

QGISRed User's Manual

Welcome to QGISRed

QGISRed is a powerful plugin for QGIS designed to facilitate the creation and analysis of hydraulic models of water distribution networks.

The best thing about QGISRed is that it combines the power of a **GIS Environment** with the precision of **EPANET**, allowing you to work with digital twins of any complexity.

Why use QGISRed?

- **Full georeferencing:** Take advantage of all the advantages of QGIS to geolocate your assets.
 - **Simple Data Management:** Use SHP and DBF files with an intuitive relational structure.
 - **Specialized Tools:** Includes utilities for network debugging, demand management and analysis of results without leaving QGIS.
 - **Digital Twins:** Supports elements such as connections, manual valves and meters for an advanced level of detail.
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QGISRed logo

Ready to get started? See [Credits](#), [Installation Guide](#), or jump directly to [Quick Guide](#).




Credits and Authorship

QGISRed is a project developed by the Hydraulic Networks Group **REDHISP** of the Institute of Water and Environmental Engineering (IIAMA).

Project Management





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Institutions

The development is part of the research and technology transfer activities of the **Universitat Politècnica de València (UPV)**.

Entity	Logo
QGISRed Portal	
REDHISP	
IIAMA	
UPV	

Collaborators

Entity	Logo
WaterPi	

💡 **NOTE:** QGISRed is free software developed with the aim of facilitating the management of the integral water cycle through freely accessible Digital Twin tools.

Getting started

Installation

To start using QGISRed, you need to have **QGIS (v3.2 or higher)** installed in a **Windows** environment.

Sections of this guide:

- [System requirements](#)
- [Installation from repository](#)
- [Installation from local ZIP](#)
- [Required dependencies](#)

! IMPORTANT: QGISRed requires **.NET Framework 4.5** or higher to function correctly.

System requirements

For optimal performance of QGISRed, make sure you comply with the following:

- **Operating System:** Windows (x86 or x64).
- **Base software:** QGIS version 3.2 to 3.99.
- **Components:** .NET Framework 4.5 installed.
- **Internet Connection:** Recommended for the initial download of dependencies.

Installation from repository

It is the easiest way to keep the plugin updated.

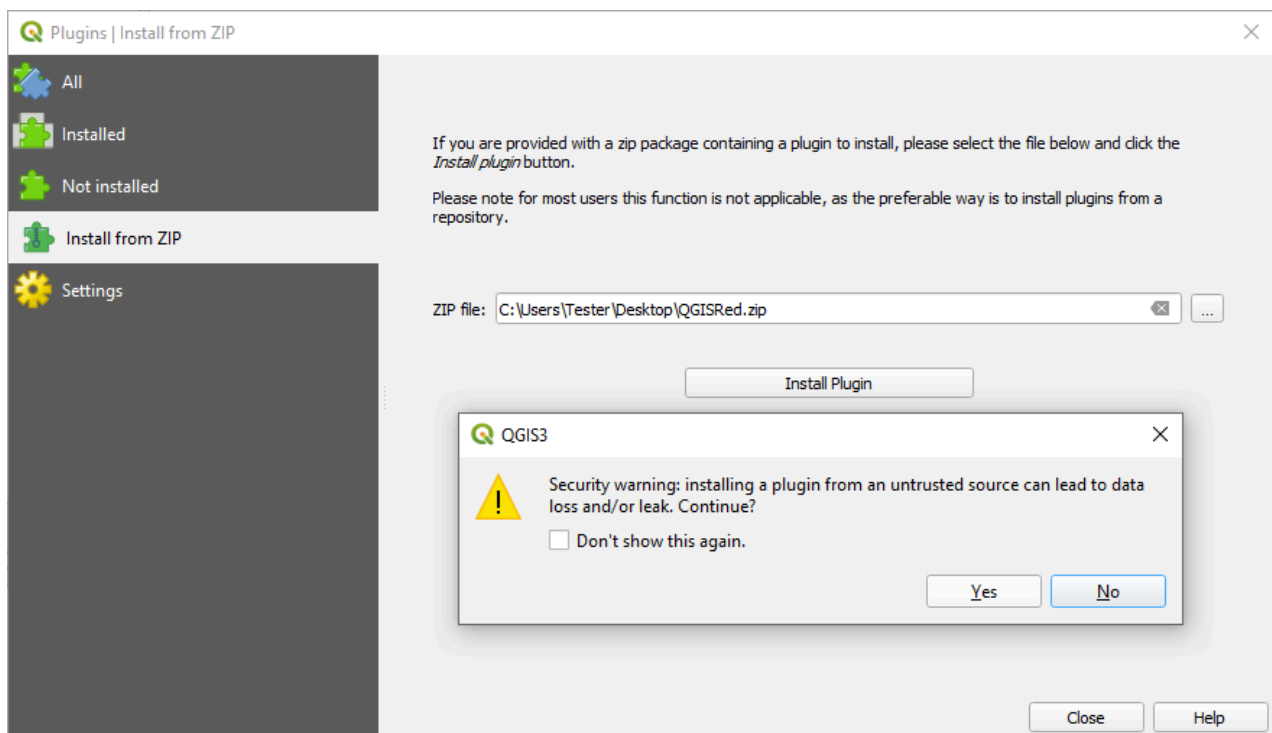
1. Open QGIS.
2. Go to the **Plugins > Manage and Install Plugins...** menu.
3. On the **All** tab, search for .
4. Click **Install Plugin**.

Ready! You should see a new toolbar in your QGIS interface.

Installation from local ZIP

If you have a specific version in an `.zip` file, you can install it manually:

1. Open QGIS.
2. Go to the **Plugins > Manage and Install Plugins...** menu.
3. Select the **Install from ZIP** tab.
4. Find your `QGISRed.zip` file and press **Install Plugin**.



Installation from ZIP

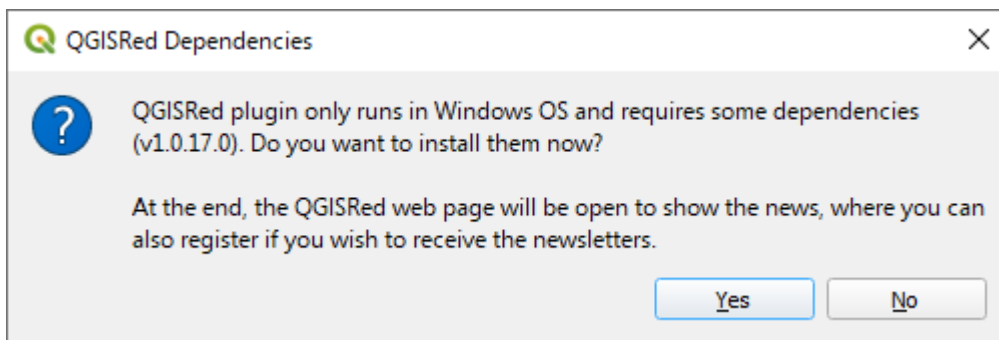
⚠ WARNING: You will see a QGIS security notice when installing from a local file. Press **Yes** to continue.

Dependency management

#Dependency Management

When trying to use a QGISRed tool for the first time, you will see a prompt asking you to install additional dependencies.

💡 **TIP:** These dependencies do not require administrator permissions and are installed automatically.



Dependencies Dialog


- If you press **Yes**, the plugin will download the necessary components (`GISRed libraries`).
- If you press **No**, you will not be able to use the analysis tools until you install them.

Quick Guide

First steps

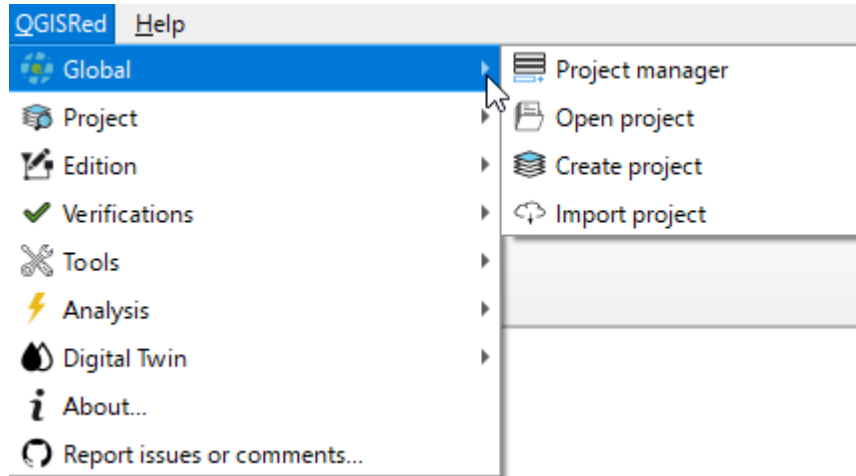
Just getting started with QGISRed? Here are the basics to get you going.

1. **Create a Project:** Use [Project Manager](#) to organize your files.
2. **Add Data:** Import from `.SHP` or `.INP` files.
3. **Draw your Network:** Use the [Edition](#) tools.
4. **Simulate:** Get hydraulic results in seconds.

 **NOTE:** All data is saved in local files under an EPANET compatible relational structure.

Project Explorer

QGISRed uses a centralized **Project Manager** to manage your water networks.



Menu QGISRed

The Project Manager

This window is the heart of file management in the plugin:

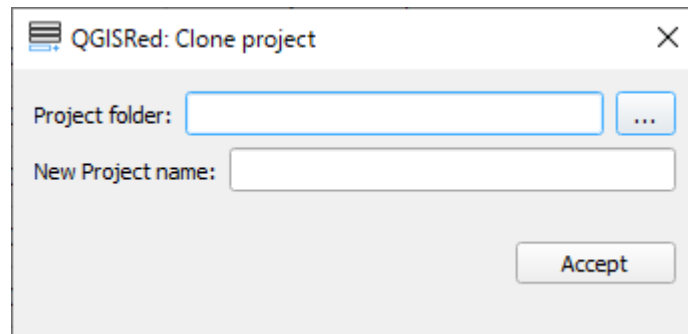
- **Recent List:** Double click on any project to open it instantly.
- **Load:** Allows you to link a project that does not appear in the list. You only need the network name and directory.
- **Rename:** Renames the project and automatically updates all linked files.
- **Delete/Unload:** Delete a project from the list or disk.
- **Shortcut:** Button to directly open the project folder in Windows.

Project Cloning

If you need to create a variant of a network:

1. Press **Clone**.
2. Specify the new name.

3. Choose the directory (several projects can coexist in the same folder if they have different names).



Clone Dialog

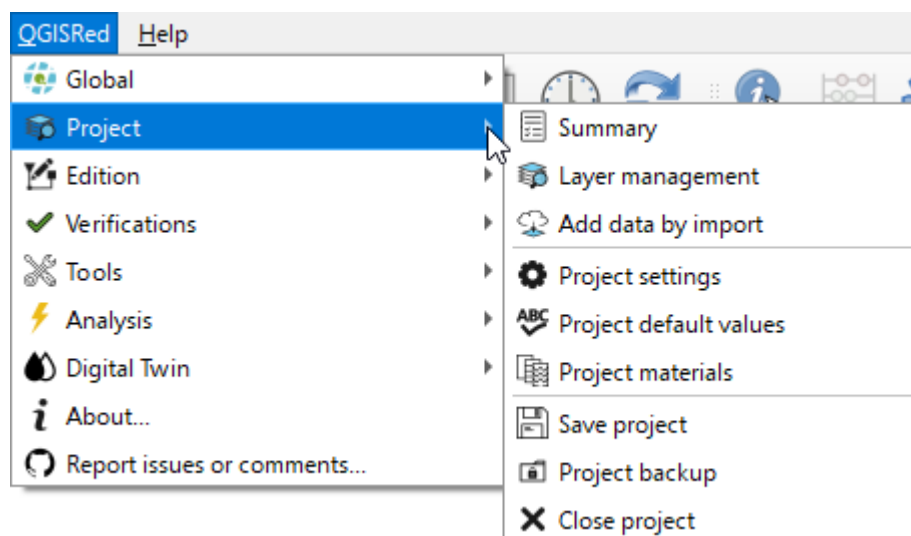
💡 **TIP:** Remember that any plugin tool will work on the files in the project directory, not just what you see open in the QGIS legend.

Layer and Input Management

QGISRed organizes information in a solid relational structure based on SHP files.

Project Creation (Inputs)

When creating a new project, the plugin automatically generates a group called **"Inputs"** in the QGIS legend.



Project Menu

This group contains at least **6 SHP files**, one for each EPANET base element:

1. **Junctions** (Demand nodes)
2. **Pipes**
3. **Tanks**
4. **Reservoirs**
5. **Valves**
6. **Pumps**

Advanced Layer Management

The **Layer Management** tool (Project > Layer Management) allows you to:

- Control the visibility of all model layers.
- **Recover deleted layers:** If you accidentally delete a SHP from the project, you can recreate it from here without losing the integrity of the model.
- **Define Projection:** Specify the CRS of the information (Note: this tool does not reproject, it only declares).

Options and Defaults

From the **Project** menu, you can access:

- **Project Options:** Creator notes, scenario name and settings for the Digital Twin.
- **Default Values:** Prefixes for new elements, minimum clearances and initial hydraulic values.
- **Table of Materials:** Definition of initial roughness and annual increments for automatic calculation based on age.

QGISRed: Import project

Project folder:

C:\Users\aguil\QGISRed\Projects

...

☐ Automatically create a subfolder for this project

Project name:

Network

CRS:

WGS 84

...

INP

SHPs

QGISRed Project

ZIP file:

...

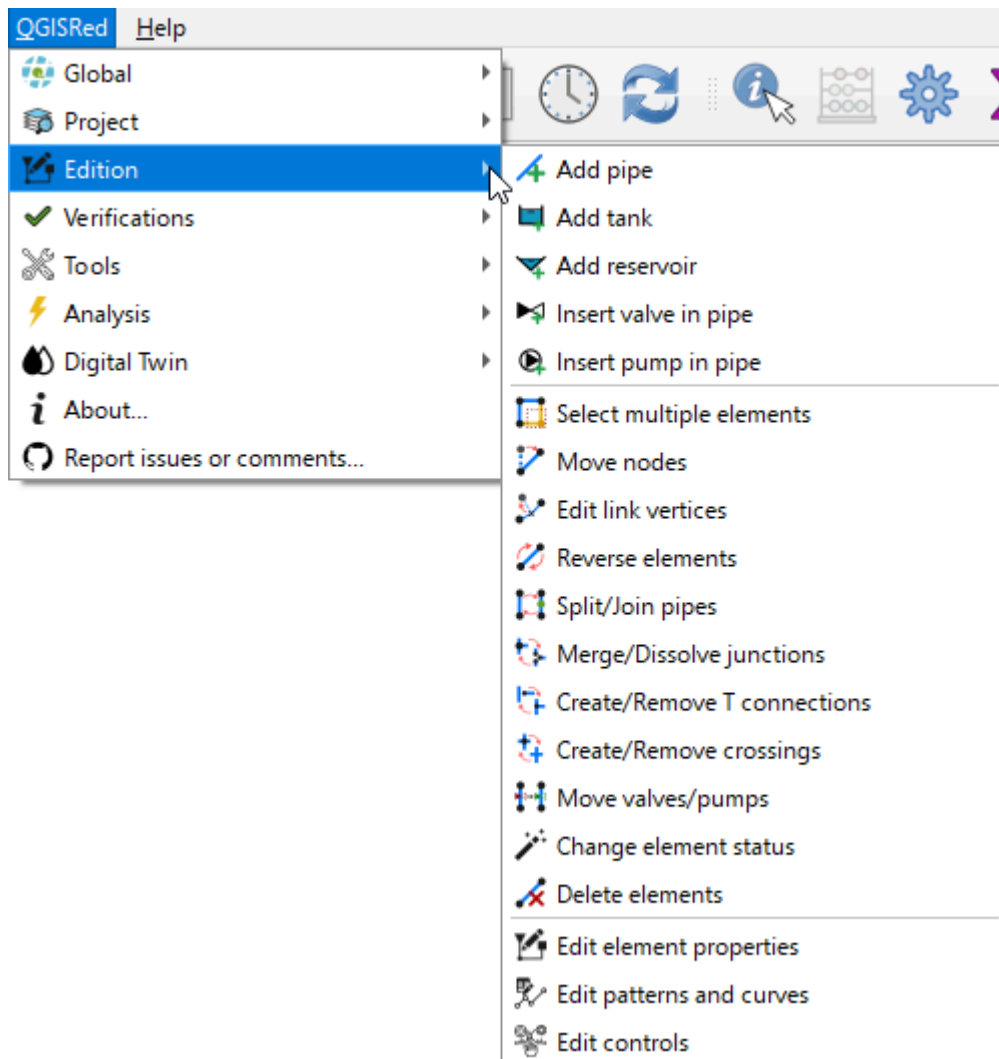
*** Project name will be ignored preserving the name of the network stored in the ZIP file*

Import From Project

Materials Table

Editing and Modeling

Editing Tools



Edit Menu

QGISRed allows you to build your water network visually and intuitively directly on the QGIS map.

What can you do?

- [Creation of basic elements](#) (Pipes, nodes, tanks).
- [Graphic manipulation](#) (Move nodes, edit vertices).
- [Editing properties](#) (Diameters, materials, roughness).

💡 **TIP:** When creating a pipe, QGISRed automatically generates the end nodes if they do not exist.

Element creation

Use the QGISRed toolbar to build your network. The buttons are designed to automate the topology.



Toolbar

Construction Mechanics

1. Pipes

- **Creation:** Click to set the start and end point. Two extreme nodes (type *Junctions*) will automatically be generated.
- **Properties:** When creating a pipeline, it is automatically assigned the project's default values.

2. Tanks and Reservoirs

- **Requirement:** You must click on an existing junction. QGISRed does not allow creating isolated nodes of this type; They must always be linked to the network.

3. Valves and Pumps

- **Inline Insertion:** Select the tool and click on an existing pipe.
- **Smart split:** The plugin will split the original pipe into two sections or shorten it to insert the new element while maintaining connectivity.

! IMPORTANT: Unlike other EPANET editors, in QGISRed you **do not need to manually define the start and end node IDs**. The plugin uses spatial analysis to connect lines and nodes automatically.

Manipulation and Vertices

QGISRed offers precise tools to manipulate the geometry and state of your network without breaking the topology.

Graphic Manipulation

Vertex Editing

Allows you to adjust the actual layout of pipes and other linear elements:


- **Move:** Drag any intermediate vertex.
- **Create:** Click anywhere on the stretch to add a break point.
- **Delete:** Right-click on a vertex to delete it.

Move Knots

This tool moves a node (Junction, Tank, Reservoir) and drags all the connected elements with it (pipes, valves, pumps) keeping the network together.

Network Tools (Net Tools)

Tool	Action
Invest	Changes the orientation of a line (affects the direction of positive flow).
Split/Join Pipe	Splits a pipe in two or joins two sections with identical properties (diameter, material, age).
Split/Join Knot	The joining process is two by two (origin → destination). Split (right button) separates connected lines into individual nodes.
T Connections	Creates or breaks joins where a connectivity node 1 coincides on a pipe.
Pipe Crossings	Merge or separate pipes that intersect on the map.
Move Valves/Pumps	Moves an element from one pipe to another while maintaining its properties.
Change Status	Toggles the status (Open/Closed) of pipes and manual valves.

 **NOTE:** If a pipe has a manual valve, the state change must be made on the valve, not on the pipe.

Editing properties

Accessing and modifying your element data is easy thanks to QGISRed's smart forms.

The Properties Dialog

When you select an element with this tool, an intuitive window opens that allows you to:

- **Modify attributes:** Change diameters, roughness, demands, etc.
- **Browser:** Quickly navigate to connected items or review recently visited items without closing the window.
- **Center element:** Button to visually locate the selected element on the map.

Alternative Methods

1. **Attribute Table:** Open the layer table (Pipes, Junctions, etc.) and use the field calculator for bulk edits.
 2. **QGIS Identifier:** If you activate "Auto open form" in the native QGIS identifier, the QGISRed form will open when clicked.
-

QGISRed Specific Data

There are additional fields that are not in EPANET but are vital for the plugin:

- **Material:** The material of the pipe (use the acronym from the materials table).
- **InstalDate:** Installation date in `yyyyMMdd` format (e.g. 20240115).
- **IsActive:** In the Digital Twin, it allows you to enable or disable elements such as connections.


Curves and Controls

This section centralizes access to the logical components that define the behavior of the network over time.

What will you find here?

For a hydraulic model to be more than just static pipes, we need to define:

- [Curves and Patterns](#): The "pace" of demand and machine performance.
- [Controls and Rules](#): The "brain" that automates the operation of valves and pumps.

 **TIP:** If you import a model from an INP file, all this information will be automatically loaded into the corresponding tables in the project.

Patterns and Curves

Manages the dynamic behavior of demands, pumps and tanks.

Modulation Curves (Patterns)

Defines how a parameter (usually demand) varies over time.

- **Types:** Volume, time or multiplying factors.
- **Edit:** You can add factors one by one or import entire series from CSV files.
- **Association:** In the demand node, make sure to put the pattern ID in the `IdPattern` field.

Behavior Curves

Defines the physical relationship between two variables.

- **Pumps (Pump Curves):** Relationship between Flow and Head. QGISRed allows you to define 1-point or 3-point curves, calculating the approximate equation automatically.
- **Deposits (Efficiency/Volume Curves):** Relationship between level and volume for deposits with irregular shapes.

Controls and Rules

Define the operating logic of your network (e.g. "if the tank is full, turn off the pump").

Simple Controls

Direct actions based on a single trigger:

- **Based on Level/Pressure:** If node X is $< 10\text{m}$, open valve Y.
- **Time Based:** At 08:00, turn on bomb Z.
- **Based on Clock:** Every Monday at 02:00, close pipe W.

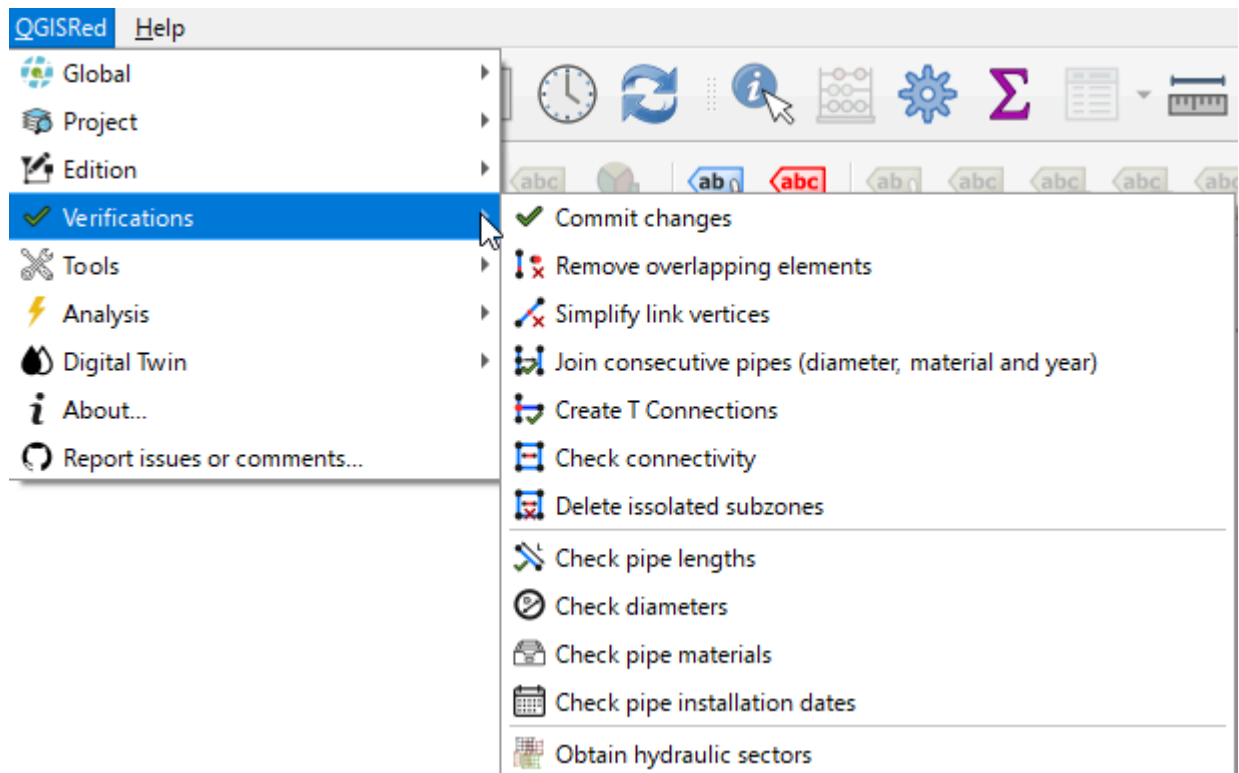
Complex Rules

They allow multiple conditions to be combined using logical operators:

- **Operators:** IF, AND, OR, THEN, ELSE, PRIORITY.
- **Interactive Interface:** Unlike classic EPANET, in QGISRed you build the rules by selecting elements and operators in drop-down menus, avoiding syntax errors in the text file.
- **Enabling:** You can disable specific rules without deleting them to test different operating scenarios.

Model Quality

Verifications



Menu Verifications

QGISRed includes a set of tools to ensure that your model is hydraulically consistent and free of topological errors.

Main tools:

- **Consolidate Data:** Verifies the integrity of all declared properties.
- **Eliminate Overlapping Elements:** Detects duplicate pipes or nodes in the same position.
- **Simplify Vertices:** Remove unnecessary vertices on straight lines to improve performance.
- **Connectivity Analysis:** Identifies isolated areas and disconnected subnets.

💡 **TIP:** Use **Hydraulic Sectors** (Type A to D) to quickly understand how each part of your network is powered.

Topology and Connectivity

These tools ensure that the physical structure of your network is correct and that there are no errors that prevent the simulation.

Topology Tools

- **Consolidate Data:** Fundamental process to ensure that all manual changes to attribute tables are correctly synchronized with the plugin's internal model.
- **Overlapping Elements:** Detect and eliminate pipes, nodes, valves or pumps that share exactly the same geographic location, avoiding redundancies.
- **Simplify Vertices:** Eliminates intermediate vertices in straight sections of pipes. This optimizes graphics performance and simplifies the model without altering its length.
- **Pipe Union:** Automatically merges sections of pipe that have identical diameter, material and year of installation, reducing model fragmentation.
- **Type T Connections:** Resolves situations where an end node coincides on the layout of a pipe, dividing it into two and establishing the real connection.

Connectivity Analysis

This utility identifies which parts of the network are isolated from supply sources.


- **Subzone Detection:** The plugin groups elements into connected subnets.
- **Automatic Cleaning:** Offers the option to automatically eliminate those subzones that have a number of pipes lower than the threshold defined by the user (useful for cleaning topological "garbage" after an import from GIS).

Attribute Analysis

QGISRed allows you to massively audit the data entered in the elements to detect logical inconsistencies.

Data Audit

- **Length Analysis:** Compares the length assigned in the attribute table (L) with the calculated geometric length (Euclidean). If the difference exceeds the user-defined percentage, the plugin issues a warning. Allows massive updating of the L value with the geometric data.
- **Diameter Analysis:** Identifies pipes whose diameters are outside the pre-established thresholds (minimum/maximum), helping to detect transcription errors.
- **Material Analysis:** Search for materials that are not defined in the official materials table of the project or that appear as "UNKNOWN".
- **Date Analysis:** Detects incorrect, poorly formatted installation dates or those that point to the future.

 **NOTE:** These verifications are essential before proceeding with the age-based roughness calculation, as they directly depend on the accuracy of the material and the date of installation.

Hydraulic Sectors

This tool classifies isolated or connected subnetworks based on their supply and demand capacity. It is vital to identify why a part of the model is not receiving water.

Sector Classification

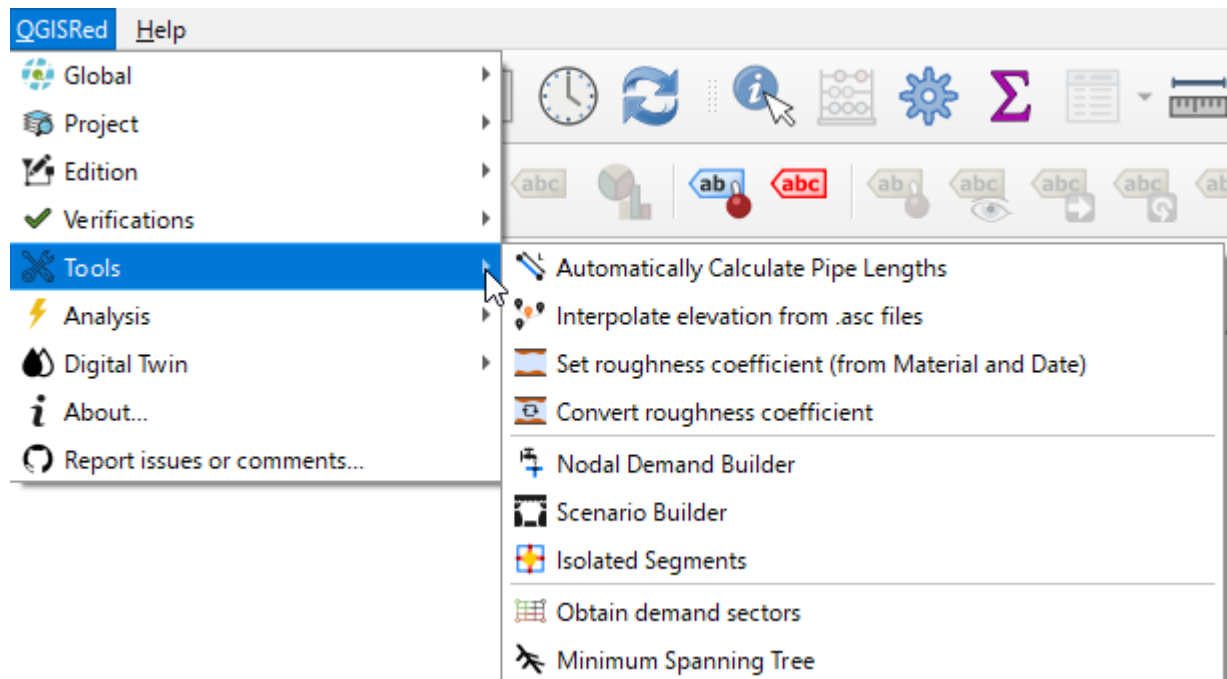
For each identified sector, QGISRed classifies it into one of these 4 types:

Type	Description	Supply Status
TYPE A	There is at least one source (reservoir/reservoir) and there are nodes with base demand.	✅ Functional: Knots can be stocked.
TYPE B	There is a supply source, but there is no demand assigned to the nodes.	⚠️ Latent: Installed capacity but no flow.
TYPE C	There are no sources of supply , but there are assigned demands.	❌ Critical Isolated: There is no water to meet demand.
TYPE D	There are no sources of supply and there are no assigned demands.	✅ Passive: Hydraulically compatible since it does not require flow.

Usefulness of Analysis

This preventive diagnosis allows detecting connectivity errors before launching a long simulation in EPANET, saving time in the diagnosis of "Disconnected Nodes".

Advanced Tools



Menu Tools

Optimize your model with massive processing tools.

Featured Features:

- **Elevation Interpolation:** Assigns elevations to all nodes automatically from MDT (ASCII) files.
- **Demand Manager:** Distributes consumption by sectors or proximity to nodes.
- **Roughness Calculation:** Estimates the roughness based on the material and age of the pipe (Hazen-Williams or Darcy-Weisbach).
- **Closed Explorer:** Determines which valves to close to isolate a break.

Dimension Interpolation

QGISRed allows you to automatically assign elevation to all specific elements (nodes, reservoirs and reservoirs) using digital terrain models in ASCII format.

MDT file format (ASCII)

The file must follow the standard ASCII raster mesh structure:

```
NCOLS 100
NROWS 100
XLLCENTER 450000
YLLCENTER 4400000
CELLSIZE 5
NODATA_VALUE -9999
[Valores de elevación separados por espacios]
```

- **XLLCENTER/YLLCENTER:** Coordinates of the center of the lower left cell.
- **CELLSIZE:** Mesh resolution.
- **NODATA_VALUE:** Value to be ignored during interpolation.

Application Rules

1. **Selectivity:** Only nodes that have the default elevation value (0 or the one configured in options) are interpolated.
2. **Preservation:** If a node already has a manually assigned or imported dimension, the plugin will respect that value and will not overwrite it.
3. **Coverage:** If an element falls outside the MDT mesh, an incident notice will be issued.

Roughness Management

One of the powers of QGISRed is the dynamic management of roughness based on the material and age of the infrastructure.

Calculation by Age and Material

The plugin estimates the roughness coefficient by crossing the **Installation Date** and **Material** of the pipe with the **Materials Table** of the project.

1. Find the material in the table to obtain the initial roughness (ϵ_0).
2. Calculate the current age (years since installation).
3. Apply the configured annual roughness increase.

Conversion between Formulas

QGISRed allows you to convert roughness coefficients automatically when you change the project's head loss formula:

- **Darcy-Weisbach (D-W)** \rightarrow **Hazen-Williams (H-W)**
- **Darcy-Weisbach (D-W)** \rightarrow **Chezy-Manning (C-M)**

! IMPORTANT: By changing the formula in **Hydraulic Options**, the plugin will ask you if you want to perform the mass conversion of all existing roughnesses to maintain the physical consistency of the model.

Table of Materials

You can set the base coefficients to `Project > Materials Table`. It is essential to use the correct acronyms (e.g. `PVC-0`, `PEAD`) for effective linking.

Claims Manager

QGISRed offers powerful tools to distribute water consumption realistically over the network.

Assignment Methods


- **By Sectors (Polygons):** Distributes a known total demand in a geographic area among all the nodes contained in said polygon.
- **By Proximity (Points):** Assigns individual consumption (for example, from a geo-referenced billing database) to the nearest demand node.

Mass Import and Export

The plugin uses a simple exchange format to manage thousands of requests:

Field	Description
IdJunction	Node identifier in QGISRed.
Base Demand	Numerical value of consumption.
IdPattern	(Optional) Identifier of the associated modulation curve.

- **Format:** CSV file separated by semicolon (;) or comma (,).
- **Selective Deletion:** Allows you to delete demands for selected nodes and, optionally, clear modulation curves that are no longer used.

 **TIP:** You can export the current status of all demands to CSV, edit them in Excel and re-import them to make bulk changes externally.

Scenarios and Closed

Beyond basic simulation, QGISRed incorporates tools for critical analysis and master plan management.

Exploration of Cerradas (Isolation)

What valves should I close to repair a pipe?

- This tool identifies the cutting elements (manual valves) necessary to isolate a section.
- Detects **collaterally isolated areas** (users who are left without water even if it is not their pipe that is being repaired).
- Suggests which valves to open to resupply critical areas during the maneuver.

Scenario Management

Allows you to save and retrieve "photographs" of the model parameters:

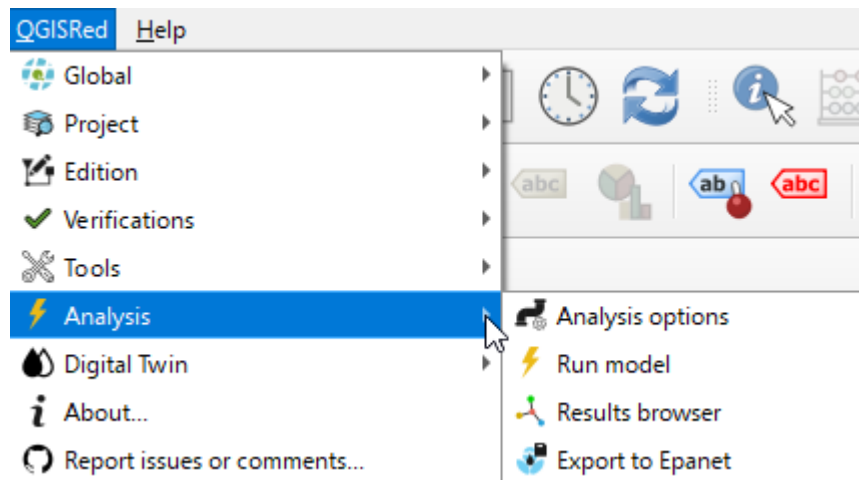
- Export and import in bulk: roughness, states, demands, qualities and elevations.
- Useful to compare the behavior of the network in the current year against future projections (Horizon 2030, 2040, etc.).

Other Tools

- **Demand Sectors:** Identifies areas delimited by flow meters.
- **Least Resistance Tree:** Calculates the most hydraulically efficient route to a point.
- **Hydraulic Sectors:** (See details in the Verifications section).

Simulation and Results

Hydraulic Analysis



Menu Analysis

Once the network is defined, QGISRed allows hydraulic and water quality simulations to be carried out using the EPANET engine.

In this section:

- [Model execution](#)
- [Results viewer](#)

! IMPORTANT: Before simulating, it is advisable to pass the topology [Verifications](#).


Execution and Options

Configure all EPANET engine parameters directly from QGIS.

Analysis Options

From the **Analysis > Analysis Options** menu, you can configure:

- **Hydraulics:** Flow units, head loss formulas (D-W, H-W, C-M) and gravity.
- **Quality:** Chlorine analysis, water age or source trace.
- **Times:** Simulation duration, hydraulic and quality time step.
- **Energy:** Electricity prices and pump efficiency.

 **NOTE:** In the **General** tab, you can also enable the **PDA (Pressure Dependent Analysis)** model for simulations where demand varies with local pressure.

The EPANET Report

Upon completion of a successful simulation, QGISRed automatically displays the text report generated by the EPANET *Toolkit*. This file contains the mass balance, negative pressure knot warnings, and convergence summary.

Results Viewer

Once the simulation is complete, the side **Results Panel** allows you to visually explore the behavior of the network over time.

Temporal Exploration

- **Timeline:** Use the slider to see how pressures and flows evolve over 24 hours (or the configured duration).
- **Variable Selection:** Choose which parameter you want to display in the nodes (Pressure, Demand, Quality) and which parameter in the lines (Flow, Speed, Unit Loss, Status).

Result Layer Management

- **Browser for Results:** Allows you to open or close specific result layer types.
- **Map Warnings:** If you enable "Map Warnings" and hold the mouse over an element, you will see the exact numerical value for that instant of time without having to open the form.

Result Scenarios

You can save "snapshots" of the results of a simulation by giving them a name and comments. This is ideal for quickly comparing the impact of a valve maneuver without having to reconfigure the initial state.

Model Export

QGISRed allows you to export the network model to the EPANET standard **INP** format. This feature is useful for sharing the model with other users, running it directly in the EPANET graphical interface, or integrating it with other hydraulic analysis tools.

To access the export, use the **Export to INP** option from the corresponding QGISRed menu.

Export Options

When launching the export, the following dialog appears with the available options:

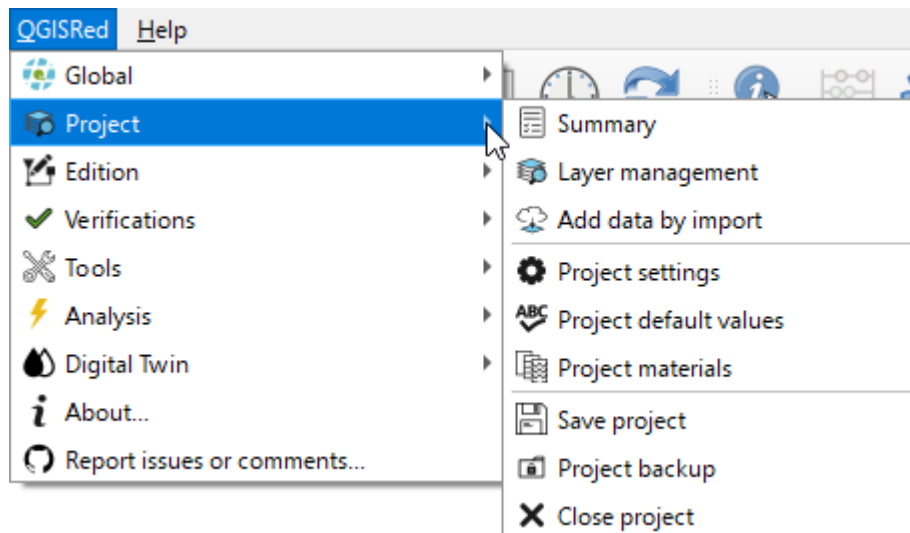
The options presented by the dialog are:

- **INP file:** Full path of the `.inp` file that will be generated. You can type it directly or use the `...` button to navigate to the desired folder.
- **Export field data files:** If this option is checked, the field data files (auxiliary files associated with the model) will also be exported.
- **Open INP file with EPANET:** If enabled, once the export is complete the INP file will automatically open in the EPANET application installed on your computer.
 - **Epanet path:** Path to the EPANET executable detected on the system. You can select a different version from the dropdown if you have several installed.
 - **Specific Epanet path:** Allows you to manually indicate the path to an EPANET executable that does not appear in the previous list.

Once the options are configured, press the **Export to INP** button to generate the file.

Digital Twin

Advanced Elements



Digital Twin Menu

Turn your GIS model into an advanced Digital Twin by incorporating elements that go beyond traditional hydraulic modeling.

Digital Twin Capabilities:

- [Connections and Counters](#): Models the connection with the end client.
- [Sensors and Remote Reading](#): Integrate data in real time (SCADA) with your model.
- **Cut-Off Valves**: Manages the manual closure of sectors and detects customer conditions.

! IMPORTANT: You can upload automatic meter readings in **Series** or **Table** formats for maximum accuracy in demands.

Connections and Remote Reading

The QGISRed Digital Twin allows you to model the network down to the individual client level using connections.

Connection Modeling

- **Geometric Drawing:** You can manually draw connections from the main pipe to the plot boundary.
- **Autocompletion:** Tool to automatically generate the section perpendicular to the nearest pipe from a supply point.
- **IsActive Field:** Allows you to quickly simulate the loss or outage of supply to specific users.

Connection Conversion


The connections in QGISRed can be treated in two ways in the final hydraulic model:

1. **Point Node:** The demand is assigned directly to the connection node.
2. **Linear Section:** The connection becomes a small diameter pipe, allowing the pressure losses in the customer connection to be simulated.

Remote reading (Smart Metering)

QGISRed supports smart meter data integration. The formats allowed to import time series are:

- **Table Format:** `Time; Id1; Id2; ...` (Columns per counter).
 - **Series Format:** `Id; Time; Demand` (One record per row).
-

 **TIP:** You can export all the accumulated remote reading data to a single CSV file for external analysis.

Sensors and Telecontrol

Integrate the reality of your network by creating virtual sensors that link field data with the model.

Types of Sensors

QGISRed allows you to declare:

- **Flow Sensors:** Linked to pipes or valves.
- **Pressure Sensors:** Linked to nodes or tanks.
- **Quality Meters:** To monitor chlorine concentrations or traces.

Digital Twin Operations

- **Status Transmission:** Before simulating, the plugin can transmit the real state of the manual or cut-off valves so that the hydraulic model reflects the operational reality.
- **Field Synchronization:** Import of real-time (or historical) data from `.dat` files to compare the simulation results with the observed reality (Calibration).

Tutorials

Practical Examples

Learn how to use QGISRed through real cases, from importing existing models to creating a network from scratch.

What will you learn?

- [Example 1: Import from EPANET](#): How to migrate an `.INP` file to QGIS in seconds.
 - [Example 2: Manual Creation](#): Step-by-step construction of a network, including drawing, attributes and simulation.
-

Productivity Tips (Tips)

- **Double Click:** In the Project Manager, double click on a recent project to open it without searching for it.
- **Incremental Import:** While importing an INP replaces the above, adding SHPs is **incremental**. You can combine multiple data sources.
- **Centralization:** The plugin uses the files in the project folder. You don't need to have all the layers open in QGIS for the tools to work.
- **Save is Key:** Save your QGIS project (`.qgz`) so that the symbology and layer organization are maintained when you reopen it.
- **Map Notices:** Select a results layer so that the values appear when you mouse over the elements.

Example 1: From INP

This example illustrates how to import a previous model available in an INP file to perform calculations immediately.

Steps to follow:

1. **Open Importer:** Press the "Import" button on the toolbar.
2. **Configure Destination:** Specifies the network name and directory where the new SHP files will be created.
3. **Select file:** Choose your `Red1_SI.inp` file and press **Import Data From INP**.


Result

Layers will automatically appear in the legend and data tables (Patterns, Curves).

Simulation

Click on **Run model**. You will instantly see:

- The EPANET text report.
- Result layers loaded with default symbology.
- Side panel to switch between time instants.

 **TIP:** Deactivate the "Inputs" layer group to better appreciate the colors of the results.

Example 2: Manual Creation

This tutorial shows how to build the "Red1_SI" model by drawing each element directly on the map.

1. Preparation

- **Create Project:** Use `Project > Create Project`, define the name and CRS (ex: WGS 84).
- **Self-assembly (Snapping):** Activate the QGIS magnet so that the pipes connect exactly at the nodes.

2. Layout Drawing

1. **Pipes:** Select the add pipe tool and draw the diagram. Right click to finish each section.
2. **Knots and Tanks:** Add the specific elements on the ends of the pipes.
3. **Valves:** Insert the regulation elements on the existing lines.

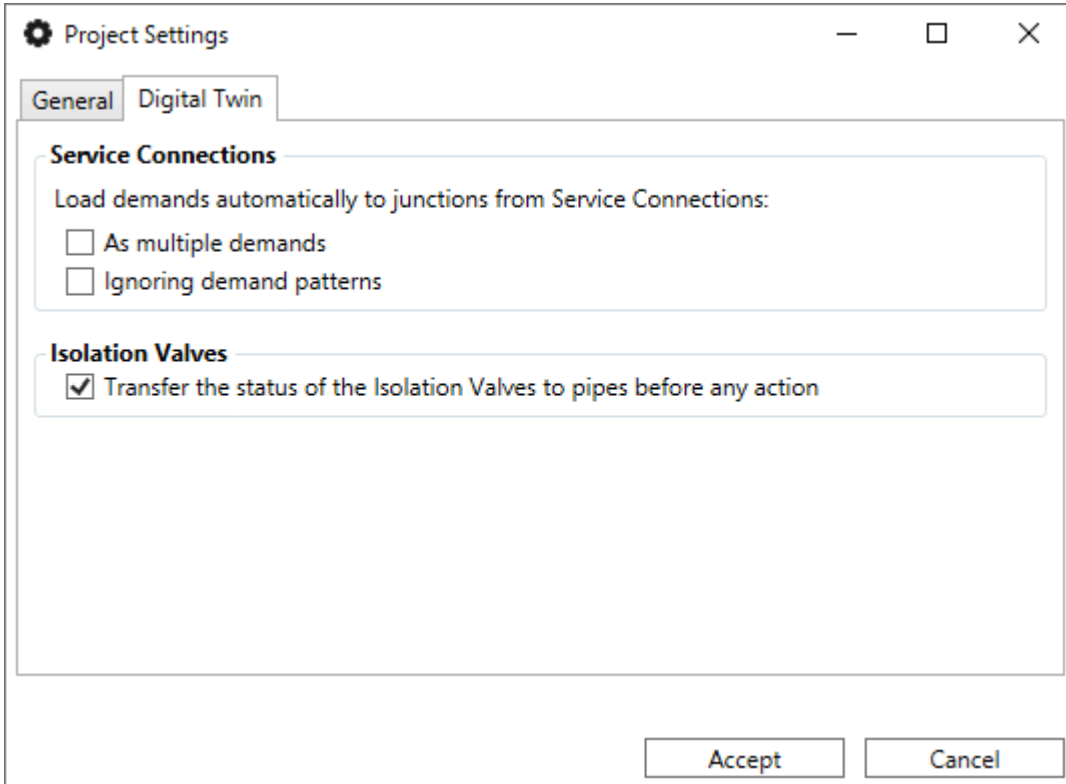
3. Data Entry

- Use the **Properties Editor** to click on each element and assign diameters, roughnesses and base demands.
- **Collect Curves:** Access the curve manager to define the characteristic curve of the pump (Flow-Head) and the demand pattern.

4. Validation and Execution

1. **Validate:** Press the Verify button to automatically create the missing nodes and consolidate the topology.
2. **Rules and Controls:** Defines control laws (e.g., turning off the pump if the tank level is > 5m).

3. **Simulate:** Run the model and verify that the results match the expected design.



The image shows a 'Project Settings' dialog box with a 'Digital Twin' tab selected. The 'General' tab is also visible. The 'Service Connections' section has two unchecked checkboxes: 'As multiple demands' and 'Ignoring demand patterns'. The 'Isolation Valves' section has one checked checkbox: 'Transfer the status of the Isolation Valves to pipes before any action'. At the bottom right are 'Accept' and 'Cancel' buttons.

Project Settings

General Digital Twin

Service Connections

Load demands automatically to junctions from Service Connections:

- ☐ As multiple demands
- ☐ Ignoring demand patterns

Isolation Valves

- ☒ Transfer the status of the Isolation Valves to pipes before any action

Accept Cancel

Network Construction

Technical Appendix

Materials List

QGISRed uses a predefined list of materials to estimate roughness automatically. Here are the standard names used up to version 0.12 (in later versions acronyms linked to the material table are used).

Metals

- **GREY CAST IRON:** Gray Cast Iron.
- **DUCTILE CAST IRON:** Ductile Cast Iron.
- **STEEL:** Steel.
- **GALVANIZED IRON:** Galvanized Iron.
- **COPPER:** Copper.

Plastics and Synthetics

- **POLYETHYLENE:** Polyethylene.
- **HIGH DENSITY POLYETHYLENE:** HDPE / HDPE.
- **MEDIUM DENSITY POLYETHYLENE:** PEMD.
- **LOW DENSITY POLYETHYLENE:** LDPE.
- **UNPLASTICIZED PVC:** PVC-U (Rigid).
- **ORIENTATED PVC:** PVC-O (Oriented).

Others

- **FIBER CEMENT:** Fiber cement.
- **CONCRETE WITH SHEET METAL JACKET:** Concrete with sheet metal jacket.
- **CONCRETE WITHOUT SHEET METAL JACKET:** Concrete without sheet metal jacket.
- **PRESTRESSED CONCRETE:** Prestressed concrete.

- **LEAD:** Lead.

💡 **NOTE:** If the material is unknown, use `UNDETERMINED` or `UNKNOWN`. In these cases, the plugin will not be able to estimate the roughness automatically and you will have to enter it manually.

DBF Formats and Management

For advanced users who prefer to edit data directly from QGIS tables or external files, the required technical formats are detailed here.

Date Format

The `InstalDate` field in the pipes layer must strictly follow the format: `yyyyMMdd`

- **yyyy:** Year (4 digits).
- **MM:** Month (2 digits, with leading zero if necessary).
- **dd:** Day (2 digits).
- *Example:* `20230715` for July 15, 2023.

Pattern and Curve Management (DBF)

Pattern and curve data are stored in `.dbf` tables. When editing them manually keep in mind:

- **Order:** There is an order field that indicates the position of the factor within the series.
- **Separators:** If editing outside of QGIS, make sure to stay consistent with the decimal (dot) separator.

Rules Management

Rules in attribute tables may appear out of order. To view them correctly, sort the table by these columns in this order:

1. **RuleOrder:** Groups all the lines of the same rule.
2. **LineOrder:** Defines the logical order of the conditions (IF, AND, OR, THEN, ELSE).

"Name" field

QGISRed adds a column to the rules and controls. This field does not affect the simulation but allows you to visually identify the function of each line in the plugin form.

Change Log

Stay up to date with the latest QGISRed improvements.

Version 0.17 (January 2026)

QGIS versions: 3.2-3.99

News:

- New closed scan tool, with multiple options.
- Display results of up to 13 states for pipes, valves and pumps.
- Transfer of states and qualities for chaining simulations in successive periods.
- New options to reset roughness, elevations and diameters in the scenario builder.
- New option to export and import scenarios with the Epanet format.
- New features in the project manager (sort, export, delete and rename).
- New buttons to open or save projects.
- New option to import a QGISRed project.
- Changes to icons and names in some menu options.
- Improved precision when writing numerical values in shapes.
- Improvement in the message when downloading the necessary dependencies.

Corrections:

- Corrected error when interpolating dimensions when the point falls on one of the ends of the mesh.
- Corrected error when distributing demands in proportion to the length of the pipes.
- Fixed error when loading demands from a layer of sectors.
- Fixed error when importing INPs with sources without a defined pattern.
- Fixed errors when importing INP related to Times and Temporary Rules.

- Fixed error when exporting INPs with very long descriptions.
- Corrected error with the decimal symbol in the PDA model options.

Previous Versions

Here you can check the detailed change history of previous versions of QGISRed.

Version 0.16

QGIS versions: 3.2-3.99

Features:

- New options in the nodal demands manager to declare consumption for the entire network or by zones.
- Possibility of exporting, editing and reimporting the links between specific consumption and nodes.
- New options to import/export/delete demand scenarios by categories.
- New tools in the nodal demands manager to consider water efficiency or assign consumption patterns by sectors.
- New Scenario Manager to store and retrieve various model parameters in bulk.
- Automatic calculation of pipe length from vertex coordinates.
- Automatic completion of the connection layout using a section perpendicular to the nearest pipe or a link to the nearest node.
- Possibility of automatically tracing connections of preset length from a point on a pipe or a node.
- New option to reflect a rush with the invest tool.
- New option to import connections as points, creating perpendiculars to the pipes or connections to the closest nodes.
- New IsActive field in connections to define whether it is operational or not.
- Verification of the contact point of a connection with a pipe or knot at both ends.
- Before calculating the hydraulic sectorization, the status of the manual valves is now transmitted.
- When exporting to INP the loss coefficient of the shut-off valves is transmitted to the pipes.

- Declaration, editing and deletion of meters of various types, as new elements of the Digital Twin.
- Editing, reading and saving the signals associated with the meters.
- New dialog to read field data and export to CSV those corresponding to the simulation interval.
- New option to export field data, together with the INP file.
- New fields in the import dialog to import more item information.
- New option to show in the auxiliary themes the elements with an incident during the import.
- New buttons and new slider in the results panel.
- Improvements in labels to display results.
- New type of result to display the Status of the lines.
- Improvements in searches from the property editor.
- Dropdown with EPANET executable paths when exporting INP for automatic opening.
- Sorting patterns by type when importing INP.
- New warning when the Id of some element is autocompleted.
- Changes to toolbar order, names and icons, and visual styles.
- New link to the QGISRed website in the info window.

Corrections:

- Corrected the reading and editing of the curve Id in GPV valves.
- Corrected error when assigning default values when importing reaction coefficients.
- Corrected error and message when reading polluting sources in tanks and reservoirs.
- Corrected problem with specific selection tools.
- Fixed error in mass creation of T connections.
- Fixed errors in multiple and polygon selection with different CRS.
- Fixed bug with snapping in QGIS 3.26.

Version 0.15

QGIS versions: 3.2-3.99

Features:

- Management of manual valves (import, creation, deletion, editing of properties, interaction with the status of the pipes...).
- New tool to change the state of linear elements and manual valves.
- New symbolization of pipes, pumps, regulation valves and manuals according to their status.
- Cancellation of isolated demands due to the closure of overlapping pipes or valves during simulations.
- Assignment of demands to nodes based on demand sectors and specific demands, with various options.
- Improvements in the properties editing window (multiple selection, connected elements, visited elements, center selected element).
- Review and expansion of analysis options (hydraulics, quality, times and energy).
- Incorporation of the new Epanet 2.2 parameters to the forms (tank overflow, pressure-dependent demands).
- Highlighted main toolbar buttons/menus.
- Default and only language is English (for now).
- Improved rules editing (with times and clocktimes).

Corrections:

- Fixed error when writing demand values with more than 4 digits.
- Fixed bug with time labels for selecting results.
- Corrected error when converting numbers in dimension interpolation.
- Corrected errors with reading, writing and order of the rules.
- Fixed error with rules using comma as decimal separator.
- Corrected problem when assigning the project projection.

- Fixed error when editing properties working with raster layers.
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Version 0.14

QGIS versions: 3.2-3.99

Features:

- **Corrected serious error** when reading metadata from previous models that prevented working with them.
 - Fixed error when installing the plugin without having previous dependencies.
 - Fixed error with time format in simple control laws.
 - User-defined decimal separator display.
 - New tool to edit the geometry of the connections.
 - The `demand multiplier` hydraulic option now supports decimals.
 - Priority of Digital Twin elements when selecting objects.
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Version 0.13

QGIS versions: 3.2-3.99

Features:

- New menu to group Digital Twin tools.
- Creation of connections with own tool and integration in deletion.
- Specific tab to edit connection properties.
- Remote reading upload under different formats to connections or nodes.
- Incorporation of connection modulation curves to the general editor.
- New demand manager for import/export and selective deletion.
- Improved access times to properties on large networks.

- Optional opening of INP in EPANET after exporting.
 - New options to define units and pressure loss formulas from GIS.
 - Corrected time format to allow days.
 - Corrected reading of dates in metadata and various SHP import errors.
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Version 0.12

QGis versions: 3.14-3.99

Features:

- Edition of the materials-roughness table for calculation according to material and age.
 - New import and export of patterns/curves in CSV format.
 - Import of base demands and curve IDs from CSV.
 - Import of connections from SHP.
 - New tool to obtain the tree of minimum resistance.
 - Update of the Epanet library to **version 2.2**.
 - Improved the roughness coefficient conversion interface.
 - Bug fixes in quality results and knots without coordinates.
 - Insertion of valves/pumps avoiding negative lengths.
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Version 0.11

QGis versions: 3.2-3.99

Features:

- Local JSON file for projections (.prj) without internet.
- Reading PUMPS formats inherited from Epanet 1.1.

- New single installer (x86 and x64).
 - Display of units and loss formula in status bar.
 - Roughness estimation by age/material compatible with various formulas.
 - Tool to create backup copy of the project.
 - Bug fixes in QGIS 3.14.15 and AM/PM time format.
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Version 0.10

QGis Versions: 3.0-3.14.1

Features:

- Writing INP headers in English.
 - Validation to prevent the same final knot in lines.
 - Simplification of duplicate vertices in initial points.
 - Unification of metadata in file `_Metadata.txt`.
 - Notice of new versions available.
 - Layer visibility control using `LayerManagement`.
 - Separation between Import (without project) and Add (with project).
 - Spatial tolerance when adding data from SHPs.
 - Manual includes ASCII format for interpolation and classification of hydraulic sectors.
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Version 0.9

QGis versions: 3.0-3.99

Features:

- New QGISRed logo.

- Agile creation of pipes, tanks and reservoirs with anchoring.
 - Path editing (move, create, delete vertices).
 - Line orientation inversion.
 - Tools for splitting/joining pipes and knots.
 - Creating/undoing T-connections and crossovers.
 - Displacement of valves and pumps.
 - Multiple selection (Ctrl adds, Shift removes) and delete per polygon.
 - Access to latest results without simulating again.
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Version 0.8

QGis versions: 3.0-3.99

Features:

- Editing properties through a dialog window with a browser.
 - Intelligent insertion/removal of valves and pumps in pipelines.
 - Editing the layout by moving nodes and coincident elements.
 - Support for 5 tool categories.
 - Dialogs for calculation options and default values.
 - Verification of repeated IDs.
 - Hiding data tables in the legend.
 - Visualization of results using fixed labels.
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Version 0.7

QGis versions: 3.0-3.99

Features:

- Model summary table.
 - Modulation Curves Manager (Patterns): edit, create, clone, export/import.
 - Behavior Curve Manager: support for 1 or 3 points with approximate equation.
 - Simple and Interactive Controls Manager.
 - Rules Manager: interactive combination of OR/AND conditions.
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Version 0.6

QGis versions: 2.0-3.99

Features:

- Project management (open, create, import, clone, delete).
- Creation of SHP vector layers for EPANET base elements.
- Import of data from INP or SHPs.
- Model validation and bug reporting.
- Export to INP with optional automatic opening.
- Simulation with EPANET Toolkit.
- Layout tools (elimination of overlaps, connectivity, sectors).