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Rome Transformed: Assessing Water Infrastructure and Hydraulics in the Eastern Caelian, Rome

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Bright orange: Rome Transformed research area

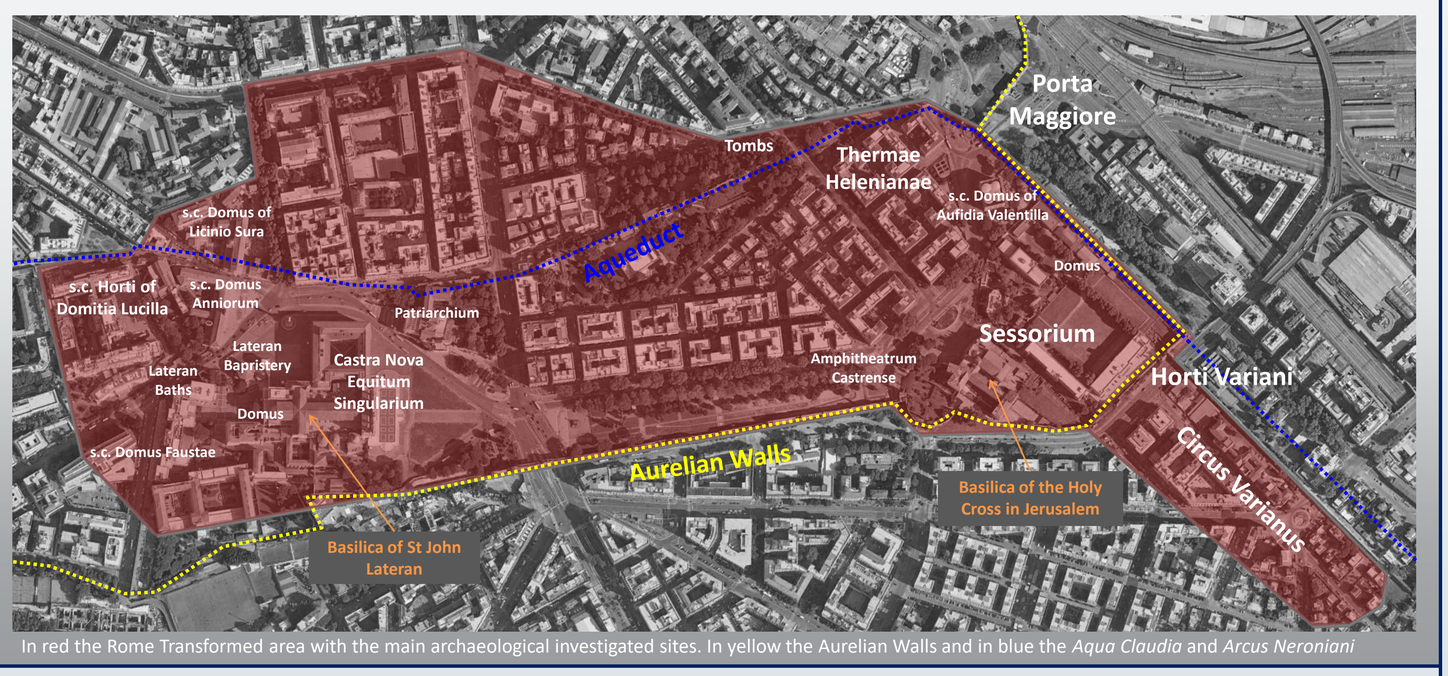
Rome Transformed

Rome Transformed is a five-year project (2019-2024), funded through an Advanced Grant of the European Research Council (ERC), awarded to Professor Ian Haynes at Newcastle University, in collaboration with the British School at Rome, the University of Florence, and the Consiglio Nazionale delle Ricerche (CNR). The project's aim is to investigate the transformations of the Eastern Caelian from the 1st century to the 8th century AD, looking at the political, military, and religious regenerations. The vital role of water management and distribution within the research area is the focus of a project PhD entitled *'Sustaining Rome: The supply and use of water in the Eastern Caelian. Impact of water on the political, military and religious transformation of the Eastern Caelian in centuries 1-8 CE'*. In keeping with the interdisciplinary character of the Rome Transformed this strand of research brings together specialists in a range of different fields, including archaeologists, architects, chemical and civil engineers, physical geographers, and historians.


Engraving of G.B. Piranesi (1775) showing the *Arcus Neroniani* next to St John Basilica

The Eastern Caelian

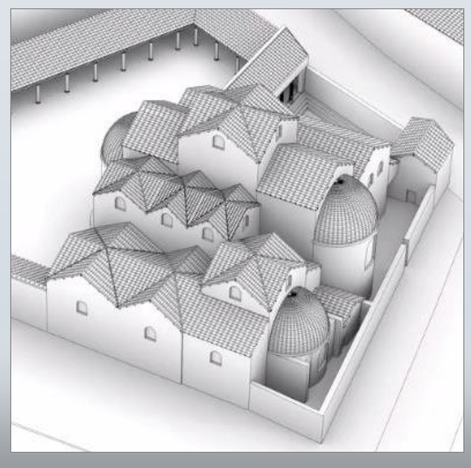
The project focuses on the Eastern Caelian, an area of about 69 hectares, that includes two of the most important Basilicas of Rome: St John Lateran (on the West), and the Basilica of the Holy Cross in Jerusalem (on the East). In the Roman period, the area underwent several transformations. In the 1st century AD, the hill was a green suburban area, with military barracks and scattered elite residences, amongst which were the *Horti* of Domitia Lucilla, mother of Marcus Aurelius. The Severan period witnessed an increase in military presence, with the construction of the *Castra Nova*, the remains of which lie under the Basilica of St John Lateran, and the establishment of an imperial residence, the *Sessorium*, at the Eastern edge of the hill. By the end of the 3rd century, the whole area had been incorporated within the city by the construction of the Aurelian Walls (271-275 AD). At this point, and following the victory of Constantine over Maxentius, the *Castra Nova* was dismantled and replaced by the Lateran Basilica, the first Basilica of Christianity, with the related Baptistery. In the same way, the *Sessorium*, chosen by Helena, mother of Constantine, as her residence (Sessorian Palace), was developed, and one of its halls converted to a church: the Basilica of the Holy Cross. By the eighth century the district was well-established as a religious and political centre, becoming the seat of papal governance with the construction of the pope's palace, the *Patriarchium*. Since the beginning of its urbanization, this area featured an incredible array of water infrastructures.



In red the Rome Transformed area with the main archaeological investigated sites. In yellow the Aurelian Walls and in blue the *Aqua Claudia* and *Arcus Neroniani*

The Caelian water system

The Caelian was crossed by five main aqueducts: the *Aqua Appia*, the *Aqua Marcia* and *Rivus Herculaneus*, the *Aqua Julia*, the *Aqua Claudia* with the *Arcus Neroniani*, and maybe also the *Specus Octavianus*. The *Arcus Neroniani* built by Nero, supplied the best quality water to the busy Caelian quarter with an increasing population, with a masonry infrastructure on tall arches. The water flows served an increasing number of water features and facilities for private and public users: *nymphaea,* fountains, latrines, three sets of baths and, from the 4th century onward, two baptisteries: the Lateran Baptistery and the Baptistery in Santa Croce in Gerusalemme. The distribution was accurately managed through the *castella aquae*, of which some traces are still preserved along the aqueduct's route. Understanding the complexity and the successive transformations of water infrastructure is key in assessing the pattern of the political, military and religious transformation that the Caelian went through the centuries.


Left: 3D survey of *Arcus Neroniani*, developed with TLS/SFM (A. Turner, M. Sordini 2022). Right: provocation of the bath complex found under the Lateran Baptistery (Haynes, Peverett)


Portions of the *Arcus Neroniani* from Porta Maggiore (right) to the Palatine (left)

Methodology for hydraulics research

The project investigates how the Eastern Caelian's water supply network and distribution system at both macro and micro levels. It attempts to identify what structures were planned alongside the courses of the aqueducts, what changes occurred through time, what the implications were for the delivery of water at different times, and how these developments fed into broader transformations within the area.

The methodology advanced here brings together several elements, such as study of legacy data and literary sources; detailed inspections and surveys; archaeological and hydraulic structural analysis on the preserved structures; the identification and cataloguing of all hydraulic features attested in the area (scheme on the right). It will be based on the division of each element in the water asset class and the identification of the functions, characteristics, location and phases of each hydraulic element. This catalogue will constitute the database for the hydraulic features of the *Rome Transformed* GIS, in which will converge also all the project data from different fields of research. A sampling campaign will allow physical and chemical analysis of: 1. Calcium carbonate deposits; 2. Hydraulic mortars; 3. Soil deposits in hydraulic channels; 4. Lead isotope analysis on lea pipes. Finally, a model of the current flow of the Caelian's aqueduct will be processed. All these datasets will be integrated to allow the development of a water net reconstruction hypothesis, which considers what hydraulic features had to be necessary for the correct functioning of the whole system.

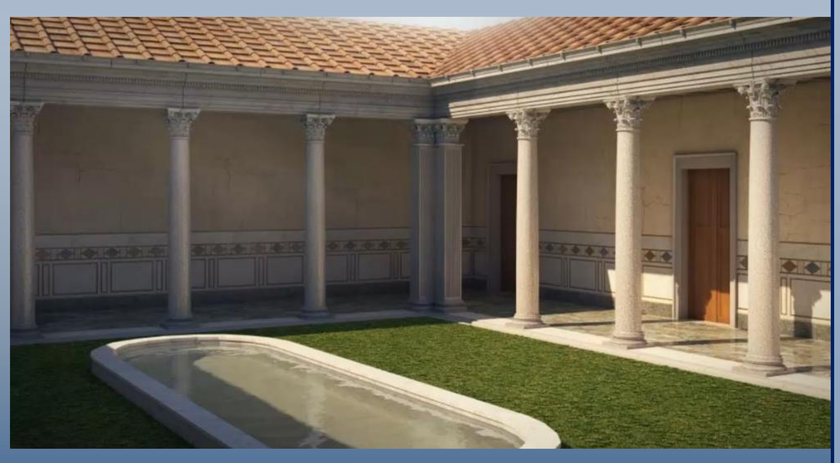
Hydraulic elements catalogue

Sheets of the hydraulic elements catalogue , examples of elements from the Roman world and function diagram of the elements (E. Santucci)


Hydraulic survey under the Baptistery Baths in the Lateran (photos: E. Santucci, T. Ravasi)

Conclusions

Through an integrated approach strategy, the Rome Transformed project will bring together all different fields of research involved to allow the complete datasets to merge into a 3D GIS environment, supported by different digital terrain models (DTMs) that simulate the study area's evolving ground surfaces. This will both allow the testing of theoretical flow models, and underpin the production of 3D visualisations (called 'provocations' by the project, as in the example shown on the right) of both macro and micro elements of the hydraulic system as it evolved through high empire to the early medieval period.


Fountain in the s.c. *Domus Anniorum* (T. Ravasi, I. Haynes, P. Liverani, I. Peverett, F. Carboni 2020)