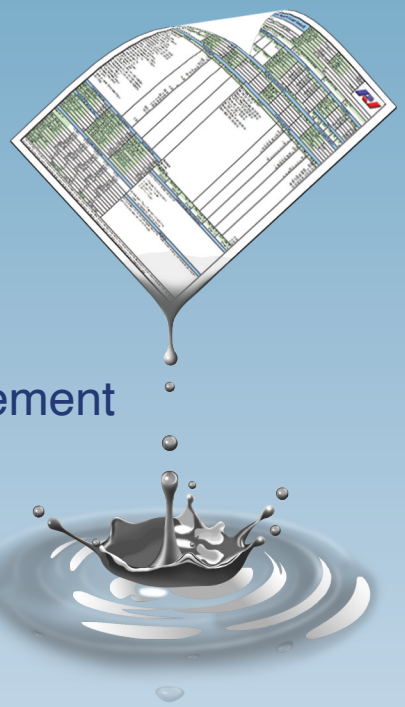
Pegasus Vertex, Inc.

Drilling Software | Sophisticated Yet Simple

WHITE PAPER

Mud Reporting:

Streamlined Process and Data Management



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I. Challenges

It is a fact that mud engineers used paper forms to record mud properties every morning. With the introduction of Microsoft Excel®, people began to take advantage of electronic filing systems. It greatly enhanced the reporting quality and filing.

However, the part critically missing with this approach is the organization of numeric daily reports and the generation of end-of-well recaps, not to mention the well comparison, which requires obtaining records of numerous drilling activities, in different periods, of multiple wells in various geographical areas.

While trying to overcome the limitations of Microsoft Excel® spreadsheets, others have developed simple mud reporting software. Unfortunately, these efforts often fall short in the following areas:

- Repeated data input
- Lack of graphs
- Report transmit
- Report management
- End-of-well recap
- Well comparison
- Data archiving
- Continuation of support and upgrade

II. New Approach

The modern approach to mud reporting is to use software with an advanced database backbone to perform solids analysis, hydraulics calculations, keep track of all inventory and cost, and quickly generate an overall view of the cost. By looking at the end-of-well recap, mud engineers and company men can easily identify the most costly drilling intervals and make the necessary modifications to the mud program for the next well. As this new technology evolves – it has the great benefit of presenting much more meaningful details to mud and oil companies.

As part of the ongoing efforts to overcome the challenges and to meet the ever-changing requirements of the drilling mud industry, Pegasus Vertex, Inc.(PVI) has developed MUDPRO+ next generation, an advanced drilling mud reporting software. Since its release, many mud engineers have been using it on a daily basis. The new MUDPRO+ (hereinafter referred to as MUDPRO+) is a comprehensive upgrade to the current version. MUDPRO+ has enhanced its existing capabilities while also adding new practical features (such as pad drilling, multi-type rheology, AI data analysis, etc.).

III. Basic Function

MUDPRO+ is designed for mud engineers at the rig sites and the company men in the office. The main function is for mud engineers to record mud data and generate daily reports. It can also be used by company men for reviewing and managing data, making an end-of-well recap, and comparing data between multiple wells.

The software contains many engineering calculations, such as solids analysis, bit optimization, wellbore hydraulics, additive concentration, mud volume, etc. It replaces hand calculations and provides more accurate results. With the input mud properties and hydraulics results, mud engineers will be able to see if the drilling hydraulics is effective. The rheology results and the additive concentration give mud engineers a clear idea that the mud is in good condition. The mud volume calculation shows the exact volume for each section of the hole, the pits volume, and the storage volume as well, so mud engineers can be aware of how much mud is required or lost. Solids analysis can work with water-based, oil-based, and synthetic-based mud. In different types of mud, the software requires different parameters and calculations for different results.

MUDPRO+ also helps mud engineers to select the proper type of mud. Users can input several mud samples with different properties and let the software predict the cuttings clearance and hydraulics. By comparing the results, engineers can select the best type of mud.

Such software normally has two types of data transmission methods. The first one is “terminals to server,” as shown in Fig. 1, and the second one is “terminal to terminal,” or “point to point” (P2P), as shown in Fig. 2. The “terminals to server” model requires an intranet and a server station to support the data transmission. Daily mud reports are created by terminal computers at the rig sites and then transferred to a central server in the office. The central server stores the data of all the wells. Mud engineers with administrative privileges can log in to the server to review the data and maintain the server. The P2P model used in this software is simpler and more flexible. It does not require a server station or an intranet. All the terminals are at equal levels and one terminal can send data to any other terminals. With the P2P model, mud engineers can send a well file to anyone via email, and the person who receives this file can open it on their computer, so they can review the data or print out the report. If the Internet signal is not available at the rig sites, mud engineers can save the data in their computers and send it to the office later whenever the Internet is available.

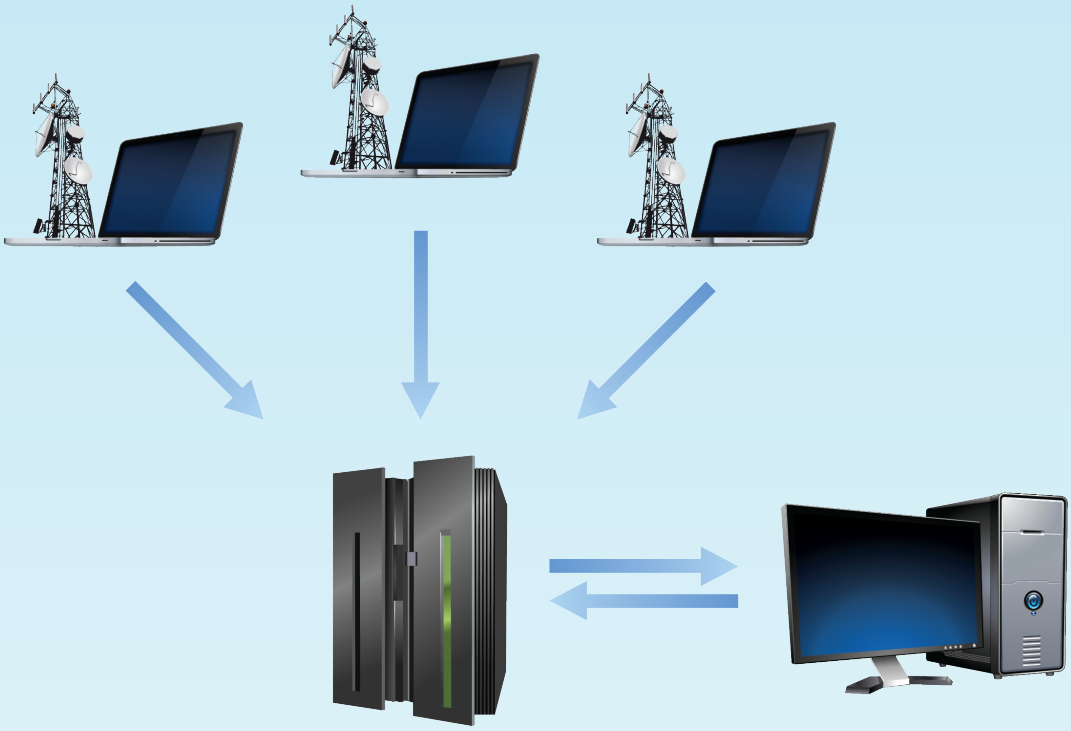

Fig. 1. Terminals to server model

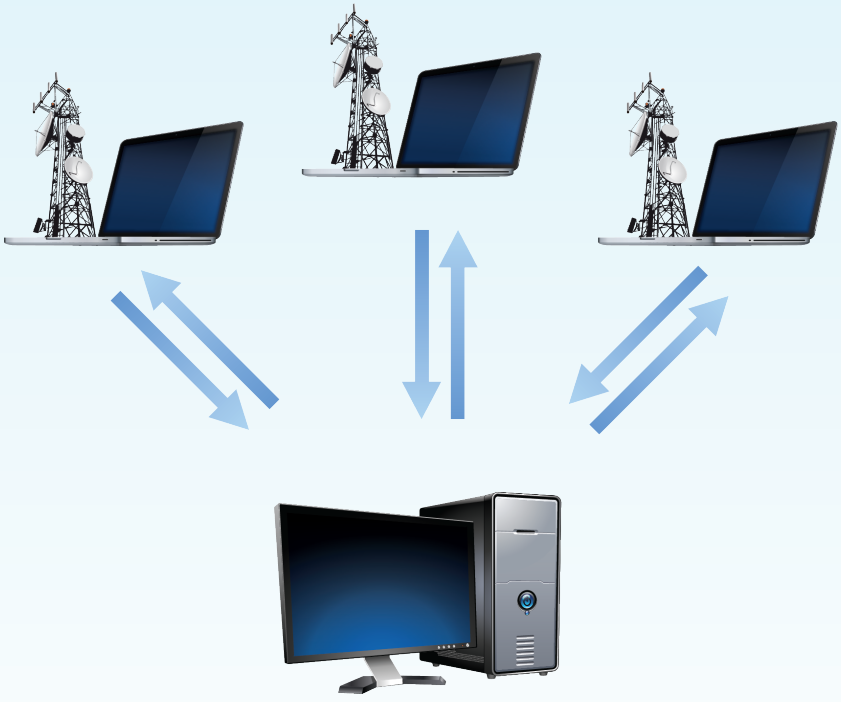

Fig. 2. Terminal to terminal model

IV. Usability

The usability of any software is an important factor in the quality of the software. A user-friendly interface not only makes the program's structure easy to understand but also allows the users to input data efficiently and accurately, creating a pleasant experience. The main interface is shown in Fig. 3. The interface of MUDPRO+ is so straightforward that an entry-level engineer can easily understand everything in the interface without receiving any training. The items in the interface are grouped by their categories.

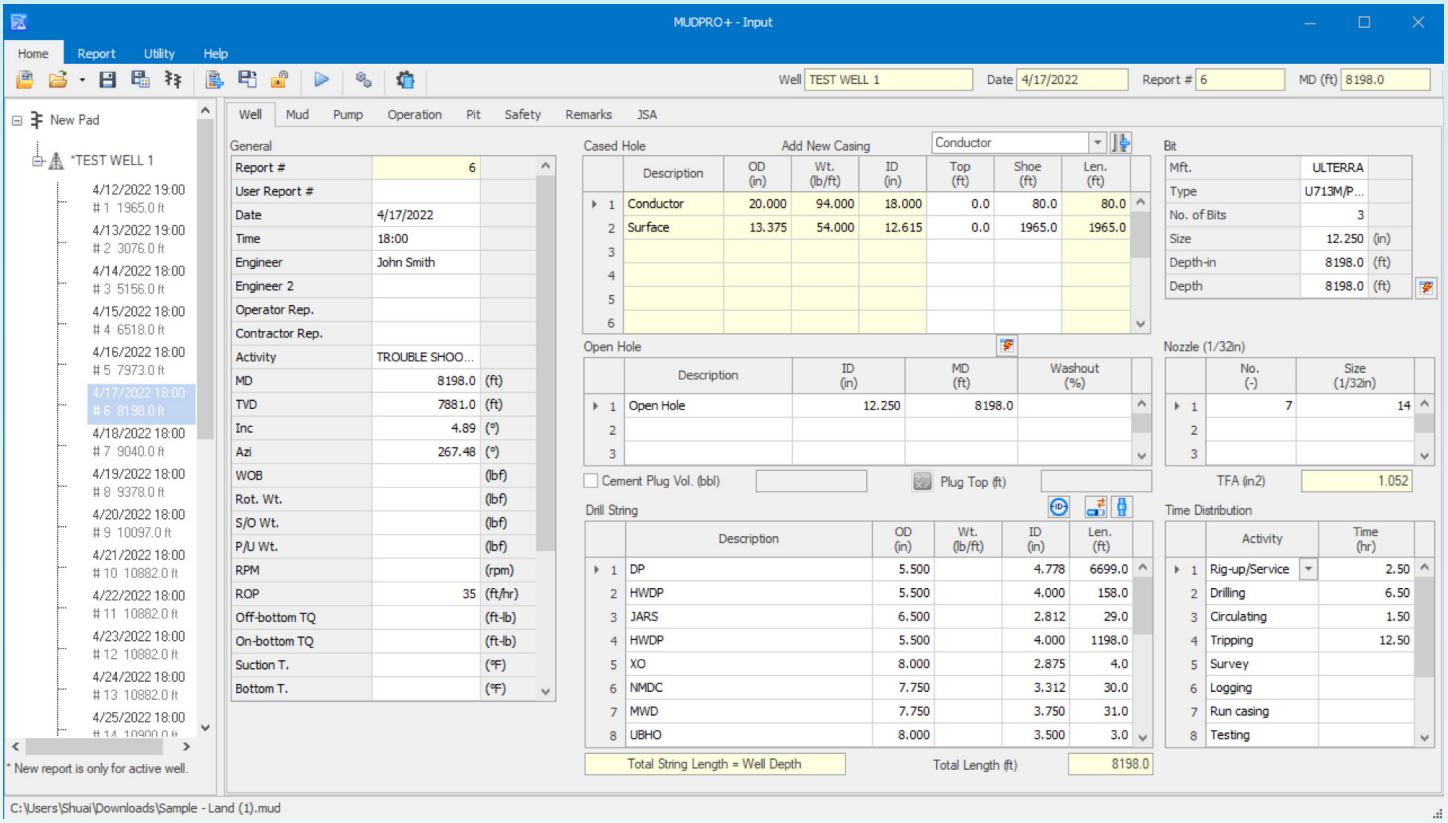

Fig. 3. Software interface

V. Flexible Designs

Compared with Microsoft Excel® spreadsheets or some other reporting tools, this software provides the user with many unique and flexible designs. The well carry-over function is one of them. It can copy the data of a completed well to a newly started well so that users don't have to input duplicated information again. Meanwhile, the ending inventory of the previous well will become the initial inventory of the new well. This function is very effective when all that is left of the previous well can be transferred directly to a new well.

Once a new report is created, one click can allow users to copy the data from the previous day to the next day's report, then users can simply update the new data and leave the unchanged data as it is. In this way, the user does not need to rewrite the same information over and over again.

Keeping track of mud data is vital to mud companies and operators. To make the task easy the software is equipped with a database for daily mud properties, product inventory, cost, and operation parameters. This database can include daily information for multiple wells. The management can import various databases created by different engineers and make an all-inclusive database for all the wells drilled within a certain time. Well comparison can then be done using the integrated database. Another benefit of the database is that engineers can use an existing well and modify it for the new well so that all the product information does not have to be retyped.

MUDPRO+ has an intelligent warning system which can reduce the chance of errors. Algorithms within the program help users input the correct data by providing calculations and messages. It can give users a warning message when an input error is detected or when a required field is missing.

Although past data rarely changes after the daily mud report is sent out, the software gives the flexibility to change the data on past reports. However, if the prices of some products changed or a mud engineer made a server mistake in a past report, then the software allows users to come back to a historical report and change the data. If the changed data is associated with some other data, then these changes will automatically be applied to all the associated data as well. For example, during the drilling of a well, if the engineer finds an incorrect price, he can go back to the beginning of this well and make the correction. Then the software will apply the new price to all the existing reports and recalculate the cost of this product for each day and the total cost as well. The price change can be applied to any specific period.

VI. Reporting

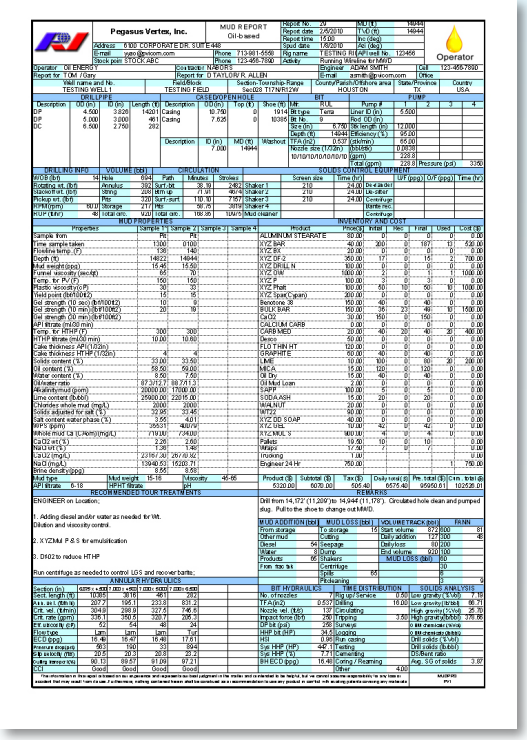

Fig. 4. A sample of the daily mud report

The daily report generated by the program not only meets the standards of the API mud report format but also provides additional information. A sample of a daily mud report is shown in Fig.4. Depending on the requirements, users have the option to hide the product price and cost, and only show the daily total cost instead. This will safeguard confidential information in case users choose to do so.

VII. Data Management

An end-of-well report, or a recap report which contains all the information on the drilling progress, is always required by the operating company when a well is finished. Manually copying data from all mud reports and then pasting it to a well recap report is a fussy and time-consuming job. Normally making a recap report for a 60-day well may take about 5 hours or even more. However, with the software's help, generating such an end-of-well report becomes as simple as a click of a button. A recap report containing data charts and graphs will be generated in a few seconds. The user could review the whole well progress, KPI, cost distribution, depth cost, etc.

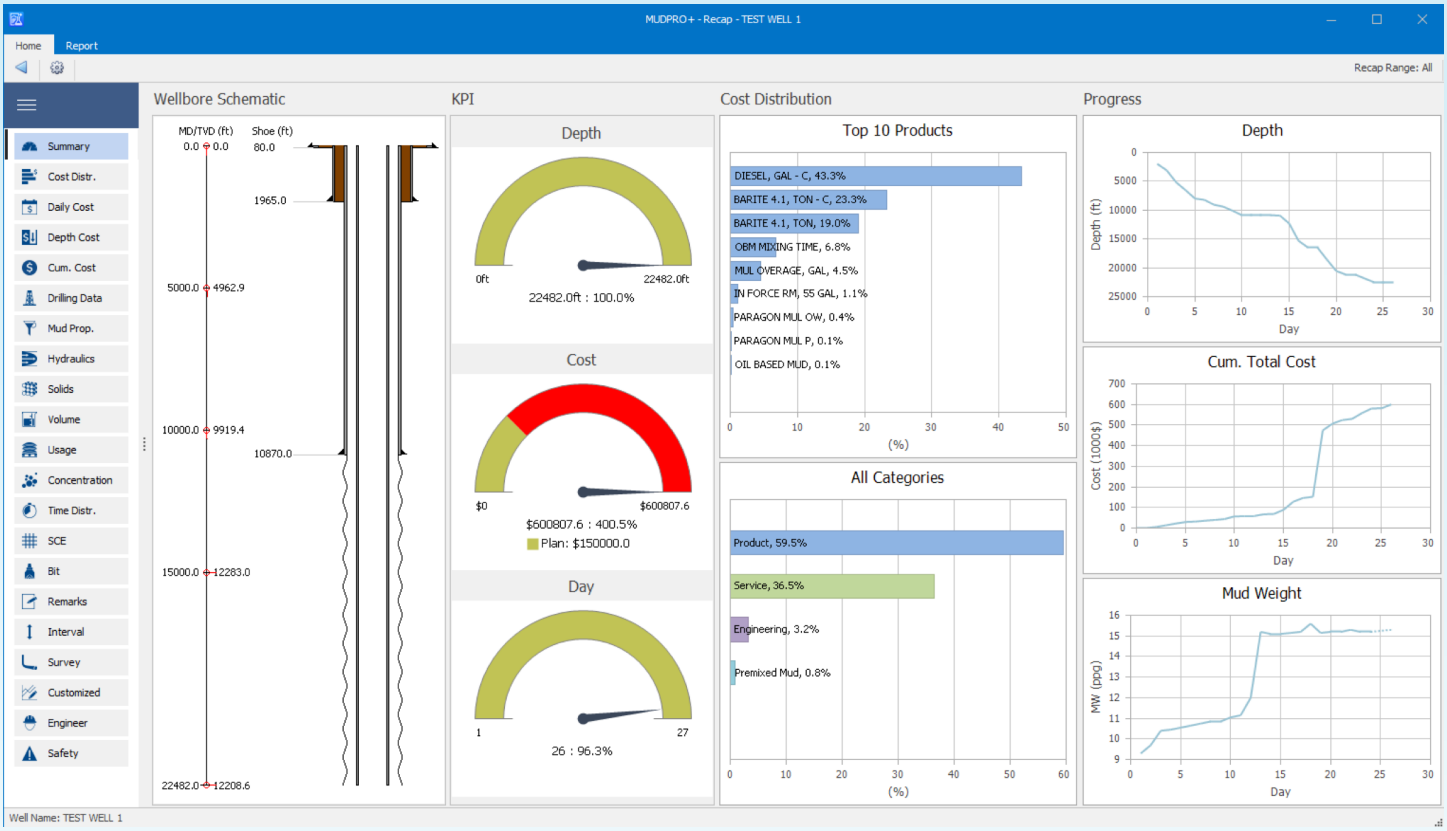

Fig. 5. Well recap

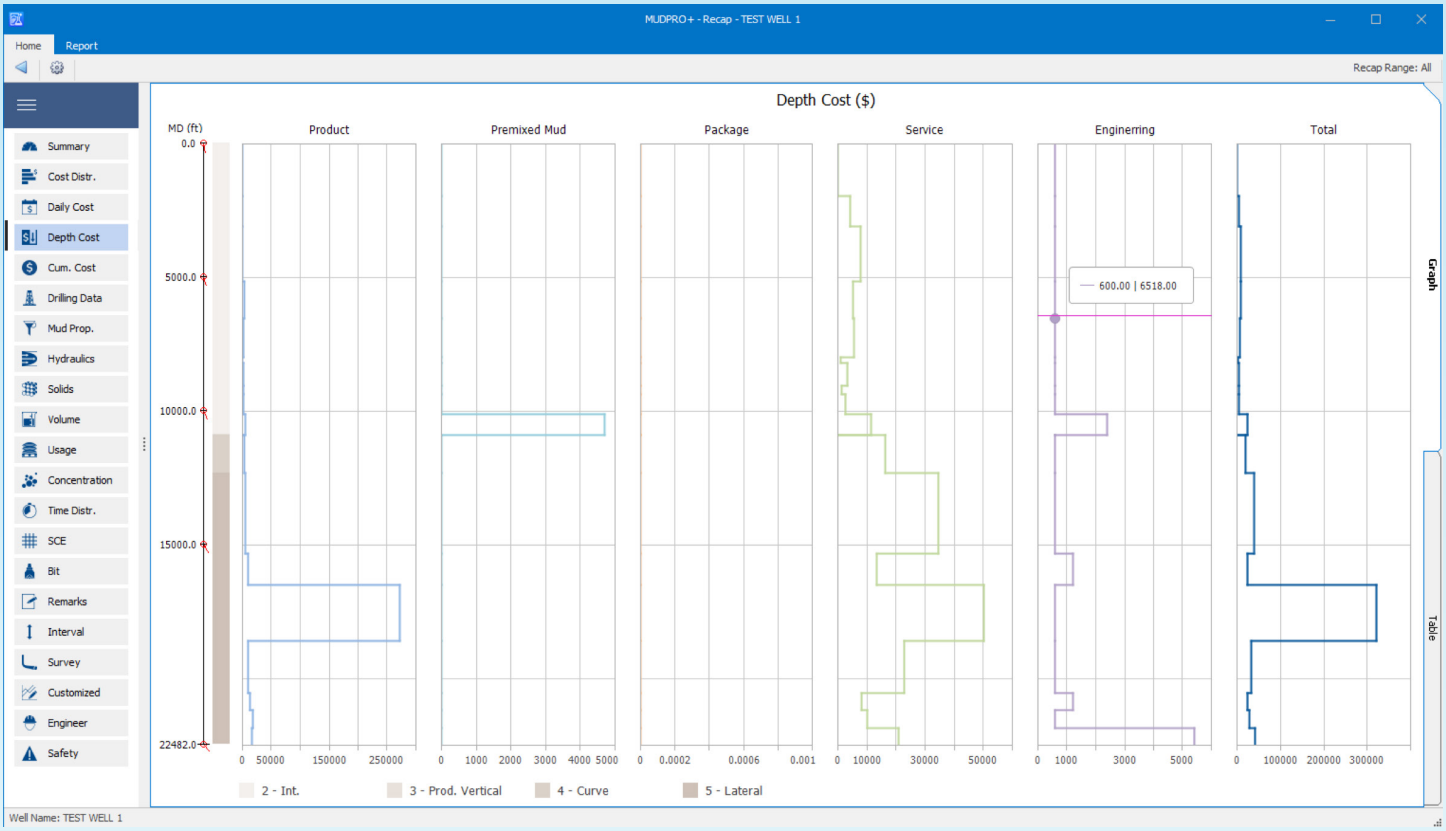

Fig. 6. Depth cost along the wellbore

The software is able to set up drilling intervals. Users can define various interval names for a well; such as conductor, surface casing, intermediate casing, etc. Then the software can summarize the data for one selected interval and generate an interval summary report.

MUDPRO+ also provides a daily alert system. It will compare the calculated values including pump pressure, bottom hole ECD, etc., and specified limits such as maximum pump pressure, fracture gradient, etc. Depending on the comparison, the program will display various warnings in the Output Window.

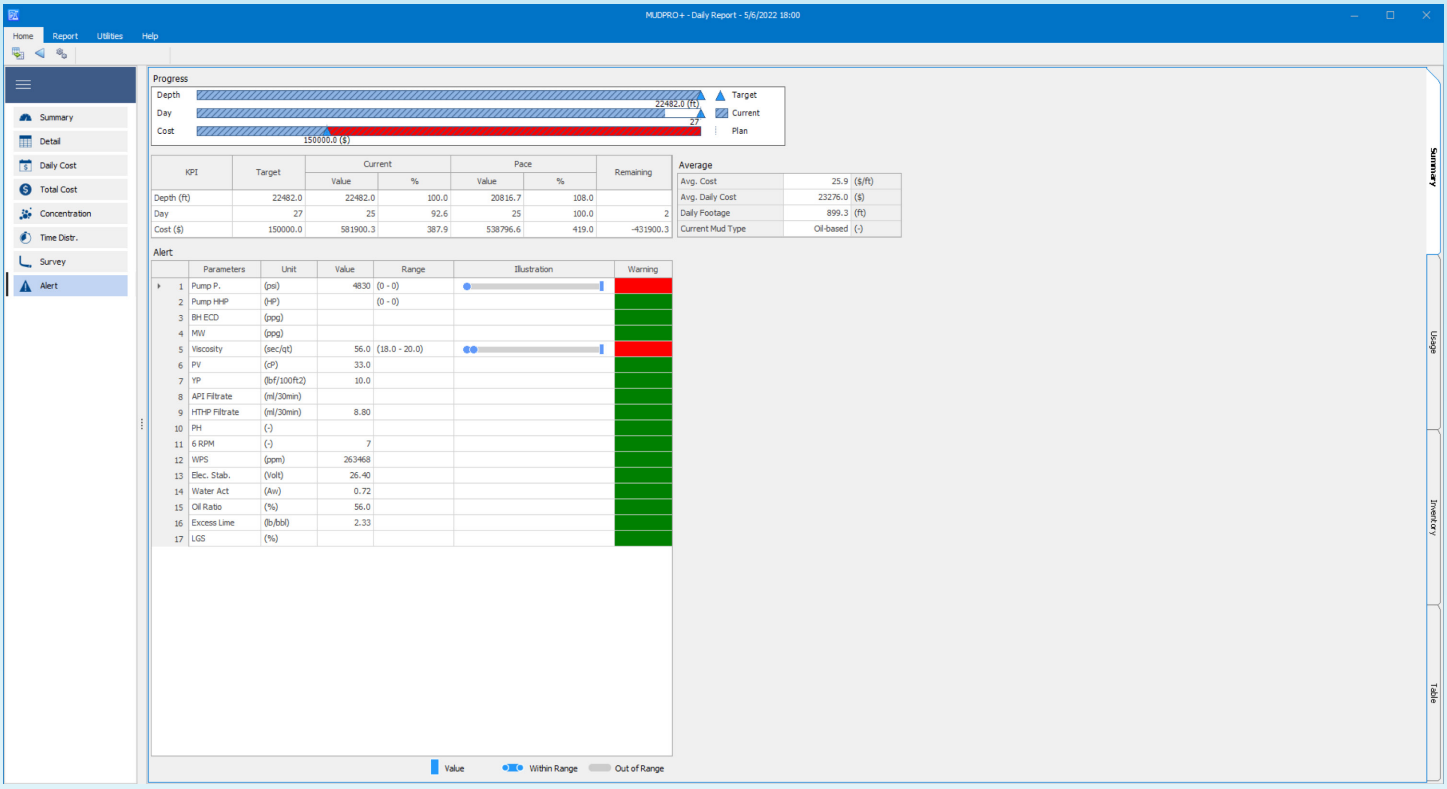

Fig. 7. Daily alert system

VIII. Conclusion

Drilling mud business may have been associated with advanced chemistry, rheology, etc., however advanced computer technology, especially software, streamlines the mud engineers' daily job as shown in the following list:

1. Standardizes the input, calculation, and reporting
2. Reduces chances of errors
3. Clarifies the communication between mud companies and operators
4. Reveals and identifies problems
5. Provides better guidance for future operations
6. Saves time and enhances job performance

For more information on MUDPRO+, please contact PVI at:

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IX. References

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2. E.K. Morton: “Computer Database Program Provides Drilling MUD System Analysis at Rig Site.” (SPE 16499) Paper presented at the Petroleum Industry Applications of Microcomputers held in Del Lago on Lake Conroe, Montgomery, Texas, June 23–25, 1987.

3. S. Corless: “Implementation of a Drilling Database System.” (SPE 23016) Paper presented at the SPE Asia Pacific Conference held in Perth, Western Australia, November 4–7, 1991.

4. R.V. Westermark, K.J. Hoff, and C.M. Boyer: “Computerized Drilling Reports Strengthen Management’s Decision Process.” (SPE 27926) Paper presented at the SPE Mid-Continent Gas Symposium held in Amarillo, Texas, May 22–24, 1994.

X. Complimentary Webinar

Connect with us from anywhere in the world through our complimentary webinars. We’ve taken time to tailor each webinar to focus on specific topics of interest surrounding our software that are useful in the oil and gas industry. Our webinars are complimentary and take place live via Microsoft Teams. Take a look at our scheduled webinars here:
www.pvisoftware.com/webinar

XI. Advanced Training

PVI offers scheduled software-based and customized training classes. These hands-on classes are provided in-house but can also be arranged at the end user’s location. Take a look at our current training schedule and sign up for our eNewsletter to learn about our upcoming events, webinars, and future trainings.
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