



Wind *PRO*

Chapter 2 BASIS

2. WindPRO BASIS

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2.0 BASIS – Intro, files, step-by-step guide etc.

2.0.1 Introduction to WindPRO BASIS

The WindPRO BASIS module is, as the name implies, the basis for all WindPRO calculation modules. With BASIS you have access to create a project, which typically consists of background maps and WTGs positioned on the map. Also, most of the other objects such as digital height contour lines, neighbors for noise calculations, etc., can be established from the BASIS module. In addition, the WTG Catalogue is managed through the BASIS module.

Enter all relevant information for a given wind energy project in BASIS, and use the WTG Catalogue to get detailed technical information for most of the wind turbines on the market and for adding new turbines to the Catalogue, e.g. for documentation and comparison purposes.

The calculations you can carry out depend upon which WindPRO calculation modules you have purchased. Non-activated modules can operate in DEMO mode, which means that you can input data, print reports (e.g. from the samples), but not calculate.

In the folder WindPRO Data\samples, some examples are included from which reports can be printed.

2.0.1.1 Conversion of WindPRO-2.5 or previous projects – new 2.6 data structure

If you have old projects saved from WindPRO 2.5 version or previous, these will be converted from .w2p to .w3p project files. please contact EMD.

The data management system is going through a comprehensive revision.

The first step of a long-term revision plan is taken in v2.6. The main idea is to use a more modularized structure, improving program efficiency. At a later stage, this modularization will make it possible for other software to interface to any part of the WindPRO project data.

When fully implemented, this will allow the creation of a RESTORE function (e.g. in the case of a power failure or “crash”), which is already partly implemented (mainly for the Meteo data object). Finally, the new structure will open up new features in upcoming updates like “revision history”, an undo function etc.

For now, the user will see following:

When opening a v2.5 project (.w2p) first time, it will take a little longer – especially if there are a lot of Meteo data objects - these must be converted into a new format.

When saving, the file format will automatically be w3p, meaning that you do not overwrite your v2.5 project from v2.6.

With the “Save As” option on the Main Menu | Project Menu, users can decide to save a project as .w2p (v2.0 – v2.5 format) in case they are sending the project file to someone running an older version of WindPRO.

If users choose to export the project, the exported project will be in the new .w3e format, BUT, if you first “Save As” .w2p, and THEN export; it will be in .w2e format. Exporting or saving to w2p/w2e formats will not include Meteo data objects due to the complete change in the Meteo object data structure. To save as .w2p the user must add the .w2p extension manually to the filename – it does not appear as a drop-down option.

2.0.1.2 File type overview

The WindPRO-2 data files:

In the folder \WindPRO Data\Projects\...

*.w3p – WindPRO-2.6 and later project file – holds data stored in objects, plus calculation reports and links to files. For objects with larger data amounts, the data is stored in separate files to speed up the data handling and keep the project file size down. The user wont “see” these files.

*.~w3p – backup of WindPRO-2.6 a later project file – is made when you save an opened project and is a backup of the opened project. This gives you the opportunity to revert to the original project file if you make

serious mistakes (delete or change data) or if your PC or software should "break down" during the saving process and damage your project file.

*.w2p – WindPRO-2.0 – 2.5 project file – holds all data stored in objects, plus calculation reports and links to files.

*.~w2p – backup of WindPRO-2 project file – is made when you save an opened project and is a backup of the opened project. This gives you the opportunity to revert to the original project file if you make serious mistakes (delete or change data) or if your PC or software should "break down" during the saving process and damage your project file.

*.wpe – WindPRO-1 export file – during export you can select which data to be included in the file (e.g. bitmap maps).

*.w2e – WindPRO-2.0 – 2.5 export file - during export you can select which data to be included in the file (e.g. bitmap maps).

*.w3e – WindPRO-2.6 and later export file - during export you can select which data to be included in the file (e.g. bitmap maps).

*.bmi - Binary map info. Coordinate settings for user-defined maps. When a local coordinate system is used, it can be imported to another project from a BMI file.

*.bx Bitmap maps with coordinates defined in a BMI file. In the current version the files are saved in a PCX format but this can be changed later. "x" is the file number, starting with "0" for the first one.

*.wpo – Digitized lines from Line Object – holds height contour or roughness lines plus a digital elevation model (Triangular Irregular Network (TIN)).

*.w2r – WindPRO regions – digitized polygons from Area Objects.

*.lty - Landscape types for WindPRO Area Object. (The landscape types are included in the .w2r files, but the .lty files makes it possible to exchange the definitions with other .w2r objects).

External file types (data from other sources), used with WindPRO:

*.map – WAsP map file format for digitized height contour and/or roughness lines

*.rsf – WAsP Wind Resource Map

In the folder \WindPRO Data\Standards

*.wmi – meteo import filter .

*.wbs – WINDBANK input file (template or complete input data file for economy calculation).

*.wsh – Solar and/or wind distribution for SHADOW calculation.

*.wpc – WindPRO color setting.

*.lty – Landscape types – can be used from Area Object to import/export predefined landscape types from one Area Object to another.

*.wti – Wind Time variation file to use for time varying AEP calculations and loss calculations. There will be some example files included that can be used.

In the folder \WindPRO Data\Windstatistics

*.wws – WindPRO Wind Statistics. Binary equivalent to LIB files, in addition to the Wind Statistics information, it contains information about country, coordinates, creation time, source, elevation, height and other info on the basis for the wind statistic. Also user comments written when the wind statistic is saved are included. File type can be locked so a license key is required to use the file (see Chapter 3).

*.LIB – Wind Statistics in Risoe's WAsP format (when saved from WindPRO, coordinate information is included) (see Chapter 3).

In the folder C:\WindPRO Data\WTG data

*.wtg – Wind turbine file – holds all relevant data of a specific WTG type, defined from manufacturer, type-designation, kW_{nom} - kW_{small} , Rotor diameter and Tower type. A typical name: **VESTAS V66 1650-300 66.0 IO!.wtg**, Where "IO!" means tubular tower and "I#" means lattice tower and "I3!" mean 3-leg tower and lastly "I-!" means unknown or other tower type. All information is integrated in a file, which is flexible to hold more different sets of e.g. power curves, noise data etc. In the .wtg files from EMD, the power curves etc. are integrated in the .wtg file. If the user adds some data, these will be placed in a separate file so an update from EMD can update previous data without destroying the user added data.

*.uwt – User-defined wind turbine file, which holds additional data to the .wtg file, added by the user. Note: The .uwt file only works together with a .wtg file with exactly the same name. If you want to send wtg data to another user, BOTH files must be copied.

Other relevant file formats:

*.shp – Shape file (from Arc View GIS software) – polygons, which can be used as an overlay map in the Project Explorer and later on imported in the Area Object or added as background map. Samples can be found in **C:\WindPRO Data\Globe**

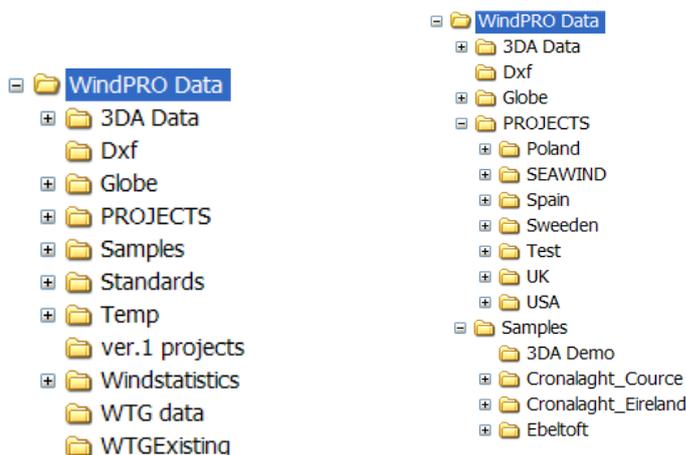
*.dxf – Auto desk exchange file format (Auto Cad) – can be digitized height contour lines, which can be imported in the Line Object or drawings of e.g. high voltage mast or lattice WTG-towers, which can be used for visualization purposes.

*.ntf – From the UK Ordinance Survey, digitized height contour lines can be imported in the Line Object.

2.0.1.3 Proposed way to organize data

We recommend that you create a folder in \WindPRO Data\projects\ for each new project (or group of projects in same region). In this folder, the project file (*.w2p) is stored as well as the local bitmap maps, digitized files, e.g. height contour maps, measured wind data, generated Wind Statistics, photos for visualization, site specific WTG-types etc. Hereafter it's always possible to have all data in the same folder, which makes backup of a complete project or handing over a complete project to other WindPRO-2 users easy.

Below on the left, the structure of default sub-folders to WindPRO Data is shown. To the right, the sub folder PROJECTS is expanded with an example grouping project sub-folders by country. If you only work in one country, other substructures might be better, depending upon how many projects you expect to handle. If only a few, each project should just have a folder with the project name.



For Wind Statistics and WTG-types that you might use for other projects, it's recommended to store a copy in the folders:

WindPRO Data\WTG Data
WindPRO Data\Windstatistics

If you are connected to a server and need to have files there for sharing of data with other employees, you simply create a folder on the server and add this folder to your Project Browser (and WTG and Wind Statistics

Browsers). This folder should have exactly the same structure as the one described above, which makes it easier, e.g. when you want to move projects from the server to your local PC or Laptop for travelling.

Note: In the WindPRO project file (*.w3p), all files, which cannot be found in the original folder will be searched for and, when found, replaced automatically in the actual project folder or sub-folder to this (working directory).

The mentioned rules of addressing files means that links to data (for example folders with WTG Data or wind statistics) will be replaced with links on the new PC if project files are moved from one PC to another.

If you always want to use WTG Data from a common server, make sure that only a search path for this is specified in the WTG Explorer.

To be completely sure that you are working with exactly the same files as your colleague, but from another PC, make an export file (from menu files|export) with all files included and open them from your own PC, or work directly with the project files placed on a common server version.

2.0.2 Recommended auxiliary hardware and software

HARDWARE

PC	Min.: 1 GHz Pentium, 1 GB RAM, 2 GB HD free space. Recommended: minimum: 2 GHz processor, 4 GB RAM, 5 GB HD free space. 3D accelerated graphic card required for the 3D-Animator
Scanner	If you don't have access to digital map sources, you will need a scanner to integrate background maps in WindPRO. An average to high quality scanner is recommended, as in low-cost solutions, deformations are likely to occur. For scanning large paper maps an A1-A0 drum scanner is ultimate, but if seldom used it will be cheaper to get this as external service.
Digital camera	For photomontages or just in general for documentation of the site a digital camera is a must. 2 Mpixel or more is preferable for visualization of WTGs. Knowledge of the exact focal length of the lens in 35 mm film equivalent is important – if the camera has zoom lens, it is an advantage to use the known min/max zoom, which then not should be too extreme. E.g. 35 – 70 mm (35mm equivalent) can be used in most tasks. Round 45 mm is closest to the human eye's "focal length" and preferred by many as "fixed lens". Most digital cameras stores EXIF info in the picture files, which is very usefully for photomontage use. The Camera object in WindPRO reads this information and you thereby get like date-time and focal length automatically loaded from photo. Some of the latest cameras store GPS coordinates for the photo position and even the direction the photo is taken. This makes it even easier to make a photomontage with WindPRO.
GPS	A useful device for acquiring coordinates of objects (e.g. Existing WTGs, Measuring mast positions, Photographers' positions) in fieldwork. Expensive models can offer increased accuracy (0.1m), but might need additional references (differential GPS) where "standard models" has round 10m, which in most cases are sufficient. Cable to transfer data to PC is very useful if many GPS points are logged in field.

SOFTWARE

WASP version 4 or 5 (DOS); or from ver. 6 and higher (Windows)	Energy calculation engine used by WindPRO for calculations on complex terrain – so far the only real difference in WASP versions used from WindPRO is the calculation speed and the size of digital contour data they can handle (last one is very limited in WASP 4). The DOS versions are
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	no longer recommended while they require some complicated installations via DOS-BOX to run in later Windows versions (XP, Vista, Win7). There are some differences from WAsP 9 to later versions, see separate notes on this topic at EMD Helpdesk. The page can be opened from WindPRO menu "Help – FAQ (Internet)".
Paint Shop Pro (preferably version 5.01 or newer)	Very powerful graphic tool for preparing scanned maps or digital photos for use in WindPRO. You can, e.g., use Paint Shop Pro (PSP) to delete already existing WTGs on photos, if you wish to repower an existing project (use the "Clone" function to copy the landscape on top of the existing WTGs).
Adobe Reader / Adobe Acrobat	To be able to read/view "PDF-files" it is a must on any PC to-day, this requires the free downloadable Adobe Reader – WindPRO also can save reports as .pdf. But being able to manipulate .pdf files like merging more files, have pdf as a standard printer etc. requires the extended version called Adobe Acrobat. But there are many different products within this field to-day, so search the web to find your needs. Installing a PDF printer is extremely convenient, while you then can print all reports as .pdf documents. There are free tools available for this purpose.

For some purposes, additional software will be required such as the WAsP software for energy calculation in complex terrain.

2.0.4 Getting started – language selection, etc.

To start WindPRO, click on the START button and then find "All Programs" and then the EMD subdirectory (if defaults are used when installing) and then WindPRO-2.x language selection.

WindPRO 2.x – let you select language when starting (if more language modules are purchased). To start with a specific language, just click on the flag.



2.0.4.1 Printing language

From WindPRO version 2.4 a new feature is available, printing reports in another language than you are working in. To use this feature it requires a Print Language module. See in the start menu (shown above) which languages are available.

2.0.5 Step-by-step Guide for creating a basic project

Ensure that you have relevant maps scanned in a proper resolution (or have them as digital files) and read which coordinate system the maps are drawn with. If the system is unknown by WindPRO, you might design an approximate system or work with local coordinates. **Alternative/supplement to scanned maps is the maps you can get from the On-line data service.**

Create a new project, typically from the Project Manager, by marking the approximate site location on globe. Fill in project properties with a relevant coordinate system and attach maps (define maps from "MAPDEF" button if maps are not yet set with coordinates.) EXIT project properties with "OK".

Push Map-button from the main menu and load relevant maps from the map buttons.

Start (typically) by entering height contour information using the Line Object.

Create relevant objects depending on which calculations you wish to perform. Read the relevant parts of the manual for a specific calculation. Follow the step-by-step guide for the desired calculation.

Go to the calculation menu, when the necessary objects have been established.

Perform the calculation and print the reports.

2.0.6 Auto save / recovery and save as older versions

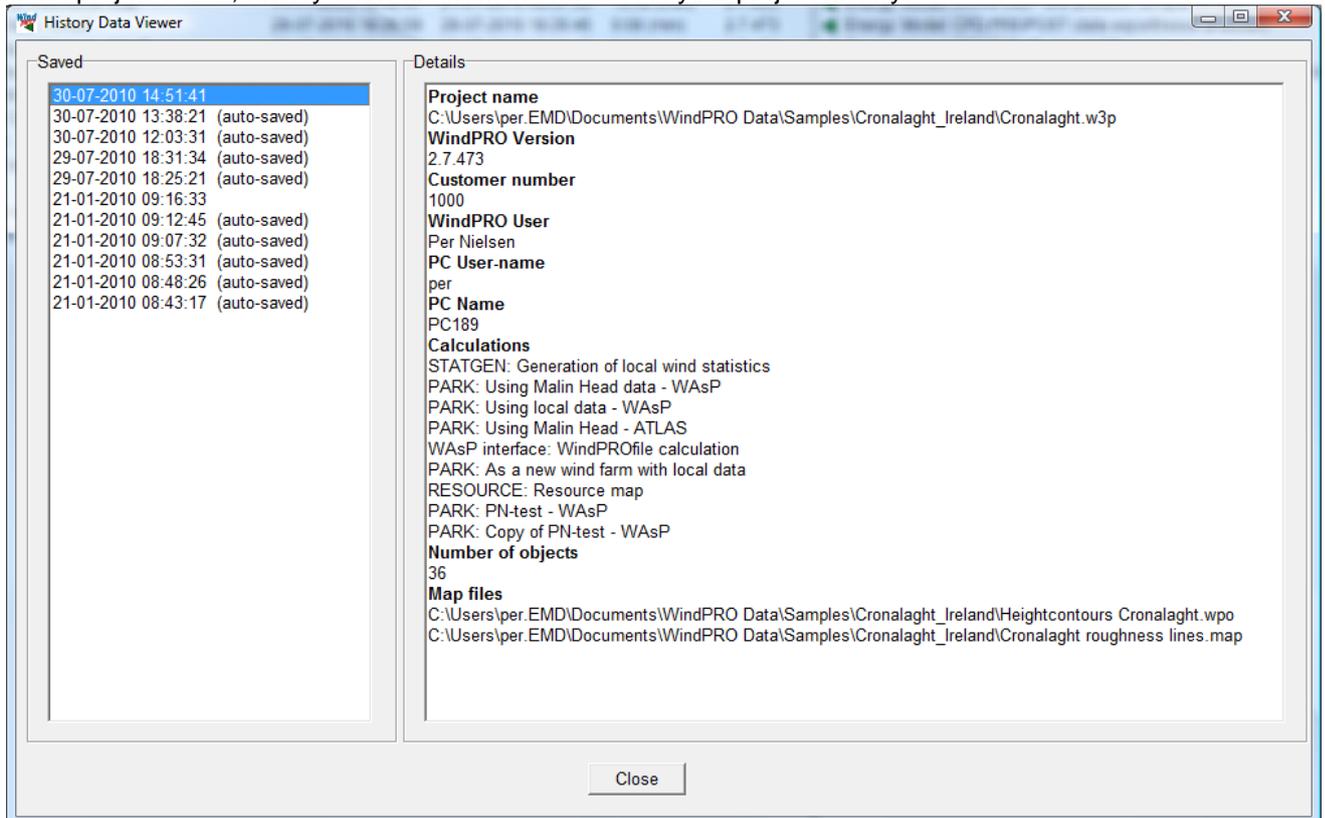
There is an automatic auto save feature. This runs each time a calculation is performed and by several other events. It is "intelligent" so it check how long time last auto save did run, if less than 3 minutes it won't run and

thereby it disturb as little as possible. If the software or the PC crashes, a restart of WindPRO will start asking if you want to open the recover file.

You can from the “save as” choose to save as version 2.5 or later – this makes it possible to open a project in older versions if needed. Simply chose the file format in the “save as type” drop down box in the save as dialogue.

2.0.7 The WindPRO history log

In the project menu, history show different information of your project history.

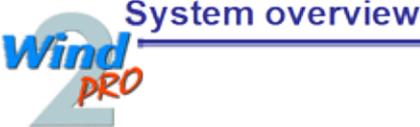


This can be used to identify which changes/calculations you made when.

2.1 BASIS - The structure of WindPRO

2.1.1 WindPRO structure – System overview

C:\Documents and Settings\Per.EMDDOMMY\Documents\KURSUS\WindPRO_system_overview2.4.xls\System Overview

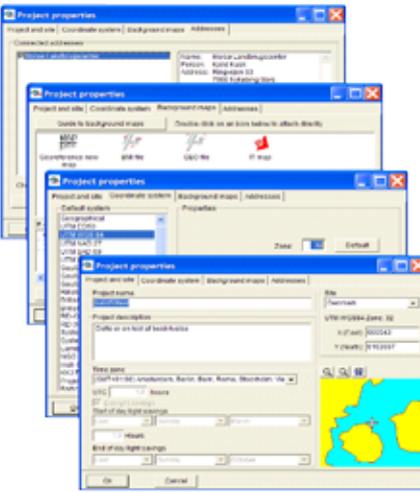


System overview

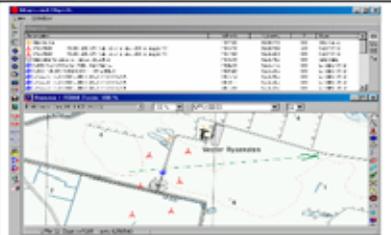
Project explorer
(Globe and list with advanced sorting)



Project Properties
Basic settings: Customer, coordinate system, Maps !



Maps and Objects
(Working space)



WindPRO data:

- WTG Data
- Windstatistics
- Predefined Standards

Objects:

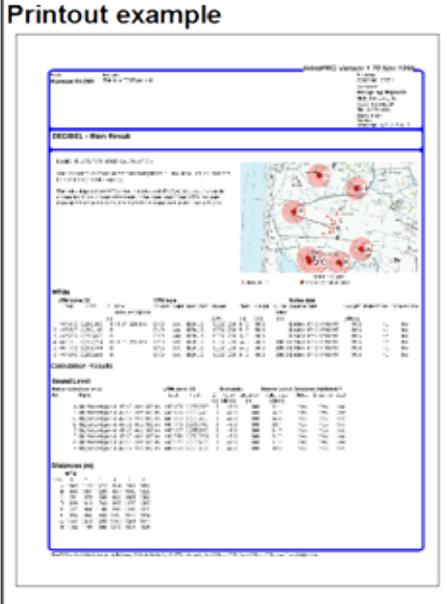
- New WTG
- Existing WTG
- Park Layout (Only with Optimize)
- Site data (energy)
- Meteo data (energy)
- Noise Sens. Area (decibel)
- Obstacle (energy)
- Camera (visual)
- Control mark (visual)
- Shadow receptor (flicker)
- Line object (height/roughness)
- 3D-object (visual)
- Area object (ZVI, roughness etc.)
- Result layer (Resource map etc.)
- WTG area (optimize, WindPlan)
- Text
- Virtual Reality (3D Animation)
- Measure tool
- Shape tool (Also for Gridlines on map)

Calculation modules
(Main menu)



Reports - ready for customer.

Printout example



Input to the program is given in the following menu items:

Project Properties, where the general project information is entered (name, client, coordinate system and any associated maps).

Maps and Objects, where the specific conditions for the project are entered (wind turbine positions, wind turbine type, information on calculation of wind conditions, noise conditions, etc., depending upon the type of calculation desired).

Calculation modules. When a calculation module is activated you can restrict the calculation to selected objects from the object/map list. You are also given various choices, e.g. which calculation module to select when more than one calculation module can be used.

The five icons shown below indicate the shortcuts to input of information:

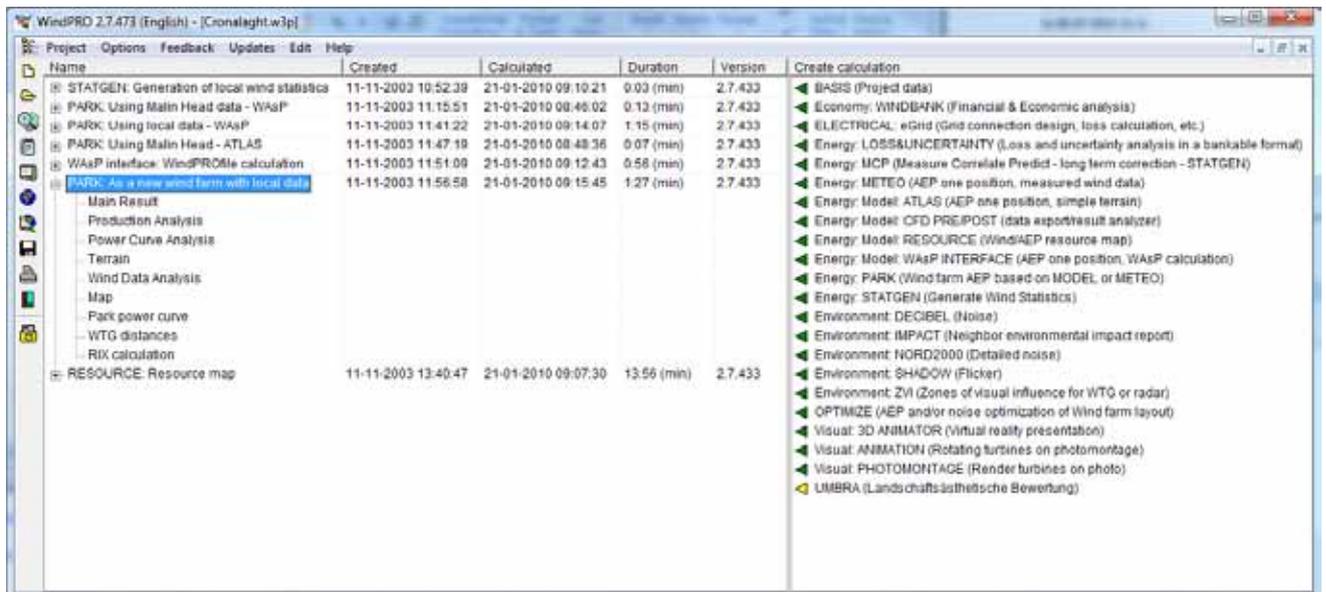
-  Project Properties
-  Objects (coordinates and object description, e.g. for the wind turbines)
-  Maps (graphic viewing of background map and entering of objects)
-  Maps and Objects (both the map and Object Lists are shown on screen)
-  Calculation (menu with calculation modules)

Calculations and outputs are carried out in the last item.

2.1.2 WindPRO structure – Calculation and report window

Calculation output (in the form of reports) is stored in WindPRO. If a printout of an earlier calculation is needed, you just have to open the project in question and print out the needed reports without having to rerun the calculations.

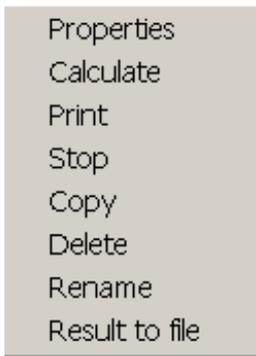
The output is arranged in a tree structure similar to the Windows Explorer. It gives you a good overview of the calculations carried out. This tree structure is shown on the calculation icon button.



When a calculation has finished, the window shown above will appear, listing the available reports that can be printed.

There will be info columns telling when calculation was created, last calculated, the duration and with which version.

A sub-level report will automatically pop up on the screen if you double-click on a sub-level report name. The sub-level report has its own right-click options, where you can define report details. When you right-click on the calculation header or on one of the calculation reports, you get access to this menu:



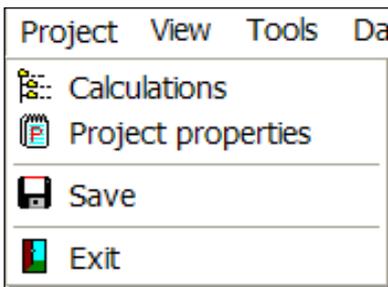
Choosing “print” gives access to setup all report features that can be modified.

The Result to file allow for saving some results in other formats, e.g. copy to clipboard and then paste to excel or save results as text files. Some graphic outputs, like iso noise lines, can be saved as shape files.

2.1.3 WindPRO structure – Menus in maps and objects

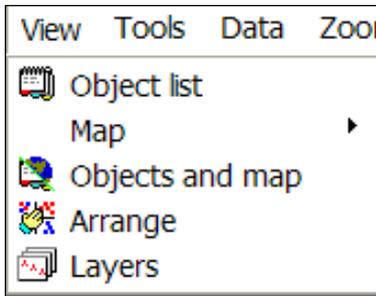
In this section, an overview of the menus is given. Note that by pressing the <Alt> key (if activated in your windows setup), all menus can be activated from the keyboard by pressing the underlined letter when the <Alt> key is held down.

2.1.3.1 Project



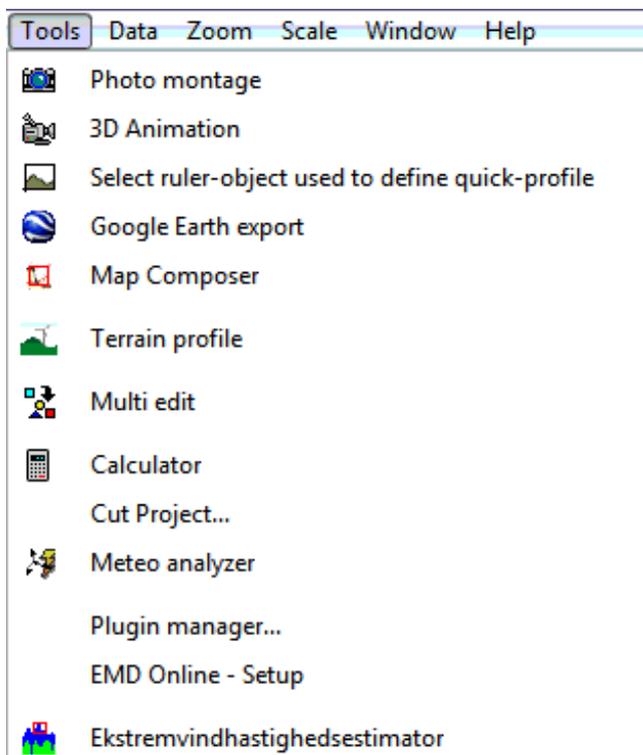
Direct links to the main functions – note that the “Save as” function is only available from the WindPRO main menu.

2.1.3.2 View



The Layer structure is very useful for organizing your objects. You can save a preferred layer structure and load it in other projects by right-click at the layer form. The layer form can be docked into the main window.

2.1.3.3 Tools



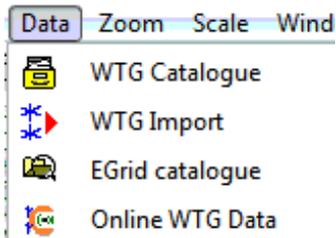
The first 2 tools (Photomontage and 3D Animation) require a license for full use.

The “Cut project” tool makes it possible to delete all data outside a given area. If you import a large amount of GIS data or height data from other sources and only wish to work on a limited part, this is an easy way to get rid of many different types of unwanted data in one operation.

The Plugin manager is more an “internal tool” that can be used to disable some services if unexpected errors occurs.

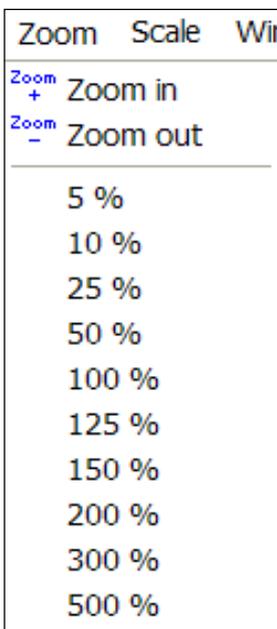
The other tools are explained in other parts of the manual.

2.1.3.4 Data



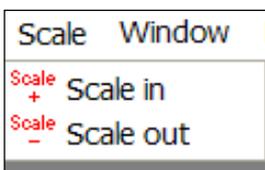
“WTG import” is for importing existing WTGs from a file prepared for this purpose. This file can be purchased for Denmark with all WTGs in Denmark, including estimated long-term production figures for each WTG. This feature are from version 2.7 replaced with Online WTG data, and the WTG import will be removed from ver. 2.8. Only by accessing via the online option give access to updated data.

2.1.3.5 Zoom



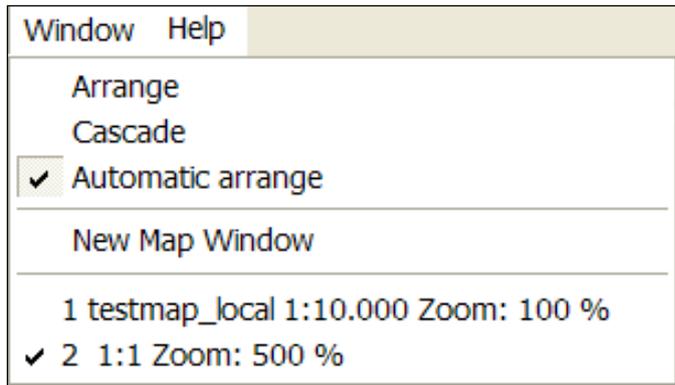
By right-clicking on map and choosing “Map-> Set zoom and scale” full free definition of the zoom factor can be chosen.

2.1.3.6 Scale



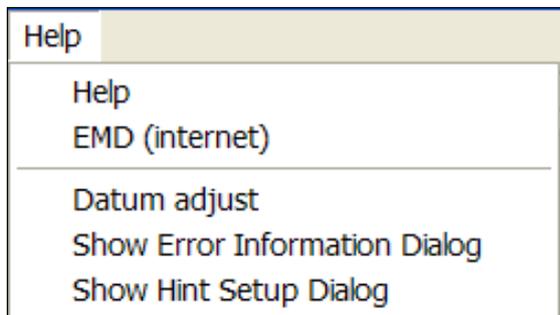
“Scale in” and “Scale out” only work with the .it map (Denmark) format holding more map scales in one file structure. More formats might be supported in future.

2.1.3.7 Window



Standard Windows-arrange functions

2.1.3.8 Help



“Datum adjust” is used for correcting errors in map datums (mainly caused by reopening old WindPRO project versions).

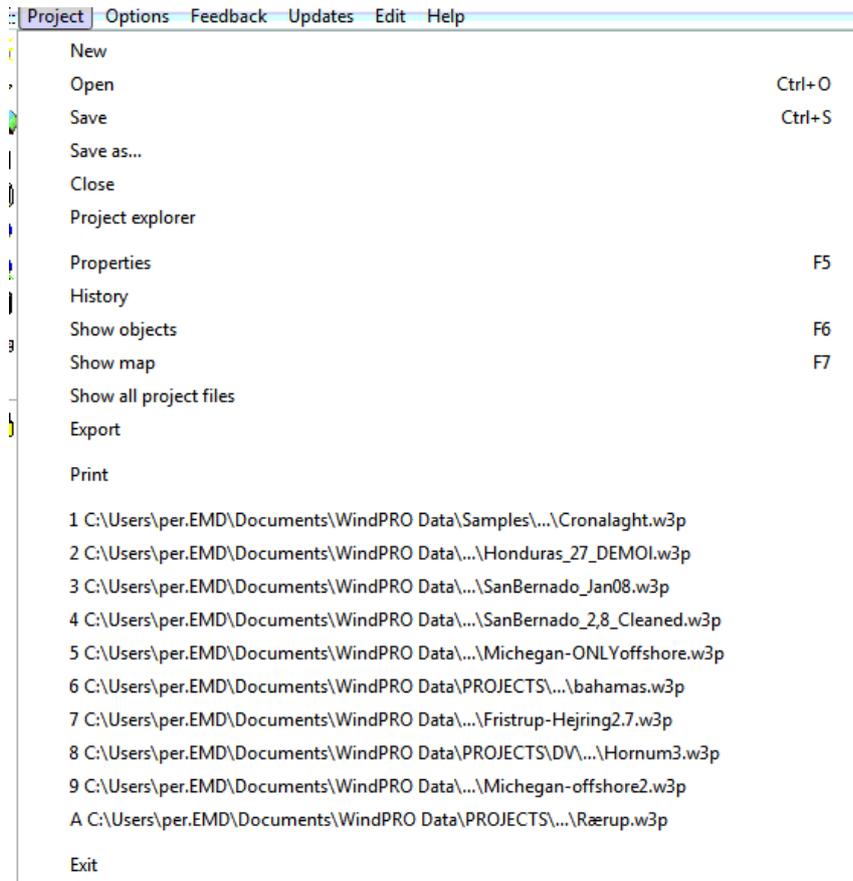
2.2 BASIS - General functions, setup and help

2.2.0 Introduction to general functions and setup



Below you will find a description of the main features, which can be found in the menu boxes under Project, Options, Feedback and Help, shown in the top menu bar shown above. In addition, you can work with the "Project Explorer", which is described in the next Section 2.3, and which will appear as the start screen unless you have deselected this option.

2.2.1 Project menu



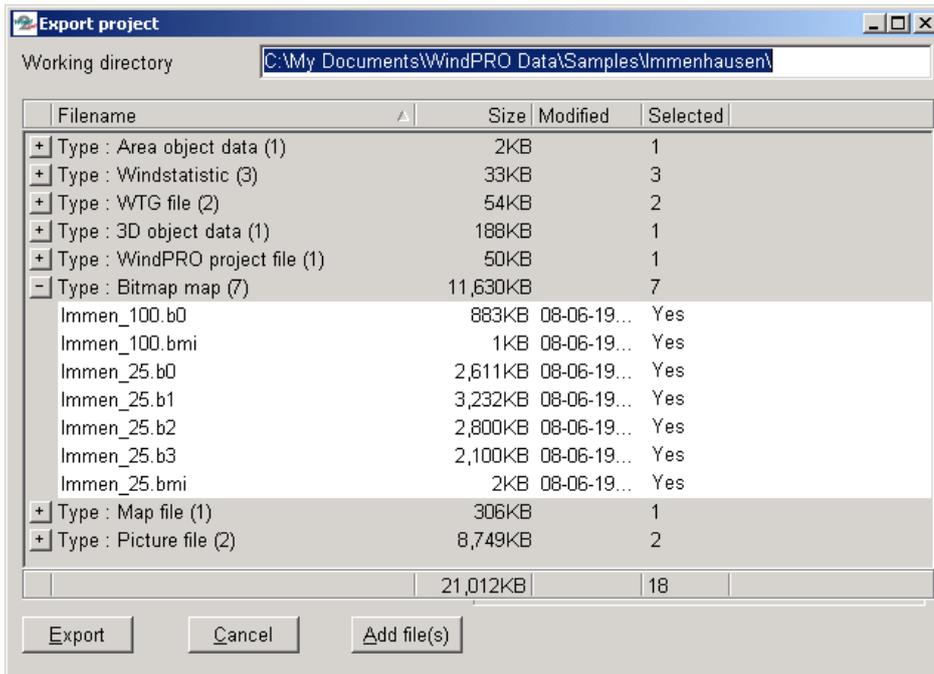
The project menu is used for "normal" navigation purposes known from other Windows software products. Below some details are explained.

2.2.1.1 Show all project files

Creates a list with all files used in current project and their locations.

2.2.1.2 Exporting WindPRO data

The export function is used when you want to copy project information from one PC to another or create complete backup packages. Since the data is structured in files, a "normal" copy with the Explorer can be used, but then you will have to make sure that all files needed by the receiver are included and that the files are placed in same folder structure. Otherwise, you have to re-link bitmap maps, Line Object files, etc. With the export function, you can let WindPRO organize what should be included, and all data will be packed into one file ready to be opened from another WindPRO-2 application with updated links.



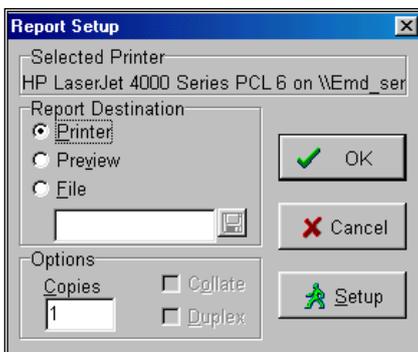
In the window shown above you can see how WindPRO lists all the relevant files for the export file. At this point, files can be deselected in order to reduce the export file size or to exclude information from the export file.

Simply expand the type of data and double-click on the file you want to select or deselect. Then click on "Export".

In addition to those files suggested by WindPRO, you can also add files into the export from the "Add file(s)" button (before exporting).

2.2.1.3 Printer Setup

By selecting the Print option you gain access to changing the printer settings, including the printer type. When defining the printer setup, the configuration will be stored as the default printer in WindPRO. However, you can always change the printer setup during printing by clicking on the Setup button. Printing functions will not be enabled for all parts of the program.



Note, that if you have Adobe Writer, and installed the PDF writer, you can let WindPRO print a complete report directly to a PDF file, ready to attach to an email or presentation on your web site. A PDF file can also be made directly from the WindPRO preview page from the "Save as" option.

2.2.2 Options

Options | Feedback | Updates | Edit

- Options
- License activation
- Deactivate all modules
- Show activation statistics
- Show detailed module status
- Default directories
- Use project explorer

The menu item “Options” gives access to defining or changing a range of settings, which typically need to be set only once. This menu item is continuously updated as new functions are added.

If you don’t want to use the Project Explorer (see Section 2.3.1), you can deselect here.

2.2.2.1 Options – User Reference in printouts

Options

User | WAsP | Maps | Modules | Misc. | File dialogs | Report logo

Licensed to:
EMD International A/S
Niels Jernesvej 10
DK-9220 Aalborg Ø
+45 9635 4444

User name / E-mail address / Custom user ID	Show in reports
Per Nielsen *	<input checked="" type="checkbox"/>
pn@emd.dk *	<input checked="" type="checkbox"/>
Testing	<input type="checkbox"/>

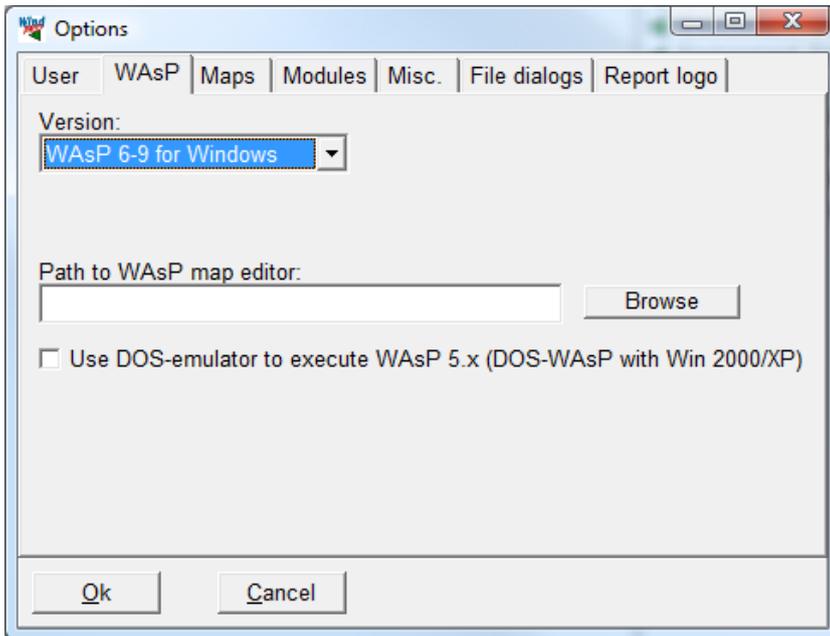
*) Read only, taken from the activation

Preview

Ok Cancel

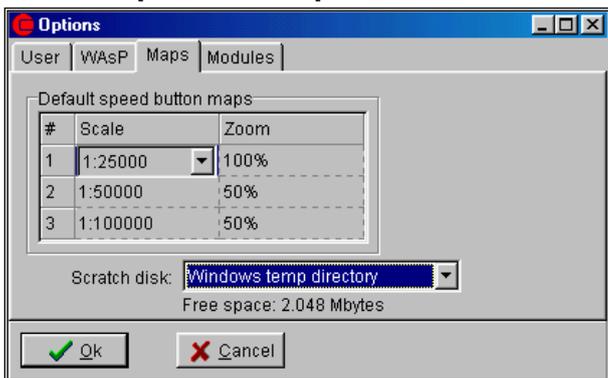
Here the name of the person and email address are from the activation (License) – it can be checked which lines shall be shown in reports. An additional line is available for e.g. department name.

2.2.2.2 Options – WAsP Setup



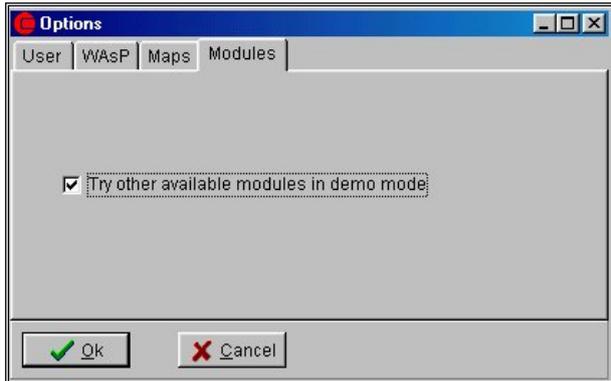
If the WAsP program from RISOE is used by one of the energy calculation modules, the version of the program and, if using the DOS version, also the path to the WAsP program, must be entered here. Note also that the WAsP Map editor (WAsP 7) can be configured for use (this is no longer relevant since the EMD editor now provides most of the functions available in the WAsP MAP editor and much more). In order to make sure that you have the correct interface between WindPRO and WAsP, see new releases on our web site www.emd.dk. New from version 2.5, is the DOS emulator that makes it possible to run DOS WAsP version 5 from Windows 2000 or XP.

2.2.2.3 Options – Maps



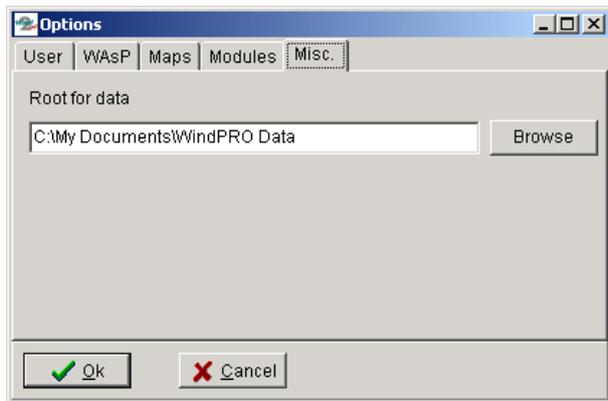
The default settings for the three map-reader shortcut icons are entered. This item is especially relevant when using maps from a CD-ROM, containing maps with different scales. The setup is also relevant with regard to the systematic use of .BMI files. The "#" symbol refers to the icon number. A click on icon #1 in the settings (shown above) will render the map in a scale of 1:25,000 with zoom 100%. A click on icon #2 will render the same area in a scale of 1:50,000 with zoom 50%, etc.

2.2.2.4 Options – Non-licensed modules in DEMO mode



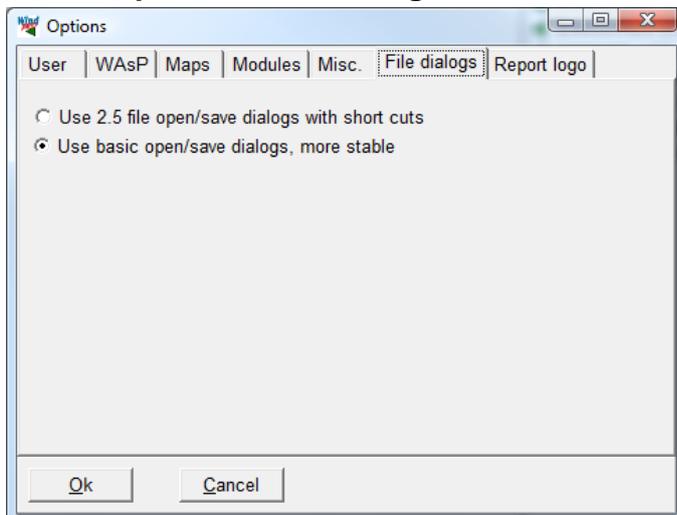
You can choose whether you wish to work with only those modules for which you have purchased a license, or if you wish also to have access to the DEMO versions of the other modules. The option of deselecting the DEMO modules has been included in order for you to get a better overview of your licensed modules when using WindPRO for specific purposes only, e.g. visualizations.

2.2.2.5 Options – Misc. Path for WindPRO Data



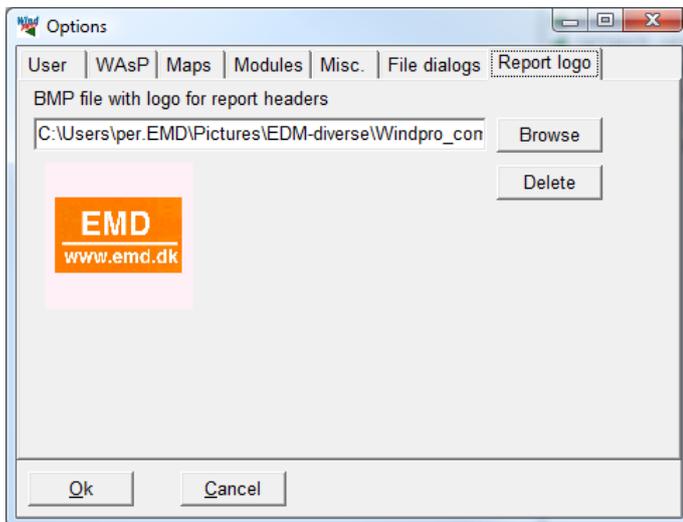
The root for your WindPRO data gives WindPRO information on where the default file location is for storing new projects, and where to search for projects, data etc.

2.2.2.6 Options – File dialogs



Older version had a more refined open/save dialog control, but with the more recent versions of Windows the needs for this seem no longer relevant, then it is better to get used to the Windows dialogue controls.

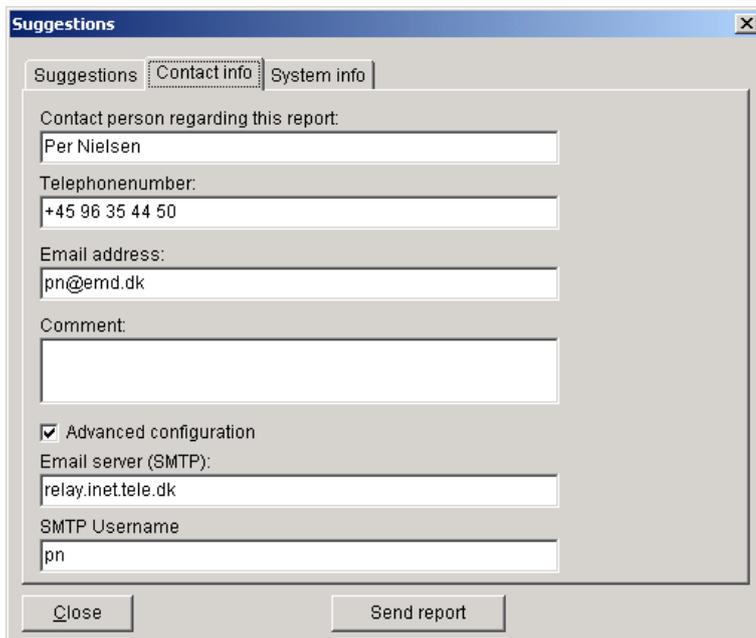
2.2.2.7 Options – Report logo



A company logo can be included which will appear on all reports.

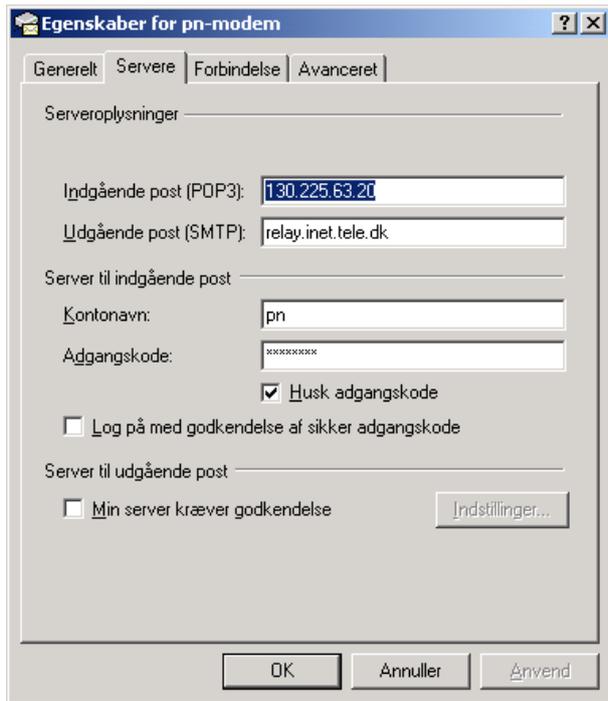
2.2.3 Feedback

The feedback option, gives us the chance to make WindPRO even better.



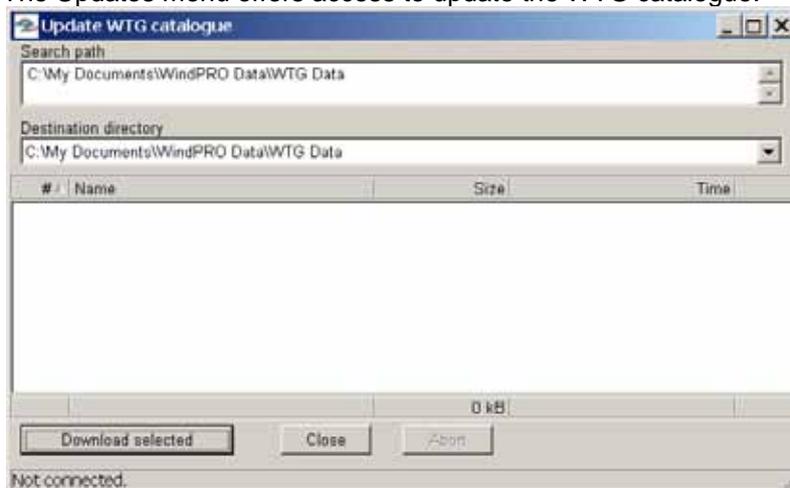
You can send suggestions as well as error reports. In both cases, when sending by email, you have to set up your server connection. This is done in the "Advanced configuration", where you have to find your email server (outgoing). This is found in your email software, e.g. in Outlook, in "Tools|Services" (or accounts in older Outlook versions). You find the server in "properties" (see the below example).

Note: If you don't have a permanent connection you have to connect before emailing.



2.2.4 Updates

The Updates menu offers access to update the WTG catalogue.

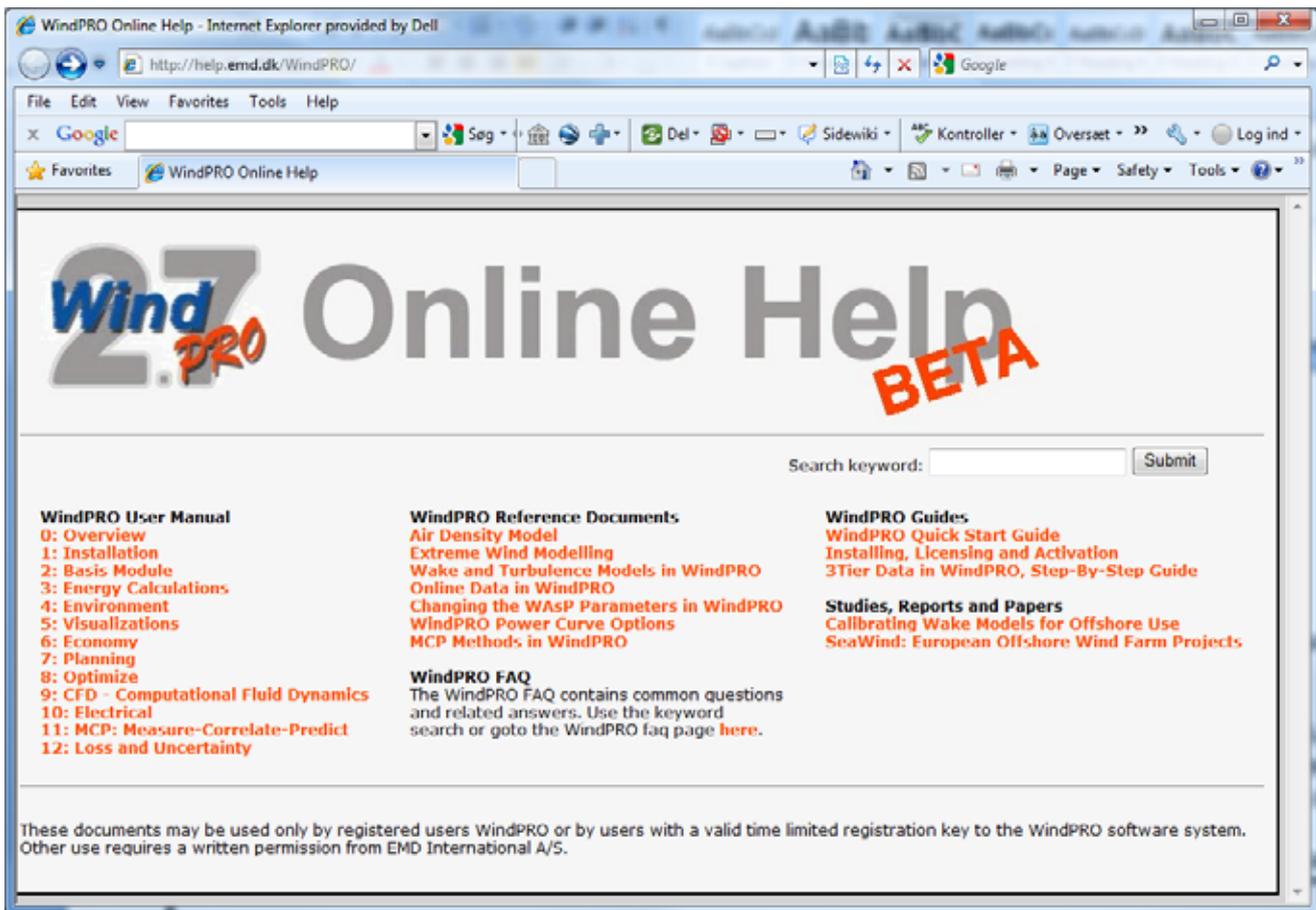


Specify the path for the WTG Data, normally directly below the WindPRO Data directory. Both the search path for existing data and destination directory can be set. Based upon the search path, WindPRO determines which new or updated WTGs will be available. The specific WTGs to be downloaded can be selected by pressing the “Download selected” button.

2.2.5 Help

The help system works like most other Windows help systems. Important to know is that by pressing the <F1> key from a specific menu, you should get the relevant help features for that specific menu/window (Context sensitive help). The build in help system is basically this manual for WindPRO.

The WindPRO Online help page, where typically the more advanced features are frequently updated based on latest research. The page can be opened from WindPRO menu “Help – FAQ (Internet)”:



A knowledge base is continuously expanded.

The “FAQ Internet” can only be accessed from the help menu in the WindPRO main screen. The two below mentioned can only be accessed from the help menu in Maps & Objects.

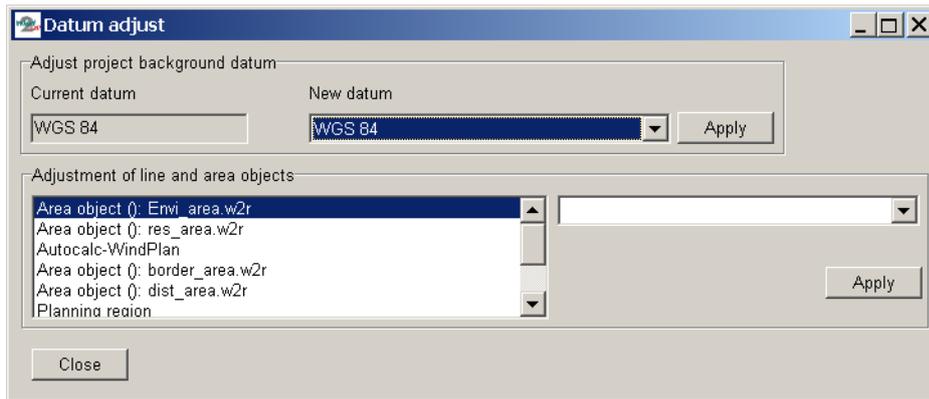
2.2.5.1 Error information dialogue

From the Help menu, you can recall the error information dialogue, which holds all recent error messages and warnings. This allows you to refer back to an error message you may have closed without reading.

2.2.5.2 Datum adjust

The Datum contains information about how the coordinate system “unfolds” the earth’s curvature. The formula for “unfolding” the earth onto a flat sheet is different at different places on the earth, partly due to differences in curvature, but also due to historical reasons, where different map makers preferred different formulas than the neighboring country, even though they may not necessarily have been better.

If you have worked with WindPRO and digitized your own contour lines, or areas, or imported them while working in one Datum, and later you realize that this Datum was incorrect, the Datum adjust menu provides you a way to change your line or area data to another datum (see menu below).

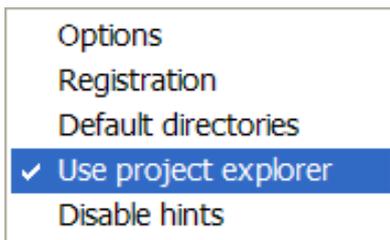


The first line is the complete project background datum you can adjust. In the lower part, you can individually adjust Datum for specific line or area data.

2.3 BASIS- Project Manager (Project Explorer)

2.3.1 Project Explorer – map and globe navigation

By default, the Project Explorer is enabled. From the WindPRO main menu, you can disable this feature if you prefer the ordinary Windows Explorer method of locating your projects. This is done from the main menu in options, see below. Here you can also enable the use of the Project Explorer.

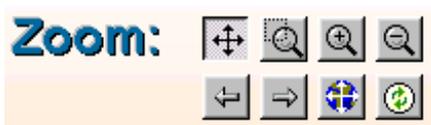


Projects are opened from the Project Explorer by hovering” over a spot on the map, and then double-clicking on the relevant project in the drop down list, which will appear containing all projects located within the user-defined search radius.



The above figure shows the start-up desktop for WindPRO if the use of the Project Explorer is not deselected. The colored dots on the globe are the projects, which are in the search paths and accepted by possible filter settings (search profiles). At the bottom of the map, the actual search paths are shown. It is possible to assign different colors to each search path in order to better organize the project view.

Navigation on the map/globe is fairly intuitive; however, a detailed description of the tools is as follows:



The Zoom buttons



Click on the button in order to move the map/globe when holding down the left mouse button.



Click on the button in order to drag a square that is then zoomed.



The buttons zoom in given steps.



Back and forward. Remembers your "zoom history", so you can quickly return to a previous zoom.



Zoom to full extent gives you the entire globe.

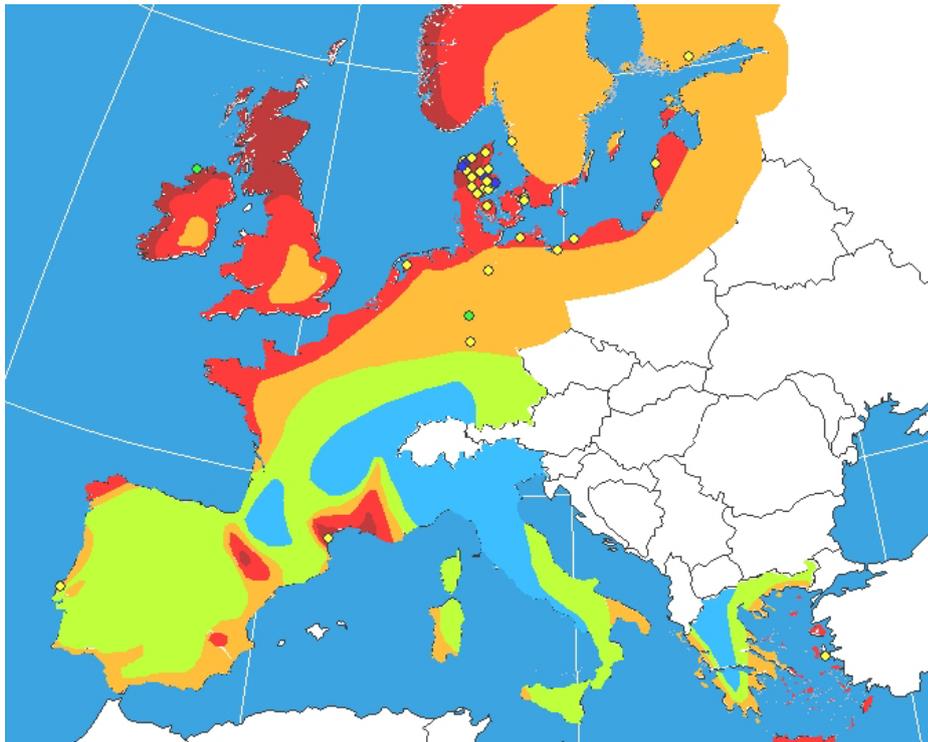


The refresh button refreshes your project list (colored dots on the map), if you e.g. copied some projects with the Windows Explorer into your Project Explorer search path or if connected to a server with additional projects.

User layer:



The "User layer" feature makes it possible to add a layer on top of the map/globe, which gives additional information e.g. roads or local administrative borders. The user layer must be a shape file (from Arc View GIS-system) where the coordinates are a geographic system (latitude/longitude). Some examples are enclosed in WindPRO Data\Globe\ and can be opened. These can provide a more precise background map and e.g. the State borders for the USA, the wind resource map from "European Wind Atlas" (see figure below), a detailed Wind Resource Map for Denmark, etc. See \WindPRO Data\Globe\ or add your own. NOTE: It's possible to search on data in the user layer (covered later).



Search:



The search option gives access to the Project Explorer list, where search paths can be added (covered later), e.g. to show only projects within a given search path. An example could be "Changed during year 2001". When this search path is selected in a drop down box, only the projects fulfilling the search path criteria will be shown on the map.

New project:

With a click on the “New Project” cross hair, you will be able to mark a specific place for creating a new project. Coordinates and country will then be transferred to Project Properties (see later), when clicking on the right button “New Project”.



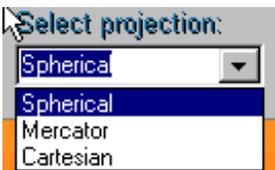
Project size adjusts the size of project dots on the map.

Search radius specifies the radius within which projects are found when "hovering" with the cursor over an area on the map.

Find country interacts with the map/globe. Click on a country that is shown in the list, and it's then highlighted on the map. You really have a brilliant tool for learning country geography as an extra benefit.

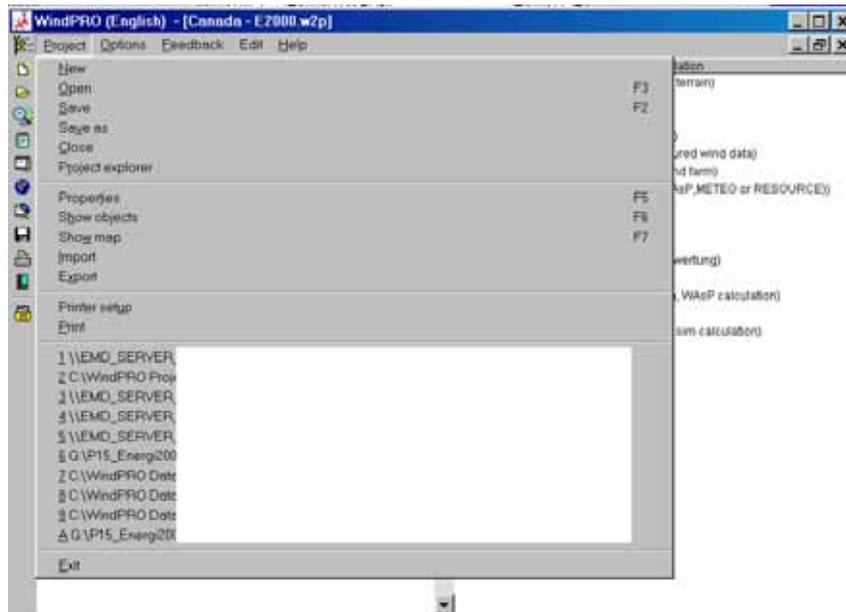
Search user layer gives the opportunity to search/show a user parameter from the user layer (shape file), if there is a database linked to the user layer (a .dbf file). The "data field button" to the right, gives access to select which field from the database to be shown in the “Search User Layer” field.

Projection – shows a map as a "round globe" or flattened out, see possibilities below.



The check boxes next to the search radius and country make it possible to disconnect these functions.

The upper left menu bar, also gives access to the project list and the same functions as in the tool panel in the right part of the screen. The last 10 opened projects can also be reopened from here.



2.3.2 WindPRO Explorer List

The WindPRO Explorer List will appear in following places:

Project Explorer
 WTG Catalogue
 Wind Statistics

Address list (in a reduced form without search profiles and same search path as the Project Explorer).

Therefore, a common review is given here in general terms.

File Name	Edit Date	Project Name	Description	File Location
Course_1.w2p	24-10-2002...	Course_1		C:\My Documents\WindPRO Data\Sam...
Donegal.w2p	16-07-2000...	Donegal		C:\My Documents\WindPRO Data\iver.1...
DEMO_PARIS-Cronalag...	25-02-2003...	E2000-Cronalaght		C:\My Documents\WindPRO Data\PROJ...
DEMO_PARIS-Cronalag...	15-09-2002...	E2000-Cronalaght		C:\My Documents\WindPRO Data\PROJ...
E2000-Cronalaght3.wpp	15-09-2002...	E2000-Cronalaght		C:\My Documents\WindPRO Data\PROJ...
EMD_case15_Cronalag...	16-09-2002...	E2000-Cronalaght		C:\My Documents\WindPRO Data\PROJ...
E2000-Cronalaght3.w2p	30-11-2000...	E2000-Cronalaght		C:\My Documents\WindPRO Data\iver.1...
E2000-Cronalaght.w2p	26-07-2000...	E2000-Cronalaght		C:\My Documents\WindPRO Data\iver.1...
E2000-Cronalaght1.w2p	10-10-2000...	E2000-Cronalaght		C:\My Documents\WindPRO Data\iver.1...
E2000-Cronalaght2.w2p	30-11-2000...	E2000-Cronalaght		C:\My Documents\WindPRO Data\iver.1...
Cronalaght_Manual_pri...	08-04-2002...	E2000-Cronalaght	This project illustrate...	C:\My Documents\WindPRO Data\Sam...
Cronalaght.w2p	29-10-2002...	E2000-Cronalaght	This project illustrate...	C:\My Documents\WindPRO Data\Sam...
Cronalaght.wpp	19-04-2001...	E2000-Cronalaght	This project illustrate...	C:\My Documents\WindPRO Data\Sam...
Cronalaght_30A.w2p	29-10-2002...	E2000-Cronalaght	This project illustrate...	C:\My Documents\WindPRO Data\Sam...
est.w2p	29-06-2001...	est		C:\My Documents\WindPRO Data\Sam...
kursus.w2p	11-10-2000...	kursus		C:\My Documents\WindPRO Data\iver.1...
Meteo-test-1.w2p	04-02-2003...	Meteo-test-1		C:\My Documents\WindPRO Data\PROJ...

The WindPRO Explorer List consists of 2 important elements:

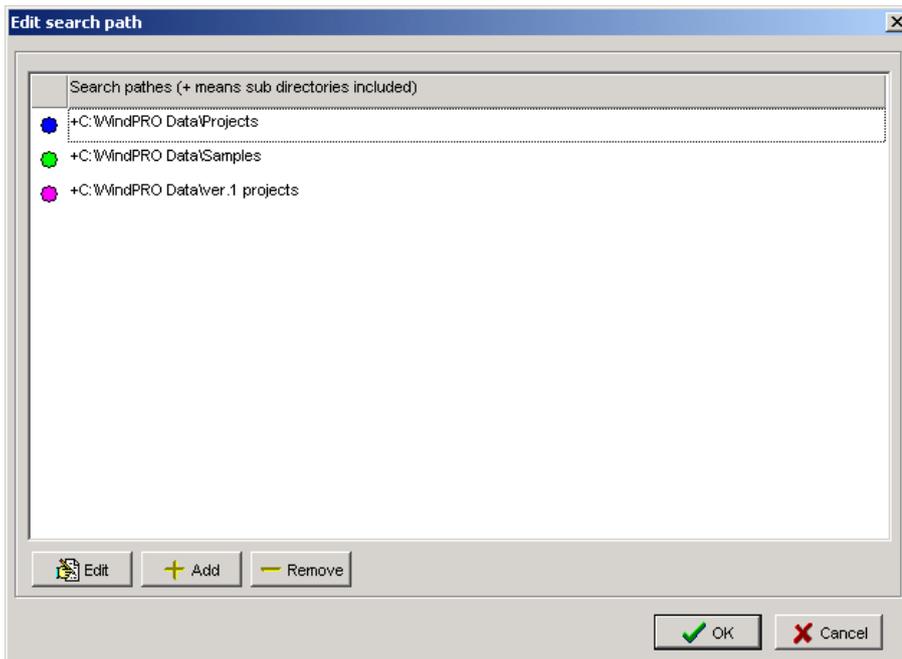
The search path setup - which specifies where to search for relevant files. This makes searching faster and makes it possible to organize projects in different ways, e.g. partly on a local disc and partly on a server version

The search profile - which is a filter to give a conditional view of files in order to find relevant files faster.

Different information on the files is shown in the list. The list can be sorted by clicking on the appropriate column heading.

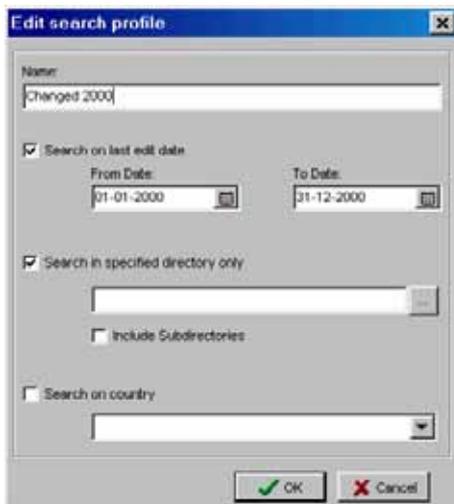
Double-clicking on a file in the list will open the project.

2.3.2.1 WindPRO Explorer – search path



Adding locations on the local disk(s) or network neighborhood gives access to the project you may want to see or work on, without searching through Giga bytes of files every time you open the software. When adding a new search path, a color can be specified which will determine how the file is shown on the map/globe.

2.3.2.2 WindPRO Explorer – search profile



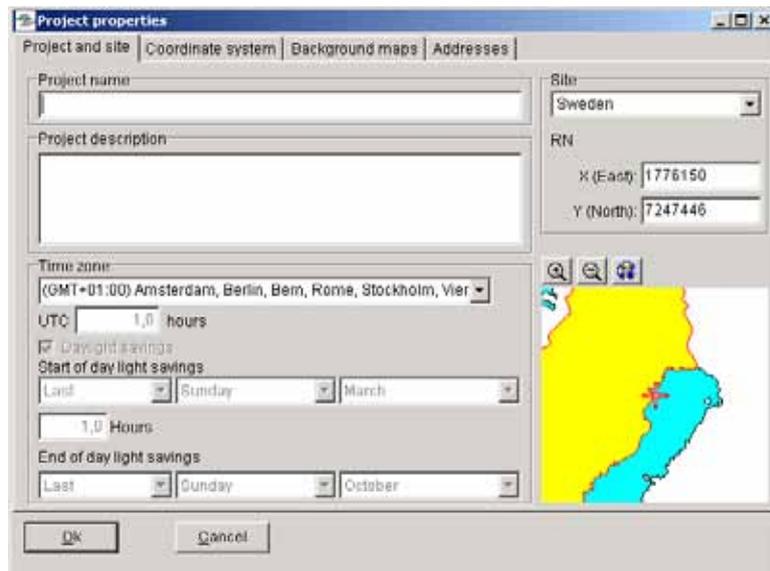
The search profile is individually designed depending on where in WindPRO the Explorer is used. The search profiles are a filter, which allows the user to limit the number of files to the ones fulfilling specific criteria in order to get an easy and fast search result of files, or to give an overview for certain presentations, e.g. sales meetings.

2.4 BASIS - Project Properties and attachment of Maps

2.4.0 Introduction to Project Properties (PP)

The term "Project Properties" is a generic term covering all information regarding site description, coordinate system, maps and addresses.

If you select "Project Properties", or if you click on the shortcut icon  or create a new project, the window for input of project information will pop up. Please see below:



2.4.1 PP Tab Sheet: Project and site

2.4.1.1 Project name and site description

A project name and a description of the project site and other information, which will appear on printouts, can be entered. Please note, that for each calculation performed, additional text relevant to the calculation can be entered. This means that the site description is the overall description of the site or general assumptions.

2.4.1.2 Site coordinates

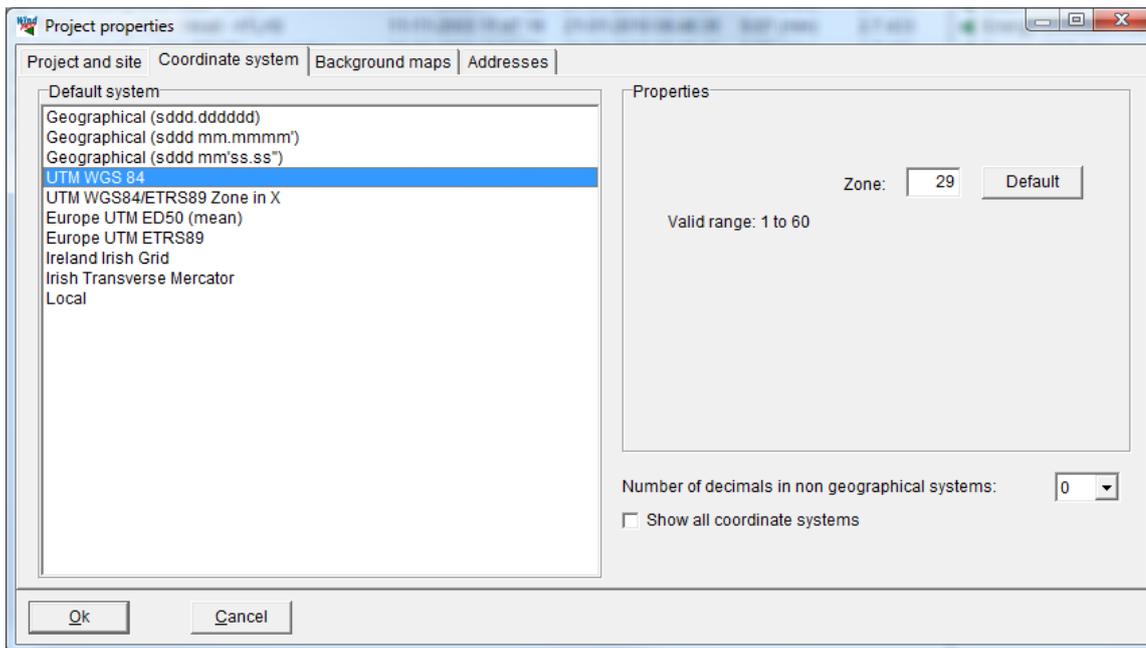
The preliminary site coordinates are entered here. If you have created a new project from the Project Explorer, site coordinates will already be filled in with approximate coordinates. The site coordinates (site center) will later appear on the map as an orange crosshair and can be adjusted. The site center will be centered on the screen when opening maps later in the project design phase.

2.4.1.3 Time zone

Selecting the correct time zone is important in order to perform a correct shadow flicker calculation or photo-montage. WindPRO will aid you in the right choice showing major cities in the different time zones.

2.4.2 PP Tab Sheet: Coordinate System

Move on to the Tab Sheet with coordinate system information by clicking on the relevant tab sheet.



On this page you can select which coordinate system you wish to work with. If you have created a new project from the Project Explorer (see Section 2.3.1), a default coordinate system and zone will automatically be provided, based on the country and the location. It's important that you select the system which matches the scanned maps you will be using.

On standard maps (paper) the coordinate system used is printed. Almost all maps will contain a latitude - longitude (lat/long) grid. Therefore this system can always be used. However, the system (degrees, minutes and seconds) is inconvenient to work with and makes measurements, conversions, checks, etc. a tiresome task. If the information is also available in a metric system, this system should be used.

Number of decimals on coordinates can be chosen to 0, 1 or 2.

The coordinate systems shown can be filtered, so only the most relevant ones for the project country are shown – or you can check “show all coordinate systems”.

2.4.2.1 The UTM System

The UTM system is used worldwide, and is often printed on the map material.

The earth is divided into 60 zones as defined in the figures below. Each UTM zone has an east-west width of 6 degrees. The median line of a 6 degree section has, by definition, the value of 500,000 meters. The widest part of a section (approximately 667 000 m) is at the Equator, (the Earth's circumference of 40,000,000 m / 60 sections). The x-coordinate value (Easting) thus lies between 167,000 and 834,000 meters, and is always positive.

In the northern hemisphere, the y-coordinate (Northing) equals the distance to the Equator. In the southern hemisphere, the y-coordinate equals 20,000,000 meters minus the distance to the Equator. This means that 1 km south of equator, the y-coordinate is 19,999,000.

The UTM South system is used more commonly, where the y-coordinate is 10,000,000 minus the distance to the Equator. In this case, 1 km south of the Equator, the y-coordinate is 9,999,000.

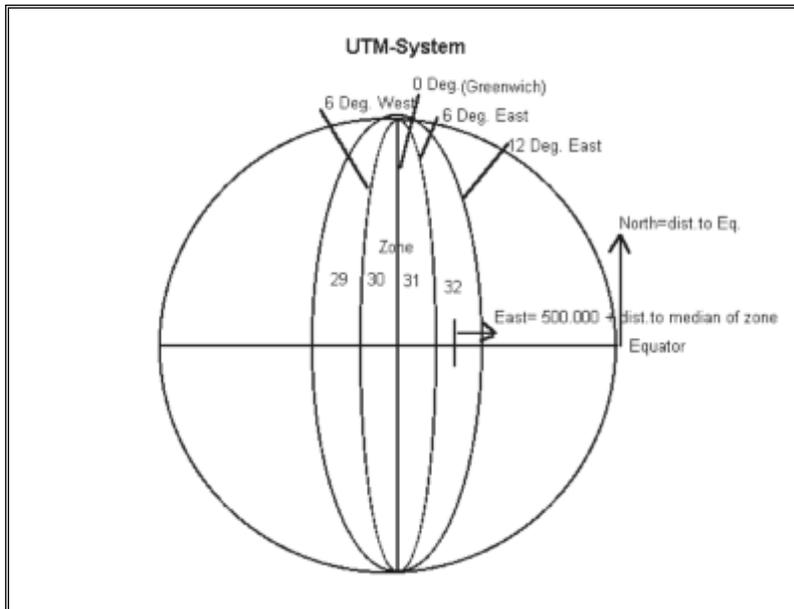
The DATUM of the UTM system indicates how much the globe differs from being exactly round (the Datum refers to the set of “unfolding” algorithms used to change the curved surface of the globe into a flat map, often referred to as the Ellipsoid). Several different DATUM'S are used in different parts of the world, but more and more countries are changing to the WGS 84 also named euref 84 in the EU.

Common Datum's used with UTM coordinate system:

WGS 84 = World Geographic System, the "New" world standard since 1984.
 ED 50 = European Datum since 1950 = Hayfort
 NAD = North American Datum (More variants)
 SAD = South American Datum

Overview of Longitudes and UTM-zones

Western longitude (West of Greenwich)			Eastern longitude (East of Greenwich)		
From	To	UTM-Zone	From	To	UTM-Zone
180	174	1	0	6	31
174	168	2	6	12	32
168	162	3	12	18	33
162	156	4	18	24	34
156	150	5	24	30	35
150	144	6	30	36	36
144	138	7	36	42	37
138	132	8	42	48	38
132	126	9	48	54	39
126	120	10	54	60	40
120	114	11	60	66	41
114	108	12	66	72	42
108	102	13	72	78	43
102	96	14	78	84	44
96	90	15	84	90	45
90	84	16	90	96	46
84	78	17	96	102	47
78	72	18	102	108	48
72	66	19	108	114	49
66	60	20	114	120	50
60	54	21	120	126	51
54	48	22	126	132	52
48	42	23	132	138	53
42	36	24	138	144	54
36	30	25	144	150	55
30	24	26	150	156	56
24	18	27	156	162	57
18	12	28	162	168	58
12	6	29	168	174	59
6	0	30	174	180	60



2.4.2.2 Other metric systems

Also, many countries have defined their own systems, which are being used instead of the UTM system. In Denmark, the System 34 is used. In Germany it's the Gauss Krüger system, and in Great Britain it's the British National Grid that is used. The list of which coordinate systems WindPRO recognizes will be updated continuously.

The British National Grid calculates with two different Ellipsoids (Datums); the AIRY and the GRS80. The British Ordnance Survey has informed us that all British maps use the AIRY Ellipsoid. The British National Grid has its origin at Lat. 49 N and Long. 2 W.

If the system you are currently working with is not included in the WindPRO list, you can define your own local system, and indicate (0,0) as the bottom left corner of the project area.

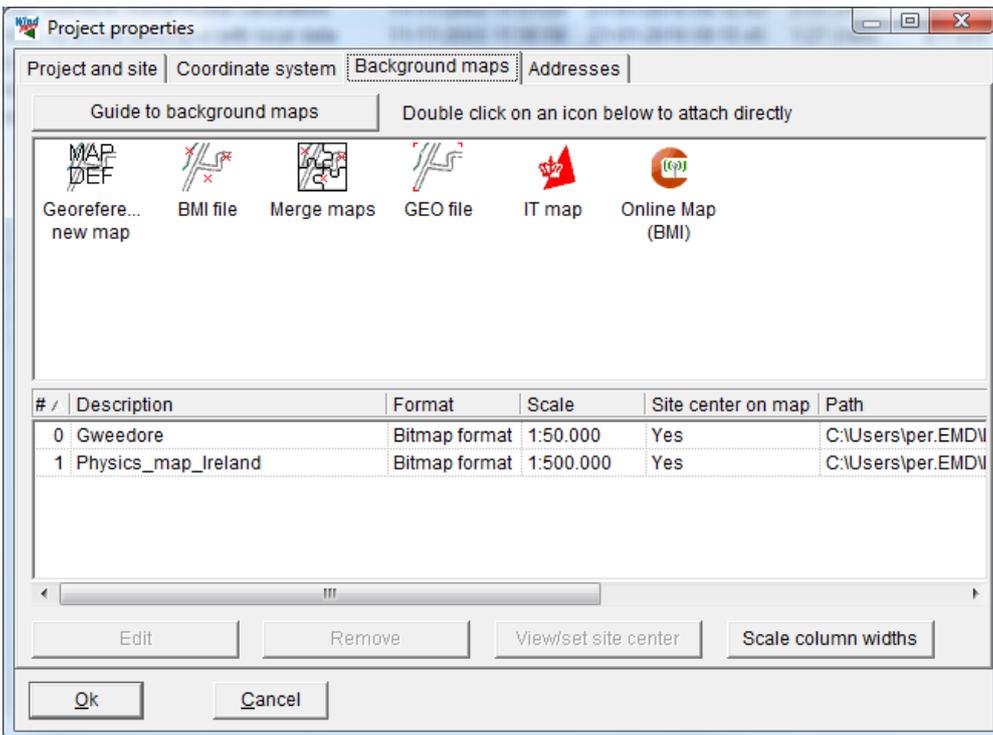
If the "Local System" is selected, you have to enter 1-3 reference points for the local system, in a coordinate system which is recognized by WindPRO in order for it to be able to calculate the exact geographic position. Several of the calculation modules and most printouts use the geographic position. Lastly, you can enter deviation data if the system used calculates with an angular deviation to geographic (true) north. This deviation is often indicated on the map material (if only at one fixed point).

One of the advantages of using a local system is that you can work with small coordinate values instead of the 6 and 7 digit coordinate values used by other systems. Another advantage is that you can continue to work with client information when you receive information from a client in his local system which he would like to see applied, e.g. in layouts.

Please notice, that your choice of coordinate system determines the system in which you can enter coordinate information. However, you can always change the system during your work and let WindPRO handle the conversion. Coordinates already entered will automatically be converted to the new system, as all coordinates are stored internally as latitude/longitude degree values. This means, that you can enter different information in different coordinate systems, e.g. wind turbine positions in the UTM system from GPS measurements and information from local authorities regarding existing populated areas (for noise calculation) in the latitude/longitude system.

2.4.3 PP Tab Sheet: Background maps

In the Tab Sheet "Background maps", link to maps and the preliminary site coordinates (site center) can be entered. This data can be adjusted later on during the project design work.



There are more ways to attach background maps:

Use MAPDEF for defining scanned maps from scratch or for stitching additional maps that already contain coordinate information (GEO Tiff maps).

BMI files (WindPRO's internal background map format), that holds information on geo-referencing and coordinate system.

Merge maps is a function where you can open a number of .bmi files and the software will automatically merge these into one map in the screen view. Note: all maps must have same resolution (pixels/m).

IT map format (DK only so far)

GEO refers to geo-referenced "world file format" which is two files, an image file and a coordinate specification file, like .JPG and .JWG files or .TIF and .TWF files can be attached just by pointing out the location of the formatted map file(s).

Online maps is a new service (from WindPRO 2.6) giving the user access to download background maps from EMD server.

2.4.3.1 Relevant background maps

As previously mentioned, maps make the project design work much easier. The maps used in WindPRO are primarily bitmap background maps, which show populated areas, roads, forests and other objects that you need to take into consideration when planning the project layout. Digital orography maps (Height Contour Lines) or roughness maps are described in Chapter 8, Line Object.

You choose the maps according to your kind of work. As a guideline, the following map scales are recommended:

1:10,000 For very accurate positioning of turbines and measuring distances for noise calculations. Possibly with landowner boundaries for planning consent work

1:25,000 Normal scale for positioning of turbines, definition of local obstacles, input of orography, measuring distances for noise calculations and entering check points for visualization.

1:50,000 Suitable for roughness classification within the nearest 5-10 km of the site.

1:100,000 Used for roughness classification between 10-20 km from the site.

If you scan the maps yourself, a combination of 1:25,000 and 1:100,000 will probably be a reasonable compromise between time consumption and usefulness.

The link to the maps function is an option - not a requirement for carrying out calculations under WindPRO. However, this option should be used whenever possible, as it's this function, which makes WindPRO unique, compared with other software - including the earlier calculation tools from EMD.

You can connect a map to WindPRO in more different ways, where new options will appear in future. The present ones in version 2.4 are:

A CD-ROM map in a format, which is recognized by WindPRO

Maps, which are bitmap graphics, scanned or cut from a CD-ROM and subsequently defined with 3, coordinate points in WindPRO

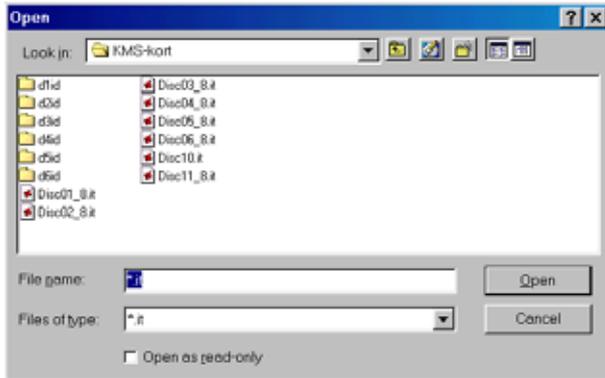
Geo-TIFF maps which mean that they consist of a graphic/bitmap *.TIF file + a *.TFW file, having the coordinate information

2.4.3.2 CD-ROM maps recognized by WindPRO

This option is the easiest one as the coordinates are already associated to the map and a complete reader for this format is included.



Double-click on the icon above and point out the location of your *.IT maps. The IT format is the format used by the Danish Kort- og Matrikelstyrelsen (the Danish Ordinance Survey).



If the IT format is selected, a click on the file list button [Browse] will invoke the Windows standard file browser. Here, you can browse to find the needed file (refer to the Windows manual for help regarding the use of the file browser), click on the needed file and then choose "Open" (or double-click on the file name) to attach the map to the project.

It's optional to enter an individual description of the map file, but it may be of great help to you when having to relocate the map file on a CD-ROM when you are editing a project at a later stage.

It's now possible to select the site center from the attached IT map. Click on the attached map and then on the View/set site center button just below. This will invoke the following map:



You can move the map around on the screen by holding down the left mouse button. A click with the left button on the map creates a red cross. If the position is wrong, you simply click on a new position. Please notice, that you must not move the mouse when you are going to mark a position. If the mouse is moving when you click it, the program will interpret it as a command to move the map around instead. In the above example, a preliminary position has been marked at the port of Ebeltoft.

Now click the "Scale+" icon in the upper left corner. Depending on which CD-ROM you is linked to, a more detailed map appears.

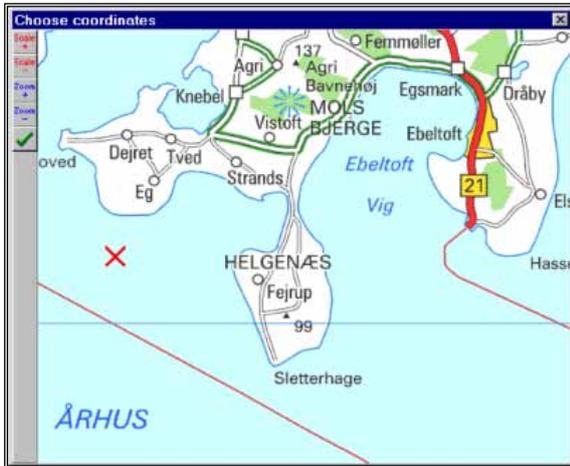


Figure 1 Increase the resolution of the site coordinates by using a smaller map scale.

The new map shows that the initial position was not marked on the exact site center. A new "cross" is therefore marked with a click. You can still drag the map around to get the correct area inside the window frame.

You can continue to zoom to more detailed map scales (depends on the present map material) if a further refinement of your preliminary site coordinates is needed. The coordinates chosen will be used to define the site center on all of the detailed maps you are going to use later on during the project design work.

More maps can be added, e.g. a scanned map with landowner boundaries. However, such map would need to be calibrated and have coordinates attached (see the next chapter).



Click on the "OK" bitmap button to exit the map. Now, all the general project information is entered and the project design work can begin.

2.4.3.3 Calibration of bitmap maps with MAPDEF

Bitmap files can be scanned or digital images of maps, where you subsequently have to make a coordinate calibration. MAPDEF is used for the Geo TIFF maps, where the TFW file holds the coordinate information. It's also used for stitching additional maps together, rotating, cutting etc.



Double-click on the icon MAPDEF in order to start processing one or more new maps for the project.

How to process (Geo-reference, cut, rotate etc.) a bitmap map in WindPRO is explained below. Apart from the main items described here, a range of other functions are available, e.g. adjustment of brightness and colors. Also the color resolution or map size can be reduced so that it occupies less space on the hard disk and is faster to use (requires less RAM). It should be noted however, that the quality (sharpness) of the map is reduced as well.

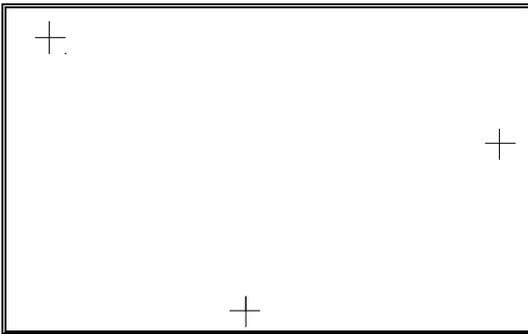
Using a bitmap image without coordinate information

Scan the needed map sections, or cut from a CD-ROM.

Select the bitmap map containing the map sections.

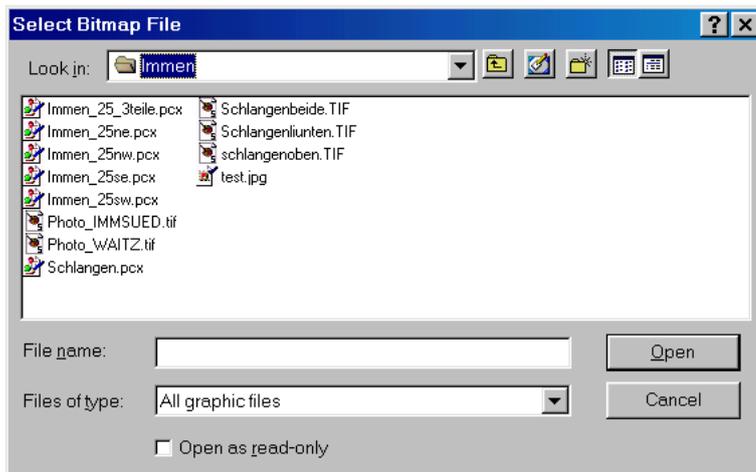
Rotate the map so that it's aligned with north (pointing up).

Mark three points and enter their coordinates. An example of positioning of the points you use for the calibration of a bitmap to a .BMI file is shown on the below sketch.



Repeat step 1-4 until three coordinates have defined each map section.
 Orient the maps so they are correctly rotated for merging (combining the maps).
 Cut eventually the edges of the map sections. Note map 1 (first attached) is at the bottom, which means that no cutting is needed for this one.
 Save the .BMI map.

Use a scanner resolution of 100-150 dpi and 256 colors. The preferred bitmap format is .PCX, although most other formats will also work. Make sure to include the edges of the maps in the scanning process, as they usually hold the grid coordinates. Please notice that the user has the full responsibility of not violating any copyrights! Save the maps in folders that you use for this purpose only, or in the WindPRO project folder with the local project.



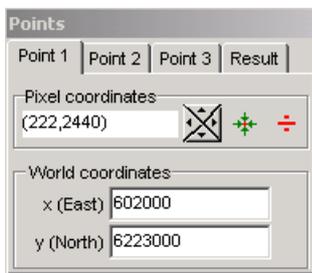
When "MAPDEF" is called, you have to select which map file(s) to add (more than one map can be added at a time). The file browser is used for this.



Once the first map segment has been scanned, the map is aligned with north and any necessary adjustments of colors and size are made. Note from ver 2.5 a color adjustment proposal will appear by default. This gives different reduction options with a preview option so you can decide which choices don't distort the map colors (which depends on the graphic image format). Hereafter, the definition of positions is made.

Try to avoid rotating the maps in steps other than $\pm 90^\circ$ and 180° . If the maps are rotated in other steps, the appearance on the screen will become distorted - text especially appears very unclear. The program will always keep track of north - providing that the coordinates have been entered correctly. BUT, if more maps are stitched together, a full horizontal or vertical edge might be needed in order to stitch without blank triangles.

The positions are marked by clicking on the positions on the map where coordinates can be read or obtained. Make sure to place the three defining coordinate sets as far away from each other as possible in order to be able to maximize the accuracy of the definition. When you mark the first point, you have to tell the program which coordinate system you are going to use. The coordinate system is usually printed on the map.



The four arrows indicate a fine adjustment of the pixel coordinates if e.g. an intersection between two gridlines hasn't been pointed out precisely enough.



The menu for entering positions enables you to center the map around the actual point (or to get it inside the area which is rendered on the screen).



If a position is incorrect (or too poorly positioned) it can be deleted.

The last Tab Sheet to the right in the menu box for entering positions is "Result". This window indicates the correlation between the entered coordinates and the pixel coordinates. One position is calculated based on the two other positions and the deviation is checked. The deviation is categorized into:

Fine

Not precise, but acceptable

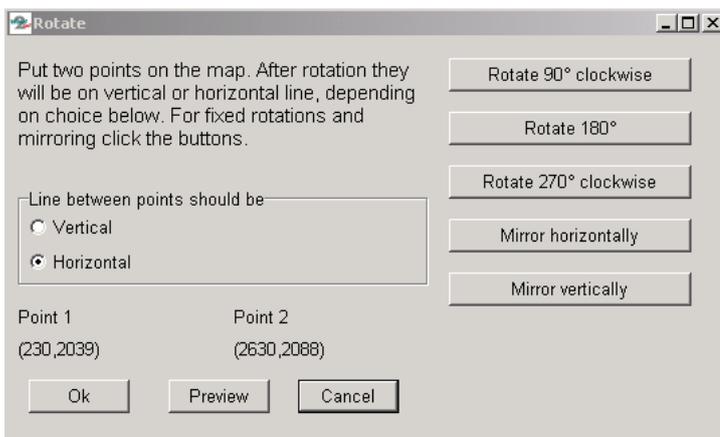
Not acceptable

The third category result indicates that you have to look for possible errors or redo the definition. Note: The levels of acceptance can be defined manually in the “points | options” menu.

You add more maps by clicking on the green arrow in the upper left corner of the window (repeat the previous actions 1-4). Please notice that this menu item is used to add maps that are to be merged to the previous map(s). Different map scales or map types are created as new maps.



You align two maps by clicking on the icon with the two rotating maps.



When you click on the icon, the dialogue box shown above will appear. On the first map you can define a certain line as the horizontal or vertical line by clicking on two points on the map (e.g. two points on a grid line) or perform fixed rotations. The program rotates all the additional maps so they are aligned with the first map - this function is based purely on the coordinate definitions, which you have entered. After having created new maps, the individual maps should be checked visually for possible errors, i.e. incorrect orientation. A misaligned map holds incorrect coordinate definitions, which must be corrected. Then the map should be realigned.



Map collars, borders, etc. can be removed by using the cutting tool. When you click on the scissors the dialogue box shown below will appear.



Choose which side of the map to cut then click on the map to indicate where you want the cut line to be and then click on “OK”. It's also possible to mark cuts off of all four sides before clicking on “OK”.

You save the map by clicking on the “OK” button. When you save the map it's added to the list of maps that WindPRO can use in the actual project. The map is saved as a .BMI file which holds the coordinate information

and file names for the new adjusted graphic files which are saved as .PXC files designated as .B0, .B1, .B2, etc. At this point, the original graphic files can be deleted to save disk space.

Once the .BMI file has been defined and linked to the project, you can define the site center coordinates on the map (for details see section 2.4.3.5 describing “view/set site center”).

2.4.3.4 GEO “world file” maps.



Double-click on GEO file to add one or more georeferenced world files, that can be .JPG and .JWG files or .TIF and TFW files. Simply select the file(s) in the list. Only the image files (.JPG or .TIF) files will be shown in the browser by default.

	O46096G6.TIF	2.500 KB	ACDSee TIF Image
	O46096G7.TFW	1 KB	TFW File

A small .TFW file holding the coordinate information must be available together with the main .TIF file holding the bitmap. WindPRO performs geo-referencing based on the .TFW file and the number of horizontal and vertical pixels in the .TIF file (so don't change the pixel size of the .TIF file without changing the info in the .TFW file!) However, it can be a good solution to change both the .TIF file and the .TFW file if the .TIF file is very large and far too detailed). Make sure that the .TFW file is stored in same folder as the .TIFF file. Please notice that the .TFW file does not hold any information on coordinate system or datum. This must be known and given as input.

2.4.3.5 EMD Online maps



Online maps are a new service that gives the user access to download background maps from EMD server. It will automatically be detected which map sources that are available for the site location. EMD will develop the service continuously and add more and more sources.

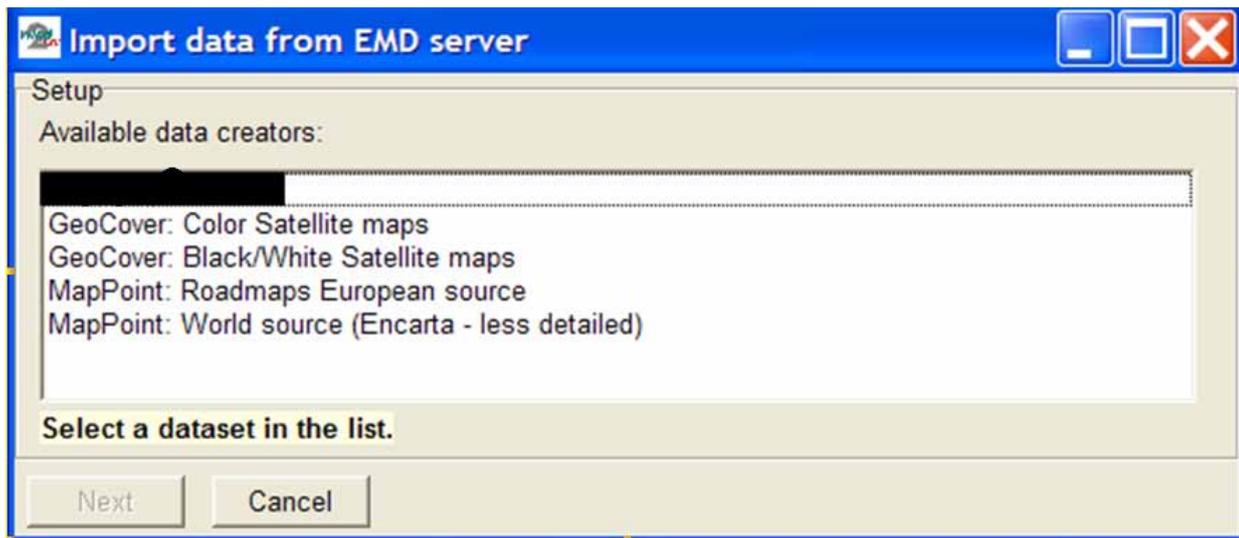


Figure 2 The online service detects which maps there are available around the location of the specified project site.

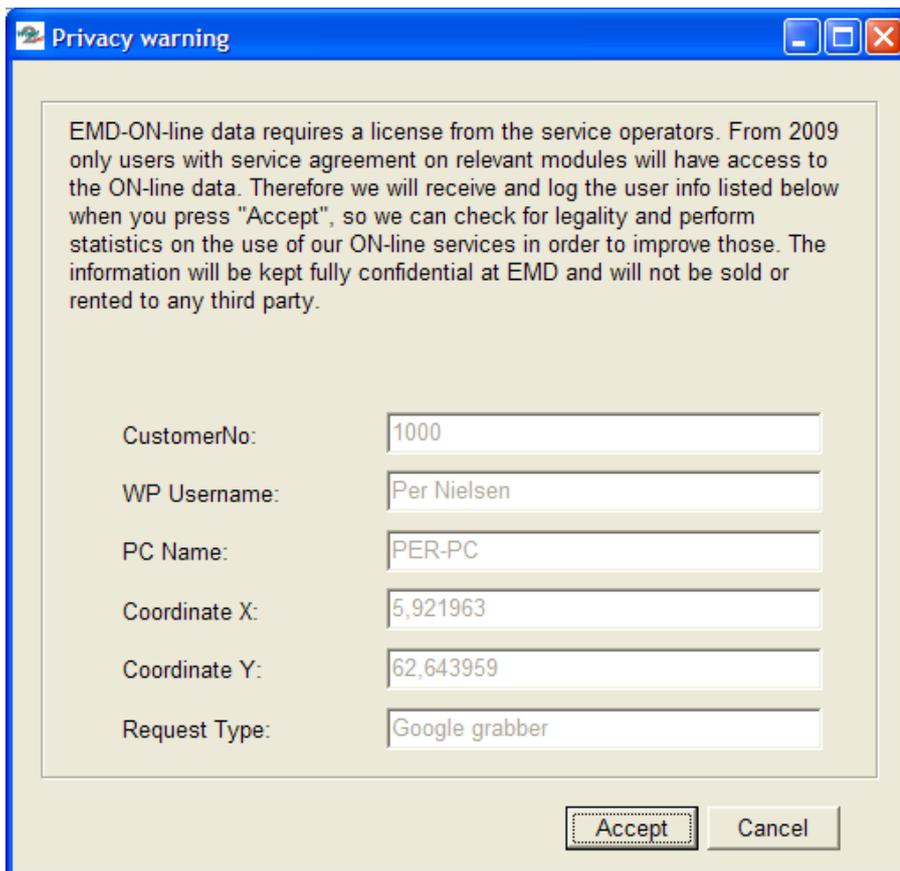


Figure 3 The service requires you to accept this "privacy warning".

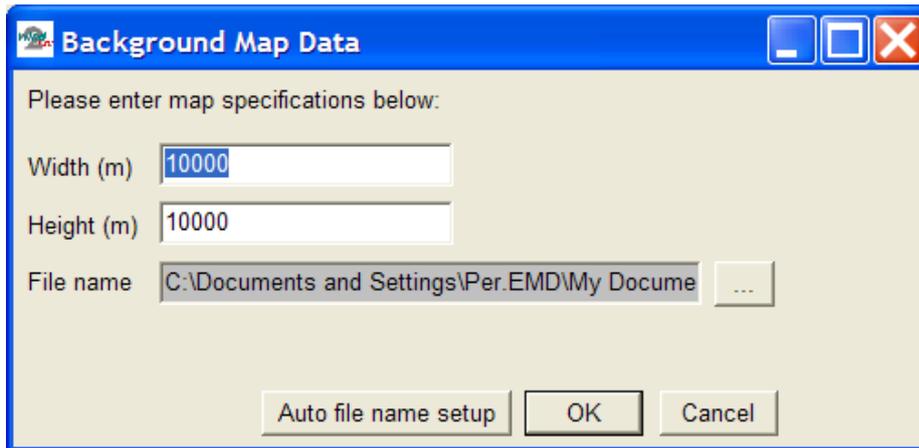


Figure 4 After selecting the source, you can specify width and height of map. The resolution will typically be automatically set to give a reasonably small file size that can be downloaded immediately, usually within a minute or so, depending on the speed of your internet connection. For some data sources you can choose resolution.

The ON-line map is added to the list as .BMI files, the internal WindPRO background map format.

2.4.3.6 View and set site center

When you click on one of the attached maps and then on the View/set site center button shown below,

#	Description	Format	Scale	Site center on map	Path
0	Ebeltoft 1:25000	Bitmap format	1:25.000	Yes	C:\WindPRO Data\Sar
1	Ebeltoft 1:500.000	Bitmap format	1:500.000	Yes	C:\WindPRO Data\Sar
2	Bitmap map: Ebe50k...	Bitmap format	1:50.000	Yes	C:\WindPRO Data\Sar

Buttons: Edit, Remove, View/set site center, Scale column widths

either the map will appear, or a square on the globe showing you that your site center is outside of the defined map (see below). If the site center is outside the defined map, either move site center or redo the geo-reference.

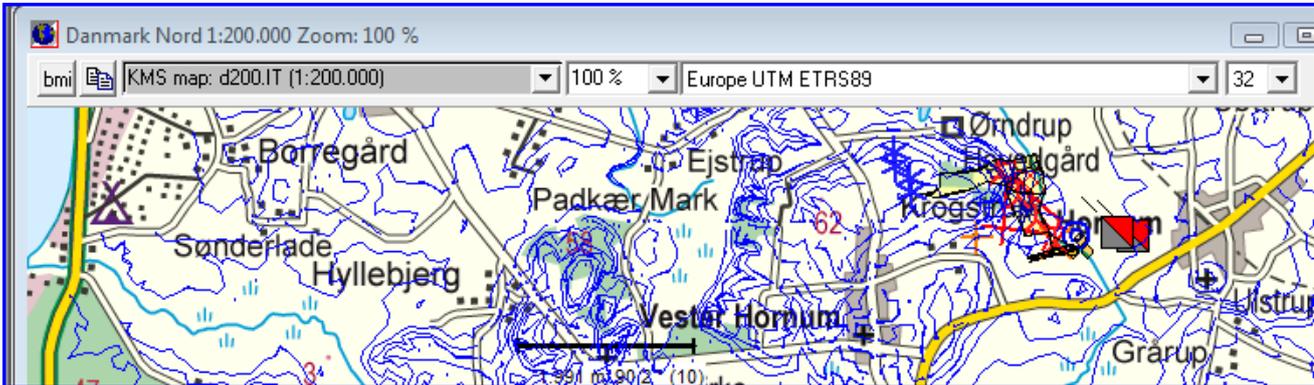


In the example shown above, the squares show the locations of the attached maps on the globe and the red cross shows the present location of the site center. The red line points to the center of the map that you are currently trying to view. To move site center inside the map, simply click inside the red square.

2.4.3.7 Blank map

If no maps are available, you can still enter objects graphically by using a blank map, which is simply a white background that is automatically scaled to your project design area. A blank map appears automatically if there are no other maps defined.

2.4.3.8 Some map window features



In the top bar of the map window, you'll find two buttons to the left.

First one creates a .bmi file (WindPRO's native background map format). This .BMI file is then including "what you see" on the map, like objects etc. The map is immediate loaded after pressing the button. If you have a large wind resource map file or detailed water depth map, that takes long time to render, it can be efficient to have a "hard copy" where you save the render waiting time.

Second one simply copy the map to clipboard, for pasting into like Word for documentation reports.

The zoom as well as the coordinate system and coordinate zone can at any time be changed by the drop down boxes. Zoom can also be changed by scroll button on mouse. Coordinate system choices can be limited to the country relevant ones to "reduce confusion". EMD maintain a list that pairs countries and coordinate systems.

2.4.3.9 Where to find other maps on the Internet?

In the USA, maps can be downloaded as zipped *.DRG files. They are either free or can be purchased for a relatively small fee.

Try these Internet locations:

www.mapmart.com

<http://data.geocomm.com/dem/demdownload.html>

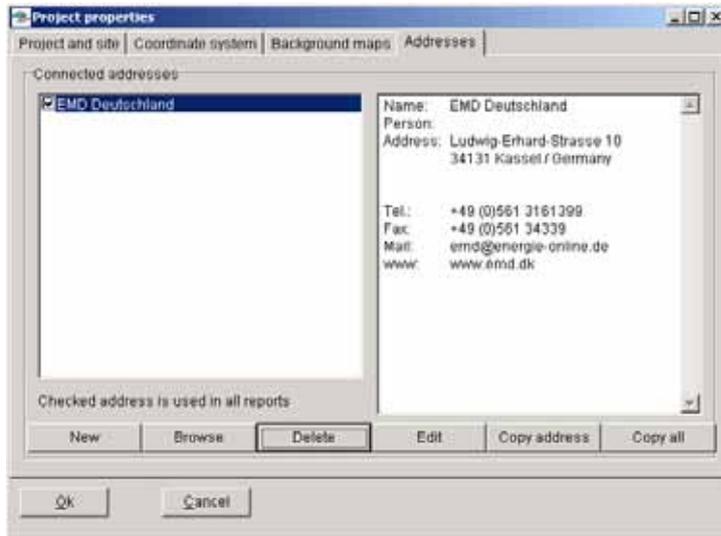
After downloading, the unzipped files can be attached to the WindPRO project as described in section 2.4.3.4. Please notice that the world map files already are georeferenced and thereby easier to use.

In Europe, a site with links (mainly for commercial map products) is:

<http://www.eurogeographics.org/gddd/INDEX.HTM>

2.4.4 PP Tab Sheet: Addresses

In the Address Tab Sheet shown below, you enter the address of the relevant customer, the electricity company, the county, etc. You can check one of the addresses, which means that this address will be printed on all printouts.



The buttons are as follow:

New: Create a new address.

Browse: Look in the list of addresses used in previous projects in order to use a previously typed address. See section 2.4.4.1 for further details.

Delete: Remove the highlighted address from the project.

Edit: Edit the highlighted address.

Copy address: Copy name, person and address to the clipboard in order to paste them into a text document e.g. a letter, a fax or an address label to send with the calculation reports.

Copy all: Copy all fields in the address record to clipboard

Besides the fields shown in the above screen, you have some additional "user-fields" in which you can add project status, costumer number referring to other costumer databank, more telephone numbers, contact persons, etc. All fields are shown below. The field lengths are practically unlimited, but remember that if you wish to use them in other databases, there might be a limited field length.

2.4.4.1 Address list browser

When you browse for addresses, you will get a list of all addresses in previous projects which are included in the project browser search path.

When opened with the browse button from Project Properties; if you double-click on an address, WindPRO will return the selected address. You can also return the address by highlighting and clicking on OK.

The address list can also be copied to other programs simply by making your selection the same as you would in the Windows Explorer (with the <Shift> key and/or the <Ctrl> key held down when clicking), then right-click and select "Copy". The entire address list with all fields can then be pasted into a spreadsheet. This can be useful when making status reports on all projects or transferring addresses to other software programs as general customer databases.

2.5 BASIS – Project design, import/export, calculation, print

2.5.1 Introduction to establishing a project

When the project properties have been entered, the actual project design work can begin. In this chapter we will describe how WTGs or other objects are entered and how general object editing, copying and import/export work. Other object inputs will depend upon the calculations you wish to perform. These other object inputs are described in the relevant chapters.

2.5.1.1 Map

WTGs and other Objects must be entered via the maps. Click on the map button to open the map window.



If one or more maps have been linked to the project, these maps can be invoked by clicking on the 5 map buttons.



Please notice that when you enter objects via maps, if you hold the <shift> key down while selecting a tool, this tool will become a default. This makes it possible to enter several objects with the same object properties, e.g. a series of noise objects with the same distance and dB requirements, or a number of parallel rows of WTGs.

You can insert bookmarks on the maps by <Ctrl+k> <1> for marking the first of up to 10 bookmarks, then <Ctrl + 1> for GOTO bookmark 1, etc. This makes it possible to move quickly between different “sweet spots” on your map.

2.5.1.2 Object List



The Object List can be opened parallel to the map. This is very useful to interact between the map view and the Object List view. In the Object List view, objects are marked with a red x if there are errors associated with the object (typically missing data that the object links to, or missing height information (TIN) where the object is placed). The latter error shows a red x in the Z-value column, only if the object is set to get its Z-value from the Digital Height Model (DHM), which in this case means the calculated Triangular Irregular Network (TIN) (see Section 2.8.2.2).

Description	Locked	X(East)	Y(North)	Z	Type	Sy	User la	Result (most recent)
Noise sensitive point: Danish 200...	No	523.166	6.299.656	25.1	Noise Sensitive Area	14		42.9 dBA @ 6 m/s; 43.8 dBA @ 8 m/s
Noise sensitive point: Danish 200...	No	523.316	6.299.242	24.6	Noise Sensitive Area	15		41.0 dBA @ 6 m/s; 41.8 dBA @ 8 m/s
Noise sensitive point: Danish 200...	No	523.765	6.298.879	23.6	Noise Sensitive Area	16		39.8 dBA @ 6 m/s; 40.6 dBA @ 8 m/s
Noise sensitive point: Danish 200...	No	524.062	6.298.904	25.0	Noise Sensitive Area	17		40.4 dBA @ 6 m/s; 41.2 dBA @ 8 m/s
Noise sensitive point: Danish 200...	No	524.297	6.298.877	26.2	Noise Sensitive Area	18		39.3 dBA @ 6 m/s; 40.1 dBA @ 8 m/s
Noise sensitive point: Danish 200...	No	524.382	6.298.944	29.1	Noise Sensitive Area	19		39.5 dBA @ 6 m/s; 40.3 dBA @ 8 m/s
Noise sensitive point: Danish 200...	No	524.732	6.299.134	20.0	Noise Sensitive Area	20		38.3 dBA @ 6 m/s; 39.1 dBA @ 8 m/s
Noise sensitive point: Danish 200...	No	525.060	6.299.984	20.0	Noise Sensitive Area	21		36.5 dBA @ 6 m/s; 37.3 dBA @ 8 m/s
4*Siemens SWT-3-115_visual 30...	No	523.427	6.300.324	34.5	New WTG	74		11.528 MWh/y; 3202 h; 36.5 % CF; 7.0 m/s; Wake eff. 97.6 %
Control Point: Uncertainty horiz. ±0 ...	No	540.685	6.299.143		Control Point	121		

In the Object List you can select several objects in the same way you would in Windows Explorer. The selection will then work on the map also. For example you can then move all the selected objects in one operation by dragging them to a new location on the map. Note also the right-click features available for selected objects in Object List, such as Delete, Edit, Copy or import/export (described in details later).

Note the feature “Results”, which show the most recent main calculation results for some selected objects like Noise Sensitive Areas or WTGs. These results can also be shown as labels on the map, and they can be copied to clipboard – a very efficient way when analyzing a special case where many different smaller adjustments are performed.

A special feature for line or Area Objects is the ability to center the object at the point where the linked data is on the map. This may help you find where the imported data in line or Area Objects are located and then possibly locate import errors.

2.5.2 Entering, moving, snapping, and selecting WTGs (and other objects)

WTGs can be created as individual WTGs or as rows with fixed in-row distance and WTG type. It's always possible to turn a row into individual WTGs (with a right-click) and still be able to edit the coordinates and WTG type individually afterwards. The WTG type must be listed in the WTG Catalogue and so, must first be created in the Catalogue if not already listed in it. In energy production calculations for single WTGs (WIND ATLAS), the hub height can be changed during the calculations without having to create all the possible hub heights in the WTG Catalogue.

After you have entered WTGs via a map, you can position it at the correct location by clicking on the WTG mark and dragging it to the desired location on the map. You can fine tune the position by holding down the <Ctrl> key and moving the selected object with the arrow keys. You can also link an object to another by holding down the <Ctrl> key when moving one object towards another object. A hook appears to illustrate the activation of this “snap” feature.

To select an object when a number of objects are positioned close together, you can move the cursor over the group of objects to get a drop-down list of the objects. You can then select the one you wish to move or enter properties for.

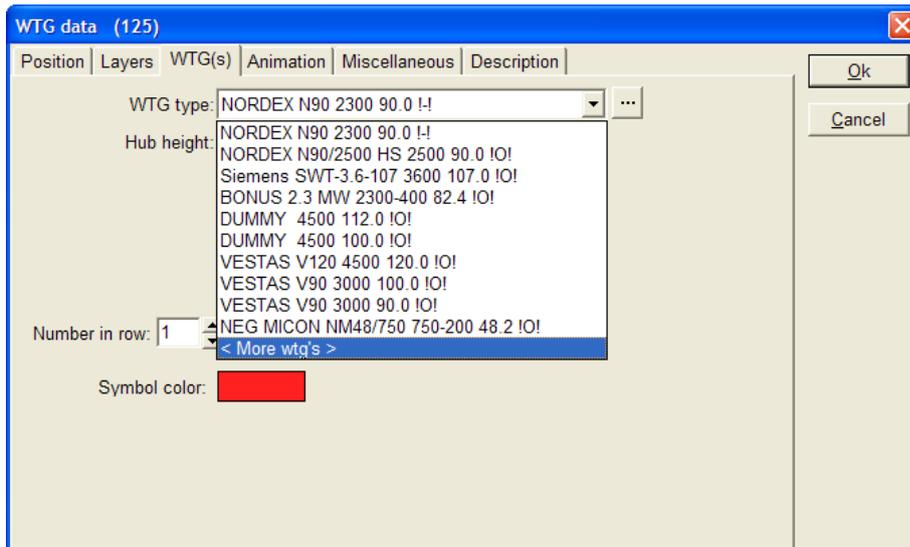
For rows of WTGs the following rule applies:

Place the cross hair inside the center mark, left-click and drag to move the row parallel to its original position. Place the cross hair inside an outer mark to rotate the row around the opposite outer mark. Hold down the <shift> key while dragging an outer mark to change the in-row distance.

2.5.2.1 WTG Object Tab Sheet: WTG(s)



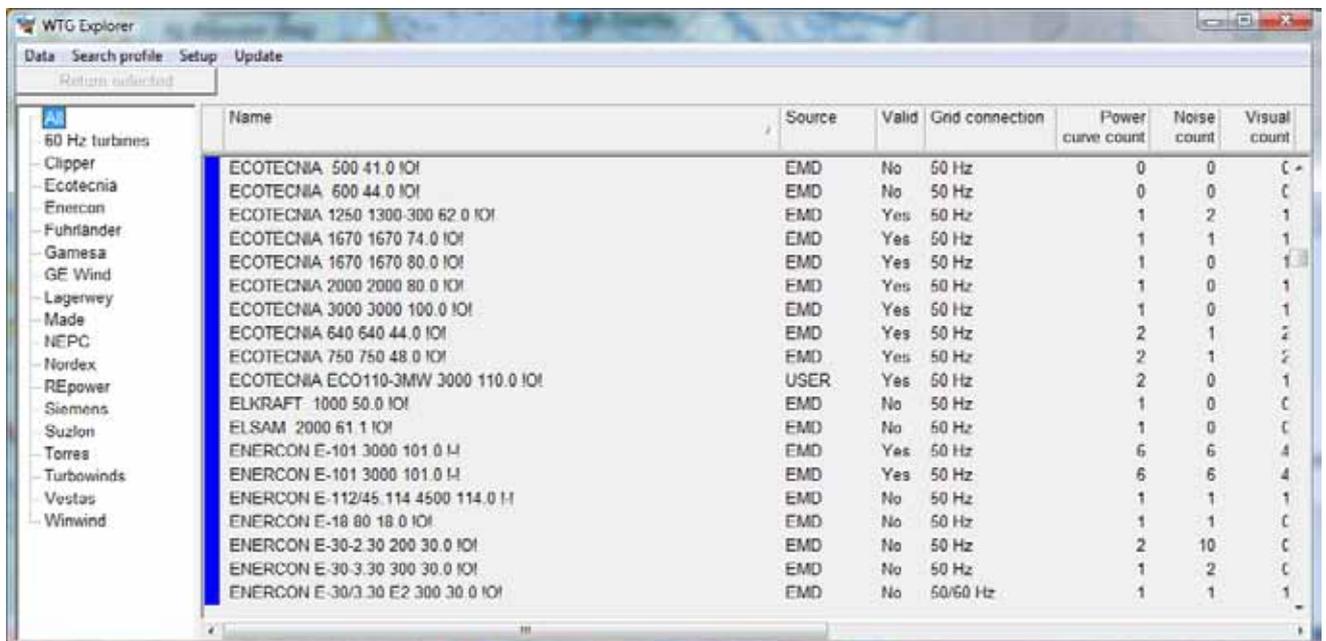
Activating the "new WTG" icon creates new WTGs by clicking on the desired position on the map. The following window will appear.



Entering new WTGs:

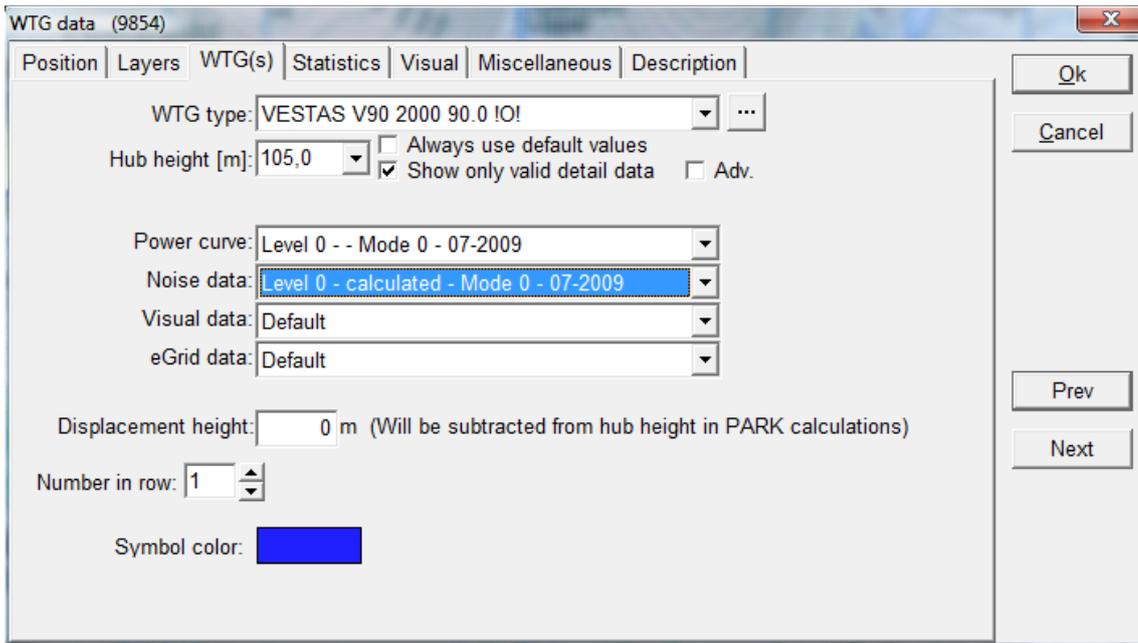
With the "Number in row" it's possible to create not only one WTG at a time, but also a row of WTGs with same in-row distance and on a straight line.

The WTG type is selected from the WTG Catalogue via the drop-down list, which holds the last 10 WTGs used. Select <more WTGs> to access the WTG Explorer (see figure below), where you can build different search profiles and select these in the WTG Explorer. This makes the searching and selecting of a specific WTG type easier and faster. Note from the Setup you can edit the search path, and thereby decide where to browse for turbines (in which folders). By default you browse in the WindPRO Data\WTG folder and the current project folder.



In the list you can sort by the different columns by clicking in the top of the column.

After having selected a WTG, it's possible to look for different power curves, noise data etc. by deselecting "Always use default" (see below).



Here 5 different sets of noise levels appear, and corresponding power curves will be selectable. It's the users' responsibility to select matching power curves and noise data, if these are coupled as for the WTG above. The "Adv." (Advanced) checkbox will be explained later.

After having entered the WTGs on a map it's easy to move them:

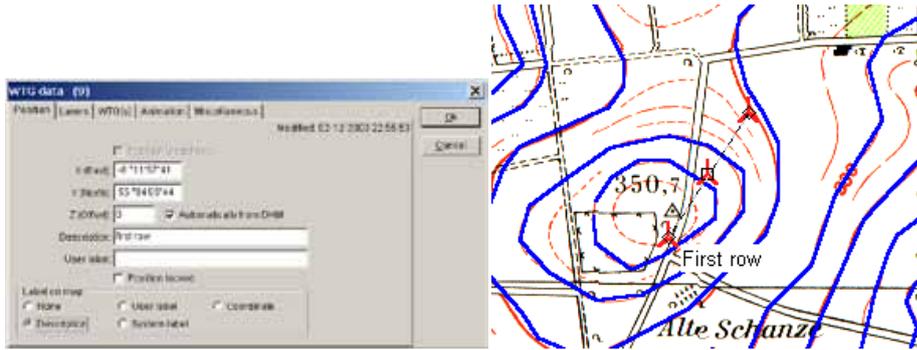
Click once on a WTG row to select it. Activate the center selection mark and drag the object sideways. Activate and drag an outer selection mark to rotate the row. Activate an outer selection mark while holding down the <Shift> key in order to change the in-row distance between the WTGs.

2.5.2.2 Object Tab Sheet: Position

By a right-click and selecting properties, the input window for a WTG or any other object will appear, and more details can be entered. The Tab Sheet "Position" is common for all objects. Here you can enter the exact coordinates. The Z-coordinate can be entered or read automatically from a Digital Terrain Model calculated on the BASIS of a Line Object (Height Contour Map), but then the object has to be inside the TIN radius, see Line Object. A description can be entered and used as label on map. It's shown in the Object List and will be shown on printouts too. You can also enter a "user label". The software automatically gives a "system label", where the first created object gets no. 1, the second no.2 etc. These system labels can never be changed. Therefore you have the opportunity to assign your own user label to objects, e.g. for a special numbering order in your WTGs or other objects. Later on (in "Printing Reports"), you can choose to sort the WTGs by user label instead of system label and thereby obtain full control. If you use letters in the user label, normal alphabetic sorting will be used.

On the map following labels can be visible next to the object:

- Description,
- User label,
- System label
- Coordinates or
- None

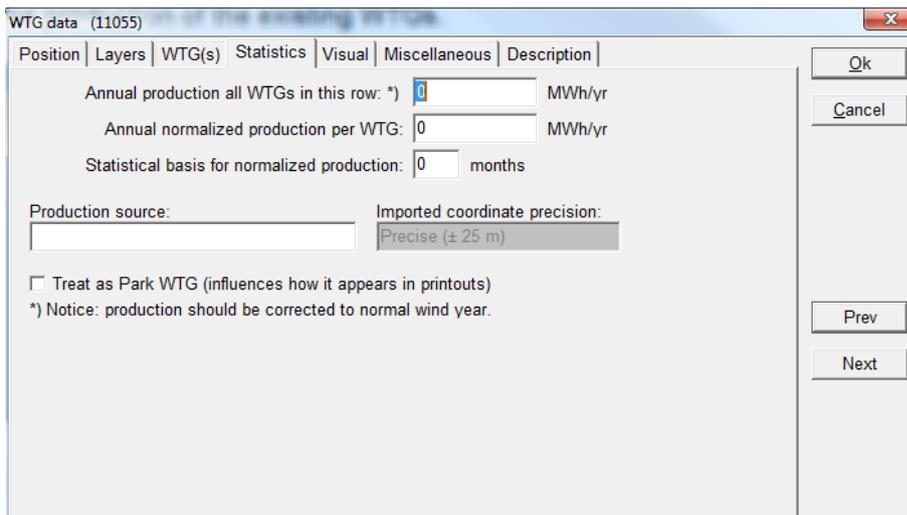


Under the Tab Sheet "Position" you can enter the exact coordinates. The Z-coordinate can be entered manually or read automatically from a Digital Terrain Model calculated on the basis of a Height Contour Map. Description can be entered and used as label on map.

2.5.2.3 Existing WTGs Tab Sheet: Statistics



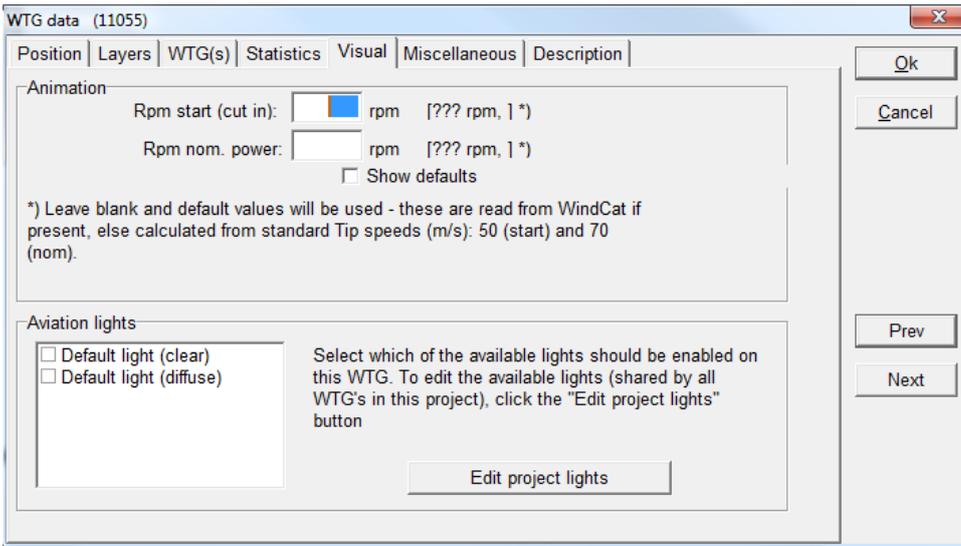
Existing WTGs are created the same way as the new WTGs. The only difference is that it's possible to input statistical data, i.e. actual production data, for the existing WTGs and thereby compare the energy production calculations. In a PARK calculation the results will be grouped in new and existing WTGs respectively, including information on the impact of the new WTGs on the production of the existing WTGs.



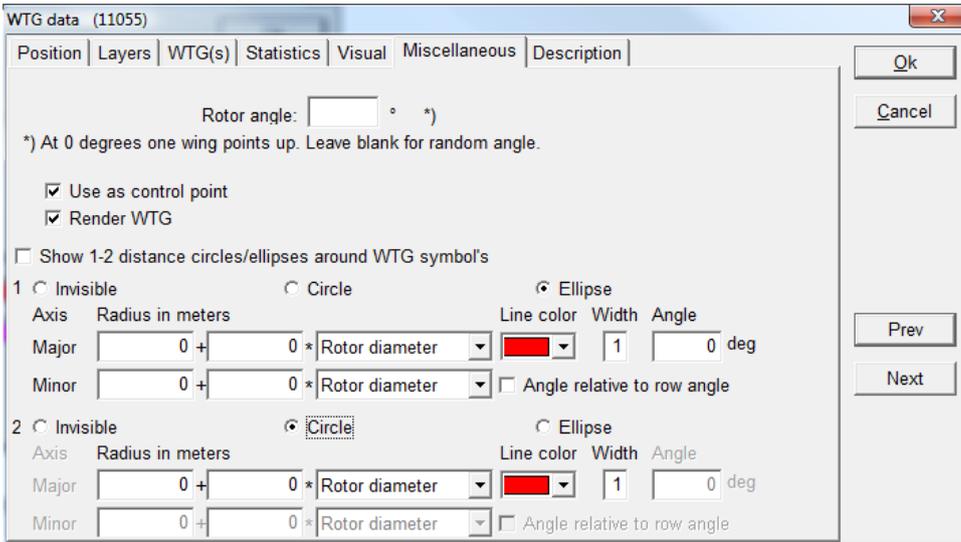
Existing WTGs can be imported (see Chapter 2.7)

2.5.2.4 WTG Object Tab Sheet: Visual

Here, the rotational speed for the WTG rotor can be specified (see Chapter 5, Animation module), and the Aviation light marking can be defined (see Chapter 5, Photomontage).



2.5.2.5 WTG Object Tab Sheet: Miscellaneous



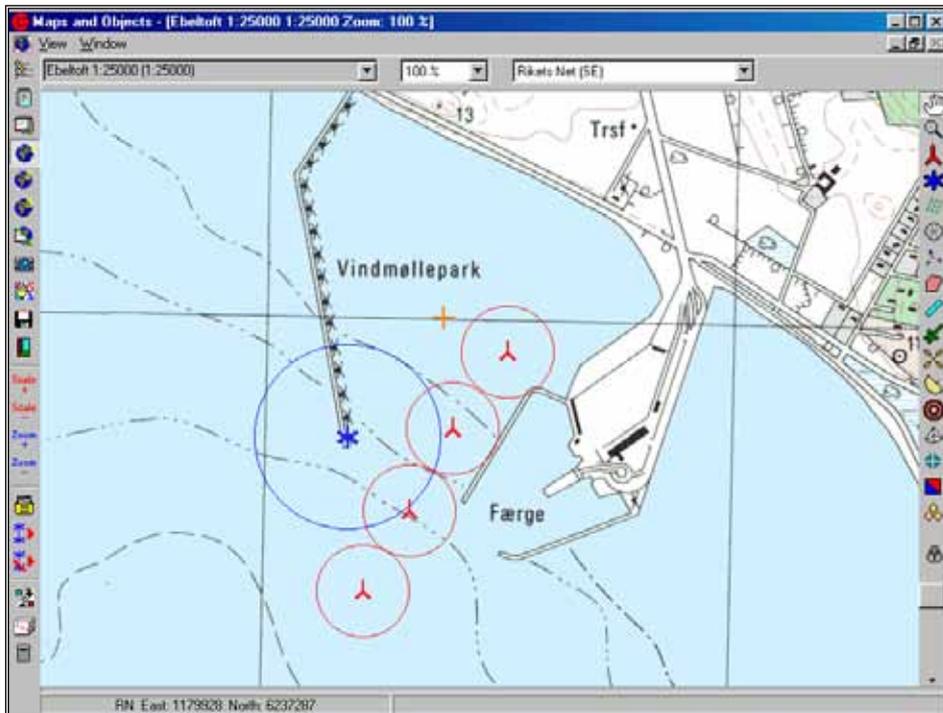
In the Tab Sheet "Miscellaneous" you can enter:

Rotor angle – only for visualization purposes

Use as control point – only for visualization purposes

Render WTG – only for visualization purposes

Distance circle/ellipses – this is often useful for project design. It's activated by right-clicking on WTG symbol and checking "Show distance circle". Two circles/ellipses can be established and the radius can be made dependent on WTG main size specifications. Color and line width can also be specified.



An example of how to use the distance circles to both ensure the distance from the new existing WTG of 200 m and a distance from the pier of 100 m is shown on the map above

2.5.2.6 Object Tab Sheet: Layer

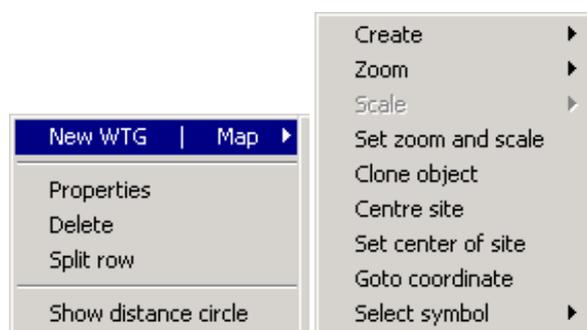
(See layer structure, Section 2.11)

2.5.3 Clone object (copy) and multi-editing

Two useful tools are available for all types of objects.

2.5.3.1 Clone object

Select one or more objects to clone (copy) from the map or the Object List. Select an object simply by clicking on the object with the left mouse button. Select additional objects by holding down the <Ctrl> key when clicking on objects on the map or multi-select in the Object List as you would in Windows Explorer. Once the objects have been selected, click on the right mouse button, then select "Clone Object" (go to the right from the top of the menu "New WTG | Map >" and a local object menu appears) (see below).



The cloned objects are placed 100 m East and 100 m South of the original ones. If the original object positions are locked, the cloned objects will be positioned at the exact same coordinates as the originals. The cloned objects can be moved normally when not locked. Cloning is a useful feature, especially for the terrain data object (see the module Energy Calculation), since you don't have to enter values twice e.g. two roughness classi-

fications nearby each other that are almost identical. It's also a good way to ensure that parallel rows of WTGs have identical properties.

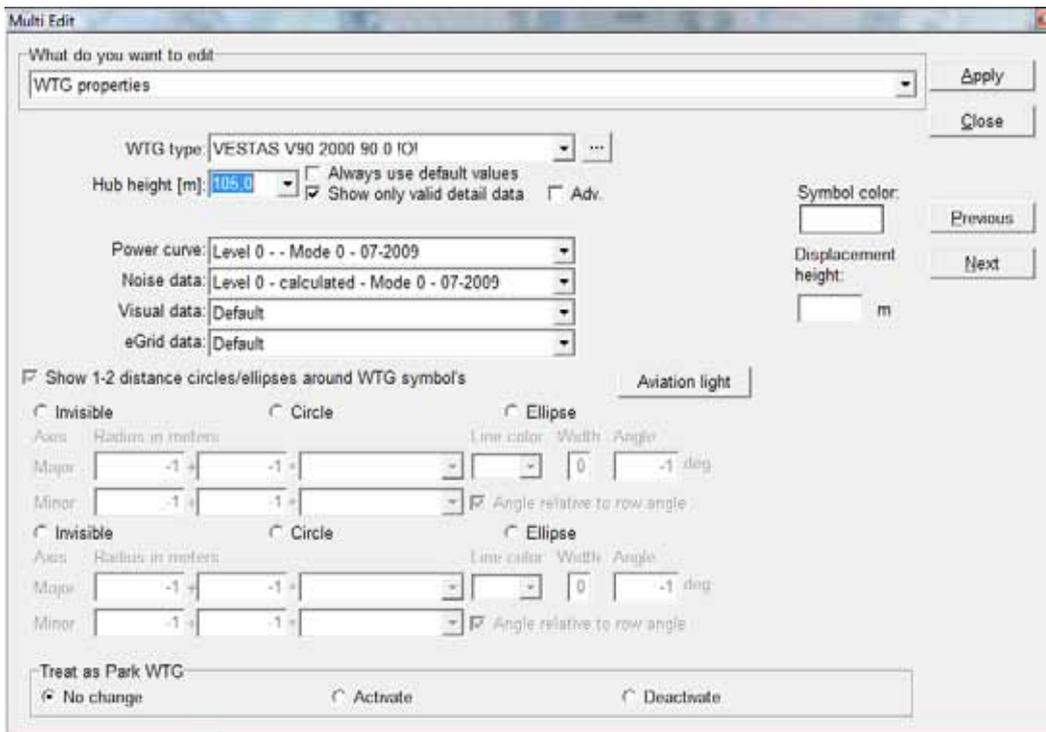
2.5.3.2 Multi-editing

When working with many WTGs or e.g. noise sensitive areas, where you need to change the WTG type in general, the hub height or noise emission data, or attach all objects to a height contour Line Object in order to read the Z-coordinates automatically, multi-editing is an efficient way of changing the characteristics for a large number of objects.

The Multi-editing tool works either by starting to select the objects to edit (possible with different WTG-types if e.g. the Z-coordinates are to be changed) or by firstly starting the "Multi-edit-window" and secondly selecting the objects to edit.



Start the "Multi-edit" tool by clicking on the symbol shown to the left. The "Multi-edit" window will appear as shown below.



Select which properties to edit as shown above, e.g. the WTG type. Different ways of Multi-editing present different choices to edit different types of objects at the same time. Only the relevant changes for each object are performed. The program will notify you of the different selected types of objects before handling.

2.5.4 Import/export and copy/paste of object data via Object List

Electronic exchange of data is becoming more and more common. You may receive coordinates for objects (WTGs, neighbors, etc.) via an email that you don't wish to enter manually. Or, you need to make some changes to a wind farm layout with the aid of a spreadsheet calculation. Maybe you want to copy all noise sensitive areas to shadow receptors at the same positions, or copy a roughness rose from one project to another. All of these operations as well as many others can be performed with help from the import/export and copy/paste functions.

The Object List window shown below is where you must be working in order to use these functions. Note that you can sort the objects by the individual columns for faster selection.



To export (copy) one or more objects, simply mark the objects by dragging when holding left mouse button down or, as in Windows Explorer, by holding down the <Ctrl> key or, by marking the first selection and then holding down the <shift> key when marking the last. When objects are selected, right-click and get the menu shown below:

Edit selected objects	Enter
Delete selected object(s)	Del
Clone object(s)	
Export	▶
Import	▶
Select all	Ctrl+A
Copy object(s)	Ctrl+C
Paste object(s)	Ctrl+V
Copy result(s)	Ctrl+R
Replace object data	

Choose “Copy object(s)” and all the stored information for the objects is placed in the Windows clipboard. The data can be pasted back as new objects or as a replacement of the copied data with the changes made in a spreadsheet, e.g. adding a user label (see next section).

2.5.4.1 Copy/paste for remote editing of object data in spreadsheet

From the clipboard, you simply paste the objects into a spreadsheet (or into the Object List in another project) and if into a spreadsheet, the list appears as shown below.

Descriptio	Object type	System la	Object ID	X	Y	Z	Object de	User label	File name	Hub heigh	Productio	Use defau	Power cur
9850	Existing WTG	5	1	186530	424058	325.6	9850		C:\Users\y	40,5	2383	yes	
9852	Existing WTG	6	1	186308	424183	332,5	9852		C:\Users\y	40,5	2501	yes	
9853	Existing WTG	7	1	186220	424382	345	9853		C:\Users\y	40,5	2632	yes	
9851	Existing WTG	8	1	186224	423942	289,7	9851		C:\Users\y	40,5	2346	yes	
9854	Existing WTG	9	1	186442	423838	287	9854		C:\Users\y	40,5	2321	yes	
				Paste from here if you want to replace object data									
				Paste from here if you want to create new object by type									
				Paste from here if you want to get a pop up list for selecting object type									

The following properties are common for all object types:

Description – Same as in Object description

Object type – Name, identifying type of object (see later in list).

(The properties listed above will not be used when copying changed object data back to the Object List).

System label – unique internal number assigned when the new object is created (cannot be edited).

Object ID - Number, identifying the type of object (see list later)

X – East coordinate

Y – North coordinate

Z – Elevation (above ground level)

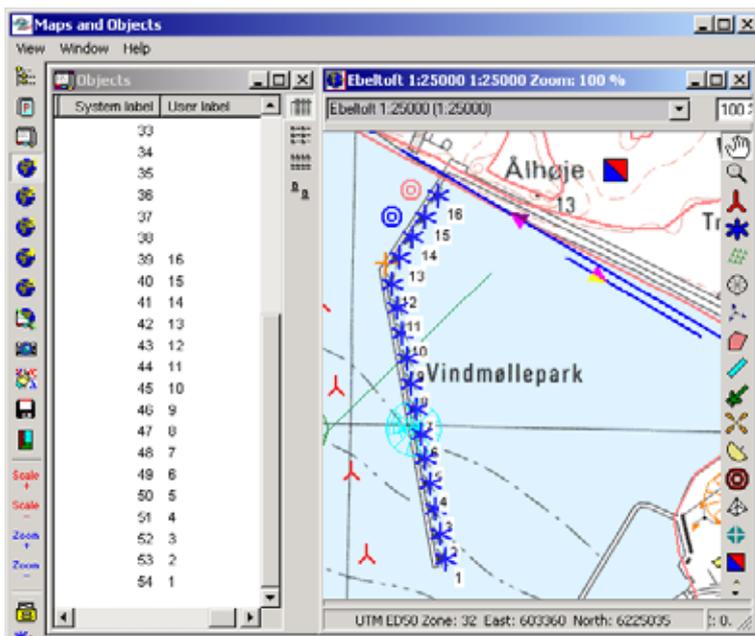
Object description - (User specified description, if no user description it is auto generated)

User label - (User label e.g. internal numbering for sorting in printout)

Lastly, depending of the type of object, additional information such as **Hub height** and **WTG type** for WTGs. See Section 2.5.4.4.

Data can now be modified in the spreadsheet and copied back to object list, see what to include in list shown above.

In the figure below, you can see how the copied 16 existing WTGs in the Ebeltoft DEMO project have been given a user label corresponding to the correct WTG number. This can be used later for deciding the print order in reports.



2.5.4.2 Export data from object list

Export		Export object position(s) to a Shape file
Import		Export to file...
Select all	Ctrl+A	Export object position(s) to a waypoint GPX file
Copy object(s)	Ctrl+C	Export to Google Earth kmz-file

There are at present 4 export options:

To shape files (for import in GIS software), a .shp file is created.

To file – a WindPRO object file (.wpobjects) is created – this is an efficient way to transport objects from one WindPRO project to another – this includes all data “behind” the objects.

To waypoint GPX file, the “standard” within GPS, meaning this is the format that can be imported into a GPS.

To Google Earth .kmz file, see chapter 2.16

2.5.4.3 Import data to object list

Import		Import placemarks from Google Earth KMZ file...
Select all	Ctrl+A	Import from file...
Copy object(s)	Ctrl+C	Import placemarks from a waypoint GPX file...

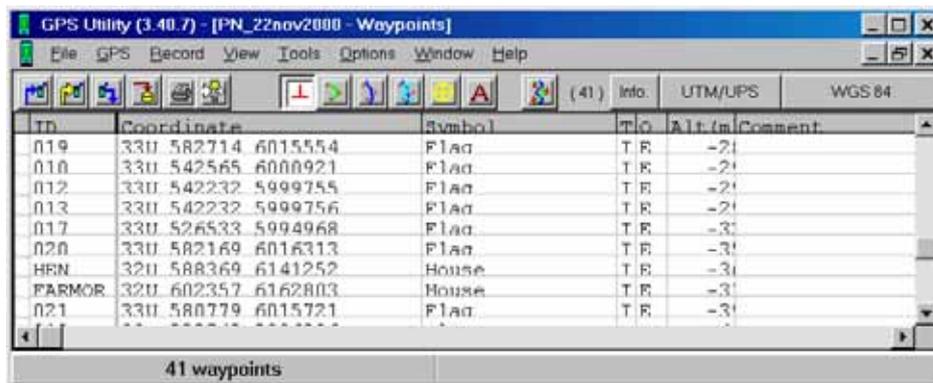
Here are at present 3 different options:

From Google kmz file, the points in the file (e.g. turbine positions specified by client) will be established as control marks in WindPRO. By copy to like Excel and paste back you can change the controlmarks to the wanted object type.

From file – the native WindPRO *.wbjects can be imported including all object information's.

Waypoints from GPX file, the GPS file format, see additional options about GPS coordinates below.

If you have data in a GPS, you need getting the data into a spreadsheet before copying. This can be done simply by typing data from the GPS screen into a spreadsheet. Or, in the case of a larger number of GPS points, by importing GPS data into a PC (a special cable is required to do this). Free software can be found on the Internet – e.g. at www.gpsu.co.uk, or purchased together with GPS. Shown below is an example of the screen in the free GPS software, GPS Utility, after downloading waypoints.



To get the coordinates pasted into a spreadsheet, you need to select one row at a time and then paste. Afterwards, you have to divide the coordinate column into two in the spreadsheet e.g. use the "MID(A1;5;6)" function to extract, starting with the 5th character, the following 6 characters from cell A1 (the X-coordinate). There are other free GPS tools like “Easy GPS” that seem to work better.

2.5.4.4 Identify what can be copy/pasted by object list

While the features that can be copied/pasted between object list and a spreadsheet will be revised from version to version, we recommend you simply copy the objects of interest from object list to spreadsheet, and there you will be able to see which features are included and thereby what can be “pasted back”.

2.5.4.5 List of Object IDs

Object type	Object ID
New WTG	0
Existing WTG	1
Site Data	2
Obstacle	3
Noise Sensitive Area	4
Shadow Receptor	8
Control Point	9
Camera	10
Line Object	11
3D Object	12
Area Object	13
Park Design Object	15
WTG areas	16
User text	17

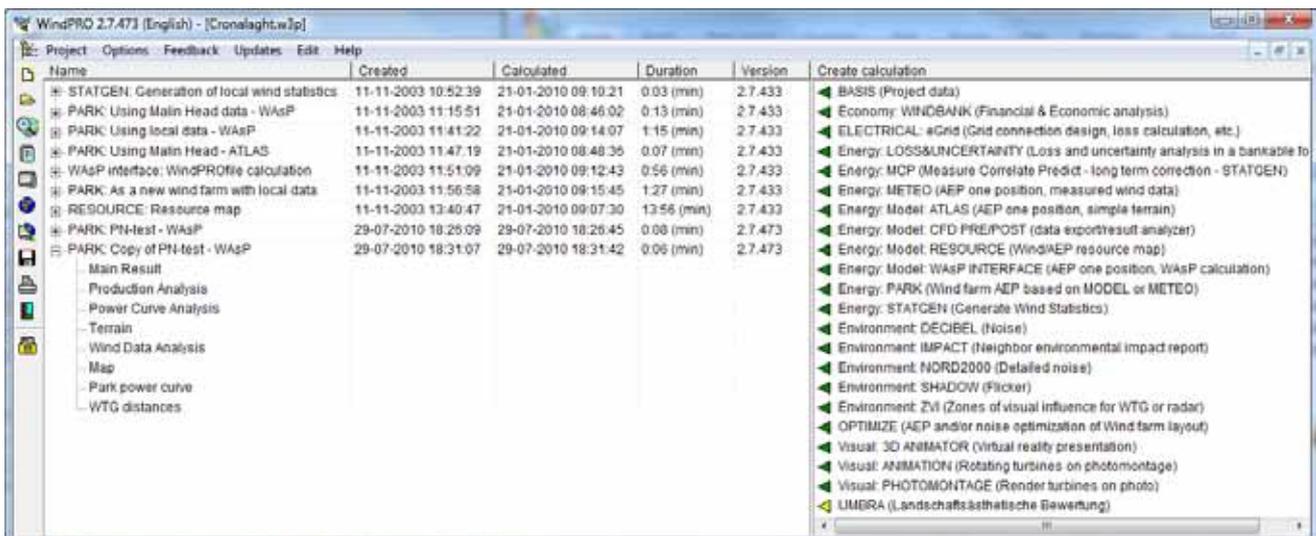
2.5.5 BASIS calculation

With the module WindPRO BASIS alone, it's possible to perform a so-called "BASIS-calculation". The "BASIS-calculation" does not calculate, it merely generates a complete report of the data that has been inputted, and a map with a presentation of the project. This gives e.g. the potential buyer of WTGs the opportunity to work with different project layouts using the WindPRO program at a very favorable price and the ability to forward the information (e.g. a WindPRO export file) to different manufacturers for calculations and quotations.

After a calculation, you can copy the calculation (by right-clicking on the report header). Then a copy of the report and all calculation settings is made. If you later change the WTG layout on the map, you can recalculate the copied calculation, so you now have two calculation reports with same specifications (e.g. air density), but with different WTG layouts so that the two sets of calculations are identical except for the layout.

2.5.6 Printing – general tips and setup

When a calculation has been performed, the following window appears.



Depending on the calculation, two or more reports will be generated. The line with the calculation name (in this case BASIS), is the "header" of the calculations report. The name the user gives the calculation (in this case "My first calculation"), also appears in the header. The reports follow subsequently.

To view ,setup or print the reports, there are a number of options described as follows:

2.5.6.1 Preview print and save file (.bmp, .jpg, .pdf, HTML)

See next sections on how to get into the preview window.

In the top of the preview window there are some functions that are used as follows:



The zoom and "full margin" buttons are self-explanatory.



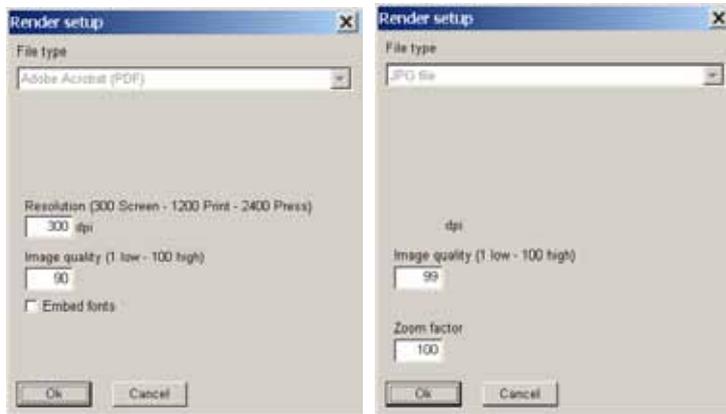
Copy to clipboard – afterwards the entire page can be pasted into another Windows document as a graphic.



Copy to file – or use the menu "file" > "save as" and choose between following options:



Note that the printer driver selected before preview will determine if there will be colors on the print preview and in the print file. This can be overruled by setting "Force color printing" or "Force monochrome printing" in the report setup



If .pdf or .jpg format is selected, then the setup options shown above will appear. This gives the option to decide the quality and size of the file.



The arrows are used to move backward and forward between pages. If only one page exists in the preview, the arrows will be grey.



The printer symbol – print the current page, selected pages or the entire report.

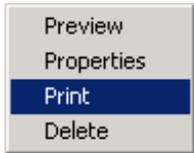


The door – closes the preview.

The Zoom window allows you to user-define the zoom factor. NOTE: Use a large zoom factor to ensure picture/graphics quality if reports are being copied to a file or to the clipboard.

2.5.6.2 Print a single report with default settings/preview

To print a single report, select report (click on report) and click on the printer symbol or right-click and select “print” from following menu:



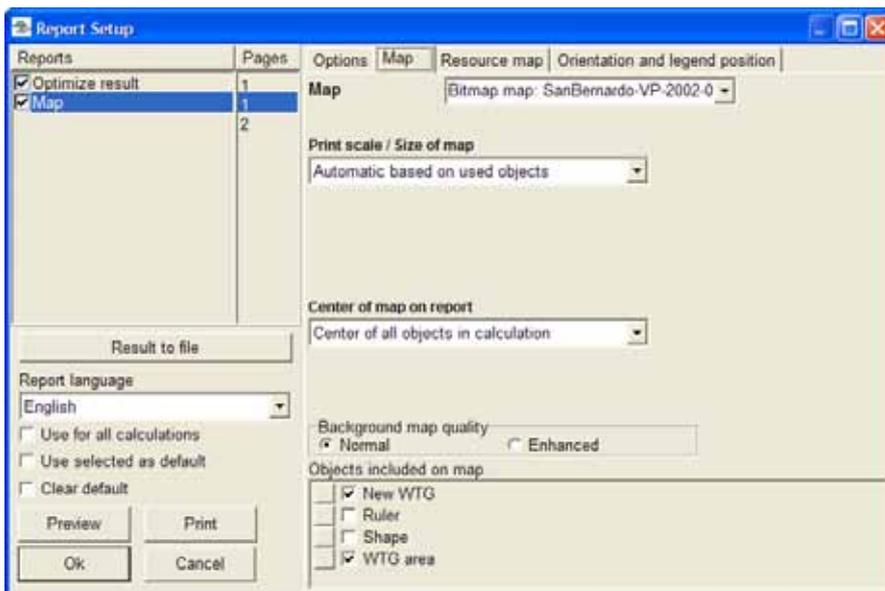
To preview a single report with default settings, simply double-click on the report, e.g. on "Map".

2.5.6.3 Setup a single report

Right-click on report name and select Properties from the following menu:



The following window appears depending on which report you have selected.

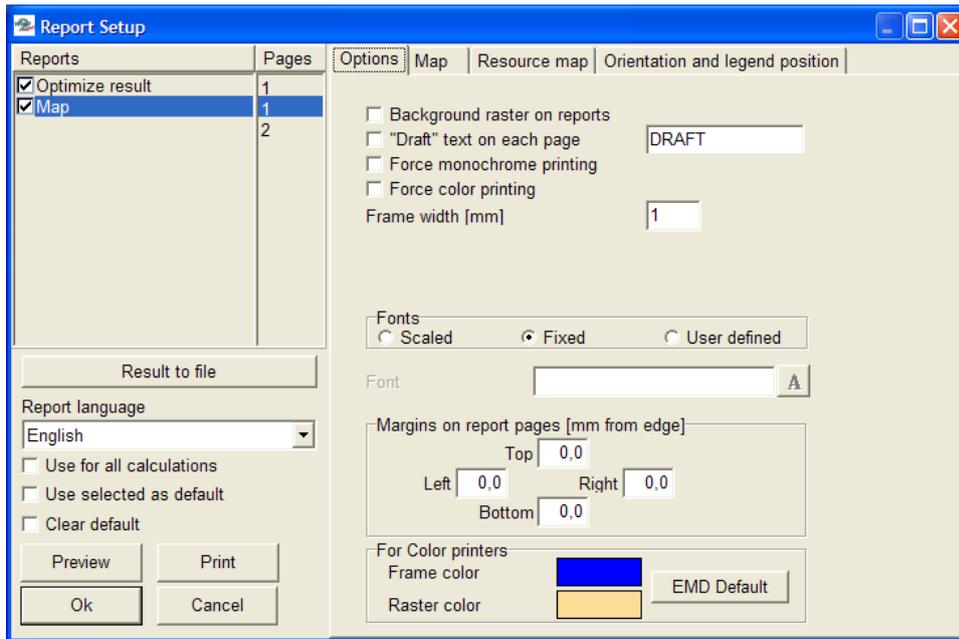


In the right half of the window you get different tab sheets where individual settings can be applied to the report. In the left part are following important features:

Result to file - in more reports; the calculation results can be saved to a file or to the clipboard for further processing in e.g. spreadsheet tools.

Report language – from version 2.4 on, some print languages will be available (if license is purchased).

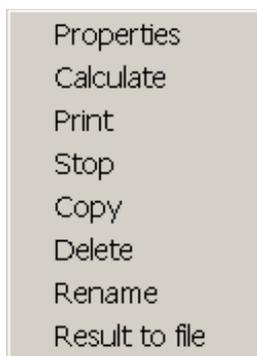
The “Report language” can be checked so it’s used in all calculations until WindPRO is shut down. The next time WindPRO is started, the original language will reappear as a default unless “use as default” is checked.



On the "Options" tab sheet, you can select "Force color printing", which is advantageous if your default printer is a black & white printer, and you want to save e.g. PDF files with colors. The many other layout options should be self-explanatory.

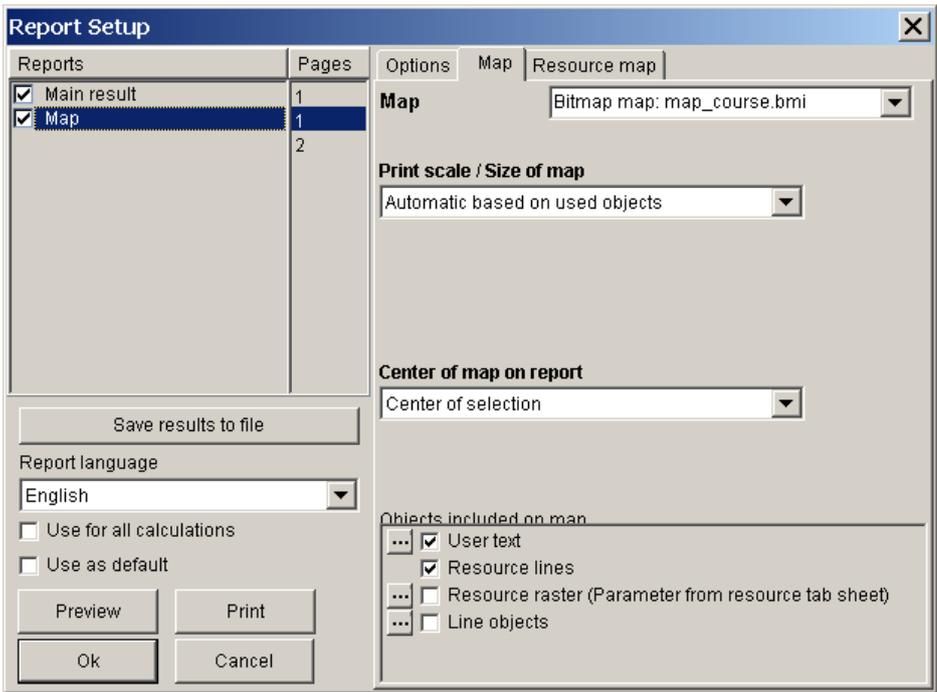
2.5.6.4 Print all reports, define reports and settings, symbol scaling, etc.

To print all reports or to set up a complete calculation report, select the report header by left-clicking on it and then click on the Printer symbol , or you can right-click on the header and select "Print" as shown in the menu below.



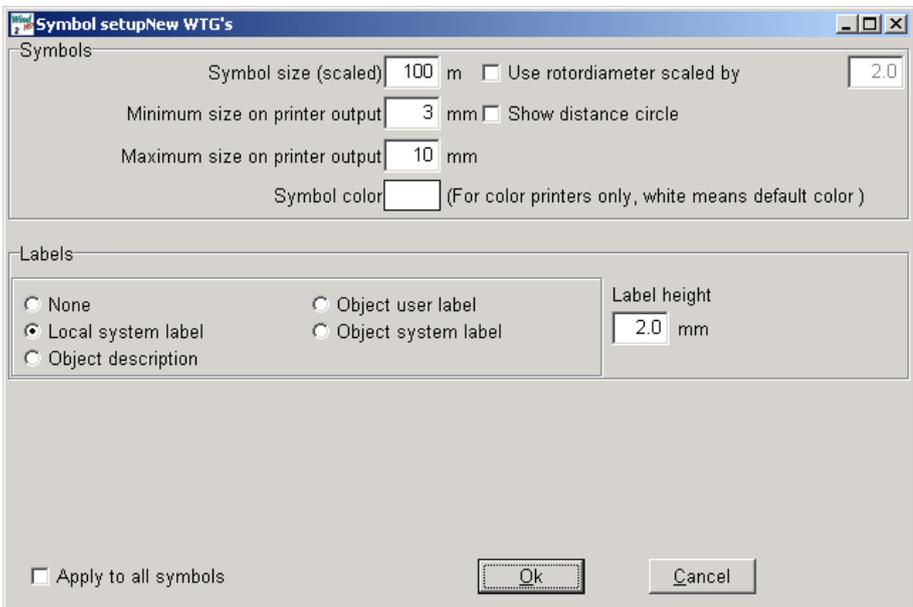
Note: With the "Rename" function you can change the calculation name and the description without recalculating.

When selecting "Print", the Report Setup menu appears.



On the left side you can select the different parts of the report you want to print, and on the right you can set up individual parameters, depending upon which report is selected.

In particular for the "Map" report, you can define which part of the map to print and which objects to be included. By clicking on the dotted button , you can define the appearance of the objects individually in the Map report (it also affects the map on Main report, see below).



Note: Scaling and individual label settings, etc., can only be made when selecting the report "map", see Section 2.5.6.3.

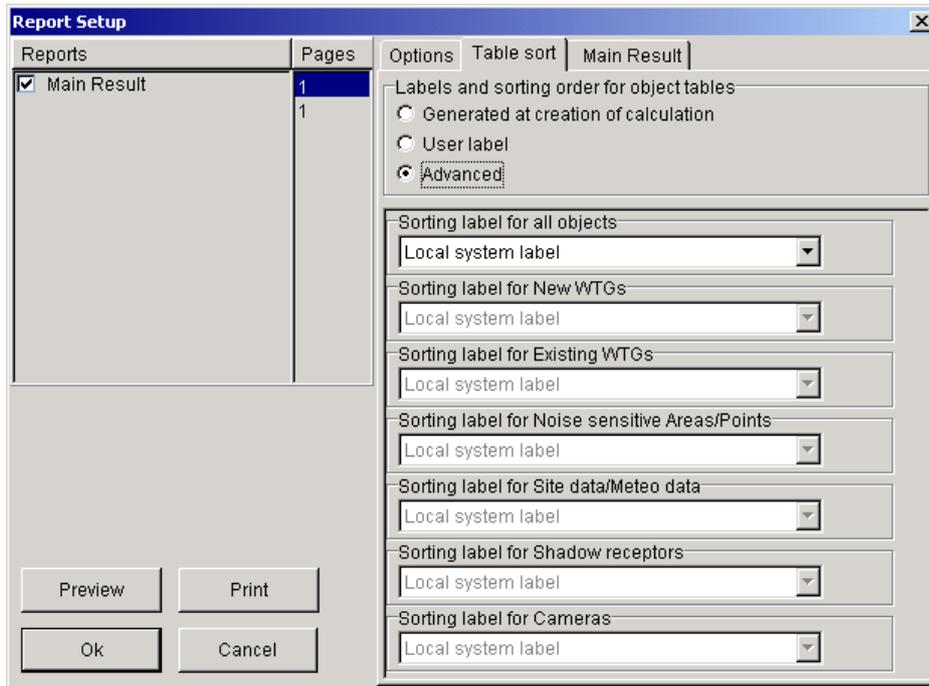
2.5.6.5 Sorting the objects by user label etc.

A unique feature in WindPRO is the ability to sort objects by user or other label. Default objects listed in reports are sorted by object system label, but are numbered after a local system label (where objects are numbered 1, 2, 3...or a, b, c...). This option is called "Auto sort" (Local system label).

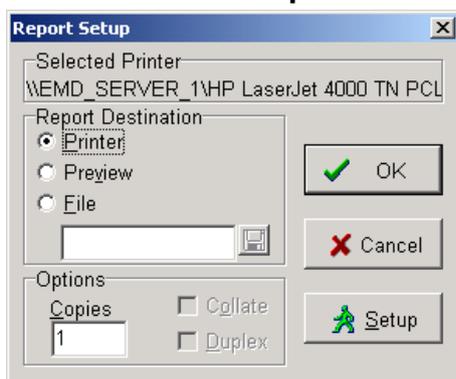
Selecting to sort by “User label”, you specify the label on the print (by supplying the objects user label) and the objects are then sorted by that user label (numerically or alphabetically).

Lastly the "Advanced" option allows you to use the WindPRO-assigned system label in printouts, in which case you always have the same label assigned to the same object, regardless of which objects have been inserted or deleted. In “Advanced”, you can chose different sorting options for different types of objects.

This feature is found under the Tab Sheet "Table sort".



2.5.6.6 Printer setup



Click on “Print” to select a printer or to specify the printer setup. This follows the normal Windows convention (please refer to your local printer manual).

If you want to output a standard file type e.g. for attaching results to an E-mail, choose “Preview”. From the Preview window you can save reports as standard PDF documents (without having to purchase Acrobat writer) or JPEG’s (see section 2.5.6.1).

Note: If you want to print to a file you must have an appropriate printer driver installed. For example, you would need a Postscript printer driver to produce a postscript file, which many copy centers can print for you on high quality printers for inexpensive mass production. An even better solution is to print with Adobe PDF writer (cost: approx. 150 US\$), PDF files are readable from Adobe Acrobat reader, which is probably the most com-

mon file format for mixed text and graphics. The Adobe reader is free on the Internet, so everybody with Internet access can read and print your reports. With a PDF file, the formatting will always remain the same independent of the printer. An advantage is that the PDF format can be highly compressed, although you can select the compression of the bitmaps (graphics), in order to get a reasonable compromise between quality and file size.

2.6 BASIS - The WTG Catalogue

2.6.0 Introduction to wind turbine catalogue

Over the years, more than 700 different WTG types and variations have been collected by EMD from a number of sources, and are included in the WTG Catalogue. The Catalogue is continuously updated.

You can add your own new wind turbines to the Catalogue and you can supply the ones created by EMD with your own data (new power curves, noise data etc.). You cannot edit the data that has been supplied by EMD. You can however, make a copy of an "EMD" turbine, and use it as a template for a new user-defined WTG.

Note, that the WTG Catalogue keeps track of whether the data is created/edited by EMD or the user. In the "Source" field in WTG Explorer, there will be 3 possibilities:

EMD
USER
EMD-U

The EMD-U designation means that it's a WTG created by EMD, but the user has added some information. Depending upon the power curve used in the calculation, it could be either an EMD or a USER power curve. In the printouts of the energy calculation, it will indicate whether an EMD or a USER power curve was used.

The information registered in the Catalogue is primarily the type of information which is most important during the design phase of a project.

The Catalogue is structured such that, if a WTG is considered to be of a certain type (same manufacturer, generator-system, rotor diameter and tower type), it's stored in one file. Inside this file there can be additional power curves, noise data sets, visualization data sets, price data, and different hub heights (tower heights). This is a compromise between reusing data and keeping the structure simple.

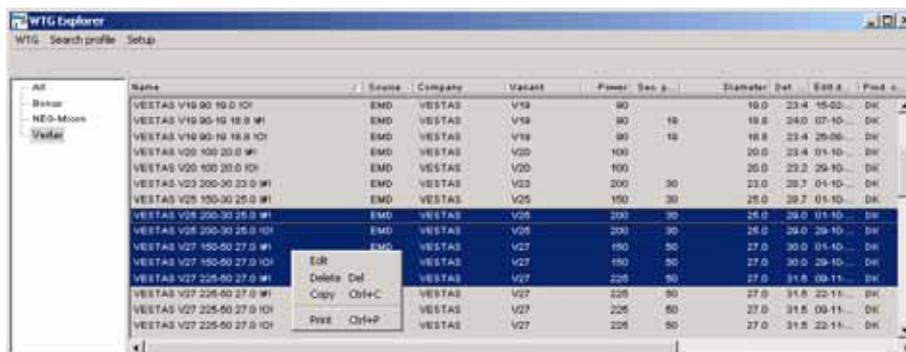
2.6.1 Invoke and Modify the WTG Catalogue



The WTG Catalogue is invoked from the WindPRO main menu by clicking on the "Archive drawer" icon.

2.6.1.1 The WTG Explorer

When the Catalogue is invoked, the WTG Explorer appears. Please see further details in the WindPRO Explorer search path and search profiles in Section 2.3.2 WindPRO Explorer list.

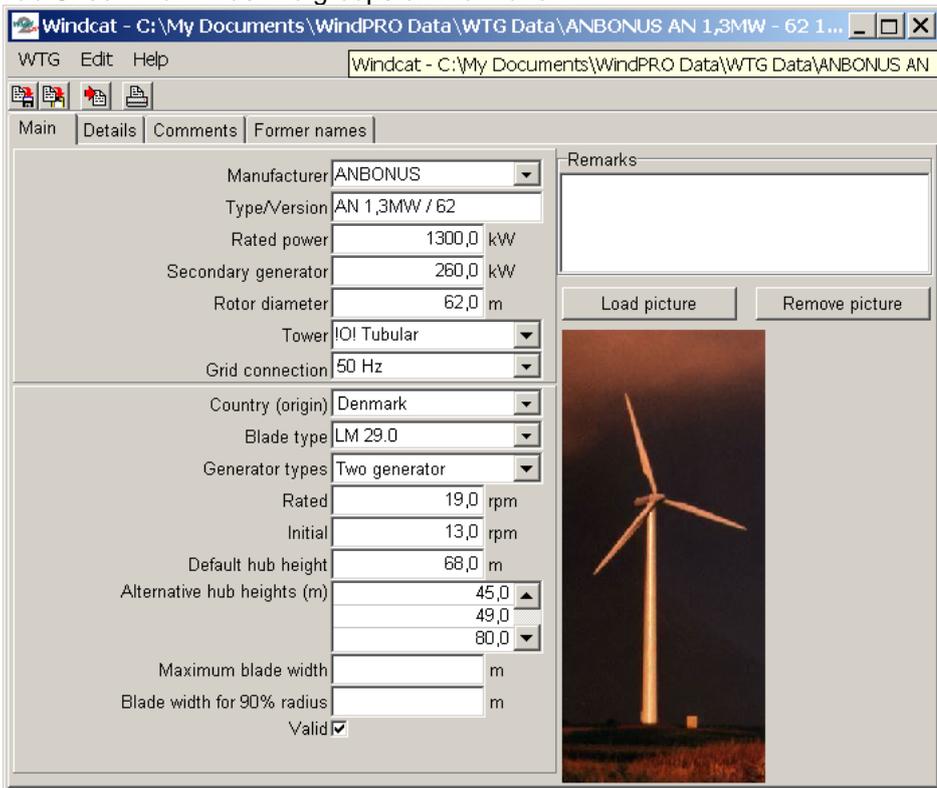


Simply right-click or double-click on a WTG, to enter the edit menu.

If you want to import specific WTG types from a spreadsheet; as in Windows Explorer, you can copy the main information of selected WTGs to the clipboard (see Section 2.5.4). You use the list to get the right file name into the spreadsheet at the point where you want to paste WTGs into the Object List.

2.6.2 WTG Catalogue Tab Sheet: Main

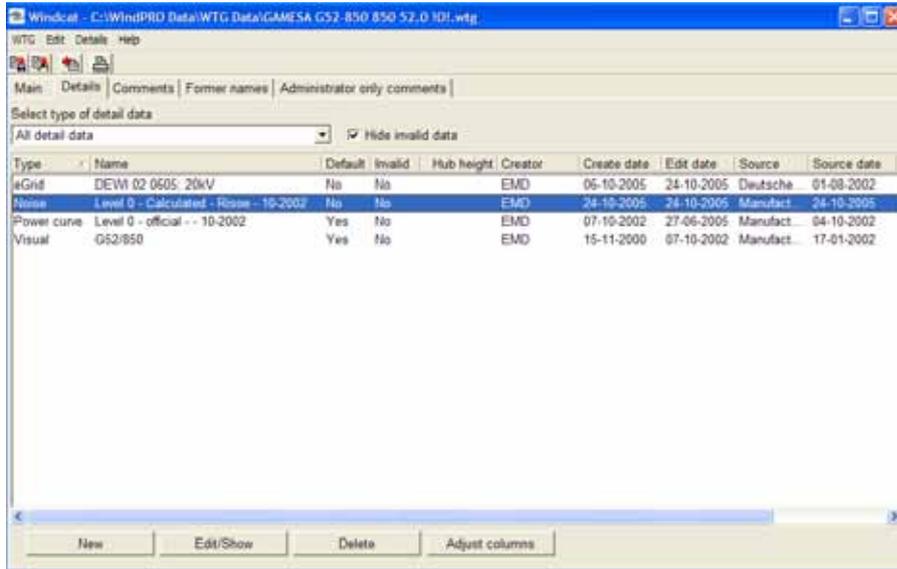
Tab Sheet “Main” has two groups of information:



The upper section contains the unique identification and description for the turbine type, i.e.: Manufacturer, Type, kWh (large/small generator), Rotor Diameter, Hub Height and Tower Type(s).

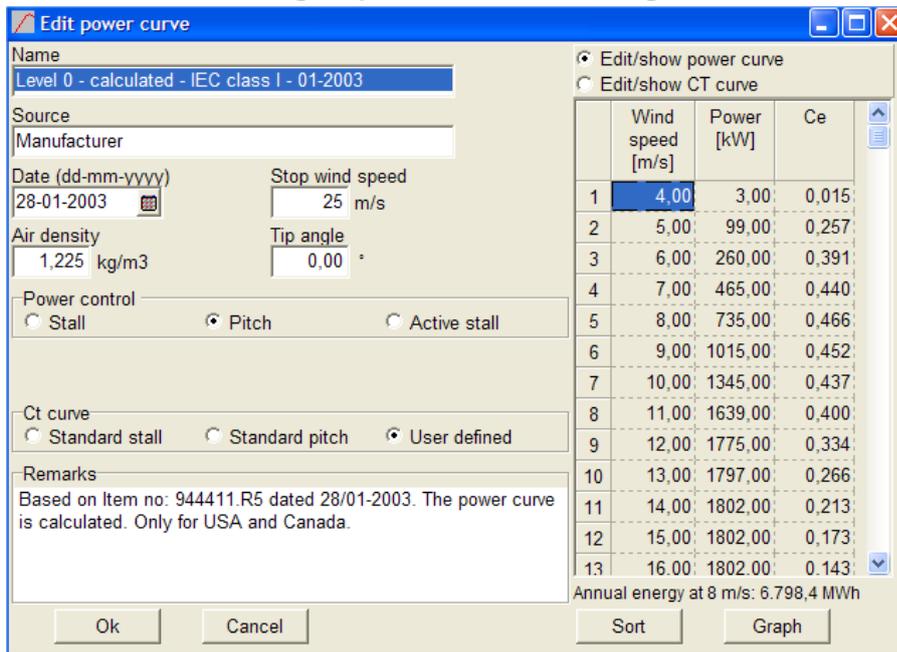
The lower section contains additional information such as: Country of Origin, Blade Type, Generator type (rpm Control), rpm, default hub height and alternative hub heights. For a SHADOW calculation, the blade width can be entered, which allows the shadow calculation to determine the distance from the turbine at which flicker may be a problem (at 20% sun coverage). Lastly, there is a field indicating whether or not the WTG is valid, a remark field and a picture.

2.6.3 WTG Catalogue Tab Sheet: Details



Under Tab Sheet “Details”, it’s possible to add multiple sets of data belonging to different variants of the specific WTG type, different sets of power curves, noise data, visual data, or eGrid data.

2.6.3.1 WTG Catalogue power curve editing



Power Curve tab sheet includes information on Source, Date, Stop wind speed (Cut-out wind), Air density for the specific power curve, Power control system, Ct curve, etc.

The Power curves are named according to different noise levels, where “level 0” is the power curve corresponding to “no noise reduced” operation, and the different noise reduced levels follow as “level 1”, “level 2”, and so forth. The name of a power curve also mentions whether it has been calculated or measured (when the information is available).

NOTE on Air density:

The air density, which has to be entered along with the power curve, is the one that the power curve is valid for. Below a few examples:

1) The power curve is measured at an air density of 1.1 kg/m³ and after that, normalized to a standard air density of 1.225 kg/m³. In this case, the standard air density of 1.225 must be entered.

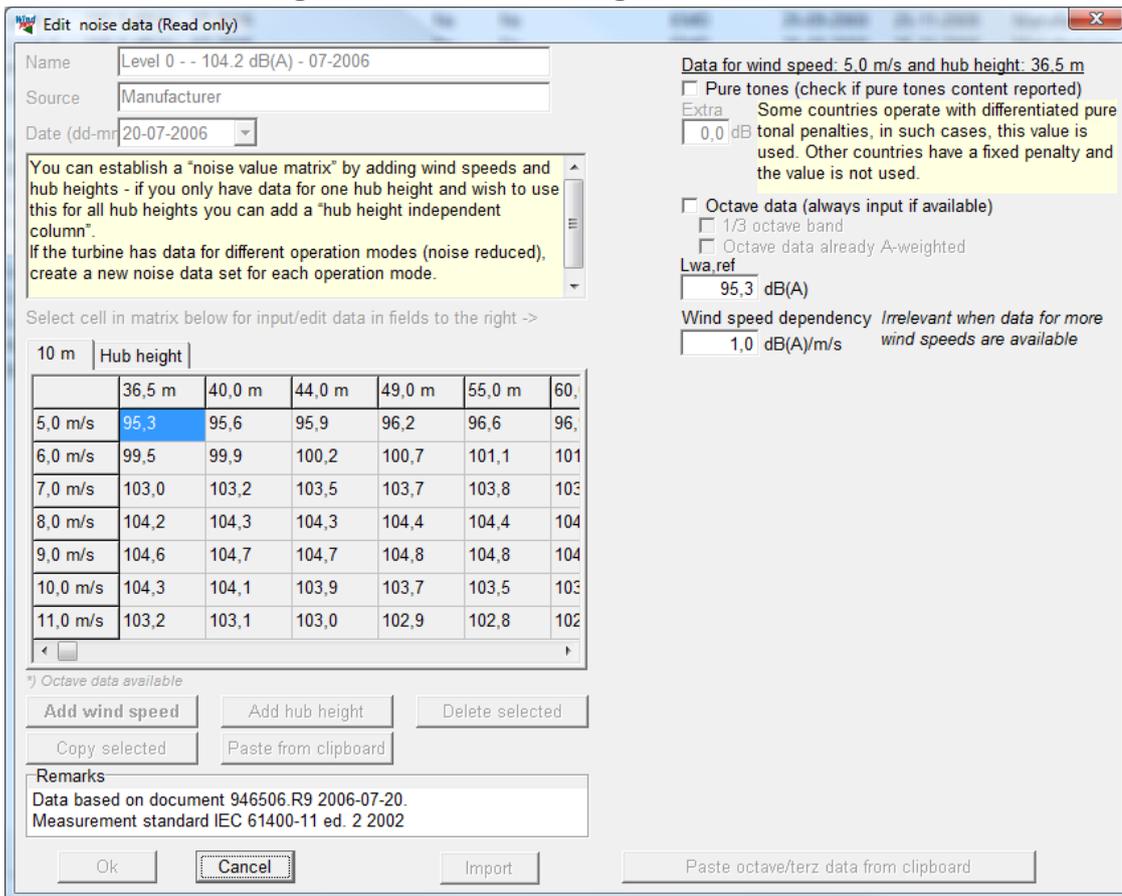
2) A power curve is recalculated and entered with an air density changed from 1.225 kg/m³ to 1.05 kg/m³ (thin air conditions). Then the air density value of 1.05 must be entered (as well as when entering a power curve in the later calculation where used with thin air conditions). The recalculated power curve will then be saved correctly as well as used correctly on the specific site.

Regarding the power curve information, it should be noted that the selection of the Ct curve affects the array loss calculations.

Click on the “Graph” button to get a plot of the power curve and the Ce curve respectively.

It’s possible to copy the power curve to a spreadsheet. Mark an arbitrary point inside the power curve (right-click and choose copy). In this fashion, it’s possible to copy a power curve or a CT curve to a spreadsheet. Pasting into a power curve can be performed in the same fashion.

2.6.3.2 WTG Catalogue noise data editing



The Tab Sheet “Noise Data” includes information on the noise level at a given wind speed and hub height.

The name of the data set has the following structure:

Level: 0 (no noise - red.), 1,2,3...

Type: e.g. Measured, Calculated

Name: e.g. 105 dB(A)

Date: ..

Level 0 corresponds to the “no noise-reduced” operation, and the different noise-reduced levels follow as level 1, 2,....

Each level can contain data for different reference wind speeds and hub heights organized in a matrix. For each combination (wind speed/hub height), there can be octave data.

The name of the noise data matches with a power curve with the same name. This power curve corresponding to this noise-reduced mode of operation should be used to make the energy calculation.

Pure Tones

If the noise measurement report states that pure tones are observed, then the field "Pure Tones" must be marked. Pure tones will result in more restrictive requirements in the calculation models.

Octave Data

Data available as octave band values (i.e. for 8 standard frequency levels), can be entered. This gives a more precise calculation, but it's not a requirement in most models used today.

Frequency Data

Data available as octave band values (i.e. very detailed, given on XX number of standard frequency levels), can be entered. This gives a more precise calculation, but it's not a requirement in most models used today.

A-weighted

If the data are given as octave band levels, this information may also be given as A-weighted values (if so, it should be stated in the noise measurement report). In this case, you should mark the field "A-weighted".

Wind speed dependency

If data are missing at given wind speeds, WindPRO will use the wind speed dependency factor to calculate the missing noise data. By default, it's set to 1 dB(A)/ m/s but it can be changed by the user.

2.6.3.3 WTG Catalogue visual data editing

Visualization data - describing the geometry of the turbine and its color(s)

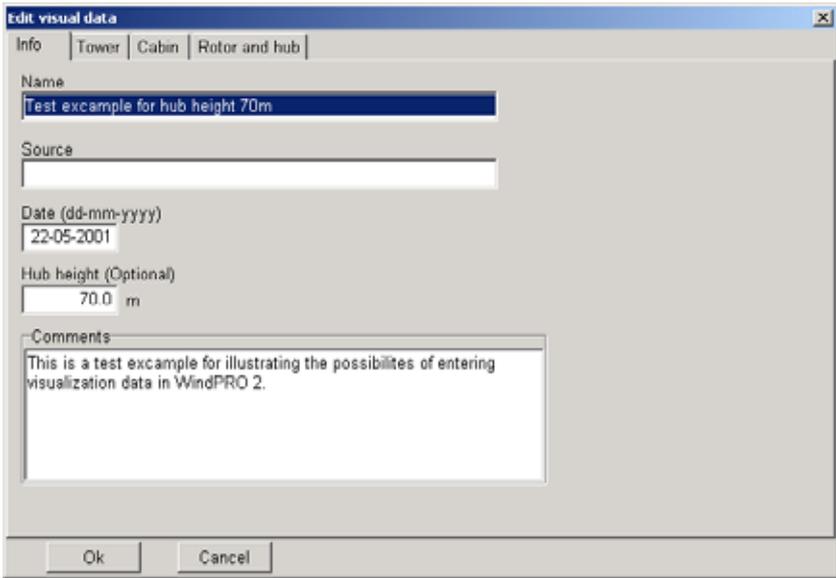
The visualization data are divided into:

Tower
Nacelle
Rotor/Hub

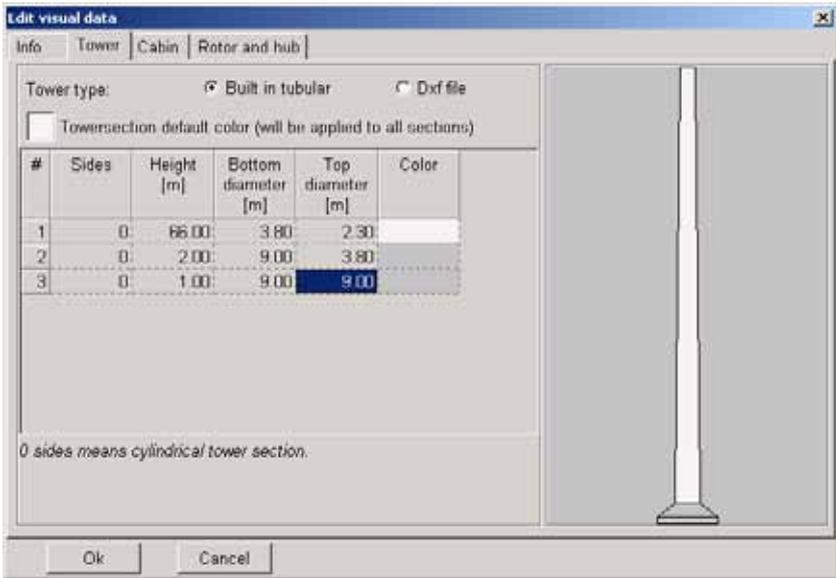
Please notice that a visualization of the input data is shown on a sketch during the input phase. You can build both the tower and the nacelle using up to 10 sections. Note also, that skew edges (different top and bottom lengths) are only allowed for the outer sections of the nacelle.

Lattice towers can be selected from a .dxf (AutoCAD) file. Some standard towers are available from the WindPRO\dxf\ library, but you can also draw your own lattice towers (see also the comments on .dxf files in section 1 of this chapter). Lattice towers are automatically scaled to the correct hub height and can also be scaled to certain widths at the bottom and top of the tower.

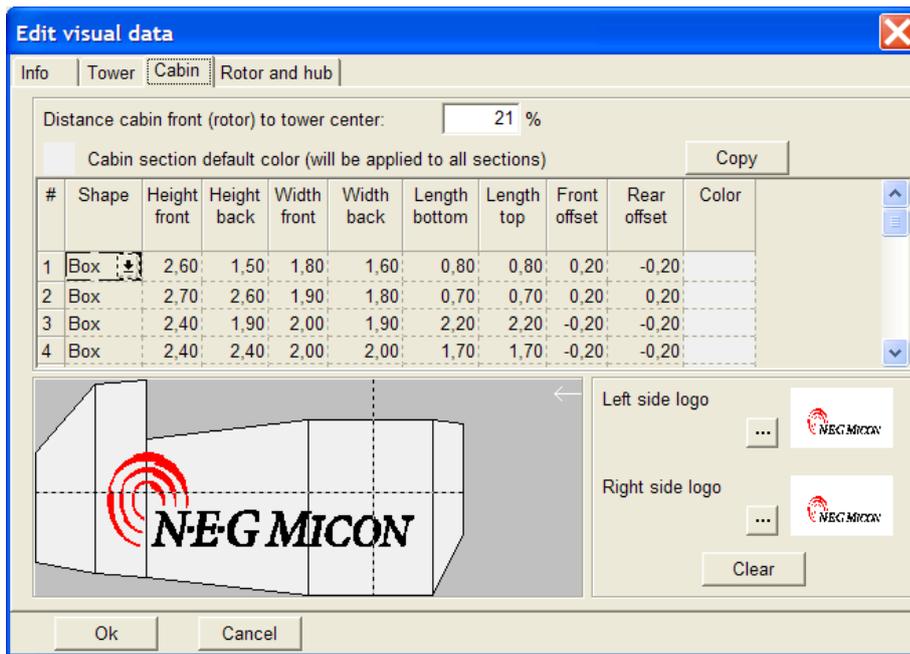
An example is given below:



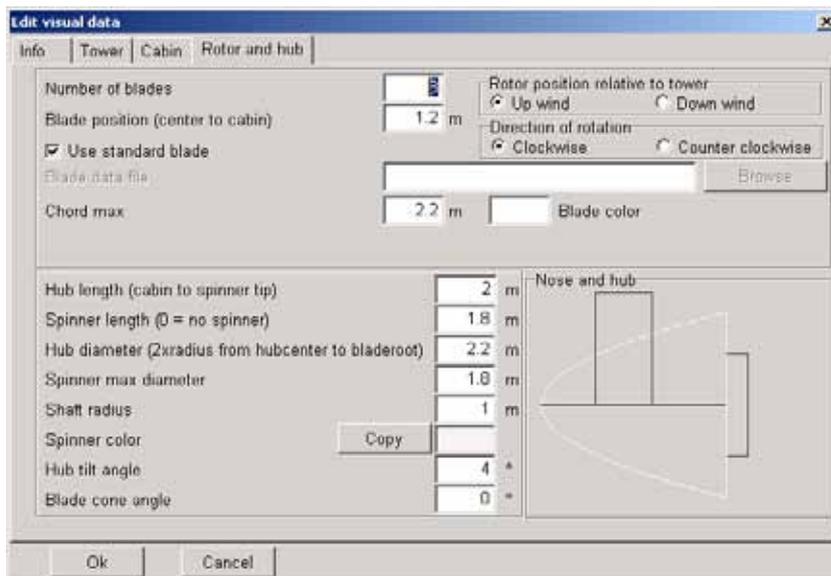
The Tab Sheet “Info” provides the ability to choose a specific hub height. Normally only one data set for all hub heights is provided and the software automatically stretches the tower to the hub height given in the WTG data input field. If data for more hub heights are entered, it will be possible to select the best-suited for the given hub height when selecting the WTG.



The tower can be a built-in tubular tower or a .dxf file, which allows full flexibility to specify the tower with an AUTOCAD drawing. Note that the AUTOCAD drawing has to be drawn following some specific rules (contact EMD to get these). A tubular tower can be fully round or with a user-specified number of sides (edges). More sections can be applied (e.g. 3 sections as shown above). More sections are added by placing the cursor in the lower right data line and pressing the <Enter> key. Data lines can be rearranged by dragging them (right-click with the mouse on the section number column).



The cabin is designed in vertical sections. A bitmap can be attached with a logo. You have to adjust the bitmap yourself so the size and placement on the cabin is correct. The bitmap will use a square around the whole shape for positioning, so it's just a question of having the right bitmap canvas size relative to the logo size.



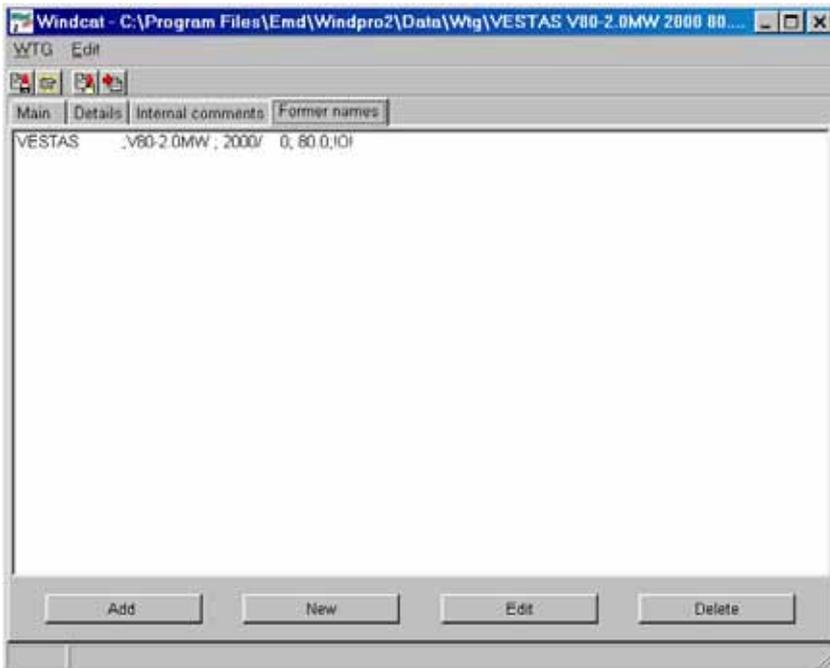
It's possible to choose up-wind or down-wind. This, together with the wind direction set in the Camera Object in Photomontage, determines on which side of the tower the rotor appears. Direction of rotation is only important when creating animations.

By deselecting "Use standard blade", you will have complete flexibility to design the blade yourself. Normally, it's only the addition of different color stripes (e.g. different blade-tip color) that it will be necessarily. Even in short distance visualization it won't be possible to see different blade shapes on a photomontage.

2.6.3.4 WTG Catalogue eGRID data editing

The eGRID data of the WTG catalogue are fully described in the eGRID chapter of the Manuel. Please refer to Section 10.1.4.

2.6.4 Former names



Here, former names from previous software versions can be given so that restructuring names will not affect the link from former projects to the specific WTG type.

2.6.5 Creating a new wind turbine

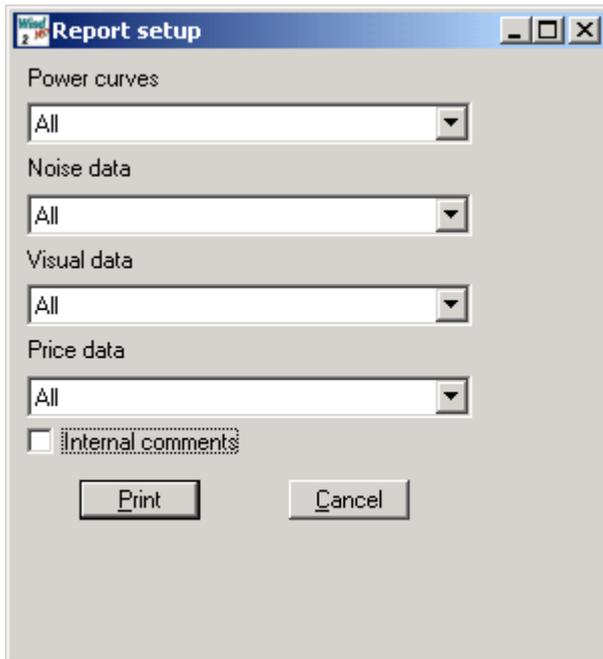
2.6.5.1 Copying and editing an existing wind turbine

It's often advantageous to use an existing turbine as a template for a new one. This can be done by entering "edit mode" of the WTG and then from the menu bar "WTG", choose "Create copy". Now the turbine is ready for editing and can be saved afterwards.

After selecting the "New WTG" icon, you are presented with a blank input form. If a manufacturer is not listed in the "Manufacturer List", you can create a new one under this menu item. The same applies for several other fields where you can select information from a list.

2.6.6 Printing WTGs

 When a WTG is "open" for view/editing use the print option to select which parts of the data to print (see Report setup below).



When one or more WTGs are selected in the WTG Explorer, all data for each selected WTG will be printed. The print function can be selected from the WTG menu drop-down by right-clicking or simply with by pressing the <Ctrl + P> keys.

2.7 BASIS – Import of existing WTGs

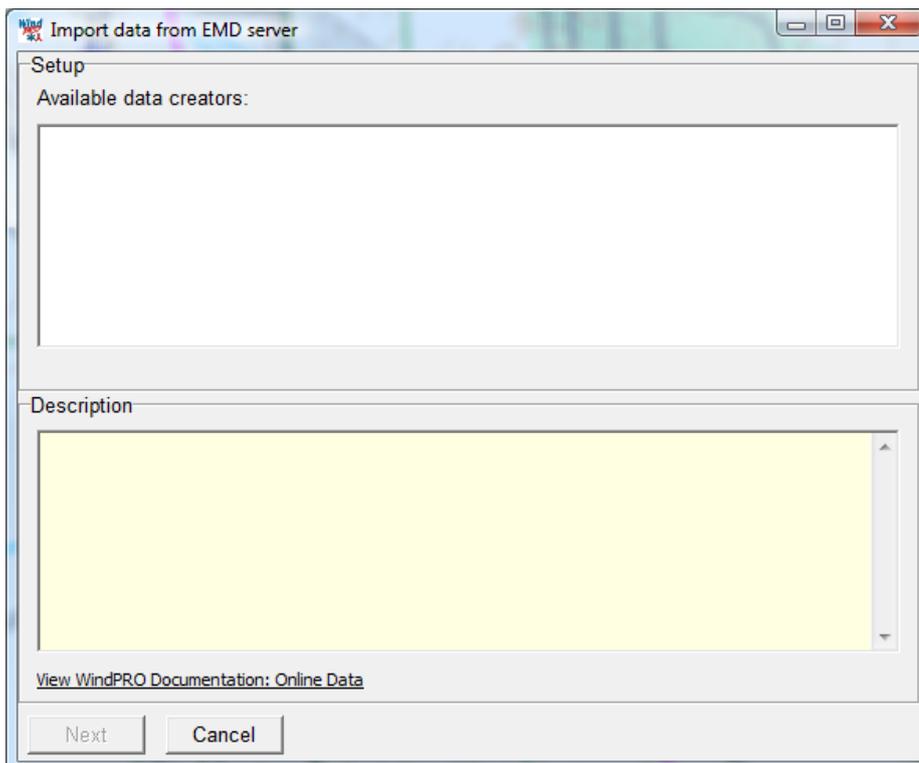
2.7.0 Introduction to Import of existing WTGs

The “Import of existing WTGs” (into a project) is a very powerful function. It can be used for project design in local areas where there are existing WTGs, as well as for planning for a larger region where existing WTGs must be taken into consideration. The use of existing WTGs is especially powerful if information on actual energy production is available. Then, existing WTGs can have a distinct influence on the energy calculation in the new project. Also, it’s often necessary in environmental calculations to include existing WTGs in order to calculate the impact on the environment not only from the new turbines, but also from all existing WTGs in the neighborhood.

2.7.1 Importing from On line data



Via this icon it’s possible to import existing WTGs from the EMD Online data server. Import from a local file is until ver. 2.7 available, but no longer updated.



When there are available existing turbine data for the region, these will appear in the list above. So far only Danish turbines are available, but it is our hope to include data for more countries in the future.

When data are available, the radius for import can be specified and the turbines will be established as “existing WTGs” in the project.

2.8 BASIS - Line Object (height, roughness and 3D-A lines)

2.8.0 Introduction to the Line Object



The WindPRO Line Object gives you a unique visual control over the height contours or roughness lines, which are often the most important inputs for the energy production calculation. The Line Object also contributes to a significant reduction in workload when the user has to find and read Z-coordinates on traditional maps before calculating, e.g., shadow flickering, noise impact and visual impacts. Height contour lines also form the basis for computer generated 3D landscape models used for visualization.

One of the major advantages of the Line Object is that it allows the user to establish on-screen lines just by clicking with the mouse and, in the same way, it's easy to edit existing height contour or roughness line files. The latest development (from version 2.4) also offers valuable help tools in the auto-digitizing features based on color recognition (hold down the <Ctrl> key), or the auto point mode (hold down the <Shift> key) when moving the mouse. Backward deleting of points is performed by holding down the <Alt> key .

Important terms when using Line Objects with height contour lines:

DHM - Digital Height Model: Normally used for a table of (X,Y,Z) values defining discrete points on the surface. An interpolation routine such as the TIN model (see below) is needed to find the Z-values for points in between the table values.

TIN - Triangular Irregular Network: The triangle model established from the digital points (basis of the contour lines), which makes it possible to calculate Z-coordinates at any point. The TIN will usually only be calculated for a selected section of the digitized lines, as they are only needed within the area where the objects are placed. Calculation time depends on the size of the TIN-radius. Due to the large number of calculations required when there is a large amount of data is present, there are very advanced features for the TIN calculation (for more information see Section 2.8.2.2).

2.8.0.1 File formats for height contour lines

WindPRO can load the following file types:

WindPRO format: *.wpo - Internal format optimized for speed. Height contours or roughness lines in one file. Includes the calculated TIN model, which means that the TIN calculations don't need to be done every time you reopen a project.

WAsP MAP file: *.map - From the energy calculation program WAsP (Risoe). Both height and roughness can be included in the same file, but when saved from WindPRO, only the data from selected purpose is saved. For this reason, always make a backup of the original .map file before editing from the Line Object. Note that some binary versions may not be read from the Line Object. If this happens, open the file in WAsP and save it as an ASCII .map file (with the DUM* command in DOS-WAsP) before loading.

(The two formats discussed above are the only two that the WindPRO Line Object can save)

KMS GTX file: *.gtx - from the Danish Ordnance Survey. Only height contour lines can be read from this format.

AutoDesk *.dxf file: *.dxf - standard format from e.g. AutoCAD digitization).**

** Please note, that reading of .dxf files requires that certain regulations be respected when producing the .dxf file.

*.hgt – format of the Shuttle Radar Topography Mission (loads direct from the hgt.zip files)

*.xyz - grid format where you know the Z-value e.g., for each square of a 50 m x 50 m

ArcView *.shp files – standard GIS (Geographical Information System) format from ESRI.

DEM files – standard GIS format in the USA. These files must be converted to *.dxf format using e.g. MicroDEM before they can be utilized. Please see section 2.8.0.3 below

2.8.0.2 EMD online data

The Online data makes it very simple to establish elevation data. Simply click the online button in line object and everything works automatically. First the service check If there are any data sources available for the site location, then you select the source and specify the height and width of the area you want to cover with data.

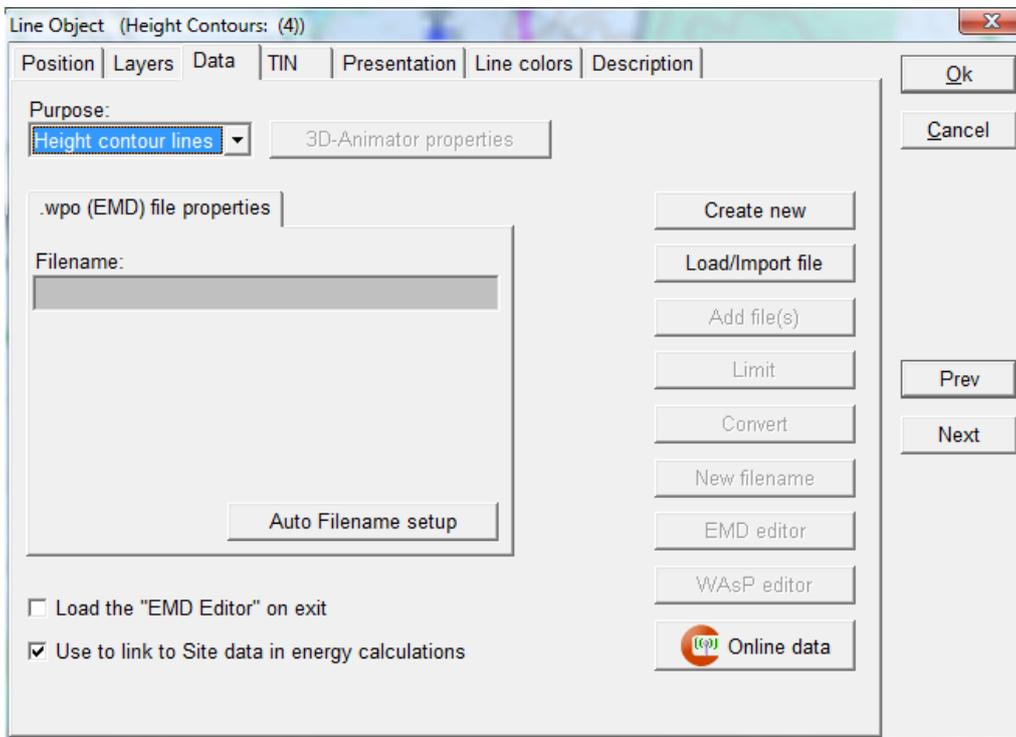


Figure 5 Shuttle Radar Topographic Mission data with 90 m equidistance will be available in the line object. Set purpose to height contours and choose the “Online Data” button.

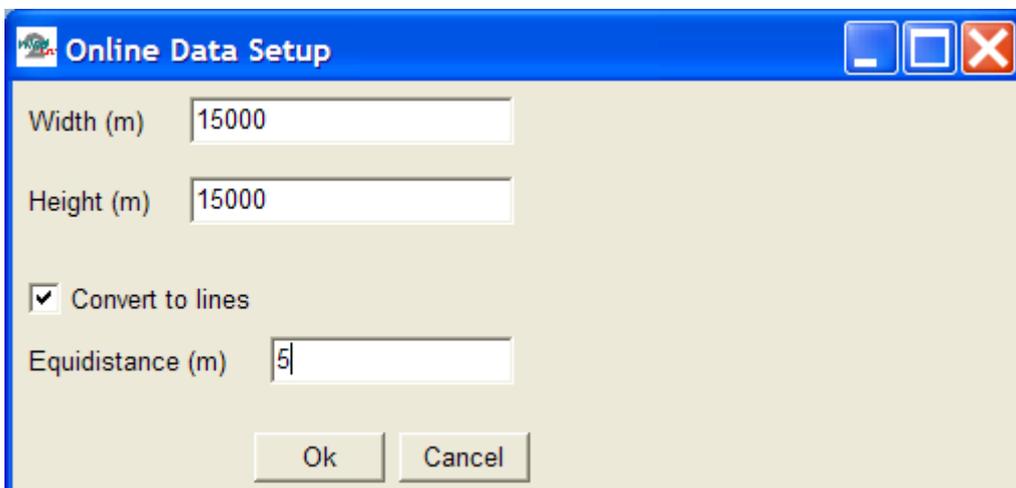
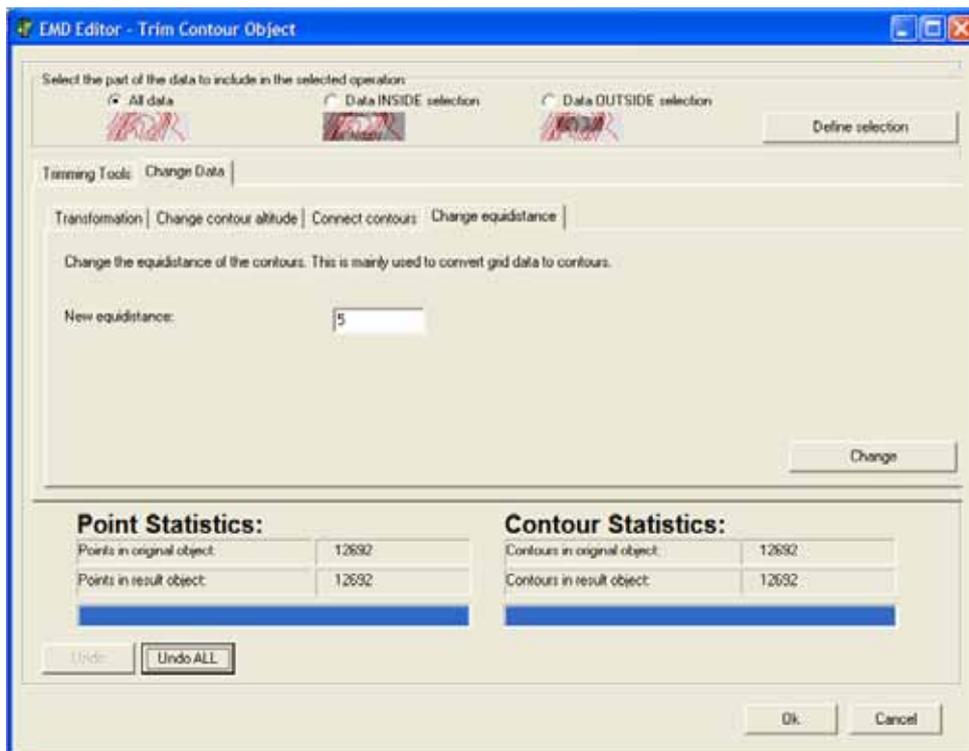


Figure 6 For elevation data, only SRTM data are available at present, but later more sources will be added. You will be able to choose “convert to lines” and the equidistance (contour separation). Then the downloaded SRTM data are automatically converted from the 90 m grid points to connected height contour lines.

2.8.0.3 Conversion of X,Y,Z and hgt data formats to lines

Height data from .xyz and .hgt files are inserted through the Line Object as point data. Point data are usable in all WindPRO modules except for energy calculations based on the WASP interface (PARK, RESOURCE and WASP interface).

If you want to use the height data in WASP, or show the data as a line, you need to convert the point data to lines using the EMD Editor. The conversion is done in the EMD Editor by changing the equidistance of the file.



In the EMD Editor, click “Change” and then “OK”.

2.8.0.4 Conversion of DEM data formats to .dxf files

DEM files can be downloaded from the Internet. Try the Internet locations:

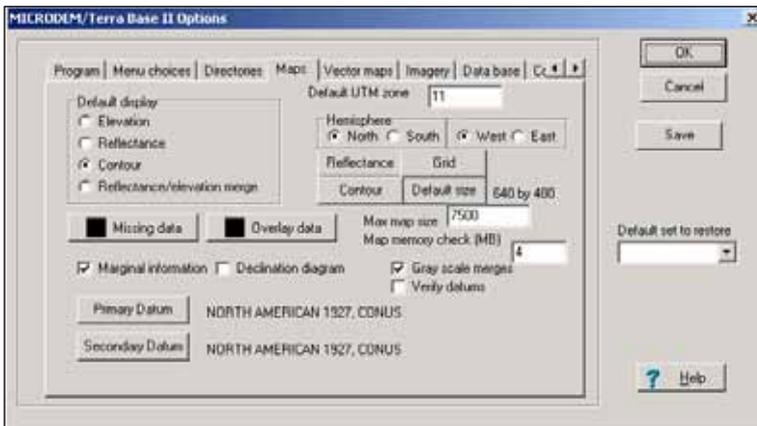
www.mapmart.com

<http://data.geocomm.com/dem/demdownload.htm>

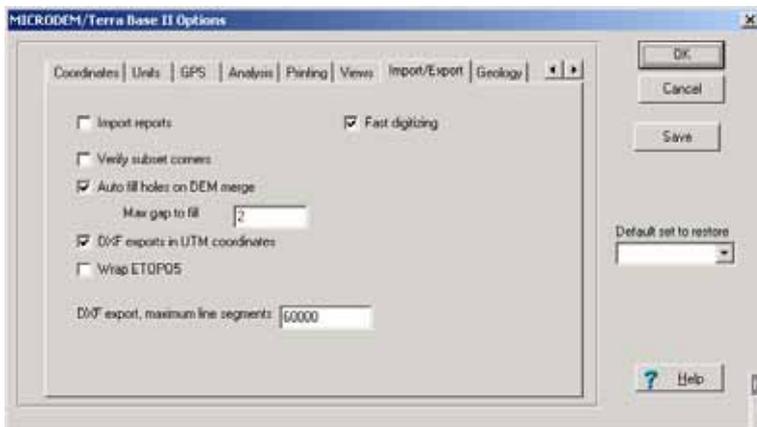
In order to convert the downloaded DEM file to DXF format, which can be read by WindPRO follow the procedure below:

Install MICRODEM on your computer if you don't already have it installed. There is a copy of MICRODEM Version 6.0 on the WindPRO installation CD.

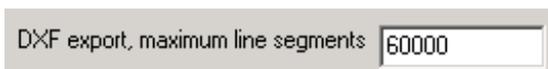
Run MicroDEM, then click on “Options” and enter the Tab Sheet “Maps”. Set the Primary and Secondary Datum to North American 1927 Conus.



Next, find the Tab Sheet "Import/Export".



Set DXF export, maximum line segments to 60,000.



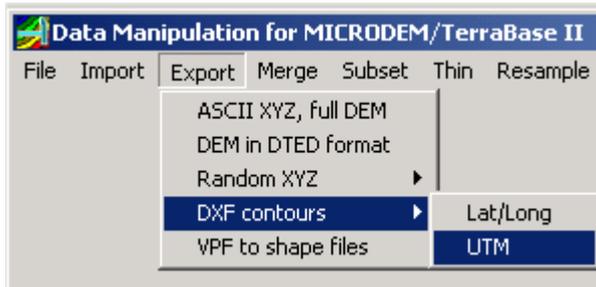
This makes the MicroDEM export larger .dxf files so there will be fewer files to load later on.

Click on "File", then "Open DEM" and choose the files one-by-one in order to open them.

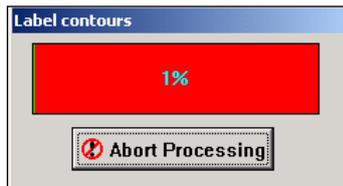
Next, open the file. The "Label contours" operation can be aborted. Now close the contour file. The only reason to open the file is that the "Export to DXF" function automatically takes the last opened file.



Next, click on the "Data Manipulation" icon and select "Export", then "DXF contours >" then "UTM".



The contours are now loaded in again. The “Label contours” operation can be aborted



Depending upon the settings in MicroDEM (and/or the region), the unit for contour interval may vary. The default unit seems to be feet, so set the contour interval to 30 feet (approx. 10 m) so that the height contour files don't get too detailed. Later on you can digitize important regions manually.



The DXF height contour vectors will be saved in: C:\mapdata\DXF (this directory was created when installing MicroDEM, and it must exist in order for MicroDEM to work properly).

The .dxf files can be loaded directly into the Line Object in WindPRO. The .dxf files should be converted to .map or .wpo format immediately after loading as this will greatly reduce the file size.

2.8.1 How to use the Line Object

In the current version, the Line Object can work with three types of data:

Height Contour Lines - The Line Object can use a number of different formats (see section 2.8.0.1), but lines can only be added or edited if the format is converted to the WASP .map format or to the *.wpo format.

Roughness Lines - The Line Object can use .map or .wpo file formats. Please note that the Area Object (next section) can also be used for digitizing roughness areas, which can then be exported as roughness lines. This is a very useful method, because it protects against crossing and inconsistent roughness lines. We recommend using this method for new projects, since the new project won't be based upon previously established .map roughness line files.

3D Animator Lines - Used for roads or tracks to follow when creating a virtual drive or flight in 3D

Height contours as well as roughness lines can be used together with WASP or WindSIM for energy calculations.

The modules DECIBEL, SHADOW and VISUAL can only use the Line Object if it contains height contour lines. With the Line Object, you can calculate triangles (TIN) between all the digitized points to allow interpolation of elevations (Z-values) to any specific location on the map within the specified TIN radius. Zones of Visual Influence (ZVI) are calculated based upon height contour lines, so for a ZVI calculation, no TIN radius is needed.

The principle is that, WTGs, noise sensitive areas, shadow recipients, etc. that are included in the calculation will automatically take their Z-coordinate (their height above sea level) from the TIN.

The calculation of shadow isolines (SHADOW module) and noise isolines using the TIN provides a more realistic calculation of the isolines by taking the variation of the terrain's elevation into account.

For visualization, you can use the TIN for the calculation of either an artificial landscape, or the visualization of a wire grid landscape. The latter is well-suited to control the camera model or to view the WTG project in proportion to the landscape without "disrupting" elements in the landscape.

For 3D Animation, a Line Object can be assigned the special purpose "road". This presents two possibilities:

- It can show a road bitmap in the 3D animation
- It can be used as a track that the camera "locks on to".

Both can be used individually, or in combination so that you can see the road you are following (see Section 5.3.4 for further details).

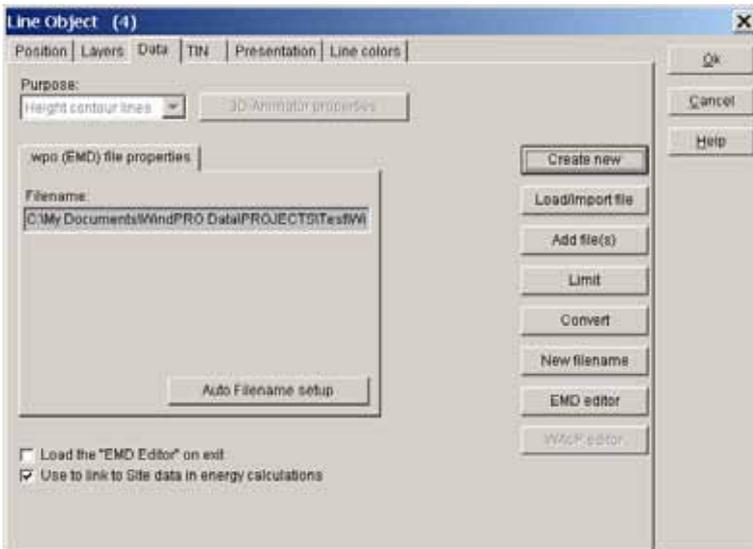
2.8.2 Establishment and presentation of the Line Object

Line Objects can be edited on-screen when they are in edit mode. The symbols shown below indicate whether the Line Object is in edit mode or not. You can activate or deactivate the edit mode by right-clicking the object symbol on the map or by pressing the <Ctrl + c> keys when an object is selected.

-  A Line Object which is not in edit mode
-  A Line Object which is in edit mode on the current map.
-  A Line Object which is in edit mode on another map (from version 2.5 this should not occur because you now can change maps while staying in edit mode).

The same principle applies for the Area Object and WTG Area Object.

2.8.2.1 Tab Sheet: Data



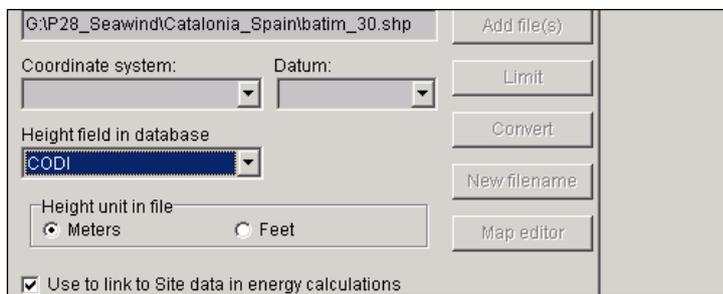
Create new - Used when starting digitizing data from scratch. First, select the input type, i.e. height contour lines, roughness or 3D animator lines in the "purpose" field.

You can choose to save data in the WAsP .map file format or in the WindPRO .wpo file format. When choosing a file format, the following points should be taken into consideration:

If files are large, the .wpo format is faster and for large TIN calculations (height contour lines only), the .wpo format has the advantage that the TIN is saved in the .wpo file, avoiding the need for recalculating when reopening the project. On the other hand, the .map file format has the advantage that the file can be used for stand-alone WAsP calculations (if this is relevant), and that the file can be loaded directly from the WAsP map editor (if installed and the path is set under "options", see Section 2.2.2.2). However, you can convert between these two formats at any time using the "Convert" button.

Load file - Loads an existing file with line data. Additional file formats can be loaded (imported). The coordinate system in which data is given must be known. If the coordinate system is a local system (or a system unknown to WindPRO) the system can be defined in "Project properties" before loading.

When GIS shape files with height contours are loaded, the dialog box changes as shown below:



In addition to the normal input, the projection datum (e.g. ED 50) must be entered along with the selection of which field in the shape file contains data on the elevation and the height unit used.

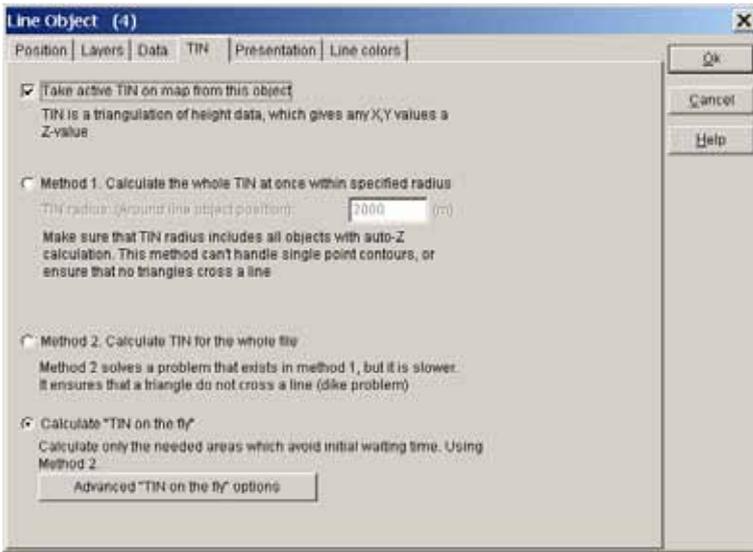
Add file - Used for merging additional files together in the same object. (see Sections 2.8.0.1 and 2.8.0.2 for file formats and conversions).

By clicking on "New filename", the file name of the file in which data is saved is changed and a copy of the file is made. The following corrections will only appear under the new file name.

After loading large files, you may not wish to use the entire amount of data for the specific project. In order to make the file-handling process faster and to save space on disk, you can limit the file so that only lines with points inside a given radius will be stored. For more advanced data-limiting operations on a .map file (e.g. cut out a square, spline, etc.), the WAsP Map editor can be used. You can also use the new EMD editor since most functionality from the WAsP map editor now exists directly in WindPRO. The EMD Map editor also works with the Area Object (see Section 2.13 for a detailed description).

By checking the box "Use to link to Site data in energy calculations" the data contained in the Line Object will be used by default in energy calculations when creating a Site Data Object.

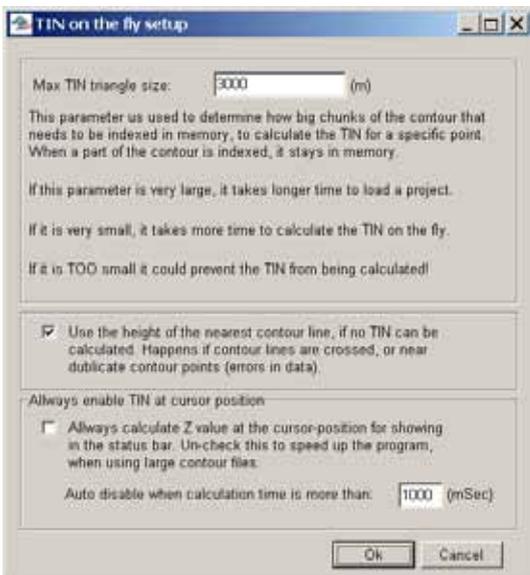
2.8.2.2 Tab Sheet: TIN

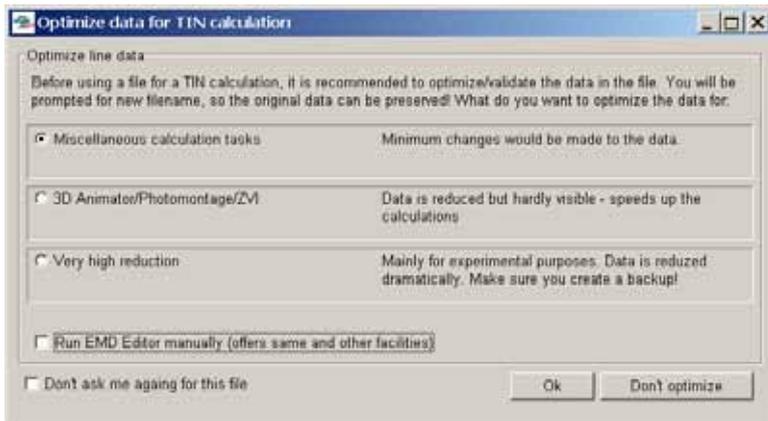


The TIN calculation can be very time consuming. For this reason, advanced settings for the TIN calculation are available. For smaller, less complex projects with a limited amount of data, method 1 or 2 will be the best choice (typically used when a .map file is preferred). Method 1 is the fastest, but doesn't guard against crossing triangles, a problem that can cause problems, particularly at dikes, where long lines based on a few points can result in triangles across the dike.

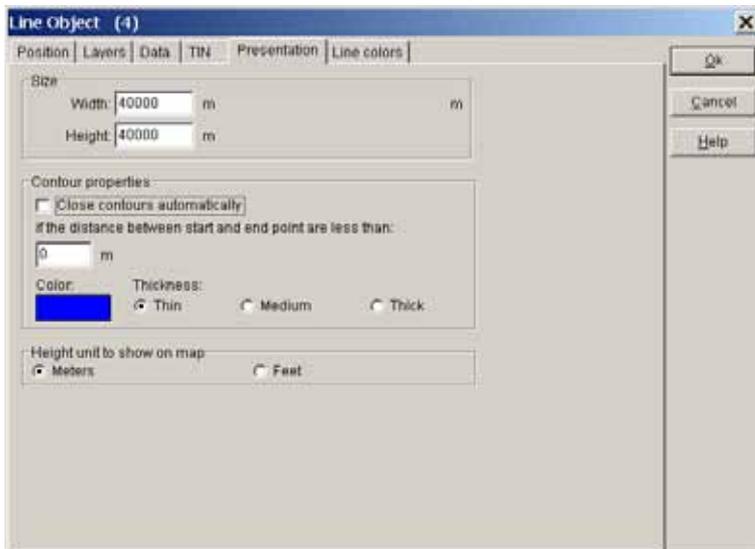
For larger amounts of data, the "TIN on the fly" method (used as default) is recommended. With this method, the TIN is calculated only as-needed while you work. The TIN database is built up as a background calculation without disturbing the current operation and will always have the necessary TIN values (e.g. where the objects is placed). It's important to know that the "TIN on the fly" calculation will be auto-disabled if it uses too much of the computer's resources. The default setting is to auto-disable the calculation if it takes more than 1000 ms (1 second) to complete.

In the "Advanced "TIN on the fly" options", the unchecked box "Always enable TIN at cursor position" in the form below indicates that "TIN on the fly" at the cursor position has been disabled. This is simply because when working with large files, the "TIN on the fly" calculation will interrupt the user too much. When the TIN is needed in some calculation, the TIN is automatically calculated for the needed region. If you need the TIN for inspecting Z-levels in specific regions while working on the map, you can enable "Always enable TIN at cursor position" and eventually increase the auto-disable time limit.





2.8.2.3 Tab Sheet: Presentation



On this tab sheet, you choose how much of the line data you want to see on the screen. Usually it's only necessary to limit the amount of data if you work with very large data sets. The TIN radius is the radius within which the Triangular Irregular Network is created. It's only within this radius that the Z-coordinate is automatically calculated and an artificial landscape can be generated.

Due to calculation time, it may be necessary to limit the calculation of the TIN to the specific area for which you need full 3D information.

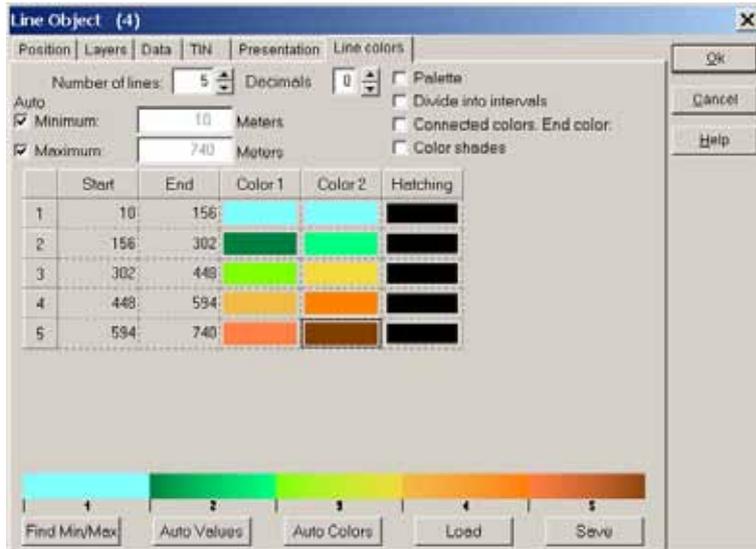
You may set the object to "Close contours automatically" for lines where two end points are positioned within the specified distance (this may improve the accuracy of the calculation and create nicer looking documentation).

You can also change the color and thickness of the isolines.

Lastly, you can choose whether the Line Object will show data in meters or feet.

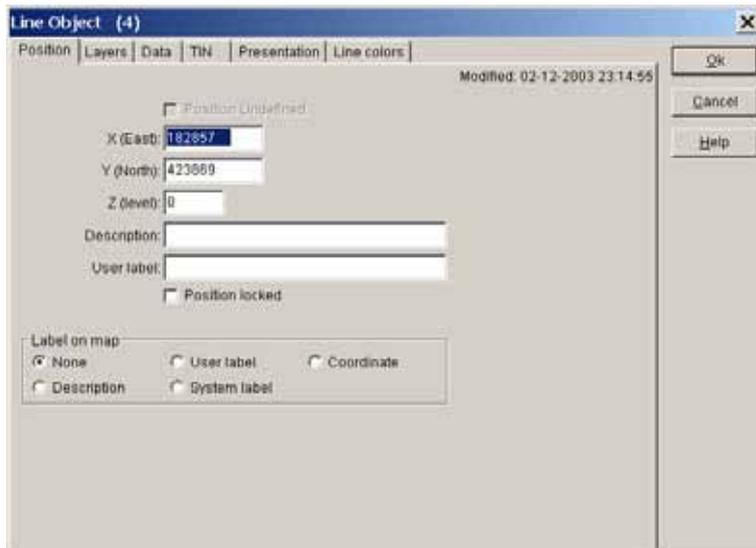
Note: In WindPRO, height contour data is always stored in meters, since e.g. WAsP always assumes meters when calculating. So if you accidentally end up with a .map file that is in feet, please use the WAsP map editor to convert it to meters. WindPRO does not convert the height data. It only offers the ability to show and digitize in feet.

2.8.2.4 Tab Sheet: Line colors



Line color definitions can be freely set. Line color definition schemes can be saved and reloaded later.

2.8.2.5 Tab Sheet: Position



In the "Position" tab sheet, you will find the coordinates for the object that represents the Line Object. These coordinates are important when you wish to relocate the object. It's recommended that the object be placed close to the site center.

2.8.3 Digitizing and editing lines

2.8.3.1 Digitizing new lines in simple mode

When a new Line Object is placed on the background map, it will be in edit mode by default. Place the cursor where you want to start digitizing the first line, then right-click and select "Create new contour". You will now be asked to enter the elevation (for height contour lines) or the roughness on the left and on the right side of the line you are going to digitize (for roughness lines). Then simply click along the line you want to digitize.



Note: In the contour elevation form, the step size when using the up/down arrows can be set in the “step” field. This is helpful when digitizing lines of equidistant elevations.

When you finish a line, you can choose between "Stop" and "Close". If you choose “Close”, the last point will then be connected to the first one you digitized.

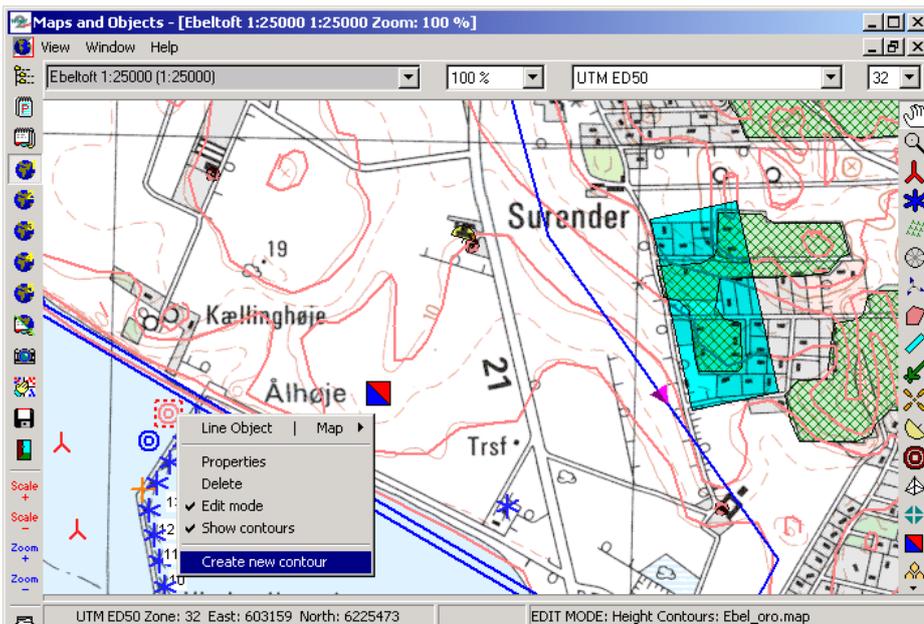
Important: When you reach the edge of the map shown on the screen, you may want to move the map while digitizing (without stopping). This can be done by setting one of your mouse buttons (if more you have than 2) to the function "middle mouse button" in Windows mouse setup. When this button is held down, you can move the map while digitizing.

Note on digitizing roughness lines:

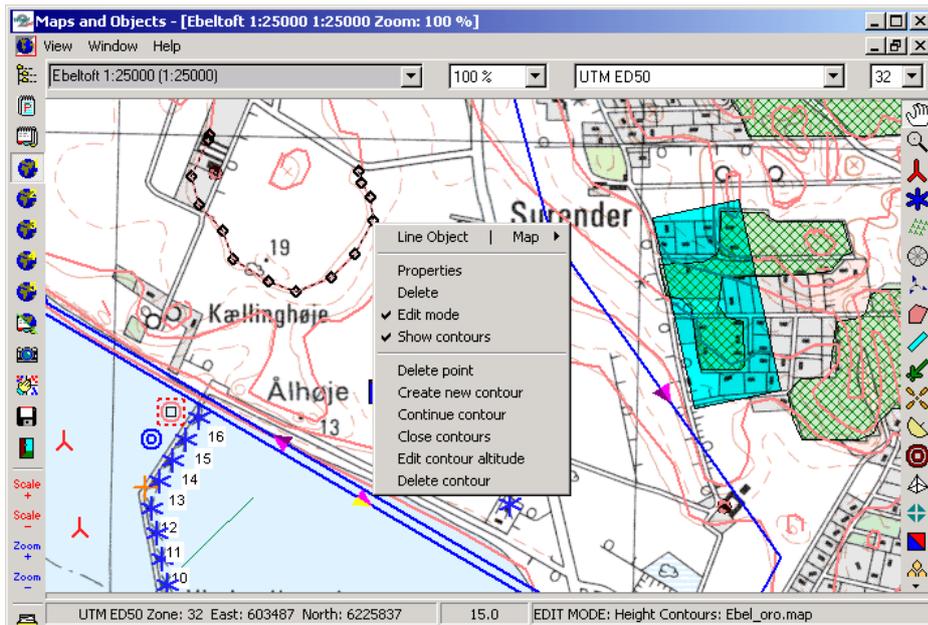
It's necessary to enter the roughness values on both the left and right side of the line in the direction of digitization. It's the user's responsibility to ensure consistency between different roughness lines. Considerable differences, e.g. unintentionally crossing lines, can result in large calculation errors with no warning message given, when using WASP. Another way to digitize roughness lines is to use the Area Object. With this method, area polygons are digitized, and lines are then exported. The export procedure makes sure that there are no consistency problems with the lines.

2.8.3.2 Viewing and editing existing lines

The Line Object makes it possible to import a file containing height contours on top of a background map. If the object is marked "Edit mode", you can edit in the imported contours by clicking once on the curve to activate it. You can then drag the individual lines or points to their correct positions by holding down the left mouse button when the cursor is inside a point and then dragging. You can also add new points, delete points, connect lines, or add new lines. In addition, it's also possible to edit the values of the individual lines.



As shown on the map above, when right-clicking on the object, a pop-up menu appears containing several options including the "Edit mode". Lines cannot be edited unless the Line Object has been set to “Edit mode”.



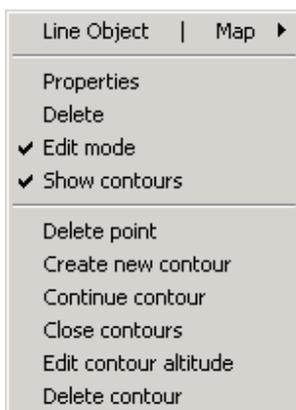
As shown above, with the Line Object in “Edit mode”, clicking on a line will activate all the points in that line. When you hover on the height contour line, its value will be shown in the line at the bottom of the window.

After selecting a line, you can drag any one of the activated height contour lines in any direction. You can also right-click on the isoline to get a menu, which gives you several options for further manipulation.

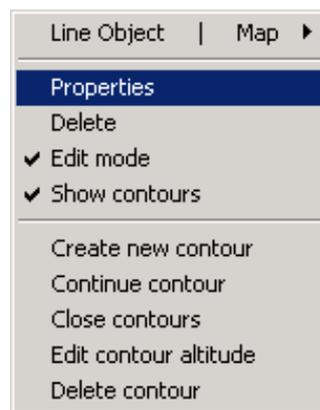
Note: Right-clicking will present different menus depending upon whether the cursor is placed on a point or on a line between two points (see below).

Another line edit function is to connect two lines. If you click on one line, and then hold down the <Ctrl> key while clicking on another line, you can select “connect contours” and the two lines will be merged. If the two lines have different values, you will be asked to enter a value.

Shown below are the four “right-click menus” that can appear when line is activated.



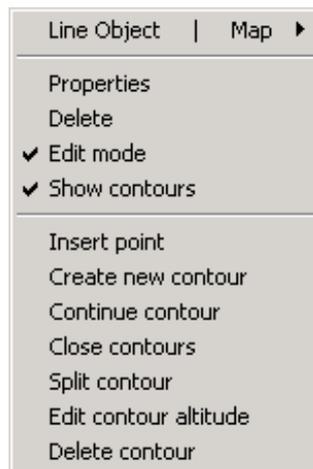
1) Cursor outside the line



2) Cursor on a point on active line



3) Cursor on a line



4) Two lines selected (between points) on an active line

Lastly, when you exit the "Edit Mode", the TIN is recalculated.

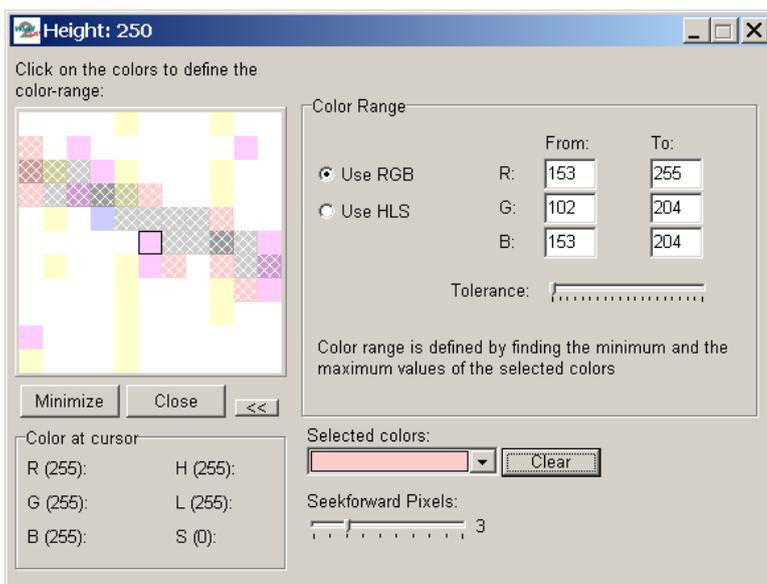
2.8.3.3 Digitizing new lines without clicking

Instead of mouse clicking for each point, simply by holding down the <Shift> key, the software will do the clicking for you. When the mouse is moved while the <Shift> key is held down, the points are set automatically.

2.8.3.4 Digitizing new lines by auto-detect

The most advanced way to digitize lines is by letting the software recognize the lines on the map by color recognition. This works as follows:

When you hold down the <Ctrl> key, a window appears in the upper left corner. Place the cursor on a line you wish to digitize then release the <Ctrl> key and move the cursor up into the window. Click on the colors (pixels) that can be identified as having the color information of the contour lines. Diagonal cross-hatching indicates the selected pixel colors (see below).



When the relevant pixel colors have been marked, move cursor back to the line you want to digitize, again hold down the <Ctrl> key and click on the line. WindPRO will auto-detect the line until it comes to a section where it does not know how to proceed further. Click on the line to help WindPRO continue in the right direction. If it finds the wrong way, simply right-click and select "Undo last autodetect" as shown below. In addition, the <Alt>

key or the <Backspace> key can be used to delete the last point and thereby “move backwards”, until the digitized line is back on the track.



Then manually click a few points (release the <Ctrl> key) to help it past the critical point and press down the <Ctrl> key again to continue the auto-detect operation.

It's important to select the right pixel colors in order to achieve successful auto-detection. It's also important that the background map has relatively clean colors for the lines. If it does, then this method can be very efficient and large maps can be digitized quickly.

2.8.4 Save and use data from Line Object

The data file containing the lines is saved when you exit the edit mode. Note that if you are working on an existing file, it will be overwritten. To prevent this (if you've made changes that you don't want to save), open the file from Windows Explorer and make a copy before leaving edit mode.

The Energy Calculation module can use the Line Object's height contour data file (only with WAsP). There are two ways to use the data; by linking the Line Object to a Site Data Object (default) or by attaching the saved file to a Site Data Object. The latter option allows you to use the data without having a Line Object in your current project.

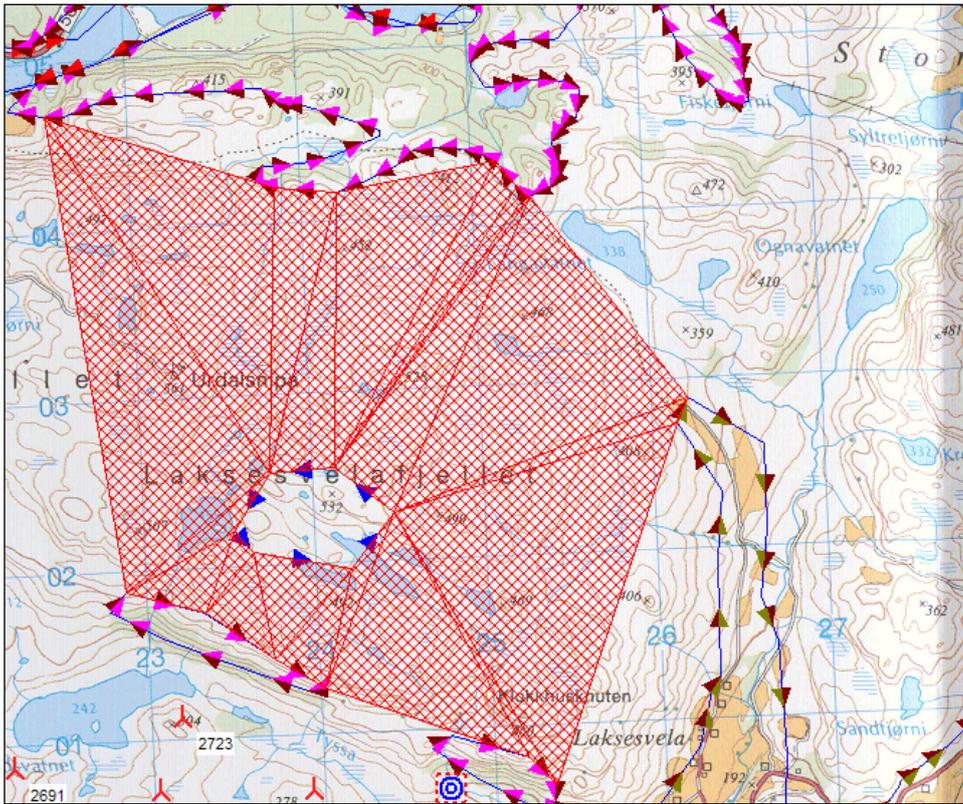
The other calculation modules (SHADOW, VISUAL, and DECIBEL) can only use DHM (the TIN) created within a certain radius around the position of the Height Contour Object. In order to be able to use the DHM you have to mark this option on the Tab Sheet "Position" under the Line Object, and indicate that the Z-coordinates of the relevant objects (WTGs, Shadow Recipients, etc.) are taken automatically from the DHM. This must also be marked on the "Position" tab sheet for the relevant objects.

2.8.5 Trimming data in Line Object

There are a number of tools available for trimming (see Section 2.13)

2.8.6 Roughness consistency check

The Line Object can be used to check the consistency of roughness lines. Inconsistency is indicated as red dots or red shaded areas (see example below).



In the figure shown above, the inconsistency due to an incorrect roughness value assigned to the roughness line digitized in the middle of the area is clearly indicated (red shaded area) by the roughness consistency check.

2.9 BASIS - Area and WTG Area Object

2.9.0 Introduction to Area Objects



The Area Object in WindPRO provides the user with a tool for importing or digitizing areas as closed polygons, each having similar characteristics. Elements such as forests, cities, water, or other landscape feature can be described using the Area Object. They typically have uniform characteristics and so can be treated similarly in e.g. a roughness classification or other landscape evaluation.

The Area Object has the advantage of allowing the user to quickly establish areas directly on-screen simply by using the mouse or importing data from e.g. GIS systems or maps in vector formats.

Note: Digitized areas can be used for other purposes also, and it is important to consider the intended purpose prior to digitizing.

Advanced digitizing options with auto-point settings are available from version 2.4. The auto-point setting is invoked by pressing the <Shift> key. Pressing the <Alt> key launches an eraser tool for deleting points.

If the areas will be used for exporting a roughness line map or for a ZVI calculation, it may require the definition of landscape types. When carrying out ZVI calculations, farm land can normally be considered as one type.

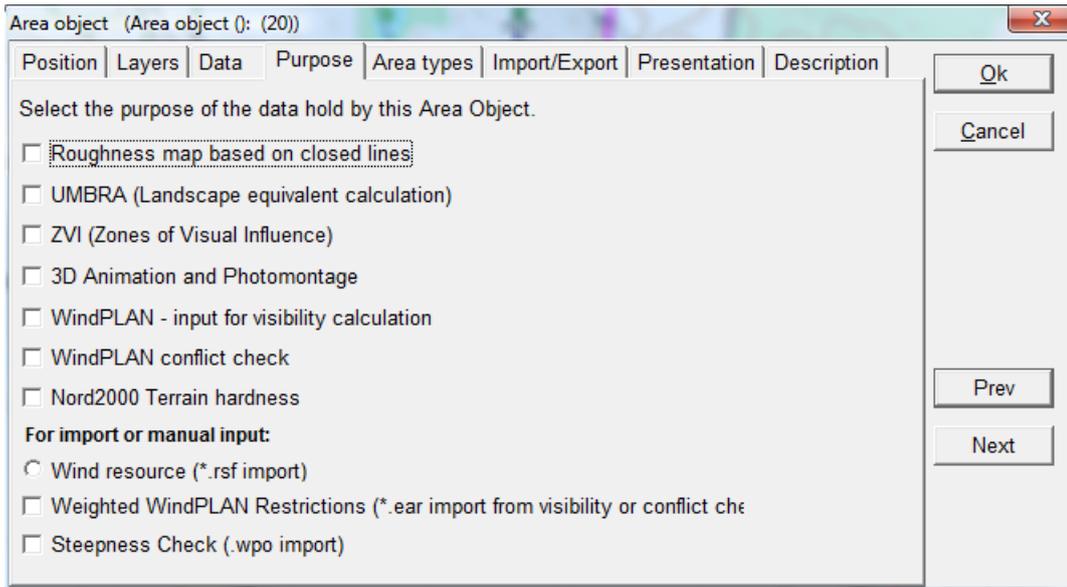
In order to use the Area Object for the export of roughness lines, it's necessary to divide the farmland into different areas controlled by a roughness subset representing the farmland. For example, a division into "farm land with low roughness" and "farm land with high roughness" (many windbreaks) may be necessary.



The WTG Area Object is a special variant of the Area Object, specialized for OPTIMIZE and WindPLAN purposes and for use together with the Park Design Object. See these chapters for further details on this object.

2.9.1 Where to use the Area Object

In the present version, the Area Object can be used for a number of different purposes including the shown below:



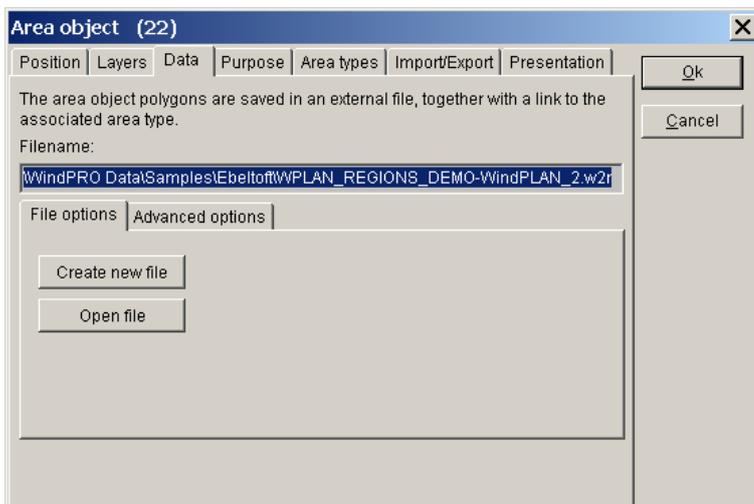
Note that the Area Object can also be used to produce roughness lines, a very useful method because it protects against crossing and inconsistent roughness lines. However, you must perform an “Export to roughness lines”, before they can be used. The exported file must be attached to a Site Data Object (via a Line Object). With regard to crossing lines, the rule when exporting is; if areas overlap, the area with highest roughness value takes precedence over the area with the lower roughness value.

Although roughness areas can also be used direct in calculations, Where EMD has established a converter from roughness areas to roughness roses. It has to be noted this feature go beyond the WAsP model, and for a full WAsP compatible calculation, the export to roughness lines should be used. Direct use of roughness areas in energy calculations shall be seen as an experimental feature so far.

The ZVI, UMBRA and WindPLAN modules depend directly upon the existence of the Area Object, which is the primary data source for the calculations along with a Line Object containing height contours.

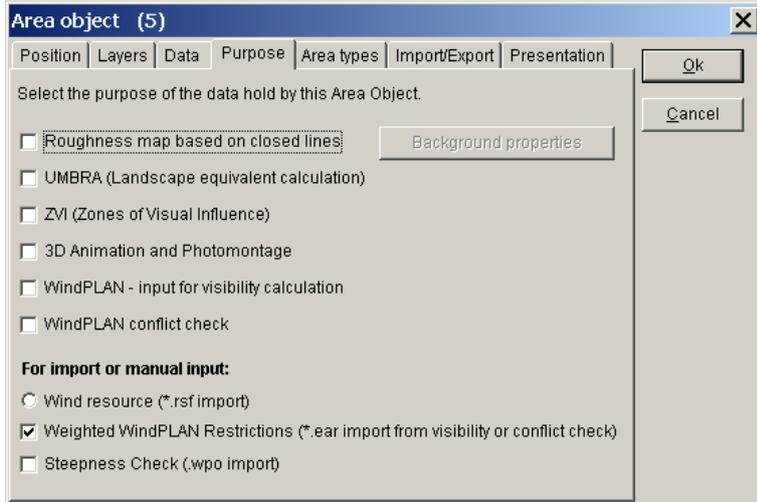
2.9.2 Establishment and presentation of the Area Object

2.9.2.1 Tab Sheet: Data



The data associated with an Area Object is saved in a file. You can create a new area file or load an existing file saved from another Area Object (a WindPRO regions .wpr file). To import data from other sources, see Tab Sheet “Import/export”.

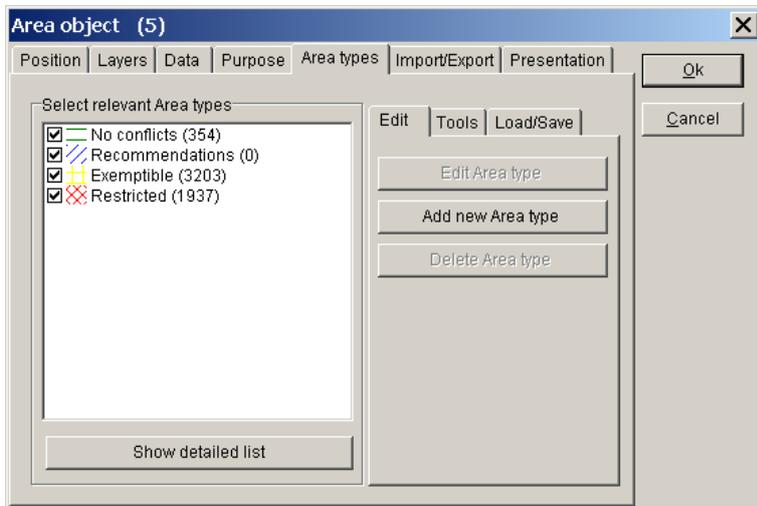
2.9.2.2 Tab Sheet: Purpose

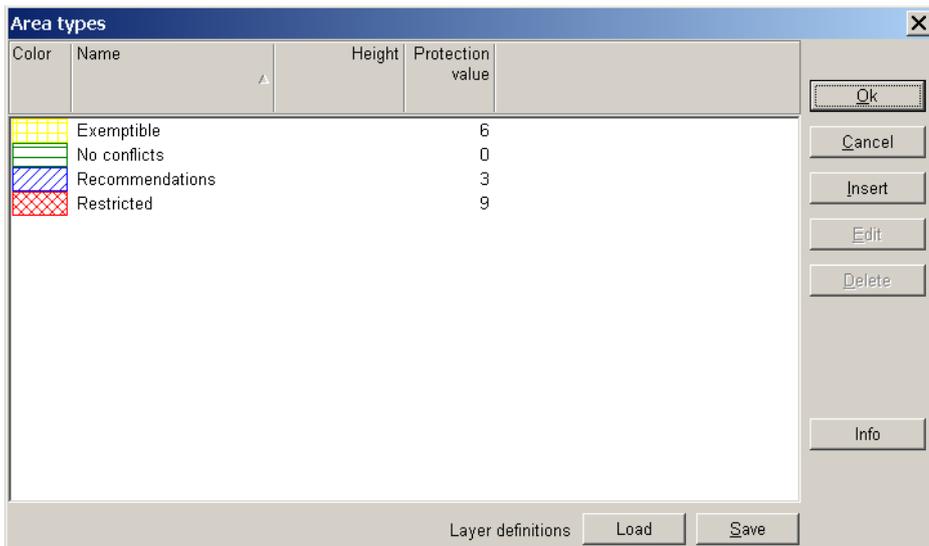


The Area Object can have multiple purposes. More than one purpose can be checked at the same time. The top group (the first six) are normally physical landscape elements such as a village, a forest, or water, while the bottom three are used for more specialized data. Note that the purpose “Steepness Check” is described in more detailed in Section 2.9.6 (last section in this chapter), while the “WindPLAN” features are described in Chapter 7.

2.9.2.3 Tab Sheet: Area types - definition of areas

To define area types, click at an Area Object and then select either "Edit Area type" or “Add new area type”.

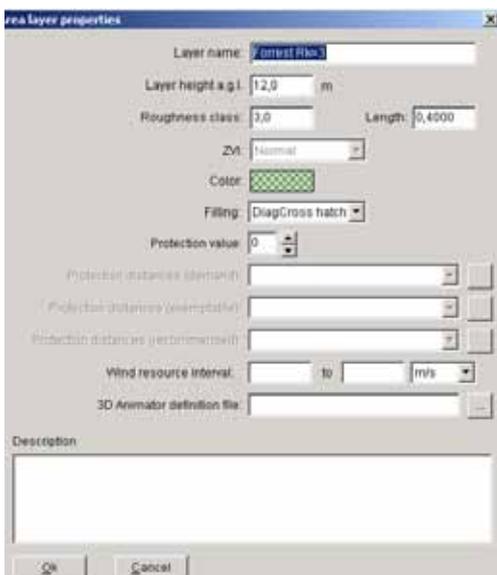




Definitions can be imported from a previously-defined Area Object, or from an .lty file which can be saved from the “Area type” dialog box. Some area definitions are available in the folder WindPRO Data\Standards\.

Some area types shown above are mainly for roughness classification purposes, but they are also useable for ZVI purposes.

New area types can be added by clicking on the "Insert" option. Previously defined area types can be edited by double-clicking on an area layer name and the dialog box shown window below will appear.

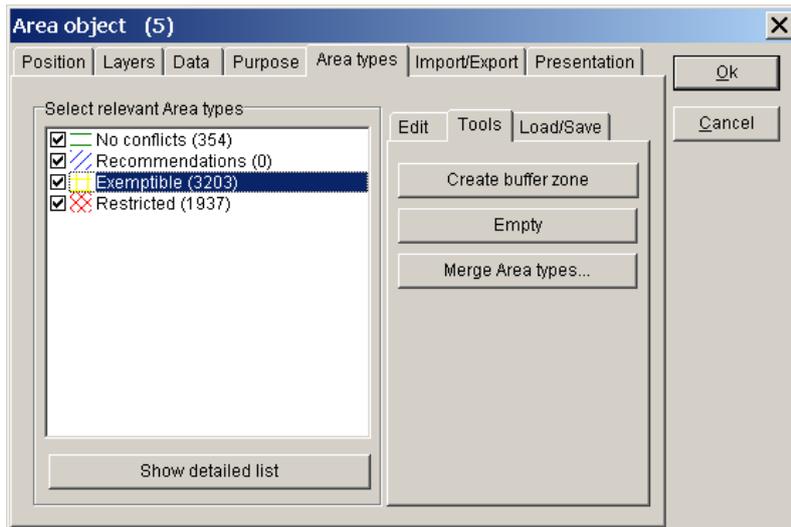


When finished defining or editing area layers, click “OK” and you are returned to the “Area types” window.

In this dialog box, you can check the area types you want to use for your current task. These are the ones that will appear in the drop-down selection menu when digitizing new areas, and will be visible on the map.

Tools

There are various tools available for utilizing the area types.



The tool "Create buffer zone" allows you to create new area types based upon already defined areas, where a new area is created in a zone defined by the user. This is used primarily for WindPLAN purposes.

Clicking on "Empty" simply deletes the areas of a specific type.

Lastly, the "Merge Area types..." moves area data from one type to another. This is very useful when importing data in multiple steps.

2.9.2.4 Tab Sheet: Import/Export – with online data

The Online data run fully automatized, while import from other sources require more settings.

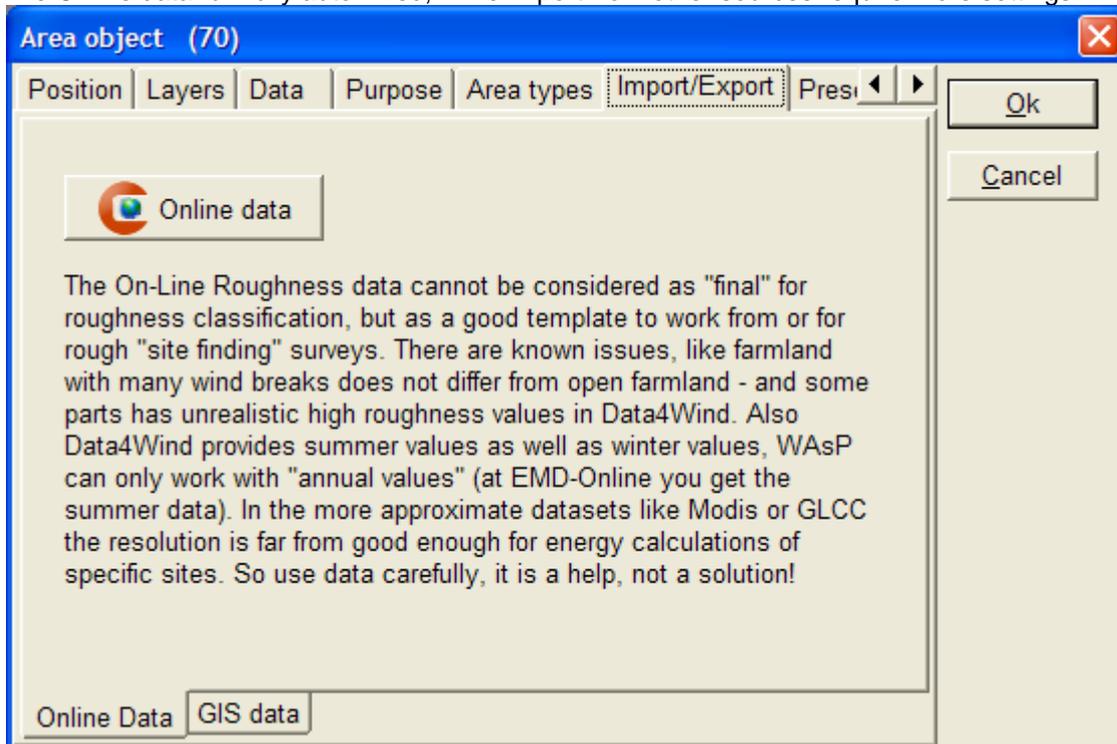


Figure 7 With the area object set to "roughness data" as purpose; you can get access to on-line data from the "Import/Export" tab.

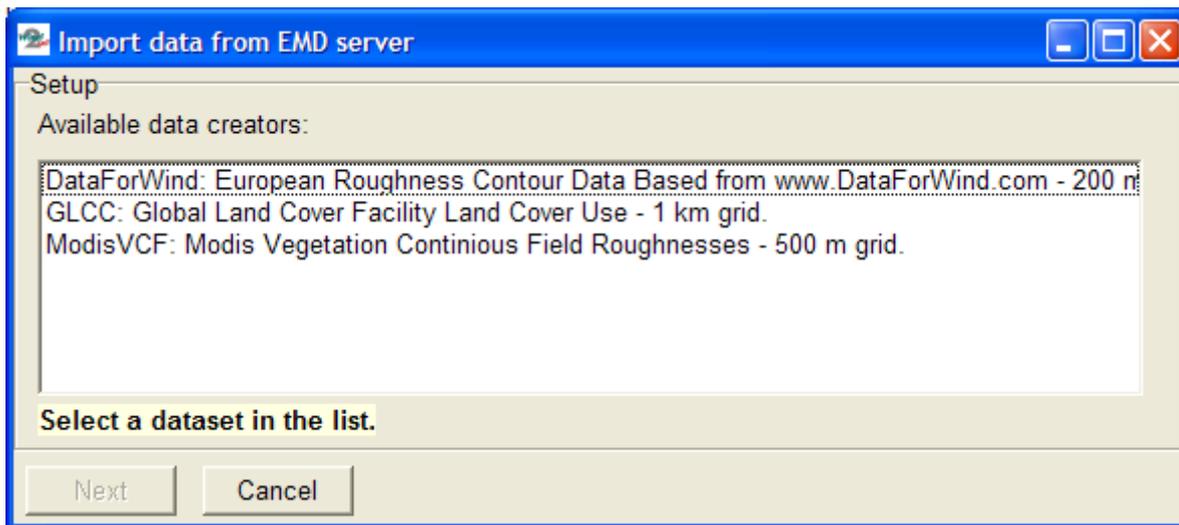


Figure 8 Example of roughness data sources at a European site.

There will be more or less types of roughness data files available describing the roughness in more or less detail, depending on where in the world the site is located. NOTE: these data will not be sufficient for a detailed energy calculation for a specific project, but are to be considered as an initial classification of roughness around a site. E.g. the Modis data only holds information on vegetation, not urban regions, so there will be some manual work required to edit and improve the accuracy of these data before they can be used for an energy calculation.

Import from other sources

Previously digitized data (polygons) from other sources (.dxf and .shp files), or for a Wind Resource map, output files from WAsP calculations, can be imported.

The process of importing data is as follows:

Press the "Import" button.

Select the file to be imported

Select the coordinate system and the datum in which the data is geo-referenced (e.g. ED 50). NOTE: This must be known. If it is a local coordinate system (or a system unknown to WindPRO), it can be defined in "Project properties" prior to importing.

The procedure for importing .dxf and .shp files is slightly different as follows:

DXF-files

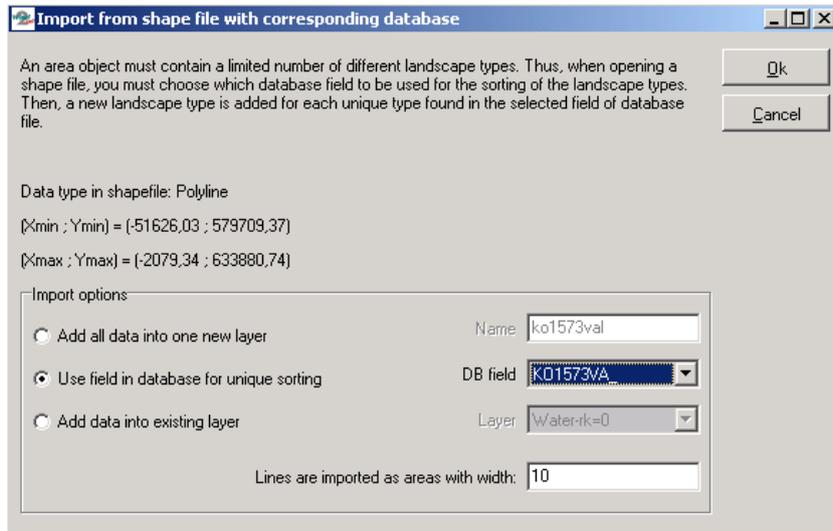
After reading the file (which may take a long time, start with a small file to test), the layers from the imported file appear in the list of landscape types with the layer number as the name.

Identify the imported layers and then select "Merge area layer" to place it into the defined layer that matches the type of data in the file (or redefine the layer).

Repeat the above steps until all imported layers are defined.

Shp-files

After defining the coordinate system, the dialog box shown below appears:



Here you can see the corner coordinates of the shape file limits (which will indicate whether or not you've chosen the correct coordinate system – if not, cancel and chose "Import" again).

There are several options for importing .shp file data:

Adding all data from all database fields into one layer

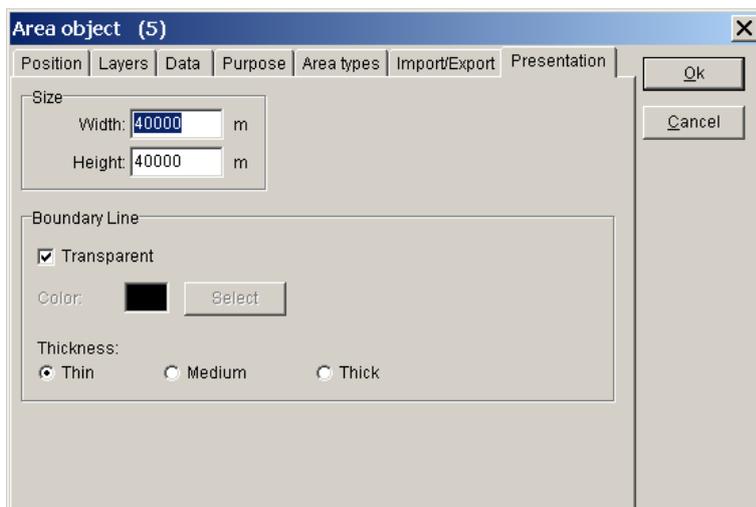
Creating one separate area layer for each unique entry into one of the database fields or adding all data into previously-defined area layers (more typical option).

After reading the file (which can take a long time – start with a small file to test), the layers from the imported file appear in the list of landscape types.

Caution:

When classifying roughness using areas, everything outside the digitized areas will be interpreted as background values. The background roughness must be given a value. For example, on islands far from the mainland, it's appropriate to use the roughness value for water as the background roughness. However, if the mainland is closer than approximately 40 km in any direction, it must be digitized. On mainland, it's usually appropriate to choose the value for "open farmland" as background (roughness class 1-1.5) and then digitize the cities, forest, water areas, and farmland with higher roughness values. In general, everything within a 20-km radius must be digitized. At a distance of 40 km, the influence of the surface roughness normally has no effect.

2.9.2.5 Tab Sheet: Presentation



In this dialog box, the visible parts of the areas are defined. The only reason to limit the visible parts would be to increase computer response when regenerating on-screen graphics.

Note that the boundary line separating each area can be made transparent. This is useful for a Steepness Check or for a Wind Resource map, where the areas cover the entire map.

2.9.3 Digitizing on-screen, editing, and viewing

Using a background map brought into WindPRO as a background bitmap image (containing all relevant information, e.g. forests, cities, etc.), it's possible to digitize the sites manually, or to view the imported data on top of the map for editing as required. The same principles as described for the Line Object in Section 2.8.3 apply to the Area Object.

2.9.4 Save and use Area Objects in calculation modules

The data file containing the area information will be saved in the file specified in the Tab Sheet "Data" when you exit the edit mode. Note that if working on an existing file, the file will be overwritten. To prevent this (if you have made changes you wish to undo), open the file from the Windows Explorer and make a copy before exiting the edit mode.

2.9.4.1 Export of roughness .map files from the Area Object

From the Tab Sheet "Data", you can export the digitized polygons (if the purpose "Roughness" is checked) to a WAsP .map file format. In the so-called polygon-cutting routine, the areas with the highest roughness have the highest priority when the areas are overlapping. Remember to define all none-digitized areas in "Background properties" on the Tab Sheet "Areas". Complex polygons may cause the polygon-cutting routine to fail, particularly if two or more polygons are overlapping or if polygons have corners with very sharp angles. Data should be checked carefully. You should check the results by loading the exported line file into a Line Object.

2.9.4.2 Use of the Area Object data in a ZVI calculation

In a ZVI calculation, every area defined with a height will be built "on top" of the digital height model. This means that, for every point with an assigned height inside a polygon, the assigned height from the area region will be added to the height model and, if the height of the area polygon is higher than the observer point in the ZVI calculation, the WTGs are treated as invisible from any point within this area, e.g. a forest.

Naturally, this will not always be the case. For example, WTGs can be visible from some points inside a forest or city. If this needs to be taken into account, these regions must be digitized in greater detail, e.g. each house modeled as a separate area.

2.9.4.3 Use of the Area Object data in an UMBRA calculation

This module is "on hold", not supported in current version.

2.9.4.4 Use of the Area Object data in a WindPLAN calculation

This module is "on hold", not supported in current version.

2.9.5 Trimming data in Area Object

There are a number of tools available for trimming, see section 2.13

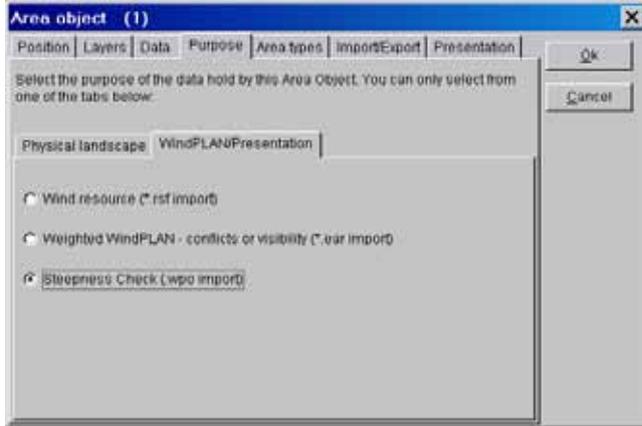
2.9.6 Steepness calculation and presentation

2.9.6.1 Purpose of the Steepness calculation

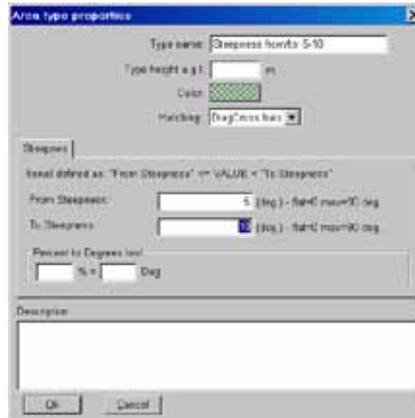
The Steepness Check (.wpo import) is used to generate areas (polygons) containing the "steepness" within certain intervals. These intervals may be used to exclude areas where it's impossible to construct turbines or to build roads due to the steepness of the slopes of the terrain. The input data is a *.wpo file from a WindPRO Line Object, and the result is placed in an Area Object.

2.9.6.2 Calculation setup in the Steepness calculation

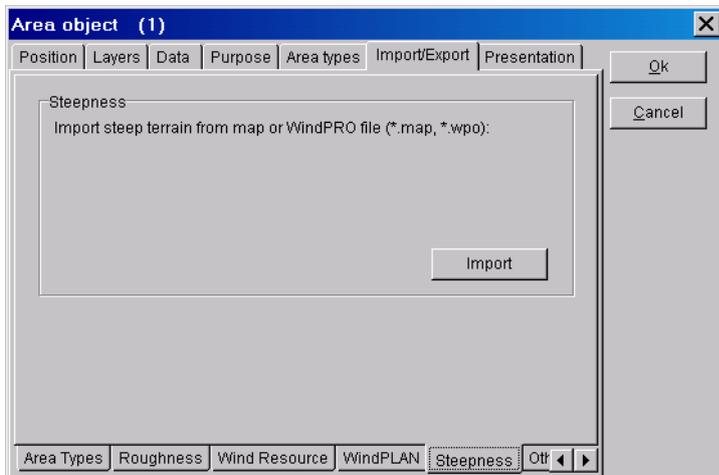
1. Insert an Area Object onto the map using the  icon.
2. Select “Steepness Check” as the purpose for the Area Object.



3. Create an area type for each steepness interval that should be created. Click on the “Add new area type” button on the “Area types” tab sheet.

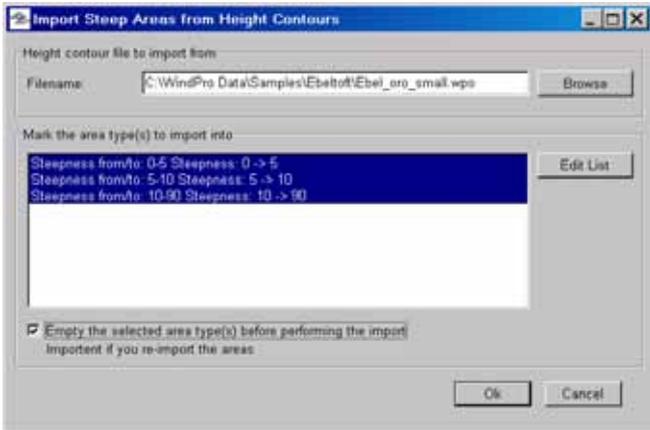


4. Select Import from the Import/Export | Steepness tab sheet.

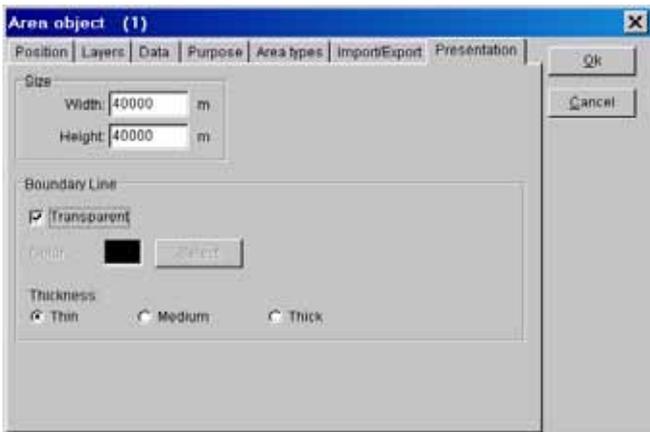


5. Now, select the *.wpo file (Line Object data file) to calculate or import the steepness data from. Mark the area types to import into (the areas that you just created). On import, WindPRO reads the steepness intervals

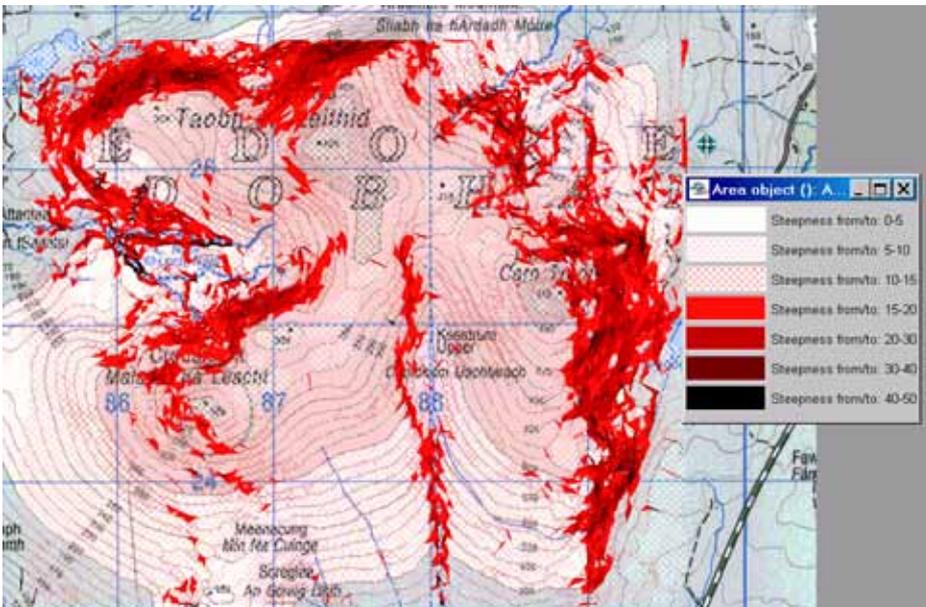
from the area types. Make sure to mark the “Empty the selected area type(s) before performing the import”, if you re-import the areas. Otherwise, duplicate areas are created.



6. Lastly, in order to make the slopes look good on the map, select the Boundary Line to be “Transparent” on the Presentation tab sheet.

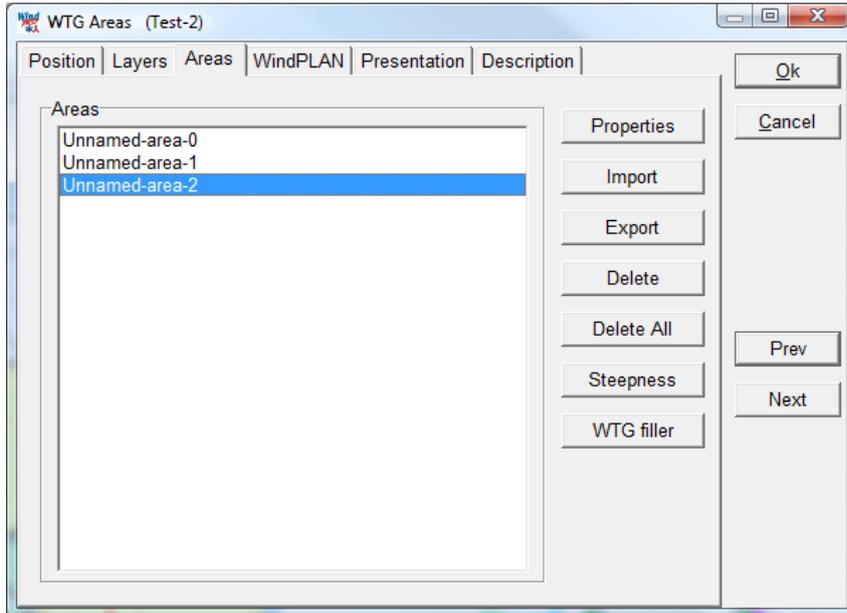


An example of results from a steepness calculation is shown in the figure below. Note that the turbines are erected in areas where the steepness (slope of the terrain) does not exceed five degrees.



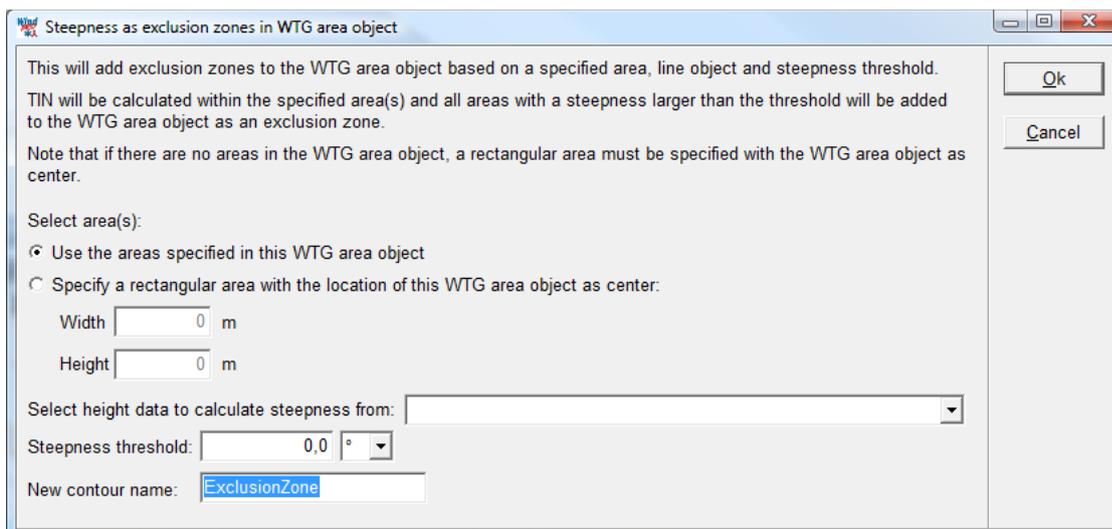
2.9.7 Specific WTG-area features

The WTG-area are as mentioned a variant of the Area object, with limited features, but specific designed for having the most needed features for designing a wind farm. The object is central for the OPTIMIZE module and shall typically always be used as the object that defines the borders of the site, e.g. based on land owner agreements.



The WTG area has some specialized features.

2.9.7.1 Steepness in WTG-area



Steepness can be established as exclusive zones based on a given steepness threshold. This is very efficient for avoiding placing turbines from e.g. the Optimize module in areas that are too steep.

2.9.7.1 WTG filler in WTG-area

The WTG filler can establish as many turbines as there are space for based on required distances, a fast way to evaluate the MW potential at a given site.

2.10 BASIS – Result Layer Object

2.10.0 How to use the Result Layer Object

With the Result Layer Object, it's possible to present the calculation results in a raster format on the working map(s), and to use the information when optimizing a project layout. It's probably most useful in an energy calculation, where a wind resource calculation (WAsP .rsf file) shows the best energy production possibilities within a given area. In addition, the Result Layer Object provides for the interactive minimization of the noise impacts from a wind park. It's also possible to represent ZVI and Shadow calculation results in the same way. The typical use would be analyzing environmental impacts from one or more projects. This can be used in evaluations to determine what can be changed in order to obtain a more acceptable environmental impact.

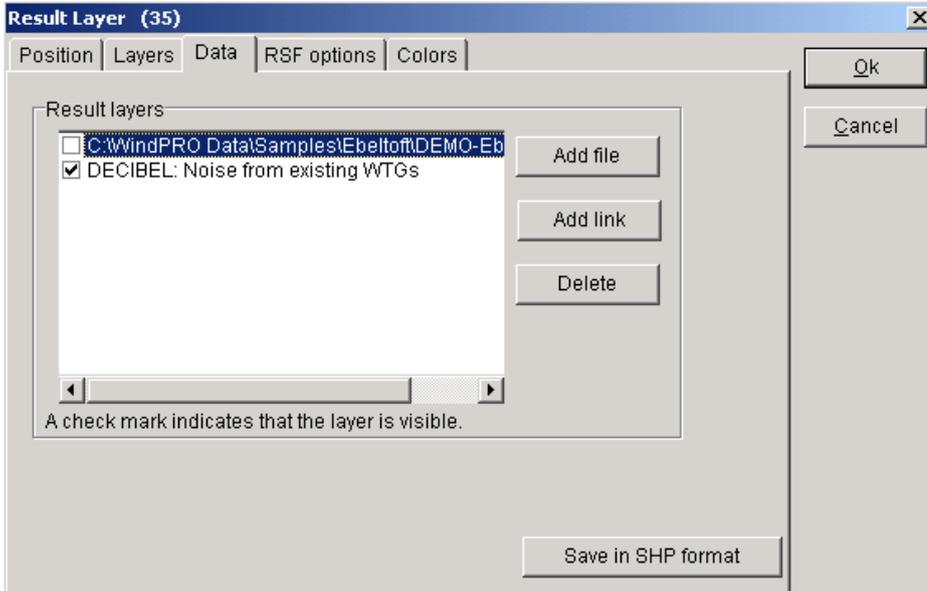
2.10.1 Creating a Result Layer



Clicking on the object button creates the object.

Please note, that by default it's only shown on one map. It is recommended that you place it on your "preferred map". Later, it can be shown on other maps.

2.10.1.1 Tab Sheet: Data



On the Tab Sheet "Data", you specified which data to use. Click on the button "Add file" to specify one of the following file types:

- .rsf - wind resource file from a WAsP calculation.
- .ear - EMD array result - a grid data file that is e.g. output from ZVI or a shadow map calculation.
- .evr - EMD vector result - a vector data file, an option which is not yet used.

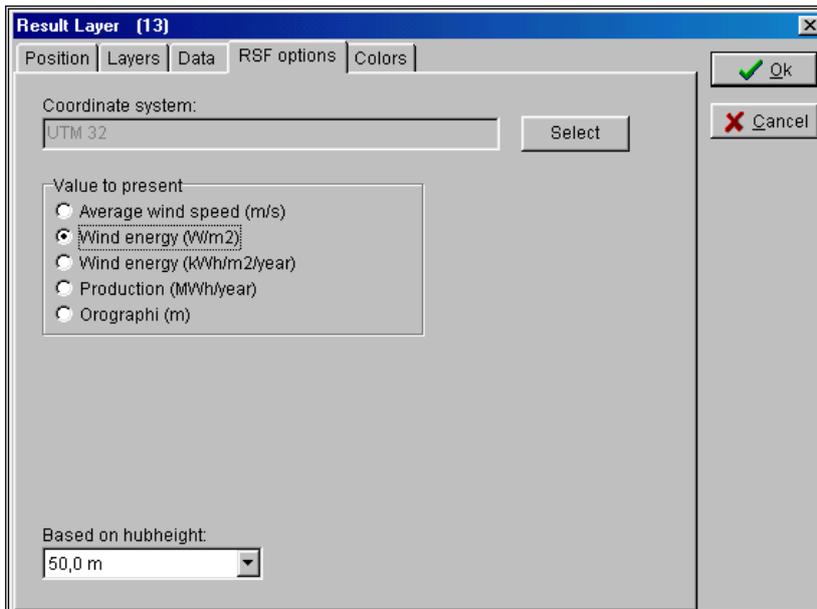
You can attach several results files to the same object. For example, if you calculated a large wind resource file, and later added additional potential WTG sites, you simply calculate a wind resource file for the additional sites and then attach it as an extra file to obtain a presentation of the entire site with identical properties.

You can select or deselect files for the presentations by means of the check boxes in front of each file.

On-screen noise optimization

Click on the "Add link" button and specify results from a previous noise calculation. The noise isolines from the calculation will appear directly on-screen when you click on "OK". Now you can change the layout of the wind farm in order to fulfil the noise demands at the neighbors. Simply move the wind turbine and the isolines are updated automatically. The isolines will also be updated (recalculated on-screen) when the type or version of the wind turbines are changed.

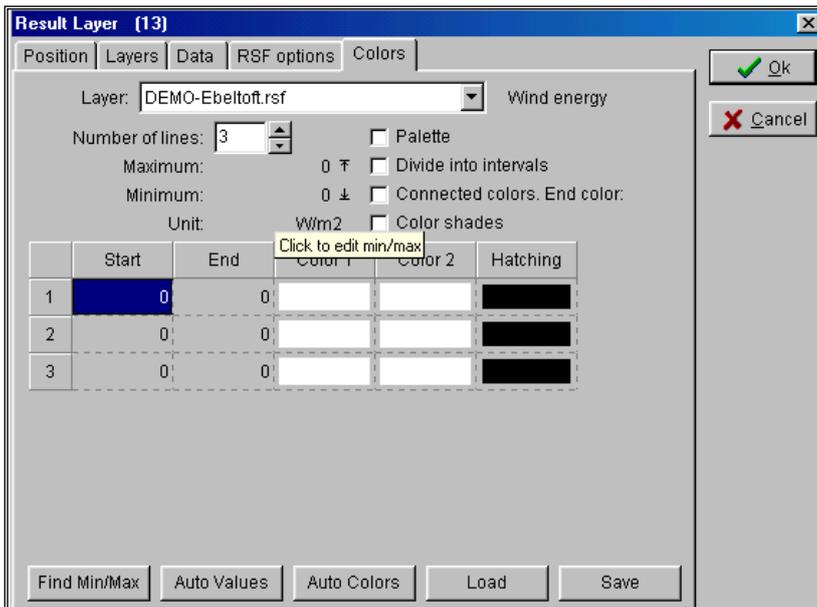
2.10.1.2 Tab Sheet: RSF options



When the wind resource is chosen for presentation, you can select which parameter to show.

Please note that if the WTG production is selected, you gain access to select a "generic WTG", that is, to specify power, rotor diameter, regulation (stall/pitch) and fixed or variable speed (rpm). The program will then, by means of standard tables from Helge Petersen (HP-tables), find the expected production values of a WTG of this size. Since these tables are valid only within a certain range, white areas will occur if the production is very high, or very low, and thereby outside the range of definition.

2.10.1.3 Tab Sheet: Colors



To define a range of colors for presentation, start by using the "Find Min/Max" function to determine the interval for which you wish to define the colors. Note that you can specify your own min/max values as well as the number of decimal places. This can be used to select more reasonable start/end values for the range.

The number of color graduations or "value intervals" is selected under "Number of lines". Start and end values can be entered manually or automatically. In particular, please note that start/end values for auto-generation can be found automatically as the min/max values in the data set or they can be entered manually in the appropriate boxes.

Also note the "Load" and "Save" options, where you can save your favorite color definitions for later use in other projects.

Lastly, colors for the presentation are chosen. There are a number of possibilities.

In short they are:

No choice: (Default) Intervals are pre-set with smooth color changes.

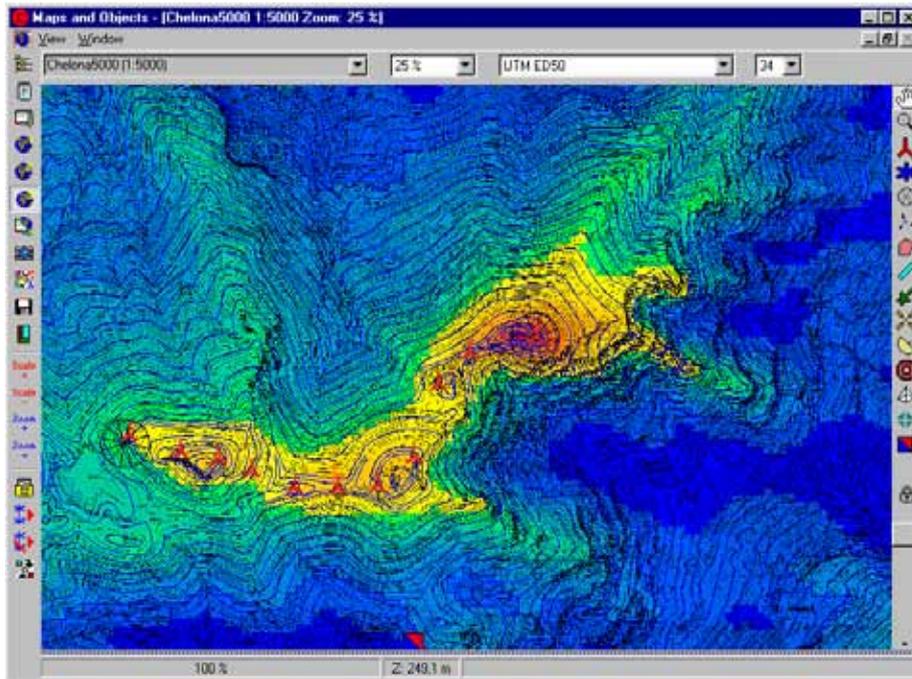
Palette: Single colors - one color for each value interval.

Divided into intervals: A start and an end color for each value interval, sub divided into nuances of colors.

Connected colors: Select a color for each interval and an end color. This will create sliding nuances of colors.

Shadow colors: Each color is "Phased out" in order to create a shadow effect.

When the color settings are ready, the program renders the results layer onto the map on which the Result Layer Object was placed. The rendering may take some time, but once rendered, the image remains in memory so that it does not need to be rendered again.



The above figure is an example of an .rsf file rendered on a map with the result layer. The map illustrates how four colors are used to show "non-usable", "usable", "good" and "excellent" WTG placements. With this information, available, it becomes much easier to place the WTGs at the best locations, although the park efficiency must also be considered.

2.10.2 Result layer handles xyz and GRD files

Golden Software's Surfer has a proprietary data format (*.DAT). Many programs use this as an export format (e.g. the advanced CFD modeling program, Meteodyn). Exported Surfer files can be converted in Surfer to *.GRD files showing, for example, inflow angle or turbulence as the modeled parameter. These can now be imported into a Result Layer object in WindPRO and shown on top of the map or draped across a 3D view.

The .wrg file reader in the Result Layer object is now more flexible, so Meteodyn export files can also be read. From Microsoft Excel you can save any x,y,z data as a text file and rename to .xyz; the files can be also be shown in a Result Layer object. On that basis you can display any chosen parameter placed in the third column with x and y co-ordinates in the first two columns.

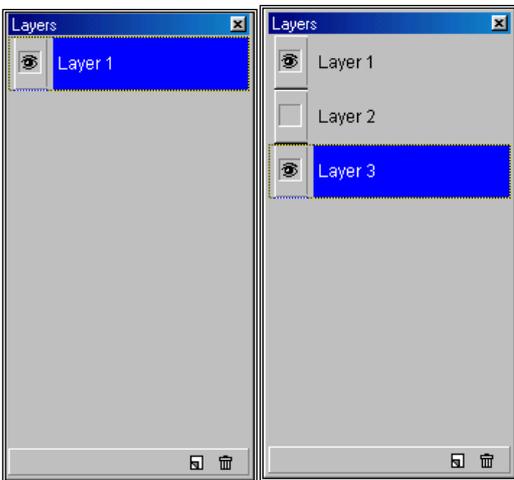
2.11 BASIS - Layer structure - organizing objects

2.11.0 Introduction to layer structure

Using a layer structure similar to that used in many programs such as AutoCAD or PhotoShop, you can organize the objects in WindPRO.



Start the "Layer Manager" with the "Layer" button in the lower left menu bar.



2.11.1 Create new layer

In this window you can create a new layer by clicking on the small icon at the bottom of the page next to the "trash bin" icon (which deletes layers). In the right window shown above is an example of two newly-created layers (3 layers total). The eye indicates whether the layer is visible or not, meaning in this case that Layer 2 is deactivated and is therefore not visible either on the map or in the Object List. Just click on the "eye" button to activate or deactivate the layer. The blue background (Layer 3) indicates the current active layer. Any new objects created will be assigned to this layer.

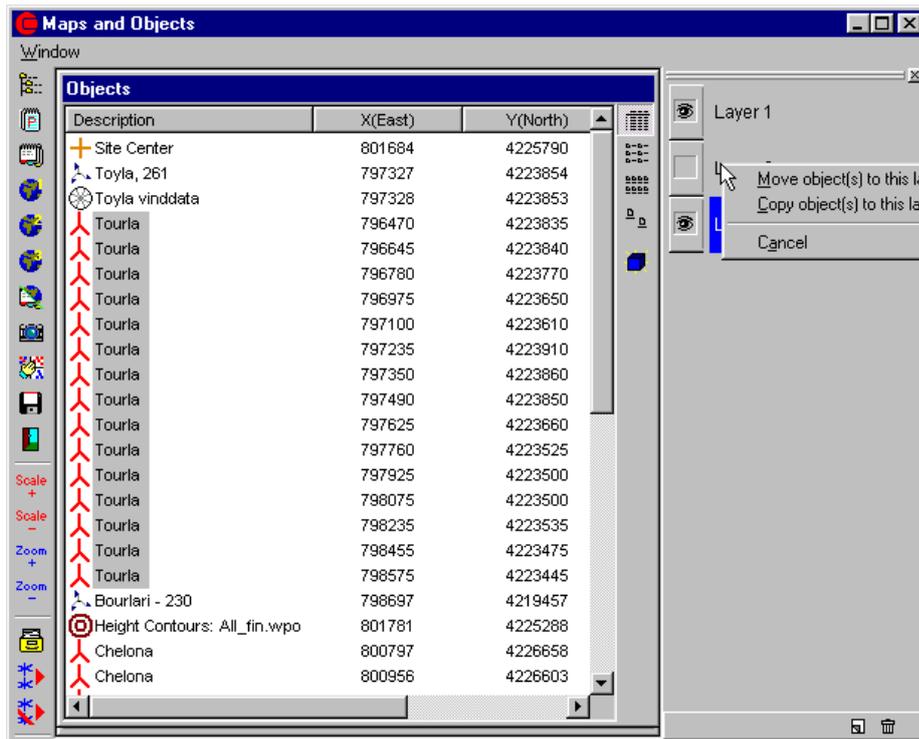
2.11.2 Layer Manager as a "docked" or a "free" window

Sometimes it's preferable to let the layer manager be a docked window (a part of the "linked" windows instead of a "free" window within (on top of) the map). Simply dragging the window to one of the edges and releasing docks the window. Then it will automatically convert into a bar. To change it back into a free window, right-click on the Layer Manager and check "docked" from the pop-up menu.

2.11.3 Move or add objects to another layer

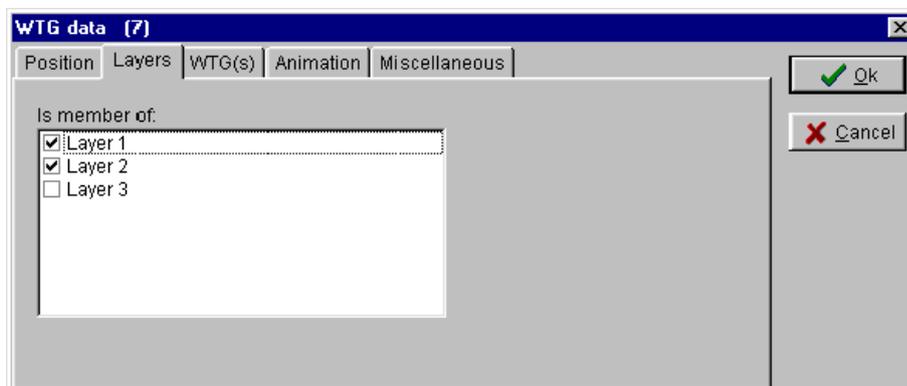
This can be done in two different ways:

1) Drag the selected objects you want to move or copy from the Object List to a layer in the Layer Manager. WindPRO will then ask whether you want to move or add them to the layer. Please note that when adding objects to a layer, a duplicate set of objects are not created on the second layer. The objects are merely assigned to both layers. If you want to duplicate objects, use the clone or copy function.



In the above figure, all WTGs called "Tourla" are selected (click on the first one with the left mouse button, hold down the <Shift> key and click on the last one). Hold down the right mouse button and drag the selected objects to the Layer 2 icon. The program will ask whether you want to "move" or "add" them to the layer. If added, they will exist in Layer 1 as well as in Layer 2.

2) In the Object Properties, you can assign the object to one or more layers.



2.11.4 How to organize objects in the layer structure

WindPRO supports many ways of organizing objects in the layer structure. Here are a few examples:

a) Several different layout alternatives for one WTG project

Here it would be natural to organize each layout in its own layer. All the basic objects such as Terrain Evaluation, Height Contour, Neighbor, Camera etc. could then be placed in Layer 1. Each layout alternative has its own layer which makes it easy to quickly see and compare the different alternatives for an evaluation. When adjusting a given layout, only one layer is visible at a time so you don't risk modifying other alternatives when moving the WTGs on the map.

b) Different object types for each layer

It's often difficult to "select" on object e.g. a noise sensitive area beneath a shadow recipient. This can be avoided by organizing all the noise sensitive areas in one layer and the shadow recipients in another. You can

now make the final adjustments to the placements with one active layer without interference from the other objects.

c) Photos for visualization with different focal lengths

If, for a visualization, you have photos with different focal lengths, but taken at the same location, the Camera Objects will be placed on top of each other on the map and will be difficult to work with. Assigning each Camera Object to a separate layer is an easy way to work around the problem.

d) Line- and Area Objects disturb the overview

The map overview becomes cluttered if you have digitized many objects such as roughness, contour lines, areas, etc. If the various information is organized in layers, it's faster to activate or deactivate the layer than to find the individual objects in the Object List and then deselect "show lines" etc.

e) Several projects in the same area

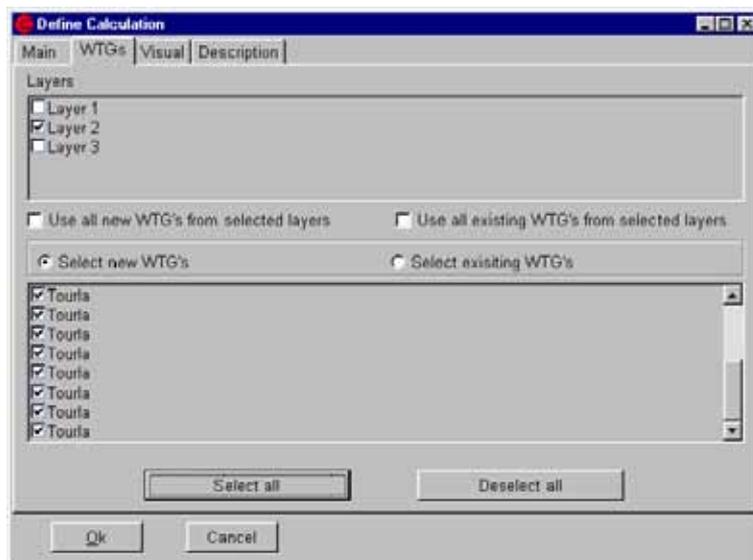
If you work with several projects within a limited geographical area it's possible to reuse much of the data and take advantage of working with many WTG projects in one WindPRO project. Information relating to each project is placed in its own layer, while all joint objects are placed in a "joint-layer", e.g. Layer 1.

f) For planning purposes

When a municipality for instance, is planning its WTG policy, they may want to organize the existing WTGs according to expected dismantle time or prioritized removal, for example. It's also possible to place new WTGs in different layers according to different development alternatives. Subsequently, it's very easy with the layer structure, to combine different dismantling and development alternatives and to perform different environmental calculations such as a ZVI calculation.

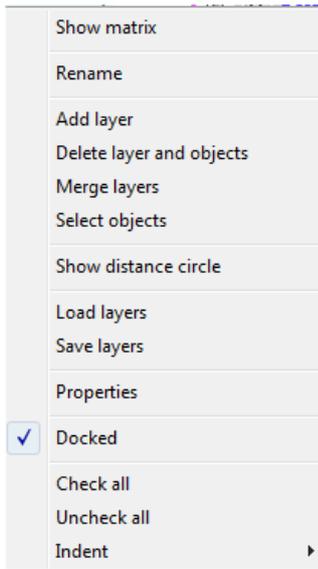
2.11.5 Usage of the layer structure in a calculation

When starting a calculation, it's possible to include WTGs from selected layers only for the calculation. You can deactivate single WTGs within each layer. Essentially, it will be much faster and more efficient to work with different alternatives in the same project.



2.11.6 Save/load layer structure

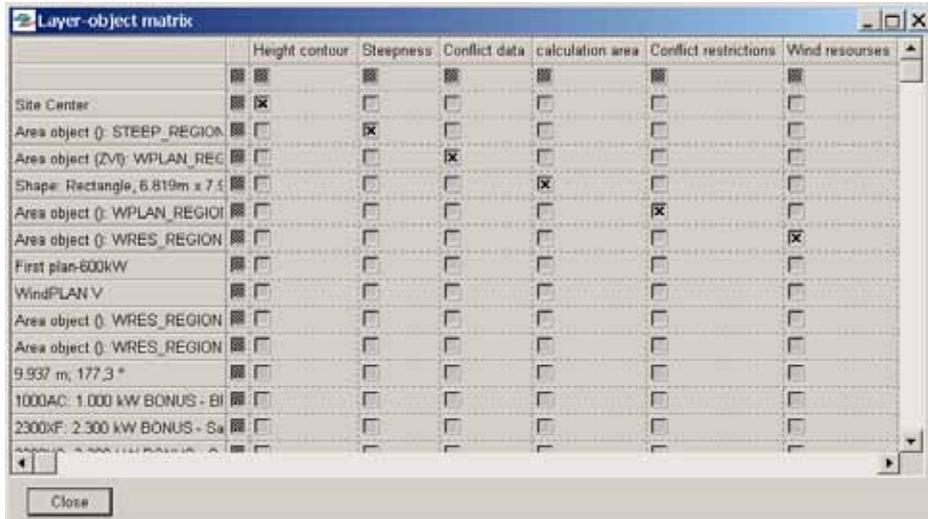
Right-click in the layer window and get the menu:



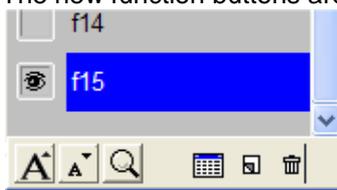
From this menu, a layer structure can be saved or loaded, which means that a good layer structure can be reused in another project.

2.11.7 Matrix view, font size, magnifier, and move layers

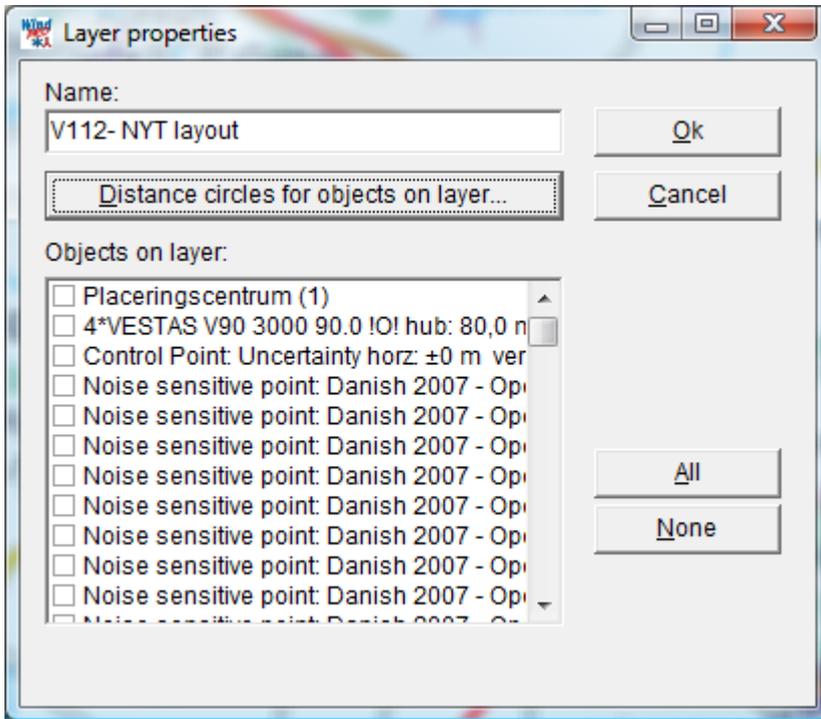
Note the “Show matrix” which allows you to see a complete overview of all layers and objects that are assigned to them (see example below).



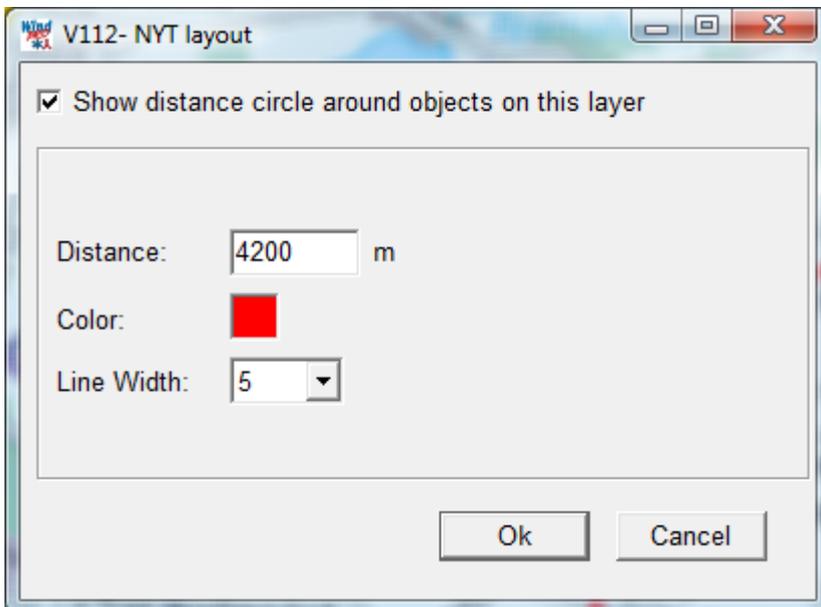
One of the recent improvements (from version 2.5) is the “Change font size” function. The magnifying glass is also new. When the magnifying glass is activated (toggle by clicking on it), only the objects in the layer that you hold the cursor on will be shown in Object List. This can help you get a quick overview on which objects belong to which layers. Lastly, you now can move layers simply by dragging them with the left mouse button down. The new function buttons are shown in the screenshot below.



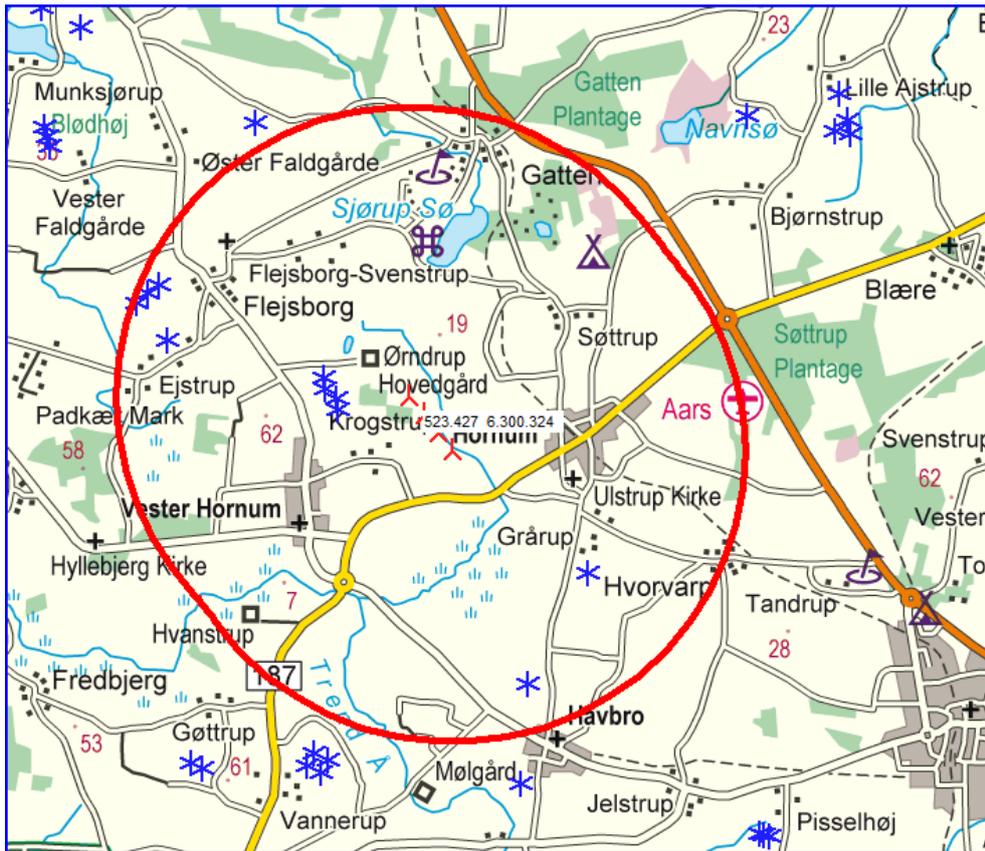
2.11.8 Distance circle around layer objects



The button "Distance circles for objects on layer" gives access to following:



Here the distance, color and line width be set. In Denmark e.g. there must be a special investigation if wind farms are established closer than 28 Rotor diameters to existing turbines. With this feature it is fast investigated if this is required:



28 x rotor diameter around the new proposed project show which existing turbines that are closer.

2.12 BASIS – Text, ruler and Shape Object

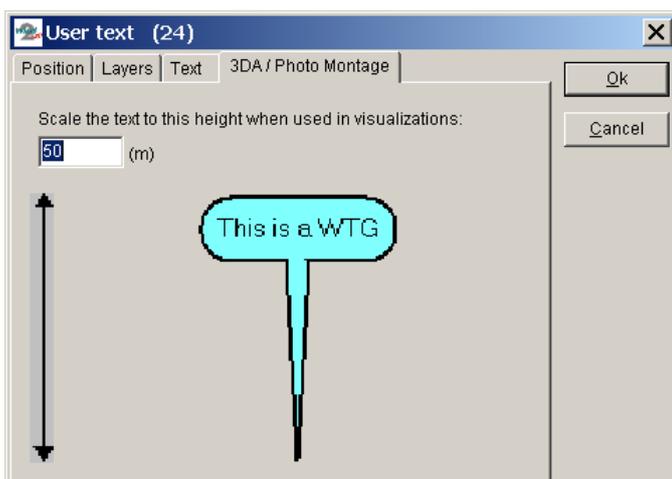
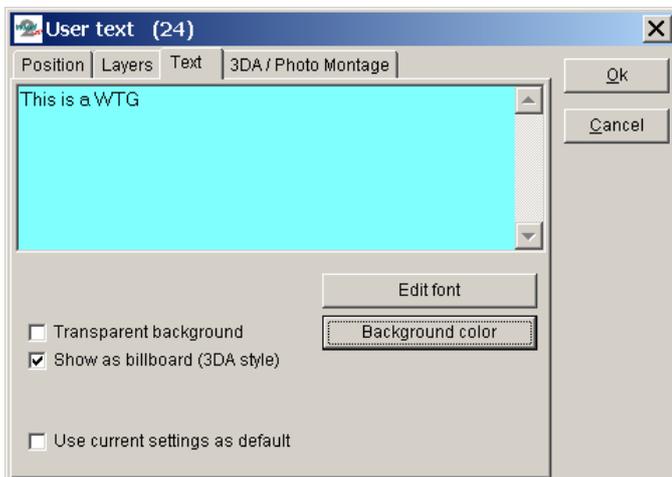
2.12.0 Auxiliary objects

WindPRO also has a group of objects that are not directly involved in calculations, but are very helpful for designing, measuring and presentation.

2.12.1 BASIS - Text Object

T

With the Text Object, you can attach text to the project map and later include it on the map printed in one of the calculation reports. You simply select the Object from the Object Bar and place it on the map and then enter the text. You can move or edit the position of the text exactly the same way as with all other objects.

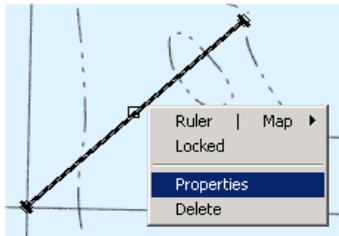


A unique feature in WindPRO is the ability to use the Text Object for showing “balloon text” on maps, as well as in Photomontages and 3D Animations, so that a specific location can be identified on map, on photo, or in the terrain model.

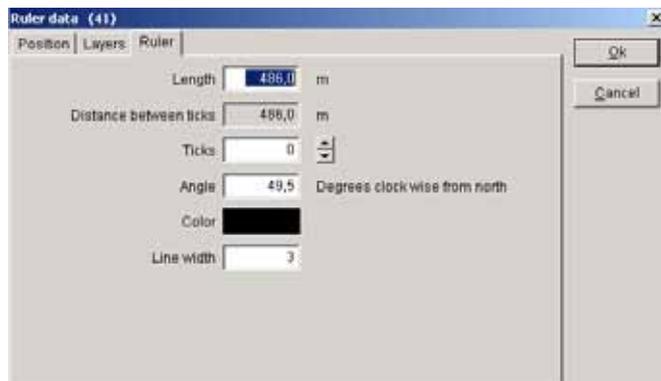
2.12.2 BASIS - Ruler Object



With the Ruler Object you can measure distances on the map. You select the button shown above from the Object Bar and place it on the map at the location where you want to start the measurement. Then you click on the location where you want to end measurement. Hovering with the cross hair over the measurement will cause the distance and the compass angle to be displayed in the status bar at the bottom of the screen. It's also possible to change the properties of the ruler. To do this, left-click on the line in order to activate it, then right-click and select "Properties" in the pop-up menu as shown below.



The following dialog box will now appear.



Here a fixed length or angle can be specified. The number of tick marks can be specified (e.g. to mark every 100 m distance) and the color and line width can be changed.

You can also move or edit the ruler line. Left-click on the line in order to activate it. Place the cross hair inside the center mark, then left-click and drag to move the ruler parallel to its original position. Place the cross hair inside an outer mark to rotate the row around the opposite outer mark. Hold down the <shift> key while dragging an outer mark to change the ruler length.

Lastly, you can measure a distance without creating a new Ruler Object. Simply create the ruler with left mouse button, but instead of finishing with a second left-click, use a right-click and the ruler will not be created.

2.12.2.1 Quick profile, based on object "ruler"



This button (at the bottom of the left-hand toolbar on "Maps and Objects" window) activates the profile after inserting a ruler;  found in the right-hand toolbar.

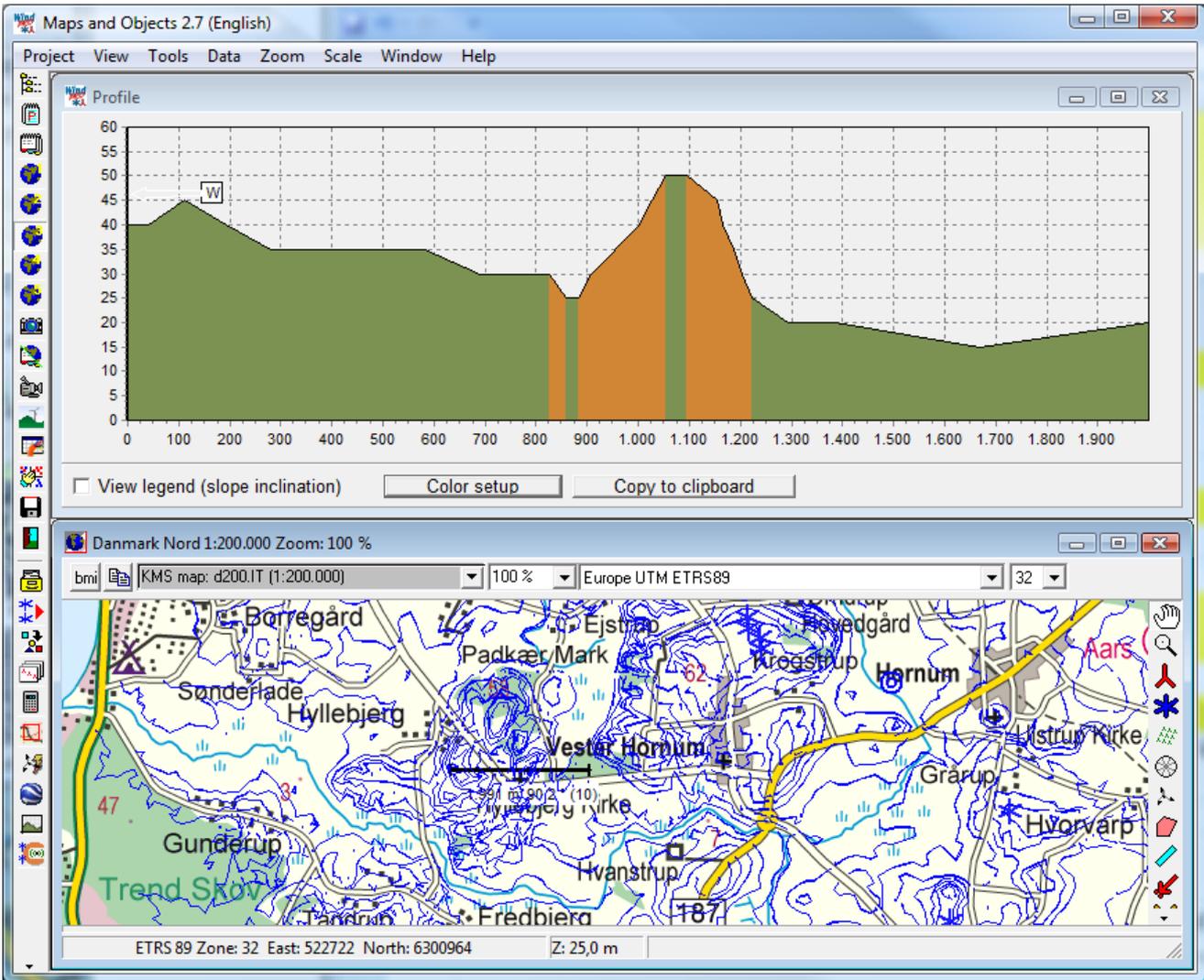


Figure 9 Create a ruler at map and right click, choose "Show Quick Profile" and a cross-sectional view is shown along the ruler line. Note: this tool uses the actual contour lines, the alternative "rendered" terrain profile based on the shape object, using the TIN.

The colors shown are pre-defined:

Green < 8°

Orange 8° - 17° (installing or transporting turbines may not be possible)

Brown > 17° (flow separation or WAsP model problems will start)

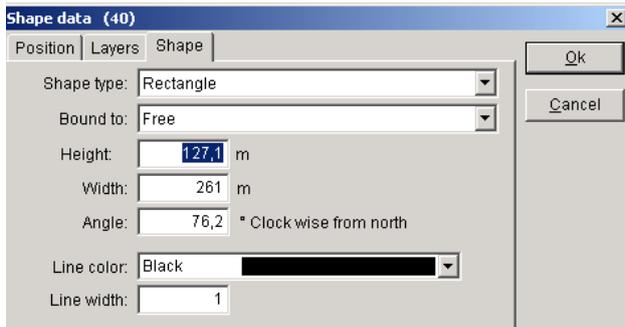
With the "color setup" button the colors and values can be user defined.

2.12.3 BASIS - Shape Object (also Grid lines)



With the Shape Object, rectangles, squares, circles, or a grid can be placed on the map as a helpful tool for measuring. Select the button shown above from the Object Bar and place it on the map where you want one of the corners of the rectangle or square to be located. Then mark the location of the opposite corner. For a circle, the two corners define the square of the inscribed circle. When the Shape Object is used as a grid, the object can be placed anywhere.

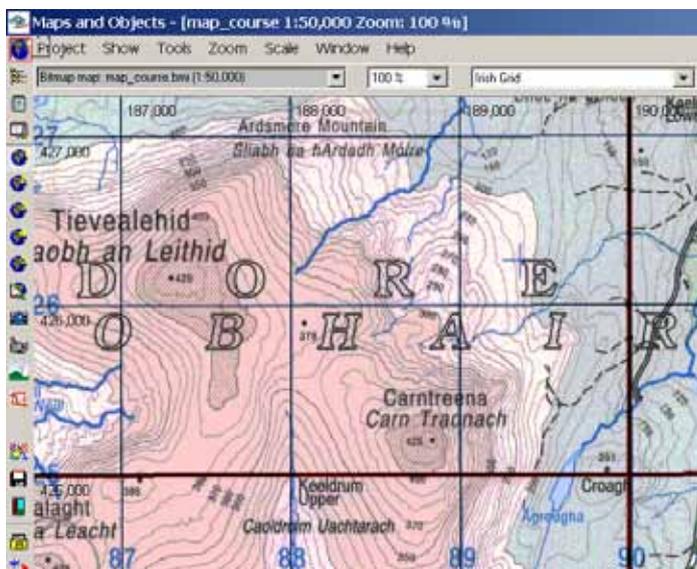
The shape object as rectangle is basis for terrain profile rendering, see 2.15.



After selecting the second corner, the dialog box shown above appears. Here the shape type, size, angle, color, and line width are defined.

The size, angle, and location of the shape can also be edited on-screen. Left-click on the Shape Object in order to activate it.

When used as a grid, right-click on the map to access the option “Show grid labels”.

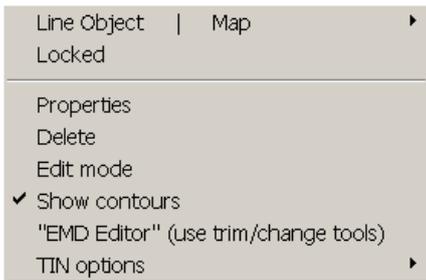


Shown above is an example of establishing two grid objects, one with thin black lines for every 1 km, and one with thick red lines for every 5 km. Notice the grid labels on the top and left edges of the map window. The labels will scroll in order to remain on the edges as the map is dragged.

2.13 BASIS – EMD Editor (Line and Area Objects)

2.13.1 EMD Editor - trim and change data

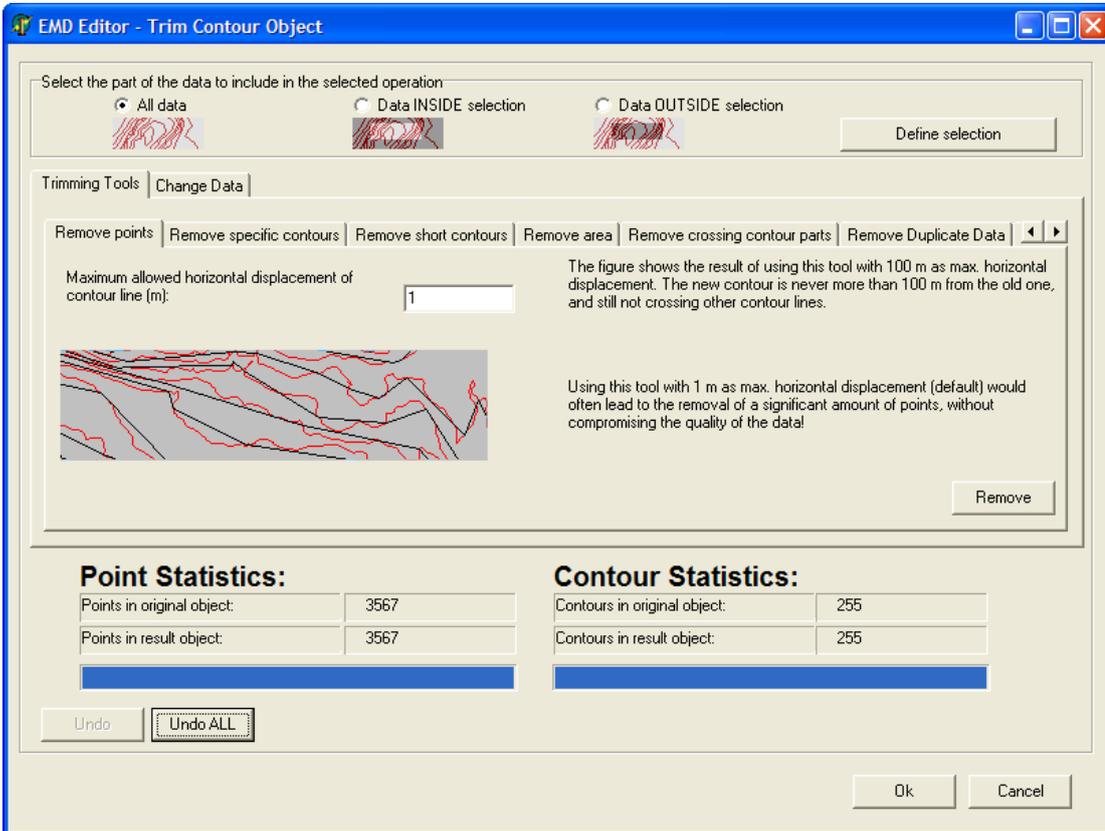
The EMD Editor works with data files associated with both Line Objects and Area Objects. Often the data files hold far more points than needed, or they may be misplaced on the map due to digitizing in the wrong coordinate system, or they may simply contain errors, possibly from converting from one file format to another.



The EMD Editor is started from the pop-up menu that appears when you right-click on the Line, Area, or WTG Area Object. If the object is in Edit mode, the Trim menu cannot be selected. The editor can also be started from the Line or Area Object form.

There are two main groups of tools: Trimming and changing data.

2.13.1.1 Trimming tools

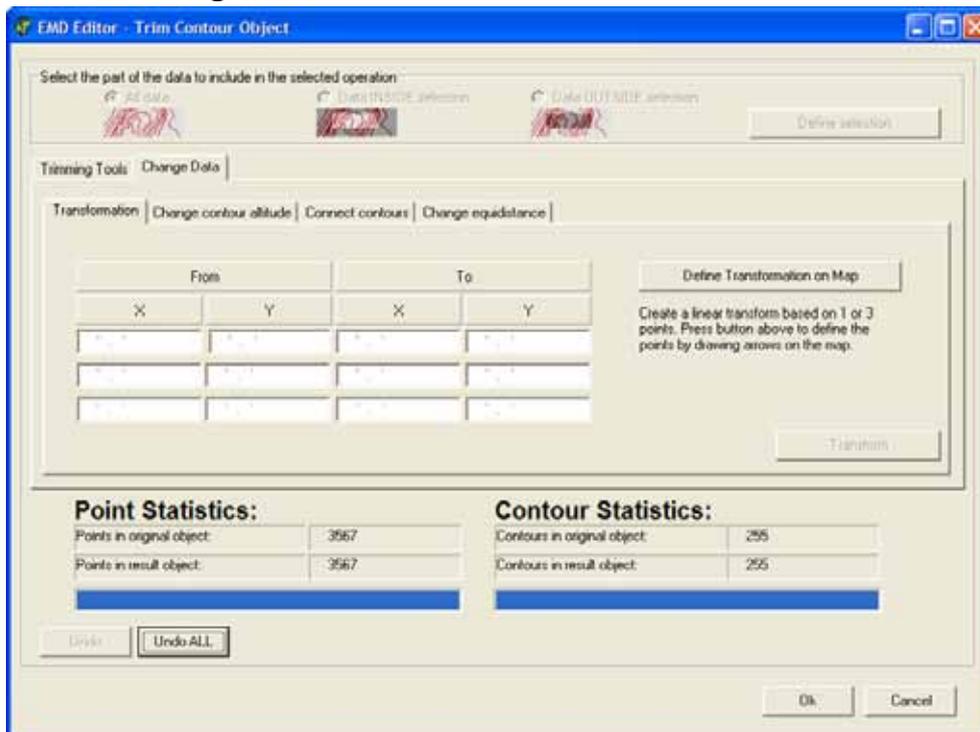


Trimming tools are typically used for removing points or lines or parts of a region to reduce the amount of data.

There are five main Trimming Tools and each is explained in detail on the respective tab sheet:

- Remove points
- Remove specific contours
- Remove short contours
- Remove area
- Remove crossing contour parts
- Remove duplicated data
- Remove “No TIN” data

2.13.1.2 Change data



Change data tools are used for moving, scaling, or converting data, or simply manually changing of a group of data.

There are four main Change Data tools and each is explained in detail on the respective tab sheet:

Transformation (move, rotate, or twist data to correct for digitization errors, e.g. digitizing based on local or wrong coordinate system or datum). The transformation can be made graphically, where either 1 or 3 arrows on the map are dragged so the “from” and “to” points are shown, indicating the coordinates for the transformation.

Change contour altitude (user-specified conversion formula to change from e.g. feet to meters).

Connect contours (spline).

Change equidistance.

2.14 BASIS - Map Composer

2.14.1 Start the Map Composer



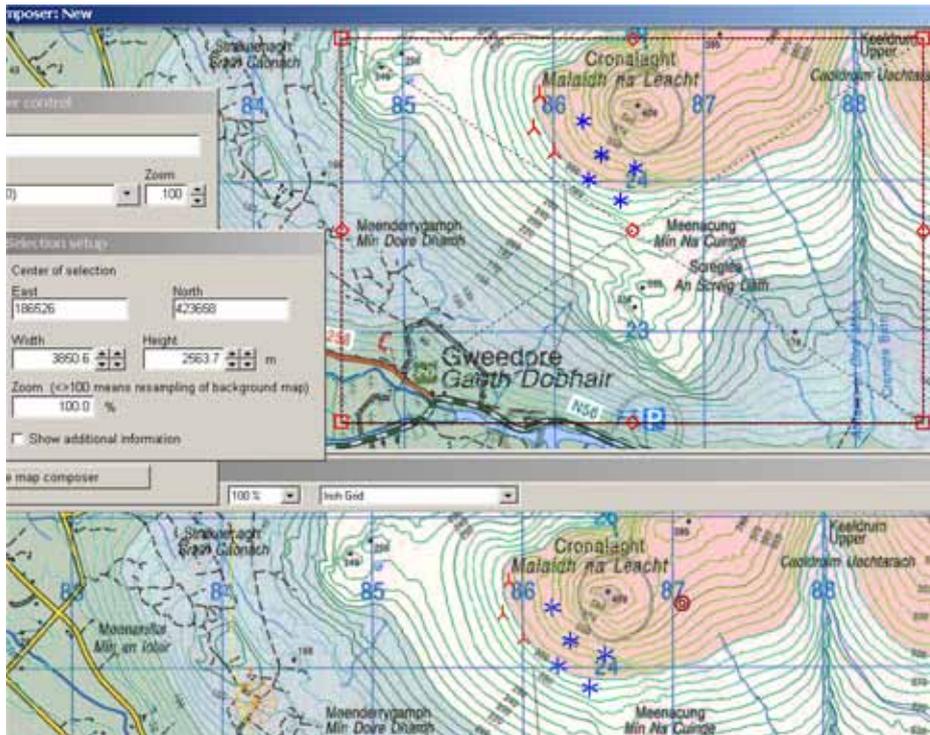
The Map Composer is used to prepare maps for use in reports. The Map Composer is started from the left tool bar by clicking on the button shown above.



Starting the Map Composer opens a split window containing the map (where the design of the composed map can be viewed), and the Map Composer Control window.

The Map Composer Control window has following options:

A name can be entered in order to find the map setup later. Different maps with different elements, scales, or symbol configurations can each be stored with a different name.

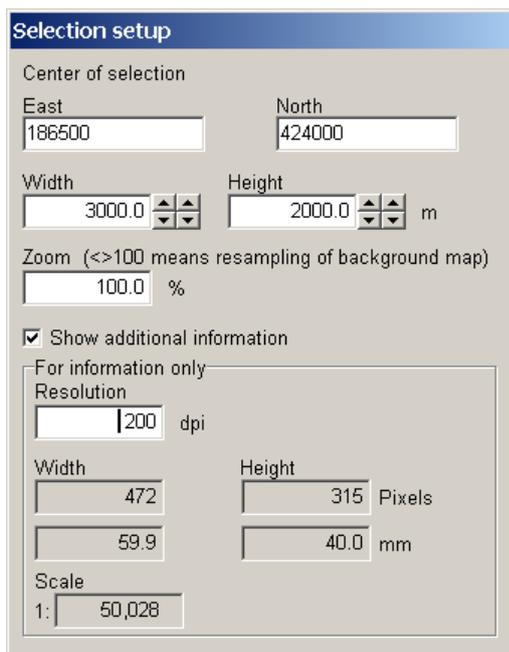


When the Map Composer option “Show selection tool” is checked, you can drag the square defining the part of the map that is to be copied to a report. This can also be specified exactly by specifying the coordinates, size, and zoom level.

With the option “Show additional information” you can specify a graphic resolution in dots per inch (dpi), which is important for reports that must be printed with high graphic quality.

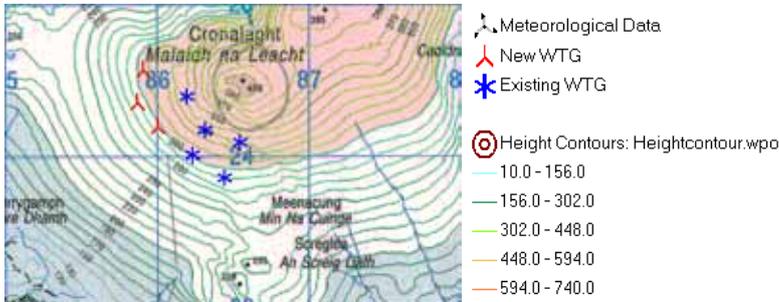
2.14.2 Select map portion and resolution with the Map Composer

Changing the resolution will change the size of the graphic in millimeters. If you specify a resolution (dpi value), the resulting width and height of the image as it will appear in the report are displayed.



If you want to show a larger map area while maintaining the size and resolution (dpi value), the zoom must be adjusted. The map will be resampled in order to fulfil your requirements.

In the example above, a 3 km x 2 km portion of the map is selected. For a 200 dpi map, an area that is 59.9 mm x 40 mm will be required on the report page. The scale will then be 1: 50.028 (it should actually be 1:50.000, but a slightly inaccurate coordinate setting makes the difference).

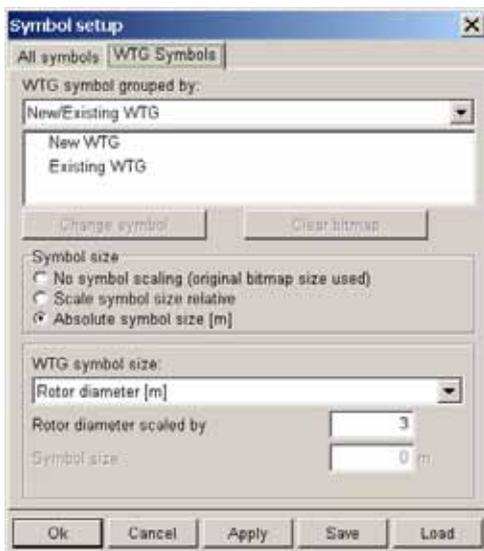


Above, the map is copied to the clipboard, and then in Word, the height is set exactly to 40 mm so that the map will print at a resolution of 200 dpi and a scale of 1:50000.

Shown above is an example of an ordinary screen dump (print screen), without the Legend, which can be added by clicking “Copy legend” in the Map Composer Control, and then pasting it into the Word document.

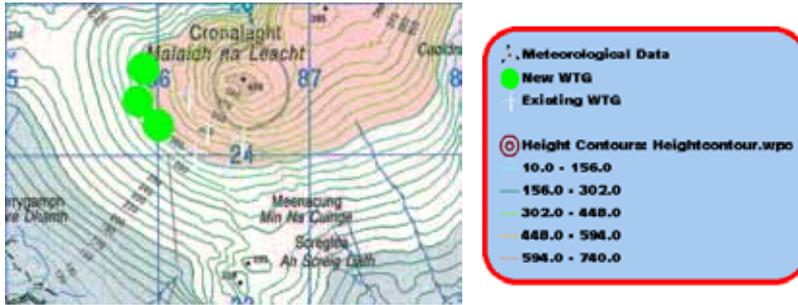
Note how the height contour lines have different colors for different heights (this is configured by a setting in the Line Object).

2.14.3 Symbol setup in Map Composer



One of the more useful features of the Map Composer is the one that allows you define custom symbols (mainly for WTGs), and to scale them according to the size of the WTG.

Any bitmap file can be used as a WTG symbol. Some examples can be found in the folder “WindPRO Data\Standards”, but any bitmap can be used. A map example with different types of symbols for new and existing WTGs is shown below.



If custom symbols are defined, the legend will be updated with the new symbols. In the example shown above, the legend has been modified slightly in order to illustrate the possibilities.

2.14.4 Legends and more options with Map Composer

The legend can be modified by the user in a number of different ways. The various options available can be seen in the Legend setup window shown below.

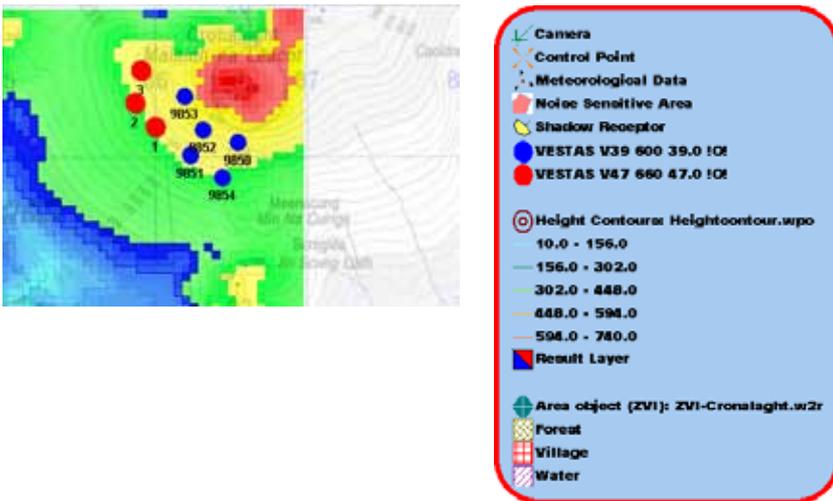


Font, background color, line height (the distance between lines in the legend), show frame, frame width, frame color, as well as rounded corners are the available options.

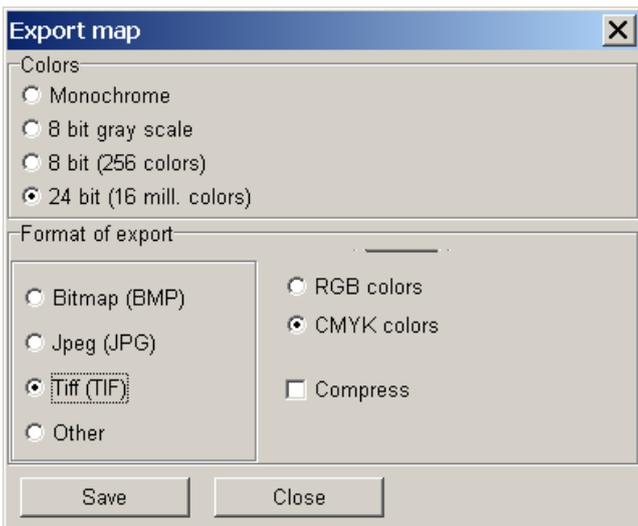
Lastly, shown below is an example which includes reduced background map intensity, symbols scaled by rotor diameter, labels, and the wind resource map from result layer.

The WTG symbols can also be divided by WTG type or manufacturer, which is illustrated by the legend for this example, with two different WTG types.

Note: The type of objects that appear in the visible layers will determine the appearance of the Legend, even though the objects may not be within the selected portion of the map.



After designing your individual map layout, you can copy it and make another map based on the same parameters, while including additional elements, e.g. one map for noise, one map for flicker, etc. This allows you to make a template, no longer limited by the default symbols in WindPRO, and then with the features you require, to copy the relevant elements to a professional report with uniform and high quality map presentations.



One final note on the Map Composer: When saving maps as .tiff files, you also have the option to save the file in the CMYK color format, which is the basic requirement for offset printing equipment.

2.15 BASIS - Terrain profile

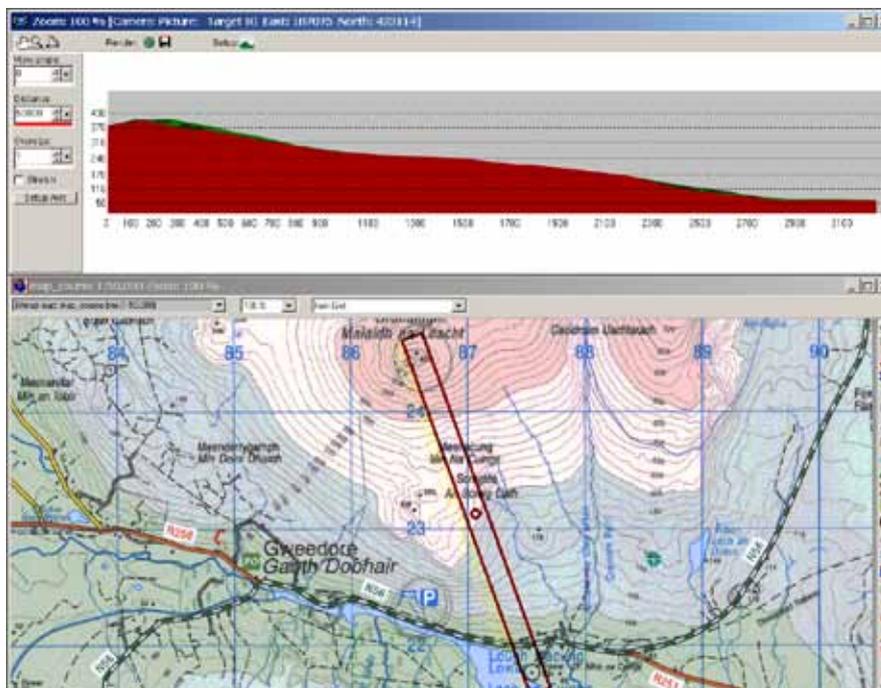
2.15.1 How to use the Terrain Profile



Using the Shape Object (right Object Bar) you first create a rectangle to define the profile cut for which you want to view the terrain profile.



The Terrain Profile tool is activated with the Terrain Profile icon (left tool bar). Note that there must be a TIN calculation based on a Line Object with height contour lines in order to use the Terrain Profile tool.

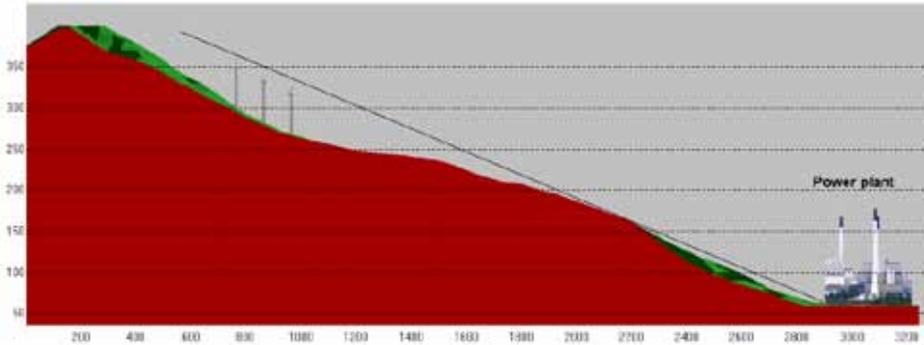
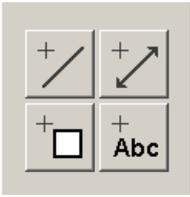


When you click on the Terrain Profile icon, a terrain profile for the selected profile-cut rectangle is rendered. The yellow arrows indicate the viewing direction for which the profile is being shown. The profile is always seen from the longer side of the rectangle. In order to view the terrain profile from the opposite side, the rectangle object must be rotated 180 degrees by dragging the corners.

The terrain profile can be over-sized and stretched, or just over-sized. The difference between stretching and over-sizing will be in the way that objects such as WTGs are shown on the terrain profile. If stretched, all objects shown will be stretched in the over-sizing operation. If “stretch” is not chosen, the objects, such as WTGs, will simply be over-sized both horizontally and vertically. This makes it easier to see the WTGs in the terrain profile, but it will also oversize them in the horizontal direction.



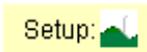
With the Draw Tool shown above, which is found in the tool menu at the top of the Terrain Profile window, lines can be drawn and text can be added to the profile view. Additional tools are available as described below.



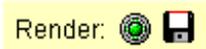
The graphic above illustrates how a bitmap (the power plant) is inserted as a 3D Object and 3 WTGs are inserted on the hill. The profile and the objects are all oversized by a factor of 3. The line from the power plant over the edge of the hill illustrates that from the left base of the power plant the WTGs will not be visible.

The part of the hill shown in red is that which would be seen on the near side of the profile-cut rectangle. The part of the hill shown in green is that which would be seen from the far side of the profile-cut rectangle. The part of the hill shown in green can also be seen from the viewpoint.

The terrain profile is ideal for analyzing local conditions and can be used for many purposes. It is especially useful for illustrating proportions between the landscape, WTGs, and other elements.



Colors can be changed with the setup button.



After any settings are changed, or any new objects are added within the terrain profile rectangle on map, the “Render” button must be clicked to update the image to include the new elements. Clicking on the floppy disc icon will save the terrain profile image as a bitmap. There is no specific report that can be generated using the terrain profile. The bitmap image is the only possible result output.

See also “quick profile” described in 2.12.2.1.

2.16 BASIS - Google Earth exporter



With a click of this button, selected objects will be exported. You can also export from the Objects List, selecting those objects to export, then right-click and select “Export to Google Earth”.

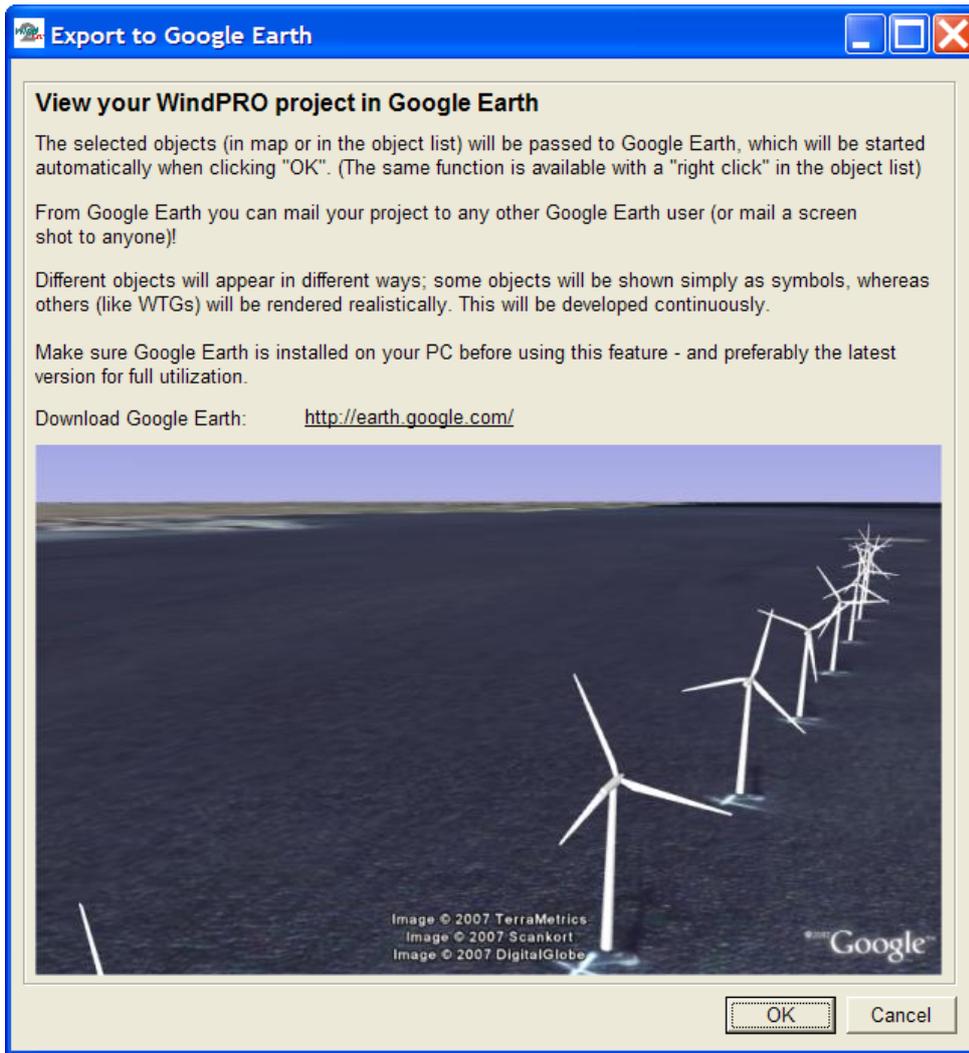


Figure 10 You need to install Google Earth before using this tool.

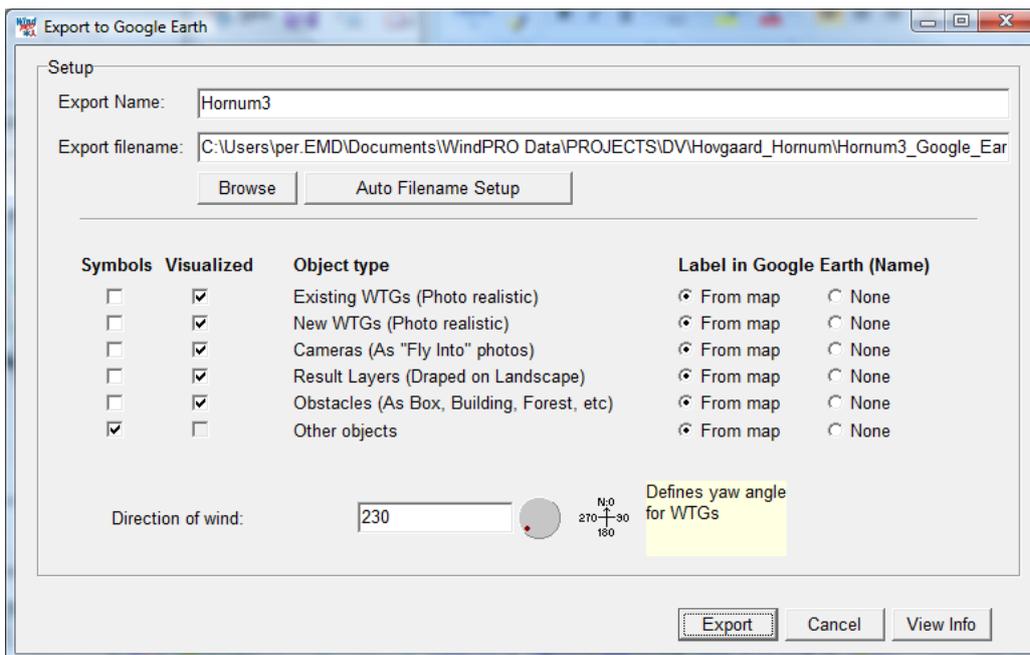


Figure 11 You can chose how some of the object types shall appear in Google Earth, including labels.

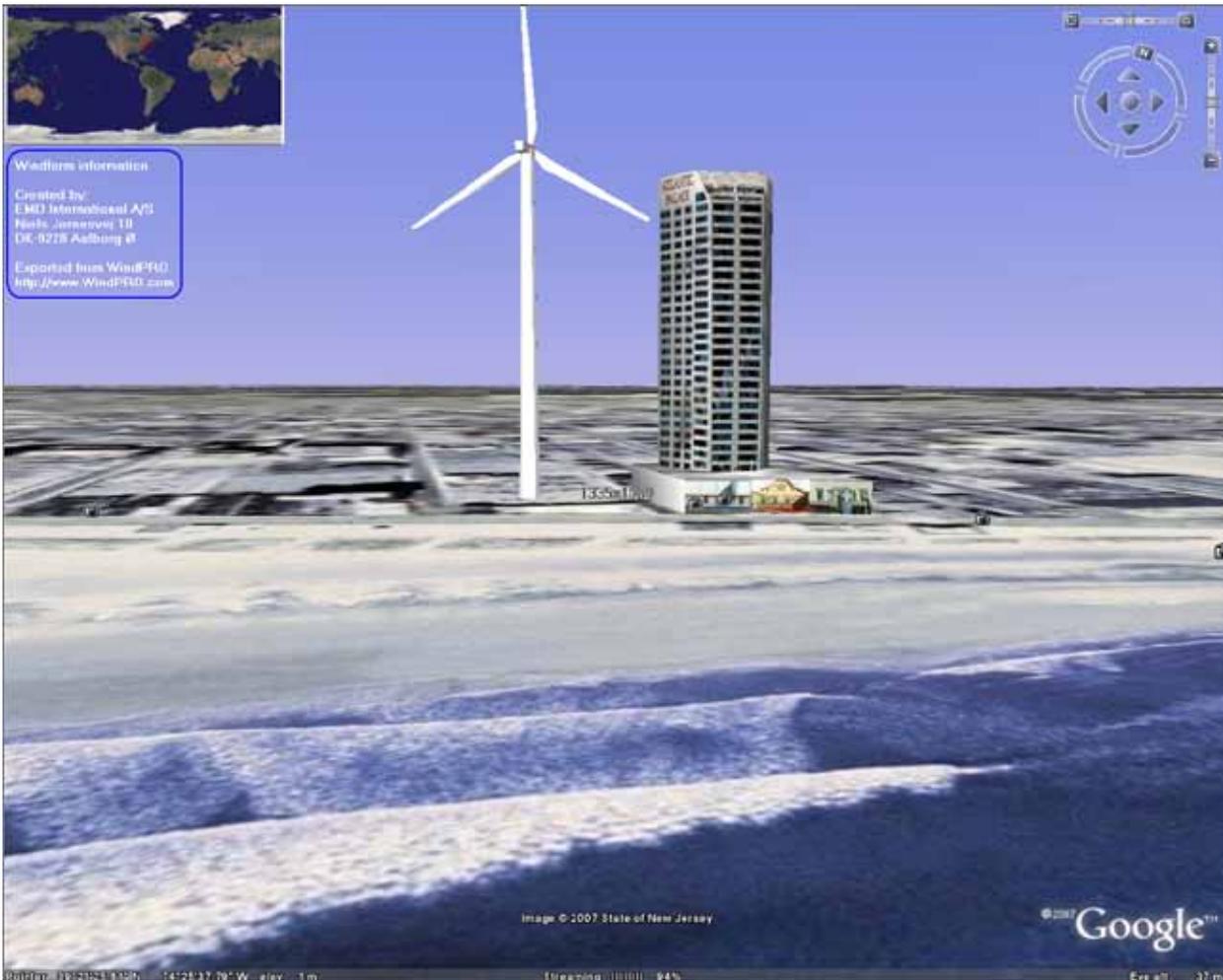


Figure 12 It has never been easier to compare a given turbine size with a known building! Or of course, to simply visualize your project.

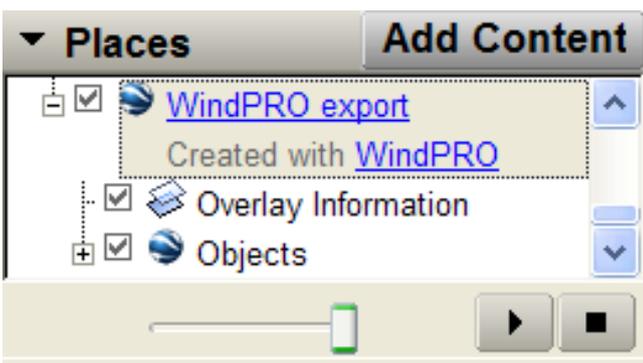


Figure 13 In the Google Earth layer structure, a WindPRO export layer is added with subfolders with object information etc. Right click at the WindPRO export and choose "Email" to send the Google Earth presentation to the chosen recipient's computer. The mail attachment is a .kmz file holding all the necessary information – this file can also be saved in your project folder (right click on the layer and choose "Save As") as part of the project documentation.

When Google Earth is closed, the file will be removed unless you perform a manual "Save As" operation. The idea is that you can "re-export" the project a number of times without getting your own Google Earth filled with several different layouts.

2.16.1 WTGs as photo realistic 3D objects

WTGs can be exported to Google Earth and shown as photo realistic 3D objects, just select the objects to export in object list and right click or click the Google Earth button.



Figure 14 Turbines exported to Google Earth.

2.16.2 Photomontages as "fly in"

Exporting cameras can give a unique test of your photomontages and a unique exporting feature, so anyone with Google Earth access can see your photomontages on a Google Earth background – creating a really impressive feature.



Figure 15 The photomontage as a "fly in" feature at Google Earth. By using the "transparency" slider in Google Earth, you can gradually increase transparency of your photo and thereby check how well it matches the Google Earth background.

2.16.3 Results layers as overlay

Result Layer objects exported to Google Earth will be draped on top of the Google Earth surface, ideal for wind resource maps, etc.

2.16.4 Other objects as symbols

All other objects will for now “just” be exported as symbols, so there is still room for improvement in future versions.