It's All In the Process….

Howard Munsell – Whitman, Requardt & Associates, LLP.

MP1285   Revit is recognized as a building design tool, for architectural, structural, plumbing and HVAC. At Whitman, Requardt & Associates our Water Wastewater discipline saw the benefits others were experiencing using Revit and decided to take Revit to the next level for use with large diameter pipe used in their process plants. With only AutoCAD 2d experience the switch to Revit identified changes needed within our design process and workflow. These changes ultimately led to a better coordinated design for our clients and Revit is now the tool of choice for many Water Wastewater projects. In this session I will demonstrate how WR&A's Water Wastewater disciplines utilized Revit for more than plumbing.

Learning Objectives

At the end of this class, you will be able to:

- Understand the "process" from initial design to hand-off to other disciplines.

- Create new pipe Types, Systems and Segments.

- Create content for larger pipe sizes.

- Learn about unique circumstances encountered and how they were overcome.

About the Speaker

Howard currently works as a CADD Systems Specialist whose primary responsibility is for supporting the BIM effort for Whitman, Requardt & Associates LLP (WR&A). WR&A is a full service Engineering, Architectural and Planning firm whose headquarters is located in Baltimore, MD. With Howards 25 years' experience as a user and providing support for Autodesk products, he provides WR&A with support, implementation and training for Autodesk products including, but not limited to, Autodesk® Revit MEP®, Autodesk® Revit Architecture®, Autodesk® Revit Structure®, and AutoCAD®. Howard also became an AutoCAD and Revit Architecture Certified Professional in 2011 and 2013.

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The Mission :

At WR&A our Water Wastewater discipline saw the benefits other disciplines were experiencing using Revit and decided to take their work to the next level. That would mean adapting Revit for use with the large diameter pipe used for Waste Water process plants.

The Mission was to see if Revit will work for WR&A's Water Wastewater group, help develop their design process and assist them with any challenges they had along the way.

The Benefits…

The benefits other disciplines were experiencing using Revit

Whitman, Requardt & Associates LLP. has been using Revit for about 6 years now. Our Architects were the first to embrace Revit, followed by Structural and soon after, Mechanical, Plumbing and Electrical followed as they want to reap the benefits of using Revit. The most recent group to join has been our Water Wastewater department.

Benefits such as:
- Automatic view creation of Sections/Elevations/Details
- Intelligent Scheduling
- File management
- Coordination
- And many more….

The Water Wastewater Group did investigate AutoCAD MEP and Plant 3D but, Revit offered them the best options for their needs.

The Switch Over…
*Identifying their current workflow and finding the best way for them to use Revit.*

The first step was to identify their current CADD process. Typically, the Water Wastewater group provided design for all disciplines themselves usually up to around 35%. In addition to the pipe design, they would draw basic Architectural and Structural elements. All design information was drawn in the same base file using only layer separation. At about 35% all other disciplines would get involved. The existing design files were then copied and cleaned up for each discipline to continue with their design.
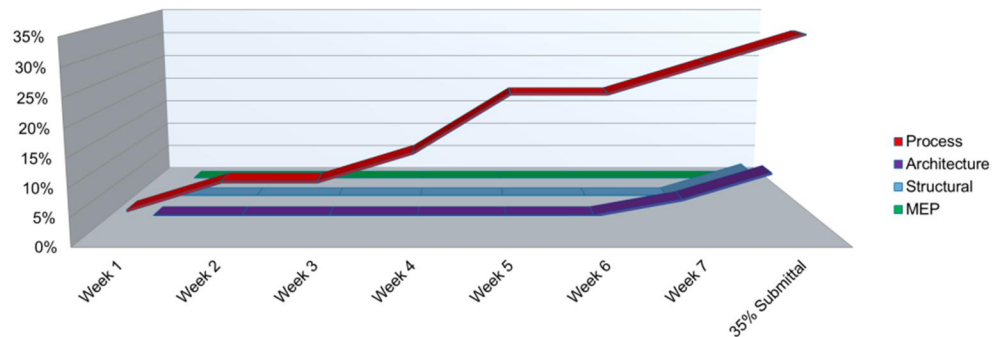
The switch to Revit forced them to change their typical workflow. Since they usually do everything themselves up to about 35%, Revit training needed to be a little more than just Mechanical. Extra time was needed to teach Architectural and Structural tasks within Revit.

The Water Wastewater group also needed to learn to work in the appropriate model for what they were designing. This was done for ease of distributing the appropriate model files to the appropriate disciplines. Since they typically start the project, they needed to understand the principles of "acquiring coordinates", "copy monitoring" and "coordination reviews" so the different models would "link" properly. In doing this they discovered other disciplines could be involved earlier in the design process, improving the overall project coordination.

The Water Wastewater group continues to start all discipline models and the initial coordination, but now the other disciplines are getting involved just after schematic design instead of waiting until 35%.
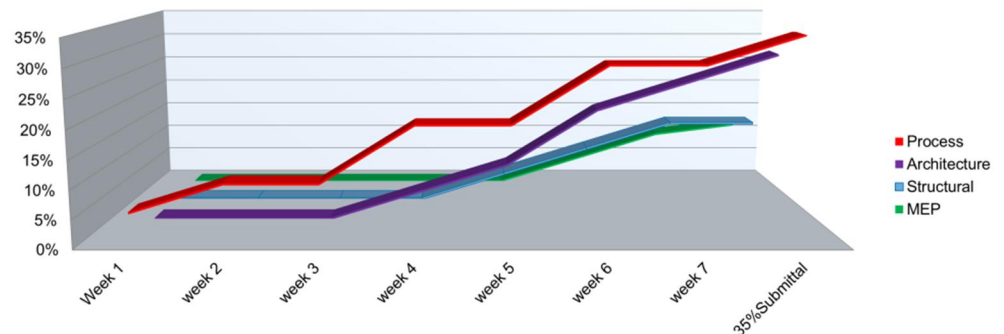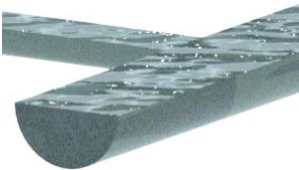
The Next Level…
Taking their Process to the next level using Revit for their large diameter pipe

The 3 components of Piping in Revit
Piping in Revit is made up of 3 main components, Segment, System and Type.

The Pipe Segment is comprised of the material, schedule or type of pipe, roughness and the Nominal, Inside & Outside diameters of the pipe.

The Piping System is basically what is flowing through the pipe. The Piping System is comprised of the calculation method, the identity data and rise/drop symbology. Hydronic and Domestic Piping Systems also contain Fluid type, temperature and Flow Conversion Method variables.

The Pipe Type combines both the pipe segment and system. The pipe type holds the Routing Preferences, how the pipe run is constructed. You can specify the pipe segment and the pipe fittings to be used for that type of pipe.

Creating a New Pipe Segment
Revit comes with many standard pipe segments "Out of the Box" (OTB). Making a segment is not difficult, but can be tedious. For our example, we used the AWWA pipe sizing chart to create the Ductile Iron class 53 pipe we needed. Because Revit requires an outside and inside diameter and the chart only gave the outside diameter and the pipe thickness, we had to do some math. To start:

- Go to the "Systems" ribbon
- From the "Mechanical Panel" select down arrow (bottom right corner)
- Select "Segments and Sizes" from the Pipe Setting list
- Select "Create New Pipe Segments" icon (right of the selection list). The "New Segment" dialog box will appear.
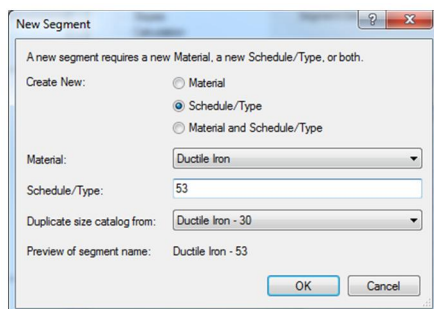
- In the "New Segment" dialog box select "Schedule/Type"
- Next select your "Material".
    o For our example we used Ductile Iron.
- Next enter the "Schedule/Type"
    o Again our example we created was class 53
- Lastly, select a "Duplicate size catalog from".
    o This will be what you will use as a base for the new pipe segment. (something must be selected)
   o For our example we selected ductile iron – 30.

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Now that the pipe segment has been created you can start making sizes:

- Select the "New Size" button
- In the "Add Pipe Size" dialog box enter the new "Nominal Diameter".
    o DO NOT HIT ENTER or OK. That closes the window and you will need to delete and remake
- For the "Inside Diameter" you may have to do some calculations.
    o If the sizing chart does give inside diameter and has a wall thickness, multiply the wall thickness by 2 and subtract that from the outside diameter and that is the inside diameter.
- Enter the "Outside Diameter"
    o Now you can hit "Enter" or select "OK"
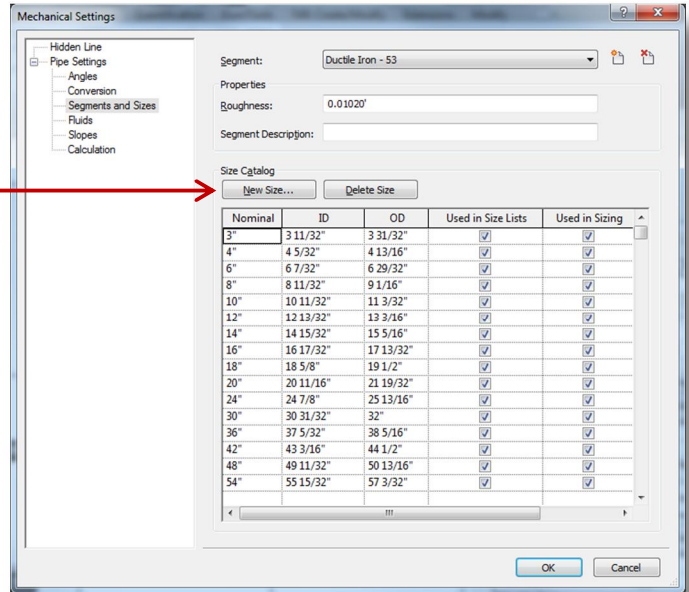
Now you can delete the remaining size(s) left from the default pipe segment you started with. Continue the above process for all needed pipe sizes for the new pipe segment.

The last 2 columns in the "Size Catalog" dialog box are "Used in size lists" and "Used in sizing".
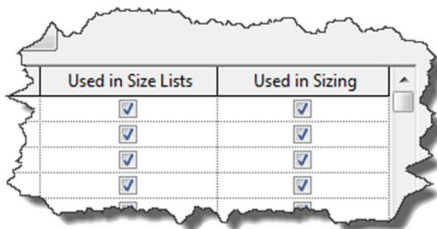

- If "Used in size lists" is checked the sizes will show in lists throughout Revit.
- If "Used in sizing" is checked Revit's sizing algorithm can be used to determine pipe sizes. By default they're both checked.

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New Piping System

In the "Project Browser", go to "Families" and then "Piping Systems". The Out-Of-The-Box Mechanical and Plumbing template has 11 standard Piping Systems, most of which are for building mechanical and plumbing. For Process, we need to add some of our own.

- Select an appropriate pre-existing Piping System
    o Whatever is closest to what you will be designing.
- Right click on it and select "Type Properties"
- Select "Duplicate" in the upper right
    o Enter name of the new Piping System.
    o Select OK when done
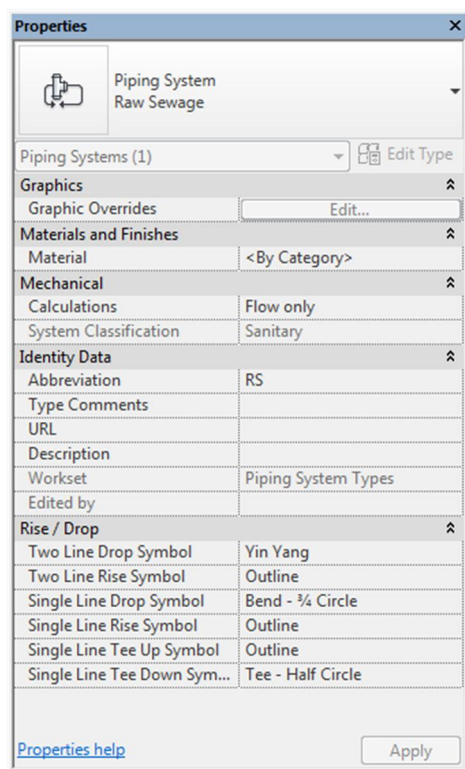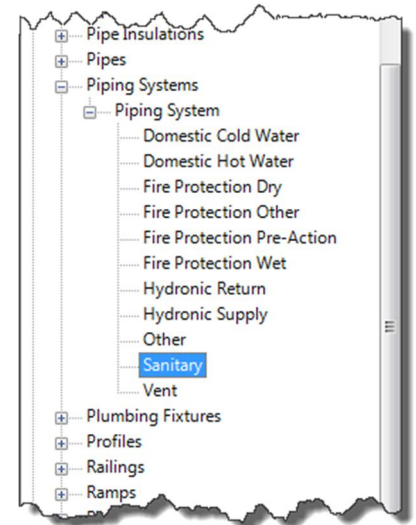
Once the new system is added to the "Piping Systems" list you can begin making changes.

- Assign a material for shaded and render appearance.
- Set the calculation for Flow.
- Enter abbreviation for the system.
- Adjust the rise and drop symbols for the piping.
- When done, select OK at the bottom of the window.

Repeat this as needed for any new Piping Systems you need. For our template we added grit, overflow and reclaimed water. Others are made as needed.

New Pipe Type

Revit includes most of the pipe types needed to start a building project. Pipe Types needed for a process facility are not in the standard Revit template, so they need to be created.

Creating new Revit pipe types is pretty straight forward. The Revit mechanical and plumbing template has 2 default pipe types, neither of which is useful for Process Piping.
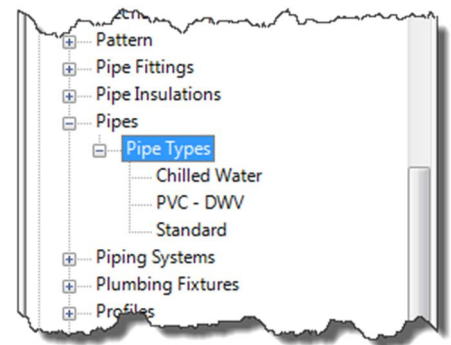

When making Pipe Types you will be combining the specific Piping System and the Pipe Segment, which should always be created first. There are 2 ways to make new pipe types, one is by using the Project Browser and the other via the Properties Palette. Below is the example of using the Properties Palette:

- From "Systems" ribbon select "Pipe" tool from the Plumbing & Piping panel.
- In the Properties palette, select "Edit Type".
- In the Edit Type window, select "Duplicate" and enter new pipe name.

After the Pipe Type is created, the Routing Preferences need to be updated. As a reminder, routing preferences control how the pipe runs are constructed. From the Type Properties window, select the "Edit" button to the Right of the Routing Preferences parameter. The Routing Preferences window offers several options:

- Select a "Pipe Segment" to use from the Pipe Segment dropdown.
- Continue down the list and Specify the fittings to be used for the Pipe Type
    - Elbows, Preferred Junctions, Junctions, Crosses, Transitions, Unions, Flanges and Caps.
    - Fittings can be loaded as needed by selecting the "Load family" button at the top of the window.
- Set minimum and maximum restrictions for the different pipe and fitting sizes

The Identity Data information is optional but, it is recommended to put the pipe type abbreviation in the type comments field. Repeat this as needed. We have added 7 additional pipe types to our template to accommodate WRA's process piping.
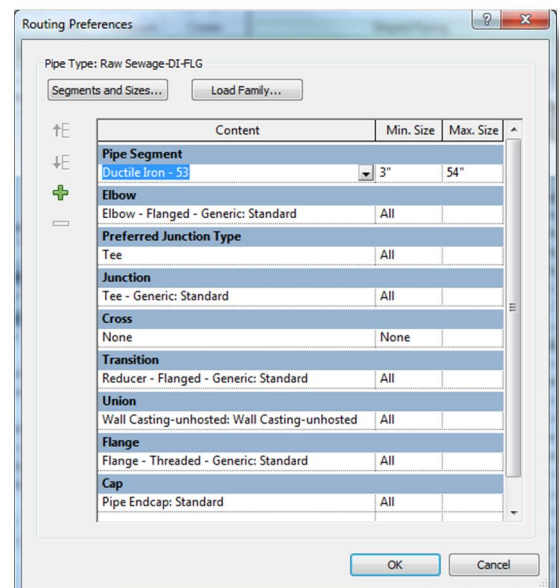
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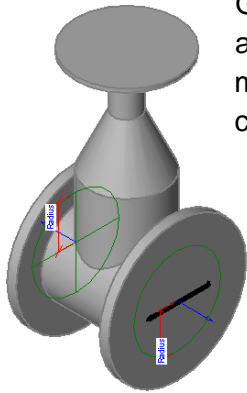
Good content can make or break a Revit model. Many out of the box fittings and accessories can be adjusted to accommodate larger diameter pipe but, most equipment will need to be created. Below are steps we took to start our content:

Revit comes with over 3000 Imperial and Metric families Out-Of-The-Box. For this example, we will start with the OTB gate valve. This well-made valve is a good start but only has sizes from 2" to 12". We need to modify it to for sizes up to 24" or larger.

Each family has family types. These hold size and/or constraints of a specific Piece of content. You do not need separate families for each size, just a family type.

- Open family
- Select "Edit Type". NEVER modify an existing family type. ALWAYS use the duplicate button, and then make changes to the new type. Adjust parameters values as needed to make additional types (do not adjust formulas). Add as needed, but if you have more than a dozen types, consider making a secondary family or a Type Catalog file for them.
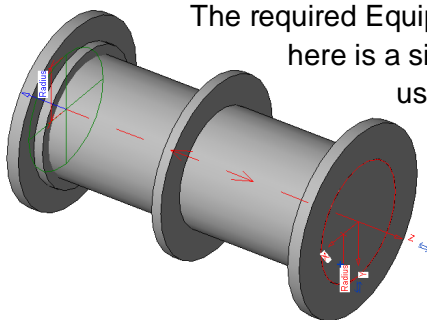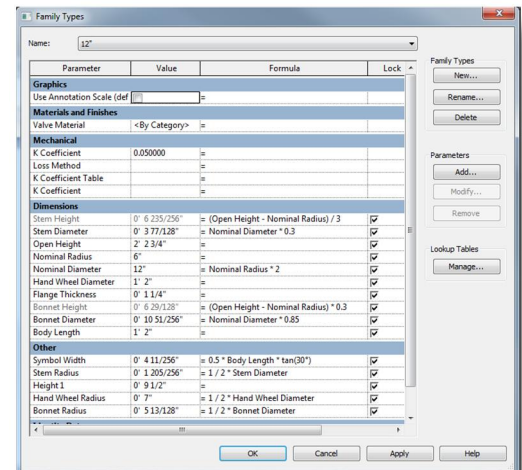
The required Equipment will most likely need to be created. The piece shown here is a simple wall casting family we needed to create. It was created using 2 cylindrical extrusions (one for the pipe and one for the cuff), 2 flanges and 2 pipe connectors. Content can be as simple or as complex as you want to make it. We believe, simple is better.

The Utilization…

How WR&A's Water Wastewater disciplines utilize Revit for Large diameter Pipe

The pipes shown in this example are part of the 300 MGD Preliminary Treatment Facilities. The pipes are 84" diameter reduced to 72" and contains a 72" magnetic flow meter and then back to 84" diameter. The piping allows for the sewer system influent flows to enter the treatment plant. It is part of the main building which is also in Revit.


"Using Revit for the process piping is allowing us to accurately see how much space is needed for the piping (clearances) and give a full understanding of the magnitude of the size of the piping. With this model being in Revit we can also take advantage of Scheduling and Quantity take-off's available through Revit." **Luis Quintanilla, P.E. | Design Engineer, WR&A**
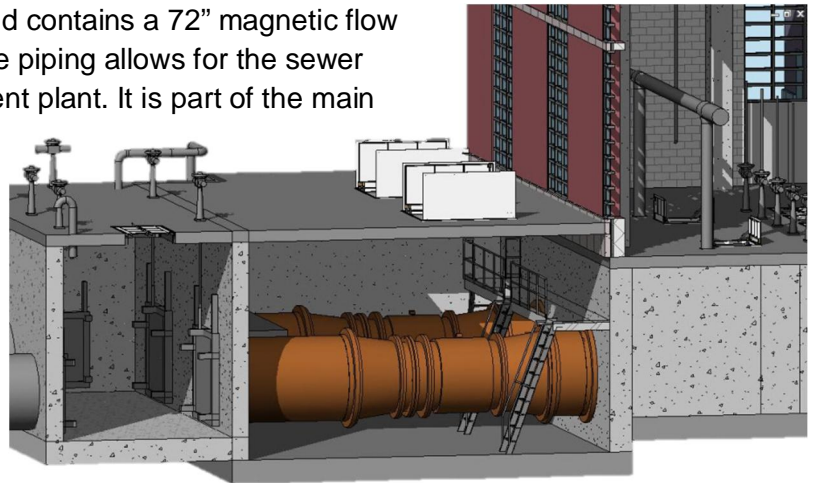
How WR&A's Water Wastewater disciplines utilize Revit for creating custom content.

As part of a relatively new wet well design guideline recommended by the Hydraulics Institute, this pump station has 4 vertical turbine solids handling pumps in a self-cleaning wet well.
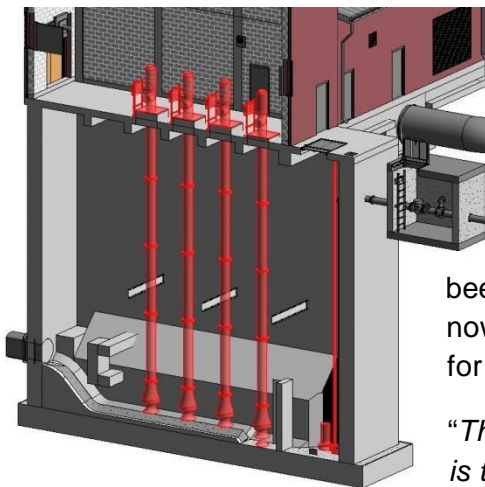

The project had several uniquely modeled families we created which include 4x45-foot long vertical pumps, sloped concrete fill, ogee ramp, flow splitter, fillets, anti-rotation baffle and a vortex suppressor. These families have been collected from the project and are now a part of the Process family library for use on other projects.
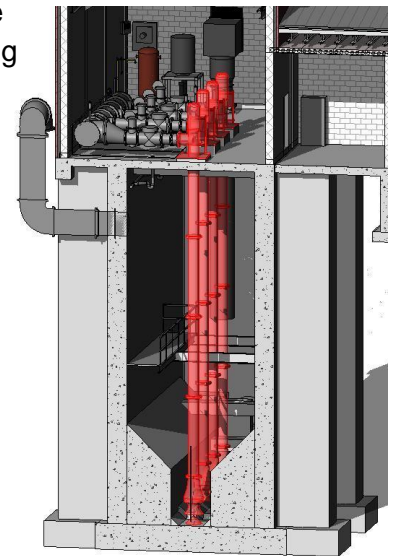
"The purpose of an engineering drawing is to fully and clearly define what is required for a project. Without Revit, properly drafting the complex geometries associated with the wet well would have been a nightmare. In CAD it would not only have taken much longer, but we would still have been left with incomplete and ambiguous depictions of these complex geometries." **Brian P. Wolcott, P.E. | Project Engineer, WR&A**

How WR&A's Water Wastewater disciplines utilize Revit for overall design and coordination.
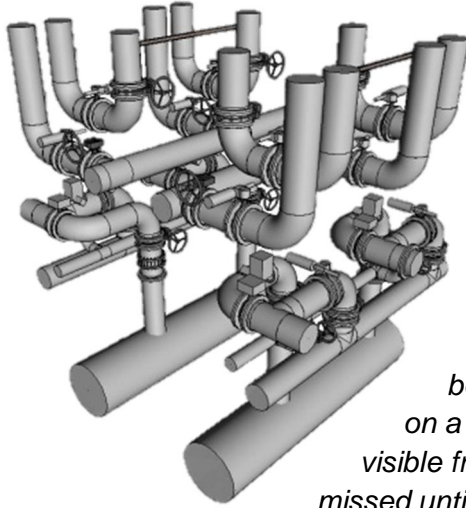
This project was originally done in AutoCAD MEP, and the vignette represents piping to and from four filters. This piping is typical for 2 rows of 14 filters long in a filter gallery, as well as the gallery on the other side of the building amounting to 52 filters total.

"We built this model because the complexity of the piping arrangement was difficult to depict and understand using 2D plans and sections. While I completed the model, it became apparent that an elbow was interfering with a valve on a pipe running perpendicular to it. This interference was not visible from the 2D plans and sections, and would likely have been missed until construction. Since the piping is typical for all 52 filters, the conflict would have been repeated 52 times, which could have been a major ordeal to fix during construction." **Paul Konrad | *Design Engineer, WR&A***

Planning for the future

When starting a Process Project in Revit, a couple things to keep in mind are:

Pick the right project

Your "first" process Revit project should be small. Revit is very intuitive and it's easy to bite off more than you can chew so pick a project that can be easily done by two people. Also, keep in mind you will need the time and money to accommodate a software learning curve.

Training

Get proper training. Don't install the software on users PC's and say good luck. There are many online webinars and tutorials, but nothing is better than proper training. Schedule any training at the start of a project. Training anyone too far in advance and they do not use it, they will lose it.

Make It As You Go

You do not need to have all your pipe types, systems, segments and families created before you start a project. As I demonstrated, things are not hard to create. Simply create as you go. Anything created can then be placed in the Revit process library for use on future projects.