rates and likely well cumulative production volumes for any field with data up to July 1999.

|                  |          |                  |           |  |       |
|------------------|----------|------------------|-----------|--|-------|
| Field Name       | Gryphon  | Field Type       | Oil       | STOIIP [MMstb]                               | 300.0 |
| Location         | Offshore | Discovery Date   | Jul-1987  | GIIP [TCF]                                   |       |
| Quadrant / Block | 9/18     | Production Start | Aug-1993  | 21 API Gravity<br>Tertiary - Eocene - Balder |       |
| Operator         | Maersk   | Field Status     | Producing |  |       |

| WellName  | Months on Production | Max Oil Rate [bbls/d] | Max Gas Rate [Mcf/d] | Max Water Rate [bbls/d] | Cumulative Oil [bbbls] | Cumulative Gas [Mcf] | Cumulative Water [bbbls] |
|-----------|----------------------|-----------------------|----------------------|-------------------------|------------------------|----------------------|--------------------------|
| 9/18- 2   | 2                    | 10,529.9              | 2,873.9              | 118.4                   | 484,762.0              | 23,567.9             | 6,623.2                  |
| 9/18b- 10 | 60                   | 10,353.8              | 8,817.8              | 6,469.5                 | 8,040,579.1            | 1,101,087.9          | 3,740,078.5              |
| 9/18b- 7  | 63                   | 8,565.5               | 6,587.8              | 5,137.7                 | 8,310,625.9            | 782,653.7            | 1,897,818.2              |
| 9/18b- 9  | 40                   | 0.0                   | 0.0                  | 20,369.6                | 0.0                    | 0.0                  | 17,302,947.7             |
| 9/18b-A1  | 69                   | 8,801.3               | 14,262.8             | 2,666.2                 | 10,774,728.3           | 2,646,639.0          | 710,031.5                |
| 9/18b-A11 | 57                   | 7,737.9               | 4,530.7              | 1,658.8                 | 6,129,961.2            | 613,174.7            | 638,434.6                |
| 9/18b-A13 | 52                   | 9,695.7               | 5,472.8              | 6,240.1                 | 3,581,864.6            | 429,940.0            | 2,919,528.7              |
| 9/18b-A14 | 46                   | 11,696.4              | 7,556.6              | 8,538.2                 | 6,779,226.8            | 971,882.6            | 4,057,342.8              |
| 9/18b-A15 | 44                   | 7,873.7               | 2,362.2              | 20,356.2                | 3,322,856.5            | 155,905.5            | 13,583,562.6             |
| 9/18b-A17 | 1                    | 1,639.3               | 6,767.7              | 2,629.2                 | 49,897.1               | 36,688.5             | 80,025.3                 |
| 9/18b-A18 | 23                   | 12,514.1              | 4,066.6              | 1,742.7                 | 3,771,269.7            | 240,283.3            | 669,399.4                |
| 9/18b-A19 | 1                    | 5,049.0               | 1,425.9              | 1,075.0                 | 153,678.9              | 7,730.2              | 32,719.6                 |
| 9/18b-A2  | 69                   | 9,958.5               | 4,229.1              | 8,289.2                 | 9,213,830.1            | 651,272.1            | 5,911,906.0              |
| 9/18b-A3  | 30                   | 12,415.7              | 3,052.6              | 8,019.1                 | 3,871,044.9            | 169,472.7            | 1,673,102.1              |
| 9/18b-A4  | 61                   | 0.0                   | 22,497.0             | 45,162.6                | 0.0                    | 455,671.6            | 62,838,162.2             |
| Minimum   |                      | 0.0                   | 0.0                  |                         |                        |                      |                          |
| Average   |                      | 8,987.0               | 6,750.2              |                         |                        |                      |                          |
| Maximum   |                      | 12,514.1              | 22,497.0             |                         |                        |                      |                          |

Again, the user can copy and paste the data table information to any external package via the two methods discussed in the previous section.



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**Part**



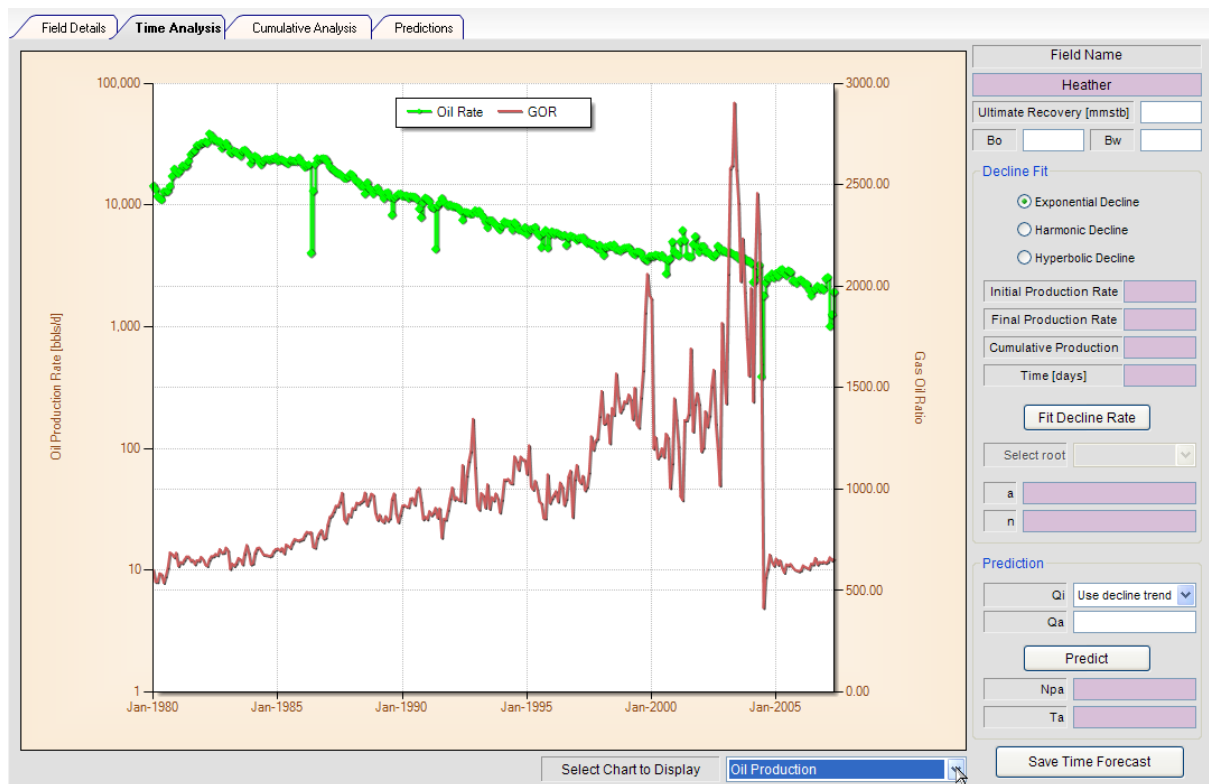
**IV**

## 4 Time Analysis

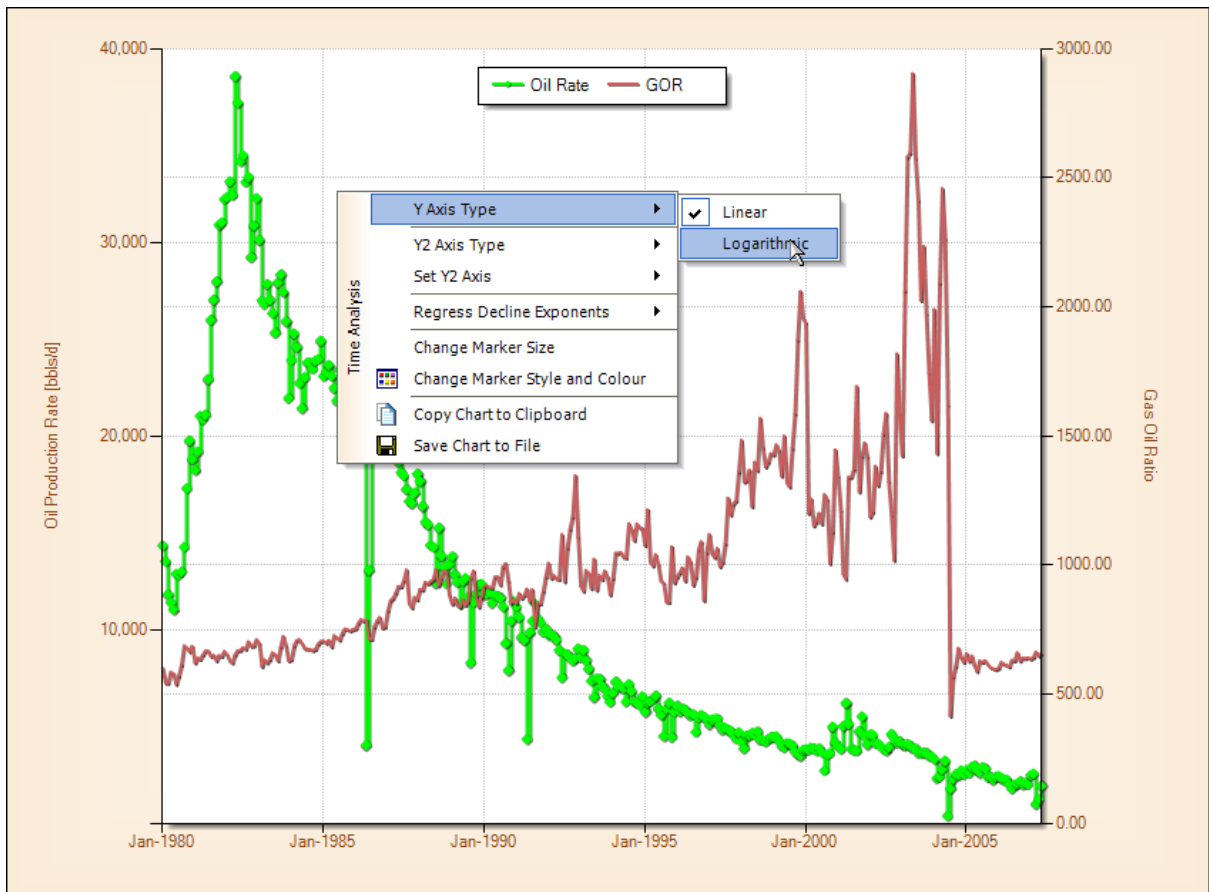
### 4.1 Oil Production

Within the Time Analysis section, the user can display numerous production and injection rates and ratios versus time.

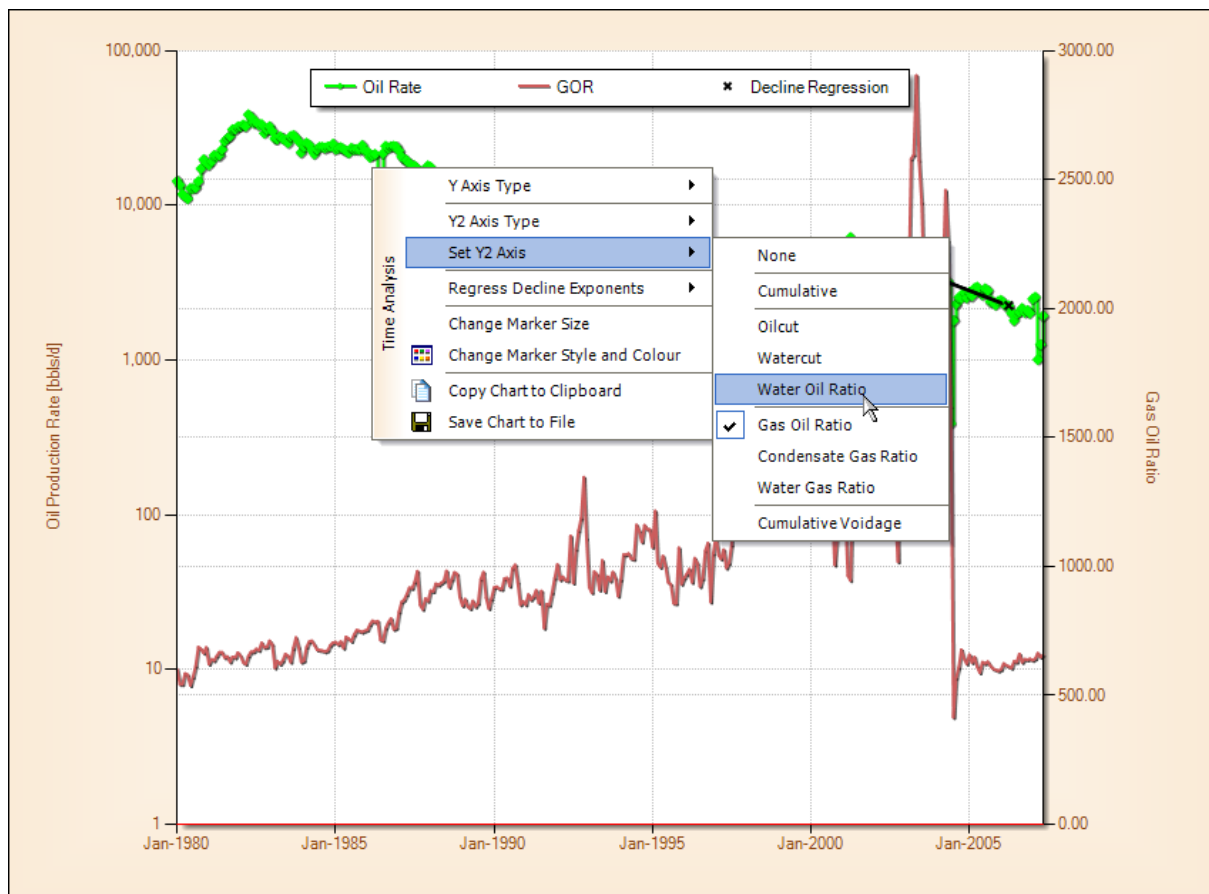
The user can also perform decline curve analysis on both the Oil and Gas production rate, for exponential, harmonic and hyperbolic decline curve equations.



The user can choose between linear and logarithmic Y axis display by selecting the chart context menu with a single right mouse click. See screen capture provided below.



Many other production ratios are provided as a secondary Y axis display, to help in the field production profile and decline curve selection. These can be changed again via the chart context menu as shown below.



The user can also choose to display the secondary Y axis as either linear or logarithmic. See screen capture provided below.

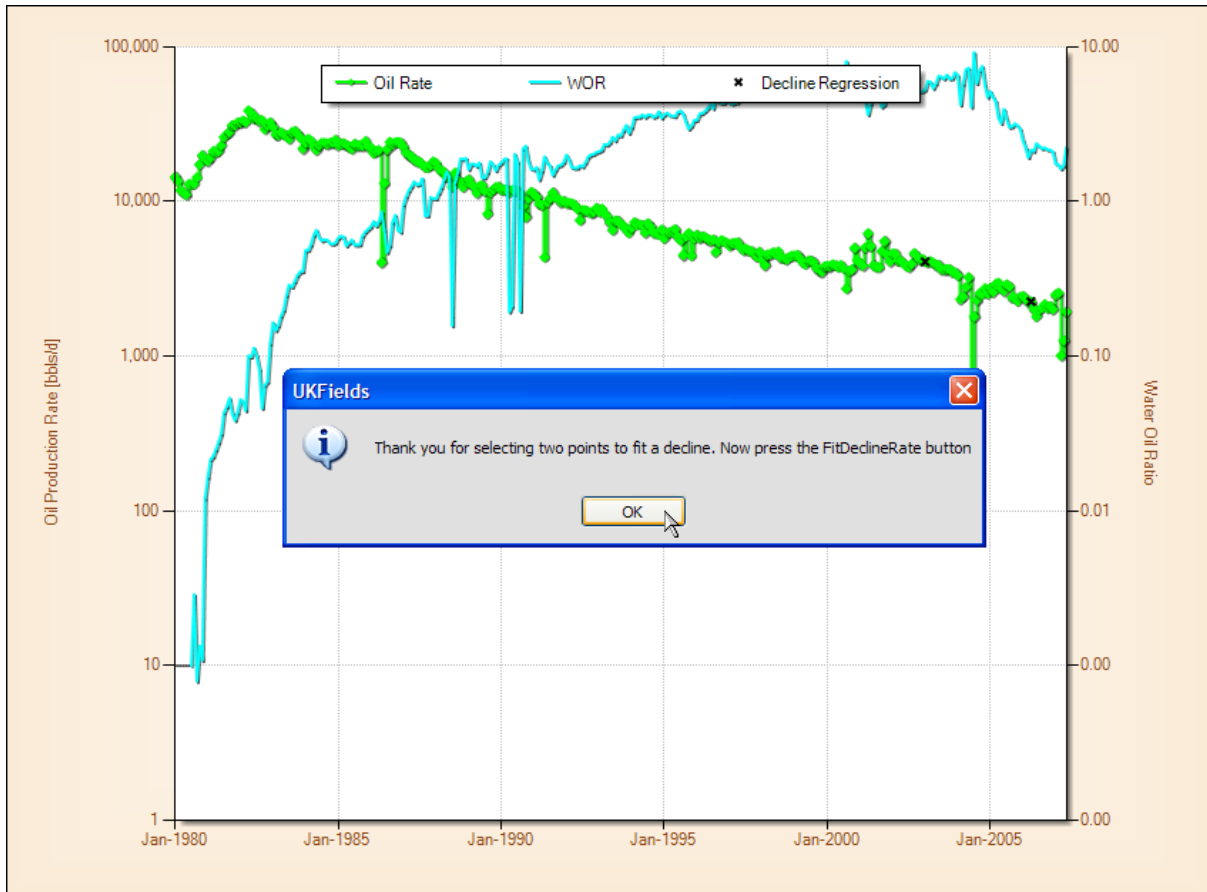


## Regress Decline Exponents

To select points for decline curve analysis, first select the Regress Decline Exponents then Select Points menu item, as shown below.



Once the user has selected 2 points a message box will pop up acknowledging the fact that 2 points were digitized. The user can then choose to fit a decline type, either Exponential, Harmonic or Hyperbolic.



Examples of each decline type are shown below.

| Decline Type        | Parameter 'a'              | Parameter 'n' |
|---------------------|----------------------------|---------------|
| Exponential Decline | 0.000500/day 0.182515/year |               |
| Harmonic Decline    | 0.000682/day 0.249072/year |               |
| Hyperbolic Decline  | 0.000500/day 0.182515/year | 0.000000      |

Where,

- a = Constant decline rate fraction, between 0 and 1
- n = additional hyperbolic constant decline exponent, typically between 0 and 1

Special cases for the hyperbolic decline equation occur at  $n=0$  [exponential decline] and  $n=1$  [harmonic decline].

The following text is taken from "Petroleum Engineering Handbook" published by the Society of Petroleum Engineers, page 40-26. "An analysis of a large number of actual production-decline curves assembled by Cutler indicates that most decline curves normally encountered are of the hyperbolic type, with values for the exponent  $n$  between 0 and 0.7, while the majority fall between 0 and 0.4."

For both the exponential and harmonic decline curves, the exponent 'a' can be solved by re-arranging their decline curve equations to the following :

Exponential Equation

$$a = \frac{\ln\left(\frac{q_i}{q}\right)}{t}$$

Harmonic Equation

$$a = \frac{\left(\frac{q_i}{q} - 1\right)}{t}$$

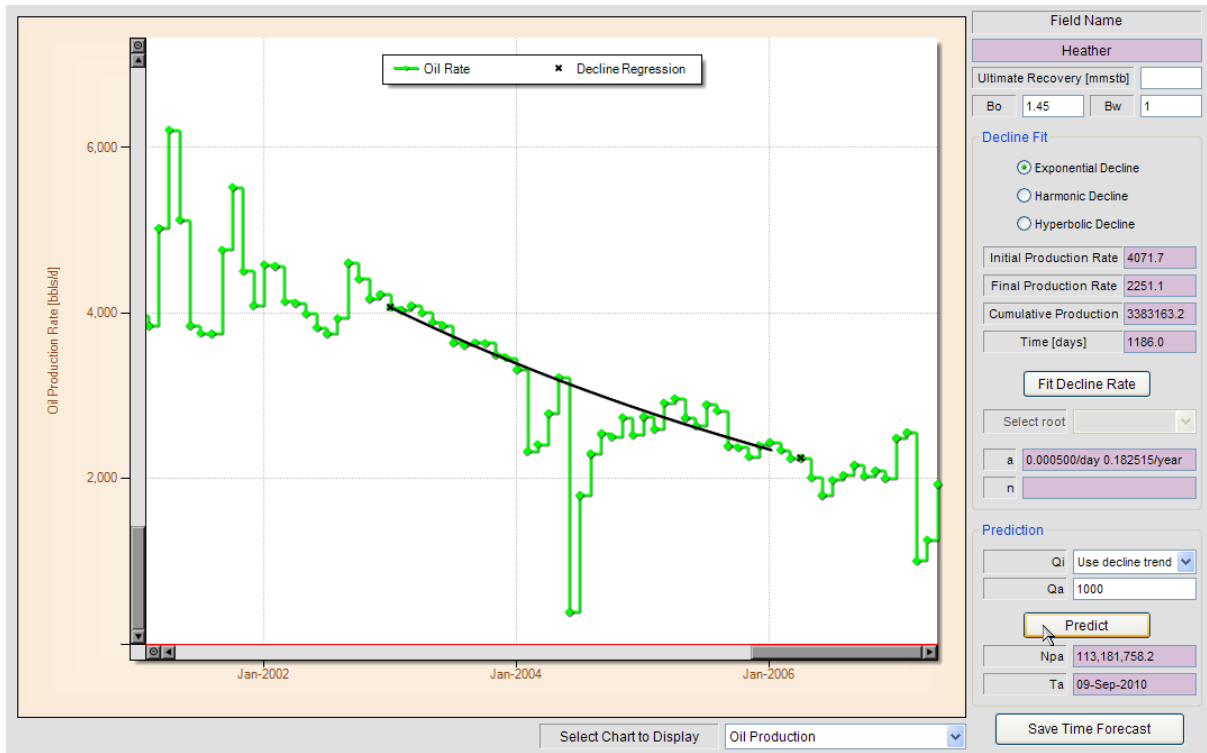
The solution of the hyperbolic parameters are based on the technique described in the following Society of Petroleum Engineers paper, where an additional parameter Cumulative production,  $N_p$ , is required.

"A Numerical Solution to Two-Parameter Representation of Production Decline Curve Analysis", SPE16505, B. Agbi and M Ng, 1987

The solution of the hyperbolic decline curve equation for values of 'a' and 'n' displays all roots of the equation, including values of 'a' at  $n=0$  (exponential decline) and  $n=1$  (harmonic decline). Typically, the value of 'n' at Root 2 is between 0 and 1.

Once the user has selected the Decline Type and pressed the **Fit Decline Rate** button, they can then approximately calculate the likely Ultimate Recovery at abandonment and Abandonment date. Should the user want a more accurate prediction of the Ultimate Recovery at abandonment and Abandonment date, then they should use





For completeness, the equations used to calculate these Ultimate Recoveries and abandonment dates are provided below, where  $q_i$  is the first digitized point and the Initial Production Rate.

**Exponential Decline**

Ultimate Recovery Equation      Abandonment Time Equation

$$N_{pa} = \frac{1}{a} \times (q_i - q_a)$$

$$T_a = \frac{\ln\left(\frac{q_a}{q_i}\right)}{-a}$$

**Harmonic Decline**

Ultimate Recovery Equation      Abandonment Time Equation

$$N_{pa} = \frac{q_i}{a} \times \ln\left(\frac{q_i}{q_a}\right)$$

$$T_a = \frac{\left(\frac{q_a}{q_i} - 1\right)}{a}$$

**Hyperbolic Decline**

Ultimate Recovery Equation      Abandonment Time Equation

$$N_{pa} = \frac{q_i}{(1-n) \times a} \times \left(1 - \left(\frac{q_i}{q_a}\right)^{(1-n)}\right)$$

$$T_a = \frac{\left[\frac{\left(\left(\frac{q_i}{q_a}\right)^n - 1\right)}{n}\right]}{a}$$

Assuming a decline curve analysis has been performed on the Oil Production Rate, the user should press the **Save Time Forecast** button to ensure that the digitized points, decline and prediction parameters are saved.

### Offtake Rates, Formation Volume Factors and Chart Tooltips

Once the user has determined the likely Ultimate field Recovery based either on the Rate vs Time analysis or any of the Rate or Ratio vs Cumulative analysis, then they can choose to input this figure into the Ultimate Recovery input box, as shown below.

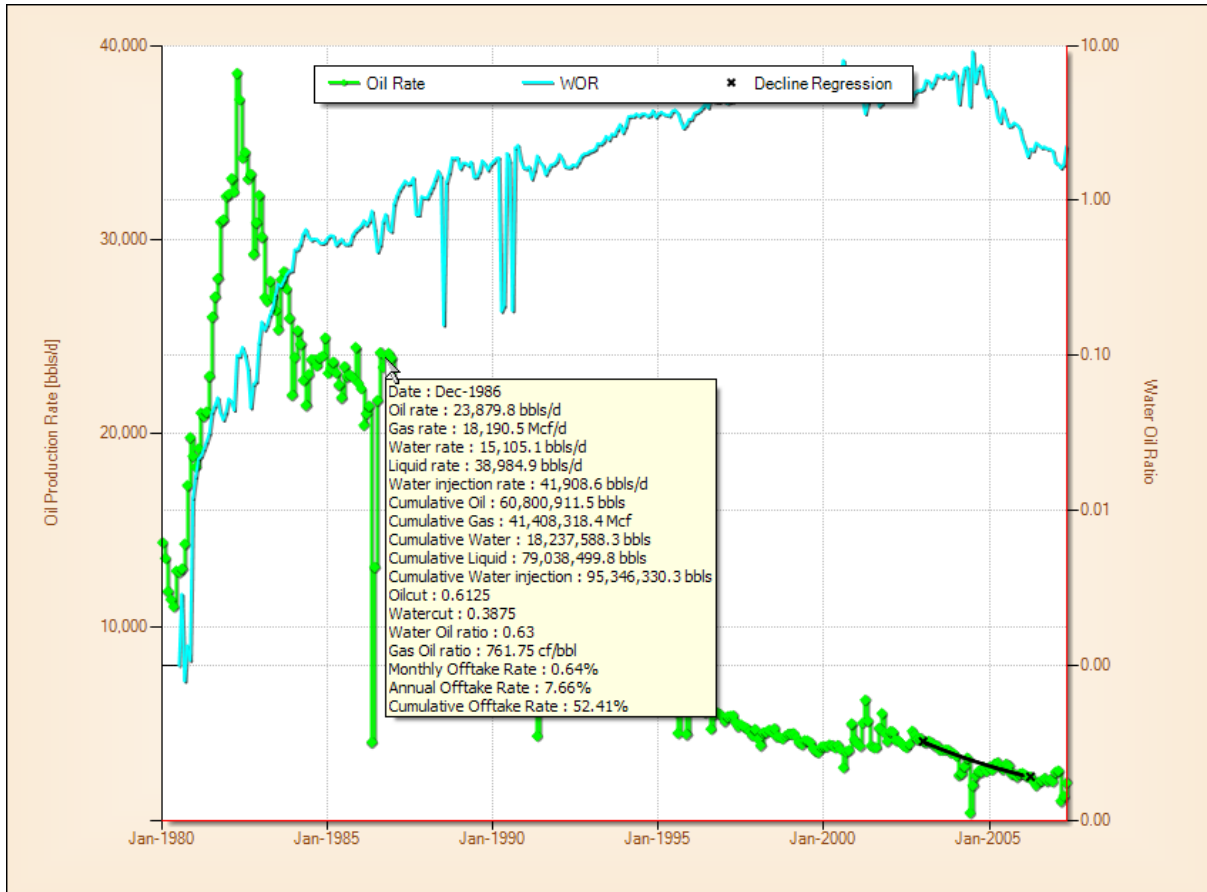
Also, should the user calculate a more accurate Cumulative Voidage Replacement, they can input values for produced Oil and Water formation volume factors as shown below. Once the user presses the **Save Time Forecast** button, as shown below, the calculation of Cumulative Voidage Replacement is updated and can be displayed in the Y2 axis by selecting Set Y2 Axis = Cumulative Voidage chart context menu item.

The image displays two side-by-side screenshots of a software interface for field analysis. Both screenshots show the same form with the following fields and values:

- Field Name:** Heather
- Ultimate Recovery [mmstb]:** 116
- Bo:** 1.45
- Bw:** 1
- Decline Fit:**
  - Exponential Decline
  - Harmonic Decline
  - Hyperbolic Decline
- Initial Production Rate:** 4071.7
- Final Production Rate:** 2251.1
- Cumulative Production:** 3383163.2
- Time [days]:** 1186.0
- Fit Decline Rate:** (button)
- Select root:** (dropdown menu)
- a:** 0.000500/day 0.182515/year
- n:** (input field)
- Prediction:**
  - Qi:** Use decline trend (dropdown menu)
  - Qa:** 1000
  - Predict:** (button)
  - Npa:** 113,181,758.2
  - Ta:** 09-Sep-2010
- Save Time Forecast:** (button)

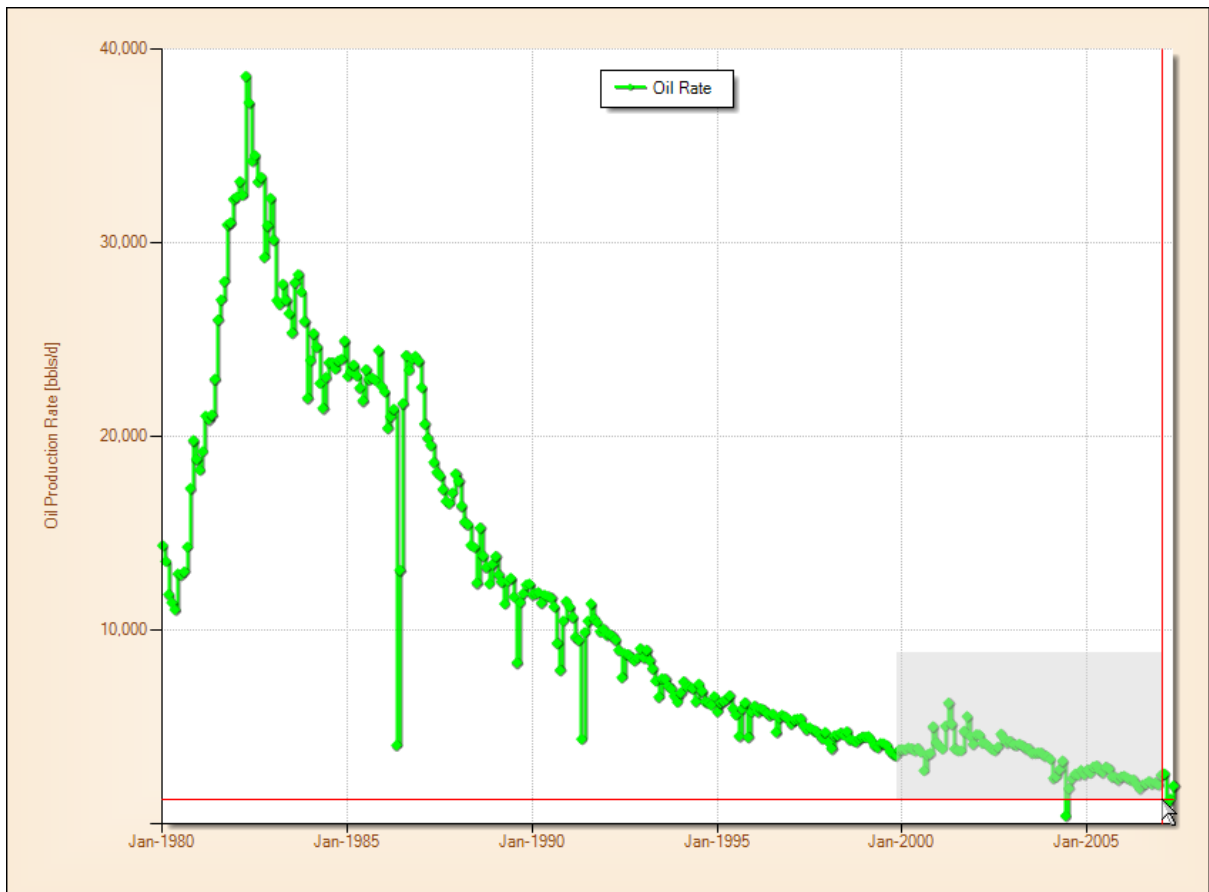
In the left screenshot, a mouse cursor is hovering over the **Bw** field. In the right screenshot, a mouse cursor is hovering over the **Save Time Forecast** button.

Once the Ultimate Recovery figure has been input into the text box, the user should press the **Save Time Forecast** button, as shown above. This will then enable the calculation of monthly, annual and cumulative offtake rates, which are displayed in the form of chart tooltips. See below.

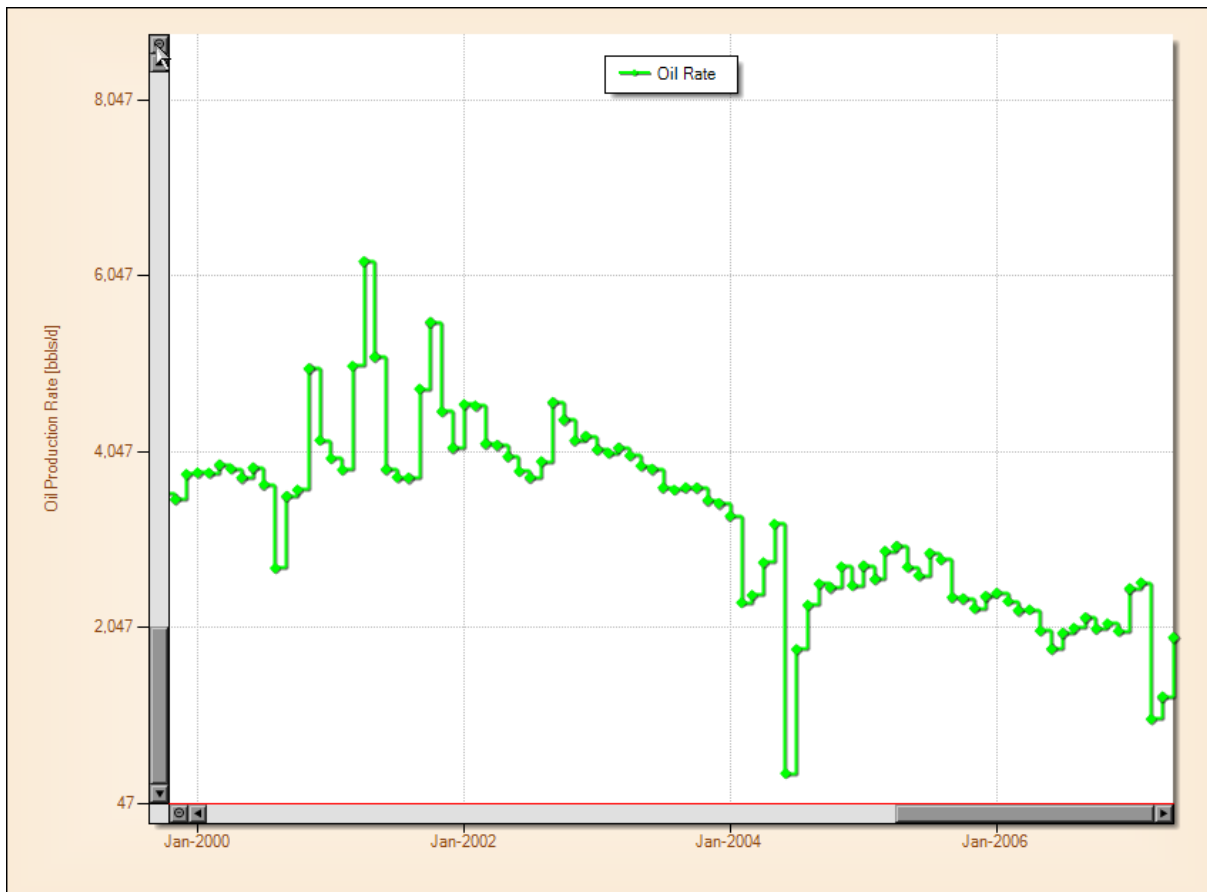


### Zooming and Unzooming within a Chart Area

Zooming within the chart area also couldn't be easier. Just single left-mouse click and drag the area of interest for zooming, as shown below.



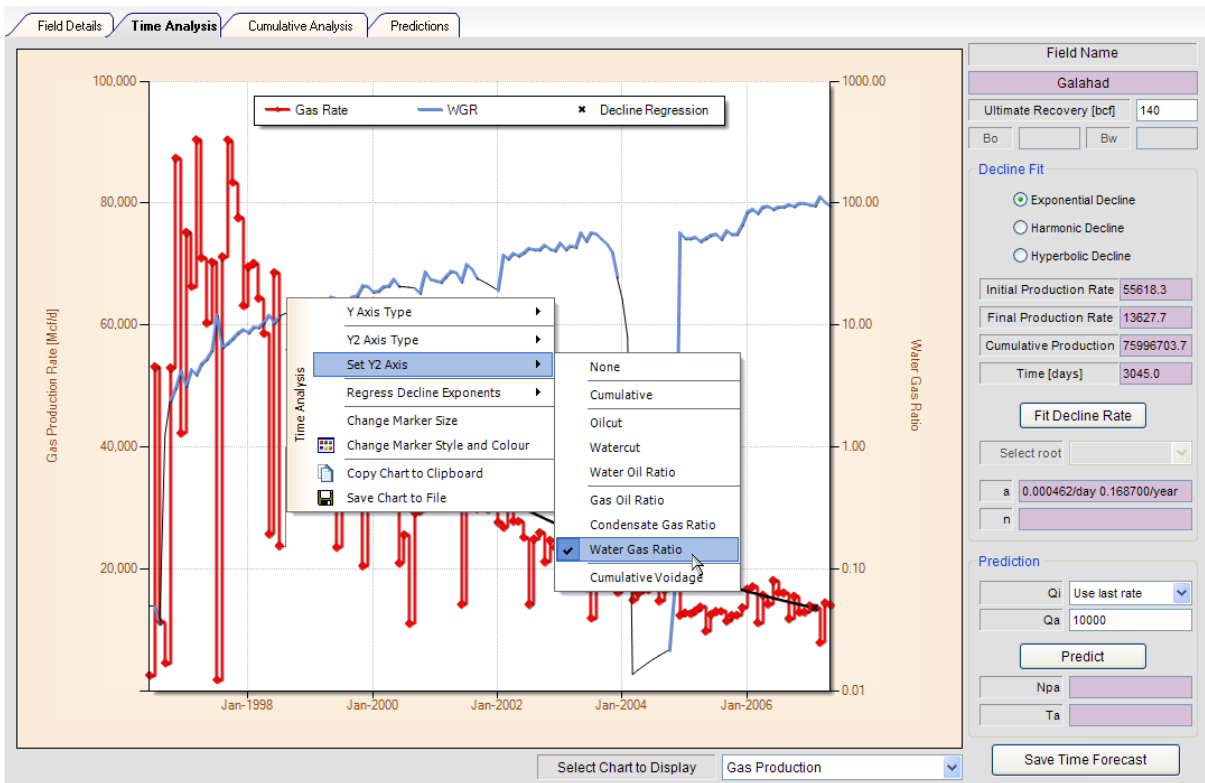
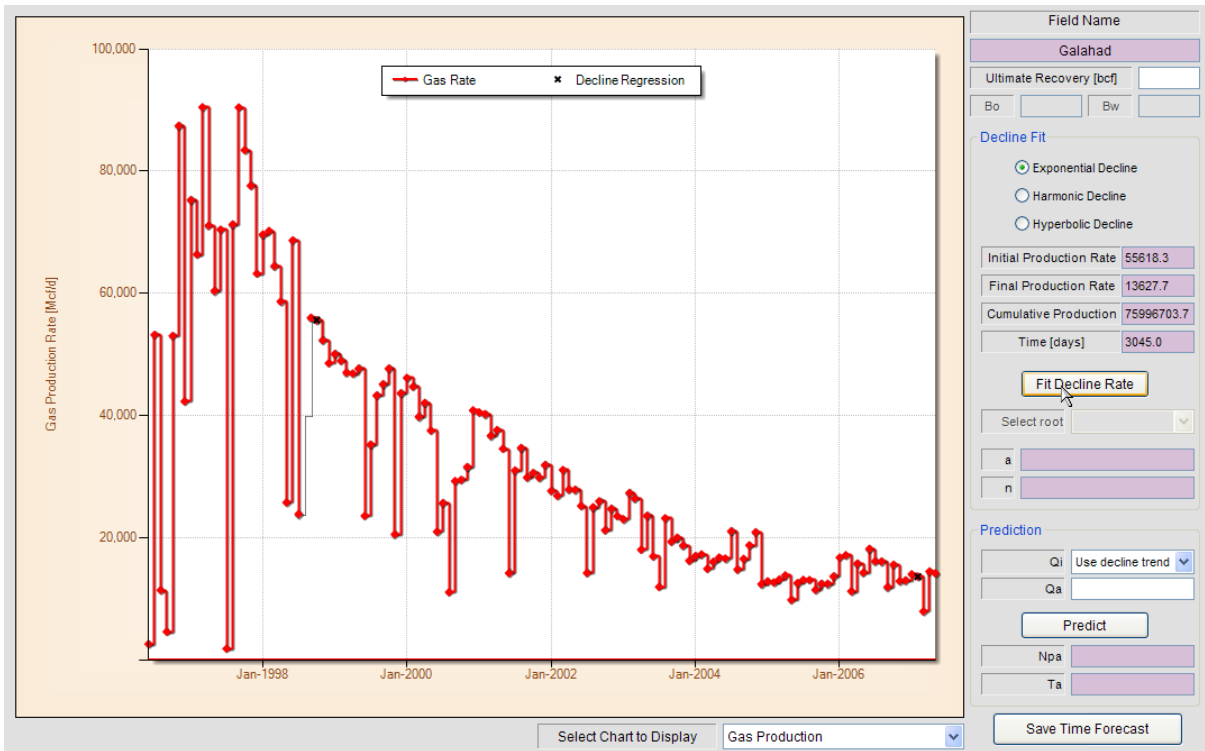
To unzoom simply single left mouse click one of the unzoom icons provided at the extremes of the axes scroll bars, as shown below.



## 4.2 Gas Production

All of the same functionality that was presented in the Oil Production section is also available for Gas Production analysis, including decline curve analysis, chart tooltips, ultimate recovery and abandonment prediction.

Two specific examples are provided below, although the equations and methods are identical to the Oil Production section.

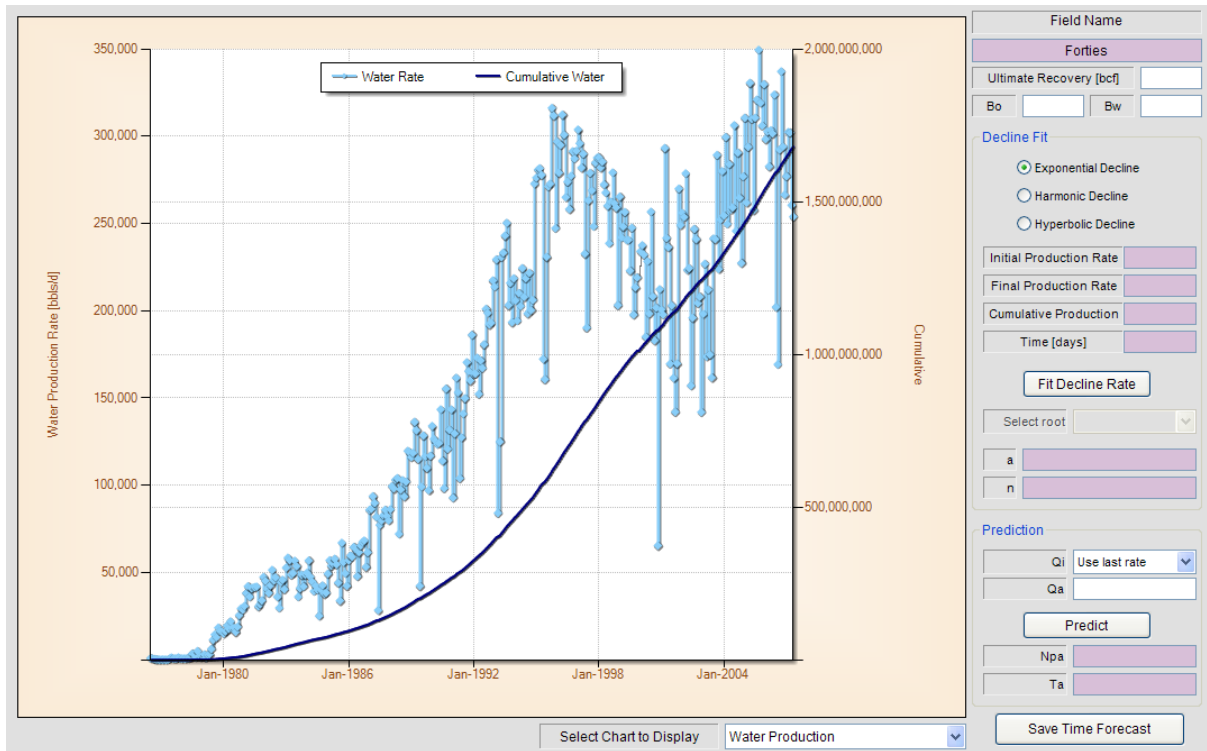


Assuming a decline curve analysis has been performed on the Gas Production Rate, the user should press the **Save Time Forecast** button to ensure that the digitized points, decline and prediction parameters are saved.

## 4.3 Water Production

Water Production rate versus time is displayed as the primary Y axis in this display.

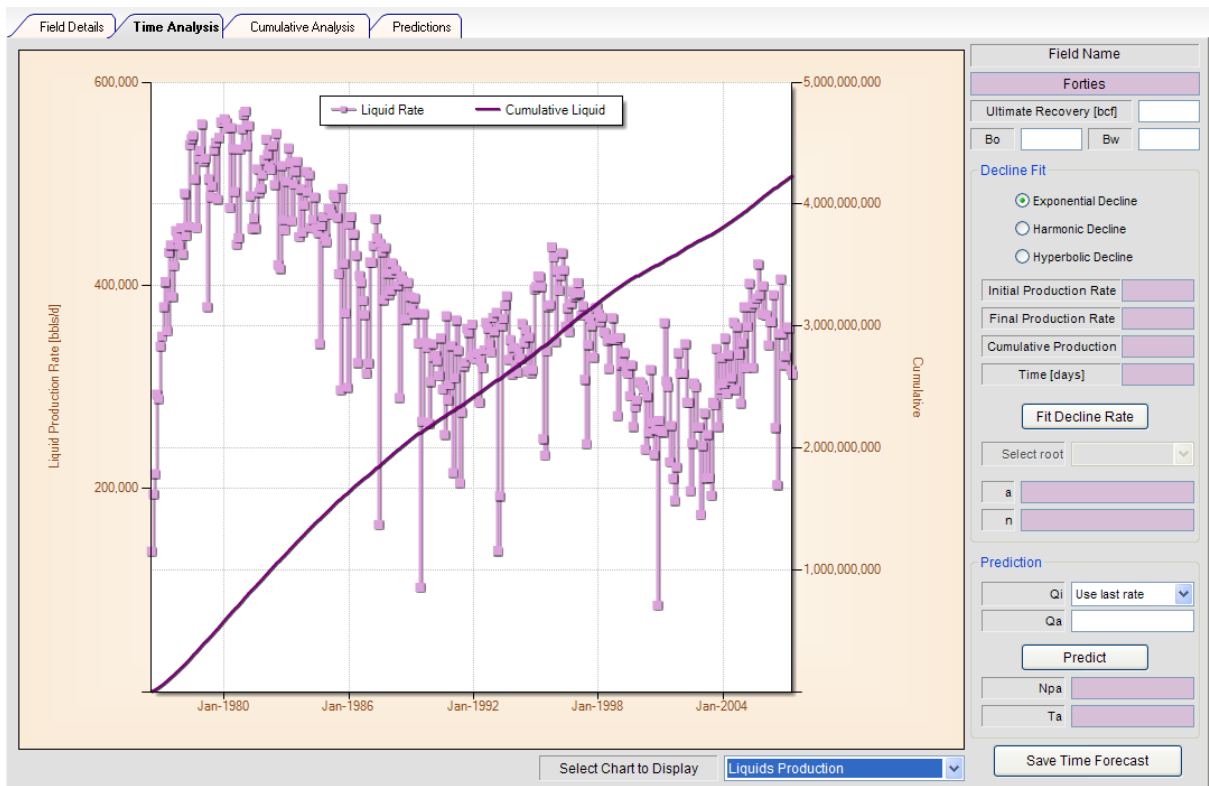
No decline curve analysis can be performed while within this display. All other chart functionality that was presented in the Oil Production Time Analysis section is available.



## 4.4 Liquid Production

Liquid Production (Oil + Condensate + Water) rate versus time is displayed as the primary Y axis in this display.

No decline curve analysis can be performed while within this display. All other chart functionality that was presented in the Oil Production Time Analysis section is available.

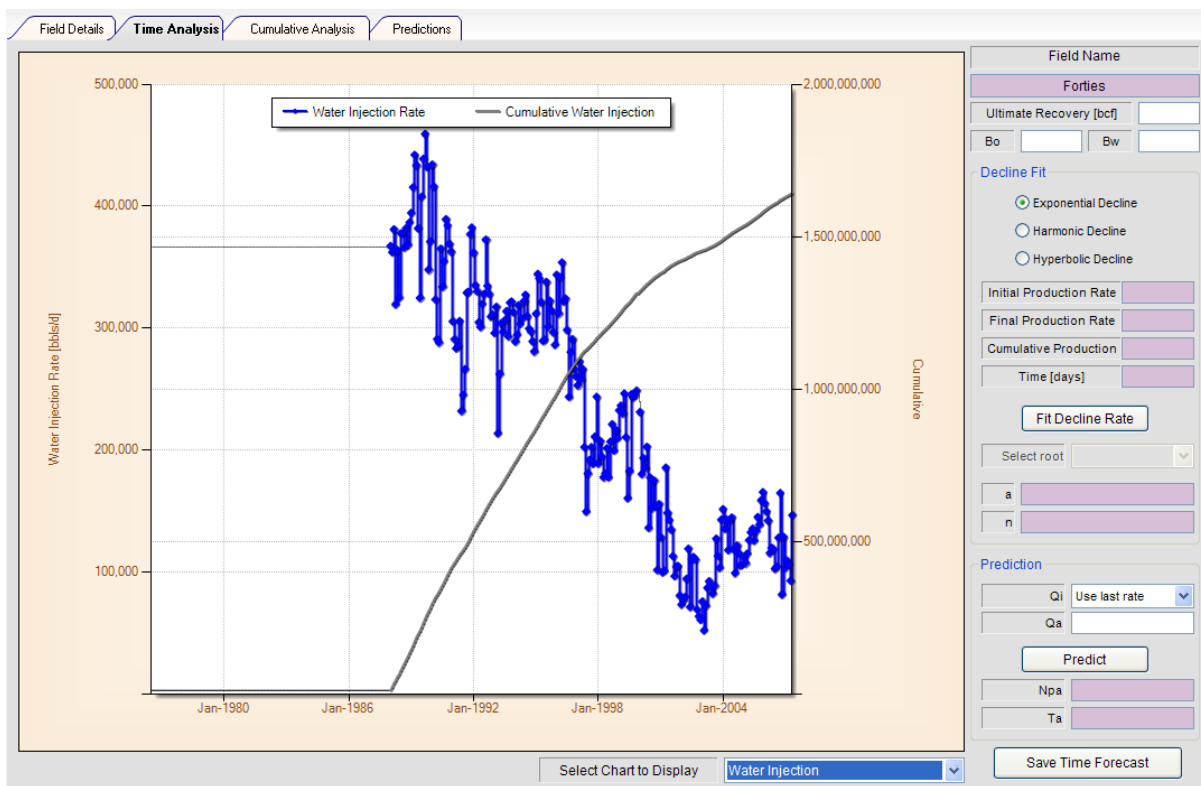


## 4.5 Water Injection

Water Injection rate versus time is displayed as the primary Y axis in this display.

No decline curve analysis can be performed while within this display. All other chart functionality that was presented in the Oil Production Time Analysis section is available.





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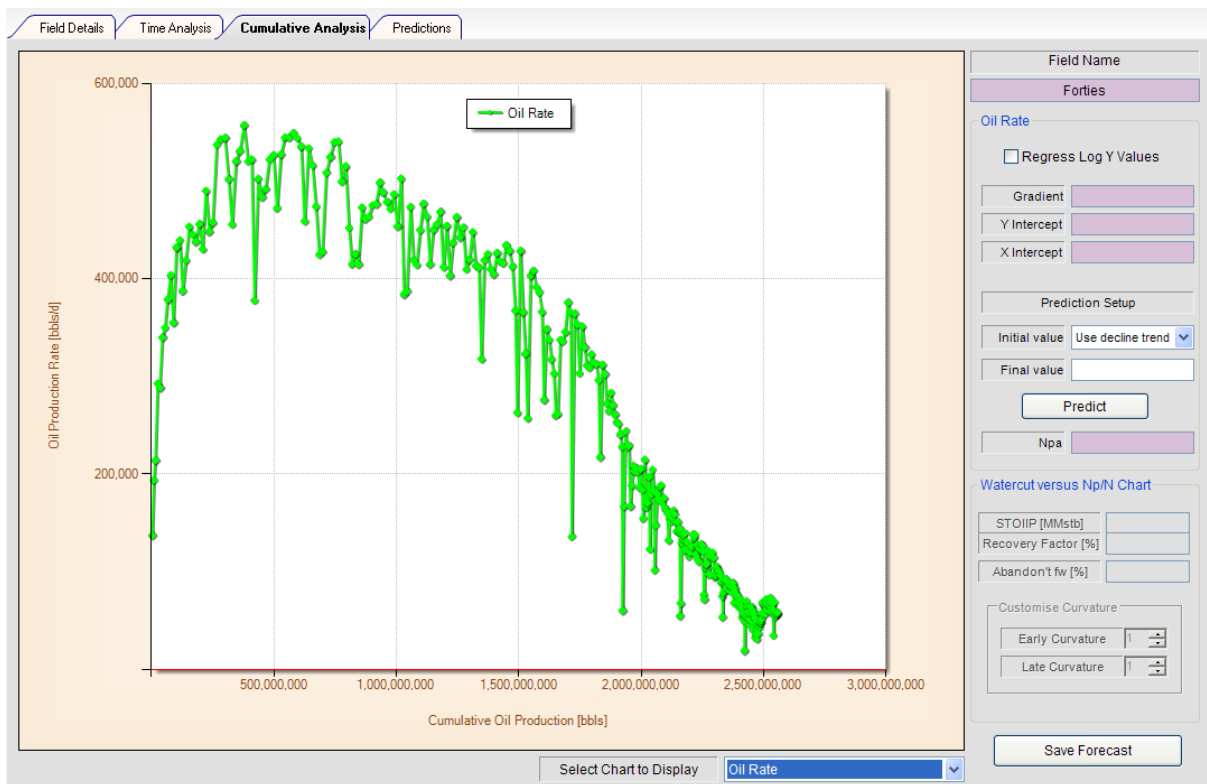


## 5 Cumulative Analysis

### 5.1 Oil Rate

Within the Cumulative Analysis section, the user can display numerous production and injection rates and ratios versus Cumulative Production.

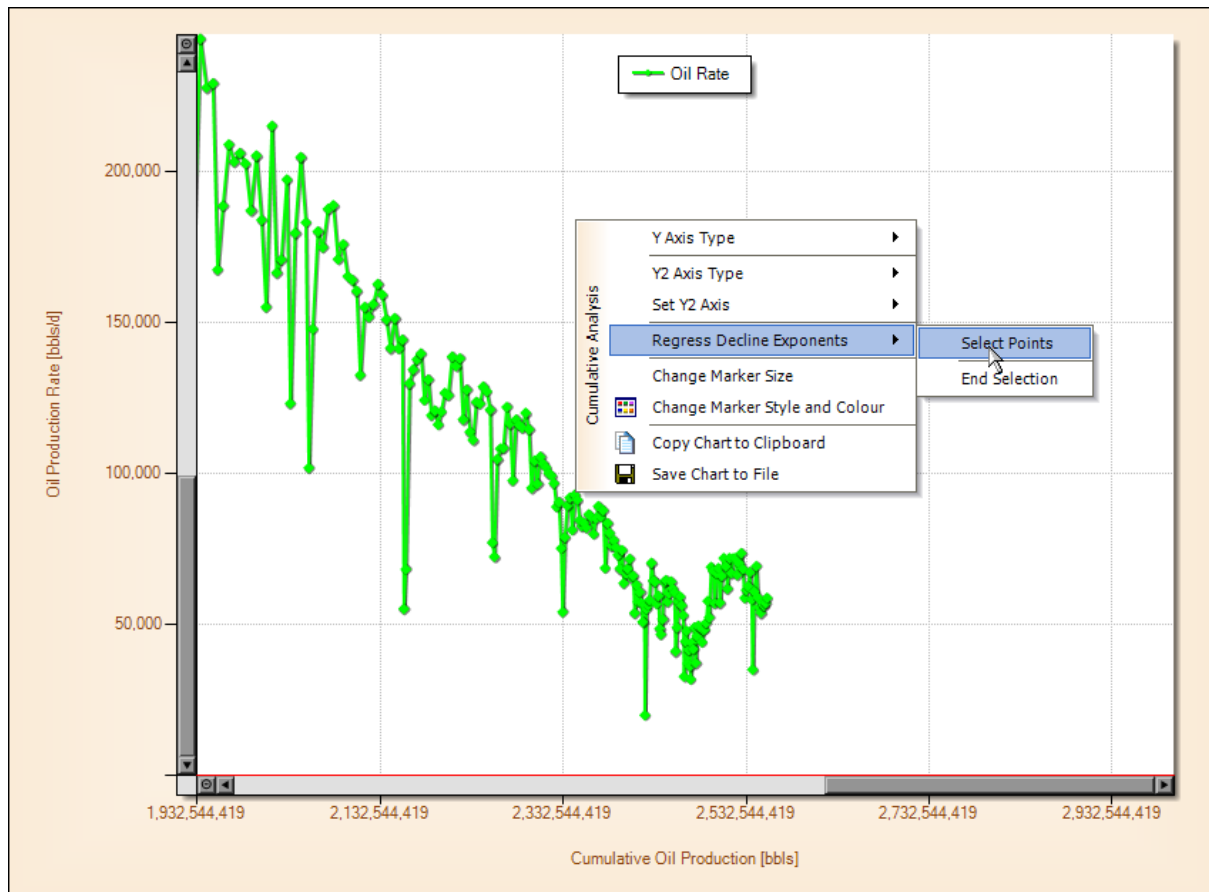
The user can also perform linear or semi-logarithmic decline curve analysis for Oil Rate, Gas Rate, Oilcut, Watercut and Water Oil Ratio versus Cumulative Production.



### Regress Decline Exponents

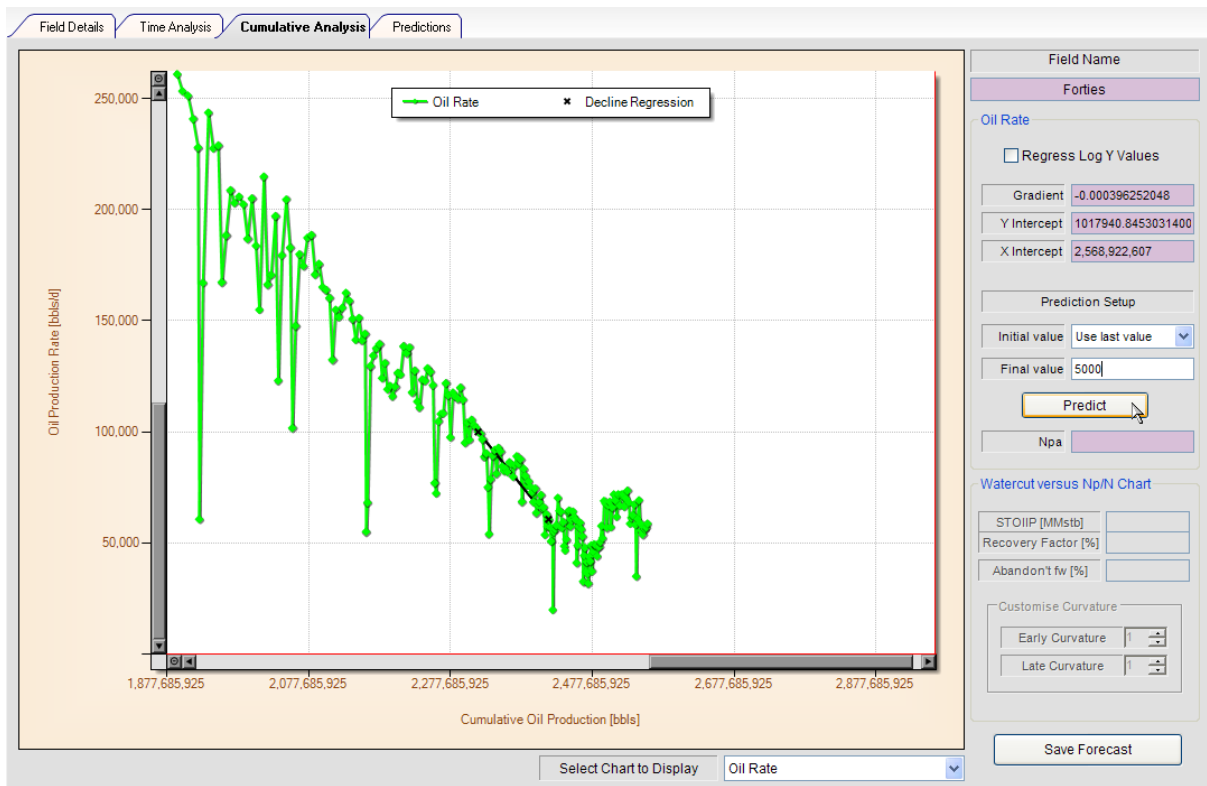
The method to regress decline exponents is identical to the Oil and Gas Rate versus Time Analysis, presented in earlier sections.

First select the Regress Decline Exponents then Select Points chart context menu item, as shown below. Then digitize two points on the chart

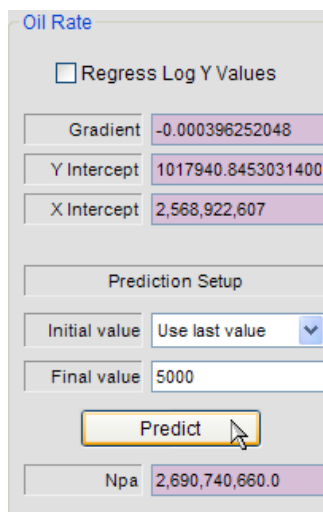


Once the user has selected two points, a message box will popup notifying the user that 2 points have been selected. The application will automatically fit a straight line between these 2 digitized points, and report the gradient and intercept of this line, as shown below.

The user can choose to fit a semi logarithmic straight line, by selecting the Regress Log Y Values check box, also shown below, assuming this is checked then the application will automatically update the fit, and report the revised gradient and intercept of this line.



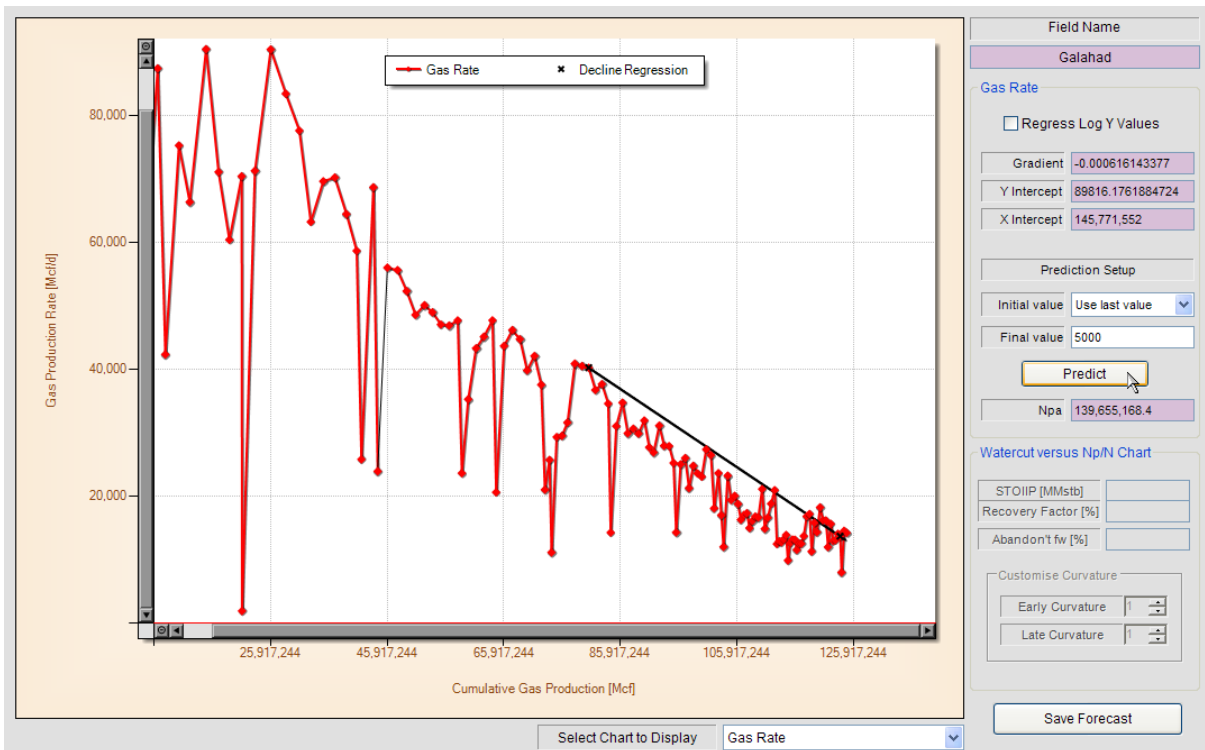
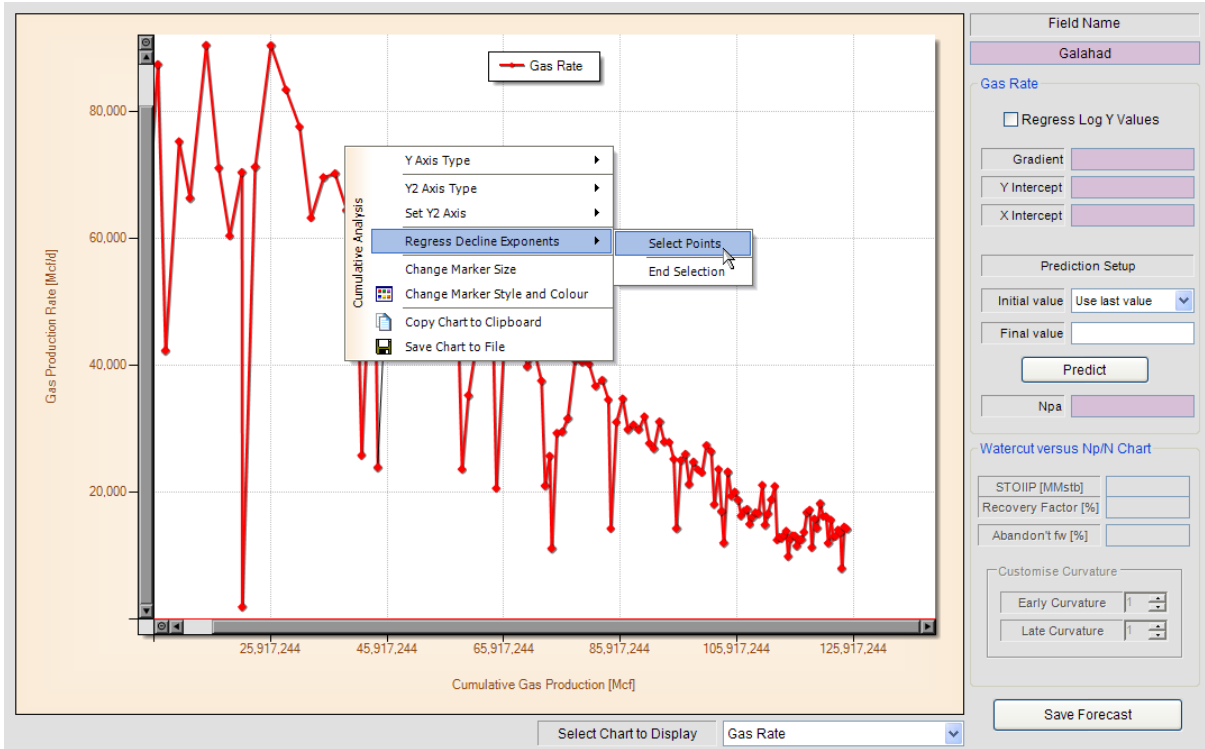
The user can also calculate an approximate Ultimate Recovery, by selecting between using the decline trend or last production value and inputting a final abandonment production value. The user should then press the **Predict** button, as shown above, to extrapolate the line to the abandonment value. See calculated result below.



## 5.2 Gas Rate

Again, all of the same functionality that was presented in the Oil Production vs Cumulative analysis section is also available for Gas Production analysis, including decline curve analysis, chart tooltips, and ultimate recovery at abandonment prediction.

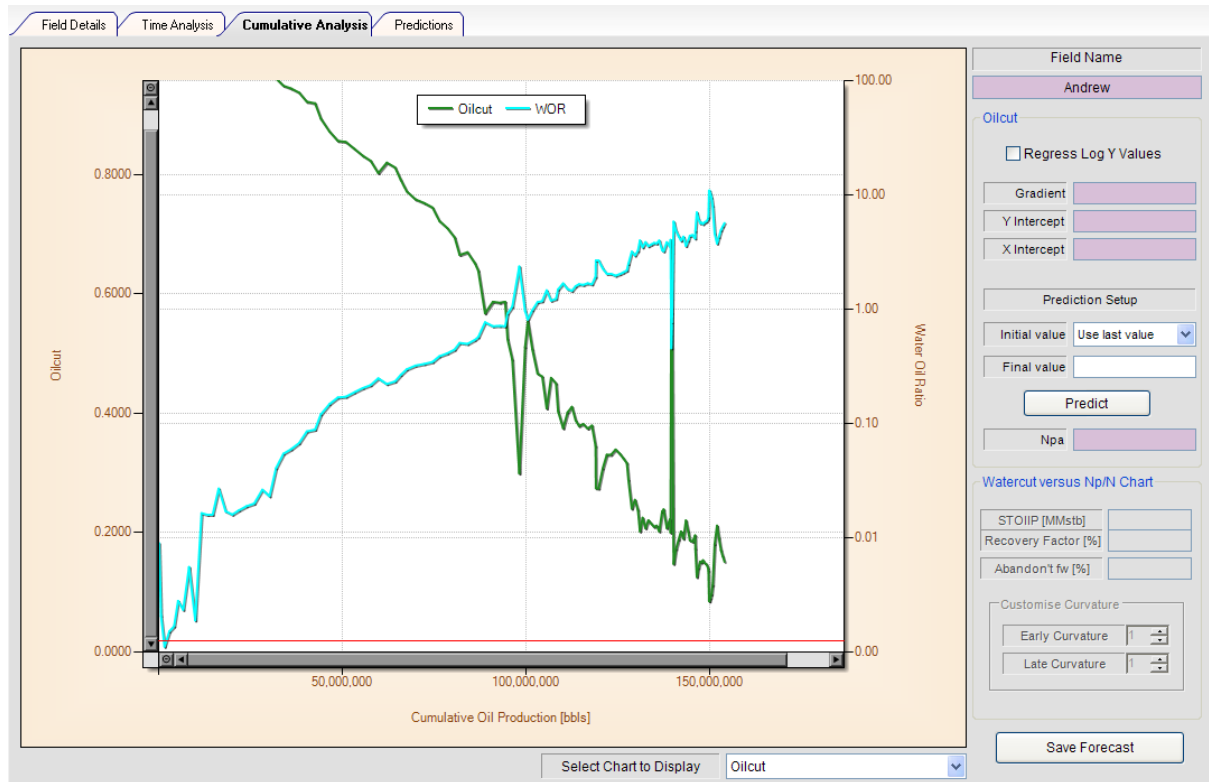
Two specific examples are provided below, although the equations and methods are identical to the Oil Production section.



## 5.3 Oilcut, Watercut and Water Oil Ratio

Again, all of the same functionality that was presented in the Oil Production vs Cumulative analysis section is also available for either Oilcut, Watercut or Water Oil Ratio versus Cumulative Production analysis, including decline curve analysis, chart tooltips, and ultimate recovery at abandonment prediction.

Specific examples are provided for completeness below, although the equations and methods are identical to the Oil Production section.



### Regress Decline Exponents

The method to regress decline exponents is identical to the Oil and Gas Rate versus Cumulative Analysis, presented in earlier sections.

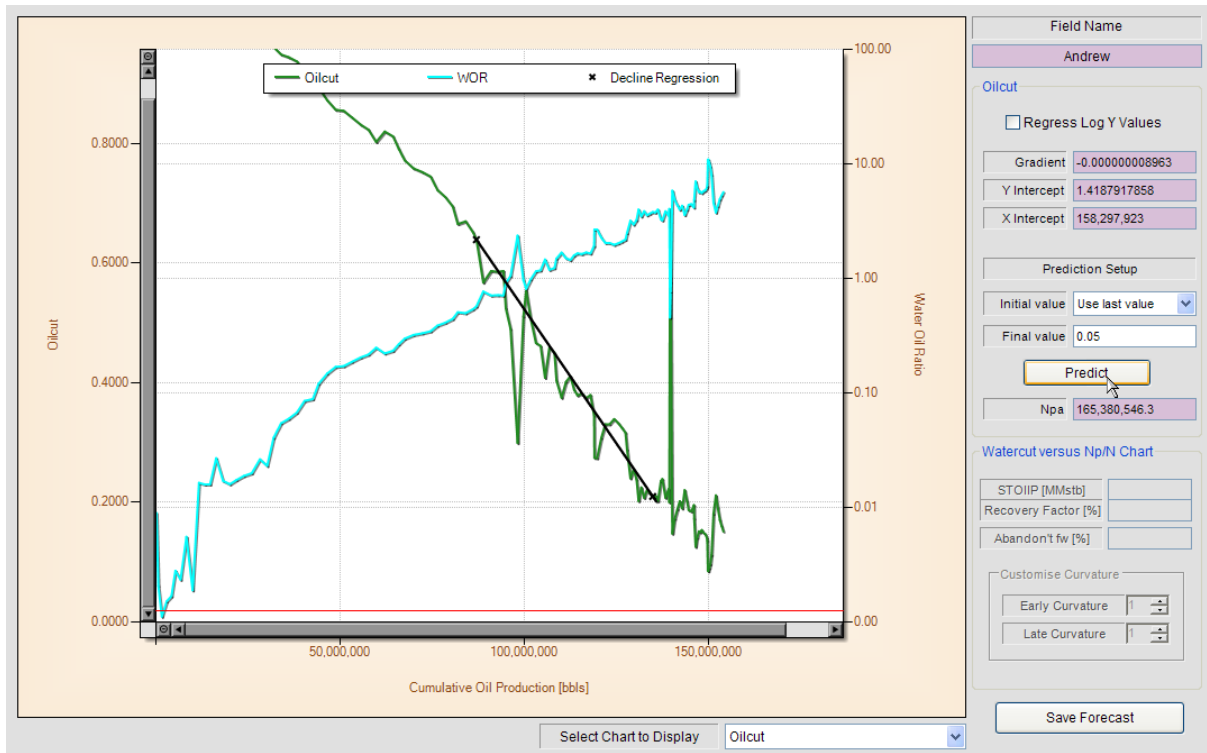
First select the Regress Decline Exponents then Select Points chart context menu item, as shown below. Then digitize two points on the chart



Once the user has selected two points, a message box will popup notifying the user that 2 points have been selected. The application will automatically fit a straight line between these 2 digitized points, and report the gradient and intercept of this line, as shown below.

The user can choose to fit a semi logarithmic straight line, by selecting the Regress Log Y Values check box, also shown below, assuming this is checked then the application will automatically update the fit, and report the revised gradient and intercept of this line.





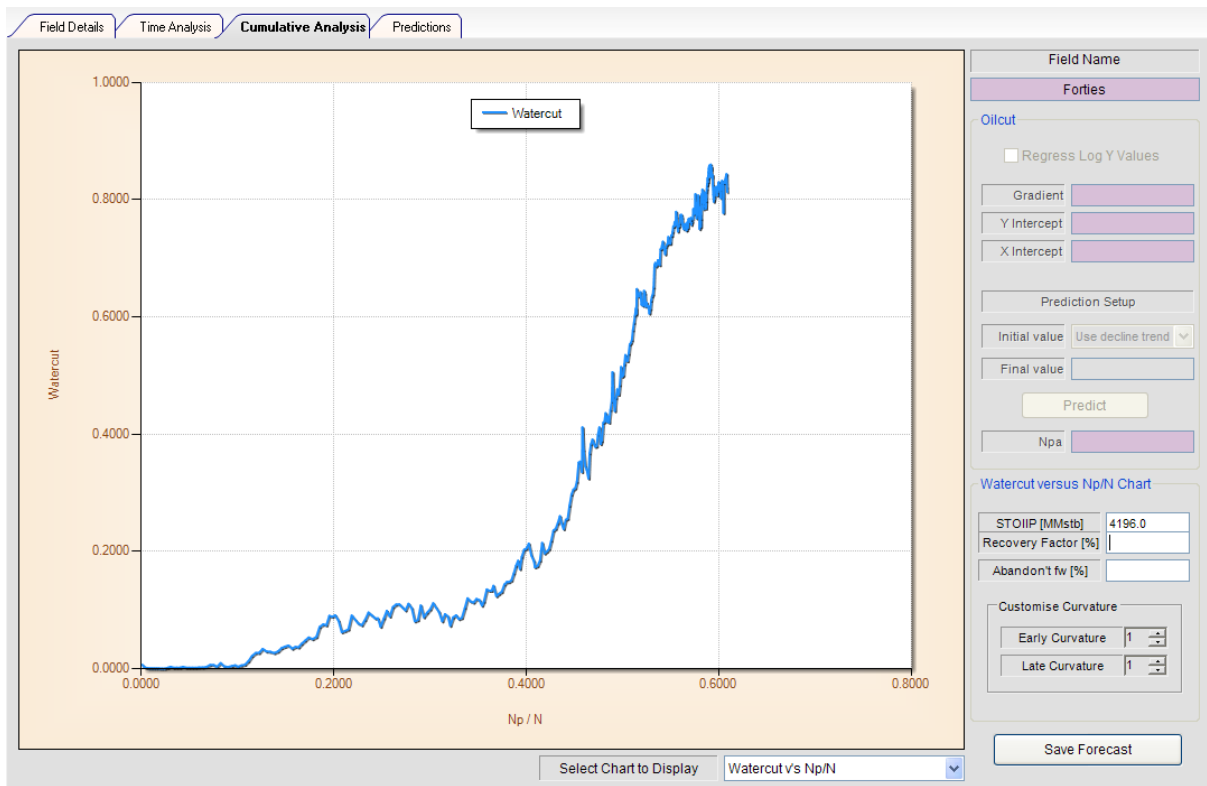
The user can also calculate an approximate Ultimate Recovery, by selecting between using the decline trend or last production value and inputting a final abandonment production value. The user should then press the **Predict** button, as shown above, to extrapolate the line to the abandonment value. See calculated result below.

|   |                |
|---|----------------|
| Field Name                                    |                |
| Andrew  |                |
| Oilcut  |                |
| <input type="checkbox"/> Regress Log Y Values |                |
| Gradient                                      | -0.00000008963 |
| Y Intercept                                   | 1.4187917858   |
| X Intercept                                   | 158,297,923    |
| Prediction Setup                              |                |
| Initial value                                 | Use last value |
| Final value                                   | 0.05           |
| Predict                                       |                |
| Npa   | 165,380,546.3  |
| Watercut versus Np/N Chart                    |                |
| STOIIP [MMstb]                                |                |
| Recovery Factor [%]                           |                |
| Abandon't fw [%]                              |                |
| Customise Curvature                           |                |
| Early Curvature                               | 1              |
| Late Curvature                                | 1              |
| Save Forecast                                 |                |

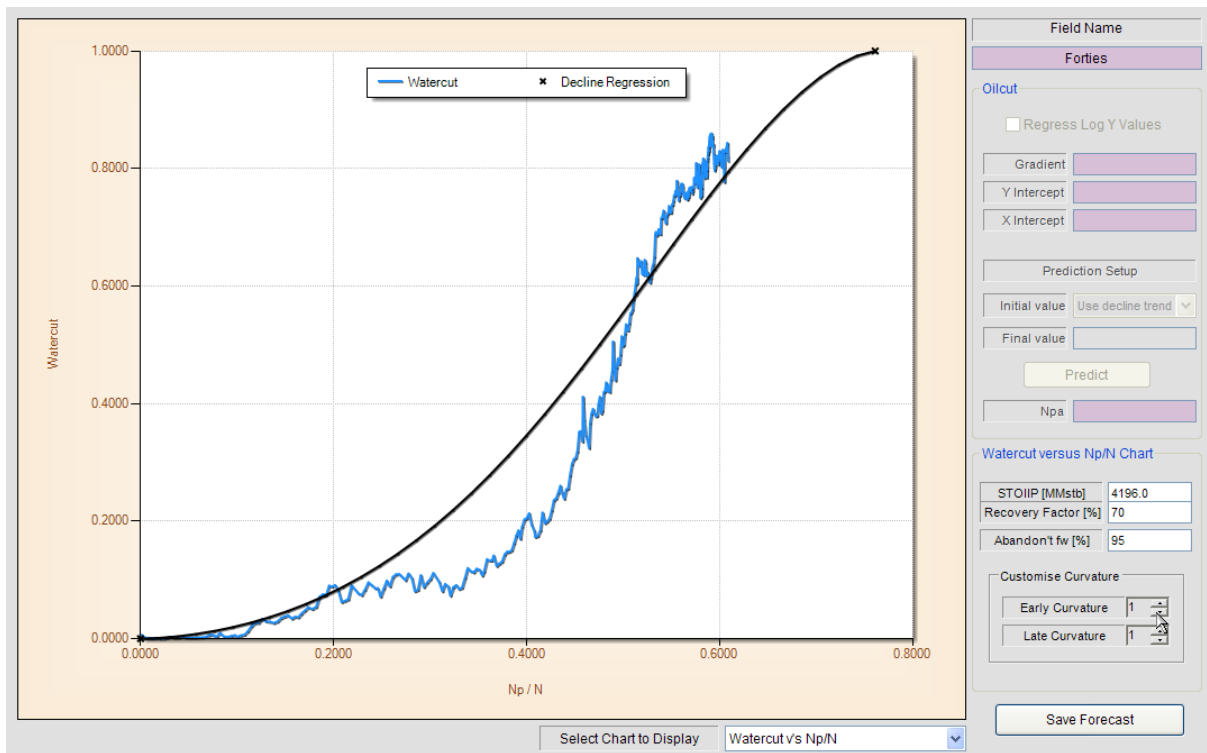
## 5.4 Watercut v's Np/N

The Watercut versus Np/N chart can be seen as a measure of the waterdrive efficiency of a specific oil field, which is typically linked to the degree of vertical permeability heterogeneity and the oil / water viscosity contrast. The chart requires additional estimated values for original in-place volumes (STOIIP), a likely abandonment ultimate recovery factor and an abandonment watercut. See below.

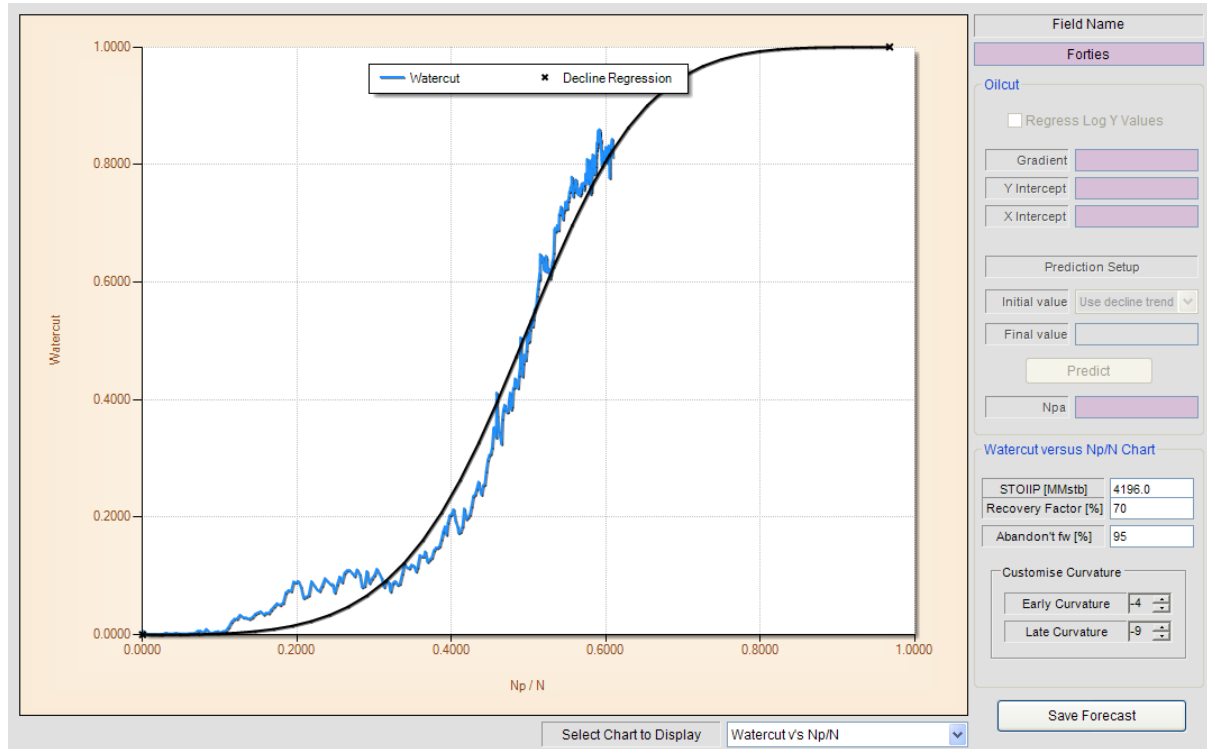
This chart can also be used as a data source for our other application **Profile**, which is a generic Production Profile Generation and Analysis application. See our homepage for more details [www.PetroleumSolutions.co.uk](http://www.PetroleumSolutions.co.uk).



Once these 3 additional values have been input the user can start to iterate values for early and late watercut curvature.



Negative values of early curvature generally translate to a delayed water production breakthrough, potentially implying good piston-like waterdrive efficiency. Highly positive of early curvature translate in rapid water breakthrough, potentially implying an adverse or poor waterdrive application, with likely high permeability streaks and/or high oil / water viscosity contrast. This situation will likely create poor vertical and/or areal sweep efficiency and create a high potential for bypassed oil.



Negative values of late curvature generally translate to a longer period of high water "tail" production, that asymptotes slowly towards the abandonment recovery factor and watercut levels. A positive value for late curvature, when combined with a negative value for early curvature is typically the best character for a waterdrive displacement process, and implies a delayed water breakthrough followed by a rapid watercut development to the likely high value of ultimate recovery factor. This is the ideal piston-like waterflood displacement process.

Should the user wish to save this match of watercut vs Np/N, they should simply select the **Save Forecast** button, as shown below.

|   |                   |
|---|-------------------|
| Field Name                                    |                   |
| Forties                                       |                   |
| Oilcut  |                   |
| <input type="checkbox"/> Regress Log Y Values |                   |
| Gradient                                      |                   |
| Y Intercept                                   |                   |
| X Intercept                                   |                   |
| Prediction Setup                              |                   |
| Initial value                                 | Use decline trend |
| Final value                                   |                   |
| Predict                                       |                   |
| Npa   |                   |
| Watercut versus Np/N Chart                    |                   |
| STOIIP [MMstb]                                | 4196.0            |
| Recovery Factor [%]                           | 70                |
| Abandon't fw [%]                              | 95                |
| Customise Curvature                           |                   |
| Early Curvature                               | -4                |
| Late Curvature                                | 9                 |
| Save Forecast                                 |                   |

# UKFields

UK Oil and Gas Field Production  
Analysis Software

**Part**



**VI**

## 6 Predictions

For all the decline curves that were saved during the Time Analysis and Cumulative Analysis sections, the user now has the ability to forecast on a monthly basis the likely future oil, gas, water and liquid production profiles.

For the Oil and Gas rate versus time, the prediction setup is simple and is highlighted at the top of the screen capture below. The uses the calculated and saved decline curve parameters and the user can change whether to forecast from the decline trend or use the last historical production rate; the user should also input the final abandonment prediction rate. Once the user presses the **Calculate Predictions** button, the application will simply progress monthly using the decline curve and prediction parameters until the abandonment production level is reached

For Oil and Gas rate versus Cumulative Production, the application progresses from month to month using the gradient and intercept relationship together with Newton-Raphson iteration to ensure that the monthly extrapolated production rates follow the original decline parameters.

The oilcut, watercut and water-oil ratio prediction methods use a similar extrapolation technique to the oil and gas rate versus cumulative production, however need to be linked to an oil production rate forecast or assume a constant liquid rate in order to convert these forecasts to time. As such the application provides three methods to generate this time forecast; namely

1. Link to Oil Rate vs Time Prediction
2. Link to Oil Rate v Cumulative Prediction
3. Input Constant Liquid Rate Value

Examples of these options are highlighted below.

The screenshot shows the 'Predictions' tab in a software application. It contains two main sections: 'Rate vs Time Prediction Setup' and 'Cumulative Prediction Setup'.

**Rate vs Time Prediction Setup:**

|              | Oil             | Gas               |
|--------------|-----------------|-------------------|
| Decline      | hyperbolic      | Exponential       |
| 'a' value    | 0.0005668201223 |                   |
| 'n' value    | 0.6670125700265 |                   |
| Initial Rate | Use last rate   | Use decline trend |
| Final Rate   | 1000            |                   |

**Cumulative Prediction Setup:**

|                         | Oil                                  | Gas                         | Oilcut                      | Watercut                    | Water Oil Ratio             |
|-------------------------|--------------------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Log Y Fit?              | <input type="checkbox"/> No          | <input type="checkbox"/> No | <input type="checkbox"/> No | <input type="checkbox"/> No | <input type="checkbox"/> No |
| Gradient                | -0.0005529645770                     |                             | -1.1797788205412            |                             |                             |
| Y Intercept             | 63391.764860669                      |                             | 1.3442340890804             |                             |                             |
| Initial value           | Use last value                       |                             | Use last value              |                             |                             |
| Final value             | 1000                                 | 0                           | 0.05                        | 0                           | 0                           |
| Convert to Time Options | Link to Oil Rate v's Time Prediction |                             |                             |                             |                             |
| Input Liquid Rate       |                                      |                             |                             |                             |                             |

At the bottom right of the interface is a button labeled 'Calculate Predictions'.

Once the user has successfully input all the appropriate data for a time forecast to be calculated and pressed the **Calculate Predictions** button, as shown above, then the Prediction Charts tab should contain an active chart with the predictions displayed.

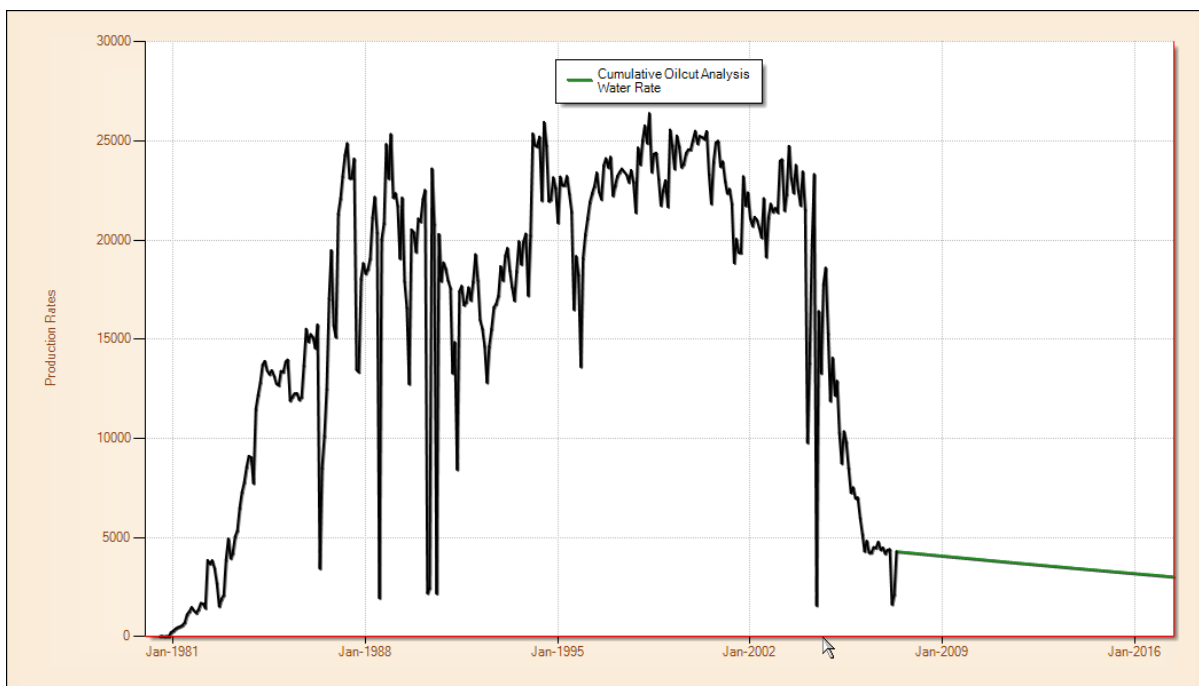


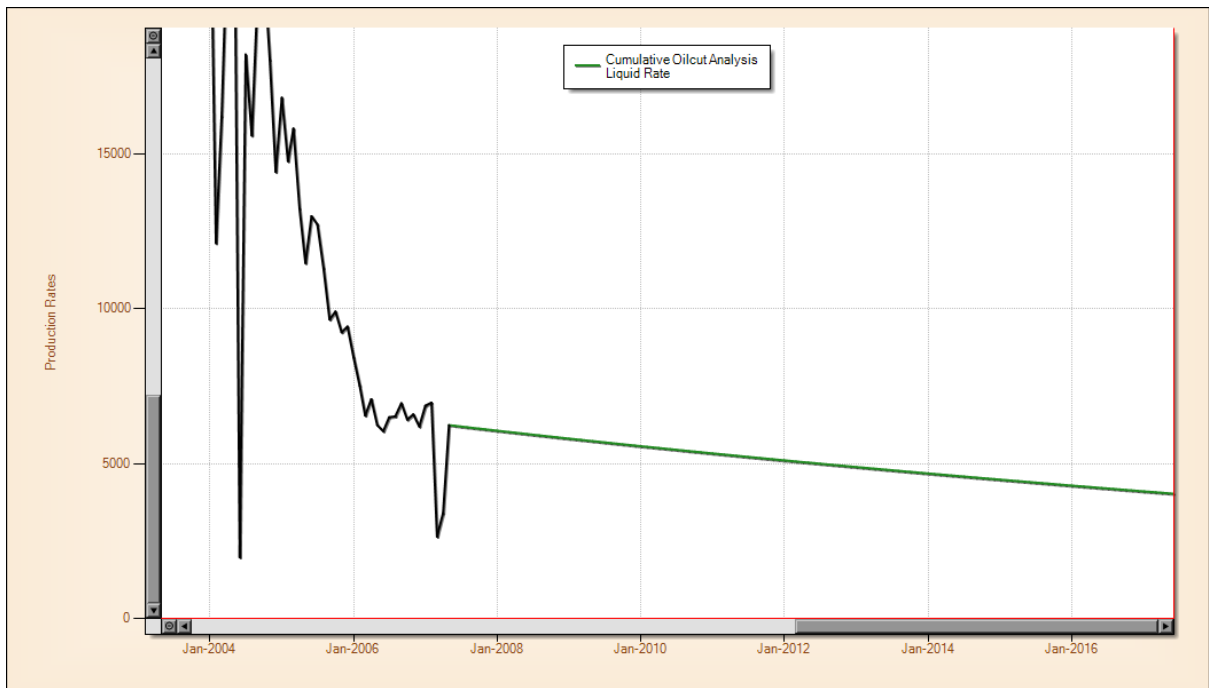
The user can zoom in and scroll around the chart area to examine and compare the range of time forecasts calculated.





Assuming an oilcut, watercut or water oil ratio forecast was successfully calculated then the user can switch to the water production rate prediction chart, as shown below, and again choose to zoom in the examine these forecasts.





All of the forecasts that were calculated are reported in the Prediction Tables tab. The user can copy and paste the data from this table to external applications, via the two methods discussed below.

1. Either press the right mouse button once over any of the tables to activate the table context menu, as highlighted below, then select the various menu item to copy a specific table to the clipboard. See screen capture example below.
2. Or, simply select and drag an area with the mouse, then press the standard windows CTRL+C keys to copy the selected area to the clipboard.

| Predictions Setup |                                |                                     | Prediction Charts |                                      |                                | Prediction Tables |                                     |                               |                                       |  |
|-------------------|--------------------------------|-------------------------------------|-------------------|--------------------------------------|--------------------------------|-------------------|-------------------------------------|-------------------------------|---------------------------------------|--|
| Month             | Oilrate Time Oil Rate [bbls/d] | Oilrate Time Cumulative Oil [bbbls] | Month             | Oilrate Cumulative Oil Rate [bbls/d] | Oilrate Cumulative Oil [bbbls] | Month             | Oilcut Cumulative Oil Rate [bbls/d] | Oilcut Cumulative Oil [bbbls] | Oilcut Cumulative Water Rate [bbls/d] |  |
| May-2007          | 1,935.4                        | 111,193,797.0                       | May-2007          | 1,935.4                              | 111,193,797.0                  | May-2007          | 1,935.4                             | 111,193,797.0                 | 4,306.5                               |  |
| Jun-2007          | 1,923.8                        | 111,255,358.4                       | Jun-2007          | 1,901.8                              | 111,254,654.0                  | Jun-2007          | 1,923.8                             | 111,255,358.4                 | 4,295.2                               |  |
| Jul-2007          | 1,912.6                        | 111,314,649.6                       | Jul-2007          | 1,869.7                              | 111,312,615.8                  | Jul-2007          | 1,912.6                             | 111,314,649.6                 | 4,284.2                               |  |
| Aug-2007          | 1,901.2                        | 111,375,486.6                       | Aug-2007          | 1,837.2                              | 111,371,406.9                  | Aug-2007          | 1,901.2                             | 111,375,486.6                 | 4,272.9                               |  |
| Sep-2007          | 1,889.8                        | 111,435,959.7                       | Sep-2007          | 1,805.3                              | 111,429,175.9                  | Sep-2007          | 1,889.8                             | 111,435,959.7                 | 4,261.6                               |  |
| Oct-2007          | 1,878.9                        | 111,494,204.3                       | Oct-2007          | 1,774.9                              | 111,484,196.4                  | Oct-2007          | 1,878.9                             | 111,494,204.3                 | 4,250.7                               |  |
| Nov-2007          | 1,867.7                        | 111,553,969.4                       | Nov-2007          | 1,744.0                              | 111,540,004.2                  | Nov-2007          | 1,867.7                             | 111,553,969.4                 | 4,239.4                               |  |
| Dec-2007          | 1,856.9                        | 111,611,533.3                       | Dec-2007          | 1,714.6                              | 111,593,156.9                  | Dec-2007          | 1,856.9                             | 111,611,533.3                 | 4,228.5                               |  |
| Jan-2008          | 1,845.9                        | 111,670,601.0                       | Jan-2008          | 1,684.8                              | 111,647,070.2                  | Jan-2008          | 1,845.9                             | 111,670,601.0                 | 4,217.2                               |  |
| Feb-2008          | 1,834.9                        | 111,729,318.3                       | Feb-2008          | 1,655.5                              | 111,700,046.2                  | Feb-2008          | 1,834.9                             | 111,729,318.3                 | 4,205.9                               |  |
| Mar-2008          | 1,824.7                        | 111,784,060.7                       | Mar-2008          | 1,628.5                              | 111,748,900.7                  | Mar-2008          | 1,824.7                             | 111,784,060.7                 | 4,195.4                               |  |
| Apr-2008          | 1,814.0                        | 111,842,107.4                       | Apr-2008          | 1,600.2                              | 111,800,106.0                  | Apr-2008          | 1,814.0                             | 111,842,107.4                 | 4,184.2                               |  |
| May-2008          | 1,803.6                        | 111,898,018.8                       | May-2008          | 1,572.2                              | 111,850,200.7                  | May-2008          | 1,803.6                             | 111,898,018.8                 | 4,173.3                               |  |
| Jun-2008          | 1,793.0                        | 111,955,393.6                       | Jun-2008          | 1,542.7                              | 111,900,275.1                  | Jun-2008          | 1,793.0                             | 111,955,393.6                 | 4,162.0                               |  |
| Jul-2008          | 1,782.8                        | 112,010,658.9                       | Jul-2008          | 1,513.6                              | 111,950,349.6                  | Jul-2008          | 1,782.8                             | 112,010,658.9                 | 4,151.2                               |  |
| Aug-2008          | 1,772.3                        | 112,067,371.9                       | Aug-2008          | 1,484.7                              | 112,000,423.8                  | Aug-2008          | 1,772.3                             | 112,067,371.9                 | 4,140.0                               |  |
| Sep-2008          | 1,761.9                        | 112,123,752.1                       | Sep-2008          | 1,457.4                              | 112,050,500.7                  | Sep-2008          | 1,761.9                             | 112,123,752.1                 | 4,128.8                               |  |
| Oct-2008          | 1,751.9                        | 112,178,060.9                       | Oct-2008          | 1,442.7                              | 112,084,923.6                  | Oct-2008          | 1,751.9                             | 112,178,060.9                 | 4,117.9                               |  |
| Nov-2008          | 1,741.7                        | 112,233,793.7                       | Nov-2008          | 1,417.6                              | 112,130,286.5                  | Nov-2008          | 1,741.7                             | 112,233,793.7                 | 4,106.7                               |  |
| Dec-2008          | 1,731.8                        | 112,287,479.8                       | Dec-2008          | 1,393.7                              | 112,173,491.2                  | Dec-2008          | 1,731.8                             | 112,287,479.8                 | 4,095.9                               |  |
| Jan-2009          | 1,721.7                        | 112,342,574.6                       | Jan-2009          | 1,369.5                              | 112,217,314.1                  | Jan-2009          | 1,721.7                             | 112,342,574.6                 | 4,084.7                               |  |
| Feb-2009          | 1,711.7                        | 112,397,348.7                       | Feb-2009          | 1,345.7                              | 112,260,375.1                  | Feb-2009          | 1,711.7                             | 112,397,348.7                 | 4,073.6                               |  |
| Mar-2009          | 1,702.7                        | 112,446,727.0                       | Mar-2009          | 1,324.4                              | 112,298,783.2                  | Mar-2009          | 1,702.7                             | 112,446,727.0                 | 4,063.5                               |  |
| Apr-2009          | 1,692.8                        | 112,500,897.2                       | Apr-2009          | 1,301.4                              | 112,340,427.7                  | Apr-2009          | 1,692.8                             | 112,500,897.2                 | 4,052.4                               |  |
| May-2009          | 1,683.3                        | 112,553,080.3                       | May-2009          | 1,279.5                              | 112,380,090.8                  | May-2009          | 1,683.3                             | 112,553,080.3                 | 4,041.6                               |  |
| Jun-2009          | 1,673.6                        | 112,606,634.9                       | Jun-2009          | 1,257.2                              | 112,420,321.6                  | Jun-2009          | 1,673.6                             | 112,606,634.9                 | 4,030.5                               |  |
| Jul-2009          | 1,664.2                        | 112,658,225.8                       | Jul-2009          | 1,236.0                              | 112,458,638.3                  | Jul-2009          | 1,664.2                             | 112,658,225.8                 | 4,019.7                               |  |
| Aug-2009          | 1,654.6                        | 112,711,173.5                       | Aug-2009          | 1,214.5                              | 112,497,503.3                  | Aug-2009          | 1,654.6                             | 112,711,173.5                 | 4,008.6                               |  |
| Sep-2009          | 1,645.1                        | 112,763,816.2                       | Sep-2009          | 1,193.4                              | 112,535,692.6                  | Sep-2009          | 1,645.1                             | 112,763,816.2                 | 3,997.5                               |  |
| Oct-2009          | 1,635.9                        | 112,814,529.8                       | Oct-2009          | 1,173.3                              | 112,572,065.0                  | Oct-2009          | 1,635.9                             | 112,814,529.8                 | 3,986.8                               |  |
| Nov-2009          | 1,626.5                        | 112,866,578.5                       | Nov-2009          | 1,152.9                              | 112,608,957.8                  | Nov-2009          | 1,626.5                             | 112,866,578.5                 | 3,975.7                               |  |

### Constant Liquid Rate Prediction

As discussed above, the user can choose to forecast the oilcut, watercut or water oil ratio prediction with time assuming a constant liquid rate. This is illustrated with the example below.

The user should select the **Input Constant Liquid Rate Value** from the **Convert to Time Options** dropdown list box, as shown below.

**Rate v's Time Prediction Setup**

|              | Oil             | Gas               |
|--------------|-----------------|-------------------|
| Decline      | Hyperbolic      | Exponential       |
| 'a' value    | 0.0005668201223 |                   |
| 'n' value    | 0.6670125700265 |                   |
| Initial Rate | Use last rate   | Use decline trend |
| Final Rate   | 1000            |                   |

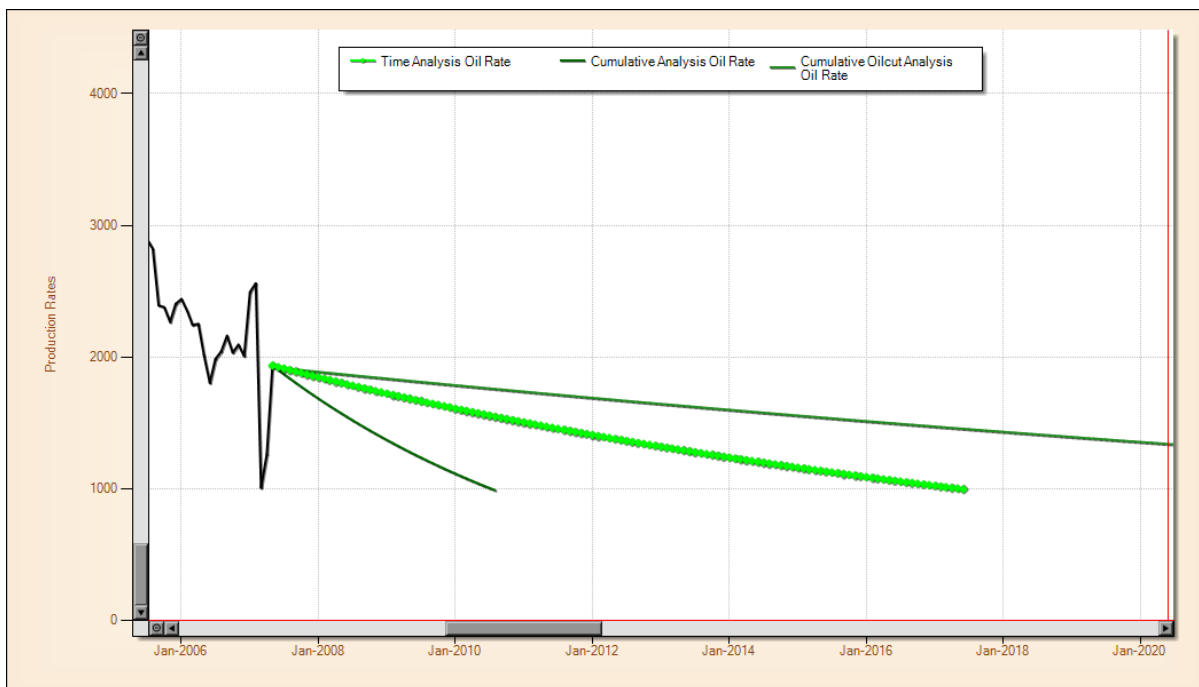
**Cumulative Prediction Setup**

|                         | Oil   | Gas                         | Oilcut                      | Watercut                    | Water Oil Ratio             |
|-------------------------|---|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Log Y Fit ?             | <input type="checkbox"/> No   | <input type="checkbox"/> No | <input type="checkbox"/> No | <input type="checkbox"/> No | <input type="checkbox"/> No |
| Gradient                | -0.0005529645770  |                             | -1.1797788205412            |                             |                             |
| Y Intercept             | 63391.764860669   |                             | 1.3442340890804             |                             |                             |
| Initial value           | Use last value  |                             | Use last value              |                             |                             |
| Final value             | 1000  | 0                           | 0.05                        | 0                           | 0                           |
| Convert to Time Options | Link to Oil Rate v's Time Prediction  |                             |                             |                             |                             |
| Input Liquid Rate       | Link to Oil Rate v's Time Prediction<br>Link to Oil Rate v's Cumulative Prediction<br><b>Input Constant Liquid Rate Value</b> |                             |                             |                             |                             |

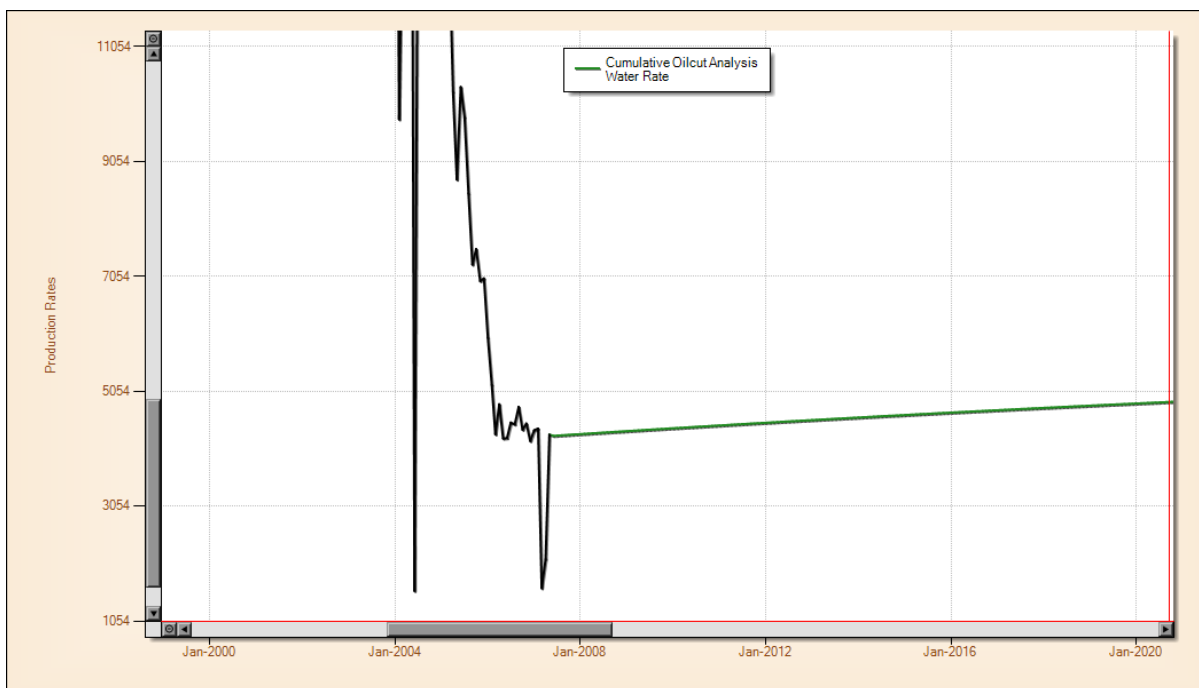
The user should then input a constant liquid rate value in the appropriate input box, as shown below. Then the user can press the **Calculate Predictions** button.

**Cumulative Prediction Setup**

|                         | Oil                              | Gas                         | Oilcut                      | Watercut                    | Water Oil Ratio             |
|-------------------------|----------------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Log Y Fit ?             | <input type="checkbox"/> No      | <input type="checkbox"/> No | <input type="checkbox"/> No | <input type="checkbox"/> No | <input type="checkbox"/> No |
| Gradient                | -0.0005529645770                 |                             | -1.1797788205412            |                             |                             |
| Y Intercept             | 63391.764860669                  |                             | 1.3442340890804             |                             |                             |
| Initial value           | Use last value                   |                             | Use last value              |                             |                             |
| Final value             | 1000                             | 0                           | 0.05                        | 0                           | 0                           |
| Convert to Time Options | Input Constant Liquid Rate Value |                             |                             |                             |                             |
| Input Liquid Rate       | 6200                             |                             |                             |                             |                             |



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