

Trimble® WM-Form™ Land Forming Solution

Version 1.2
Revision B
March 2016



Agriculture Business Area

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Meerheide 45
5521 DZ Eersel, NL

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Introduction

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This user guide provides a reference for using Trimble® WM-Form™ land forming solution.

About this guide

This guide is a reference for setting up and using WM-Form™ land forming solution.

Technical assistance

If you cannot find the information you need in the product documentation, contact your local reseller.

Alternatively:

1. Go to the [Trimble website](#).
2. Under Support & Training, choose the appropriate category.

If you need to contact Trimble technical support, visit http://www.trimble.com/Support/Technical_Support.aspx.

Changes for this version

WM-Form land forming solution, Version 1.2, Revision B includes:

- Addition of settings for display driver compatibility to ensure proper functionality. See [WM-Form solution requirements \(page 21\)](#).

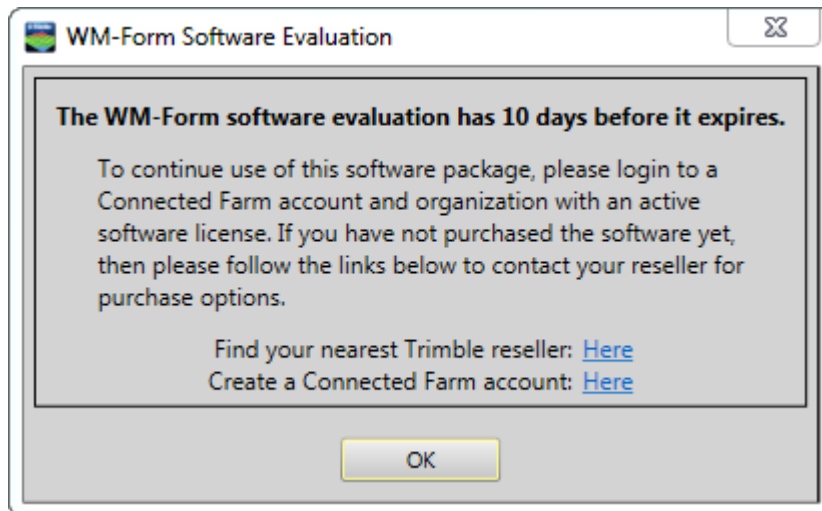
WM-Form land forming solution, Version 1.2, Revision A includes:

- [Drainage design \(page 83\)](#) updates
- Initializing view with black surface in general user settings. See [Black surface view \(page 81\)](#) and [General settings \(page 34\)](#).
- Contour toggle button in the Field Editor. See [Field Editor controls \(page 53\)](#).
- Design Editor additions, including:
 - Activity area creations for drainage design. See [Drainage design \(page 83\)](#).
 - Enhancement to UI layer controls. See [Layers tool \(page 79\)](#).
 - Visual grid aid. See [Visual Grid \(page 67\)](#).
- Combined design summary and constraints into one [Summary Report \(page 118\)](#).
- Cut Fill Analysis tool for Land Leveling Cut Fill Report. See [Cut Fill Report \(page 113\)](#).
- [Analysis tools \(page 68\)](#) (Elevations, Surface Slopes, Ponding, Watersheds and Flow Paths) for Design Editor and Reports.

Demo mode

The 10-day demo mode enables you to use all features of the WM-Form solution for 10 consecutive days. The only functionality unavailable during the demo period is exporting a .GPS file and printing a file.

When you first launch WM-Form solution, the evaluation notice opens to inform you of the 10-day expiration.



WM-Form basics

In this chapter:

| | |
|--|-----------|
| WM-Form solution benefits | 20 |
| WM-Form solution requirements | 21 |
| Main views | 23 |
| Frequently asked questions | 25 |

Trimble® WM-Form solution enables you to use landforming techniques to create surface drainage. You can build an existing surface model from a field survey.

WM-Form solution benefits

The WM-Form solution is a fully integrated solution that enables you to perform the following while minimizing the amount of earthworks:

- Survey
- Analysis
- Design
- Land forming

With the WM-Form solution, you can create leveling, surface drainage and irrigation designs that optimize the field for effective water management. You can design variable-shaped fields based on:

- Existing topography
- Water needs of individual crops
- Individual farming practices

Flexibility for all field types

By using the WM-Form solution, you can create designs for:

- Full multiplanar leveling
- Fields that previously were too hilly or expensive to level
- Fields that do not necessarily need to be flat, such as:
 - Sprinkler irrigated
 - Furrow irrigated
 - Drip irrigated
- Fields requiring topsoil conservation and adequate surface water runoff

Multiple capabilities

WM-Form solution enables you to:

- Level fields in single or multiple planes using a best-fit or custom plane, or with multiple hinges
- Create multi-directional land forming designs
- Create section lines and design each section individually
- Generate multiple design variations for the field, then compare them in 3D view against the original topography

- Produce 2D cut/fill estimates and reports
- Generate job estimates on earthworks
- Export and upload designs for use with the Trimble FieldLevel™ II system

Forward compatibility

Any previous .mph files can be viewed and edited with the latest version of the software. There is no need to have multiple versions for older files.

WM-Form solution requirements

WM-Form solution requires:

- A 64-bit PC with at least a 2 G processor and 8 GB RAM
- Windows 7

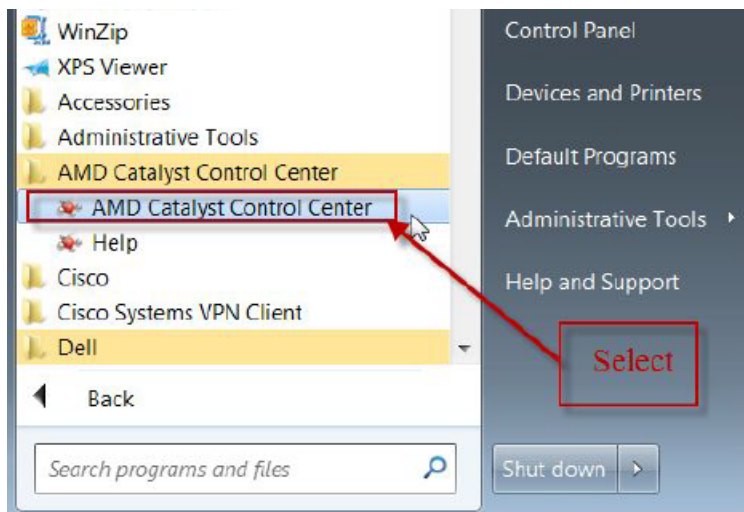
The CPU processor will have an effect on the speed of the design calculations.

Display driver compatibility

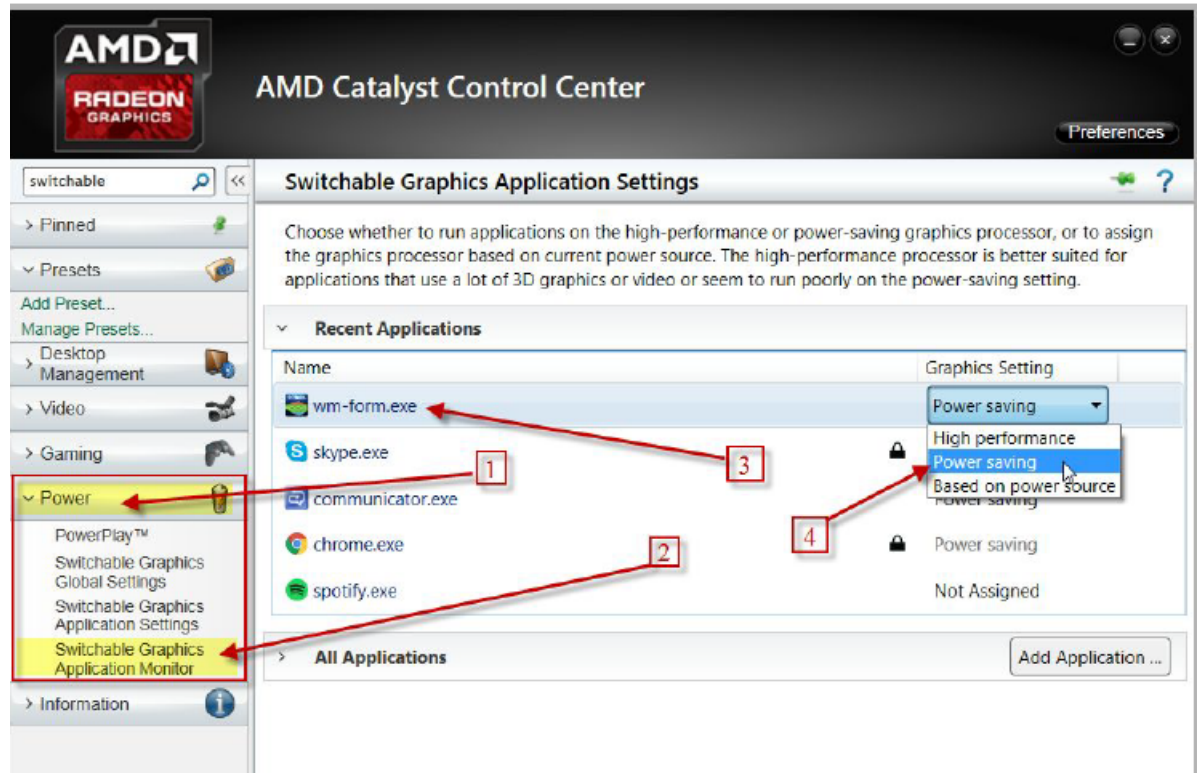
To ensure proper functionality of WM-Form solution contour and export functions when using a computer with an AMD graphics card:

Download and install the latest driver from the computer manufacturer's support website.

1. Set the appropriate power state for the AMD graphics card.
 - a. Open the AMD Catalyst Control Center application.



- b. Place WM-Form solution in the power-saving mode.

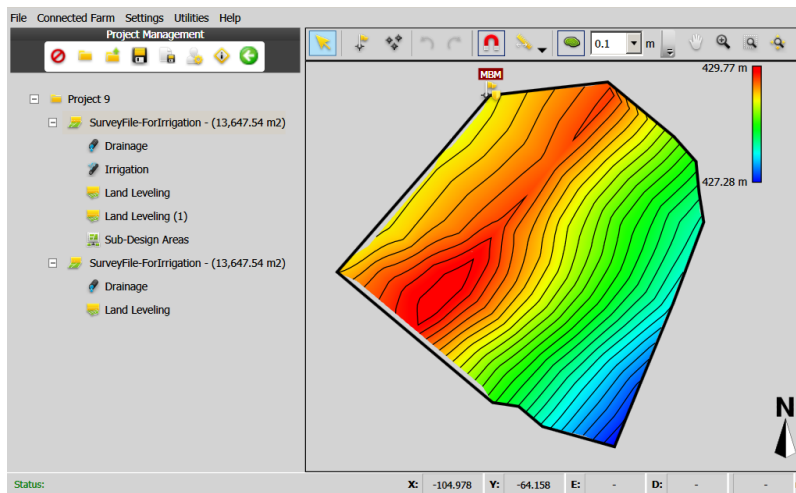


2. Upgrade the display driver to the latest available for your device. Download and install the latest driver from the computer manufacturer's support website. If this is unavailable, download the latest driver from AMD. You must also run the latest release version of DirectX 10 or higher to utilize this functionality.

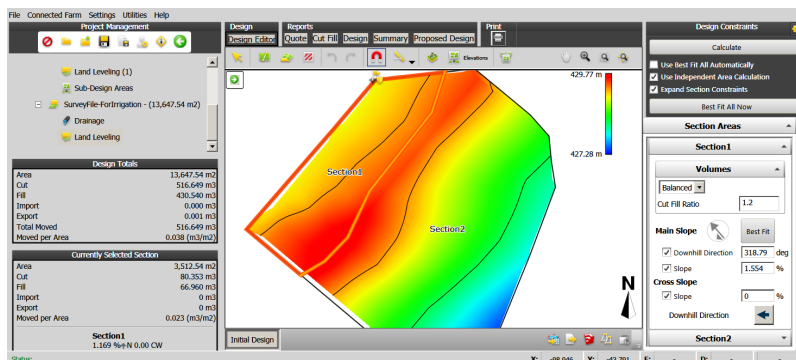
Main views

WM-Form solution has three main views:

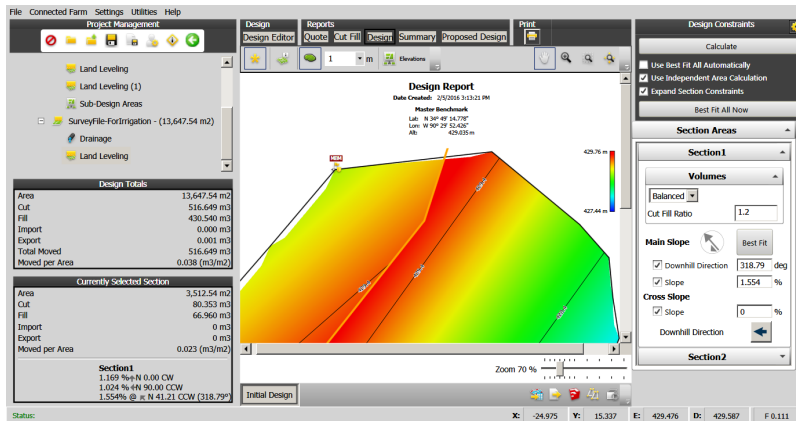
- **Field Editor (page 52):** For viewing and editing the field survey and any additional survey data associated with the field



- **Design Editor (page 60):** For editing a design of the field



- [Reports editor \(page 112\)](#): For viewing and editing various types of reports



Frequently asked questions

For land leveling designs, I want to only use best fit.

You can either:

- Click the **Best Fit All Now** button every time you calculate.
- If you have automatic calculation turned on, make sure the **Best Fit All Automatically** option is on. See [Best fit calculations \(page 91\)](#).

I created sections in my design for land leveling. I don't want to move soil from one section to the next. How do I calculate this?

Make sure the [Independent area calculation \(page 91\)](#) option is checked. This keeps all movement of soil within each section.

I have survey files in Multiplane.txt and Fieldlevel.xml formats. Can I use these?

Yes. See [Fields in .txt or .xml format \(page 46\)](#).

I want to try out the software before I buy it.

The 10-day [Demo mode \(page 18\)](#) provides full access to all functions of WM-Form solution except for exporting a file and printing.

Licenses

In this chapter:

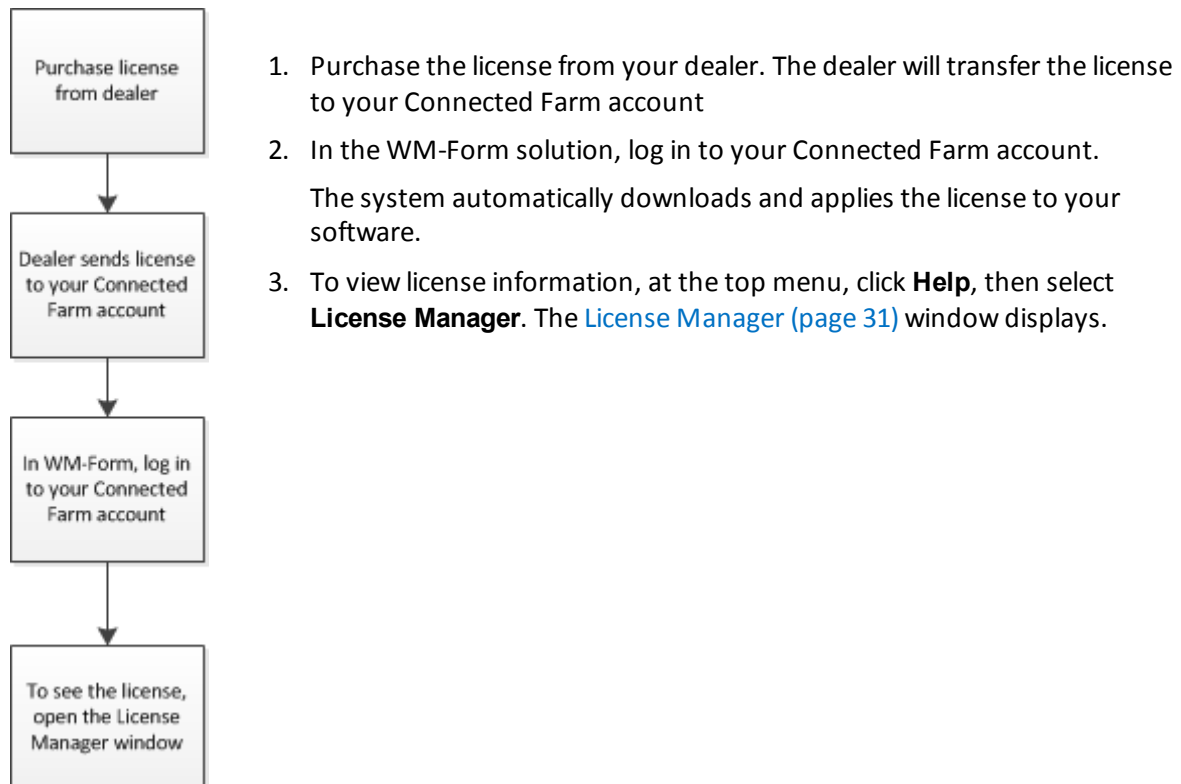
| | |
|----------------------------|----|
| Licenses for acreage | 28 |
| License Manager | 31 |

Before you can print or export a file, you must purchase a license for design.

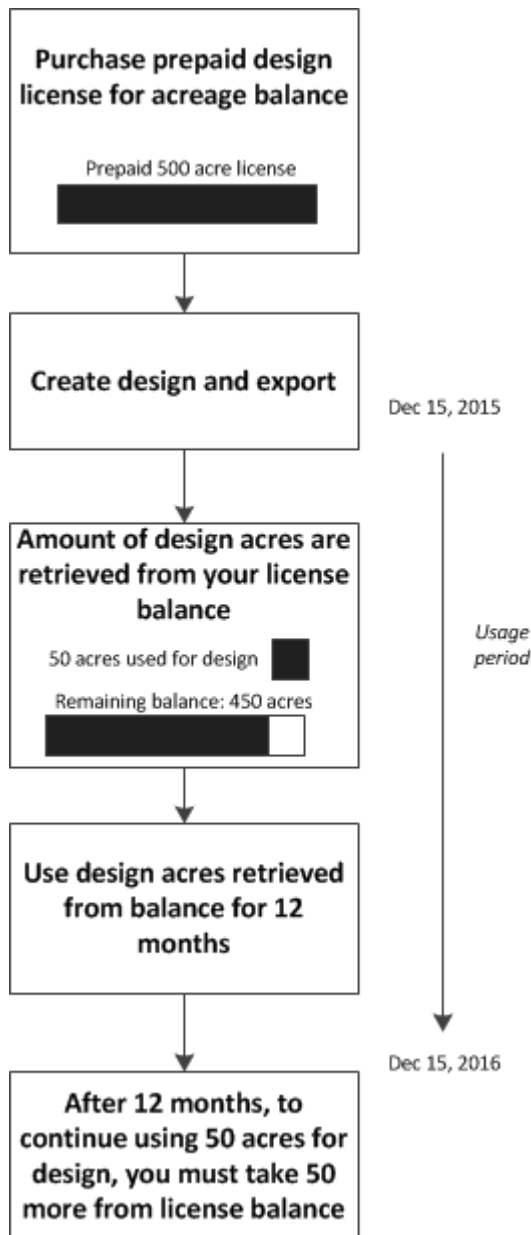
Licenses for acreage

After you complete your design, you must have a license that provides you the rights to design acreage before you can export the design to .gps. There are two types of licenses: [Prepaid licenses \(page 29\)](#) and [12-month licenses \(page 30\)](#).

Acquire license



Prepaid licenses



When you purchase a prepaid license, it does not expire until you have used all the acreage associated with it.

Acreage balance

After purchasing the license, the amount of acreage assigned to your license is now in an acreage balance for you to use.

When you export a design file, the amount of acreage for the design is subtracted from the amount in your acreage balance.

12-month usage period

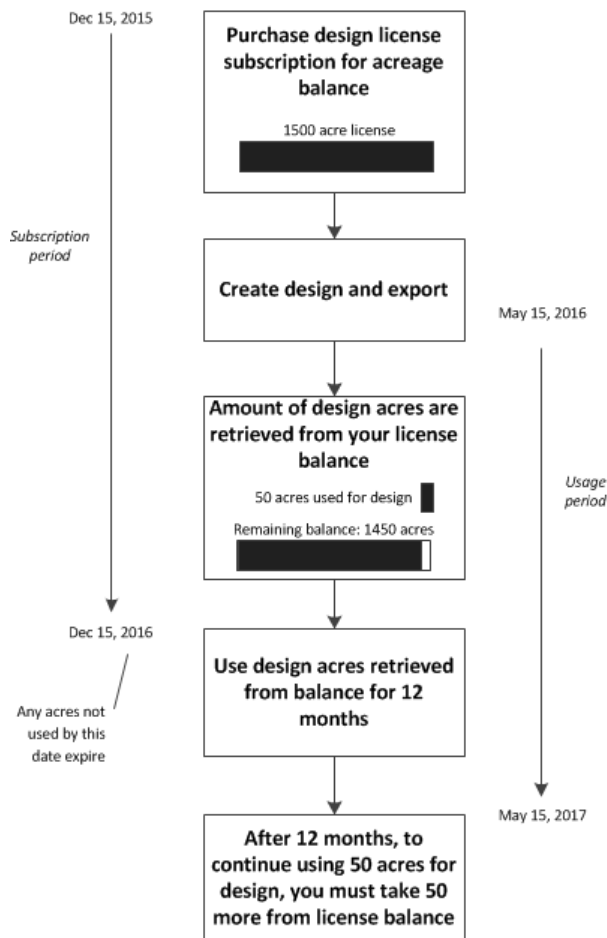
From the date the system extracts the acreage for the design from your balance, you have 12 months to manipulate the design. After the 12 months, you must take more acreage from your balance to further manipulate or export the design.

To find out the amount of acreage you have remaining to use, view the [License Manager \(page 31\)](#).

Also see [Maximizing license usage \(page 136\)](#).

Note – If you have a prepaid license and a 12-month license, the system will draw acreage from the 12-month license first since this acreage will expire. If you have more than one 12-month license, the system will draw acreage from the license that will be expiring the soonest.

12-month licenses



A 12-month license can be purchased at a lower rate per acre than a prepaid license.

Subscription period

When you purchase a 12-month license, it expires after 12 months from the date of purchase. If there are remaining acres after the expiration date, they will no longer be available.

Acreage balance

After purchasing the license, the amount of acreage assigned to your license is now in an acreage balance for you to use.

When you export a design file, the amount of acreage of the design is subtracted from the amount in your acreage balance.

12-month usage period

From the date the system extracts the acreage for the design from your balance, you have 12 months to

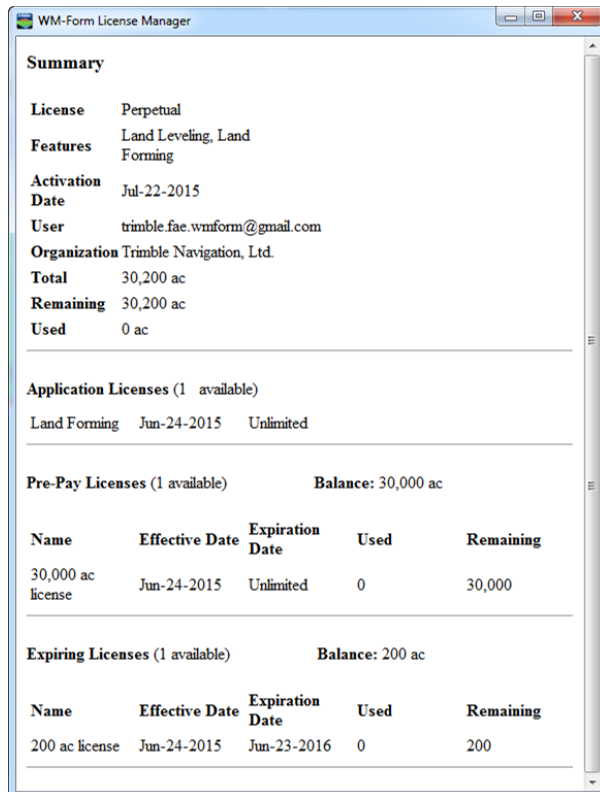
manipulate the design. After the 12 months, you must take more acreage from your balance to further manipulate or export the design.

To find out the amount of acreage you have remaining to use, view the [License Manager \(page 31\)](#).

Also see [Maximizing license usage \(page 136\)](#).

Note – If you have a prepaid license and a 12-month license, the system will draw acreage from the 12-month license first since this acreage will expire. If you have more than one 12-month license, the system will draw acreage from the license that will be expiring the soonest.

License Manager



When you open the WM-Form solution **License Manager** window, you can view the:

- Types of design licenses you have purchased
- The amount of acreage you have used for each license and the remaining balance


User settings

In this chapter:

| | |
|---------------------------------|-----------|
| User settings | 34 |
| Folders settings | 34 |
| General settings | 34 |
| Materials settings | 35 |
| Reports settings | 36 |
| Units settings | 37 |

With user settings, you can customize various aspects of WM-Form solution.


User settings

To access user settings, in the Project Management panel, click  to open the **User Settings** window.

You can edit:

- [Folders settings \(page 34\)](#): Where your workspace files will be saved.
- [General settings \(page 34\)](#): Radius for snapping, auto calculation and creating adjacent nodes
- [Materials settings \(page 35\)](#): The type of settings to calculate and show
- [Reports settings \(page 36\)](#): What information will show on report headings
- [Units settings \(page 37\)](#): Which units of measure to use

Folders settings

Select the **Folders** tab and indicate where you want projects and exported files to be stored. Enter the path name or click  to indicate the location.

General settings

| Setting | Explanation |
|---------------------------------------|--|
| Snap object to radius | The number of pixels a line can be separated from the beginning of a shape to perform line snapping. See the Snap option in Design Editor controls (page 63) . |
| | Initialize with Black Surface: When checked, the view of the design will have a black surface. See Black surface view (page 81) . |
| Auto calculate (Land leveling design) | Check to automatically calculate a land leveling design. See Best fit calculations (page 91) , Independent area calculation (page 91) and Calculating designs (page 137) . |
| Move co-located nodes together | Enables you to manipulate one end of numerous lines. See Moving multiple points in Add section lines (page 93) . |

Materials settings


Select the **Materials** tab and complete the settings.

| Setting | Explanation |
|---|---|
| Use cut fill ratio | Check the box if you want to use cut/fill ratio for materials. |
| Material volume property to automatically calculate | <p>Choose the property you want the system to automatically calculate:</p> <ul style="list-style-type: none"> • Shrinkage: A measure of the decrease in volume of material as it is excavated and extracted from its original state and placed into compacted earth fill. • Haul Bulkage: A measure of the increase in volume of soil due to expansion and loosening occurring as a result of its excavation. • Haul Compaction: A measure of the decrease in volume of soil from its loose haulage or stockpiled state to its compacted state where it is placed. |
| Show Cut/Fill volume as | <p>Choose whether you want the cut/fill volume to display as either:</p> <ul style="list-style-type: none"> • Bank Volumes: The volume calculated by multiplying loose volume and the load factor. • Loose Haul Volumes: The density state of soil after having been excavated and loosely placed into a stockpile, or into some container for the purpose of transporting it from one location to another. <p>Note – Cut/fill ratio and bank volumes are standards of the Agriculture industry.</p> |

Reports settings

Select the **Reports** tab. To customize the report header, enter text for:

- Title Line1
- Title Line2
- Title Line3
- Title Line4
- Title Line6

Click  to browse for an image file for the Title Logo File. Formats accepted are:

- .BMP
- .GIF
- .ICO
- .JPG
- .PNG

Units settings

Select the **Units** tab and choose the units of measurement you want to use in the system.

| Setting | Available Units |
|----------|---|
| Area | <p>The unit used for area measurement:</p> <ul style="list-style-type: none"> • Acres - (ac) • Square Feet - (ft²) • Square Meters - (m²) • Hectares - (ha) |
| Distance | <p>The unit used for distance:</p> <ul style="list-style-type: none"> • International Feet - (ft) • Meters - (m) |
| Depth | <p>The unit used for depth:</p> <ul style="list-style-type: none"> • International Feet - (ft) • Inches - (in) • Centimeters - (cm) |
| Volume | <p>The unit used for volume:</p> <ul style="list-style-type: none"> • Cubic - (ft³) • Cubic Yards - (yd³) • Cubic meters - (m³) |

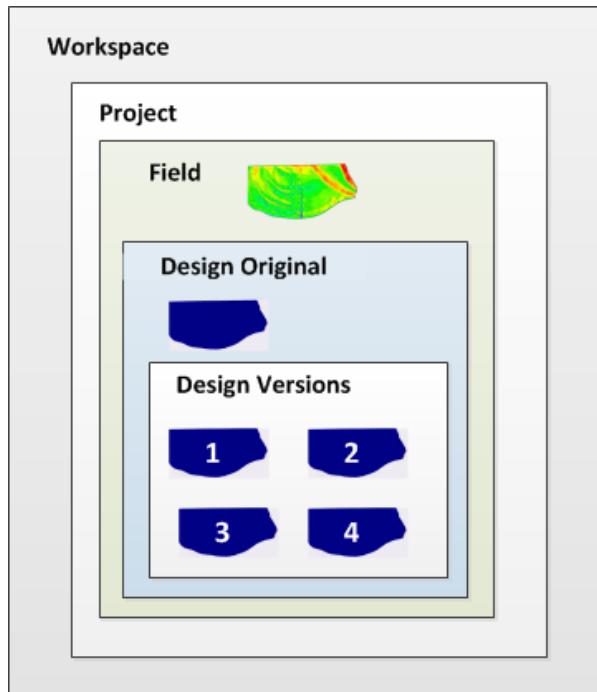
Project management

In this chapter:

| | |
|--|----|
| File structure | 40 |
| Project Management panel | 41 |
| Create a project | 43 |
| Open a workspace | 44 |
| Clear a workspace or close the application | 45 |
| Save a workspace | 45 |
| Import field survey | 46 |
| Fields in .txt or .xml format | 46 |
| Field Boundary Editor Utility | 48 |
| Clone a field | 48 |
| Create a design | 49 |
| Clone a design | 49 |
| Rename items | 50 |
| Delete files | 50 |

Field surveys and their associated files are listed in the project management panel for you to access.

File structure



When you work in WM-Form solution, you are in a workspace. Workspace files have the suffix .mph.

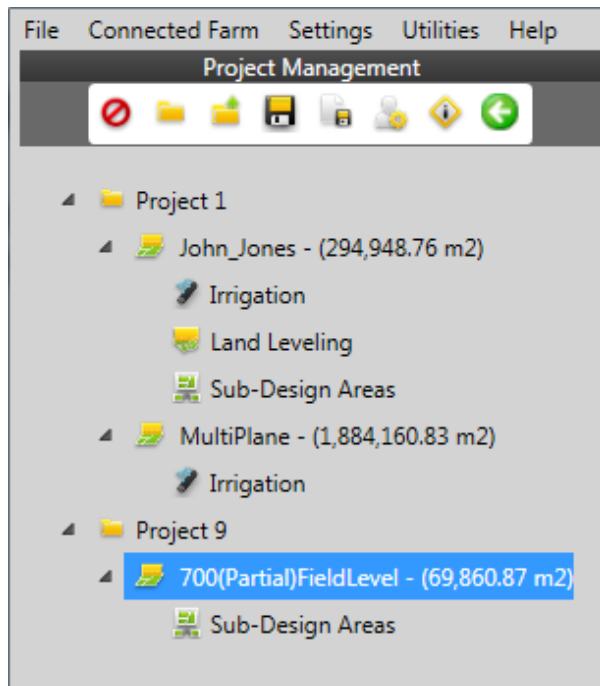
A workspace can include multiple projects.

A project can contain multiple fields.

A field can contain multiple designs for itself.

A design can have multiple [Design versions](#) ([page 77](#)).

Project Management panel

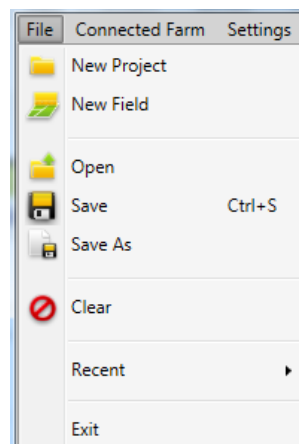


The Project Management panel lists the data in your workspace file (*.mph) that includes:









- A project: The highest level of structure. A project can have multiple field survey files.
- Field survey file(s): One or more field survey files. A field survey file can have one or more designs associated with it.
- Design file(s): One or more designs you create for the field file.

Also see [File structure \(page 40\)](#).

At the top of the Project Management panel is a file menu and a set of buttons. Some of the functions performed by the buttons are also available on the menu.




Controls

| Project Management Button | File Menu Item | Use to... |
|--|------------------------|---|
|  Clear | File > Clear | Clear the workspace to use for a different project. See Clear a workspace or close the application (page 45) . |
|  New Project | File > New Project | Create a project (page 43) . |
|  Open Workspace | File > Open | Open a workspace (page 44) . |
|  Save | File > Save | Save a workspace (page 45) . Shortcut key: CTRL + S |
|  Save As | File > Save As | Save the workspace with another name. |
|  User Settings | Settings > User | Access the User settings (page 34) . |
|  Help About | Help > About | See information about the software version. |
| N/A | Help > View help | See the help guide. |
| N/A | Help > License Manager | View the License Manager (page 31) . |
|  Hide / Show Panel | | Hide or show the Project Management panel. |
| N/A | File > Recent | Open a recently opened file. |


| Project Management Button | File Menu Item | Use to... |
|---------------------------|---|---|
| N/A | Connected Farm > Login | Log in to Connected Farm. |
| N/A | Connected Farm > Select Organization | Select the organization you want after you have logged into Connected Farm. |
| N/A | Utilities > Create Support File | Create a Support file (page 140) . |
| N/A | Utilities > Field Boundary Editor Utility | Open the See Field Boundary Editor Utility (page 48) . |

Create a project

1. Click File on the top menu or at the [Project Management panel \(page 41\)](#) controls click .
2. Select New Project. The **New Project Wizard** window opens. You can choose to name your project and field here or at another step.
3. Choose the type of design you want to create and click **Next**. Design types are:
 - Land Leveling: For planar designs. See [Land leveling design \(page 89\)](#).
 - Irrigation: For designing an irrigation pipeline and row oriented to a specific direction. See [Irrigation design \(page 86\)](#).
 - Sub-Design area: For creating different designs in the same field. See [Sub-design areas design \(page 98\)](#).

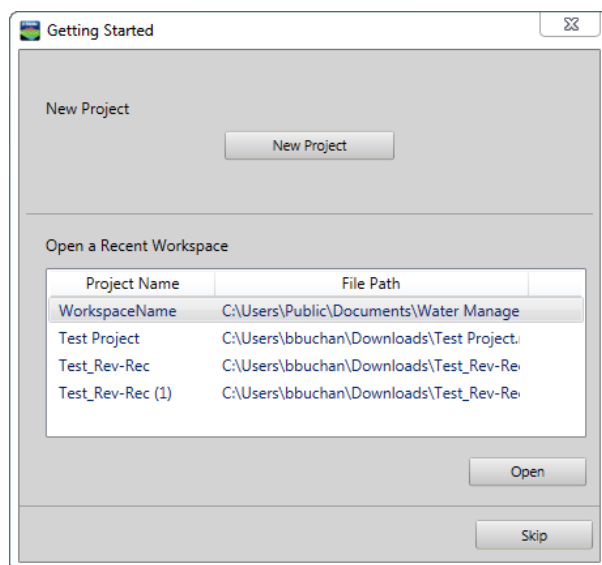
Note – You can create numerous types of designs of the same field.
4. The system gives you another opportunity to change the name of your project and field, or accept the default names given by the system. Click **Finish**.
5. The field opens in the [Field Editor \(page 52\)](#). The field and design names displayed in the [Project Management panel \(page 41\)](#).

Open a workspace

- To open a workspace, you can either:
 - Click  in the Project Management controls and choose the file you want to open.
 - On the menu, click **File** and select Open.
- If you have a current workspace open, the system displays a message asking if you want to save the current workspace. Click your choice:
 - Yes:** To save the workspace before opening a new project
 - No:** To open a new project and not save the workspace
 - Cancel:** To exit and not open a new project

Launching WM-Form solution

If you have previously created workspace files and you launch WM-Form solution, the **Getting Started** window displays listing the most recent workspace files you have opened.





You can either:

- Click on one of the workspace files in the list. WM-Form solution opens that workspace.
- Click **Skip** to open WM-Form solution.



Clear a workspace or close the application

You can either:

- Clear the workspace and continue working in WM-Form solution: Click  and save the changes made in the workspace. This includes all projects and the files and designs associated with them. The WM-Form solution workspace is still open.
- Exit WM-Form solution:
 - At the top menu, click File and select Exit. Save the workspace. WM-Form solution then closes.
 - Click the  in the upper right of the application window.

Save a workspace

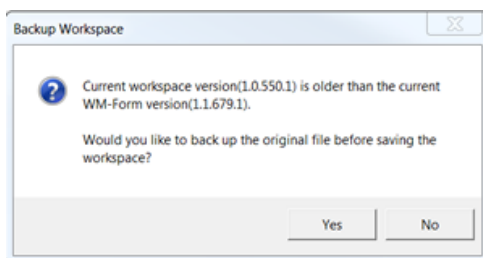
To save a workspace, in the [Project Management panel \(page 41\)](#) controls, click:

-  to save the workspace under its current name
-  to save the workspace under a different name

The system saves all the projects and their fields, related designs and design versions for this workspace.

Saving files from previous versions

If you open a file from a previous version of WM-Form solution, the system will ask you if you want to back up the original file before you save the workspace.



If you choose to save the original file, you will have this file and a new file saved in the new version.

Import field survey

To import a field file into an existing project:

1. At the Project Management panel, right-click the name of the project.
2. Click **New Field**.
3. In the **New Field Wizard** window, click **Next**.
4. Click **Browse** and choose the field survey file you want to import, then click **Next**.
5. If the survey file is a Multiplane.txt or FieldLevel.xml format (WM-Form solution supports both of these), see [Fields in .txt or .xml format \(page 46\)](#) for instructions.
6. Select the design type you want to create for the field survey.
7. Click **Next**.
8. Optionally, change the name of the field.
9. Click **Finish**.

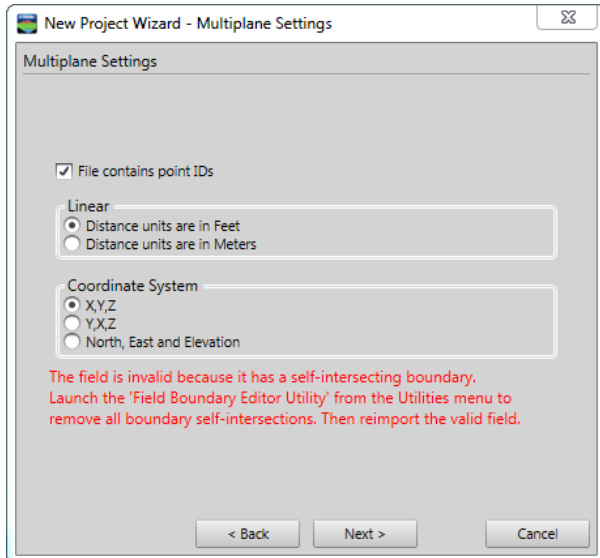
Fields in .txt or .xml format

If the field survey file you want to open in WM-Form solution is in a .txt or .xml format, the system asks you to select the Multiplane Settings for the field survey. After you complete these settings, click **Next**.

| Setting | Explanation |
|-------------------------|---|
| File contains point IDs | Check the box if the file contains point IDs |
| Linear | <ul style="list-style-type: none">• Distance units are in Feet• Distance units are in Meters |
| Coordinate System | <ul style="list-style-type: none">• X,Y,Z• Y,X,Z• North, East and Elevation |

Self-intersecting boundaries

Some files contain a boundary where the boundary line crosses over itself. In such a case, the system displays an error.



To edit the field, open the [Field Boundary Editor Utility \(page 48\)](#) and open the field file. With this utility, you can erase self-intersecting areas by choosing and deleting:

- Single points on the boundary
- Multiple points on the boundary

Field Boundary Editor Utility


The **Field Boundary Editor Utility** enables you to remove self-intersecting boundaries so that you can import the field survey into WM-Form solution. This utility is different from the *Field Editor* view in WM-Form solution.

Open the editor

To open the **Field Boundary Editor Utility** window:

1. Click Utilities on the file menu.
2. Select Field Boundary Editor Utility.


Single point delete

To delete a single point on a boundary, click .

1. Click the point you want to delete.
2. Right-click and select Delete Boundary Point.

Multiple point delete

To delete multiple points on a boundary:

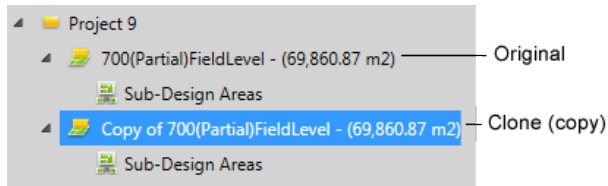
1. Click .
2. Move the red dot over the area you want to erase.

Clone a field

To clone (copy) a field:

1. Select the field or design from the file list in the [Project Management panel \(page 41\)](#).
2. Right-click.
3. Select Clone.
4. Enter the name of the copy.

- Click **OK**. The system also copies any designs you have created that are associated with the field.



Create a design

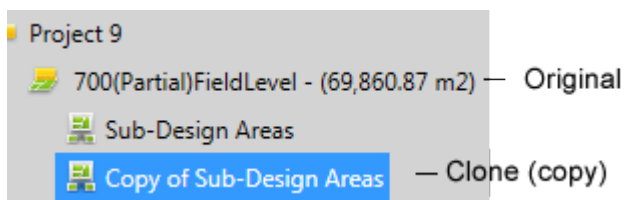
To create a design for a field survey you have already imported:

- From the file list of the [Project Management panel \(page 41\)](#), right-click the name of the field.
- Click New Design.
- Click the design type you want to create.
- The design displays under the name of the field.

Clone a design

There are two ways to clone (copy) a design:

- Create a version of the design. See [Design versions \(page 77\)](#).
 - Create another copy that shows in the [Project Management panel \(page 41\)](#). Follow the next steps.
- Select the design from the file list of the [Project Management panel \(page 41\)](#) and right-click.
 - Select Clone.
 - Enter the name of the copy.
 - Click **OK**.



Rename items

To rename a workspace, field or design:

1. Select the project, field or design from the file list in the [Project Management panel \(page 41\)](#).
2. Right-click.
3. Select Rename.
4. Enter the new name.
5. Click **OK**.

Delete files

To delete a project, field or design:

1. Select the project, field or design from the file list in the [Project Management panel \(page 41\)](#).
2. Right-click and select Delete.
3. At the confirmation message, click **Yes**.

Note – If you delete a project, all fields and designs in this project will be deleted. If you delete a field, all designs and design versions for this field will also be deleted. If you delete a design, all design versions associated with it will be deleted.

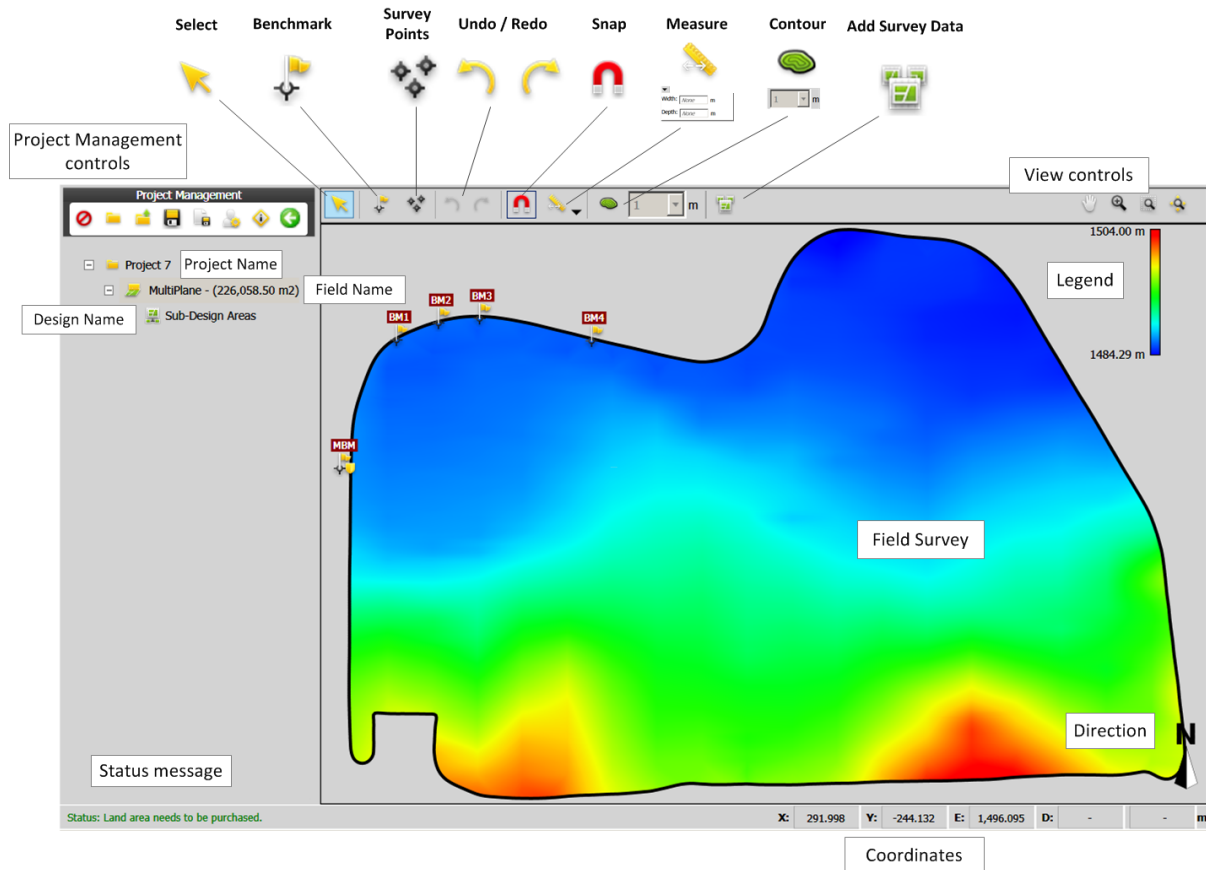
Field Editor

In this chapter:

| | |
|-----------------------------|----|
| Field Editor | 52 |
| Field Editor controls | 53 |
| Edit a field boundary | 56 |
| Copy / clone a field | 57 |
| Rename a field | 57 |
| Delete a field | 57 |

In the *Field Editor*, you can make changes to the field survey.

Field Editor



In the *Field Editor*, you can edit the field by:

- Adding or deleting benchmarks
- Adding or deleting survey points
- Adding survey data to the field from other files

You can also [Edit a field boundary \(page 56\)](#). Changes you make to the field will be included in all designs related to the field.

Project Management panel

On the left-hand side of the screen, the [Project Management panel \(page 41\)](#) contains a list of the files that are part of the workspace file you currently have open.

Field controls







The [Field Editor controls \(page 53\)](#) enable you to edit the field.


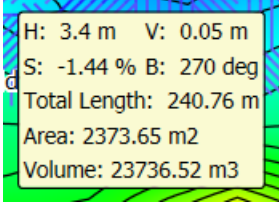


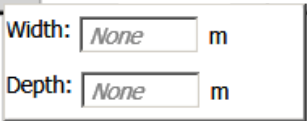

Field Editor controls


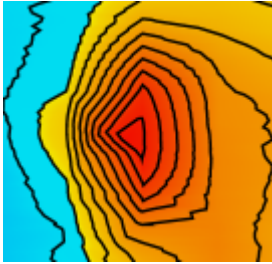

In the *Field Editor*, the controls available are:

- [Field controls](#) (upper left side)
- [View controls](#) (upper right side)





Field controls

| Field Control | Explanation |
|---|--|
|  Select | <p>Select the boundary of a field to edit it. See Edit a field boundary (page 56).</p> <p>Click to escape out of other commands, such as Measure Distance.</p> |
|  Benchmark | <ul style="list-style-type: none"> • Click in a field to add a benchmark to the field. • Click on a survey point to change it to a benchmark. • Click on an existing benchmark to open its properties and edit them. |
|  Add Survey Point | <ul style="list-style-type: none"> • Click in the field to add a survey point to the field. The system recalculates immediately after you have added a survey point. • Click on an existing survey point to open its properties and edit them. • Right click on an existing survey point and click Delete Survey Point. |
|  Undo | <p>Undo an action.</p> <p>Note – <i>Undo does not affect the values in constraints.</i></p> |
|  Redo | <p>Redo an action.</p> <p>Note – <i>Redo does not affect the values in constraints.</i></p> |
|  Snap Option | <p>Toggle snapping. When the snap option is on, the final line you are creating or editing will snap to the point that you began the shape with. To set the distance the final line will snap to the original point, see General settings (page 34).</p> |

| Field Control | Explanation |
|---|--|
|  <p>Measurement Tool</p> | <p>Measure the distance between two or more points you select on the field.</p>  <ol style="list-style-type: none"> Click . On the field, click the point you want to start measuring from. Click the point where the measurement ends. The system displays the following: <ul style="list-style-type: none"> H: The horizontal distance between the currently measured two points V: The elevation difference between the last two points S: The slope of the line B: The bearing from the last set point Total length: The total length of all line segments defined Area: The total area of all line segments Volume: The total area of all line segments When you are finished measuring, press the Enter key. To cancel the measurement, press the Escape key. |
|   <p>Measurement Tool Options</p> | <p>Click ▼ to enter the width and depth of the measurement line so the system can calculate the area and volume of all line segments.</p> |
|  <p>Add Design Data</p> | <p>Add external design data to the design.</p> |


| Field Control | Explanation |
|---|---|
|  Contour | Toggle on the contour view.  |
|  Contour Interval | Tap ▼ to change contour distance based on the unit of measure you have designated in settings. Note – Unit types depend on settings. See Units settings (page 37) . |

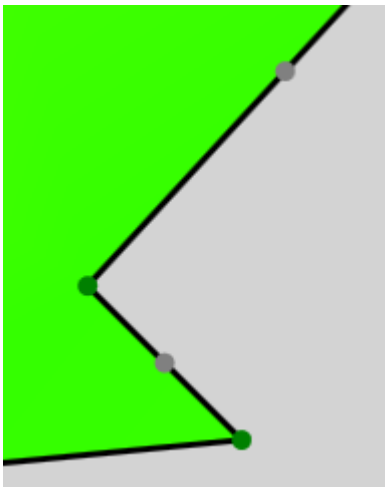
View controls

| View Control | Click to... |
|---|--|
|  Pan | Move the design around in the view. Mouse shortcut: Hold down the scroll wheel. |
|  Zoom | Enable zooming, then zoom in or out with the mouse wheel. |
|  Zoom to Area | Outline an area on the report to zoom in. |
|  Zoom to Fit | Zoom to fit. Zooms view to fill the window. |

Edit a field boundary

To edit a field boundary:

1. At the *Field Editor*, zoom to the area you want to edit.
2. Make sure you have selected .
3. Zoom to the area you want to edit.
4. Press click and hold on the field boundary, then release. The points (nodes) of the boundary will display.



5. To add a point (node), hover over a gray point and click.
6. To drag a point (node), hover over a green point, then click and drag the point.

Copy / clone a field

You can copy a field to keep an unedited version of the field as a backup. Then you can manipulate the field without worry of altering the original field.

1. From the list in the [Project Management panel \(page 41\)](#), right-click on the field you want to copy.
2. Click Clone.
3. The field is copied as well as all of the designs related to the field.

Rename a field

To change the name of a field:

1. In the file list of the [Project Management panel \(page 41\)](#), right-click on the field you want to rename.
2. Select Rename.
3. When the Rename window displays, enter the name of the field and click **OK**.

Delete a field

To remove a field from the project:

1. In the file list of the [Project Management panel \(page 41\)](#), right-click on the field you want to delete.
2. Click Delete.
3. When the Delete Field confirmation message displays, click **OK**.

Note – When you delete a field, all designs associated with this field are also removed.

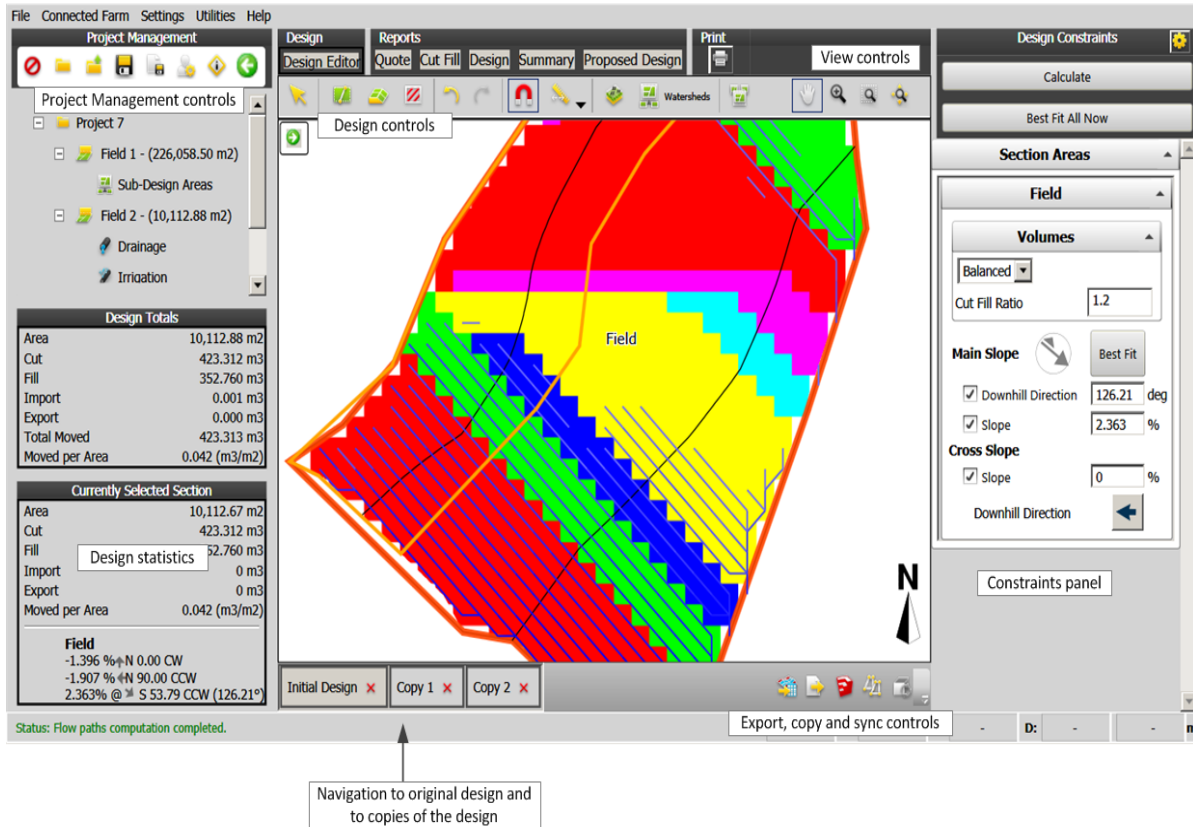
Design Editor

In this chapter:

| | |
|------------------------------|----|
| Design Editor | 60 |
| Design Editor controls | 63 |

In the *Design Editor*, you can edit a design as well as a version of a design.

Design Editor



To access the *Design Editor*, select a design in the [Project Management panel \(page 41\)](#) file list.

In the *Design Editor*, you can:

- Manipulate, copy and export designs and cut sheets
- Add design data from other files to the design, such as features

Project Management panel

On the upper left of the screen, the [Project Management panel \(page 41\)](#) contains a list of the files you are currently working with. Also see [File structure \(page 40\)](#).

Design statistics

Design statistics display in the lower left corner of the screen after you have calculated any changes to the design.

| Design Totals | |
|----------------------------------|---------------|
| Area | 69,860.97 m2 |
| Cut | 3,451.039 m3 |
| Fill | 2,875.865 m3 |
| Import | 0.000 m3 |
| Export | 0.000 m3 |
| Total Moved | 3,451.039 m3 |
| Moved per Area | 0.049 (m3/m2) |
| Currently Selected Section | |
| Area | 69,859.85 m2 |
| Cut | 3,451.039 m3 |
| Fill | 2,875.865 m3 |
| Import | 0 m3 |
| Export | 0 m3 |
| Moved per Area | 0.049 (m3/m2) |
| Field | |
| -0.85 % ↗ N 0.00 CW | |
| -0.155 % ↗ N 90.00 CCW | |
| 0.864% @ ↘ S 10.31 CCW (169.69°) | |

Constraints panel

In the constraints panel on the right-hand side of the *Design Editor*, you can enter constraints for on the design report.

| Volumes | |
|--|------------|
| Balanced | |
| Shrinkage | 15.666666% |
| Haul Bulkage | 0 % |
| Haul Compaction | 15.666666% |
| <input type="checkbox"/> Limit Cut Depth | |
| Row Constraints | |
| Downhill Direction | 190 deg |
| Width | 10.000 m |
| Min Slope | None % |
| Max Slope | None % |
| Max Change Rate | None % |
| | 1.000 m |
| Cross Slope | |
| Min Slope | None % |
| Max Slope | None % |
| Max Change Rate | None % |
| | 1.000 m |

Design controls

In the *Design Editor*, you manipulate the designs. There are templates based on design types for creating a design.

Some controls in the Design Editor are specific to a design type. Others are common controls. See [Design Editor controls \(page 63\)](#).



View controls

The view controls enable you to move the design around and zoom in or out. See [Design Editor controls \(page 63\)](#).



Design types

The types of designs you can create are:

- [Irrigation design \(page 86\)](#) pipelines
- [Drainage design \(page 83\)](#) and activity areas
- [Create a land leveling design \(page 90\)](#) which allows you to create sections of the field and design them independently of each other
- [Create a sub-design area design \(page 102\)](#)
 - [Custom area \(page 103\)](#)
 - [Level pad area \(page 104\)](#)
 - [Pipe bed area \(page 105\)](#)
 - [Tail ditch area \(page 107\)](#)
 - [Topsoil area \(page 108\)](#)
- [Exclusion zone area \(page 109\)](#) which will not be part of your design







Design Editor controls



The *Design Editor* controls are:

- [Design controls \(page 63\)](#)
- [Common controls \(page 65\)](#)
- [View controls \(page 66\)](#)
- [Analysis tools \(page 68\)](#)
- [Visual Grid \(page 67\)](#)
- [Export, copy and sync controls \(page 73\)](#)

Design controls






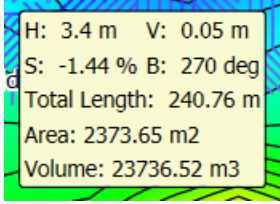

The controls that display to manipulate designs depend on the type of design you are working with.

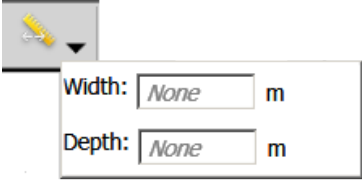

| Design Control | Design Type | Click to... |
|---|---|---|
|  Exclusion Zone | All | Create an area that is excluded from the design. |
|  Activity Area | Drainage | Create an area that can have separate, individual constraints, just as a Create a sub-design area design (page 102) can. See Drainage design (page 83) . |
|  Layers | All except for irrigation designs. | Show the Layers tool (page 79) window. |
|  Analysis tools | Depends on design type. | Shows various views. See Analysis tools (page 68) . |
|  Pipeline | Irrigation design (page 86) | Create a pipeline. |
|  Section line | Create a land leveling design (page 90) | Create a section divider. |

| Design Control | Design Type | Click to... |
|--|--|--|
|  Hinge | Create a land leveling design (page 90) | Create a hinge. |
|  Sub-design area | Create a sub-design area design (page 102) | Create a: <ul style="list-style-type: none">• Custom area (page 103)• Level pad area (page 104)• Pipe bed area (page 105)• Tail ditch area (page 107)• Topsoil area (page 108) |





Common controls

Common design controls are available for all designs created with WM-Form. For controls that show with imported .txt files, see [Fields in .txt or .xml format \(page 46\)](#).

| Common Control | Click to... |
|---|---|
|  Select | <p>Enable selection of items you have placed on the design, such as level pads, pipe beds, and so on.</p> <p>Click to escape out of other commands, such as when you are measuring with the measuring tool.</p> |
|  Undo | <p>Undo an action.</p> <p>Note – <i>Undo does not affect the values in constraints.</i></p> |
|  Redo | <p>Redo an action.</p> <p>Note – <i>Redo does not affect the values in constraints.</i></p> |
|  Snap Option | <p>Toggle snapping. When the snap option is on, the final line you are creating or editing will snap to the point that you began the shape with. To set the distance the final line will snap to the original point, see General settings (page 34).</p> |
|  Measure Tool | <p>Measure the distance between two or more points you select on the design.</p>  <ol style="list-style-type: none"> Click  . On the design, click the point you want to start measuring from. Click the point where the measurement ends. The system displays the following: <ul style="list-style-type: none"> H: The horizontal distance between the currently measured two points V: The elevation difference between the last two points |

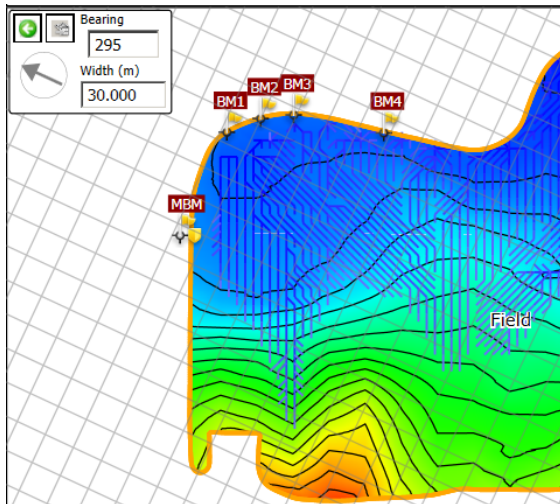
| Common Control | Click to... |
|---|--|
| | <ul style="list-style-type: none"> • S: The slope of the line • B: The bearing from the last set point • Total length: The total length of all line segments defined • Area: The total area of all line segments • Volume: The total area of all line segments <p>4. When you are finished measuring, press the Enter key.</p> <p>5. To cancel the measurement, press the Escape key.</p> |
|  <p>Measurement Tool Options</p> | Click ▼ to enter the width and depth of the measurement line so the system can calculate the area and volume of all line segments. |
|  <p>Add Design Data</p> | Add external design data to the design. |




View controls

| View Control | Click to... |
|---|--|
|  <p>Pan</p> | Move the design around in the view. Mouse shortcut: Hold down the scroll wheel. |
|  <p>Zoom</p> | Enable zooming, then zoom in or out with the mouse wheel. |
|  <p>Zoom to Area</p> | Outline an area on the report to zoom in. |
|  <p>Zoom to Fit</p> | Zoom to fit. Zooms view to fill the window. |

Visual Grid

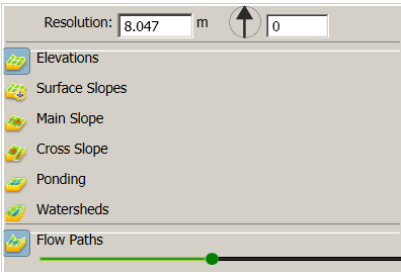
The visual grid controls are available for any design you create. The visual grid assists you in visually understanding the scale of features you are drawing on the design.




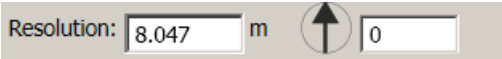
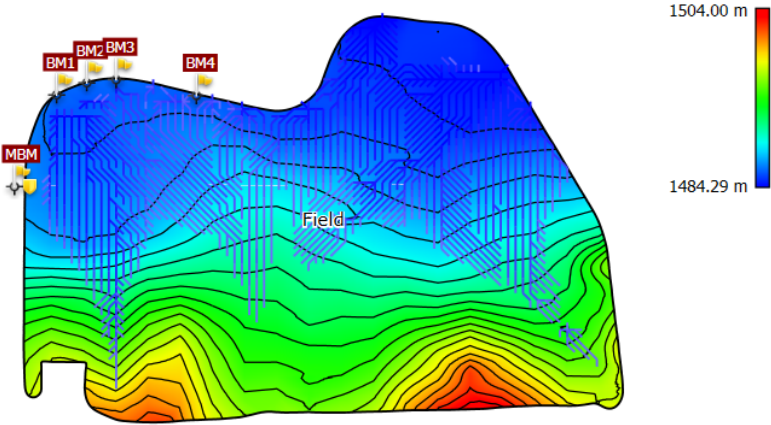
| Visual Grid Control | Explanation |
|---|--|
|  Show-Hide Arrow | Click to show or hide the Visual Grid controls. |
|  Visual Grid Toggle | Click to toggle the visual grid on or off. |
|  Orientation | Click and move the mouse to change the orientation of the visual grid. |
| Bearing | Enter the bearing to show the orientation of the visual grid. |
| Width | Enter the amount in meters for the spacing of the visual grid. |

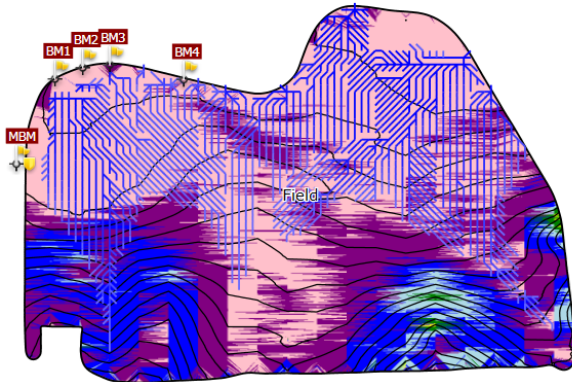
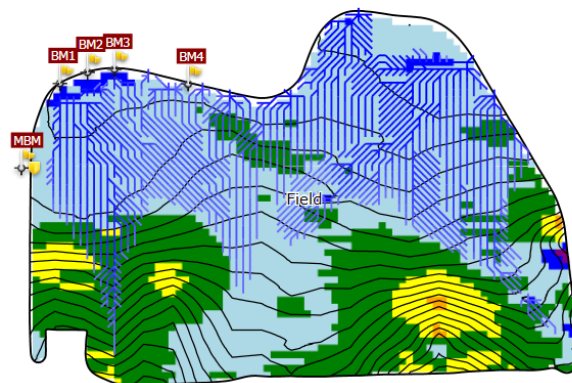
Analysis tools

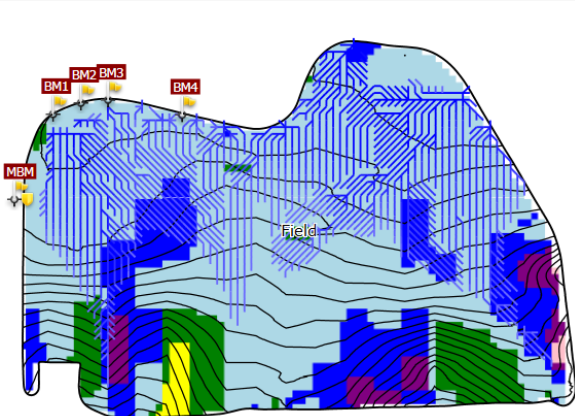
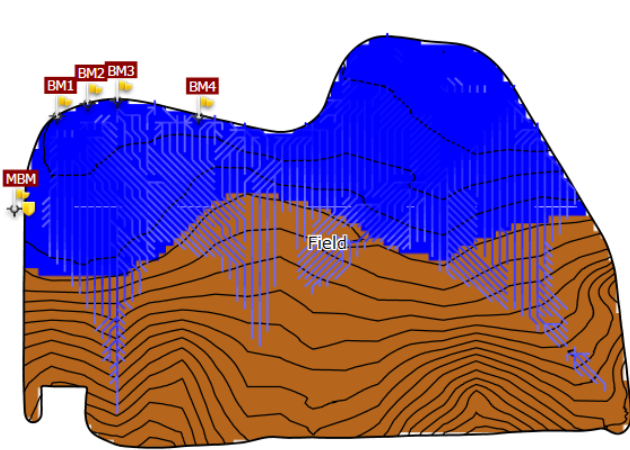
To access the analysis tools in the [Design Editor \(page 60\)](#), click .

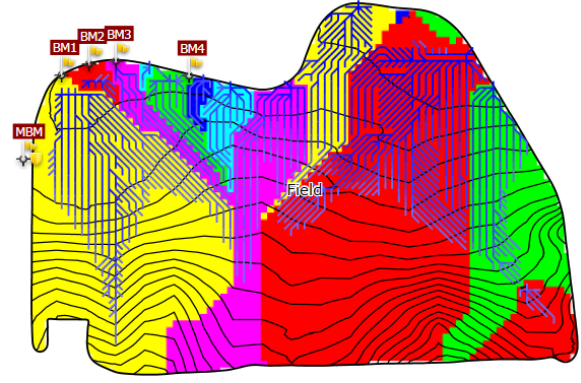
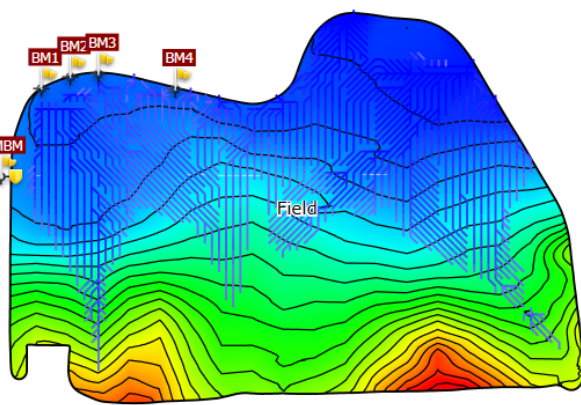




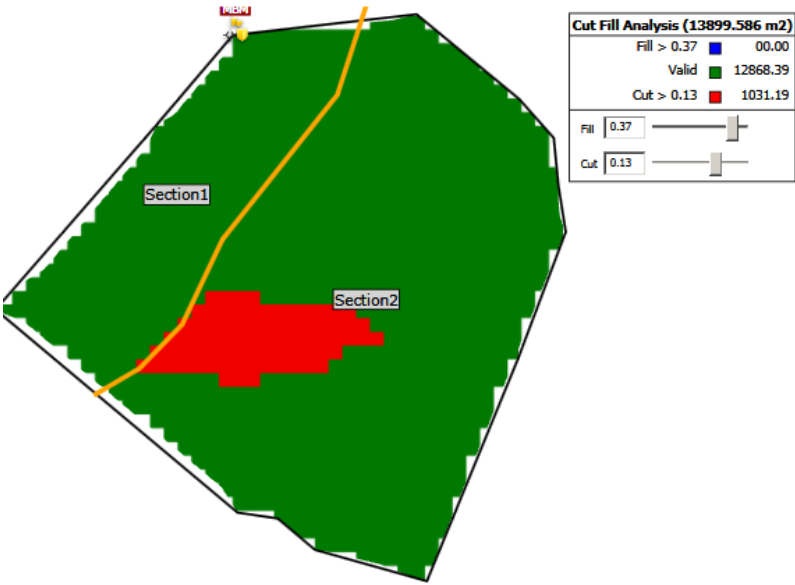
To access the Cut Fill analysis tool in the [Cut Fill Report \(page 113\)](#), click .

| Analysis Tool | Explanation |
|---------------|---|
| Resolution | <p>Enter the meters and orientation (or move the orientation arrow) you want to view.</p>  |
| Elevations | <p>Click to show the elevations view.</p>  <p>Available for all designs and design reports.</p> |




| Analysis Tool | Explanation | | | | | | | | | | | | | | | | | | | |
|-----------------|--|----------------|--|--|---------------|-------|---------------|--------|---------------|----------|---------------|----------|---------------|-----------|---------------|----------|----------------|----------|-----------------|-----------|
| Surface Slopes | <div>Click to show surface slopes. Use the slider to change the range you want to view.</div> <div><table><tr><th colspan="3">Surface Slopes</th></tr><tr><td>25.37 - 28.99</td><td>01.62</td></tr><tr><td>21.75 - 25.37</td><td>00.81</td></tr><tr><td>18.13 - 21.75</td><td>120.34</td></tr><tr><td>14.51 - 18.13</td><td>1203.76</td></tr><tr><td>10.89 - 14.51</td><td>8659.70</td></tr><tr><td>7.27 - 10.89</td><td>37067.00</td></tr><tr><td>3.65 - 7.27</td><td>67639.93</td></tr><tr><td>0.03 - 3.65</td><td>110998.02</td></tr></table><div>Min. 0.03 28.99 Max.</div></div> <div>Available for all designs and design reports.</div> | Surface Slopes | | | 25.37 - 28.99 | 01.62 | 21.75 - 25.37 | 00.81 | 18.13 - 21.75 | 120.34 | 14.51 - 18.13 | 1203.76 | 10.89 - 14.51 | 8659.70 | 7.27 - 10.89 | 37067.00 | 3.65 - 7.27 | 67639.93 | 0.03 - 3.65 | 110998.02 |
| Surface Slopes | | | | | | | | | | | | | | | | | | | | |
| 25.37 - 28.99 | 01.62 | | | | | | | | | | | | | | | | | | | |
| 21.75 - 25.37 | 00.81 | | | | | | | | | | | | | | | | | | | |
| 18.13 - 21.75 | 120.34 | | | | | | | | | | | | | | | | | | | |
| 14.51 - 18.13 | 1203.76 | | | | | | | | | | | | | | | | | | | |
| 10.89 - 14.51 | 8659.70 | | | | | | | | | | | | | | | | | | | |
| 7.27 - 10.89 | 37067.00 | | | | | | | | | | | | | | | | | | | |
| 3.65 - 7.27 | 67639.93 | | | | | | | | | | | | | | | | | | | |
| 0.03 - 3.65 | 110998.02 | | | | | | | | | | | | | | | | | | | |
| Main Slope | <div>Click to show the main slope. Use the slider to change the range you want to view.</div> <div><table><tr><th colspan="3">Main Slope</th></tr><tr><td>18.18 - 23.01</td><td>00.00</td></tr><tr><td>13.36 - 18.18</td><td>638.14</td></tr><tr><td>8.54 - 13.36</td><td>13646.54</td></tr><tr><td>3.71 - 8.54</td><td>70745.97</td></tr><tr><td>-1.11 - 3.71</td><td>126527.38</td></tr><tr><td>-5.94 - -1.11</td><td>2995.42</td></tr><tr><td>-10.76 - -5.94</td><td>184.76</td></tr><tr><td>-15.59 - -10.76</td><td>00.00</td></tr></table><div>Min. -15.59 23.01 Max.</div></div> <div>Available for all designs and design reports except land leveling designs.</div> | Main Slope | | | 18.18 - 23.01 | 00.00 | 13.36 - 18.18 | 638.14 | 8.54 - 13.36 | 13646.54 | 3.71 - 8.54 | 70745.97 | -1.11 - 3.71 | 126527.38 | -5.94 - -1.11 | 2995.42 | -10.76 - -5.94 | 184.76 | -15.59 - -10.76 | 00.00 |
| Main Slope | | | | | | | | | | | | | | | | | | | | |
| 18.18 - 23.01 | 00.00 | | | | | | | | | | | | | | | | | | | |
| 13.36 - 18.18 | 638.14 | | | | | | | | | | | | | | | | | | | |
| 8.54 - 13.36 | 13646.54 | | | | | | | | | | | | | | | | | | | |
| 3.71 - 8.54 | 70745.97 | | | | | | | | | | | | | | | | | | | |
| -1.11 - 3.71 | 126527.38 | | | | | | | | | | | | | | | | | | | |
| -5.94 - -1.11 | 2995.42 | | | | | | | | | | | | | | | | | | | |
| -10.76 - -5.94 | 184.76 | | | | | | | | | | | | | | | | | | | |
| -15.59 - -10.76 | 00.00 | | | | | | | | | | | | | | | | | | | |

| Analysis Tool | Explanation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------|---|-------------|--|------|---------------|---------|-------|---------------|--|---------|--------------|--|---------|-------------|--|----------|--------------|--|-----------|---------------|--|----------|----------------|--|---------|-----------------|--|--------|-------------|--|------------|
| Cross Slope | <div><p>Click to show the cross slope. Use the slider to change the range you want to view.</p><div><table><tr><th colspan="3">Cross Slope</th></tr><tr><td>15.25 - 19.48</td><td></td><td>00.00</td></tr><tr><td>11.02 - 15.25</td><td></td><td>00.00</td></tr><tr><td>6.79 - 11.02</td><td></td><td>2438.72</td></tr><tr><td>2.56 - 6.79</td><td></td><td>18774.37</td></tr><tr><td>-1.68 - 2.56</td><td></td><td>149767.14</td></tr><tr><td>-5.91 - -1.68</td><td></td><td>36931.67</td></tr><tr><td>-10.14 - -5.91</td><td></td><td>7168.68</td></tr><tr><td>-14.37 - -10.14</td><td></td><td>501.20</td></tr><tr><td colspan="2">Min. -14.37</td><td>Max. 19.48</td></tr></table></div><p>Available for all designs and design reports except land leveling designs.</p></div> | Cross Slope | | | 15.25 - 19.48 | | 00.00 | 11.02 - 15.25 | | 00.00 | 6.79 - 11.02 | | 2438.72 | 2.56 - 6.79 | | 18774.37 | -1.68 - 2.56 | | 149767.14 | -5.91 - -1.68 | | 36931.67 | -10.14 - -5.91 | | 7168.68 | -14.37 - -10.14 | | 501.20 | Min. -14.37 | | Max. 19.48 |
| Cross Slope | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15.25 - 19.48 | | 00.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11.02 - 15.25 | | 00.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.79 - 11.02 | | 2438.72 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.56 - 6.79 | | 18774.37 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -1.68 - 2.56 | | 149767.14 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -5.91 - -1.68 | | 36931.67 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.14 - -5.91 | | 7168.68 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -14.37 - -10.14 | | 501.20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Min. -14.37 | | Max. 19.48 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ponding | <div><p>Click to show ponding areas. Use the slider to change the range you want to view.</p><div><table><tr><th colspan="2">Ponding</th></tr><tr><td>Pond</td><td></td></tr><tr><td>1504.00</td><td></td></tr><tr><td>1484.29</td><td></td></tr><tr><td>1494.14</td><td></td></tr></table></div><p>Available for all designs and design reports.</p></div> | Ponding | | Pond | | 1504.00 | | 1484.29 | | 1494.14 | | | | | | | | | | | | | | | | | | | | | |
| Ponding | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pond | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1504.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1484.29 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1494.14 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Analysis Tool | Explanation |
|---------------|--|
| Watersheds | <div>Click to show watershed areas.</div> <div></div> <div>Available for all designs and design reports.</div> |
| Flow Paths | <div>Click to show flow paths. Move the slider to change the amount of detail you want to see.</div> <div><div></div></div> <div>Available for all designs and design reports.</div> |

| Analysis Tool | Explanation |
|--|---|
| <div> Cut Fill Analysis</div> | <p>Toggle on or off cut fill analysis view and controls in a Cut Fill report for drainage, irrigation and land leveling designs. See Cut Fill Report (page 113).</p> <div></div> |

Export, copy and sync controls

| Design Control | Click to... |
|--|---|
|  Export cut sheet | Export cut sheet (page 132). |
|  Export to display | Export to display (page 133). |
|  Export to Sketchup | Export to Sketchup. |
|  Copy Selected Design | <p>Copy and create a new version of the original design. See Design versions (page 77).</p> <p>Creating a new version of the design is different from cloning/copying a design in the Project Management panel. See Clone a design (page 49).</p> |
|  Not in Sync (gray) | <p>Sync the view of all Design versions (page 77) and reports. All design views will be synced to your current design view's perspective.</p> <p>When this button is gray, it indicates the perspective and zoom level for the field and all design versions are different.</p> |
|  Sync (color) | <p>Turn Sync off. The button will then turn gray.</p> <p>When in color, this button indicates the perspective and zoom level for each version of the design and the field are the same. All design views will be synced to your current design view's perspective.</p> |

Designing

In this chapter:

| | |
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This chapter explains how to design in the *Design Editor*.

Start a new design


1. [Create a project \(page 43\)](#).
2. Right-click on the field name.
3. Select New design and the type of design you want to create.
4. The new design displays in the [Design Editor \(page 60\)](#).

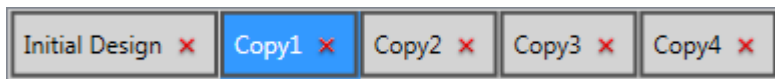
Design versions

You can create multiple versions of one design so that you can:

- Make changes to each version and compare the versions with each other
- Compare the original and its various versions

Create a new version

1. To create another version of the design currently displayed in either the *Design Editor* or in the *Reports Editor*, click  at the bottom right-hand side of the screen.
2. Rename the version if you do not want the default name.
3. The version name will show below the design or report area. The version you are viewing is highlighted in blue.



Rename a design version




Right-click on the version name to rename it.

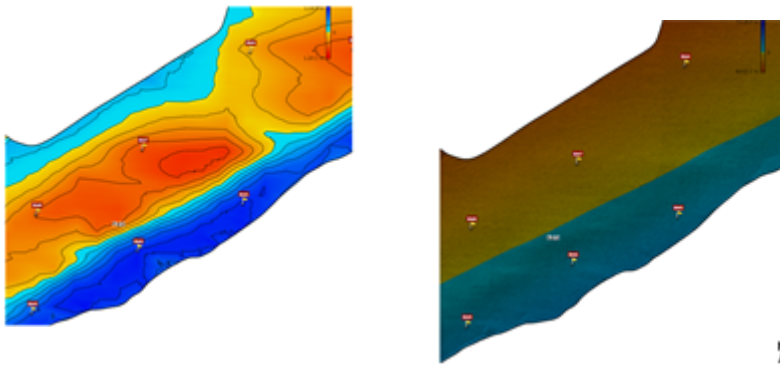
Delete a design version

Right-click on the version name or click the red X beside the version name to delete the version.

Synchronize views

You can synchronize the perspective and zoom level of multiple design versions and reports.

1. Create more than one version of the design.
2. Change the design constraints and click **Calculate** for each version.
3. For each version, choose the same type of report you want to view (for example, Cut Fill).
4. View one of the versions and change the perspective and zoom level to the one you want.
5. If the design views are out of sync, the sync button will show as gray . Click  to sync the design you are currently viewing with the original design and all versions, including those displaying on reports. The button changes from gray to full color , indicating the views for all versions of the report type are in sync.



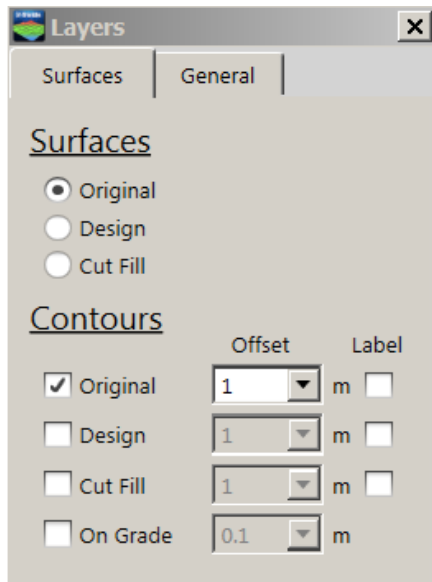
For additional design versions you create for this design, the perspective will also be the same. When you change the perspective view of the design in your current view, it changes all views to this perspective as long as you have Sync on.


Unsync views

To remove the syncing option, click . The button changes to gray .

When Sync is off, your original design and various design versions or views in reports can now be in different perspectives.

Layers tool



The **Layers** window provides controls for you to see different layers of the design. To launch the window, in the *Design Editor* click .

Note – The *Layers* window is not available in an irrigation design.

Surface tab

On the **Surface** tab, click which surface on which you want the layer to display.

| Setting | Explanation |
|----------|--|
| Original | Display the layer on the field surface. |
| Design | Display the layer on the design surface. |
| Cut Fill | Display the layer on the cut fill surface. |

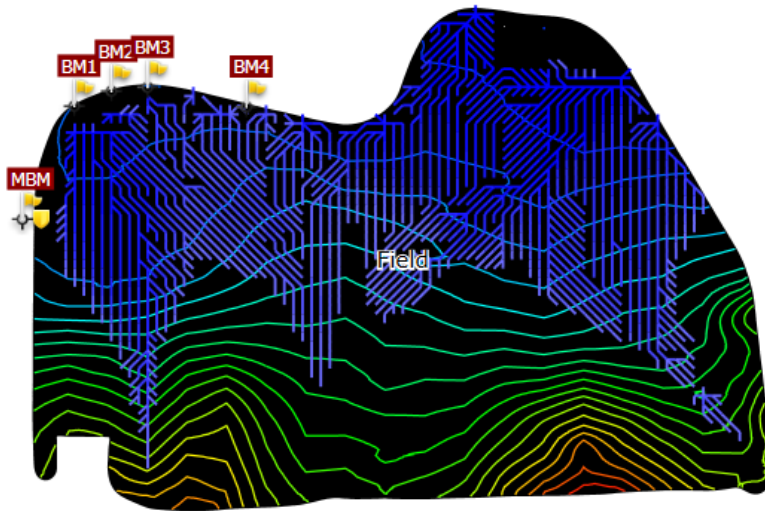
General tab

On the **General** tab, click the views you want to see.

| Setting | Explanation |
|---------------|--|
| Survey Points | Display the survey points. |
| Black Surface | Change the view to show the surface in black. See Black surface view (page 81) . |
| Show Notes | Show the Sticky notes (page 82) you have created. |
| Control Nodes | Show the control nodes. |

Black surface view

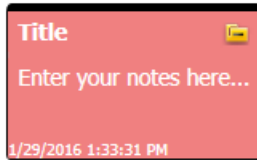
The black surface view can provide contrast that enables you to see details that may be less clear in other views.



To turn the black surface on, use the [Layers tool \(page 79\)](#).

Sticky notes

You can add notes in the *Design Editor*, either on or near the design.




Add a sticky note

To add a note:

1. Right-click where you want the note to display.
2. Click Sticky Note.
3. Enter the title of the note.
4. Enter your notes.

Open or close a note

To open a note, click on the expand button  next to the title of the note.



Close the note by clicking the collapse button  in the upper right corner of the sticky note.

Delete a note

To delete a note, right-click on the note and select *Delete*.

Drainage design

Use a drainage design for drainage. In this design type, you can create:

- [Activity areas](#)
- [Exclusion zones](#)

Create a drainage design

To create a drainage design:

1. Right-click on the field name.
2. Select New Design, and then Drainage.
3. Enter the [constraints](#) for the design to use the natural drainage of the surface so that:
 - a. Ponding is minimized or eliminated.
 - b. Minimum and maximum slope are manipulated to knock down peaks.
 - c. Water speed is increased.
4. Click **Calculate** (or ALT + A) if you do not have the automatic calculate function on. See [General settings \(page 34\)](#).



Constraints for drainage designs

| Constraint | Explanation |
|--------------------------------|--|
| Material Info / Cut Fill Ratio | Ratio of cut to fill volume for balancing the field design. |
| Sampling Grid / Spacing | The re-sampling spacing for definition of the design surface. |
| Method of soil balancing | <ul style="list-style-type: none"> • Balanced: Cut/fill ratio is balanced based on the ratio you enter. • Import: Import volume into activity area. • Export: Export volume from activity area. • Free: Optimized surface without an import, export or balance constraints |
| Limit Cut Depth | After checking the box, enter the limit for the cut depth. |
| Minimum slope | The minimum percentage of the slope |
| Maximum slope | The maximum percentage of the slope |

Create an activity area

Activity areas allow you to create different kinds of areas on the design that can have their own individual constraints. Using activity areas, you can set import and export settings to import to or export from this area.

To create an activity area:

1. Select a drainage design you want to work with.
2. If you are not in the *Design Editor*, click **Design Editor**.
3. Click .
4. Click on the design where you want the activity area to begin. Drag to the next point and click. Continue dragging and clicking until you have completed the shape for the activity area. If you have Snap Options  activated, the last point will snap to the first line. See [Design Editor controls \(page 63\)](#).
5. To indicate you are complete, you can:
 - a. Right-click and select Complete.
 - b. Press the Enter key.
6. To cancel the creation of the activity area, press the Escape key.
7. Enter the [constraints](#) for the activity area.
8. Click **Calculate** (or ALT + A) if you do not have the automatic calculate function on. See [General settings \(page 34\)](#).


Constraints for activity areas

| Constraint | Explanation |
|--------------------------|--|
| Method of soil balancing | <ul style="list-style-type: none"> • Balanced: Cut/fill ratio is balanced based on the ratio you enter. • Import: Import volume into activity area. • Export: Export volume from activity area. • Free: Optimized surface without an import, export or balance constraints |
| Limit Cut Depth | After checking the box, enter the value for cut depth limit. |
| Minimum slope | The minimum percentage of the slope |
| Maximum slope | The maximum percentage of the slope |

Create an exclusion zone

Exclusion zones are areas not included in the calculations for the design. You can use exclusion zones for [Maximizing license usage \(page 136\)](#)

To create an exclusion zone:

1. Select a drainage design you want to work with.
2. If you are not in the *Design Editor*, click **Design Editor**.
3. Click .
4. Click on the design the point where you want the exclusion zone to begin.
5. Continue dragging and clicking until you have completed the shape for the zone.
6. Press the Enter key (or right-click and click Complete) when you are satisfied with the zone's shape and location.
7. To cancel the creation of the zone, press the Escape key.
8. Click **Calculate** (or ALT + A) if you do not have the automatic calculate function on. See [General settings \(page 34\)](#).

Irrigation design

For this design type, you can create:


- [Pipelines](#)
- [Exclusion zones](#)

Constraints for irrigation designs

Volumes constraints

| Constraint | Explanation |
|--------------------------|---|
| Method of soil balancing | <ul style="list-style-type: none"> • Balanced: Cut/fill ratio is balanced based on the ratio you enter. • Import: Import volume into balanced design. • Export: Export volume exported from balanced design. • Free: Optimized surface without an import, export or balance constraints |
| Shrinkage | Percentage of or factor by which the material will shrink when it is cut and then used as fill |
| Haul Bulkage | Percentage of or factor by which the material will swell (expand) when it is cut and then hauled in loose condition |
| Haul Compaction | Percentage of or factor by which the material will shrink when it is cut and then hauled in loose condition |
| Limit Cut Depth | After checking the box, enter the value for cut depth limit. |

Row constraints


| Setting | Explanation |
|---|--|
| Downhill Direction  | Heading of water flow |
| Width | Maximum width the cross-slope is allowed to break over |
| Minimum Slope | The minimum allowable slope |
| Maximum Slope | The maximum allowable slope |
| Maximum Rate Change | Percentage of distance. Used to limit the design change over distance. |


Cross slope


| Setting | Explanation |
|---------------------|--|
| Minimum Slope | The minimum allowable slope |
| Maximum Slope | The maximum allowable slope |
| Maximum Rate Change | Percentage of distance. Used to limit the design change over distance. |

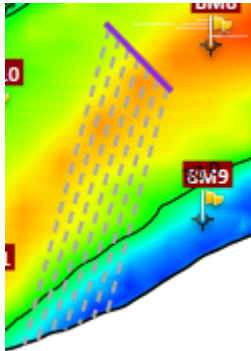
Create a pipeline

To create a pipeline:

1. In the [Project Management panel \(page 41\)](#), select an irrigation design you want to work with.
2. If you are not in the *Design Editor*, click **Design Editor**.
3. Click .
4. Click on the design to indicate the start of the pipeline. Drag to the next point and click.
5. Continue with additional lines until you have completed the shape.
6. To indicate you are complete, you can:
 - Right-click and select **Complete**.
 - Press the Enter key.

If you have Snap Options  activated, the last point will snap to the first line.

The estimated furrow layout displays after you define the pipeline. You can change the direction of the furrow layout by changing the downhill direction  in the Row Constraints.




7. To cancel the pipeline creation, press the Escape key.
8. Use the [Design Editor controls \(page 63\)](#) to manipulate the design.
9. Complete the [constraints](#) for the design.
10. Click **Calculate** (or ALT + A) if you do not have the automatic calculate function on. See [General settings \(page 34\)](#).

Create an exclusion zone

Exclusion zones are excluded from all calculations for the design. You can use exclusion zones for [Maximizing license usage \(page 136\)](#)

Note – To prevent unnecessary acreage from being deducted from your acreage balance, exclusion zones must be present and defined before exporting your design.

To create an exclusion zone:

1. Choose an irrigation design you want to work with.
2. If you are not in the *Design Editor*, click **Design Editor**.
3. Click .
4. Click on the design the point where you want the exclusion zone to begin.
5. Continue dragging and clicking until you have completed the shape for the zone.
6. Press the Enter key (or right-click and click **Complete**) when you are satisfied with the zone's shape and location.
7. Click **Calculate** (or ALT + A) if you do not have the automatic calculate function on. See [General settings \(page 34\)](#).
8. To cancel the creation of the zone, press the Escape key.

Land leveling design

Use a land leveling design for basic land leveling. In this design type, you can:

- Add section lines to create separate sections on the design, add to or edit information about section lines, and rename lines. See [Add section lines \(page 93\)](#).
- Add a hinge and change hinge properties. See [Add a hinge \(page 95\)](#).
- [Create an exclusion zone \(page 97\)](#).





Constraints for land leveling designs

If you have created sections in your design, you can automatically expand the section by clicking on it. See the setting for [Expand section constraints \(page 93\)](#).

Volumes

| Constraint | Explanation |
|------------------|---|
| (Type of volume) | Balanced: The volume of soil removed and replaced remains the same. Import: The volume of soil added is greater than what is currently there. Export: The volume of soil removed is greater than what is currently there. Free: Optimized surface without an import, export or balance constraints |
| Shrinkage | Percentage of or factor by which the material will shrink when it is cut and then used as fill |
| Haul Bulkage | Percentage of or factor by which the material will swell (expand) when it is cut and then hauled in loose condition |
| Haul Compaction | Percentage of or factor by which the material will shrink when it is cut and then hauled in loose condition |
| Cut/Fill | Ratio of cut to fill volume for balancing the field design. |

Field (Custom)

| Constraint | Explanation |
|--|---|
| Main Slope  | Move the arrow to the direction of the main slope. Downhill Direction: Enter the degree of the downhill slope if you choose not to move the arrow in the direction of the main slope. Slope: Enter the percentage of the slope if you choose not to move the arrow to indicate direction. |
| Cross Slope  | Slope: Click  or  to toggle the direction of the cross slope. If you use cross slope, the arrow indicator includes an additional small arrow point to show the cross slope. If you choose to use Best Fit, the system assumes the cross slope is zero, and the cross slope indicator also shows. |

Create a land leveling design


To create a land leveling design:

1. Right-click on the field name.
2. Select **New Design**, and then **Land Leveling**.

Land leveling design options and controls

Land leveling designs provide additional options for you to perform calculations and easily see each section's constraints:

- Use [Best fit calculations \(page 91\)](#).
- Use [Independent area calculation \(page 91\)](#) to keep movement of soil within a section.
- Use [Expand section constraints \(page 93\)](#) to quickly see the constraints for the section you are viewing.

To open these options, click  in the upper right-hand corner of the screen next to **Design Constraints**.

Best fit calculations

There are three ways to perform best fit calculations on a land leveling design:

- Turn on the [option to Best Fit All Automatically](#) for all sections whenever the system performs calculations
- Calculate all sections by clicking the [Best Fit All Now button](#)
- Click the [Best Fit button](#) for each section

Best Fit All Automatically option

The option to **Use Best Fit All Automatically** always performs a best fit calculation on all sections:

- When the system automatically calculates after a change in the design. See the Auto Calculation option in [General settings \(page 34\)](#).
- When you click the **Calculate** button

Best Fit All Now button

Click **Best Fit All Now** to have the system perform a calculation for best fit on all sections. Use this button when you:

- Do not have or do not want the **Auto Calculation** option on in [General settings \(page 34\)](#)
- Do not have the **Best Fit All Automatically** option on

Best Fit for section button

Click the **Best Fit** button to calculate best fit for the section. This button is useful if you:


- Do not have or do not want the **Auto Calculation** option on in [General settings \(page 34\)](#)
- Do not have the **Best Fit All Automatically** option on

Independent area calculation

For land leveling designs, you have the option to calculate sections independently of each other. This type of calculation prevents the movement of soil outside of a section.

Note – *This option is enabled by default and is highly recommended for use.*


To turn this feature on:

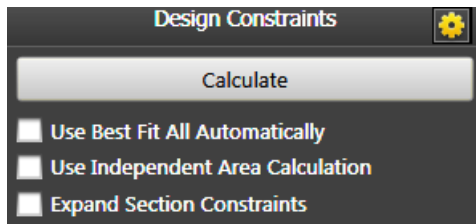
1. Click  in the upper right-hand corner of the screen next to **Design Constraints**.
2. Check the box next to **Use Independent Area Calculation**.
3. Select the section you want to calculate.

4. Click **Calculate** (or ALT + A) if you do not have the automatic calculate function on. See [General settings \(page 34\)](#). The results of the calculation will display in the **Currently Selected Section** box on the lower left.

Expand section constraints

On land leveling designs, you can expand each section's constraints as you click on the section of the design. To turn on this feature:

1. Got to the *Design Editor*.
2. View the land leveling design you want.
3. Click  in the upper right-hand corner. The system opens a set of options.




4. Check the box next to **Expand Section Constraints**.


Add section lines

You can add:

- Single section lines that run from one boundary to another boundary of the design
- Section lines that join together to form a shape

To create one or more section lines:

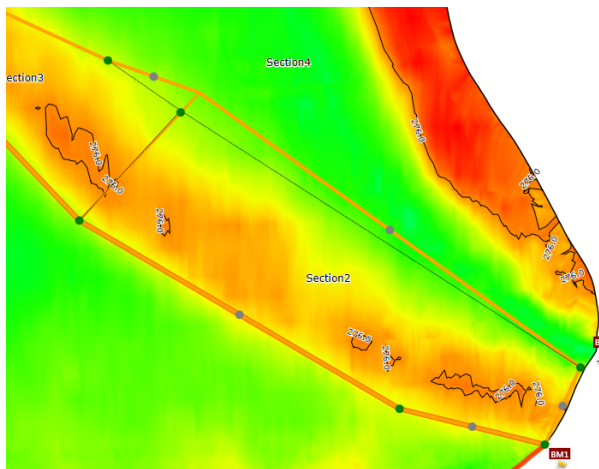
1. Select a land leveling design you want to work with.
2. If you are not in the *Design Editor*, click **Design Editor**.
3. Click .
4. Click on the design where the section line should start.
5. Drag the line to the point you want it to end and click again.
6. If you are finished drawing the line, you can:
 - a. Right-click and select complete.
 - b. Press the Enter key.
 - c. To cancel the line creation, press the Escape key.
7. If you want to continue drawing additional lines to create a shape:
 - a. Drag the line to the next point.
 - b. Continue with additional lines until you have completed the shape.

If you have Snap Options  activated, the last point will snap to the first line. See [Design Editor controls \(page 63\)](#).

8. If you are finished drawing, you can:
 - a. Right-click and select complete.
 - b. Press the Enter key.
9. To cancel the line creation, press the Escape key.
10. Use the [Design Editor controls \(page 63\)](#) to manipulate the design.
11. Enter the [constraints](#).
12. Your options for calculating the design are:
 - Click **Calculate** (or ALT + A) if you do not have the automatic calculate function on. See [General settings \(page 34\)](#).
 - Click **Best Fit All Now** to best fit all sections.
 - Click **Best Fit** in the section you want to calculate.

If you want the movement of soil to stay within a section, see [Independent area calculation \(page 91\)](#).

Moving multiple points (nodes)




If your section lines are joined, you can move more than one node at a time. Choose a node and start dragging it. A dotted line will indicate which nodes can be moved together with the selected node.

You must have enabled **Move co-located nodes together** in [General settings \(page 34\)](#).

Rename / add notes

You can add information to section lines, including:

- A custom name
 - Notes
1. In the *Design Editor*, click  if it is not already selected.
 2. Click the section line.
 3. Right-click and select **Properties**.
 4. Enter the new name of the line and any notes.
 5. Click **OK**.

Add a hinge


When two independent sections are designed into planes based on slope, orientation, and cut/fill balance, it does not mean that they join nicely on the section boundary. This is real problem for operators today as they cannot easily drive from one section to another when running FieldLevel II.

You can use hinges to:

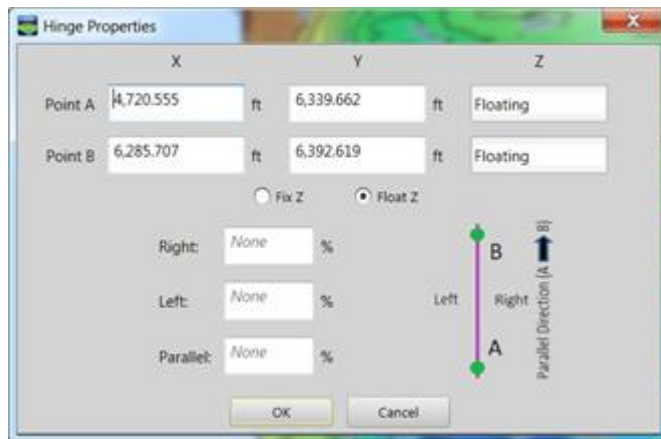
- Hold slopes and cut/fill balance fixed: In this case, the planes will essentially remain the same, but new section boundaries will be created based on where the planes intersect.
- Hold cut/fill balance and boundaries fixed: In this case, modify the design slopes to allow the boundaries to join at the original locations. In some cases, it may be impossible depending on geometry, in which case we may need to apply some best fit algorithms to do the best we can.
- Hold cut/fill balance, boundaries and slopes fixed: When all three are selected, provide the result that Multiplane does today, i.e. planes do not join at the boundaries. Maybe this is not required as the customer can just choose not to apply the Plane Joiner tool.
- Hold slopes and boundaries fixed: In this case, the cut/fill balance will need to be modified to ensure the planes join at the boundaries.
- Hold slopes fixed: Modify the boundaries and cut/fill balance to all the planes to join.
- Hold boundaries fixed: Modify the cut/fill balance and slopes to join the planes.
- Hold cut/fill balance fixed: Modify the slopes and boundaries to allow the planes to join.

Where plane parameters are automatically modified, the user must be able to view the new parameters.

1. Select a land leveling design you want to work with.
2. If you are not in the *Design Editor*, click **Design Editor**.

3. Click .
4. Click on the design where the hinge line should start.
5. Drag the line to the point you want the hinge to end and click again.
6. Click **Calculate** (or ALT + A) if you do not have the automatic calculate function on. See [General settings \(page 34\)](#).

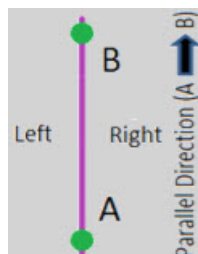
Change hinge properties




You can change:

- The coordinates of the hinge
- The type of hinge:
 - Fixed: The Z value is fixed at the existing elevation or at the Z value you defined.
 - Floating: The Z value floats to the optimal elevation.
 - Right Slope %: Define a fixed slope value of the design surface to the right of the hinge line
 - Left Slope %: Define a fixed slope value of the design surface to the left of the hinge line
 - Parallel Slope %: Define the fixed slope value of the hinge line

Note – Direction of slope is defined based on the definition direction of the hinge line A to B. Conflicting slope constraints for multiple hinges will cause a calculation error.



To change properties of a hinge:


1. In the *Design Editor*, click  if it is not already selected.
2. Click the hinge to select it.
3. Right-click and select **Properties**. The Hinge Properties window displays.
4. Change any of the coordinates or change the hinge type.
5. Click **OK**.
6. Click **Calculate** (or ALT + A) if you do not have the automatic calculate function on. See [General settings \(page 34\)](#).

Create an exclusion zone

Exclusion zones are excluded from all calculations for the design. You can use exclusion zones for [Maximizing license usage \(page 136\)](#)

Note – To prevent unnecessary acreage from being deducted from your acreage balance, exclusion zones must be present and defined before exporting your design.

To create an exclusion zone:

1. Choose a land leveling design to work with.
2. If you are not in the *Design Editor*, click **Design Editor**.
3. Click .
4. Click on the design the point where you want the exclusion zone to begin.
5. Continue dragging and clicking until you have completed the shape for the zone.
6. Press the Enter key (or right-click and click **Complete**) when you are satisfied with the zone's shape and location.
7. Click **Calculate** (or ALT + A) if you do not have the automatic calculate function on. See [General settings \(page 34\)](#).
8. To cancel the creation of the zone, press the Escape key.

Sub-design areas design

A design type of Sub-design area allows you to create different kinds of sub-design areas on the design that can have its own individual constraints.

General constraints for a sub-design area design

The general constraints that display for any type of sub-design area are:

- [Volumes](#)
- [Sampling Grid](#)

Note – To better see constraints in the sequence you want, you can reorder constraints by clicking and dragging them.

Volumes

The type of volumes are:

- **Balanced:** The volume of soil removed and replaced remains the same.
- **Import:** The volume of soil added is greater than what is currently there.
- **Export:** The volume of soil removed is greater than what is currently there.
- **Free:** Optimized surface without an import, export or balance constraints

Cut Fill Ratio: Percentage of cut / fill

Sampling Grid

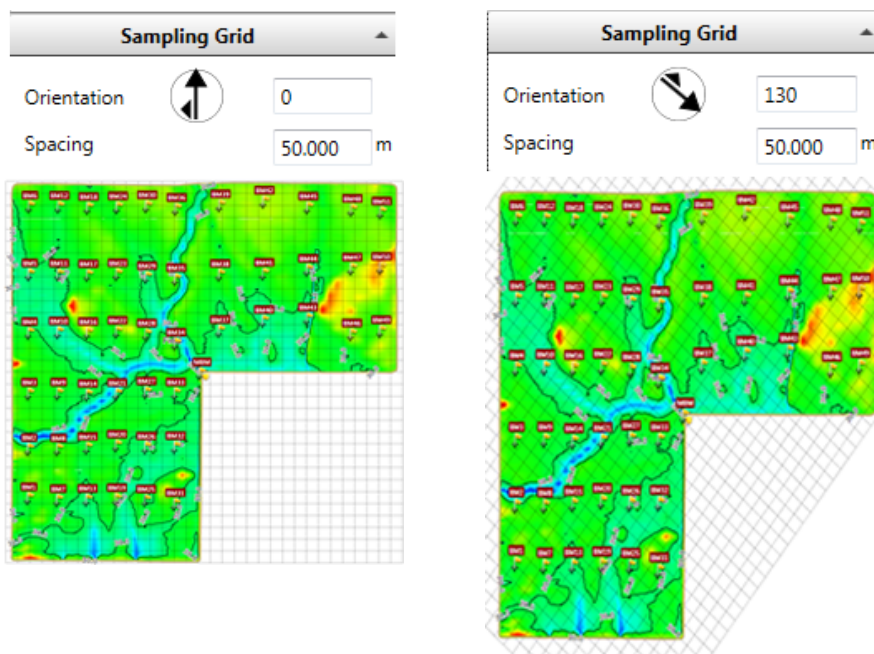
Use the sampling grid to define:

- The main slope heading
- The resampling spacing for definition of the design surface

The size of the surface resampling grid allows you to choose the level of granularity you want the design to achieve. The lower the number the more refined the surface and the lower the volume. However, the lower the value the longer the calculation period.

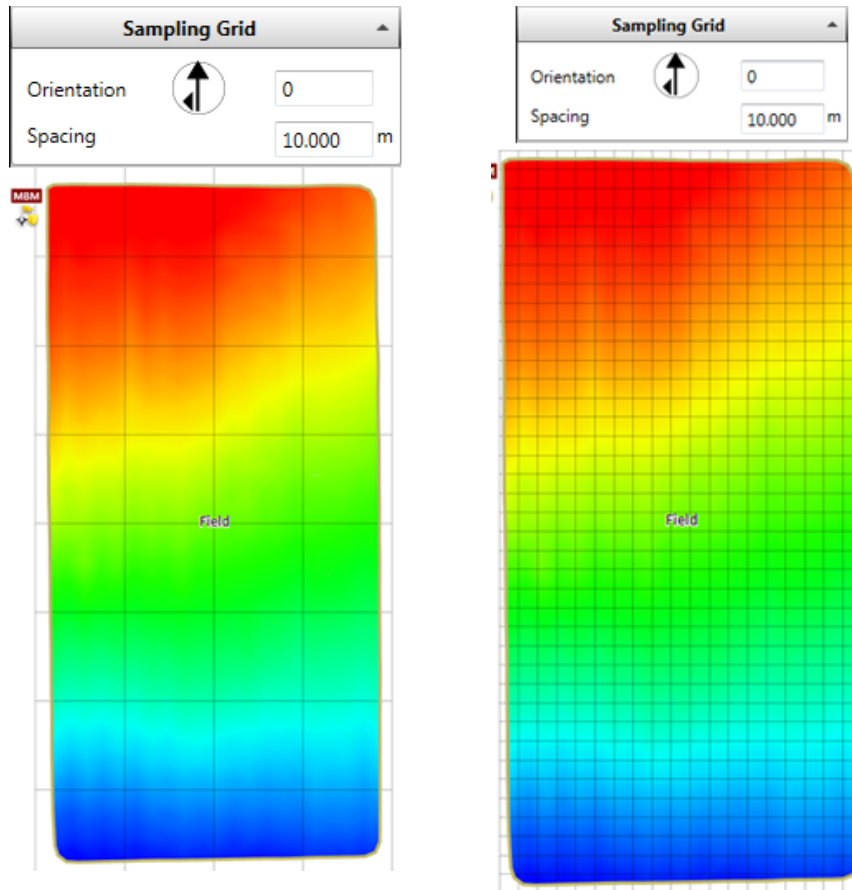
Orientation

Orientation is the orientation of the grid the design is on. You can enter the degrees or move the arrow.



Spacing

Spacing defines the resampling spacing for the design surface.



Field constraints for sub-design area designs

For sub-design area designs, you can enter constraints for the entire field as well as any sub-design area.


| Constraint | Explanation |
|-------------|--|
| Main Slope | Minimum: The maximum percentage of slope Maximum: The minimum percentage of slope Max Change Rate: The maximum rate of change Total |
| Cross Slope | Minimum: The maximum cross slope percentage Maximum: The minimum cross slope percentage Max Change Rate: The maximum rate of change Total |
| Elevation | Minimum: Minimum elevation of the design Maximum: Maximum elevation of the design |
| Cut / Fill | Maximum Cut: The maximum amount of material that should be removed Maximum Fill: The maximum amount of material that should be replaced |

Create a sub-design area design

To create a Sub-Design Areas design:

1. In the [Project Management panel \(page 41\)](#), right-click on the field name.
2. Select New Design, and then Sub-Design Areas.
3. The field constraints panel displays on the right-hand side of the screen where you can enter the appropriate information.

| Field | | |
|--------------------|-------|---|
| Type Custom | | |
| Main Slope | | |
| Minimum | None | % |
| Maximum | None | % |
| Max Change Rate | None | % |
| | 1.000 | m |
| Cross Slope | | |
| Minimum | None | % |
| Maximum | None | % |
| Max Change Rate | None | % |
| | 1.000 | m |
| Elevation | | |
| Minimum | None | m |
| Maximum | None | m |
| Cut / Fill | | |
| Maximum Cut | None | m |
| Maximum Fill | None | m |



4. To create a sub-design area, click  and choose the type of sub-design area you want to create:
 - [Custom area \(page 103\)](#)
 - [Exclusion zone area \(page 109\)](#)
 - [Level pad area \(page 104\)](#)
 - [Pipe bed area \(page 105\)](#)
 - [Tail ditch area \(page 107\)](#)

The constraints for the sub-design area you have created display.

| Sub-Design Area1 | | |
|------------------|-----------|---|
| Type | Level Pad | |
| Min Elevation | 0.000 | m |
| Max Elevation | None | m |


Viewing sub-design areas

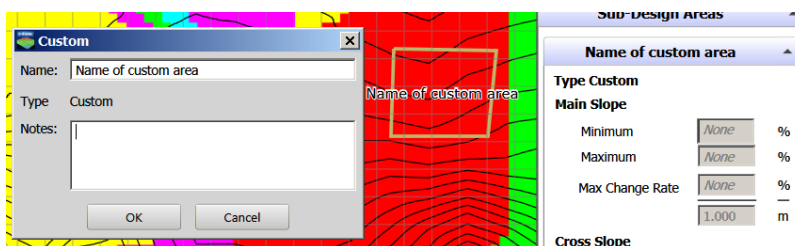
In the constraints panel, you can:

- Collapse a sub-design area by clicking the down arrow  next to the sub-design name
- Expand a sub-design area by clicking the up arrow  next to the sub-design name
- Reorder the view of sub-design areas by pressing Shift and holding down the left mouse button while over the field or sub-design area name

Custom area

Use the custom area for general land leveling.

1. If you are not in the *Design Editor*, click **Design Editor**.
2. In the file list of the [Project Management panel \(page 41\)](#), select the design you want to work with.
3. Click  and choose Custom. The mouse pointer changes to a pencil.
4. Click the point where you want the custom sub-design to begin.
5. Continue dragging and clicking until you have completed the shape for the custom sub-design.
6. Press the Enter key (or right-click and click Complete) when you are satisfied with the custom sub-design's shape and location. (To cancel the area's creation, press the Escape key.)
7. Rename the custom area:
 - a. Right-click on the border of the custom area you just created and click Properties.
 - b. Enter a name for the custom area and any notes you want to include about the area.
 - c. Click **OK**. The name of the area changes on the design and in the Design Constraints panel.



8. Enter the [constraints](#).
9. Click **Calculate** (or ALT + A) if you do not have the automatic calculate function on. See [General settings \(page 34\)](#).


Custom area constraints


Note – To better see constraints in the sequence you want, you can reorder constraints by clicking and dragging them.

| Constraint | Explanation |
|-------------|--|
| Main Slope | Minimum: The maximum percentage of slope Maximum: The minimum percentage of slope Max Change Rate: The maximum rate of change |
| Cross Slope | Minimum: The maximum cross slope percentage Maximum: The minimum cross slope percentage Max Change Rate: The maximum rate of change |
| Elevation | Minimum: Minimum elevation of the design Maximum: Maximum elevation of the design |
| Cut / Fill | Maximum Cut: The maximum amount of material that should be removed Maximum Fill: The maximum amount of material that should be replaced |

Level pad area

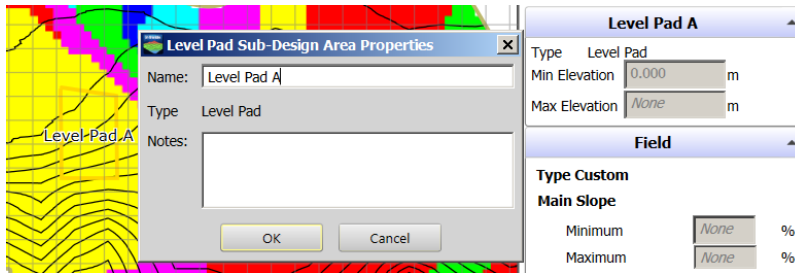
Use this area type to create a level pad.

1. Choose the sub-design areas design you want to work with.
2. If you are not in the *Design Editor*, click **Design Editor**.
3. In the file list of the Project Management panel, select the design you want to work with.
4. Click  and choose LevelPad. The mouse pointer changes to a pencil.
5. Click the point where you want the level pad to begin. Drag to the next point and click.
6. Continue dragging and clicking until you have completed the shape for the pad.

If you have Snap Options  activated, the last point will snap to the first line. See [Design Editor controls \(page 63\)](#).

7. Press the Enter key (or right-click and click Complete) when you are satisfied with the level pad shape and location. (To cancel the area's creation, press the Escape key.)
8. Rename the level pad area:
 - a. Right-click on the border of the level pad area you just created and click Properties.
 - b. Enter a name for the level pad area and any notes you want to include about the area.

- c. Click **OK**. The name of the area changes on the design and in the Design Constraints panel.



9. Use the [Design Editor controls \(page 63\)](#) to manipulate the design.
10. Enter the [constraints](#).
11. Click **Calculate** (or ALT + A) if you do not have the automatic calculate function on. See [General settings \(page 34\)](#).


Constraints for level pad areas

Note – To better see constraints in the sequence you want, you can reorder constraints by clicking and dragging them.

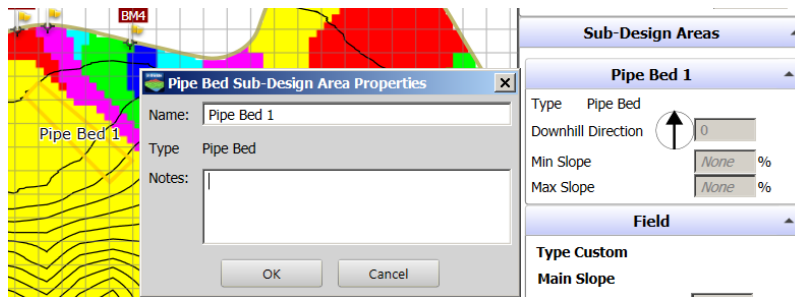
| Constraint | Explanation |
|----------------|-----------------------------------|
| Min. Elevation | The minimum elevation of the pad. |
| Max. Elevation | The maximum elevation of the pad. |

Pipe bed area

Use this area type to create an irrigation pipe bed area for optimal placement of irrigation pipes for furrow irrigation.

1. If you are not in the *Design Editor*, click **Design Editor**.
2. In the file list of the [Project Management panel \(page 41\)](#), select the design you want to work with.
3. Click  and choose Pipe Bed. The mouse pointer changes to a pencil.
4. Click the point where you want the pipe bed to begin.
5. Continue dragging and clicking until you have completed the shape for the pipe bed.
6. Press the Enter key (or right-click and click **Complete**) when you are satisfied with the pipe bed's shape and location. (To cancel the area's creation, press the Escape key.)


7. Rename the pipe bed area:
 - a. Right-click on the border of the pipe bed area you just created and click Properties.
 - b. Enter a name for the pipe bed area and any notes you want to include about the area.
 - c. Click **OK**. The name of the pipe bed area changes on the design and in the Design Constraints panel.



8. Enter the [constraints](#) for the pipe bed.
9. Click **Calculate** (or ALT + A) if you do not have the automatic calculate function on. See [General settings \(page 34\)](#).
10. Enter the constraints for the tail ditch.
11. Click **Calculate** (or ALT + A) if you do not have the automatic calculate function on. See [General settings \(page 34\)](#).

Constraints for pipe bed areas

Note – To better see constraints in the sequence you want, you can reorder constraints by clicking and dragging them.


| Constraint | Explanation |
|--|---|
|  Downhill Direction | Slope direction of the pipe bed. Enter the degrees or use your mouse to move the direction arrow. |
| Min Slope | Percentage of minimum slope |
| Max Slope | Percentage of maximum slope |

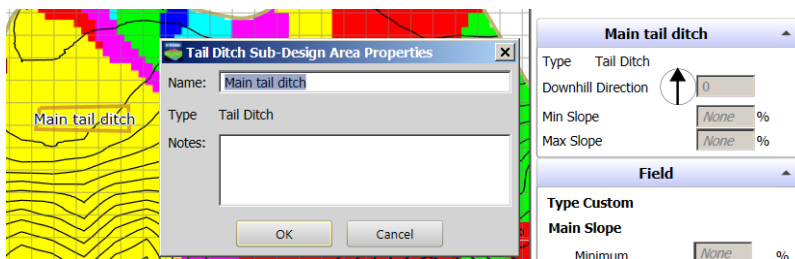
Note – Cross slope is fixed at 0.

Note – You can connect multiple areas with different headings and constraints to manipulate a design plane.

Tail ditch area

Use this area type to create designs for controlling runoff.


1. If you are not in the *Design Editor*, click **Design Editor**.
2. In the file list of the Project Management panel, select the design you want to work with.
3. Click  and choose Tail Ditch. The mouse pointer changes to a pencil.
4. Click the point where you want the tail ditch to begin.
5. Continue dragging and clicking until you have completed the shape for the tail ditch.
6. Press the Enter key (or right-click and click Complete) when you are satisfied with the tail ditch's shape and location. (To cancel the area's creation, press the Escape key.)
7. Rename the tail ditch area:
 - a. Right-click on the border of the tail ditch area you just created and click Properties.
 - b. Enter a name for the tail ditch area and any notes you want to include about the area.
 - c. Click **OK**. The name of the tail ditch area changes on the design and in the Design Constraints panel.



8. Enter the constraints for the tail ditch.
9. Click **Calculate** (or ALT + A) if you do not have the automatic calculate function on. See [General settings \(page 34\)](#).

Constraints for tail ditch areas

Note – To better see constraints in the sequence you want, you can reorder constraints by clicking and dragging them.

| Constraint | Explanation |
|--|---|
|  Downhill Direction | Degrees of downhill direction. Enter the degrees or use your mouse to move the direction arrow. |
| Minimum Slope | Percentage of minimum slope |


| Constraint | Explanation |
|---------------|-----------------------------|
| Maximum Slope | Percentage of maximum slope |

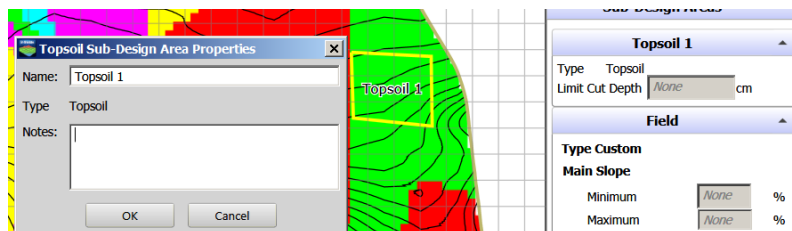
Note – Cross slope is fixed at 0.

Note – You can connect multiple areas with different headings and constraints to manipulate a design plane.

Topsoil area

Use this design type to limit the depth of cut of any area in the field.

1. If you are not in the *Design Editor*, click **Design Editor**.
2. In the file list of the Project Management panel, select the design you want to work with.
3. Click  and choose Topsoil. The mouse pointer changes to a pencil.
4. Click the point where you want the area to begin.
5. Continue dragging and clicking until you have completed the shape for the topsoil area.
6. Press the Enter key (or right-click and click Complete) when you are satisfied with the area's shape and location. (To cancel the area's creation, press the Escape key.)
7. Rename the topsoil area:
 - a. Right-click on the border of the topsoil area you just created and click Properties.
 - b. Enter a name for the topsoil area and any notes you want to include about the area.
 - c. Click **OK**. The name of the topsoil area changes on the design and in the Design Constraints panel.



8. Enter the constraints for the topsoil area.
9. Click **Calculate** (or ALT + A) if you do not have the automatic calculate function on. See [General settings \(page 34\)](#).

Constraints for topsoil areas


Limit Cut Depth: Enter the maximum depth that you want the top soil to be cut.

Exclusion zone area

Exclusion zones are excluded from all calculations for the design. You can use exclusion zones for [Maximizing license usage \(page 136\)](#).

Note – *To prevent unnecessary acreage from being deducted from your acreage balance, exclusion zones must be present and defined before exporting your design.*

To create an exclusion zone:

1. Select a design you want to work with.
2. If you are not in the *Design Editor*, click **Design Editor**.
3. In the file list of the Project Management panel, select the design you want to work with.
4. Click .
5. Click on the design the point where you want the exclusion zone to begin.
6. Continue dragging and clicking until you have completed the shape for the zone.
7. Press the Enter key (or right-click and click Complete) when you are satisfied with the zone's shape and location.
8. To cancel the creation of the zone, press the Escape key.
9. Click **Calculate** (or ALT + A) if you do not have the automatic calculate function on. See [General settings \(page 34\)](#).

Reports

In this chapter:

| | |
|---|-----|
| Reports editor | 112 |
| Cut Fill Report | 113 |
| Design Report | 116 |
| Summary Report | 118 |
| Summary Report controls | 119 |
| Drainage Design Summary Report | 120 |
| Irrigation Design Summary Report | 123 |
| Land Leveling Design Summary Report | 125 |
| Proposed Design Report | 128 |
| Quote Report | 130 |
| Export cut sheet | 132 |
| Export to display | 133 |

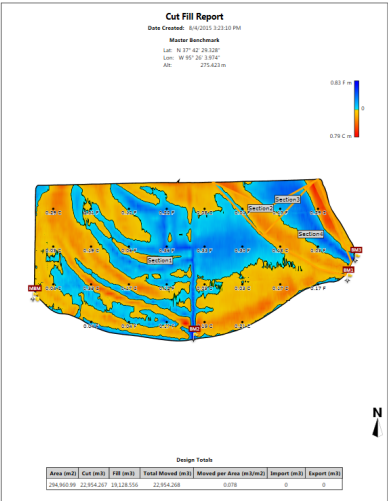
WM-Form provides six report templates for all design types except irrigation.

Reports editor

The Reports editor contains the report types:

- [Cut Fill Report \(page 113\)](#)
- [Design Report \(page 116\)](#)
- [Summary Report \(page 118\)](#)
- [Proposed Design Report \(page 128\)](#)
- [Quote Report \(page 130\)](#)

Cut Fill Report



This report provides detailed information on cut/fill, including cut/fill information at grid intervals and what the cut/fill ratio is at a point. Controls specific to this report are [Layer controls](#) to view different layers of the design

Also see [Export cut sheet \(page 132\)](#).




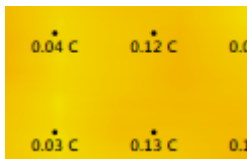


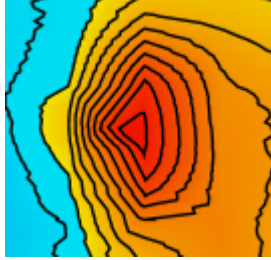


Note – The constraints for any type of report depend on the type of design you have created.

Design totals

| Information | Explanation |
|----------------|--|
| Area | Measurement of the area in which the cut/fill will occur |
| Cut | Quantity of material to remove |
| Fill | Quantity of material to fill |
| Total Moved | Total volume of material moved |
| Moved per Area | Volume of material moved per unit of area. For example, (yd ³ /ac) or (m ³ /ha). |
| Import | Volume of soil to be imported to complete the design (if applicable) |
| Export | Volume of soil to be exported to complete the design (if applicable) |

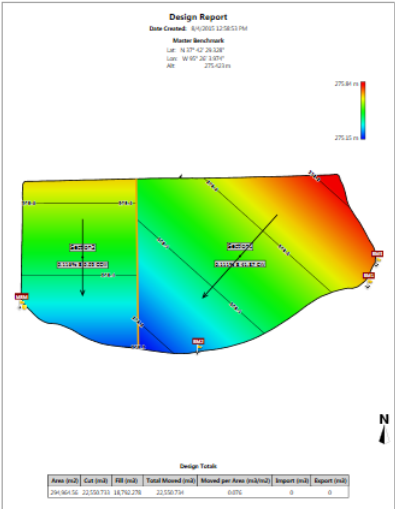
Layer controls

Use the report controls to view different layers of the design on the report.

| Layer Control | Click to... |
|--|---|
|  Annotation Layer | Toggle the annotation layer on or off, showing benchmarks, section boundaries, hinges and exclusion zone boundaries.  |
|  Surface Info | Toggle the surface info on or off, showing coordinate locations and cut/fill point values.  |
|  Surface Info Spacing | Define the spacing of the visible cut/fill point values. Note – The type of units depend on settings. See Units settings (page 37) . |
|  Contours | Toggle on contours.  |
|  Contours Interval | Change contour distance based on unit of measure you have designated in settings. Note – Unit types depend on settings. See Units settings (page 37) . |
|  On-Grade Band | Toggle to hide or view the neutral areas that do not require cut or fill. |

| Layer Control | Click to... |
|---|--|
| |  |
| <div>0.1 ▾ m</div> <div>On-Grade Band Interval</div> | <div>Change how close or far apart the on-grade bands display on the design.</div> <div>Note – Unit types depend on settings. See Units settings (page 37).</div> |
| <div></div> <div>Cut Fill Analysis</div> | <div>Toggle on or off cut fill analysis view and controls.</div> <div></div> |

Design Report



This report provides detailed information on cut/fill. Controls specific to this report are [layer controls](#) to view different layers of the design.




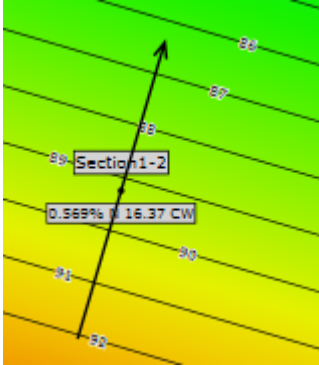

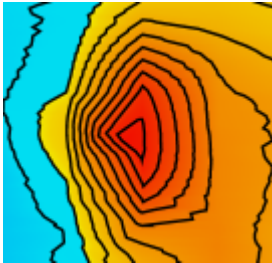

Note – The constraints for any type of report depend on the type of design you have created

Design totals

| Information | Explanation |
|----------------|--|
| Area | Measurement of the area in which the cut/fill will occur |
| Cut | Quantity of material to remove |
| Fill | Quantity of material to fill |
| Total Moved | Total volume of material moved |
| Moved per Area | Volume of material moved per unit of area. For example, (yd ³ /ac) or (m ³ /ha). |
| Import | Volume of soil to be imported to complete the design (if applicable) |
| Export | Volume of soil to be exported to complete the design (if applicable) |

Layer controls

Use the report controls to view different layers of the design on the report.

| Layer Control | Click to... |
|--|---|
|  Annotation Layer | Toggle the annotation layer on or off, showing benchmarks, section boundaries, hinges and exclusion zone boundaries.  |
|  Surface Info | Toggle the surface information on or off, showing section labels, slope percentage and direction  |
|  Contours | Toggle on contours.  |
|  Contours Interval | Change contour distance based on unit of measure you have designated in settings. Note – Unit types depend on settings. See Units settings (page 37) . |

Summary Report

The summary report includes design and constraint details for these designs:




- Drainage. See [Drainage Design Summary Report \(page 120\)](#).
- Irrigation. See [Irrigation Design Summary Report \(page 123\)](#).
- Land leveling. See [Land Leveling Design Summary Report \(page 125\)](#).

Summary Report controls




The Summary Report has controls that enable you to change the view of the report depending on your needs.




Single page view

Click  for a single page view and use the page controls  1 of 3  to see other pages.

Two page view

Click  to view two pages and use the page controls  1 of 3  to see other pages.

Scrolling page view

Click  to view a scrolling page and use the scroll bar to see the content.

Font controls

Use the zoom controls to increase or decrease the size of the fonts in the report.



Drainage Design Summary Report

Constraints Summary section

Section Area Volumes

This section of the report indicates the volumes for the entire field or all sections.

| Information | Explanation |
|-------------------|--|
| Spacing | The size of the surface resampling grid. The lower the number the more refined the surface and the lower the volume. However, the lower the value the longer the calculation period. |
| Cut/Fill Ratio | The cut/fill ratio |
| Shrinkage % | Percentage of shrinkage |
| Haul Bulkage % | Percentage of the increase in volume of soil due to expansion and loosening occurring as a result of its excavation |
| Haul Compaction % | Percentage of the decrease in volume of soil from its loose haulage or stockpiled state to its compacted state where it is placed |

Activity Areas

This section of the report indicates the constraints for each activity area of the design.

| Information | Explanation |
|----------------------|----------------------------------|
| Name | Name of the activity area |
| Volume Mode | Balanced, Import, Export or Free |
| Volume (m3) | Total volume of soil |
| Limit Cut Depth (cm) | Limit for the cut depth |
| Min Slope (%) | Percentage of minimum slope |
| Max Slope (%) | Percentage of maximum slope |

Design Summary section

Design Totals

| Information | Explanation |
|------------------------|--|
| Area | Measurement of the area(s) in which the cut/fill will occur |
| Cut (m2) (Bank) | Quantity of material to remove |
| Fill (m3) (Bank) | Quantity of material to fill |
| Total Moved (m3) | Total amount of material moved |
| Moved per Area (m3/m2) | Volume of material moved per unit of area. For example, (yd ³ /ac) or (m ³ /ha). |
| Import (m3) | Volume of soil to be imported to complete the design (if applicable) |
| Export (m3) | Volume of soil to be exported to complete the design (if applicable) |

Activity Areas

| Information | Explanation |
|----------------------|---|
| Name | Name of section |
| Area (m2) | The size of the activity area |
| Cut (m2) (Bank) | Total volume of soil volume that was cut within the specified activity area. |
| Fill (m3) (Bank) | Total volume of soil volume that was filled within the specified activity area. |
| Cut per Area (m3/m2) | Total volume cut from the activity area divided by the total area of the activity area. |
| Import (m3) | Volume of soil to be imported to complete the design (if applicable) |
| Export (m3) | Volume of soil to be exported to complete the design (if applicable) |

Benchmarks

| Information | Explanation |
|----------------|-----------------------------------|
| Name | Name of the benchmark |
| X (m) | The X coordinate of the benchmark |
| Y (m) | The Y coordinate of the benchmark |
| Elevation (m) | The elevation of the benchmark |
| Cut / Fill (m) | The cut / fill ratio |

Irrigation Design Summary Report

Constraints Summary section

Volumes

| Information | Explanation |
|-------------------|---|
| Type | Balanced, Import, Export or Free |
| Cut/Fill Ratio | The cut/fill ratio |
| Shrinkage % | Percentage of shrinkage |
| Haul Bulkage % | Percentage of the increase in volume of soil due to expansion and loosening occurring as a result of its excavation |
| Haul Compaction % | Percentage of the decrease in volume of soil from its loose haulage or stockpiled state to its compacted state where it is placed |

Rows

| Information | Explanation |
|-----------------------|---|
| Orientation (deg) | Heading at which the original surface was resampled to generate the design surface |
| Width (m) | Width of the rows used to optimize the surface for row-water applications |
| Min Slope (%) | Percentage of minimum slope |
| Max Slope (%) | Percentage of maximum slope |
| Max Change Rate (%/m) | The smoothing factor that limits the allowed change in slopes within a design over a given distance |

Cross Slope

| Information | Explanation |
|---------------|-----------------------------|
| Min Slope (%) | Percentage of minimum slope |
| Max Slope (%) | Percentage of maximum slope |

| Information | Explanation |
|-----------------------|---|
| Max Change Rate (%/m) | The smoothing factor that limits the allowed change in slopes within a design over a given distance |

Design Summary section

Design Totals

| Information | Explanation |
|------------------------|--|
| Area | Measurement of the area(s) in which the cut/fill will occur |
| Cut (m2) (Bank) | Quantity of material to remove |
| Fill (m3) (Bank) | Quantity of material to fill |
| Total Moved (m3) | Total amount of material moved |
| Moved per Area (m3/m2) | Volume of material moved per unit of area. For example, (yd ³ /ac) or (m ³ /ha). |
| Import (m3) | Volume of soil to be imported to complete the design (if applicable) |
| Export (m3) | Volume of soil to be exported to complete the design (if applicable) |

Benchmarks

| Information | Explanation |
|----------------|-----------------------------------|
| Name | Name of the benchmark |
| X (m) | The X coordinate of the benchmark |
| Y (m) | The Y coordinate of the benchmark |
| Elevation (m) | The elevation of the benchmark |
| Cut / Fill (m) | The cut / fill ratio |

Land Leveling Design Summary Report

Constraints Summary section

Section Area Volumes

This section of the report indicates the volumes for the entire field or all sections.

| Information | Explanation |
|-------------------|---|
| Name | Name of area: Either All Sections or Field |
| Type | The balance method used |
| Cut/Fill Ratio | The cut/fill ratio |
| Volume (m3) | Total of all Cut + Export + Import soil for a given section area |
| Shrinkage % | Percentage of shrinkage |
| Haul Bulkage % | Percentage of the increase in volume of soil due to expansion and loosening occurring as a result of its excavation |
| Haul Compaction % | Percentage of the decrease in volume of soil from its loose haulage or stockpiled state to its compacted state where it is placed |

Section Areas

This section of the report indicates the constraints for each section of the design.

| Information | Explanation |
|---------------------------|---|
| Name | Name of the section |
| Slope (%) | Percentage of slope for the section |
| Downhill Dir. (deg) | Degrees of downhill direction |
| Cross Slope (%) | Percentage of cross slope |
| Cross Slope Downhill Dir. | Direction of cross slope going downhill (left or right) |
| # of Point Constraints | The benchmarks used to define points where the design must intersect. (The maximum allowed to be "fixed" per section is 3.) |

Design Summary section

Design Totals

This section of the report indicates the design totals for all sections.

| Information | Explanation |
|----------------|--|
| Area | Measurement of the area(s) in which the cut/fill will occur |
| Cut | Quantity of material to remove |
| Fill | Quantity of material to fill |
| Total Moved | Total amount of material moved |
| Moved per Area | Volume of material moved per unit of area. For example, (yd ³ /ac) or (m ³ /ha). |
| Import | Volume of soil to be imported to complete the design (if applicable) |
| Export | Volume of soil to be exported to complete the design (if applicable) |

Section and Hinge Area Slopes

This section of the report contains slope information for section and hinge areas.

| Information | Explanation |
|-----------------|-------------------------|
| Name | Name of section |
| Main Slope | Main slope heading |
| Cross Slope | Cross slope heading |
| Composite Slope | Composite slope heading |

Section Area Volumes

This section of the report indicates the volumes for the entire field or each section.

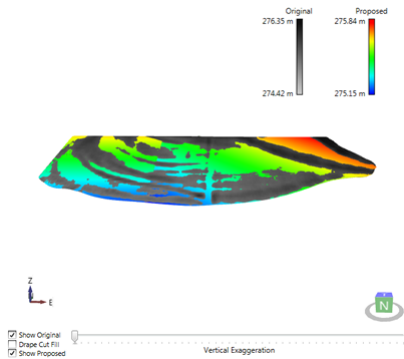
| Information | Explanation |
|-----------------|------------------------------------|
| Name | Name of section or field |
| Area (m2) | Total area of the section |
| Cut (m3) (Bank) | The total cut area for the section |


| Information | Explanation |
|------------------------|---|
| Fill (m3) (Bank) | The total fill area for the section |
| Total Moved (m3) | The amount of soil moved for the section |
| Moved per Area (m3/m2) | The amount of soil moved for the area |
| Import (m3) | Volume of soil to be imported from the section to complete the design (if applicable) |
| Export (m3) | Volume of soil to be exported from the section to complete the design (if applicable) |

Benchmarks

| Information | Explanation |
|----------------|-----------------------------------|
| Name | Name of the benchmark |
| X (m) | The X coordinate of the benchmark |
| Y (m) | The Y coordinate of the benchmark |
| Elevation (m) | The elevation of the benchmark |
| Cut / Fill (m) | The cut / fill ratio |



Proposed Design Report




The Proposed Design Report type shows a 3D view of the design or design version.
To view different perspectives of the design, click .

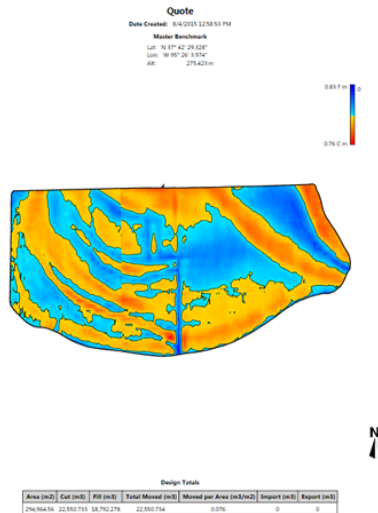
Controls and indicators

The following controls and indicators are specific to this report.

| Control / Indicator | Explanation |
|---|--|
| Show Original | When checked, the view shows the original design |
| Show Proposed | When checked, the view shows the proposed design |
| Vertical Exaggeration | Sliding on this scale changes the exaggeration of the elevation |
|  | Indicates the position of the current view |
|  | Indicates the position of the current view. T = Top view B = Bottom view E = East N = North S = South W = West Click to change the design plane to the direction shown. Double-click to change the design plane opposite of the direction shown. |

| Control / Indicator | Explanation |
|---|---|
|  | Click to change the mouse control. Use to change the perspective of the design. |

Quote Report



This report provides information on how much soil to move and a rough estimate.

Note – The constraints for any type of report depend on the type of design you have created.

Design totals

| Information | Explanation |
|----------------|--|
| Area | Measurement of the area in which the cut/fill will occur |
| Cut | Quantity of material to remove |
| Fill | Quantity of material to fill |
| Total Moved | Total amount of material moved |
| Moved per Area | Volume of material moved per unit of area. For example, (yd ³ /ac) or (m ³ /ha). |
| Import | Volume of soil to be imported to complete the design (if applicable) |
| Export | Volume of soil to be exported to complete the design (if applicable) |

Set Fee control



To quickly calculate the fee, click in the upper right-hand corner to the right of the zoom controls.

| Set Fee Setting | Explanation |
|-----------------|----------------------------|
| Fixed Fee | Enter the fee. |
| Calculated Fee | Enter the cost per volume. |

The calculation shows in the Design Totals at the bottom of the report.

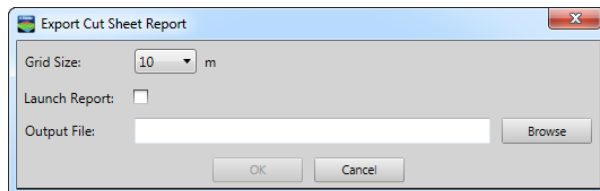
Export cut sheet

From any design type, you can export a cut sheet to an HTML file that you can open in Excel or a browser.

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| -1018 | -1019 | -1020 | -1021 | -1022 | -1023 | -1024 | -1025 | -1026 | -1027 | -1028 | -1029 | -1030 | -1031 | -1032 | -1033 | -1034 | -1035 | -1036 | -1037 | -1038 | -1039 | -1040 | -1041 | -1042 | -1043 | -1044 | -1045 | -1046 | -1047 | -1048 | -1049 | -1050 | -1051 | -1052 | -1053 | -1054 | -1055 | -1056 | -1057 | -1058 | -1059 | -1060 | -1061 | -1062 | -1063 | -1064 | -1065 | -1066 | -1067 | -1068 | -1069 | -1070 | -1071 | -1072 | -1073 | -1074 | -1075 | -1076 | -1077 | -1078 | -1079 | -1080 | -1081 | -1082 | -1083 | -1084 | -1085 | -1086 | -1087 | -1088 | -1089 | -1090 | -1091 | -1092 | -1093 | -1094 | -1095 | -1096 | -1097 | -1098 | -1099 | -1100 | -1101 | -1102 | -1103 | -1104 | -1105 | -1106 | -1107 | -1108 | -1109 | -1110 | -1111 | -1112 | -1113 | -1114 | -1115 | -1116 | -1117 | -1118 | -1119 | -1120 | -1121 | -1122 | -1123 | -1124 | -1125 | -1126 | -1127 | -1128 | -1129 | -1130 | -1131 | -1132 | -1133 | -1134 | -1135 | -1136 | -1137 | -1138 | -1139 | -1140 | -1141 | -1142 | -1143 | -1144 | -1145 | -1146 | -1147 | -1148 | -1149 | -1150 | -1151 | -1152 | -1153 | -1154 | -1155 | -1156 | -1157 | -1158 | -1159 | -1160 | -1161 | -1162 | -1163 | -1164 | -1165 | -1166 | -1167 | -1168 | -1169 | -1170 | -1171 | -1172 | -1173 | -1174 | -1175 | -1176 | -1177 | -1178 | -1179 | -1180 | -1181 | -1182 | -1183 | -1184 | -1185 | -1186 | -1187 | -1188 | -1189 | -1190 | -1191 | -1192 | -1193 | -1194 | -1195 | -1196 | -1197 | -1198 | -1199 | -1200 | -1201 | -1202 | -1203 | -1204 | -1205 | -1206 | -1207 | -1208 | -1209 | -1210 | -1211 | -1212 | -1213 | -1214 | -1215 | -1216 | -1217 | -1218 | -1219 | -1220 | -1221 | -1222 | -1223 | -1224 | -1225 | -1226 | -1227 | -1228 | -1229 | -1230 | -1231 | -1232 | -1233 | -1234 | -1235 | -1236 | -1237 | -1238 | -1239 | -1240 | -1241 | -1242 | -1243 | -1244 | -1245 | -1246 | -1247 | -1248 | -1249 | -1250 | -1251 | -1252 | -1253 | -1254 | -1255 | -1256 | -1257 | -1258 | -1259 | -1260 | -1261 | -1262 | -1263 | -1264 | -1265 | -1266 | -1267 | -1268 | -1269 | -1270 | -1271 | -1272 | -1273 | -1274 | -1275 | -1276 | -1277 | -1278 | -1279 | -1280 | -1281 | -1282 | -1283 | -1284 | -1285 | -1286 | -1287 | -1288 | -1289 | -1290 | -1291 | -1292 | -1293 | -1294 | -1295 | -1296 | -1297 | -1298 | -1299 | -1300 | -1301 | -1302 | -1303 | -1304 | -1305 | -1306 | -1307 | -1308 | -1309 | -1310 | -1311 | -1312 | -1313 | -1314 | -1315 | -1316 | -1317 | -1318 | -1319 | -1320 | -1321 | -1322 | -1323 | -1324 | -1325 | -1326 | -1327 | -1328 | -1329 | -1330 | -1331 | -1332 | -1333 | -1334 | -1335 | -1336 | -1337 | -1338 | -1339 | -1340 | -1341 | -1342 | -1343 | -1344 | -1345 | -1346 | -1347 | -1348 | -1349 | -1350 | -1351 | -1352 | -1353 | -1354 | -1355 | -1356 | -1357 | -1358 | -1359 | -1360 | -1361 | -1362 | -1363 | -1364 | -1365 | -1366 | -1367 | -1368 | -1369 | -1370 | -1371 | -1372 | -1373 | -1374 | -1375 | -1376 | -1377 | -1378 | -1379 | -1380 | -1381 | -1382 | -1383 | -1384 | -1385 | -1386 | -1387 | -1388 | -1389 | -1390 | -1391 |
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To export a cut sheet:

1. Click . The **Export Cut Sheet Report** window opens.




2. Complete the information and click **OK**.

| Setting | Explanation |
|---------------|---|
| Grid Size | Choose the size of grid you want to use. Choices are in meters: 10, 25, 50, 100, 200. Note – If you choose to enlarge the size of the grid for printing purposes, be aware the more you enlarge the grid, the less accurate your cut sheet becomes. |
| Launch Report | Check the box to display the report in your browser. |

| Setting | Explanation |
|-------------|---|
| Output File | Click Browse to go to the location where you want the file stored. Enter a name for the file and click Save . |

Export to display

From any design report, you can save the design file for use on a Trimble display.

1. In the design or design version you want, click . The Export to Trimble Display window displays.
2. Complete the settings and click **OK**.

| Settings | Explanation |
|-----------------|--|
| Grid Size | Enter the size of the grid. |
| File Size | Shows the size of the design file. |
| High Resolution | Check for high resolution which allows grid spacing as small as 2 feet (1 meter). This is useful if you have quick breaks in your design. Note – Only works with FmX Plus on the TmX-2050 display. |
| Output File | Enter the name of the file or click Browse and locate the file you want to save the data in. |

Best practices

In this chapter:

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|--------------------------------|-----|
| Maximizing license usage | 136 |
| Calculating designs | 137 |
| Comparing designs | 138 |
| Increasing accuracy | 138 |

In this section are tips and suggestions for effectively using WM-Form solution.

Maximizing license usage

Only draw from your licensed acreage balance after all designing is complete. This gives you a full 12 months before the usage period for the acreage expires to further manipulate the design. Note the date you exported your design if you need to keep track of when your usage period expires.

If there is a part of your field that you will not be designing, exclude that area prior designing. The acreage in the exclusion zone will not be deducted from your acreage balance.

If you have a large area that cannot be finished in 12 months, set up multiple designs of the field with different exclusion zones. When you are ready to begin work, the acreage in the exclusion zone will not be deducted from your acreage balance.

Also see [Licenses for acreage \(page 28\)](#).

Calculating designs

WM-Form solution provides flexibility in how and when you calculate.

For example:

- If it seems your calculations are taking a lot of time, see [Reducing initial calculation time \(page 137\)](#) and [Maximizing design time \(page 137\)](#).
- If you want to keep the movement of soil within a section, see [Calculating per section \(page 137\)](#).

Maximizing design time

To maximize design time:

1. Turn off the automatic calculation option. See [General settings \(page 34\)](#).
2. Create and manipulate designs.
3. Then click **Calculate** to begin the calculation of all designs and design versions at once. The system will show the status of these calculations at the bottom of the screen.

Reducing initial calculation time

The more precise your constraints are, the more time your system will take to perform calculations. When you first begin designing, use the default settings:

- Sub-Design area designs: Initially use the default spacing for Grid Spacing. See [Create a sub-design area design \(page 102\)](#). The larger the grid space, the faster (and less precise) the calculated result.
- Irrigation designs: Initially use the default **Width** for row constraints. See [Irrigation design \(page 86\)](#). A longer width will calculate faster (and less precisely).

After your design is much closer to its final version, you can change these settings to be more precise. (This will exponentially increase the system's calculation time.)

Calculating per section

If you use [Independent area calculation \(page 91\)](#), each section is treated separately. This is useful if you:

- Want the movement of soil to stay inside each section
- Want to define a different cut/fill ratio for each area. See using sections in [Create a land leveling design \(page 90\)](#).

Comparing designs

You can create different design scenarios by copying the design or creating design versions of the original. Alter each copy or design version, and then compare them. You may find comparing design versions are easier than comparing copies of designs.


See:

- [Design versions \(page 77\)](#)
- [Clone a design \(page 49\)](#)
- [File structure \(page 40\)](#)

Increasing accuracy

Merging surveys

You can add additional survey data to your field survey as long as the different surveys have the same master benchmark and only one boundary. This will strengthen the data you have and contribute to the accuracy of your design.

1. To add data to a field or design, click . The **Add Data Wizard** window opens.
2. Click **Browse** and locate the file.
3. Click **Next**. If the master benchmark is not the same as the existing field or design, the system will display an error and you will not be able to continue. Otherwise, the system includes the data in your design or field.

Using sections in land leveling designs

When you calculate a [Create a land leveling design \(page 90\)](#) using the cut/fill ratio, the system averages the entire design based on this ratio.

You can create sections based on soil type and material volume to show more accurate figures for moving soil.

For example, let's say you have more sandy soil in one portion of your field and in others there is soil with more clay. Clay soil expands and shrinks very differently from more sandy soil.

1. Create sections for each type of soil.
2. Turn on [Independent area calculation \(page 91\)](#) if you want to move soil only within each section instead between sections.
3. Instead of the cut/fill ratio, use shrinkage, haul bulkage or haul compaction for the system calculation. See [Materials settings \(page 35\)](#).

Troubleshooting

In this chapter:

| | |
|------------------------------|------------|
| Support file | 140 |
| Troubleshooting | 141 |

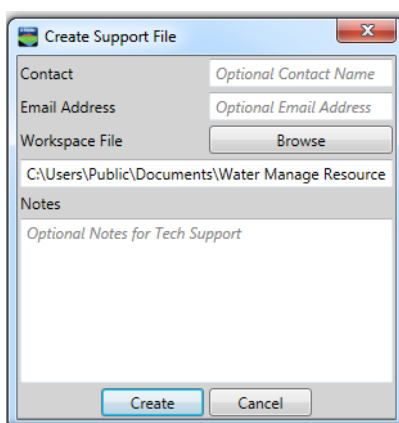
This section contains troubleshooting information, including how to create a support file to send to your dealer.

Support file

If you have a question or issue with a file, you can create a support file to send to your reseller.

To create a support file:

1. At the top menu, click **Utilities**.
2. Select Create Support File. If you have not saved the workspace, the system will prompt you to do so.
3. At the **Create Support File** window, complete the settings and click **Create**.



| Setting | Explanation |
|----------------|---|
| Contact | Optional name of the person you want contacted. |
| Email Address | The email address where the response should go. |
| Workspace File | Click Browse to navigate to where you want the file saved. Note – The currently open workspace will be automatically populated in this screen. |
| Notes | Put any detailed notes in this section. |

Troubleshooting

Cannot export design.

If you are using the [Demo mode \(page 18\)](#), you cannot export the design. You must have a license with available acreage in your balance before you can export a design.

If you have a license and your usage period for the design has expired, you must withdraw additional acreage from your license balance to export the design again. See [Licenses for acreage \(page 28\)](#).

Cannot successfully create a design.

Recalculate the desired design. Note any error messages that display and fix the errors.

Calculations are taking too long.

See [Calculating designs \(page 137\)](#) and [WM-Form solution requirements \(page 21\)](#) for the minimum CPU processor.

Glossary

B

Bank

The condition of the soil in a natural state before it is disturbed.

Bank volume

The volume calculated by multiplying [loose volume](#) and the [load factor](#).

Benchmark

A permanent reference point on the field that relates to the master benchmark. There can be multiple benchmarks to a field. You can rename any benchmark except for the master benchmark.

Boundary

A boundary is a closed set of at least three line segments to form an enclosed area.

Break line

A line or polyline indicating where a change in the topography of a surface occurs. Break lines are used to create or edit surfaces so that the surfaces accurately reflect actual or design topography.

Bulkage

The increase in volume and decrease in density of soil or other material due to expansion. Bulkage is a common result when soil's original density is excavated from a job site and moved elsewhere.

C

Compaction

The process of using weight to compress soil to increase its density.

Compound slope

The compound slope tells you how much a plane tilts in both directions and is the true direction of fall.

Contour line

A set of lines on a topographic image that remain at the same elevation. Contour lines are derived from points that make up a surface. If you walk along a contour line you will remain at the same height and neither go uphill nor downhill.

Constraint

A parameter that is edited to change the design.

Cross slope

The cross slope is always perpendicular to the primary slope. For example, if a field is furrowed, the cross slope is the slope of the field across the furrows.

Cut

A cut is a point on the field where soil needs to be removed. A cut occurs when the existing area is higher than the proposed area surface.

Cut/fill map

A map with shading and/or a grid of measurements at an interval showing the elevation differences between two surfaces, such as an original ground surface and a design surface. Cut/fill maps are color-coded to indicate where earth needs to be cut or filled.

Cut/fill ratio

The cut/fill ratio is the amount of cut dirt that equals one volume of fill dirt. This ratio takes into account the amount of expansion or contraction that results when the dirt is cut.

Cut sheet

A report that shows visual points for cut/fill values and the design elevations.

D

Design surface

The intended surface that was designed, meaning the final surface after all earthworks have been completed.

E

Exclusion zone

A shape (polygon) that can exist anywhere on a field that is not used for design and not included in design calculations.

F

Field

An area of land area that is the focus of a particular design or area of work.

Fill

A point on the field where dirt must be added. A fill occurs when the existing area is lower than the proposed area surface.

Flow arrow

Flow arrows indicate the direction in which the water flows freely on a surface.

Furrow

Furrows are small, parallel channels made to carry water in order to irrigate the crop.

Furrow arrows

Arrows on the design that indicate the flow of irrigation water.

H

Haul bulkage

Percentage of or factor by which the material will swell (expand) when it is cut and then hauled in loose condition.

Haul compaction

Percentage of or factor by which the material will shrink when it is cut and then hauled in loose condition.

Hinge line

A line segment used within the software to join fields/areas that are adjacent to each other in reality. A hinge line begins and ends on a boundary of a field or section area. Hinge lines are used in land leveling. A hinge line is a 2-point line that divides a field into two portions. These portions fold along the hinge.

I

Interior point

A point inside the field boundary.

L

Land forming

A type of design that smooths the land surface so that no areas of the field have an area steep enough to cause erosion and no areas too flat to cause ponding.

Land leveling

A type of design that shapes the land surface using large flat planes. These planes are inclined to drain water off the field to prevent ponding.

Load factor

An amount used to calculate bank volume. The load factor is calculated by dividing the loose volume by the bank density.

Loose volume

The density state of soil after having been excavated and loosely placed into a stockpile, or into some container for the purpose of transporting it from one location to another.

M

Master benchmark

A point at a known location in the field to which all other benchmarks are related. There can only be one master benchmark per field.

O

Original surface

An imported surface (also referred to as topo or existing surface). This is the shape of the land before it is leveled or formed.

P

Point ID

Line numbers at the beginning of every line in the file.

Polyline

A line made up of more than one line segments joined end to end.

R

Row

Rows on each side of a ridge have the same orientation (water flowing into rows on one side will flow 180 degrees out of phase with the other side).

S

Section area

A shape that subdivides a field created by boundary edges, section line edges and / or exclusion zone edges. Fields are subdivided into section areas for convenience or to help influence the final design.

Section line

One or more connected line segments. Each segment has a starting point and an end point. Section lines are used to create section areas in a field.

Shrinkage

The decrease in volume of soil due to contraction, settling and compaction. Percentage of or factor by which the material will shrink when it is cut and then used as fill.

Shrinkage percentage

The percentage that soil decreases in volume when it is compacted.

Slope

An inclination from the horizontal or inclined face of a cutting, canal or embankment. A measure of the steepness, incline, grade/gradient, or constant rate of elevation change, of a surface. A higher slope value indicates a steeper incline. Slope is normally described by the ratio of the "rise" divided by the "run" between two points on a line.

Survey point

Elevations are measured at specific locations across a field. The point measured will have a location (x,y) and an elevation (z). The collections of surveyed points will approximate the actual surface of the field. The more points the more accurate the approximation.

Surface

A collection of points with elevation that describe the extent and elevation characteristics of an area of land.

Swell percentage

The percentage that soil increases in volume when it is excavated.

T

Topography

Also referred to as "topo", the general configuration of the land surface including relief and position of natural and man made features.

V

Volumetric report

A report that summarizes the proposed design elements.

W

Watershed boundary

Line signifying the outer edge of a given watershed area.