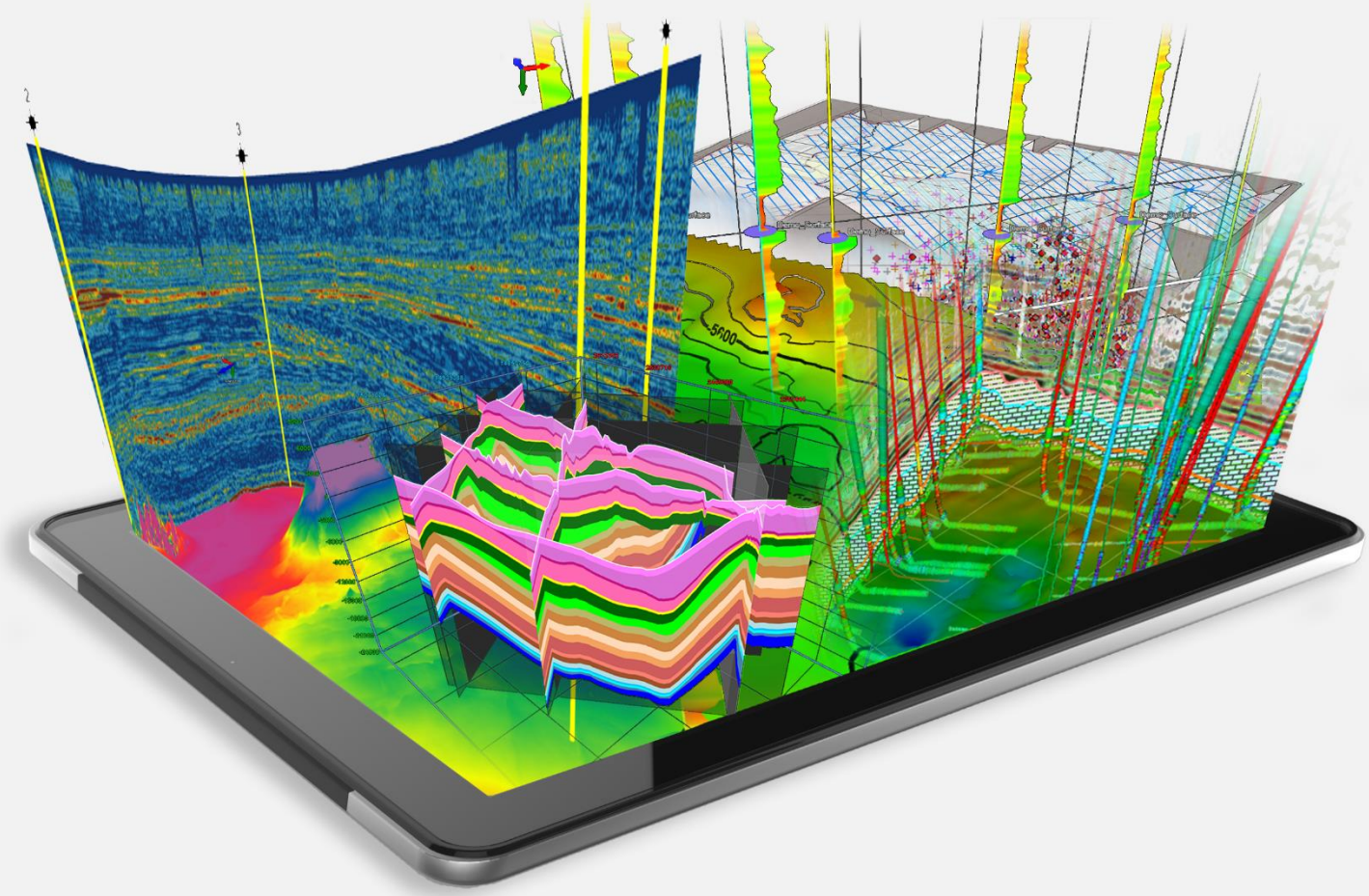

Release Notes

GeoGraphix 2017.3

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Contents

GeoGraphix® and Discovery™ on OpenWorks® 2017.3

LMKR is pleased to announce the release of the GeoGraphix® and Discovery™ on OpenWorks® 2017.3 software.

This release includes new and updated geophysical interpretation tool for GeoGraphix, and also brings many new features and performance improvements, which are highlighted in the New Features section of this document.

This document also provides important information regarding the system requirements and valuable resources that will allow you to get the most out of the GeoGraphix 2017.3 release.

Note: Users upgrading from GeoGraphix 2017.1 or 2017.2 to GeoGraphix 2017.3 do not require a new license. New users or users upgrading from other versions of GeoGraphix need a valid LMKR license. The LMKR License Management Tool (LMT) must be installed to configure the license. Download the latest LMT from the LMKR Support Portal > Downloads page. See the "LMKR Licensing" section of the Installation Guide for Release 2017.3 for more information.

Note: If working in a network environment, in order for all computers to work together on shared projects, ALL computers (clients and servers) must be updated to the same version of the software. It is intentional that computers with different versions of GeoGraphix software cannot and should not be connected with each other.

GeoGraphix 2017.3 is an integrated product suite that incorporates shared data management and geological, petrophysical, and geophysical interpretation software. It utilizes a Sybase (SAP SQL Anywhere) database in GeoGraphix Discovery mode, or accesses the OpenWorks®/SeisWorks® (Oracle) database in Discovery on OpenWorks mode.

This release consists of the following:

GVERSE® Field Planner

- This application intelligently populates wells over an entire field based on defined hazards, lease areas, and constraints. It uses an advanced optimization algorithm to lay out hundreds of wells in minutes. It works with you by taking into account surface hazards, existing wells in the area, and lease boundaries to maximize lateral length in the zone.

GVERSE® Geophysics

- New, intuitive and easy-to-use seismic interpretation system with powerful 3D visualization and interpretation capabilities. GVERSE Geophysics enables geoscientists to execute end-to-end workflows for basic interpretation and more advanced geophysical tasks.

GVERSE® Geomodeling

- An integrated environment for modeling that incorporates existing mapping and cross section features of smartSECTION® with a newly built 3D View. It takes your smartSECTION interpretations to a whole new level with 3D modeling, while also enabling you to fully utilize the existing smartSECTION features.

Pro 3D

- Enables interpreters to get the most from their data by quickly creating powerful and informative base maps, fence diagrams and seismic backdrops. Using the Pro 3D window you can show IsoMap® structural surfaces, cultural layers, wells, seismic data, cross sections and fence diagrams in the 3D Scene.

Field Planning

- The advanced field planning tool is designed to reduce the time required for efficient field development. It provides the ability to create, save, analyze and manage multiple field plan scenarios before committing them to the database. Designed for horizontal well plans, the Field Planner includes determination of the optimum location and orientation of wells. These proposed wells can all be visualized by creating a layer for display in GeoAtlas™.

Data Manager™ includes ProjectExplorer™, Coordinate System Manager™, WellBase™, SeisBase™, QueryBuilder™, LandNet™, LeaseMap™, and ZoneManager™.

- The GeoGraphix and Discovery on OpenWorks project and data management engine

GeoAtlas™

- The map display and montage environment working on ESRI MapObjects

IsoMap®

- The gridding contouring engine, featuring 10 powerful gridding algorithms

XSection™

- A fully integrated geological interpretation tool and cross section display tool

PRIZM™

- An interactive petrophysical and log analysis system

smartSECTION®

- Map view for viewing GeoAtlas layers and defining cross sections for picking tops and faults for structural and sequence stratigraphic analysis

Discovery™ 3D

- The 3D scene viewer that uses the most recent video and X-Box tools to display seismic and geologic data in three dimensions

pStaX™

- The post stack processing module for enhancing seismic character and detecting anomalies related to geologic features

SCAN™

- The patented semblance calculation for enhanced fault interpretation

LogM Advanced Synthetics™

- The geophysical application used for interactively editing well logs and evaluating synthetic trace character response

LogM Modeling™

- The 2D forward seismic waveform, ray tracing and structural modeling tool to predict seismic response away from the well

STRUCT™ Model Entry

- The comprehensive forward seismic structural modeling tool that is used to determine the seismic response of complex geologic structures in areas where there is little or no well control

Discovery™ on OpenWorks®

- Enables the GeoGraphix software to access OpenWorks and SeisWorks projects, and uses the OpenWorks and SeisWorks data within the GeoGraphix framework

Xchange Tools

WellXchangePlus™

- Transfer well information to or from two GeoGraphix projects, or between GeoGraphix and OpenWorks

SeisXchange™

- Transfer seismic data between Geophysics and SeisWorks

GridXchange

- Transfer of map point sets and grids from GeoGraphix to OpenWorks

Note: SeisBase, LandNet, LeaseMap, LogMModelBuilder (LogM Modeling), LogM Well Editor (LogM Advanced Synthetics), Field Planner, and Advanced 3D Visualization (Pro 3D) are not available in the current version of Discovery on OpenWorks.

New Features at a Glance

The new features available in the GeoGraphix 2017.3 release are listed below.

GVERSE Geomodeling/smartSECTION

- Interface is significantly improved. Click here for details.
- Determine the length and percentage of drilling wells within a target zone. Click here for details.
- Add or remove wells from a Geomodel. Click here for details.
- Fault aliasing in 3D view. Click here for details.
- Auto grouping of wells of a cross section. Click here for details.
- Microseismic display and animation of wells. Click here for details.
- Add, remove, or modify surface tops and fault cuts on wells in 3D View. Click here for details.
- Navigate through the multiple open cross sections. Click here for details.
- Improved Cross Sections list in 3D Panel. Click here for details.
- 3D cursor tracking is supported. Click here for details.

PRIZM

- Create multi-colored multi-well crossplots. Click here for details.
- Export curve values in a text file. Click here for details.
- Export selected well data points from a crossplot. Click here for details.
- View multi-well crossplot wells in other GeoGraphix applications. Click here for details.
- Import/Export curves lists and curves aliases. Click here for details.
- Decimal representation of curve depth values. Click here for details.
- Z-Axis color spectrum is available. Click here for details.
- Save PRIZM sessions. Click here for details.
- Save Curve Data Statistics (CDS) template with desired parameters. Click here for details.
- Customize WellBase filters. Click here for details.
- Choose and rename curves during Import. Click here for details.
- Single well export is improved. Click here for details.

DepthRegistration

- Display formation tops on straightened images. Click here for details.
- Support for RasCalML (XML) v2.2 is added. Click here for details.

GVERSE Geophysics

Tighter Integration

- Create cross sections in GVERSE Geomodeling and smartSECTION. Click here for details.
- Open wells in WellBase, PRIZM, ZoneManager, DepthRegistration, and LogM Well Editor directly from the 3D module. Click here for details.
- Send seismic sections displayed in 3D view to vertical and horizontal seismic display windows and work with sections in 2D view. Click here for details.

- View seismic sections displayed in 2D windows instantly in 3D view. Click here for details.
- Access interpretation, survey and section derived trace scaling options in 3D. Click here for details.
- Apply customized PALX format color palette to seismic sections, horizon surfaces and more. Click here for details.

Enhanced Interpretation Capabilities

- Pick horizons using a new 2D auto pick algorithm. Click here for details.
- Snap horizons more accurately. Click here for details.
- Flatten an entire 3D scene on a horizon. Click here for details.
- Independent action lists for individual horizons and faults for more flexible and context aware undo and redo functionality. Click here for details.
- Verify well-seismic tie using a variable density display for synthetic seismograms. Click here for details.

Increased Visualization Functionality

- Add mapping grids to the 3D scene and Map of the new 3D module. Click here for details.
- View horizon picks associated with mapping grids in the 3D scene. Click here for details.
- Draw IsoMap layers directly on the horizon surface. Click here for details.

Improved Efficiency and Usability

- Access all depth conversion settings at a single location. Click here for details.
- Shortcuts to depth conversion workflows in the 3D view. Click here for details.
- Scene-specific toolbars for a true multiscreen experience. Click here for details.
- Hotkeys for arbline and probe face navigation. Click here for details.
- Single click to open seismic sections at well locations and horizon and fault surfaces. Click here for details.
- View well symbols in the 3D scene as defined in WellBase. Click here for details.
- Manipulate and modify arbitrary lines directly in the 3D scene. Click here for details.
- Partial transparency options added to the color palette control. Click here for details.

GVERSE Field Planner

- LMKR is pleased to announce the release of GVERSE Field Planner. This application intelligently populates wells over an entire field based on defined hazards, lease areas, and constraints. Click here for details.
- Use surface and subsurface hazards as shapefiles. Click here for details.
- Use DEM (Digital Elevation Model) as a surface hazard file through auto field planning. Click here for details.
- Plan wells simultaneously in multiple drilling windows. Click here for details.
- Create well deviation surveys. Click here for details.

Lease Planner

- Create custom azimuths for lease blocks. Click here for details.
- Build internal setbacks. Click here for details

Pro 3D

- Pro 3D is now available for free to users with a geo-interpretation package. Click here for more details.

GeoAtlas

- Create surface and subsurface hazards layers. Click here for details.
- Access FTP Hyperlinks in ESRI Shapefiles. Click here for details.

Architecture

- ESRI ArcGIS Runtime Engine 10.5.1 support is added. Click here for details.
- Advanced database security is implemented. Click here for details.
- Microsoft Office 2016 support is added. Click here for details.

For details on the new features, fixed issues and known issues for the GeoGraphix 2017.3 release, click the following.

- New Features
- Fixed Issues
- Known Issues

System Requirements

In the following sections, you will find hardware and software system requirements for this release of GeoGraphix and Discovery on OpenWorks:

- GeoGraphix Workstation
- GeoGraphix Project Server

System requirements can vary considerably, depending on your computing environment and software objectives. Please contact your Sales Representative or Customer Support if you have questions or need more information about system requirements.

Important Notes:

- Users upgrading from GeoGraphix 2017.1 and 2017.2 to GeoGraphix 2017.3 do not require a new GeoGraphix license. New users or users upgrading from other versions of GeoGraphix also need valid LMKR licenses. Please contact COS@lmkr.com to request a license.
  For information on license requirements for GVERSE applications, refer to their respective release notes and installation documents on the LMKR Support Portal > Knowledge Center > Release Notes and Installation Guides page.
  The LMKR License Management Tool (LMT) must be installed to configure the license. Download the latest LMT from the LMKR Customer Support Portal > Downloads page. See the "LMKR Licensing" section of the Installation Guide for Release 2017.3 for more information.
- Discovery on OpenWorks is compatible with OpenWorks for Windows 5000.10.6.03 and SeisWorks 5000.10.
- Refer to the LMKR Customer Support > Knowledge Center > System Requirements page for up-to-date information on system requirements for all GeoGraphix and GVERSE applications.

GeoGraphix Workstation and Laptops

The requirements for GeoGraphix Workstation and Laptops are as follows:

Software and Hardware Requirements

We recommend using the latest Microsoft service packs and security patches. The following table lists the operating systems which are supported.

Supported Operating System	RAM	CPU
Windows® 7 Professional x64 Windows® 7 Enterprise x64 Windows® 7 Ultimate x64 Windows® 10 Professional x64 Windows® 10 Enterprise x64	8 GB Minimum 16+ GB recommended	Pentium i5/i7 or any Quad Core Processor

Note 1: GVERSE Geophysics and GVERSE Geomodeling specifically require Windows platform update package KB2670838 installed on the machine, in case the operating system is Windows 7.

Additional Requirements and Recommendations

- DVD-ROM required for media installation. Download installation available through Electronic Software Delivery from the LMKR Support Portal > Downloads page.
- DCOM/Firewalls configured to allow remote access. Only necessary if sharing projects.
- Microsoft .NET 4.5.1 runtime required.

Hardware Requirements

We recommend the following Hardware to run the GeoGraphix applications:

Applications Support Level	Required Operating System	Required Hardware
All GeoGraphix Applications including Discovery 3D and advanced 3D visualization (Pro 3D), and GVERSE Geomodeling	Refer to the supported operating systems mentioned on the previous page.	2 GB Minimum 4 GB Recommended DirectX 11 capable hardware **(see Note 2 below)**
GVERSE Geophysics	Refer to the supported operating systems mentioned on the previous page.	**Minimum** • 2.4 GHz 64-bit processor • 8 GB RAM • Any DirectX 11.1 capable card comparable with Nvidia® GeForce GTX 430 with 1GB VRAM. DirectX is not shipped with GeoGraphix 2017.3. You must download and install it separately. • 1366 x 768 screen resolution **Recommended** • Quad 3.2 GHz 64-bit processor • 32 GB RAM • Any DirectX 11.1 capable card comparable with Nvidia® GeForce GTX 1060 with 6GB VRAM. DirectX is not shipped with GeoGraphix 2017.3. You must download and install it separately. • Solid state hard disk • 1920 x 1080 screen resolution

Note 1: Microsoft DirectX End-User Runtime (June 2010) is required to run Discovery 3D, advanced 3D visualization (Pro 3D), GVERSE Geomodeling, and GVERSE Geophysics.

Note 2: To run Discovery 3D, advanced 3D visualization (Pro 3D), and GVERSE Geomodeling, it is recommended that an NVIDIA DirectX 11 compatible card be used. We recommend using the latest video drivers and MS updates for your system.

Optional Software Requirements

The following table lists the software requirements for using different tools available in GeoGraphix.

Tools	Software Requirements
Spreadsheet import utility in WellBase, SeisBase, and LeaseMap	Excel 2007, 2010, 2013 or 2016 (32 or 64 bit) In case the macros are not working in Excel, ensure the **gxdb.xla** file is present in the relevant Microsoft Office Library installation folder.
Selected Help files	Adobe Reader
For Discovery on OpenWorks, GridXchange, and SeisXchange	OpenWorks for Windows 5000.10.6.03 – Basic or Full (recommended) Install available on Landmark's LSM. (See Notes on the next page), and SeisWorks 5000.10 (for seismic workflows)
ESRI geo-referenced images and ESRI CAD file import in GeoAtlas	ESRI ArcGIS Runtime Engine 10.2.x or 10.3.x or 10.4.x or 10.5.x (included in the 3rd Party Installer).
For LOGarc™ Version 4.1.0.3 access in smartSECTION	To use the LOGarc™ feature, the LOGarc™ Version 4.1.0.3 software must be downloaded from IHS LogTech Canada, LTD and a valid account must be in place. You must have administrator rights to the computer on which you will load the software.
For GVERSE Field Planner	This application requires MATLAB Runtime R2018a (9.4).

Note for Discovery on OpenWorks: The OpenWorks Full installation requires Hummingbird Exceed. The Oracle client installation in use with the OpenWorks Full installation requires that the "Administrator" option be selected. The "Administrator" option type includes the SQL Plus and the Oracle Database Utilities components, which are needed to run Discovery on OpenWorks, as part of the total OpenWorks package.

Note: Hummingbird Exceed is not required for the OpenWorks Basic installation. If the OpenWorks Basic installation is used, the Oracle client installation can use the "Administrator" option, which will include all of the needed components. Or, the Oracle client installation for the OpenWorks Basic installation can use the "Custom" installation type. However, the following components must be installed with the "Custom" installation type:

- Oracle Database Utilities 12.1.0.2
- SQL *Plus 12.1.0.2
- Oracle JDBC/THIN Interfaces 12.1.0.2
- Oracle Net 12.1.0.2

You may experience the following error related to Oracle installation:
The SQLLoader.exe error may generate when working with Filters in GeoGraphix due to a missing Oracle DLL file. This is a known issue of Oracle 12.1.0.2 where oranfsodm12.dll is not shipped with the installer.
Workaround: After Oracle installation, create a copy of the oraodm12.dll file, rename it as oranfsodm12.dll, and then place the renamed file in the BIN folder of both 32-bit and 64-bit Oracle installations.

GeoGraphix Project Server

The requirements for GeoGraphix Project Server are as follows:

Software and Hardware Requirements

We recommend using the latest Microsoft service packs and security patches. The following table lists the operating systems which are supported.

Supported Operating System	RAM	CPU
Windows® Server 2008 R2 Standard x64 Windows® Server 2008 R2 Enterprise x64 Windows® Server 2012 R2 Standard x64	32 GB Minimum 64+ GB Recommended SSD Drives Recommended	Intel Xeon Processor or Equivalent Quad 2.4GHz 64-bit or better

Additional Requirements and Recommendations

- DVD-ROM is required for media installation.
- DCOM/Firewall must be configured to allow remote access. For DCOM configuration recommendations, refer to the LMKR Support Portal > Knowledge Center > White Papers page.

Server performance is subject to a large number of variables. It is impossible to give specific recommendations here, but these are some guiding principles to use. In general, multi-user performance of a GeoGraphix project server is best when the server is dedicated to GeoGraphix and not shared with other applications, especially database applications or intensive file-system applications. In addition, consideration should be made for the number of GeoGraphix users and the size and number of concurrently accessed projects. At some point, having multiple project servers becomes a better solution than having all users on one server. Generally, somewhere between 10 and 20 users is when a second server might be suggested.

Networking

Networking performance depends on the number of users trying to access a server simultaneously, as well as the bandwidth requirements for those users. Recommendations for server bandwidth typically specify server connectivity at a higher bandwidth than an individual user. For instance, users running at 100 Mbit should be accessing a server running on a 1-Gbit backbone. If users are at 1 Gbit, consider running multiple 1-Gbit connections or a single higher-bandwidth connection on the server.

Database Cache

A large database cache is an important factor to consider when dealing with multiple users accessing large databases. The database engine is capable of addressing a practically unlimited amount of cache memory. The best way to size the memory is to estimate the memory requirements for other running applications and allow the database cache to dynamically allocate any remaining free memory. The engine will only allocate what it needs when using dynamic allocation up to the maximum specified.

It is highly recommended that you let the database engine use as much cache memory as it requires on the host server. Increasing database cache memory is the quickest and most effective way to improve database related performance on large network projects.

On a workstation, it might be appropriate to reserve 1 to 2 GB for the OS and file system cache and 2 to 4 GB for other running applications. On a dedicated project server, not much memory needs to be reserved for other applications. The ideal maximum varies by the project size, the number of users, and other load considerations. But as a general rule, the higher you can set the maximum, the better.

Storage

A great deal of GeoGraphix's access patterns on a server deal with file I/O. Database access, raster images, and seismic data are examples of files that benefit substantially from a fast disk sub-system. Server environments also place a high importance on data integrity and reliability. At a minimum, consider using a RAID 5 (stripe-set with parity) array. As the size of disks increase, you may also want to consider a hot swap drive and/or RAID 6 (striped with dual parity). Using a controller card with its own cache can also help improve performance.

Network Attached Storage (NAS), Storage Area Networks (SAN), and Other Non-Windows Storage Solutions

There are two typical methods used for accessing external storage devices from a project server: iSCSI and CIFS.

- iSCSI allocates a block of storage on the external device and makes it appear to be a physical disk on the project server. This has the advantage of a 100% compliant file system. However, since the external device sees the allocation as one big file, it can make backing up and restoring of individual files using the external device's capabilities more difficult. Standard backup and restore procedures from the server will still work.
- Using CIFS for external storage devices depends greatly on the vendor's implementation of the CIFS protocol used by the Windows platform. In general, a 100% compliant implementation of CIFS for a performant system is required. In particular, vendor's implementation of the "File Change/Notify" functionality has been problematic. Devices based on Windows Storage Server should be 100% compatible since it shares its components with Windows. Implementations based on UNIX/Linux are where problems occur due to the fact that the kernel level support is not present. Due to these uncertainties with CIFS implementations LMKR does not technically support CIFS.

Compatibility with OpenWorks Software

The Discovery™ on OpenWorks® (DOW) software directly links a GeoGraphix application to the data in an OpenWorks® project, and provides a shared project environment for interpretation applications. Landmark Software has delivered the OpenWorks and DOW software for Release 5000 and will continue to provide updates and enhancements to these products. When planning your uptake of Release 5000 and verifying your workflow, you should consider version compatibility between the OpenWorks software and the Discovery on OpenWorks software.

In the compatibility table below, the table indicates the level of compatibility of previous releases and of upcoming scheduled and planned releases. This table will be updated as new releases are planned. The objective is to provide closely coupled compatible versions of the software to allow you to more easily take up current releases.

LMKR performs full release testing for those combinations indicated as Release, R, in the table, but may not exercise full release testing on other version combinations. For these iterative releases, LMKR performs compatibility testing between the OpenWorks and DOW software (indicated as Compatibility, C, in the table). See the table below for the level of testing for each version combination. Although LMKR does not anticipate any integration issue, in these cases it is recommended that customers also verify compatibility in their own environment.

LMKR supports the versions listed as Release in the table. However, while LMKR has completed compatibility testing, LMKR/GeoGraphix Support may not be able to fully support the versions listed as Compatibility in the table. When customers request support for a Compatibility environment, LMKR/GeoGraphix Support works on a best effort basis to troubleshoot any issues, and if an issue needs additional attention, LMKR/GeoGraphix Support reports such issues to LMKR Research & Development. The LMKR/GeoGraphix Support Team cannot guarantee any resolution service levels associated with issues from a compatibility environment.

Combinations which have not been tested, either in the full release or in a compatibility environment, are indicated by U (untested). P indicates the indicated versions are probably incompatible, as the OpenWorks version has a newer development kit (devkit) than that of the indicated DOW version. Blank cells in the table indicate that OpenWorks and GeoGraphix are incompatible and will not operate together.

For the most current version of this information and an overview of suggested compatibility test paths, please refer to the LMKR Technical Support Solution Document KBA-65218-F9D7D5.

Compatibility Matrix

Discovery on OpenWorks

OpenWorks Version	OW License 5000	DOW License 5000.02								
	GeoGraphix Version	2017.3	2017.2	2017.1	2016.1	2015.1	2015.0	2014.0	2013.0	2012.0.0
	OW 5000.10.6.03	**R**	**R**	**R**	**C**	**U**	**U**			
	OW 5000.10.3.02	**C**	**R**	**R**	**C**	**U**	**U**			
	OW 5000.10.1.05				**R**	**R**	**R**			
	OW 5000.8.3.01				**R**		**C**	**R**		
	OW 5000.8.1.1								**R**	
	OW 5000.8.0.0									**R**
	OW 5000.0.3.5									**C**

Legend

R = Release level full testing

C = Compatibility level basic testing

U = Untested

P = Probably incompatible since OW and GeoGraphix are running different OW devkits.

A blank cell indicates that OW and GeoGraphix are incompatible

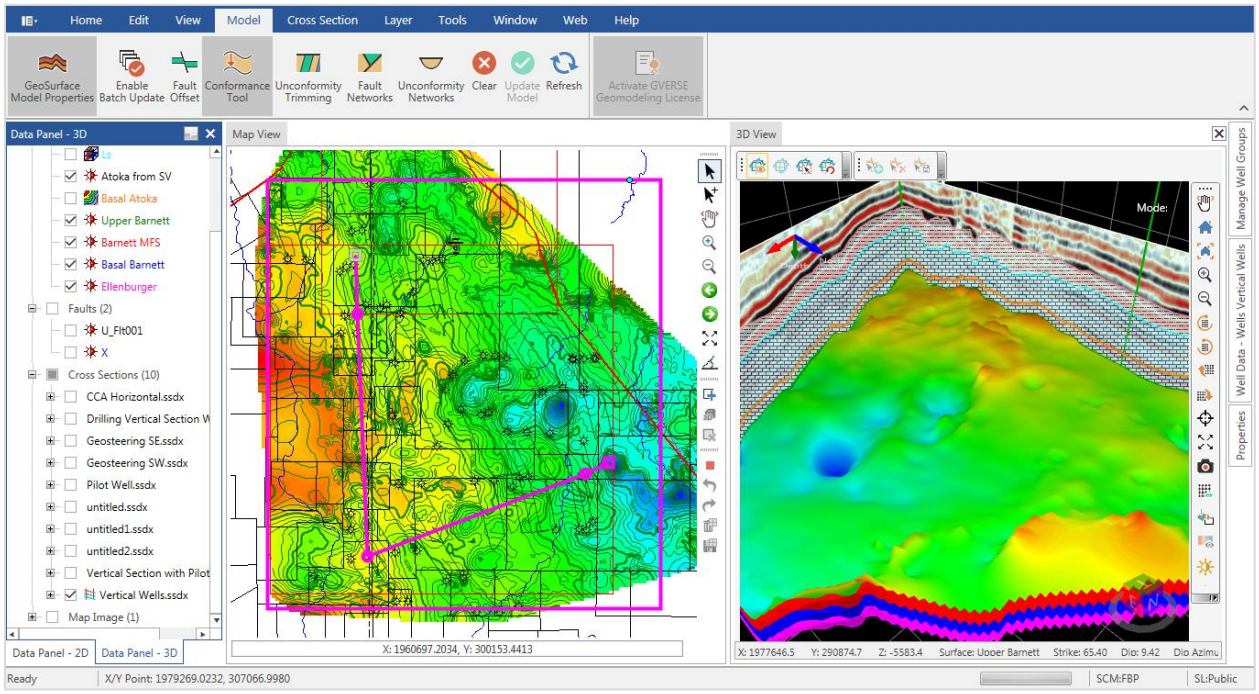
New Features

This section contains a brief description of the exciting new features included in the 2017.3 release.

GVERSE Geomodeling/smartSECTION

Modern Graphical User Interface

Experience better usability with the redesigned application window that provides improved docking support and easy to access ribbon controls, optimized for efficiency and productivity.



Calculate Wells Length and Percent in Zones

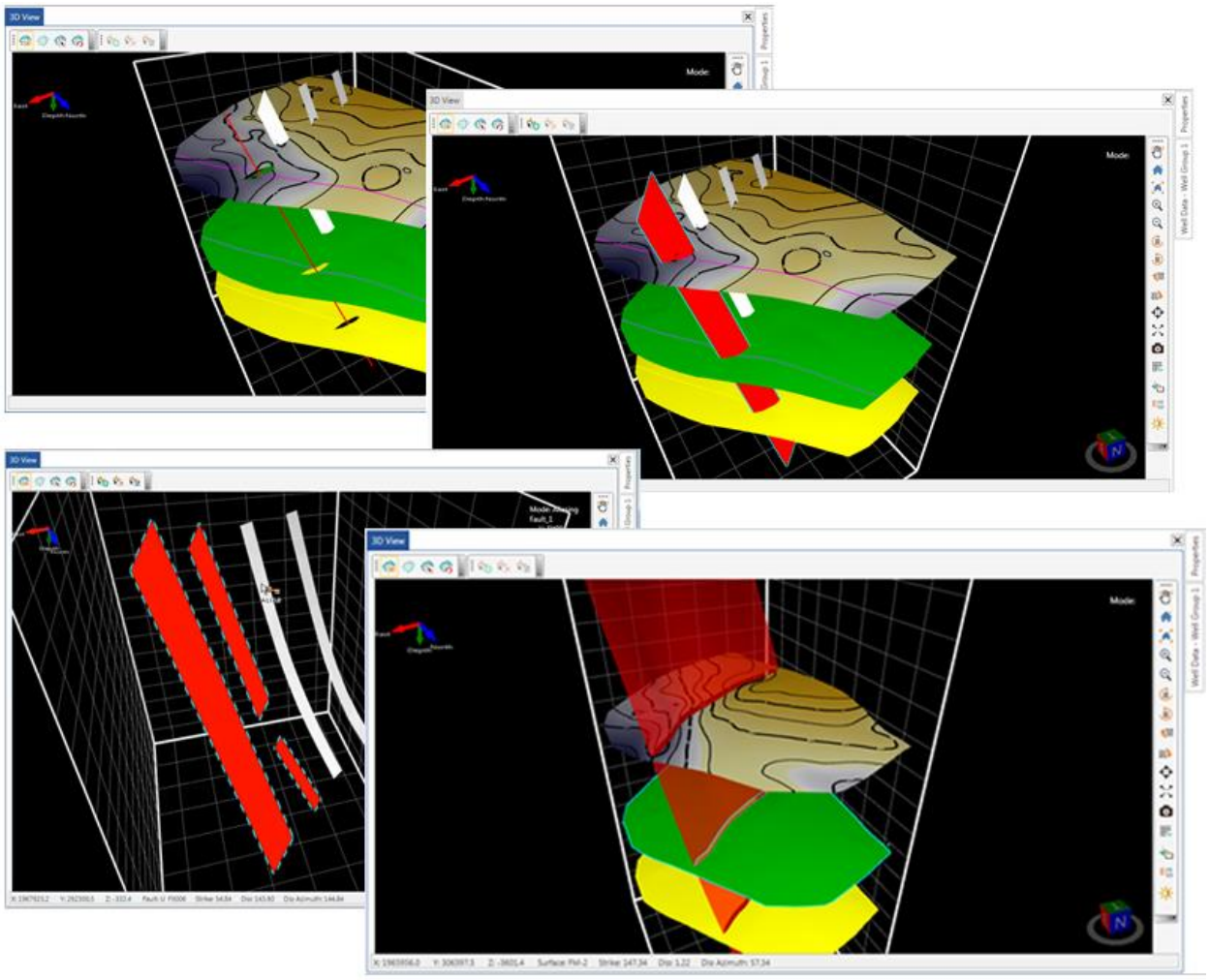
Determine the length and percentage of drilling wells within a target zone and save the calculations in ZoneManager or export the details in an ASCII file. To access the Calculate Well(s) In Zone dialog box, either select **Tools > Calculate Well(s) In Zone** option or right click the selected well(s) and choose **Calculate Well(s) In Zone** option from the context menu in Map/Cross Section View.

Add/Remove Wells from Geomodel

Update the geomodel by choosing to include or exclude specific wells to/from your interpretation without changing any settings. Simply add or remove wells in a geomodel from either of the views you are working in; Map View, 3D View, or Cross Section View. To remove well(s) from the geomodel; right-click the well(s) you want to remove and select **Remove Well(s) from Geomodel** from the context menu in Map View, or select **Remove Well from Geomodel** from the context menu in 3D/Cross Section View. To add a removed well back into the geomodel, choose **Add Well(s) in Geomodel** from the context-menu.

Fault Aliasing in 3D View

Visualize the relationships between the named fault and unassigned faults in the 3D View. Use the tools available in the **Fault Aliasing** toolbar to alias unassigned faults to the named faults. You can use the **Fault Aliases** tool to select the unassigned faults and then use the **Save Aliases** tool to add them as aliases to the named fault. The relationship is instantly updated in the 3D View. The **Fault Aliasing** toolbar is available on top of the 3D View by default.

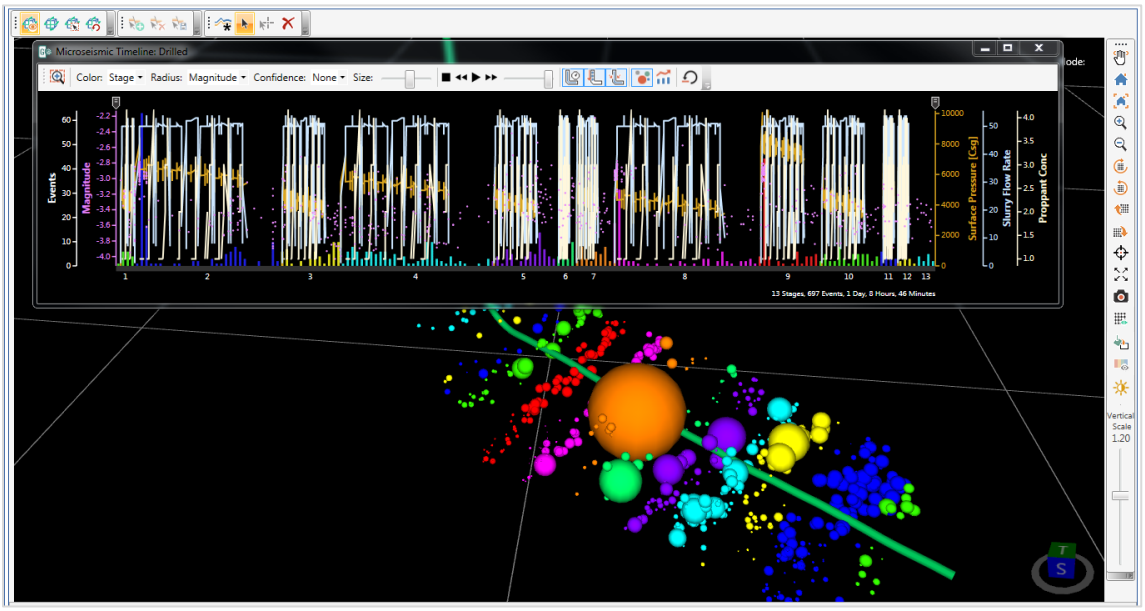


Auto Grouping of Wells of a Cross Section

All wells existing in a cross section are automatically grouped into a well group which is listed under the Cross Sections node in Data Panel 3D. This allows for better usability and for applying desired properties selectively to the wells of a particular cross section.

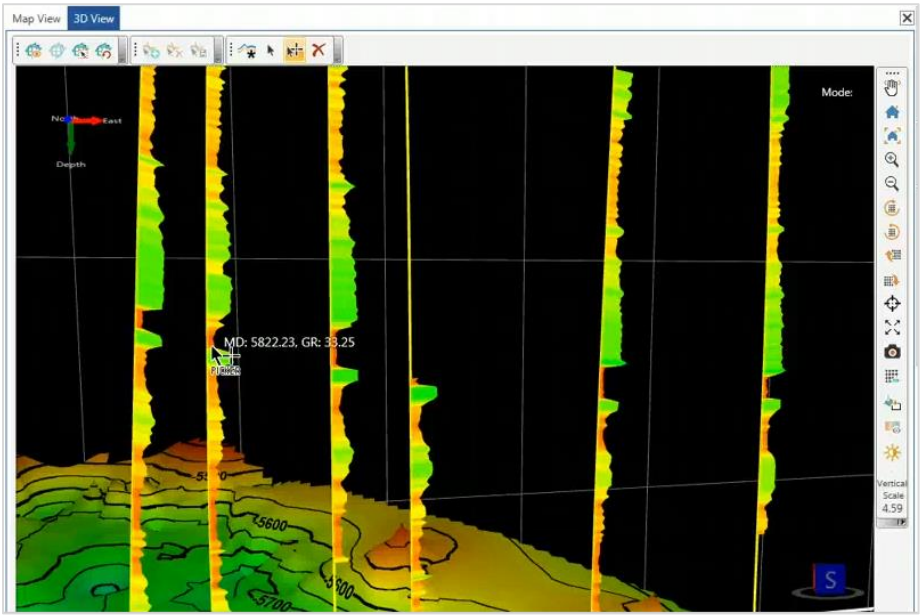
Microseismic Display and Animation

With Microseismic display in 3D View, analyze hydraulic fracturing stages, pressures, slurry and proppant characteristics, and corresponding seismic events in the treatment well. Select a well that has the Microseismic data, right click and choose **Show Microseismic** from the context menu to display microseismic events. To display the Microseismic Timeline dialog box, choose **Show Microseismic Timeline** option from the context menu of the selected well(s) in 3D View.



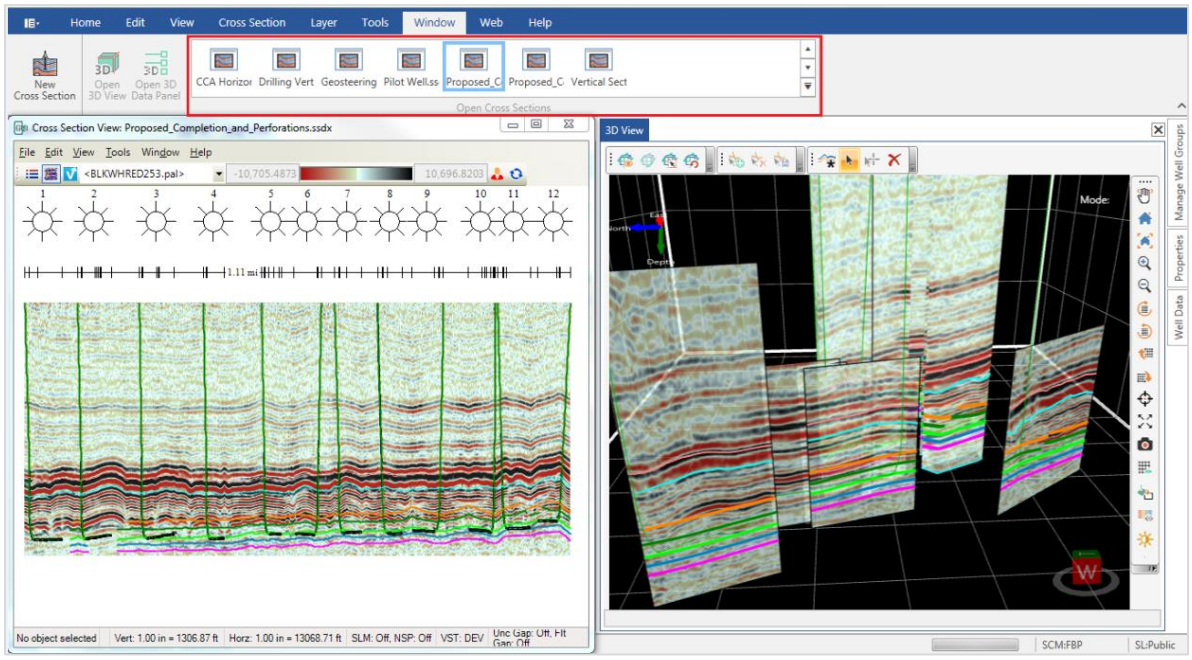
Picking Options Tools

Add, remove, or modify surface tops and fault cuts on wells in the 3D View, using the tools available on the **Picking Options** toolbar. The picking cursor, when placed on a well, displays the depth in MD and the curve value if a curve is applied on the well. You can also use the **Select** tool to click and drag a pick to change its depth. The **Picking Options** toolbar is available on top of the 3D View by default.



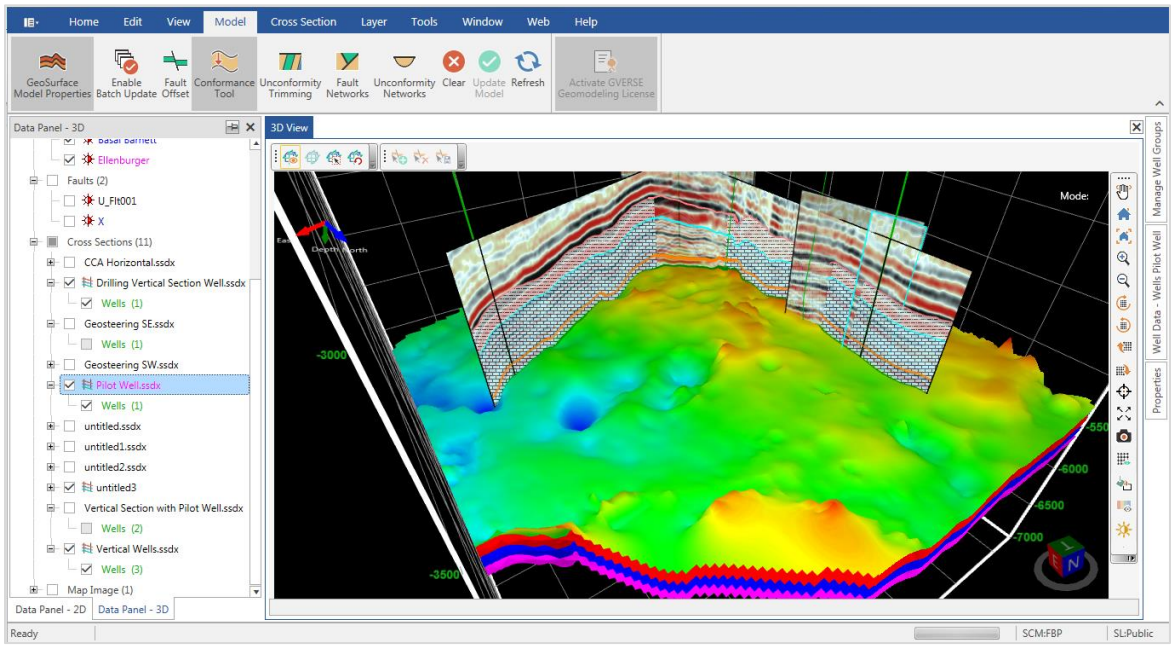
Cross Section Navigation Panel

All the open cross sections in an interpretation display in the Cross Sections Navigation Panel on top of the Map/3D View, which makes it easier to navigate through the multiple open cross sections. To directly maximize a cross section window, simply click once on its respective tile in the navigation panel. The navigation panel is available on the **Windows** tab of the main application window.



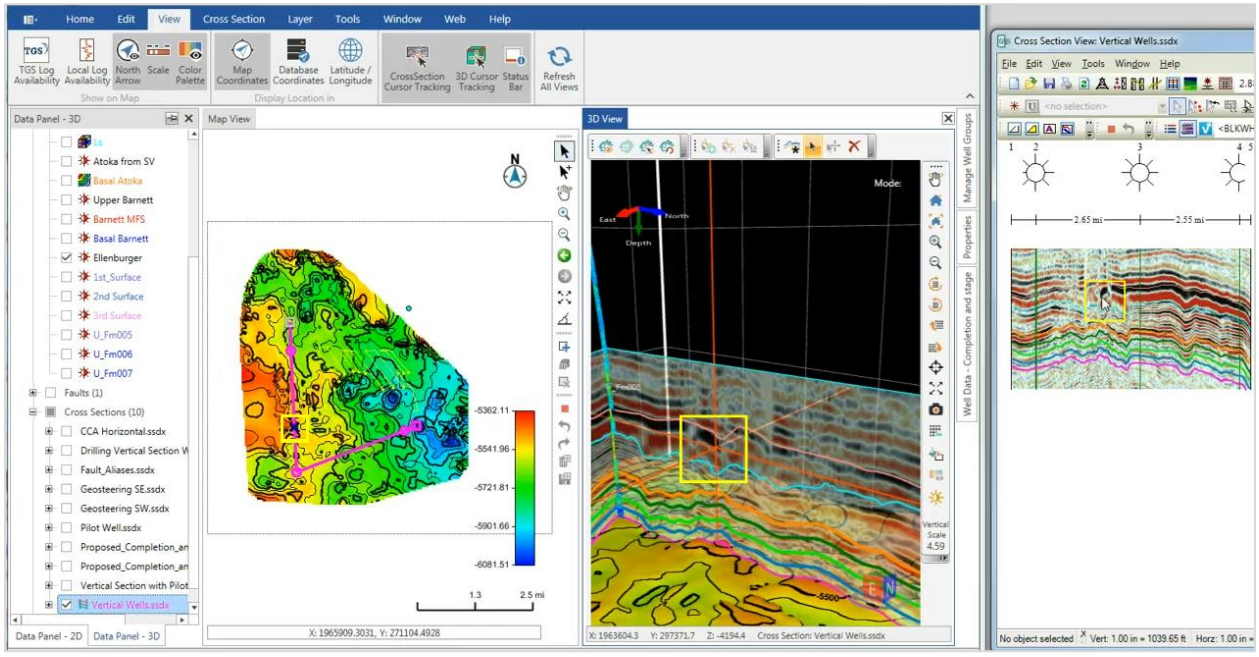
Improved Cross Sections list in 3D Panel.

A list of all cross sections is available in Data Panel - 3D for better usability. Differentiating between open and close Cross Sections or Fences is easier with the help of cross section annotation symbols added next to open cross sections or fences. To view the list of cross sections in an interpretation, activate 3D View and expand the **Cross Sections** node in the **Data Panel – 3D.**



3D Cursor Tracking

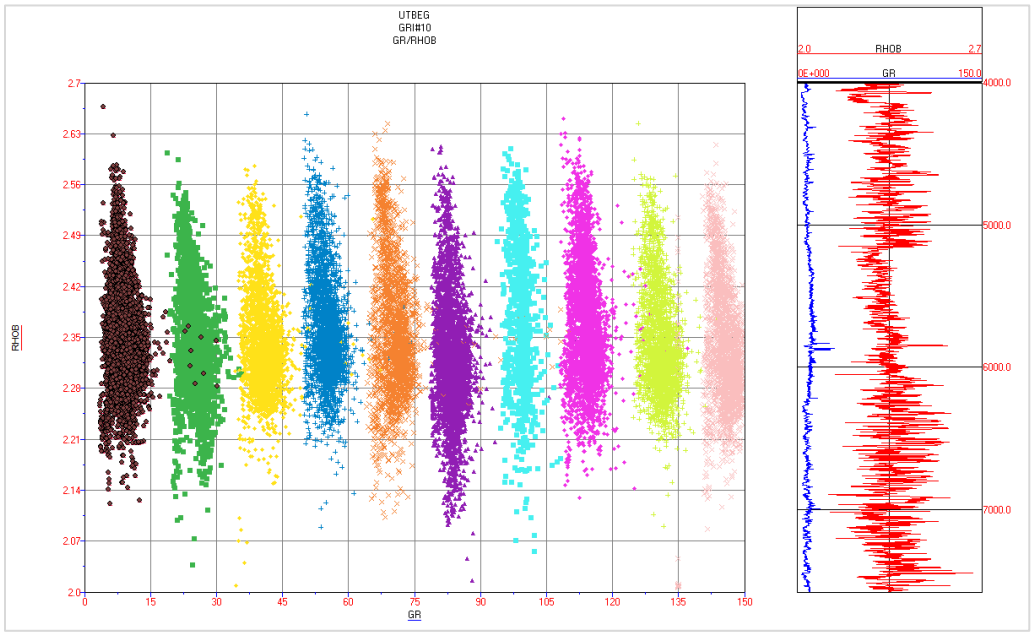
Identify your position inside the model by tracking cursor in all views. Cursor tracking is available for 3D view, Map View, Fence, and Cross Section View. The 3D Cursor Tracking feature is toggled on or off by selecting **View > 3D Cursor Tracking from the main application window.**



PRIZM

Multi-colored Multi-well CrossPlot

Display multi-well clusters in different colors to easily differentiate between the data points belonging of different wells and analyze petrophysical behavior of the wells. Choose **Tools > Multiwell Crossplot > Points and Histograms and select the desired** features you want to display on the multi-well crossplot.

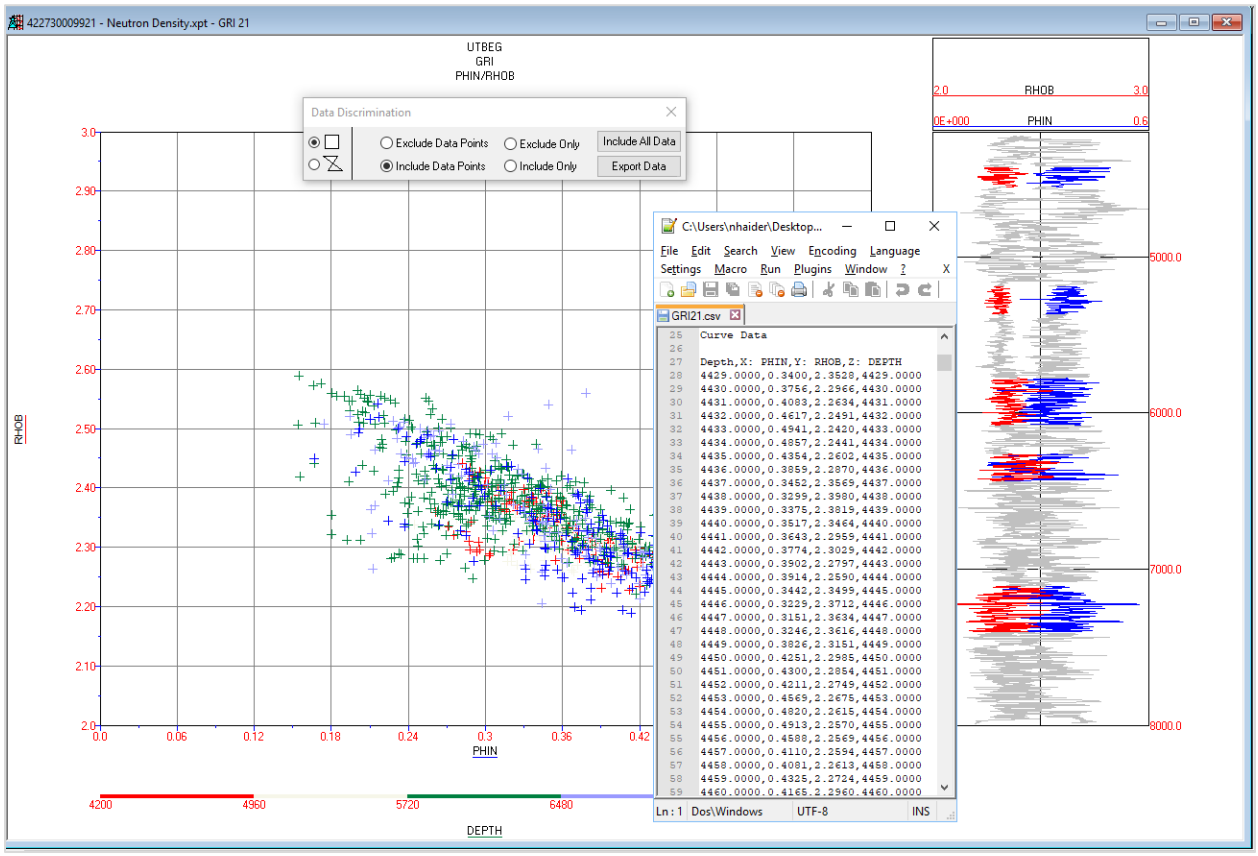


ASCII Export

Export the curve values in a text file using tab, space, or comma as a field separator. In Report View, choose **File > Export > ASCII Export/Copy to Clipboard** to access the ASCII Export dialog box. Alternatively, you can also choose **Tools > ASCII Export/Copy to Clipboard** or, right-click the Report View and select **ASCII Export/Copy to Clipboard** from the context menu.

Crossplot Data Points Export

Export the selected well data points from a crossplot to a CSV file. Choose **Tools > Data Discrimination**, or click the Data Discrimination button on the Crossplot toolbar to open the Data Discrimination dialog box. Use this dialog box to include/exclude the well data points for export.



View Multi-well Crossplot Wells in other GeoGraphix Applications

Select a group of points in a Multi-well crossplot and open the corresponding wells in WellBase, GeoAtlas, smartSECTION, GVERSE Geomodeling, and ZoneManager. In the Crossplot View, choose **Tools > Data Selection** to access the Data Selection dialog box, and then select the desired data points for display in other applications. Alternatively, you can also right-click the crossplot area and choose **View Wells of Selected Cluster** option from the context menu.

Import/Export Curves List and Curves Aliases

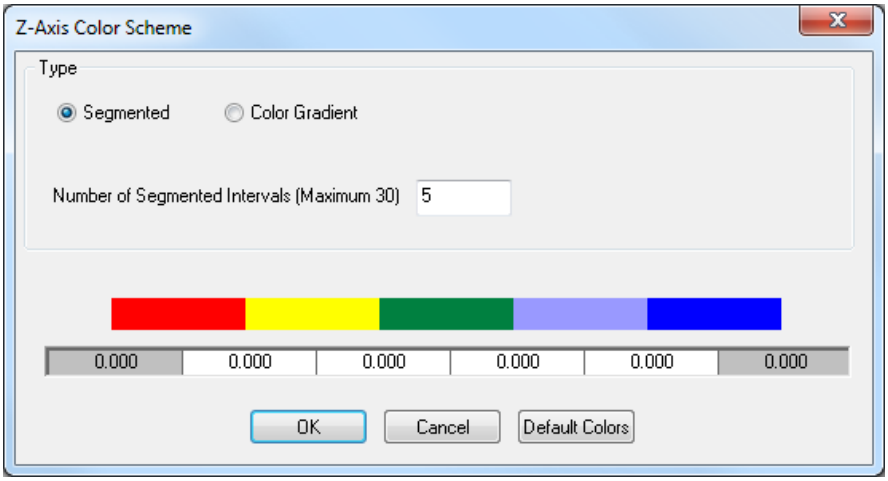
Import/Export the default curves list and their associated curve aliases by using the options available in the Default Curves tab of the Project Default Settings dialog. To access the Default Curves options, choose **Project > Default Settings** from the main menu.

Decimal Representation of Curve Depth Values

Using the Data Readout mode, increase or decrease the decimal places in the curve depth values. The depth values in the curve insert area display up to three decimal places by default and can be increased to six decimal places. To activate the data readout mode, choose **Tools > Data Readout** from an active Log View window.

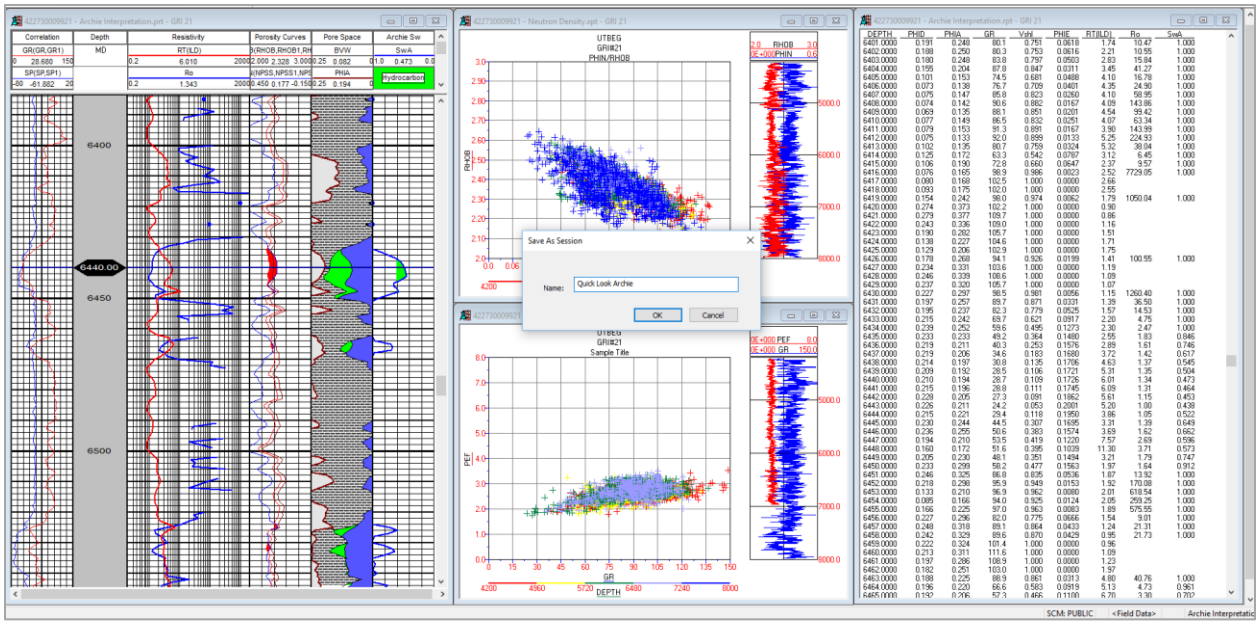
Z-Axis Color Spectrum

Get more control over the Z-axis color bar by adding more segments and colors. Enter any number between 1 to 30 for segmented intervals for color and scales on the crossplots. To access the Z-Axis Color Scheme dialog box, choose **Edit > Crossplot** from the active crossplot window, select the **Z Axis** option and then click the **Color** button.



Save PRIZM Sessions

Save PRIZM sessions, including display windows, templates, Data Interval, Display Interval (log and crossplot), and UDE to an interpretation file that can be restored at a later time. To save a session, choose **File > Save**, or **File > Save As** from the main menu.



CDS Template

Save the Curve Data Statistics template with the desired parameters set in the Curve Data Statistics dialog box. The saved template in the project directory can be used again with the Load Template option. To access the CDS dialog box, choose **Interpretation > Curve Data Statistics** and then click the **Save Template** button to save a template with preferred properties.

Customized WellBase Filters

Use customized WellBase filters to quickly locate the desired well for core, deviation, and dipmeter data import. Choose the relevant option from **File > Import** to import the required data from an ASCII file.

Choose and Rename Curves during Import

Select specific curve(s) from the LAS file to import into the database and rename it to a new curve name during a manual import operation. To select the desired curves, choose **File > Import > LAS/LBS Import.**

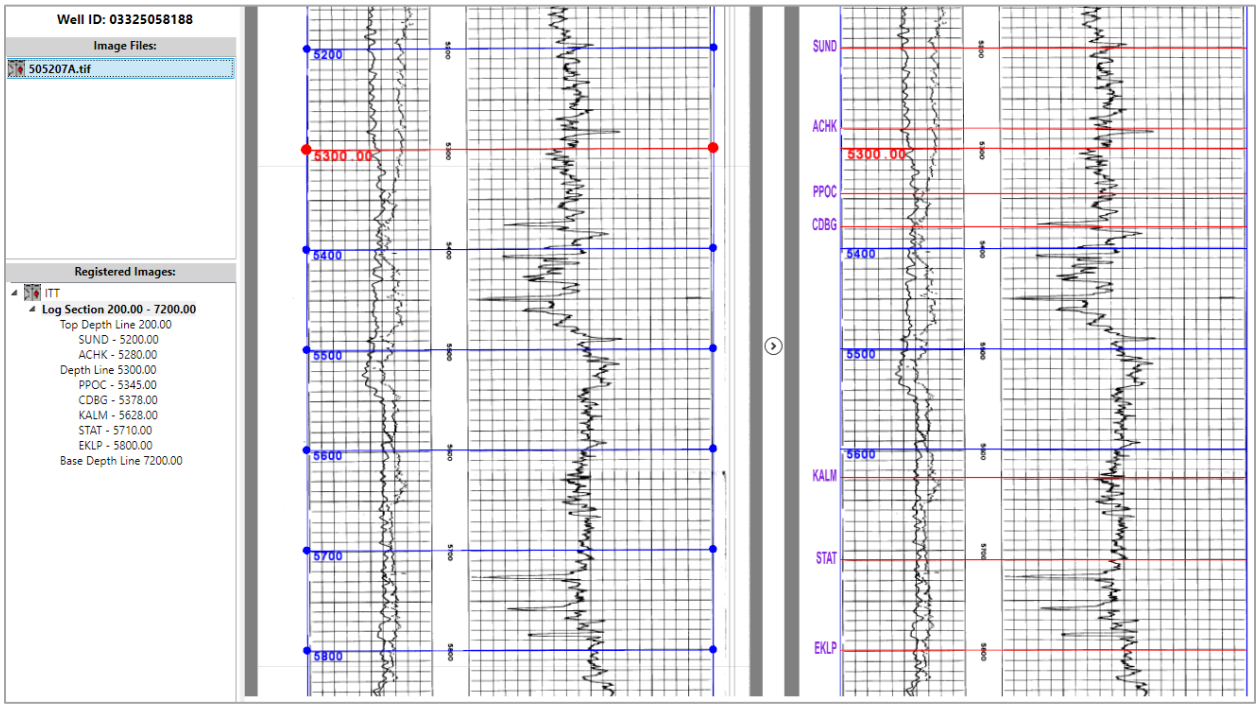
Improved Single Well Export

Select the desired curves from multiple curve sets and export the curves to a single LAS or CSV file over any specific zone, formation interval, or depth range. Choose **File >> Export >> Single Well LAS/CSV Export** to access the dialog box for exporting curves.

DepthRegistration

Display Formation Tops on Straightened Images

Choose to display or hide the formation tops marked on straightened images. Once the formation tops are selected to be displayed on raster images, the **Formation Tops** button in the standard toolbar acts as a toggle to show or hide the formation tops marked on the straightened Images. To select the formation tops to display, choose **View > Formation Tops** from the main menu.



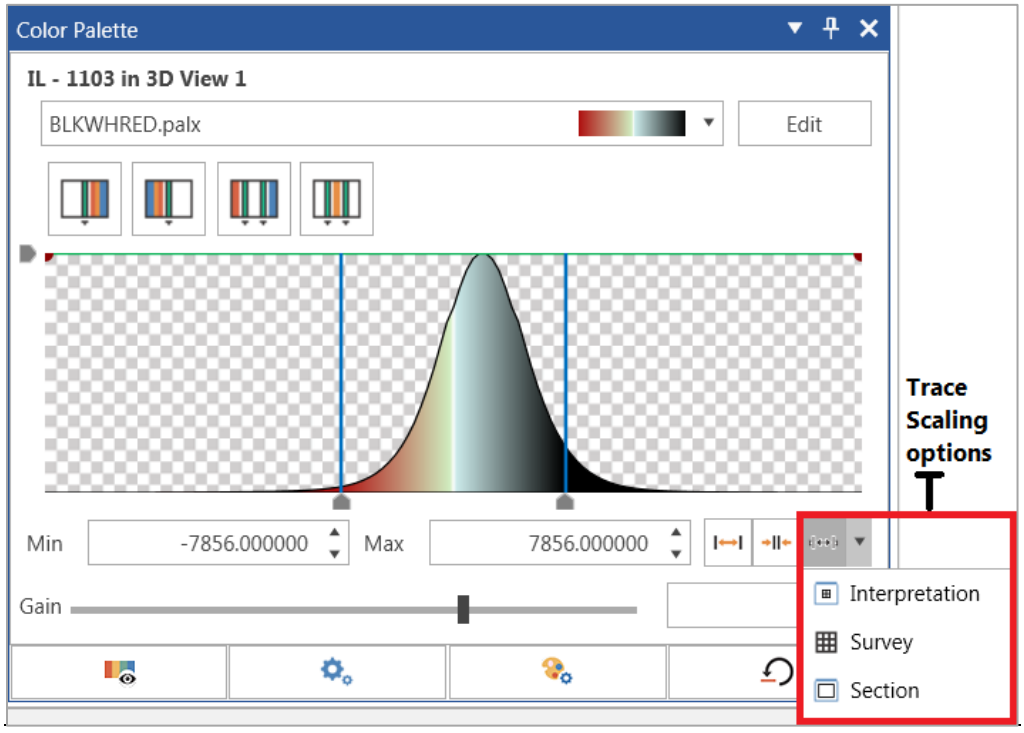
Support for RasCalML (XML) v2.2

Added the support for RasCalML (XML) v2.2 for DepthRegistration data imports.

GVERSE Geophysics

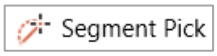
Tighter Integration

- Create cross sections in GVERSE Geomodeling and smartSECTION with a single click. To do so, select the desired seismic section, right-click and select **Create Cross Section In > GVERSE® Geomodeling**, or **Create Cross Section In > smartSECTION** from the context menu.
- Open wells in WellBase, PRIZM, ZoneManager, DepthRegistration, and LogM Well Editor directly from the 3D module. To do so, right-click on the desired well and choose one of the listed GeoGraphix/GVERSE applications to open wells in, from the context menu.
- Send seismic sections displayed in the 3D view to vertical and horizontal seismic display windows and work with sections in a 2D view. To do so, select any open seismic section in the 3D interface, right-click and select **View in 2D** from the context menu.
- View seismic sections displayed in 2D windows immediately in the 3D view by clicking the **View open seismic section(s) in 3D** icon on the **3D View** toolbar to open the **Open in 3D View** dialog box. Select the desired objects that you want to send to the 3D view.
- Access the interpretation, survey and section derived trace scaling options in the 3D interface. These options are available in the Color Palette control.

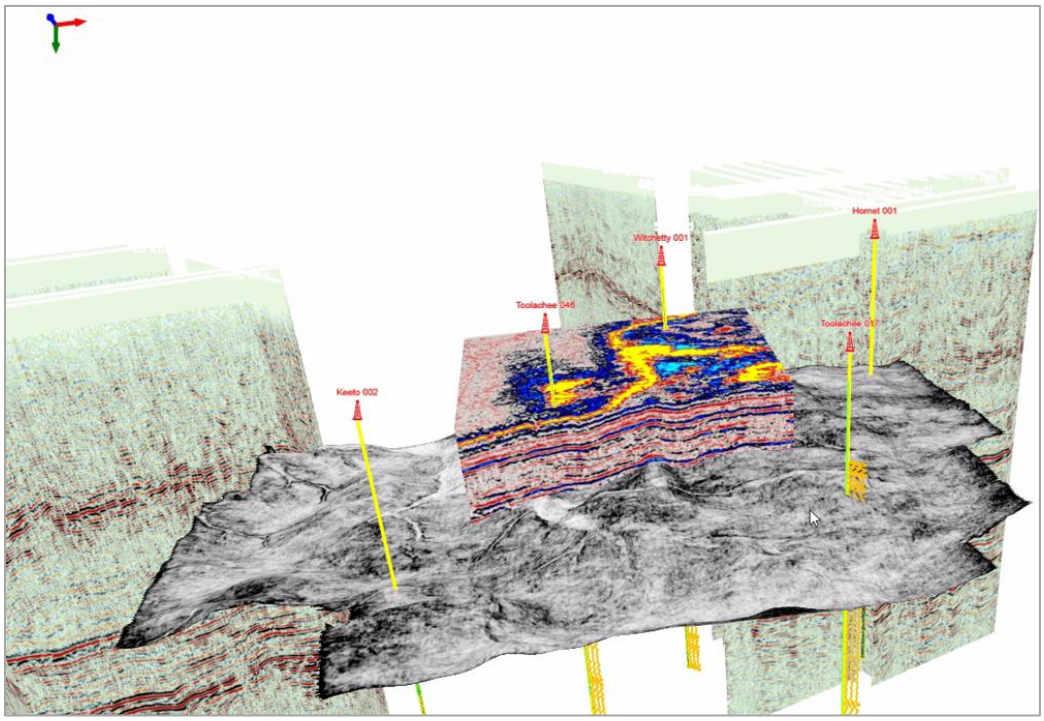


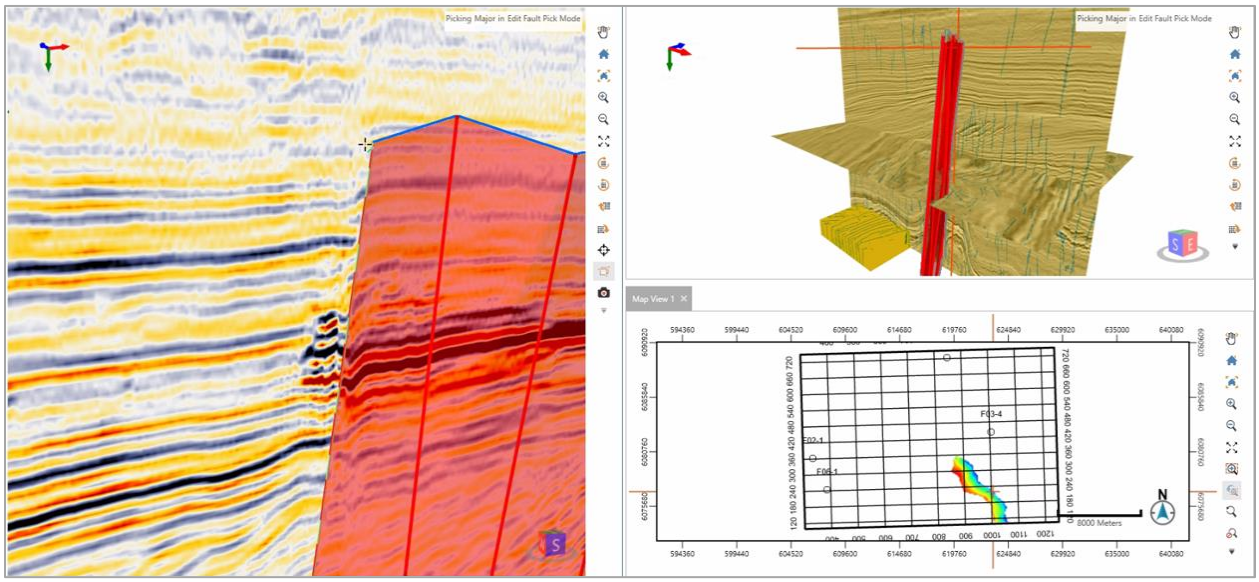
- Apply customized PALX format color palette to seismic sections, horizon surfaces and more in the main GVERSE® Geophysics interface.

Enhanced Interpretation Capabilities

- Quickly pick horizons even through noisy data with a new 2D auto pick algorithm. This option is available in both the main interface as well as the 3D interface.
  - Main Interface: Click the **Segment Pick mode** icon  on the **Horizon palette.**
  - 3D Interface: Click the **Segment Pick mode** 

button under **2D Pick modes** in the **Picking** menu of **Horizons** tab.



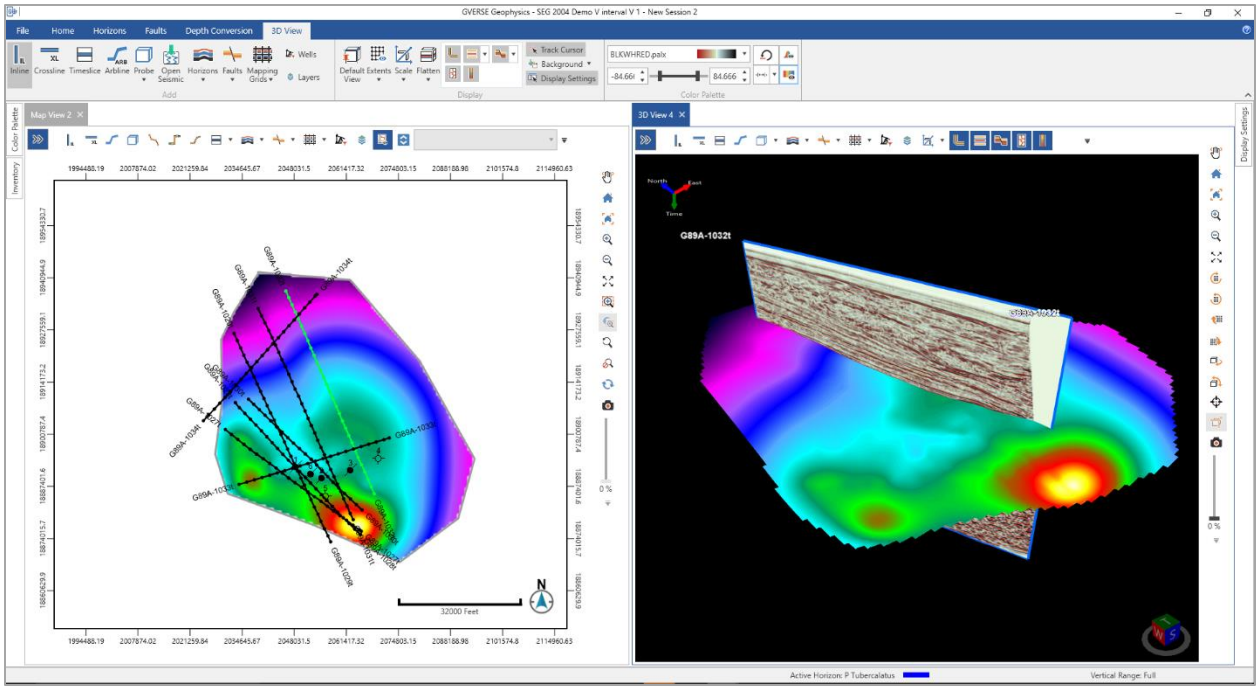


- Snap horizons more accurately with additional options to snap to events above, below or near existing picks. To access the **Snap Horizons** dialog box, select **Horizons > Horizon Operations > Snap Horizon** from the main GVERSE Geophysics interface menu bar.
- Gain more insight into stratigraphic features by flattening the entire 3D scene on a horizon. To do so, select **3D View** tab **> Display** menu **> Flatten** drop-down list > the horizon on which to flatten the seismic data
- Independent action lists for individual horizons and faults for more flexible and context aware undo and redo functionality. This option is available for horizons and faults in both the main and 3D interfaces. To perform this action:
    - **Main Interface: For Faults**: Select **Undo Fault Pick**  or **Redo Fault Pick**  icons from the **Fault Palette.**
    - **Main Interface > Horizons**: Select **Undo Horizon Pick**  or **Redo Horizon Picks**  icons from the **Horizon Palette**.
    - **3D Interface > Faults**: Click the **Undo Last Action**  icon on the **Picking** menu on **Faults** tab to perform single undo actions. To undo more than one actions, select the number of desired actions from the **Undo** drop-down list. Click the **Redo Last Action**  icon on the **Picking** menu on **Faults** tab to perform single redo actions. To redo more than one actions, select the number of desired actions from the **Redo** drop-down list.
    - **3D Interface > Horizons**: Click the **Undo Last Action**  icon on the **Picking** menu on **Horizons** tab to perform single undo actions. To undo more than one actions, select the number of desired actions from the **Undo** drop-down list. Click the **Redo Last Action**  icon on the **Picking** menu on **Horizons** tab to perform single redo actions. To redo more than one actions, select the number of desired actions from the **Redo** drop-down list.
- Easily verify well-seismic tie using a variable density display for synthetic seismograms.

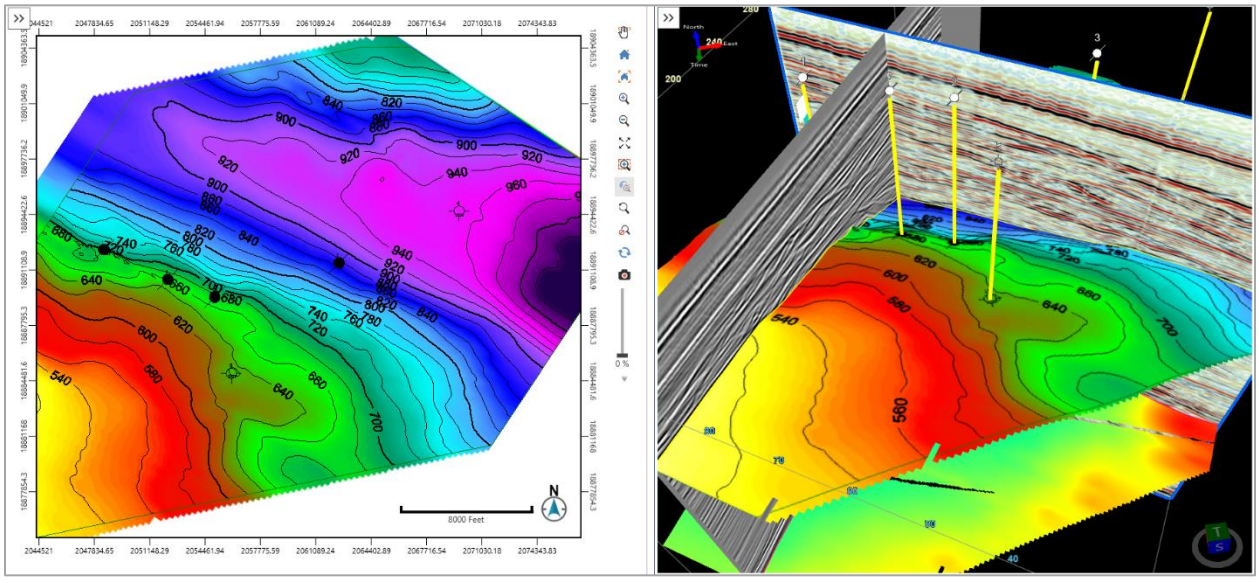
Increased Visualization Functionality

- Add mapping grids to the 3D scene and Map of the new 3D module.
    - 3D View: Select **3D View** tab > **Display** menu > **Mapping grid** drop-down list > select the desired mapping from the list to apply on the 3D scene.
    - Map View: Select **Map View** tab > **Display** menu > **Mapping grid** drop-down list > select the desired mapping from the list to apply on the Map view.

- View horizon picks associated with mapping grids in the 3D scene. To do so, select the horizon in the 3D scene and select the desired mapping grid from the available **Mapping Grids** list in the **Horizon Display Settings**.

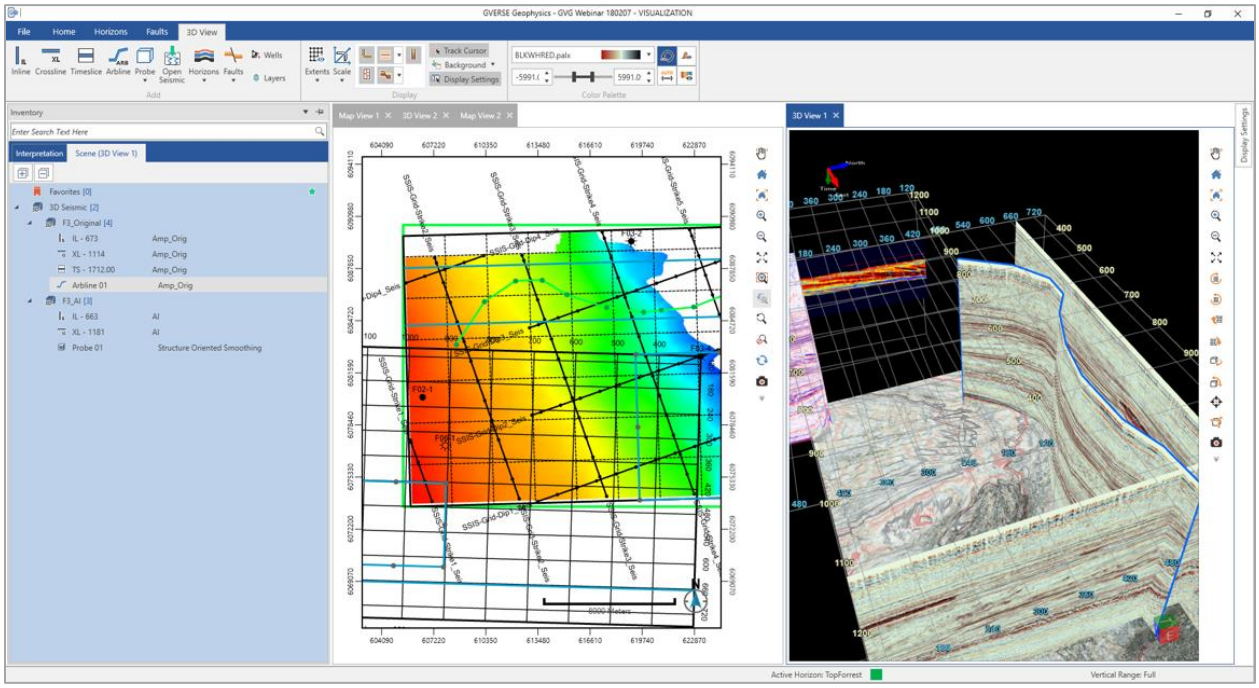


- Gain more insight into your structures by drawing IsoMap layers directly on the horizon surface. These layers can be draped on the horizon from the **Horizon Display Settings** in the 3D interface.



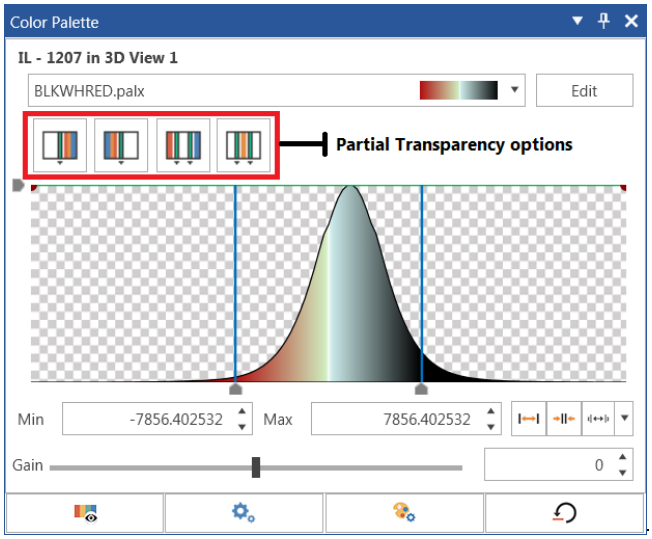
Improved Efficiency and Usability

- Access all depth conversion settings at a single location. The depth conversion settings can be accessed using:
  - Main Interface: Select **Depth Conversion > Depth Conversion Settings** from the menu bar.
  - 3D Interface: **Depth Conversion** tab **> Settings**.



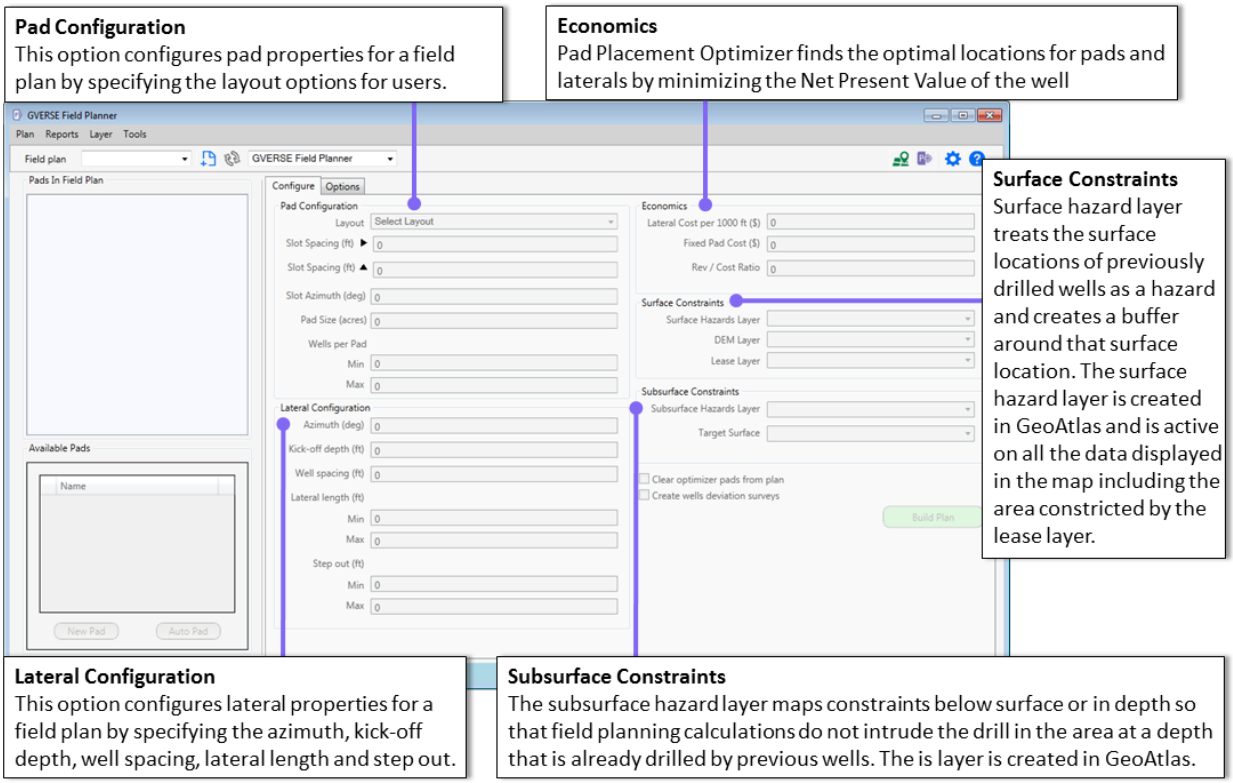
- Shortcuts to depth conversion workflows in the 3D view. The workflows that can be accessed from the Depth Conversion menu are:
  - Using Velocity Manager
  - Create Velocity Model
  - Create Velocity Volume
  - Create Depth Survey
  - Configure Reference Wells
- Scene-specific toolbars for a true multiscreen experience. These toolbars are available at the top of the scene in both the Map and 3D Views of the 3D interface.
- Arblines and probes can be navigated using hotkeys. Probes can also be resized using the hotkeys.
- Single click to open seismic sections at well locations and horizon and fault surfaces.
- View well symbols as defined by the status field in **WellBase** in the 3D scene. The wells are displayed either at surface or bottom hole location. The location of wells symbols can be set in the **Display Settings** of the chosen well.
- Manipulate and modify arbitrary lines directly in the 3D scene. You can now move the control points of arbitrary lines to rearrange them quickly and efficiently.

- Quicker access to partial transparency options in the color palette control in the 3D interface through pre-set buttons.



GVERSE Field Planner

LMKR is pleased to announce the release of GVERSE Field Planner. This application intelligently populates wells over an entire field based on defined hazards, lease areas, and constraints. It uses an advanced optimization algorithm to lay out hundreds of wells in minutes. It works with you by taking into account surface hazards, existing wells in the area, and lease boundaries to maximize lateral length in the zone. GVERSE Field Planner is flexible and allows you to make granular changes to well geometry, orientation, and location throughout the development of the field.

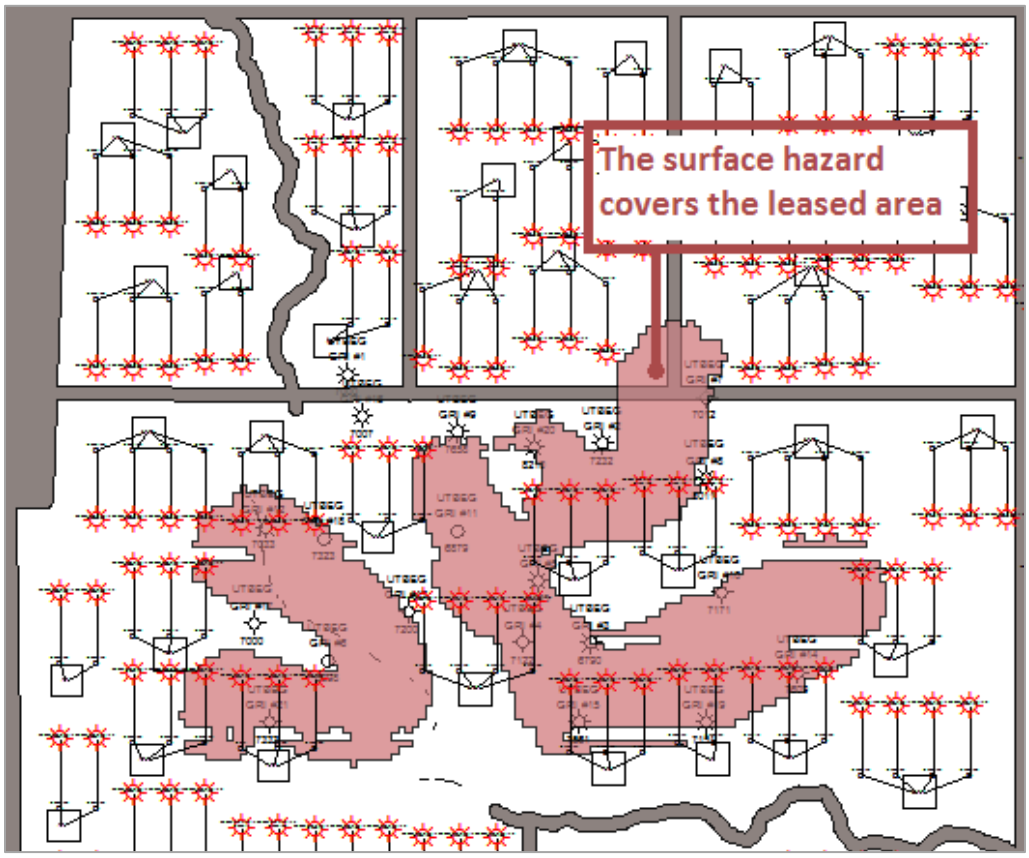


Surface and Subsurface Hazards

Use surface and subsurface hazards as shapefiles in GVERSE Field Planner to avoid high sloped areas, rivers, existing pads, custom restricted areas, and existing wells already drilled in the area for the most optimized field plan. To apply surface hazards to build field plans, use the options available in the **Configure** tab **> Surface Constraints** group box in GVERSE Field Planner. These options can also be used to define subsurface hazards.

DEM as Surface Hazards Shapefile

Use DEM (Digital Elevation Model) as a surface hazard file in auto field planning. Calculate the gradient of the grids on DEM layer. If the gradient is higher than a user-selected number, then the area automatically becomes a hazard zone. You can add a DEM layer using the **Configure** tab **> Surface Constraints** group box **> DEM Layer** drop-down list.

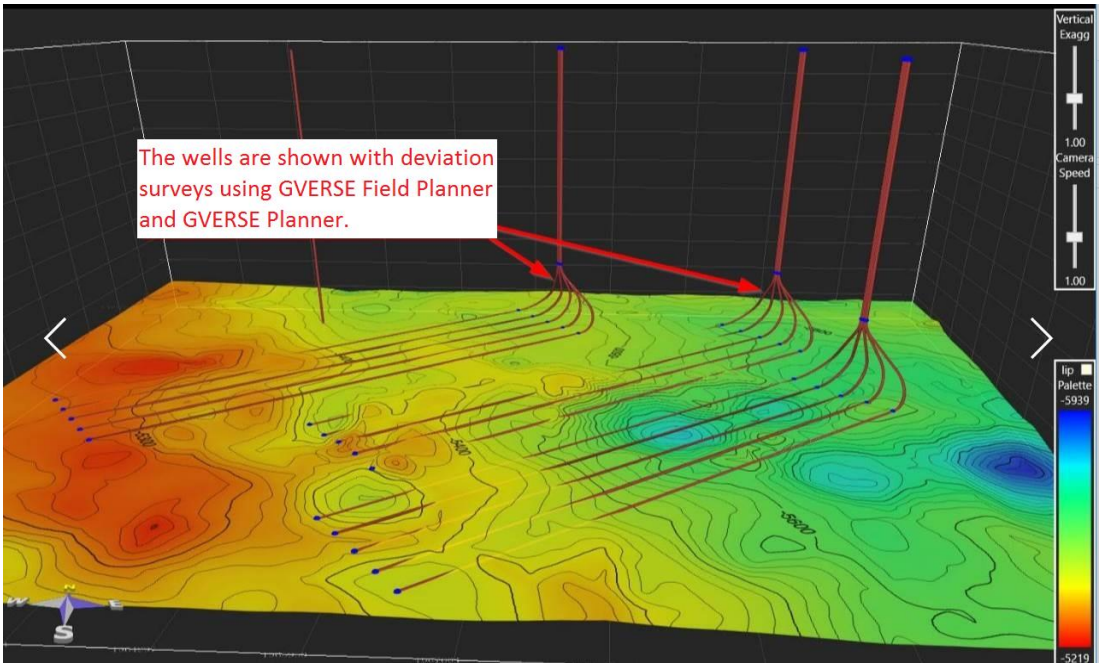


Plan Wells Simultaneously in Multiple Drilling Windows

Specify multiple drilling windows as shapefiles in one field, and then use GVERSE Planner to generate optimally spaced wells. It's possible to provide custom azimuths to each drilling window.

Create Well Deviation Surveys

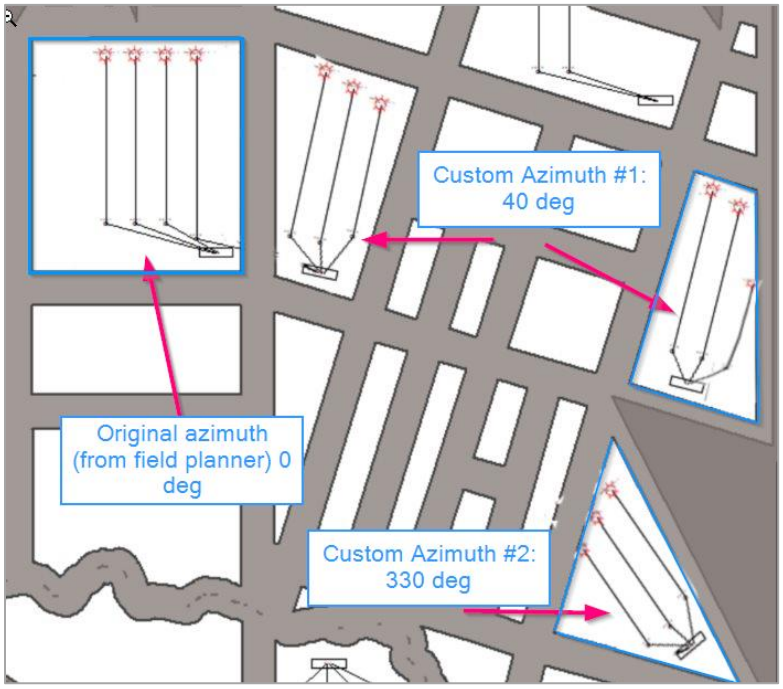
Create deviation surveys using the **Create wells deviation surveys** option, available in the **Configure** tab of GVERSE Field Planner.



Lease Planner

Custom Azimuths for Lease Blocks

Set custom azimuths for different lease blocks and tracts in Lease Planner. Azimuth for one or multiple tracts can be set and modified simultaneously for certain drilling windows. To set custom azimuths, right-click a lease area with tracts and select the **Modify Azimuth** option from the context menu.



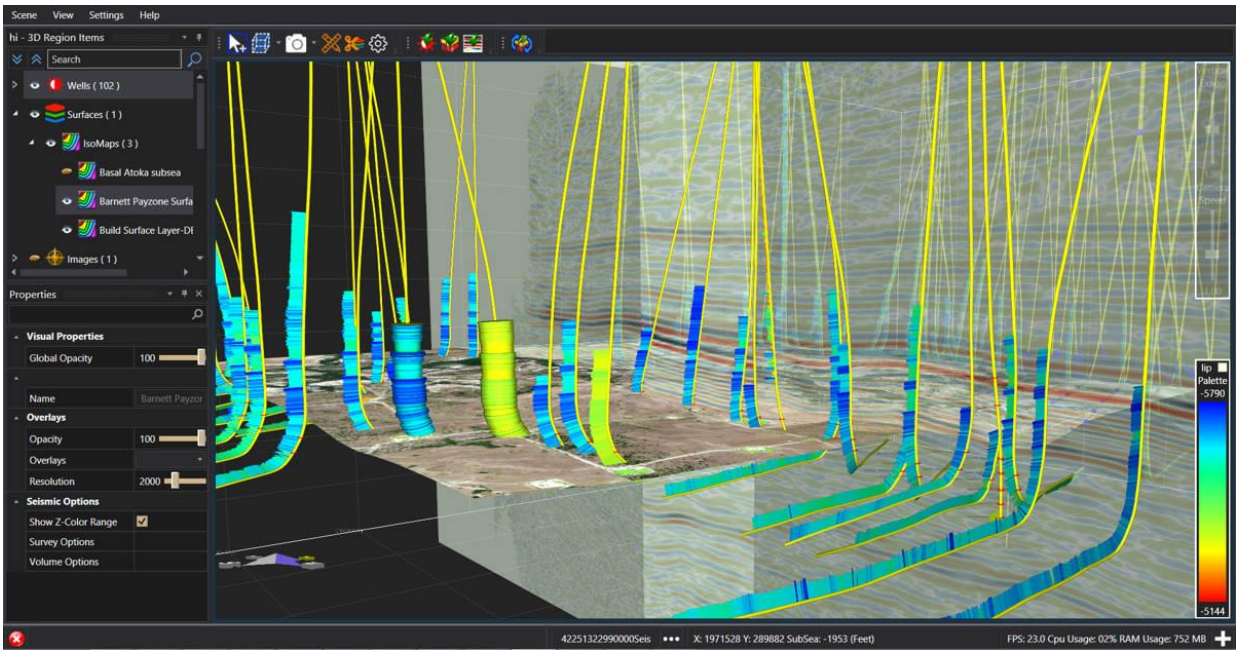
Build Internal Setbacks

Add internal setbacks while adding multiple tracts in a selected lease area in Lease Planner. To add internal borders to a selected lease area by default, before adding the lease area, select the **Build Internal Setbacks** option above the map area in Lease Planner.

Pro 3D

Now Pro3D is Available for Free to Users with Geo-Interpretation Package

You're no longer restricted to viewing Geology in 2D. If you have a geo-interpretation package, you now have the power of Advanced 3D visualization, Pro 3D. Pick a region to view in GeoAtlas, and the data you need is automatically loaded into the scene.



GeoAtlas

Create Surface and Subsurface hazards Layers

Create surface and subsurface hazards layers as shapefiles in GeoAtlas to avoid high sloped areas, rivers, existing pads, custom restricted areas, and existing wells already drilled in the area. You can add surface/subsurface hazards to a map using the **Pro** toolbar **> Create Surface/Subsurface Hazards** icon **> Build Hazard Layer** dialog box in GeoAtlas.

Access FTP Hyperlinks in ESRI Shapefiles

Access FTP hyperlinks imported in ESRI shapefiles via data attributes in GeoAtlas.

Architecture

ESRI ArcGIS Runtime Engine 10.5.1

ESRI ArcGIS Runtime Engine 10.5.1 is supported in this release.

Advanced Database Security

All users are now logged into the database using their active directory credentials instead of the default user ID and password. This enables you to trace transactions performed on the database for auditing purposes.

Microsoft Office 2016

Support for Microsoft Office 2016 (32-bit and 64-bit) is added.

Fixed Issues

The following customer reported issues were fixed in this release.

GVERSE Geomodeling/smartSECTION

ID	Description
389	Added the ability to export the crossplot data points into a CSV file.
1409	In addition to Z-axis coloring, introduced the options to color the multi-well crossplot points by UWI. Also added the ability to choose custom colors and symbols for differentiating between the wells.
2398	Added the ability to save the CDSS settings in XML format (CST).
8277	Added an Export button in the Project Default Settings dialog box to export curve aliases in an ASCII file.
18915	Added the ability to change the number of decimals for the Data Readout value by clicking the curve insert area and then using +/- keys or the mouse scroll wheel. Previously, users were unable to change the readout decimals precision for curve values.
29582	Added an Import button in the Project Default Settings dialog box to import curve aliases from an ASCII file.
85186	Issue is resolved by restricting modelling only to the extents of the active AOI. Previously, interwell points outside the extents of AOI were also modelled.
122138	Fixed the issue by refreshing PRIZM and sending signal to other applications after curve is aliased through Curve Data Edit dialog box. Previously, curves when aliased through Curve Data Edit in PRIZM did not display in XSection cross sections until the application was restarted.
135522	Added support for RasCalML IHS Version 2.2.
155824	Fixed the LAS export logic so the last two depth steps values are no longer null when exported. Previously, the last two curve values were exported as null values with depth interval applied.
156495	Correct caption of Load Well Data displays when the well already exists in the database. Previously the import button title was incorrect.
156855	Fixed the Multi-well LAS import function to treat UWI as case insensitive. Previously multiwell imports did not work when there was a case difference between the well IDs in the LAS files and the database.
160208	Prevented reloading of crossplot data on resizing the PRIZM window. Previously crossplot was redrawn every time the PRIZM window was resized.

158655	Added a new dialog box where the null value to be exported has the default value of -999.25. Alternatively, users can also specify a custom null value. Also added the ability to choose between Space, Tab and Comma delimiter. Previously null values did not post in the exported text and hence the columns were shifted.
160088	Restricted the Display Interval function only to the active crossplot window whenever the option is selected. Previously display interval was applied to all open windows in PRIZM even with the option checked off.
162453	Increased the number of characters from 7 to 20 to avoid blending of results in CDS report. Previously when the integer values exceeded 7 digits, the curve data report results were merged.
167766	Corrected lateral curve rectangle clipping in raster track to display log curves on raster track. Previously, any vector curve displayed on a raster track did not display in cross sections.

GVERSE Geophysics

ID	Description
161613	There was an error in calculation of log curves position. The log curves now display on either side of the wellbore.
161709	The radius calculation for well display was ignoring the bottom hole for “Both” and “Bottom Hole” options. It is fixed and now the bottom hole is included for measuring radius when these settings are used.

WellBase

ID	Description
12294	During import, new formation tops are only added to the public Strat column. Previously, they were added to the active user defined Strat column.
80078	The County Name can be updated using County Code and Number.
121477 121535	New picks add successfully to OpenWorks 5000.10.6.03 without generating any errors.
150911 163824	The dimensions of the Quick Filter dialog can be changed dynamically, and the dialog also adjusts correctly to the screen resolution.
151574	The protection of survey data does not affect the Parent Type in WellBase. Previously, protected data would automatically set Parent Type to Null for all wells.
158367 163827	The active filter returns correct results in Zone Manager.

158699	The Find and Replace tool works properly for County names in Scout Ticket and List views.
158733	ASCII4 format files containing County Names and Code import successfully for both bulk and regular import options.
158998 159457 159921	The County fields synchronize correctly in Legal Taxes locations and well header
161341 163831	The completion and perforation data is imported properly for projects with active data protection for completion and perforation.
162921	ASCII4 format files containing alias formation data import successfully.
160149	The performance of the Ordered Formation view is improved.

IsoMap

ID	Description
158647	The IsoMap layers update correctly without generating any error messages.

SpreadSheet Importer

ID	Description
150333	The GeoGraphix spreadsheet service for Excel macro is updated and now the installed macro is retained as an Add-in.
149351 163826	The bottom hole location data for Congress location is successfully imported from a spreadsheet.

Architecture

ID	Description
158756	Multiple projects can be updated to the 2017.3 release in batches using the Database Rebuilder tool. Previously, a message used to appear before each project rebuild.

Known Issues

This section lists the known issues in this release.

GVERSE Geophysics

ID	Description
165700	Timeslice flattened along a horizon in the GVERSE Geophysics 3D interface does not match the one in the main GVERSE Geophysics interface.
165334	Depth Surface generation of a horizon fails when it is marked in the GVERSE Geophysics 3D interface. **Workaround:** This can be avoided by generating the depth surface in the main GVERSE Geophysics interface, and then using it in the GVERSE Geophysics 3D interface.

PRIZM

ID	Description
168639	If CCA is on and UDE edits/outputs project default curve, the displayed default curve shows resolved (input) curve instead of edited (output) curve. **Workaround:** For UDE output curve name, use a name different from the project default curve name.

GVERSE Geomodeling/smartSECTION

ID	Description
169325	In the TGS Shopping Cart, if a LAS (Vector) log is selected for purchase and the Automatically import downloaded logs checkbox is also checked, then the LAS file is not imported into Prizm. **Workaround:** During the TGS setup, a TGS download directory is created on the local hard drive that stores the zip file archive, which is created when TGS log data is purchased. The purchased LAS file is included in the zipped archive. Unzip the archive and import the LAS file from PRIZM.
161779	Data Panel – 2D does not have an autohide state. **Workaround:** To remove the Data Panel – 2D, dock it outside of the window and use it as a floating panel.

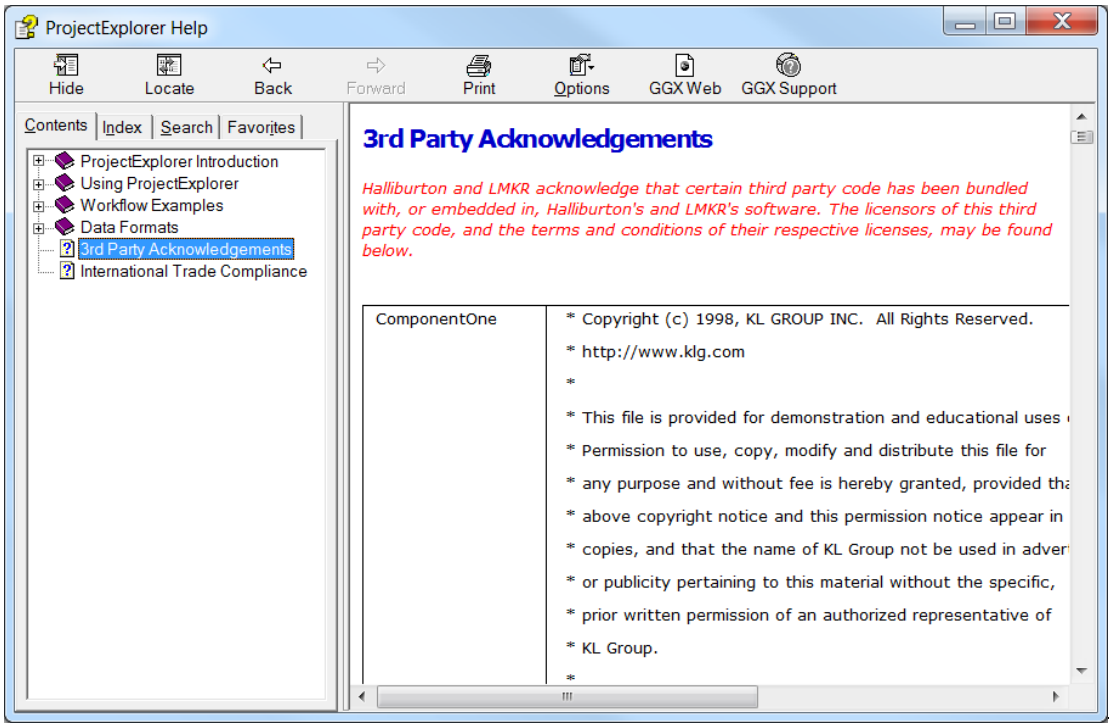
Third Party Applications

LMKR uses various third-party applications in the development of its software.

LMKR acknowledges that certain third party code has been bundled with, or embedded in, its software. The licensors of this third party code, and the terms and conditions of their respective licenses, may be found in the GeoGraphix Help files:

1. Open your help files.
2. In the list of topics on the left, locate the **3rd Party Acknowledgements** topic and click to open the topic.

   A list of third party applications and their details display.



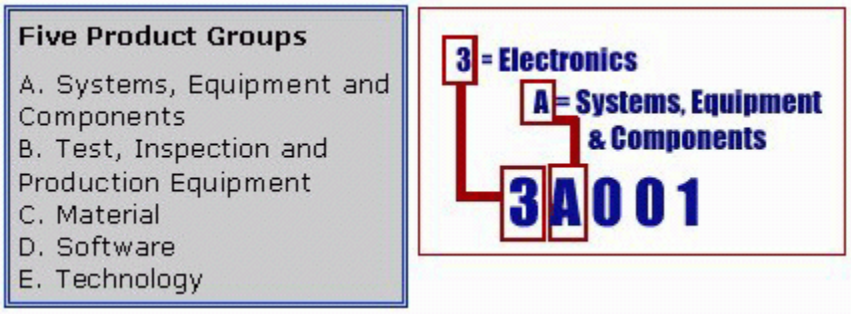
International Trademark Compliance

This application is manufactured or designed using U.S. origin technology and is therefore subject to the export control laws of the United States. Any use or further disposition of such items is subject to U.S. law. Exports from the United States and any re-export thereafter may require a formal export license authorization from the government. If there are doubts about the requirements of the applicable law, it is recommended that the buyer obtain qualified legal advice. These items cannot be used in the design, production, use, or storage of chemical, biological, or nuclear weapons, or missiles of any kind.

The ECCNs provided here represent LMKR's opinion of the correct classification for the product today (based on the original software and/or original hardware). Classifications are subject to change. If you have any questions or need assistance please contact us at support@lmkr.com.

Under the U.S. Export Administration Regulations (EAR), the U.S. Government assigns your organization or client, as exporter/importer of record, responsibility for determining the correct authorization for the item at the time of export/import. Restrictions may apply to shipments based on the products, the customer, or the country of destination, and an export license may be required by the Department of Commerce prior to shipment. The U.S. Bureau of Industry and Security provides a website to assist you with determining the need for a license and with information regarding where to obtain help.

The URL is: http://www.bis.doc.gov.



Definitions

CCATS (Commodity Classification Automated Tracking System) - the tracking number assigned by the U.S. Bureau of Industry and Security (BIS) to products formally reviewed and classified by the government. The CCATS provides information concerning export/re-export authorizations, available exceptions, and conditions.

ECCN - Export Control Classification Number - The ECCN is an alpha-numeric code, e.g., 3A001, that describes a particular item or type of item, and shows the controls placed on that item. The CCL (Commerce Control List) is divided into ten broad categories, and each category is further subdivided into five product groups. The CCL is available on the EAR Website.

The ECCN number, License Type, and the CCATS Numbers for this product are included in the table below. Also included is the date the table was last updated.

Product/Component/R5000	ECCN Number	License	CCATS Number	Last Updated On
GeoGraphix	--	-	-	-
LMKR License Manager	5D002C.1	ENC	G055172	6/19/2007

Contacting LMKR Support

LMKR is committed to providing the highest level of technical customer support in the industry. With an average tenure of more than thirteen years, our highly trained and experienced staff of technical analysts is comprised of geoscientists, engineers, land professionals, petrophysicists, and system specialists.

Please refer to our Customer Support timings mentioned below to ensure that you have access to our support analysts assigned to your region. When getting in touch with LMKR support, please remember that real-time support will not be available during bank holidays or after office hours. If you do get in touch with LMKR Support outside of work hours, please leave a voice message with a brief description of the issue that you are facing. Your voice message will be used to automatically create a support case for you. This will enable our analysts to attend to your issue and provide you with a resolution as soon as possible

North and South America	**Europe, Middle East & Africa**
Monday – Friday 8 am-6 pm CST* Toll Free (US/Canada) : +1 855 GGX LMKR (449 5657) **Colombia:** +57 1381 4908 **United States:** +1 303 295 0020 **Canada:** +1 587 233 4004 **Excluding bank holidays*	**UK:** Monday - Friday 8 am – 5 pm* +44 20 3608 8042 **UAE:** Sunday - Thursday (Dubai GMT+4) 8 am – 5 pm* +971 4 3727 999 **Excluding bank holidays*
Asia Pacific & Australian Continent	**Southwest Asian countries**
Malaysia: Monday - Friday (Kuala Lumpur GMT+8) 9 am – 6 pm* +60 32 300 8777 **Excluding bank holidays*	**Pakistan:** Monday - Friday (Islamabad GMT+5) 9 am – 6 pm* +92 51 209 7400 **Excluding bank holidays*

Helpful Links

Name	Website Address
LMKR home page	http://www.lmkr.com
LMKR Support Portal	http://support.lmkr.com