Appendix: TSTool Installation and Configuration for CDSS

CDSS Version, 12.00.00, 2017-04-16

1. Overview

This appendix describes how to install TSTool in the CDSS (Colorado's Decision Support Systems) environment. CDSS consists of the HydroBase database, modeling, and data viewing/editing software. TSTool can be used within this system to process time series from the HydroBase database, CDSS model files, and other databases and files. Alternatively, TSTool can be installed independently of CDSS, in which case the only connection is that the installation folder defaults to *C:\CDSS\TSTool-Version*.

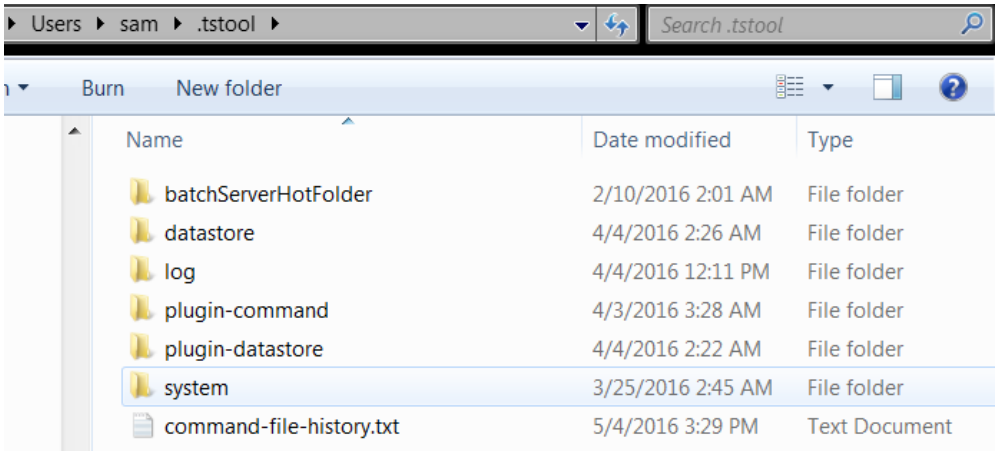
2. File Locations

Standard locations of TSTool software files are as follows. Files are normally installed on Windows on the *C:* drive but can be installed in a shared location on a server. Note that the following list of software **.jar* files may be different from the current TSTool version. In the future separate documentation may be provided explaining software components and licenses.

C: \CDSS\TSTool-Version	Top-level install directory.
bin	Software program files directory.
batik.jar*	Scalable Vector Graphics (SVG) output packages.
Blowfish.jar*	Used for encryption/security.
cdss.domain.jar*	CDSS components.
h2.jar*	H2 embedded database.
HydroBaseDMI.jar*	State of Colorado HydroBase database interface package.
jcommon.jar, jfreechart.jar	Plotting package.
jsr173_1.0_api.jar, libXMLJava.jar	XML support.
jython.jar	Jython support.
msbase.jar *mssqlserver.jar* *msutil.jar*	Microsoft SQL Server packages.
NWSRFS_DMI.jar*	National Weather Service River Forecast System (NWSRFS) package.
RiversideDB_DMI.jar*	Riverside Technology, inc., RiversideDB database package.
RTi_Common.jar*	Riverside Technology, inc. supporting packages.
SatmonSysDMI.jar*	State of Colorado Satellite Monitoring System package.
StateMod.jar*	State of Colorado's StateMod and StateCU model packages.
TSCommandProcessor.jar*	Time series command processor package.

tstool	Shell script to run TSTool on Linux and Mac.
TSTool.bat	Batch file to run TSTool using the JRE software. This may need to be edited if the installation is not standard.
TSTool.exe	Executable program to run TSTool using the JRE software, recommended over batch file.
TSTool.l4j.ini	Configuration file for *TSTool.exe* launcher.
TSTool.jar*	TSTool program components.
doc\TSTool\UserManual	Main documentation directory for TSTool.
TSTool.pdf	TSTool documentation as PDF.
examples	Example data and command files.
logs	Directory for TSTool log files (should be writable). See also user files below.
system	Directory for system files.
CDSS.cfg	CDSS configuration file for HydroBase database configuration.
DATAUNIT	Data units file.
TSTool.cfg	Configuration file to modify TSTool defaults. See also user files below.
**.cfg*	Shared datastore configuration files. See also user files below.
*jre**	Java Runtime Environment used by TSTool

User files are saved in a *.tstool* folder under the user's home folder and provide user-specific customization of the TSTool installation. Folders names beginning with a period are by default hidden on Linux computers. These files apply to all versions of TSTool and therefore allow settings to persist even when newer TSTool software versions are installed. User configuration files will override the installation configuration file settings when configuration setting values are found in both places.



Config_UserFiles

TSTool User Configuration Files

TSTool user configuration files on Windows:

C:\Users\UserID\.tstool		User's TSTool configuration files.
batchServerHotFolder		If TSTool is run with `-batchServer` and `-batchServerHotFolder FolderName`, TSTool will look for command files in this folder, process them, and then delete the files.
command-file-history.txt		History of opened command files, used to populate choices in the ***File / Open / Command*** file menu.
ui-state.txt		Properties describing the user interface state, such as last selected choices.
log.log*		Startup log file, which will be used until `StartLog()` commands specify a different log file.
datastore **.cfg*		User's datastore configuration files. Unlike the installation datastore files (in TSTool *system* folder), these files stand on their own and do not require a reference in the *TSTool.cfg* file. Use the `Enabled=True` property in a datastore configuration file to enable the datastore and `Enabled=False` to disable the datastore. Other options to disable the datastore re delete the datastore file or move out of the .*tstool\datastor*e folder.
plugin-command *CommandName* *bin* *bin-depend* *doc* *images* **.png, etc.* *include* **.css, etc.* *CommandName.html*		Plugin commands as follows: • *CommandName* matching the command name in TSTool. • *bin* contains a jar file with code for plugin command (see plugin developer documentation). • *bin-depend* contains jar file(s) needed by plugin. • *doc* contains command documentation as HTML, which is accessed from plugin command editors.
plugin-datastore *DatastoreName* *bin* *bin-depend* *doc* *images* **.png, etc.*		Plugin datastores as follows: • *DatastoreName* matching the datastore type TSTool, which is the value of the `Type` property in the datastore configuration file.

include **.css, etc.* *CommandName.html*		• *bin* contains a jar file with code for plugin datastore (see plugin developer documentation). • *bin-depend* contains jar file(s) needed by plugin. • *doc* contains command documentation as HTML, which is accessed from the TSTool user interface.
system *TSTool.cfg*		User's TSTool configuration settings. This file is mainly used to enable/disable datastore types that are of interest to the user. See the example below.
template-graph		Folder containing template graphs, which are shown in the lower right of the ensemble and time series results next to the ***Graph with template:*** buttons.

```
# ./tstool/system/TSTool.cfg
#
# TSTool configuration file containing user settings, shared between TSTool versions
# This file indicates which datastore software features should be enabled.
# Disabling datastore types that are not used can improve TSTool performance and simplifies the user interface.
# Refer to the TSTool.cfg file under the software installation folder for global configuration properties.
# User settings in this file will override the installation settings.

HydroBaseEnabled = true
#HydroBaseEnabled = false
ReclamationHDBEnabled = true
```

TSTool user configuration files on Linux are similar to those on Windows:

/home/UserID/.tstool/ *See file list for Windows*	User's TSTool configuration files. Files are described above.

3. Installing TSTool

TSTool can be installed either as part of the HydroBase Tools CD/DVD installation, or as a separate installation. In both cases, is recommended that the normal CDSS file structure be used.

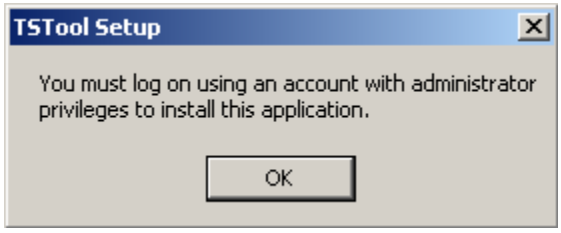
3.1 Installing TSTool from the "HydroBase data set Analysis Query Tools CD/DVD"

If you have purchased a HydroBase CD/DVD, TSTool will be installed during the CD install process. Refer to the installation instructions for that distribution. The version that is installed may be older than the version available on the CDSS web site; however, multiple versions can be installed and run independently.

3.2 Installing TSTool from the TSTool Setup File

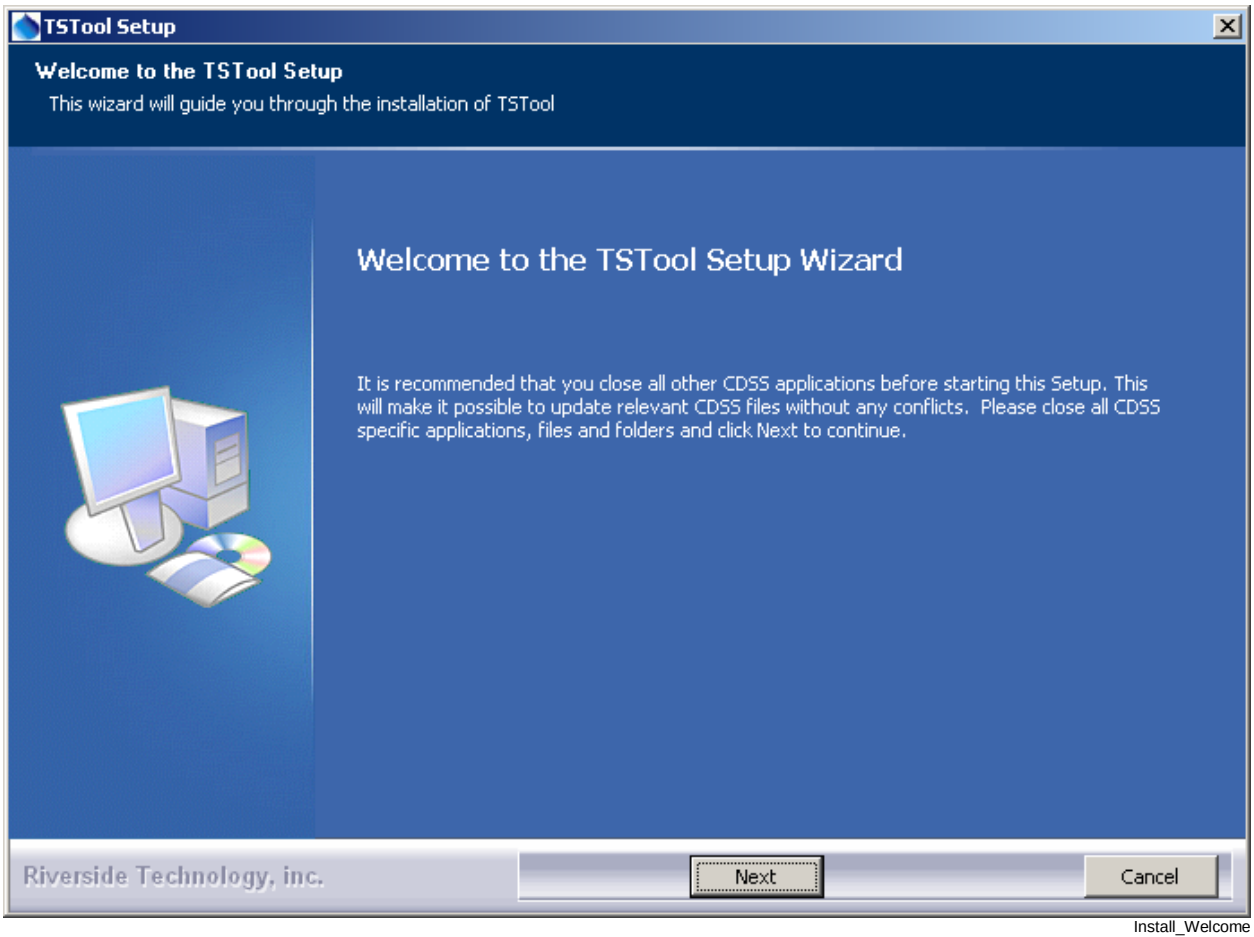
Use the following instructions to install TSTool using the *TSTool_CDSS_Version_Setup.exe* installer program, for example if TSTool software was downloaded from the CDSS web site (*http://cdss.state.co.us*):

1. Run the *TSTool_CDSS_Version_Setup.exe* file by selecting from Windows Explorer, the ***Start / Run…*** menu, or from a command shell. You must be logged into the computer using an account with administrator privileges. Otherwise, the following warning will be displayed:



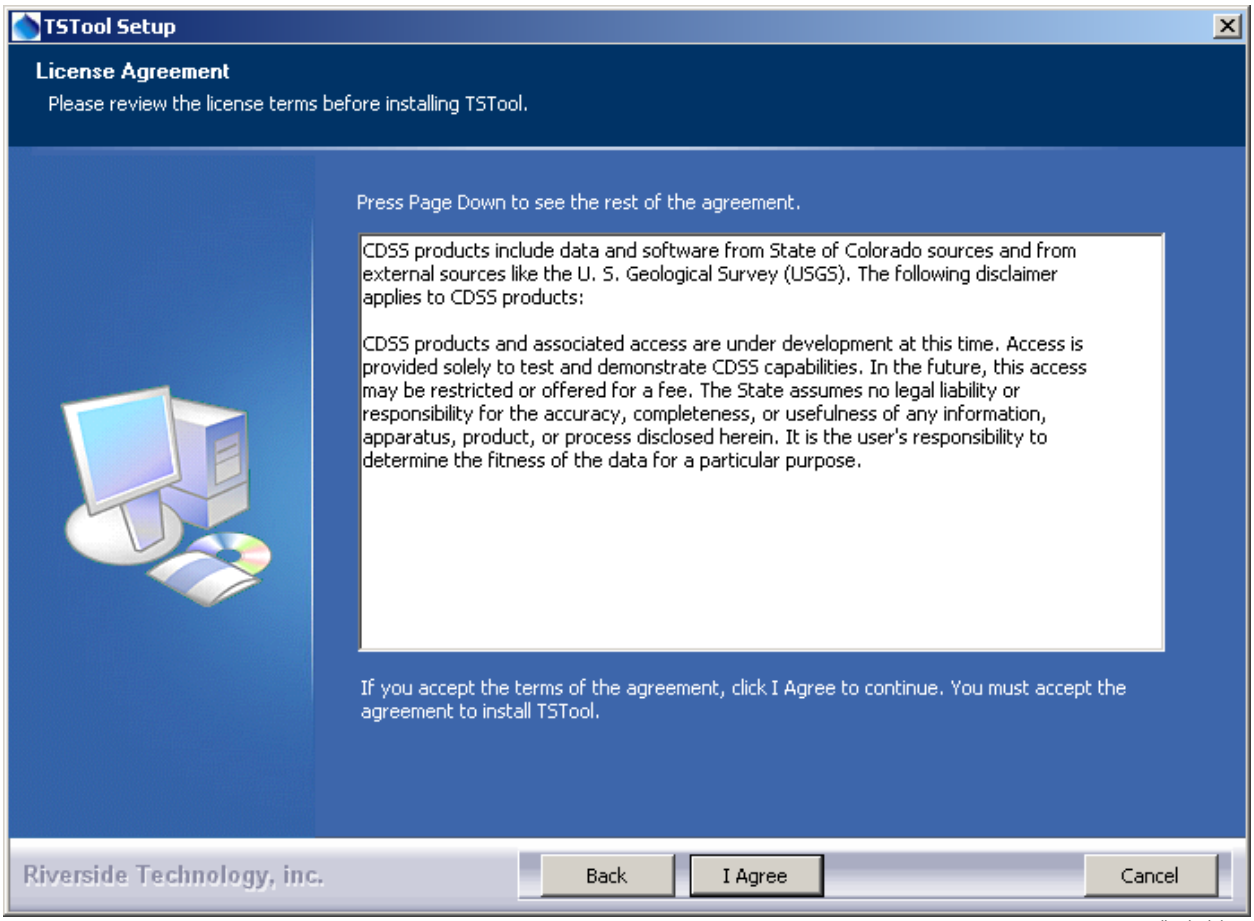
Install_AdministratorWarning

If you have administrative privileges, the following welcome will be displayed, and the installation can continue:



Install_Welcome

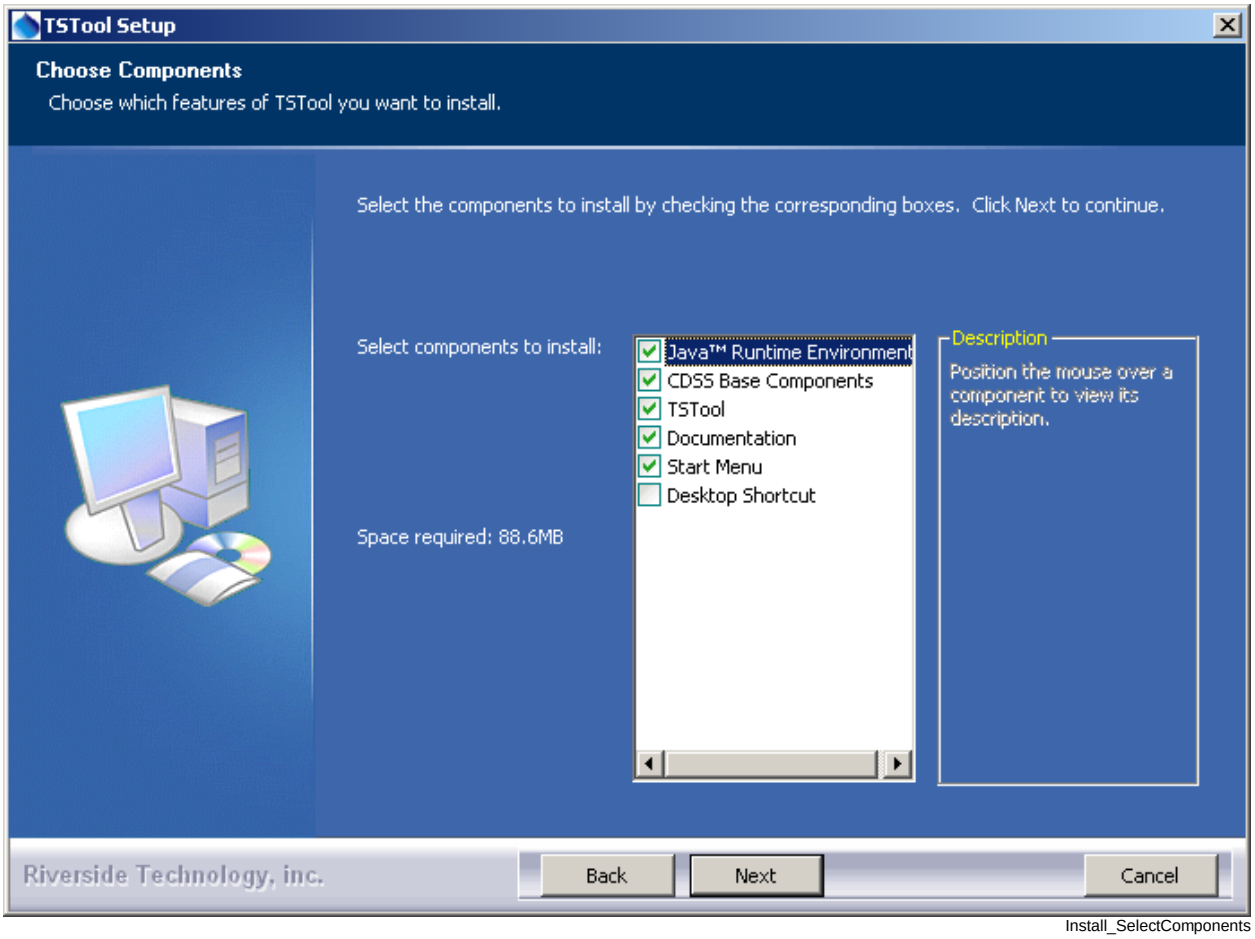
Press ***Next*** to continue with the installation.



Install_Disclaimer

TSTool is distributed with CDSS with no license restrictions. However the disclaimer must be acknowledged. Press ***I Agree*** to continue with the installation.

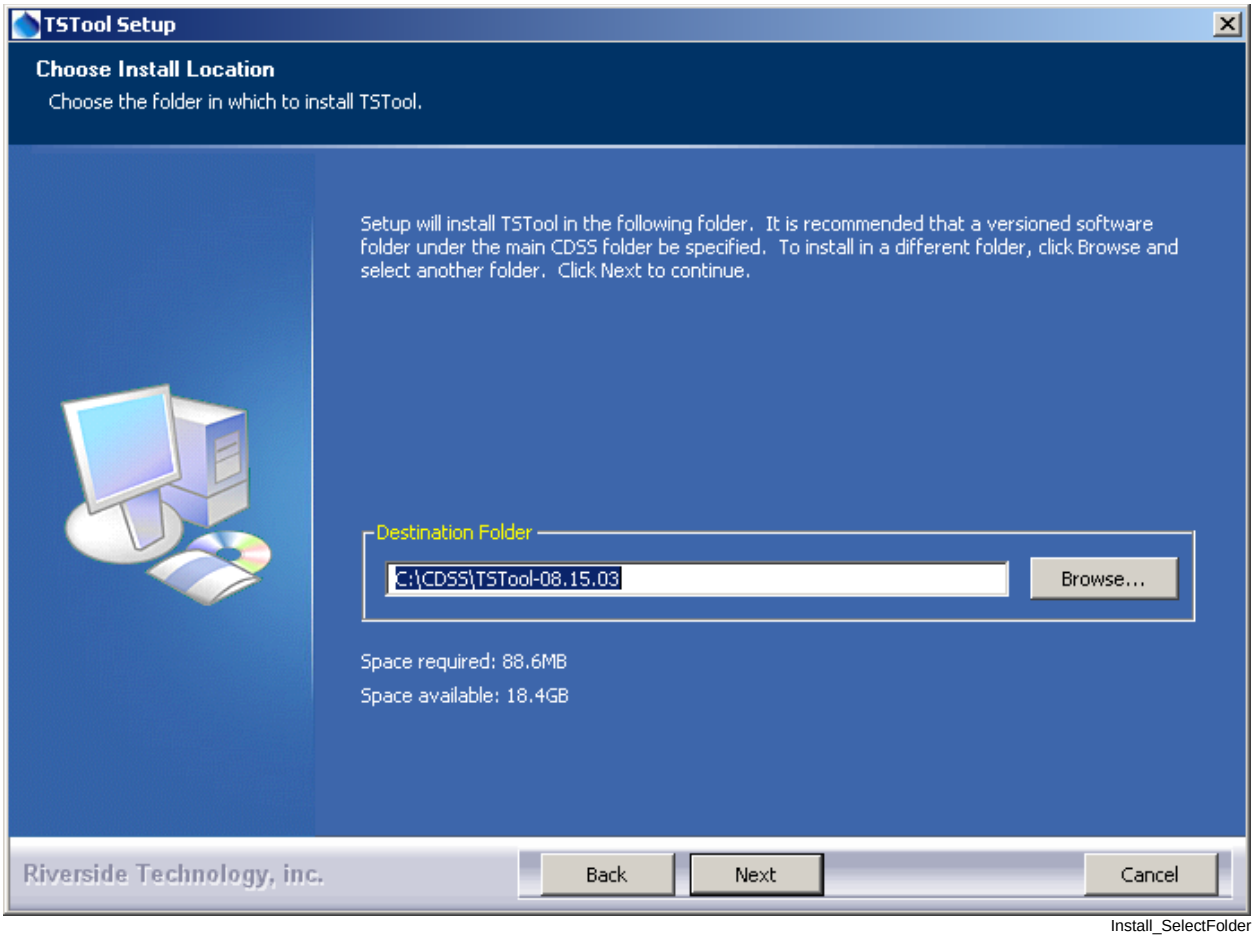
2. Several components can be selected for the install as shown in the following dialog. Position the mouse over a component to see its description.



Install_SelectComponents

Select the components to install and press ***Next***.

3. The following dialog is then shown and is used to select the installation location for TSTool. Multiple versions of TSTool can be installed and there are no dependencies between the versions. It is recommended that the default install location shown is used.

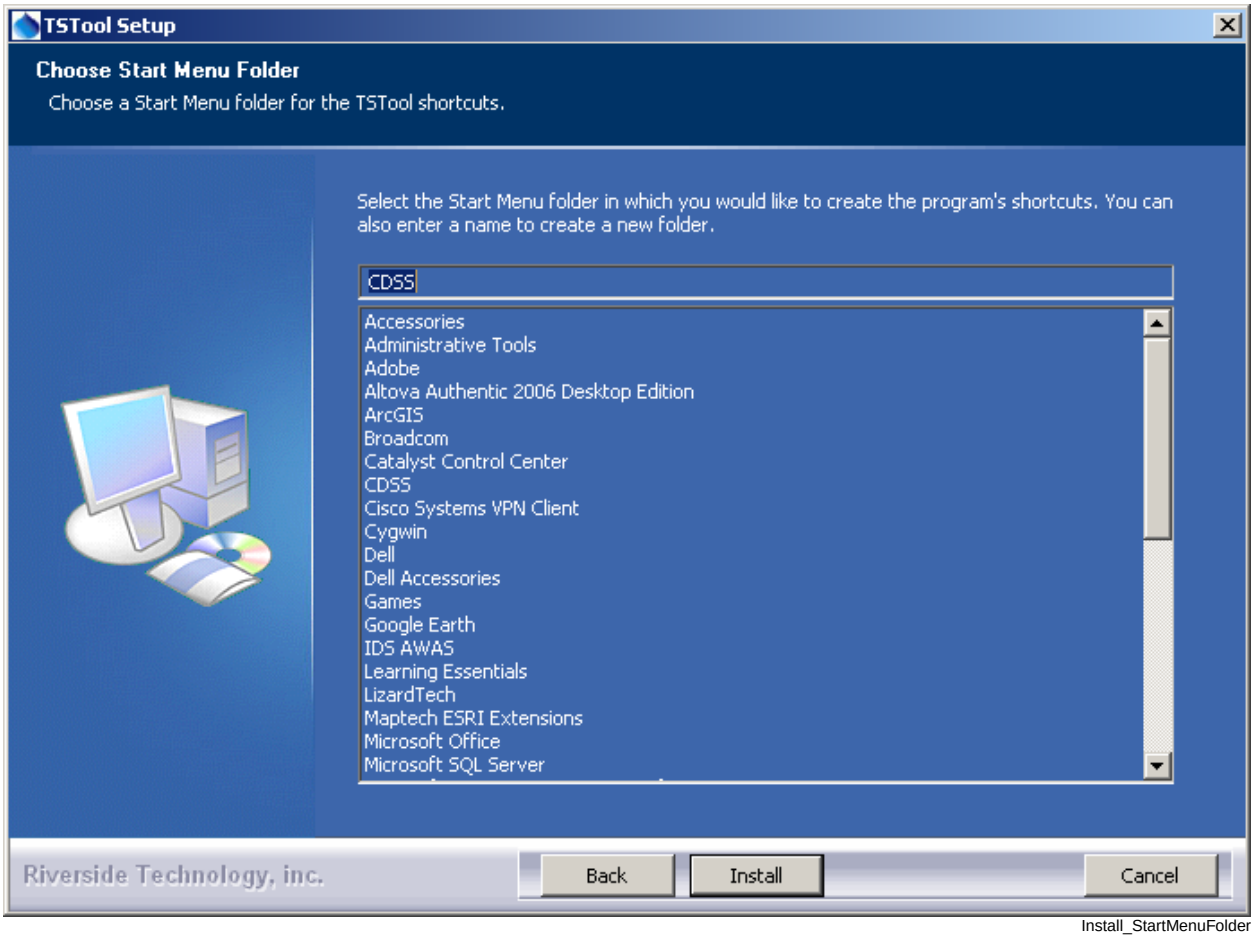


Install_SelectFolder

After selecting the install location, press ***Next***.

Note that this location will be saved as a Windows registry setting (*HKEY_LOCAL_MACHINE\Software\State of Colorado\TSTool-Version\Path*) to allow future updates to check for and default to the same install location, and to allow the standard software uninstall procedure to work correctly.

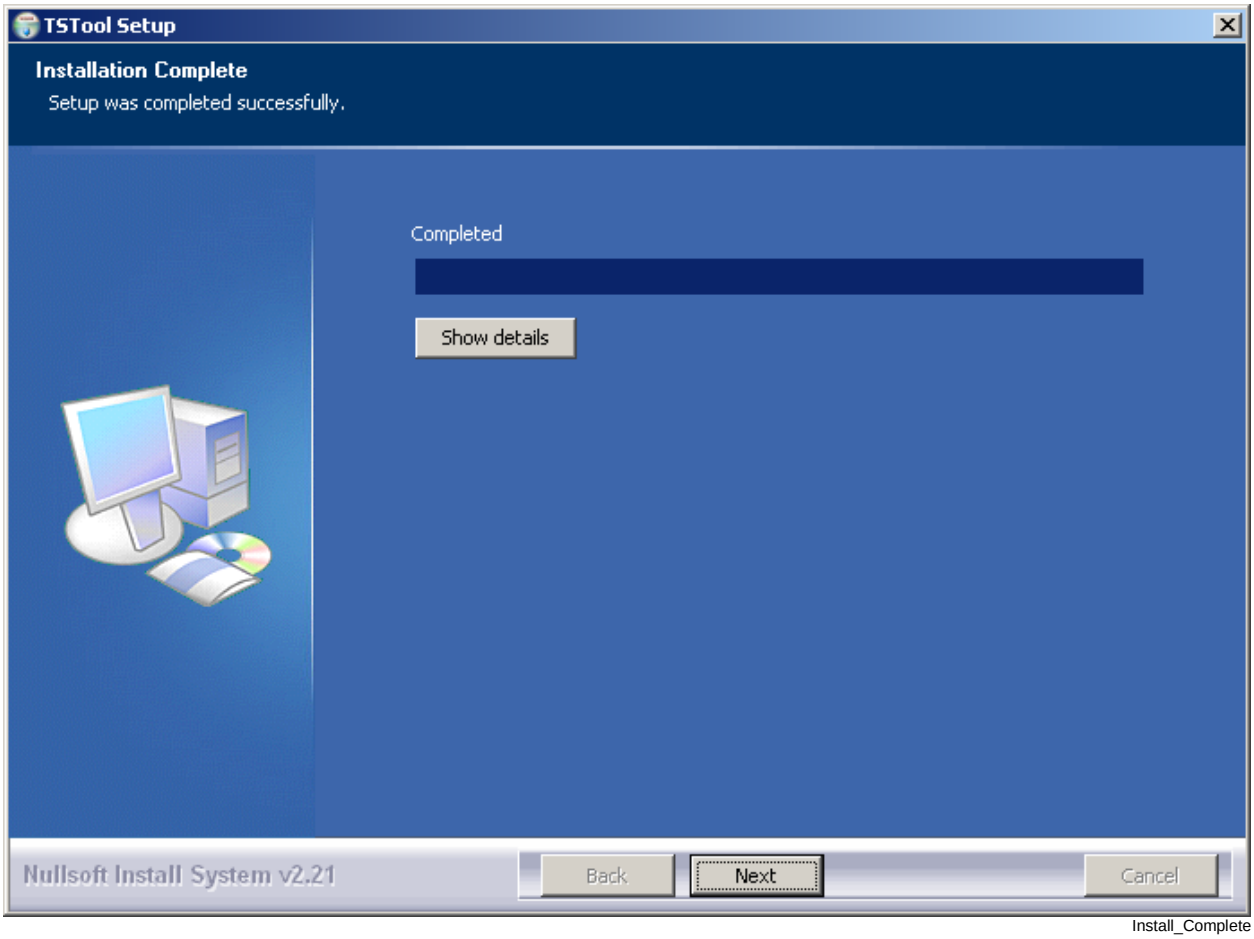
4. The following dialog will be shown to select the menu for the software:



Install_StartMenuFolder

After selecting the folder, press ***Install***.

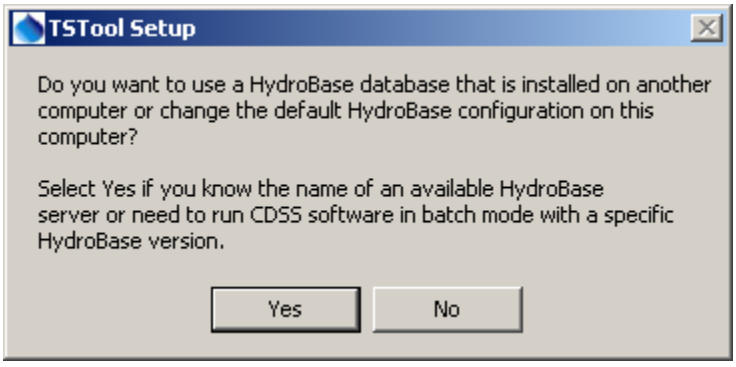
5. The following dialog will show the progress of the installation:



Install_Complete

Press Show details to see the files that were installed or press ***Next*** to continue.

6. If the CDSS Base Components were selected for install, the following dialog will be displayed:

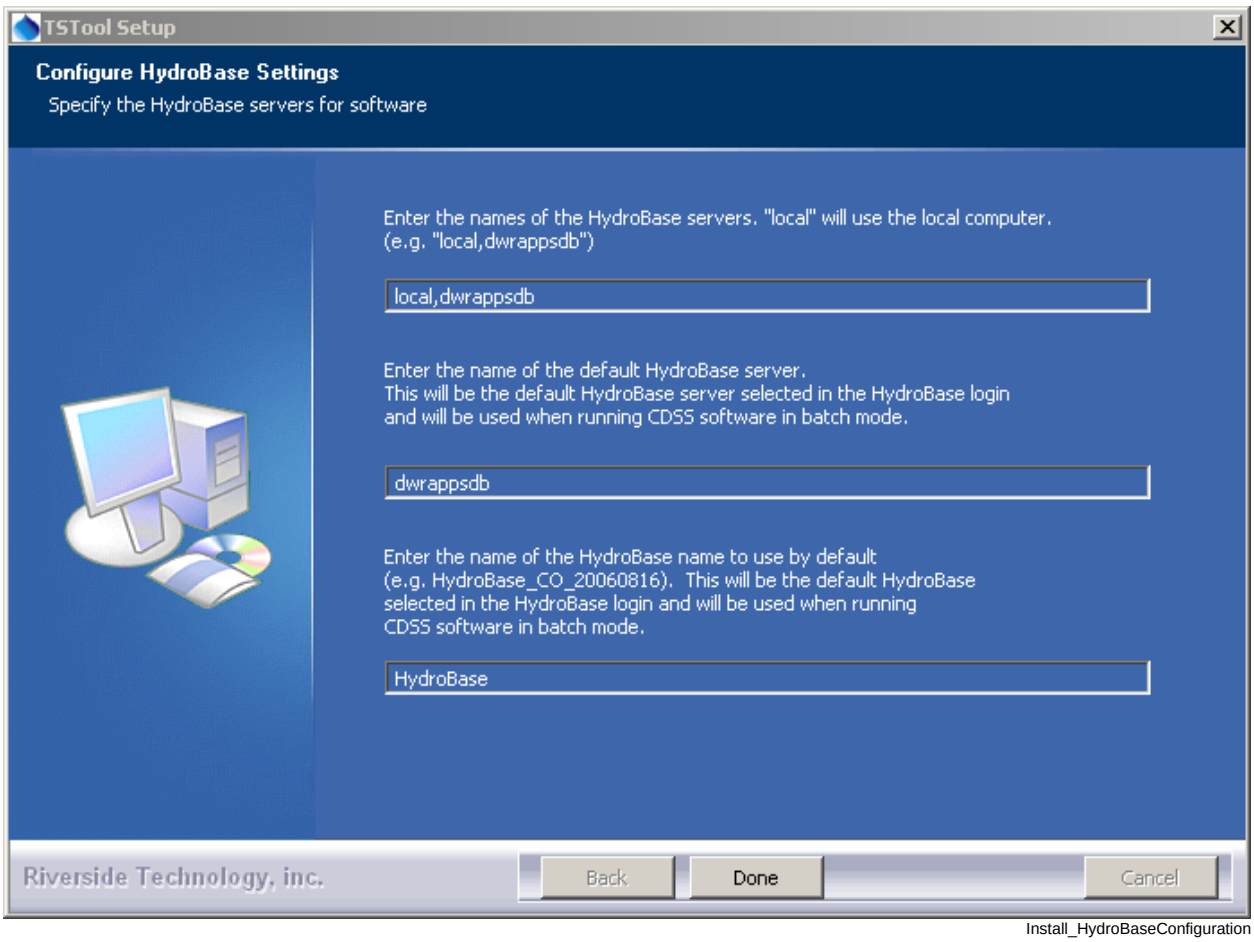


Install_HydroBaseQuestion

TSTool and other CDSS software can utilize HydroBase running on the local computer as well as other computers. Press ***Yes*** if HydroBase has been installed on another computer in the network environment and may be used by the software (then continue to the next step). Also press ***Yes*** if

TSTool will be run in batch mode because the specific HydroBase name must be specified in configuration files. Otherwise, press ***No*** (skip to step 8).

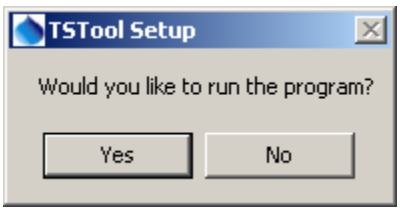
7. The following dialog allows additional HydroBase servers to be specified for use by CDSS software (the example below configures CDSS software to list the dwrappsdb HydroBase server in choices and defaults to HydroBase on the local computer). The dialog will initially show previous settings from the *\CDSS\TSTool-Version\system\CDSS.cfg* file and settings typically only need to be changed after installing a new HydroBase version.



Install_HydroBaseConfiguration

After entering the name of a HydroBase server and the default server to use, press ***Done***.

8. The following dialog will then be shown asking whether the TSTool software should be run:



Install_RunTSToolQuestion

Press ***Yes*** to run the software or ***No*** to exit the installation procedure.

9. TSTool is distributed with a default configuration for CDSS. If you have edited the configuration properties, you can import the old configuration file using the ***Help / Import Configuration…*** menu'. See also the TSTool ***Tools / Options*** menu.

3.3 Installing TSTool on a File Server

TSTool can be installed on a file server, which allows software updates to be made in one location, thereby eliminating the need to install software on individual machines. As of TSTool 11.09.00 user configuration files will be saved under the user's folder to facilitate persistence of user settings between software updates. For this type of installation, all computers that access the software should typically have similar configuration, including network configuration. The standard installer described in this documentation focuses on individual installs on user computers. To make TSTool software installed on a server available to other computers, perform the following (this is typically performed by system administrators):

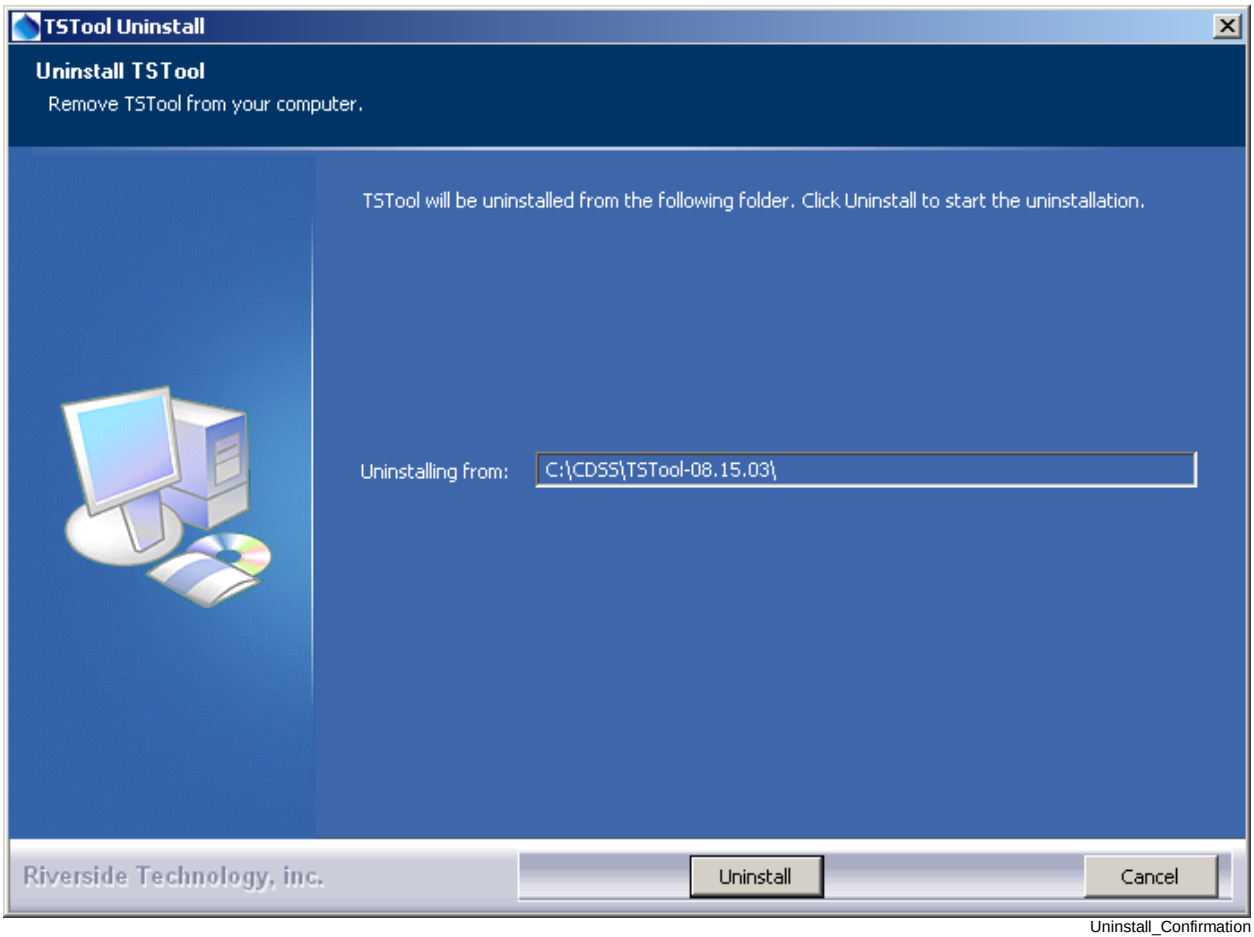
1. Run the *TSTool_CDSS_Version_Setup.exe* installer as described above. During installation specify the TSTool installation home using a drive letter and path for the server or specify a Universal Naming Convention (UNC) path (e.g., *\\ServerName\CDSS\TSTool-Version*).
2. Or….Copy the files from a local installation to a network location. The TSTool software will detect the file location when run using the *TSTool.exe* file. If the *TSTool.bat* file is used to run the software, it may need to be modified to specify the location of files on the server.

The menus and shortcuts will only be configured for the computer from which the installation was run. Therefore, menus and shortcuts for other computers will need to be manually configured.

If TSTool has been installed on a local computer and it is also available on the network, the network version can be run by running the software in the *ServerName\CDSS\TSTool-Version\bin* folder. The software will expect that file locations use the same drives as when the software was installed.

4. Uninstalling TSTool Software

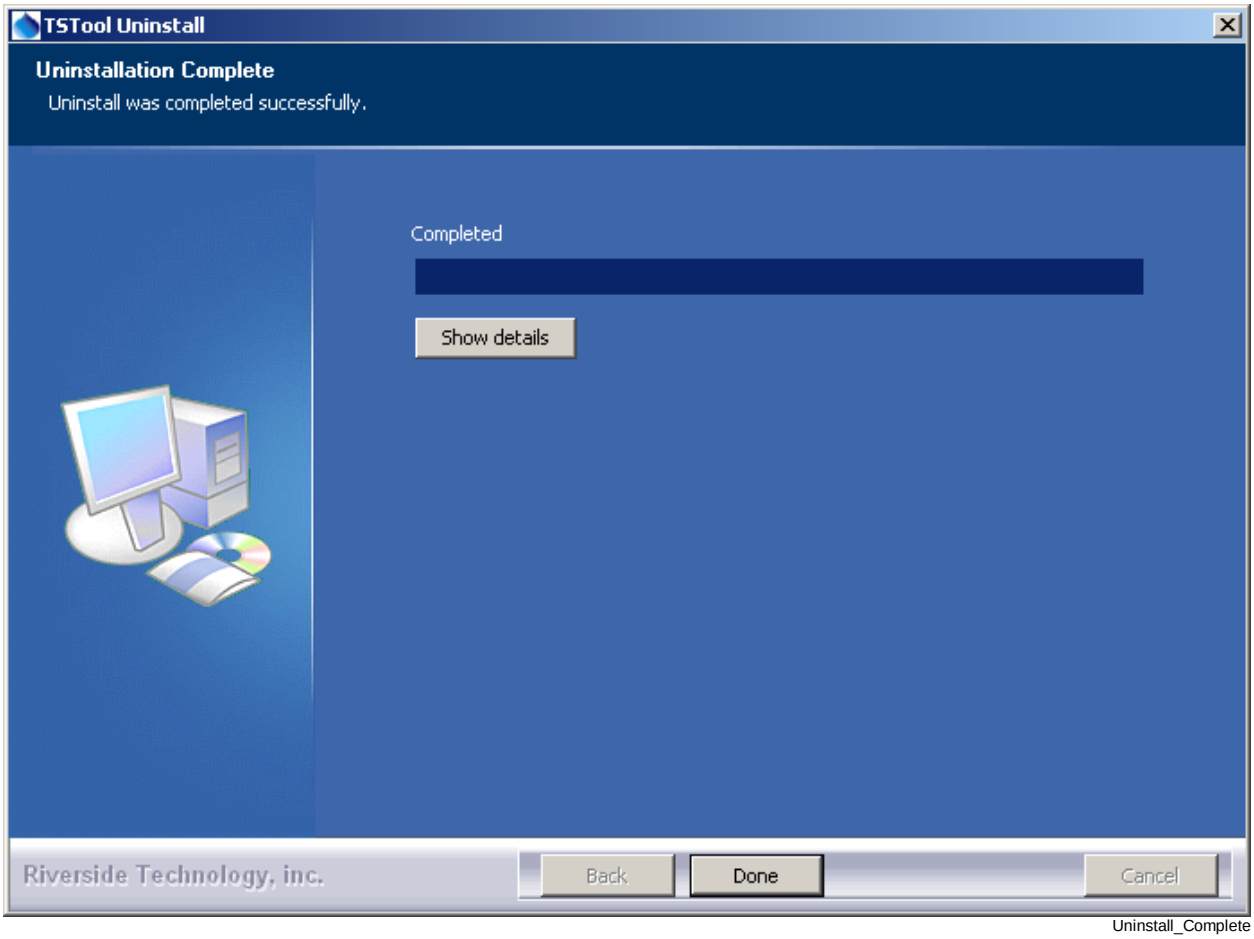
To uninstall TSTool software, select the ***CDSS / Uninstall / TSTool*** from the ***Start*** menu and confirm the uninstall. CDSS components that are used by other software (e.g., CDSS Base component software) as well as user data will remain installed.



Uninstall_Confirmation

Press ***Uninstall*** to uninstall the software.

The following dialog shows the status of the uninstall process.



Uninstall_Complete

Press ***Show details*** to see the list of files that were removed. Press ***Done*** to exit the uninstall.

5. Running TSTool

TSTool can be started in several ways as described below.

5.1 CDSS Menu

The ***Start / All Programs / CDSS / TSTool-Version*** (or ***Start / Programs / CDSS / TSTool-Version***) menu can be used to start the software. This runs the *TSToolInstallHome\bin\TSTool.exe* software.

5.2 Command Line Executable

The installation process does NOT add the *TSToolInstallHome\bin* folder to the path; however, this addition can be made by the user, allowing the TSTool software to be started anywhere by running *TSTool*. Running TSTool from any location will result in the software being run in the installation location. Specifying a command file on the command line or interactively will reset the working directory to that of the command file.

5.3 TSTool Batch File – Windows

A batch file can be used to run the *TSTool.exe* program, for example using the `-commands` command line parameter to specify a command file. In this case it may be necessary to specify the absolute path to the command file to ensure that the software can locate related files.

6. TSTool Configuration

TSTool requires minimal configuration after installation. This section describes TSTool configuration files that can be customized for a system. Configuration is specified for each TSTool installation and as of TSTool 11.09.00 several user configuration files.

6.1 TSTool Configuration File

The *system\TSTool.cfg* file under the main installation directory contains top-level configuration information for TSTool. The format of the file is as follows:

```
#
# Configuration file for TSTool

[TSTool]

ColoradoSMSEnabled = true
DateValueEnabled = true
HydroBaseEnabled = true
RiverWareEnabled = true
StateCUEnabled = true
StateModEnabled = true
… etc …

# Program to use for file differences, intended to be graphical file difference
# viewer. The program will be called as DiffProgram File1 File2.
# It is up to the user to install KDiff3 on the computer or change the following
# to a different program.
DiffProgram = "C:\Program Files\KDiff3\kdiff3.exe"

# Set for the user interface look and feel.  Default is SystemLookAndFeel.  See:
#    http://docs.oracle.com/javase/tutorial/uiswing/lookandfeel/plaf.html
# For example, the following can be used on Linux if Motif is not desired
#UILookAndFeel = "com.sun.java.swing.plaf.gtk.GTKLookAndFeel"

MapLayerLookupFile = "\cdss\gis\co\TimeSeriesMapLookup.csv"

#############################################################################
# Begin configuration of data stores that will be opened when TSTool starts
#  - the data store name in the data store configuration (*.cfg)
#    file takes precedence; by convention the names should match
#  - the data stores will be opened only if the data store type is enabled above
#  - alphabetize the data stores by type below
#  - also see the "Enabled" property in the configuration files, for finer
#    control
#  - see also user configuration files for datastores
#############################################################################

# Data store for Colorado Water HBGuest web service
#(active if ColoradoWaterHBGuestEnabled=true above)
[DataStore:ColoradoWaterHBGuest]
ConfigFile = "ColoradoWaterHBGuest.cfg"
```

```
# The license information will be removed as TSTool moves to open source licensing

LicenseOwner = "CDSS"
LicenseType = CDSS
LicenseCount = NoLimit
LicenseExpires = Never
LicenseKey = 00-77960bdfb1dde707-1dd052fe0327a332-a07266ee645e8845-7560192d374235c5-
1dd052fe0327a332
```

Example TSTool Installation Configuration File

The example illustrates the format of the file. The `*Enabled` properties can be used to enable/disable input types. Common formats are enabled by default and more specialized formats are disabled by default, if not specified in the file. For example, use `HydroBaseEnabled = false` to disable the automatic HydroBase login that occurs with the HydroBase input type (e.g., if HydroBase is unavailable for some reason). Each input type can have additional properties, although only a few currently do, as described below. Use the ***Tools / Options*** menu for a dialog that helps with editing the `*Enabled` properties.

The optional `MapLayerLookupFile` property indicates the name of the time series to map layer lookup file. See the **Map Configuration** section below.

The user configuration file./tstool/system/TSTool.cfg under the user's home folder provides additional configuration, for example to disable datastores based on the user's preferences:

```
# TSTool configuration file containing user settings, shared between TSTool versions
# This file indicates which datastore software features should be enabled.
# Disabling datastore types that are not used can improve TSTool performance and
# simplifies the user interface.
# Refer to the TSTool.cfg file under the software installation folder for global
# configuration properties.
# User settings in this file will override the installation settings.

HydroBaseEnabled = true
```

Example TSTool User Configuration File

6.2 Data Units File

The *system\DATAUNIT* file under the main installation directory contains data unit information that defines conversions and output precision. In most cases the default file can be used but additional units may need to be added for a user's needs (in this case please notify the developers so the units can be added to the default file distributed with installations). Currently, the *DATAUNIT* file is the only source for units information – in the future units may be determined from the various input sources.

6.3 HydroBase Configuration

The following properties can be defined in the installation *TSTool.cfg* file in a [HydroBase] section to control how TSTool interacts with HydroBase. See also the **CDSS Configuration File** section below. **These properties may be moved to a HydroBase datastore configuration file in the future**.

TSTool HydroBase Configuration Properties

Property	Description	Default
`AutoConnect`	If `False`, a HydroBase login dialog will be shown at startup. If `True`, the default database information in the CDSS configuration file (see next section) will be used to automatically connect to the database, and the login dialog will not be shown.	`False`
`WDIDLength`	Indicates the length of water district identifiers (WDIDs) constructed from separate WD and ID data, when creating time series identifiers. Because time series identifier strings are compared literally, it is important that the WDIDs are consistent within a commands file.	`7`

6.4 CDSS Configuration File

By default, TSTool will automatically look for HydroBase databases on the current (local) machine and the State servers. State server databases are typically only accessible to State of Colorado computers. If SQL Server or MSDE HydroBase versions have been installed on a different machine, the *\cdss\TSTool-Version\system\CDSS.cfg* file can be used to indicate the database servers. An example of the configuration file is as follows. **These properties may be moved to a HydroBase datastore configuration file in the future**.

```
[HydroBase]

ServerNames="ServerName,local"
DefaultServerName="ServerName"
DefaultDatabaseName="HydroBase_CO_20080730"

[ColoradoSMS]

ServerNames="ServerName,local"
DefaultServerName="ServerName"
DefaultDatabaseName="RealtimeStreamflow"
UserLogin="UserLogin"
```

The ColoradoSMS input type is being used to support annotation of real-time data graphs with alert information, within the State of Colorado's offices.

Properties can be specified on the TSTool command line using the notation "`Property=Value`" and will in some cases override the values in the configuration file. These features are under development as necessary.

The CDSS configuration properties are described in the following tables:

CDSS HydroBase Database Configuration Properties

Property	Description	Default
`ServerNames`	A comma-separated list of server names to list in the HydroBase login dialog.	The state server is listed.
`Default ServerName`	The default HydroBase server name to use. This allows the HydroBase login dialog to preselect a default that applies to most users in the system. If TSTool is run in batch mode and the HydroBase input type is enabled, use this property to make a default connection to HydroBase, for use with other commands in the batch run.	`greenmtn. state.co.us`
`Default DatabaseName`	The default HydroBase database name to use. This allows the HydroBase login dialog to preselect a default that applies to most users in the system. If TSTool is run in batch mode and the HydroBase input type is enabled, use this property to make a default connection to HydroBase, for use with other commands in the batch run.	
`Database Engine`	Reserved for internal use.	
`DatabaseName`	The database name to use for the initial connection. This overrides the default server.	
`Database Server`	The server name to use for the initial connection. This overrides the default server.	
`SystemLogin`	Reserved for internal use.	
`SystemPassword`	Reserved for internal use.	
`UserLogin`	Reserved for internal use.	

CDSS Satellite Monitoring System (ColoradoSMS) Database Configuration Properties

Property	Description	Default
`ServerNames`	A comma-separated list of server names to list in the SMS login dialog.	The state server is listed.
`Default ServerName`	The default SMS database server name to use. This allows the SMS login dialog to preselect a default that applies to most users in the system. If TSTool is run in batch mode and the ColoradoSMS input type is enabled, use this property to make a default connection to the SMS database, for use with other commands in the batch run.	`greenmtn. state.co.us`
`Default DatabaseName`	The default SMS database name to use. This allows the SMS login dialog to preselect a default that applies to most users in the system. If TSTool is run in batch mode and the ColoradoSMS input type is enabled, use this property to make a default connection to the SMS database, for use with other commands in the batch run.	
`Database Engine`	Reserved for internal use.	
`DatabaseName`	The database name to use for the initial connection. This overrides the default server.	
`Database Server`	The server name to use for the initial connection. This overrides the default server.	
`SystemLogin`	Reserved for internal use.	
`SystemPassword`	Reserved for internal use.	
`UserLogin`	The user login, for use with TSTool batch runs. The `ColoradoSMS.UserLogin` parameter can be specified on the command line and will be used when making the initial SMS database connection.	

The SMS database cannot currently be opened with a login dialog. Therefore, correct information must be specified in the CDSS configuration file and the TSTool command line.

6.4 Map Configuration

TSTool can display maps configured as GeoView project files, although this functionality is experimental and has not been widely utilized. See the **GeoView Mapping Tools Appendix** for more information about these files. To allow a link between time series and map layers, use the `TimeSeriesMapLayerLook` property in the *TSTool.cfg* file to specify a time series to map layer lookup file (see the **TSTool Configuration File** section above). The following example file illustrates the contents of the lookup file:

```
# This file allows time series in TSTool to be linked to stations in spatial
# data layers.  The columns are used as appropriate, depending on the direction
# of the select (from time series list or from the map).
#
# This file has been tested with the \CDSS\GIS\CO\co_TSTool.gvp file.  Not all
# possible combinations of time series and map layers have been defined - only
# enough to illustrate the configuration.
# Additional attributes need to be added to the point files to allow more
# extensive functionality.  For example, if attributes for data interval (time
# step) and data source are added to the attributes, then a definition query
# can be defined on the layer for displays to use the same data file.  The
# configuration below can then use the different names to configure the link
# to time series.
#
# TS_InputType - the time series input type, as used in TSTool
# TS_DataType - the data type shown in TSTool, specific to an input type
#               For example, TSTool uses "Streamflow" for HydroBase, whereas
#               for other input types a different data type string may be used.
# TS_Interval - time series interval of interest (e.g.,"Month", "Day", "1Hour"
#               "Irregular")
# Layer_Name - the layer name used in the map layer list
# Layer_Location - the attribute that is used to identify a location, to be
#               matched against the time series data location
# Layer_DataType - the attribute that is used to indicate the data type for a
#               station's time series (CURRENTLY NOT USED - UNDER EVALUATION)
# Layer_Interval - the attribute that is used to indicate the interval for a
#               station's time series
# Layer_DataSource - the attribute that is used to indicate the data source for
#               a station's time series.
#
# When matching time series in the TSTool time series query list with features
# on the map, the TS_* values are matched with the time series identifier
# values and the Layer_* attributes are matched against specific time series.
#
# Data layers are listed from largest interval to smallest.
"TS_InputType","TS_DataType","TS_Interval","Layer_Name","Layer_Location","Layer_DataSource"
HydroBase,DivTotal,Day,"Diversions",id_label_7,""
HydroBase,DivTotal,Month,"Diversions",id_label_7,""
HydroBase,EvapPan,Day,"Evaporation Stations",station_id,""
HydroBase,EvapPan,Month,"Evaporation Stations",station_id,""
HydroBase,Precip,Irregular,"Precipitation Stations",station_id,""
HydroBase,Precip,Day,"Precipitation Stations",station_id,""
HydroBase,Precip,Month,"Precipitation Stations",station_id,""
HydroBase,RelTotal,Day,"Reservoirs",id_label_7,""
HydroBase,RelTotal,Month,"Reservoirs",id_label_7,""
HydroBase,Streamflow-DISCHRG,Irregular,"Streamflow Gages - Real-time",station_id,""
HydroBase,Streamflow,Day,"Streamflow Gages - Historical",station_id,""
HydroBase,Streamflow,Month,"Streamflow Gages - Historical",station_id,""
```

Example Time Series Map Layer Lookup File

The columns in the lookup file indicate how information in the time series input/query list can be matched against time series in map layers. In particular, the `TS*` columns define values that are seen in the TSTool interface and the `Layer*` columns define the layer and attribute names for map layers. The

`Layer_Interval` and `Layer_DataSource` are optional but if specified result in more specific links between time series and map layers.

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