SpecMaps™ ProTurf

Table of Contents

Introduction

Thank you for purchasing SpecMaps ProTurf. The ProTurf version has all the functionality of the original SpecMaps program with additional features designed specifically for the turf irrigation customer.

SpecMaps allows you to create 2-dimensional color charts of geo-referenced data from any Field Scout meter with a serial input connected to a GPS source. The contour plots give a powerful visual image of the variability across the site. The data point charts give you the ability to see the impact of individual data points on the interpolated map. A summary of the data is also included along with a histogram to give an additional visual image of the data.

Additionally, SpecMaps ProTurf allows for the inclusion of sprinkler head locations as well as the radius of throw for each individual head. The measurement summary includes a computation of the lower quartile Distribution Uniformity. This is a useful addition to the traditional irrigation audit because it is based on water in the soil profile rather than irrigation water applied to the surface.

Spectrum Technologies
12360 S. Industrial Dr. East
Plainfield, IL 60585
ph (800) 248-8873
fx (815) 436-4460
www.specmeters.com

Collecting Data

Data points taken in the field can be divided into 3 main categories defined below:

Boundary Points: Measurements taken on the outer perimeter of the site being sampled (see **Map Boundary**, p. 2)

Interior Points: Measurements taken, often in a grid pattern, within the area being sampled. If doing an irrigation audit, the interior sampling pattern could be the same as one would use for placing catch can devices.

Sprinkler Head Locations (TDR meter only): Locations of sprinkler heads are identified by taking a reading with the TDR meter in air (VWC = 0%) just above the sprinkler. These points are not used when creating the two-dimensional contour plots.

Map Boundary

The chart generated by SpecMaps automatically draws a boundary around the field. Therefore, when sampling, it is strongly recommended that data points also be taken around the perimeter of the area being measured. There are 2 ways that these perimeter points can be incorporated into the data file.
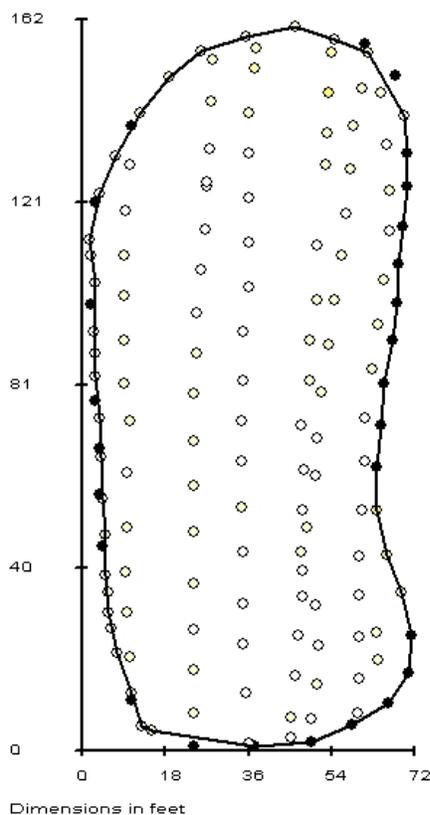

Dimensions in feet

Auto Generate option: Sample the field in any pattern you choose keeping in mind that points on the boundary must be sampled as well. The program creates a boundary based on the outermost points in the data file. This is the default format assumed by SpecMaps.

Pre-Measured option: Before sampling the interior of the area of interest, take readings along the perimeter of the site only. When finished collecting the boundary data points, begin data collection at the opposite end of the field. This method creates a cleaner boundary because the program will be given the points that lie on the boundary rather than being required to identify or compute them. This allows SpecMaps to distinguish between the two sets of data.

When uploading a file, you must identify which method was used to sample the perimeter (see **Uploading a Data File**, p. 3).

Figure 1. Plot showing locations of boundary (darkened circles) and interior (open circles) data points on a golf course putting green.

Uploading a Data File

Uploading and viewing data is initiated from the FILE screen. This screen is accessed by clicking on the FILE button on the SpecMaps toolbar. In the upper right portion of the screen is an **Upload File** button. Clicking this button will bring up the **Upload Spectrum Sensor File** screen (fig. 2). The screen's fields are described as follows:

Upload File - The browse button allows you to locate and select the Field Scout data file for which a chart will be generated.

Sensor Type - To create a map, SpecMaps must know what Field Scout meter was used to generate the data file. Click the arrow button to bring up the dropdown menu and select the appropriate meter type. This allows the correct color scheme and units to be applied to the chart. The SC900 Soil Compaction meter measures data points at multiple depths for a given geographic location. In this case, a specific depth must also be selected.
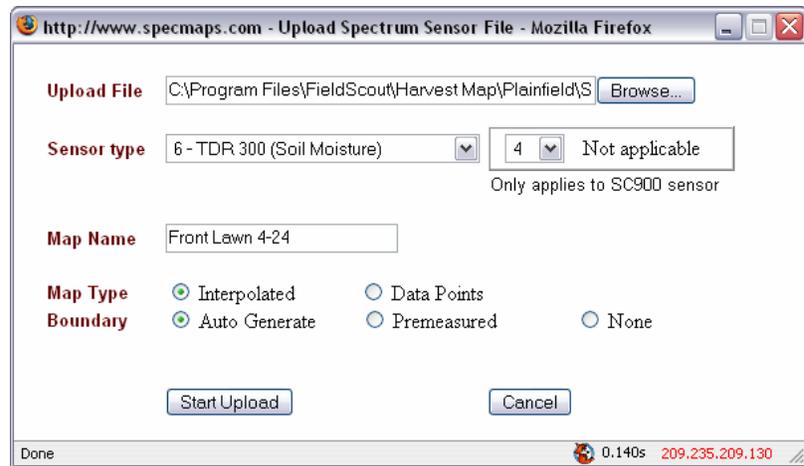

Figure 2. Upload Spectrum Sensor File

Map Name - The FILE screen identifies all maps by name. When uploading a file, a unique name must be given to the chart that will be created. The uniqueness of the name is relative to previous names you have used when uploading. The name will appear in the list of maps.

Map Type - SpecMaps can produce 2 types of graph. The **Interpolated** option uses statistical interpolation to create 2-dimensional contour maps. The **Data Points** option displays the data points alone with no smoothing of the data.

Boundary - Select the manner in which the boundary data was collected (see **Map Boundary**, p. 2). **Auto Generate** is the default option. If the **None** option is selected, the boundary will simply be the smallest possible rectangle that encloses all the data points.

The **Start Upload** button begins the process of creating the map. Once complete, a chart with the assigned name will appear in the FILE screen. If there is a problem, SpecMaps will generate an error message stating that there is a problem (see **Unable to Process Data**, p. 7). You will then be directed to Spectrum Technologies for support.

If you are uploading a TDR300 data file that includes sprinkler head locations, an additional screen will appear before the map is generated (see **Including Sprinkler Heads**, p. 4). This extra screen is used to input the radius of throw for each sprinkler.

IMPORTANT: The uploading of a sensor file is a multi-step automatic process. Those steps, along with their progress, will be indicated in the display. Do <u>not</u> close the display window. Upon completion of these steps, the progress window will close automatically, and the file page will be refreshed automatically with the newly uploaded file in the list.

SpecMaps is designed to work with Field Scout data files downloaded directly from a Field Scout meter. These files should be in comma-delimited text format If these data files have been manipulated, they may not upload properly into SpecMaps.

Including Sprinkler Heads (only available for maps created with TDR300 data)

Capturing Data: When generating a map of soil moisture data, it is possible to include the position and radius of throw of the sprinkler heads along with the contour plot. The sprinkler locations are captured by taking a reading with the rods completely in the air (thus giving a volumetric water content of 0%) just above each sprinkler head. The sprinkler head data points can be located anywhere in the data file. However, it is recommended that the sprinkler locations be taken before capturing the boundary points or at the very end of the sampling session. This makes it easier to troubleshoot bad data points that are due to poor GPS coverage or erroneous non-zero TDR300 readings.

Inputting Radius of Throw: If the software detects sprinkler locations in the data file, it will prompt the user to enter a radius of throw for each sprinkler in the order they were captured in the field (fig. 3). Each sprinkler will be identified on the contour plot with a letter (fig. 4). The letter begins with 'A' and continues through the alphabet with the first letter (a) being assigned to the first sprinkler head located, and letter B to the next and so forth. The location of the letter is based upon the actual GPS coordinates of the sprinkler head.
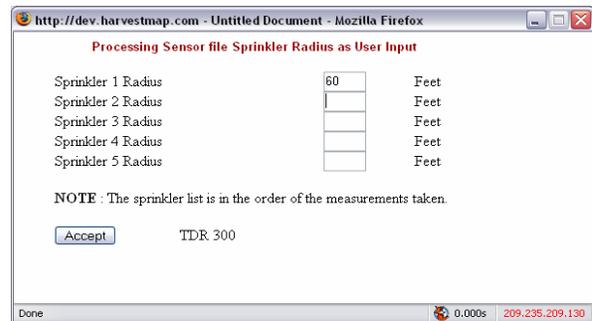

Figure 3. Sprinkler radius input screen

Maps with Sprinkler Head Locations Only: If it is desirable to place the sprinkler locations on the map but not the radii, simply enter a 0 for the sprinkler radius (fig. 5).
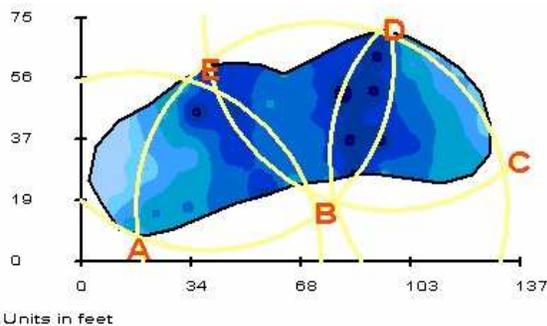

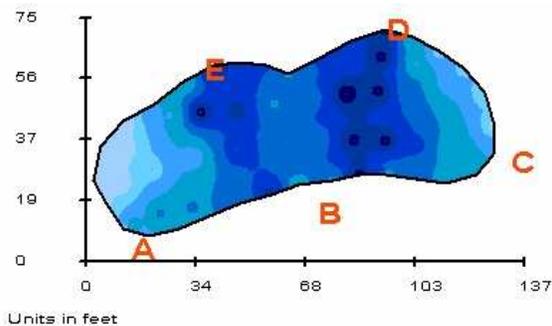Figure 4. Contour plot with sprinklers and throw radii

Figure 5. Contour plot with sprinklers only

4

Viewing an Existing Chart

All charts that have already been created can be accessed via the FILE screen (fig. 6). Relevant information about each chart is displayed in columns on this screen. A chart is selected and opened by clicking the map's name in the far left column.

The existing charts can be sorted by map name, meter type, upload filename or upload date by clicking on the respective column header. When sorted by upload date, the most recent date will appear first.

Figure 6. FILE screen

Deleting Maps

Maps can be deleted by clicking the **Delete Files** button on the FILE screen. This will bring up the **Delete Files** screen (fig. 7). Check the boxes for the maps you wish deleted and click the **Delete** button in the lower left corner of the screen.

Caution: Once the files are deleted, they cannot be retrieved.

Figure 7. Delete Files screen

SpecMaps Charts

When a chart is selected from the FILE screen (see **Viewing an Existing Chart**, p. 5), a new screen appears that contains the chart itself as well as some basic statistical information.

Chart
The chart itself is shown at the top of the screen (see fig. 8). The color scheme of the chart is pre-determined and is based on the type of meter that measured the data. The overall data range is divided into 8 sub-ranges. These sub-ranges as well as the number of data points in each sub-range is shown in the chart legend to the right of the chart itself. The dimensions of the field are shown on the chart axes. The latitude and longitude information does not appear on the chart. Some basic identification information about the map is given above the chart. SpecMaps also allows you the option of producing charts that display only the actual data points measured (fig. 9). This is useful for identifying the location of potential outliers.
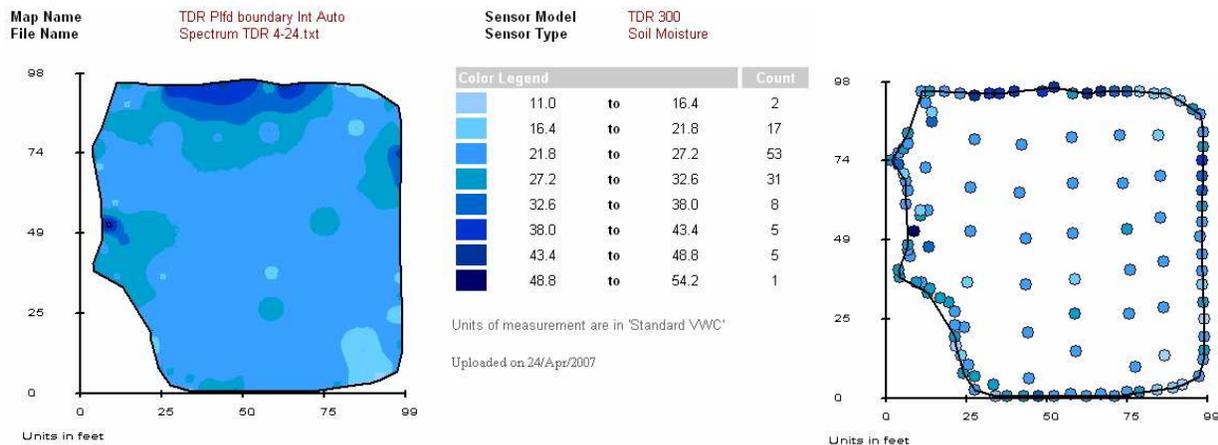
Figure 8. *Interpolated* map for a TDR 300 soil moisture meter

Figure 9. *Data Point* map of data used to produce map in figure 8

Statistical Information
The lower part of the chart screen has a table with the Distribution Uniformity (TDR data only), some basic statistical information, and a summary of the physical dimensions of the sampled area (fig. 10). A histogram is shown in the lower right corner. A histogram is a tool for visualizing which part of the complete data range comprises most of the data. This is the same type of information shown in the "Count" column of the chart legend.
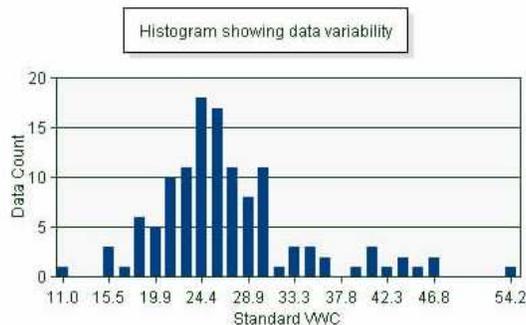
Figure 10. Measurement summary and histogram

6

Unable to Process Data

If SpecMaps is unable to successfully produce a chart from an uploaded data file, a warning message (figure 11) will appear asking you to contact Spectrum Technologies for technical support. Some of the more common sources of error are listed in this message.

- Bad latitude/longitude value. SpecMaps will not produce a chart if there are any data points located more than 5 miles from one another because this may indicate that the data file consists of multiple sites.

- Data point outside the expected range. SpecMaps has a pre-determined range of possible data values for each meter type. A chart will not be produced if a data point lies outside this range. This error could occur if the wrong meter type is selected when uploading a file.

- Inconsistency in the measurement units. This error would most likely occur with the EC and TDR meters. These meters not only report a value of the measurement but the units as well. Further, the EC meter has an auto-ranging feature that causes it to transition between units of microsiemens to millisiemens depending on the salinity of the sample. In these cases, the data file must be manually corrected so a graph can be constructed.
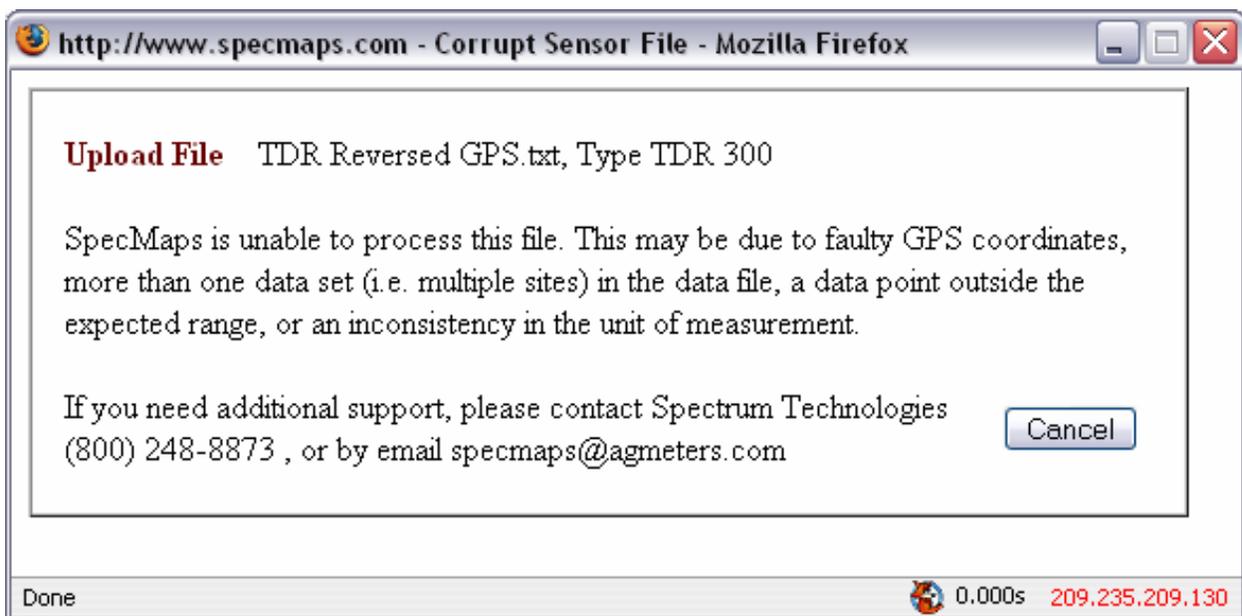

Figure 11: SpecMaps Error Message

Distribution Uniformity

In the measurement summary for maps generated from TDR300 data, SpecMaps ProTurf includes a computation of the lower quartile distribution uniformity (DU_{LQ}). This term is used when reporting the results of an irrigation audit. Commonly, the calculation is commonly done with water collected in catch cans laid out in the area being irrigated. The DU_{LQ} is the average of the lowest 1/4 of the catch can volumes divided by the overall average of all catch can volumes. The process is detailed in the **Certified Golf Irrigation Auditor** and **Certified Landscape Irrigation Auditor** manuals available from the Irrigation Association.

A similar process is followed by SpecMaps to compute the DU_{LQ} of the soil moisture data. The data is ranked from lowest to highest soil moisture content. The average of the lowest quarter of readings is divided by the overall average. The result is presented as a percent. The value of this calculation, compared to the catch can DU_{LQ}, is that it is a measure of water in the soil profile as opposed to water applied to the turf surface. Factors such as compaction, thatch, slope, and moisture re-distribution can cause the variability pattern to be very different between the application (catch can) and soil moisture measurements. The following example illustrates how the DU_{LQ} computation would be performed manually.

<u>Example</u>

Figure 12 shows the results of a typical grid sampling. Values in the circles are volumetric water content percentages. This data is then transferred to a spreadsheet (fig. 13) and ranked from lowest to highest values.

<u>Calculations</u>:
Overall average of all 28 readings = **27.75%**.
Average of lowest quarter of readings (7 readings) = **24.57%**

$DU_{LQ} = 100 * (24.57 / 27.75) = \underline{\textbf{88.54\%}}$

23	29	30	32
23	29	30	32
24	29	30	34
24	29	32	34
27	29	32	37
27	30	32	37
27	30	32	39

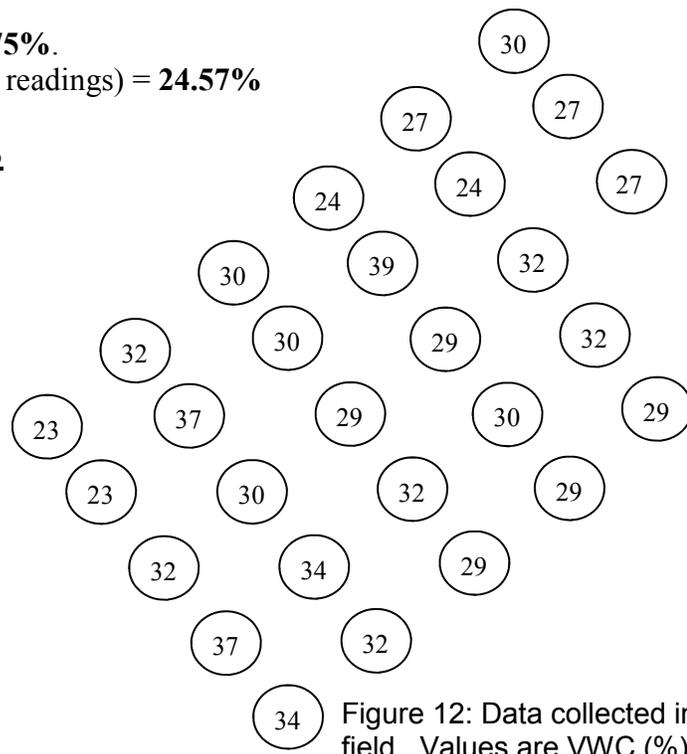Figure 13: Data from fig. 12
ranked from lowest to highest

Figure 12: Data collected in field. Values are VWC (%).