



12d<sup>®</sup> International Conference

2016

# 12d International Innovation Awards

## Mal Peaker Water Main Designs

**WINNER: DRAINAGE, SEWER & UTILITIES**



Name:

Mal Peaker

Position:

Design Office Manager

Company:

Engineering Solutions QLD

Name Project:

Water Main Designs

Client:

Wide Bay Water Corporation

Category:

- Design & Visualisation
- Survey & Construction
- Drainage, Sewer, Utilities & Rivers
- Customisation
- 12d Synergy





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## Description of Project:

- Various Water Main design projects for the local water authority (WA).

## Description of problem faced / task undertaken:

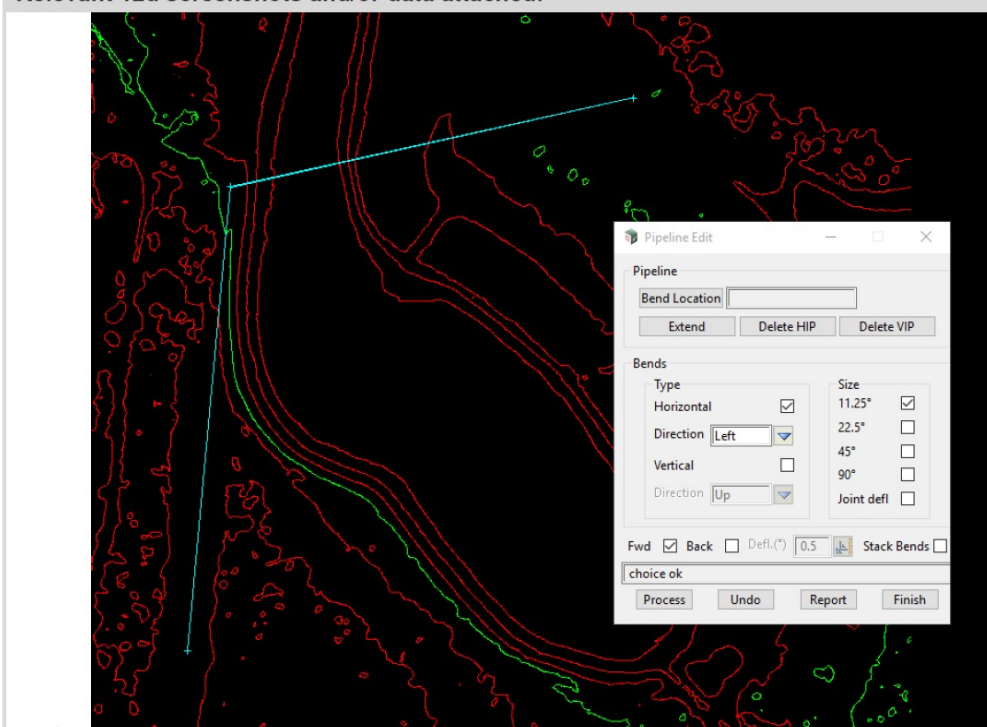
- WA have very specific requirements relating to design of water mains, particularly with regard to documentation of bends and joint deflections in the pipework. WA only allow 50% of the maximum manufacturer recommended joint deflection, both for pipe joints and DICL bends. Depending on what pipe type has been selected for the main, the maximum joint deflection will change.
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- The pipeline module in 12d works in % grades vertically, as it was originally a variant of the alignment module. While it was workable, it added some level of difficulty in terms of needing to convert all degrees of vertical deflection to % and then adding a new VIP and including the deflection manually. That approach led to the possibility of calculation error or user error, so we needed to find some way of automating the task and reducing the possibility of error creeping in to the designs.
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- Additionally, the ability to link horizontal and vertical deflections was not overly simple. With 90degree horizontal bends, for example, the joint can be rotated vertically to allow any vertical deflection required, however it's important to ensure that the vertical "bend" happens coincident with the horizontal fitting. This was not a simple exercise when manually adding HIPs and VIPs, and again was prone to human error.
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- Reporting was also difficult due to the way that WA wanted the deflections annotated. The pipeline reporting included in 12d didn't allow us to generate deflection tables in the required format.

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## How the problem was solved:

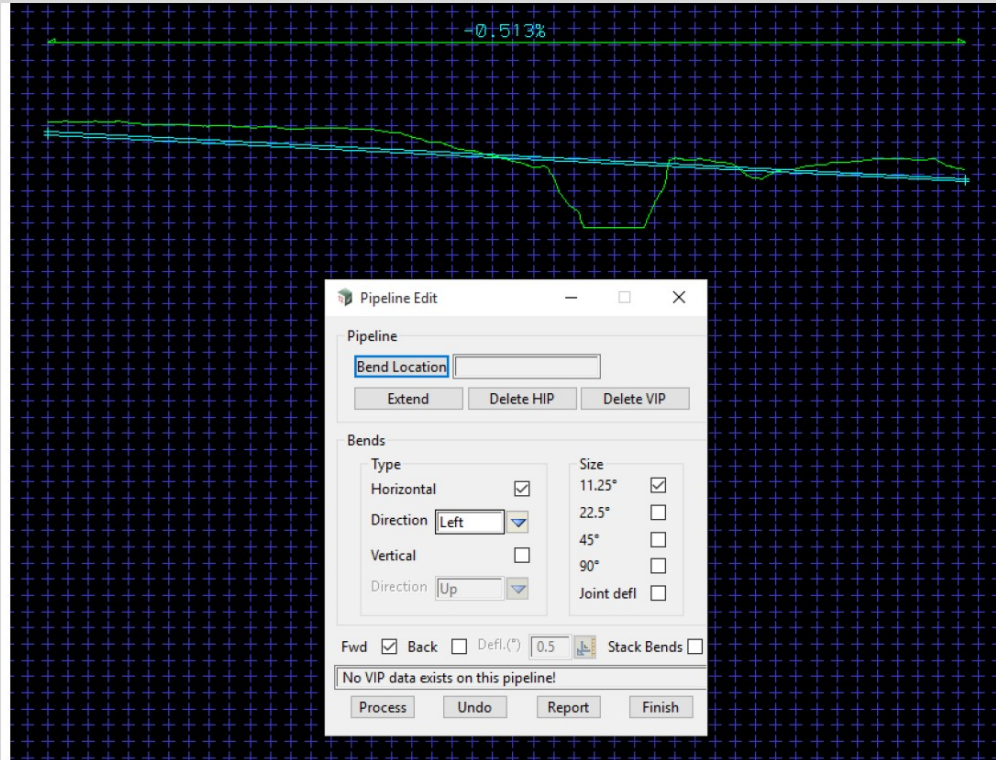
- I wrote a macro to facilitate the addition of both horizontal and vertical standard bends (11.25°, 22.5°, 45° and 90°) to a pipeline. Using the pipe length attribute associated with pipelines, the ability to apply pipe joint deflections of any size (set by the user) was able to be included. The macro needed to be able to function in either the forward or reverse directions for the pipeline as the fixed point is variable depending on the situation. Another feature that was added was the ability to 'stack' bends to get non-standard deflections (i.e.  $11.25^\circ + 22.5^\circ = 33.75^\circ$ )
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- Additionally, a reporting function was included that would output the setout for the deflections/bends in the standard format required by WA.
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- The macro resulted a significant reduction on design time, and provided confidence in the design values, consequently reducing checking times. It is an ongoing project, with changes underway to further improve the effectiveness of it for design use. At the current time, development is progressing with regard to a preliminary automated vertical grading which will try to follow the ground surface with a pre-set minimum cover, using a defined max. joint deflection and standard bends. However, at the time of writing this, the coding is not complete so I wasn't able to include the information in this entry.

## Relevant 12d screenshots and/or data attached:

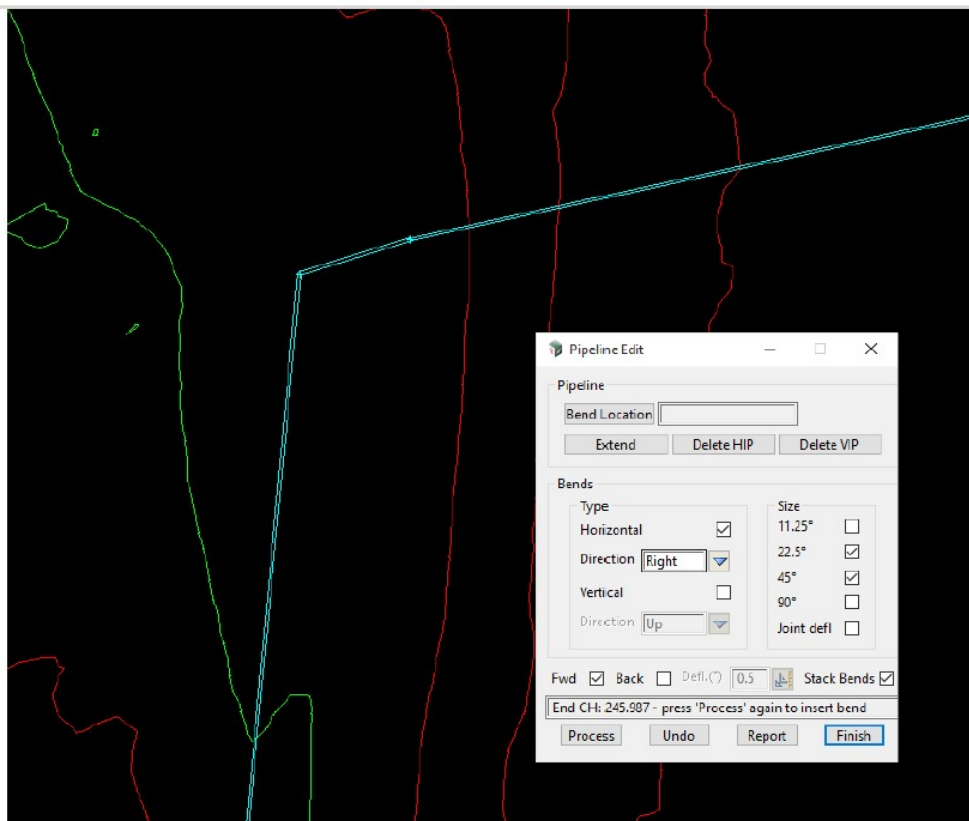


- Initial horizontal alignment for pipeline, with macro panel open

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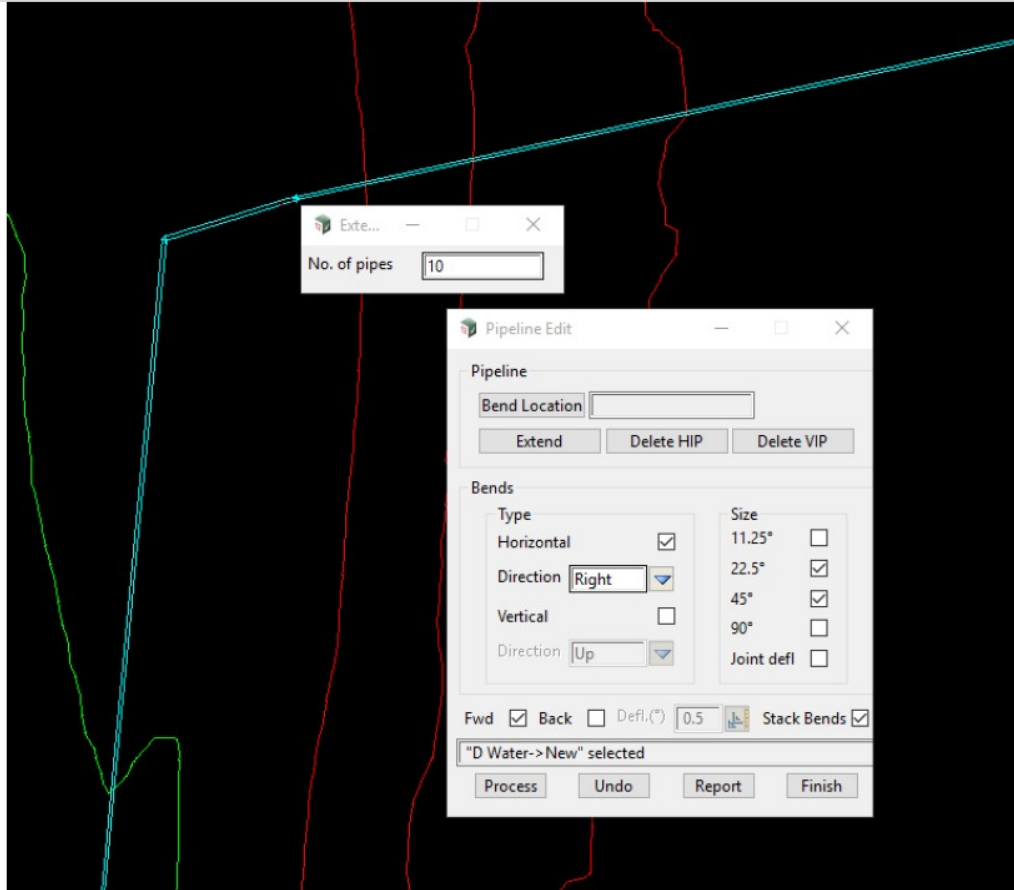


Initial Vertical alignment with macro panel open

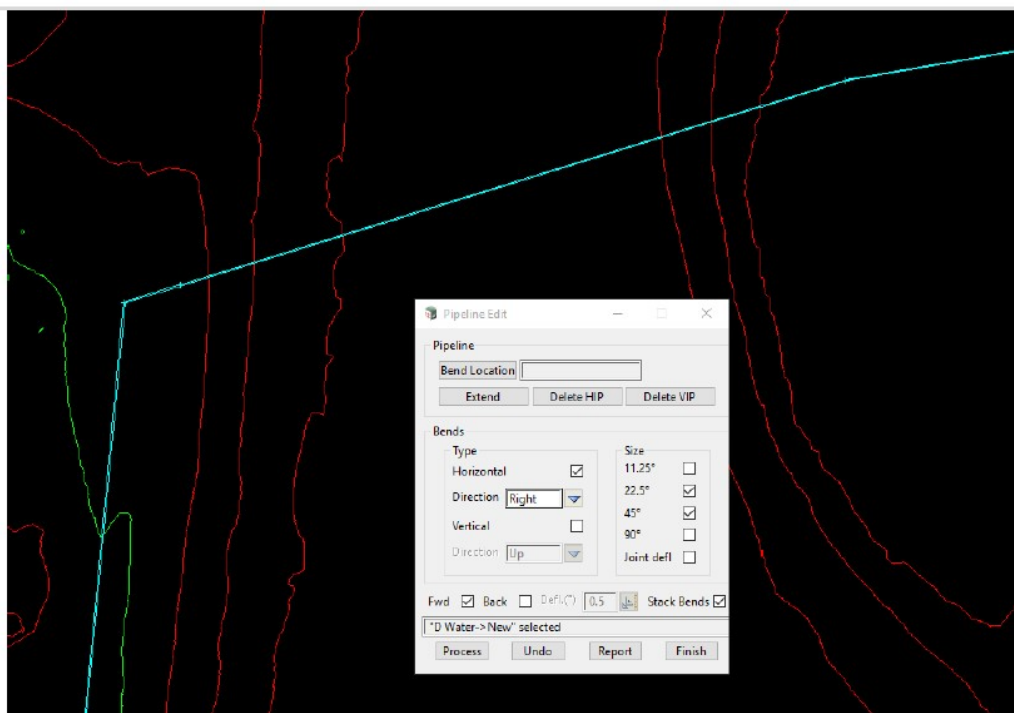


Inserted 'stacked' 45 and 22.5 degree horizontal bend

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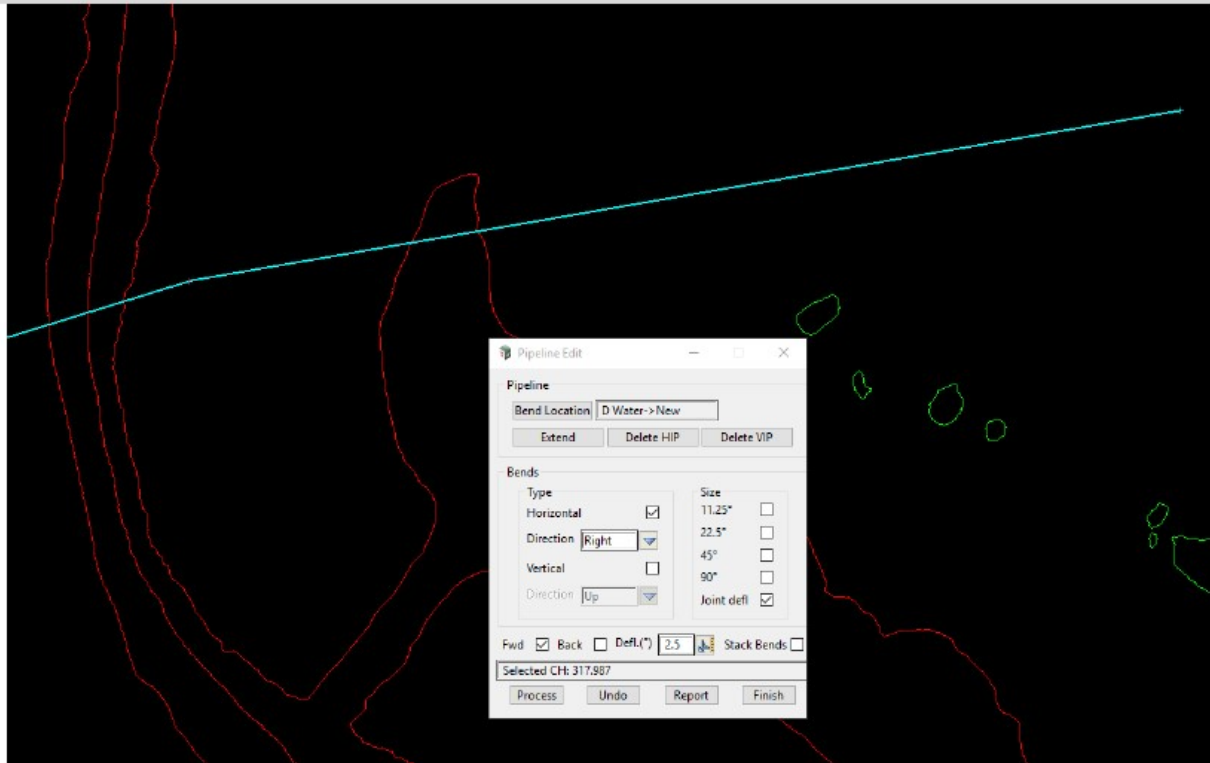


Extend alignment sub-panel to extend the bearing

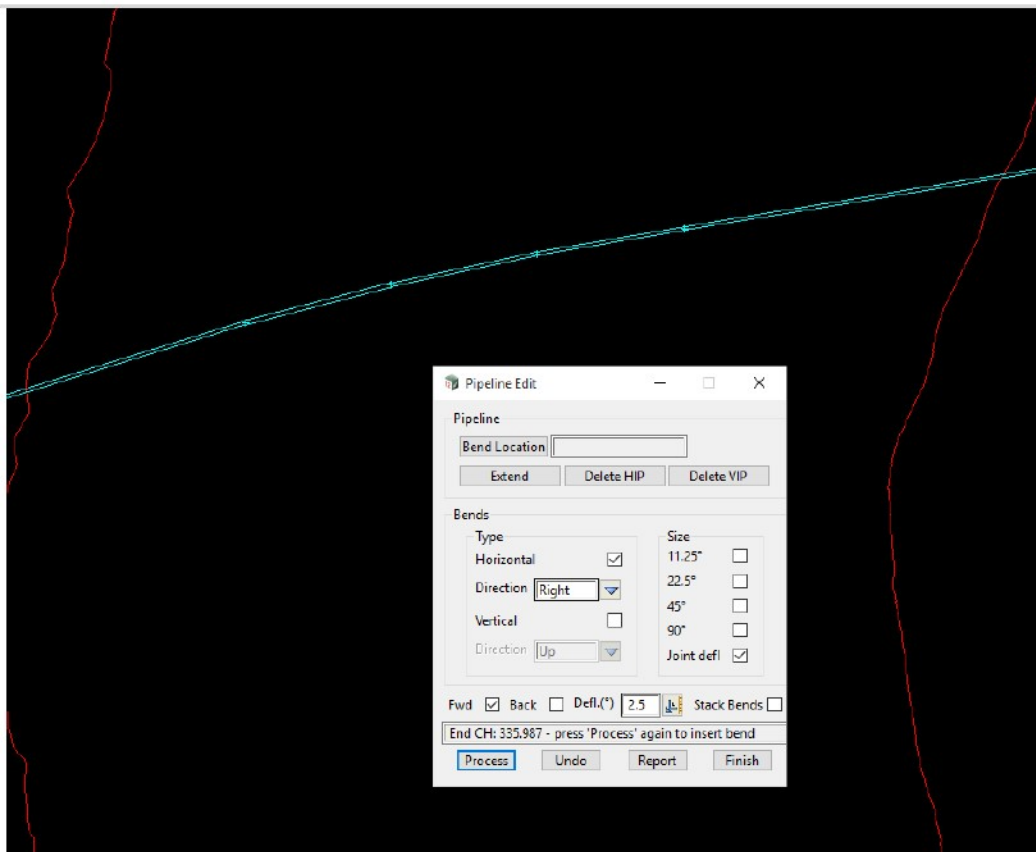


Horizontal bearing extended past the lake

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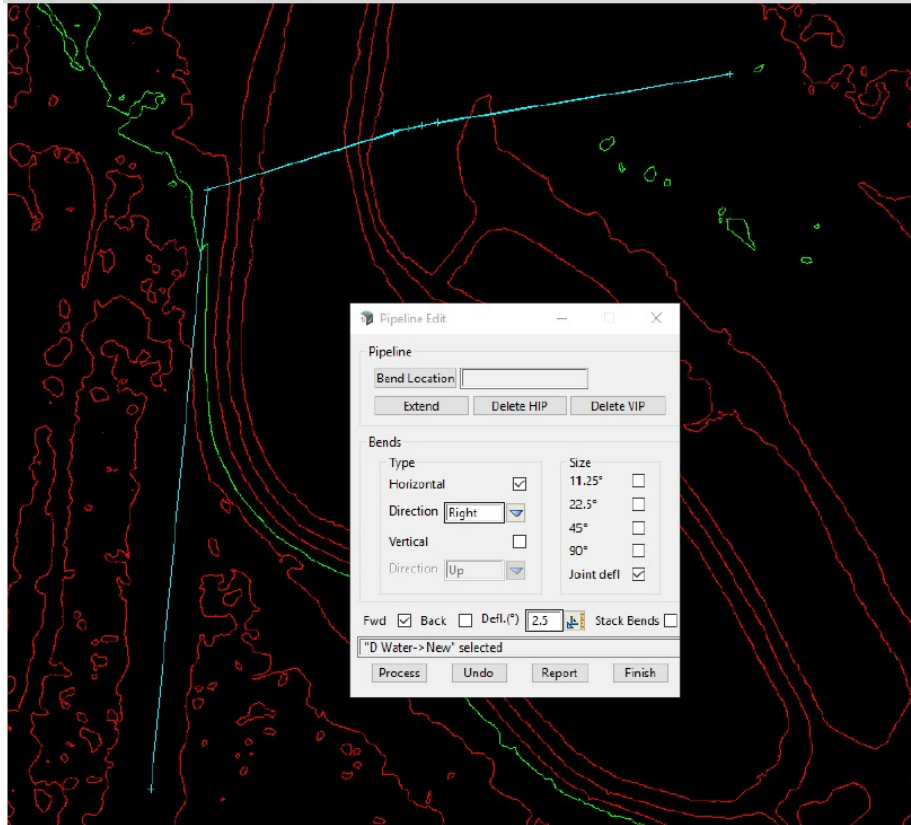


Now we want to insert 2.5 degree pipe joint deflections to 'bend' the pipe around

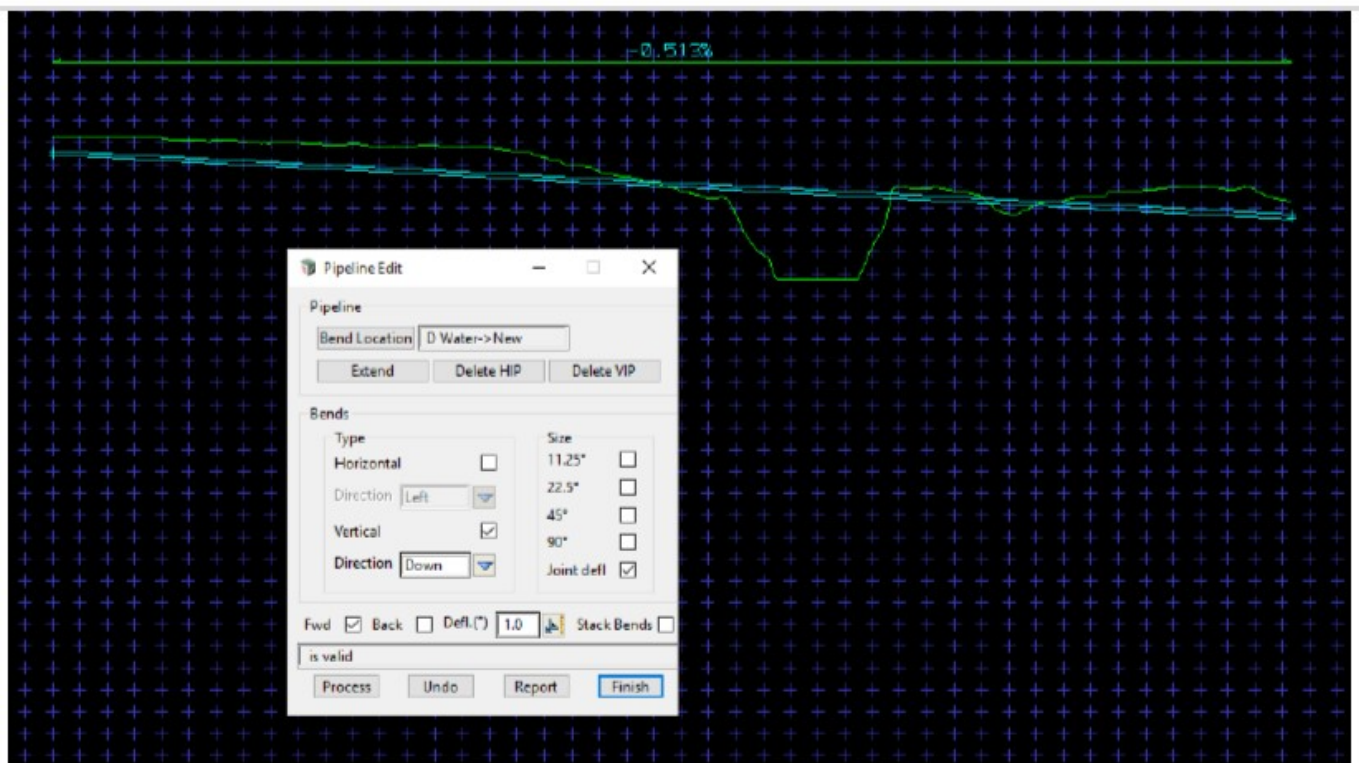


3 Joint deflections inserted simply by repeatedly pressing "Process"

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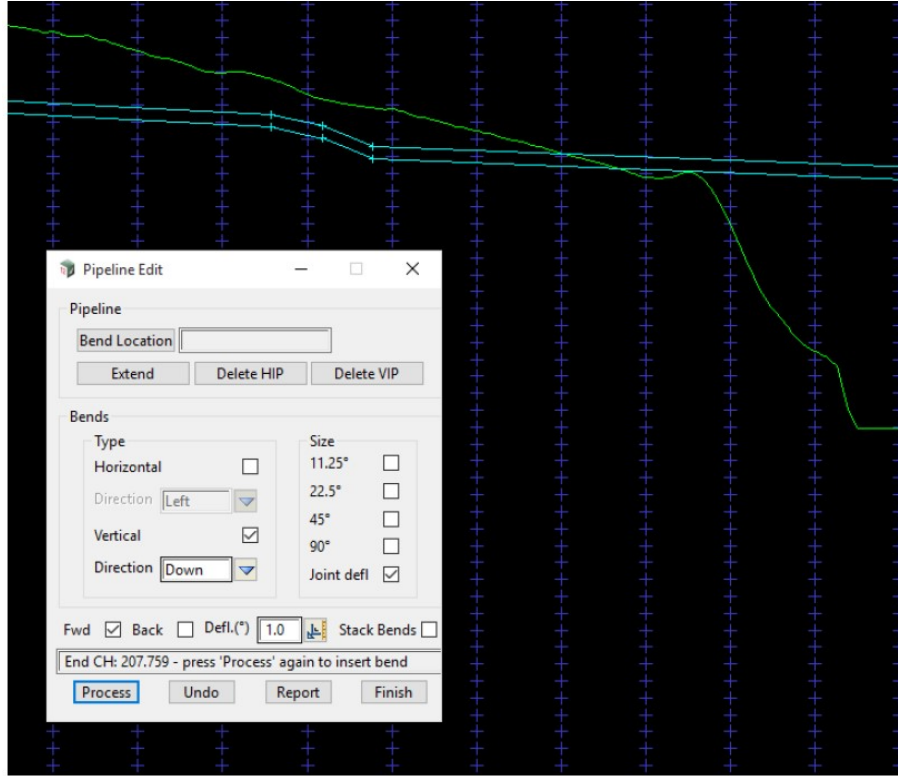


Final horizontal alignment completed

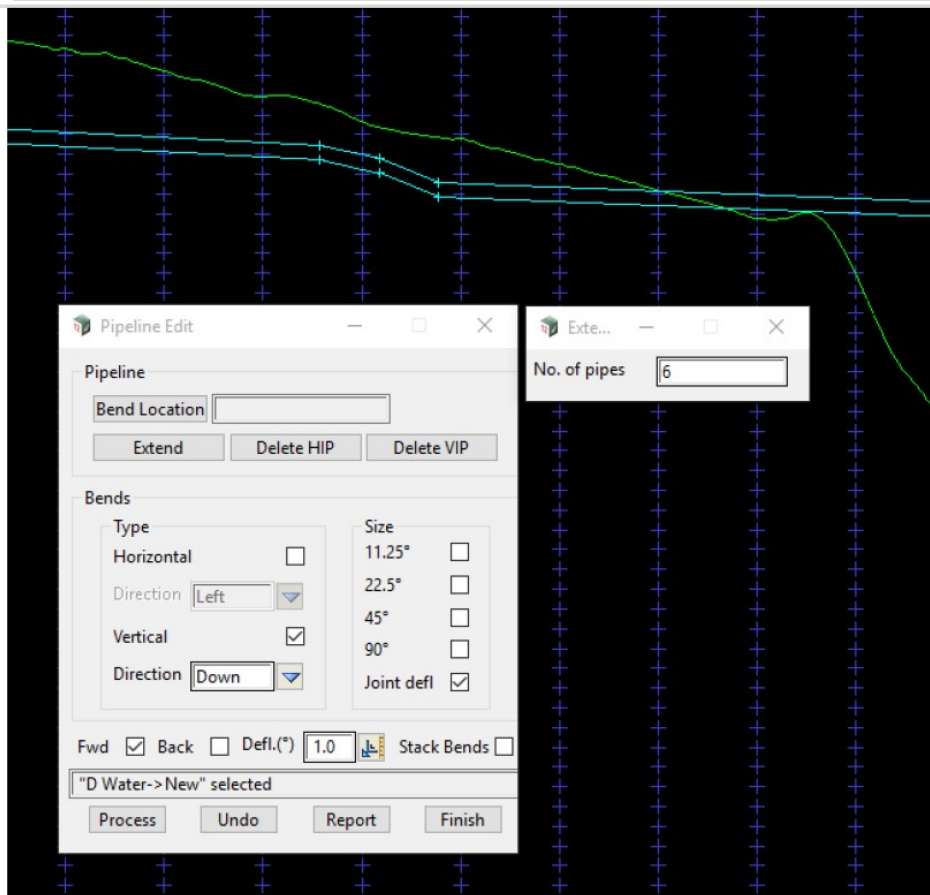


Now to insert some 1.0 degree vertical joint deflections to roll down prior to the lake

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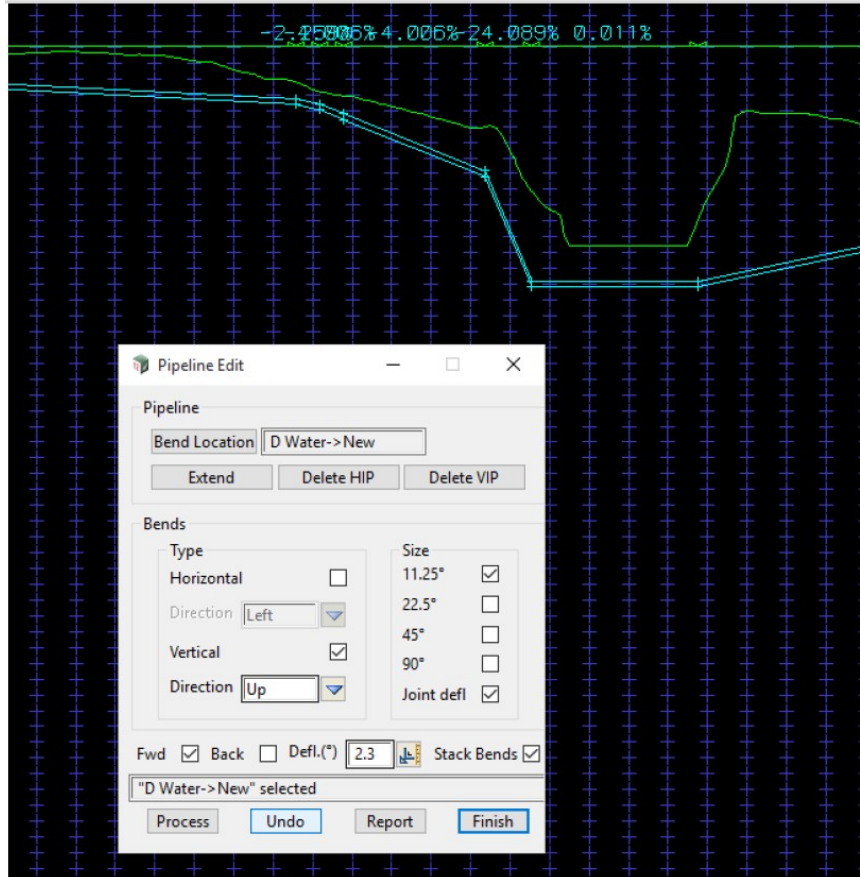
Vertical deflections inserted



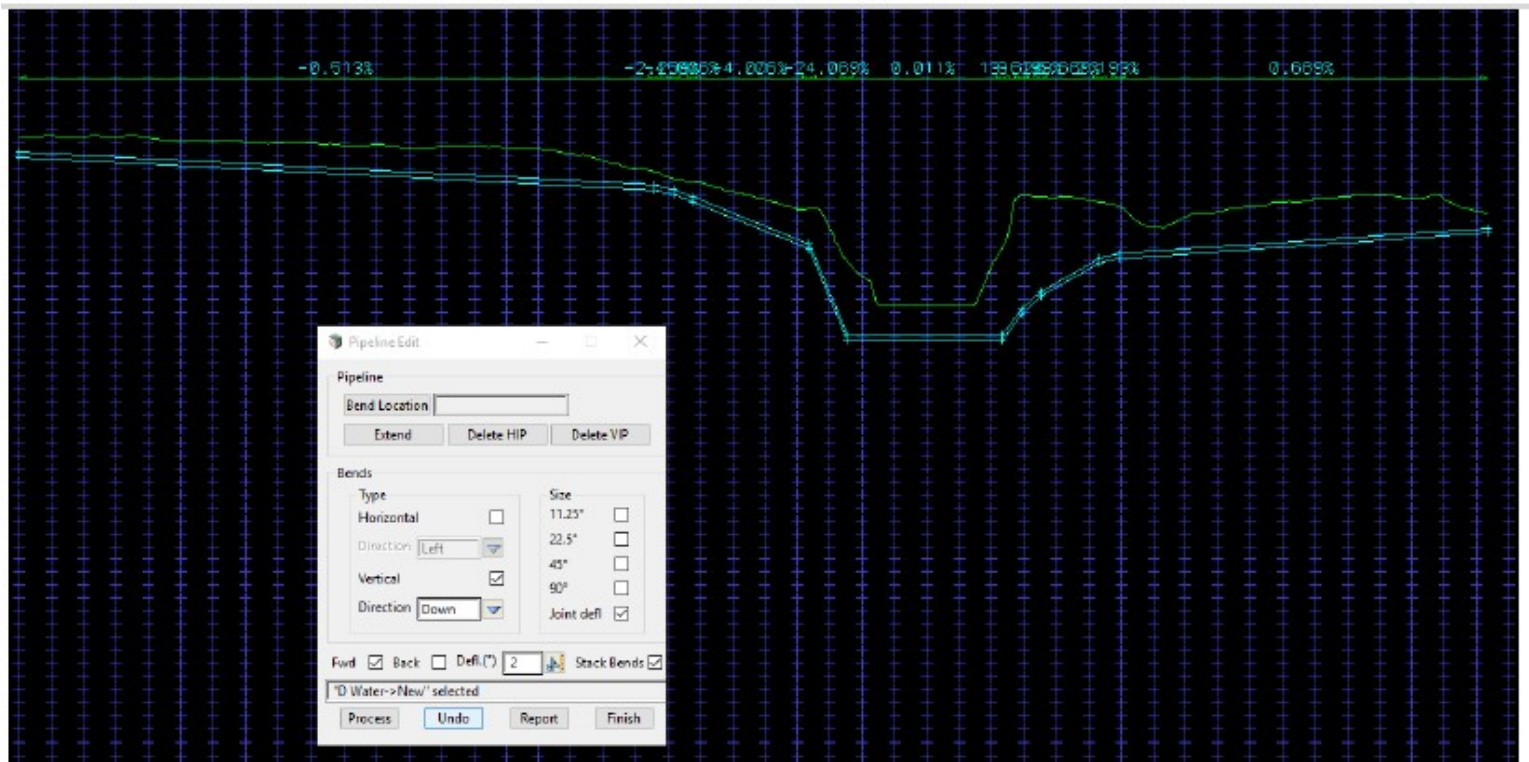
Extend the grade by 6 pipe lengths



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After inserting vertical 11.25 degree bends with joint deflections 'stacked'



Final vertical grading

