Engineering and hydrogeological site investigations in urban areas require an understanding of subsurface lithological variation and related properties, between and within stratigraphic units. In the Glasgow conurbation, Scotland, large-scale and long-term projects aimed at regenerating post-industrial (brownfield) sites are underway; these need to anticipate ground conditions and potential groundwater and contaminant migration pathways. To help planners at early stages in these activities the British Geological Survey (BGS) has undertaken a programme of attributed three-dimensional geological modelling, as part of the Clyde-Urban Super-Project (CUSP) and in partnership with Glasgow City Council and others. The modelling is based on a densely-spaced and extensive digital borehole dataset (>50,000 coded boreholes). This work compares the results of two different types of modelling workflow undertaken in central Glasgow – an area underlain by complex and heterogeneous glacial and post-glacial (including anthropogenic) deposits. The first workflow adheres to a determined lithostratigraphy and requires significant ‘geologically-reasoned’ input from the model operator, while the second adopts a stochastic approach using only lithological codes from the borehole dataset. While there is general agreement in terms of the overall sediment architecture produced by both models, notable differences in output exist between the two. These are assessed and the relative merits of each modelling workflow discussed. Outputs from both methodologies are also compared in terms of their potential for fusion with other (e.g. groundwater) modelling platforms. This combined approach will facilitate better understanding between geologists, groundwater modellers, engineers, planners, and regulators.